ENGLISH TRANSLATION

OPERATIONAL GUIDELINES FOR TERRESTRIAL MOBILE MULTIMEDIA BROADCASTING BY TRANSMISSION SYSTEM BASED ON CONNECTED SEGMENTS FOR VHF-HIGH BAND

ARIB TECHNICAL REPORT

ARIB TR-B33 Version 2.3

(Fascicle 2)

Established on March 28th, 2001
Revised on September 30th, 2015 Version 2.3

Association of Radio Industries and Businesses

General Notes to the English Translation of ARIB Standards and Technical Reports

1. Notes on Copyright

2. Notes on English Translation

- ARIB Standards and Technical Reports are usually written in Japanese. This document is a translation into English of the original document for the purpose of convenience of users. If there are any discrepancies in the content, expressions, etc. between the original document and this translated document, the original document shall prevail.

- ARIB Standards and Technical Reports, in the original language, are made publicly available through web posting. The original document of this translation may have been further revised and therefore users are encouraged to check the latest version at an appropriate page under the following URL: http://www.arib.or.jp/english/index.html.

Foreword

The Association of Radio Industries and Businesses (ARIB) investigates and summarizes the basic technical requirements for various radio systems in the form of “ARIB Standards”. These standards are developed with the participation of and through discussions amongst radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

ARIB Technical Reports contain the concrete measurement methods, detailed explanation and remarks in respect to the operation and maintenance of the radio equipment and broadcasting equipment in order to ensure their compatibility and adequate quality, based on the ARIB Standards deriving from “governmental technical regulations” (mandatory standard) and “private technical standards” (voluntary standards).

This ARIB Technical Report is developed for the terrestrial television broadcasting and the terrestrial multimedia broadcasting by means of segment-connected transmission system using terrestrial basic stations through the use of radio waves with a frequency in the range of 207.5–222 MHz (VHF high band). In order to ensure fairness and transparency in the defining stage, the report was set by consensus at the ARIB Standard Assembly with the participation of both domestic and foreign interested parties from radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

ARIB sincerely hopes that this ARIB Technical Report will be widely used by radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

Integrated Contents

VOLUME 4

Multimedia Broadcasting

Provisions for PSI/SI Operations

Contents

Chapter 1 General Terms

1.1 Preface

The electronic program guide (EPG) service for multimedia broadcasting is provided based on the Ordinance and Notification of the Ministry of Internal Affairs and Communications and on the provisions of "Service Information for Digital Broadcasting Systems (ARIB STD-B10)" of the Association of Radio Industries and Businesses (hereinafter referred to as the "ARIB"). However, in order to widely use the standards, detailed operational standards need to be specified separately. Therefore, this "Multimedia Broadcasting Provisions for PSI/SI Operations" have been created.

The delivering standard of transmission control information specified in this document is based on the premise that flexibility of program scheduling by each broadcaster and expandability towards the future development of broadcasting services are ensured.

Multimedia broadcasters must comply with these provisions when transmitting PSI/SI.

It is preferable that the multimedia broadcasting receiver being used can receive signals sent based on these provisions and is designed so as not to cause a malfunction or other problems by receiving signals other than the defined signals.

1.2 Purpose

This volume defines the transmission provisions for multimedia broadcasting based on ARIB STD-B10 "Service Information for Digital Broadcasting System".

1.3 Scope

These provisions are applied to the configuration of the PSI/SI, signal types, basic data structure, use of identifiers, and transmission standards in multimedia broadcasting.

The binding power of these provisions is shown below.

[Receiving End]

The purpose of these provisions is to define the specifications for PSI/SI transmission operations in multimedia broadcasting; however, based on the operations, receivers must not strictly implement them. However, even if the receiving end requires operation that is not specified in these provisions, there is no guarantee that broadcasting companies will deal with such operation.

[Transmitting End]

These provisions shall not have absolute binding power against the transmitting end but if signals are not transmitted in accordance with these provisions, there is no guarantee that receiving units will operate normally.

1.4 References

This volume specifies detailed provisions for operation of multimedia broadcasting based on ARIB STD-B10 "Service Information for Digital Broadcasting System".

The related documents are listed below.

(1) ISO/IEC 13818-1 Information technology -- Generic coding of moving pictures and associated audio information: Systems (MPEG-2 Systems standard)

(2) "Data Multiplex Broadcasting System for The Conventional Television Using The Vertical Blanking Interval" ARIB STD-B5

(3) "Service Information for Digital Broadcasting System" ARIB STD-B10

(4) "Data Coding and Transmission Specification for Digital Broadcasting" ARIB STD-B24

(5) "Conditional Access System Specifications for Digital Broadcasting" ARIB STD-B25

(6) Technical Report ARIB TR-B15 "Volume 4 BS Digital Satellite Broadcasting Operational Guidelines for PSI/SI"

(7) Technical Report ARIB TR-B14 "Volume 4 Digital Terrestrial Television Broadcasting Provisions for PSI/SI Operations"

(8) Technical Report ARIB TR-B27 "Volume 4 Digital Broadcasting System based on Home Server Provisions for PSI/SI Operations"

1.5 Terminology

The terms used in these provisions are defined as shown below.

1-segment broadcast	A 1-segment broadcast is a broadcast that is received using the OFDM frame in 1-segment mode that conforms to ARIB STD-B29.
13-segment broadcast	A 13-segment broadcast is a broadcast that is received using the OFDM frame in 13-segment mode that conforms to ARIB STD-B31.
Actual	Original TS. This is a table sent in the original TS (NIT actual, EIT actual).

ARIB	Association of Radio Industries and Business: The ARIB is an organization that standardizes technologies in relation to the use of radio in Japan, with participation by broadcasters, telecommunications operators, and equipment manufacturers.
BCD	Binary Coded Decimal
BIT	Broadcaster Information Table: A table in which the configuration information on multimedia broadcasting broadcaster is described. The transmission parameters for all stations/each station and other information are described.
bslbf	Bit string, left bit first.
CA	Conditional Access System: CA is a system that controls reception of services (service channels) and events (programs).
CAT	Conditional Access Table: CAT is used to specify the identifier of the TS packet that transmits the individual information among the related information comprising pay broadcasting.
component	Component that comprises events (programs), such as video, sound, character, and other data
component_tag	Component_tag is defined as the label used to identify component streams
CRC	Cyclic Redundancy Check: CRC is a code to check cyclic redundancy to verify the accuracy of data.
current_next_indicator	Current_next_indicator is used to show whether each section is "currently" valid or will be valid in the "future".
descriptor	Descriptor is defined as the description area placed in the table to list various information.
DRCS	Dynamically Re-definable Character Sets: DRCS is a system to transmit external characters in patterns. Used in character coding standards for text broadcasting and data broadcasting.
DTCP	Digital Transmission Content Protection: DTCP is a standard for the content transmission and recording control system using a digital interface for authentication and encryption.
ECG	Electronic Content Guide: the method used to enable the presentation of the content information provided in multimedia broadcasting as well as the selection of content
ECM	Entitlement Control Message: the common information comprised of program information, such as information on the program and the key used to descramble, as well as the control information

EIT	Event Information Table; contains some information on the program, such as the name, broadcast time, and description; there are three types of EITs for multimedia broadcasting: N-EIT for display in weak-layer services, M-EIT for display in strong-layer services, and W-EIT for display in partial-transmission-layer services.
EIT[p/f]	Information on the current event (p:present) and next event (f:following) in the EIT.
EIT[p/f after]	Information that follows after the present and following in M-EIT and L-EIT.
EIT type delivering flag	Collective term for H-EIT_flag/M-EIT_flag/L-EIT_flag specified within the service loop of the SDT.
EMM	Entitlement Management Message: EMM is individual information that includes work Key to decipher a contract information and common information of each subscriber.
EPG	Electronic Program Guide; method used to enable the presentation of program information, such as the timetable, and the selection of programs for real-time broadcasting services
EPG/ECG metadata	Description language-type metadata stipulated in ARIB STD-B38; this is used for performing content guides and content navigations.
ERT	Event Relation Table: ERT is the table in which the relation between an event and local event is described.
ES	Elementary Stream; corresponds to encoded video, sound, and independent data in a PES packet; one ES is transmitted by a PES packet with an identical stream ID.
event	Collection of streams with certain start/end times in the identical service (program channel), such as news or drama
event_id	Event_id is defined as the id number of an event that is uniquely assigned within a single service.
EWS	Emergency Warning Signal
following	EIT[p/f]: Time series information on the present and following events and the former is called "present" and the latter is called "following".
free_CA_mode	Free_CA_mode is a 1bit field used to identify whether the program is "chargeable" or "free". Chargeable program when the bit is 1. Its definition is different from the one in ARIB STD-B10.
IEC	International Electrotechnical Commission
IEC60958	IEC60958 is the Digital audio interface standard defined by the IEC(International Electrotechnical Commission)
Index	(Program) index is defined as additional information associated with a program to be used for digest reception, multi-scenario reception, etc.

INT	IP/MAC Notification Table: Specifies the transport stream ID/service ID/component tag/target receiver's IP address that corresponds to an applicable platform ID in a stream that configures the storable broadcasting service.
ISO	International Organization for Standardization
ISO-639-language-code	ISO-639-language-code is used to identify components and languages in which characters are described. 3 character-codes standardized by ISO639 Part 2 are coded into 8-bit. (Ex: “jpn” to “0x6A706E”)
ITT	Index Transmission Table: ITT describes offset information between the time information described in the LIT and PTS in order to enable accurate synchronization of program components within a program segment index.
JST	Japan Standard Time: (Defined as ”UTC+9 hours“ by ARIB STD-B10)
JTC	Japan Time Code: JST in BCD
LIT	Local Event Information Table: LIT is the table which includes all the descriptions regarding local events of a single program.
M-EIT	Middle-EIT: The general term for the EIT that is transmitted in the high protection layer when three layers are used for transmission in multimedia broadcasting.
MJD	Modified Julian Date: MJD is the date accumulated starting from at 0:00 on Nov 17th, 1858 (UT). MJD is calculated based on the method provided in "ARIB STD-B10 Part 2 Annex C", expressing the date in Japanese standard time.
MPEG-2	Moving Pictures Expert Group-2: MPEG-2 is defined as the compression and coding technology for data (such as moving images and audio data) specified by the International Organization for Standardization (ISO/IEC 13818).
N-EIT	Narrow-EIT: The general term for the EIT that is transmitted in the weakest layer in multimedia broadcasting.
network	Network is defined as a collection of multiplexed MPEG-2 TSs transmitted by a single distribution system.
network_id	Network_id is defined as the identifier assigned to each master transmitter. One network_id is assigned to the entire multimedia broadcasting network.
NIT	Network Information Table: NIT is defined as the table that carries information to relate transmission path information such as frequencies to channels and that lists ID numbers for all the service channels contained in a distribution system.
NVOD	Near Video On Demand: NVOD provides the same service at different times.
original_network_id	Original_network_id is the identifier unique to each network.
PAT	Program Association Table: PAT is used to specify the ID of the TS packet that carries the PMT.

payload	Payload is defined as a stream of bytes following the header within the packet.
PCAT	Partial Content Announcement Table: PCAT is the table that includes announcements of content difference distribution and transmission schedule information in stored type data broadcasting.
PCR	Program Clock Reference: The standard for the timing at which to transmit the ES with a PTS/DS for a receiver, such as video, audio, and captions/superimpositions.
PES	Packetized Elementary Stream: PES is defined as the packetized video, audio and other data with variable lengths.
PID	Packet ID (Identifier): the 13-bit stream identification information of the TS packet header; this indicates the attribute of each stream in the applicable packet.
PMT	Program Map Table: this specifies the packet IDs of the TS packets that transmit the encoding signals comprising the program or that transmit the ECM.
PPV	Pay Per View: pay broadcasting where the fee is collected for each program or program group in accordance with the user's watching style
program_number	Program_number is equal to service_id.
PSI	Program Specific Information: required for selecting the necessary program; this is comprised of five tables: PAT, PMT, NIT, CAT, and INT.
PTS	Presentation Time Stamp: The information that manages the time when a PES packet header is played back.
reserved	“Reserved” means that the relevant coding bitstream may be defiend in the ISO standard for future extension. All the bits that are separatedly defined in the ARIB standard should be set to “1”.
reserved_future_use	“Reserved_future_use” means that the relevant coding bitstream may be defined in the ARIB standard for future extension. All the bits that are separated should be set to “1”.
rpchof	Remainder polynomial coefficients, highest order first.
RST	Running Status Table: RST is the table that shows running status of a program at the current time and is not used in multimedia broadcasting.
running status	Running status shows the running status of events and services such as “in execution” and “under suspension”.
SDT	Service Description Table: this contains information on the program channel, such as the channel name and the broadcasting enterprise name.
SDTT	Software Download Trigger Table: SDTT is defined as the table used to download software and to send schedule information about differential data for stored broadcasts.
section	Section is defined as the syntax structure used to map SI in the TS packet

section_number	Section_number enables re-placing sections in a certain table in the original order using decoder. In the ARIB standard, it is assigned to a sub-table and is unique in a single sub-table.
service	Service (service channel) is defined as a series of scheduled broadcasting programs transmitted by each broadcaster.
service_id	Service_id is defined as the identifier for each service in the network.
SI	Service Information: information stipulated for the convenience of program selection; this is defined by the Ordinance of the Ministry of Internal Affairs and Communications, and the content is stipulated as the ARIB standard. It contains the ARIB standard-specific extension as well as the PSI information of MPEG-2.
ST	Stuffing Table: ST is defined as the table to invalidate a table.
STD	Standard.
sub_table	Sub-table is a collection of sections with the same table ID (identifier) and same table id extension.
table	Table is composed of multiple sub-tables with the same table ID (identifier).
table_id	Table_id is defined as the identifier to specify a table to which a section belongs.
table_id_extension	Table_id_extension is used to identify a sub-table.
TDT	Time and Date Table: TDT indicates the current date and time. This is not transmitted in multimedia broadcasting.
TMCC	Transmission and Multiplexing Configuration Control: TMCC is defined as the transmission control signal that carries information, for example, about the transmission system, frame structure and TS_id.
TOT	Time Offset Table: TOT is used to specify the current date and time and to specify the time difference between the actual time and the displayed time when the summer time starts. (In multimedia broadcasting, only the TOT is sent, while the TDT is not sent.)
TS	Transport Stream; stipulated in the MPEG-2 Systems Standard (ISO/IEC 13818-1); 13-segment broadcasting is used for multimedia broadcasting, with 1 TS for each 1-segment of broadcasting.
TS_id	TS_id is defined as the identifier assigned to each TS. Unique in the network_id.
uimsbf	Unsigned integer, most significant bit first

UTC	Universal Time Coordinated: UTC is defined as the time commonly used around the world based on the international agreement.
version_number	version_number is used to indicate that new PSI/SI data that includes updated information will be transmitted when changing information in the table, a sub-table with the next version number will be transmitted.
W-EIT	wide-EIT: The wide-EIT is a general term for the EIT that is transmitted in the partial reception hierarchy in multimedia broadcasting.
Adaptation field	Adaptation field is defined as the field with the information transmission function (such as PCR) and stuffing function.
Service type	Service types include digital TV, digital audio, digital broadcasting, and special service.
Service list	Service list is a list of services with service identifiers and service types.
Series	A collection of programs of the same nature. For example, a series is defined for a collection of drama programs that are divided into multiple events.
Single shift (Character coding control)	Single shift is the control that calls only one code following this temporarily to the 8-bit-code table.
Stuffing	Stuffing is to fill the remaining part in a TS packet with "0xFF".
Section	Section
Segment	A section that is divided by time in one video/audio resource that is included in an available unit of content. For example, a segment represents one news topic in a news video.
Tiered-charging system	Tiered-charging system is defined as the system in which viewers pay for individual program or program group that they subscribe to.
Default ES	Default ES is defined as the component and group of components presented first when a service is selected. Defined with a component tag value.
Transport stream	See the TS item.
Partial transport stream	The partial transport stream is defined as a bit stream obtained by removing transport packets that do not relate to specially selected one or more programs from MPEG transport packets.
Flat rate-charging system	Flat rate-charging system is defined as the system in which viewers pay for service channels they subscribe to.
Broadcaster	Broadcaster is defined as a broadcaster or a collection of broadcasting companies operated under the common operation system.
Payload	payload

Macro code (Character coding control)	Macro code is a single code with the function to process a series of code strings that comprise codes and control codes on behalf of them.
Multi-sectionization	Multi-sectionization is to transmit a single packet with more than two sections inserted in it.
Locking shift (Character coding control)	Locking shift is the control that calls a collection of codes to the 8-bit-code table, and constantly keeps it in the 8-bit-code table until it is switched using another locking shit.
Hierarchical transmission	Hierarchical transmission is defined as simultaneous transmission of OFDM segment groups with different transmission path coding.
Descriptor	Descriptor is defined as the description area placed in the table to list various information.
Commonly operated SI	Commonly operated SI is defined as the SI transmitted in common operation by all broadcasting companies
Emergency warning broadcasting (EWS)	Emergency Warning System: Broadcasts disaster-related information; this system enables a receiver to automatically start the broadcast by sending an activation control signal, etc
Empty section	Empty section is defined as the section that has CRC32 after the section header and in which no descriptor is described.
Individually operated SI	Individually operated SI is defined as the SI that carries information that exceeds the defined range of Commonly operated SI unique to each broadcaster.
Repetition rate	Repetition rate is a cycle at which the same table is repeatedly transmitted regardless of whether it is updated or not.
Designation control (Character coding control)	Designation control is to designate a single collection of codes from the collections of codes as G0, G1, G2 and in the 8-bit character code control.
Subtitle/Caption	A service related to video content among the service that is provided by superimposing textual information over video content distributed in real-time broadcasting.
Identifier	Identifier is defined as an id assigned keeping its uniqueness in a certain range. A value to identify an element within a table and descriptor.
Repetition Rate Group	A collection of tables transmitted at the same repetition rate. Tables are grouped by table type.
Product design	Functions and operations that depend on the receiver or item
Transmission frequency	Repetition rate
Area code	Area code is defined as the code indicating the target area placed in the emergency information descriptor, during emergency warning broadcasting (ARIB STD-B10 Annex D).
Storable broadcasting	One of the terrestrial multimedia broadcasting services based on connected segment transmission, which is provided when downloading
Multimedia broadcasting broadcaster	Multimedia broadcasting broadcasters are entrusted broadcasters in multimedia broadcasting.

Additional symbol	Additional symbol is so called external character and additional code placed in different locations from *Kanji* and alphanumeric characters such as signs and composite glyphs.
In-program index	In-program index provides information to support selection and search of part of a program (events in a program).
Service information	SI
Superimposition	Subtitling service that is not synchronized with the main video, audio, or data, e.g., news flashes, schedule remarks, time signals, earthquake early warnings, etc.
Undecided event	Undecided event is defined, as an event whose broadcast schedule has not been decided and content has not been fixed. Both start_time and duration are set to all 1.
Reservation term	Reservation term are defined as fixed terms to describe a program such as “Leading performers”, “Producer” and “Synopsis”.
Special service	Special service is defined as the service temporarily broadcast in another service channel that is different from regular channel. This service is only temporarily used.
Connected transmission	Connected transmission means to send multiple segments without a guard band from the same transmission point.
Entrusted broadcasters	Same as “certified infrastructural broadcaster"
Entrusting broadcaster	Same as “infrastructural broadcasting provider”

Chapter 2 Coding of Character Strings

The character codes and control codes that can be used in PSI/SI are based on the 8-bit code system as specified in Part 2 of Vol.1 of "Data Coding and Transmission Specification for Digital Broadcasting" ARIB STD-B24. However, due to the nature of PSI/SI, i.e. it carries information on a program, it is assumed that there may be cases where characters which include names of people and places and the original titles of programs need to be expressed in EPG, etc and consideration should be given to such names and titles and their rights domestically and internationally. The JIS (Japan Industrial Standard) Code level 1 and level 2 *Kanji* sets are specified for the collections of *Kanji* systems in ARIB STD-B24, but they are not sufficient enough and there have been a lot of problems even in paper media, etc., and therefore, a character set with more character types was required. In multimedia broadcasting, based on ARIB STD-B24, implementation of functions of equipment including receiver units that are not compatible with the JIS level 3 and level 4 standards (JIS X0213:2004) is specified taking into account sharedness, compatibility and scalability, and implementation of the JIS level 3 and level 4 *Kanji* sets depends on the product design.

In addition, because EPGs are presented for free, use of external characters that use DRCS will be inevitably complicated; therefore, it has been decided not to use them.

2.1 Character Sets

The Collections of codes are shown below. G0, G1, G2 and G3 are called to the 8-bit unit code tables (GL and GR) with call controls. In addition, with designation control, a single collection of codes is designated as G0, G1, G2 and G3 from the collections of codes.

The character sets used in SI are shown in Table 2-1.

Table 2-1: Character Sets Used in SI (Collections of Codes)

Collections of character codes	
JIS-compatible *Kanji* plane 1 (2 byte code)	See [Annex 3]*1
JIS-compatible *Kanji* plane 2 (byte code)	See [Annex 3]
Alphanumeric characters (1 byte code)	ARIB STD-B24
Hiragana (1 byte code)	ARIB STD-B24
Katakana (1 byte code)	ARIB STD-B24
Additional symbols (2 byte code)	See [Annex 3]

*1 When JIS X0213:2004 is not used, collections of kanji systems shall be placed on JIS-compatible Kanji plane 1 because ARIB STD-B24 allows to do so even if this plane is used. Please note that additional symbols defined in Row 90 to Row 94 conventionally should not be placed on this plane.

- Collection of DRCS codes

  Not used.

- Collection of macro codes

  Not used.

2.2 Control Codes

The control codes and call controls used in each character string field within a descriptor are shown in Table 2-2 and Table 2-3. In addition, the designation controls are shown in Table 2-4.

Table 2-2: Control codes used in SI

Control code	Details
APR	Linefeed at operation position
LS1	Call collection of codes 1 (Locking shift)
LS0	Call collection of codes 0 (Locking shift)
SS2	Call collection of codes 2 (Single shift)
ESC	Extended code system
SS3	Call collection of codes 1 (Single shift)
SP	Space
MSZ	Specify middle size (1-byte) character. Please note that only alphanumeric characters (1-byte codes and 2-byte codes defined in Table 8-2 of ARIB STD-B5) and space (Row 1 Cell 1 0x2121 and 0x20) can be specified.
NSZ	Specify standard size (2-byte) character.
XCS(CSI)	Define alternate code string (*1)

*1 XCS is alternative code string definition defined as the CSI extended control code (Table 7-14, Chapter 7 of ARIB STD-B24).
Conventionally, this is used to display an alterative when DRCS can not be displayed, but when a receiver unit that is not compatible with the JIS level 3 and level 4 standards can not display a level 4 standard *Kanji* code, it displays a code string within the sequence placed immediately after it. When displayed normally, the code string from the start to the end of the definition will be ignored. When a code other than the ones defined in Table 2-1 or level 3 and level 4 standard *Kanji* code are transmitted, an alternate code string defined with XCS is transmitted immediately after each character. Therefore, the receiver unit never displays character codes that does not support and an alternate character immediately after such a code is displayed. On the transmitting end, it returns to the original code set when it is finished.

Code sequence: CSI P1 I1 F

CSI :	09/11	(Control sequence introducer)
P1 :	03/0	Start definition
	03/1	End definition

I1 : 02/0 (Intermediate character)
F : 06/6 (Terminate character)

Table 2-3: Call controls

		Control details		
Call control	Coding	Collection of codes	Called	Call style
LS0	00/15	G0	GL	Locking shift
LS1	00/14	G1	GL	Locking shift
LS2	ESC 06/14	G2	GL	Locking shift
LS3	ESC 06/15	G3	GL	Locking shift
LS1R	ESC 07/14	G1	GR	Locking shift
LS2R	ESC 07/13	G2	GR	Locking shift
LS3R	ESC 07/12	G3	GR	Locking shift
SS2	01/9	G2	GL	Single shift
SS3	01/13	G3	GL	Single shift

Table 2-4: Code designation controls

Coding	Control details	
	Collection of character codes	Designate
ESC 02/8 F	1 byte G set	G0
ESC 02/9 F		G1
ESC 02/10 F		G2
ESC 02/11 F		G3
ESC 02/4 F	2 byte G set	G0
ESC 02/4 02/9 F		G1
ESC 02/4 02/10 F		G2
ESC 02/4 02/11 F		G3

The termination codes are shown in Table 2-5.

Table 2-5: Types and F (termination codes) of collections of codes

Types of collection of codes	Collection of character codes	Termination code(F)
G set	JIS-compatible Kanji plane 1	03/9
	JIS-compatible Kanji plane 2	03/10
	Alphanumeric characters	04/10
	Hiragana	03/0
	Katakana	03/1
	Additional symbols	03/11

2.3 Initialization

Initialization of each string field within a descriptor when designating and calling codes are defined in Table 2-6.

Table 2-6: Initialization status of each string field

Designation	G0	JIS-compatible *Kanji* plane 1
	G1	Collection of alphanumeric characters
	G2	Collection of *Hiragana*
	G3	Collection of *Katakana*
Call	GL	LS0(G0)
	GR	LS2R(G2)
Character size	-	NSZ

2.4 Use of External Characters

External characters are not used.

2.5 Maximum Length of Strings

The maximum length of each string field within SI is shown in Table 2-7. Please note that two 1-byte characters are counted as one 2-byte character.

Table 2-7: Maximum length of each string field within SI

Field name	Descriptor	Maximum length
Network name	Network Name Descriptor	10 2-byte characters or less and 20 bytes or less
TS name	TS Information Descriptor	10 2-byte characters or less and 20 bytes or less
Service Channel name	Service Descriptor	10 2-byte characters or less and 20 bytes or less
Program title(Note 1)	Short Event Descriptor	40 2-byte characters or less and 96 bytes or less
Program description	Short Event Descriptor	80 2-byte characters or less and 192 bytes or less
IP/MAC platform name	IP/MAC Platform Name Descriptor	20 2-byte characters or less and 48 bytes or less
IP/MAC platform provider name	IP/MAC Platform Provider Name Descriptor	20 2-byte characters or less and 48 bytes or less

Note 1: A program title shall include “Program Title + Program Sub-Title”, and it is strongly requested to display a name of a long program within 40 characters, but taking into account that there maybe cases where only up to 20 characters can be used due to display limitations, etc. the transmitting

end should make arrangements such as putting titles on the order of precedence. In addition, a name of a program that is 30 minutes or less should be displayed in 20 characters or less as a rule.

<Blank Page>

Chapter 3 Definition of Tables/Descriptors

In PSI and SI, each broadcaster transmits signals in compliance with ARIB STD-B10 overlapped with transport streams that are their broadcasting signals. In this document, ARIB STD-B10 and MPEG-2 Systems (ITU-T H.222.0, ISO/IEC 13818-1: Hereinafter, referred to as "ISO/IEC 13818-1") are referred to.

3.1 Types and Identification of Tables

In multimedia broadcasting, the following tables are used for Program Specific Information (PSI) and Service Information (SI).

The following tables specified in ministerial ordinances are used for PSI, which are also described in 4.1 of Part 1 of ARIB STD-B10. Table 3-1 lists PSI tables.

Table 3-1: PSI tables used in multimedia broadcasting

Table Name	Functional Overview
PAT (Program Association Table)	Specifies the PID of the TS packet that carries PMT related to each program.
CAT (Conditional Access Table)	Specifies the PID of the TS packet that carries information related to chargeable broadcasting and content protection programs.
PMT (Program Map Table)	Specifies the PID of the TS packet that carries coded signals for each program.
NIT (Network Information Table)	Carries information to relate transmission path information and broadcasting programs such as modulating frequencies.
IP/MAC Notification Table INT(IP/MAC Notification Table)	Specifies the transport stream ID/service ID/component tag/target receiver's IP address that corresponds to the platform ID in a stream that configures a storable broadcasting service.

The SI tables are described in 4.1 of Part 1 of ARIB STD-B10, and among those tables, the ones used in these provisions are shown in Table 3-2.

Table 3-2: SI tables used in multimedia broadcasting
(ones specified in ARIB STD-B10)

Table Name	Functional Overview
BIT (Broadcaster Information Table)	Specifies SI transmission parameters etc related to Commonly operated SI and individually operated SI for each broadcaster.
SDT (Service Description Table)	Carries service channel related information such as service channel names and broadcaster names.
EIT (Event Information Table)	Specifies program related information such as program titles, air dates and times and brief program descriptions.
TOT (Time Offset Table)	Specifies the current date and time, and the time difference between the actual time and the displayed time when the summer time starts.
ST (Stuffing Table)	Invalidate tables.

* In multimedia broadcasting, the TDT, RST, NBIT and LDT are not transmitted.

* For the BAT, LIT, ERT, ITT and PCAT, when a possibility of using them in the future arises, their information will be revised in relevant provision documents.

In multimedia broadcasting, other than SI tables, tables specified in ARIB STD-B21 are used. Table 3-3 is a list of those tables.

Table 3-3: Tables used in multimedia broadcasting (other than SI tables)

Table Name	Functional Overview
SDTT (Software Download Trigger Table)	Designates notice information regarding downloaded software, such as service IDs, schedule information and types of receiver units to be updated. See Vol. 1 for the details.

Furthermore, PID values of transport stream packets that carry PSI/SI sections are shown in Table 3-4.

Table 3-4: Assignment of PID values to PSI/SI

PID	Table
0x0000	PAT
Indirect specification with PAT	PMT
0x0001	CAT
0x0010	NIT, ST
0x0011	SDT, ST
0x0012,0x0026,0x0027	EIT*1, ST
0x0014	TOT, ST
0x0023,0x0028	SDTT
0x0024	BIT
Indirect specification with PAT	INT

*1 A maximum of three types of PID values are used based on the layered transmission for the EIT in multimedia broadcasting. For details, see Section 12.9.

Among values specified in 5.2 of Part 1 of ARIB STD-B10, the ones shown in Table 3-5 below should be used for values assigned to identify PSI/SI Tables used in multimedia broadcasting (table_id).

Table 3-5: Assignment of table_id values

table_id	Table
0x00	PAT
0x01	CAT
0x02	PMT
0x40	NIT
0x42	SDT
0x4C	INT
0x4E	EIT[p/f], EIT[p/f after]
0x72	ST
0x73	TOT
0xC4	BIT
0xC3	SDTT

3.2 Types and Identification of Descriptors

With regard to descriptors used in PSI and SI, among the ones specified in announcements and ones specified in 4.2 of Part 1 of ARIB STD-B10, the ones shown in Table 3-6 below should be used. Table 3-7 shows the descriptors used in the INT.

Table 3-7 is provided as separate table because the descriptors are only used in the INT.

Table 3-6: Descriptors used in multimedia broadcasting[*1,*2]

Descriptor name	Functional overview
Conditional Access Descriptor	Describes the conditional access system and the PID that carries its ECM/EMM (Shows information on EMM when placed in the CAT, and information on ECM when placed in the PMT).
Network Name Descriptor	Describes the network name.
Service List Descriptor	Describes the list of service channels and their identification.
Stuffing Descriptor	Ensures descriptor space and invalidate descriptors.
Service Descriptor	Describes the service channel name and its broadcaster name.
Linkage Descriptor	Describes the linkage to another service channel name Describes the linkage to an INT in the NIT.
Short Event Descriptor	Describes the program title and brief explanation of the program.
Stream Identifier Descriptor	Describes identification of each component.
Local Time Offset Descriptor	Describes the time difference between the actual time (UTC + 9 hours) and the displayed time when the summer time starts.
Digital Copy Control Descriptor	Describes information that controls the copy generation in a digital recorder and its maximum transmission rate.
Video Decode Control Descriptor	Used to control the video decoding when the video coding system is switched within the same service_id, and to identify whether still pictures are being transmitted.
Download Content Descriptor	Describes attribute information such as size, type and download ID of content to be downloaded. Descriptor specified in ARIB STD-B21.
CA Contract Info Descriptor	Describes a type of conditional access service for a scheduled program (Tiered/Flat/PPV) andavailability of viewing/recording.
TS Information Descriptor	Describes various additional information on the relevant TS.
SI Parameter Descriptor	Describes the SI transmission parameter (Repetition Rate Group or re-transmission cycle, etc).
Broadcaster Name Descriptor	Describes a multimedia broadcasting broadcaster name.

Descriptor name	Functional overview
Content Availability Descriptor	Describes information related to program recording and output control.
Connected Transmission Descriptor	Describes the physical conditions for connected transmission using a multimedia broadcasting transmission route.
Terrestrial Delivery System Descriptor	Describes physical conditions for terrestrial transmission path
Partial Reception Descriptor	Describes the service identifier that is transmitted in the partial reception layer of the terrestrial transmission path.
Emergency Information Descriptor	Describes information necessary as an emergency warning signal and its functions.
Data Component Descriptor	Identifies the data coding system
System Management Descriptor	Identifies whether the relevant network is broadcasting or non-broadcasting.
Data Broadcast Id Descriptor	Describes data broadcast identification information.

*1 Among descriptors specified in ARIB STD-B10, copyright descriptor, country availability descriptor, NVOD reference descriptor, time shifted service descriptor, timeshifted event descriptor, parental rating descriptor, mosaic descriptor, CA identifier descriptor, partial transport stream descriptor, network identification descriptor, partial transport stream time descriptor, SI prime TS descriptor, board information descriptor, LDT linkage descriptor, connected transmission descriptor, broadcaster name descriptor, target region descriptor, CA_EMM_TS descriptor, hierarchical transmission descriptor and hyperlink descriptor should not be used.

*2 Descriptors that are not included in Table 3-6 shall be revised in relevant provision documents when a possibility of using them in the future arises.

Table 3-1: Descriptors for INT used in multimedia broadcasting

Descriptor name	Function overview
Target smart card descriptor (target_smartcard_descriptor)	Describe this descriptor when filtering receivers for storable broadcasting service by smart card ID.
Target IP address descriptor (target_IP_address_descriptor)	Describe this descriptor when filtering receivers for storable broadcasting service that uses an IPv4 address, by IP address.
Target IPv6 address descriptor (target_IPv6_address_descriptor)	Describe this descriptor when filtering receivers for storable broadcasting service that uses an IPv6 address, by IP address.
IP/MAC platform name descriptor (IP/MAC_platform_name_descriptor)	Describe the IP platform name of the storable broadcasting service.

Descriptor name	Function overview
IP/MAC platform provider name descriptor (IP/MAC_platform_provider_name_descriptor)	Describe the IP platform provider name of the storable broadcasting service.
IP/MAC stream location descriptor (IP/MAC_stream_location_descriptor)	Describe the network ID/transport stream ID/service ID/component tag that corresponds to an applicable platform ID in a stream that configures the storable broadcasting service.

Tag values (descriptor_tag) are assigned to a descriptor that conforms to the provisions defined in Section 5.3 in Part 1 of ARIB STD-B10. Table 3-8 lists the tag values, while Table 3-9 shows the tag values assigned to the descriptors used in the INT.

Table 3-9 is provided separately because these tag values are used only in the INT.

Table 3-2: Assigning the tag value of a descriptor

Tag Values	Descriptor Name
0x09	Conditional Access Descriptor
0x40	Network Name Descriptor
0x41	Service List Descriptor
0x42	Stuffing Descriptor
0x48	Service Descriptor
0x4A	Linkage Descriptor
0x4D	Short Event Descriptor
0x52	Stream Identifier Descriptor
0x58	Local Time Offset Descriptor
0x66	Data Broadcast Identifier Descriptor
0xC1	Digital Copy Control Descriptor
0xC8	Video Decode Control Descriptor
0xC9	Download Content Descriptor (Note 1)
0xCB	CA Contract Info Descriptor (Note 2)
0xCD	TS Information Descriptor
0xD7	SI Parameter Descriptor
0xD8	Broadcaster Name Descriptor
0xDD	Connected Transmission Descriptor
0xDE	Content Availability Descriptor
0xFA	Terrestrial Delivery System Descriptor
0xFB	Partial Reception Descriptor
0xFC	Emergency Information Descriptor
0xFD	Data Component Descriptor
0xFE	System Management Descriptor

Note 1: Descriptor specified in ARIB STD-B21
Note 2: Descriptors specified in ARIB STD-B25

Table 3-3: Tag values assigned to the descriptors used in the INT

Tag value	Descriptor name
0x06	Target smart card descriptor
0x09	Target IP address descriptor
0x0A	Target IPv6 address descriptor
0x0C	IP/MAC platform name descriptor
0x0D	IP/MAC platform provider name descriptor
0x13	IP/MAC stream location descriptor

3.3 Use of Identifiers

Assignment of various types of identifiers (uniqueness) is shown in Table 3-10.

Table 3-10: Use of identifiers

Identifier	Use (Uniqueness)
system_management_id	Set to 0x0A01 for multimedia broadcasting.
network_id	One network_id is assigned to the entire multimedia broadcasting network. Unique within Japan.
transport_stream_id	Assigned to TSs. In multimedia broadcasting, one transport_stream_id is used in each 13-segment broadcast and 1-segment broadcast. The id is unique to a network.
service_id(=program_number)	Assigned to each schedule channel. The id is uniquely assigned within a multimedia broadcasting network (excluding engineering service).
event_id	Assigned to each event. Unique within a service. For the uniqueness of assignment of this identifier regarding time direction, see Section 6.2.1.
broadcaster_id	In multimedia broadcasting, one broadcaster_id of a BIT is assigned per entrusted broadcaster. The id is unique to a network.
component_tag	Assigned to each ES (component). Unique within a service. For the use of component_tag, see Chapter 13.
PID	Assigned uniquely within a TS. Please note that a fixed PID value is assigned to PSI/SI other than ones in the PMT (see Table 3-4).
CA_system_id	The system ID of the conditional access system defined in multimedia broadcasting is unique in Japan.
platform_id	Uniquely assigned within a multimedia broadcasting network.

super_CA_system_id	The system ID for the conditional access system with a valid smart card, which is defined in multimedia broadcasting, is unique in Japan.
original_network_id	One original_network_id is assigned to the entire multimedia broadcasting network. The id is unique in Japan. The same value as the network_id is assigned.
data_broadcast_id	One data_broadcast_id is assigned to the entire multimedia broadcasting network. The id is unique in Japan.

Chapter 4 Use of Items Common To All Tables

4.1 Use of version_number

version_number is assigned independently to each sub-table. In other words, sections that have the same table_id and table_id_extension within a TS should be assigned the same version_number, and different version_numbers should not be assigned to ones with the same table_id and table_id_extension.

version_number is usually incremented by 1 when updated/changed. However, it is sometimes incremented by 2 or a larger number due to special circumstances such as equipment failures. Additionally, the version may be updated even though the content has not been changed due to special circumstances such as equipment failures.

4.2 Use of current_next_indicator

current_next_indicator in all the tables should be set to '1' and transmitted. A table with this value set to '0' should not be transmitted.

If a table with this value set to '0' is transmitted, this table will be invalid on the receiving end.

4.3 Use of running_status

running_status in the SDT and the EIT should be set to reserved (0x0) and transmitted.

If it is transmitted with a value other than reserved (0x0), the receiving end will regard this value as 0x0 and process it accordingly.

4.4 Use of reserved and reserved_future_use items

'1' should be set to all the bits.

The receiving end should ignore it regardless of the value in this item.

4.5 Scrambling

In multimedia broadcasting, all the tables defined in these provisions should not be scrambled.

<Blank Page>

Chapter 5 Change of SI Information

Each broadcaster can change SI information optionally as needed. However, the following points should be taken into cosideration because improper change of information that has been transmitted may confuse viewers.

- Basically, information related to recording control and viewing control in the EIT should not be changed once it has been defined because the recording function may have some trouble if the status of the receiver unit is defined between at programming and broadcasting.
- Basically, information related to recording control and reception control in the SDT should not be changed because it is used in conjunction with the EIT. When it is changed, it has to be changed so that information after change is consistent with information in the EIT.
- It should be avoided to change information that can help viewers understand the content of a program such as program title and program description as much as possible once it has been defined.

<Blank Page>

Chapter 6 Definition of Services/Events

6.1 Definition of Services and Service Types

A service is so called service channel and defined as “a series of programs that can be broadcast as part of the schedule and is organized by each broadcaster” (Section 3.1 of ARIB STD-B10).

A service is considered to have been defined when service_id is described in the service list descriptor in the NIT. Additionally, a service described in the service list descriptor in the NIT should be always described in the SDT (Engineering service excluded). Therefore, if a service that is described in the service list descriptor in the NIT and at the same time, it does not exist in the SDT, such a service can be considered being deleted or added in the transition period. Please note that such a service should be a channel selection target.

Furthermore, it is possible to transmit a program for which service is not defined in the NIT, in which case, a program that has not been defined in the NIT has been entered in the PAT. This program is not considered to be a channel selection target.

One service_type should always be assigned to each service in order to show its type. In multimedia broadcasting, the following service_types are used. In multimedia broadcasting, 0xC2 is set as the service_type value in all services except for engineering service, and the service is identified by the high-order 4 bits of a service ID (service_id).

For details about how to assign a service ID (service_id), see "Section 7.1.2 Guidelines for allocating the service IDs (service_id) of the individual services" in Vol. 7.

● Video real-time broadcasting service

This real-time broadcasting service has at least one or more video streams of which stream_type is set to "0x1B" and is mainly provided for viewing video streams.

● Audio real-time broadcasting service

This real-time broadcasting service has at least one or more audio streams of which stream_type is set to "0x0F" and is mainly provided for viewing audio streams.

● Independent data broadcasting service

This data broadcasting service has at least one or more data carousels of which stream_type is set to "0x0D" and is mainly provided for real-time viewing of data content.*

* Data carousel may not be included in some cases when the partial reception layer contains a

- Engineering service

Engineering service is defined as the software maintenance service for receiver units. More specifically, the service includes fixing bugs, solving transmission related problems, correcting problems arising from the difference in the interpretation of operation among receiver units, improving the display, accelerating response and improving operability For more information, see Vol. 1.

- Storable broadcasting service

This storable broadcasting service has at least one piece of storable broadcasting data of which the stream_type is set to "0x91" and which is sent to receivers via broadcasting waves, unlike a general broadcasting service, and which is also viewed/used after storing it. The time when the service was sent and the time when the service was used are not the same.

- EPG/ECG metadata service

This is the EPG/ECG metadata service that includes the program information on the stream_type that is set to "0x91".

6.2 Definition of Events

An event is defined as "a collection of broadcasting data streams with a preset starting and ending time within the same service and is a single program such as news and drama. It can be a feature in a program where necessary for operational reasons (from Section 3.1 of ARIB STD-B10). Since there is not a definition of a "program", what sort of event should be defined for the program content is left to the discretion of each broadcaster.

An event is considered to have been set up when event_id appears in the event loop of an EIT. In multimedia broadcasting, multiple EITs for both Commonly operated SI and individually operated SI exist, and even when one of these EITs is described, an event becomes valid.

- The basic concept on event set up is shown below.
  - During a service suspension, there is no need to set up an event.
  - While test waves are being transmitted, a component exists but an event does not have to be set up.
  - More than one event with the same time slot cannot be set up within the same service.
  - The maximum number of events in a day is 288 events/services.

---

simple movie stream with stream_type="0x1B"

- Duration time for which an event can be set up is between 48 hours and 1 minute. However, the minimum duration time can be less than 1 minute when it is inevitable. In such a case, it is desirable to organize events so that the minimum duration times are maintained as much as possible by incorporating an event of which duration time is less than one minute with previous or next events or by setting up such a period as a period in which events do not exist to enable receiving units to record programmed programs.
- In real-time broadcasting service for multimedia broadcasting, organization of events is often changed due to unexpected events and accidents (Refer to Chapter 18 “Event schedule change”). In other words, multimedia broadcasting is premised on changeable program scheduling. Changes include changes in start_time and duration of an event and an event becoming undecided. When organization of events is fixed, the decision should be reflected into the EIT promptly but organization of events could stay unconfirmed for a long period of time depending on the situation.

● When setting up an event, the following points should be taken into consideration.

Setting up an event means not only defining a channel and the time for broadcasting and assigning event_id but also setting up the “content of the program to be broadcast”. When you look at this from a viewer’s standpoint, an event is the content of a program itself that can be assumed from the program title and description. Therefore, it should be avoided as much as possible to broadcast a program with a different content with the event_id unchanged.

6.2.1 Reuse of event_id (uniqueness of time direction)

With regard to event_id described in the EIT being transmitted, the same value should not be assigned to another event within the same service. Additionally, even when an event_id value that had been assigned to an event disappears from the EIT because the event was broadcast and ended or canceled, so the description of the event disappeared, the same value should not be assigned to another event and described in the EIT within 24 hours from the event ending time that can be worked out from the start_time and duration of the event that had been described in the EIT (When the start_time and duration of a previous event was changed due to fluid organization, etc, the latest ending time among all the ending times – all the descriptions before, after and during the change) (This does not mean that it will be ok as long as events whose event_id values are the same are 24 hours or more apart from each other. In the EIT that is being transmitted, more than one event with the same event_id should not exits).

For the relationship between the event_id of an EID and the CRID of the EPG/ECG metadata, see also the "event_id" part in Table 3-74 "Correspondence between EIT and metadata (EIT body)" in Section 3.9.2 "Correspondence between EIT and metadata" in Vol. 10.

Explanation:

The same event_id value cannot be assigned to two events within the service because event_id itself is unique within the service_id. However, after an event has been broadcast, and its ending time is passed, the event_id value that was assigned to the event disappears from the EIT and after a certain period of time, the same value can be assigned to another event. However, if the same value is assigned to another event immediately after it disappeared from the EIT, it will be quite difficult to see on the receiving end whether the schedule of event was slightly changed or the event was ended. Especially, if an event to which an event_id value had been assigned was canceled and this same value is re-used after a short while, that will cause programmed programs not to be recorded properly. To prevent such cases, it was decided to make regulations.

Actual examples are shown below.

[Case 1]

Suppose that event_id = 0x0010, start_time = August 20 19:00, duration = 1 hour were assigned to Event A and described in the EIT[schedule] on August 13th. If everything goes smoothly, a program of Event A will start at 19:00 on August 20th and end 1 hour later, which is at 20:00. At this ending time, the description of Event A will disappear from both EIT[p/f] and EIT[schedule]. After the description disappears, if event_id = 0x0010 which was used for Event A is assigned to Event B, Event B will be described in the EIT after 20:00 on August 21st or later because it is prohibited to describe within 24 hours after the ending time of Event A. The point here is that it will be possible to describe Event B only after 20:00 on August 21st regardless of the start-time and duration of Event B.

[Case 2]

As in Case 1, if Event A is not broadcast and if the description of Event A disappears from the EPG/ECG metadata on August 16th, 4 days before the program starts, the scheduled end time for Event A is used as a base. Therefore, the date and time when Event B with the same event_id can be described in the EIT is after August 21st, 20:00, which is the same as Case 1.

[Case 3]

Same as Case 1, if the start_time and the duration of Event A were changed due to flexible organization, etc and change was made to the EIT, the time at which it is allowed to describe Event B whose event_id value is the same as Event A in the EIT will be worked out based on the latest ending time among all the ending times – before, after and including changes at the middle if various changes have been done. For example, if changes are made to Event A as below,

start_time = August 20th 19:00, duration = 1 hour

↓

start_time = August 20th 20:00, duration = 2 hour

↓

start_time = August 20th 20:00, duration = 1 hour

the latest ending time of the event will be"start_time = August 20th 20:00 and duration = 2hours". Actually, Event A will end at 21:00 on August 20th but it is at 22:00 on August 21st or later, which is 24hours after 22:00 on August 20th. when Event B can be described in the EIT.

<Blank Page>

Chapter 7 Transmission Model of Multimedia Broadcasting, Multimedia Broadcasting Broadcaster and IP Platform

7.1 Network Unit

Figure 7-1 shows an example of the TS configuration of a network in multimedia broadcasting.

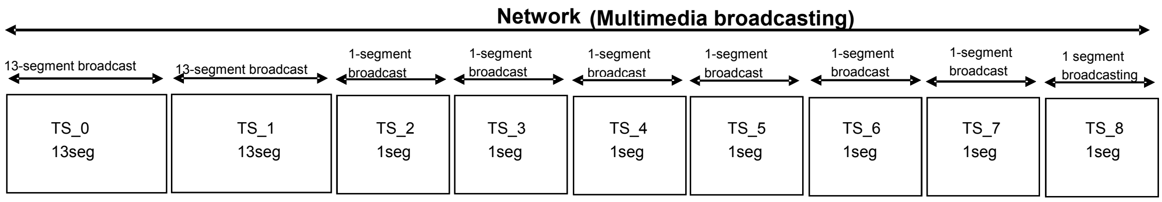


Fig. 7-1: Example of the TS configuration of a network

According to ARIB STD-B10, a network is defined for multiplexed TS in MPEG-2 specified for one distribution system. A network for multimedia broadcasting is identified by the network_id for multimedia broadcasting.

One transport stream (TS) can be transmitted in a 13-segment broadcast or a 1-segment broadcast on a network.

When focusing on one TS, an applicable TS is referred to as an "original TS", while the other TSs in the network are referred to as "other TSs". In the NIT and BIT, which will be described later in SI transmission, other TS information is included, and identical content is transmitted in all TSs.

7.2 Media Types

Like media types for digital terrestrial television broadcasting, the concept of a media type that unifies multiple services is used in multimedia broadcasting. As it is not preferable to define a group for a new service every time it is introduced, an operation group called "media type", which groups multiple services, is used.

Table 7-1 shows correspondence between media type and service and the services used in multimedia broadcasting.

Table 7-1: Correspondence between media type and service

Media type (media_type)	Corresponding service	
Meaning	service_type	Meaning
TV type	0xC2	Video real-time broadcasting service (service_id=0x8000 to 0x8FFF)
Audio type	0xC2	Audio real-time broadcasting service (service_id=0x9000 to 0x9FFF)
Data type	0xC2	Independent data broadcasting service (service_id=0xA000 to 0xBFFF)
	0xA4	Engineering service
Storage type	0xC2	Storable broadcasting service (service_id=0x2000 to 0x5FFF)
		EPG/ECG metadata service (partial reception layer) (service_id=0x0001 to 0x0FFF)
		EPG/ECG metadata service (other than the partial reception layer) (service_id=0x1000 to 0x1FFF)

Note: Each service is identified by the high-order 4-bits of a service ID (service_id). For the assignment of a service ID (service_id), see Section 7.1.2 "Guidelines for allocating the service IDs (service_id) of the individual services" in Vol. 7.

Each service must belong to a single media type. When a new service is added in the future, it corresponds to one of four media types in the table above. As the information in the table above is not transmitted as a parameter, the receivers that do not know about the service cannot receive the SI information on the newly added service. It is assumed that unknown services, including channel selection, are not accessed at all. Therefore, it is acceptable that the SI information of the applicable service cannot be received. As mentioned previously, there are four media types in multimedia broadcasting.

The receivers, which were developed after a service is added, can receive the SI of the service, because they know the media type and corresponding service. Once the corresponding service is defined, it cannot be changed.

Each media type is defined based on how a receiver presents program information or selects a channel. Therefore, when the receivers perform the processing per media

(TV/audio/data/storage-type), they can use Section 7.1.2 "Guidelines for allocating the service IDs (service_id) of the individual services" in Vol. 7.

7.3 Use of Multimedia Broadcasting Broadcasters

A multimedia broadcasting broadcaster is a broadcaster unit that is grouped based on a multimedia broadcasting network. The broadcasters belonging to a multimedia broadcasting network use the SI common to all media types (TV/audio/data/storage-type).

A multimedia broadcasting broadcaster is assigned per entrusted broadcaster and is identified by the broadcaster_id of the BIT as explained later.

In a multimedia broadcasting network, multimedia broadcasting broadcasters can use multiple TSs. Multiple multimedia broadcasting broadcasters can also be assigned to one TS.

In addition, one multimedia broadcasting broadcaster can use multiple services with different media types.

Table 7-2 shows the relationship among multimedia broadcasting broadcaster, media type, and TS.

Table 7-2: Relationship among multimedia broadcasting broadcaster, media type, and TS

<table>
<tr><th rowspan="2">Broadcaster</th><th colspan="4">media_type</th><th rowspan="2">TS</th></tr>
<tr><th>TV</th><th>Radio</th><th>Independent data</th><th>Storage type</th></tr>
<tr><td>Broadcaster_0</td><td>○</td><td>○</td><td>○</td><td>○</td><td>TS_0</td></tr>
<tr><td>Broadcaster_1</td><td>○</td><td></td><td>○</td><td>○</td><td rowspan="2">TS_1</td></tr>
<tr><td>Broadcaster_2</td><td></td><td>○</td><td></td><td>○</td></tr>
<tr><td rowspan="2">Broadcaster_3</td><td></td><td>○</td><td>○</td><td>○</td><td>TS_2</td></tr>
<tr><td></td><td>○</td><td>○</td><td>○</td><td>TS_3</td></tr>
<tr><td>Broadcaster_4</td><td></td><td>○</td><td>○</td><td>○</td><td>TS_4</td></tr>
<tr><td>Broadcaster_5</td><td></td><td>○</td><td>○</td><td>○</td><td>TS_5</td></tr>
<tr><td>Broadcaster_6</td><td></td><td></td><td>○</td><td>○</td><td>TS_6</td></tr>
<tr><td>Broadcaster_7</td><td></td><td></td><td>○</td><td>○</td><td>TS_7</td></tr>
<tr><td>Broadcaster_8</td><td></td><td></td><td>○</td><td>○</td><td>TS_8</td></tr>
</table>

Table 7-2 shows various available media types based on a multimedia broadcasting broadcaster and TS.

For instance, Broadcaster_0 is a multimedia broadcasting broadcaster that provides service including TV-type for all four types of media (TV/audio/data/storage-type), while Broadcaster_3 to 5 are the multimedia broadcasting broadcasters that provide service including radio-type for three types of media (audio/data/storage-type). The row for Broadcaster_3 indicates that one multimedia broadcasting broadcaster can use multiple TSs.

Broadcaster_6 to 8 are multimedia broadcasting broadcasters that can use only two types of media (independent data/storage-type). These broadcasters represent the multimedia broadcasting broadcasters that do not provide TV and audio services.

Broadcaster_1 to 2 indicates that multiple multimedia broadcasting broadcasters are assigned to one TS.

In multimedia broadcasting, multiple multimedia broadcasting broadcasters exist in one network.

The same parameter is used for each multimedia broadcasting broadcaster in the SI that is individually used by the broadcaster. Each broadcaster can use a series per media type in multimedia broadcasting broadcaster. When using a series, the uniqueness of the "GIT/GI/@groupId" of the EPG/ECG metadata is maintained in a multimedia broadcasting broadcaster. Therefore, if the same multimedia broadcasting broadcaster uses multiple transport streams (TSs), it can be determined that the same series is provided in different TSs.

As a multimedia broadcasting broadcaster is a broadcaster that uses service information (SI), the receivers can provide a viewer with a viewing selection function by taking into account multimedia broadcasting broadcasters. In addition, a viewing selection function, which is designed targeting an applicable multimedia broadcasting broadcaster, can be provided to viewers per media type.

Figure 7-2 is the conceptual diagram that shows the relationship between a multimedia broadcasting broadcaster and network/TS provided in Table 7-2. Figure 7-3 is the conceptual diagram that shows each media type for a multimedia broadcasting broadcaster.

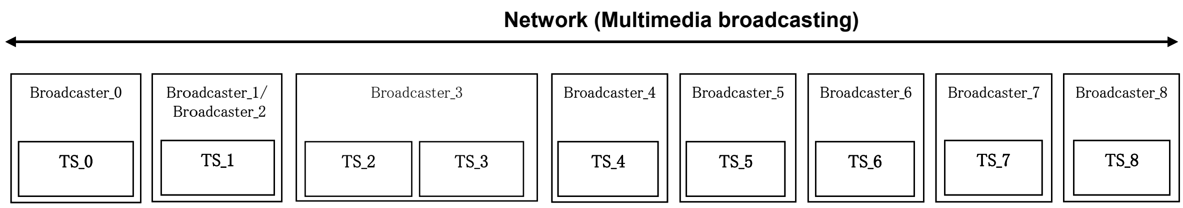


Fig. 7-2: Multimedia broadcasting broadcaster and network/TS

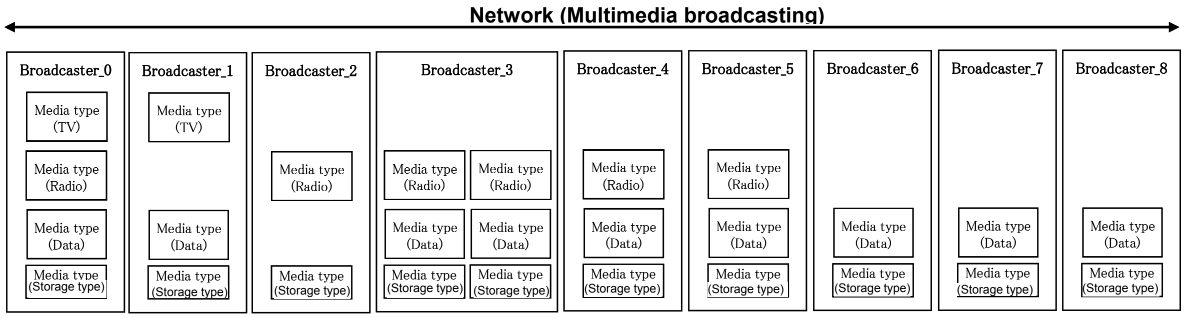


Fig. 7-3: Multimedia broadcasting broadcaster and media types

The services used by a multimedia broadcasting broadcaster are grouped per media type. Figure 7-4 shows the relationship between the services and each media type used in a multimedia broadcasting broadcaster.

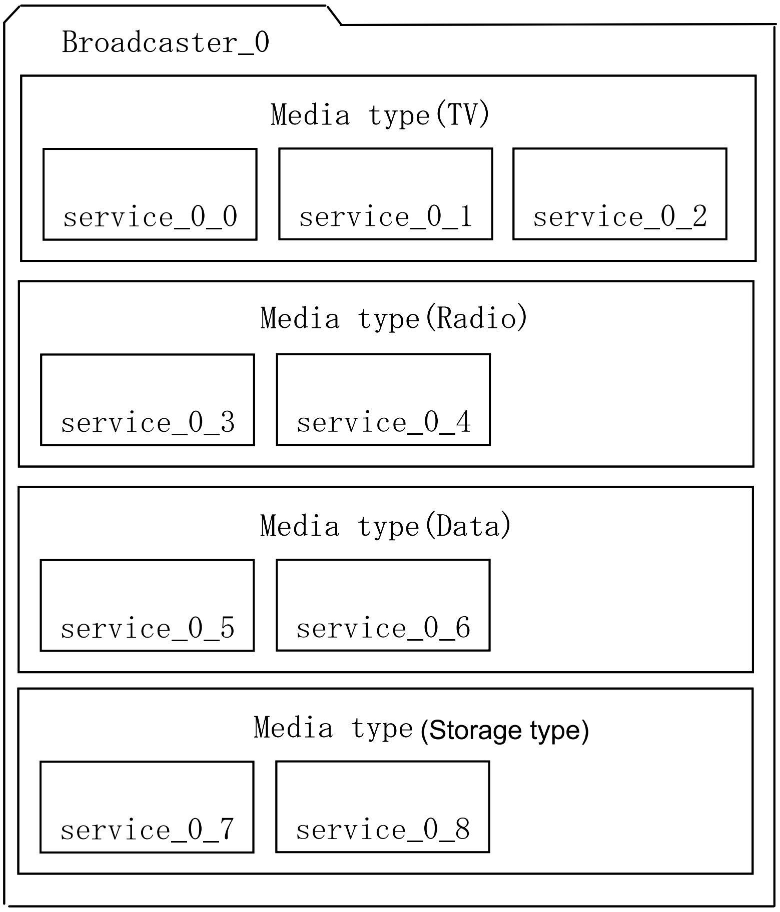


Fig. 7-4: Relationship between the service and media type used in multimedia broadcasting broadcasters

An event is set to a program in a real-time broadcasting service. An event is defined as a group of configuration elements of a broadcasting data stream that belongs to the same service and that is transmitted at specified start and end times, based on ARIB STD-B10.

Figure 7-5 shows the example of events in a real-time broadcasting service.

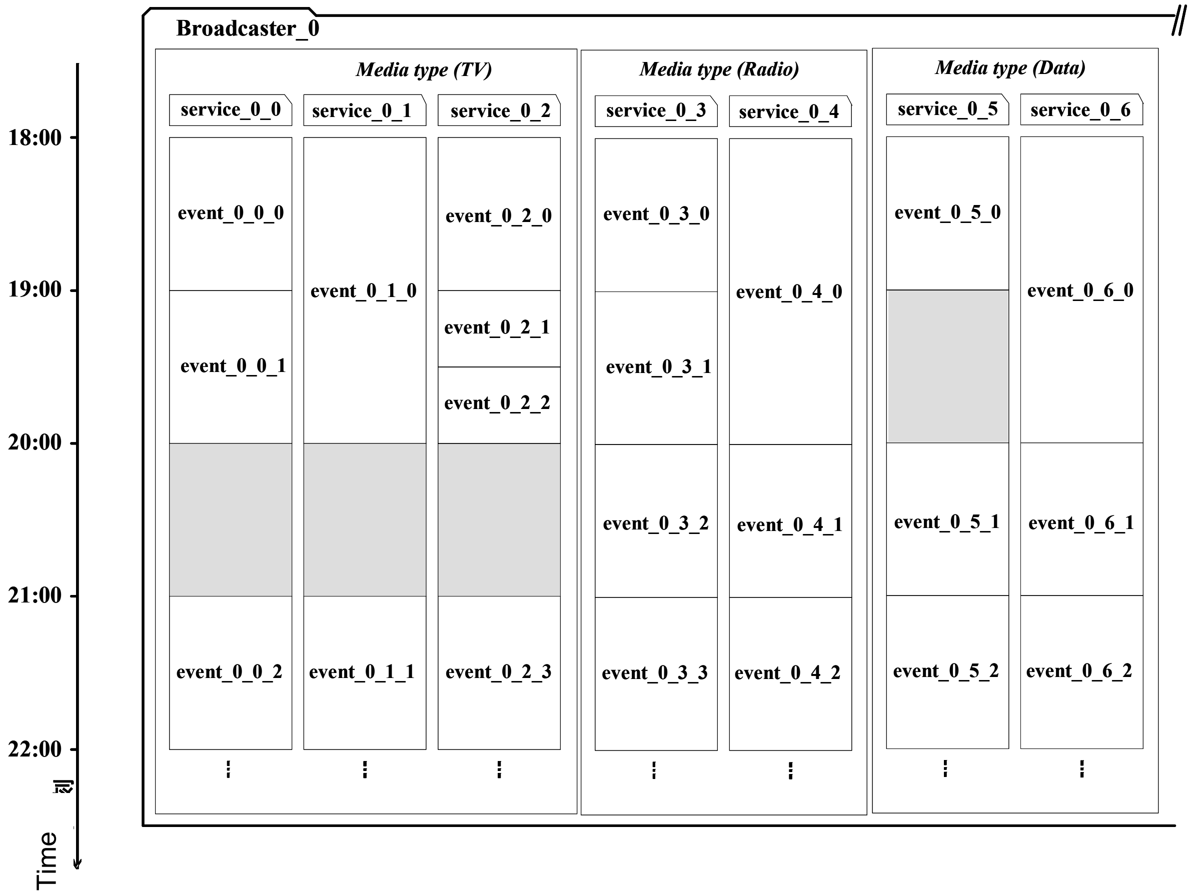


Fig. 7-5: Events in a multimedia broadcasting broadcaster

An event is identified by the event_id that is uniquely assigned in a real-time broadcasting service. An event that is being transmitted during a certain period of time is referred to as a "current event" (present event), while the event that will be sent next is referred to as the "next event" (following event). For instance, between 18:00 to 19:00 in the figure above, the current event of service_0_0 is event_0_0_0, and the next event is event_0_0_1.

According to the Attachment in ARIB STD-B10, at most one current event exists in any period of time. This means that multiple events are not used in the same period of time in one service.

A current or next event may not exist in a real-time broadcasting service. For instance, during 20: 00 to 21: 00 in the figure above, the current event of service_0_0 does not exist, and the next event is event_0_0_2.

If an event exists in a different service depending on the time in the single-media type real-time broadcasting service that is provided by a multimedia broadcasting broadcaster as shown in Fig. 7-5, the receivers can provide information and a channel selection function per multimedia broadcasting broadcaster.

For the services and programs (content) in a storable broadcasting service, see Section 2.1.1.1 "Transmission of Content" in Vol. 11 and Section 2.1.1.2 "Contents Delivery Schedule" in Vol. 11.

Service areas in multimedia broadcasting are used (SFN usage) in one network in Japan.

7.4 Use of IP Platform

An IP platform in multimedia broadcasting is a unit that manages the conditional access system and the IP address mask of a receiver that provides services when offering a storable broadcasting service or an EPG/ECG metadata service. An IP platform is identified by the platform_id described in a link descriptor in the NIT. A platform_id must be unique to a network.

In multimedia broadcasting, multiple platforms exist in one network.

In a multimedia broadcasting network, multiple services can be used on one IP platform. However, one service cannot be assigned to multiple IP platforms.

This is because one PID is assigned to one service in a storable broadcasting service or EPG/ECG metadata service in multimedia broadcasting (see Section 2.1.1.1 "Transmission of Content" in Vol. 11).

The overview of the services and IP platforms is shown in Fig. 7-6 "Services and IP platforms".

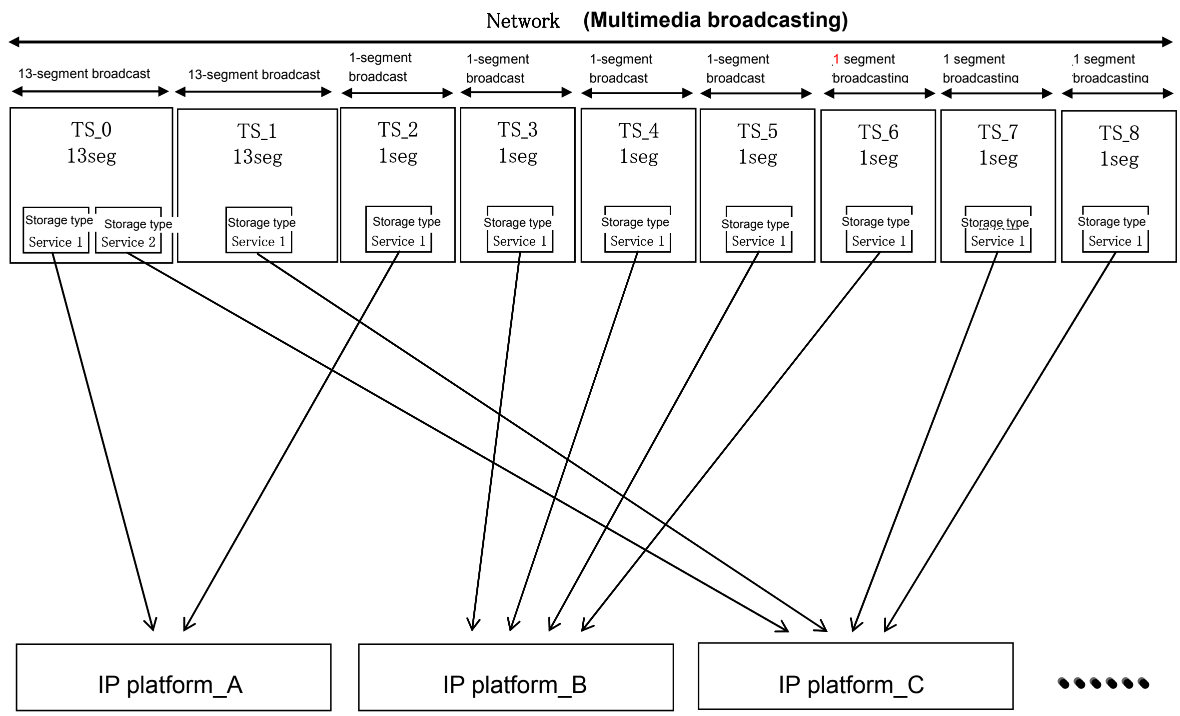


Fig. 7-6: Service and IP platforms

<Blank Page>

Chapter 8 Commonly Operated SI and Individually Operated SI

8.1 Overview of Commonly Operated SI and Individually Operated SI

In multimedia broadcasting, in order to effectively use a limited broadcast band, it is necessary to limit the SI information to be used and to take into account the proper distribution ratio for each component in a service.

To realize this, the "commonly operated SI" part that is transmitted by common operation and the "individually operated SI" part that allows each broadcaster to uniquely operate are provided to transmit the SI information that is appropriate for the service.

[Commonly operated SI]

All broadcasting companies should give consideration to stable operation of receiver units when processing information and convenience of viewers, and transmit minimum information required to be transmitted as SI in operation which is common to all broadcasting companies. This SI is defined as “commonly operated SI”.

Common operation is performed for the following items regarding programs transmitted as commonly operated SI.

- Tables, delivering level of descriptors (See Sections 8.2 and 8.3)
- Range of each Repetition Rate Group, repetition rate of each repetition rate group (See sections 10.3 and 10.4)
- Data amount

  Although there is no provision to follow regarding data amount, estimated values for data amount assumed to be stored in a receiver unit is shown in Annex 2. When SI information processing is expected to be stored in a receiver unit, the amount of data that a receiver unit is capable of storing should not exceed much these values.

As a rule, broadcasters that use multimedia broadcasting transmit the commonly operated SI after confirming the information on a target program.

Generally, all broadcasters transmit the commonly operated SI. Potential difficulty when transmitting the SI is not taken into account due to a facility maintenance issue when each broadcaster starts using multimedia broadcasting.

[Individually operated SI]

As there is a limit to the amount of data in service information transmitted in commonly operated SI, the description should be kept to minimum. On the other hand, broadcasting companies can transmit information which exceeds the defined range of commonly operated SI regarding services they provide, in SI within the operational band in operation unique to individual broadcaster. This SI is defined as individually operated SI.

In an individually operated SI, the EIT[p/f after] for the stream can be described. EIT[other] is not transmitted in multimedia broadcasting.

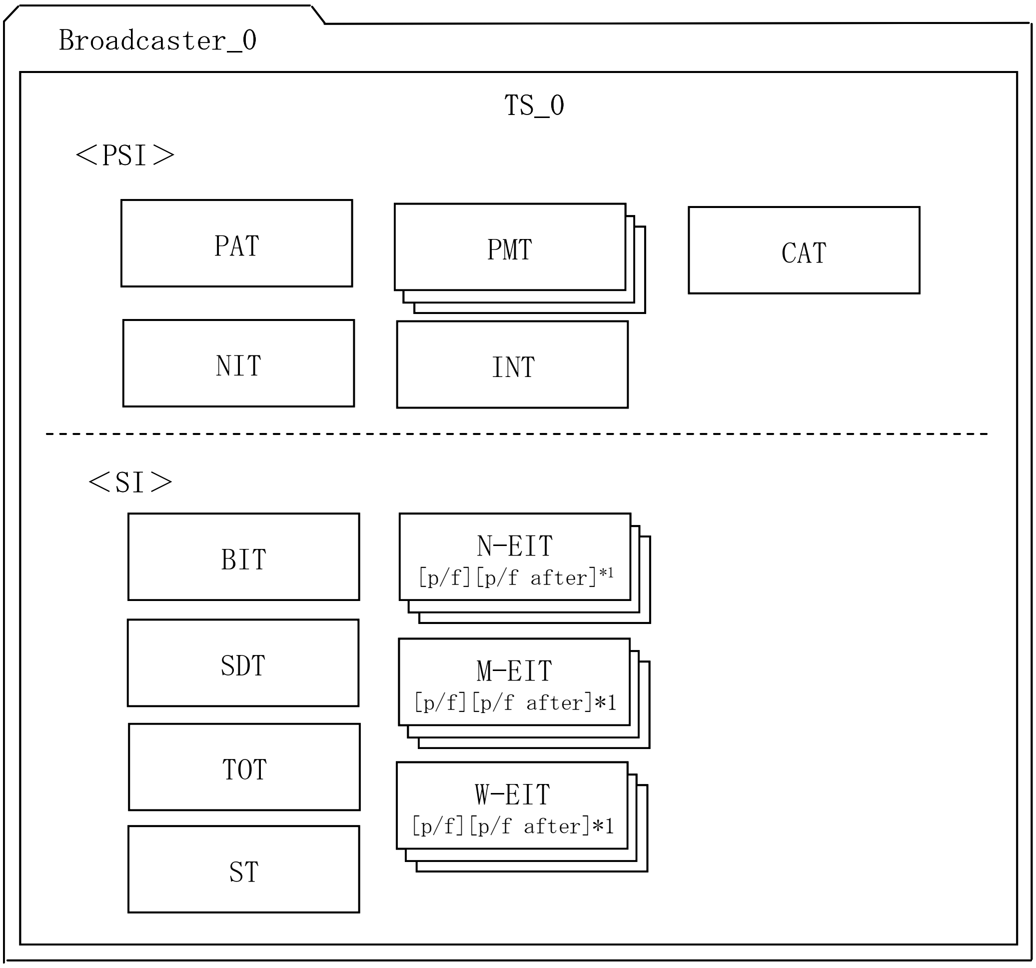
The Types and amount of individually operated SI transmitted by each broadcaster can be operated freely within the defined range. However, if the same broadcaster frequently changes such information to be transmitted as the broadcasting situation changes, that will affect the stable operation of receiver units as well as confuse viewers. Therefore, it is essential for each broadcaster to stably operate individually operated SI.

It is assumed that the types and amount of information transmitted between broadcasting companies will be different. Additionally, broadcasting companies can transmit TSs at diffident SI Table transmission cycles, and therefore, it is assumed that each TS may have different transmission cycles. Information described differently depending on received TS and service and different transmission transmission cycles, similarly to the above, may affect stable operation of receiver units and convenience of viewers. It is required to make efforts to enable receiver units to smoothly provide the above information as well as the transmitting end to operate individually operated SI stably.

8.2 Tables and Descriptors Used in PSI and Commonly Operated SI

The tables used in PSI and common operations SI are shown in Fig. 8-1.

In Fig. 8-1, some EIT[p/f] and EIT[p/f after] are used as a commonly operated SI.



*1: The p/f after of N-EIT/M-EIT/W-EIT is transmitted when the number of events transmitted as a commonly operated SI is greater than 2.

Fig. 8-1: Tables Used in PSI and commonly operated SI

The tables transmitted in PSI and commonly operated SI are shown in Table 8-1. Also, the descriptors placed in tables that are transmitted in PSI and commonly operated SI are shown in Table 8-2.

- Tables transmitted in commonly operated SI are NIT, BIT, TOT, SDT and EIT.
- As one NIT is described for a network in multimedia broadcasting, the same NIT is transmitted in each TS.
- In BIT, the information on a multimedia broadcasting broadcaster is described, and also, all the information on all multimedia broadcasting broadcasters in a multimedia broadcasting network is collectively described. Therefore, the same BIT is transmitted in each TS.
- The TOT is the table in which time information is described and transmitted in each TS.
- In SDT, the services used in multimedia broadcasting are described. Only one SDT is

transmitted in the sub-table of an original TS. A table/sub-table of other TS is not transmitted in multimedia broadcasting.

- The EIT is the table described regarding an event included in a service provided in multimedia broadcasting and a sub-table of a service of actual TS is transmitted for the number of times the service is applied. Similarly to the SDT, other networks, table of other TS services and sub-tables are not transmmitted.
- INT is described when transmitting storable broadcasting services in multimedia broadcasting. An INT for the IP platform used in the TS is transmitted. When multiple INTs are used in an original TS, all the INTs are transmitted.

Three different types of EIT (N-EIT/M-EIT/W-EIT) with a PID are used in each layered transmission in a table that is set to 0x4E. The data amount is the same among the three types of EITs.

In the N-EIT, M-EIT, and W-EIT, if the number of events that are transmitted as the commonly operated SI is greater than 2, the EIT[p/f after], in which the information about the events after the next event is described, is transmitted. The EIT[p/f after] is the part that belongs to the same table as the EIT[p/f] and is described after Section 2. The EIT[p/f after] has the same PID and same table_id.

(For details, see "Chapter 12 EIT Transmission".)

Table 8-1: Tables transmitted in PSI and commonly operated SI

Table_id	Table	Delivering level
0x00	PAT	Always
0x01	CAT	As needed
0x02	PMT	Always
0x40	NIT	Always
0x42	SDT	Always
0x4C	INT	As needed
0xC4	BIT	Always
0x4E	N-EIT[p/f], M-EIT[p/f] , W-EIT[p/f]	Always
0x4E	N-EIT[p/f after], M-EIT[p/f after] , W-EIT[p/f after]	As needed(Note 1)
0x73	TOT	Always
0x72	ST	As needed

Delivering level: Always... Always transmitted
As needed... Transmitted as needed

Note 1: The EIT[p/f after] is transmitted when the number of events transmitted as Commonly operated SI is greater than 2. The number of events transmitted as Commonly operated SI is specified with a parameter described with the SI parameter descriptor in the first loop of the BIT (All-station applied transmission parameter).

Table 8-2: Descriptors placed in Tables Which are transmitted in PSI and commonly operated SI

Table_id	Table	Descriptor	Delivering level
0x01	CAT	Conditional Access Descriptor	A(Note2)
0x02	PMT (First loop)	Conditional Access Descriptor	N(Note2)
		Digital Copy Control Descriptor	N
		Emergency Information Descriptor	N
		Content Availability Descriptor	N
		Data Broadcast Identifier Descriptor	N
	PMT (Second loop)	Conditional Access Descriptor	N(Note2)
		Stream Identifier Descriptor	A
		Digital Copy Control Descriptor	N
		Video Decode Control Descriptor	N(Note1)
		Data Component Descriptor	N
0x40	NIT (First loop)	Network Name Descriptor	A
		System Management Descriptor	A
		Link Descriptor	N
	NIT (Second loop)	Service List Descriptor	A
		Terrestrial Delivery System Descriptor	A
		TS Information Descriptor	A
		Partial Reception Descriptor	N
		Connected Transmission Descriptor	N(Note3)
0x42	SDT	Service Descriptor	A
		Digital Copy Control Descriptor	N
		CA Contract Info Descriptor	N(Note2)
0x4C	INT	Target Smart Card Descriptor	N
		Target IP Address Descriptor	N
		Target IPv6 Address Descriptor	N
		IP/MAC Platform Name Descriptor	A
		IP/MAC Platform Provider Name Descriptor	A
		IP/MAC Stream Location Descriptor	A
0xC4	BIT (First loop)	SI Parameter Descriptor	A(Note2)
	BIT (Second loop)	Broadcaster Name Descriptor	A
		Service List Descriptor	A
		SI Parameter Descriptor	N(Note2)
0x4E	N-EIT[p/f] N-EIT[p/f after]	Short Event Descriptor	A
	M-EIT[p/f] M -EIT[p/f after]	Short Event Descriptor	A
	W-EIT[p/f] W-EIT[p/f after]	Short Event Descriptor	A
0x73	TOT	Local Time Offset Descriptor	N

Delivering level: A… Always placed
N… Placed as needed

Note1: May be not placed depending on media type.
In addition, not placed for a service in the partial reception layer
Note 2: More than one can be placed in the same loop.
* Stuffing descriptors are placed as needed.
Note 3: Mandatory when performing connected transmission.

8.3 Tables and Descriptors used in Individually Operated SI

The overview of the tables used in individually operated SI is shown in Fig. 8-2.

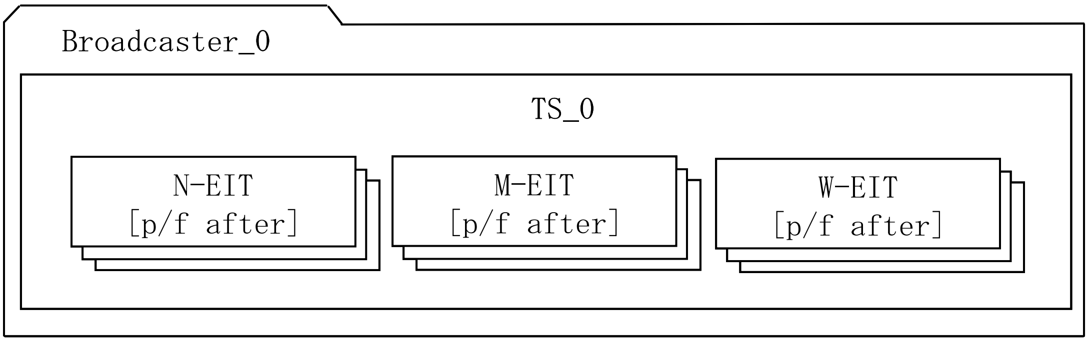


Fig. 8-2: Tables used in individually operated SI

The SI that is transmitted with the individually operated SI is the EIT[p/f after] information of a maximum of 10 programs from the program following a description target program in the commonly operated SI.

The individually operated SI must be described so as not to differ from the content in the commonly operated SI.

The tables transmitted in individually operated SI and delivering levels are shown in Table 8-3. Furthermore, the descriptors placed in the tables transmitted in individually operated SI are shown in Table 8-4.

Table 8-3: Tables transmitted in individually operated SI

Table_id	Table	Delivering level
0x4E	N-EIT[p/f after], M-EIT[p/f after] , W-EIT[p/f after]	N(Note1)

Delivering level: A… Always placed
N… Placed as needed

Note 1: The description range is specified by the parameter (each-station applied transmission parameter) described in the SI parameter descriptor in the second loop of the BIT.

Table 8-4: Descriptors placed in tables transmitted in individually operated SI

Table_id	Table	Descriptor	Delivering level
0x4E	N-EIT[p/f after]	Short Event Descriptor	A
	M-EIT[p/f after]	Short Event Descriptor	A
	W-EIT[p/f after]	Short Event Descriptor	A

Delivering level: A… Always placed
N… Placed as needed

8.4 All-station/Each-Station Applied Transmission Parameter

As for the parameter for the commonly operated SI, a value that is common to multimedia broadcasting is described in the first loop of the BIT. This is referred to as the "all-station applied transmission parameter part."

On the other hand, each broadcaster can uniquely use the individually operated SI. The parameter is described in the second loop of the BIT. This is referred to as the "each-station applied transmission parameter."

The relations between commonly operated SI/individually operated SI and All-station applied transmission parameter/each station are shown in Fig. 8-3. The relations between each part in Fig. 8-3 and SI tables are shown in Fig. 8-4.

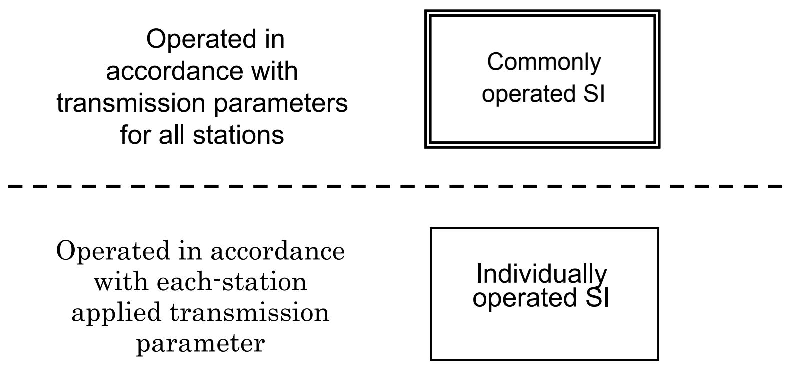
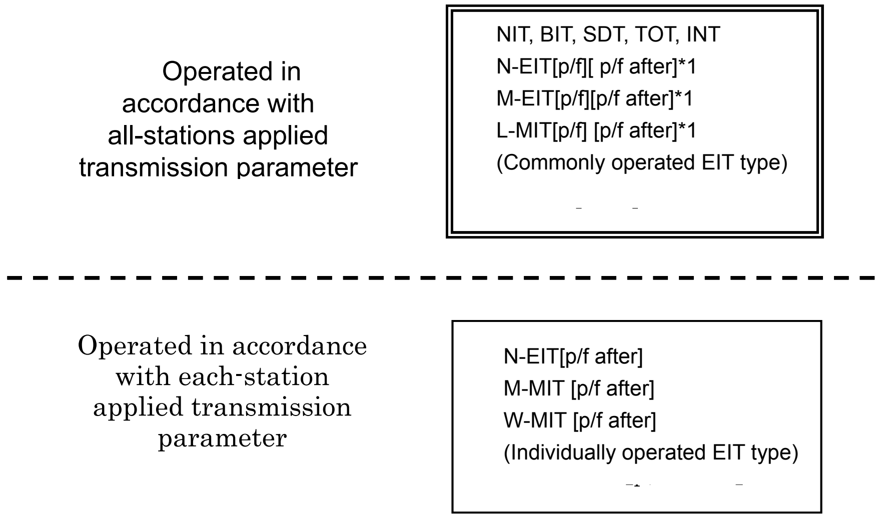


Fig. 8-3: Relations between commonly operated SI/individually operated SI and all-station applied transmission parameter/each-station



Note 1: The “p/f after” of the N-EIT/M-EIT/W-EIT is transmitted when the number of events that is transmitted as the commonly operated SI is greater than 2.

Fig. 8-4: Relations between tables transmitted in commonly operated SI/Individually operated SI and all-station applied transmission parameter/each station

(Reference) Differences between all-station SI and each-station SI in BS digital broadcasting

In BS digital broadcasting, SI information of own and other stations is shared via collection/distribution centers and information on all services including ones of other stations is transmitted as all-station SI in order to enable receiver units to obtain SI on all services without interfering with reception of programs by viewers.

It is also desirable to use SI for all stations including other stations in multimedia broadcasting. However, as the bandwidth per TS is small, it is difficult to ensure the bandwidth for transmitting EIT information other than the EIT[p/f] and EIT[p/f after]. Therefore, the NIT and BIT are transmitted as SI for all services, including SI for all stations with other stations; however, the SDT and EIT are transmitted as SI for individual station service.

- Only N-EIT[p/f]/N-EIT[p/f after]/M-EIT[p/f]/M-EIT[p/f after]/W-EIT[p/f]/W-EIT[p/f after] is used as EIT. The information on other programs is transmitted as EPG/ECG metadata.

It is desirable to present the program guide of all stations in multimedia broadcasting. Therefore, the receivers need to collect the program information, which is transmitted in the TSs of all broadcasters whose transmissions can be received, using EPG/ECG metadata, and to store such so that the program guide of all stations can be presented.

Chapter 9 TS-Packetization and Transmission Rules

This chapter describes the rules to be followed when sections in PSI and SI are TS-packetized and transmitted.

9.1 Detailed Rules for Placement of Sections in TS Packets

Sections should be inserted directly into a transport stream packet. Because the start of the first section in the payload in a transport stream packet is specified in a pointer field, a section does not have to begin from the start of the payload in the transport stream packet. The standard does not allow having spaces between sections in a transport stream packet; thus, the start of a section can be specified by counting the lengths of the first and subsequent sections. Therefore, only one pointer field is allowed in a transport stream packet.

In a transport stream packet with a single PID value, a section should start after the previous section ends. Otherwise, the section header to which the data belongs cannot be identified. If a section ends before a transport stream packet does and it is not convenient to start another section, the stuffing function is used to fill the space.

Stuffing is performed by filling the remaining bytes in a transport stream packet with "0xFF". Therefore, the "0xFF" value should not be used for table identification. If a byte that is immediately after the last byte in a section is "0xFF", the remaining bytes in the transport stream packet should be filled with "0xFF". These bytes can be discarded in the decoder. Stuffing can be also performed using the adaptation filed function.

For the detailed method and function, see ISO/IEC 13818-1, especially Section 2.4.4 and Annex C.

The above was quoted from 5.1.2 of Part 2 of ARIB STD-B10. The above rules should be applied also in multimedia broadcasting. Furthermore, the following rules should be followed.

[Transmission Operating Rule]

A section header should not be described across multiple TS packets.
A section header is the first 8 bytes in a section defined by the MPEG2 Extended Section Format but an SI section has a section header that is extended uniquely for each table. A section can be placed immediately after the last byte in the previous section in a TS packet, but it is not allowed to describe a section across multiple TS packets including extended section header.

The following table shows section header lengths of PSI/SI tables.

Table 9-1: Section header lengths (bytes) of PSI/SI tables

PAT	PMT	CAT	NIT	BIT	SDT	EIT*	SDTT	TOT	INT
8	8	8	8	8	11	14	15	10	8

*This includes the H-EIT, M-EIT and L-EIT.

For example, when an EIT sections is placed in a TS packet and there are less than 14 bytes remained in the TS packet, another section should not be placed and stuffing should be performed for this 14byte remaining area.

9.1.1 Multisection transmission

There are times when more than one section is inserted in a single packet. This transmission style is called “Multisection Transmission”. Multisection transmission itself is a transmission method defined in the MPEG system standard, as it is clear from a method to identify the start of another section is described in the above packetization rules. However, it should be clearly described as special processing maybe needed in receiver units.

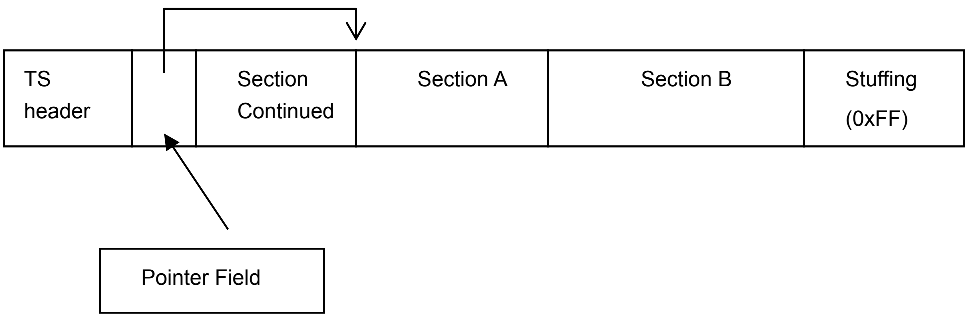


Fig. 9-1: Example of placement of sections in a TS packet at multisection transmission

Based on the above, the following rules should be followed.

[Transmission Operating Rule]

- Tables that can be transmitted in the multisection transmission method are the PMT, NIT, BIT, SDT, EIT, SDTT, TOT and INT. Please note that the PAT and CAT cannot be transmitted in the multisection transmission method because their sub-tables do not have multiple sections.
- Even at multisection transmission, the general rules for paketization described above should be followed. Such rules include “A pointer filed specifies the first section header in

a TS packet", "No space should exist between the end of a section and the start of the next section" and "A section header should not be described across multiple TSs". Additionally, stuffing may be performed for the ending as needed.

- The maximum number of sections that can be inserted in a single TS packet at multisection transmission is 10 (please note that in the PMT, the maximum number of programs to which the same PID can be assigned is 4 (see Section 30.1.1), thus, the maximum number of sections that can be inserted in a single TS packet is 4).
- Multisection transmission can be performed for each repetition rate group optionally. For details of repetition rate groups, see Section 10.3.
- Multisectionization cannot be done across multiple repetition rate groups.
- Sections in the same sub-table can be placed consecutively up to 4 KB in a TS packet. For instance, the present and following information in the EIT[p/f] can be transmitted by connecting them by segment unit. When transmitting in such a way, in multimedia broadcasting, sections in the same sub-table are not transmitted at intervals of 25 ms or more. For details of the transmission rules that were established for the purpose of stable reception processing by receiver units, see Section 9.2.

9.2 Details of TS Packet Transmission

To enable stable reception of data in sections in PSI/SI, TS packets are transmitted in accordance with the following transmission rules.

[Transmission Operating Rule]

(1) When sections are carried, the maximum number of TS packets that can be transmitted uninterruptedly with the same PID is 6. This is a rule that should be applied when all TS packets in a transport stream, including video and audio, are multiplexed, and is valid regardless of the bandwidth of a transport stream.

(2) A TS packet that carries all SI sections should be transmitted at 1 Mbit or less per any one second, which is a total value of SI in each table that exists in all the transmission layers in the same transport stream. To be more specific, SI sections here mean the NIT, BIT, SDT, EIT, TOT, SDTT, ST and INT.

(3) A TS packet with the same PID that carries PSI sections should be transmitted at 320kbit or less per any one second.

(4) When sections are carried, a TS packet with the same PID is transmitted within the range of 4KB±100% per 32ms. This rule of "4KB per 32ms" was established to define furthermore the "1Mbit per 1 second" for each PID. This rule presents a section reception model based on this standard. In other words, a 4KB reception buffer per PID and the processing speed that enables processing a maximum of 4KB section data that was received within 32ms are required. Additionally, "4KB±100%" means that up to 8KB can be transmitted (when considering that the above rule (2) is guaranteed to be followed at the same time, it is obvious this "transmission of up to 8KB" is only a temporarily possibility). More than one piece of PSI and SI data is usually required to be received and processed at the same time, but taking into consideration the reception model shown above will enable setup of reception according to the capability of each receiver unit.

In multimedia broadcasting, the delivering standard regarding TS packets that carry PSI/SI tables includes only 4 rules described above. Receiver units should be designed so that they will have no failures (at least, when processing reception at the TS packet level) as long as TS packets are transmitted according to these 4 rules.

9.3 Continuity Counter

The Continuity Counter is usually incremented by 1 but not during system failures, in which case, the counter is incremented irregularly, although it rarely happens. Receiver units should be deigned assuming such a situation.

Chapter 10 Table (Section) Transmission

This chapter describes transmission of tables (sections) in details.

In Sections 10.1 and 10.2, general rules for section structures are explained and in Section 10.3 and later, the rules for transmission at the table (section) level are described in details focusing on the concept of cycles.

10.1 Division of Sections

When an SI section is divided, the following rules should be applied.

[Transmission Operating Rule]

- Sections within a sub-table is placed in order starting from section number 0 and all sections till the section with the last section number should exist. Please note that the section length of each section within sub-tables is variable.
- Sub-tables of the PAT, PMT and CAT are not divided into multiple sections. In other words, 0 is always set to section_number field and last_section_number field. Additionally, sub-tables of the NIT and BIT can be divided into multiple sections but only section whose section_number is set to 0 contains the first descriptor loop and other sections are divided with 0 assigned as the descriptor loop length.
- When a table includes a loop such as descriptor loop, a section is not divided in the middle of a loop. For example, in the EIT, a section can be divided between loops that includes event_id field.

10.2 Placement of Descriptors in Sections

When descriptors are placed in PSI/SI sections, the following rules are applied.

Basically, the order of placement of descriptors within a descriptor loop can be determined optionally. However, in the following cases, the placement rules are applied.

[Transmission Operating Rule]

- When the same descriptor is placed more than once, they should be placed uninterruptedly.
- Stream identifier descriptor placed in the PMT should be placed at the start of a descriptor loop.

10.3 Definition of a Repetition Rate Group and Re-Transmission Cycle

A repetition rate group is a collection of information transmitted at the same repetition rate within each PSI/SI table. Normally, a repetition rate group is set individually per PID value and table_id value; however, the repetition rate group is used in a special way only in the EIT. For the concept of repetition rate group setup regarding the EITs, see the decription in Section 12.12.

Repetition rate can be setup for each repetition rate group (excluding the PMT: See Section 10.3.1), and multisectionizaion is also done for each repetition rate group (for the relation between multsectionization units and repetition rate groups, see Section 9.1.1).

Repetition rate defined for each repetition rate group are for each whole repetition rate group. On the other hand, a cycle at which individual section is re-transmitted does not exactly consistent with the re-transmission cycle for the whole repetition rate group. See the description in Section 10.6 for details.

A re-transmission cycle for a repetition rate group can be changed as service structures change. However, Repetition rate for the PSI tables (PAT, PMT, CAT, NIT, INT) are not changed. See the description in Section 10.4 for details.

When the amount of data changes, some adjustments may be made to Repetition rate (only when it is unavoidable). See the description in Section 10.5 for details.

Please note that in reception processing, adjustments to Repetition rate are different from changes to Repetition rate.

In the following sections, operation of repetition rate groups in multimedia broadcasting is described.

10.3.1 PSI repetition rate group

With regard to the PSI tables, repetition rate groups are setup for each PID value and table_id. The cycle of the PMT (service excluding engineering service) is not determined based on the repetition rate group and can be set only using the following two method types: partial reception service and PMT for a 1-segment broadcast.

10.3.2 Repetition rate groups of all-station appliedtransmission parameter

The repetition rate groups of All-station applied transmission parameter and the meaning of each parameter (transmission range) are shown in Tables10-1 and 10-2 respectively.

Table 10-1: Repetition rate groups of all-station applied transmission parameter

Repetition Rate Group Unit	Parameter (Transmission range)
NIT	-
BIT	-
SDT	-
N-EIT[p/f]、N-EIT[p/f after]	EN1 (Program)
M-EIT[p/f]、M-EIT[p/f after]	EM1 (Program)
W-EIT[p/f]、W-EIT[p/f after]	EW1 (Program)
TOT	-

Note: For the definition of repetition rate groups in the EITs, see Section 12.12.

Table10-2: Meaning of each parameter (transmission range) of repetition rate groups of all-station applied transmission parameter

Parameter	Meaning
EN1	Represents the number of programs transmitted (starting from the present event) in the "All-station applied transmission parameter" part in the N-EIT.
EM1	Represents the number of programs transmitted (starting from the present event) in the "All-station applied transmission parameter" part in the M-EIT.
EW1	Represents the number of programs transmitted (starting from the present event) in the "All-station applied transmission parameter" part in the W-EIT.

10.3.3 Repetition rate groups of each-station applied transmission parameter

The repetition rate groups of each-station applied transmission parameter and the meaning of each parameter (transmission range) are shown in Tables10-3 and 10-4 respectively.

Table 10-3: Repetition rate groups of each-station applied transmission parameter

Repetition Rate Group Unit	Parameter (Transmission range)
N-EIT[p/f after]	EN2 (Program)
M-EIT[p/f after]	EM2 (Program)
W-EIT[p/f after]	EW2 (Program)
SDTT	-

Table 10-4: Meaning of each parameter (transmission range) of repetition rate groups of each-station applied transmission parameter

Parameter	Meaning
EN2	Represents the number of programs transmitted (starting from the present event) in the "Each-station applied transmission parameter" part in the N-EIT.
EM2	Represents the number of programs transmitted (starting from the present event) in the "Each-station applied transmission parameter" part in the M-EIT.
EW2	Represents the number of programs transmitted (starting from the present event) in the "Each-station applied transmission parameter" part in the W-EIT.

10.4 Change of Cycles and Default Repetiton Rate

Repetition rate for each repetition rate group and spans of all-station applied transmission parameter may be reviewed in the future. In addition, each-station applied transmission parameter can be changed for each terrestrial broadcaster according to their own transmission band (very rarely). Assuming such a case, a re-transmission cycle for each repetition rate group is currently transmitted in the form of SI data (SI parameter descriptor in the BIT).

In the sections below, ranges of cycle changes in each repetition rate group for PSI/SI and default re-transmission cycle values are described. A range of cycle change is assigned to each repetition rate group, and transmission within this range for each repetition rate group is mandatory and will be in the future. Additionally, a default re-transmission cycle is a re-transmission cycle established as of now assuming the initial stage of multimedia broadcasting in parameters for all stations.

Furthermore, transmission parameters for the SDTT are specified as each-station applied transmission parameter in order to show whether the table is transmitted or not (if it is, "table_id" of the SDTT should be described in the SI parameter descriptor in the second loop of BIT), and a value common for all broadcasting companies should be specified for a re-transmission cycle when transmitted. For Repetition rate of the SDTT, see Vol.1 of this document.

10.4.1 Repetition rate of PSI

Repetition rate of PSI should not be changed. Table 10-5 shows Repetition rate of each PSI table.

Table 10-5: Repetition rate of PSI

Table Type	Repetition rate
PAT	100ms
PAT (1-segment broadcast service)	200ms *2
PMT (services transmitted other than in the partial reception layer)	100ms *1
PMT (services transmitted other than in the partial reception layer)	200ms *2
PMT (1-segment broadcast service)	200ms *2
CAT	10s
INT	30s

*1) Please note that up to 1 second can be set up for a re-transmission cycle of PMT for engineering services

*2) Up to 500ms can be setup.

10.4.2 Ranges of transmission cycle change and default cycles of all-station applied transmission parameter

The ranges of cycle change and default cycles for each repetition rate group of All-station applied transmission parameter are shown in Table 10-6 and the parameters that show the ranges of repetition rate groups of All-station applied transmission parameter are shown in Table 10-7.

Table 10-6: Ranges of cycle change and default cycles for each repetition rate group of all-station applied transmission parameter

Repetition rate group	Parameter	Cycle change range		Default cycle (sec)
		Min (sec)	Max (sec)	
NIT	-	1	3	1
BIT	-	1	3	1
SDT	-	1	3	2
N-EIT[p/f], N-EIT[p/f after]	EN1	1	3	1
M-EIT[p/f], M-EIT[p/f after]	EM1	1	3	1
W-EIT[p/f], W-EIT[p/f after]	EW1	1	3	1
TOT	-	5	5	5

Table 10-7: Parameters that show the ranges of repetition rate groups of all-station applied transmission parameter

Parameter	Parameter change range		Default
	Min	Max	
EN1	2 programs	10 programs	2 programs
EM1	2 programs	10 programs	2 programs
EW1	2 programs	10 programs	2 programs

10.4.3 Ranges of transmission cycle change and reference cycles of each-station applied transmission parameter

The ranges of cycle change and reference cycles for each repetition rate group of Each-station applied transmission parameter are shown in Table 10-8 and the parameters that show the ranges of repetition rate groups of Each-station applied transmission parameter are shown in Table 10-9.

Table 10-8: Ranges of cycle change and reference cycles for each repetition rate group of each-station applied transmission parameter

Repetition rate group	Parameter	Cycle change range		Repetitio n rate group
		Min (sec)	Max (sec)	
N-EIT[p/f after]	EN2	1	10	3
M-EIT[p/f after]	EM2	1	10	3
W-EIT[p/f after]	EW2	1	10	3
SDTT	-	180	180	180

Table 10-9: Parameters that show the ranges of repetition rate groups of each-station applied transmission parameter

Parameter	Parameter change range		Reference value
	Minimum	Maximum	
EN2	3 programs	10 programs	5 programs
EM2	3 programs	10 programs	5 programs
EW2	3 programs	10 programs	5 programs

10.5 Cycle Adjustment

Each PSI/SI table is usually transmitted according to the re-transmission cycle defined for each repetition rate group. However, to deal with changes in data amounts at different times, Repetition rate may be slightly adjusted (usually, data amounts are minutely defined when making SI data in order to prevent changes in data amount at different times as much as possible, but there are times when adjustment has to be made due to differences in data amount for each EIT[p/f] event or when event schedule is changed).

Below is the description regarding the range of re-transmission cycle adjustment in such a case. Receiver units should be designed with consideration to the following rules for transmission and operation so that there will be no problems during the reception process.

[Transmission Operating Rule]

- With regard to PSI/SI tables, the range of cycle adjustment should be ±30% of the re-transmission cycle defined for each repetition rate group. For example, in case of EIT[p/f], if the re-transmission cycle is defined as 1 second, it can be changed, if needed, between 0.7 second and 1.3 seconds due to the amount of transmitted data, etc.
- Adjustment of a cycle should be made for each repetition rate group. For more information, see the decryption in Section 10.7.

10.6 Transmission Cycle for Each Section

A re-transmission cycle defined for each repetition rate group is for a large scope (for each repetition rate group) and does not define a transmission cycle of each section within a repetition rate group. A transmission interval of the same section can be significantly different due to transmission swing within a repetition rate group (for details on SI transmission within a repetition rate group, see the description in Section 10.7) and behaviors when updating data (see the description in Section 10.8). However, transmission intervals for each section are considered to be important as they influence the time out setup of receiver units, so the following rules should be applied.

[Transmission Operating Rule]

- The maximum length of time for a transmission interval for each section should be two times the length of time for the re-transmission cycle set up for each repetition rate group. (The re-transmission cycle adjustment range is not added to this value). This value is considered as the length of time required to transmit a desired section securely, so it can be used for setting time out on receiver units. For example, a section that belongs to a repetition rate group whose re-transmission cycle is set to 10 seconds can be securely transmitted within 20 seconds.

10.7 Details of SI Transmission within a Repetition Rate Group

Within the range of a re-transmission cycle setup for each, sections should be transmitted in accordance with the following rules and guidelines.

[Transmission Operating Rule]

- Within a repetition rate group, a re-transmission cycle should not be changed individually, for example, for each sub-table. When a re-transmission cycle is changed within the range of ±30% for cycle adjustment, the adjustment should be made for the whole repetition rate group, not for individual sub-table.

[Transmission Operating Rule]

- Within a repetition rate group, section data should be distributed within a cycle range that has been set up and transmitted. In addition, as up to 4KB of sections in the same sub-table can be multisectionalized, data is not always distributed on a sectional basis but it should be distributed as much as possible on the basis of up to 4KB-multisection.
- Within a repetition rate group, multiple sections within a sub-table should always be transmitted in the same order. As shown in the example in the figure below, in a sub-table which is comprised of four sections with sections numbers 0 to 3, if these sections are transmitted in the order of 1, 3, 2, 0, they should also be transmitted in this order the next time they are re-transmitted.

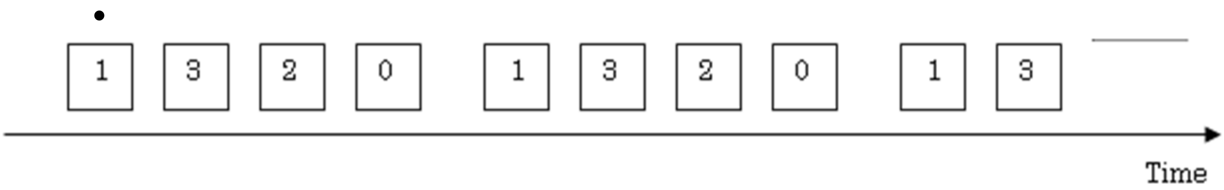


Fig. 10-1: Example of transmission of sections ("section_number") within a repetition rate group (order of transmission)

There is a case where this order may not be used. This should be kept in mind when the reception process is performed based on the order of transmission of sections within a repetition rate group.

In addition, sections are generally transmitted in ascending order of section number, but this rule is not always followed, therefore, performing the reception process based on this rule should be avoided (Figure 10-1 illustrates an example of a case where the rule is not followed).

It shall be noted that sections will always be retransmitted in the same order only within the same repetition rate group. For example, as shown in Fig. 10-2, the sections with section numbers 0 and 1 and with section numbers 2 and 3 will be transmitted in the same respective order if multiple repetition rate groups exist for the sections comprising the sub-tables (i.e. when the repetition rate group that sections with section numbers 0 and 1 belong to is different from the repetition rate group that sections with section numbers 2 and 3 belong to).

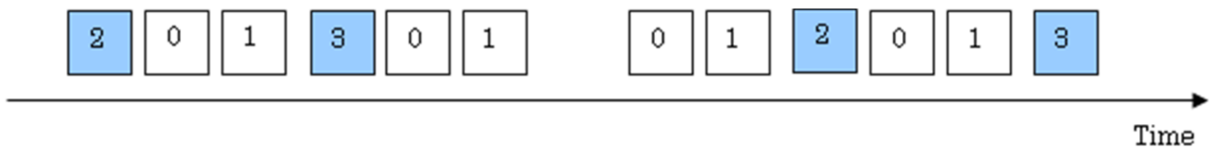


Fig. 10-2: Examples of the transmission operation (order) by sections ("section_number") in the case when 2 repetition rate groups exist

(When the retransmission interval of sections with section numbers 0 and 1 have been set to 1 second and those with section numbers 2 and 3 have been set to 3 seconds)

10.8 Rules When Sub-Tables Are Updated

When a sub-table is updated, the following rules should be applied. Detailed transmission methods other than described here differ depending on transmission system.

[Transmission Operating Rule]

- The new version and old versions should not exist in the same sub-table. In other words, after a section in a sub-table is updated, sections with old version numbers in the same sub-table should not be transmitted. This rule is also valid when multiple repetition rate groups are used in the same sub-table, such as EIT.
- It is possible to update a sub-table in the middle of a re-transmission cycle. In other words, there may be a case where the transmission interval of a section may become shorter than that of re-transmission cycle.
- When updating a sub-table, a transmission interval of the same section (section with the same section number) should not be more than two times that of the re-transmission cycle.

Figure 10-3 shows an example of when the sub-table is updated and it indicates that, when updating a sub-table consisting of 4 sections from 0-3, it would be possible to start transmitting the new version of the sub-table before all 4 sections have been fully transmitted. In such a case, sections 0 and 1 will be transmitted in a shorter interval than the re-transmission cycle; and sections 2 and 3 will be transmitted in a longer interval than the re-transmission cycle. The final item of the above transmission rules indicates that the transmission interval of section 2 or 3 must not exceed the double of the re-transmission cycle.

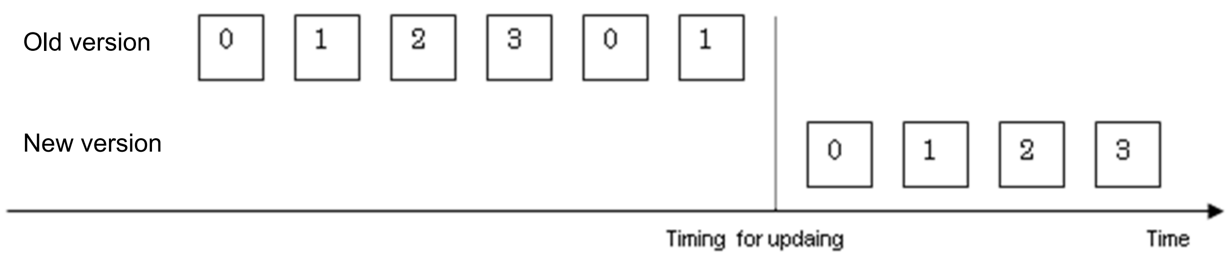


Fig. 10-3: Example of transmission of sections ("section_number")
when updating a sub-table

10.9 Update of Tables

The reasons for updating each table and guidelines for update frequencies are shown in Table 10-10.

Table 10-10: Reasons for updating tables and guidelines for update frequencies

Tables	Main reasons for updating	Guidelines for update frequency	Notes
PAT	・Suspension and re-start of broadcasting of a service.	Irregularly.	PIDs of the PMT are rarely changed.
PMT	・Change of a component structure. ・Change of copy control/control access. ・When emergency warning signal is transmitted (emergency information descriptor)	Irregularly. Frequent updates on an event basis or on a basis of smaller units are possible.	
CAT	・Addition/deletion of a CA system.	Rarely changed.	
NIT	・Addition/change of a transmission frequency. ・Addition/change/transfer of a service. ・Change of a service structure for each layer.	Rarely changed.	
BIT	・Addition/change/transfer of a service. ・Change of a service structure for each layer. ・Change of a delivering EIT type, Each-station	Rarely changed.	

	applied transmission parameter.		
SDT	・Addition/change/transfer of a service. ・Change of a service name.	Rarely changed.	
EIT[p/f] EIT[p/f after]	・When an event starts/ends. ・When an event schedule is changed.	Updated per event.	
INT	・Change of an IP/MAC platform name. ・Change of an IP/MAC platform provider name. ・Addition/deletion of a service.	Rarely changed.	

<Blank Page>

Chapter 11 Concept of Storage Control

For details on the concept of storage control, see Section 3.16 in "Guidelines for PSI/SI Receiver Units" in Appendix 1 in this volume.

<Blank Page>

Chapter 12 EIT Transmission

This chapter explains EIT transmission in details.

12.1 Definition of EIT-Related Terms and Outline of EIT Transmission

EIT-related terms that are used in this chapter and the whole Vol. 4 are defined and a basic EIT transmission model is explained.

12.1.1 Distinction between actual and other

As in digital terrestrial television broadcasting, EITs related to other TSs are not transmitted in multimedia broadcasting. This means that only the EIT in each TS is transmitted. Taking this into account, in the explanation below, actual/other is not used to distinguish each EIT, for instance, EIT[p/f actual] is expressed as EIT[p/f] and EIT[p/f after actual] is expressed as EIT[p/f after].

12.1.2 Commonly operated EIT

Collective term for EITs commonly operated by all broadcasting companies in common operation SI. See Section 12.2.1 for details.

12.1.3 Individually operated EIT

Collective term for EITs that are transmitted optionally for the purpose of enhancing event information presented on receiver at the discretion of each broadcaster. See Section 12.2.2 for details.

12.1.4 N-EIT/M-EIT/W-EIT

Layered transmission is used in multimedia broadcasting to improve the reception status of radio waves. When transmitting EITs, the three types of EITs (N-EIT/M-EIT/W-EIT) are transmitted based on the transmission layer to be used.

These three types of EITs are transmitted using a different PID (see Section 12.9).

12.1.5 Definition of the EIT names used in this volume (Volume 4)

The definition of the EIT names used in this volume is shown in Table 12-1.

Table 12-1: Definition of the EIT names used in this volume

Name (Term)	Definition
EIT	Collective term for N-EIT/M-EIT/W-EIT
EIT[p/f]	Collective term for N-EIT[p/f]/M-EIT[p/f]/W-EIT[p/f]
EIT[p/f after]	Collective term for N-EIT[p/f after]/M-EIT[p/f after]/W-EIT[p/f after]
N-EIT	Collective term for N-EIT[p/f]/N-EIT[p/f after]

M-EIT	Collective term for M-EIT[p/f]/M-EIT[p/f after]
W-EIT	Collective term for W-EIT[p/f]/W-EIT[p/f after]

For the detailed definition of each N-EIT/M-EIT/W-EIT, see Section 12.11.2.

12.1.6 Service layer

The Service layer is the layer in which the PMT of a service is transmitted. For example, when three layers are used and the PMT of Service A is transmitted in the low protection layer, no matter in which layers the components which comprise Service A are transmitted, it can be said "the service layer of Service A is the low protection layer".

12.1.7 Portable receivers

Portable receivers indicate the portable terminal receivers for multimedia broadcasting that can receive a 33-segment, which is used by optionally combining layered transmission patterns (1) to (3) shown in Table 14-3 "Parameters used for the operation of hierarchical transmission" in Chapter 14 in Vol. 0. The portable receivers can obtain/display all three types of EITs (N-EIT/M-EIT/W-EIT).

12.1.8 All-stations applied transmission parameter

The transmission parameter of the commonly operated EIT (transmission table, transmission span, transmission cycle, repetition rate group configuration) is used by defining the details per EIT type (N-EIT/M-EIT/W-EIT) so as to be commonly used by all broadcasters. This is referred to as an "all-station applied transmission parameter." Regardless of the service, the commonly operated EIT for a service must be transmitted using the all-station applied transmission parameter that is defined for each EIT type (N-EIT/M-EIT/W-EIT). Roughly, there are three types of all-station applied transmission parameters, which are commonly used by all multimedia broadcasters.

1) All-stations applied transmission parameter in the N-EIT

2) All-stations applied transmission parameter in the M-EIT

3) All-stations applied transmission parameter in the W-EIT

12.1.9 Each-station applied transmission parameter

In addition to the all-station applied transmission parameter, there is a parameter that can be optionally specified by each broadcaster, which is referred to as an "each-station applied transmission parameter." The each-station applied transmission parameter (transmission table, transmission span, transmission cycle, and repetition rate group configuration) is also used by defining the details per EIT type (N-EIT/M-EIT/W-EIT). Roughly, there are three types of each-station applied transmission parameters, which are commonly used by a multimedia broadcasting broadcaster.

1) Each-station applied transmission parameter in the N-EIT[p/f after]

2) Each-station applied transmission parameter in the M-EIT[p/f after]

3) Each-station applied transmission parameter in the W-EIT[p/f after]

The N-EIT, M-EIT, and W-EIT cannot be transmitted at the same time using one layer.

The commonly operated EIT and individually operated EIT can be transmitted at the same time using one layer.

EITs with the same PID are not transmitted at the same time using multiple layers.

Table 12-2: Extended delivering EIT type that can be transmitted and their transmission layers for each transmission pattern and service layer

Pattern (1)

Segment configuration / Service Layer	Layer A (Low protection layer)
Low protection layer	Service Layer ○N-EIT[p/f] ○N-EIT[p/f after] (note) ●N-EIT[p/f after]

Pattern (2)

Segment configuration / Service Layer	Layer A (Partial Reception Layer)	Layer B (Low protection layer)
Partial Reception Layer	Service Layer ○W-EIT[p/f] ○W-EIT[p/f after] (note) ●W-EIT[p/f after]	
Low protection layer		Service Layer ○N-EIT[p/f] ○N-EIT[p/f after] (note) ●N-EIT[p/f after]

Pattern (3)

Segment configuration / Service Layer	Layer A (Partial Reception Layer)	Layer B (High protection layer)	Layer C (Low protection layer)
Partial Reception Layer	Service Layer ○W-EIT[p/f] ○W-EIT[p/f after](note) ●W-EIT[p/f after]		
High protection layer		Service Layer ○M-EIT[p/f] ○M-EIT[p/f after](note) ●M-EIT[p/f after]	
Low protection layer			Service Layer ○N-EIT[p/f] ○N-EIT[p/f after] note) ●N-EIT[p/f after]

(○: Commonly operated EIT ●: Individually operated EIT)

(Note: EIT[p/f after] is transmitted when the number of events that is transmitted as the commonly operated SI is greater than 2.)

12.1.10 EIT type delivering flag

The EIT type delivering flag is a collective term for N-EIT_flag/M-EIT_flag/W-EIT_flag specified within the service loop of the SDT. A flag indicates an EIT that is transmitted in the TS for applicable service. It shows 3 bits defined as the EIT user defined flag (EIT_user_defined_flags) in ARIB STD-B10.

12.2 Commonly Operated EIT and Individually Operated EIT

Now that the terms have been defined, the precise definition of the commonly operated EIT and individually operated EIT are provided below.

12.2.1 Commonly operated EIT

A commonly operated EIT is defined as "among the tables of the EIT that must be transmitted for each service, the tables that are transmitted using the transmission parameter defined in the all-station applied transmission parameter". For instance, if a service is transmitted using the low protection layer, the commonly operated EIT is the N-EIT that is transmitted based on the all-station applied transmission parameter of the N-EIT (1 in Section 12.1.8).

12.2.2 Individually operated EIT

An individually operated EIT is defined as "the EIT that should be transmitted for each service, excluding the commonly operated EIT (additional transmission part)". Individually operated EITs can be transmitted optionally at the broadcaster's discretion, but any individually operated EITs cannot be transmitted for a service for which the commonly operated EIT has not been transmitted.

The individually operated EIT is the program information that is transmitted after the transmission span for the all-station applied transmission parameters in the EIT of each service. (The each-station applied transmission parameter is used.)

12.3 Rough Idea of EIT Transmission

The following two methods are used to transmit the EIT in multimedia broadcasting for a commonly operated EIT and an individually operated EIT. The commonly operated EIT is transmitted based on the all-station applied transmission parameter. The individually operated EIT is transmitted based on the each-station applied transmission parameter. As the commonly operated EIT, EIT[p/f] and EIT[p/f after] can be transmitted. As the individually operated EIT, EIT[p/f after] can be transmitted. For instance, when transmitting a 13-segment broadcast, the following tables can be transmitted: the commonly operated EIT[p/f after] (4 programs) + individually operated EIT[p/f after] (4 programs). If the transmission is performed using a 1-segment broadcast, by taking into account the service bandwidth to be ensured, only the commonly operated EIT[p/f after] (4 programs) can be transmitted.

[Distinction between the commonly operated EIT and the individually operated EIT]

Event information that should be always transmitted by all broadcasting companies is the commonly operated EIT, and event information that can be transmitted optionally by each broadcaster is the individually operated EIT.

[Distinction between all-stations applied transmission parameter and each-station applied transmission parameter]

"All-stations applied transmission parameter" means a transmission parameter standardized by all broadcasting companies (delivering range, repetition rate grouping, repetition rate) and there is no concept of "mandatory/optional" regarding transmission of parameters. "Each-station applied transmission parameter" is a transmission parameter that can be defined for each "N-EIT/M-EIT/W-EIT" freely by each broadcaster.

12.4 EIT Transmission Model

The transmission rules for the actual transmission model, which represent the rough idea provided in Section 12.3, by EIT type, can be summarized as follows.

(1) The commonly operated EIT (EIT that is transmitted based on the all-station applied transmission parameter part) must be transmitted for all real-time broadcasting services (the services for which the EIT transmission level is set to “mandatory” in Table 12-3 in 12.6.1).

(2) Transmission is performed using the same parameter for each EIT type (N-EIT/M-EIT/W-EIT) for the services for which whether or not transmission is performed is specified (using the EIT type delivering flag of the SDT; see Section 12.8.2) for each EIT type (N-EIT/M-EIT/W-EIT).

Examples of transmission patterns are as follows. As a transmission pattern, only one of the following four patterns is allowed to be used per TS.

Pattern 1: The EIT[p/f] and the EIT[p/f after] as commonly operated EITs are transmitted.

* The number of programs described in the EIT[p/f after] as the commonly operated EIT is optional, from 0 to 8.

Pattern 2: The EIT[p/f], the EIT[p/f after] as a commonly operated EIT, and the EIT[p/f after] as an individually operated EIT are transmitted.

* The total number of programs described in the EIT[p/f after] as a commonly operated EIT and the EIT[p/f after] as an individually operated EIT is optional, from 0 to 8.

Pattern 3: Only the EIT[p/f] is transmitted.

Pattern 4: The EIT[p/f] and the EIT[p/f after] as individually operated EITs are transmitted.

* The number of programs described in the EIT[p/f after] as an individually operated EIT is optional from 0 to 8.

12.5 How to Transmit an All-station/Each-station Applied Transmission Parameter to Receiver

Parameters are specified in the following locations

- All-stations applied transmission parameter ----- SI parameter descriptor within the first loop of the BIT.
- Each-station applied transmission parameter ----- SI parameter descriptor within the second loop of the BIT

12.5.1 Communication of all-stations applied transmission parameter to receiver

As described earlier, the EITs that use the all-station applied transmission parameter are EIT [p/f] and EIT[p/f after].

All-stations applied transmission parameter are standardized and operated by all broadcasters in a multimedia broadcasting network, and basically, any changes are not supposed to be made to them. However, taking into consideration changes that may be made to specifications of receiver in the future (due to penetration of receiver which implemented double tuners, etc), they are inserted in broadcast signals so that they can be changed. Specifically, in the first loop of the BIT, along with all-stations applied transmission parameter for the NIT, BIT, TOT and SDT, SI transmission parameter in which all-stations applied transmission parameter (repetition rate and delivering range, etc) for each "N-EIT/M-EIT/W-EIT" should be placed. Please note that in order to minimize the size of the BIT, the desctiption can be omitted at the table level when a default value is used. (See Section 12.12.2.)

12.5.2 Communication of each-station applied transmission parameter to receiver untis

As stated earlier, the EIT that uses the each-station applied transmission parameter is EIT[p/f after].

The each-station applied transmission parameter is arbitrarily transmitted in a 13-segment/1-segment broadcast service. When transmitting, two to 10 programs can be set for each entrusted broadcaster. When the individually operated EIT is used, the parameter must be inserted in a broadcast signal. Specifically, the SI parameter descriptor, in which the each-station applied transmission parameter (including the SDTT) is described, is placed in the second loop of the BIT. However, if any individually operated EIT is not used for an applicable EIT, the each-station applied transmission parameter for the EIT must not be described.

12.6 EIT Delivering Level for Each service_type

12.6.1 Commonly operated EIT (part in the basic delivering EIT type that is transmitted with all-stations applied transmission parameter)

For services of some service_type, commonly operated EITs are not transmitted or transmitted optionally. Delivering levels of commonly operated EITs (transmitted or not) for each service_type are shown in Table 12-3.

Table 12-3: Delivering levels of commonly operated EITs for each service_type

service_ type	Meaning	media_ type	Delivering level		
			Basic delivering EIT type for this service		
			N-EIT[p/f]	M-EIT[p/f]	W-EIT[p/f]
0xC2	Video real-time broadcasting service	TV type	Mandatory*1	Mandatory*1	Mandatory*1
0xC2	Audio real-time broadcasting service	Audio type	Mandatory*1	Mandatory*1	Mandatory*1
0xA4	Engineering service*2	Data type	No transmission	No transmission	No transmission
0xC2	Independent data broadcasting service	Data type	Mandatory*1	Mandatory*1	Mandatory*1
0xC2	Storable broadcasting service EPG/ECG metadata service	Storage type	No transmission	No transmission	No transmission

*1: Transmission of a delivering range defined as an all-stations applied transmission parameter (number of events) is mandatory. Transmission of subsequent delivering range is optional.

*2: Engineering service is not described in the SDT, too (see Section 31.2.1).

12.6.2 Individually operated EIT (each-station applied transmission parameter part in the EIT)

The individually operated EIT (N-EIT[p/f after]/M-EIT[p/f after]/W-EIT[p/f after]) does not have the service_type, which is necessary for transmission, due to its characteristic. The individually operated EIT is optionally transmitted.

An EIT must not be transmitted for engineering service, storable broadcasting service, and EPG/ECG metadata service.

12.7 Service That does not Transmit an EIT Due to a Facility Maintenance Issue

As described in Section 8.1, potential difficulty when transmitting the EIT is not taken into account due to a facility maintenance issue when a broadcaster starts using multimedia broadcasting.

12.8 How to set EIT_present_following_flag of an SDT

12.8.1 EIT_present_following_flag

The EIT_present_following_flag is set for an applicable service based on the condition below.

- The EIT for an applicable service is N-EIT.

  '1' is set if the all-station applied transmission parameter for the N-EIT[p/f]/N-EIT[p/f after] is transmitted. If not, '0' is set.

- The EIT for an applicable service is M-EIT.

  '1' is set if the all-station applied transmission parameter for the M-EIT[p/f]/M-EIT[p/f after] is transmitted. If not, '0' is set.

- The EIT for an applicable service is W-EIT.

  '1' is set if the all-station applied transmission parameter for the W-EIT[p/f]/W-EIT[p/f after] is transmitted. If not, '0' is set.

12.8.2 Setting the EIT_present_following_flag of the SDT for each EIT transmission pattern example

Table 12-4 provides some examples based on Section 12.6, Section 12.7, and the setting method above.

Table 12-1: Setting the EIT flag of the SDT for each EIT transmission pattern

Pattern example	N-EIT [p/f]/ [p/f after] All station part	N-EIT [p/f after] Each station part	M-EIT [p/f]/ [p/f after] All station part	M-EIT [p/f after] Each station part	W-EIT [p/f]/ [p/f after] All station part	W-EIT [p/f after] Each station part	EIT Type transmission flag	SDT p/f flag
1	M	–					100	1
2	M	O					100	1
3			M	–			010	1
4			M	O			010	1
5					M	–	001	1
6					M	O	001	1

M: A mandatory item is transmitted. O: An optional item is transmitted.

–: An optional item is not transmitted.

The empty spaces in the table above indicate that an applicable EIT cannot be transmitted.

The EIT type delivering flag indicates a value specified in the 'N-EIT_flag/M-EIT_flag/W-EIT_flag'. For instance, '100' indicates that N-EIT_flag=1, M-EIT_flag=0, and W-EIT_flag=0.

12.9 PID of a TS Packet that Transmits an EIT Section

A different PID of the TS packet for sending the EIT is assigned for each transmission layer.

Table 12-2: PID of the TS packet that transmits EIT sections

EIT	PID
N-EIT	0x0012
M-EIT	0x0026
W-EIT	0x0027

The EITs with the same PID are not transmitted using multiple layers at the same time.

12.10 table_id of an EIT Section

Table 12-6 shows the table_id of an EIT section.

Table 12-3: table_id of an EIT section

EIT	table_id
N-EIT[p/f], N-EIT[p/f after]	0x4E
M-EIT[p/f], M-EIT[p/f after]	
W-EIT[p/f], W-EIT[p/f after]	

For details, see Section 12.13.

12.11 Detailed EIT Transmission

12.11.1 Role and characteristics of EITs

The number of characters in a character area, descriptor to be placed, transmission span, and usage in another table level are all applied to an EIT in the same way as they are to digital terrestrial television broadcasting, etc. Basically, the EIT is not used for creating a program guide. If it is necessary to use the EIT to create a program guide, the minimum information is set to the EIT, such as the capacity of a character area, descriptor to be placed, and number of programs to be transmitted. The EIT uses N-EIT (a low protection layer), M-EIT (a high protection layer), and W-EIT (a partial reception layer) based on the transmission layer used for an applicable service. These three types of EITs are used in the same way, except for transmission layers.

12.11.2 Configuration of EIT sub-table and expression form

The configuration of an EIT sub-table is defined as follows:

- Current (present) program → section_number = 0 (1 section 1 event)
- Next (following) program → section_number = 1 (1 section 1 event)
- Programs following the next program (after) → After section_number = 2 (1 section multiple events)

The operation rules for the EIT are defined as follows.

- The last_section_number of the EIT must have a value set from 0x01 to 0x03.

This means that the programs that follow the next program must be described in an EIT within a maximum of two sections.

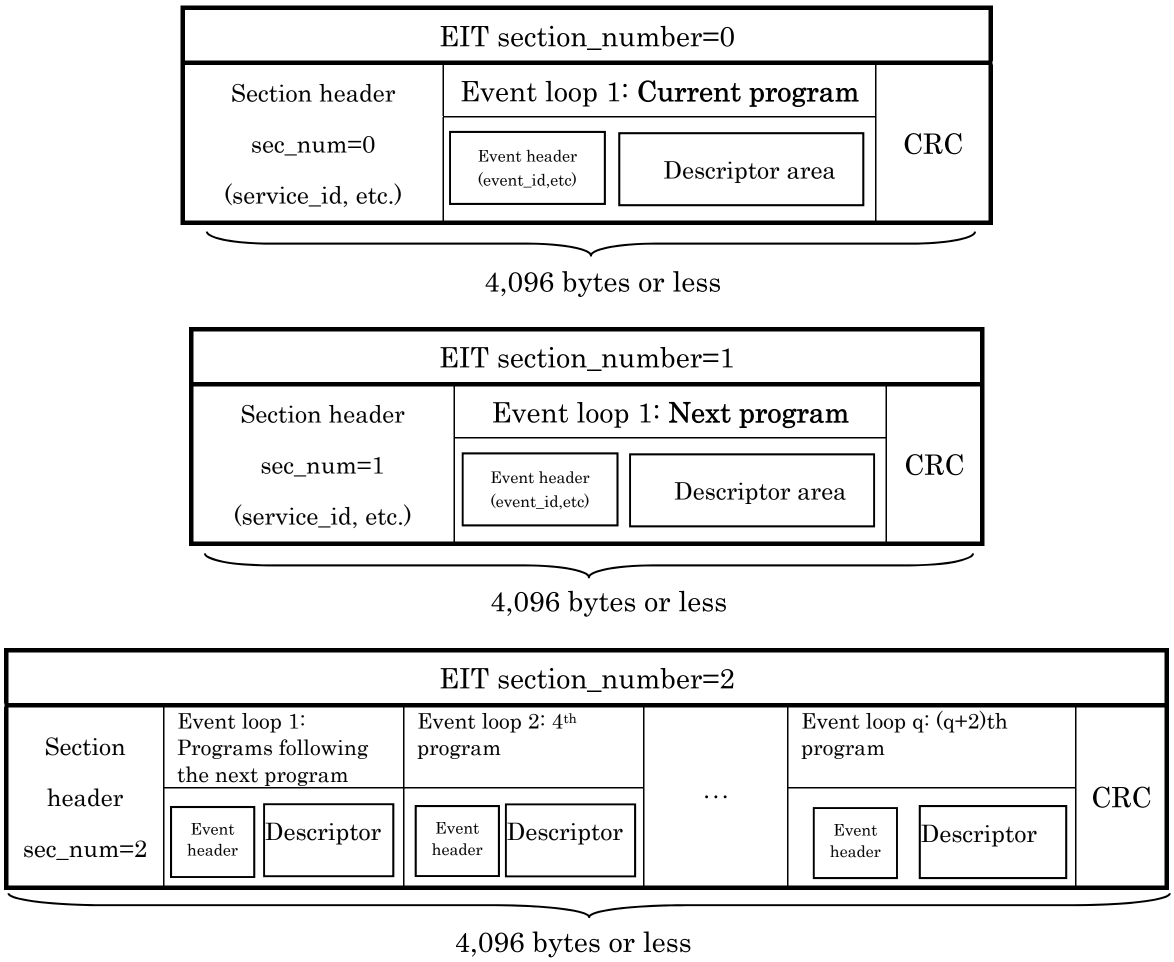
- The maximum of 10 events, including the current/next programs, that can be transmitted are specified in an EIT, regardless of the all-station applied transmission parameter/each-station applied transmission parameter.

- The event loops must be described in the start_time order in a section in which information on the programs following the next program is stored.
- A section_number should not be missing.

For instance, if the transmission span of the all-station applied transmission parameter for an EIT is five programs, the number of programs that can be specified for the each-station applied transmission parameter is six to 10. When mapping multiple programs following the next program to a section, an event loop must be described in the order of the start_time. The mapping is performed in the ascending order of the section_number.

Caution should be applied because the method of mapping to a section is limited based on the transmission span (number of programs) during which the program information about the programs following the next program (after) is transmitted as the all-station applied transmission parameter part. For details, see Section 12.14.

Figure 12-1 shows the EIT structure.



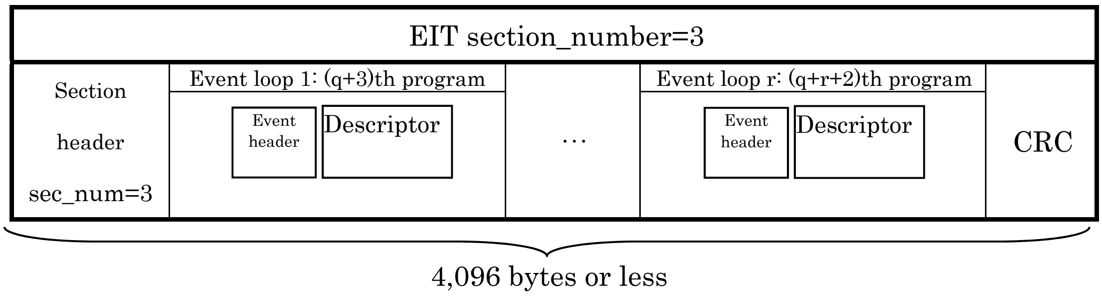
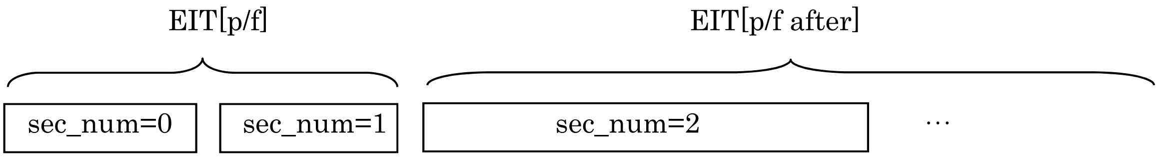


Fig. 12-1: EIT structure

The transmission operating rules shown in Fig. 12-1 are as follows.

- The last_section_number of the EIT must be 1 ≤ last_section_number ≤ 3.
- The EIT must be q+r+2 ≤ 10 (the values of q and r can be set freely).

The name of each section is defined as follows.



- Both sec_num=0 and sec_num=1 of the EIT are referred to as "EIT[p/f]".
- The sec_num=2 and following are referred to as "EIT[p/f after]".

12.11.3 Transmission operation of EIT

The EIT is transmitted based on the data structure of the EIT table that is defined in ARIB STD-B10. For details on the sub-table structure, see Section 12.11.2.

The transmission span of the all-station applied transmission parameter part in the EIT is defined as the EN1 program, EM1 program, and EW1 program, all of which can include the current program, per transmission layer. The transmission span is described in the SI parameter descriptor that is placed in the first loop of the BIT.

(Transmission cycle: Specified in the N-EIT_table_cycle, number of EN1 programs: num_of_N-EIT_event; transmission cycle: specified in the M-EIT_table_cycle, number of EM1 programs: num_of_M-EIT_event; transmission cycle: specified in the W-EIT_table_cycle, number of EW1 programs: num_of_W-EIT_event)

In the actual TS, it is necessary to describe the transmission parameter, which is related to the M-EIT, in the SI parameter descriptor that is placed in the first loop of the BIT; for instance, even if the M-EIT is not used.

However, the specification of the transmission parameter can be omitted when the default all-station applied transmission parameter part is used. (For details, see Section 12.12.2.)

As for the EIT, the transmission of the EIT[p/f] is mandatory, and the transmission of the EIT[p/f after] is optional for an applicable service for which the EIT type delivering flag in the SDT is valid (N-EIT_flag='1', M-EIT_flag='1', W-EIT_flag='1'). The transmission of the EIT[p/f] is mandatory and the transmission of the EIT[p/f after] is optional for the service_type of which the EIT field of an applicable service in Table 12-3 is described as "mandatory".

The receivers determine that the EIT is transmitted based on the all-station applied transmission parameter part described in the table_id, which is set to "0x4E (EIT) in the SI parameter descriptor in the first loop of the BIT, for the service of which the EIT type delivering flag in the SDT is valid (N-EIT_flag='1', M-EIT_flag='1', or W-EIT_flag='1') and the EIT_present_following_flag is set to '1'.

The transmission span of the each-station applied transmission parameter part is defined per layered transmission as (EN1+1) program to EN2 program, (EM1+1) program to EM2 program, (EW1+1) program to EW2 program, EN2 program, EM2 program, and EW2 program. The transmission span is described in the SI parameter descriptor that is placed in the second loop of the BIT.

Each-station applied transmission parameter part is arbitrarily used by each multimedia broadcasting broadcaster.

The receivers determine that the EIT in the each-station applied transmission parameter part is transmitted at the cycle as set in the table_cycle (N-EIT, M-EIT, or W-EIT) if the number of programs described in the num_of_N-EIT_event, num_of_M-EIT_event, or num_of_W-EIT_event of the table_id, which is set to "0x4E" in the SI parameter descriptor in the second loop of the BIT, is greater than the number as defined in the all-station applied transmission parameter, for the service of which the EIT_flag of the EIT type delivering flag in the SDT is set to '1' and the EIT_present_following_flag is set to '1'.

Once the transmission of EITs starts, the EITs must be transmitted steadily as far as the service exists.

Each table in an EIT is configured based on the description in Section 12.11.2 and must be described correctly, except under any unavoidable circumstances, such as the interruption of emergency broadcast.

If there is no event in a certain period of time, both p/f (as well as p/f after) for the time period may be set as an empty section. The empty section is a section where an event loop does not exist because CRC32 comes after a 14-byte section header.

The duration in the present information may be set to undefined (all '1'). The start_time and/or duration in the following information may be set to undefined (all '1'). If both the start_time and duration are set to "undefined" in the following information, then the event is set to an undefined event (see Section 18.1).

The use of the EIT[p/f] with a time when an event does not exist is explained using Fig. 12-2. This example shows that Program-A ends at AM1:00 and that Program-B, which is scheduled to be broadcast next, starts from AM2:00. Basically, while Program-A is being broadcast, the information of Program-B is described in the EIT[following] and is being transmitted (Pattern 1). However, the EIT[following] can also be left as an empty section (Pattern 2) depending on the transmission equipment. During the period of time when an event does not exist, the EIT[following] can be left as an empty section (Pattern 3). In this case, the information of Program-B must be described in the EIT[following] and transmitted at least 30 seconds before the start time of Program-B. Therefore, if the time when no event exists is under 30 seconds, the information of Program-B must be described in the EIT[following] and transmitted 30 or more seconds before starting Program-B (namely, during Program-A) (only Pattern 1 can be used).

"The time when no event exists" described earlier does not always mean the suspension of components, such as video and audio.

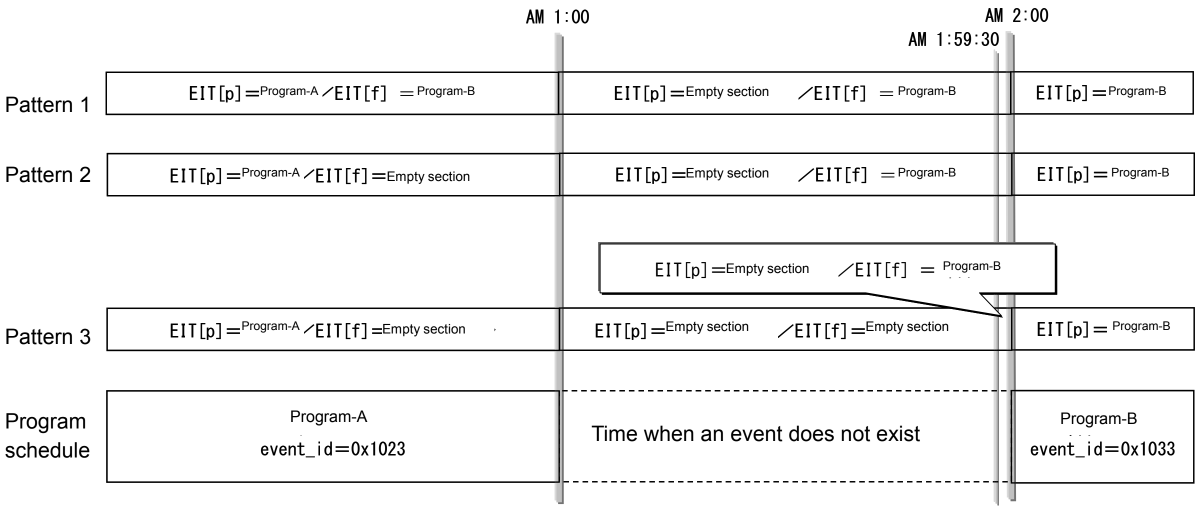


Fig.12-2: Transmission of EIT[p/f] including a time without an event

The running status is always set to "undefined (0x0)".

12.12 Setting a Repetition Rate Group for EIT

This chapter describes the repetition rate group for an EIT. For the definition on the repetition rate group, refer to sections on the definition of the repetition rate group and re-transmission cycle. As shown in Table 12-7, there are two repetition rate groups for an EIT. The method for using N-EIT, M-EIT, or W-EIT in each layered transmission is the same.

Table 12-4: Repetition rate group for EITs

Group number	Table type
1	EIT[p/f]/EIT[p/f after] (all-station applied transmission parameter part)
2	EIT[p/f after] (each-station applied transmission parameter part)

12.12.1 Setting a repetition rate group for EITs (group number 1 and 2)

In the EIT, the following two repetition rate groups can be set: "all-station applied transmission parameter part in the EIT" and "each-station applied transmission parameter part in the EIT".

As for the EIT, not only the all-station applied transmission parameter part but also the each-station applied transmission parameter part must be transmitted at a shorter cycle so that the program information can be smoothly referenced by the viewers to obtain/display the information when updating events, etc.

Caution should be applied when mapping the event information to a section because the transmission span of the EIT can be specified by the "number of programs", which indicates that "if multiple sections that configure a sub-table are transmitted using multiple cycles, the sections that are transmitted at different cycles must be transmitted by section unit".

Specifically, if multiple event loops exist in one section, the first half ("n" programs) is transmitted at cycle a, and the last half ("m" programs) is transmitted at cycle b. This means that the EIT cannot be transmitted in this way according to the packet rule (as the next section cannot start transmitting until the transmission of the previous section is completed). (See Section 10.1.)

If the transmission span (the number of programs) of the all-station applied transmission parameter part is three programs or more (if the EIT[p/f after] is transmitted as the all-station applied transmission parameter part) and if the transmission cycle of the all-station applied transmission parameter part is different from the each-station applied transmission parameter part, the receivers cannot determine when they finish receiving the all-station applied transmission parameter part until they receive the last_section_number to obtain all sections because they receive them by section and need to know the section_number of the all-station applied transmission parameter part to be transmitted. Thus, there is no advantage of dividing repetition rate groups.

Therefore, the method of mapping the event information to each section of the EIT[p/f after] is restricted based on the transmission span of the all-station applied transmission parameter part and the cycles of both repetition rate groups. For details on the mapping method, see Section 12.14.

12.12.1.1 All-station applied transmission parameter part in the EIT (group number 1)

The all-station applied transmission parameter part in the EIT specifies only the number of programs and re-transmission cycles. As this part includes the most recent information, such as the current program and the next program, it normally uses the same cycle as EIT[p/f].

The number of programs that can be specified is two to 10. The default number of programs is two.

12.12.1.2 Each-station applied transmission parameter part in EIT (group number 2)

The each-station applied transmission parameter part in the EIT also specifies only the number of programs and the re-transmission cycle. Each multimedia broadcasting broadcaster can uniquely use the part, including the decision regarding whether or not to use the part. If the EIT[p/f after] is transmitted at the same re-transmission cycle as the EIT[p/f], the same re-transmission cycle as the all-station applied transmission parameter part must be specified.

The value obtained by adding one to 10 to the value specified for the all-station applied transmission parameter part can be specified as the number of programs. If the all-station applied transmission parameter part in the EIT is transmitted but the each-station applied transmission parameter part in the EIT is not transmitted, then the number of programs set to the all-station applied transmission parameter part in the EIT is described in the "num_of_N-EIT_event, num_of_M-EIT_event, num_of_W-EIT_event" of the SI parameter descriptor in the second loop of the BIT.

12.12.2 How to describe each transmission parameter in the BIT

This section provides the method used to describe the transmission parameter of the BIT for each repetition rate group of the EIT.

The same information must be described in the SI parameter descriptor, which is placed in the first descriptor loop of the BIT, for all broadcasters of multimedia broadcasting.

It is mandatory to place the SI parameter descriptor in the first descriptor loop of the BIT. However, the description of the parameter can be omitted by table_id unit (it is not necessary to omit describing) when using the default value shown in Table 10-6 and Table 10-7 in Chapter 10. For instance, it is not necessary to describe the information after the update_time if the default value is used in all tables (NIT, BIT, SDT, EIT, and TOT). (See Section 31.1.2.1.)

The SI parameter descriptor that is placed in the second descriptor loop of the BIT can be optionally specified by broadcaster. A table, which is not transmitted using the each-station applied transmission parameter, must not be described.

If the all-station applied transmission parameter part must be changed, the SI parameter descriptor, for which update_time is set to the date when the parameter part will be changed, must be set at least two days before the date of the change. This means that at least during the two days prior to the parameter being changed, multiple SI parameter descriptors with different update_time are placed in the same descriptor loop.

There are three patterns for placing the SI transmission parameter in the second descriptor loop of the BIT when changing the each-station applied transmission parameter.

(1) The parameter is changed but the transmission is performed based on the each-station applied transmission parameter before and after the change:
Like the all-station applied transmission parameter part, the multiple SI parameter descriptors with different update_time are placed in the second descriptor loop of the BIT at least two days before the date of the change.

(2) The transmission starts after the parameter is changed although the transmission was not performed based on the each-station applied transmission parameter (only the all-station applied transmission parameter part is transmitted) before the change:
The SI parameter descriptor, in which the changed parameter is described, is placed in the second loop of the BIT at least two days before the date of the change.

(3) The transmission is performed based on the each-station applied transmission parameter before the change; however, the transmission is not performed at all after the change (only the all-station applied transmission parameter part is transmitted):
The empty SI parameter descriptor (without the information after update_time), in which the update_time is set to the date when the parameter will be changed, is additionally placed in the second descriptor loop of the BIT at least two days before the change, and the empty SI parameter descriptor must be placed for at least two days after the change.

If there is no description in the table_id, which is described in the SI parameter descriptor (all-station applied transmission parameter part) that is placed in the first loop of the BIT, after the change, the receivers determine that the transmission parameter of the table returns to the default value.

If there is no description in the table_id, which is described in the SI parameter descriptor (each-station applied transmission parameter part) that is placed in the second loop of the BIT, after the change, the receivers determine that the transmission of the each-station applied transmission parameter of the table is not performed.

12.12.3 Summary of repetition rate group setting

It can be easily recognized that the term, "commonly operated EIT/individually operated EIT", is not included in the description in this Section 12.12 (Setting a Repetition Rate Group for EIT).

This means that the term, "commonly operated EIT/individually operated EIT", is used to "define the services for the EIT that must be transmitted by broadcasters". The receivers determine which EIT is transmitted at which cycle in an applicable TS only based on the "SI parameter descriptor" included in the BIT, the "EIT type delivering flag" included in the SDT, and the "EIT_present_following_flag" in the SDT.

The receivers can determine that the all-station applied transmission parameter part, which is at least defined in the respective EIT, is always transmitted for all the services for which the transmission flag of the EIT type delivering flag is set to '1' in each transmission layer. This means that the all-station applied transmission parameter part, which is defined in each EIT type (N-EIT/M-EIT/W-EIT), in the EIT for which the EIT type delivering flag is set to '1', must be transmitted for each service. In the same way as the transmission based on the each-station applied transmission parameter, the receivers determine whether the transmission is performed only based on the EIT type delivering flag and the SI parameter descriptor placed in the second loop of the BIT.

12.13 Assignment of “table_id” and “section_number” in the EIT

Table 12-8 shows the table_id and section_number of the EIT. A sub-table is created per service_id, and the last_section_number is the last section_number. A section after 0x04 may be set in the future.

In this case, the receivers should be implemented so as to normally process 0x00 to 0x03 and to ignore the section after 0x04.

Table 12-8: Assignment of “table_id” and “section_number” in the EIT

	table_id	section_ number	Details
EIT [p/f]	0x4E	0x00	Current event (present)
	0x4E	0x01	Next event (following)
EIT [p/f after]	0x4E	0x02 –0x03	Programs following the next program (after)

12.14 How to Map Event Information into Sections in the EIT[p/f after]

As described in Section 12.12.1, when information on events in the part transmitted in accordance with all-stations applied transmission parameter and in the part transmitted in accordance with each-station applied transmission parameter exist in the EIT[p/f after] and at the same time, the repetition rate of the part transmitted in accordance with all-stations applied transmission parameter is different from the one of the part transmitted in accordance with each-station applied transmission parameter, “section_number” which includes event information in the part transmitted in accordance with all-stations applied transmission parameter should be defined clearly. The transmission rules on how to map event information into the sections in the EIT[p/f after] are defined as below.

- When the delivering range (number of events) of the part transmitted in accordance with all-stations applied transmission parameter is specifed as less than 2 events,

  ”section_number=0” (current event) and ”section_number=1” (next event) should be transmitted as the part transmitted in accordance with all-stations applied transmission parameter, and event information in the part transmitted in accordance with each-station applied transmission parameter should be mapped into “section_number=2” or later and transmitted.

- When the delivering range (number of events) of the part transmitted in accordance with all-stations applied transmission parameter is specified as 3 events or more and at the same time, when the repetition rate of the parts transmitted in accordance with all-stations applied transmission parameter and for each-station are the same,

  “section_number=0” (current event) and “section_number=1” (next event) should be transmitted as the part transmitted in accordance with all-stations applied transmission parameter, and event information in the part transmitted in accordance with each-station applied transmission parameter after this should be mapped so that it is included in “section_number=2”. Furthermore, event information in the part transmitted in accordance with each-station applied transmission parameter should be mapped into “section_number=2” or later (in other words, event information in the part transmitted in accordance with each-station applied transmission parameter may be additionally mapped into “section_number=2”).

- When the delivering range (number of events) of the part transmitted in accordance with all-stations applied transmission parameter is specified as 3 events or more and at the same time, when the repetition rate of the parts transmitted in accordance with all-stations applied transmission parameter and for each-station are different,

  ”section_number=0” (current event) and ”section_number=1” (next event) should be transmitted as the part transmitted in accordance with all-stations applied transmission parameter, event information in the part transmitted in accordance with all-stations applied transmission parameter after this should be mapped so that it is included in "section_number=2". Additionally, event information in the part transmitted in accordance with each-station applied transmission parameter should be mapped into "section_number=3" or later.

When the above rules are followed, a receiver may recognize that, when the delivering range of the part transmitted in accordance with all-stations applied transmission parameter ("num_of_N-EIT_event/num_of_M-EIT_event/num_of_W-EIT_event" within the first loop of the BIT) is specified as 2 events or less and when it is specified as 3 events or more, up to "section_number=1" and up to "section_number=2" are transmitted at a cycle of the part transmitted in accordance with all-stations applied transmission parameter (value of the table_cycle(N-EIT/M-EIT/W-EIT) within the first loop of the BIT) respectively and process obtained information accordingly.

12.15 Transmission of the EIT as Time Passes

The programs described in the EIT move one-by-one to a direction every time the program is transitioned.

In the following example, the EIT is used as follows according to the lapse of time (an example of N-EIT).

[All-stations applied transmission parameter] Number of events (EN1)=2

[Each-station applied transmission parameter] Number of events (EN2)=6

An event of "event_id=a" is being broadcast

sec_num=0 (present)	sec_num=1 (following)	sec_num=2			
event_id=a	event_id=b	event_id=c	event_id=d	event_id=e	event_id=f

↓

The "start_time" of an event of "event_id=b" comes, and after broadcasting of an event of "event_id=b" has started

sec_num=0 (present)	sec_num=1 (following)	sec_num=2			
event_id=b	event_id=c	event_id=d	event_id=e	event_id=f	event_id=g

If the status of the next program is changed to an undefined event when the possibility of extending the current program occurs, the events after the next event may start moving in the opposite direction.

An event of "event_id=a" is being broadcast

sec_num=0 (present)	sec_num=1 (following)	sec_num=2			
event_id=a	event_id=b	event_id=c	event_id=d	event_id=e	event_id=f

↓

When an event of "event_id=a" is being broadcast, emergency news cut-in arises and an event of "event_id=a" is being suspended.

sec_num=0 (present)	sec_num=1 (following)	sec_num=2			
event_id=x (Emergency news)	event_id=a (being suspended)	event_id=b	event_id=c	event_id=d	event_id=e

The EIT can show the status of an undefined event or undefined time. For details, see Chapter 18.

<Blank Page>

Chapter 13 Use of "component_tag"

It is mandatory to specify a "component_tag" value (assignment of a stream identifier descriptor) for every ES defined within the PMT. This chapter explains the use of "component_tag" and PIDs for ESs.

13.1 Concept of "component_tag" and PID

Because the user selects an ES from SI when they select a station or for programming, a "component_tag" value that relates the user interface to an ES is very important. A receiver unit selects an ES based on a "component_tag" when selecting a service, and finds its PID to separate it from TS and decode it. With regard to an ES that has been selected (is being displayed), a receiver unit keeps decoding ESs with the same "component_tag" value. In other words, for example, when an ES of component_tag="0x11" is being displayed, no matter whether it is within an event or between events, a receiver units keeps decoding ESs of "0x11" as long as the viewer does nothing. Therefore, when there are no ESs with a "component_tag" value that was selected and received, a receiver unit performs a process that is similar to the one to be performed when a station is selected because a new "component_tag" has to be selected.

In addition, the rule that a receiver unit keeps decoding ESs with the same "component_tag" value is followed even when the value of a PID with the "component_tag" value is changed, but when ES_PID value defined in the PMT is changed, the receiver unit performs PID filtering control, so it appears on the display the same phenomenon as a tuning operation. In other words, it is highly possible that decoding of video or audio streams gets suspended. Therefore, when continuous display on a receiver unit is desired, changing a PID value the middle of a program should be avoided whenever possible.

The number of components (ESs) can be changed within an event or between events but the default ES' should always exist.

13.2 Assignment of "component_tag" Values

As explained above, for continuous display on a receiver unit, "component_tag" values should not be changed.

In multimedia broadcasting, based on the concept explained in Section 13.1, "component_tag" values are assigned to each component type as shown in Table 13-1, and especially, fixed values are assinged to the default ES.

Table 13-1: Assignment of “component_tag” values

Component type	component_tag value
Video*1	0x00
Audio*1	0x10,0x11 Please note that 0x10 is assigned to the default ES.
Subtitle/superimposition*2	0x30: Subtitle 0x38: Superimposition
Data broadcasting*2	Data carousel (DII, DDB) 0x40, 0x41 Default ES is assigned to 0x40. Event message 0x50, 0x51
Storable broadcasting content	0xC0

*1: The component indicates the video/audio stream that is defined in the multimedia broadcasting transmission operation standard. Within the range permitted in the standard, an audio stream, to which a component_tag value is assigned, is included in the choices when selecting an individual component in a receiver.

*2: Video/audio streams other than the above *1 can be included. However, a video/audio stream to which a “component_tag” value within this range is assigned cannot be a target for individual component selection by a receiver unit.

If an ES with a component_tag value that is being decoded disappears from the PMT, the audio ES is switched to the default ES.

13.2.1 ES priority

As for audio ES, if multiple ESs with the same stream_type are defined in one PMT, priority is given to a smaller component_tag value in the order of the ESs (components). In other words, the default ES has the highest priority and the larger the “component_tag” value, the lower the priority becomes. This order of priority can be applied, for example, when a list of streams is displayed on the EPG or when the stream switch button is pressed.

13.3 Assignment of PIDs

There are no rules defined for how to assign PID values to ESs. However, as shown in Section 13.1, changing a PID value in the middle of a program or when a program switches is equal to selecting a service on a receiver unit. Therefore, it is desired that assignment of PIDs, especially PIDs of default components, should not be changed as much.

Possibilities of changing PIDs at the broadcasting system are shown below.

[Change of a PID in the middle of an event]

Generally, it should not be changed. However, when a "component_type" (video/audio mode) is switched in the middle of a program or when a transmission system failure occurs, a PID value may be changed as the encoder changes.

[Change of a PID value as an event changes]

A PID may be changed when a component is added/deleted to switch a program (increase/decrease in audio ES, etc.) or when a video format is changed. Therefore, it should be taken into account that this situation commonly occurs.

<Blank Page>

Chapter 14 Definition of Service "On service"/"Off service"

Use of PSI/SI with regard to "On service"/"Off service" is as follows.

- Valid PAT and PMT should be transmitted for a service on service.
- The description of a service in the SDT should not be changed depending on the status of "on service"/"off service".
- When all the services within relevant TS are off service, PAT should be emptied regardless of other PSI/SI.
- A status where PMT_PID is described in the PAT but no PMT is transmitted (use not defined in the MPEG regulation) can be allowed.
- "On service" and "Off service" are one of the following statuses in Table 14-1.

Table 14-1: Types of "On service" and "Off service"

Status	NIT in TS	Description of service list in NIT	Description of this service into PAT	PMT of this service	Remarks
On service	Yes	Yes	Yes	Yes	Normal broadcasting
Off service	Yes	Yes	No	No	Available in all services
	Yes	Yes	Yes	No	
No signals	No	No	No	No	RF only/off the air

Combinations other than the above are in a transition status and previous status is displayed.

Please note that the interpretation of receiver unit operation is assumed as below.

- When valid PAT and PMT exist, the service is "on service".
- SDT is never used to judge whether a service is "on service" or "off service".
- When PAT is empty, all the services within this TS is "off service", regardless of other PSI and SI.

<Blank Page>

Chapter 15 Operation of Time-Related Information

Information on the present date and present time (JST_time) is transmitted in the TOT. The JST_time is defined as "UTC (Universal Time Coordinated) +9 hours" in the ARIB STD-B10, which will be the same all year even if daylight saving time is introduced. A receiver unit is capable of using the TOT to correct its internal clock and based on this internal clock, the time display and the synchronous presentation are implemented. A total of 40 bit field, which consists of lower 16 bits in coded MJD (year/month/day) and 24 bit JTC (JST in 6 binary coded decimal numbers (4 bit each. hour/minute/second)) are used to represent information on dates and times.

(See Annex C, Part 2 of the ARIB STD-B10)

15.1 Relation between the TOT and Program Presentation and Delays in Recording

- The TOT should be transmitted so that at the moment it is received by a receiver unit. Its allowable difference range should be ±500ms. However, when adjustments are made by inserting leap seconds, a maximum difference of approximately 1.5 seconds is allowed for a few minutes before and after the insertion of leap seconds.
- After program source signals are transmitted from a VTR or camera at a broadcasting station until they are presented on a receiver unit, delays caused by transmission media should be taken into account. Such delays include a delay caused by encoding a video at a broadcasting station and decoding it on a receiver unit and a delay caused by transmission lines between broadcasting stations.

15.2 Information Related to Dates and Times Coded in SI

A list of information related to dates and times coded in SI is shown in Table 15-1.

Table 15-1: Date/Time-related information coded in SI

TOT	
JST_time	40bit (year, month, date, hour, minute, second)
EIT	
start_time	40bit (year, month, date, hour, minute, second)
duration	24bit (hour, minute, second)
Local Time Offset Descriptor (TOT)	
local_time_offset	16bit (hour, minute)
time_of_change	40bit (year, month, date, hour, minute, second)
next_time_offset	16bit (hour, minute)

SI Parameter Descriptor (BIT)	
update_time	16bit (year, month, date)

Coded "UTC (Universal Time Coordinated) +9 hours" should always be used for the three types of time-related information in the above table ("JST_time" in TOT, "start_time" in EIT and "time_of_change" (Local Ttime Offset Descriptor)) whether or not daylight saving time is introduced.

15.3 MJD after the year 2038

The lower 16 bits in MJD (Modified Julian Date) will become all '1' on a day in 2038 and all '0' the next day. If the conversion formula in Annex C, Part 2 of the ARIB STD-B10 was used, all '0' would be a day in the 1800's. Therefore, in multimedia broadcasting, the following measures will be taken.

- The conversion formula defined in Annex C, Part 2 of the ARIB STD-B10 will be used after the year 2038 until February 28th, 2100, and lower 16 bits in a converted MJD value will be transmitted.
- Receiver units should memorize dates such as the shipping date of the receiver unit and when information dated obviously later than this date is transmitted, it should be calculated with the 17th bit as '1' and processed accordingly.
- What should be done after the year 2100 has not been decided as of now because a new MJD conversion formula itself should be defined.

Chapter 16 Event Sharing

Event sharing is not used in multimedia broadcasting.

<Blank Page>

Chapter 17 Use of Series

As an example of an application that handles programs as a group, an application that is used to program the recording of serial drama episodes as a series can be considered. The EIT series descriptor is defined in ARIB STD-B10 for such an application. However, the series descriptor is not used in multimedia broadcasting. An application, such as the timer recording per series, is realized using GroupInformation in EPG/ECG metadata. For the correspondence between the series descriptor and EPG/ECG metadata, see "Section 3.9.2 Correspondence between EIT and metadata" in Vol. 10.

In addition, for details about how to realize the scheduled recording per series for real-time broadcasting content, see Section 2.3.3 "Scheduled recording by series unit" in Appendix 1 of Vol. 2. For details about how to realize the scheduled storage per series for storable broadcasting content, see Section 4.4.3 "Scheduled storage by group unit (series/pack)" in Appendix 1 of Vol. 2.

17.1 Information to be Used

- Series information is defined using the GroupInformation (groupType="series") of EPG/ECG metadata. For an example of the group information (series) that is described using GroupInformation, see Annex 3 "Guidelines for Creating the EPG/ECG Using Metadata" in Vol. 10.
- Series information may not be placed in all events.

<Blank Page>

Chapter 18 Event Schedule Change

This chapter describes the rules on and the concept of updating SI information (mainly, EIT[p/f]) when initial broadcasting schedule has to be changed (mostly urgently) as event schedule is changed.

18.1 Undefined Status

As a way to handle an urgent event schedule change and show the status of the actual operation at a station, schedule "undefined status" can be defined.

There are two types of schedule "undefined status" – one is "undecided event status" to show that an event cannot be fixed and the other is "undefined time status" to show that an event has been fixed but time has not.

18.1.1 Undecided event

"Undecided event" shows that the broadcasting schedule has not been decided and its content has not been fixed. "Undecided event" can be defined only in the EIT[p/f] when the event schedule is urgently changed,

"Undecided event" is identified with the "start_time" and "duration" fields in an EIT. In other words, an event with all 1 assigned to both "start_time" and "duration" is "undecided event". In such a case, "event_id" has no meaning.

"Undecided event" is allowed to exist only in "following" in the EIT[p/f].

18.1.2 Undefined time

"start_time" and "duration" can be defined as "undecided" only in the EIT[p/f] when the event schedule is urgently changed. When all 1 is assigned to either of "start_time" or "duration", that means that the time information is undecided. Moreover, when all 1 is assigned to both "start_time" and "duration", that means that the event is an undecided event.

Even when "undefined time" is set up, its "event_id" is valid.

When "undefined time" is set up, events are recognized as below.

- When the "start_time" is undecided.
  This means that the event is scheduled to be broadcast as the next program but the precise start time is undecided due to reasons such as that the ending time of the currently broadcast program is not fixed. This status can occur only in "following" in the EIT[p/f].

- When "duration" is undecided.

  This means that the duration of time that was set up initially may be changed in an event currently being broadcast or being suspended. This status can occur only in "present" and "following" in the EIT[p/f].

18.2 Principles Regarding Change of Programming

- Once the start time of an event has been defined, it should not be transmitted at an earlier time. However, there are times events are started earlier due to unavoidable circumstances.

- The EIT[p/f] reflects changes made to event schedule most reliably.

- Generally, the ETI[p/f] should be transmitted with the corrected content at least 30 seconds before the update and if it is transmitted later, normal operation of recording devices, etc. can not be guaranteed. However, there are cases where this rule cannot be followed due to unavoidable circumstances. Examples of such cases are shown below.

1) When a program registered in "following" is changed to another program immediately before the start time (3 seconds at the shortest).
2) When a program suddenly appears in "present" without appearing in "following" and broadcasting of the program starts.
3) When the current event is extended without updating "present/following" and the start of the next event is delayed.
4) When the current event is extended and the start time of the next event is delayed but "present/following" is updated at the times as described.

18.3 Basic Rules regarding Event Progress

Progress of an event is shown in the EIT[p/f]. To understand the precise progress, the EIT[p/f] should be obtained. There are three parameters to show event progress in the EIT[p/f] as shown below.

- Placement of an event in "present"/"following"
- "start_time" of an event
- "duration" of an event

Please note that the "running_status" in an EIT exists to show the progress of an event like this, but in multimedia broadcasting, it is always defined as "reserved" and is not used.

- Judgement of "Ongoing"/"Ended"

Whether or not an event is ongoing (and an event has ended) can be judged from whether the event is placed in "present" in the EIT[p/f]. In other words, when an event is placed in "present", it is being broadcast and when an event that was placed in "present" disappears from the EIT[p/f], it is regarded that the event has ended.

- Judgement of "Started"

Whether or not an event has started is judged based on the "start_time" of "following" in the EIT[p/f]. In other words, it is regarded that an event has started when it is the time shown in "start_time" of "following". Please note that an EIT will not always be updated at the time shown in "start_time" because of EIT cycles. EIT[p/f] should be updated without fail within 10 seconds after "start_time" of "following". If it is not updated within 10 seconds, it is regarded that it is in an abnormal status. Only during this 10 seconds, while a program is regarded as "being broadcast" based on the status of "present", it is regarded as started based on the status of "following".

- Judgement of "Interrupted"

Whether or not an event is being interrupted is judged by comparing "start_time" of "following" in the EIT[p/f] and the present time. Please note that when an event is going to be interrupted soon, the times in "present" and "following" may overlap each other. To interrupt an event, the content of "present" should be moved to "following" without changing "start_time" (an event can be recognized as "suspended" when it is in this status). To re-start an event, the content of "following" should be placed in "present" without changing "start_time". Additionally, an event is judged as "re-started" when the EIT[p/f] is placed in "present". This is because the re-start time cannot be described as "start_time" of a intterupted event (following) should not be changed.

- Judgement of "Cancelled"

A broadcaster judges that an event has been cancelled when this event has not been described in SI after more than 3 hours have passed from the initially scheduled start time. For example, even when event schedule is changed and a program will be broadcast the next day or later, the EIT[schedule] needs to be updated within 3 hours.

Table 18-1 shows progress of events judged from "start_time" and "duration" in the EIT[p/f]

Table 18-1: Values of “start_time” and “duration” in the EIT[p/f] and status shown with those values

	start_time	duration (end_time)	Status
Present	Before the present time	Before the present time	Program in progress (during the transition period) (Note 1)
	Before the present time	After the present time	Program in progress
	Before the present time	Undecided	Program in progress and ending time undecided (Very likely to change to “early ending”, “extension”, etc)
	Undecided	Optional	Abnormal status
	After the present time	Any value	Abnormal status
Following	Any value	Before the present time	Abnormal status
	Before the present time	After the present time	Program being suspended. Scheduled to end at the ending time shown with “duration” value including the suspended period (Note 1).
	Before the present time	Undecided	Program being suspended. Scheduled ending time undecided.
	After the present time	After the present time	Schedule to be broadcast as the next program.
	After the present time	Undecided	Schedule to be broadcast as the next program but the ending time undecided.
	Undecided	Other than Undecided	Schedule to be broadcast as the next program but the scheduled start time undecided. The “duration” value is valid.
	Undecided	Undecided	Next program itself is undecided. Described event has no meaning.

Note 1: Although the rule says that EIT[p/f] should be updated without fail within 10 seconds after “start_time” of “following”, there may be just a delay in the update of the EIT[p/f]. For example, if “start_time” and “duration” of “following” are before the present time and after the present time respectively as shown in the above table, this can be regarded that the program is being suspended. On the other hand, if the present time is very close to “start_time” of “following” (less than 10 seconds), there may be a delay in the update of the EIT[p/f], so this should be taken into account and should be regarded that the program is in progress.

18.4 Consistency between EIT and EPG/ECG Metadata

Normally, there is consistency between the information in the EIT and EPG/ECG metadata. However, a situation where consistency may not be obtained can occur due to a change in an event schedule. In a receiver, a program guide is usually created using the data obtained from

EPG/ECG metadata. The EIT is used to confirm or set a scheduled recording for real-time broadcasting.

18.4.1 Notes on consistency between EIT and EPG/ECG metadata

The speed of updating the EIT is faster and more accurate than that of the EPG/ECG metadata. In addition, the frequency of transmitting the EPG/ECG metadata is lower. Therefore, information on the program currently being executed may not be obtained due to a schedule change. On the other hand, the program currently being executed is always described in the EIT, although a maximum of 10 programs can be described. As a result, in order to realize an application, such as an EPG, in the receivers, an event list must be created in chronological order starting from the event currently being broadcasted. When creating the list, the event information stored in the EIT and the receivers must be merged.

In normal status, the information in the EIT and EPG/ECG metadata is used with consistency. However, if an event schedule has been changed, inconsistency exists between the information in the EIT and EPG/ECG metadata.

The guidelines for the receivers when creating an event list by merging the information in the EIT and EPG/ECG metadata to store the merged information in the receivers are provided below.

- If the event information stored in a receiver and the event_id of the EIT are the same and if there is a difference between both start_time or duration, the start_time or duration of the event information stored in the receiver is corrected based on the information in the EIT.

  (Desirable correction method examples)

  - If the start_time in an applicable EIT is different from the value stored in a receiver, correct the duration of the previous event information to match the start_time in the EIT.
  - If the duration in an applicable EIT is different from the values stored in a receiver, correct the start_time of the event information that follows immediately after the information in the EIT to match the duration in the EIT.

- If the event information stored in a receiver does not match the event_id in the EIT, correct the event information stored in the receiver using the information in the EIT. The start_time and duration in the EIT are used in preference. If there is an event for which the time overlaps, correct the start_time and duration of the event information stored in the receiver so as not to overlap those in the EIT.

  (Desirable correction method examples)

  - If there is an event for which the start_time overlaps in an applicable EIT, correct the duration in the event information to match the start_time in the EIT.

- If there is an event for which the duration overlaps in an applicable EIT, correct the start_time of the event information to match the duration in the EIT.

The following conditions must be taken into account when performing the correction operation provided in the guidelines above.

◇Among the event lists stored in a receiver, event information that is older than the current date and time must be discarded before merging with the EIT, and such information must not be used for merging.

◇When merging with the EIT, the order of the merging process is the same as the correction process of the present event in the EIT (priority is given to the most recent event when processing):

Correction processing of the present event

↓

Correction processing of the following event

↓

Correction processing of the after event

18.4.2 Integrity between EIT[p/f] and EIT[p/f after]

As only a maximum of two programs can be described in the EIT[p/f] and a maximum of eight programs can be described in the EIT[p/f after], then the EIT[p/f] and EIT[p/f after] need to be used after merging them in order to create an event list in chronological order starting from the current broadcasting event in a receiver and to merge the event information in the EIT and the event information stored in the receiver.

In the normal state, the event information can simply be merged. However, if an event schedule is changed, inconsistency between the information in the EIT[p/f] and EIT[p/f after] might exist.

It is desirable to note the following points when merging the EIT[p/f] and EIT[p/f after] in a receiver.

○ If the present, following, and after events that are presented in the EIT are fixed (namely, each event is not in an undefined status), merge the EIT[p/f] and EIT[p/f after] without changing them.

○ If the duration time of the present event is set to undefined, the EIT[p/f after] may be transmitted as an empty section. Even if the EIT[p/f after] has been transmitted, there is a strong possibility that the EIT[p/f after] is inconsistent with the EIT[p/f]. Therefore, the event is specified as a present event until the last event end time as described in the

EIT[p/f after].

○ If the present event is defined but the following event is not defined, the EIT[p/f after] may be transmitted as an empty section. Even if the EIT[p/f after] has been transmitted, there is a strong possibility that the EIT[p/f after] is inconsistent with the EIT[p/f]. Therefore, the defined present event is used as-is, and the event is specified as the following event (undefined) until the last event end time described in the EIT[p/f after].

18.5 Guidelines for Transmission of Change of Programming

Guidelines for transmission of the change of programming are shown below. The operation as described below cannot always be guaranteed because actual operation at each station may be different (For example, "undecided event" or "undefined time" may be transmitted before schedule change is fixed). However, they should be considered as a basic idea.

Please note that the following guidelines are given to describe schedule change of events described in SI and not to mention management units such as programs within a station. How events should be assigned to management units within a station should be decided by each broadcaster based on the definition of events.

18.5.1 Event-extension

When an event is extended (a program is broadcast beyond the scheduled ending time), changes should be made to the EITs as shown below.

At least 30 seconds before the scheduled ending time of the event, "duration" of "present" in the EIT[p/f] should be changed. In other words, the "duration" value should be changed to a correct value for the extension or set to "undecided". At the same time, "start_time" of "following" should be changed for consistency. It is prohibited to set up the times in "present" and "following" in a way they overlap each other. Additionally, the minimum extension time is 1 minute.

EIT can be updated repeatedly to extend an event. For example, when a baseball game program is extended, the EIT is updated for 10-minute extension tentatively and can be updated again for further extension according to the situation.

Please note that even after an EIT is transmitted with "undefined times", it is desirable to update the EIT accordingly as soon as extension schedule is fixed.

18.5.2 Event-shortening (early ending of an event)

Event-shortening (a program ends earlier than the scheduled time), changes should be made to the EITs as shown below.

When it is decided to end an event earler, the EIT[p/f] based on the new schedule should be transmitted promptly, in which case, the “duration” value of “present” should be smaller than the original one. It is desirable to have transmitted the fixed EIT[p/f] at least 30 seconds before the actual early ending time. Please note that a receiver unit regards that a program has ended when the description disappears from the EIT[p/f].

How to describe an EIT after an event ends earlier is up to each broadcaster but it should be avoided to broadcast an event at a time earlier than the initially defined starting time.

18.5.3 Event-delay

When an event starts later (a program starts later than the scheduled time), changes should be made to the EITs as shown below.

When it is decided to start an event later, the EIT[p/f] should be updated and transmitted promptly if necessary (if it is decided that the change will influence the table). In this case, the “start_time” value should be changed so that the event will be delayed for a required duration of time. Also, at least 30 seconds before the initially scheduled start time, fixed EIT[p/f] should be transmitted.

Event if the change due to the late starts of an event will not influence the EIT[p/f], the fixed content should be reflected into the EIT[schedule] promptly. In this case, information on the event including the newly fixed broadcasting time should be described within 3 hours of the initially scheduled start time. If it takes more than 3 hours before the fixed information is described, a receiver unit should recognize that this event has been canceled.

18.5.4 Event-Interrupption

When an event is suspended (a program is stopped while it is being broadcast for some reason and another program is broadcast), changes should be made to the EITs as shown below.

When the suspension time comes, the present event in the EIT[p/f] should be described in “following” and ”start_time” and “duration” should not be changed (when it is clear that the duration of time will be changed because of the event suspension, only “duration” should be changed). The description of the “present” event can be decided according to the content of the program to be broadcast.

It is allowable to suddenly place an event (multiple events), such as news, in the present while suspending. However, placing an event that is defined in the EPG/ECG metadata in advance must be avoided.

To re-start an event, it should be re-placed in “present” at the re-start time.

To end an event that is being suspended without re-starting it, the description of the suspended event should be erased from the EIT[p/f] (another event should be described in "following").

Additionally, times in "present" and "following" may overlap each other during suspension.

18.5.5 Cut-in of an event

When an event cuts in (a program is suddenly inserted during broadcast), changes should be made to the EITs as shown below.

When prior arrangement can be made, a cut-in event should be described in "following" in the EIT[p/f]. When prior arrangement cannot be made, a cut-in event should be suddenly described in "present" in the EIT[p/f]. A cut-in event needs to be given a new event ID but the same ID should not be given as described in the event ID assignment rules.

To suspend an event that is currently broadcast as an event cuts in, changes should be made to the EIT[p/f] in accordance with the description in Section 18.6.4.

18.5.6 Event-forwarding (early start of an event)

As a rule, event-forwarding (bringing forward the start time of a program) must not be used.

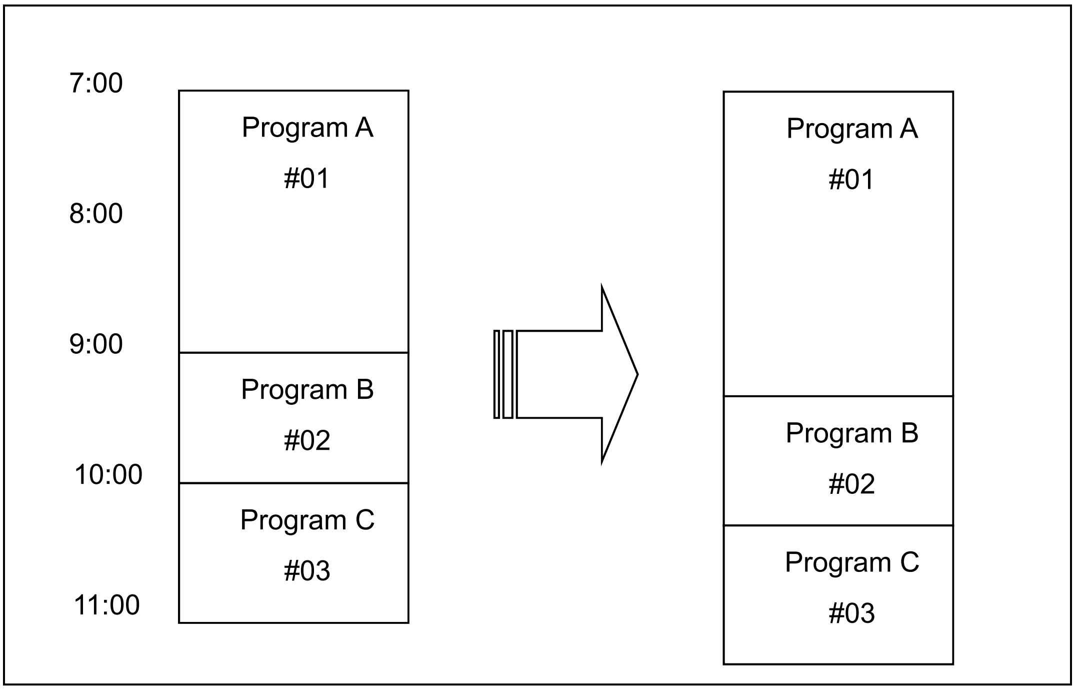
18.6 Examples of Transmission of the Change of Programming

Examples of EIT[p/f] transmission of the change of programming in each case are shown below.

Tables will not always be transmitted as described below but they can be useful for how to define undefined times and undecided events.

18.6.1 Case of event-extention

As the ending time of Program A is changed from 9:00 to 9:20, the start times of Program B and C is delayed for 20 minutes.



[Initial Schedule]

	present				following			
Time	Program title	event _id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
9:00	Program B	02	9:00	1:00	Program C	03	10:00	1:00

[Examples of Schedule Change]

When extension of the event is repeated based on the fixed content.

It is decided to extend an event for 10 minutes first (8:55), then another extension for 10 minutes is fixed (9:05).

	present				following			
Time	Program title	event _id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:55	Program A	01	7:00	2:10	Program B	02	9:10	1:00
9:05	Program A	01	7:00	2:20	Program B	02	9:20	1:00
9:20	Program B	02	9:20	1:00	Program C	03	10:20	1:00

When the content is fixed quickly when “undecided” events are used.

The programs after the next are defined as “undecided” when a possibility of extension arises (8:55) and the EIT is fixed when the extension times are fixed (9:15).

	present	following

Time	Program title	event _id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:55	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
9:15	Program A	01	7:00	2:20	Program B	02	9:20	1:00
9:20	Program B	02	9:20	1:00	Program C	03	10:20	1:00

When it takes long to fix the content when "undecided" events are used (1)

The programs after the next are defined as "undecided" when a possibility of extension arises (8:55), the contents of events in "undefined status" cannot be fixed in time (9:30) and Program B starts without notice (9:20).

	present				following			
Time	Program title	event _id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:55	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
9:20	Program B	02	9:20	Undecided	Undecided	Any	Undecided	Undecided
9:30	Program B	02	9:20	1:00	Program C	03	10:20	1:00

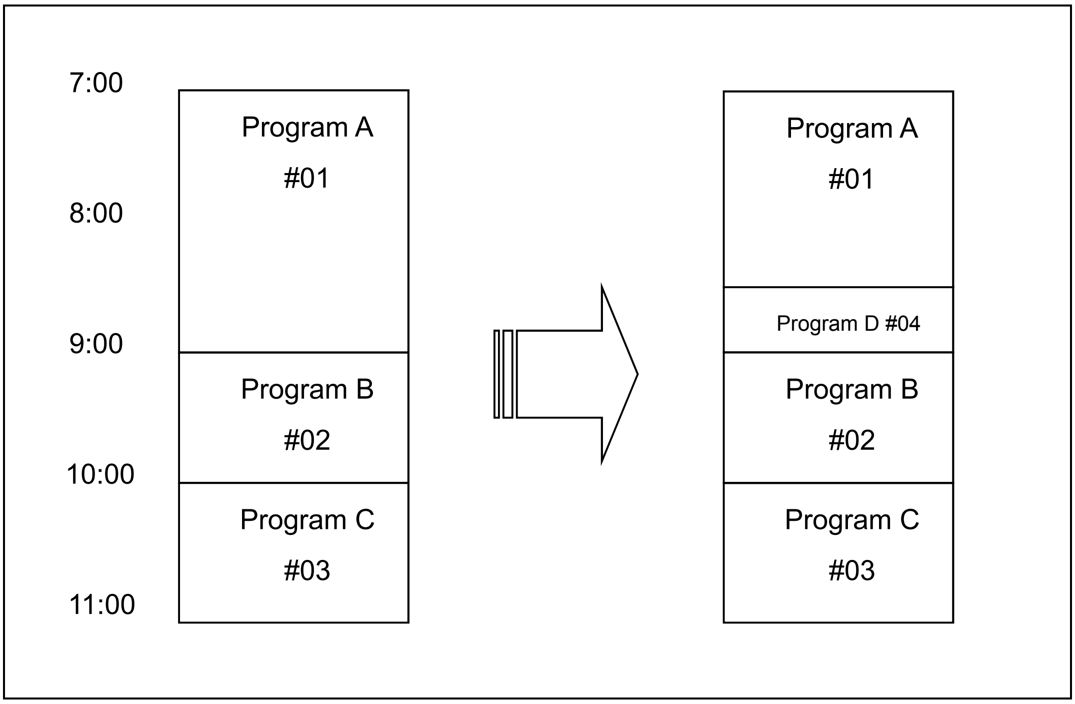
When it takes long to fix the content when "undecided" events are used (2)

The programs after the next are defined as "undecided" when a possibility of extension arises (8:55), the contents of events in "undefined status" cannot be fixed in time (9:30) and Program B starts without notice (9:20). Please note that whether or not Program A will be canceled has not been decided at the time (9:20).

	present				following			
Time	Program title	event _id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:55	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
9:20	Program B	02	9:20	Undecided	Program A	01	7:00	Undecided
9:30	Program B	02	9:20	1:00	Program C	03	10:20	1:00

18.6.2 Event-shortening

As Program A ends 20 minutes earlier than the initial schedule, a new Program D is broadcast for 20 minutes. Programs B and C are broadcast as scheduled.



[Initial Schedule]

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
9:00	Program B	02	9:00	1:00	Program C	03	10:00	1:00

[Examples of Schedule Change]

When changes are made based on the fixed content.

At 8:30, it is fixed that Program A will end earlier and Program D will be broadcast after Program A.

	present				following			
Time	Program title	event _id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:30	Program A	01	7:00	1:40	Program D	04	8:40	0:20
8:40	Program D	04	8:40	0:20	Program B	02	9:00	1:00
9:00	Program B	02	9:00	1:00	Program C	03	10:00	1:00

When the content is fixed quickly when "undecided" events are used.

When the possibility of ending an event earlier becomes high (8:30), programs after the next are defined as “undecided”. Then, before the actual early ending time (8:40), the content of the next programs can be fixed (8:35).

	present				following			
Time	Program title	event _id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:30	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
8:35	Program A	01	7:00	1:40	Program D	04	8:40	0:20
8:40	Program D	04	8:40	0:20	Program B	02	9:00	1:00
9:00	Program B	02	9:00	1:00	Program C	03	10:00	1:00

When it takes long to fix the content when “undecided” events are used (1)

When the possibility of ending an event earlier becomes high (8:30), programs after the next are defined as “undecided” and information can not be updated in time for the actual early ending time (8:40). (8:50)

	present				following			
Time	Program title	event _id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:30	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
8:40	Program D	04	8:40	Undecided	Undecided	Any	Undecided	Undecided
8:50	Program D	04	8:40	0:20	Program B	02	9:00	1:00
9:00	Program B	02	9:00	1:00	Program C	03	10:00	1:00

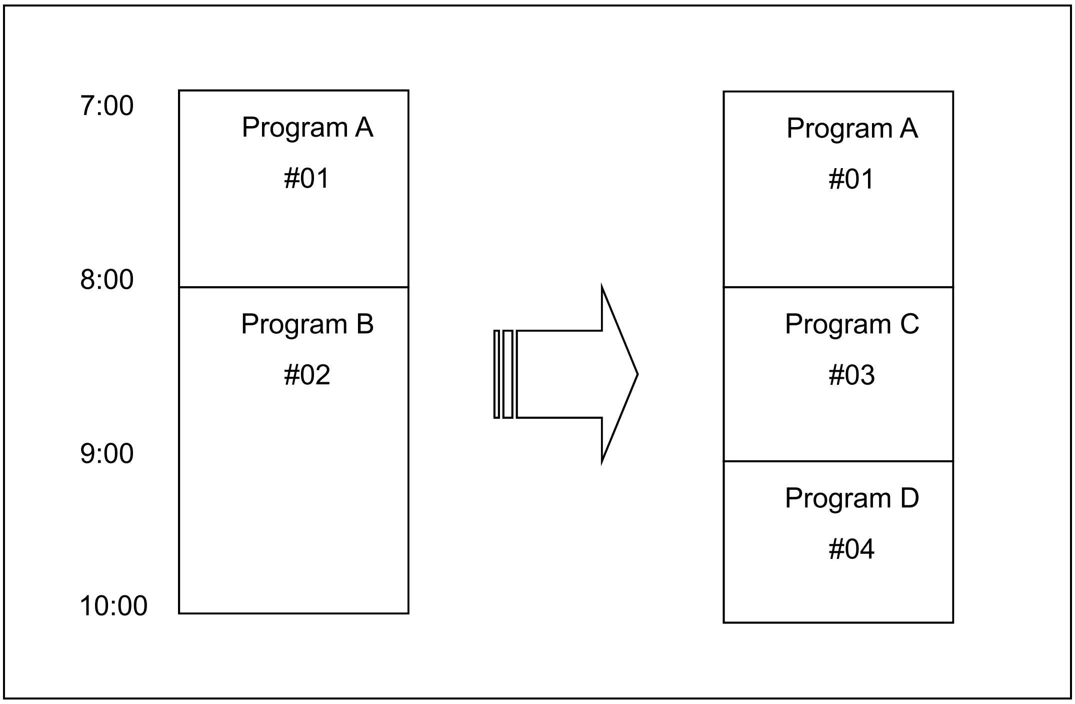
When it takes long to fix the content when “undecided” events are used (2)

When the possibility of ending an event earlier becomes high (8:30), programs after the next are defined as “undecided” and information can not be updated in time for the actual early ending time (8:40) (8:50). (Program A remains in “following” at the time of 8:40).

	present				following			
Time	Program title	event _id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	2:00	Program B	02	9:00	1:00
8:30	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
8:40	Program D	04	8:40	Undecided	Program A	01	7:00	Undecided
8:50	Program D	04	8:40	0:20	Program B	02	9:00	1:00
9:00	Program B	02	9:00	1:00	Program C	03	10:00	1:00

18.6.3 Event-change

Program B that was scheduled to be broadcast is canceled and Programs C and D are broadcast instead.



[Initial Schedule]

	present				following			
Time	Program title	event_ id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	2:00

[Examples of Schedule Change]

When changes are made based on the fixed content.

At 7:40, the cancellation of Program B and the broadcasting of Programs C and D are fixed.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	2:00
7:40	Program A	01	7:00	1:00	Program C	03	8:00	1:00
8:00	Program C	03	8:00	1:00	Program D	04	9:00	1:00

When the content is fixed quickly when “undecided” events are used.

When the possibility of canceling Program B becomes high (7:20), programs after the next are defined as “undecided”. Then, at the time when the cancellation is fixed (7:40), the next program, Program C, is described.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	2:00
7:20	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
7:40	Program A	01	7:00	1:00	Program C	03	8:00	1:00
8:00	Program C	03	8:00	1:00	Program D	04	9:00	1:00

When it takes long to fix the content when "undecided" events are used (1)

When the possibility of canceling Program B becomes high (7:20), programs after the next are defined as "undecided". Then, the cancellation is fixed and broadcasting of Program C starts (8:00) but information cannot be updated in time (8:10).

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	2:00
7:20	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
8:00	Program C	03	8:00	Undecided	Undecided	Any	Undecided	Undecided
8:10	Program C	04	8:00	1:00	Program D	04	9:00	1:00

When it takes long to fix the content when "undecided" events are used (2)

When the possibility of canceling Program B becomes high (7:20), programs after the next are defined as "undecided". Then, the cancellation is fixed and broadcasting of Program C starts (8:00) but information cannot be updated in time (8:10). (Program A remains in "following" at the time of 8:00).

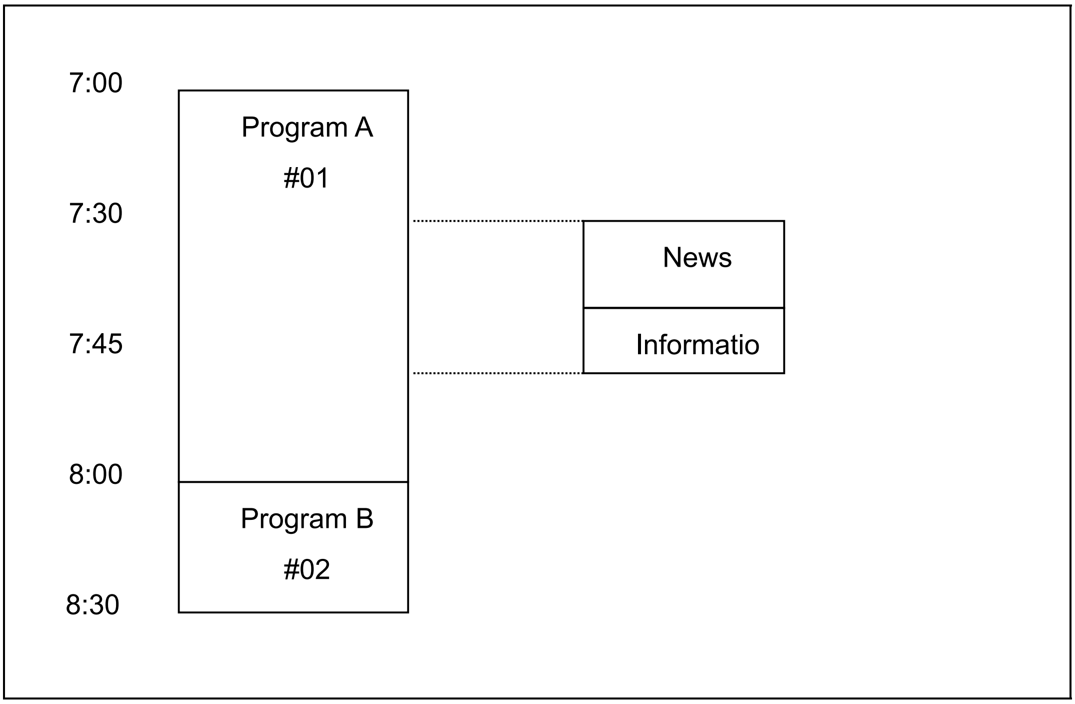
	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	2:00
7:20	Program A	01	7:00	Undecided	Undecided	Any	Undecided	Undecided
8:00	Program C	03	8:00	Undecided	Program A	01	7:00	Undecided
8:10	Program C	04	8:00	1:00	Program D	04	9:00	1:00

18.6.4 Program cut-in (1)

While Program A is being broadcast, emergency news, etc. is inserted.

After the news, a filler or information is broadcast.

Then, Program A is re-started.



[Initial Schedule]

	present				following			
Time	Program title	event_id	start	duration	Program title	event_id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30

[Examples of Schedule Change]

When changes are made based on the fixed content.

	present				following			
Time	Program title	event_id	start	duration	Program title	event_id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30
7:25	Program A	01	7:00	1:00	News	99	7:30	0:10
7:30	News	99	7:30	0:10	Program A	01	7:00	1:00
7:40	Information	88	7:40	0:05	Program A	01	7:00	1:00
7:45	Program A	01	7:00	1:00	Program B	02	8:00	0:30

* It is also possible to make sudden changes at 7:30 without making changes at 7:25.

When information is updated after “undefined status” is defined

	present				following			
Time	Program title	event_id	start	duration	Program title	event_id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30

7:25	Program A	01	7:00	undecided	undecided	Any	undecided	undecided
7:30	News	99	7:30	undecided	Program A	01	7:00	undecided
7:40	Information	88	7:40	undecided	Program A	01	7:00	undecided
7:45	Program A	01	7:00	1:00	Program B	02	8:00	0:30

When dealing with the changes by changing the event name without changing the event.

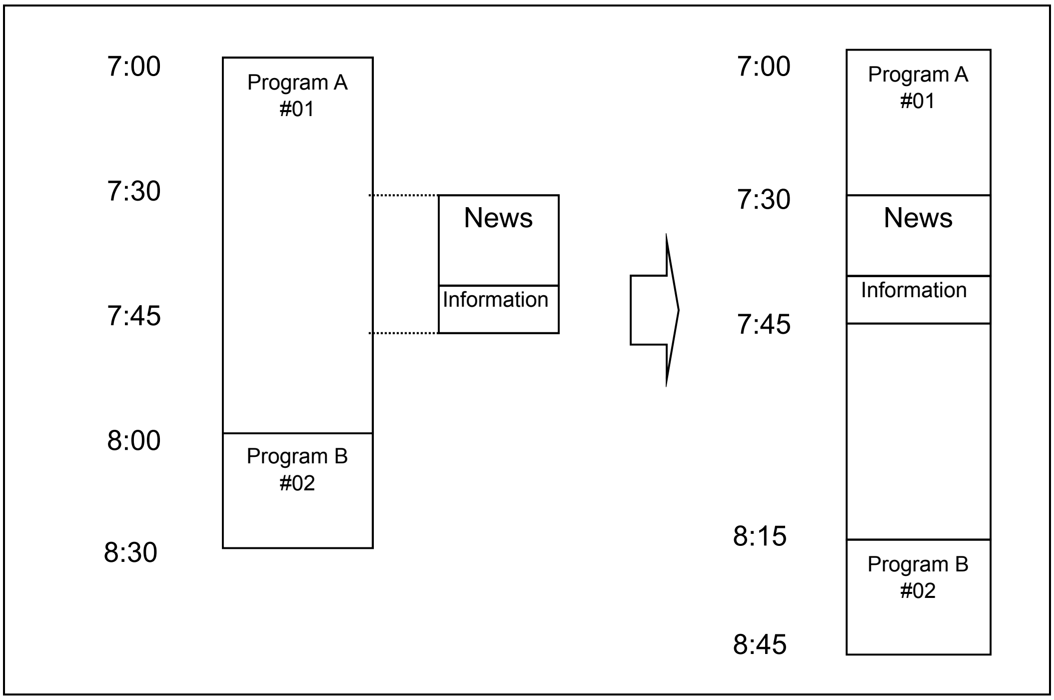
	present				following			
Time	Program title	event_ id	start	duration	Program title	event _id	start	duratio n
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30
7:30	News	01	7:00	1:00	undecided	Any	undecided	undecided
7:40	Information	01	7:00	1:00	undecided	Any	undecided	undecided
7:45	Program A	01	7:00	1:00	Program B	02	8:00	0:30

18.6.5 Program cut-in (2)

While Program A is being broadcast, emergency news, etc. is inserted.

After the news, a filler or information is broadcast.

Then, Program A is re-started from where it was suspended. Therefore, the ending time of Program A is delayed.



[Initial Schedule]

	present				following			
Time	Program title	event _id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30

[Examples of Schedule Change]

When changes are made based on the fixed content.

	present				following			
Time	Program title	event _id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30
7:25	Program A	01	7:00	1:15	News	99	7:30	0:10
7:30	News	99	7:30	0:10	Program A	01	7:00	1:15
7:40	Information	88	7:40	0:05	Program A	01	7:00	1:15
7:45	Program A	01	7:00	1:15	Program B	02	8:15	0:30

* It is also possible to make sudden changes at 7:30 without making changes at 7:25.

When information is updated after "undefined status" is defined.

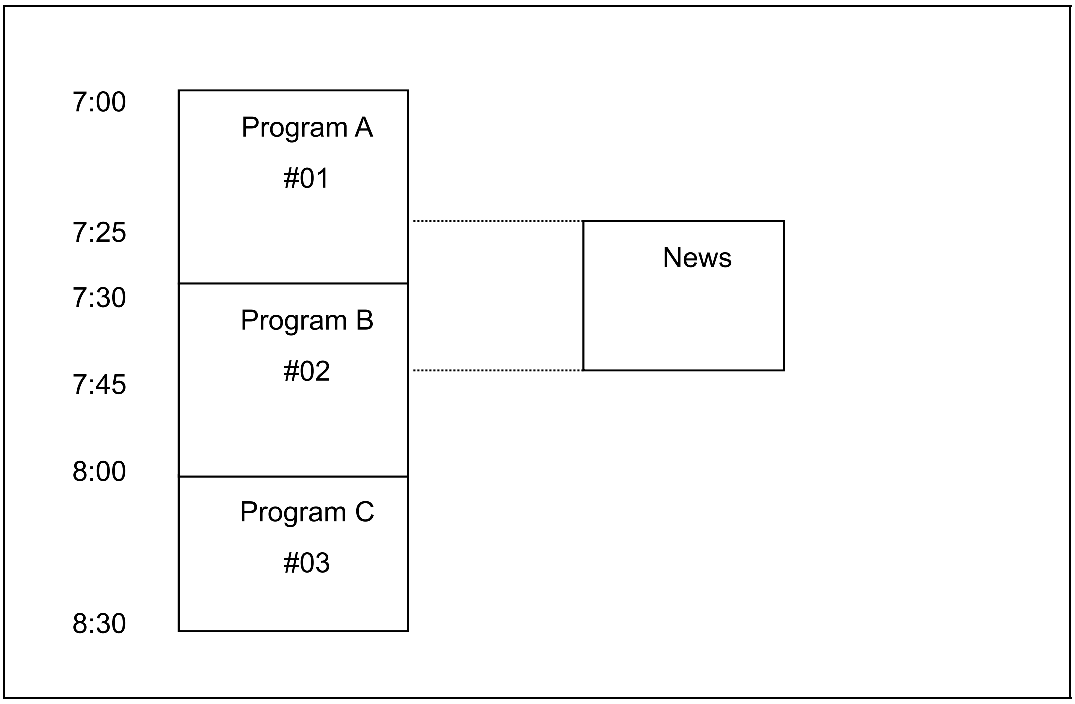
	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30
7:25	Program A	01	7:00	undecided	undecided	Any	undecided	undecided
7:30	News	99	7:30	undecided	Program A	01	7:00	undecided
7:40	Information	88	7:40	0:05	Program A	01	7:00	1:15
7:45	Program A	01	7:00	1:15	Program B	02	8:15	0:30

When dealing with the changes by changing the event name without changing the event.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	1:00	Program B	02	8:00	0:30
7:30	News	01	7:00	undecided	undecided	Any	undecided	undecided
7:40	Information	01	7:00	undecided	undecided	Any	undecided	undecided
7:45	Program A	01	7:00	1:15	Program B	02	8:15	0:30

18.6.6 Program cut-in (3)

Emergency news is inserted during broadcasting of Program A and ends during the scheduled broadcasting time of Program B. Then, Program B is re-started (started).



[Initial Schedule]

	present				following			
Time	Program title	event_ id	start	duration	Program title	event _id	start	duration
7:00	Program A	01	7:00	0:30	Program B	02	7:30	0:30
7:30	Program B	02	7:30	0:30	Program C	03	8:00	0:30

[Examples of Schedule Change]

When changes are made based on the fixed content.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	0:30	Program B	02	7:30	0:30
7:20	Program A	01	7:00	0:25	News	99	7:25	0:20
7:25	News	99	7:25	0:20	Program B	02	7:45	0:15
7:45	Program B	02	7:45	0:15	Program C	03	8:00	0:30

* It is also possible to make sudden changes at 7:25 without making changes at 7:20.

When information is updated after “undefined status” is defined.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event _id	start	duration

7:00	Program A	01	7:00	0:30	Program B	02	7:30	0:30
7:25	News	99	7:25	undecided	Program A	01	7:00	0:30
7:30	News	99	7:25	undecided	undecided	Any	undecided	undecided
7:45	Program B	02	7:45	0:15	Program C	03	8:00	0:30

When dealing with the changes by changing the event name without changing the event.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	0:30	Program B	02	7:30	0:30
7:25	News	01	7:00	0:30	undecided	Any	undecided	undecided
7:30	News	02	7:30	0:30	undecided	Any	undecided	undecided
7:45	Program B	02	7:30	0:30	Program C	03	8:00	0:30

When “following” is defined as “undecided”.

	present				following			
Time	Program title	event_ id	start	duration	Program title	event_ id	start	duration
7:00	Program A	01	7:00	0:30	Program B	02	7:30	0:30
7:20	Program A	01	7:00	undecided	undecided	Any	undecided	undecided
7:25	News	99	7:25	undecided	Program A	01	7:00	undecided
7:40	News	99	7:25	0:20	Program B	02	7:45	0:15
7:45	Program B	02	7:45	0:15	Program C	03	8:00	0:30

18.6.7 Event-forwarding

Event-forwarding is not used.

Chapter 19 Conditional Access

Note: The content of this chapter is applied when conditional access is used in multimedia broadcasting. For details, see Vol. 5.

Attention should be paid to the following points when PSI/SI is created and transmitted in conditional access broadcasting. See Vol. 5 for details

19.1 Specification of EMM Streams

How to describe PSI/SI when an EMM stream is transmitted is shown below.

- When an EMM stream is transmitted, a conditional access descriptor should be present in the CAT in a TS.
- When EMM streams in multiple conditional access systems are transmitted, conditional access descriptors for each system should be present.
- When an EMM stream is transmitted, its transmission format should be described in the first byte in the "private_data_byte" field of the conditional access descriptor placed in the CAT.

The transmission format of an EMM stream should be specified according to Table 19-1. For the details of EMM stream transmission formats, see Vol. 5.

Table 19-1: EMM stream transmission formats

Value	Meaning
0x00	Undifined
0x01	Type A
0x02	Type B
0x03 to FF	Reserved for future use

19.2 Setup of Chargeable Units for Programs

Setup of a chargeable unit, relations between a chargeable unit and an ECM, and between an ECM and scrambling are shown below.

- Setup of a chargeable unit
  - Only one chargeable unit can be setup for one program.
- Relation between a chargeable unit and an ECM
  - Multiple ECMs support a chargeable unit.
  - For a Protected Free Program, one ECM corresponds to each conditional access system

in the program.

However, even in the above case, if an ES has "component_tag" set to either of 0x30 to 0x7F or 0x84 to 0x86, it does not have to correspond to an ECM.

- Relation between ECM and scrambled ES
  - An ES which has a corresponding ECM are scrambled.
  - However, when there is a transient response between programs on the transmitting end or a filler is inserted, an ECM-supporting ES is not necessarily scrambled. Whether or not a component is scrambled can be shown with the "transport_scrambling_control" field in a TS packet header.

Please note that programs can be defined and categorized as follows depending on whether the program is chargeable/non-chargeable.

- Free program: A program whose group of default ES' are non-chargeable
  - In multimedia broadcasting, all ESs that belong to a free program are non-chargeable.
- Pay program: A program whose group of default ES' are chargeable
  - The same chargeable unit (ECM) should be setup for group of default ES' at least.
  - Components other than group of default ES' can be setup as non-chargeable only when they are ESs whose "component_tag" is set to either of 0x30 to 0x7F, 0x84 or 0x86.

Groups of default ES' in Conditional Access Broadcasting are defined for each "service_type" taking into chargeable/non chargeable programs (See Table 30-61). This is shown in Table 19-2.

Table 19-2: Groups of default ES' in conditional access

service_type	Content	Groups of default ES'
0xC2	Video real-time broadcasting service	Video default ES (component_tag=0x00) Audio default ES (component_tag=0x10)
0xC2	Audio real-time broadcasting service	Audio default ES (component_tag=0x10)
0xC2	Independent data broadcasting service	Data (entry component)

Services which are not defined above are not chargeable, therefore their groups of default ES' are not defined.

19.2.1 PMT

When a program is charged, or scrambled because it is a Protected Free Program, a conditional access descriptor should be present in the PMT and a valid ECM should be specified. The rules of PMT are provided below.

1) For a pay program or a Protected Free Program, a conditional access descriptor describing a valid ECM should be present in the first loop.

2) For a Protected Free Program, an ECM_PID with a Broadcaster identifier for copyright protection should be specified. For Broadcaster identifier values for copyright protection, see Vol. 8.

3) If the conditional access system descriptor is placed in the first loop by specifying an effective ECM, the conditional access system descriptor is placed in the second loop by specifying the ECM_PID as 0x1FFF only for an ES, of which component_tag is set to 0x30 to 0x7F, 0x84, or 0x86, other than the default ES group, thus creating a non-scramble state.

   In this case, the ECM for which ECM_PID is set to 0x1FFF is not transmitted.

4) If the conditional access system descriptor is placed in the first and second loops, priority is given to the description in the second loop in the ESs where the conditional access system descriptor is placed.

19.2.2 SDT/EIT

In the SDT and EIT, taking into account convenience for scheduling of program recording, in multimedia broadcasting, values of the “free_CA_mode” field are assigned as shown below to identify whether a program is free or chargeable.

0: Free program

1: Pay program

The rules for setting up the values are provided below.

- In the SDT, a free/chargeable ID value which is setup by a broadcaster for each service channel should be assigned.

  For example, “1” is normally assigned to this field in the SDT for a service channel subscribed under a flat/tiered-rate charging contract on which pay programs are broadcast, and even if a free program is broadcast for a certain period of time or in a certain slot on this service channel, this value remains “1”.

- In the EIT, a free/chargeable ID value should be assigned to identify whether each program is free/chargeable.

Therefore, in order to identify whether each program is free or chargeable, a receiver unit uses the values in EITs, not the values in SDTs.

For details about how to identify free/charged content in storable broadcasting services, see "PLT/BE/Free/@value" (Table 3-74 in Section 3.9.2 in Vol. 10).

19.3 Setup of Information on Confirmation of Programming for Viewing (Recording)

A CA contract info descriptor provides the information on the availability of viewing or recording the program on the view or schedule recording of a chargeable program. Attention should be paid to the following points when this descriptor is described.

CA contract info descriptors can be present in the SDT. The rules are provided below.

1) When a chargeable unit has been set up, only one descriptor can be present.
   In other words,

- When “free_CA_mode” is set to ‘0’, this descriptor should not be present.
  (this should not be present for a Protected Free Program).

- When “free_CA_mode” is set to ‘1’, a descriptor whose “CA_unit_id” is set to ‘0x1’ should be always present.

2) In the SDT, default contract confirmation information for overall programs transmitted on the service channel should be described.

A receiver unit will make judgments based on the following criteria.

1) Contract confirmation information in the SDT is invalid in either of the following cases.

   a) When “free_CA_mode” is set to ‘0’ and at the same time, a CA contract info descriptor whose ”CA_unit_id” is set to ‘0x1’ exists.

   b) When “free_CA_mode” is set to ‘1’ and at the same time, a CA contract info descriptor whose “CA_unit_id” is set to ‘0x1’ does not exist.

2) 0x1 to 0xF is set as a CA_unit_id value.
   When this descriptor whose “CA_unit_id” is set to a value either of 0x2 to 0xF exists in the SDT,

   a) When IC card contract confirmation command/response was “PPV service”, it will be processed as PPV non-compatible receiver unit.

b) When it was other than “PPV service”, this descriptor is treated as invalid.

3) Reservations cannot be made if the content described in the SDT is invalid.

Please note that once confirmation information has been transmitted, changing it should be avoided as much as possible as that may cause a malfunciton when scheduling view/record of a receiver unit starts.

19.4 Setup of Chargeable Units in the Multi-View Television

Multi-view TV service is not provided in multimedia broadcasting.

19.5 Setup of Display Control in Automatic Display of Message

Automatic message display is not supported in multimedia broadcasting.

19.6 Setup of a Link to a CA substitute Service

A link to CA substitute service is not used in multimedia broadcasting.

<Blank Page>

Chapter 20 Notifying Various URIs to Receivers

20.1 Notifying the URI of the Linked BML Document

The URI of the linked BML document is not notified in multimedia broadcasting.

20.2 Notifying Authority

An authority is not notified in multimedia broadcasting.

<Blank Page>

Chapter 21 Digital Copy Control

Digital copy control descriptors and content availability descriptors are used by a broadcaster to transmit information on digital recording and signal output conditions of a program to receiver units and digital recorders. In a digital copy control descriptor, digital copy control information in DTCP-compatible high-speed digital interfaces and the maximum bit rate used to check recording availability and to select a recording mode can be specified. Additionally, in a content availability descriptor, the encryption status of output signals can be specified.

Any TS output other than that using a high-speed digital interface that corresponds to the DTCP is not permitted in multimedia broadcasting. In other words, if a broadcaster sets "copy_control_type" in a digital copy control descriptor to '01' in order to protect the content, it means that content protection under DTCP is used. An important point to keep in mind here is that if, for example, in a video real-time broadcasting service, a value other than '01' is set for "copy_control_type", basically, not only digital data output but also analogue video output will be prohibited. When a new digital output method is implemented in a receiver unit in the future, new regulations should be added (For details, see Table 3-1 "Output control by digital copy control descriptor and content availability descriptor" in Section 3.3.2 in Vol. 8).

A digital copy control descriptor can be present in the first and second loops in a PMT and a SDT (for details, see Table 8-2 and Table 8-4 in Chapter 8 of this volume). Basic copy control is performed in accordance with Annex F of the ARIB STD-B10, but the detailed operation is described in the section about the descriptors. Moreover, a content availability descriptor can be placed in the first loop of PMT.

The digital copy control descriptor is not placed in the PMT for a storable broadcasting service. For the digital copy control for the storable broadcasting service content, see the Mode/@href of the LIT/LI/RMPIDescription/OutputRestriction/Port[@href="ARIBOutputPortCS:digital_serial] in EPG/ECG metadata and Table 3-80 "Correspondence between EIT and metadata (digital copy control descriptor)" in Section 3.9.2 in Vol. 10.

21.1 Priorities of Copy Control Information

Copy control information in a digital copy control descriptor placed in the PMT is used when a program is actually recorded, and copy control information described in the SDT is used when preparing for the start of recording.

When descriptors are present in the first and second loops of the PMT, the description in the second loop should be given a priority for the relevant component. However, the copy control information described in the second loop becomes valid only for components whose "component_tag" is set to a value between '0x40' and '0x7F' (See Section 30.3.3.3). When a descriptor is present in the second loop for a component with other values (for example, when the maximum bit rate of a video component needs to be specified), the description of the first loop is given a priority (when there is no descriptor in the first loop, the default copy control information is applied).

Additionally, for the control of analogue video output, digital audio output and output of IEC60958 conformant audio streams from a high-speed digital interface, the description of the descriptor in the first loop of the PMT should be given a priority. For the control of MPEG TS output from a high-speed digital interface, the description of a component with the most strict copy control among components to be output (when specific components are deleted from received services, remaining components after the deletion) should be given a priority. See the section of digital copy control descriptor for concrete levels of copy control.

The real recording control is definitely performed based on the description in the PMT. When non-default copy control (see next section) is performed, a descriptor should be present also in the PMT.

Information of digital copy control descriptors in the SDT is used when events are reserved for recording. To specify information on copy control regarding a whole service, a digital copy control descriptor should be present in the SDT.

21.2 Default Digital Copy Control Information

The default digital copy control information, when a digital copy control descriptor is not present in either of PMT or SDT, is "Copy freely". Specifically, this is equivalent to

(a) Video real-time broadcasting service
copy_control_type='01', digital_recording_control_data='00'

(b) Audio real-time broadcasting service
copy_control_type='01', digital_recording_control_data='00'

(c) Independent data broadcasting service
copy_control_type='01/11', digital_recording_control_data='00'

As described above, as the final recording control is performed in accordance with the description in the PMT, no matter what sort of digital copy control information is in the SDT, as long as this descriptor specified as other than "Copy freely" is not present in the PMT, the final control will be "Copy freely", which should be kept in mind. However, as the basic rule, there should not be any inconsistency between information in the SI (SDT) and PSI (PMT).

Digital copy control descriptors are not described in a storable broadcasting service.

21.3 Maximum Bit Rate Information

In the "maximum_bit_rate" field in a digital copy control descriptor, a rough value worked out by rounding to the nearest 1/4Mbit/s above for each event is described. In other words, for example, if this value is "0x24", the maximum bit rate is 9Mbit/s. For a variable bit rate, the maximum value is described. The maximum value is described also in the PMT and the value should not be changed real time as the actual bit rate changes.

When the maximum bit rate of a transmitted service exceeds or is remarkably below a value shown in Tables from 21-1 to 21-2 in the next section, or is not listed in any of these tables, a broadcaster should set a digital copy control descriptor and describe the value in the "maximum_bit_rate". The description method is described in "Digital Copy Control Descriptor" in [Section 3] "Detailed Use of Table" of this Volume.

21.3.1 The maximum bit rate values when the maximum bit rate is not described

See "3.2.8. Default Maximum Bit Rate" in Vol. 7 for this section. Specific values are shown in Tables 21-1 and Table 21-2.

Table 21-1: Default maximum bit rates for each component (TS rate)

Video	QVGA	~800kbit/s
	525HHR, 525SD	~4Mbit/s
Audio	Standard stereo	~330kbit/s
	High quality sound stereo	~330kbit/s
	5.1ch stereo	~458kbit/s
Additional Data		4Mbit/s
Caption		256kbit/s
Superimpose		256kbit/s
Storage type		4Mbit/s

Table 21-2: Default maximum bit rates for each media type (TS rate)

TV type	QVGA	1Mbit/s
	525HHR, 525SD	5Mbit/s
Data type		2.2Mbit/s

21.3.2 How to specify the maximum transmission rate in multi-view television

Multi-view television service is not provided in multimedia broadcasting.

21.4 Change of Copy Control Information

Basically, once copy control information of an event has been defined, it should not be changed. Especially, when the status is changed from “Copy allowed”(Copy freely/Copy one generation) to “Copy never”, an event which was allowed to record when scheduling to record will not be recorded after all.

For the same reason, the content of copy control information described in the SDT should not be changed carelessly. This is because, the information described in the SDT will be used and scheduling of recording might have been done based on that information. To change the copy control information described in the SDT, the information needs to be changed a maximum of N days before the point of time when the change will be made (when the information for N days is transmitted as EPG/ECG metadata).

21.5 Copy Control Restriction of Contents

By using “encryption_mode” in a content availability descriptor, a broadcaster can control the output from a high-speed digital interface for “Copy freely” contents.

A content availability descriptor can be set only in the first loop of the PTM. Please note that for details of Copy control restriction of contents, see 3.3 of Vol. 8.

21.5.1 Default copy control restriction

A content availability descriptor is used in combination with copy control information in a digital copy control descriptor. When a digital copy control descriptor is not present simultaneously, a content availability descriptor will not be valid. When a content availability descriptor or a digital copy control descriptor is not present in the first loop of the PMT, the default is “encryption_mode” is set to ‘1’ (Output content is not protected).

21.5.2 Encryption Plus Non-Assertion (EPN)

The encryption_mode will be effective when outputting from the high-speed digital interface if the copy_control_type of the digital copy control descriptor is set to '01' and the digital_recording_control_data is set to "Copy freely". It can be interpreted that the conditions above are applied to the default copy control information when the digital copy control descriptor is not placed (copy_control_type is set to '01' and digital_recording_control_data is set to "Copy freely"). However, as the digital copy control descriptor must be placed to validate the content usage descriptor, caution needs to be taken so that the digital copy control descriptor, in which the conditions above are specified, is placed to specify encryption_mode.

A digital copy control descriptor can be present also in the second loop of the PMT but when all the components included in output from a high-speed digital interface is “Copy freely”, “encryption_mode” will be valid. In other words, when “copy_control_type” is set to ‘01’ and “digital_recording_control_data” is set to “Copy freely” in a digital copy control descriptor present in the first loop of the PMT and at the same time, when copy control information other than “Copy freely” is not described in the second loop of the PMT, “encryption_mode” will be valid.

For details of operation of “encryption_mode”, see Vol. 8 and the DTCP specifications.

21.6 Retension of Contents

The concept of retension has a meaning only when the copy control information is “Copy never”.

Even when the copy control information is “Copy never”, the contents can be temporarily stored for up to the maximum allowed temporary retension time. A digital copy control descriptor can be present also in the second loop of the PMT but if any of the components to be retained is “Copy never”, such a content will be temporarily retained.

More than one value of maximum allowed temporary retension time is defined in the ARIB STD-B10, but only “one hour and 30 minutes” (retention_mode=‘0’, retention_state=‘111’) can be used.

For details of retention, see Vol. 8.

21.7 Restricted Copying

If the digital copy control information of the digital copy control descriptor in PMT is "copy one generation", it is possible to specify whether or not "copyable with restriction" will be operated using copy_restriction_mode of the content availability descriptor. (Refer to Section 30.3.2.4.)

If a digital copy control descriptor specified as "copy one generation" is placed in PMT but no content availability descriptor is placed in PMT, "copyable with restriction" (default value) shall be applied. Therefore, if "copyable with restriction" will not be operated, both the digital copy control and content availability descriptors must always be placed in PMT. Moreover, copy_restriction_mode of the content availability descriptor shall only be meaningful when a digital copy control descriptor set to "copy one generation" has been placed in the first or/and second loop of PMT.

While a digital copy control descriptor is placeable in both the first and second loops of PMT, a content availability descriptor can only be placed in the first loop. When "copy one generation" has been specified to the relevant component by the digital copy control descriptor in the second loop of PMT, whether or not "copyable with restriction" will be operated shall be determined based on the content availability descriptor in the first loop of the same PMT. If no content availability descriptor is placed in PMT, "copyable with restriction" shall be applicable to its components.

Refer to Vol. 8 for the details of "restricted copying".

Chapter 22 PSI/SI Transmission Layers at Layered Transmission

The layered transmission can be performed using multiple modulation systems in one TS because transmission can be executed using multiple modulation systems (a maximum of three) at the same time for one carrier (channel) in multimedia broadcasting. For the transmission layer definition, see Section 5.3 "Layered transmission" in Vol. 7 of this standard.

This section defines PSI/SI transmission layers at layered transmission.

Table 22-1 defines the PSI/SI layered transmission by the pattern ((1) to (3)) provided in Table 14-3 "Parameters used for the operation of hierarchical transmission" in Chapter 14 of Vol. 0. For the layered transmission using the EIT, see Table 12-2 in Section 12.1.9. Additionally, PMTs should be transmitted in a service layer for each service (For details of PMT transmission layers, see Sections 6.1.2 to 6.1.5 of Vol. 7).

Table 22-1: PSI/SI transmission layers (PMT and EIT transmission layers excluded)

Pattern			
	Layer A (low protection layer)		
(1)	・PAT ・CAT ・NIT ・TOT ・SDT ・BIT ・SDTT for low protection layer ・SDTT for partial reception layer ・INT		
	Layer A (partial layer)	Layer B (low protection layer)	
(2)	・PAT ・CAT ・NIT ・TOT ・SDT ・BIT ・SDTT for partial reception layer ・INT	・SDTT for low protection layer	
	Layer A (partial layer)	Layer B (high protection layer)	Layer C (low protection layer)
(3)	・PAT ・CAT ・NIT ・TOT		・SDTT for low protection layer

	・SDT ・BIT ・SDTT for partial reception layer ・INT		

Chapter 23 Use of PSI/SI in Connected Transmission

Connected transmission means to transmit multiple unit transmission waves (13-segment mode or 1-segment mode transmission modes) without a guard band from the same transmission point. For the connected transmission definition and details, see Chapter 4 "Connected Transmission Signal Types" in ARIB STD-B46.

When performing the connected transmission, the connected transmission descriptor must be transmitted as a means to notify the information regarding the connected transmission to the receivers in advance. The connected transmission descriptor is placed in the second loop of the NIT.

For details on the connected transmission descriptor, see Section 30.4.3.5.

<Blank Page>

Chapter 24 Special Service

Special video service is not used in multimedia broadcasting.

<Blank Page>

Chapter 25 Event Relay

Event relay is not used in multimedia broadcasting.

<Blank Page>

Chapter 26 Use of Emergency Warning Broadcasting (Emergency Warning System (EWS))

26.1 Transmission of Emergency Warning Broadcasting

The following steps should be used to start and stop the EWS.

(When starting the EWS)

(1) The emergency information descriptor that specifies EWS conditions (start_end_flag, the classification of Type 1 and Type 2, and area code) should be carried in the PMT.

(2) Broadcaster should set the start flag for emergency warning broadcasting in the TMCC signal to 1 for transmission.

(3) Contents that can be recognized as emergency warning broadcasting should be used to start the broadcasting.

(When stopping the EWS)

(1) The start flag for emergency warning broadcasting should be set to 0 for transmission.

(2) The emergency information descriptor should be deleted from the PMT.

26.2 How to Handle the Start Flag for Emergency Warning Broadcasting in the TMCC Signal

Senders should keep the start flag for emergency warning broadcasting in the TMCC signal set to 1 while emergency warning broadcasting is provided on a channel carried by the TS (network) under the emergency warning system, regardless of the transmission layer in which the service that provides the EWS is carried. The receiver units with automatic startup function periodically monitor the start flag for emergency warning broadcasting in the TMCC signal.

26.3 Multiplexing Locations of the Emergency Information Descriptor

The emergency information descriptor should be included in the first descriptor's loop of the PMT for the emergency warning broadcasting service. In order to clearly indicate that the emergency warning broadcasting is being provided for EWS-compatible receiver units, it is mandatory to include this descriptor in the PMT for the emergency warning broadcasting service. It is up to each broadcaster as to which PMT (or which service) to use to include the emergency information descriptor. Please note that when services in different layers are described, they may be ignored on receiver units.

Table 26-1 PMT used to include the emergency information descriptor

	PMT other than emergency warning broadcasting in a TS where an emergency warning broadcasting is performed	PMT for the emergency warning broadcast
Whether or not to include the emergency information descriptor	Optional	Mandatory

26.4 Modification of the Information in the Emergency Information Descriptor

If a necessity to change the information (for example, the area code) in the emergency information descriptor arises during emergency warning broadcasting, the procedure to end the EWS should be performed (which specifically involves setting the start flag for emergency warning broadcasting in the TMCC signal to 0 and deleting the emergency information descriptor from the PMT). Then, after inserting the modified emergency information descriptor into the PMT, the start flag for emergency warning broadcasting in the TMCC signal should be set to 1 again. Alternatively, the start flag for emergency warning broadcasting in the TMCC signal should be set to 0, and then, after modifying the information while the emergency information descriptor remains in the PMT, the same flag should be set to 1.

In either case, the duration from when the start flag for emergency warning broadcasting is set to 0 to when the same flag is set to 1 should be a minimum of one second (if the length of the 4 OFDM frame is less than one second) and four OFDM frames (if the length of the 4 OFDM frame is more than one second). The receiver units continuously perform ESW processes for 90 seconds after the start flag for emergency warning broadcasting switches to 0. To change, for example, the target area, without ending the EWS processes, therefore, the broadcaster should switch the start flag for emergency warning broadcasting to 1 within 90 seconds.

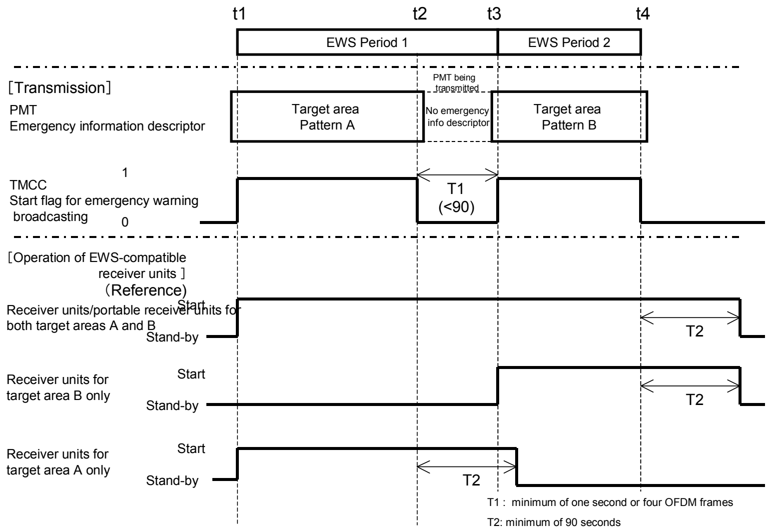


Fig. 26-1: Modification of the emergency information descriptor and an example of operation of the receiver unit

26.5 Use of Emergency Warning Broadcasting Test Signals

During the test emergency warning broadcasting, the start_end_flag value in the emergency information descriptor should be set to 0 (meaning an end) from the beginning. During the test broadcasting period, the descriptor should continuously be included in the PMT. After the end of the test broadcasting, when the start flag for emergency warning broadcasting in the TMCC signal switches to 0, the emergency information descriptor should be deleted from the PMT.

<Blank Page>

Chapter 27 Operation of PSI/SI of Programs with Caption

Operation of PSI/SI of programs with caption are described in Vol. 3 of the document.

<Blank Page>

Chapter 28 Operation of PSI/SI for Daylight Saving Time

28.1 Use of a Local Time Offset Descriptor

By inserting a local time offset descriptor into the TOT when the daylight saving time is introduced, the time difference between the actual time (UTC +9 hours) and the displayed time is transmitted. Conversely, a local time offset descriptor is not inserted when the daylight saving time is not introduced, and from the moment the date and time when the offset time will be changed next time is fixed, it can be inserted.

This descriptor should be continuously transmitted starting from at least 32 days before the date and time when the offset time (date and time which is described in "time_of_change") will be changed. In addition, after the offset time is changed (after the "time_of_change" has passed), the offset time that was set for "next_time_offset" should be set for "local_time_offset" and transmitted after 48 hours but within 7 days after the switching.

[Example of description of a local time offset descriptor]

(When the daylight saving time will be introduced from 2011, and the displayed time will moved forward one hour between 2:00 am on April 1st and 2:00 am on October 1st).

(1) A local time offset descriptor as below will be transmitted 32 days before the daylight saving time starts at the latest (March 1st).

- local_time_offset_polarity=0 (Offset to forward direction)
- local_time_offset=0:00
- time_of_change= 2:00:00 on April 1st, 2011
- next_time_offset=1:00

(2) The local time offset descriptor will be changed as below and transmitted within 7 days after the daylight saving time starts (April 1st) at the latest.

- local_time_offset_polarity=0 (Offset to forward direction)
- local_time_offset=1:00
- time_of_change= 2:00:00 on October 1st, 2011
- next_time_offset=0:00

(3) The local time offset descriptor will be changed as below and transmitted within 7 days after returning to the normal time (UTC+9 hours) from the daylight saving time (October 1st) at the latest.

- local_time_offset_polarity=0 (Offset to forward direction)
- local_time_offset=0:00
- time_of_change= 2:00:00 on April 1st, 2012
- next_time_offset=1:00

(If it is not known when the daylight saving time will start in 2012 at this moment, this descriptor does not have to be transmitted up to 1 month before the daylight saving time starts in 2012)

Chapter 29 Change of Service Structures and Layers

As definition of services is very important in terms of interfaces with viewers, once a service is defined, it should not be changed easily. In other words, definition of a service structure in a TS is usually fixed.

In addition, a service should not be transferred from one layer to another and transmission parameter types of a whole transmission layer to which a service belongs (see Chapter 14 in Vol. 0) should not be changed frequently because change of the coverages may disable viewers to receive some services which could be received without notice or may enable them to receive some services which could not be received, which will confuse viewers.

Change of service structures and layers include the following cases:

- Addition and deletion of a service
- Transfer of a service from one layer to another
- Change of transmission parameters of a whole layer

In addition, a service type should not be changed for a service.

29.1 Addition/Deletion of Services

A receiver unit identifies addition/deletion of a service based on the service list descriptor in the NIT. In other words, if a service has been deleted from the service list descriptor in the NIT, that means that the service has been deleted, and if a new service has been added to the list that means that the service has been added.

Also, when "service_id" which has been deleted is re-used for a service with a different content, it should not be used for at least 32 days after the deletion in order to avoid confusion with the previous service.

When updating, related SI information should be updated almost at the same time. However, when updating, it is unavoidable for the information to become inconsistent temporarily. "Inconsistent" means that the information is described in the NIT but SDT and EIT are not transmitted or vice versa. The information can stay inconsistent only during transition when updating, and it should not stay inconsistent for a period longer than this transition period. Because a receiver unit identifies addition and deletion of a service based on the information in the NIT, even during transition, if SDT and EIT of the service described in the NIT are transmitted at least, the influence on the reception process will be little.

When a service is added, it should be added to the service list descriptor and TS information descriptor in the NIT, and the description should be added to the SDT as well as necessary EIT should be transmitted. How many days before the start of broadcasting a service should be defined is left up to the discretion of each broadcaster.

When a service is deleted, it should be deleted from the service list descriptor and TS information descriptor in the NIT and the service description should be deleted from the SDT as well as transmission of the EIT should end. This procedure should be performed after the broadcasting of a program is ended and the service is off. An event should not be setup after the time when the service is deleted.

29.2 Change of Service Layers

There are the following two cases where a layer in which a service is transmitted is changed, which are collectively called “change of service layers”.

1) When a service transfers from one existing layer to another existing layer.
2) When transmission parameter types of a whole layer to which a service belongs are changed.

When a service layer is changed, the description of this service in the TS information descriptor in the NIT should be changed to the transmission parameter type after the change. The descriptions in the N-EIT_flag, M-EIT_flag, and W-EIT_flag in the SDT are also changed, and at the same time, the transmission of a corresponding EIT starts/stops.

At this time, at least the EIT that corresponds to the service layer must be transmitted after the change. In addition, the EIT that is described in the N-EIT_flag, M-EIT_flag, or W-EIT_flag of the SDT must be consistent with the transmitted EIT. It is acceptable if there is some inconsistency between them during the transition period after the change; however, persistent inconsistency for a long period of time should be avoided. The influence on a receiver is small if the EIT has been transmitted based on the information of the N-EIT_flag, M-EIT_flag, or W-EIT_flag that is described in the SDT during the transition period.

If a service layer is changed, the receiver may obtain all PSI/SI again. This may affect viewing services, such that suddenly a service cannot be viewed, or that control using the SI may not be performed, including the failure of a scheduled recording in a receiver (recording stopped, failure to start, etc.). Taking these into consideration, service layers should be changed carefully. For example, when a service layer is changed while the service is being off or broadcast emission is being stopped, influence on the process by receiver unit will be little.

Chapter 30 Use of PSI Table

30.1 PAT (Program Association Table)

30.1.1 Structure and use of PAT

[Use]

Specify TS packet PID to transmit PMT related to broadcast program

[Syntax]

PAT structure is shown in Table 30-1.

Table 30-1: Structure of PAT (program association table)

Data structure	bit	Identifier
program_association_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
'0'	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
transport_stream_id	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
for (i = 0;i< N;i++) {		
program_number	16	uimsbf
reserved	3	bslbf
if(program_number == "0x0000"){		
network_PID	13	uimsbf
}		
else{		
program_map_PID	13	uimsbf
}		
}		
CRC_32	32	rpchof
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.1 of Part 2 in ARIB STD-B10 and the definitions in Section 2.4.4 of ISO/IEC13818-1.

[Transmission Operating Rule]

◎ PAT should be transmitted whenever any stream is included in the transport stream.

◎ The strongest layer is used for transmission.

● In principle, a PMT_PID that has not been transmitted should not be described. However, it is acceptable to describe a PMT_PID that is not transmitted (the operation that is not defined in the MPEG2).

● 1 PAT is transmitted in 1 transport stream.

● For repetition rate, follow Section 10.4 of this document.

● For the update frequency, follow Section 10.9 of this document.

● When the same PMT_PID is specified to the different program_number including multi-section PMT, the maximum number of program_number that can be specified to the same PMT_PID is 4.

The Transmission Operating Rule for each field are shown in Table 30-2.

Table 30-2: Transmission operating rule for PAT

Transmission operating rule for each field of PAT	
table_id	Set to "0x00".
section_syntax_indicator	Set to '1'.
section_length	Describe PAT section length. Since the maximum length of section is 1024 bytes, this value should be 1021 at maximum.
transport_stream_id	Describe transport_stream_id of transport stream containing PAT.
version_number	For normal use, describe a value incremented by 1 every time contents are updated. However, when a system error occurs, a value incremented by more than 1 can be described.
current_next_indicator	Set to '1'.
section_number	Set to "0x00".
last_section_number	Set to "0x00".
[program_loop]	Do not define the maximum loop count.
program_number	Describe service_id of the target service. Make sure to describe only one program_loop of program_number="0x0000" in PAT. (Describe PID["0x0010"] of NIT in the following PID field.)
network_PID	Describe PID("0x0010") of NIT.
program_map_PID	Describe PID of PMT. If the multi-sectioning of the PMT is performed, the same PID value can be assigned for a maximum of four programs.

[Rules for Reception Processing]

- If the PAT cannot be received, it is determined that the streams that can be received do not exist in a transport stream or that the transmission system does not work normally.
- If the service information described in NIT is not described in PAT, it should be judged that the relative service is off.

The rules for reception processing for each field are shown in Table 30-3.

Table 30-3: Rules of PAT receiving process

Transmission operating rule for each field of PAT	
table_id	= "0x00": Judge that the relative table is PAT.
section_syntax_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_length	≤1021: Section length >1021: Judge that the relative section is invalid.
transport_stream_id	Judge as transport_stream_id of transport stream containing the relative PAT.
version_number	If any change occurs, judge that the relative table has been updated.
current_next_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_number	="0x00": Judge that the relative section is valid. ≠"0x00": Judge that the relative section is invalid.
last_section_number	="0x00": Judge that the relative section is valid. ≠"0x00": Judge that the relative section is invalid.
[loop]	
program_number	≠"0x0000": Judge as service_id of service included in the target transport stream. ="0x0000": Judge as NIT PID of the target transport stream. If the service information described in NIT but not described in PAT, is shown that the relative service is off. (See Chapter 14.)
network_PID	
program_map_PID	

[Special Remarks]

None

30.2 CAT (Conditional Access Table)

30.2.1 Structure and use of CAT

[Use]

Describe the relationship between CA system (conditional access system) and EMM stream.

[Syntax]

The structure of CAT is shown in Table 30-4.

Table 30-4: Structure of CAT(conditional access table)

Data structure	bit	Identifier
conditional_access_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
'0'	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
reserved	18	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
for (i = 0;i< N;i++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.2 of Part 2 in ARIB STD-B10 and the definitions in Section 2.4.4 of ISO/IEC13818-1.

[Transmission Operating Rule]

◎ Only one table should be transmitted in the same TS during the period of transmitting EMM.

◎ The transmission layer should be layer A.

- Update when changing the PID of stream that transmits EMM/EMM message for CA system.
- For repetition rate, follow Section 10.4 of this document.
- For the update frequency, follow Section 10.9 of this document.

The Transmission Operating Rule for each field are shown in Table 30-5.

Table 30-5: Transmission operating rule for CAT

Transmission operating rule for each field of CAT	
table_id	Set to "0x01".
section_syntax_indicator	Set to '1'.
section_length	Describe CAT section length. Since the maximum length of section is 1024 bytes, this value should be 1021 at maximum.
version_number	For normal use, describe a value incremented by 1 every time contents are updated. However, when a system error occurs, a value incremented by more than 1 can be described.
current_next_indicator	Set to '1'.
section_number	Set to "0x00".
last_section_number	Set to "0x00".
[descriptor_loop]	Do not define the maximum loop count.

[Rules for Reception Processing]

- When CAT is received within the provided transmission frequency, it should be judged that EMM/EMM message is transmitted in the same TS.

The rules for reception processing for each field are shown in Table 30-6.

Table 30-6: Rules of CAT receiving process

Rules for reception processing for each field	
table_id	= "0x01": Judge that the relative table is CAT.
section_syntax_indicato r	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_length	≤1021: Section length >1021: Judge that the relative section is invalid.
version_number	If any change occurs, judge that the relative table has been updated.
current_next_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_number	="0x00": Judge that the relative section is valid. ≠"0x00": Judge that the relative section is invalid.
last_section_number	="0x00": Judge that the relative section is valid. ≠"0x00": Judge that the relative section is invalid.
[descriptor_loop]	

[Special Remarks]

None

30.2.2 Descriptor to be inserted into CAT

30.2.2.1 Conditional access descriptor

[Use]

Specify the PID of EMM stream based on CA system (conditional access system).

[Syntax]

The structure of conditional access descriptor is shown in Table 30-7.

Table 30-7: Structure of conditional access descriptor

Data structure	bit	Identifier
CA_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_ID	16	uimsbf
reserved	3	bslbf
CA_PID	13	uimsbf
for(i=0; i<N; i++){		
private_data_byte	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in Section 2.6.16 of ISO/IEC13818-1.

[Transmission Operating Rule]

◎ Only one conditional access descriptor must be placed in one conditional access system identifier.

● If there are multiple conditional access systems that transmit the EMM, multiple conditional access descriptors are placed.

The transmission operating rule for each field is shown in Table 30-8.

Table 30-8: Transmission operating rule of conditional access descriptor (CAT)

Transmission operating rule for each field	
descriptor_tag	Set to "0x09".
descriptor_length	Describe the descriptor length of the relative descriptor.
CA_system_ID	Describe the conditional access system identifier. Among the

	conditional access system identifiers, any identifier value other than "0x000F", which is applied to multimedia broadcasting, must not be described.
CA_PID	Describe EMM_PID.
private_data_byte	Describe EMM transport system in the first byte (See Table 30-9). Do not describe in the second and later byte.

Table 30-9: EMM transport system

Value	Transport system
0x01	Type A
0x02	Type B

Note: For the meanings of Type A and B, see Chapter 4 of Vol.5.

[Rules for Reception Processing]

- If CAT, where the descriptors are allocated under the above transmission operating rule, cannot be received, it should be judged that the specification of transporting stream for EMM/EMM message is invalid.
- If any invalid value is described in EMM transport system, it's not required to ensure to obtain EMM.

The rules for reception processing for each field are shown in Table 30-10.

Table 30-10: Receiver process standard for conditional access descriptor (CAT)

Rules for reception processing for each field	
descriptor_tag	= “0x09”: Judge that the relative descriptor is a conditional access descriptor.
descriptor_length	Judge as the descriptor length of conditional access descriptor.
CA_system_ID	= “0x000F”: Judge as the conditional access system identifier. = Other value: Judge that the relative descriptor is invalid.
CA_PID	Judge as EMM_PID.
private_data_byte	Interpret that the first byte is EMM transport system (See Table 30-9.) Ignore all values in the second and later byte if any value is described.

[Special Remarks]

None

30.3 PMT (Program Map Table)

30.3.1 Structure and use of PMT

[Use]

Specify the PID of TS packet that carries coded signals for each program.

[Syntax]

The structure of PMT is shown in Table 30-11.

Table 30-11: Structure of PMT (program map table)

Data structure	bit	Identifier
program_map_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
'0'	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
program_number	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
reserved	3	bslbf
PCR_PID	13	uimsbf
reserved	4	bslbf
program_info_length	12	uimsbf
for (i = 0;i< N;i++) {		
descriptor()		
}		
for (i = 0;i< N;i++) {		
stream_type	8	uimsbf
reserved	3	bslbf
elementary_PID	13	uimsbf
reserved	4	bslbf
ES_info_length	12	uimsbf
for (j = 0;j< M;j++) {		
descriptor()		
}		
}		
CRC_32	32	rpchof
}		

[Semantics of each field]

For the definition of each field, comply with the provisions in 5.2.3 of Part 2 in ARIB STD-B10 and the definitions in Section 2.4.4 of ISO/IEC13818-1.

[Transmission Operating Rule]

◎ PMT should be transmitted for each service described in PAT. However, in case of data service, PMT does not have to be transmitted even though the service is described in PAT (for use except for MPEG2 provisions).

- For repetition rate, follow Section 10.4 of this document.
- For the update frequency, follow Section 10.9 of this document.

The Transmission Operating Rule for each field are shown in Table 30-12.

Table 30-12: Transmission operating rule of PMT

Transmission operating rule for each field of PMT	
table_id	Set to "0x02".
section_syntax_indicator	Set to '1'.
section_length	Describe PMT section length. Since the maximum length of section is 1024 bytes, this value should be 1021 at maximum.
program_number	Describe service_id for the relative service.
version_number	For normal use, describe a value incremented by 1 every time contents are updated. However, when a system error occurs, a value incremented by more than 1 can be described.
current_next_indicator	Set to '1'.
section_number	Set to "0x00".
last_section_number	Set to "0x00".
PCR_PID	Describe the PID of PCR. Set to "0x1FFF" if the relative service does not see PCR.
program_info_length	Describe the length of the first loop. The maximum loop length is limited by section_length.
[1st(program) loop]	
[2nd(ES)_loop]	The maximum loop count is 32.
stream_type	Describe the stream type identifier for the target ES (provided in Table 30-13).
elementary_PID	Describe the PID of TS packet that carries the related ES or payload.
ES_info_length	Describe the length of subsequent ES descriptor.

The assignments for stream type identifiers to be used in multimedia broadcasting are shown in Table 30-13.

Table 30-13: Stream type identifier applicable when multimedia broadcasting starts

stream_type	Assignment
0x05	INT for storable broadcasting
0x06	ITU-T Rec.H.222 ｜ ISO/IEC 13818-1 (MPEG2 SYSTEMS) PES packets containing private data (caption/superimpose)
0x0D	ISO/IEC 13818-6 (data carousel)
0x0F	ISO/IEC 13818-7 (MPEG2 AAC audio) ISO/IEC 14496-3 (MPEG4 HE-AAC audio)
0x1B	ITU-T Rec. H.264 ｜ ISO/IEC 14496-10Video (video)
0x91	Storable broadcasting content data, EPG/ECG metadata

[Rules for Reception Processing]

- When the service is carried in the layer except for partial reception layer,and is except for engineering service, and the PMT of the service described in PAT is not received within 1000ms, judge that the relative service is off or disabled to receive*.
- In case of the partial reception layer service, when the PMT of the service that is described in the PAT is not received within 2000 ms, it is determined that the target service is off or disabled to be received.*
- In case of a 1-segment broadcast service, when the PMT of the service that is described in the PAT is not received within 2000 ms, it is determined that the target service is off or disabled to be received.*
- In case of engineering service, when the PMT of the service described in PAT is not received within 4000ms, judge that the target service is off or disabled to receive*.

* For off or disabled service, see Vol.2.

The rules for reception processing for each field are shown in Table 30-14.

Table 30-14: Receiver process standard for PMT

Rules for reception processing for each field	
table_id	= "0x02": Judge that the relative table is PMT.
section_syntax_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_length	≤1021: Section length >1021: Judge that the relative section is invalid.
program_number	Judge as service_id of the target service.
version_number	If any change occurs, judge that the relative table has been updated.
current_next_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_number	="0x00": Judge that the relative section is valid. ≠"0x00": Judge that the relative section is invalid.
last_section_number	="0x00": Judge that the relative section is valid. ≠"0x00": Judge that the relative section is invalid.
PCR_PID	="0x1FFF": Judge that the relative service does not see PCR. ≠"0x1FFF": Judge as the PID of PCR for the relative service.
program_info_length	
[1st(program) loop]	
[2nd(ES) loop]	If the second loop count exceeds 32, judge that ES information for the succeeding loop is invalid.
stream_type	If receiver unit does not support the described stream_type, judge that the relative ES loop is invalid.
elementary_PID	Judge as the PID of ES.
ES_info_length	

[Special Remarks]

None

30.3.2 Descriptor described in the first loop (program loop) of PMT

30.3.2.1 Conditional access descriptor

[Use]

Specify the PID of ECM stream in CA (conditional access) system when the whole service is for conditional access.

[Syntax]

The structure of conditional access descriptor is shown in Table 30-7.

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in Section 2.6.16 of ISO/IEC13818-1.

[Transmission Operating Rule]

◎ Only one conditional access descriptor must be transmitted for one conditional access system identifier.

If multiple conditional access systems are used, one applicable descriptor must be placed in one conditional access system.

○ Only paid broadcasters can set a parental rate and describe it in the first byte of private_data_byte. If a parental rate is specified for a non-billing program in paid broadcaster broadcasting, the descriptor in which the CA_PID (ECM_PID) is set to "0x1FFF" is inserted to specify the parental rate.

The transmission operating rules for each field are shown in Table 30-15.

Table 30-15: Transmission operating rule of conditional access descriptor (first loop of PMT)

Transmission operating rule for each field	
descriptor_tag	Set to "0x09”.
descriptor_length	Describe the length of conditional access descriptor.
CA_system_ID	Describe the conditional access system identifier. Among the conditional access system identifiers, any identifier value other than "0x000F", which is applied to multimedia broadcasting, must not be described.
CA_PID	Describe an ECM_PID. The CA_PID can be set to "0x1FFF" only when an applicable program is not the target of limited reception (see Section 19.2.1).
private_data_byte	A parental rate is described in the first byte based on the rules on the rating field of the parental rate descriptor. The second byte and later are not used for the moment. If a viewing age is not limited, this item can be omitted. 0x00: G (No age limit) 0x01 to 0x11: Minimum viewing age = rating + 3 0x01: R-4 0x02: R-5 0x03: R-6 0x04: R-7 0x05: R-8 0x06: R-9 0x07: R-10 0x08: R-11 0x09: R-12, PG-12 0x0A: R-13 0x0B: R-14 0x0C: R-15 0x0D: R-16 0x0E: R-17 0x0F : R-18 0x10: R-19 0x11: R-20 0x12 to 0Xff: Broadcaster specification (not used for the moment)

[Rules for Reception Processing]

- Judge that the relative service is for conditional access.
- If this descriptor is placed but TS packet (ECM) for PID described in CA_PID field cannot be received within 2 seconds, judge that the transmission system is not properly functioning. (Except for the case of CA_PID=”0x1FFF”)

- If multiple descriptors are placed, only the descriptors with the corresponding CA_system_ID are interpreted.

The rules for reception processing for each field are shown in Table 30-16.

Table 30-15: Receiver process standard for conditional access descriptor (first loop of PMT)

Rules for reception processing for each field	
descriptor_tag	= "0x09": Judge that the relative descriptor is a conditional access descriptor.
descriptor_length	Judge as the length of conditional access descriptor.
CA_system_ID	= "0x000F": Judge as an applicable conditional access system identifier.*1 = Other value: Judge that the relative conditional access descriptor is invalid.
CA_PID	Judge as ECM_PID. However, in case of "0x1FFF", judge as the non-chargeable program. (The ECM for the relative PID is not transported in this case.)
private_data_byte	Judge that the first byte is the parental rate of an applicable service. If this item is omitted, it determines that there is no viewing age limit. If any value is described in the second byte or later, the value is determined as invalid. 0x00: G (no age limit) 0x01 to 0x11: Minimum viewing age=rating+3 0x01: R-4 0x02: R-5 0x03: R-6 0x04: R-7 0x05: R-8 0x06: R-9 0x07: R-10 0x08: R-11 0x09: R-12, PG-12 0x0A: R-13 0x0B: R-14 0x0C: R-15 0x0D: R-16 0x0E: R-17 0x0F: R-18 0x10: R-19 0x11: R-20 0x12 to 0Xff: Specified by a broadcaster (not used for the moment)

*1 If CA_system_ID is other than supporting conditional access system identifier, judge that the relative conditional access descriptor is invalid.

[Special Remarks]

For use of conditional access, see Vol. 5.

30.3.2.2 Digital copy control descriptor

[Use]

For the whole relative service, place this descriptor when control information regarding digital and analog copy is displayed, or when the maximum bit rate is described.

This descriptor is not used for storable broadcasting services.

[Syntax]

The structure of digital copy control descriptor is shown in Table 30-21.

Table 30-16: Structure of digital copy control descriptor

Data structure	bit	Identifier
digital_copy_control_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
digital_recording_control_data	2	bslbf
maximum_bit_rate_flag	1	bslbf
component_control_flag	1	bslbf
copy_control_type	2	bslbf
if(copy_control_type != 00){		
APS_control_data	2	bslbf
}		
else{		
reserved_future_use	2	bslbf
}		
if(maximum_bit_rate_flag == 1) {		
maximum_bit_rate	8	uimsbf
}		
if(component_control_flag ==1){		
component_control_length	8	uimsbf
for(j=0;j<N;j++){		
component_tag	8	uimsbf
digital_recording_control_data	2	bslbf
maximum_bitrate_flag	1	bslbf
reserved_future_use	1	bslbf
copy_control_type	2	bslbf
if(copy_control_type != 00) {		
APS_control_data	2	bslbf
}		
else{		
reserved_future_use	2	bslbf

}		
if(maximum_bitrate_flag==1){		
maximum_bitrate	8	uimsbf
}		
}		
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in 6.2.23 of Part 2 and Annex F in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for the relative service if the copy control other than default copy control is performed.

● This descriptor should be placed if the maximum bit rate for the relative service is not within the range of default maximum bit rate specified in Table 21-1. In this case, it is required to describe the correct copy control information if the same copy control as that for default is performed.

The transmission operating rules for each field are shown in Table 30-18.

Table 30-18: Transmission operating rule of digital copy control descriptor (first loop of PMT)

Transmission Operating Rule for each field	
descriptor_tag	Set to "0xC1".
descriptor_length	Describe the length of digital copy control descriptor.
digital_recording_control_data	This 2-bit field indicates the information used for copy generation control and is coded according to Table 30-19 and Table 30-20.
maximum_bit_rate_flag	Set to '0' if the maximum bit rate for the relative service is not described. Set to '1' if the maximum bit rate for the relative service is described.
component_control_flag	If '0' is set, the digital copy control information is defined for the whole program, and the field later than component_control_length does not exist. If this descriptor is transmitted using PMT, always set to '0'.
copy_control_type	This 2-bit field indicates the information used for copy generation control and is coded according to Table 30-19 and Table 30-20.
APS_control_data	Analog output copy control information. This 2-bit field indicates the information used for analog output copy control if copy_control_type is set to '01', '10' or '11' and is

	coded according to Table 30-19 and Table 30-20.
maximum_bit_rate	Describe the maximum bit rate for the whole service. (Describe in increments of 1/4Mbit/s.)

Note that the specifications for controlling each output terminal using digital copy control descriptor vary according to service_type.

[Points of Use (video real-time broadcasting service and audio real-time broadcasting service)]

If the service_type described in the service list descriptor of the NIT is set to "0xC2" (video real-time broadcasting service) or "0xC2" (audio real-time broadcasting service), coding must be performed based on Table 30-19.

Table 30-19: Operation of the descriptor for video real-time broadcasting service and audio real-time broadcasting service

<table>
<tr><th rowspan="2">Digital Copy Control</th><th rowspan="2">Analog Copy Control*3</th><th colspan="3">Operation of the digital copy control descriptor</th><th colspan="2">Operation of the content availability descriptor</th></tr>
<tr><th>copy_control_type</th><th>digital_recording_control_data</th><th>APS_control_data</th><th>encryption_mode*6</th><th>copy_restriction_mode*6</th></tr>
<tr><td>Copy freely *5</td><td rowspan="2">Copy freely</td><td rowspan="8">01</td><td rowspan="2">00</td><td rowspan="2">00</td><td>0</td><td rowspan="2">Don’t care</td></tr>
<tr><td>Copy freely</td><td>1</td></tr>
<tr><td rowspan="2">Copy never *1</td><td>Copy never, without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">11*9</td><td>00</td><td>Don’t care</td><td>Don’t care</td></tr>
<tr><td>Copy never *4</td><td>Other than 00</td><td>Don’t care</td><td>Don’t care</td></tr>
<tr><td>Copy one generation *2 *7</td><td rowspan="2">Copy one generation, without Macrovision protection.
It shall therefore be copyable on conventional analog recording devices.</td><td rowspan="4">10</td><td rowspan="2">00</td><td rowspan="2">Don’t care</td><td>1</td></tr>
<tr><td>Copy one generation *2</td><td>0</td></tr>
<tr><td>Copy one generation *2 *7</td><td>Becomes ”Copy never” after copying over one generation *4 *8</td><td rowspan="2">Other than 00</td><td rowspan="2">Don’t care</td><td>1</td></tr>
<tr><td>Copy one generation *2</td><td>Becomes ”Copy never” after copying over one generation *4</td><td>0</td></tr>
</table>

*1: In the case of high-speed digital interface output, the Copy Never process of the source function defined in DTCP shall be performed. However, the No More Copies process shall be performed when only outputting the audio stream in IEC60958-conformant format.

*2: In the case of high-speed digital interface output, the Copy One Generation process of the source function defined in DTCP shall be performed.

*3: It shall only be applicable to composite and component video outputs. It shall also include the case of outputting the received video signal after format conversion. Macrovision control shall be applicable to 480i composite and component video signals.

*4: Refer to Section 3.3 and Section 3.5.1.2 of Vol. 8 for the analog video output.

*5: In the case of high-speed digital interface output, encryption shall be performed according to the prescriptions defined in DTCP. However, no encryption will be performed when outputting only the audio stream in IEC60958-conformant format.

*6: If there is no content availability descriptor, encryption_mode and copy_restriction_mode shall both be judged to be '1'.

*7: Recordable (accumulatable) as "copyable with restriction".

*8: Refer to Section 3.8 of Vol. 8 if content was recorded (accumulated) with "copyable with restriction".

*9: See Vol. 8 for details about how to use digital_recording_control_data "11" of a digital copy control descriptor.

[Points of Use (independent data broadcasting service)]

If the service_type described in the service list descriptor of the NIT is set to "0xC2" (independent data broadcasting service), coding must be performed based on Table 30-20.

Table 30-17: Operation of the descriptor for independent data broadcasting service*7

Digital Copy Control	Analog Copy Control*3	Operation of the digital copy control descriptor			Operation of the content availability descriptor	
		copy_ control_ type	digital_ recording_ control_data	APS_ control_ data	encryption_ mode *6	copy_ restriction_ mode*6
Copy freely *5	Copy freely	01	00	00	0	Don't care
Copy freely					1	
		11	00	00	1	
Copy never *1	Copy never, without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.	01	11	00	Don't care	Don't care
	Copy never *4			Other than 00		

<table>
<tr><td rowspan="2">Copy never, and the output of MPEG_TS is disabled.*10</td><td>Copy never, without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">11</td><td rowspan="2"></td><td>00</td><td rowspan="2">Don’t care</td><td rowspan="2">Don’t care</td></tr>
<tr><td>Copy never *4</td><td>Other than 00</td></tr>
<tr><td>Copy one generation *2 *8</td><td rowspan="2">Copy one generation, without Macrovision protection.
It shall therefore be copyable on conventional analog recording devices.</td><td rowspan="4">01</td><td rowspan="8">10</td><td rowspan="2">00</td><td rowspan="4">Don’t care</td><td>1</td></tr>
<tr><td>Copy one generation *2</td><td>0</td></tr>
<tr><td>Copy one generation *2 *8</td><td>Becomes ”Copy never” after copying over one generation *4 *9</td><td rowspan="2">Other than 00</td><td>1</td></tr>
<tr><td>Copy one generation *2</td><td>Becomes ”Copy never” after copying over one generation *4</td><td>0</td></tr>
<tr><td>Copy one generation, but the output of MPEG_TS is disabled. *8 *10</td><td rowspan="2">Copy one generation, without Macrovision protection.
It shall therefore be copyable on conventional analog recording devices.</td><td rowspan="4">11</td><td rowspan="2">00</td><td rowspan="4">Don’t care</td><td>1</td></tr>
<tr><td>Copy one generation, but the output of MPEG_TS is disabled. *10</td><td>0</td></tr>
<tr><td>Copy one generation, but the output of MPEG_TS is disabled. *8 *10</td><td>Becomes ”Copy never” after copying over one generation *4 *9</td><td rowspan="2">Other than 00</td><td>1</td></tr>
<tr><td>Copy one generation, but the output of MPEG_TS is disabled. *10</td><td>Becomes ”Copy never” after copying over one generation *4</td><td>0</td></tr>
</table>

*1: In the case of high-speed digital interface output, the Copy Never process of the source function defined in DTCP shall be performed. However, the No More Copies process shall be performed when only outputting the audio stream in IEC60958-conformant format.

*2: In the case of high-speed digital interface output, the Copy One Generation process of the source function defined in DTCP shall be performed.

*3: It shall only be applicable to composite and component video outputs. It shall also include the case of outputting the received video signal after format conversion. Macrovision control shall be applicable to 480i composite and component video signals.

*4: Refer to Section 3.3 and Section 3.5.1.2 of Vol. 8 for the analog video output.

*5: In the case of high-speed digital interface output, encryption shall be performed according to the prescriptions defined in DTCP. However, no encryption will be performed when outputting only the audio stream in IEC60958-conformant format.

*6: If there is no content availability descriptor, encryption_mode and copy_restriction_mode shall both be judged to be '1'.

*7: For the relationship between copy control operation and service type, see Section 2.1 "Use of the Contents Protection System Received through the Real-time Broadcasting Service" in Vol. 8.

*8: Recordable (accumulatable) as "copyable with restriction".

*9: Refer to Section 3.8 of Vol. 8 if content was recorded (accumulated) with "copyable with restriction".

*10: In the case of IP interface, outputting of MPEG_PS shall also be prohibited.

[Points of Use (Common in All Services)]

Transmission and use should not be applied to other combinations than those specified in Table 30-19 and Table 30-20.

For CGMS-A, when copy_control_type is set to ’01’, ’10’ and ’11’, digital_recording_control_data and APS_control_data are copied in the area specified by CGMS-A.

When the relative descriptor includes the copy control information, the copyright process appropriate to analog video output, high-speed digital interface output and digital audio output is performed before outputting. CGMS-A and MACROVISION is used for analog video output, DTCP for high-speed digital interface output, and SCMS for digital audio output. For the details of process, see the specifications and standards.

When multiple services are outputted from the high-speed digital interface, the copy control designation (including output control) for each service is interpreted as follows:

- Outputting streams which includes services where output is prohibited or disabled is prohibited.

- The stream cannot be outputted if the service where copy_control_type=01 and the other where copy_control_type=11 are mixed. However, it can be outputted if the services of copy freely are mixed.
- Copy control is most strict for copy never, then copy one generation and copy freely in order.

The information should be accurately reflected in the copyright bit and category code of the channel status specified by IEC 60958.

The category code is set to "001_0000L" if digital copy control descriptor is provided.

Copy freely: Set the copyright information bit to 1.

Copy one generation: Set the copyright information bit to 0 and L bit of category code to 0.

Copy never: Set the copyright information bit to 0 and L bit of category code to 1.

If no relative descriptor is described, it is regarded as copy freely.

[Rules for Reception Processing]

The rules for Reception Processing for each field are shown in Table 30-21.

Table 30-18: Receiver process standard for digital copy control descriptor (first loop of PMT)

Rules for reception processing for each field	
descriptor_tag	= “0xC1”: Judge that the relative descriptor is digital copy control descriptor.
descriptor_length	Judge that it is the length of digital copy control descriptor.
digital_recording_control_data	This 2-bit field indicates the information used for copy generation control and decoded according to Table 30-19 and Table 30-20.
maximum_bit_rate_flag	='0': Judge that the maximum bit rate for the relative service is within the range of default maximum bit rate specified in Table 21-1 and Table 21-2. ='1': Judge that the maximum bit rate for the relative service is described below.
component_control_flag	='0': Judge that the relative descriptor is valid. ='1': Judge that the relative descriptor is invalid.
copy_control_type	This 2-bit field indicates the information used for copy generation control and is decoded according to Table 30-19 and Table 30-20.
maximum_bit_rate	Judge that it is the maximum bit rate for the relative service.

[Special Remarks]

Since the analog output signal copy control conforms to the individual contracts between broadcastiers and Macrovision, it seems necessary to re-consider carefully.

If this descripter is not described in the first loop but described in the second loop only, the copy control information for the first loop is regarded as "Copy freely".

If the rules for reception processing are not specified in Table 30-19 and Table 30-20, see Table 3-1 of Vol. 8.

30.3.2.3 Emergency information descriptor

[Use]

Indicate the emergency warning broadcasting or emergency warning test broadcasting is implemented in the relative service.

[Syntax]

The structure of emergency information descriptor is shown in Table 30-22.

Table 30-19: Structure of emergency information descriptor

Data structure	bit	Identifier
emergency_information_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i=0;i<N;i++){		
service_id	16	uimsbf
start_end_flag	1	bslbf
signal_level	1	bslbf
reserved_future_use	6	bslbf
area_code_length	8	uimsbf
for (j=0;j<N;j++){		
area_code	12	bslbf
reserved_future_use	4	bslbf
}		
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.24 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be inserted if the emergency warning broadcasting or emergency warning test broadcasting is being implemented in the relative service. If they are implemented in other services, the insertion of this descriptor is optional.

The transmission operating rule for each field are shown in Table 30-23.

Table 30-20: Transmission operating rule of emergency information descriptor

Transmission Operating Rule for each field	
descriptor_tag	Set to "0xFC".
descriptor_length	Describe the length of emergency information descriptor.
[service_id_loop]	The loop count is 1.
service_id	Describe service_id where the emergency warning broadcasting or emergency warning test broadcasting is implemented.
start_end_flag	Set to '1' for actual emergency warning broadcasting and '0' for test broadcasting.
signal_level	Describe according to 6.2.24 of Part 2 in ARIB STD-B10.
area_code_length	It is limited based on the maximum length of Descriptor_length.
[area_code_loop]	Loop for the number of target area codes. Loop at least once.
area_code	Describe the area code specified in Annex D of Part 2 in ARIB STD-B10.

[Rules for Reception Processing]

- Judge that the emergency awarning broadcasting or emergency warning test broadcasting is being implemented in the service shown in service_id.
- Judge that the emergency warning broadcasting is being implemented in the area specified by the area code during the period when start_end_flag='1' is described in the relative descriptor and the relative descriptor is placed.
- Judge that the emergency warning test broadcasting is being implemented in the relative service during the period when start_end_flag='0' is set in the relative descriptor and the relative descriptor is placed.
- If the relative descriptor is not placed, judge that the emergency warning broadcasting or emergency warning test broadcasting is not being implemented.

The rules for reception processing for each field are shown in Table 30-24.

Table 30-21: Receiver process standard for emergency information descriptor

Rules for reception processing for each field	
descriptor_tag	= “0xFC”: Judge that the relative descriptor is the emergency information descriptor.
descriptor_length	Judge that it is the length of emergency information descriptor.
[service_id_loop]	Judge that the loops except for the first loop are invalid.
service_id	Judge that it is service_id where the emergency warning broadcasting or emergency warning test broadcasting is implemented.
start_end_flag	‘0’: Judge that the emergency warning test broadcasting is being implemented in the relative service. ‘1’: the emergency warning broadcasting is being implemented for the area specified by the area code in the relative service.
signal_level	Judge that it is the signal type described according to 6.2.24 of Part 2 in ARIB STD-B10.
area_code_length	
[area_code_loop]	Judge that the area codes to be looped exist.
area_code	Judge that it is the area code specified in Annex D of Part 2 in ARIB STD-B10.

[Special Remarks]

For detailed use of emergency warning broadcasting, see Chapter 26.

30.3.2.4 Content availability descriptor

[Use]

Place this descriptor when describing control information on recording and outputting regarding the relative program. This descriptor shall also be placed for specifying whether "copyable with restriction" will be operated for the relevant program or component.

[Syntax]

The structure of content availability descriptor is shown in Table 30-25.

Table 30-22: Structure of content availability descriptor

Data structure	bit	Identifier
content_availability_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
reserved_future_use	1	bslbf
copy_restriction_mode	1	bslbf
image_constraint_token	1	bslbf

retention_mode	1	bslbf
retention_state	3	bslbf
encryption_mode	1	bslbf
for(i=0;i<N;i++){		
reserved_future_use	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.45 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed if the relative program is the output protection target.

Output protection refers to the use of the output protection bit (encryption_mode) of the content availability descriptor to protect the copy-freely contents from being output to the high-speed digital interface.

◎ If "copyable with restriction" will be operated with the digital copy control information of the relevant program or component set to "copy one generation", this descriptor shall either be not placed or placed with copy_restriction_mode = '1'.

◎ If "copyable with restriction" is not operated with the digital copy control information of the relevant program or component set to "copy one generation", this descriptor shall be placed with copy_restriction_mode = '0'.

The transmission operating rules for each field are shown in Table 30-26.

Table 30-26: Transmission operating rule of content availability descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0xDE".
descriptor_length	Describe the length of content availability descriptor.
copy_restriction_mode	Set to '1' if "copyable with restriction" will be operated, and '0' if not. (Note that the default value of '1' will be set if the relevant descriptor is not placed.)
image_constraint_token	Set to '1'.
retention_mode	Set to '0'.
retention_state	Set to '111'.
encryption_mode	Set to '0' if the digital copy control information is "Copy freely" and high-speed digital interface output protection is used. (Note that the default value is set to '1' when the relative descriptor is not placed.)

[Points of Use]

The relative descriptor is used in combination with the digital copy control descriptor. Place the digital copy control descriptor whenever the relative descriptor is placed.

With regard to the information described in copy_restriction_mode, image_constraint_token, retention_state and encryption_mode, note that '1' shows the default state.

[Rules for Reception Processing]

The relative descriptor is used in combination with the digital copy control descriptor; therefore, the relative descriptor is regarded as invalid if the digital copy control descriptor is not placed in the first loop of PMT.

The rules for reception processing for each field are shown in Table 30-27.

Table 30-23: Receiver process standard for content availability descriptor

Rules for reception processing for each field	
descriptor_tag	= “0xDE”: Judge that the relative descriptor is content availability descriptor.
descriptor_length	Judge that it is the length of content availability descriptor.
copy_restriction_mode	=‘1’:It shall be judged that "copyable with restriction" will be operated.*3 =‘0’:It shall be judged that "copyable with restriction" will not be operated.*3
image_constraint_token	Judge that the resolution for outputting video signal is not limited even though any value is entered.
retention_mode	Judge that the temporary recording is enabled even though any value is entered.*1
retention_state	Judge that the temporary recording permission time is 1.5 hour even though any value is entered. *1
encryption_mode	=‘1’: Judge that protection is not applied to high-speed digital interface outputting.*2 =‘0’: Judge that protection is applied to high-speed digital interface outputting.*2

*1 It is applicable only when the digital copy control information is "Copy never". (For details, see Vol. 8.)
*2 It is applicable only when the digital copy control information is "Copy freely". (For details, see Vol. 8.)
*3 It will be meaningful only if the digital copy control information is "Copy one generation". (Refer to Vol. 8 for details.)

[Special Remarks]

If the relative descriptor is not placed, the value for each field is regarded as follows:

- copy_restriction_mode = ‘1’
- image_constraint_token = ‘1’
- retention_mode = ‘0’
- retention_state = ‘111’
- encryption_mode = ‘1’

For detailed use and process, see Chapter 21 and Vol. 8.

The high-speed digital interface control should be processed in accordance with the DTCP specifications.

30.3.2.5 Data broadcast ID descriptor

[Use]

This descriptor is used to identify a data component format.

[Syntax]

The structure of the data broadcast ID descriptor is shown in Table 30-28.

Table 30-24: Structure of the data broadcast ID descriptor

Data structure	bit	Identifier
data_broadcast_id_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
data_broadcast_id	16	uimsbf
for(i=0; i < N;i++){		
id_selector_byte	8	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-29.

Table 30-25: Definitions of the data broadcast ID descriptor field

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with an 8-bit field length defines the total byte length of the data of the descriptors after this field.
data_broadcast_id	This 16-bit field is used to identify the data broadcast specifications. The value of this field is assigned based on the standard defined by an applicable organization for standardization.
id_selector_byte	This 8-bit field relies on the data broadcast identifier. If the data broadcaster identifier is set to 0x000B, it has the data structure for the INT as shown in Table 30-30.

Table 30-26: Data structure of ID_SELECTOR_BYTE for INT

Data structure	bit	Identifier
IP/MAC_notification_info () {		
platform_id_data_length	8	uimsbf
for (i=0; i<N; i++){		
platform_id	24	uimsbf
action_type	8	uimsbf
reserved	2	bslbf
INT_versioning_flag	1	bslbf
INT_version	5	uimsbf
}		
for (i=0; i<N; i++){		
private_data_byte	8	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-31.

Table 30-27: Definitions of ID_SELECTOR_BYTE field for INT

Definition of each field	
platform_id_data_length	This 8-bit field identifies the total byte length of the subsequent platform identifier loops.
platform_id	This 24-bit field identifies the platform of an IP service.
action_type	This 8-bit field identifies the location of the IP/MAC stream.
INT_versioning_flag	If this field is set to "1", changes made to the INT are applied to the version field. If this field is set to "0", then the version field value is invalid.
INT_version	This 5-bit field is valid when the INT version flag is set to "1" and one value is added every time the INT content is changed. This value is the same as the version number in the INT.
private_data_byte	This 8-bit field has a value that is individually defined.

[Transmission Operating Rule]

◎ This descriptor is always placed when transmitting a service with storable broadcasting data, ECG metadata, and INT, which are encapsulated by the ULE (IETF RFC4326) that is transmitted in multimedia broadcasting.

The transmission operating rules for each field are shown in Table 30-32.

Table 30-28: Transmission operating rule for the data broadcast ID descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0x66".
descriptor_length	Describe the descriptor length of a data broadcast ID descriptor.
data_broadcast_id	Set to "0x000B".
platform_id_data_length	This 8-bit field indicates the total byte length of the subsequent platform identifier loops.
platform_id	Describe an IPplatform ID. "0xFFF000" is set for multimedia broadcasting.
action_type	Set to "0x01". "0x01": For a case where the storable broadcasting service stream for multimedia broadcasting network is included "0x00": Undefined "0x02" to "0xFF": Undefined
INT_versioning_flag	Set to '1'. '0' is set only when an INT_version value is invalidated due to a test or other reason.
INT_version	The version number is incremented by one every time the INT is updated.
private_data_byte	Describe the private data. This is not used in multimedia broadcasting for the moment.

[Rules for Reception Processing]

Table 30-33 shows the rules for the reception processing of each field.

Table 30-29: Rules for the reception processing of the data broadcast ID descriptor

Reception processing rules for each field	
descriptor_tag	= "0x66": An applicable descriptor determines the data broadcast ID descriptor.
descriptor_length	Judge as the descriptor length of the data broadcast ID descriptor.
data_broadcast_id	= "0x000B": Judge as the multimedia broadcasting using the INT in an applicable service. = Other than "0x000B": Judge as the multimedia broadcasting that is not using the INT in an applicable service. In multimedia broadcasting, "0 x 000B" is always set.
platform_id_data_length	This 8-bit field indicates the total byte length of the subsequent platform identifier loops.
platform_id	Judge as an IP platform identifier.
action_type	If "0x01" is set, it is regarded that the stream of a storable broadcasting service for a multimedia broadcasting network is included.
INT_versioning_flag	If "1" is set, an INT version value can be used.
INT_version	This can be used as the update number of an INT.
private_data_byte	Judge as the private data for expansion. This is not used in multimedia broadcasting for the moment.

[Special Remarks]

None

30.3.3 Descriptor inserted in the second loop of PMT (ES loop)

30.3.3.1 Conditional access descriptor

[Use]

If the relative ES is for conditional access, specify the PID for ECM stream in CA system (conditional access system).

[Syntax]

The structure of conditional access descriptor is shown in Table 30-7.

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in Section 2.6.16 of ISO/IEC13818-1.

[Transmission Operating Rule]

◎ Only one descriptor should be transmitted for each conditional access system identifier if the descriptor specifies the different ECM_PID from that described in the conditional access descriptor that is placed in the first loop of the PMT.

If multiple conditional access systems are used, place one relative descriptor for each conditional access system identifier.

The transmission operating rule for each field are shown in Table 30-34.

Table 30-34: Transmission operating rule for conditional access descriptor (second loop of PMT)

Transmission operating rule for each field	
descriptor_tag	Set to “0x09”.
descriptor_length	Describe the length of conditional access descriptor.
CA_system_ID	Describe the conditional access system identifier. Among the conditional access system identifiers, any identifier value other than "0x000F", which is applied to multimedia broadcasting, must not be described.
CA_PID	Only CA_PID=”0x1FFF” can be specified. (See 19.2.1.)
private_data_byte	Do not describe any.

[Rules for Reception Processing]

- Judge that the relative ES is applied to the conditional access.
- If the relative descriptor is described both in the first and second loops of PMT, the information of descriptor described in the second loop is valid.

The rules for reception processing for each field are shown in Table 30-35.

Table 30-30: Receiver process standard for conditional access descriptor (second loop of PMT)

Rules for reception processing for each field	
descriptor_tag	= “0x09”: Judge that the relative descriptor is the conditional access descriptor.
descriptor_length	Judge as the length of conditional access descriptor.

CA_system_ID	= "0x000F": Judge as an applicable conditional access system identifier.*1 = Other value: Judge that the relative conditional access descriptor is invalid.
CA_PID	Judge that any other than "0x1FFF" is invalid. In case of "0x1FFF", the ECM for the relative PID is not transported.
private_data_byte	Judge that any entered value is invalid.

*1 If CA_system_ID is other than supporting conditional access system identifier, judge that the relative conditional access descriptor is invalid.

[Special Remarks]

None

30.3.3.2 Stream identifier descriptor

[Use]

This descriptor is used to label the relative ES.

[Syntax]

The structure of stream identifier descriptor is shown in Table 30-36.

Table 30-36: Structure of stream identifier descriptor

Data structure	bit	Identifier
stream_identifier_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
component_tag	8	uimsbf
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.16 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

This descriptor should be placed at the head of the second loop of the PMT.

The transmission operating rule for stream identifier descriptor are shown in Table 30-37.

Table 30-31: Transmission operating rule of stream identifier descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0x52".
descriptor_length	Describe the length of stream identifier descriptor.
component_tag	Describe component_tag for the relative ES loop.

[Rules for Reception Processing]

◎ Judge as the component type of an applicable ES.

The rules for reception processing for each field are shown in Table 30-38.

Table 30-32: Receiver process standard for stream identifier descriptor

Rules for reception processing for each field	
descriptor_tag	= "0x52": Judge that the relative descriptor is the stream identifier descriptor.
descriptor_length	Judge as the length of stream identifier descriptor.
component_tag	Judge as the component_tag value for the relative ES loop.

[Special Remarks]

- Unique component_tag value can be assigned for each service.
- For the rules of assigning component_tag value, see 13.2.

30.3.3.3 Digital copy control descriptor

[Use]

For each ES in the relative service, place this descriptor when control information regarding digital and analog copy is displayed, or when the maximum bit rate is described.

This descriptor is not used in storable broadcasting service.

[Syntax]

The structure of digital copy control descriptor is shown in Table 30-39.

Table 30-39: Structure of digital copy control descriptor

Data structure	bit	Identifier
digital_copy_control_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
digital_recording_control_data	2	bslbf
maximum_bit_rate_flag	1	bslbf
component_control_flag	1	bslbf
copy_control_type	2	bslbf
if(copy_control_type != 00){		
APS_control_data	2	bslbf
}		
else{		
reserved_future_use	2	bslbf
}		
if(maximum_bit_rate_flag == 1) {		

maximum_bit_rate	8	uimsbf
}		
if(component_control_flag ==1){		
component_control_length	8	uimsbf
for(j=0;j<N;j++){		
component_tag	8	uimsbf
digital_recording_control_data	2	bslbf
maximum_bitrate_flag	1	bslbf
reserved_future_use	1	bslbf
copy_control_type	2	bslbf
if(copy_control_type != 00) {		
APS_control_data	2	bslbf
}		
else{		
reserved_future_use	2	bslbf
}		
if(maximum_bitrate_flag==1){		
maximum_bitrate	8	uimsbf
}		
}		
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.23 and Annex F of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for the relative ES when specifying the digital copy control and analog copy control that are different from that specified for the whole service. However, the different copy control from that for the whole service can be specified only if the component tag value is set to 0x40 to 0x7F.

- This descriptor should be placed if the maximum bit rate for the relative ES is not within the range of default maximum bit rate specified in Table 21-1.
- When this descriptor is placed, make sure to describe the value in the field if it is different from the default value.
  For example, even though the maximum bit rate is same as that for the whole service, the field value should be described if it is different from the default maximum bit rate.
  (Otherwise, the field value is regarded as the default maximum bit rate.)

The transmission operating rule for each field are shown in Table 30-40.

Table 30-40: Transmission operating rule of digital copy control descriptor (second loop of PMT)

Transmission operating rule for each field	
descriptor_tag	Set to “0xC1”.
descriptor_length	Describe the length of digital copy control descriptor.
digital_recording_control_data	This 2-bit field indicates the information used for copy generation control and is coded according to Table 30-41 and Table 30-42.
maximum_bit_rate_flag	Set to '0' if the maximum bit rate for the relative service is not described. Set to '1' if the maximum bit rate for the relative service is described.
component_control_flag	If ‘0’ is set, the digital copy control information is defined for the relative ES, and the field later than component_control_length does not exist. If this descriptor is transmitted using PMT, always set to '0’.
copy_control_type	This 2-bit field indicates the information used for copy generation control and is coded according to Table 30-41 and Table 30-42.
APS_control_data	Analog output copy control information. This 2-bit field indicates the information used for analog output copy control if copy_control_type is set to '01’, ’10’ or ’11’ and is coded according to Table 30-41 and Table 30-42.
maximum_bit_rate	Describe the maximum bit rate. (Describe in increments of 1/4Mbit/s.)

Note that the specifications for controlling each output terminal using digital copy control descriptor vary according to service_type.

[Points of Use (Video Real-time Broadcasting Service and Audio Real-time Broadcasting Service)]

If the service_type set to the service list descriptor in the NIT is "0xC2" (video real-time broadcasting service) or "0xC2" (audio real-time broadcasting service), coding must be performed based on Table 30-41.

Table 30-41: Operation of the descriptors when providing video real-time broadcasting service and audio real-time broadcasting service

Digital Copy Control	Analog Copy Control*3	Operation of the digital copy control descriptor			Operation of the content availability descriptor*11	
		copy_ control_ type	digital_ recording_ control_data	APS_ control_ data	encryption_ mode*6	copy_ restriction_ mode*6
Copy freely *5	Copy freely	01	00	00	0	Don't care
Copy freely					1	
Copy never *1	Copy never, without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.		11*9	00	Don't care	Don't care
	Copy never *4			Other than 00	Don't care	Don't care
Copy one generation *2 *7	Copy one generation, without Macrovision protection. It shall therefore be copyable on conventional analog recording devices.		10	00	Don't care	1
Copy one generation *2						0
Copy one generation *2 *7	Becomes "Copy never" after copying over one generation *4 *8			Other than 00	Don't care	1
Copy one generation *2	Becomes "Copy never"after copying over one generation *4					0

*1: In the case of high-speed digital interface output, the Copy Never process of the source function defined in DTCP shall be performed. However, the No More Copies process shall be performed when only outputting the audio stream in IEC60958-conformant format.

*2: In the case of high-speed digital interface output, the Copy One Generation process of the source function defined in DTCP shall be performed.

*3: It shall only be applicable to composite and component video outputs. It shall also include the case of outputting the received video signal after format conversion. Macrovision control shall be applicable to 480i composite and component video signals.

*4: Refer to Section 3.3 and Section 3.5.1.2 of Vol. 8 for the analog video output.

*5: In the case of high-speed digital interface output, encryption shall be performed according to the prescriptions defined in DTCP. However, no encryption will be performed when outputting only the audio stream in IEC60958-conformant format.

*6: If there is no content availability descriptor, encryption_mode and copy_restriction_mode shall both be judged to be '1'.

*7: Recordable (accumulatable) as "copyable with restriction".

*8: Refer to Section 3.8 of Vol. 8 if content was recorded (accumulated) with "copyable with restriction".

*9: digital_recording_control_data of the digital copy control descriptor set to '11' will not be operated as pay-per-view will not be operated at the initial stage of the broadcasting. (Refer to Vol. 8 for details.)

*10: It shall be placed in the first loop of PMT.

[Points of Use (Independent Data Broadcasting Service)]

If the service_type set to the service list descriptor in the NIT is "0xC2" (independent data broadcasting service), coding must be performed based on Table 30-42.

Table 30-33: Operation of the descriptors when providing an independent data broadcasting service*7

<table>
<tr><th rowspan="2">Digital Copy Control</th><th rowspan="2">Analog Copy Control*3</th><th colspan="3">Operation of the digital copy control descriptor</th><th colspan="2">Operation of the content availability descriptor*16</th></tr>
<tr><th>copy_ control_ type</th><th>digital_ recording_ control_data</th><th>APS_ control_ data</th><th>encryption_ mode *6</th><th>copy_ restriction_ mode*6</th></tr>
<tr><td>Copy freely *5</td><td rowspan="3">Copy freely</td><td rowspan="2">01</td><td rowspan="2">00</td><td rowspan="2">00</td><td>0</td><td rowspan="3">Don’t care</td></tr>
<tr><td rowspan="2">Copy freely</td><td>1</td></tr>
<tr><td>11</td><td>00</td><td>00</td><td>1</td></tr>
<tr><td rowspan="2">Copy never *1</td><td>Copy never, without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">01</td><td rowspan="4">11</td><td>00</td><td rowspan="2">Don’t care</td><td rowspan="2">Don’t care</td></tr>
<tr><td>Copy never *4</td><td>Other than 00</td></tr>
<tr><td rowspan="2">Copy never, and the output of MPEG_TS is disabled. *10</td><td>Copy never, without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">11</td><td>00</td><td rowspan="2">Don’t care</td><td rowspan="2">Don’t care</td></tr>
<tr><td>Copy never *4</td><td>Other than 00</td></tr>
<tr><td>Copy one generation *2 *8</td><td>Copy one generation, without Macrovision protection.</td><td>01</td><td>10</td><td>00</td><td>Don’t care</td><td>1</td></tr>
</table>

Copy one generation *2	It shall therefore be copyable on conventional analog recording devices.					0
Copy one generation *2 *8	Becomes "Copy never" after copying over one generation *4 *9			Other than 00		1
Copy one generation *2	Becomes "Copy never" after copying over one generation *4					0*14
Copy one generation, but the output of MPEG_TS is disabled. *8 *10	Copy one generation, without Macrovision protection. It shall therefore be copyable on conventional analog recording devices.	11		00	Don't care	1
Copy one generation, but the output of MPEG_TS is disabled. *10						0
Copy one generation, but the output of MPEG_TS is disabled. *8 *10	Becomes "Copy never" after copying over one generation *4 *9			Other than 00		1
Copy one generation, but the output of MPEG_TS is disabled. *10	Becomes "Copy never" after copying over one generation *4					0*14

*1 : In the case of high-speed digital interface output, the Copy Never process of the source function defined in DTCP shall be performed. However, the No More Copies process shall be performed when only outputting the audio stream in IEC60958-conformant format.

*2: In the case of high-speed digital interface output, the Copy One Generation process of the source function defined in DTCP shall be performed.

*3: It shall only be applicable to composite and component video outputs. It shall also include the case of outputting the received video signal after format conversion. Macrovision control shall be applicable to 480i composite and component video signals.

*4: Refer to Section 3.3 and Section 3.5.1.2 of Vol. 8 for the analog video output.

*5: In the case of high-speed digital interface output, encryption shall be performed according to the prescriptions defined in DTCP. However, no encryption will be performed when outputting only the audio stream in

IEC60958-conformant format.

*6 : If there is no content availability descriptor, encryption_mode and copy_restriction_mode shall both be judged to be '1'.

*7 : For the relationship between copy control and service type, see Section 2.1 " Use of the Contents Protection System Received through the Real-time Broadcasting Service" in Vol. 8.

*8 : Digital copy control can be registered (stored) as "copyable with restriction".

*9 : If digital copy control can be registered (stored) as "copyable with restriction", see Section 3.8 in Vol. 8.

*10 : If an IP interface is used, the MPEG_PS also cannot be output.

*11 : This descriptor is placed in the first loop of the PMT.

［Points of Use (Common to All Services)］

Transmission must not be performed using any combination other than that specified in Table 30-41 and Table 30-42.

For CGMS-A, when copy_control_type is set to '01', '10', and '11', digital_recording_control_data and APS_control_data are copied to the area specified by CGMS-A.

If an applicable descriptor has copy control information, proper copyright protection process is performed for analog video output, high-speed digital interface output, and digital audio output in reception processing to output. CGMS-A and MACROVISION are used for analog video output. DTCP is used for high-speed digital interface output. SCMS is used for digital audio output. For details on the process, see the respective specification and standard document.

When outputting multiple components from a high-speed digital interface, the copy control of each component (including output control) can be explained as follows.

- The use of the descriptor defined for each service is applied to the descriptor described in the first and second loops.
- Output of a stream with components that are prohibited for output and that cannot be output is prohibited.
- It is prohibited to output a stream in which the component for which copy_control_type is set to 01 and the component for which copy_control_type is set to 11 exist together. However, output can be performed using the MPEG_TS in which a component is set to copy free and based on IEC60958 in an independent data broadcasting service.
- The degree of the copy control increases in the order of copy never, copy one generation, and copy freely.

The information needs to be accurately reflected in the copyright bit and category code of the channel status specified in IEC 60958.

The category code is set to "001_0000L" if the digital copy control descriptor is provided.

copy freely: Set the copyright information bit to 1.

copy one generation: Set the copyright information bit to 0 and L bit of the category code to 0.

copy never: Set the copyright information bit to 0 and L bit of the category code to 1.

[Rules for Reception Processing]

Table 30-43 shows the rules for the reception processing of each field.

Table 30-34: Rules for the reception processing of a digital copy control descriptor (PMT second loop)

Reception processing rules for each field	
descriptor_tag	= "0xC1": Indicate that this descriptor is a digital copy control descriptor.
descriptor_length	Judge as the length of a digital copy control descriptor.
digital_recording_control_data	This 2-bit field indicates the information used for copy generation control and is decoded according to Table 30-41 and Table 30-42.
maximum_bit_rate_flag	= '0': Judge that the maximum transmission rate of an applicable ES is within the range of the default maximum bit rate defined in Table 21-1 and Table 21-2. = '1': Judge that the maximum transmission rate of an applicable ES is described below.
component_control_flag	= '0': Judge that this descriptor is valid. = "1': Judge that this descriptor is invalid.
copy_control_type	This 2-bit field indicates the information regarding a type to control copy generation. Decoding is performed based on Table 30-41 and Table 30-42.
maximum_bit_rate	Judge as the maximum transmission rate for the service.

[Special Remarks]

The copy control for analog output signals must be carefully considered in the future in order to comply with each contract between an applicable broadcaster and Macrovision, etc.

For the reception processing that is not defined in Table 30-41 and Table 30-42, see Table 3-1 in Vol. 8.

30.3.3.4 Data component descriptor

The transmission operating rule of the relative descriptor is described in Vol. 3.

30.3.3.5 Video decode control descriptor

[Use]

This descriptor is used for controlling the video decode at the moment when the video coding system is changed in the same service_id. Also, it shows whether the relative ES is MPEG-I frame still image or not.

[Syntax]

The structure of video decode control descriptor is shown in Table 30-44.

Table 30-44: Structure of video decode control descriptor

Data structure	bit	Identifier
video_decode_control_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
still_picture_flag	1	bslbf
sequence_end_code_flag	1	bslbf
video_encode_format	4	bslbf
reserved_future_use	2	bslbf
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.30 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed when transmitting still image streams.

- This descriptor should be placed when the seamless switching is used.

  In this case, the PMT which has relative descriptor containing the information of components after the switching is performed, istransmitted 0.5 to 2 seconds before the video is switched.

- Except the above, this descriptor can be placed any time.

The transmission operating rule for each field is shown in Table 30-45.

Table 30-45: Transmission operating rule of video decode control descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0xC8”.
descriptor_length	Describe the length of video decode control descriptor.
still_picture_flag	Set to ’1’ when the relative component is the still picture

	(MPEG-I picture) and '0' when it is the moving picture.
sequence_end_code_flag	Set to '1' if the old video component (*1) transmits the sequence end code.
video_encode_format	Describe the encode format of new video component (*2). 0000: 1080p 0001: 1080i 0010: 720p 0011: 480p 0100: 480i 0101: 240p 0110: 120p 1000 to 1111: video_encode_format Extension

*1: It refers to the video component used at the moment when transmission of the PMT, where the relative descriptor is placed, is started.
*2: It refers to the component used after the switching has been performed.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 30-46.

Table 30-35: Rules for reception processing for video decode control descriptor

Rules for reception processing for each field	
descriptor_tag	= "0xC8": Judge that the relative descriptor is the video decode control descriptor.
descriptor_length	Judge that it is the length of video decode control descriptor.
still_picture_flag	='1': Judge that the relative component is the still picture (MPEG-I picture). ='0': Judge that the relative component is the moving picture. '0' is always used for multimedia broadcasting.
sequence_end_code_flag	='1': Sequence end code is transmitted; therefore, it can be used for switching of decoding.
video_encode_format	It is used for setting to decoding as an encode format for new component.

[Special Remarks]

The video decode control descriptor is described for the purpose of sending the operation sequence to the receiver unit if switching is applied so that the receiver unit can implement the seamless switching based on the sequence, as well as showing that it is the still picture. For the details of seamless switching, see "Appendix 1 Method of Switching the Video Format" in ARIB STD-B21.

30.4 NIT (Network Information Table)

30.4.1 Structure and use of NIT

[Use]

Transmit the information on transmission path such as modulation frequency and linking broadcasting service. Show the service structure of the entire network.

[Syntax]

The structure of NIT is shown in Table 30-47.

Table 30-36: Structure of NIT (network information table)

Data structure	bit	Identifier
network_information_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
network_id	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
reserved_future_use	4	bslbf
network_descriptor_length	12	uimsbf
for (i = 0;i< N;i++) {		
descriptor()		
}		
reserved_future_use	4	bslbf
transport_stream_loop_length	12	uimsbf
for (i = 0;i< N;i++) {		
transport_stream_id	16	uimsbf
original_network_id	16	uimsbf
reserved_future_use	4	bslbf
transport_descriptors_length	12	uimsbf
for (j = 0;j< N;j++) {		
descriptor()		
}		
}		
CRC_32	32	rpchof
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.4 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ NIT should be transmitted if any stream is included in the transport stream.

◎ The transmission layer should always be layer A.

● For the re-transmission cycle, follow Section 10.4 of this document.

● For the update frequency, follow Section 10.9 of this document.

● NIT and the corresponding SDT shall describe basically the same service information (excluding engineering service), except for the transition period. (Note that there is no information on other TS in SDT, because only the SDT for actual is operated (see 31.2.1 of this section for detail))

The transmission operating rule for each field are shown in Table 30-48.

Table 30-37: Transmission operating rule of NIT

Transmission operating rule for each field	
table_id	Set to “0x40”.
section_syntax_indicator	Set to ‘1’.
section_length	Describe the section length of NIT. Since the maximum length of section is 1024 bytes, this value should be 1021 at maximum.
network_id	Set to "0x0200", which is the network_id for multimedia broadcasting.
version_number	For normal use, describe a value incremented by 1 every time contents are updated. However, when a system error occurs, a value incremented by more than 1 can be described.
current_next_indicator	Set to '1’. Use based on the MPEG standards.
section_number	
last_section_number	
network_descriptor_length	The maximum loop count is not defined.
[1st_loop]	
[descriptor]	
transport_stream_loop_length	
[2nd_loop]	Describe the information on transport stream included in the target network. The maximum number of loops is not defined.
transport_stream_id	
original_network_id	Describe the same value as that for "network_id".
transport_descriptors_length	The maximum value is not defined.
[descriptor]	

[Rules for Reception Processing]

- Since the NIT is not the table that is often upgraded, the receiver units can receive information based on the NIT information stored in the non-volatile memory to shorten the operation time. If the NIT cannot be received within the specified repetition rate, judge that any receivable stream does not exist in the transport stream, or that the transmission system is not normally functioning. If the NIT is received, follow the received information.
- Multimedia broadcasting utilizes a single network and transmits the same tables in each TS. The receivers need to manage them as the NIT that is common to all stations.
- It is regarded as a transition period if the service information in the NIT and the service information in the corresponding SDT are different, excluding the case where a service type is different only in the description related to engineering services.

The rules for reception processing for each field are shown in Table 30-49.

Table 30-38: Rules for reception processing for NIT

Rules for reception processing for each field	
table_id	= "0x40": Judge that the relative table is NIT.
section_syntax_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_length	Judge as the section length of NIT.
network_id	Judge as "network_id" for the target network.
version_number	If any change occurs, judge that the relative table has been updated.
current_next_indicator	= '0': Judge that the relative section is invalid. = '1': Judge that the relative section is valid.
section_number	
last_section_number	
network_descriptor_length	The maximum loop count is not defined.
[1st_loop]	
[descriptor]	
transport_stream_loop_length	
[2nd_loop]	It shows each transport stream information included in the target network.
transport_stream_id	
original_network_id	
transport_descriptors_length	
[descriptor]	

[Special Remarks]

None

30.4.2 Descriptor inserted into the first loop of NIT (network loop)

30.4.2.1 Network name descriptor

[Use]

Describe network name.

[Syntax]

The structure of network name descriptor is shown in Table 30-50.

Table 30-50: Structure of network name descriptor

Data structure	bit	Identifier
Network_name_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i = 0;i< N;i++) {		
char	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.11 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for the network loop in the NIT.

● The network name should be the texts representing the broadcasting station name.

The transmission operating rules for each field are shown in Table 30-51.

Table 30-51: Transmission operating use of network name descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0x40”.
descriptor_length	Describe the length of the relative descriptor.
[char]	The maximum number of characters is 10 two-byte or 20 one-byte characters. Do not use linefeed codes. For the rule on use, see [Appendix H].

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 30-52.

Table 30-39: Rules for reception processing for network name descriptor

Rules for reception processing for each field	
descriptor_tag	= "0x40": Judge that the relative descriptor is the network name descriptor.
descriptor_length	Judge as the length of network name descriptor.
[char]	Judge as the network name. It is not generally presented to viewers.

[Special Remarks]

None

30.4.2.2 System management descriptor

[Use]

This descriptor judges whether the relative network is for broadcasting or not, and is used for identifying the standard system if the relative network is for broadcasting.

[Syntax]

The structure of system management descriptor is shown in Table 30-53.

Table 30-40: Structure of system management descriptor

Data structure	bit	Identifier
system_management_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
system_management_id() {		uimsbf
broadcasting_flag	2	uimsbf
broadcasting_identifier	6	uimsbf
additional_broadcasting_identification	8	uimsbf
}		
for (i = 0;i< N;i++) {		
additional_identification_info	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.21 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for the network loop in the NIT.

The transmission operating rules for each field are shown in Table 30-54.

Table 30-41: Transmission operating rule of system management descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0xFE”.
descriptor_length	Describe the length of system management descriptor.
[system_management_id]	
broadcasting_flag	Set to ‘00’. (It refers to "broadcast".)
broadcasting_identifier	Set to '001010’ (this ID indicates a broadcasting method for multimedia broadcasting).
additional_broadcasting_ identification	Set to “0x01”.
[loop]	
additional_identification_ info	Do not describe.

[Rules for Reception Processing]

- Judge whether the target network is for broadcasting or not and whether the broadcasting is multimedia broadcasting or not if the network is for broadcasting.

The rules for reception processing for each field are shown in Table 30-55.

Table 30-42: Rules for reception processing for system management descriptor

Rules for reception processing for each field	
descriptor_tag	= “0xFE”: Judge that the relative descriptor is the system management descriptor.
descriptor_length	Judge as the length of system management descriptor.
[system_management_id]	
broadcasting_flag	= ‘00’: Judge that the relative network is for broadcasting. ≠ ‘00’: Judge that the relative network is for any other than broadcasting.
broadcasting_identifier	= '001010': Judge that the network is used in multimedia broadcasting. ≠ '001010': Judge that the network is used in broadcasting other than multimedia broadcasting.
additional_broadcasting_ identification	Ignore.
[loop]	
additional_identification _info	Ignore.

[Special Remarks]

None

30.4.2.3 Link descriptor

[Use]

Describe a link to the INT (table for referencing an IP) for a storable broadcasting service.

[Syntax]

The structure of a link descriptor is shown in Table 30-56.

Table 30-43: Structure of link descriptor

Data structure	bit	identifier
linkage_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
transport_stream_id	16	uimsbf
original_network_id	16	uimsbf
service_id	16	uimsbf
linkage_type	8	uimsbf
if(linkage_type ==0x0B){		
platform_id_data_length	8	uimsbf
for (i=0; i<N; i++) {		
platform_id	24	uimsbf
platform_name_loop_length	8	uimsbf
for (i=0; i<N; i++) {		
ISO_639_language_code	24	bslbf
platform_name_length	8	uimsbf
for (i=0; i<platform_name_length; i++) {		
text_char	8	uimsbf
}		
}		
}		
for (i = 0;i< N;i++) {		
private_data_byte	8	uimsbf
}		
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in 6.2.8 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ One link descriptor must be placed in a TS that includes a storable broadcasting service stream.

The transmission operating rules for each field are shown in Table 30-57.

Table 30-44: Transmission operating rules for the link descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0x4A".
descriptor_length	Describe the descriptor length of a link descriptor.
transport_stream_id	Describe a transportation stream identifier that includes a linked service.
original_network_id	Describe the network identifier in which the linked service has been transmitted.
service_id	Describe the linked service identifier.
linkage_type	Set to "0x0B" (INT structure).
platform_id_data_length	Describe the data length of the IP platform ID and the IP platform name.
platform_id	Describe an IP platform ID. "0xFFF000" is set for multimedia broadcasting.
platform_name_loop_length	Set the loop length of an IP platform name.
ISO_639_language_code	Describe a character encoding language that is used for the applicable descriptor, "text_char". The ISO_639_language_code is created by coding a 3-character code, which is standardized by ISO639 Part 2, into 8-bit. (e.g.: "jpn" → "0x6A706E")
platform_name_length	Describe the IP platform length.
text_char	Describe an IP platform name.
private_data_byte	Describe the private data for expansion. The private_data_byte is not used in multimedia broadcasting for the moment.

［Rules for Reception Processing］

Table 30-58 shows the rules for the reception processing of each field.

Table 30-45: Rules for the reception processing of the link descriptor

Reception processing rules for each field	
descriptor_tag	If "0x4A" is set, the descriptor is judged as a link descriptor.
descriptor_length	Judge as the description length of a link descriptor.
transport_stream_id	Judge as a transport stream identifier with linked service.
original_network_id	Judge as the network identifier in which the linked service has been transmitted.
service_id	Judge as the service identifier of a linked service.
linkage_type	="0x0B": Judge as a link descriptor for the INT.
platform_id	Judge as the IP platform identifier.
ISO_639_language_code	Describe a character encoding language that is used for an applicable descriptor, "text_char". The ISO_639_language_code is created by coding a 3-character code, which is standardized by ISO639 Part 2, into 8-bit. (e.g.: "jpn" → "0x6A706E")
text_char	Judge as IP platform name.
private_data_byte	Judge as the private data for extension. This is not used in multimedia broadcasting for the moment.

［Special Remarks］

None

30.4.3 Descriptor inserted into the second loop (TS loop) of NIT

30.4.3.1 Service list descriptor

[Use]

Describe the list by services and service types in the transport stream.

[Syntax]

The structure of service list descriptor is shown in Table 30-59.

Table 30-46: Structure of service list descriptor

Data structure	bit	Identifier
service_list_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i= 0;i< N;i++) {		
service_id	16	uimsbf
service_type	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.14 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for TS loop in NIT.

The transmission operating rules for each field are shown in Table 30-60. The values for "service_type" are shown in Table 30-61.

Table 30-47: Transmission operating rule of service list descriptor (second loop of NIT)

Transmission operating rule for each field	
descriptor_tag	Set to “0x41”.
descriptor_length	Describe the length of service list descriptor.
[loop]	Describe the loops for the number of services included in the target transport stream.
service_id	Describe "service_id" included in the relative transport stream.
service_type	Describe the service type of the relative service. (Specified in Table 30-61.)

Table 30-61: "service_type"

service_type	Definitions
0x02	Video real-time broadcasting service
0x02	Audio real-time broadcasting service
0xC2	Independent data broadcasting service
0xA4	Engineering service (Note1)
0xC2	Storable broadcasting service EPG/ECG metadata service

Note that the number of "service_type" may increase in the future.
Note1: For details, see the Operation Rule in Vol. 1.

[Rules for Reception Processing]

- Judge that it is the information on transport stream included in the target network.

The rules for reception processing for each field are shown in Table 30-62.

Table 30-48: Rules for reception processing for service list descriptor (Second Loop of NIT)

Rules for reception processing for each field	
descriptor_tag	“0x41”: Judge that the relative descriptor is the service list descriptor.
descriptor_length	Judge as the length of service list descriptor.
[loop]	
service_id	Judge as "service_id" for the relative transport stream.
service_type	It indicates the type of the relative service. Judge that any other service than that specified in Table 30-61 is invalid.

[Special Remarks]

None

30.4.3.2 Terrestrial delivery system descriptor

[Use]

Indicate the physical conditions of terrestrial transmission path.

[Syntax]

The structure of terrestrial delivery system descriptor is shown in Table 30-63.

Table 30-63: Structure of terrestrial delivery system descriptor

Data structure	bit	Identifier
terrestrial_delivery_system_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
area_code	12	bslbf
guard_interval	2	bslbf
transmission_mode	2	bslbf
for (I = 0;i< N;i++) {		
frequency	16	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.31 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for the TS loop when the NIT is transmitted.

- 1/4 guard interval and Model 3 are fixed. (For details, see Section 5.5 of Vol. 7.)
- In case of MFN, enter all frequencies used by the transmission facility for transmitting the relative TS.

However, in multimedia broadcasting, this is used in the single frequency network (SFN).

The transmission operating rules for each field are shown in Table 30-64.

Table 30-64: Transmission operating rule of terrestrial delivery system descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0xFA”.
descriptor_length	Describe the length of terrestrial delivery system descriptor
area_code	Enter the service area code. (Each value is specified in Table D-2 of Annex D of Part 2 in ARIB STD-B10.)
guard_interval	Enter the guard interval. (Specified in Table 30-65.)
transmission_mode	Enter the mode information. (Specified in Table 30-66.)
[loop]	In case of MFN, describe the loop for the number of frequencies used by the transmission facility for transmitting the relative TS.
frequency	Describe the frequency. Unit is 1/7MHz.

Table 30-49: Guard interval

guard_interval	Definitions
00	1/32 Note1
01	1/16 Note1
10	1/8 Note1
11	1/4

Note 1: Not available in multimedia broadcasting.

Table 30-66: Mode Information

transmission_mode	Definitions
00	Mode1 Note1
01	Mode2 Note1
10	Mode3
11	Undefined

Note 1: Not available in multimedia broadcasting.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 30-67.

Table 30-50: Rules for reception processing for terrestrial delivery system descriptor

Rules for reception processing for each field	
descriptor_tag	= "0xFA": Judge that the relative descriptor is the terrestrial delivery system descriptor.
descriptor_length	Judge as the length of the terrestrial delivery system descriptor.
area_code	Judge as the service area code of the relative TS.
guard_interval	Judge as the guard interval length of the relative TS.
transmission_mode	Judge as the transmission mode of the relative TS.
[loop]	
frequency	Judge as each frequency of the broadcast for the relative TS. Note that the entered frequency information may not completely match the actual transmission frequency due to added transmission station and frequency repacking.

[Special Remarks]

None

30.4.3.3 Partial reception descriptor

[Use]

Specify the service identifier transmitted in the partial reception layer of the terrestrial transmission path.

[Syntax]

The structure of partial reception descriptor is shown in Table 30-68.

Table 30-51: Structure of partial reception descriptor

Data structure	bit	Identifier
partial_reception_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i = 0;i< N;i++) {		
service_id	16	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.32 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor should be placed for the TS loop when using the partial reception layer.

The transmission operating rules for each field are shown in Table 30-69.

Table 30-52: Transmission operating rule of partial reception descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0xFB”.
descriptor_length	Describe the length of partial reception descriptor.
service_id	Describe "service_id" transmitted in the partial reception layer.

[Rules for Reception Processing]

● Judge that the receiver units only for receiving in partial reception layer are available for "service_id" described here only.

The rules for reception processing for each field are shown in Table 30-70.

Table 30-70: Rules for reception processing for partial reception descriptor

Rules for reception processing for each field	
descriptor_tag	“0xFB”: Judge that the relative descriptor is the partial reception descriptor.
descriptor_length	Judge as the length of the partial reception descriptor.
service_id	Judge as "service_id" transmitted in the partial reception layer.

[Special Remarks]

None

30.4.3.4 TS information descriptor

[Use]

Write various additional information attached to the relative TS.

[Syntax]

The structure of TS information descriptor is shown in Table 30-71.

Table 30-71: Structure of TS information descriptor

Data structure	bit	Identifier
ts_information_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
remote_control_key_id	8	uimsbf
length_of_ts_name	6	bslbf
transmission_type_count	2	uimsbf
for (i = 0;i< length_of_ts_name;i++) {		

ts_name_char	8	uimsbf
}		
for (j = 0;j< transmission_type_count;j++) {		
transmission_type_info	8	bslbf
num_of_service	8	uimsbf
for (k = 0;k< num_of_service;k++) {		
service_id	16	uimsbf
}		
}		
for (l = 0;l< N;l++) {		
reserved_future_use	8	bslbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-72.

Table 30-53: Definitions of TS information descriptor fields

Definitions of fields	
remote_control_key_id	This 8-bit field indicates the remote control ID value.
length_of_ts_name	This 6-bit field indicates the number of bytes for the TS name.
transmission_type_count	This 2-bit field indicates the number of transmission parameter types to be entered later. It is equal to the number of layers structuring the relative TS.
ts_name_char	This 8-bit field indicates the name of the relative transport stream.
transmission_type_info	This -8-bit field is used for classifying the transmission layers.
num_of_service	This 8-bit field indicates the number of services where the relative layer is used as a service layer.
service_id	This 16-bit field indicates "service_id" of the service where the relative layer is used as a service layer (including engineering service).

[Transmission Operating Rule]

◎ This descriptor should be placed for the TS loop in the NIT.

The transmission operating rules for each field are shown in Table 30-73.

Table 30-73: Transmission operating rule of TS information descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0xCD".
descriptor_length	Describe the length of TS information descriptor.
remote_control_key_id	Describe the remote control key ID value in the binary mode. The values are limited to 1 to 12 (0x01 - 0x0C). Other values are for the future extension. In multimedia broadcasting, receivers do not use this value. Therefore, a fixed value, 255

Transmission operating rule for each field	
	(0xFF) is set.
length_of_ts_name	Describe the byte length of the TS name. The maximum length is 20.
transmission_type_count	Describe the number of transmission parameter types (= the number of layers structuring the relative TS) to be entered later. The values are limited to 1 to 3.
[ts_name_char _loop]	
ts_name_char	Describe the name of the relative transport stream. A fixed value, "0xFF", is set because the ts_name_char is not used in multimedia broadcasting.
[transmission_type_loop]	Multiple parameter types should be entered in the alphabetical order.
transmission_type_info	It is used for classifying the transmission layers. Describe a transmission parameter type value that is used in multimedia broadcasting, using MSB 2 bits of 8 bits, and describe the modulation system of an applicable layer using the next 2 bits. The remaining 4 bits are for the future extension, however, use 0xF for the time being. - Transmission parameter type value 00: Type a 01: Type b 10: Type c 11: Reserved The transmission parameter type is always set to "11" because the transmission_type_info is not used in multimedia broadcasting. - Modulation system 00: 64QAM 01: 16QAM 10: QPSK 11: Reserved For instance, if the modulation system of an applicable loop is [QPSK], this part is expressed as '11101111 (0xEF)' based on the transmission order.
num_of_service	Describe the number of services where the relative layer is used as a service layer.
[service_id_loop]	Describe the primary service of each layer first.
service_id	Describe "service_id" of the service where the relative layer is used as a service layer.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 30-74.

Table 30-74: Rules for reception processing for TS information descriptor

Rules for reception processing for each field	
descriptor_tag	= "0xCD": Judge that the relative descriptor is the TS information descriptor.
descriptor_length	Judge as the length of TS information descriptor.
remote_control_key_id	The remote_control_key_id is ignored in the receivers because it is not used in multimedia broadcasting.
length_of_ts_name	Judge as the byte length of the TS name.
transmission_type_count	Judge as the number of transmission parameter types (= the number of layers structuring the relative TS) to be entered later. If the value is '0', judge that the entire relative descriptor is invalid.
[ts_name_char _loop]	
ts_name_char	The ts_name_char is ignored in the receivers because it is not used in multimedia broadcasting.
[transmission_type_loop]	
transmission_type_info	Judge as the values for classifying the transmission layers regarding the relative layer. MSB 2 bit is a transmission parameter type value. However, the value is ignored in the receivers because it is not used in multimedia broadcasting. For the next 2 bits, judge as the modulation system of the relative layer. If the value is set to '11', it is the new modulation system but it can be processed as well as other existing systems if it can be normally demodulated. For the remaining 4 bits, ignore from the receiver unit side. For instance, if the modulation system of an applicable loop is [QPSK], this part is expressed as '11101111 (0xEF)' based on the transmission order.
num_of_service	Judge as the number of services where the relative layer is used as a service layer.
[service_id_loop]	
service_id	Judge as the service where the relative layer is used as a service layer. Also judge that the first service is the primary service of the relative layer.

[Special Remarks]

None

30.4.3.5 Connected transmission descriptor

[Use]

This descriptor indicates the physical conditions when performing connected transmission over a multimedia broadcasting transmission path.

[Syntax]

The structure of the connected transmission descriptor is shown in Table 30-75.

Table 30-54: Structure of the connected transmission descriptor

Data structure	bit	Identifier
connected_transmission_descriptor (){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
connected_transmission_group_id	16	uimsbf
segment_type	2	bslbf
modulation_type_A	2	bslbf
modulation_type_B	2	bslbf
modulation_type_C	2	bslbf
for(i= 0;I<N;i++){		
additional_connected_transmission_info	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in 6.2.41 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ The connected transmission descriptor must be placed in a TS loop when performing connected transmission.

The transmission operating rules for each field are shown in Table 30-76.

Table 30-55: Transmission operating rules for the connected transmission descriptor

Transmission operating rules for each field	
descriptor_tag	Set to "0xDD".
descriptor_length	Describe the descriptor length of the connected transmission descriptor.
connected_transmission_group_id	Describe an ID to identify a connected transmission group.
segment_type	Describe a segment mode type. • Segment type 00: 1 segment 10: 13 segments 01: 3 segments 11: See TMCC.
modulation_type_A	Describe the modulation system type of the A layer. • Modulation system type 00: Differential modulation 10: Reserved 01: Synchronous modulation 11: See TMCC.
modulation_type_B	Describe the modulation system type of B layer.*1 • Modulation system type 00: Differential modulation 10: Reserved 01: Synchronous modulation 11: See TMCC.
modulation_type_C	Describe the modulation system type of C layer.*1 • Modulation system type 00: Differential modulation 10: Reserved 01: Synchronous modulation 11: See TMCC.

*1: If the segment mode type is 1-segment, it is redundant.

[Rules for Reception Processing]

○ It is determined that the connected transmission is performed for the segment currently being received.

○ If there is temporarily an inconsistency between the segment_type/modulation_type and the information described in the TMCC when changing, priority is given to the information in the TMCC.

Table 30-77 shows the rules for the reception processing of each field.

Table 30-56: Rules for the reception processing of the connected transmission descriptor

Reception processing rules for each field	
descriptor_tag	Judge that this descriptor is the connected transmission descriptor if "0xDD" is set.
descriptor_length	Judge as the descriptor length of the connected transmission descriptor.
connected_transmission_group_id	Judge as the ID of a connected transmission group for which connected transmission was performed.
segment_type	Judge the segment mode type of an applicable segment.
modulation_type_A	Judge as the modulation system type of the layer A.
modulation_type_B	Judge as the modulation system type of B layer. This field can be ignored if an applicable segment is identified as 1-segment mode and if a receiver for a 1-segment broadcast is used.
modulation_type_C	Judge as the modulation system type of C layer. This field can be ignored if an applicable segment is identified as 1-segment mode and if a receiver for a 1-segment broadcast is used.

[Special Remarks]

None

30.5 INT (IP/MAC Notification Table)

30.5.1 Configuration and use of INT

[Use]

A transport stream ID/service ID/component tag/target receiver's IP address for a platform ID is specified in a stream in storable broadcasting service.

[Syntax]

The structure of INT is shown in Table 30-78.

Table 30-57: Structure of INT (IP/MAC Notification Table)

Data structure	bit	Identifier
IP/MAC_notification_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
action type	8	uimsbf
platform_id_hash	8	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
platform_id	24	uimsbf
processing_order	8	uimsbf
platform_descriptor_loop()		
for (i = 0;i< N;i++) {		
target_descriptor_loop()		
operational_descriptor_loop()		
}		
CRC_32	32	rpchof
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in ARIB STD-B10.

[Transmission Operating Rule]

◎ The INT must be transmitted when a stream for a storable broadcasting service is included in the transport stream.

◎ The transmission layer should be layer A.

- For the re-transmission cycle, follow Section 10.4 of this document.
- For the update frequency, follow Section 10.9 of this document.

The transmission operating rules for each field and the descriptor loop structure are shown in Table 30-79 and in Table 30-79 to Table 30-83.

Table 30-58: Transmission operating rules for INT

Transmission operating rules for each field	
table_id	Set to "0x4C".
section_syntax_indicator	Set to '1'.
section_length	Describe the section length of the INT. The maximum value is 4093 because the maximum total section length is 4096 bytes.
action_type	Set to "0x01". "0x01": This is set when a storable broadcasting service stream for multimedia broadcasting network is included. "0x00": Undefined "0x02"–"0xFF": Undefined
platform_id_hash	Describe a value by performing XOR on each bit for the following 3 bytes of Platform_id [23..16], platform_id [15..8], and platform_id [7..0].
version_number	For normal use, describe a value incremented by 1 every time the version is updated. However, when a system error occurs, a value incremented by 1 or more can be described.
current_next_indicator	Set to '1'. The current_next_indicator is used based on the MPEG standard.
section_number	Describe a section number. The section number of the first section is 0. A value increased by 1 is set every time a section is increased.
last_section_number	Describe the last section number of a sub-table that is divided into sections.
platform_id	Describe an IP platform identifier that is related to an applicable storable broadcasting service or EPG/ECG

	metadata service. "0xFFF000" is set in multimedia broadcasting.
processing_order	Describe an action in Table 30-80. The order of processing in a receiver can be specified with this code when multiple INT sub-tables are used in the same platform ID.
[platform_descriptor_loop]	Place a descriptor in a platform descriptor area.
[target_descriptor_loop]	Place a descriptor in a target descriptor area.
[operational_descriptor_loop]	Place a descriptor in an operation descriptor area.

Table 30-59: Processing order code

processing_order	Meaning
0x00	First action
0x01-0xFE	Subsequent action (in ascending order)
0xFF	Do not process.

Table 30-60: Structure of platform_descriptor_loop

Name	bit	Identifier
platform_descriptor_loop () {		
reserved	4	bslbf
platform_descriptor_loop_length	12	uimsbf
for (i = 0;i< N;i++) {		
platform_descriptor()		
}		

Table 30-61: Structure of target_descriptor_loop

Name	bit	Identifier
target_descriptor_loop () {		
reserved	4	bslbf
target _descriptor_loop_length	12	uimsbf
for (i = 0;i< N;i++) {		
target _descriptor()		

}		

Table 30-62: Structure of operational_descriptor_loop

Name	bit	Identifier
operational_descriptor_loop () {		
reserved	4	bslbf
operational_descriptor_loop_length	12	uimsbf
for (i = 0;i< N;i++) {		
operational_descriptor()		
}		

30.5.2 Descriptors inserted into the INT

Table 30-84 shows the descriptors placed in the INT loop.

Table 30-63: Descriptor placed in the INT loop

Tag value	Descriptor	Descriptor area		
		Platform	Target	Operation
0x06	Target smart card descriptor	×	○	×
0x09	Target IP address descriptor	×	○	×
0x0A	Target IPv6 address descriptor	×	○	×
0x0C	IP/MAC platform name descriptor	◎	×	×
0x0D	IP/MAC platform provider name descriptor	◎	×	×
0x13	IP/MAC stream location descriptor	◎*1	×	◎*1

◎→ The descriptor must be inserted into an applicable descriptor area in a table.
○ → The descriptor is optionally inserted into an applicable descriptor area in a table.
× → The descriptor cannot be inserted into an applicable descriptor area in a table.
*1: An IP/MAC stream location descriptor must be inserted into a platform or operation area.

30.5.2.1 Target smart card descriptor

[Use]

Describe this descriptor when filtering receivers for a storable broadcasting service through a small card ID.

[Syntax]

The structure of a target smart card descriptor is shown in Table 30-85.

Table 30-64: Structure of a target smart card descriptor

Data structure	bit	Identifier
target_smartcard_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
super_CA_system_id	32	uimsbf
for (i = 0;i<N;i++) {		
private_data_byte	8	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-86.

Table 30-65: Definition of the target smart card descriptor field

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with an 8-bit field length defines the total byte length of the data part in the descriptors that follow immediately after this field.
super_CA_system_id	Describe the system ID of the multimedia broadcasting conditional access system as "…"(T.B.D.).
private_data_byte	Describe the conditions for filtering smart card numbers that are defined in the multimedia broadcasting conditional access system.

[Transmission Operating Rule]

◎ The target smart card descriptor can be placed and transmitted when performing the filtering service, which uses the conditional access system, with a smart card ID.

The transmission operating rules for each field are shown in table 30-87.

Table 30-66: Transmission operating rules for the target smart card descriptor

Transmission operating rules for each field	
descriptor_tag	Set to "0x06".
descriptor_length	Describe the descriptor length of the target smart card descriptor.
super_CA_system_id	Describe the system ID of the multimedia broadcasting conditional access system as "…"(T.B.D.).
private_data_byte	Describe the conditions for filtering smart card numbers that are defined in the multimedia broadcasting conditional access system.

[Rules for Reception Processing]

○ If either following condition satisfies, the smart card information is identified as invalid.

- The descriptor area of "target" and the descriptor, in which the descriptor_tag is set to 0x06, are not placed.
- The super_CA_system_id does not have a value that is defined in the multimedia broadcasting conditional access system.

The reception processing rules for each field are shown in Table 30-88.

Table 30-67: Reception processing rules for target smart card descriptor

Reception processing rules for each field	
descriptor_tag	= "0x06": Judge that this descriptor is a target smart card descriptor.
descriptor_length	Judge as the descriptor length of a target smart card descriptor.
super_CA_system_id	The id is regarded as valid if a smart card defined in multimedia broadcasting has a valid identification value of the conditional access system. Other values indicate that the unsupported conditional access system is used.
private_data_byte	Perform a measure defined in the conditional access system for which a valid smart card defined in multimedia broadcasting is used.

30.5.2.2 Target IP address descriptor

[Use]

Describe this descriptor when filtering receivers for a storable broadcasting service that uses an IPv4 address, by IP address.

[Syntax]

The structure of the target IP address descriptor is shown in Table 30-89.

Table 30-68: Structure of the target IP address descriptor

Data structure	bit	Identifier
target_ IP_address_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
IPv4_addr_mask	32	uimsbf
for (i = 0;i<N;i++) {		
IPv4_addr	32	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-90.

Table 30-69: Definitions of the target IP address descriptor fields

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with 8-bit field length defines the total byte length of the data part in the descriptors that follow immediately after this field.
IPv4_addr_mask	Describe the 32-bit specified address of an IPv4 subnet mask.
IPv4_addr	Describe the 32-bit specified address of an IPv4 unicast/multicast/broadcast.

[Transmission Operating Rule]

◎ The target IP address descriptor can be transmitted by placing it for a storable broadcasting service when filtering receivers with an IPV4 address by IP address.

The transmission operating rules for each field are shown in Table 30-91.

Table 30-70: Transmission operating rules for the target IP address descriptor

Transmission operating rules for each field	
descriptor_tag	Set to "0x09".
descriptor_length	Describe the descriptor length of the target IP address descriptor.
IPv4_addr_mask	Describe the 32-bit specified address of the IPv4 subnet mask.
IPv4_addr	Describe the 32-bit specified address of an IPv4 unicast/multicast/broadcast.

[Rules for Reception Processing]

○ If the following conditions are satisfied, the storable broadcasting service is identified as invalid.

・ In a receiver with an IPv4 address, the descriptor area of "target" and the descriptor, in which the descriptor_tag is set to 0x09, are not placed.

Reception processing rules for each field are shown in Table 30-92.

Table 30-71: Reception processing rules for the target IP address descriptor

Reception processing rules for each field	
descriptor_tag	= "0x09": Judge that this descriptor is a target IP address descriptor.
descriptor_length	Judge as the descriptor length of a target IP address descriptor.
IPv4_addr_mask	Judge as a subnet mask that is used when receiving a storable broadcasting service using a receiver with an IPv4 address.
IPv4_addr	Check whether or not a receiver with an IPv4 address is used for a storable broadcasting service. Reception processing is not performed when invalid.

30.5.2.3 Target IPv6 address descriptor

[Use]

Describe this descriptor when filtering receivers for a storable broadcasting service that use an IPv6 address, by IP address.

[Syntax]

The structure of the target IPv6 address descriptor is shown in Table 30-93.

Table 30-72: Structure of the target IPv6 address descriptor

Data structure	bit	Identifier
target_ IPv6_address_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
IPv6_addr_mask	128	uimsbf
for (i = 0;i<N;i++) {		
IPv6_addr	128	uimsbf
}		
}		

[Semantics of Each Field]

The definitions of each field are shown in Table 30-94.

Table 30-73: Definitions of the target IPv6 address descriptor fields

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with an 8-bit field length defines the total byte length of the data part in the descriptors that follow immediately after this field.
IPv6_addr_mask	Describe the 128-bit specified address of an IPv6 subnet mask.
IPv6_addr	Describe the 128-bit specified address for IPv6.

[Transmission Operating Rule]

◎ The target IPv6 address descriptor can be transmitted by placing it for a storable broadcasting service when filtering receivers with an IPV6 address by IP address.

The transmission operating rules for each field are shown in Table 30-95.

Table 30-74: Transmission operating rules for the target IPv6 address descriptor

Transmission operating rules for each field	
descriptor_tag	Set to "0x0A".
descriptor_length	Describe the descriptor length of the target IPv6 address descriptor.
IPv6_addr_mask	Describe the 128-bit specified address of an IPv6 subnet mask.
IPv6_addr	Describe the 128-bit specified address for IPv6.

[Rules for Reception Processing]

○ If the following conditions are satisfied, the storable broadcasting service is identified as invalid.

・In a receiver with an IPv6 address, the descriptor area of "target" and the descriptor, in which the descriptor_tag is set to 0x0A, are not placed.

The reception processing rules for each field are shown in Table 30-96.

Table 30-75: Reception processing rules for the target IPv6 address descriptor

Reception processing rules for each field	
descriptor_tag	= "0x0A": Judge that this descriptor is a target IPv6 address descriptor.
descriptor_length	Judge as the descriptor length of a target IPv6 address descriptor.
IPv6_addr_mask	Judge as a subnet mask that is used when receiving a storable broadcasting service using a receiver with an IPv6 address.
IPv6_addr	Check whether or not a receiver with an IPv6 address is used for a storable broadcasting service. Reception processing is not performed when invalid.

30.5.2.4 IP/MAC platform name descriptor

[Use]

Describe the IP platform name of the storable broadcasting service.

[Syntax]

The structure of the IP/MAC platform name descriptor is shown in Table 30-97.

Table 30-76: Structure of the IP/MAC platform name descriptor

Data structure	bit	Identifier
IP/MAC_platform_name_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
ISO_639_language_code	24	bslbf
for (i = 0;i<N;i++) {		
text_char	8	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-98.

Table 30-77: Definitions of the IP/MAC platform name descriptor fields

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with an 8-bit field length defines the total byte length of the data part in the descriptors that follow immediately after this field.
ISO_639_language_code	Describe the character encoding language that is used for the applicable descriptor, "text_char". The ISO_639_language_code is created by coding a 3-character code, which is standardized by ISO639 Part 2, into 8-bit. (e.g.: "jpn" → "0x6A706E")
text_char	Describe the IP platform name.

[Transmission Operating Rule]

◎ The IP platform name of the storable broadcasting service is transmitted.

Table 30-99 shows the transmission operating rule for each field.

Table 30-78: Transmission operating rule for the IP/MAC platform name descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0x0C".
descriptor_length	Describe the descriptor length of the IP/MAC platform name descriptor.
ISO_639_language_code	Describe the character encoding language that is used for the applicable descriptor, "text_char". "jpn" → "0x6A706E"
text_char	Describe the IP platform name.

[Rules for Reception Processing]

○ If the descriptor area of "platform" and the descriptor, in which the descriptor_tag is set to 0x0C, are not placed, the IP/MAC platform name descriptor is identified as invalid.

The reception processing rules for each field are shown in Table 30-100.

Table 30-79: Reception processing rules for the IP/MAC platform name descriptor

Reception processing rules for each field	
descriptor_tag	= "0x0C": Judge that this descriptor is a target IP address descriptor.
descriptor_length	Judge as the descriptor length of the IP/MAC platform name descriptor.
ISO_639_language_code	Describe the character encoding language that is used for the applicable descriptor, "text_char". This is not processed using a receiver without a code-converting function.
text_char	Display is made using a receiver with a function to display the IP platform name.

30.5.2.5 IP/MAC platform provider name descriptor

[Use]

Describe the IP platform provider name of the storable broadcasting service.

[Syntax]

The structure of the IP/MAC platform provider name descriptor is shown in Table 30-101.

Table 30-80: Structure of the IP/MAC platform provider name descriptor

Data structure	bit	Identifier
IP/MAC_platform_provider_name_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
ISO_639_language_code	24	bslbf
for (i = 0;i<N;i++) {		
text_char	8	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-102.

Table 30-81: Definitions of the IP/MAC platform provider name descriptor fields

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with an 8-bit field length defines the total byte length of the data part in the descriptors that follow immediately after this field.
ISO_639_language_code	Describe the character encoding language that is used for the applicable descriptor, "text_char". The ISO_639_language_code is created by coding a 3-character code, which is standardized by ISO639 Part 2, into 8-bit. (e.g.: "jpn" → "0x6A706E")
text_char	Describe the IP platform provider name.

[Transmission Operating Rule]

◎ The IP platform provider name of a storable broadcasting service is transmitted.

Table 30-103 shows the transmission operating rule for each field.

Table 30-82: Transmission operating rule for the IP/MAC platform provider name descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0x0D".
descriptor_length	Describe the descriptor length of the IP/MAC platform provider name descriptor.
ISO_639_language_code	Describe the character encoding language that is used for the applicable descriptor, "text_char". "jpn"→"0x6A706E"
text_char	Describe a IP platform provider name.

[Rules for Reception Processing]

○ If the descriptor area of "platform" and the descriptor, in which the descriptor_tag is set to 0x0D, are not placed, the IP/MAC platform provider name descriptor is identified as invalid.

The reception processing rules for each field are shown in Table 30-104.

Table 30-83: Rules for reception processing for the IP/MAC platform provider name descriptor

Reception processing rules for each field	
descriptor_tag	= "0x0D": Judge that this descriptor is the IP/MAC platform provider name descriptor.
descriptor_length	Judge as the descriptor length of the IP/MAC platform provider name descriptor.
ISO_639_language_code	Describe the character encoding language that is used for the applicable descriptor, "text_char". This is not processed using a receiver without a code-converting function.
text_char	Display is made using a receiver with a function to display the IP platform provider name.

30.5.2.6 IP/MAC stream location descriptor

[Use]

Describe the information, such as network ID, transport stream ID, and service ID/component tag, of the applicable platform ID in the stream that configures the storable broadcasting service.

[Syntax]

The structure of the IP/MAC stream location descriptor is shown in Table 30-105.

Table 30-84: Structure of the IP/MAC stream location descriptor

Data structure	bit	Identifier
IP/MAC_stream_location _descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
network_id	16	uimsbf
original_network_id	16	uimsbf
transport_stream_id	16	uimsbf
service_id	16	uimsbf
component tag	8	uimsbf
}		

[Semantics of Each Field]

The definition of each field is shown in Table 30-106.

Table 30-85: Definitions of the IP/MAC stream location descriptor field

Definition of each field	
descriptor_tag	The descriptor tag is an 8-bit field and identifies each descriptor. The value based on the MPEG-2 standard is described in the ISO/IEC 13818-1.
descriptor_length	This descriptor with an 8-bit field length defines the total byte length of the data part in the descriptors that follow immediately after this field.
network_id	The network_id functions as a label that distinguishes the distribution system indicated by the INT from other distribution systems.
original_network_id	This 16-bit field functions as a label that defines the network identifier of the original distribution system.
transport_stream_id	This 16-bit field functions as a label to distinguish the transport stream indicated in the INT from other multiplexed

	transport streams in the distribution system.
service_id	The service_id identifies the service in the transport stream. The service identifier corresponds to the broadcasting program identifier (program_number) in the corresponding program map section.
component_tag	The component tag is a label to distinguish between component streams and has the same value as the component tag in the stream identifier descriptor.

[Transmission Operating Rule]

◎ The IP stream location for the storable broadcasting service is transmitted.

The transmission operating rules for each field are shown in Table 30-107.

Table 30-86: Transmission operating rules for the IP/MAC stream location descriptor

Transmission operating rules for each field	
descriptor_tag	Set to "0x13".
descriptor_length	Describe the descriptor length of the IP/MAC stream location descriptor.
network_id	Describe the network_id, "0x0200", of multimedia broadcasting.
original_network_id	Describe the same value as the network_id.
transport_stream_id	Describe the transport_stream_id (unique ID in a multimedia broadcasting network) of the target TS.
service_id	Describe the service_id included in the applicable transport stream.
component_tag	Describe the component_tag value of the applicable ES.

[Rules for Reception Processing]

○ If the descriptor area of "platform"/"operation" and the descriptor, in which the descriptor_tag is set to 0x13, are not placed, an IP/MAC stream location descriptor is identified as invalid.

The reception processing rules for each field are shown in Table 30-108.

Table 30-87: Reception processing rules for the IP/MAC stream location descriptor

Reception processing rules for each field	
descriptor_tag	= "0x13": Judge that this descriptor is a stream location descriptor.
descriptor_length	Judge as the descriptor length of the IP/MAC stream location descriptor.
network_id	Judge as the network_id of the target network.
original_network_id	Judge as the network_id of the original distribution system.
transport_stream_id	Judge as the transport_stream_id of the target TS.
service_id	Judge as the service_id of the applicable service.
component_tag	Describe the component_tag value of the applicable ES.

<Blank Page>

Chapter 31 Operation of SI Table

31.1 BIT (Broadcaster Information Table)

31.1.1 Structure and use of BIT

[Use]

The BIT is used to present the multimedia broadcasting broadcaster information on a network.

Also, write the information on all stations/each station parameters.

[Description]

The BIT is home to the sub-tables per original network and to the information loop for each multimedia broadcasting broadcaster. In sub-tables, there are separate descriptor loops for each original network and broadcaster; therefore, it provides such structure that each information can be described.

As the information for each original network, the all-stations applied transmission parameter is set using the SI parameter descriptor.

As the information for each multimedia broadcasting broadcaster, a multimedia broadcasting broadcaster name, the service list provided by the multimedia broadcasting broadcaster, and the each-station SI transmission parameter that is used per multimedia broadcasting broadcaster are set. The multimedia broadcasting broadcaster name is indicated using the broadcaster name descriptor. The multimedia broadcasting broadcaster name can be used to realize a function for each multimedia broadcasting broadcaster, such as a function to provide a program guide for each multimedia broadcasting broadcaster and a function to select a channel for each multimedia broadcasting broadcaster. The service list is indicated using the service list descriptor. The transmission parameter of each station SI is indicated using the SI parameter descriptor.

For a detailed explanation on the multimedia broadcasting broadcaster, see the content described in Section 7.3.

[Syntax]

The structure of BIT is shown in Table 31-1.

Table 31-1: Structure of BIT (Broadcaster Information Table).

Data structure	bit	Identifier
broadcaster_information_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
original_network_id	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
reserved_future_use	4	bslbf
first_descriptors_length	12	uimsbf
for (i = 0;i< N1;i++) {		
descriptor()		
}		
for (j = 0;j< N2;j++) {		
broadcaster_id	8	uimsbf
reserved_future_use	4	bslbf
broadcaster_descriptors_length	12	uimsbf
for(k=0;k<N3;k++){		
descriptor()		
}		
}		
CRC_32	32	rpchof
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.13 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This table should be transmitted in multimedia broadcasting.

◎ Each service belongs to at least one multimedia broadcasting broadcaster.

◎ As all-stations SI, the same content is transmitted to all TSs.

◎ Sub-tables should be structured for each "original_network_id".

◎ The same descriptor in the first loop should be placed for all multimedia broadcasting.

◎ The transmission layer should be always layer A.

● For the re-transmission cycle, follow Section 10.4 of this document.

● For the update frequency, follow Section 10.9 of this document.

The transmission operating rule for each field are shown in Table 31-2.

Table 31-2: Transmission operating rule of BIT

Transmission operating rule for each field	
table_id	Set to “0xC4”.
section_syntax_indicator	Set to ‘1’.
section_length	Describe the section length of BIT. Since the maximum length of all sections is 1024 bytes, this value should be 1021 at maximum.
original_network_id	Describe "original_network_id" for the target BIT network.
version_number	When the contents of sub-table are changed, set a value incremented by 1.
current_next_indicator	Set to ‘1’.
section_number	Describe the section number. The section number for the first section is 0; therefore, set a value incremented by 1 every time the section is increased by 1.
last_section_number	Describe the last section number.
first_descriptors_length	Describe the descriptor length to be mentioned later. When the section number is greater than 0, set to '0' for the section.
[descriptor loop]	The information that is effective for the entire multimedia broadcasting is placed as a descriptor. The same information is described in multimedia

	broadcasting.
[broadcaster loop]	The information for all the multimedia broadcasting broadcasters that exist in an applicable network must be described. During the loop, the section should not be divided.
broadcaster_id	Describe the broadcaster_id of the multimedia broadcasting broadcaster. The broadcaster_id is uniquely set in the network_id. There is no specified maximum number of multimedia broadcasting broadcasters.
broadcaster_descriptors_length	Describe the length of broadcaster descriptor to be mentioned later.
[descriptor loop]	Place the information, which is effective for each multimedia broadcasting broadcaster, as a descriptor.

[Rules for Reception Processing]

- Since the BIT is not the table that is often upgraded, the receiver units can receive information based on the BIT information stored in the nonvolatile memory to shorten the operation time.

The rules for reception processing for each field are shown in Table 31-3.

Table 31-3: Rules for reception processing for BIT

Rules for reception processing for each field	
table_id	= “0xC4”: Judge that the relative table is BIT.
section_syntax_indicator	= ‘0’: Judge that the relative section is invalid. = ‘1’: Judge that the relative section is valid.
section_length	≤1021: Judge as the section length. >1021: Judge that the relative section is invalid.
original_network_id	Indicate the BIT in multimedia broadcasting if this value is the same as the network identifier for multimedia broadcasting. Ignore this section if an unknown value is described.
version_number	If any change occurs, judge that the relative sub-table has been updated.
current_next_indicator	= ‘0’: Judge that the relative section is invalid. = ‘1’: Judge that the relative section is valid.
section_number	≤"last_section_number": Section number in the relative sub-table > "last_section_number": The relative section is invalid.
last_section_number	Last section number in the relative sub-table
first_descriptors_length	It shows the length of the later descriptor loop. Given the value of "section_length", if the value of this field seems abnormal, judge that the relative section itself is invalid.

	If this value is set to 0, the descriptor does not exist in the descriptor loop. This value is set to 0 except that for section number 0. If this value is set to any other than 0, skip only the descriptor length described in this field (that is, skip the contents for the later descriptor loop only); then continue to process.
[descriptor loop]	In this loop, the descriptors available for the whole multimedia broadcasting are laid out consecutively. Only the descriptor announced to be placed should be processed so that other descriptors can be skipped.
[broadcaster loop]	The length of the relative loop is judged from the values of "section_length" and "first_descriptors_length" for each section. When the entire sub-table is received, the multimedia broadcasting broadcasters that exist in the loop are all multimedia broadcasting broadcasters that exist in the network.
broadcaster_id	The broadcaster_id indicates the multimedia broadcasting broadcaster described in an applicable broadcaster loop.
broadcaster_descriptors_length	It shows the length of the later descriptor loop. When this value is set to 0, the descriptor does not exist in the descriptor loop. Given the value of "section_length", if the value of this field seems abnormal, judge that the relative section itself is invalid.
[descriptor loop]	In this loop, the descriptors that are valid for an applicable multimedia broadcasting broadcaster are placed close together. Only the descriptor announced to be placed should be processed so that other descriptors can be skipped.

[Special Remarks]

None

31.1.2 Descriptor inserted into the first loop of BIT

31.1.2.1 SI parameter descriptor

[Use]

Specify the SI transmission parameter.

Specify the all-stations applied transmission parameter if this descriptor is placed in the first descriptor loop of BIT.

[Syntax]

The structures of SI parameter descriptor and "table_description_byte" for each "table_id" are shown in Table 31-4 and Table 31-5.

Table 31-4: Structure of SI parameter descriptor

Data structure	bit	Identifier
SI_parameter_descriptor() {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
parameter_version	8	uimsbf
update_time	16	bslbf
for(i=0:i<N;i++){		
table_id	8	uimsbf
table_description_length	8	uimsbf
for(j=0;j<N;j++){		
table_description_byte	8	uimsbf
}		
}		
}		

Table 31-5: Structure of "table_description_byte" for each "table_id" (first loop of BIT)

table_id	table_description_byte	bit	Identifier
0x40 (NIT)	table_cycle	8	bslbf
0xC4 (BIT)	table_cycle	8	bslbf
0x42 (SDT)	table_cycle	8	bslbf
0x4E (N-EIT,M-EIT,W-EIT)	table_cycle(N-EIT) table_cycle(M-EIT) table_cycle(W-EIT) num_of_N-EIT_event num_of_M-EIT_event num_of_W-EIT_event Reserved	8 8 8 4 4 4 4	bslbf bslbf bslbf uimsbf uimsbf uimsbf uimsbf

[Semantics of Each Field]

The definitions of each field for SI parameter descriptor and "table_description_byte" are shown in Table 31-6 and Table 31-7.

Table 31-6: Definition of each field for SI parameter descriptor (first loop of BIT)

Field	Definitions
parameter_version	This 8-bit field indicates the version number of all-stations applied transmission parameter. Describe the value incremented by one every time the transmission parameter is updated.
update_time	This 16-bit field indicates the date when the described transmission parameter becomes valid. Describe the lower 16 bits of MJD.
table_id	This 8-bit field indicates the type of table to be described in the later field.
table_description_length	This 8-bit field indicates the length of description to be described in the later field. It is coded in the 8-bit binary mode (unit: byte).
table_description_byte	In this field, describe the transmission parameter for each SI table type used by all-stations applied transmission parameter.

Table 31-7: Definition of each field for "table_description_byte" (first loop of BIT)

Field	Definitions
table_cycle	This 8-bit field indicates the retransmission cycle for each table. It is coded in the two-digit BCD format (unit: second).
table_cycle (N-EIT)	This 8-bit field indicates the retransmission cycle for each table. It is coded in the two-digit BCD format (unit: second). If "table_id" is set to 0x4E, the first byte indicates the retransmission cycle for N-EIT used by all-stations applied transmission parameter.
table_cycle (M-EIT)	This 8-bit field indicates the retransmission cycle for table. It is coded in the two-digit BCD format (unit: second). If "table_id" is set to 0x4E, the second byte indicates the retransmission cycle for M-EIT used by all-stations applied transmission parameter.
table_cycle (W-EIT)	This 8-bit field indicates the retransmission cycle for each table. It is coded in the two-digit BCD format (unit: second). If "table_id" is set to 0x4E, the third byte indicates the retransmission cycle for W-EIT used by all-stations applied transmission parameter.
num_of_N-EIT_event	This 4-bit field is indicated as the binary coded number of transmission programs (consecutive programs including the current program) in an N-EIT that uses the all-station applied transmission parameter.
num_of_M-EIT_event	This 4-bit field is indicated as the value that is the binary coded number of transmission programs (consecutive programs including the current program) in an M-EIT that uses the all-station applied transmission parameter.
num_of_W-EIT_event	This 4-bit field is indicated as the value that is the binary coded number of transmission programs (consecutive programs including the current program) in a W-EIT that

	uses the all-station applied transmission parameter.

[Transmission Operating Rule]

◎ This descriptor should be placed for the first loop of BIT (including the case of default operation in all tables). In general, the use of transmission parameter is changed at 0:00. In this case, the descriptor should be placed two days before the change. If the transmission system cannot change at 0:00, the value should be placed at the same time when the use of all-stations applied transmission parameter is changed.

◎ The same table is transmitted to all TSs in an applicable network.

● In case of the default transmission parameter and table type with no change, it is possible to omit the description of "table_id" and "table_description_byte".

● The transmission parameters should be set within the allowable range.

● Multiple descriptors with the different "update_time" in the same loop can be placed. For example, if a valid descriptor is currently placed and the parameter will be changed three days later, multiple descriptors should be placed.

The transmission operating rule for each field are shown in Table 31-8 and Table 31-9.

Table 31-8: Transmission operating rule of SI parameter descriptor (first loop of BIT)

Transmission operating rule for each field	
descriptor_tag	Set to “0xD7”.
descriptor_length	Describe the length of the relative descriptor (byte).
parameter_version	The value is incremented by 1 every time the descriptor is updated.
update_time	Describe the date when the relative descriptor becomes valid using the lower 16 bits of MJD. If the future date is described in this field and the prior transmission is performed, make sure to send just at 0:00 of the date shown in the field according to the parameters shown in this descriptor. If the prior transmission is not performed, describe all-stations applied transmission parameter after updated and transmit the descriptor including the changed date in this field.
[table_id loop]	It is required to describe the table type if updating the default transmission parameter. Otherwise, it is not required to describe. For the default transmission parameters, see Section 10.4.
table_id	Describe the typical table identifier of the target table types. For the available values, see Table 31-5.
table_description_length	Describe the description length (byte) of the latter "table_description_byte" field.
table_description_byte	Describe the all-stations applied transmission parameter

	based on the separately determined format by table type. For detailed information on each table type, see Table 31-5 and Table 31-7.

Table 31-9: Transmission operating rule of "table_description_byte" (first loop of BIT)

table_description_byte : Transmission operating rule for each field	
table_cycle	Describe the retransmission cycle for each table type (unit: second). It is coded in the two-digit BCD format (unit: second).
table_cycle (N-EIT)	Describe the retransmission cycle for N-EIT used by all-stations applied transmission parameter.
table_cycle (M-EIT)	Describe the retransmission cycle for M-EIT used by all-stations applied transmission parameter.
table_cycle (W-EIT)	Describe the retransmission cycle for W-EIT used by all-stations applied transmission parameter.
num_of_N-EIT_event	Describe the number of programs transmitted using N-EIT (serial programs including the currently transmitted programs) used by all-stations applied transmission parameter.
num_of_M-EIT_event	Describe the number of programs transmitted using M-EIT (serial programs including the currently transmitted programs) used by all-stations applied transmission parameter.
num_of_W-EIT_event	Describe the number of programs transmitted using W-EIT (serial programs including the currently transmitted programs) used by all-stations applied transmission parameter.

[Rules for Reception Processing]

◎ Judge that the SI transmitted by all-stations applied transmission parameter is transmitted according to the default transmission parameter if there is no value for "table_id" (defined in Table 31-5) in the relative descriptor in the first descriptor loop of BIT.

◎ Judge that the contents described in the relative descriptor becomes effective at 0:00 of the date described in "update_time" field if the date is set to the time later than next day. If the date described in "update_time" field is set to the time before the current day, judge that the contents are effective at least at the present time.

◎ Even if the relative descriptor exists in the first descriptor loop of BIT, judge that the SI transmitted by all-stations applied transmission parameter is transmitted according to the default transmission parameter (at the present time) if there is not effective descriptor at the present time (judge from the "update_time" field in the descriptor).

◎ If the table type to be specified by all-stations applied transmission parameter is not described in the relative descriptor, judge that the relative table type is used by the default transmission parameter.

- If multiple SI parameter descriptors are placed, judge that the descriptor with the latest date and time from the current moment is effective at the present time.
- In case that the relative descriptor does not exist in the first descriptor loop of BIT, judge that the SI transmitted by all-stations applied transmission parameter is transmitted according to the default transmission parameter.

The rules for reception processing for each field are shown in Table 31-10 and Table 31-11.

Table 31-10: Rules for reception processing for SI parameter descriptor (first loop of BIT)

Rules for reception processing for each field	
descriptor_tag	="0xD7": Judge that the relative descriptor is the SI parameter descriptor.
descriptor_length	
parameter_version	The parameter_version can be used as the update number of a SI transmission parameter.
update_time	It is used as the date when the transmission parameter described in the relative descriptor becomes effective. If the date specified in this field is the time later than next day, judge that the transmission parameter is actually updated and effective at 0:00 of the relative date. If the date is the time before the current day, judge that the transmission parameter is already effective at least at the present time. It is coded using the lower 16 bits of MJD; therefore, how to handle the date such as 2038 complies with the description in the TOT.
[table_id loop]	If the table type is specified by all-stations applied transmission parameter that does not exist in the relative loop, judge that it is used by the default transmission parameter. If any unsupported table type exists, care should be taken not to cause faulty operation by ignoring the loop itself. For the default transmission parameters, see Section 10.4.
table_id	It indicates the table type described in the relative loop.
table_description_length	It indicates the description length (byte) of the later "table_description_byte".
table_description_byte	All-stations applied transmission parameter should be interpretable based on the separately determined format by table type.

Table 31-11: Rules for reception processing for "table_description_byte" (first loop of BIT)

table_description_byte: Rules for reception processing for each field	
table_cycle	The retransmission cycle for the relative table type is described (unit: second). If the relative table type is received at the date and time later than that described in "update_time" field of the relative descriptor, it is recommended to perform the receiving process based on the value described in this field. For the available range of values, see Section 10.4. Judge as an abnormal state if the value is not within the range.
table_cycle (N-EIT)	Judge as the retransmission cycle for N-EIT used by all-stations applied transmission parameter.
table_cycle (M-EIT)	Judge as the retransmission cycle for M-EIT used by all-stations applied transmission parameter.
table_cycle (W-EIT)	Judge as the retransmission cycle for W-EIT used by all-stations applied transmission parameter.
num_of_N-EIT_event	Judge as the number of programs transmitted using N-EIT (serial programs including the currently transmitted programs) used by all-stations applied transmission parameter.
num_of_M-EIT_event	Judge as the number of programs transmitted using M-EIT (serial programs including the currently transmitted programs) used by all-stations applied transmission parameter.
num_of_W-EIT_event	Judge as the number of programs transmitted using W-EIT (serial programs including the currently transmitted programs) used by all-stations applied transmission parameter.

[Special Remarks]

For the details of SI transmission parameters, see 10.3.2, 10.4, and 12.11.

For example, N-EIT, M-EIT and W-EIT in the EIT used by all-stations applied transmission parameter are set to the following transmission parameter from January 1, 2010:

- Delivering cycle: 3 seconds
- Number of programs transmitted using N-EIT: 5
- Number of programs transmitted using M-EIT: 4
- Number of programs transmitted using W-EIT: 2

If the transmission parameter setting above is applied, the following coded value is used.

Table 31-12: Description example of the SI parameter descriptor (first loop of BIT)

Field	Coded value
[SI_parameter_descriptor]	
descriptor_tag	0xD7
descriptor_length	0A
parameter_version	0xFF
update_time	55197
[table_id loop 1]	
table_id	0x4E
table_description_length	5
table_cycle(N-EIT)	3
table_cycle(M-EIT)	3
table_cycle(W-EIT)	3
num_of_N-EIT_event	5
num_of_M-EIT_event	4
num_of_W-EIT_event	2
reserved	all 1

31.1.3 Descriptor inserted into the second loop (broadcaster loop) of BIT

31.1.3.1 SI parameter descriptor

[Use]

- Specify the SI transmission parameter.
- If this descriptor is placed in the second descriptor loop in a BIT, it indicates the each-station applied transmission parameter that is uniquely used by each multimedia broadcasting broadcaster.
- The SDTT indicates whether the SDTT is transmitted or not by the respective multimedia broadcasting broadcaster.

[Syntax]

- The structure of SI transmission parameter is shown in Table 31-13.

  The structure is same as that in Table 31-4.

Table 31-13: Structure of the SI parameter descriptor

Data structure	bit	Identifier
SI_parameter_descriptor() {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
parameter_version	8	uimsbf
update_time	16	bslbf
for(i=0:i<N;i++){		
table_id	8	uimsbf
table_description_length	8	uimsbf
for(j=0;j<N;j++){		
table_description_byte	8	uimsbf
}		
}		
}		

The structure of "table_description_byte" for each "table_id" is shown in Table 31-14.

Table 31-14: Structure of "table_description_byte" for each "table_id"
(second loop of BIT)

table_id	table_description_byte	bit	Identifier
0x4E	table_cycle(N-EIT)	8	bslbf
(	table_cycle(M-EIT)	8	bslbf
N-EIT,	table_cycle(W-EIT)	8	bslbf
M-EIT,	num_of_N-EIT_event	4	uimsbf
W-EIT	num_of_M-EIT_event	4	uimsbf
)	num_of_W-EIT_event	4	uimsbf
	reserved	4	uimsbf
0xC3 (SDTT)	table_cycle	16	bslbf

[Semantics of Each Field]

The definitions of each field for SI parameter descriptor and "table_description_byte" are shown in Table 31-15 and Table 31-16.

Table 31-15: Definitions of each field for SI parameter descriptor (second loop of BIT)

Field	Definitions
parameter_version	This 8-bit field indicates the version number of each station transmission parameter. Increment by one every time a descriptor is updated.
update_time	This 16-bit field indicates the date when the described transmission parameter becomes valid. Describe the lower 16 bits of MJD.
table_id	This 8-bit field indicates the type of table to be described in the later field.
table_description_length	This 8-bit field indicates the length of descriptor to be described in the later field. It is coded in the 8-bit binary mode (unit: byte).
table_description_byte	In this field, describe the transmission parameter for each SI table type used by each-station applied transmission parameter.

Table 31-16: Definitions of each field for "table_description_byte" (second loop of BIT)

Field	Definitions
table_cycle	It indicates the retransmission cycle for table. It is coded in the four-digit BCD format (unit: second).
table_cycle(N-EIT)	This 8-bit field indicates the retransmission cycle for each table. It is coded in the two-digit BCD format (unit: second). If "table_id" is set to '0x4E', the first byte indicates the retransmission cycle for N-EIT used by each-station applied transmission parameter.
table_cycle(M-EIT)	This 8-bit field indicates the retransmission cycle for each table. It is coded in the two-digit BCD format (unit: second). If "table_id" is set to '0x4E', the second byte indicates the retransmission cycle for M-EIT used by each-station applied transmission parameter.
table_cycle(W-EIT)	This 8-bit field indicates the retransmission cycle for each table. It is coded in the two-digit BCD format (unit: second). If "table_id" is set to '0x4E', the third byte indicates the retransmission cycle for W-EIT used by each-station applied transmission parameter.
num_of_N-EIT_event	This 4-bit field indicates the number of programs transmitted using N-EIT (serial programs including the currently transmitted programs) used by each-station applied transmission parameter in the relative terrestrial broadcaster, provided that it is coded in the binary mode.
num_of_M-EIT_event	This 4-bit field indicates the number of programs transmitted using M-EIT (serial programs including the currently transmitted programs) used by each-station applied transmission parameter in the relative terrestrial broadcaster, provided that it is coded in the binary mode.

num_of_W-EIT_event	This 4-bit field indicates the number of programs transmitted using W-EIT (serial programs including the currently transmitted programs) used by each-station applied transmission parameter in the relative terrestrial broadcaster, provided that it is coded in the binary mode.

[Transmission Operating Rule]

◎ This descriptor should be placed if the EIT used by each-station applied transmission parameter is used, or if SDTT is transmitted.

◎ The table type that is transmitted as the EIT used by each-station applied transmission parameter should be described.

◎ In general, the use of transmission parameter is changed at 0:00. In this case, the descriptor should be placed two days before the change. If the transmission system cannot change at 0:00, the value should be placed at the same time when the use of each-station applied transmission parameter is changed.

● The transmission parameters should be set within the defined range.

● Multiple descriptors with the different "update_time" in the same loop can be placed. For example, if a valid descriptor is currently placed and the parameter will be changed three days later, multiple descriptors should be placed.

The transmission operating rules for each field are shown in Table 31-17 and Table 31-18.

Table 31-17: Transmission operating rule of SI parameter descriptor (second loop of BIT)

Transmission operating rule for each field	
descriptor_tag	Set to “0xD7”.
descriptor_length	Describe the length of the relative descriptor (byte).
parameter_version	Increment by one every time a descriptor is updated.
update_time	Describe the date when the relative descriptor becomes valid using the lower 16 bits of MJD. If the date later than next day is described in this field and the prior transmission is performed, make sure to send just at 0:00 of the date shown in the field according to the parameters shown in this descriptor. If the prior transmission is not performed, describe each-station applied transmission parameter after updated and transmit the descriptor including the changed date in this field.
[table_id loop]	The table type that is transmitted as the SI used by each-station applied transmission parameter should be described. The table type that is not transmitted should not be described.
table_id	Describe the target table type. For the available values, see Table 31-14.

table_description_length	Describe the description length (byte) of the later "table_description_byte" field.
table_description_byte	Describe the each-station applied transmission parameter based on the separately determined format by table type. For detailed information on each table type, see Table 31-14 and Table 31-16.

Table 31-18: Transmission operating rule of "table_description_byte" (second loop of BIT)

table_description_byte : Transmission operating rule for each field	
table_cycle	This field is used only when the table_id is set to 0xC3 (SDTT). The value that indicates the cycle, which is commonly used in a multimedia broadcasting network, is described.
table_cycle(N-EIT)	Describe the retransmission cycle for N-EIT used by each-station applied transmission parameter. However, if the N-EIT used by each-station applied transmission parameter is not transmitted, set this field to '0'.
table_cycle(M-EIT)	Describe the retransmission cycle for M-EIT used by each-station applied transmission parameter. However, if the M-EIT used by each-station applied transmission parameter is not transmitted, set this field to '0'.
table_cycle(W-EIT)	Describe the retransmission cycle for W-EIT used by each-station applied transmission parameter. However, if the W-EIT used by each-station applied transmission parameter is not transmitted, set this field to '0'.
num_of_N-EIT_event	The number of transmission programs (consecutive programs including the current program) in the N-EIT that uses the each-station applied transmission parameter in an applicable multimedia broadcasting broadcaster is described. If the N-EIT is not transmitted, then '0' is described in this field. If the N-EIT used by each-station applied transmission parameter is not transmitted, set to the same value as that described when N-EIT is used by all-stations applied transmission parameter. If the N-EIT used by each-station applied transmission parameter is transmitted, set to the value greater than that described when N-EIT is used by all-stations applied transmission parameter.
num_of_M-EIT_event	The number of transmission programs (consecutive programs including the current program) in the M-EIT that uses the each-station applied transmission parameter in an applicable multimedia broadcasting broadcaster is described. If the M-EIT is not transmitted, then '0' is described in this field. If the M-EIT used by each-station applied transmission parameter is not transmitted, set to the same value as that described when M-EIT is used by all-stations applied transmission parameter. If the M-EIT used by each-station applied transmission parameter is transmitted, set to the value greater than that described when M-EIT is used by all-stations applied transmission parameter.

table_description_byte : Transmission operating rule for each field	
num_of_W-EIT_event	The number of transmission programs (consecutive programs including the current program) in the W-EIT that uses each-station applied transmission parameter in an applicable multimedia broadcasting broadcaster is described. If the W-EIT is not transmitted, then '0' is described in this field. If the W-EIT used by each-station applied transmission parameter is not transmitted, set to the same value as that described when W-EIT is used by all-stations applied transmission parameter. If the W-EIT used by each-station applied transmission parameter is transmitted, set to the value greater than that described when W-EIT is used by all-stations applied transmission parameter.

[Rules for Reception Processing]

◎ If this descriptor does not exist in the second descriptor loop in a BIT, it indicates that the EIT, which uses the each-station applied transmission parameter, is not used by an applicable multimedia broadcasting broadcaster and the SDTT is not sent.

◎ Judge that the contents described in the relative descriptor becomes effective at 0:00 of the date described in "update_time" field if the date is set to the time later than next day. If the date described in "update_time" field is set to the time before the current day, judge that the contents are effective at least at the present time.

◎ Even if the relative descriptor exists in the second descriptor loop of BIT, judge that the EIT used by each-station applied transmission parameter is not used at the present time if there is not effective descriptor at the present time (judge from the "update_time" field in the descriptor).

◎ If the table type included in the EIT used by each-station applied transmission parameter or SDTT descriptions are not described in the relative descriptor, judge that the relative table type, or SDTT are not used.

● If multiple SI parameter descriptors are placed, judge that the descriptor with the latest date and time from the current moment is effective at the present time.

The rules for reception processing for each field are shown in Table 31-19 and Table 31-20.

Table 31-19: Rules for reception processing for SI parameter descriptor (Second Loop of BIT)

Rules for reception processing for each field	
descriptor_tag	="0xD7": Judge that the relative descriptor is the SI parameter descriptor.
descriptor_length	
parameter_version	The parameter_version can be used as the update number of the SI transmission parameter.
update_time	It is used as the date when the transmission parameter described in the relative descriptor becomes effective. If the date specified in this field is the time later than next day, judge that the transmission parameter is actually updated and effective at 0:00 of the relative date. If the date is the time before the current day, judge that the transmission parameter is already effective at least at the present time. It is coded using the lower 16 bits of MJD; therefore, how to handle the date such as 2038 complies with the description in the TOT. (See Section 15.3.)
[table_id loop]	If the SI table type is used by each-station applied transmission parameter that does not exist in the relative loop, judge that it is not used.
table_id	It indicates the table type described in the relative loop. If any unknown table type exists, care should be taken not to cause faulty operation by ignoring the loop itself. If the table_id is set to 0xC3 (SDTT), it indicates that an applicable multimedia broadcasting broadcaster transmits an SDTT.
table_description_length	It indicates the description length (byte) of the later "table_description_byte".
table_description_byte	Each-station applied transmission parameter should be interpretable based on the separately determined format by table type.

Table 31-19: Rules for reception processing for "table_description_byte"
(second loop of BIT)

table_description_byte : Rules for reception processing for each field	
table_cycle	The retransmission cycle for the relative table type is described (unit: second). If the relative table type is received at the date and time later than that described in "update_time" field of the relative descriptor, it is recommended to perform the receiving process based on the value described in this field.
table_cycle(N-EIT)	Judge as the retransmission cycle for N-EIT used by each-station applied transmission parameter. However, if it is set to '0', judge that the N-EIT used by each-station applied transmission parameter is not transmitted.
table_cycle(M-EIT)	Judge as the retransmission cycle for M-EIT used by each-station applied transmission parameter. However, if it is set to '0', judge that the M-EIT used by each-station applied transmission parameter is not transmitted.
table_cycle(W-EIT)	Judge as the retransmission cycle for W-EIT used by each-station applied transmission parameter. However, if it is set to '0', judge that the W-EIT used by each-station applied transmission parameter is not transmitted.
num_of_N-EIT_event	Judge as the number of programs transmitted using N-EIT (serial programs including the currently transmitted programs) used by each-station applied transmission parameter in the relative terrestrial broadcaster. If it is set to '0', judge that the N-EIT is not transmitted.
num_of_M-EIT_event	Judge as the number of programs transmitted using M-EIT (serial programs including the currently transmitted programs) used by each-station applied transmission parameter in the relative terrestrial broadcaster. If it is set to '0', judge that the M-EIT is not transmitted.
num_of_W-EIT_event	Judge as the number of programs transmitted using W-EIT (serial programs including the currently transmitted programs) used by each-station applied transmission parameter in the relative terrestrial broadcaster. If it is set to '0', judge that the W-EIT is not transmitted.

[Special Remarks]

For the details of SI transmission parameters, see 10.3 and 10.4.

31.1.3.2 Broadcaster name descriptor

[Use]

Present a multimedia broadcasting broadcaster name.

[Syntax]

The structure of the broadcaster name descriptor is shown in Table 31-21.

Table 31-20: Structure of the broadcaster name descriptor

Data structure	bit	Identifier
broadcaster_name_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for(i=0; i<N; i++) {		
char	8	uimsbf
}		
}		

[Semantics of Each Field]

The definition of each field is shown in Table 31-22.

Table 31-21: Definitions of the broadcaster name descriptor field

Definition of each field	
char	A multimedia broadcasting broadcaster name is described in this field.

[Transmission Operating Rule]

◎ The broadcaster name descriptor must be placed in all multimedia broadcasting broadcaster loops in a BIT.

- The maximum number of characters is 10 two-byte characters or 20 bytes.

The transmission operating rules for each field are shown in Table 31-23.

Table 31-22: Transmission operating rules for the broadcaster name descriptor

Transmission operating rules for each field	
descriptor_tag	Set to "0xD8".
descriptor_length	Describe the descriptor length of the multimedia broadcasting broadcaster name descriptor.
[char]	The maximum number of characters is 10 two-byte characters or 20 bytes. Do not use line feed codes.

[Rules for Reception Processing]

- Ignore the characters after the 11th character.

The reception processing rules for each field are shown in Table 31-24.

Table 31-23: Reception processing rules for the broadcaster name descriptor

Reception processing rules for each field	
descriptor_tag	= "0xD8": Judge that this descriptor is a multimedia broadcasting broadcaster name descriptor.
descriptor_length	
[char]	Ignore the characters after the 11th character or after the 21st byte.

[Special Remarks]

None

31.1.3.3 Service list descriptor

[Use]

This descriptor is used to describe the service list that belongs to the multimedia broadcasting broadcaster.

[Syntax]

The structure of the service list descriptor is shown in Table 30-59.

[Semantics of Each Field]

For a definition of each field, comply with the provisions in 6.2 of Part 1 in ARIB STD-B10 and the definitions in 6.2.14 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ Every service must belong to one multimedia broadcasting broadcaster and must not belong to two or more multimedia broadcasting broadcasters at the same time.

◎ The service arrangement for a multimedia broadcasting broadcaster must not be easily changed.

The transmission operating rules for each field are shown in Table 31-25.

Table 31-24: Transmission operating rules for the service list descriptor (BIT)

Transmission operating rule for each field	
descriptor_tag	Set to “0x41”.
descriptor_length	Describe the descriptor length of the service list.
[loop]	
service_id	Describe the service_id included in the applicable multimedia broadcasting broadcaster.
service_type	Describe the service type of the applicable service. The same content described in the NIT must be described.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 31-26.

Table 31-25: Reception processing rules for the service list descriptor (BIT)

Rules for reception processing for each field	
descriptor_tag	= "0x41": Judge that this descriptor is a service list descriptor.
descriptor_length	
[loop]	Judge that the services described in this loop are the services that belong to the applicable multimedia broadcasting broadcaster.
service_id	
service_type	This field should not be referenced. The service type of a service should be determined based on the content described in the NIT.

[Special Remarks]

None

31.2 SDT (Service Description Table)

31.2.1 Structure and use of SDT

[Use]

Describe the information on service channel such as service channel name.

Only SDT [actual] is used in multimedia broadcasting.

[Syntax]

The structure of SDT is shown in Table 31-27.

Table 31-26: Structure of SDT (Service Description Table)

Data structure	bit	Identifier
service_description_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
transport_stream_id	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
original_network_id	16	uimsbf
reserved_future_use	8	bslbf
for (i = 0;i< N;i++) {		
service_id	16	uimsbf
reserved_future_use	3	bslbf
N-EIT_flag	1	bslbf
M-EIT_flag	1	bslbf
W-EIT_flag	1	bslbf
EIT_schedule_flag	1	bslbf
EIT_present_following_flag	1	bslbf
running_status	3	uimsbf
free_CA_mode	1	bslbf
descriptors_loop_length	12	uimsbf
for (j = 0;j< M;j++) {		
descriptor()		
}		
}		

CRC_32 }	32	rpchof

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.6 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ The own TS information should be transmitted using one actual table.

◎ The transmission layer should be always layer A.

- All service channels of the own TS which are defined in the NIT must be described. However, do not describe regarding engineering service.
- Changing the information on the service channels should be based on the changed contents.
- For the update frequency, comply with the provisions in Section 10.9 of this document.

Transmission operating rule for each field are shown in Table 31-28.

Table 31-27: Transmission operating rule of SDT

Transmission operating rule for each field	
table_id	Set to “0x42”.
section_syntax_indicator	Set to ‘1’.
section_length	Describe the section length of SDT. Since the maximum length of section is 1024 bytes, this value should be 1021 at maximum.
transport_stream_id	Describe the transport_stream_id of the target TS (the id is unique to the multimedia broadcasting network).
version_number	For normal use, describe a value incremented by 1 every time version is updated. However, when a system error occurs, a value incremented by more than 1 can be described.
current_next_indicator	Set to ‘1’.
section_number	Describe the section number in the relative sub-table.
last_section_number	Describe the last section number in the relative sub-table.
original_network_id	Describe "network_id" for the target network.
[loop]	Do not define the maximum value for loop.
service_id	Describe the service_id of the target service channel (the id is unique to the multimedia broadcasting network).
N-EIT_flag	Set to '1' if the N-EIT for the target service channel is transmitted. For transmitting N-EIT, comply with the provisions in Chapter 12.
M-EIT_flag	Set to '1' if the M-EIT for the target service channel is transmitted. For transmitting M-EIT, comply with the

	provisions in Chapter 12.
W-EIT_flag	Set to '1' if the W-EIT for the target service channel is transmitted. For transmitting W-EIT, comply with the provisions in Chapter 12.
EIT_schedule_flag	'0' is always set because the EIT_schedule_flag is not transmitted in multimedia broadcasting.
EIT_present_following _flag	Comply with the provisions in Section 12.8.2 of this document.
running_status	Set to ‘0’.
free_CA_mode	Set to ‘0’ if the relative service is based on free programs. Set to ‘1’ if the relative service is based on chargeable programs. For the definitions of free and chargeable programs, see Section 19.2.
descriptor_loop_length	Describe the loop length of the subsequent descriptor. The maximum value is 1013.
[descriptor_loop]	Do not define the maximum loop count.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 31-29.

Table 31-29: Rules for reception processing for SDT

Rules for reception processing for each field	
table_id	= “0x42”: Judge that the relative table is the SDT for the target TS.
section_syntax_indicator	= ‘0’: Judge that the relative section is invalid. = ‘1’: Judge that the relative section is valid.
section_length	≤1021: Section length >1021: Judge that the relative section is invalid.
transport_stream_id	Judge as "transport_stream_id" for the target TS.
version_number	If any change occurs, judge that the relative table has been updated.
current_next_indicator	= ‘0’: Judge that the relative section is invalid. = ‘1’: Judge that the relative section is valid.
section_number	≤ "last_section_number": Judge as the section number in the relative sub-table. > "last_section_number": Judge that the relative section is invalid.
last_section_number	Judge as the last section number in the relative sub-table.
original_network_id	Judge as "network_id" for the target network.
[loop]	
service_id	Judge as "service_id" for the target service.
N-EIT_flag	= ‘0’:Judge that N-EIT for the relative service does not exist. = ‘1’: Judge that N-EIT for the relative service exists.

M-EIT_flag	= '0': Judge that M-EIT for the relative service does not exist. = '1': Judge that M-EIT for the relative service exists.
W-EIT_flag	= '0': Judge that W-EIT for the relative service does not exist. = '1': Judge that W-EIT for the relative service exists.
EIT_schedule_flag	= '0': Judge that EIT[schedule basic] for the relative service does not exist in the target TS. = '1': Judge that EIT[schedule basic] for the relative service exists in the target TS. '0' is always set in multimedia broadcasting.
EIT_present_following_flag	= '0': Judge that EIT for the relative service does not exist in the target TS. = '1': Judge that EIT for the relative service exists in the target TS
running_status	= "0x0": Undefined ≠ "0x0": Process on the assumption that it is set to "0x0".
free_CA_mode	='0': Judge that the relative service is based on free programs. ='1': Judge that the relative service is based on chargeable programs. For the definitions of free and chargeable programs, see Section 19.2.
descriptor_loop_length	≤1013: Loop length of the subsequent descriptor >1013: Judge that the relative section is invalid.
[descriptor]	

[Special Remarks]

- During the transition period after a change due to adding/deleting service channels, a service channel of the own TS that is described in the NIT but not described in the SDT may exist. These service channels should be also selectable.

31.2.2 Descriptor inserted into SDT (service loop)

31.2.2.1 Service descriptor

[Use]

Describe the basic information on services such as service name and company name.

[Syntax]

The structure of service descriptor is shown in Table 31-30.

Table 31-28: Structure of service descriptor

Data structure	bit	Identifier
service_descriptor () { descriptor_tag	 8	 uimsbf

descriptor_length	8	uimsbf
service_type	8	uimsbf
service_provider_name_length	8	uimsbf
for (i = 0;i< N;i++) {		
char	8	uimsbf
}		
service_name_length	8	uimsbf
for (i = 0;i< N;i++) {		
char	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and definitions in 6.2.13 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎Only one descriptor should be placed for the target service channel.

The transmission operating rules for each field are shown in Table 31-31.

Table 31-29: Transmission operating rule of service descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0x48”.
descriptor_length	Describe the length of the relative descriptor.
service_type	Describe the service type. For the service types, see Table 30-61.
service_provider_name _length	Describe the length of the company name. The maximum number of characters is 20 characters.
[char]	Describe the company name. The maximum number of characters is 10 two-byte characters.
service_name_length	Describe the length of service channel name. The maximum value is 20.
[char]	Describe the service channel name within the range of 20 bytes and 10 standard size characters. For the rule on use, see [Appendix H].

[Rules for Reception Processing]

◎Judge that the basic information on the target service is invalid if the SDT placed in accordance with the above rules on transmission cannot be received.

The rules for reception processing for each field are shown in Table 31-32.

Table 31-30: Rules for reception processing for service descriptor

Rules for reception processing for each field	
descriptor_tag	= “0x48”: Judge that the relative descriptor is the service descriptor.
descriptor_length	Judge as the length of service descriptor.
service_type	Judge that the relative descriptor is invalid except for "service_type" shown in Table 30-61.
service_provider_name_length	≤ 20: Length of the company name > 20: Judge that the company name is invalid.
[char]	Judge as the company name.
service_name_length	≤ 20: Length of service channel name > 20: Judge that the service channel name is invalid.
[char]	Judge as the service channel name.

[Special Remarks]

- For the service definitions by service type, see 6.1.

31.2.2.2 Digital copy control descriptor

[Use]

For the whole relative services, place this descriptor when control information regarding digital and analog copy is displayed, or when the maximum bit rate is described.

[Syntax]

The structure of digital copy control descriptor is shown in Table 31-33.

Table 31-31: Structure of digital copy control descriptor

Data structure	bit	Identifier
digital_copy_control_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
digital_recording_control_data	2	bslbf
maximum_bit_rate_flag	1	bslbf
component_control_flag	1	bslbf
copy_control_type	2	bslbf
if(copy_control_type != 00)){		
APS_control_data	2	bslbf
}		
else{		
reserved_future_use	2	bslbf
}		
if(maximum_bit_rate_flag == 1) {		
maximum_bit_rate	8	uimsbf
}		
if(component_control_flag ==1){		

component_control_length	8	uimsbf
for(j=0;j<N;j++){		
component_tag	8	uimsbf
digital_recording_control_data	2	bslbf
maximum_bitrate_flag	1	bslbf
reserved_future_use	1	bslbf
copy_control_type	2	bslbf
if(copy_control_type != 00) {		
APS_control_data	2	bslbf
}		
else{		
reserved_future_use	2	bslbf
}		
if(maximum_bitrate_flag==1){		
maximum_bitrate	8	uimsbf
}		
}		
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.23 and Annex F of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor can be placed for the relative service when implementing copy control that is different from the default copy control. (See Chapter 21.)

● This descriptor can be placed if the maximum bit rate for the relative service is not within the range of default maximum bit rate specified in Table 21-2. In this case, it is required to describe the correct copy control information even when implementing the same copy control as the default copy control. (See Chapter 21.)

The transmission operating rule for each field are shown in Table 31-34.

Table 31-32: Transmission operating rule of digital copy control descriptor (SDT)

Transmission operating rule for each field	
descriptor_tag	Set to “0xC1”.
descriptor_length	Describe the length of digital copy control descriptor.
digital_recording_control_data	This 2-bit field indicates the information used for copy generation control and is coded according to Table 31-35 and Table 31-36.
maximum_bit_rate_flag	Set to '0' if the maximum bit rate for the relative service is not described. Set to '1' if the maximum bit rate for the relative service is

	described.
component_control_flag	Set to ‘0’ (whole program only)
copy_control_type	This 2-bit field indicates the information used for copy generation control type and is coded according to Table 31-35 and Table 31-36.
APS_control_data	Analog output copy control information. This 2-bit field indicates the information used for analog output copy control if "copy_control_type" is set to '01’, ’10’ or ’11’ and is coded according to Table 31-35 and Table 31-36.
maximum_bit_rate	Describe the maximum bit rate.

The details of each service are shown in the following sections.

Note that the specifications for controlling each output terminal using digital copy control descriptor vary according to the service contents.

[Points of Use (video real-time broadcasting service and audio real-time broadcasting service)]

If the service_type set to the service list descriptor in the NIT is "0xC2" (video real-time broadcasting service) or "0xC2" (audio real-time broadcasting service), coding must be performed based on Table 31-35.

Table 31-33: Descriptors for the video real-time broadcasting service and audio real-time broadcasting service

<table>
<tr><th rowspan="2">Digital Copy Control</th><th rowspan="2">Analog Copy Control *3</th><th colspan="3">Operation of each field</th></tr>
<tr><th>copy_control_type</th><th>digital_recording_control_data</th><th>APS_control_data</th></tr>
<tr><td>Copy freely</td><td>Copy freely</td><td rowspan="5">01</td><td>00</td><td>00 *5</td></tr>
<tr><td rowspan="2">Copy never*1</td><td>Copy never without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">11</td><td>00</td></tr>
<tr><td>Copy never *4</td><td>Other than 00</td></tr>
<tr><td rowspan="2">Copy one generation*2</td><td>Copy one generation without Macrovision protection.
It shall therefore be copyable on conventional analog recording devices.</td><td rowspan="2">10</td><td>00</td></tr>
<tr><td>Becomes “Copy never” after copying over one generation. *4</td><td>Other than 00</td></tr>
</table>

*1: When output to the High-Speed Digital Interface, the Copy Never protection of the Source function specified by DTCP shall be applied. However, when outputting only audio streams in the IEC60958 conformant format, the No More Copies protection shall be applied.

*2: When output to the High-Speed Digital Interface, the Copy One Generation protection of the Source function specified by DTCP shall be applied.

*3: Applicable to composite and component video output. Also applicable to the cases where received video signals are format converted and output. Macrovision copy protection is applied to 480i composite and component video signals.

*4: Analog video output should be performed in accordance with the parameters specified by Macrovision and specified "APS_control_data".

*5: The receiver units do not use this field value for the judgment of receiving process.

[Points of Use (independent data broadcasting service)]

If the service_type set to the service list descriptor in the NIT is "0xC2" (independent data broadcasting service), coding must be performed based on Table 31-36.

Table 31-34: Descriptors for the independent data broadcasting service

<table>
<tr><th rowspan="2">Digital Copy Control</th><th rowspan="2">Analog Copy Control *3</th><th colspan="3">Operation of each field</th></tr>
<tr><th>copy_control_type</th><th>digital_recording_control_data</th><th>APS_control_data</th></tr>
<tr><td>Copy freely</td><td>Copy freely</td><td>01/11</td><td>00</td><td>00 *5</td></tr>
<tr><td rowspan="2">Copy never*1</td><td>Copy never without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">01</td><td rowspan="4">11</td><td>00</td></tr>
<tr><td>Copy never. *4</td><td>Other than 00</td></tr>
<tr><td rowspan="2">Copy never, and the output of MPEG_TS is disabled. *6</td><td>Copy never without Macrovision protection. Therefore, it shall only be copyable on conventional analog input/recording devices.</td><td rowspan="2">11</td><td>00</td></tr>
<tr><td>Copy never. *4</td><td>Other than 00</td></tr>
<tr><td rowspan="2">Copy one generation*2</td><td>Copy one generation without Macrovision protection.
It shall therefore be copyable on conventional analog recording devices.</td><td rowspan="2">01</td><td rowspan="4">10</td><td>00</td></tr>
<tr><td>Becomes “Copy never” after copying over one generation. *4</td><td>Other than 00</td></tr>
<tr><td rowspan="2">Copy one generation, but the output of MPEG_TS is disabled. *6</td><td>Copy one generation without Macrovision protection.
It shall therefore be copyable on conventional analog recording devices.</td><td rowspan="2">11</td><td>00</td></tr>
<tr><td>Becomes “Copy never” after copying over one generation. *4</td><td>Other than 00</td></tr>
</table>

*1: When output to the High-Speed Digital Interface, the Copy Never protection of the Source function specified by DTCP shall be applied. However, when outputting only audio streams in the IEC60958 conformant format, the No More Copies protection shall be applied.

*2: When output to the High-Speed Digital Interface, the Copy One Generation protection of the Source function specified by DTCP shall be applied.

*3: Applicable to composite and component video output. Also applicable to the cases where received video signals are format converted and output. Macrovision copy protection is applied to 480i composite and component video signals.

*4: Analog video output should be performed in accordance with the parameters specified by Macrovision and specified "APS_control_data".

*5: The receiver units do not use this field value for the judgment of receiving process.

*6: In the case of IP interface, outputting of MPEG_PS shall also be prohibited.

[Points of Use (Common in All Services)]

Transmission and use should not be applied to other combinations than those specified in Table 31-35 and Table 31-36.

For CGMS-A, when "copy_control_type" is set to ’01’, ’10’ and ’11’, "digital_recording_control_data" and "APS_control_data" are copied in the area specified by CGMS-A.

When the relative descriptor includes the copy control information, the copyright process appropriate to analog video output, high-speed digital interface output and digital audio output is performed before outputting. CGMS-A and MACROVISION is used for analog video output, DTCP for high-speed digital interface output, and SCMS for digital audio output. For the details of process, see the specifications and standards.

When multiple services are output from the high-speed digital interface, the copy control designation (including output control) for each service is interpreted as follows:

- Outputting streams (including services where output is prohibited or disabled) is prohibited.
- The stream cannot be output if the service where "copy_control_type=01" and the other where “copy_control_type=11" are mixed. However, it can be output if the services where copy is unconditionally enabled are mixed.
- Copy control is most strict for copy disabled, then copy enabled for one generation and copy enabled unconditionally in order.

The information should be accurately reflected in the copyright bit and category code of the channel status specified by IEC 60958.

The category code is set to "001_0000L" if digital copy control descriptor is provided.

Copy is enabled unconditionally: Set the copyright information bit to '1'.

Copy is enabled for one generation: Set the copyright information bit to '0' and L bit of category code to '0'.

Copy is disabled: Set the copyright information bit to '0' and L bit of category code to '1'.

If no relative descriptor is described, it is regarded as copy free.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 31-37.

Table 31-35: Rules for reception processing for digital copy control descriptor (SDT)

Rules for reception processing for each field	
descriptor_tag	= “0xC1”: Judge that the relative descriptor is digital copy control descriptor.
descriptor_length	Judge as the length of digital copy control descriptor.
digital_recording_control_data	This 2-bit field indicates the information used for copy generation control and coded according to Table 31-35 and Table 31-36.
maximum_bit_rate_flag	='0': Judge that the maximum bit rate for the relative service is within the range of default maximum bit rate specified in Table 21-1 and Table 21-2. ='1': Judge that the maximum bit rate for the relative service is described below.
component_control_flag	='0': Judge that the relative descriptor is valid. ='1': Judge '0'.
copy_control_type	This 2-bit field indicates the information on type used for copy generation control and is coded according to Table 31-35 and Table 31-36.
maximum_bit_rate	Judge as the maximum bit rate for the relative service.

[Special Remarks]

Since the analog output signal copy control conforms to the individual contracts between broadcasting companies and Macrovision, it seems necessary to re-consider carefully.

If the rules for reception processing are not specified in Table 31-35 and Table 31-36, see Table 3-1 of Vol. 8.

31.2.2.3 CA contract info descriptor

[Use]

Describe the confirmation information related to whether or not a program is viewed (recorded) in an original setting to reserve the program with a billing target component(s) in a service channel.

[Syntax]

The structure of CA contract info descriptor is shown in Table 31-38.

Table 31-36: Structure of CA contract info descriptor

Data structure	bit	Identifier
CA_contract_info_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_id	16	uimsbf
CA_unit_id	4	uimsbf
num_of_component	4	uimsbf
for (i = 0;i< num_of_component ;i++) {		
component_tag	8	uimsbf
}		
contract_verification_info_length	8	uimsbf
for (i = 0;i< contract_verification_info_length ;i++) {		
contract_verification_info	8	uimsbf
}		
fee_name_length	8	uimsbf
for (i = 0;i< fee_name_length ;i++) {		
fee_name	8	uimsbf
}		
}		

[Semantics of Each Field]

The definitions of each field are specified in Table 31-39.

Table 31-39: Definitions of each field for CA contract info descriptor

Definitions	
CA_system_id	This 8-bit field indicates the conditional access system identifier. Set to "0x000F" for multimedia broadcasting.
CA_unit_id	This 4-bit field indicates chargeable/non-chargeable unit identifier that the component belongs to. However, the relative descriptor does not use "0x0". 0x0: Non-chargeable unit group 0x1: Chargeable unit group including group of default ES' of the event 0x2-0xF: Chargeable unit group except for the above
num_of_component	This 4-bit field indicates the number of chargeable unit components specified in the above "CA_unit_id"
[component_tag]	This 8-bit field is the label for identifying the target component streams in the chargeable unit components specified in the above "CA_unit_id". If the stream identifier descriptor exists in the PMT, it is the same value as the component tag described in the stream identifier descriptor.

contract_verification _info_length	This 8-bit field indicates the byte length of the subsequent contract verification information.
[contract_verification _info]	This is an 8-bit field. The contract verification information is described in a sequence of verification information fields.
fee_name_length	"0" is always set to this 8-bit field in multimedia broadcasting.
[fee_name]	This 8-bit field is not used in multimedia broadcasting.

[Transmission Operating Rule]

◎ Only one descriptor should be placed and transmitted if the relative service is based on the chargeable services.

- When "free_CA_mode=0", the relative descriptor for "CA_unit_id=0x1" should not be placed.
- When "free_CA_mode=1", the relative descriptor for "CA_unit_id=0x1" should be placed.
- Do not change the value if possible, once it is set up.

The transmission operating rules for each field are shown in Table 31-40.

Table 31-37: Transmission operating rule of CA contract info descriptor (SDT)

Transmission operating rule for each field	
descriptor_tag	Set to “0xCB”.
descriptor_length	Describe the length of the relative descriptor. The maximum value is 209.
CA_system_id	Describe the conditional access system identifier. Describe "0x000F" in multimedia broadcasting.
CA_unit_id	Describe the chargeable unit identifier. Only "0x1" is used in multimedia broadcasting.
num_of_component	Describe the number of the relative chargeable unit components. The maximum value is 12.
[component_tag]	Describe the tag value of the relative chargeable unit components.
contract_verification _info_length	Describe the length of contract verification information. The maximum value is 172 byte.
[contract_verification _info]	Describe the contract verification information.
fee_name_length	Set to the fixed value, '0'.
[fee_name]	This field is not used.

[Rules for Reception Processing]

- When either of the following conditions is fulfilled, judge that the contract verification information for the SDT is invalid.
  - The relative descriptor including "free_CA_mode=0" and "CA_unit_id=0x1" is placed.

・ The relative descriptor including "free_CA_mode=1" and "CA_unit_id=0x1" is not placed.

The rules for reception processing for each field are shown in Table 31-41.

Table 31-38: Rules for reception processing for CA contract info descriptor (SDT)

Rules for reception processing for each field	
descriptor_tag	= "0xCB": Judge that the relative descriptor is the CA contract info descriptor.
descriptor_length	Judge as the length of the CA contract info descriptor.
CA_system_id	It is valid if the value is a valid conditional access system identification value specified in Vol. 5 (Section 5.22). Judge that any other value refers to the noncompliant conditional access system (reservation is not available).
CA_unit_id	=0x0: Judge as invalid. =0x1: Judge as the chargeable unit identifier including group of default ES'. >0x1: Perform the receiving process for noncompliant PPV if the contract confirmation command/response indicates PPV. For any other contract programs, judge that the whole relative descriptor is invalid.
num_of_component	= 0: Judge that the whole relative descriptor is invalid. ≤12: Judge as the number of relative chargeable unit components. >12: Judge that the whole relative descriptor is invalid.
[component_tag]	Judge as the tag value for the relative chargeable unit component.
contract_verification_info_length	≤172: Length of contract verification information >172: Judge that the whole relative descriptor is invalid.
[contract_verification_info]	Judge as the contract verification information.
fee_name_length	The receiver units ignore.
[fee_name]	The receiver units ignore.

31.3 EIT (Event Information Table)

31.3.1 Structure of EIT

[Use]

Specify the program related information such as program titles, air dates and times and brief program descriptions.

Only N-EIT[p/f]/N-EIT[p/f after]/M-EIT[p/f]/M-EIT[p/f after]/W-EIT[p/f]/W-EIT[p/f after] is used in multimedia broadcasting.

[Syntax]

The structure of EIT is shown in Table 31-42. This structure can commonly apply to N-EIT, M-EIT and L-EIT.

Table 31-39: Structure of EIT (Event Information Table)

Data structure	bit	Identifier
event_information_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
service_id	16	uimsbf
reserved	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
transport_stream_id	16	uimsbf
original_network_id	16	uimsbf
segment_last_section_number	8	uimsbf
last_table_id	8	uimsbf
for (i = 0;i< N;i++) {		
event_id	16	uimsbf
start_time	40	bslbf
duration	24	uimsbf
running_status	3	uimsbf
free_CA_mode	1	bslbf
descriptors_loop_length	12	uimsbf
for (j = 0;j< M;j++) {		
descriptor()		
}		
}		
CRC_32	32	rpchof
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.7 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ Regarding the service used in the target network, this table should be transmitted within the all-stations applied transmission parameter of the basic transmission EIT type.

◎ The PID for N-EIT, M-EIT and W-EIT complies with Table 12-5.

- For the re-transmission cycle, follow 10.4 of this document.

- For the update frequency, follow 10.9 of this document.

The transmission operating rules for each field are shown in Table 31-43.

Table 31-40: Transmission operating rule of EIT

<table>
<tr><th colspan="3">Transmission operating rule for each field</th></tr>
<tr><td>table_id</td><td colspan="2">Describe according to Table 12-6 to 12-8.</td></tr>
<tr><td>section_syntax_indicator</td><td colspan="2">Set to ‘1’.</td></tr>
<tr><td>section_length</td><td colspan="2">Describe the section length of EIT. Since the maximum length of all sections is 4096 bytes, this value should be 4093 at maximum.</td></tr>
<tr><td>service_id</td><td colspan="2">Describe "service_id" for the target program.</td></tr>
<tr><td>version_number</td><td colspan="2">For normal use, describe a value incremented by 1 every time version is updated. However, when a system error occurs, a value incremented by more than 1 can be described.</td></tr>
<tr><td>current_next_indicator</td><td colspan="2">Set to ‘1’.</td></tr>
<tr><td>section_number</td><td colspan="2">Describe the section number.</td></tr>
<tr><td rowspan="8">last_section_number</td><td colspan="2">Describe the maximum section number. The description for each table type complies with the following rule:</td></tr>
<tr><td>Table type</td><td>Description</td></tr>
<tr><td>N-EIT[p/f]</td><td rowspan="6">Describe the last "section_number".</td></tr>
<tr><td>N-EIT[p/f after]</td></tr>
<tr><td>M-EIT[p/f]</td></tr>
<tr><td>M-EIT[p/f after]</td></tr>
<tr><td>W-EIT[p/f]</td></tr>
<tr><td>W-EIT[p/f after]</td></tr>
<tr><td>transport_stream_id</td><td colspan="2">Describe "transport_stream_id" for the target transport stream.</td></tr>
<tr><td>original_network_id</td><td colspan="2">Describe "network_id" for the original delivery system.</td></tr>
<tr><td rowspan="8">segment_last_section_number</td><td colspan="2">Describe the last "section_number" used in each relative segment. The description for each table type complies with the following rule:</td></tr>
<tr><td>Table type</td><td>Description</td></tr>
<tr><td>N-EIT[p/f]</td><td rowspan="6">Set to the same value as that for "last_section_number" field.</td></tr>
<tr><td>N-EIT[p/f after]</td></tr>
<tr><td>M-EIT[p/f]</td></tr>
<tr><td>M-EIT[p/f after]</td></tr>
<tr><td>W-EIT[p/f]</td></tr>
<tr><td>W-EIT[p/f after]</td></tr>
<tr><td>last_table_id</td><td colspan="2">Describe the last "table_id". The description for each table type complies with the following rule:</td></tr>
</table>

<table>
<tr><th colspan="3">Transmission operating rule for each field</th></tr>
<tr><td rowspan="7"></td><td>Table type</td><td>Description</td></tr>
<tr><td>N-EIT[p/f]</td><td rowspan="6">Same as "table_id"</td></tr>
<tr><td>N-EIT[p/f after]</td></tr>
<tr><td>M-EIT[p/f]</td></tr>
<tr><td>M-EIT[p/f after]</td></tr>
<tr><td>W-EIT[p/f]</td></tr>
<tr><td>W-EIT[p/f after]</td></tr>
<tr><td rowspan="8">[loop]</td><td colspan="2">The maximum loop count for each table type complies with the following rule:</td></tr>
<tr><td>Table type</td><td>Description</td></tr>
<tr><td>N-EIT[p/f]</td><td>1</td></tr>
<tr><td>N-EIT[p/f after]</td><td>8</td></tr>
<tr><td>M-EIT[p/f]</td><td>1</td></tr>
<tr><td>M-EIT[p/f after]</td><td>8</td></tr>
<tr><td>W-EIT[p/f]</td><td>1</td></tr>
<tr><td>W-EIT[p/f after]</td><td>8</td></tr>
<tr><td>event_id</td><td colspan="2">Describe "event_id". It is uniquely assigned in "service_id".
For the unique "event_id" for the direction of time, see Section 6.2.1.</td></tr>
<tr><td>start_time</td><td colspan="2">Describe the program start time. Describe in MJD+BCD hours:minutes:seconds format. Only in case of "following", "Undefined" (all bit ‘1’) is available.</td></tr>
<tr><td>duration</td><td colspan="2">Describe the program length for the event.
Describe in BCD hours:minutes:seconds format. Only in case of "present/following", "Undefined" (all bit‘1’) is available.</td></tr>
<tr><td>running_status</td><td colspan="2">Set to “0” (undefined) for all.</td></tr>
<tr><td>free_CA_mode</td><td colspan="2">Set to ’0’ if the relative program is a free program.
Set to '1' if the relative program is a chargeable program.
For the definitions of free and chargeable program, see Section 19.2.</td></tr>
<tr><td>descriptors_loop_length</td><td colspan="2">Describe within the range of section length.</td></tr>
<tr><td>[descriptor_loop]</td><td colspan="2"></td></tr>
<tr><td>[descriptor]</td><td colspan="2"></td></tr>
</table>

[Rules for Reception Processing]

Specify the program related information such as program titles, air dates and times and brief program descriptions. The rules for reception processing for each field are shown in Table 31-44.

Table 31-41: Rules for reception processing for EIT

Rules for reception processing for each field		
table_id	= “0x4E”: Judge that the relative table is the EIT.	
section_syntax_indicator	= ‘0’: Judge that the relative section is invalid. = ‘1’: Judge that the relative section is valid.	
section_length	≤4093: Section length >4093: Judge that the relative section is invalid.	
service_id		
version_number	If any change occurs, judge that the relative table has been updated.	
current_next_indicator	= ‘0’: Judge that the relative section is invalid. = ‘1’: Judge that the relative section is valid.	
section_number	Judgment for each table type complies with the following rule:	
	Table type	Description
	N-EIT[p/f], N-EIT [p/f after]	=‘0’: Judge that the relative section is information on the current event ("present"). =‘1’: Judge that the relative section is information on the next event ("following"). =‘2’–‘3”: Judge that the relative section is information on the following or later program after the next event ("after"). >‘3’: Ignore the relative section.
	M-EIT[p/f], M-EIT [p/f after]	=‘0’: Judge that the relative section is information on the current event ("present"). =‘1’: Judge that the relative section is information on the next event ("following"). =‘2’–‘3”: Judge that the relative section is information on the following or later program after the next event ("after"). >‘3’: Ignore the relative section.
	W-EIT[p/f]、 W-EIT [p/f after]	=‘0’: Judge that the relative section is information on the current event ("present"). =‘1’: Judge that the relative section is information on the next event ("following"). =‘2’–‘3”: Judge that the relative section is information on the following or later program after the next event ("after"). >‘3’: Ignore the relative section.
last_section_number		
transport_stream_id		
original_network_id		

Rules for reception processing for each field	
segment_last_section_number	
last_table_id	
[loop]	
event_id	
start_time	Only in case of "following", judge as undefined if all bit is set to '1'.
duration	Only in case of "present/following", judge as undefined if all bit is set to '1'.
running_status	= '0': Judge that the relative event is valid. ≠ '0': Perform process on the assumption to be set to '0'.
free_CA_mode	= '0': Judge that the relative program is a free program. = '1': Judge that the relative program is a chargeable program. For the definitions of free and chargeable program, see Section 19.2.
descriptors_loop_length	
[descriptor_loop]	
[descriptor]	

[Special Remarks]

- The maximum "duration" is 48 hours.
- The maximum number of events for a day is 288 per service.

For reissuing another program with the same "event_id" (unique "event_id" for the direction of time), see 6.2.1.

31.3.2 Descriptor inserted into EIT (event loop)

The descriptors to be placed for the event loops in the EIT are shown in Table 31-45.

Table 31-42: Descriptors to be placed for event loops in EIT

Tag	Descriptor	N-EIT [p/f]	N-EIT [p/f after]	M-EIT [p/f]	M-EIT [p/f after]	W-EIT [p/f]	W-EIT [p/f after]
0x4D	Short Event Descriptor	◎	◎	◎	◎	◎	◎

◎: Should be inserted into the relative descriptor area in table

31.3.2.1 Short event descriptor

[Use]

Describe the short textual information related to event names and events.

[Syntax]

The structure of short event descriptor is shown in Table 31-46.

Table 31-46: Structure of short event descriptor

Data structure	bit	Identifier
short_event_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
ISO_639_language_code	24	bslbf
event_name_length	8	uimsbf
for (i = 0;i< event_name_length;i++) {		
event_name_char	8	uimsbf
}		
text_length	8	uimsbf
for (i = 0;i< text_length;i++) {		
text_char	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and definitions in 6.2.15 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ Only one short event descriptor is transmitted for one event.

The transmission operating rules for each field are shown in Table 31-47.

Table 31-47: Transmission operating rule of short event descriptor

Transmission operating rule for each field	
descriptor_tag	Set to "0x4D".
descriptor_length	Describe the length of the short event descriptor. Do not define the maximum value.
ISO_639_language_code	Set the language code to "jpn ("0x6A706E")".
event_name_length (Note1)	Describe the length of program title. It should be less than 96 bytes and 40 standard size characters.
[event_name_char]	Describe the program title. It should be less than 96 bytes and 40 standard size characters. Do not use APR codes. If the series descriptor exists in the same loop and the series name is not described in the descriptor, this program title is also used as series name.
text_length	Describe the description length of the program. It should be less than 192 bytes and 80 standard size characters.

[text_char]	Describe the program description. It should be less than 192 bytes and 80 standard size characters. The total number of APR codes used in the relative field is not limited, but to avoid abusing, the purposes of use are limited as follows: - To avoid that a personal name is displayed across the line. - To avoid beginning a new line from the undesired part of a sentence.

Note1: The program title should consist of "program title + subtitle". It is strongly recommended to use 40 characters for the program title of long-time program. However, the transmitter always consider the case that only 20 characters can be displayed due to the display limitation and need to adjust by listing the titles in order of precedence, etc. For 30-minute or shorter programs, generally use 20 characters or less.

[Rules for Reception Processing]

- It can judge the title and subtitle for each event and is used for displaying, etc.

The rules for reception processing for each field are shown in Table 31-48.

Table 31-43: Rules for reception processing for short event descriptor

Rules for reception processing for each field	
descriptor_tag	= “0x4D”: Judge that the relative descriptor is the short event descriptor.
descriptor_length	Judge as the length of the relative descriptor.
ISO_639_language_code	If it is set to any other value than “jpn (“0x6A706E”)”, assume that the character code to be placed later is “jpn”.
event_name_length	≤96 bytes and 40 standard size characters or less: Length of program title >96 bytes or 41 standard size characters or more: Ignore the parts of the program title exceeding 96 bytes (40 standard size characters).
[event_name_char]	Judge as the program title. If the series descriptor exists in the relative loop and the series name is not described in the descriptor, judge as program title = series name.
text_length	≤192 bytes or 80 standard size characters or less: Length of program description >192 bytes or 81 standard size characters or more: Ignore the parts of the program title exceeding 192 bytes (80 standard size characters).
[text_char]	Judge as the program description.

[Special Remarks]

None

31.4 TOT (Time Offset Table)

31.4.1 Structure and use of TOT

[Use]

Transmit the JST, date and time offset value used when summer time is applied.

[Syntax]

The structure of TOT is shown in Table 31-49.

Table 31-49: Structure of TOT (Time Offset Table)

Data structure	bit	Identifier
Time_offset_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
JST_time	40	bslbf
reserved	4	bslbf
descriptor_loop_length	12	uimsbf
for (i = 0;i< N;i++) {		
descriptor()		
}		
CRC_32	32	bslbf
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.9 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ Only one table should be transmitted to one TS.

● For the re-transmission cycle, follow Section 10.4 of this document.

The transmission operating rules for each field are shown in Table 31-50.

Table 31-50: Transmission operating rule of TOT

Transmission operating rule for each field	
table_id	Set to “0x73”.
section_syntax_indicator	Set to ‘0’.
section_length	Describe the section length of TOT. Since the maximum length of all sections is 1024 bytes, this value should be 1021 at maximum.
JST_time	When the receiver unit receives, adjust the time for transmission so that it can be JST±500ms.

descriptor_loop_length	
[descriptor_loop]	

[Rules for Reception Processing]

◎ If the relative table is not in the TS, use the internal clock in the receiver unit until the TOT is received.

The rules for reception processing for each field are shown in Table 31-51.

Table 31-51: Rules for reception processing for TOT

Rules for reception processing for each field	
table_id	= “0x73”: Judge that the relative table is TOT.
section_syntax_indicator	='0': Judge that the relative section is valid. ='1': Judge that the relative section is invalid.
section_length	≤1021: Judge as section length >1021: Judge that the relative section is invalid.
JST_time	
descriptor_loop_length	
[descriptor_loop]	

[Special Remarks]

- Japan Standard Time (JST) is defined as "UTC (Universal Time Coordinated) + 9" (as defined in ARIB STD-B10).
- The changing time of Modified Julian Day is based on "UTC + 9".
- When the receiver unit receives, adjust the time for transmission so that the error margin can be within ±500ms respect to JST. However, for a few minutes before/after the insertion of leap seconds when the leap second is applied, the maximum allowable difference from JST is 1.5 second.
- For the process in 2038 or later, see Section 15.3.

31.4.2 Descriptor inserted into TOT

31.4.2.1 Local time offset descriptor

[Use]

It is used to provide the certain offset value between the actual time (UTC + 9 hours) and displayed time when the summer time starts.

[Syntax]

The structure of Local Time Offset descriptor is shown in Table 31-52.

Table 31-44: Structure of local time offset descriptor

Data structure	bit	Identifier
local_time_offset_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i = 0;i< N;i++) {		
country_code	24	bslbf
country_region_id	6	bslbf
reserved	1	bslbf
local_time_offset_polarity	1	bslbf
local_time_offset	16	bslbf
time_of_change	40	bslbf
next_time_offset	16	bslbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.25 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

◎ This descriptor is not inserted into the TOT unless summer time is applied. If it is applied, only one descriptor can be inserted from January 1st of the year when summer time starts.

◎ If this descriptor is inserted, its description should be unified in all networks.

● The descriptor should be transmitted 32 days before the offset time is changed ("time_of_change"). In addition, the set value in "next_time_offset" should be moved to "local_time_offset" for transmission within 7 days after 48 hours has passed since the summer time is changed.

The transmission operating rule for each field are shown in Table 31-53.

Table 31-53: Transmission operating rule of local time offset descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0x58”.
descriptor_length	Describe the length of the local time offset descriptor.
[loop]	Set the loop count to '1'.
country_code	Set to “JPN (“0x4A504E”)”.
country_region_id	Set to all ’0’
local_time_offset_ polarity	Specify if the time is set to "JST_time" + offset time or "JST_time" - offset time.
local_time_offset	Describe the current offset time for "JST_time" in the BCD hours:minutes format.

time_of_change	Describe the date and time when it is changed to offset time in the MJD+BCD hours:minutes:seconds format.
next_time_offset	Describe the offset time used after the date and time specified in "time_of_change" in BCD hours:minutes format.

[Rules for Reception Processing]

◎Judge that the summer time is not applied if this descriptor is not placed.

The rules for reception processing for each field are shown in Table 31-54.

Table 31-45: Rules for reception processing for local time offset descriptor

Rules for reception processing for each field	
descriptor_tag	= “0x58”: Judge that the relative descriptor is the local time offset descriptor.
descriptor_length	Judge as the length of local time offset descriptor.
[loop]	If the loop count is above 2, ignore the second and later loop.
country_code	= Other than “JPN”: Judge that this descriptor is invalid.
country_region_id	= Other than all ’0’: Judge that this descriptor is invalid.
local_time_offset_ polarity	=’0’: Judge that the time is advanced for the offset time from "JST_time". =’1’: Judge that the time is delayed for the offset time from "JST_time".
local_time_offset	Judge as the current offset time for "JST_time".
time_of_change	Judge as the date and time when the offset time is changed.
next_time_offset	Judge as the offset time used after the date and time specified in "time_of_change".

[Special Remarks]

None

31.5 ST (Stuffing Table)

31.5.1 Structure and use of ST

[Use]

Disable tables.

[Syntax]

The structure of ST is shown in Table 31-55.

Table 31-55: Structure of ST (stuffing table)

Data structure	bit	Identifier
stuffing_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
for (i = 0;i< N;i++) {		
data_byte	8	uimsbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 5.2.10 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

The transmission operating rule for each field are shown in Table 31-56.

Table 31-56: Transmission operating rule of ST

Transmission operating rule for each field	
table_id	Set to “0x72”.
section_syntax_indicator	Set to ‘0’.
section_length	
[data_byte]	Set to all ‘1’.

[Rules for Reception Processing]

The rules for reception processing for each field are shown in Table 31-57.

Table 31-57: Rules for reception processing for ST

Rules for reception processing for each field	
table_id	=”0x72”: Judge that the relative table is the ST.
section_syntax_indicator	= Other than ‘0’: Judge that this table is invalid.
section_length	
[data_byte]	Ignore any value.

[Special Remarks]

None

31.6 Descriptor Undefined in Each Table

31.6.1 Stuffing descriptor

[Use]

Used when disable the previously coded descriptor or insert dummy descriptor for table stuffing.

[Syntax]

The structure of stuffing descriptor is shown in Table 31-58.

Table 31-46: Structure of stuffing descriptor

Data structure	bit	Identifier
stuffing_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i = 0;i< N;i++) {		
stuffing_byte	8	bslbf
}		
}		

[Semantics of Each Field]

For the definition of each field, comply with the provisions in 6.2 of Part 1 and the definitions in 6.2.17 of Part 2 in ARIB STD-B10.

[Transmission Operating Rule]

The transmission operating rule for each field are shown in Table 31-59.

Table 31-47: Transmission operating rule of stuffing descriptor

Transmission operating rule for each field	
descriptor_tag	Set to “0x42”.
descriptor_length	Describe the length of the stuffing descriptor.
[loop]	
stuffing_byte	Set to all ’1’.

[Rules for Reception Processing]

When any relative descriptor is included, ignore without any process.

The rules for reception processing for each field are shown in Table 31-60.

Table 31-60: Rules for reception processing for stuffing descriptor

Rules for reception processing for each field	
descriptor_tag	= "0x42": Judge that the relative descriptor is the stuffing descriptor.
descriptor_length	Judge as the length of the relative descriptor.
[loop]	
stuffing_byte	Ignore any value.

[Special Remarks]

None

Annex 1 Processing Operation of Receivers for Connected Transmission

The connected transmission is a transmission type of multimedia broadcasting. When executing the connected transmission, frame synchronization is performed for each segment. If the modulation system of another segment, to which the connected transmission is applied, can be known in advance, then the receivers can be stabilized and the processing can be accelerated when performing demodulation operation or when switching a channel. As a means to notify the information related to the connected transmission to the receivers in advance, the connected transmission descriptor is provided. This section explains the processing operation of receivers for performing connected transmission.

1 Connected Transmission

Connected transmission means "to transmit multiple unit transmission waves (13-segment mode or 1-segment mode transmission modes) without a guard band from the same transmission site" (cited from ARIB STD-B46). When performing the connected transmission, OFDM frame synchronization is used to coordinate the timing at which to synchronize unit transmission waves. When a receiver reselects a channel using a unit transmission wave in the same connected transmission signal, the receiver does not need to newly establish the OFDM frame synchronization, which enables the receiver to select a channel faster.

2 Connected Transmission Descriptor

Whether or not connected transmission is performed via a unit transmission wave (broadcast TS signal) can be determined using the connected transmission descriptor in the broadcast TS signal. The connected transmission descriptor is necessary for connected transmission and is placed in the second loop of the NIT. The connected transmission descriptor mainly has a connected transmission group identifier, segment mode identifier, and a modulation system identifier per layer. If the connected transmission descriptor does not exist, it can be determined that the TS signal does not perform connected transmission. For details on connected transmission descriptors, see Section 30.4.3.5.

3 Each Parameter Information and Processing Operation in Receivers

The connected transmission group identifier (connected_transmission_group_id) of the connected transmission descriptor is used to identify a connected transmission group using an applicable unit transmission wave. The receivers can determine that connected transmission is performed for multiple unit transmission waves where the same identifier is used. This means that when selecting a channel via the unit transmission waves, reception operation can be performed without executing frame synchronization.

The segment mode identifier (segment_type) and the modulation system identifier per layer (modulation_type_A, modulation_type_B, and modulation_type_C) of the connected transmission descriptor are used to identify the segment mode and modulation system used in the unit transmission waves. This means that the receivers can know the channel selection information transmitted via the unit transmission waves from the TS without obtaining the TMCC information from a demodulation device. In addition, the receivers can perform demodulation operation and synchronization processing based on the information when selecting a channel.

Annex 2 Estimation Examples of SI Data Amount

This section provides the estimation examples of the N-EIT[p/f], which is expected to perform memory storage in receivers in the PSI/SI transmitted in multimedia broadcasting. The values shown here are only examples calculated based on the premise; therefore, the actual SI data amount may vary depending on the descriptor, number of programs and data amount of programs used by each broadcaster. The premise used in this appendix are determined on the assumption that slightly higher amount of data is used than that generally used by broadcasters; therefore, the values can be used for reference when designing receiver units. The values used here are not the maximum values based on the assumed data amount. Accordingly, it is recommended to use them by adding some margin to the calculated amount. In addition, although the memory storage amount depends on the receiver units, if the broadcaster transmit much higher amount of SI information than the provided example, it is necessary to recognize that it may not be stored in the receiver unit memory

<Estimation Target>

・ N-EIT[p/f] capacity for all services per TS

Premise:

1) The number of services that transmit N-EITs is 10 video real-time broadcasting services that use 12 segments (low protection layer) in a 13-segment broadcast. The services that use the partial reception layer do not transmit N-EITs but transmit W-EITs.
2) 24-hour continuous broadcasting (the number of programs above exist in a 12-segment). Any empty section is not transmitted.
3) The transmission span is between the current event (present) and subsequent event (following) of a video real-time broadcasting service.
4) The length of short event descriptor is 257 bytes. (Considering the maximum length of program title and description, it will be 6+96+1+192=295 bytes; therefore, it will be above 257 bytes, that is the maximum value per descriptor.)

Estimation:

[1] Data amount of the N-EIT for the current event (present)

+ Header	14 bytes
+Event loop	
+Event loop header	12 bytes
+Descriptor loop	
+Short-format event descriptor	257 bytes
+CRC	4 bytes

The data amount of the current event per transmission frequency of 2 seconds is calculated as follows:

14 (header) + (12+257) × 10 (without event sharing) + 4 (CRC) = 2,708 bytes

[2] Data amount of the N-EIT in the subsequent event (following)

+Header	14 bytes
+Event loop	
+Event loop header	12 bytes
+Descriptor loop	
+Short-format event descriptor	257 bytes
+CRC	4 bytes

The data amount of the subsequent event per a transmission frequency of 2 seconds is calculated as follows:

14 (header) + (12 + 257) × 10 (without event sharing) + 4 (CRC) = 2,708 bytes

Therefore, the data amount of the N-EIT[p/f] for the 10 services per a transmission frequency of 2 seconds can be calculated as follows:

Current event + next event = 2,708 + 2,708

= 5,416 bytes

Estimation result:

Based on the calculation above, the data amount of 10 services per TS is as follows:

N-EIT[p/f] amount per a transmission frequency of 2 seconds: 5,416 bytes

Annex 3 Character Set Used in SI

The following six character sets (collection of codes) are used in characters in the SI transmitted in multimedia broadcasting.

○ JIS-compatible Kanji plane 1 (two-byte code)

○ JIS-compatible Kanji plane 2 (two-byte code)

○ Alphanumeric code (one-byte code)

○ Hiragana (one-byte code)

○ Katakana (one-byte code)

○ Additional symbol (two-byte code)

For alphanumeric code, Hiragana and Katakana, comply with Tables 7-5, 7-7 and 7-6 of Part 2 in Vol. 1 of ARIB STD-B24.

Other three character sets are provided here.

1 Operation of JIS 3rd and 4th Level Kanji

JIS 3rd and 4th level Kanji sets are not used at the initial stage of multimedia broadcasting.

With the mounting situation of JIS 3rd and 4th level character ROM into the receiver units, JIS 3rd and 4th level character codes are sequentially operated under each broadcaster's decision. However, if JIS 3rd and 4th level Kanji sets are used, careful transmission is required so that the receiver units without JIS 3rd and 4th level character ROM can smoothly display the JIS 3rd and 4th level characters under the definitions of External Character Set (XCS: See Section 2.2.). If any JIS 3rd and 4th level character is included in the Additional symbols, use the Additional symbol.

2 JIS-Compatible Kanji Plane1 (two-byte code table)

At the initial stage of multimedia broadcasting, the characters defined in the 1st to 84th row, which are included in the Kanji set provided in ARIB STD-B24, are defined here without changing the code points. If JIS 3rd level Kanji will be used in the future, the characters, which are defined in Kanji plane1 in JIS X0213: 2004, are defined here without changing the code points.

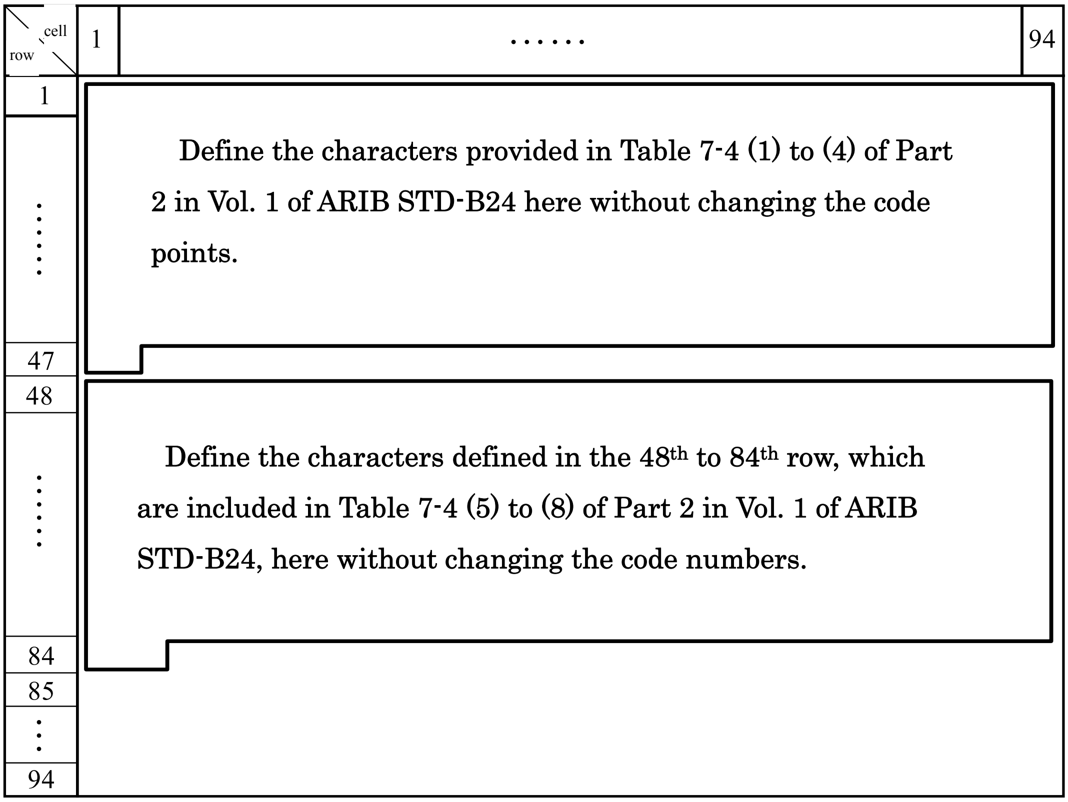


Fig. S3-1: Kanji Plane 1 Code Table (JIS 3rd level not used)

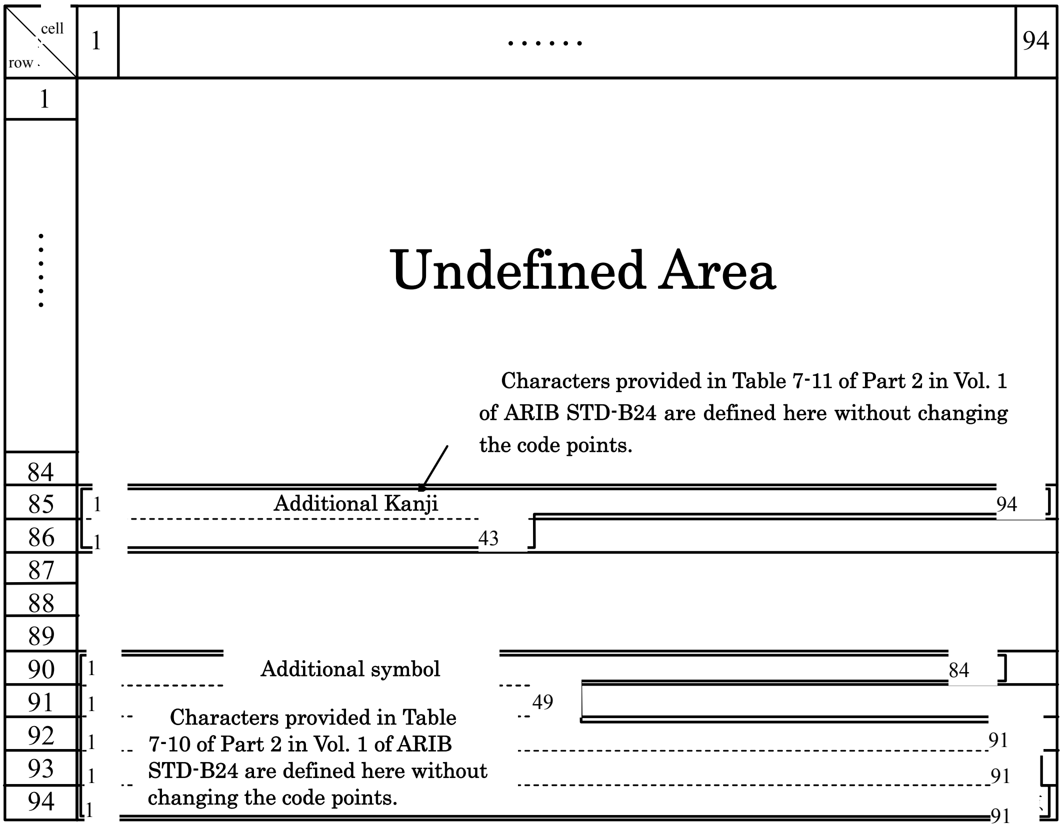
3 JIS-Compatible Kanji Plane 2 (two-byte code table)

The Kanji plane 2 is the plane (code table) used when JIS 4th level Kanji will be used in the future. The character sets and code points are defined here without changing the codes according to the characters defined in Kanji plane 2 in JIS X0213: 2004.

4 Additional Symbol (two-byte code table)

On the Additional symbol plane, the Additional symbols used in the existing text broadcasting and FM multiplex broadcasting, and new Additional symbol and Kanji that will be required as program information are defined.

The Additional symbols provided in Table 7-10 of Part 2 in Vol. 1 of ARIB STD-B24 and additional Kanji provided in Table 7-11 of Part 2 in Vol. 1 of ARIB STD-B24 are defined on this plane without changing the code points.



* For the details of VICS symbols, it is recommended to comply with Appendix (3) of ARIB STD-B3.
The fonts in the 90th row (excluding 45 to 63 and 66 to 84 cell) and 91st row were proposed by Vehicle Information and Communication System Center (VICS Center).

Fig. S3-2: Additional Symbol Code Table

<Blank Page>

Annex 4 Unified Operations and Display Requests

- Describe the program title and sub-title as a program title in "event_name_char" transmitted by the EIT short event descriptor.
- The maximum value of the program title is 40 wide characters (or 96 bytes).
- For 30-minute or shorter programs, use 20 wide characters or less generally.
- Describe the brief description on program in the program description, "text_char".
- The maximum value of the program description is 80 wide characters (or 192 bytes).
- Do not use linefeed codes for program titles.
- The program titles and series names may be used with Additional symbols such as N, 天, 字, and 二. Whether those symbols are used or not depends on each broadcaster. Therefore, when the Additional symbols N, 天, 字, and 二 are used as a search key to search a program attribute, the selected program may not have the attribute at all stations or cross-sectionally. It is recommended to use the information in other descriptors to judge the attribute.

<Blank page>

- How to place program titles (title and sub-title) and program descriptions are decided by broadcasters; therefore, they may include "Notice", "Program Contents", "Cast", "Segment Name", etc.

(Display Requests)

- Display "program title" exactly as possible.
- Use "..." to show there is more information clearly to viewers if it is difficult to display the whole list on the screen. Provide such design that the complete program titles can be displayed when selecting.
- Additionally, it is requested to display "program description” following "program title".

<Blank Page>

Annex 5 Assumed Item Titles

Item Titles (Reservation term)

Item titles (reservation term)	Assumed contents
Notice	Information including alternative program, cancellation, interruption, extension and changed schedule, notification of open program and panelist offering, inquiry, special information, etc.
Program Contents	Synopsis, series commentary, theme, segment, subject, matter special topic, match-up schedule, contest name, tournament name, highlight, subject, announcement, etc.
Cast	Cast, host, newscaster, reporter, analyst, commentator, announcer, play-by-play commentator, narrator, voice-over, interpreter, guests, etc.
Original Story/Script	Original story, script, serial magazine, scenario, translation, etc.
Direction	Director, technical director, editorial supervisor, producer, composition writer, CG staff, research staff, etc.
Music	Song title, music, singer, lyrics writer, composer, player, conductor, orchestra, theme song, insert song, theme music, etc.
Production	Production copyright, production cooperation, production year, production country, production place, research period, research location, location site, event place, event site, theater, playing field, etc.
Free Description ・ Keyword ・ Notice of gifts ・ Hot information ・ Inside story of program ・ Message from producer ・ Others	Others

<Blank Page>

Annex 6 Rules on Using Network Name, TS Name, and Service Name

	Usage standard
Network name	Describe a network name to identify the sender of radio waves based on the following. A common name that is unique in all stations is described in 2-byte characters in multimedia broadcasting.
TS name	Describe a brand name or a generally known service name by which viewers can identify the service provider of the TS that is being received. It is assumed that such names are displayed when the receivers make the viewers identify a TS (confirmation of the transmission TS for the EMM, etc.). Therefore, each TS must be named so that the viewers can identify a difference between the receiving TSs. The same TS name must not be used for a TS with a different TS-ID. Example: Channel 1, stream 2
Service name	Describe a service channel name. It is assumed that a service name is displayed on the channel list, etc., in the receivers. It is not intended that the receivers display a service name with a TS name. Therefore, the service name must be named so that the name distinguishes itself from other names. The same service name can be used for multiple services in the same TS (an example is provided in the section related to BS). Example: Live-1, Music-1

* In the three fields above, 10 two-byte or 20 one-byte characters can be described.

* Changing the transmitted names may cause confusion among viewers. The name should not be changed, except under unavoidable circumstances.

* The examples above are only for reference. Each broadcaster must decide the details.

<Blank Page>

Appendix

Appendix 1 Reference Material – PSI/SI Receiver Unit Guideline

1 Mandatory Process of PSI/SI

Since whether to use PSI/SI completely depends on the manufacturers, strictly, there is no mandatory process of PSI/SI. However, if the receiver units are designed for using PSI/SI, there are the rules that should be complied with to avoid malfunctions. This chapter explains the rules that should be followed on the assumption that the receiver units use the PSI/SI.

(1) The basic selection functions shall not be interrupted when any error occurs in SI.

Viewers should be always able to select the desired service using PSI only including NIT. Any error in SI should not interrupt channel selection using the PSI only. Channel selection using PSI only means that the viewers can select at least services (including switching TS) and the default components can be presented in the service.

The SI is not always transmitted in the same layer as that for the service; therefore, a part of SI may not be received when the service is received. Also, moving the mobile unit may cause SI not to be obtained. In this case, it is necessary to concern the same thing.

(2) Multi section transmission shall be supported.

Even when multi section PSI/SI is transmitted, the receiver units should be able to process all sections placed in the TS packet in accordance with the transmission rule.

(3) Discontinuous version numbers shall be able to follow

The receiver units should be able to judge as updated when the version number of sub-table is changed even if the version numbers are not serial. It is not necessary to detect immediately after the number is changed but it is required to be able to follow functionally.

(4) The transmitted information shall not be used for the different purpose from the transmission intention.

SI is transmitted for each purpose. Since the SI is presentation free, how it is used or presented to viewers depends on each manufacturer. But the users should use the SI according to each purpose.

(5) No malfunction shall be caused when the area obtained for future extension is used.

This rule is essential to extend the PSI/SI specifications smoothly in the future. To comply with the rule, there are two patterns of fields in syntax.

a Fields the receiver units cannot refer to:

Fields where the receiver units cannot process using any value. The following are examples:

- "reserved" and "reserved_future_use" fields in section syntax.
- "running_status" field in EIT and SDT
- "ISO_639_language_code" field

b Fields the receiver units should judge as invalid if other value than the specified value is described

In such fields, the values are provided in the current transmission operating rule, and it is possible that other values will be used in the future. If these fields are extended in the future, it is assumed that the receiver units before extention cannot use the fields. Conversely, the current receiver units should not specify the usage and cause any malfunction subsequently.

The following table shows how each field should become invalid.

Fields	Invalid range
current_next_indicator	If it is not set to '1', invalidate the received section itself.
service_type	The service with "service_type" that is not self-supported should not be presented to viewers. Accordingly, channel selection and displaying program table should not be available.
content_nibble user_nibble	If any value that is not self-supported is set, ignore the value only. However, if it is known in the large category only, it can be used in the large category only. If unsupported extension area is set, do not refer to "user_nibble" field.
stream_type	Do not select (present) the component in "stream_type" that is not self-supported.
stream_content	If any value that is not self-supported is described, ignore the value only. Therefore, do not present the existence of the described component.
component_type	
data_component_id	If "data_component_id" that is not self-supported exists, do not present the existence of the relative data component.
table_id	Do not use any table with "table_id" that is not self-supported. Even if the table (or sub-table) is self-supported, do not use the table that is not specified to transmit by the received TS in the operation rule. (Note)

descriptor_tag	If any value that is not self-supported is described, do not use the descriptor itself. Even if the descriptor is self-supported, do not use the descriptor placed in other descriptor loop than those specified to place the relative descriptor in the operation rule.

Note: The other tables in the NIT, SDT, and EIT are not used in multimedia broadcasting. Ignore the sections with their "table_id". Ignore other transport streams than the relative TS and sub-tables for other services than those used in the relative TS if any. They can be usually recognized by the NIT transmitted by the TS.

(6) Characters shall be correctly displayed according to the binary code where the character codes are described.

Controls codes such as linefeed code should be correctly interpreted based on the rules on transmission. Do not modify the contents for the receiver unit's convenience. Regarding the character string length, it is possible to add linefeeds based on the display area, cut the character string and add some characters to show "continued".

2 Rules for Reception Processing for Each Table and Error Process

2.1 Common Rules (Section Header and Descriptor Header)

With regard to receiving PSI/SI sections, it is important to interpret section headers correctly. At the stage of receiving the section correctly with the section header, the analysis process for the internal section can be performed. Normally, a descriptor loop exists in the section and descriptor also has the descriptor header syntax; therefore, there is a common rule on receiving process.

The rules for reception processing (especially error process) for section header and descriptor header are shown below:

Rules on Error Process for Section Header	
table_id	If any value that is not self-supported is described, do not use the received section. Even if the value in "table_id" is self-supported, do not use the section that is not specified to transmit by the received TS in the operation rule.
section_syntax_indicator	If it is not set to '1' in the MPEG extended section, do not use the section itself.
section_length	If the value is not within the range limited by syntax structure for each "table_id" and operation, do no use the section itself. If the value is not correct, normally an error occurs during the CRC check.

table_id_extension	Regarding this field, a purpose of use is determined for each table type; therefore, for the rule on error process, see the chapter for each table.
version_number	
current_next_indicator	If it is not set to '1', do not use the section itself.
section_number	
last_section_number	
descriptor_tag	If any value that is not self-supported is described, do not use the relative descriptor for any purpose. Even if the value in "descriptor_tag" is self-supported, do not use the descriptor received by other descriptor loop than those specified to place the relative descriptor in the operation rule.
descriptor_length	It is possible to cut the byte sequence of the descriptor using the value in this field but this process should be performed comparing with the length of descriptor loop in the section syntax.

[Process Rule on Section]

The analysis process for internal section can be performed after the bit sequence received according to "section_length" field is cut, CRC check is performed, all fields are checked for each table, then it is confirmed that the section is valid. For judging if the section is valid, see the chapter for each table.

If the section is invalid, do not use the section for any purpose as if the section is never received. For example, if PAT is received and "section_syntax_indicator" is set to '0', discard the received PAT immediately and judge that the PAT has never been received.

The analysis process of the receiver unit is performed not by section unit but by slightly bigger semantically-group unit. For example, when NIT is received, the section where "section_number"='1' is not correctly received while "last_section_number"='1'. In this case, all sections including the section where "section_number"='0' should be discarded. However, in case of EIT, etc., the partially received sections can be used. In this case, care should be taken not to influence other processes.

The following are the filed to be referred to constitute a sub-table for each table type. The sections with the same fields described below belong to the same sub-table. (The sub-tables for PAT, PMT and CAT*1 are constituted by 1 section.)

* Sub-table for CAT does not exist since CAT is private section type; therefore, sub-table = table.

For TOT, there is no conception of sub-table (since section type is different).

Table type	Fields to identify sub-tables
PAT	table_id / transport_stream_id / version_number
PMT	table_id / program_number / version_number
CAT	table_id / version_number*1
NIT	table_id / network_id / version_number
BIT	table_id / original_network_id / version_number
SDT	table_id / transport_stream_id / original_network_id / version_number
EIT*2	table_id / service_id / transport_stream_id / original_network_id / version_number

*1 In CAT, the whole table is regarded as one sub-table.

*2 The EITs with the same "table_id" can transmit the different information using the different PID; therefore, it is necessary to check the PID before processing.

[Process Rule on Descriptor]

The descriptor is identified by descriptor header, and the bit sequence in the descriptor loop is cut. The bit sequence is cut based on the value in "descriptor_length" field. Even if the different value from the "descriptor_length" value assumed based on the descriptor syntax is described, cutting should be performed based on the described value. In this case, check the length of the relative descriptor loop (assumed for each section syntax), and do not exceed the length when cutting. Such case occurs only at an abnormal state, but it is still a required process to avoid influencing out of the descriptor loop.

It is required to analyze the descriptor in each syntax defined for each descriptor tag. At this time, an invalid or abnormal state may occur due to the description in each field.

The invalid state occurs when the value that is not self-supported is described in the field. In this case, do not analyze the descriptor itself as if the descriptor does not exist. In consideration of the future extension, this case can easily occur; therefore, it is necessary to try not to recognize for the unsupported receiver units.

The error state occurs when the described bit sequence is not compatible with the syntax structure after the descriptor is recognized and it is analyzed based on the syntax. The error is caused when the descriptor length is inconsistent with the length in the descriptor syntax. In this case, ignore the contents of the relative descriptor, and consider to provide functional limitations as necessary. However, these limitations should not influence the function of channel selection.

Additionally, the error state occurs, for example, when there is the overlapping time between "start_time" and "duration" after "start_time" and "duration" of the events that belong to the same sub-table in EIT are interpreted. Accordingly, the error state occurs if there is any difference among the fields that are correlated.

Character string fields often exist in descriptors. If the length of character string exceeds the maximum length (number of characters or bytes) provided in the operation rule, ignore the part exceeding the maximum length. In other words, if the length of the character string field exceeds the maximum number of bytes or characters, the character string can be cut at the stage of processing and displaying. However, do not perform any process that may influence other information. It means that the whole descriptor unit should be processed as normal.

The following chapters explain the receiving/storing process guideline and analysis process guideline focusing on error process by tables.

2.2 PAT

2.2.1 Purpose of use

- It is used to obtain PMT PID for the target services.
- It is used to understand the currently being broadcasted services in the selected TS.

2.2.2 Receiving/storing process

The PAT for the receiving TS should always receive the latest information. "version_number" field can be used to judge if the contents are updated. If the value in "version_number" does not change while observing, it can be judged that the contents in the PAT are not changed. However, the values in "version_number" may not be serial due to failure at the playout systems; therefore, care should be taken to avoid that the PAT cannot be received after the failure.

2.2.3 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
PAT	0x0000	table_id	0x00
		section_syntax_indicator	1
		current_next_indicator	1
		section_number	0

In addition, if the value in "section_length" is not correct from the view of the syntax structure, the received section should be also discarded and processed as if the section cannot be received.

If the PAT cannot be obtained or the section is not valid, judge that the relative frequency cannot be received at the time. Therefore, there is no need to decode all services transmitted with this frequency.

Even if the description is not compatible with that in the NIT, it is not regarded as error. During the off service, the service described in the NIT may not exist in the PAT. Or if the service not described in the NIT exists in the PAT (usually, this case does not occur), it is safe to ignore.

2.3 PMT

2.3.1 Purpose of use

- It is used to decode the components for the selected services.

2.3.2 Receiving/storing process

The PMT for the selecting service should always receive the latest information. "version_number" field can be used to judge if the contents are updated as well as PAT. However, the values in "version_number" may not be serial due to failure at the playout systems; therefore, care should be taken to avoid that the PMT cannot be received after the failure. If the latest PMT for the selecting service is cached in the receiver unit before using, the response rate such as switching components can increase. It is not necessary to receive/analyze the PMT for the services that are not selected.

There is no direct relationship between updating PMT and event segment. For example, the PMT can be updated during the event, or PMT may not be updated among the events. If the process requires the event segment, EIT[p/f] should be used. The PMT should be updated without relation to the events.

It takes 500 ms for re-transmitting a service that uses a partial reception layer and a 1-segment broadcast service. The time is longer than the time taken for retransmitting the service using another layer. It also takes time to decode simple video. Therefore, it is desirable to shorten the time to present a video by storing PMTs. To use the stored PMT, there is the limitation on the PID operation of elementary stream for the service. For the details, see Vol. 7.

2.3.3 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
PMT	PAT indirect designation	table_id	0x02
		section_syntax_indicator	1
		program_number	Value described in the PAT as "program_number" for the relative PID
		current_next_indicator	1
		section_number	0

After it is confirmed that the section is correctly received, the received section is analyzed. When analizyng the PMT section syntax except for the section headers, care should be taken for following:

● "stream_type" field

If the value that is not self-supported is described in "stream_type", do not interpret the relative loop. Skip the descriptor loop according to the value in "ES_info_length".

● "program_info_length" and "ES_info_length" field

If the values in "program_info_length" and "ES_info_length" are not compatible with that in "section_length", judge that the received section has error. Accordingly, process as if the PMT cannot be received.

● Number of second descriptor loops of PMT

If the described number of the second descriptor loops of PMT is above the upper limit of elememtary stream count, the elementary stream with the upper limit value or lower should be normally processed in order of description.

If the PMT cannot be received more than 1000ms (any service other than partial reception and 1-segment broadcast service)/2000ms (partial reception service and 1-segment broadcast), or the valid section cannot be received, judge that the relative service is off service or unreceivable. Therefore, there is no need to decode the relative service.

[Descriptor]

When analyzing the descriptor fields for the PMT, care should be taken for the following:

■ Process for Descriptor Placed in the First Descriptor Loop of PMT

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)

Conditional access descriptor	Decoding of the selecting program can be stopped.
Digital copy control descriptor	Contents can be outputted for copying on the assumption that the descriptor does not exist. Do not influence the decoding process for the selecting program. Since the content availability descriptor functions only in combination with the digital copy control descriptor, ignore the content availability descriptor.
Content availability descriptor	Process can be performed on the assumption that the descriptor does not exist.
Emergency information descriptor	It can be judged that emergency warning broadcasting or emergency warning signal test is not broadcasted.
Data broadcast ID descriptor	The processing can be performed providing that the descriptor does not exist.

■ Process for Descriptor Placed in the Second Descriptor Loop of PMT

The process should be implemented so that it cannot influence out of the relevant elementary stream, basically.

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
Conditional access descriptor	Decoding of the relative component can be stopped.
Stream identifier descriptor	Process can be performed on the assumption that the stream identifier descriptor does not exist. It may not be able to relate the EIT. If the relationship between the values in "component_tag" and "stream_type" is different from that provided, the same process should be performed.
Digital copy control descriptor	Content can be outputted for copying on the assumption that the descriptor does not exist. Do not influence the decoding process for the selecting component.
Video decode control descriptor	Process can be performed on the assumption that the descriptor does not exist.
Data component descriptor	Process can be performed on the assumption that the descriptor does not exist. Accordingly, there is no need to decode the data broadcasting service.

2.4 CAT

2.4.1 Purpose of use

The CAT is used for the following purposes:

- Obtain "EMM_ PID" transmitted in the TS.
- Obtain the display control information on Automatic display of message for the services in the TS.

2.4.2 Receiving/storing process

The CAT is not the type of table where the contents are often changed, but it is still recommended to receive the latest CAT as long as the CAT is transmitted to the TS for the selected station. In this case, "version_number" field can be used to judge if the contents are updated. However, as well as other tables, the values in "version_number" may not be serial due to failure at the playout systems; therefore, care should be taken to avoid that the CAT cannot be received after the failure.

The PID for EMM stream in the TS is not generally changed; therefore, the received information can be stored in the receiver units by TS to use. It means it is possible to receive the EMM stream directly without waiting for the CAT reception. However, it is required to obtain the latest CAT and check if the contents are not changed.

2.4.3 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
CAT	0x0001	table_id	0x01
		section_syntax_indicator	1
		current_next_indicator	1
		section_number	0

[Descriptor]

When analyzing the descriptor fields for the CAT, care should be taken for the following:

■ Process for Descriptor Placed in the CAT Descriptor Loop

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
Conditional access descriptor	Process can be performed on the assumption that the descriptor does not exist. Therefore, there is no need to obtain the EMM stream.
CA service descriptor	Process can be performed on the assumption that the descriptor does not exist. Therefore, do not start displaying the Automatic display of messages in the target services.

2.5 NIT

2.5.1 Purpose of use

The NIT is used for the following purposes:

- Identify a network in multimedia broadcasting.
- Identify the networks and TS uniquely.
- Use for identifying a network in multimedia broadcasting.
- Obtain the TS structure in the network and service structure for each TS.
- Obtain the TS name, the number of layered transmissions, the transmission parameter type for each layer, and the service configuration of each layer in a TS in a received network.

2.5.2 Receiving/storing process

2.5.3 Receiving/storing process in portable receiver

As multimedia broadcasting is defined as being transmitted via a common network, the NIT transmitted from each master is a common NIT. All frequencies for multimedia broadcasting can be obtained without scanning them by obtaining the NIT transmitted from an optional master.

It is recommended to update the NIT to the latest status by checking the version_number of the NIT regularly because the NIT information, including the service configuration, may be changed. All frequencies do not need to be scanned. It is necessary to scan only the network preset in a receiver as a receivable network.

If a problem is found, such as if a radio wave cannot be received and if the NIT cannot be obtained, while scanning, the network must not be removed from the receivable network list, as there is a case where the radio wave for the network may be stopped. A new network should be added or deleted after checking if the viewer will perform a scan again, in order to avoid confusion for the viewer.

The cycle of the NIT is described in the SI transmission parameter in the first loop of the BIT (all-station applied transmission parameter part). Therefore, the cycle of the NIT cannot be known until the BIT is received. However, the cycle of the NIT is common to multimedia broadcasting, excluding the period when the all-station applied transmission parameter is changed. In addition, the cycle of the NIT rarely changes. It is not always true that the cycle of the NIT does not change. The cycle of the all-station applied transmission parameter may be different per network. By taking these situations into account, it is necessary to be prepared to obtain the NIT in the case where the cycle of the NIT is different from that of the all-station applied transmission parameter.

The content of the NIT is not frequently changed. However, the stored NIT may be very old if power has not been supplied for a long time or if only a specific network has been received as the power has been turned on for a long time. In order to avoid such a problem, it is desirable to update the NIT by obtaining the latest NIT after a network is moved to tune the service. The version_number should not be relied on because the numbers may have just completed circulating one cycle. The NIT version_numbers are not necessarily synchlonized among different TSs. In order to know whether the content of the NIT has been changed, the content must be checked.

While tuning the network, the content of the NIT, such as the service configuration and the layer belonging to the service, may be changed. Therefore, though it is not necessary to constantly monitor the NIT, it is necessary to always check whether the content has been updated. While checking, if the version_number has not changed, then the content of the NIT can be considered unchanged. However, it is not always true that the content has changed because the version_number has changed. As stated earlier, in order to know whether the content of the NIT has been changed, the content must be checked. In addition, the version_number may not change consecutively due to an error in transmission equipment or other reason. Caution should be paid so as to prevent failure in receiving the NIT after that.

2.5.4 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
NIT	0x0010	table_id	0x40
		section_syntax_indicator	1

		network_id	Same value as "TS_id" obtained from PAT
		current_next_indicator	1
		section_number	≤ last_section_number

For a safe process, note that the NIT is not valid until all sections structuring sub-table are received. If one or more of the sections structuring sub-table (from the section where "section_number" = '0' to the section indicated by "last_section_number") is not received, the process should be performed on the assumption that the relative sub-table for NIT cannot be received.

In this case, it is recommended to use the already stored old information to do everything. Normally, the assignments of frequencies and TS, and locations of services and layers are not often changed. In consideration of the above natures, it is recommended to switch the network and TS based on the (old) NIT in the meantime and judge the included services using the PAT. At the time, if there is any inconsistency between the NIT and PAT, set the compatible services to be selectable. The NIT can directly influence the channel selection function. If the sub-table cannot be structured as mentioned above, the corrected contents may be transmitted immediately; therefore, it is recommended to obtain the updated NIT as soon as possible.

If the NIT has not been received and stored, judge that the relative network cannot be received. In this case, there is no need to decode all services within the network.

When analyzing the NIT section syntax except for the section headers, care should be taken for the following:

● "network_id", "original_network_id" and "TS_id" fields

The same value is always set to the network_id and original_network_id in multimedia broadcasting. If the TS_id value obtained from the NIT is different from the TS_id value obtained from the PAT, then it is preferable that the TS is not processed as the TS for an applicable network.

● "length" fields

If there is an inconsistency between the values in "network_descriptor_length", "transport_stream_loop_length" and "transport_descriptors_length", and the value in "section_length", judge that there is an error in the received section. Thus, since the sub-table cannot be completed, the process should be performed on the assumption that the relative sub-table of the NIT cannot be received.

[Descriptor]

When analyzing the descriptor fields for the NIT, care should be taken for the following:

■ Process for Descriptor Placed in the First Descriptor Loop of NIT

It is generally allowed that the whole network may be influenced, but the influence should be limited within the descriptor as possible.

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
Network Name Descriptor	Mandatory descriptor. The influence should be limited to the extent that the network names become unavailable.
System Management Descriptor	Mandatory descriptor. Since the relative network cannot recognize multimedia broadcasting, judge that the relative network cannot be received. There is no need to decode all services within the network.
Link descriptor	It can be considered that the descriptor does not exist. It is not necessary to perform INT reception processing.

■ Process for Descriptor Placed in the Second Descriptor Loop of NIT

The process should be implemented so that its influence can be limited within the relative TS.

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
Service List Descriptor	Mandatory descriptor. There is no need to receive the relative TS itself. (Process should be performed on the assumption that no services exist in the relative TS.)
Terrestrial Delivery System Descriptor	Mandatory descriptor. But since it is not sufficiently meaningful, there is no need to use this descriptor for processing.
TS Information Descriptor	Mandatory descriptor. There is no need to receive the relative TS itself. (Process should be performed on the assumption that no services exist in the relative TS.)
Partial Reception Descriptor	Care should be taken not to cause an error by receiving the relative TS.
Connected Transmission Descriptor	Indicate that connected transmission is not performed.

2.6 BIT

2.6.1 Purpose of use

The BIT is used for the following purposes:

● Obtain the relationship between services and multimedia broadcasters in order to implement the functions by multimedia broadcaster unit. The function include series and EPG using individually operated SI which is a type of Basic delivering EIT type.

● Obtain the all-station/each-station applied transmission parameter.

2.6.2 Receiving/storing process

2.6.2.1 Receiving/storing processing using portable receivers

Like NIT, BIT is a table that is common to all stations. The cycle that is necessary to obtain the SI, etc., is described in the BIT. As the content of the BIT rarely changes, the BIT can be used by storing/managing it in non-volatile memory or other device.

It is recommended to update the BIT to the latest status by scanning a receivable network regularly, as in the case of the NIT, because the information, such as the parameter for the cycle that is necessary to obtain the SI, including the all/each-station applied transmission parameter, is described in the BIT and because such information may be changed.

As in the case of the NIT, the cycle of the BIT is described in the all-station applied transmission parameter part of the BIT. Therefore, the transmission cycle cannot be known until the BIT is received. In this case, as in the case of the NIT, it is necessary to be prepared to obtain the BIT in the case where the cycle of the BIT has been changed or where the all-station applied transmission parameter is different among networks.

The content of the BIT is not frequently changed. However, the stored BIT may be very old if power has not been supplied for a long time or if only a specific network has been received as power has been turned on for a long time. In order to avoid such a problem, it is desirable to update the BIT by obtaining the latest BIT after a network is moved to tune the service. The version_number should not be relied on because the numbers may have just completed circulating one cycle. In order to know whether the content of the BIT has been changed, the content must be checked.

While tuning the network, the content of the BIT, such as the SI transmission parameter, may be suddenly changed. Therefore, as in the case of the NIT, though it is not necessary to constantly monitor the BIT, it is necessary to always check whether the content has been updated. While checking, if the version_number has not changed, then the content of the BIT can be considered unchanged. However, it is not always true that the content has changed because the version_number has changed. As stated earlier, in order to know whether the content of the BIT has been changed, the content must be checked. In addition, the version_number may not change consecutively due to an error in transmission equipment or other reason. Caution should be paid so as to prevent failure in receiving the BIT after that.

2.6.3 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
BIT	0x0024	table_id	0xC4
		section_syntax_indicator	1
		original_network_id	The network_id that identifies multimedia broadcasting
		current_next_indicator	1
		section_number	≤ last_section_number

For a safe process, note that the BIT is not valid until all sections structuring sub-table are received. If one or more of the sections structuring sub-table (from the section where "section_number" = '0' to the section indicated by "last_section_number") is not received, the process should be performed on the assumption that the relative sub-table for BIT cannot be received. In this case, it is recommended to use the already stored old information to do everything. In some cases the selection station function is influenced by the table. If the sub-table cannot be structured as mentioned above, the corrected contents may be transmitted immediately; therefore, it is recommended to obtain the updated BIT as soon as possible.

If the BIT cannot be received and stored, then the following unavoidable problems will occur: the SI that is transmitted via an applicable network cannot be obtained, and services, such as independent data broadcasting using the multimedia broadcasting broadcaster ID and affiliation identifier, cannot be decoded.

After it is confirmed that the section is correctly received, the section is analyzed. When analyzing the BIT section syntax except for the section header, care should be taken for the following:

- If there is an inconsistency among the values in "first_descriptors_length" and "broadcaster_descriptors_length" and the value in "section_length", judge that there is an error in the received section. Thus, since the sub-table cannot be completed, the process should be performed on the assumption that the relative sub-table of the BIT cannot be received.

[Descriptor]

When analyzing the descriptor fields for the BIT, care should be taken for the following:

■ Process for Descriptor Placed in the First Descriptor Loop of BIT

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
SI Parameter Descriptor	Even if an only part of syntax has an error, the descriptor itself should not be interpreted. In the worst case, it is inevitable that the SI used by the all-station applied transmission parameter including the commonly operated SI cannot be received. But it is recommended to receive the SI using the stored SI parameter descriptor or under the default setting, provided that a fatal situation should not be caused by the different transmission from the assumed one.

■ Process for Descriptor Placed in the Second Descriptor Loop of BIT

The process should be implemented so that its influence can be limited within the relative terrestrial broadcaster.

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
SI Parameter Descriptor	Even if an only part of syntax has an error, the descriptor itself should not be interpreted. It is inevitable that the SI used by the each-station applied transmission parameter of the relative Terrestrial broadcaster cannot be received. It is possible to try to receive the SI using the stored SI parameter descriptor, provided that a fatal situation should not be caused by the different transmission from the assumed one.
Service List Descriptor	It is not necessary to receive an applicable TS because this is an inevitable descriptor (the TS can be processed as a stream without any services).

2.7 SDT

2.7.1 Purpose of use

The SDT are used for the two main purposes.

- Present the service name.
- Refer to the default values for viewing/recording limitations for each event.

The latter purpose is important to the receiver units that support the reservation by event unit. (The viewing/recording limitations for channel selection are described in PMT.) Therefore, it is recommended that the receiver units that support the reservation by event unit can handle the SDT.

The SDT is also used to identify whether or not the EIT (N-EIT, M-EIT, and W-EIT) and EIT[p/f] is transmitted to the respective layered transmission service.

As a rule, all broadcasters must transmit the EIT[p/f].

2.7.2 Receiving/storing process

2.7.2.1 Receiving/storing process using portable receivers

The SDT is divided into sub-tables by TS unit. However, in multimedia broadcasting, only one sub-table of the SDT is transmitted per master because each master uses one TS. The SDT can use only an original TS and cannot obtain another master's SDT. Therefore, it is necessary to scan all receivable networks in order to obtain the SDTs of all services.

The receivers obtain/storage the SDTs based on the non-volatile memory size for storage and implemented functions as necessary.

The contents of SDT are not often changed, but they may be changed when the service structure and the layer structure within the TS are changed. In this case, the NIT is changed at the same time. Thus, when the changed service structure and layer structure of the NIT is detected, it is preferable to obtain the SDT at the same time. However, note that the NIT and SDT may not be compatible during transition before/after a change is made. Under such situation, it is still necessary to use the NIT information for the service structures within the TS.

In addition, the version of the SDT may be updated when starting to transmit the EIT, stopping the transmission, etc. The influence on the receivers' operation is not as significant as when updating the NIT. However, it is desirable to obtain the SDT as quickly as possible in order to reflect the transmission intention of the broadcaster.

2.7.3 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
SDT	0x0011	table_id	0x42
		section_syntax_indicator	1
		transport_stream_id	The value that corresponds to the TS_id described in a PAT
		current_next_indicator	1
		section_number	≤ last_section_number

		original_network_id	The network_id that identifies multimedia broadcasting

For a safe process, note that the SDT is not valid until all sections structuring sub-table are received. If one or more of the sections structuring sub-table (from the section where "section_number" = '0' to the section indicated by "last_section_number") is not received, the process should be performed on the assumption that the relative sub-table for SDT cannot be received.

If the SDT is not received, it is recommended to display the service list and program table using the stored SDT information if any.

If the SDT has not been stored, however, it is inevitable that, regarding the services within the relative TS, the program table present function using the EIT becomes unavailable since the EIT within the relative TS cannot be received.

Even though the SDT cannot be received and has not been stored, the channel selection function should not be influenced.

After it is confirmed that the section is correctly received, the received section is analyzed. When analizyng the SDT section syntax except for the section headers, care should be taken for following:

● "service_id" field

"service_id" field correlates with the service list described in the NIT. Although the service where "service_type" = "0xA4" (engineering service) is not described in the SDT, other services are described in the SDT; therefore, it can be judged that the SI information on the incompatible service is invalid. However, the functions such as channel selection should be performed in accordance with the NIT.

● Transmission flag per EIT[p/f] and EIT type
(EIT_present_following_flag/N-EIT_flag/M-EIT_flag/W-EIT_flag field)

The transmission flag of each EIT and EIT[p/f] is related to the layer information of the service described in the NIT. A unique basic delivering EIT type is defined based on the transmission parameter type of the service described in the NIT, then transmission of the EIT type is mandatory. Accordingly, if the transmission flag for EIT[p/f] ("EIT_present_following_flag") is set to '1', the flag for the basic delivering EIT type should be also set to '1'. If they are not compatible, judge that the EIT for the relative service is invalid (not transmitted).

Since the basic delivering EIT type with the higher resistance than that for the service layers are not transmitted, ignore such EITs even though they are set to '1'. The type of an EIT (N-EIT/M-EIT/W-EIT) is identified based on the transmission parameter type of the service described in the NIT.

● "running_status" field

Ignore this field since it is not used.

● "descriptor_loop_length"

If the values in "descriptor_loop_length" and "section_length" are not compatible, judge that the received section has any error. Thus, since the sub-table cannot be completed, the process should be performed on the assumption that the relative sub-table of the SDT cannot be received.

[Descriptor]

When analyzing the descriptor fields for the SDT, care should be taken for the following:

■ Process for Descriptor Placed in SDT Descriptor Loop

In general, the process should be implemented so that its influence can be limited within the relative service.

The descriptors not described below should not be described. Ignore them if any.

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
Service Descriptor	Mandatory descriptor. The influence should be limited to the extent that the service names become unavailable.
Digital Copy Control Descriptor	It is inevitable that the functions such as scheduling of recording for all events in the relative service become unavailable.
CA Contract Info Descriptor	It is inevitable that the functions such as program reservation for the events in the relative service become unavailable.

2.8 EIT

2.8.1 About EIT

2.8.1.1 Relationship between EIT and receivers

In multimedia broadcasting, a service may be transmitted using a maximum of three layers. Therefore, three EITs with different PIDs are transmitted because the EIT cannot be transmitted with the same PID using multiple layers. In this case, each EIT simply uses a different layered transmission, and a receiver can reference the EIT in every layer (for details, see Section 12.1).

2.8.1.2 Determination of a receivable EIT

The transmitted EITs may vary depending on the layer service. Which EIT is transmitted to which layer service can be identified based on the combination of the EIT type delivering flag (N-EIT_flag/M-EIT_flag/W-EIT_flag) of the SDT and the EIT_present_following_flag.

It is also true that the reception of a transmitted EIT is not always successful. As a reason for this, a layer in which EITs are transmitted cannot be demodulated due to a bad radio wave environment, etc.

The following table shows the relationship between an EIT and a layer in which the EIT is transmitted.

EIT	Transmission layer
N-EIT	Low protection layer
M-EIT	High protection layer
W-EIT	Partial reception layer

Originally, the receivers can receive all EITs. However, it cannot be known beforehand whether or not an EIT can really be received when radio wave conditions are bad, etc. The receivers need to be designed so that they process after they try to receive an EIT and can receive it.

2.8.2 Determination of the SI transmission parameter of the EIT

Whether or not each EIT is transmitted is specified per TS, however, the SI transmission parameter, such as the transmission range of each EIT and a repetition rate group, is the same regardless of the service. This means that the SI transmission parameter is determined based on the EIT. Therefore, receivers simply receive/store the EIT.

2.8.3 EIT[p/f], EIT[p/f after]

2.8.4 Purpose of use

- The EIT is used to know the start and end time of an event that is currently being broadcast, broadcast in the next program, and broadcast after the next program.

  It is recommended to schedule a viewing/program recording by referencing the EIT for the service layer.

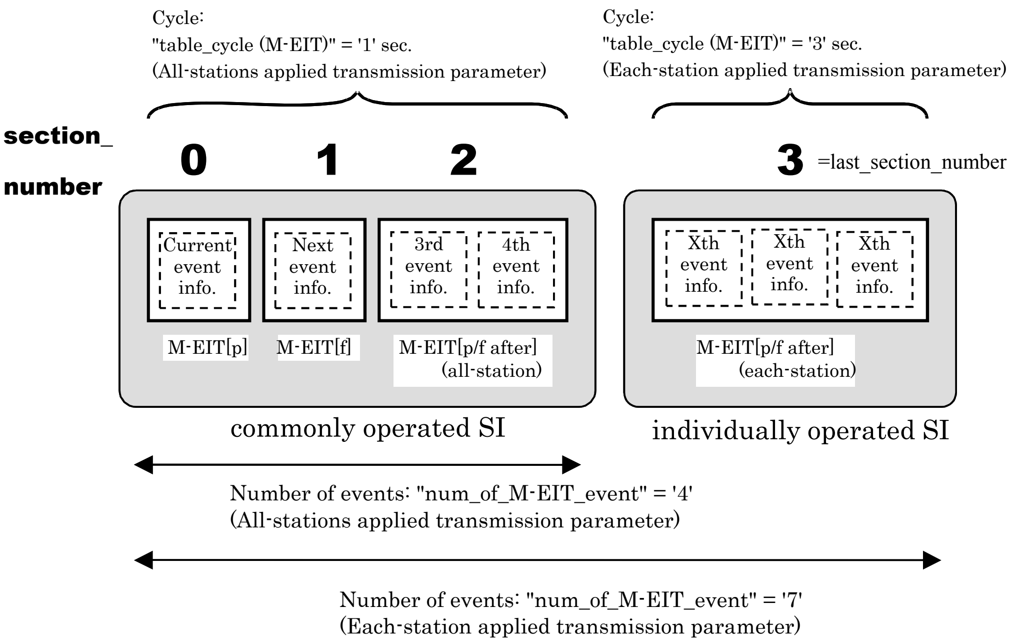
- These are used to obtain information about programs from the current program to a maximum of 9 successive programs (a maximum of 10 programs, including the current program).

- If there is any inconsistency between the EIT and the event information obtained from the EPG/ECG metadata stored in a receiver, the EIT can be used by merging it with the event information stored in the receiver. However, caution should be applied when merging because the data amount may differ between the EIT and the event information obtained from the EPG/ECG metadata.

2.8.5 Receiving/storing process

The figure below shows the mapping to the EIT[p/f] and EIT[p/f after] sections and the relationship between the all-station applied transmission parameter and the each-station applied transmission parameter (the figure shows an example of M-EIT).

Note: The parameters in the following figure are only an example. The figure shows the arrangement in the section in case of such parameter values.



Reception should be performed in receivers according to the following rules.

- When transmitting an EIT[p/f], the section_number must be set to 0 or 1 in the EIT[p/f]. If only one event is described in one section and if the current or next event does not exist (is stopped), the section becomes an empty section with the section header only.

  The re-transmission cycle is indicated in the table_cycle (N-EIT/M-EIT/W-EIT) for the all-station applied transmission parameter.

- EIT[p/f after] is transmitted by setting the section_number from 2 to 3 as necessary. Multiple events are described in one section.
- The number of events transmitted as the commonly operated SI is determined by referencing the num_of_N-EIT_event, num_of_M-EIT_event, and num_of_W-EIT_event of the

all-station applied transmission parameter part. However, it is not always true that the number of events described in the num_of_N-EIT_event, num_of_M-EIT_event, and num_of_W-EIT_event is transmitted. Sometimes, the number of events transmitted in the EIT[p/f after] may be 0. However, the number of events transmitted does not exceed the number of events described in the num_of_N-EIT_event, num_of_M-EIT_event, and num_of_W-EIT_event.

- The events after the next event are transmitted as the commonly operated SI when the section_number of the EIT[p/f after] is set as follows: section_number ≥ 2. However, the events after the next event may not be transmitted. The relationship between the number of events transmitted as the commonly operated SI and the section_number transmitted as the commonly operated SI is uniquely determined as shown in the table below. Reception should be performed based on the table.

num_of_N-EIT_event num_of_M-EIT_event num_of_W-EIT_event (all-station applied transmission parameter)	EIT[p/f after] transmission
0, 1	Abnormal status; this status indicates that the EIT[p/f after] is not transmitted.
2	The EIT[p/f after] of the commonly operated SI is not transmitted. (Even if the EIT[p/f after] has been transmitted, the events of the commonly operated SI are not included within it.)
≥3	The EIT[p/f after] for the commonly operated SI is transmitted by setting as follows: section_number ≥ 2. Even if the number of events transmitted in the EIT[p/f after] is 0, the setting, section_number = 2, is always transmitted (empty section).

The transmission cycle of the individually operated SI in the EIT may be slower than that of the commonly operated SI in the EIT. Therefore, if it is necessary to receive the commonly operated SI in the EIT more quickly, it can be received in a shorter time by using the rules above so as to receive only the commonly operated SI part by specifying the section_number.

- The events for which the number exceeds the number of events transmitted as the commonly operated SI are identified as the events transmitted as an individually operated SI.

Whether or not the events in the individually operated SI are transmitted are determined by checking that the num_of_N-EIT_event, num_of_M-EIT_event, or num_of_W-EIT_event of the each-station applied transmission parameter is greater than the num_of_N-EIT_event, num_of_M-EIT_event, num_of_W-EIT_event of the all-station applied transmission parameter.

The last section number of the EIT[p/f after] cannot be known before receiving it because the number can be known only in the last_section_number of the EIT. Therefore, the EIT[p/f after] of the individually operated SI cannot be received by specifying the section_number. However, the EIT[p/f after] can be received if the commonly operated SI of the same version_number has been received.

- If the cycles of the commonly operated SI and individually operated SI in an EIT are the same, the event in the commonly operated SI and the event in the individually operated SI may be transmitted in the same section of the EIT[p/f after]. In this case, it is not necessary to receive the EIT[p/f after] of the individually operated SI after receiving the EIT[p/f after] of the commonly operated SI.

Whether or not they are transmitted in the same section (whether or not it is necessary to obtain the section in the EIT[p/f after] in order to obtain the event in the individually operated SI) can be determined by referencing the last_section_number of a section in the obtained EIT.

2.8.5.1 Analysis process

[Section]

Whether the received section is valid or not can be judged based on the following table:

The sections with invalid values for the fields in the following table are invalid. Discard them immediately.

table	PID	Section header field	Field value for section valid
EIT	N-EIT =0x0012 M-EIT =0x0026	table_id	0x4E
		section_syntax_indicator	1
		service_id	Value in the currently selected TS in the NIT
		current_next_indicator	1

	W-EIT =0x0027	section_number	A value that is 3 or less and the last_section_number or less
		last_section_number	A value from 1 to 3
		transport_stream_id	Value equal to TS ID for the currently selected TS
		original_network_id	The network_id that identifies multimedia broadcasting

The transmission and definition of EIT can be divided by the following units. Use the following units to analyze.

- EIT[p/f]
- EIT[p/f after] (Range of all-station applied transmission parameter)
- EIT[p/f after] (Range of each-station applied transmission parameter)

If the EIT[p/f] is not received, it is allowed that, regarding the relative service, the functions using the EIT such as performing reserved program/viewing, displaying the channel banner or displaying the program table become unavailable. It is possible to use the stored old information or EIT[p/f after], but the correct operation is not guaranteed. In this case, it is required to adjust so that other services cannot be influenced.

If the EIT[p/f after] is not received, it is allowed that the functions using the EIT[p/f after] such as displaying the program table (program list) become unavailable. However, it is required to adjust so that functions using EIT[p/f] cannot be influenced.

After it is confirmed that the section is correctly received, the received section is analyzed. When analizyng the EIT section syntax except for the section headers, care should be taken for the following:

● "segment_last_section_number" and "last_table_id" fields

Ignore this field since it has no meaning.

● Event loop count

The maximum event loop count is 1 if "section_number" = '0' or '1'. Ignore the loop with the higher count than the maximum.

● "start_time" and "duration" fields

For the relationship among "start_time", "duration" and the current time, see Chapter 18 of this document. Table 18-1 shows the error conditions. No specific rules on such error process are provided.

● "descriptors_loop_length" field

If the values in "descriptors_loop_length" and "section_length" are not compatible, judge that there is an error in the received section.

[Descriptor]

Descriptor	Process for descriptor error/invalidity (including the case that the mandatory descriptors are not placed)
Short Event Descriptor	Mandatory descriptor. The influence should be limited to the extent that the event names and program descriptions become unavailable.

2.9 TOT

2.9.1 Purpose of use

- TOT is used to obtain the correct JST and correct the internal clock in the receiver units.
- When the summer time is applied in the future, it is used to obtain the changing date and time and correction time.

2.9.2 Receiving/storing process

The receiver units that can mount the internal clock can receive the TOT and perform the correction process as necessary. The receiver units that do not mount the internal clock should receive the TOT any time (as long as necessary) to obtain the current time. However, the repetition rate of the TOT is 5 seconds; therefore, high resolution cannot be expected.

The TOT does not have the version number. As a result, it cannot be judged if other information included in the TOT (local time offset descriptor) has been changed. The contents of the TOT should be checked.

2.9.3 Analysis process

The TOT is constantly updated table. If any error occurs at the time when the TOT is obtained, discard it immediately and wait for the next transmission. With regard to the local time offset descriptor, if any error occurs in the latest information, wait for the next transmission, or maintain and use the stored information.

2.10 INT

2.10.1 Purpose of use

The INT is used for the following purpose.

- Obtaining the control information of the IP/MAC stream that is transmitted in a TS

2.10.2 Receiving/storing process

The content of the INT is not frequently changed. However, it is desirable to update the INT to the latest status as far as a TS where the INT is transmitted is used for channel selection. When updating, the version_number field can be used to check whether the content is updated. The version_number may not change consecutively due to an error in transmission equipment or other reason. Caution should be paid so as to prevent failure in receiving the INT after that.

2.10.3 Analysis process

[Section]

The table below is used to determine whether a received section is valid or not.

A section that does not have a valid value for each field in the table below is invalid. Such a section should be discarded immediately.

Table	PID	Section header field	Valid field value for a section
INT	Optional	table_id	0x4C
		section_syntax_indicator	1
		current_next_indicator	1
		section_number	0

[Descriptor]

Caution should be applied to the following points when analyzing the descriptor field in the INT.

■Processing of a descriptor placed in the INT descriptor loop

Descriptor	Processing when a descriptor is abnormal/invalid (including the case where mandatory descriptors are not placed)
Target smart card descriptor	The processing is performed providing that the descriptor does not exist.
Target IP address descriptor	The processing is performed providing that the descriptor does not exist.
Target IPv6 address descriptor	The processing is performed providing that the descriptor does not exist.
IP/MAC platform name descriptor	The processing is performed providing that the descriptor does not exist.
IP/MAC platform provider name descriptor	The processing is performed providing that the descriptor does not exist.
IP/MAC stream location descriptor	The processing is performed providing that the descriptor does not exist.

3 Function Guideline for PSI/SI Receiver Units

3.1 Types of receiver units

The SI function should be implemented on the receivers for multimedia broadcasting after careful consideration of the characteristics that are expected for the receivers. However, each manufacturer can decide on the actual implementation of the function of the receivers depending on the product design policy.

3.2 Precautions of obtaining SI

The EIT[p/f] and EIT[p/f after] are used in multimedia broadcasting. As EIT types, there are N-EIT[p/f], N-EIT[p/f after], M-EIT[p/f], M-EIT[p/f after], W-EIT[p/f], and W-EIT[p/f after]. All tables other than these tables are obtained from the EPG/ECG metadata. The SI has two types: "commonly operated SI" which is assumed that all broadcasting stations transmit, and "individually operated SI" which can be used for individual use. To clarify the transmission/no transmission or transmission cycle, there are "all-stations applied transmission parameter" and "each-station applied transmission parameter". It does not mean that the specific table type always uses the specific SI or transmission parameters, or " commonly operated SI " is used by "all-stations applied transmission parameter" only either. It is required to understand such relationship securely before implementing into the receiver unit. For the details, read "12. EIT Transmission" thoroughly.

3.3 Obtaining layers, services, and SI table structure within network

The receiver units can obtain the layers, services and SI table structure within the network on the assumption of the following:

- If one frequency is received, then one complete network and one complete transport stream are constituted.
- One network is never divided by multiple broadcasters.
- "network_id" is provided for each transmission master system.
- If "network_id" is same, the completely same TS is transmitted from the different transmission point.
- Layered transmission is performed in multimedia broadcasting. How many layers are used or what type of layer is used for the service is described in the TS information descriptor in the NIT.

3.4 Channel list

The channel list required for the receiver units generally includes receivable services and is created based on the contents described in the NIT (partial reception descriptor, TS information descriptor and service list descriptor) and SDT (service loop and service descriptor).

- Channel number

The channel number that is separately defined in a receiver is displayed.

- Service name

  It uses the service channel name described in the service descriptor in the SDT. The company names for the service descriptor are used in multimedia broadcasting.

- When a broadcasting station name is presented

  The multimedia broadcasting broadcaster name in the broadcaster name descriptor in the BIT is used.

- Service type, media type and service class

  For the service type, the type described in the service list descriptor in the NIT is used. The media type is determined based on the service type. The service class (specified in Vol. 7) is obtained from "service_id".

3.5 Program guide

See "Section 3.9.2 Correspondence between EIT and metadata" in Vol. 10.

3.5.1 Order of channels in program guide

The order of channels display in program guide depends on the product design. In general, it is preferable to display in order of "service_id". If the residential area is specified, it is preferable to display the services for the residential area first using "area identifier" included in "service_id", then other services if they can be received.

3.5.2 Listing of program guide

It is the function to list the currently being broadcasted events and following events (10 events or less) for each service. It is the main method of displaying SI in the portable receiver units. To implement such function, it is recommended to take the following steps:

Obtain the EIT[p/f] and EIT[p/f after] (if transmitted) transmitted for the "service_id" and display it in order of start date and time. If the EPG/ECG metadata has been transmitted, a list can be displayed using the event information in the metadata. However, it is desirable to give priority to the EIT[p/f] and EIT[p/f after] information in the EIT when presenting the information as far as it is necessary to correctly present the current status.

"present" in the EIT[p/f] refers to the currently being broadcasted event, and "following" refers to the next event to be broadcasted. If the "present" is empty section, there is no currently being broadcasted event (it may be different from "service suspension"), and if the "following" is empty section, there is no next event (it may appear as time passes). Even if the "following" is not empty section, there may be a certain interval between the end time of "present" event and start time of "following" event. This shows that the "following" event will start after the "present" event ends then some time without any event is finished. Note to perform a correct process in such case that the program description is described in the EIT[p/f after] but the "following" is empty section.

In special case, the event may be interrupted. In this case, the event placed in "present" can be processed as a currently being broadcasted event. With regard to the event placed in "following", judge that the event is currently being interrupted by inserting the "present" event while it is supposed to be broadcasted at the time. Thus, it is preferable to adjust so that such interruption can be informed when presenting the information. No undetermined events can be described in the EIT[p/f after].

If the receiver unit has the function to display the program list, it should have the function to present all events transmitted by the EIT[p/f after]. The EIT[p/f] and EIT[p/f after] in the EIT should be displayed by obtaining the latest information.

If the duration time of the "present" event described in the EIT[p/f] is not determined, or if the "following" event is not determined, it is highly possible that an empty section in the EIT[p/f after] is transmitted or there is an inconsistency with the contents. The receiver unit should not display the contents of EIT[p/f after] or display in consideration that there is an inconsistency with the contents.

3.5.3 Program guide in radio/television schedule format of newspaper (referred to as "radio and TV listings")

A program guide covering all services, such as the radio-and-television listings, can be created based on EPG/ECG metadata. It is determined that portable receivers should have a function to display the program guide.

In addition, the program guide is presented generally based on the stored information. But it is recommended to use the latest information as possible from the obtainable information being displayed.

3.5.4 Precautions when adding Information to a program guide in a radio-and-television listings format

A program guide should present not using EIT but using EPG/ECG metadata in multimedia broadcasting.

3.5.5 Obtaining tables for all networks

As the EIT[other] information is not transmitted in multimedia broadcasting, it is necessary to store EPG/ECG metadata beforehand in order to display a program guide in the radio-and-television listings format.

At least, the NIT, BIT, SDT, and EIT[p/f] must be obtained as PSI/SI by performing a scan. Needless to say, the NIT, BIT, and SDT that are being transmitted must be viewed to obtain the EIT.

It is desirable to start obtaining these when updating the EPG/ECG metadata that is transmitted in storable broadcasting.

When scanning the networks, no tables may be obtained at all due to no carrier. In this case, judge that a suspension of program operation temporarily occurs due to maintenance, etc. and restart obtaining the tables after a while.

3.5.6 Information type used in program guide

Mainly EPG/ECG metadata is used for the information to be presented to viewers as a program guide. In addition to that, the following information can be considered. Each information is provided by a table in an EIT or a descriptor described in the table. Sometimes, the content of an SDT may be referenced. The explanation below is mainly about the EIT. For the correspondence between each field of an EIT and each element/attribute of EPG/ECG metadata, see "3.9.2 Correspondence between EIT and metadata" in Vol. 10 of this technical document.

■ Program title and program description

Use the short event descriptor in EIT.

Using the two textual strings provided by the short event descriptor, the program information is provided in the style of newspaper/magazine program guide (radio and TV listings). In the radio and TV listings format, the following textual strings are described:

1) <Title>

Live professional baseball game

2) <Sub-title> Quotation mark, " ", is placed in many cases.

"Tigers vs. Giants 20th game"

3) <Others> Program contents, cast, features, etc.

HANSHIN KOSHIEN STADIUM

Commentator: **

The program title defines individual events using the minimum textual strings. Accordingly, in multimedia broadcasting, the program name field in short event descriptor is used to transmit the above 1) and 2). The reason why <Sub-title> is contained in progmam name field is that the event cannot be sufficiently defined by <Title> only as shown above. (Generally, <Title> refers to the frame name.) However, the above example is not always used. There may be no information used for <Title>, or <Title> may be enough to explain the event. As a result, it is required to use the whole textual strings (given as a programname field) as one textual string without regard to the difference between <Title> and <Sub-title> in the receiver units. In addition, <Title> is closely related to the series name (to be mentioned later), but they do not always provide the same textual string. The receiver units should handle them as totally different things.

As mentioned above, the program title refers to the textual string including <Title> and <Sub-title>. As a result, the maximum number of characters as the program title is 40. It is preferable to adjust so that all characters transmitted as a program title can be displayed in the receiver units. However, if all of them cannot be displayed due to the limitation of display area, it is recommended to use "…", etc. to show the program title will be continued and to adjust so that the whole program title may be displayed as a result. In the portable receiver units, it is assumed that approximately 10 characters can be displayed on one line at most. Therefore, if 40 characters are transmitted, it is preferable to apply some way to display the whole program title.

In the radio and TV listings of newspaper/magazine, the special characters are often used. Many of the special characters defined in multimedia broadcasting are created based on the radio and TV listings. They are assumed to be used for the program titles. However, the operation of special characters depends on broadcasters, and it is not unified. (They may be also used for various textual string fields as well as program titles.)

On the other hand, the program description refers to the above 3) <Others>. It includes various kinds of information such as informations, contents, casts, features depending on broadcasters. But most of them are provided for program promotion. The program description is assumed to be displayed following the program title; therefore, it is preferable to present the program description following the program title as long as the display area is obtained. In consideration that many of them include promotional contents, it is preferable to display a list of program description at one time. However, it is clear that the program title is more important. The maximum number of characters as a program description is 80.

It is very difficult to achieve a balance between listing information and data amount of individual events. It is preferable to design in consideration of the above contents.

The textual string transmitted using the short event descriptor is assumed to be used while changing its data amount according to the duration of event. In other words, the longer textual strings to be transmitted are used for the longer events.

■ Scheduled Program Start and End Time

Use "start_time" and "duration" fields in the EIT. The maximum duration of event is 48 hours. Thus, the event end time can be two days later at most. Care should be taken when presenting the information in this case. The minimum duration of event is 1 minute. However, note that the duration of event may be set to below 1 minute due to unavoidable circumstances, and the start time is not always set in every minutes. When the summer time system is applied, it is recommended to display the time added by the offset time using the local time offset descriptor described in the TOT.

■ Information on Charge/Contract/Restriction to Viewing

The free_CA_mode field of an EIT and the BroadcastEvent/Free/@value of EPG/ECG metadata are used. It is also required to refer to CA contract info descriptor in the SDT.

"free_CA_mode" in the EIT is used to distinguish between chargeable and free events. The events in the flat contract channel are judged as chargeable. Note that viewing events by the already contracted viewers does not always result in charges. Whether an event is a paid event or not can be determined by referencing the free_CA_mode of an EIT. However, a confirmation must be made using an IC card to check whether the event can be viewed or not by referencing the license reference information (LicenseInformation) or other data in the EPG/ECG metadata. If the license reference information (LicenseInformation) or other data does not exist in the EPG/ECG metadata, but if the CA contract information descriptor exists in the SDT, the contract information is used.

"free_CA_mode" and the CA contract info descriptor in the SDT are provided only as characteristics of conditional access broadcasting in the relative service. Note that they cannot be used independently for viewing control and it is required to use them carefully if they are used for displaying information.

■ Information on Recording Control

The RMPI information (LicenseInformation/RMPIDescription) described in the license reference information in the EPG/ECG metadata is used. If the RMPI information does not exist in the EPG/ECG metadata, but if there is a digital copy control descriptor in the SDT, the descriptor must be used. However, the RMPI information in EPG/ECG metadata is used only for presenting the information, and when performing recording control, the ECM is used to properly process.

In addition, the combination of the content availability descriptor and digital copy control descriptor can be used as information on recording control. However, since the content availability descriptor is placed in the PMT but not in the SDT/EIT, set the value in "copy_restriction_mode" and "encryption_mode" to undefined until the PMT is received when making reservation/reservation for recording.

■ Information on Component Structure

The audio-visual information in the EPG/ECG metadata (ProgramInformation/AVAttributes) is used. In the audio-visual information, character strings, which are used for presenting each audio and video information to viewers, are also described. Even if the character strings are not provided, the default character string is defined and can be used when presenting the audio-visual information. If multiple audio and video components exist, the information should be presented in ascending order of each component tag value (AVAttributes/AudioAttributes/StreamDescription/@id, AVAttributes/VideoAttributes/StreamDescription/@id).

In the audio-visual information, the angle and aspect ratio of a video, the audio mode, and the number of channels (the information that corresponds to the component_type field in the EIT) are described. Such information can be used for presenting a video/audio type.

Caution needs to be paid to the component tag value when using the information of the component configuration. Specifically, the information of the components, which do not correspond to the range specified for video and audio in Table 15-1 (the range specified for video components is 0x00 to 0x0F, while the range specified for audio components is 0x10 to 0x11), must not be presented.

The component descriptor and audio component descriptor cannot be used because they are not placed in the EIT.

■ Program Category/Program Characteristic

As program genre information, the genre information described in the EPG/ECG metadata (ProgramInformation/BasicDescription/Genre) is used. The genre information is described in the EPG/ECG metadata by referencing the genre dictionaries provided in Annex A.1. in STD-B38.

As genre information, content information is used. A maximum of three information inputs can be described based on the genre code table in the order of a typical genre code. While the large and middle categories are provided in the codes, the code for "others" is always assigned in the middle category. The information is described in "others" when it is difficult to place the event in one middle category, or when all of middle categories are not appropriate to the event. In this case, a correct category code should be indicated at least in the large category. The code for "others" is also assigned to the large category ("0xF"). This code may be described when all large categories are not appropriate to the event. It is preferable to use "others" as a category code, as well as other large categories. The codes, "0xC" and "0xD" in the large category, are not defined at the initial stage of multimedia broadcasting. They are assigned for the future extension; therefore, it is preferable that the receiver units should not use them if they do not support extensions. For category search using the category information, see section 3.7 of Appendix 1.

For the program characteristic information, the keyword information on ECG metadata (ProgramInformation/BasicDescription/Keyword[@type="other"]; for details, see Table 3-1 in Vol. 10 of this technical document) is used. The program characteristic information mainly provides the information on how to announce a change of programming, which is the characteristic of the digital broadcasting and is used to present the information on icons, etc. It can be also used for the recording control.

■ Detailed Event Description

Article information in EPG/ECG metadata (ProgramInformation/BasicDescription/Synopsis[@length="long"]) is used. In this article information, multiple item names and the corresponding item description that are described in the extended form event descriptor of the EIT are provided as text. The item names include reservation term whose purposes are predetermined. The detailed event guides can be provided by making use of them well. The Extended Event Descriptor is not available in the EIT since it's not placed.

■ Series Information

As series information, the information on the series name, number of episodes, last episode number, end date of series, programming pattern, etc. can be displayed. See Section 3.10 of Appendix 1. The information described in the series descriptor in an EIT is described separately in the program metadata (ProgramInformation) and group metadata (GroupInformation). For details, see 3.9.2 in Vol. 10 of this technical document. The series descriptor is not available in the EIT since it's not placed.

■ Related Data Broadcasting information (including subtitles)

EPG/ECG metadata subtitle information (ProgramInformation/BasicDescription/CaptionLanguage) is used. For the details, see "Specifications for Data Broadcasting Operations".

3.5.7 How to handle undefined event and undefined time

The undefined events and time are not defined in the EIT[p/f after] but is described in the EIT[p/f] only.

The undefined time includes undefined end time of "present" event and undefined start time of "following" event. During the event suspension, it includes undefined end time of "following" event.

Even if the undefined time is displayed, the currently being broadcasted and next events are determined. Accordingly, when the information is displayed for such purpose (ex. the function to add some meaning to the current and next event in program guide list, etc.), use the contents in the EIT[p/f] as they are and set the time to undefined. If the event information is presented in order of time without caring current/next events, use the contents in the EIT[p/f] in priority to others as long as it is desirable to display the current situation as accurately as possible.

The undefined event is displayed only for "following" events, and it indicates the next event itself to be broadcasted is not defined. It is recommended to show that the next event is undefined when the current/next event information is displayed in the program guide list, etc. If the event information is presented in order of time without caring current/next events in the program guide in the radio and TV listings format, the information on "present" event should be displayed in priority to "following" event, then it is recommended to perform the process (the information obtained from EPG/ECG metadata is presented) on the assumption that the "following" event (undefined event) does not exist.

3.5.8 Compatibility between EITs

EIT includes N-EIT[p/f], M-EIT[p/f] and W-EIT[p/f]. The receiver units separately obtain and manage each EIT, but still it is inevitable that an inconsistency of information occurs in the receiver units. The inconsistency mentioned here includes the following:

- Overlapping of event times (The events to be broadcasted are overlapped at a certain time.)
- Two events with the same "event_id" exist. (The same event has the two different "start_time".)

- The same event has the two different event names and descriptions.

Such information inconsistency may be caused by the following:

■ Inconsistency between EIT[p/f] and EPG/ECG metadata when changing the most recent event schedule

Inconsistency between EIT[p/f] and EPG/ECG metadata occurs when an event schedule is changed especially because the EIT[p/f] in an EIT is immediately updated. Such a problem also occurs when there is a status that is specified as undefined (undefined time or event) in the EIT[p/f] because the status is not applied to the EPG/ECG metadata.

Inconsistency between EIT[p/f] and EPG/ECG often occurs due to the characteristics of the tables. Therefore, it is desirable that the EIT[p/f] and EPG/ECG metadata are managed separately in a receiver and that they are used by combining them as necessary.

■ Inconsistency due to receiving timing of EPG/ECG metadata

Even if the EPG/ECG metadata is transmitted from the transmission master system without any inconsistency, an inconsistency occurs within the receiver unit if the EPG/ECG metadata is not received collectively by receiving unit.

Especially, note that an inconsistency may occur between sub-tables in the same service if the table is received by sub-table unit, and that an inconsistency (overlap of time) may occur between the old and new versions if the table is received by segment unit. As long as the EPG/ECG metadata is transmitted from the transmission master system without any inconsistency, no inconsistency is caused at the stage of receiving all of transmitted latest data. Therefore, when receiving the EPG/ECG metadata, all tables within the same service should be received and stored at one time if possible.

3.5.9 Event sharing

Event sharing is not used in multimedia broadcasting.

3.5.10 Presentation when summer time system is applied

If the function to display the summer time supported time information including event start time is employed before/after the summer time system is applied, it is required to use the local time offset descriptor in the TOT. Accordingly, interpret the "time_of_change" field to determine if the start_time of the event to be displayed should be before the "time_of_change" field or after. Then add the value in "local_time_offset" or in "next_time_offset" field.

3.6 Detailed event information display

The event detail information is provided by EPG/ECG metadata. The event detail information has multiple items, based on which item information is created. It is coordinated so that it can be displayed as beautiful as possible in such format. Therefore, care should be taken for this format also when designing the screen of the receiver unit. The receiver units automatically insert the linefeeds according to each display area and display the textual string. At the same time, they should not ignore the transmitted linefeed codes. If the automatic linefeed and transmitted linefeed are overlapped, it is preferable that the receiver unit insert the automatic linefeed, then another linefeed again based on the transmitted linefeed.

The number of lines is not limited. It is preferable to provide the scrolling function to display all texts.

Detailed information is not described for all events. Sufficient responsiveness cannot be maintained because the re-transmission cycle of the EPG/ECG metadata is slow. Almost all TSs must be received if trying to receive every detailed piece of information provided by all multimedia broadcasting broadcasters.

Whether or not detailed information exists in each event cannot be known without obtaining the EPG/ECG metadata. A transmission rate can be used to estimate the data amount or to determine whether or not acquisition operation is performed; however, it is not necessary to use this if it is not needed.

In "detailed event description" mentioned earlier, the usage of the item titles defined as reservation terms are already defined. It is required to provide a receiver function based on the definition.

- "Notice" mainly provides the description about the change of programming. If this item is described, it is usually prioritized. It is closely related to the event characteristic information.
- "Program contents" refers to detailed information on an event. It is described on the assumption that 20 two-byte characters × 10 lines.
- "Cast", "original story/script" and "director/direction" provides personal names. The method of describing the item descriptions for those items is generally determined. If the method is used, the person search function, where personal names can be found form the contents described in the receiver unit, may be enabled based on the above. But the further details are beyond the category of this chapter. In EPG/ECG metadata, the information for this item may be described as credit information (ProgramInformation/BasicDescription/CreditsList).

The extended form event information of an EIT has the special structure; therefore, care should be taken when analyzing it. The descriptor is extended in "descriptor_number" and "last_descriptor_number" fields. Only one item can be described in one descriptor. The maximum amount of item description for one descriptor is 100 two-byte characters (220 bytes), the maximum for one item is 200 two-byte characters (440 bytes). Thus, two descriptors may be placed for one item. In this case, "descriptor_number" should be continuously assigned to them that placed in the EIT, and the item name is not described in the second descriptor. The extended form event information is interpreted in ascending order of descriptor_number. Whether or not one item is finished descripting is determined if an item name is defined in the next descriptor. If the item description uses two descriptors, the receiver unit can display them as one textual string. The two fields are simply separated in the binary level. Thus, in this case (second item description field), initialization of textual string to be performed for each field is not applied. The receiver units should add two fields in the binary level and treat as one textual string. As the "detailed event description" for the EPG/ECG metadata, a maximum of 408 characters can be described in one Synopsis [@length="long"] and a maximum of 18 Synopsis [@length="long"] items can be described in one metadata. It is recommended to describe each content based on the EIT structure; however, each service provider can decide on the usage.

3.7 Event search

A function to search the genre of a broadcast event can be implemented using the information that can be obtained from the EPG/ECG metadata. The genre search of events are enabled based on the information described in the “program genre information” as described above and can be used across the broadcasters since it is provided as WPG/ECG metadata.

The program genre information includes large categories and middle categories. When the event category search function is employed in the receiver unit, it is recommended to provide the search function that can be searched at least by large category unit. The large category set as "others" is also one of the category codes; therefore, it is recommended that it can be treated the same as other large category codes. "0xC" and "0xD" in the genre code table are the codes that will be used to extend the genre codes in the future (1.2 Metadata-genre Dictionaries 2 in Annex A in STD-B38). They must not be used in receivers that do not support genre code extension.

It is assumed that it takes quite a long time to dynamically obtain a table when searching a genre, taking into account the re-transmission cycle of the EPG/ECG metadata.

The event search can provide various functions such as search by event name, cast and key word. However, such functions should be reviewed by each manufacturer using the EIT and EPG/ECG metadata and shall be beyond the category of this material.

3.8 Event reservation

The reservation function of broadcasting events can be provided using the information obtained from the EIT and EPG/ECG metadata. The portable receivers can provide the event reservation function using the EIT, but events in the distant future cannot be reserved because only EIT[p/f] and EIT[p/f after] are used for this function. This section explains such function in consideration of using the EPG/ECG metadata. The reservation function can be divided into three main functions: reservation registration, reservation check and reservation execution.

3.8.1 Reservation registration

It is the function to register the event by selecting events from the program guide, etc. by viewers.

When actually registering an event reservation, it is recommended to check if the event can be viewed as follows:

- Check on components that can be displayed

  Confirm that the corresponding AVAttributes are used by checking whether the AVAttributes/VideoAttributes and AVAttributes/AudioAttributes exist in the EPG/ECG metadata.

- Check for free/chargeable and contracted/not contracted event

  First, use "PLT/BroadcastEvent/Free/@value" for the relative event to check if the event is free/chargeable. If it is chargeable, check if it can be actually viewed. This can be done only by contacting to IC card using the CA contract info descriptor for the relative event. If the CA contract info descriptor does not exist in the EPG/ECG metadata, it is required to use the CA contract info descriptor in the SDT for the service transmitting the relative event.

  For details on scheduled recording operation, see Appendix 1 "Guidelines for Creating the EPG/ECG Using EPG/ECG Metadata" in Vol. 2.

- Check in case of data event

  The data type of service generally is a data event. It is recommended to check that the supported data broadcasting system is used by referencing the data coding scheme descriptor in the PMT. In addition, whether events are viewable or not may be defined every data broadcasting system. Then, comply with the provisions specified for each data broadcasting system.

  What kind of information on other events should be displayed when reserving the events depends on the product design.

It is recommended to memorize at least the values in "service_id", "event_id" and "start_time" for the events to be reserved when reserving them. Such information will be required for executing reservation. To display the reservation list (reservation confirmation function), it is preferable to memorize the other event information on the relative events than the above as necessary. Normally, an event name provided in EPG/ECG metadata is recorded. It is preferable to see the latest stored EPG/ECG metadata when displaying the sheduled recording list screen.

As one of operations performed during reservation registration, it is likely to install the function to check if the broadcasting time of the event overlaps that of the already reserved event. However, such process depends on the receiver units; therefore, it shall be beyond the category of this material.

3.8.2 Reservation check

The receiver units supporting event reservation should preferably install the function to check the reserved events. If the user interface to check the reserved and registered events is installed, simply display the reservation information stored in the receiver units.

It is desirable to reference the EPG/ECG metadata that is most recently stored when presenting the reservation confirmation screen. By doing so, if a change is made before starting to record the programmed event (e.g., a change of start time), this can be notified to viewers. There is also the possibility that a reserved event may be temporarily removed from the EPG/ECG metadata due to an event schedule change and so on. In this case, the event should not be considered canceled until the registered start_time (until obtaining the EIT transmitted at the point of time). In such a case, it is required to only display the reservation information stored in the receiver unit and perform the changeable program scheduling around the stored "start_time". Obviously, it may be found that, during the reservation check, the event time was shifted to another time zone. The situation can be obtained by searching the event using "event_id" within the same service. When the situation is obtained, the event can be used on the assumption that the obtained change is correct. Actions such as notifying viewers that a schedule has been changed to a new one and automatically changing a reservation schedule can be performed based on the obtained new EPG/ECG metadata.

In addition, while rare, the broadcasting service for the event may be changed. There is no secure system to obtain this situation. Service can be changed only by the same multimedia broadcasting broadcaster in the same media type. The changed information is placed in the EIT.

If it is detected that an event, which will be placed in the EIT, is moved while analyzing the EPG/ECG metadata, it is recommended to check whether a reserved event has not moved by comparing it with the reserved event list.

3.8.3 Reservation execution

Taking into account that the basic concept of the reservation execution function is to notify the start of a reserved event, the reserved event service should be selected around the registered start_time and the EIT should be referenced.

For details on event reservation or recording including channel selection, see Section 3.5 "Program guide" in Appendix 1 and Chapter 18 "Event Schedule Change".

3.9 Common range of NVRAM area used for data contents

In the NVRAM area that is used for data content, the multimedia broadcasting broadcaster identifier, which indicates a common valid range of the service_id, and the information, which indicates the access permission of the NVRAM, are included.

3.9.1 Affiliation identifier

The affiliation identifier is not used in multimedia broadcasting.

3.9.2 "original_network_id" and "broadcaster_id"

An ID for multimedia broadcasting is described in the original_network_id and broadcaster_id, which are described in the broadcaster descriptor. The ID indicates that access to the described NVRAM area for broadcasting stations is allowed. "original_network_id" and "broadcaster_id" can be described more than once.

3.10 Series

Various kinds of functions supporting series can be installed using SI. Series information is described in the EIT and EPG/ECG metadata.

For series, see Chapter 17 of Provisions for PSI/SI Operations.

Caution should be paid such that the series function in multimedia broadcasting is defined focusing on broadcast events (so as to be able to make determination based on transmission type) and not defined for the series list function and other functions.

3.10.1 Reservation of series

It is recommended to store at least the value in "series_id" when registering the series. The receivers that have a function to present registered content, such as a series registration list screen, should store other information related to the series at the same time. Especially, it is preferable to store the information on "last_episode_number" and "expire_date" if the receiver units will implement the function to automatically delete the series reservation. The series name is important for the receiver units, and it is described in "series_name_char" field. If the series name does not exist, the event name is used; the same event name is used for all events within the same series. Caution should be paid, unlike event reservation registration, when registering a series, as there is a period when the information about the registered series cannot be received from the EPG/ECG metadata.

To delete the series reservation automatically, it is required to detect the end of series.

In general, judge that the series ends when "expire_date" has passed. However, the "expire_date" may not be operated. In this case, it is required to detect the last episode event based on the "episode_number" defined for each series event. Note that the "episode_number" is provided every "repeat_label". If the last episode event is not detected unfortunately, delete the series reservation when the series event cannot be found for 100 days.

3.10.2 Confirmation of the series events

Events included in a series are the events that have the same series_id in the series information in EPG/ECG metadata. Receivers need to search the information obtained from the EPG/ECG metadata. The service range to be searched is all media type services in the same multimedia broadcasting broadcaster. For instance, the following case can be considered: a receiver searches the information obtained from the EPG/ECG metadata stored in a receiver on a series event confirmation screen and presents an applicable event list.

If the series auto reservation function is supported, it is necessary to search the information obtained from the EPG/ECG metadata relatively regularly (at least). For instance, check the series events every time when receiving/storing the EPG/ECG metadata. It is possible to check the series events based on the information on the programmed pattern provided.

3.10.3 Execution of the series reservation

It is generally considered that the series reservation is executed as an event reservation. Thus, every events of a series are checked before the series starts, then reserve as event. There may be such case that the receiver units automatically reserve the series as a set of events, and also such case that the event information included in the series is informed to the viewers then the viewers can select the events to reserve. After the reservation for each event is made, perform the same process as that for normal execution of the event reservation.

If the receiver units install the function to automatically detect the events that belong to the series and reserve (for recording) the event, care should be taken for the following:

In case a live professional baseball game is cancelled due to rainout, the event belonging to the series may suddenly appear. This is the case that the event is indicated on radio and TV listings in newspaper, etc. as a program to be broadcasted when the baseball game is cancelled, and the series event may be also included in those events. Cancellations due to rain or other reasons may be determined immediately before the broadcast (such a determination may be presented only in the EIT[p/f]). Therefore, it is highly possible that such information cannot be detected by searching the information obtained from the EPG/ECG metadata once a day. If the receiver unit is not always running, there is no other way to detect. To increase the detecting rate, the programmed pattern of series ("program_pattern" field in the series descriptor) can be used. Especially, for weekly series, the broadcasting days and times are usually fixed; therefore, it is possible to detect by starting the receiver at the days and times during the series period and checking the EIT[p/f].

3.11 Channel selection

3.11.1 Basic operation of channel selection

If channel selection defined as selection of the service, and decoding and presenting the components included in the service, the operation of channel selection is enabled based on the following:

3.11.1.1 Basic channel selection operation using portable receivers

(1) Check if the specified service exists, using the NIT.

If the target service does not exist in the NIT, the specified service is not correct. This error may be caused when specifying the channel number with the remote controller. The operation of receiver units in this case is beyond the category of this chapter.

For operation of channel selection, it is required to constantly store the NIT into the receiver units.

(2) Check the service type of service.

If the service type is not supported in the receiver unit, do not select the channel. In this case, perform the same process as that performed when the selected service does not exist. Otherwise, inform that the channel cannot be selected.

(3) Change the TS and receive the PAT if necessary, and obtain the PID of PMT for the relative service.

If the PAT cannot be received, there is no receivable streams within the TS due to transmission system error, etc. perform the same process as that for the case that the service is suspended.

If the target services are not described in the PAT ("program_number"), the service is suspended.

(4) Obtain the PMT for the relative service and check the existing components.

If the PMT described in the PAT cannot be received, it is a reception error. However, in case the media type is data, the broadcast may be suspended. (See section 3.11.4 of Appendix 1.)

The PID of PMT is almost operated as fixed number for each service; therefore, it is possible to directly receive the PMT without the process of receiving PAT and increase the response of channel selection if the PID of PMT is stored in the receiver units according to "service_id". However, the receiving process of PAT is performed at the same time and process suitably if any change occurs, it is required to correspond to such situation.

The process to be performed after the PMT is received generally depends on the component structure within the program and should be performed based on the description in the PMT. The following explanation is based on the television service where data components do not exist:

(5) Select the presenting components based on the description in the PMT.

When the conditional access system descriptor is placed in the first descriptor loop of the PMT

If the conditional access system descriptor is placed in the first descriptor loop of the PMT, it indicates that the entire service is the target of conditional access broadcast.

- When the default components are selected as normal process:

  In general, it is preferable to select the default components as those presented first at selecting. Inspect the component tag value ("component_tag" field in stream identifier descriptor) described in the second descriptor loop of PMT and present the components with "0x00" (default video) and "0x10" (default audio). If a video/audio component with a component tag value of 0x00 or 0x10 does not exist, an optional video/audio component is selected based on the stream_type value.

  In this case, the components that do not belong to the range assigned to video/audio (the range specified to video components is 0x00, while the ranges assigned to audio components are 0x10 and 0x11) in Table 13-1 are not selected.

- When selecting based on the components specified at reservation:

  The reservation of a component is performed using the EPG/ECG metadata. Specifically, the reservation is made based on the component tag value obtained from the EPG/ECG metadata. In this case, search the component tag value described in the PMT and present the relative components if any. However, since the component tag values may be changed by each event except for the default components, the desired components may not exist when the channel is selected. In this case, select the default components, etc., then monitor the PMT update.

- When automatic audio language tracking is performed:

  It is very difficult to enable this function strictly, but it is still possible on the assumption that the EPG/ECG metadata is stored. Check the information on the current event (refer to "start_time" field, etc. in the received and stored event information) in the service where the channel is selected, and search the component tag values based on the language specification for the audio component included in the information, and present the relative components. This method sometimes does not work well since the change timing of an event in the EIT is not synchronized with the PMT. In this case, it is recommended to receive the actual PMT and present the default components if the desired components do not exist on the assumption of the above.

(6) Present selected components.

The transmission specification for components transmitted by the packets of the PID described in the PMT and the value of timeout when the transmission is made are determined for each component.

(7) Receive EIT[p/f].

The EIT[p/f] can be also obtained at the same time of channel selection. At this time, it is desirable to obtain the EIT[p/f]. It is considered the EIT[p/f] is received later than PAT and PMT due to the difference of retransmission cycle. While receiving, presentation processing can be performed based on the event information obtained in the EPG/ECG metadata stored in the receiver.

The multi-view television service is not used in multimedia broadcasting.

3.11.2 Component tracking after channel selection

For any changes of component structure of video and audio components after the channel selection, follow based on the component tag values in the stream identifier descriptor placed in the PMT. Thus, even if the PMT is updated, the components for the described ES PID can be presented if the selected component tag value exists. The component tag values are not changed by event units. When the ES PID and mode of the components referred by the component tag values are changed, it is required to automatically follow such changes. In addition, the number of components may be also changed. It is preferable to continue to present the components even when the component shifts the layer.

If the component with the selected component tag value is deleted when the number of components is increased/decreased within the event or the event is switched, another component within the same program should be immediately presented. Normally, the default component is presented. (The default component is never deleted.)

3.11.3 Component switching

A selected component is switched based on the audio component information obtained from the EPG/ECG metadata in advance.

- If dual mono audio or multiple audio components exist, the audio component information obtained from the EPG/ECG metadata in advance is used. If the OSD is used to create a select menu, use the textual string in the audio component information and present the information on component mode, etc. as necessary. If there is no textual string described, use the default texts.

  As a component_tag value is provided in the audio component information, an applicable component can be identified by referencing the stream identifier descriptor in the PMT based on the component_tag value. Priority is given to smaller component_tag values in each component type. Therefore, the menu should be displayed or toggle switching should be performed in ascending order of component_tag value.

When switching components based on the component information obtained from the EPG/ECG metadata, the content may differ (temporarily) from the actual component structure provided in the PMT. Although default components always exist, other components may be removed. It is desirable that the default component can be presented even if a component that is selected based on the component information obtained from the EPG/ECG metadata cannot be found in the PMT. There is also strong possibility that the audio mode is different from the information obtained from the EPG/ECG metadata. The information may also be changed during an event. It is desirable that receivers can automatically update to the latest information.

It is desirable that a component can be switched by referencing the stream_type and component_tag ("0x10" and "0x11" if the stream_type is set to "0x0F") described in the PMT in ES, even if the information cannot be obtained from the EPG/ECG metadata or if the description does not exist.

3.11.4 Operation during suspension of broadcasting

After the channel selection, the desired service entry may not exist in the PAT. In this case, the broadcast is suspended; therefore, it is recommended to display the message, etc. as necessary. According to the circumstances, the receiver units can automatically present other services running within a multimedia broadcasting broadcaster.

If the PMT cannot be obtained after the PAT is obtained, it can be unconditionally judged that the broadcast is suspended. PAT

In addition, the PAT may not exist in the TS due to accident or maintenance of broadcasting system. When such situation is detected (when the PAT cannot be received), handle in the same way as above.

3.11.5 Operation of event relay

Event relay is not used in multimedia broadcasting.

3.11.6 Fringe area

Problems in fringe areas do not occur in multimedia broadcasting because SFN is used.

3.11.7 Selecting storable broadcasting service

For selecting a channel in a storable broadcasting service, see Section 1.2 "Selecting a Storable Broadcasting Service Channel" in Appendix 1 in Vol. 2 and Section 2.1 "Operation of Data Transmission System" in Vol. 11.

3.12 Event recording

In order to provide the receiver units with the function to record by event while automatically tracking the extension, etc., it is recommended to design as follows. Especially, if they include the function to automatically track the emergent change of programming, care should be taken for handling the EIT[p/f].

To realize this automatic tracking function to track the change of programming as a function of the receiver units, there are still some issues on remaining capacity in the recording media, overlap of reserved events, etc., but those are beyond the category of this chapter.

3.12.1 Reservation/reservation check

It is recommended to mainly use the EPG/ECG metadata for reservation functions by event.

The information on events that will be broadcast in the future is described in the EPG/ECG metadata. It is recommended to conduct design so that information is presented to viewers based on such event information, in order to make reservation smoothly.

The determination of whether or not to record and the determination of the record mode to be used for recording should be made based on the digital copy control descriptor described in the EPG/ECG metadata and SDT.

Effective information for recording reservations can be found in the program characteristic information that is provided in the EPG/ECG metadata. Especially, the attachment information related to the changeable program scheduling shows the possibility of event program change; therefore, this can provide the function where the viewers can select the recording operation when the event program is actually changed.

Refer to section 3.8 of Appendix 1 (Event Reservation) which can be applied here.

3.12.2 Reservation execution

If it is necessary to refer to the EIT, refer to the EIT[p/f].

3.12.2.1 Before event start

The start of event is judged from "start_time" of "following" in the EIT[p/f]. Normally, the event proceeding is determined 30 seconds before "start_time" of "following"; therefore, it is recommended to consider the above time if it is desired to start recording slightly before the event starts. However, it may not be possible to record the components before the event starts, due to viewing/recording limitation of the previous event.

When other networks are being received, obtaining the EIT[p/f] for the relative event is disabled. Therefore, the network should be switched to the one for the relative event before the event starts.

Immediately before the event starts (30 seconds before), the following may occur in the EIT[p/f]:

(1) The event to be recorded does not appear in the EIT[p/f].

The possible causes include the change of event start time and cancellation of event. The operation of receiver units for this case will be mentioned later in Section 3.12.2.4 of Appendix 1.

(2) The event to be recorded is described in "present" in the EIT[p/f] (the earlier time than the original start time is described in "start_time").

This occurs when the event started broadcasting earlier than the expected time. It is usually prohibited but occurs due to inevitable circumstances in programming. When the receiver unit detects such case, it should immediately perform the recording process (unless there is any problem on charges). It also may be in the status of event-interupption. In this case, it should be judged that the event has already started and is being interrupted; therefore, it is preferable to perform the appropriate process after the example of the process performed when the event is being progressed.

(3) The event to be recorded is described in "following" in the EIT[p/f] but the values in "start_time" and "duration" have been changed.

This occurs when the change of event start/end time has been previously determined. It is preferable that the receiver units perform the recording preprocess according to the contents described in "following". In this case, the "start_time" may be changed to "undefined". This case will be also mentioned later in Section 3.12.2.4 of Appendix 1.

During the period from the time immediately before the event starts to the start time, the contents in the EIT[p/f] may be changed. There are various kinds of changes, but in any case, it is required to perform the appropriate process according to Table 18-1 in "Provisions for PSI/SI Operations". The important thing is that the event should not be judged as progressing until the start time of the event. For example, even if the event described in "following" is deleted from both "present" and "following" immediately before the event starts, it should not be judged that the event ended. Always judge that the event has not started, and the start time was changed or event was cancelled.

In addition, while rare, the channel to broadcast the event may be changed. If a scheduled event is not presented at the time scheduled in the EIT[p/f], it is recommended to check the EIT[p/f] of another service that is provided by the same multimedia broadcasting broadcaster or that uses the same media type because the broadcast channel of an event can be changed only to the same multimedia broadcasting broadcaster's other service that uses the same media type.

3.12.2.2 Event progressing

It is preferable that the receiver units supporting changeable program scheduling always detect a change of EIT[p/f] during recording and perform the appropriate process to the change.

While the EIT[p/f] is updated regarding the event being recorded, the following may occur:

(1) The value in "duration" suddenly changes while the event being recorded is described in "present" in the EIT[p/f].

In this case, the "duration" may be changed to earlier time (early end), delayed time (extension) or "undefined". In any case, the event being recorded is still progressing. It is preferable to continue to record the event under any situation if the "event_id" for the event being recorded is described in the EIT[p/f].

(2) The event being recorded disappears from "present" in the EIT[p/f], and it is not described in "following" in the same sub-table.

In this case, the event ends regardless of the end time in original "duration". It is preferable to end recording, regardless of other conditions, if the event being recorded is deleted from both p/f in the EIT[p/f].

The EIT[p/f] may be unreceivable. In this case, it cannot be judged as event end. Whether to continue the event recording or not depends on the product design, but it is still recommended to detect the event end based on time.

(3) The event being recorded disappears from "present" in the EIT[p/f] and is described in "following" in the same sub-table.

This occurs when the event is interrupted by emergency news, etc. It is preferable that the receiver units continue to record or suspend temporarily and wait for restart if they detect the event interruption. However, the viewing/recording control information of the event broadcasted during the interruption is not always same as that of the original event; therefore, the event broadcasted during the interruption may be disabled to record.

3.12.2.3 Event interruped

It is preferable to keep monitoring the EIT[p/f] when the event is being interrupted, whether the receiver unit continues to record or not. During the time, the following may occur:

(1) The event being interrupted disappears from both “present” and “following” in the EIT[p/f].

This occurs when the event ends. It is preferable to end recording process that is continued or suspended, regardless of other conditions.

(2) The event being interrupted is described in "present" in the EIT[p/f].

This occurs when the event being interrupted restarts. If the receiver units suspended recording, immediately perform the recording restart process. Since the restart of event cannot be known until such condition is caused, restarting after suspension will always cause the beginning of the event to be cut.

While there are more possible ways to update the EIT[p/f], if the receiver units can correspond to the above two cases, there will be no problem.

During the event interruption, if the network is switched to another network due to any reason such as designation by viewer, care should be taken for the following:

While other network is being received, the EIT[p/f] for the relative event cannot be obtained. Therefore, the state of the relative event cannot be known, and it cannot be judged whether the interrupted event restarted or still being interrupted.

3.12.2.4 Event start time change and event cancellation

If the event does not appear in the EIT[p/f] at the originally scheduled start time, the start time of event is changed or the event is cancelled. (The event may start broadcasting earlier than the start time and already end although it is generally prohibited. In this case, perform the same process as that for event cancellation.)

There is no method of judging which case of the above two is caused. It should be judged by comparing the updated EIT[p/f], EIT[p/f after] and EPG/ECG metadata. For example, if the event does not appear in the EIT for more than three hours from the originally scheduled start time, the event is cancelled. Otherwise, the start time of the event is changed. To understand this situation accurately by the receiver units, they keep monitoring the EIT[p/f] for the relative service (EIT[p/f after] if possible) for three hours and inspect the appeared event. If the event does not appear, they inspect all EIT[p/f after] for the relative service three hours later to check if the relative event exists or not (search by "event_id"). If 24 hours passes, the same "event_id" will be assigned to another event; therefore, the relative event should not be inspected.

There is no guarantee that the processing above can be completed successfully because the EIT of another network is not transmitted (processing related to the individually operated SI is not always implemented). Therefore, whether the event is cancelled or whether the start time is changed is determined by the receiver's processing. For example, suppose that the event start time is changed in the television service 10 days later. If the receiver unit can handle the individually operated SI and detect the change, it can inform the viewers about the changed event start time. However, if the receiver unit cannot handle the individually operated SI, it will inform the viewers that the event is cancelled. (The method of announcing can be voluntarily determined. In all cases, the announcement can be that the event is not broadcasted at the originally scheduled start time.)

In addition, if the event does not appear in the EIT[p/f] at the originally scheduled start time, the event may be moved. If possible, it is recommended that the receiver units perform the same process as the above for other services in the same terrestrial broadcaster and with the same media type to check if the event is moved, in addition to the above process.

3.12.2.5 Event-forwarding

Event-forwarding is not used in multimedia broadcasting.

3.12.2.6 Automatic tracking to event relay

Event relay is not used in multimedia broadcasting.

3.13 Special service

Special service is not used in multimedia broadcasting.

3.14 Layer shift of service

In general, the service does not move to another layer after the service starts broadcasting. However, while rare, the service may temporarily move to another layer with higher resistance in the event of a natural disaster, etc. so that more receiver units can receive the service. Also, when the broadcaster intends to change an object of service contents, the service may move to another layer.

In which layer the service is broadcasted can judged from the TS information descriptor in the NIT. It is required to keep monitoring the NIT to detect the layer shift of service and immediately respond if the layer shift is detected.

When the layer shift of service occurs, care should be taken for the handling of EIT. Since the layer shift changes the EIT, EIT type and PID to be transmitted are changed. The type of the required EIT can be judged from the SDT. At this time, if the N-EIT is not transmitted, its reliability is lowered. Therefore, the obtained data of N-EIT which received before should not be used.

If the layer is temporarily shifted in the event of a natural disaster, etc., the SI (except the NIT) may not be correctly transmitted. Even in such case, the receiver units should display the video, audio and data correctly.

3.15 Process performed when SI transmission parameters are changed

When the SI transmission parameters are changed, in general, the SI parameter descriptor including the change date is previously placed, and the parameters are changed at 00:00 of the change date. It is recommended that the receiver units track the change of SI transmission parameters based on the description in the previously obtained SI parameter descriptor and time information.

However, the SI parameter descriptor may not previously placed and may be placed with the new contents in the BIT at the same time when the SI transmission parameters are changed. In this case, it is also recommended that the receiver units track the change of SI transmission parameters based on the description by constantly monitoring the BIT.

3.16 Concept of storage control

This section describes the storage control using EPG/ECG metadata in storable broadcasting.

For the same definition applied for the storable broadcasting content using EPG/ECG metadata, see Section 8.2 "Use of Location Resolution" in Vol. 10. For details on storage operation in the receivers, see Section 4 "ECG" in Appendix 1 of Vol. 2.

3.16.1 Storage reservation type

The following two methods are available for scheduling storage in storable broadcasting: manual storage by user and auto storage.

Manual storage can be scheduled using ECG, browsers, email, etc. As for auto storage, the content that is selected based on the information registered by the user in advance or the content that is selected based on the recommendation can be automatically scheduled to be stored, viewed, or used.

Whether or not a storable broadcasting service is used can be determined by referencing the service type value defined in the service list descriptor of the NIT.

For details on whether or not storage can be performed, see Vol. 2 "Multimedia Broadcasting Function Specification for the Receiver".

3.16.2 Reference model

Figure A1-1 shows the relationship among EPG/ECG metadata reception, transmission control metadata reception, content reception, reservation, and reservation execution in receivers for multimedia broadcasting. The receivers for multimedia broadcasting must be able to process EPG/ECG metadata correctly in the following situations.

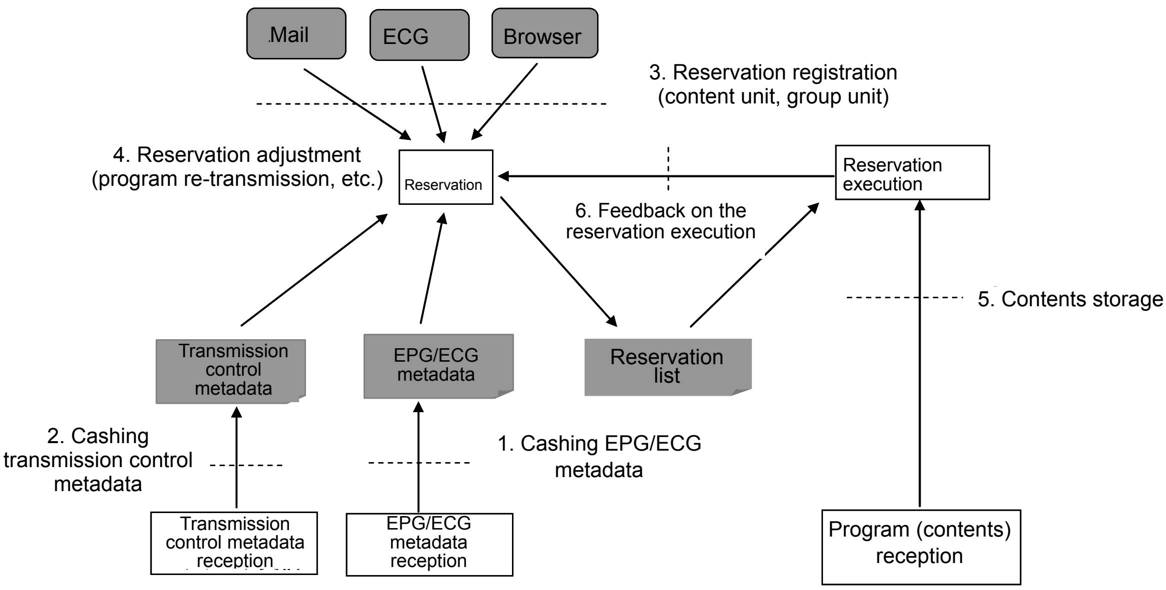


Fig. A1-1: Storage control reference model using EPG/ECG metadata

3.16.2.1 Caching EPG/ECG metadata and transmission control metadata

Caching is performed to present content information to the ECG and to reference reservation details from a browser.

It is desirable to cash the EPG/ECG metadata and transmission control metadata so that all registered content can be correctly reserved in a receiver for multimedia broadcasting. However, the degree to cache the EPG/ECG metadata and transmission control metadata is determined by the processing of the receiver for multimedia broadcasting.

EPG/ECG metadata and transmission control metadata may be updated. If the metadata is updated, it is preferable that the receivers for multimedia broadcasting check the update of the EPG/ECG metadata and transmission control metadata regularly, and reset the reservation and notify users immediately if a reservation schedule is changed.

Transmission should be performed, taking into account that the receivers for multimedia broadcasting cannot always immediately detect the update of the EPG/ECG metadata and transmission control metadata.

3.16.2.2 Reservation function

For the registration of the storage reservation of the content scheduled to be distributed in storable broadcasting, reservation arrangement, and content storage, see Section 4.4 "Scheduled Storage of Storage-based Broadcasting Content Using the ECG" in Appendix 1 in Vol. 2.

3.16.2.3 Feedback on reservation execution

It is necessary to provide feedback on a reservation execution result in order to notify failure of the storage reservation or an auto registration for reserving the content after a group reservation. The specific operation varies depending on the product design policy of each manufacturer.

VOLUME 5

Multimedia Broadcasting
Conditional Access System
Operational Regulations
Receiver Specifications

Contents

Chapter 1: General Terms

1.1 Preface

The specifications of the conditional access system for multimedia broadcasting receivers are stipulated in Part 4 of "Conditional Access System Specifications for Digital Broadcasting" by the Association of Radio Industries and Businesses (hereinafter referred to as "ARIB STD-B25").

Based on ARIB STD-B25, this volume supplementally stipulates the regulations for on-air operations and the requirements of receiver specifications. Therefore, see ARIB STD-B25 for other topics that are not presented in this volume.

This volume also describes in advance the operation of multiple conditional access systems, in order to avoid any malfunction of receivers during the operation of various future conditional access systems, including but not limited to the adoption of a scramble system for content protection using any future systems and new conditional access systems for new services.

1.2 Objective

Based on ARIB STD-B25, this volume describes the requirements of multimedia broadcasting receivers and operational information that must be considered when equipping CAS functions to such receivers.

1.3 Scope

The specifications described in this document apply to the on-air operation guidelines and the specifications of receivers in the Conditional Access System (CAS), which conforms to ARIB STD-B25 for multimedia broadcasting.

1.4 References

(1) Report of the Telecommunications Technology Council, Deliberation No.17
(2) Report of the Telecommunications Technology Council, Deliberation No.74
(3) Ordinance of the Ministry of Internal Affairs and Communications No. 87 of 2011
(4) Ministry of Internal Affairs and Communications Public Notice No. 298 of 2011
(5) Ministry of Internal Affairs and Communications Public Notice No. 299 of 2011
(6) Ministry of Internal Affairs and Communications Public Notice No. 302 of 2011
(7) "Service Information for Digital Broadcasting System" Standard (ARIB STD-B10)
(8) "Receiver for Connected Segments for Terrestrial Mobile Multimedia Broadcasting" Standard (ARIB STD-B53)
(9) "Content Download Systems for Advanced Wide-band Digital Satellite Broadcasting"

Standard (ARIB STD-B45)

(10) "Conditional Access System Specifications for Digital Broadcasting" Standard (ARIB STD-B25)

(11) "Operational Guidelines for Digital Terrestrial Television Broadcasting" Technical Report (ARIB TR-B14)

(12) "Operational Guidelines for Digital Satellite Broadcasting" Technical Report (ARIB TR-B15)

(13) "Digital Broadcasting System Based on Home Servers" Technical Report (ARIB TR-B27)

1.5 Terminology

The terms used in this technical report are defined as below.

ARIB	Association of Radio Industries and Business: The ARIB is an organization that standardizes technologies in relation to the use of radio in Japan, with participation by broadcasters, telecommunications operators, and equipment manufacturers.
AES	Advanced Encryption Standard: The U.S. government's next-generation standard for encryption, which has been certified by the National Institute of Standards and Technology (NIST) in 2001
BML	Broadcast Markup Language: The XML application language stipulated in "ARIB STD-B24, Volume 2"
CAS client ID	Identifier used to uniquely identify the CAS client
CAS client	Tamper-resistant module that performs the CAS process on multimedia broadcasting receivers
CAS server	Server that issues and manages the licenses
CA_system_id (CA system ID)	Identifier used to uniquely identify the CA system
CAT	Conditional Access Table; this specifies the identifier of the TS packet that transmits the individual information among related information comprising pay broadcasting.
CBC	Cipher Block Chaining: One of the encryption modes of block cipher; when encrypting a block, CBC performs the XOR (exclusive or/exclusive disjunction) operation between the block and the previous one, before performing the encryption.
Component	Component that comprises events (programs), such as video, sound, character, and other data
CRID	Content Reference Identifier: Name used to uniquely identify the available unit(s) of content
ECG	Electronic Content Guide; the method used to enable the presentation of the content information provided in multimedia broadcasting as well as the selection of content

ECM	Entitlement Control Message; the common information comprised of program information, such as information on the program and the key used to descramble, as well as the control information
EIT	Event Information Table; contains some information on the program, such as the name, broadcast time, and description; there are three types of EITs for multimedia broadcasting: N-EIT for display in weak-layer services, M-EIT for display in strong-layer services, and W-EIT for display in partial-transmission-layer services.
EMM	Entitlement Management Message; contains individual information that includes the work key used to decode the encryption of the common information and the subscription information for each subscriber
EPG/ECG metadata	Description language-type metadata stipulated in ARIB STD-B38; this is used for performing content guides and content navigations.
EPG	Electronic Program Guide; method used to enable the presentation of program information, such as the timetable, and the selection of programs for real-time broadcasting services
ES	Elementary Stream; corresponds to encoded video, sound, and independent data in a PES packet; one ES is transmitted by a PES packet with an identical stream ID.
Event	Collection of streams with certain start/end times in the identical service (program channel), such as news or drama
HTTP	Hypertext Transfer Protocol: Application layer protocol stipulated in "IETF RFC1945"
HTTPS	Hypertext Transfer Protocol Secure; among the application layer protocols, the protocol used for World Wide Web data transmission (RFC2616)
Kc	Content key: Key used to encrypt the content that is distributed using storable broadcasting
Km	Master key: Key used to encrypt the EMM containing the work key distributed via broadcasting; this is unique to each CAS client.
Ks	Scramble key: Key used to encrypt real-time broadcasting content; this key is updated periodically.
Kw	Work key: Key used to encrypt the scramble key
module_id	Identifier used to uniquely identify the module in the data carousel
OFB	Output Feedback: Output feedback mode; one of the encryption modes of the block cipher; this defines the encryption block from the XOR operation between the encrypted initialization vector and the block to be encrypted.
PID	Packet ID (Identifier); the 13-bit stream identification information of the TS packet header; this indicates the attribute of each stream in the applicable packet.
PMT	Program Map Table; this specifies the packet IDs of the TS packets that transmit the encoding signals comprising the program or that transmit the ECM.

PPC	Pay Per Content: Storable broadcasting service where one can purchase each available unit of content
PPV	Pay Per View; pay broadcasting where the fee is collected for each program or program group in accordance with the user's watching style
PSI	Program Specific Information; required for selecting the necessary program; this is comprised of five tables: PAT, PMT, NIT, CAT, and INT.
RMPI	Rights Management and Protection Information: This is the condition under which content is used.
SDT	Service Description Table; this contains information on the program channel, such as the channel name and the broadcasting enterprise name.
SI	Service Information; information stipulated for the convenience of program selection; this is defined by the Ordinance of the Ministry of Internal Affairs and Communications, and the content is stipulated as the ARIB standard. It contains the ARIB standard-specific extension as well as the PSI information of MPEG-2.
TS	Transport Stream; stipulated in the MPEG-2 Systems Standard (ISO/IEC 13818-1); 13-segment broadcasting is used for multimedia broadcasting, with 1 TS for each 1-segment of broadcasting.
TS packet	Packet with a fixed length of 188 bytes, as stipulated in “ISO/IEC13818-1”
URI	Uniform Resource Identifier; description system used to indicate the resource location; this concept includes the URL.
XML	Extensible Markup Language: One of the description languages established by W3C
Storable broadcasting	One of the terrestrial multimedia broadcasting services based on connected segment transmission, which is provided when downloading
Event	For programs, the “event” described in “ARIB STD-B10”
Conditional access system for playback	Conditional access system for playback in digital broadcasting
Conditional access system for reception	Conditional access system for reception in digital broadcasting
Content key (Kc)	Key used to encode or decode the key of storable broadcasting content (Kc); this is unique to the CRID.
Free program with content protection	Free programs that securely transmit content on the airwaves, with the purpose of protecting the rights of the content
Free program with rights protection	Free programs that control duplications using a digital copy control descriptor and a content availability descriptor
Business entities identifier	Code used to identify the service business entity for the operation of the Conditional Access System; this is included in the related information.
Receiver	Receivers that support multimedia broadcasting
Receiver storage device	Storage devices built into the receiver
Product/merchandise design	Functions and operations that depend on the receiver or merchandise

Scramble key (Ks)	Key used to encrypt the real-time broadcasting content; this is updated periodically.
Real-time broadcasting content	Content for which the time necessary to send out and the time necessary to view always coincides; for broadcasting, this is encrypted using the scramble key (Ks).
Trickplay	Special playback, such as fast-forward, rewind, and skip play
Secure authenticated channel	The secure communication session that is established after authentication between different components; the data on this channel is encrypted with a session key, which is shared when establishing the communication session.
Merchandise	The concept that refers to the smallest unit of content that can be available through a procedure, such as service subscription, and a collection of licenses for the exploitation rights of the content; plain and simple, a collection of content that is generally considered a unit for billing; equivalent to a package in existing TRs
Receiver ID	ID assigned to each receiver for the identification of the receiver
Storable broadcasting content	Content, for which the time necessary to send out and the time necessary to view does not always coincide; for broadcasting, this is transmitted in the IP over the MPEG2 format and encrypted using the content key (Kc).
Flat/tier	Subscription services for multiple channels or by channel
Master key (Km)	Key used to encrypt the EMM containing the work key (Kw); this is unique to each CAS client.
Metadata	The term “metadata” in this volume refers to the aforementioned “EPG/ECG metadata” (the description language-type metadata stipulated in ARIB STD-B38).
License	The information regarding usage conditions (RMPI) and the exploitation rights of the available unit of content; this also refers to the copyright data containing the usage conditions (RMPI) and the decryption key used to decode the encrypted content. The license ID is configured as information used to uniquely identify the license.
License reference information	Metadata that contains the information on licenses
License ID	Identifier used to uniquely identify the license in the CAS
Resource	The smallest reference unit and usage unit, which comprise the available unit of content; the same concept as the object, described in Volume 11; however, the description is not unified across different parts, toward understanding the related STD and TR in the same technical field.
Available unit of content	Content for exploitation by users; unit content is comprised of one or more resources. This volume may simply describe the unit content as “content.”
Resident application	In receivers, the function block that performs the listing of licenses

Renderer	The only function block that can handle the encrypted content, content key, and usage conditions within the receiver; a renderer is comprised of a descrambler, a decryptor, an AV decoder, and a BML browser and clock. It decrypts the encrypted content and decodes it.
Renderer usage conditions	Usage conditions used to control the exploitation of the content by renderers; they are created by the CAS client based on the license.
Work key (Kw)	Key used to encrypt the scramble key
Conditional access broadcasting	Broadcasting using the conditional access descriptor; conditional access broadcasting includes pay programs and free programs with content protection.
Free program	Non-chargeable programs; the free_CA_mode of these programs described in the SDT and EIT is set to 0.
Chargeable program	Chargeable programs; the free_CA_mode of these programs described in the SDT and EIT is set to 1.
Content protection system	The content protection system is defined as the technique that uses, for example, encryption, to prevent the illegal modification and copying of content, for the purpose of protecting the rights of the content.
Entrusted broadcaster	Same as "certified infrastructural broadcaster"
Entrusting broadcaster	Same as "infrastructural broadcasting provider"

Chapter 2: Conditional Access System Specifications for Multimedia Broadcasting

2.1 Conditional Access System Specifications for Multimedia Broadcasting

The conditional access system (CAS) for multimedia broadcasting is categorized into the conditional access system for reception and the conditional access system for playback, as stipulated in Part 4 of "ARIB STD-B25 Conditional Access System Specifications for Digital Broadcasting."

The conditional access system for reception decrypts the encrypted (scrambled) content upon receipt to enable the content to be viewed and used in realtime. On the other hand, the conditional access system for playback decrypts the encrypted content stored in storage devices in multimedia broadcasting receivers upon playback to enable the content to be viewed and used as per the usage conditions permitted by the broadcaster.

Table 2-1 classifies the conditional access systems, service names, license types, and transmission methods for multimedia broadcasting systems.

Table 2-1: Classification of conditional access systems (service name, license type, and transmission method)

Conditional access system	For reception		For playback
Service name	Realtime broadcasting service		Storable broadcasting service
License type	Realtime broadcasting license		Storable broadcasting license
Message name	ECM	EMM	
Transmission by broadcasting	○	△*1	–
Transmission by communication	–	○	○

○: Operable (required for performing the service)

△: Operable (optional)

–: Not operable

*1 The transmission of the realtime broadcasting license by communication (EMM) is sent out from the receiver. Therefore, if you want to send out the EMM from the transmitter, the transmission is only available by broadcasting.

2.2 Overview of Conditional Access Systems

2.2.1 System reference model

Figure 2-1 illustrates the reference model of the conditional access system (CAS) in multimedia broadcasting.

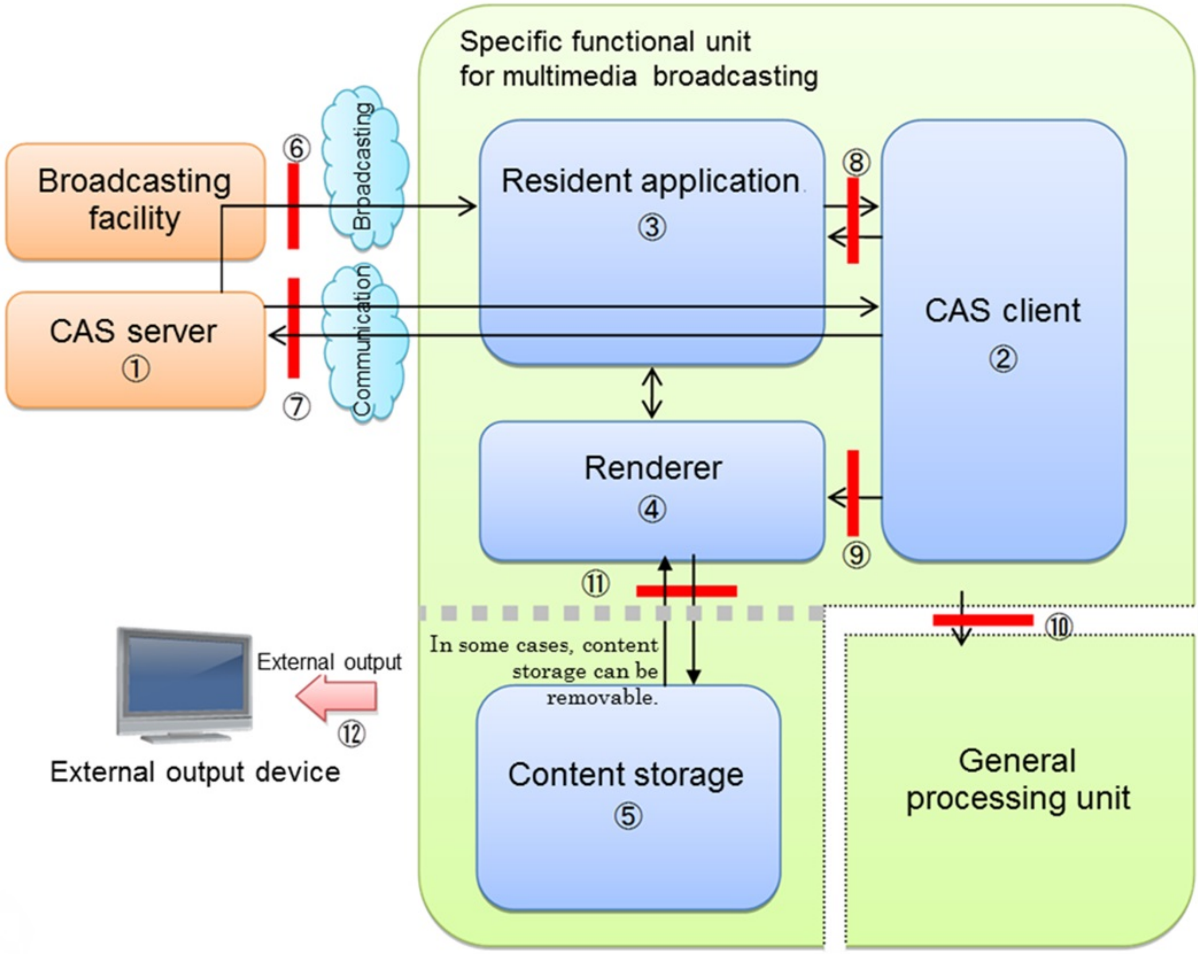


Figure 2-1: Reference model of the CAS

2.2.1.1 Components of the CAS in multimedia broadcasting

The CAS in multimedia broadcasting is comprised of the following components [1]–[4].

- CAS server [1]

The component that manages the licenses

The main functions of the CAS server are as follows.

- Management of keys necessary for the realtime and storable broadcasting services
- Encryption of the content of the realtime and storable broadcasting services
- Issuing the license for the realtime and storable broadcasting

- CAS client [2]

The component that manages the licenses received via broadcasting or communication and that controls the usage of the content based on those licenses

The main functions of the CAS client are as follows.

- Storing keys necessary for the realtime and storable broadcasting services
- Obtaining the license for the realtime and storable broadcasting

- Deciding the availability of the content of the realtime and storable broadcasting services

- Resident application [3]

The component that provides users with the interface and that controls the renderer and the CAS client

The main functions of the resident application that relate to the CAS are as follows.

- Obtaining the current time
- Providing the communication function necessary for obtaining licenses
- Exporting the content based on the content usage conditions

- Renderer [4]

The component used to playback and use the content

The main functions of the renderer that relate to the CAS are as follows.

- Decrypting and descrambling the content using the content key and scramble key
- Controlling the playback of the content (such as limiting the duration of playback and controlling external copies)
- Operation within the period permitted by the obtained license

2.2.1.2 Related components of the CAS in multimedia broadcasting

The CAS in multimedia broadcasting is mainly comprised of the following.

- Content storage [5]

The unit that stores the content received through storable broadcasting services and that reads the stored content in response to a read-out request

The main functions of the content storage are as follows.

- Storing the content received in storable broadcasting services as it is, i.e., without decrypting it if it is encrypted with the content key
- Reading out the stored content in response to a read-out request and passing it to the renderer

- The function used to pass the stored data from the internal processing interface [10] to the general processing unit; this processing unit is not specified in this technical report.
- General processing unit

  The processing unit that uses unique content created from the receiver's product/merchandise design; this processing unit is not specified in this technical report.

2.2.1.3 Interface of the CAS in multimedia broadcasting

The interface between CAS components in multimedia broadcasting is comprised of the following interfaces [6]–[12].

- Transmission system by broadcasting for licenses [6]

The transmission system by broadcasting for the realtime broadcasting license

The realtime broadcasting license transmitted by broadcasting is transferred to the CAS client by the resident application-CAS client interface [8].

- CAS server-CAS client interface [7]

The interface by communication between the CAS server and the CAS client

- Resident application-CAS client interface [8]

The CAS client does not have broadcast receiving, de-multiplexing, and communication functions. Therefore, you need a function to transmit the realtime broadcasting license and storable broadcasting license distributed from the CAS server via broadcasting or communication to the CAS client. The resident application provides these functions.

- Renderer-CAS client interface [9]

The CAS client does not have functions to render the content, such as playback or usage. Therefore, you need functions to transmit instructions for the playback or usage of content from the CAS client. The renderer provides these functions.

- Interface between the specific functional unit for multimedia broadcasting and the general processing unit [10]

The interface between the specific functional unit for multimedia broadcasting and the general processing unit on the receiver

- Content storage output interface [11]

The content is input and output between the specific functional unit for multimedia broadcasting and the content storage.

The main functions and the information that are input and output are listed below. Removable memories may be used for the content storage.

  - Storing the content obtained by the receiver through the storable broadcasting service

- External output interface [12]

For the external output from the receiver in multimedia broadcasting, follow the functional requirements for the content protection stipulated in “3.3 Output control,” Volume 8 of this technical report.

2.2.2 Interface that requires provision for security

For the interface that transmits licenses and content keys, it is necessary to establish a secure channel to ensure security.

The interfaces that require a provision for security are listed below.

- CAS server-CAS client interface [7]

  Prevents unauthorized obtainments of licenses using a secure authenticated channel

- Renderer-CAS client interface [9]
  Upon implementation, you must be on the alert for unauthorized obtainments of content keys or scramble keys.

2.2.3 Configuration of the CAS client

The CAS client has two types of functions: the ones that are configured individually by the entrusted broadcaster, which the users subscribe to, and the other ones that are used commonly regardless of the entrusted broadcaster.

2.3 License Models

2.3.1 Definition of licenses

Multimedia broadcasting presumes two types of service: storable broadcasting service and realtime broadcasting service.

The key to decrypt the encrypted content, which is necessary to subscribe to these two services, and the information detailing the scope of exploitation rights, are called "storable broadcasting licenses" and "realtime broadcasting licenses," respectively.

2.3.2 Types of licenses

Types and characteristics of licenses used in the CAS

(1) Storable broadcasting license (classed as a single-tier license)

This includes the license ID, content key, and usage conditions (RMPI).

(2) Realtime broadcasting license (classed as a two-tiered license)

There are two types: EMM and ECM. The EMM contains the work key to encrypt the ECM and the expiry date.

This license is only available when both the EMM and ECM are valid.

2.3.3 Transmission of licenses

For the transmission of licenses in multimedia broadcasting, both realtime broadcasting and storable broadcasting services mainly use the communication function. The CAS client requests the CAS server to obtain the license, and the license is issued based on the user's subscription status. A secure authenticated channel must be used for the communication.

Broadcasting enterprises may update the realtime broadcasting license (EMM) through broadcasting. Therefore, receivers must have a function to obtain the EMM through broadcasting.

2.3.4 Storage management of licenses on the CAS client and receivers

This section describes where and how the licenses are stored in the CAS client by license type, along with an overview of the management method.

- Storage of storable broadcasting licenses
  1. Storable broadcasting licenses are stored in the CAS client to prevent any tampering of licenses.
  2. The CAS client must be managed associating storable broadcasting licenses to the CRID that refers to unit content.
  3. When the CAS client memory used to store licenses is full, it cannot store new storable broadcasting licenses. As a result, a significant reduction of usability is predicted. To prevent such conditions, receivers must have a function to delete expired licenses. It is desirable to have a mechanism to prevent the memory from becoming full, using some functions such as releasing memory by automatically deleting expired licenses and restricting the obtainment of new storable broadcasting license when the memory is full. This volume does not describe specific mechanisms and operations, except the license deletion function, which is used to prevent the memory full.
  4. The CAS server selects valid storable broadcasting licenses under agreement among those corresponding with the CRID that are required by the CAS client, and transmits the applicable licenses. If there are multiple valid storable broadcasting licenses for one CRID, one of those licenses is transmitted. This volume does not describe which license is transmitted.

- Storage of realtime broadcasting licenses
  1. Realtime broadcasting licenses are stored in the CAS client.
  2. With realtime broadcasting licenses, you can estimate the upper limit of the required storage capacity. When updating, licenses must be overwritten in the area assigned to the CAS client.

2.3.5 Operable services and forms of license transmission

Table 2-2 lists the services operable with the conditional access system and the supported forms of license transmission.

Table 2-2: Services operable with this service and the supported forms of license transmission

Type of content	Form of service	License model	License transmission method	Type of license
Realtime broadcast content	PPV PPM PPP	Two-tiered license	Communication/broadcasting (EMM)	Realtime broadcasting license
			Broadcasting (ECM)	

Storable broadcast content	PPC PPM PPP	Single-tier license	Communication	Storable broadcasting license

2.3.6 Components of licenses

This section describes the main components of each license.

2.3.6.1 Storable broadcasting licenses

Table 2-3 lists the main components of storable broadcasting licenses.

Table 2-3: Main components of storable broadcasting licenses

Component	Description
License ID	Identifier of a license
Content key (Kc)	Key used to decrypt the encrypted content
Usage conditions (RMPI)	Content usage conditions (See “2.3.6.3 ” in this volume.)

2.3.6.2 Realtime broadcasting licenses

Table 2-4 lists the main components of realtime broadcasting licenses.

Table 2-4: Main components of realtime broadcasting licenses

Component	Description
Business identifier	Business identifier
Tier bit	Bit stream used to identify the service that the user subscribes to
Expiry	Expiry date of a realtime broadcasting license
Work key ID (even)	Work key identifier (even)
Work key ID (odd)	Work key identifier (odd)
Work key (even)	Work key (even)
Work key (odd)	Work key (odd)
Extension tier	Information necessary to operate the PPV

2.3.6.3 Content usage conditions (RMPI)

Table 2-5 lists the usage conditions (RMPI) in the conditional access system.

Table 2-5: Items regarding usage conditions (RMPI)

Control	Item of usage conditions (RMPI)	Description
Playback	Start of expiration for viewing	Start time of expiration for viewing/usage of content

	End of expiration for viewing	End time of expiration for viewing/usage of content
	Expiration for viewing	Duration of time (in seconds) available for viewing the content since the start of viewing/usage
	Viewing counts	Number of times the content can be viewed or used
	View control information	Information on the control of viewing counts
Trickplay	Possibility of trickplay	Specifies the possibility of trickplay
	ID information for sections where fast-forwarding is prohibited	Flag string corresponding with the scene ID (SceneID)
External output during playback	Output control information during playback	Information on the output control when playing back the content
	Rating information	Rating information for parental control

2.3.7 Renderer usage conditions

The renderer usage conditions are the conditions for the renderer to control the usage of content. The renderer usage conditions are sent by the CAS client from the license usage conditions (RMPI) to the renderer.

Renderer usage conditions upon playback and exporting are called “renderer usage conditions upon playback” and “renderer usage conditions upon export,” respectively.

Note that the format of the renderer usage conditions is not defined in this technical report.

2.3.8 Overview of license processing

This section describes the overview of license processing in the entire receiver and the overview of license processing in the CAS client and the renderer when using the content.

2.3.8.1 Overview of license processing in the entire receiver

Figure 2-2 illustrates the overview of processing in the entire receiver for the licenses issued from the CAS server.

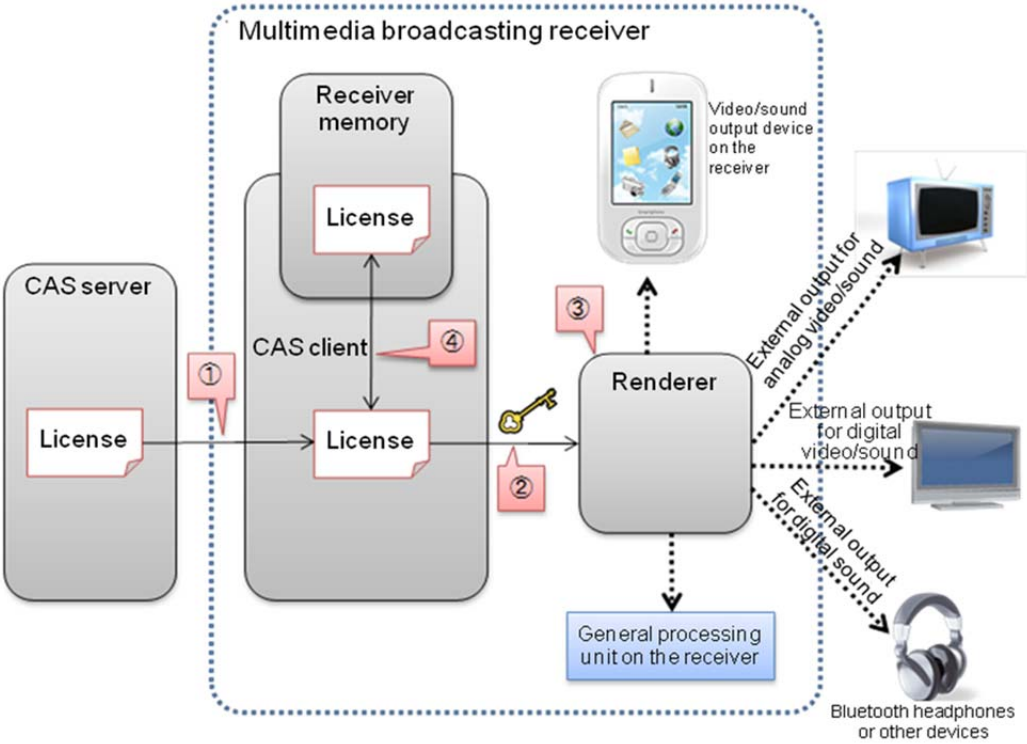


Figure 2-2: License processing in the entire receiver

[1] Obtaining and updating licenses

The CAS client obtains realtime broadcasting licenses through broadcasting or communication, or storable broadcasting licenses through communication from the CAS server. Regarding whether communication or broadcasting is used for the obtainment, see Table 2-1.

When requested by the CAS client, the CAS server issues the license based on the subscription information of the user having the receiver with the applicable CAS client.

Even if the program has already been purchased and licensed, re-issuing the same license may be limited when the license has not yet expired (storable broadcasting services).

For receivers, from the viewpoint of preventing congestion on the CAS server or network, which can cause the substantial reduction of usability, it is required that necessary and sufficient licenses may be requested in accordance with the CAS server or network resources. Note that the format of communication is not defined in this volume (storable broadcasting services).

[2] Availability decisions using the CAS client

For storable broadcasting services, the CAS client determines the availability of content based on the usage conditions (RMPI) of the obtained licenses. If the content is available, the content key and renderer usage conditions are sent to the renderer.

For realtime broadcasting services, the CAS client always checks the correspondence between the information on the availability of content contained in the realtime broadcasting license and the content usage condition information that is sent out with the realtime broadcasting content, and then determines that the content is available only when this information matches.

[3] Availability decisions and usage control using the renderer

The renderer obtains the renderer usage conditions and content key as a storable broadcasting license, along with the scramble key as a realtime broadcasting license, from the CAS client.

For storable broadcasting services, the renderer controls the usage of content according to the renderer usage conditions, decrypts the encrypted content using the content key, plays back the content, and passes the content to other processing units that are internally connected.

In realtime broadcasting services, the renderer decrypts the encrypted content using the scramble key and plays back the content.

[4] Storing, managing, and deleting storable broadcasting licenses

See 2.3.4.

[5] Storing, managing, and deleting realtime broadcasting licenses

See 2.3.4.

2.3.8.2 License management in the CAS client

To associate content with storable broadcasting licenses, use the CRID assigned to the content as the license management ID. Therefore, you must specify the CRID on the receiver to use or delete licenses stored in the CAS client or to input or output licenses stored in the receiver.

2.3.8.3 License processing on the CAS client and the renderer when using storable broadcast content

This section describes the overview of license processing on the CAS client and the renderer when using storable broadcast content.

2.3.8.3.1 Overview of processing for storable broadcasting services

The renderer requests the CAS client for use of the content by specifying the following items.

- License to playback the content (CRID)

When the CAS client receives the request for use of the content from the renderer, it performs the following processing.

(1) Availability decision

- For storable broadcasting licenses, the CAS client determines availability from the usage conditions (RMPI) and the RMPI items that are consumed on use, i.e., the expiration for viewing or the viewing counts.
- It is prohibited to use multiple licenses in use simultaneously, as they may contain the abovementioned RMPI items. When the CAS client receives the notification from the renderer that it has finished using the content, those licenses in use now can be used simultaneously.

(2) Submission of a content key and renderer usage conditions to the renderer
- The renderer usage conditions are generated from the usage conditions (RMPI).
- The content key and renderer usage conditions are sent to the renderer.

When the renderer receives the content key and renderer usage conditions, it performs the following processing.

(3) Availability decision using the renderer usage conditions
- The availability of content is determined using the renderer usage conditions obtained from the CAS client.

(4) Usage of content
- If the content is judged to be available due to the availability decisions, the renderer decrypts the content using the content key.

The renderer controls the usage of content by performing the abovementioned processing.

When the user stops using the content, or when the content is judged to have been used beyond the renderer usage conditions, such as due to the expiration of the playback time, the renderer stops decrypting the content and erases the content key.

Figure 2-3 illustrates the overview of processing in the CAS client and the renderer when using content.

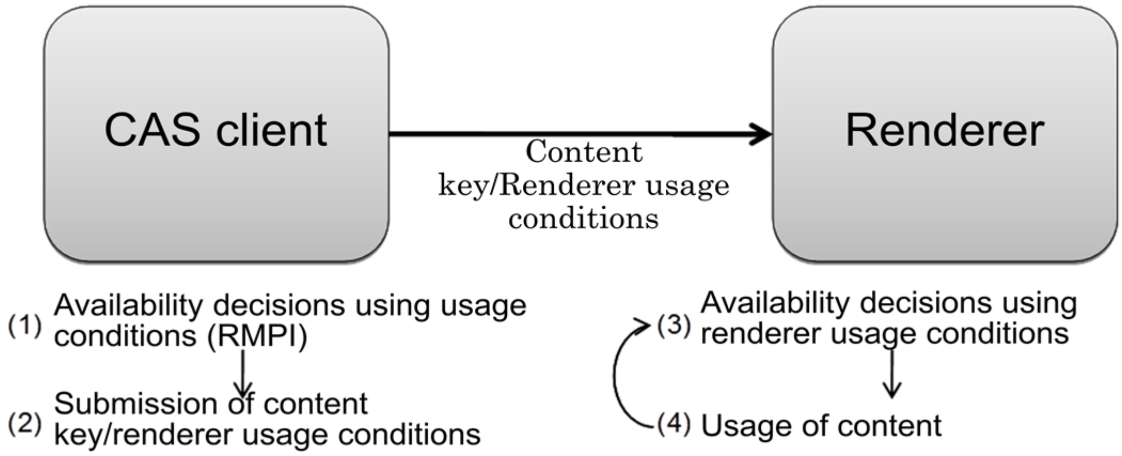


Figure 2-3: Overview of processing in the CAS client and the renderer when using storable broadcast content

- Supplemental remarks

  For an available unit of content comprised of multiple resources, the usage conditions (RMPI) configured in the license are applied as follows.

  - The usage conditions consumed when the content is used, i.e., the viewing counts, are only applied to specific resources including the available unit of content, which is separately specified in the manifest file. For more information on the manifest file, see Volume 11 of this technical report.
  - Other usage conditions not consumed when the content is used, i.e., the expiration for viewing, are applied to the entire available unit of content.

2.3.8.3.2 Overview of processing for realtime broadcasting services

When the CAS client receives a request for using the content from the renderer, it performs the following processing.

(1) Availability decision

- The CAS client always checks the correspondence between the information on the availability of content described in the realtime broadcasting license and the usage conditions described in the ECM that are transmitted with the realtime broadcast content, and then it determines that the content is available only when both of these conditions are satisfied and match,

(2) Sending back from the CAS client to the renderer

- Result of content availability decisions
- The scramble key and the renderer usage conditions are sent back.

When the renderer receives the scramble key and renderer usage conditions, it performs the following processing.

(3) Usage of content

- If the content is judged to be available by the availability decision, the renderer decrypts the content using the scramble key.

The renderer controls the usage of the content by performing the abovementioned processes.

Figure 2-4 illustrates the overview of processing in the CAS client and the renderer when using content.

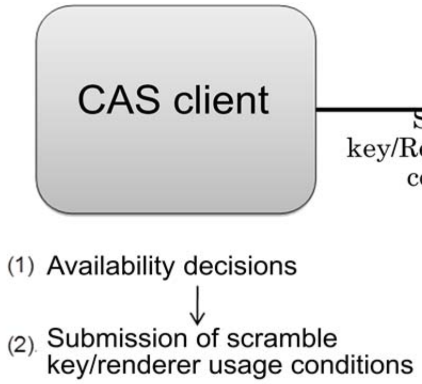


Figure 2-4: Overview of processing in the CAS client and the renderer when using realtime broadcast content

- Supplemental remarks

The renderer obtains the scramble keys, which are periodically updated, in succession from the CAS client.

2.4 Information Related to Access Control

2.4.1 License reference information

License reference information refers to the information for users to check the usage conditions coming with the content by using an interface, such as the ECG, when purchasing merchandise or before obtaining licenses. For more information, see Section 3.6.1 in Volume 10 of this technical report.

2.4.1.1 Presumptions for the operation of license reference information

It is desirable that the information is transmitted with the program information elements. When such metadata is not transmitted, the license reference information is not transmitted as well.

For more information, see Section 3.6.3 in Volume 10 of this technical report.

2.4.1.2 Relationship among license reference information, merchandise information elements describing the merchandise, and program information elements

Figure 2-5 illustrates the license reference information and the license such refers to, along with the merchandise information elements describing the merchandise and the merchandise such refers to, program information elements and the content such refers to, and the relationships among all of them. One license corresponds to only one available unit of content, without exception. The license (and the corresponding license reference information), the merchandise information elements describing the merchandise, and the content (and the corresponding program information elements) are identified using the license ID (LicenseID), purchase ID (PurchaseId), and the content ID (CRID), respectively.

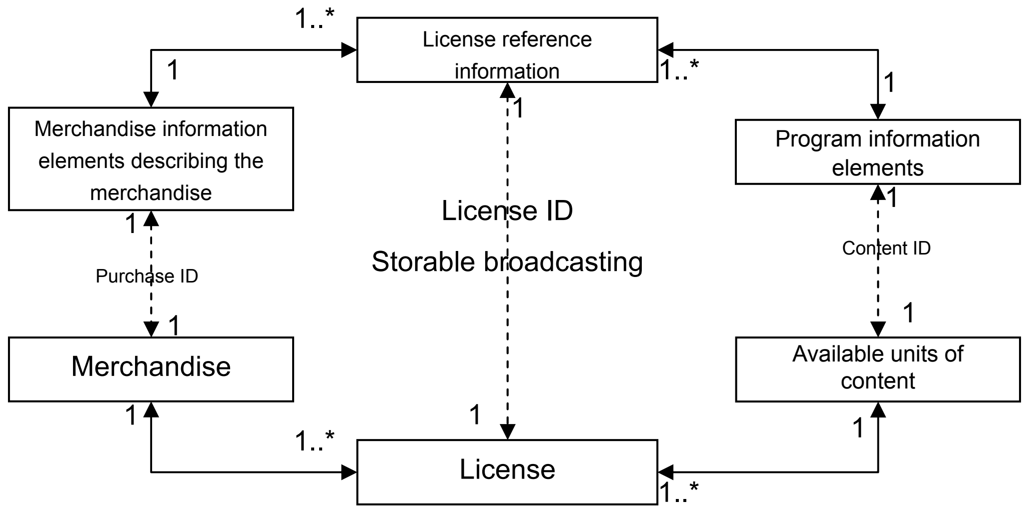


Figure 2-5: Relationship among the license reference information, merchandise information elements describing the merchandise, and program information elements

1..*: One-to-many correspondence

2.4.2 Merchandise (for reference)

2.4.2.1 Overview of merchandise

This volume does not define merchandise. This section describes the conceptual relationship between merchandise and licenses, compared to the common sales of goods.

As shown in Figure 2, merchandise can be comprised of one or more available units of content. An available unit of content and the license come in one-to-one correspondence for one piece of merchandise. As shown in Figure 27, an available unit of content can belong to multiple merchandise items simultaneously.

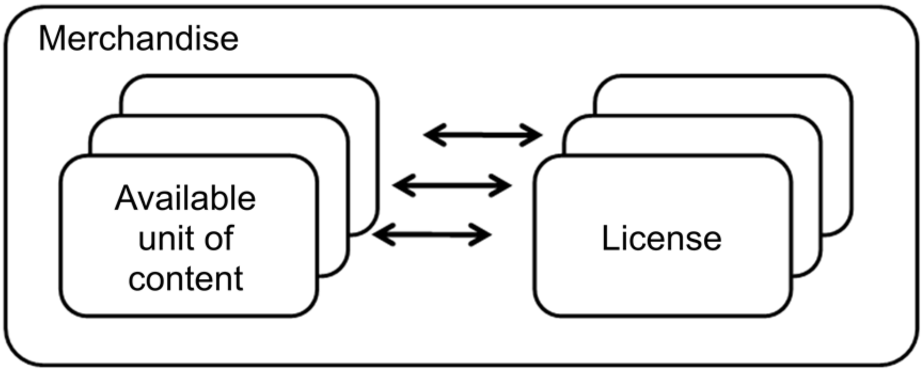


Figure 2-6: Correspondence between an available unit of content and a license in common merchandise

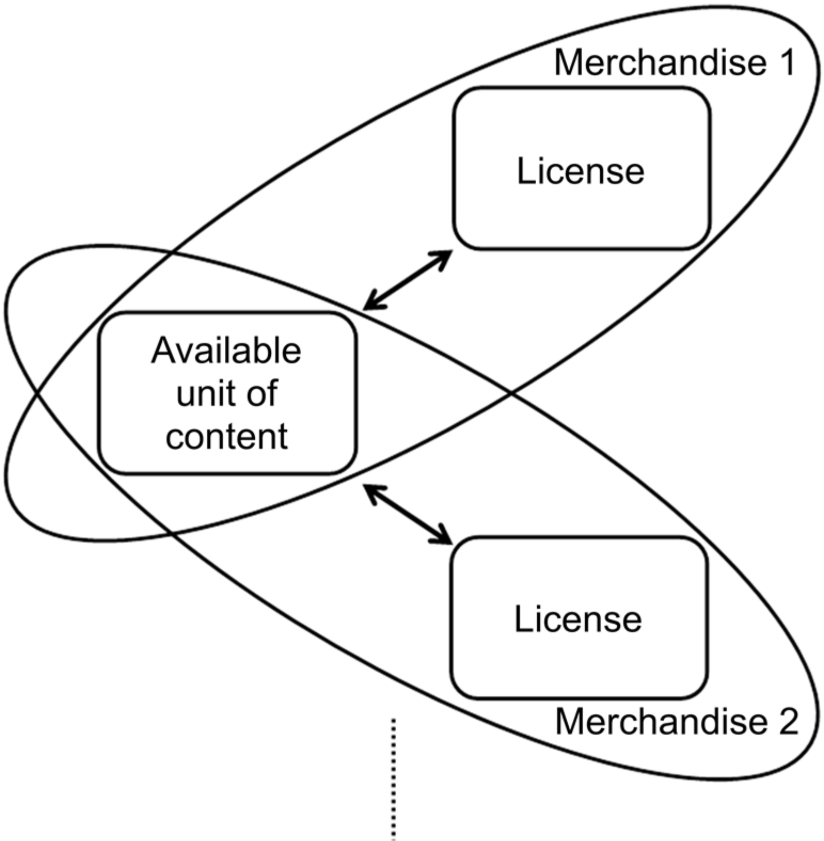


Figure 2-7: Correspondence between an available unit of content and a license

All available units of content are not always broadcasted simultaneously. Purchase information elements describing the merchandise (PurchaseInformation) are described as metadata designating merchandise, according to “Volume 10 Multimedia Broadcasting Meta

Data Operational Regulations" in this technical report. The types of merchandise (PurchaseType) are described in the following section.

2.4.2.2 Purchase types

The purchase types can be grouped according to whether the merchandise is billed or not, by the type of service, and by the assumed forms of the licenses, as shown in Table 2-6.

Table 2-6: Example of the classification of purchase types

Purchase type	Summary	Billing	Service type	Presumed license
Free	Merchandise that can be viewed and used free of charge	Free	Realtime	Realtime broadcasting license
			Storable	Storable broadcasting license
Merchandise under the basic contract	Merchandise for which the contract can be updated for a certain period as required	Periodic rate amount	Realtime	Realtime broadcasting license
			Storable	Storable broadcasting license
Merchandise that requires additional contracts				
Pay Per Minute (PPM)	Merchandise that can be viewed and used by the periodic subscribing of additional merchandise and by making a contract	Periodic rate amount	Realtime	Realtime broadcasting license
			Storable	Storable broadcasting license
Pack (PPP)	Merchandise that can be viewed and used by purchasing a package comprised of a limited number of content	Package	Realtime	Realtime broadcasting license
			Storable	Storable broadcasting license
Pay Per View/Pay Per Content	Merchandise that can be viewed and used by purchasing each available unit content	Single unit	Realtime	Realtime broadcasting license
			Storable	Storable broadcasting license

2.4.2.3 Subscription and license obtainment for merchandise or services

A service subscription necessary for receiving multimedia broadcasting involves a process where a user assigns certain merchandise to a receiver permitted for each unit of content and where the receiver obtains the exploitation rights for the content in the merchandise. As the result of the service subscription, the user obtains the exploitation rights for the content. The user cannot always obtain the license on the CAS client at that time. It is assumed that the license is obtained after the service subscription is completed until the user utilizes the content for the first time.

CAS client activation is an operation necessary for using the CAS client for the first time. After the CAS client is activated, the broadcaster can register the assignment between the merchandise and the receiver. Then, the broadcaster can issue the license for the available unit of content comprising the merchandise, in accordance with the request from the CAS client.

As the result of service subscription, the user must set the resident application to keep track of assigned merchandises, along with the available units of content that comprise the merchandise and their licenses. This is because the content must be available with the explicit specifications of the available licenses through the product design of a receiver when the user uses the ECG to display the availability of content or the purchase history of merchandises, as well as when playing back the available unit of content—especially when an available unit of content corresponds to several licenses.

2.4.2.4 Merchandise information elements describing the merchandise

Elements of merchandise information are used for merchandise, and the purchase ID (PurchaseID) is used as the merchandise information elements describing the merchandise.

The merchandise information elements describing the merchandise are assumed to be used for the following purposes.

- Service subscription in the ECG

In cases shown in Table 2-6, if a user wants to subscribe to services in the ECG using the receiver's resident application, it is necessary to obtain and store the merchandise information elements describing the merchandise in the receiver by the time of service subscription. Then, it is presumed that the user subscribes to the services after checking the structure and price of the merchandise through some related information such as the merchandise list in the ECG. The service subscription involves the use of communication. Therefore, it is presumed that the user selects the merchandise in the ECG, accesses the URI including the URL of the site on the location indicated by the PricingServerURL in the purchase information describing the merchandise (PurchaseInformation), and then makes the detailed service subscription by specifying the metadata obtained from the URI.

- Displaying the purchase information and related content information using the ECG after subscribing to services

In cases shown in Table 2-6, if a user wants to display the list of merchandise under contract and the list of content included in the merchandise in the ECG using the receiver's resident application, it is necessary to obtain and store the merchandise information elements describing the merchandise, as along with program information elements and license reference information. The example is an operation where a user obtains and stores such elements and information concurrently with the available unit of content when receiving storable broadcast content. At the time of service subscription, the user must record and store the purchase ID (PurchaseId) for the subscribed merchandise within the receiver. By performing these operations, the list of the merchandise information elements under the contract of the service subscription can be displayed with the purchase ID of the subscribed merchandise stored in the receiver and the merchandise information elements describing such merchandise. Additionally, it is also possible to display the information on the content that belong to the merchandise by combining the program information elements.

To implement such application, the desirable operation is such that the merchandise information elements are transmitted with both the program information elements and license reference information, upon which the receiver obtains and stores such information together.

2.4.3 License link information (LLI)

LLI is not used in multimedia broadcasting.

2.4.4 Information on subscribed merchandise (for reference)

To show the list of the merchandise that is already purchased and under contract in the ECG of the receiver's resident application and to play back the unit content explicitly specifying the license for which the user has the right, the information with which the target content may be identified must be registered and stored when completing the subscription.

The receiver receives the notification on the completion of the subscription, then registers and stores the purchase ID (PurchaseId) in the receiver. At the time when the receiver obtains both of the purchase ID and the merchandise information elements describing the corresponding merchandise, the ECG can display the list of the merchandise that is already purchased and under contract.

2.4.5 Trickplay segment information

The trickplay segment information can be operated by setting anti-trickplay segment information for each scene of information that is inscribed in the manifest file, which is one of the resources comprising storable broadcast content, and by then specifying the anti-trickplay segment with the RMPI. TSI (Trickplay Segment Information) is not used.

Chapter 3: Content Encryption Schemes

3.1 Encryption Schemes of Broadcasted Content

3.1.1 Scrambling scheme of content for realtime broadcasts

For the scrambling scheme of content for realtime broadcasts, see the appended Table 1 through Table 3 of Article 1 (3) of Public Notice No. 302. AES is used as an encryption algorithm. Its key length is defined as 128 bits for the moment.

The range of scrambling is defined as the payload of TS packets, as specified in Article 1 (1) of Public Notice No. 302. The encryption mode is implemented as CBC mode, as specified in the appended Table 2 of Public Notice No. 302, while fractions are processed in OFB mode.

3.1.2 Encryption schemes of storable broadcast content

3.1.2.1 Structure of storable broadcast content (for reference)

Storable broadcast content is an aggregate of one manifest file and one or more resources, constituting an available content unit with the structure shown in Figure 3-1.

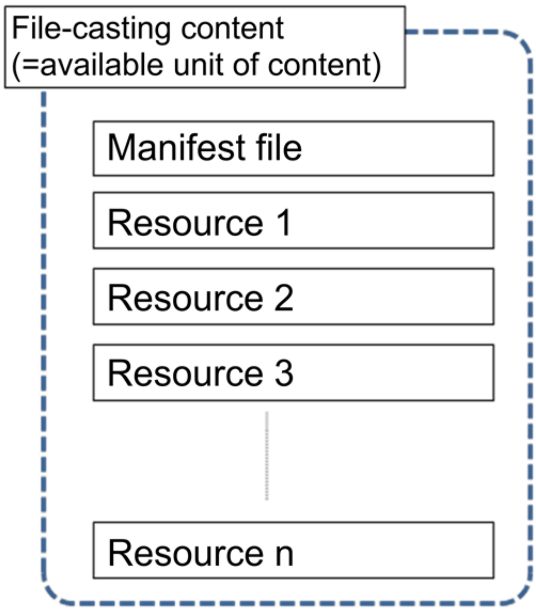


Figure 3-1: Structure of storable broadcast content

3.1.2.2 Targets of encryption

The targets of encryption can be set for each resource. It is recommended to encrypt any content resources necessary to be protected.

Whether or not each resource includes encryption can be identified from the manifest file. Any manifest file including any encrypted resources shall be encrypted.

3.1.2.3 Handling of content keys

An available content unit shall have one content key applied. In short, more than one content unit in the same available content unit shall be encrypted with the same content key.

3.1.2.4 Encryption algorithms

AES (Advanced Encryption Standard) is adopted. Use a key of 128-bit length.

CBC mode is used as the encryption mode, while fractions are processed in accordance with PKCS#7.

3.1.2.5 Specification of the encryption scheme

The scheme described in "3.1.2.4 Encryption algorithms" shall be used for the encryption scheme.

3.1.2.6 Concurrent use with conditional access systems

Conditional access systems shall not be used concurrently.

Chapter 4: Provisions of Operating Delivery

4.1 Conditional Access Systems

- This is a broadcast that uses the descriptors of conditional access systems.
- Conditional access systems include pay programs, and free programs with content protection.

4.2 Unit of Charging (ES to be charged)

- The unit of charging is for the valid ECM.
- Only one ECM is placed in the first loop of each PMT. Therefore, there is no charge for each ES (component).

4.3 Non-scrambling/scrambling

4.3.1 Overview

- To identify the scrambling mode of components in the receiving end, the "transport_scrambling_control" field in the TS packet header is referenced.
- As for "free_CA_mode," this is used only for the distinction between pay or free. No decision of the scrambling mode must be used for the distinction between pay or free.
- Not all pay components are necessarily scrambled.
  The cases that require non-scrambling in the operations are described in "4.11.4 Changes in the application of the ECM."

4.3.2 Operation of captions/supers

- When the default ES group is described in the first loop of PMT as a valid ECM_PID (the normal scrambling mode), any components of captions and supers that are scrambled shall have the same "ECM_PID" as the default ES group.
- Even with the default ES group in scrambling mode, it is possible to handle the components of captions/supers in non-scrambling mode. In such cases, an invalid statement: "ECM_PID = 0x1FFF", must always be described for such components in the second loop of the PMT.
- When the default ES group is in non-scrambling mode, both the components of captions and of supers should be handled in non-scrambling mode.

4.4 Free Programs, Pay Programs

4.4.1 Free programs, pay programs

4.4.1.1 Definition of free programs/pay programs

- A free program refers to that in which the default ES group is of a non-paying type, while a pay program entails the situation where the default ES can be charged for. For the default ES group, refer to "Volume 4, 19.2 Setting the Billing Fees for Programs" in this technical report.
- The default ES group is defined for each service type.

Example: For the realtime broadcasting of video:
Default ES group = default video ES and default sound ES

4.4.1.2 Operation of free/pay programs

(1) Free programs

- All ESs are not charged for.
- In the SDT or EIT, they are operated with the configuration of “free_CA_mode=0”.

(2) Pay programs

- Only one valid ECM is placed in the first loop of the PMT, while pay per component is disabled.
- In the SDT or EIT, they are operated with the configuration of “free_CA_mode=1”.
- If non-scrambling is operated in any other ES than the default ES group, “ECM_PID=0x1FFF” shall be placed in the second loop of the PMT.
- Any program or its part delivered free or temporarily free to their subscribers by a broadcaster of pay programs shall be operated as a pay program (“free_CA_mode=1”).

4.4.2 Free programs containing protected content

4.4.2.1 Definition of free programs containing protected content

- A free program containing protected content is defined as a free program scrambled to deliver content securely with broadcast waves for the purpose of protecting content.
- The function of a "scrambled free program" in the conditional access system compliant with ARIB STD-B25 will be exploited.
- Any free programs with content protection must incorporate the broadcaster identifier specified in “4.4.2.2 Operation of free programs containing protected content” so that they shall be identified as such by the receivers with the broadcaster identifier value described in the unencrypted part of the ECM (TBD).

4.4.2.2 Operation of free programs containing protected content

- ECMs must always be transferred.
  Only one PID that represents a valid ECM through the common broadcaster identifier specified in Part 8 of this technical report shall be place in the first loop of the PMT. Refer to the corresponding part in Volume 8 of this technical report.
- No descriptor for CA contract information needs to be placed in any free program containing protected content.
- Since the identification of the broadcasters of free programs with content protection is achieved by using the common value throughout the operation of the same program, if an

EMM is to be sent, receivers are required to manage them for each broadcaster. Therefore, they shall be operated with care after all operators have agreed to avoid problems (TBD).

- A broadcaster of pay programs may operate free programs with content protection temporarily or as per program.

4.4.3 Operational combinations of pay programs, free programs, and free programs containing protected content

- Table 4-1* lists the operational conditions of pay programs, free programs, and free programs containing protected content. Table 4-2* shows the operable combinations regarding scrambling/non-scrambling for the default ES group, as well as that for any other group.

Table 4-1: Operation of pay programs, free programs, free programs containing protected content, and free programs with protected rights

No		1	2*1 (TBD)	3	4*1 (TBD)
Program type		Free program	Free program with protected content (Other than conditional access)	Pay program*4	Free program with protected rights (Only a conditional access layer)
Division of free/pay		Free	Free	Pay	Pay
Additional pay ES		×	×	×	×
Free_CA_mode		0	0	1	0
Content protected	Default ES group	Not	Protection available	Protection available	Protection available
	Any other group	Not	Protection available	Protection available	Protection available
TS packet header *3	Default ES group	00	10,11	10,11	00
	Any other group	00	10,11	10,11	00
Charge	Default ES group	No	No	Charge permitted	No
	Any other group	No	No	Charge permitted	No
ECM transfer		Not required	Required	Required	Not required
EMM transfer		Transferrable	Transferrable*2	Required	Not required
Business entities identifier used	Default ES group	-	Right-protection shared ID	Broadcaster specific ID	-
	Any other group	-	Only the PMT's 1st loop has a valid ECM.	Only the PMT's 1st loop has a valid ECM.	-

*1 Not available for the time being

*2 Also in the free programs containing protected content, the EMM can be transferred for the purpose of updating Kw.

*3 "transport_scrambling_control" field in TS packet headers. The headers may temporarily become "00" for any program type according to the operations as described in 4.11.4.

*4 Includes the operations of 0-yen billing, with the programs practically becoming equivalent to free programs

Table 4-2: Operable combinations of scrambling/non-scrambling

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="4">Default ES group</th></tr>
<tr><th>Free program</th><th>Free program containing protected content*2
(Other than a conditional access layer) (TBD)</th><th>Pay program</th><th>Free program containing protected content
(Only a conditional access layer) (TBD)</th></tr>
<tr><td rowspan="4">Other than the default ES group</td><td>Non-scrambling *1</td><td>○
1st: None or PID=0x1FFF
2nd: None</td><td>○
1st: Right-protection shared
2nd: PID=0x1FFF</td><td>○
1st: Specific broadcaster
2nd: PID=0x1FFF</td><td>○
1st: None
2nd: None</td></tr>
<tr><td>Scrambling for content protection</td><td>×</td><td>○
1st: Right-protection shared
2nd: None</td><td>×</td><td>×</td></tr>
<tr><td>Scrambling for pay programs</td><td>×</td><td>×</td><td>○
1st: Specific broadcaster
2nd: None</td><td>×</td></tr>
<tr><td>None
(No 2nd loop)</td><td>○
1st: None</td><td>○
1st: Right-protection shared</td><td>○
1st: Specific broadcaster</td><td>○
1st: None</td></tr>
</table>

*1 Nothing other than the default ES group can be operated during non-scrambling, excluding any groups other than the default ES group that have the component tag of caption ES of 0x30 or of super ES of 0x38, along with those that have the component tag of 0x40, 0x41, 0x50, or 0x51.

– Terminology used in Table 4-2:
  - ○: Operable; ×: Prohibited (restricted)
  - Content of a conditional access descriptor placed in the first loop (1st) and second loop (2nd) of PMT:

1) None: No conditional access descriptor is used.

2) PID=0x1FFF: A conditional access descriptor is used, defining an invalid ECM as a point. No ECM stream exists.

3) Right-protected shared: A conditional access descriptor is used, defining the right-protected shared ECM for identifying the provider ECM as a point (TBD).

4) Specific broadcaster: A conditional access descriptor is used, defining the ECM of the broadcaster identifier specific to the broadcaster as a point.

4.5 Operation of Conditional Access Service in the Layered Transfer

4.5.1 Transferring layers and the transfer of related information on conditional access system services

- The CAT is transferred in Layer A.
- The ECM is transferred in the same or if any stronger layer such as PMT is described.

Table 4-3: Transfer of related information on conditional access system services when transferring the conditional access layer

Pattern	Layer used	# of segments	Information on CAS		
			CAT	EMM	ECM
(1)	A	1	○	○	○
(2)	A	1 (conditional access)	○	○	○
	B	12	×	○	○
(3)	A	1 (conditional access)	○	○	○
	B	11-1	×	○	○
	C	1-11	×	○	○

Legend: ○: Transferrable; ×: Not transferred

4.6 Setting of the Parental Rate

A parental rate uses an 8-bit field to define the user-recommended minimum age (←up to 20 years old, using the broadcaster definition of ARIB STD- B10).

Table 4-4: Setting of the parental rate

Parental rate	Definition
0x00	Undefined (unspecified)
0x01 - 0x11	Minimum age=rating + 3
0x12 - 0xFF	Specified by the broadcaster (not available for the time being)

- A parental rate shall be assigned to each program; never assign it to any component as a unit.

  A) First one byte of the “private_data_byte” field in the conditional access descriptor placed in PMT

4.7 Operation of Previews

Within the range of conditions specified per program, a preview is operable.

In operating a preview, the total time of the preview and the stop time of the preview can be specified for each program. Note that changes must not be made to both the total time of the preview and the stop time of the preview after starting the program. In addition, this standard does not stipulate the receiver motion when the changes were made.

4.8 PPVs

4.8.1 Overview of PPVs

The PPV allows you to control the access of each piece of realtime broadcast content (program) within the same service ID of the realtime broadcasting service. A preview is operable.

4.8.2 Operation of PPVs

In the operation of the PPV, the EMM and ECM for the realtime broadcasting license will be used.

4.8.2.1 ECMs supporting PPVs

The ECM will be expanded to support the PPV.

4.8.2.2 Operation of the PPV at a receiver

4.8.2.2.1 Availability for the broadcast and identification of previews

The method of judging the availability and identification of a preview is shown below.

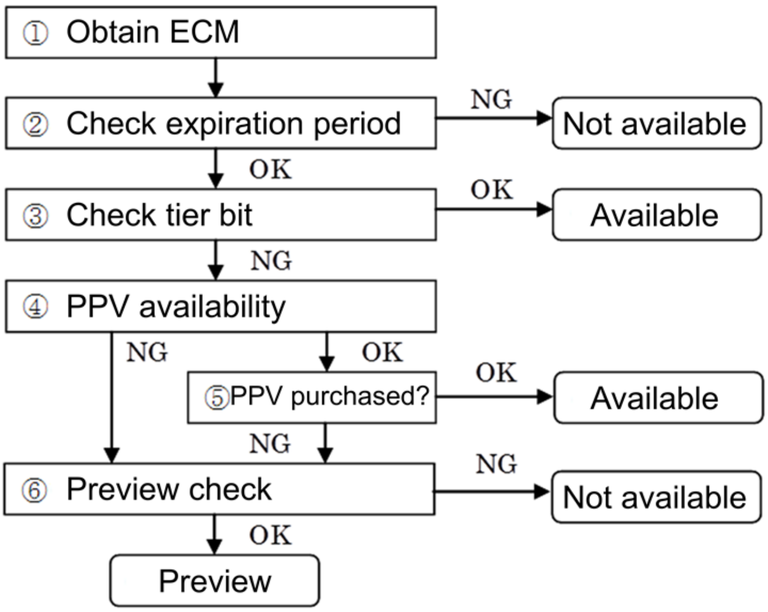


Figure 4-1: Sequence of judging availability for broadcasting and previewing

Sequence of the renderer

[1] Obtain the ECM.

Sequence of a CAS client

[2] Compare the expiration of the EMM with the present time.

[3] Check the tier bit of the ECM with the receiver's EMM.

[4] Check whether the ECM is the PPV program or not.

[5] Search for any contracted PPV programs in the EMM.

[6] Check whether a preview is available or not through the preview information in the ECM.

4.8.2.3 Operable range of PPVs

PPVs can be set up in any program provided in the realtime broadcasting service. However, it is desirable that the receiver is equipped with a mechanism to prevent any purchasing procedure so that no content can be purchased as PPV that are available for broadcasting at the receiver.

4.8.2.4 Precautions in the operation of PPVs

The ECM is not always changed upon the change of programs. Therefore, it is desirable that broadcasting be operated in consideration of the start time of the recording and the update of the ECM.

4.9 Conditional Access Descriptors

4.9.1 Functions

- When described in the CAT, it identifies the TS packet ID that transfers the EMM.
- More than one conditional access descriptors may be described in the CAT (not assumed at the beginning of operation).
- When described in the PMT, it identifies the TS packet ID that transfers the ECM.
- More than one conditional access descriptors may be described in the PMT (not assumed at the beginning of operation).

4.9.2 Data structure

- As specified in Appendix 1 of Appendix Table 20, Ministry of Internal Affairs and Communications Public Notice No. 299 (2011)

4.9.3 Operation

- Only one conditional access descriptor is described in the CAT for the same "CA_system_id".
- The same number of conditional access descriptors as the number of "CA_system_id"(s) within the TS that transmit the EMM are described in the CAT.
- The same number of conditional access descriptors as the number of "CA_system_id"(s) operated in the program are described in the PMT.
- When scrambling ES and non-scrambling ES exist in a component of the program, the method of placing conditional access descriptors in the PMT is as follows:

  1) If a conditional access descriptor is placed in the first loop of the PMT, the

corresponding ECM is applied to all the components in the program.

2) A conditional access descriptor can be placed in the second loop of the PMT.
3) Place an invalid “ECM_PID=0x1FFF” only if non-scrambling operation is conducted in any group other than the default ES group.
4) When describing more than one conditional access descriptor, the number of such descriptors in the first loop, that in the second loop, and that of the “CA_system_id” describing such descriptors are the same. Also, in such a case, the descriptor in the second loop takes the invalid ECM PID value representing a non-scrambling ES (not assumed at the beginning of operation).

- When describing a conditional access descriptor in the CAT, the EMM transfer identifier shall be described in the first one byte of the “private_data” area. For details, see “4.12.1 Specification of the transmission of the EMM via broadcasting.”
- Even when multiple conditional access descriptors are operated within the same TS, only one method of transferring the EMM is utilized; that is, in no cases are different EMM transfer identifiers used in the same TS (not assumed at the beginning of operation).

4.10 Trasmission of the CAT

4.10.1 TS PID to be transferred

- As specified in Appendix 1 "Allocation of the PID," Appendix Table 6, Ministry of Internal Affairs and Communications Public Notice No. 299 (2011), a CAT's PID takes the value of (0x0001).

4.10.2 Data structure

- As specified in Appendix Table 16 "Structure of the CAT," Ministry of Internal Affairs and Communications Public Notice No. 299 (2011)

4.10.3 Descriptors to be transferred and their structure

- Any descriptors transferred by the CAT are conditional access descriptors.
- For “CA_system_id,” refer to “Volume 7: Transmission Operation for Multimedia Broadcasting” in this technical report.

4.10.4 Frequency of transmissions

- The CAT will transmit using the frequency specified in “Volume 4: PSI/SI Operation for Multimedia Broadcasting” in this technical report.
- The frequency of transmission is operated in the same manner as in current digital terrestrial broadcasting.

4.10.5 Frequency of updates

- When the PID that transfers the EMM is changed, the CAT will also be updated.
- The frequency of update during regular operation is once or less a day, as is the case with current digital broadcasting.

4.11 ECM

4.11.1 Identification of the ECM

- When a conditional access descriptor is described in the first loop of the PMT, the PID of the TS packet in which the ECM is transferred is identified.
- Such ECM is not transferred only when the PID of the conditional access descriptor is 0x1FFF.

4.11.2 Data structure of the ECM

4.11.2.1 Sectional format

- The ECM shall be transferred in the extended sectional format described in Appendix Table 1, Ministry of Internal Affairs and Communications Public Notice No. 299 (2011), and the table identifier takes only 0x82, not 0x83. The "table identifier extension" is not used.

4.11.2.2 ECM body

- For the data structure of the ECM body in any ECM section, see ARIB STD-B25.

4.11.3 Application of the ECM

- If the conditional access descriptor is placed in the first loop of the PMT, the corresponding ECM is applied to all the ESs transferring any broadcast program components. Essentially, the corresponding ECM should be applied to the relevant ES when described in the second loop of the PMT, but only the first loop of the PMT has a valid ECM_PID in the multimedia broadcasting.
- The ECM_PID (conditional access PID), taking the value of 0x1FFF, indicates that the corresponding ES is non-scrambling; an ECM with PID=0x1FFF is not transferred.

4.11.4 Changes in the application of the ECM

4.11.4.1 Start of scrambling

- When non-scrambling broadcasting (or non-scrambling ES transmitting the broadcast program elements) changes to scrambling broadcasting (or scrambling ES transmitting the broadcast program elements), the broadcast signals will be changed as follows.

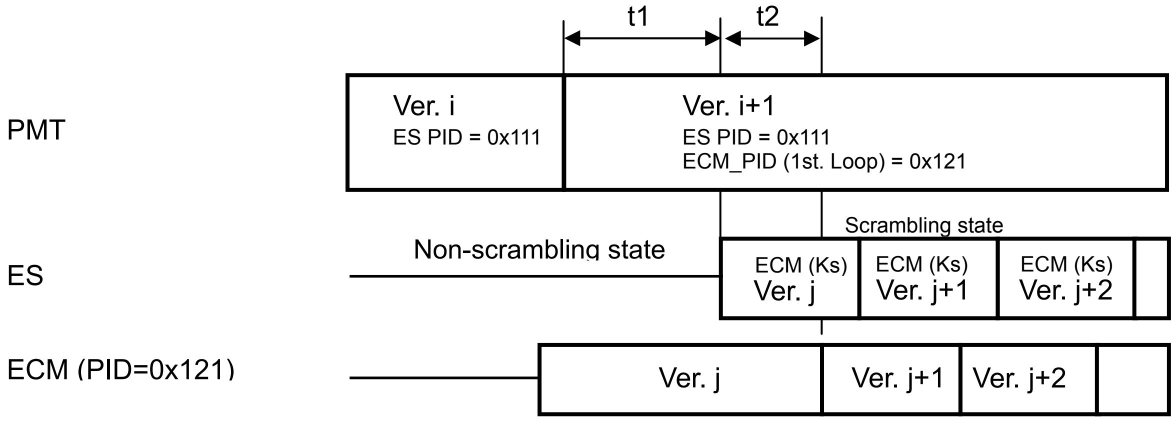


Figure 4-2: Changes in the broadcast signal upon the start of scrambling

1) With the ES is transmitted in a non-scrambling state, the ECM is transmitted.
2) After the ECM is transmitted, the relation between the ECM and the ES (group) is described in the first loop of the PMT. Then, the PMT is tramsmitted (update of the PMT).
3) After t1 seconds from the update of the PMT, the scrambling of the ES (group) begins.
4) After t2 seconds from the start of scrambling, the first ECM update occurs.
   t1= 2, 0<t2

The update of the ECM follows the provisions of "4.11.5.2 Frequency of updating/retransferring the scramble key" and "4.11.5.3 Update of the ECM and the change in the scramble key."

4.11.4.2 End of scrambling

- When scrambling broadcasting (or scrambling ES transmitting the broadcast program elemements) changes to non-scrambling broadcasting (non-scrambling ES transmitting the broadcast program elements), the broadcast signals will be changed as follows.

1) The scrambling of the ES (group) stops.
2) After t3 seconds, the relation between the ECM and the ES (group) is removed from the first loop of the PMT. Then the PMT is transmitted (update of the PMT). t3=1

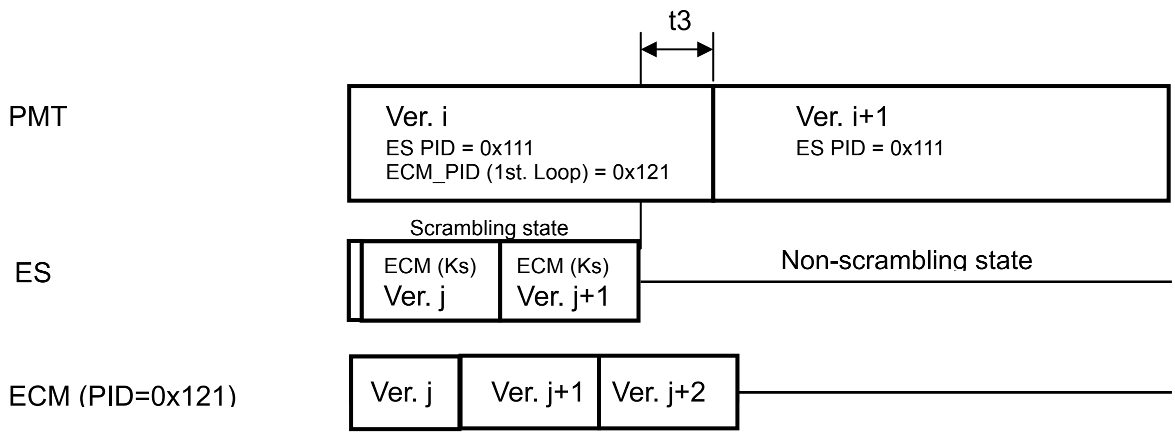


Figure 4-3: Changes in the broadcast signal upon the end of scrambling

4.11.4.3 Change in the relation between the ES transmitting the broadcast program elements and the ECM

(1) With the change of ECM_PID:

- When a conditional access descriptor is described in the first loop of the PMT, if the relation between the ES transmitting the broadcast program elements and the ECM_PID already described in the PMT is changed, and ECM_PID is also changed, then the following transition procedure from a scrambling to non-scrambling state will be applied.

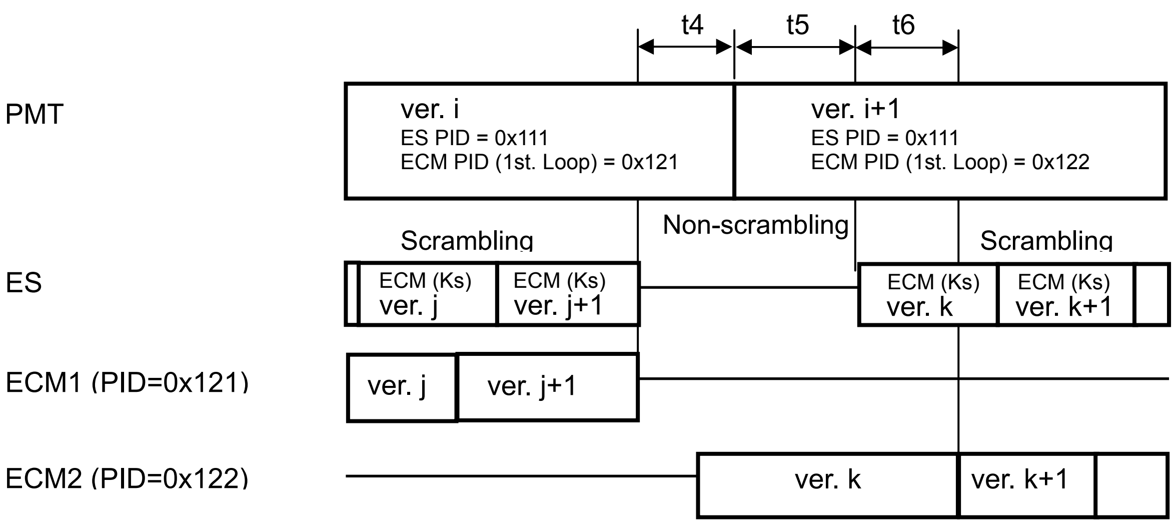


Figure 4-4: Procedure for changing ECM_PID upon the stop of scrambling

1) All of the ESs will be transmitted in a non-scrambling state.

2) A new ECM will be transmitted.

3) After t4 seconds from 1), the PMT will be updated.

4) After t5 seconds from update of the PMT, the scrambling of the ES will start.

5) After t6 seconds from the start of the scrambling of the ES, the first update of the ECM will occur.

t4 = 1, t5 = 2, 0 < t6

The update of the ECM follows the provisions of "4.11.5.2 Frequency of updating/retransferring the scramble key" and "4.11.5.3 Update of the ECM and the change in the scramble key."

(2) Without a change in ECM_PID:

- When a conditional access descriptor is described in the first loop of the PMT, if the relation between the ES transmitting the broadcast program elements and the ECM_PID already described in the PMT is changed, but ECM_PID is not changed, then there is no need to go through any special transmission procedure, including the transition from a scrambling to a non-scrambling state.
- As an example, the following figure shows the changes in the broadcast signal when a new ES is added.

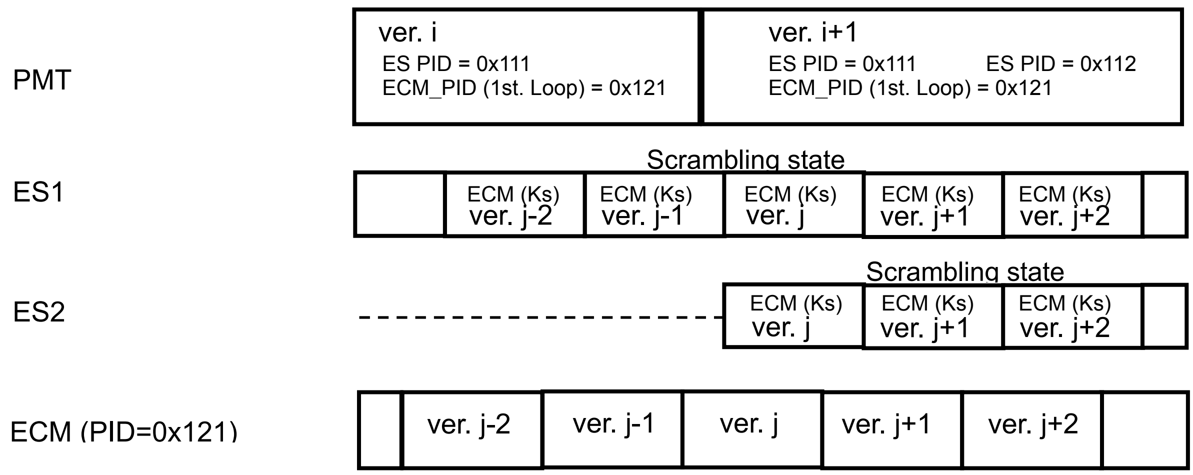


Figure 4-5: Change in the broadcast signal when ECM_PID is not changed upon the stop of scrambling

4.11.4.4 Relation between the ES and ECM when viewing conditions are changed

When viewing conditions are changed without involving the change of ECM_PID, the contents of the PMT temporarily become inconsistent with those of the ECM because there is a need to transmit the ECM ahead of the corresponding ES and PMT. In order to avoid the time period necessary to occur in which normally viewable programs are judged as unviewable due to this inconsistent state, it is intended to make it possible to implement either one or both of the following two items; (1) a permission for viewing using the preview setup, and (2) a non-scrambling operation on a temporary basis. In this paragraph, the item (2) non-scrambling operation is described.

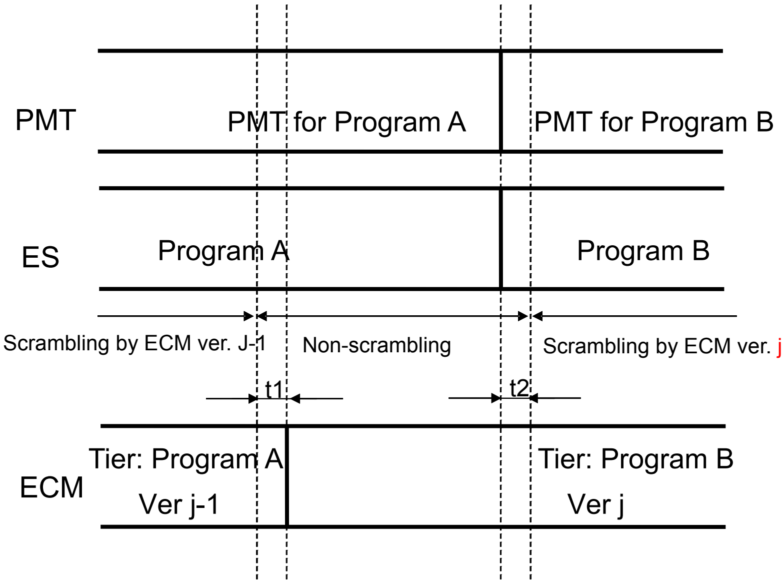


Figure 4-6-1: Non-scrambling operation when viewing conditions are changed

1) Due to the switching from Program A to Program B with different viewing conditions, the ES is changed to a non-scrambling state t1>0 seconds before the transmission of the ECM (ver. j) for Program B.
2) Start of transmission of a new ECM (ver. j)
3) The PMT is updated for Program B in timing with the transmission of the ES of Program B
4) t2>0 seconds later, start scrambling Program B using the ECM (ver. j).

4.11.5 Update and retransfer of the ECM

- When the ES scramble key to a certain ECM is applied and changed, the ECM will be updated prior to the change of the key. The update of the ECM is notified through the change of the version number of the extended sectional format.

4.11.5.1 Change in the scramble key

- The change in the scramble key (Ks) of the ES to which an ECM is applied shall be achieved through the transport scramble control flag in the ES header. As the scramble key is changed, the transport scramble control flag is always changed. The change of an odd key follows the change of an even key, and vice versa, while there is no case in which the same key is changed repeatedly.

4.11.5.2 Frequency of updating/retransferring the scramble key

- See ARIB STD-B25.
- The table below shows the recommendation of the frequency of updating and retransferring the ECM.

Table 4-5: Recommendation of the frequency of updating/retransferring the ECM

	Other than the Partial Reception Layer	Partial Reception Layer
ECM update	Every about 30 sec	TBD
ECM retransfer	Every 100 msec or longer	TBD

4.11.5.3 Update of the ECM and the change in the scramble key

- The update of the ECM and the change in the scramble key in the case of the single application of the ECM are illustrated in the figure below.

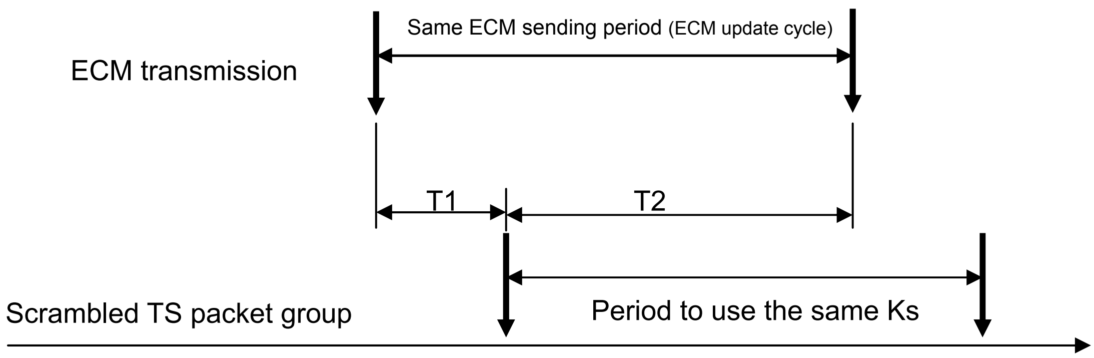


Figure 4-7: Update of the ECM and the change in the scramble key

- If the ECM is applied to multiple TS packets, then the minimum values of T1 and T2 are applied to each packet.

4.11.6 Other operations relating to the ECM

4.11.6.1 ECMs and scrambling

- If there is no conditional access descriptors in the first and second loops of the PMT, all ES groups transmitting the broadcast program elements are not in the scrambling transmission.
- In reverse, there is the possibility of operations where all components constituting the service are not scrambled, even if there are conditional access descriptors both in the first and second loops of the PMT (in consideration of the transition status from a scrambling broadcasting to a non-scrambling broadcasting).
- However, no ES associated with ECM_PID=0x1FFF shall be scrambled.

4.11.6.2 Interruption of the ECM

(1) Detection of the interruption of the ECM

Since each ECM is retransferred if it is described in the PMT as specified in "4.11.5.2 Frequency of updating/retransferring the scramble key," the receiver is able to detect the interruption of the ECM when it fails to receive the ECM within the specified time period.

(2) Operation of the receiver upon an encounter regarding interruption of the ECM

The receiver detecting the interruption of the ECM during the selection of programs shall refer to the transport scrambling control flag in the header of the TS packets that constitute the broadcast program, in order to make a decision on operation, regardless of the existence of the CAS client.

4.11.6.3 ECMs and seamless transmission

No seamless transmission is conducted in multimedia broadcasting.

4.12 EMMs

4.12.1 Specification of the transmission of the EMM via broadcasting

- The structure of the header of the EMM section conforms to the Ministry of Internal Affairs and Communications Public Notice No. 299 (2011).
- For the structure of the EMM body in the EMM section, see ARIB STD-B25.
- No EMM sections shall be transmitted during a multi-section status.

The frequency of transmitting EMMs conforms to 4.12.2.

- The receiver shall NOT reference the version number of the EMM section.
- The order of the transmission of the EMM conforms to the provision in "4.12.3 Order of the transmission of EMMs."

4.12.1.1 Methods of specifying EMM streams

This specification defines the two methods of transmitting the EMM.

(1) Instrument to identify the transmission method

- The format of transmission (Type A/Type B) shall be described in the first one byte of the “private_data_byte” field of the conditional access descriptor described in the CAT.

Table 4-6: First one byte of the “private_data_byte” of the conditional access descriptor described in the CAT

Value	Meaning
0x00	Undefined
0x01	Type A
0x02	Type B
0x03 - FF	Reserved for future use

- The first byte of the “private_data_byte” field of the conditional access descriptor placed in the CAT always contains the information used to identify the EMM transmission format.
- Cases where there is no valid identification value for the EMM transmission format in the first byte of “private_data_byte” of the conditional access descriptor described in the CAT are rare; in such a case, the acquisition of the EMM by the receiver is not ensured, and there is the possibility of no EMM being acquired.

4.12.1.2 Specification of the transmission of the EMM with any layer other than the partial reception layer

(1) Transmission specification: Type A

- The value of the first byte of the “private_data_byte” field of the conditional access descriptor in the CAT must be specified as "Type A".
- The structure of the header of the EMM section conforms to the Ministry of Internal Affairs and Communications Public Notice No. 299 (2001).
- For the structure of the EMM body in the EMM section, see ARIB STD-B25.
- No EMM sections shall be transmitted during a multi-section status.
- The frequency of the transmission of the EMM is as follows.
  The frequency of the transmission of the EMM shall be fixed for both EMM sections. The frequency of transmission follows 4.12.2.
- The receiver shall NOT reference the version number of the EMM section.
- The order of the transmission of the EMM conforms to 4.12.3.

(2) Transmission specification: Type B

- The value of the first byte of the "private_data_byte" field of the conditional access descriptor in the CAT must be specified as "Type B".
- One EMM section includes only one EMM body; namely, a single piece of CAS client ID information. Each section contains only a section header, a single EMM body, and a section CRC.
- One TS packet is permitted to include more than one EMM section.
  No information subject to EMM filtering (14 bytes: 8 bytes of the section header and 6 bytes of a part of the CAS client ID) shall be split across multiple TS packets.
- As specified in "Volume 4: Multi-sectional Transmission" of this technical report, one TS packet is allowed to embed up to ten (10) sections.
- The interval of transmitting the EMM to the same receiver ID shall follow the specified interval of one second or longer. Therefore, even if one TS packet contains multiple EMMs, only one EMM is ensured to be transmitted.
- No group ID or global ID is handled.

4.12.1.3 Specification of transmitting the EMM in the partial reception layer

Same as the specification for transmitting the EMM in any other layer.

4.12.2 Frequency of transmitting the EMM via broadcasting

4.12.2.1 Frequency of transmitting the EMM in any layer other than the partial reception layer

- Frequency of transmitting EMM sections

(1) TypeA

- Regarding the frequency of the transmission of EMM sections at the TS-packet level, the basic concept conforms to "Volume 4" of this technical report. (The basic concept conforming to Volume 4 of this technical report means that the frequency of transmitting EMMs is not specified by the interval between EMM sections, but by the densities of EMM sections according to the operational provision of the PSI/SI.)
- When transmitting EMM section(s), the TS packet of the corresponding PID will be transmitted within the range of 1.28 kB ± 100% in units of 32 ms. No TS packet of one PID containing EMM section(s) shall exceed 320 kbits per second.
  (Of the 320 kbits described above, the data amount of one EMM section shall be considered as 4 kB.)

(2) TypeB (Not available for the time being)

- When transmitting EMM section(s), the TS packet of the corresponding PID will be transmitted within the range of 8.0 kB ± 100% in units of 32 ms. No TS packet of one PID containing EMM section(s) shall exceed 2.0 Mbits per second. (Of the 2.0 Mbits described above, the data amount of one EMM section shall be considered as 4 kB.)

4.12.2.2 Frequency of transmitting EMMs in the partial reception layer

Same as the specification of transmitting EMMs in any other layer

4.12.3 Order of the transmission of EMMs

(1) TypeA

- EMMs are transmitted with multiple information items included in each section.

  To facilitate filtering at the receiver, the following restriction will be forced on the order of EMM items in each section.

  1) The first EMM shall be the one having the smallest receiver ID in the section.
  2) The second EMM shall be the one having the largest receiver ID in the section.
  3) All the subsequent EMMs shall be sorted in ascending order of the receiver IDs.

- Assuming that there are the number of "n" of EMMs in a section that are sorted as, for example, EMM_1, EMM_2, EMM_n, etc., according to the ascending order of the receiver IDs, they will be placed in the following order.

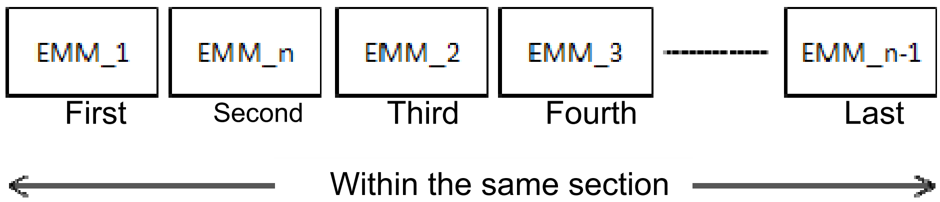


Figure 4-8: Order of transmitting EMMs

- The receiver can determine whether the section includes any EMM sent to it by checking the first two EMMs. When it finds that there is at least one, the receiver checks them one by one from the top and can determine that there is no EMM being sent to it at the point where the PID is larger than its receiver ID. The receiver is permitted to discard all remaining parts of the section when it finds that there is no EMM for the receiver, eliminating the need to check for the whole of the section.

(2) Type B

- Only one EMM shall be transmitted toward one CAS client for each section.

4.13 Operation of Conditional Playback Descriptors

No conditional playback descriptor shall be handled.

4.14 Transmission Methods for Information Relating to Access Control

4.14.1 Operation of the license reference information

No license reference information shall be handled.

4.15 Operational Method of Communications

4.15.1 Methods of transmitting licenses

If the receiver uses its own communication function to obtain a license regardless of the type of license, such communication shall be made through a secure authenticated channel. The CAS client sends a request for license acquisition to the CAS server, and then receives a license through the response of the CAS server.

It is assumed that the URI of the CAS server is retained by the CAS client at the beginning of using the CAS client described in 2.2.3 of this volume.

4.15.1.1 Methods of transmitting storable broadcasting licenses

The CAS client's request for a storable broadcasting license shall be issued to the CAS server in which the URI of the CAS client is notified of and retained in advance. The CAS server that receives such request shall send the storable broadcasting license back to such CAS client as a response, depending on the result of the decision regarding availability for viewing.

4.15.1.2 Method of transmitting realtime broadcasting licenses

The CAS client's request for a realtime broadcasting license shall be issued to the CAS server which the CAS client is notified of and retained in advance. The CAS server that receives such request shall send back the realtime broadcasting license indicating the viewing conditions at this time to such CAS client in the form of an EMM, based on the CAS client ID and the receiver ID.

4.15.2 Method of transmitting the work key

The receiver issues a request for a work key to the CAS server which the CAS client is notified of and retained in advance, when the receiver needs to update or obtain such a work key. The CAS server that receives such request shall send back the Kw to be used by such CAS client at this time to such CAS client in the form of an EMM, based on the CAS client ID and the receiver ID.

4.16 CA Contract Information Descriptors

- For the handling of CA contract information descriptors, see Volume 4 of this technical report.
- A CA contract information descriptor shall be placed correctly in the SDT or EIT. The receivers determine whether such program is a PPV, based on the relationship between

the CA contract information descriptor and the CAS client.

- A "Fee name" (used in contract programs for flat/tier) in the CA contract information descriptor shall not be used.

4.17 Return of the Recording Control

No return of the recording control shall be performed.

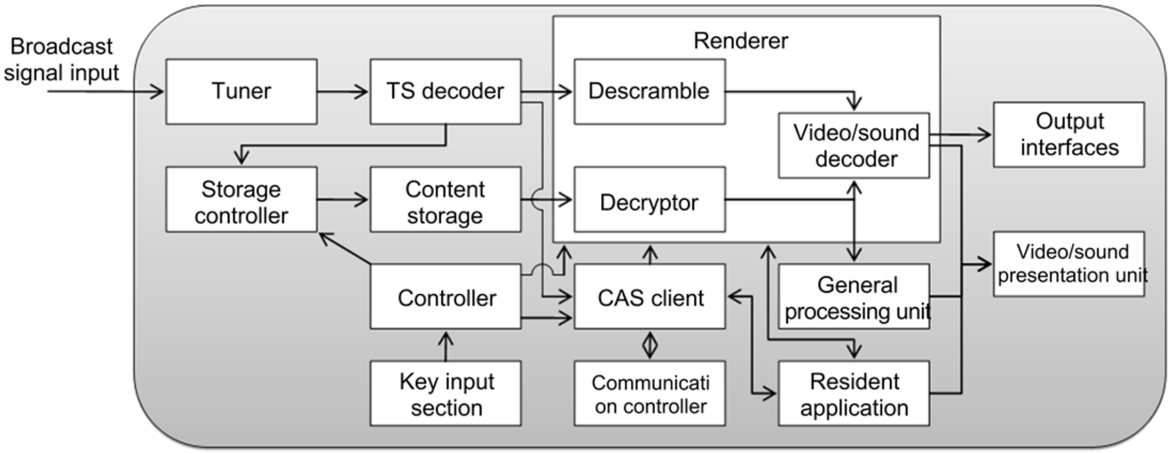
4.18 Operation of the “CA_EMM_TS” Descriptor

“CA_EMM_TS” descriptors shall not be used.

Chapter 5: Requirement Specifications of the Receivers

5.1 Structure of the Receivers

Figure 5-1 illustrates the hardware structure of the CAS. This is only a structural model in order to explain the specification; the actual structure is determined by the designer of the receiver.



In some cases, content storage* can be removable.

Figure 5-1: Basic structure of the receivers

5.1.1 Tuner

The tuner receives and selects broadcast signals under the control of the controller and then conducts the packet processing and error correction of transmitted signals.

5.1.2 TS decoder

- The TS decoder separates the required packets from TS-multiplexed signals; then, it selects the broadcast program signals, separates content based on each service (realtime broadcasting services and storable broadcasting services), and separates the types of multiplexed data (SI data, ECM, EMM, etc.).

5.1.3 Storage controller

- The storage controller reconstructs storable broadcast content from that separated by the TS decoder.

5.1.4 Storage

- This is used to store the content received or reconstructed (no decryption will be conducted if content is encrypted using a content key).
- This reads and delivers to the renderer a part or all of the stored content in response

to a read-out request.

5.1.5 Renderer

Based on the content usage condition information (RMPI), the scramble key (Ks), and the content key (Kc) from a CAS client, the renderer controls descrambling and decryption, decodes video/sounds, controls external output (output to the video/sound presentation unit equipped with the receiver, and the output of video/sound signals through the external interface), and delivers decrypted content for the general processing unit through the internal interface.

The descrambler, the decryptor, and the video/sound decoder are the main functional components of the renderer.

5.1.5.1 Descrambler

- Under the control of the controller, this unit descrambles certain AES-encryted packets.
- Refer to ARIB STD-B25.

5.1.5.2 Decryptor

- Under the control of the controller, this unit decrypts certain received AES-encrypted content, based on the RMPI.
- The unit has the function of delivering decrypted data to the video/sound decoder and/or to the general processing unit through the internal interface.

5.1.5.3 Video/sound decoder

- The video/sound decoder decodes video/sound/data or any other information into a format that can be output to the video/sound presentation unit of the receiver or to any external output interface. Specifically, it provides a video decoder, a sound decoder, an image viewer, an HTML decoder, and so on.
- Compliant to the usage conditions, it controls the output of such information to any external output interface or to the video/sound presentation unit.

5.1.6 Structure of the CAS client

The main functions of the CAS client relating to license processing are listed in Table 5-1.

Table 5-1: Main functions of the CAS client

CAS client function	Description
Acquisition of licenses	Acquires realtime broadcasting license and/or storable broadcasting license from the CAS server
Processing of license usage conditions	Decides the availability of licenses and outputs the renderer usage conditions and content key
Accumulation of licenses	Accumulates the realtime broadcasting licenses and storable broadcasting licenses acquired through communication with the CAS server

Update of licenses	Acquires updated realtime broadcasting licenses from the CAS server
Removal of licenses	Removes the storable broadcasting licenses that have accumulated in the CAS client
Initial configuration of the receiver for the CAS	Conducts an initial configuration of the receiver for the CAS

5.1.7 Video/sound presentation unit

The video/sound presentation unit provides a user interface for the display and sound of ECGs/EPGs, as well as for service portals, contract information, warnings such as errors, and the display of content.

5.1.8 Output interfaces

Output interfaces may include digital video/sound output through HDMI, sound output through Bluetooth, analog video/sound output through composite signals, and so on. The renderer determines whether any of the signals described above are to be output, based on the specification of the RMPI that specifies whether any output interface is permitted for signal output.

5.1.9 Resident application

The resident application controls all of the receiver's functions. The functions relating to the CAS include communication with the CAS client, the processing of separated data from broadcast signals, the control of the renderer, timekeeping, the control of display processing, and key input processing.

5.1.10 General processing unit

The general processing unit processes any content not specified in this technical report.

5.1.11 Controller

The controller controls all of the receiver's functions. The functions relating to the CAS include communication with the CAS client, the processing of separated data from broadcast signals, the control of descrambler, the control of display processing, and key input processing.

5.1.12 Key input section

This section obtains the key-input information from a variety of buttons on the receiver.

5.1.13 Communication controller

The communication controller allows the CAS client to connect with the CAS server to acquire licenses via communication. Communication shall be implemented using TCP/IP.

5.2 User Interface

The details of the user interface depend on each product/merchandise design.

5.3 Memory

No specification on NVRAM for the conditional access system for reception shall be provided.

5.4 Power Saving

Power saving shall be determined by the implementation of the receiver.

5.5 Power-supply Control

No power-supply control shall be used.

5.6 Power-supply Call Control

No power-supply call control shall be used.

5.7 Priority of Operations during the Waiting Time

Exclusive control and the control of the priority of operation regarding the multimedia broadcasting used by the receiver shall be dependent on the implementation of the receiver. This technical report provides no specification regarding this.

5.8 Viewing Control of Realtime Pay Programs

5.8.1 Viewing processing

- The basic operations contain the selection of the transport streams of the selected programs based on PSI/SI, along with the selection of the components constituting the program.
- Referring to the scramble control flag and adaptation field control in the TS packet header, the receiver feeds the ECMs received one by one to the CAS client and uses the responses to conduct viewing control.
- Only one ECM shall be specified for each service, described in the first loop of the PMT.
- Pay per component (ES) shall not be used.

5.8.2 Related standards

- Refer to ARIB STD-B25.
- Specified in "Chapter 4: Provisions of Operating Delivery" of this document.

5.9 Viewing Control of Free Programs with Content Protection

5.9.1 Viewing processing

- The basic operations contain the selection of the transport streams of the selected programs based on PSI/SI, along with the selection of the components constituting the program.
- Referring to the scramble control flag and adaptation field control in the TS packet header, the receiver feeds the ECMs received one by one to the CAS client and uses the responses to conduct viewing control.

5.9.2 Related standards

- Refer to ARIB STD-B25.

5.10 Reservation of Viewing Pay Programs

This section provides specifications for the viewing reservation of pay programs for the realtime broadcasting service.

5.10.1 Overview

Pay programs and free program should be handled equally regarding the reservation of programs. Therefore, the reservation function equipped by the receiver, if any, should be able to handle any pay programs.

5.10.2 Cancellation of viewing reservations

- Any viewing reservation can be cancelled before starting the program (i.e., before the issuance of a PPV purchase command), but no cancellation after purchase shall be permitted.
- If a reserved program is not viewed after the expiration of the reserved purchase for some reason, such program reservation can be cancelled automatically.
- It is desirable that there be some instrument to enable the user to present with a history of user-operated or automatic cancellations for reserved programs.

5.10.3 Related standards

- Refer to ARIB STD-B25.

5.11 Storage Reservations of Pay Programs

Storage reservations of pay programs shall be stipulated by each broadcaster.

5.12 Processing of PPV Viewing

5.12.1 Overview

- A user interface that allows the user to purchase the program shall be displayed, when response from the CAS client calls for any part outside of the preview period, or when any user operation quits the preview to transition to program purchase. If such program cannot be recorded, a message notifying such will be issued, with copy protection applied to the program.

- For any cases where only the user can record the purchased program at the time of purchase, see "5.13 Copy protection for pay programs" Copy protection for pay programs" in this document.
- If the receiver is equipped with a monthly PPV program purchase limit and/or limit on single-program purchases, the receiver shall conduct a certain operation at the time of purchase.
- The receiver design needs to be provided with a way to distinguish between the interruption of previewing and viewing a purchased program, in some way, such as by suppressing the transmissions of the ECM to the CAS client, when the viewing of a purchased program is interrupted, through a menu item or parental control during a time within the period of preview, as the continuous transmission of the ECM to the CAS client is the same as the processing performed during previewing.

5.12.2 Related standards

- Refer to ARIB STD-B25.

5.12.3 Controls to limit monthly PPV purchases

Controls to limit monthly PPV purchases shall not be provided as a function specified in this document. It is assumed that broadcasters have control over this for the purpose of customer management or for a banking system.

5.12.4 Controls to limit single-program PPV purchases

Controls to limit single-program PPV purchases shall not be provided as a function of the CAS. This function is assumed to be provided by another system of broadcasters.

5.12.5 History of PPV purchases and displaying such

A history of PPV purchases shall not be provided as a function of the CAS.

5.13 Copy Protection for Pay Programs

- For the methods of copy protection, refer to Volume 8 of this technical report.
- For copy protection information in PSI/SI, refer to Volume 4 and Volume 8 of this technical report.

5.14 Transmission of View History

The transmission of view history is unnecessary, as no view history is generated during the operation of the PPV.

5.15 Parental Control (age limits for viewing)

Parental control must be possible to set up.

5.16 Enabled/disabled CAS Client

The CAS client can be classified into the two states shown in Table 5-2, depending on the state of the receiver.

Table 5-2: States of the CAS client

State	Description
Enabled	All available functions of the CAS client work well.
Disabled	Some necessary function(s) are not available.

This volume provides no specification for receivers without a communication feature.

5.16.1 Enabled CAS client

The enabled CAS client shall meet all of the following conditions:

1. Activation of the CAS client is properly completed; and
2. Neither a part nor all of functions of the receiver equipping the CAS client shall be considered to be revoked. (This technical report provides no information on the methods of judging this.)

5.16.2 Disabled CAS client

A disabled CAS client does not meet a part or all of the conditions of an enabled CAS client. How to determine whether the conditions are met shall be dependent on the implementation of the receivers and thus shall not be specified in this document.

An operation of receiving by the user sometimes transitions the CAS client to the enabled state, by forcing the activation of the CAS client to work properly in some cases.

5.17 Display of CAS Client Information

The display of CAS client information shall be dependent on the implementation of the receiver and thus shall not be specified in this volume.

5.18 Error Message Display

This is not specified in this volume.

5.19 Operations in Case There Are No Enabled CAS Clients

If there is no enabled CA client as described in "5.16 Enabled/disabled CAS client," the notification of such state to the user shall be optional. The timing for displaying such message shall be dependent on the implementation of the receiver. In addition, this technical report provides no specification on the content of such messages displayed by the receiver.

5.19.1 Methods of displaying an error message when there is no enabled CAS client

This volume provides no specification on displaying an error message when there is no enabled CAS client.

5.19.1.1 Conditions for displaying an error message

This volume provides no specification on the conditions for displaying an error message.

5.19.1.2 Method of display

This volume provides no specification on the conditions for displaying an error message.

5.19.2 Conditions for the format of messages issued when there is no CAS client in the transmitter

This volume provides no specification on the conditions for the format of messages issued when there is no CAS client in the transmitter.

5.19.3 Others

- This volume provides no specification on displaying such message during the output of analog VTR.

5.20 Scrambling and Display Priority of Captions and Supers

5.20.1 Captions

- Display of captions with the default ES group in the scrambled state shall be fundamentally determined by the design of the receiver. As a guideline, it is desirable that, when caption is enabled, captions be displayed only if the default ES group is properly descrambled, regardless of the scrambling state of caption components.

5.20.2 Supers

- The display of supers with the default ES group in the scrambled state shall be fundamentally determined by the design of the receiver.

5.21 Operation within the Partial Reception Layer of the Devices not Supporting Pay Programs

No device not supporting pay programs within the Partial Reception Layer is assumed in multimedia broadcasting.

5.22 Valid Conditional Access System for Reception (consistency check of "CA_system_id" between the CAS client and broadcast waves)

- A conditional access system for reception is defined as valid if "CA_system_id" from the CAS client and "CA_system_id" sent by the PSI/SI is the same after the launch of a receiver.
- Attention must be paid so that no misoperation is caused by any service or event inconsistent with "CA_system_id" in the conditional access descriptor placed in the PMT and in the CA contract information descriptor in the SDT/EIT. However, because in the SDT/EIT any free programs containing protected contents may be operated without any CA contract information descriptor or with "free_CA_mode=0", program reservation is likely to be considered available even if "CA_system_id" of the broadcasting wave and CAS client is not the same.

<Blank Page>

Chapter 6: Processing Specifications of the Receiver

This chapter describes the processing specifications of the receiver (the resident application and the renderer).

6.1 During the First Start

The resident application and the renderer perform the following processing during the start of the receiver.

- Status check of the CAS client
- Activation (CAS client activation) when the CAS client is disabled
  Detail information other than that described here varies depending on the implementation of the receiver. This is not specified in this volume.

6.2 Reception and Storage of Content

The resident application and the renderer store the reserved content in the storage device of the receiver.

Detail information varies depending on the entrusted broadcaster. This is not specified in this volume.

6.3 License Acquisition

The resident application requests that the CAS client acquire a license from the CAS server via communication.

- The license that can be acquired is a realtime broadcasting license (EMM) and stoable broadcasting license.

6.3.1 Acquisition of a realtime broadcasting license

- Resident application processing during request message transmission
  1. The realtime broadcasting license is processed by the CAS client according to the instructions from the resident application when the content provided using a realtime broadcasting service is purchased or when the realtime broadcasting license must be updated.
  2. The CAS client transmits a realtime broadcasting license (Kw) acquisition request, including the identifier of the receiver, to the CAS server.

3. The CAS client receives a new realtime broadcasting license as a response from the CAS server and saves it in a realtime broadcasting license storage area that the CAS client has.

- Resident application processing during request message reception

The CAS client notifies the resident application of processing completion when it acquires a realtime broadcasting license and saves the license in a storage area.

The resident application notifies the user of the information when it receives the notification of completion from the CAS client.

Detail information varies depending on the implementation of the recever or the services offered. This is not specified in this volume.

6.3.2 Acquisition of a stoable broadcasting license

- Position information that the CAS client must notify to the CAS server for license acquisition

For some content, license acquisition from foreign countries may be allowed. During license acquisition, the position information of the receiver must be notified to the CAS server regardless of whether the license is acquired from Japan or foreign countries. The position information can consist any of the items below. A higher level must be notified as far as possible.

- level2: Three-character code, prescribed in ISO3166-1 alpha3, for identifying a country or mobile country code prescribed in ITU-T E.212
- level1: Identification information of a service area network
- level0: When the levels described above cannot be discriminated between or when a user rejects the notification of the above levels

- Resident application processing during request message transmission

1. When the content provided using a storable broadcasting service is purchased and used, the resident application specifies a CRID for the CAS client and requests the CAS client to transmit a storable broadcasting license acquirement request with arbitrary timing.
2. The CAS client transmits a storable broadcasting license acquisition request, including the identifier and the CRID of the receiver, to the CAS server.
3. The CAS client receives the storable broadcasting license requested as a response from the CAS server and saves it in a storable broadcasting license storage area that the CAS client has.

- Resident application processing during request message reception

The CAS client notifies the resident application of processing completion when it acquires a storable broadcasting license and saves the license in a storage area.

The resident application notifies the user of the information when it receives the notification of completion from the CAS client.

Detail information varies depending on the implementation of the receiver or the services offered. This is not specified in this volume.

6.4 License Information Acquisition

The resident application acquires license information from various licenses stored in the CAS client and lists it as content.

Detail information varies depending on the implementation of the receiver or the services offered. This is not specified in this volume.

6.5 Playback of Realtime Broadcast Content

The realtime broadcast content provided using the specified realtime broadcasting service is received according to the instructions of the resident application. After scrambling is decoded, and video and audio signals are decoded, the content is output from an output unit.

Detail information varies depending on the implementation of the receiver or the services offered. This is not specified in this volume.

6.6 Playback of Storable Broadcast Content

A storable broadcasting license corresponding to the CRID of the relevant storable broadcast content is requested to the CAS client according to the selection of the user of the content viewed and used from the ECG provided using the resident application. When the playback conditions based on the RMPI prescribed separately are satisfied, a content key is withdrawn, and the encrypted storable broadcast content is decoded and output in the format of the relevant data.

Detail information varies depending on the implementation of the receiver or the services offered. This is not specified in this volume.

6.7 Identification of Legal Segmentation Meta Data

This volume is not related to segmentation metadata.

6.7.1 Identification of user metadata

This volume is not related to user metadata.

6.7.2 Creation of user metadata

This volume is not related to user metadata.

6.8 Export of Storable Broadcast Content

The export of storable broadcast content is not specified in this volume. The content type to be exported for each broadcaster is prescribed separately.

6.9 Deletion of Storable Broadcasting Licenses

A license can be deleted according to the instructions of the resident application.

Only the storable broadcasting license stored in the CAS client that satisfies the following conditions can be deleted.

- Storable broadcasting license in which the expiration date is reached
- Storable broadcasting license in which the number of views and use times is reached

However, even a storable broadcasting license that does not satisfy the requirements above can be exceptionally deleted in the range prescribed based on service requirements when the remaining amount in the storage area for storable broadcasting licenses is small by a fixed amount or more. Detail information is not specified in this volume.

6.10 Updating of Realtime Broadcasting Licenses

The CAS client communicates with the CAS server according to the instructions from the resident application and updates a realtime broadcasting license. The license update based on the EMM to be broadcast can be operated, thus it is not necessary to consider the deletion function of the realtime broadcasting license. The actual operation method is not specified in this volume.

6.10.1 Updating based on instructions from the resident application

The resident application requests that the CAS client transmit a realtime broadcasting license acquisition request to the CAS server if a valid realtime broadcasting license has not been acquired when the purchase of content provided using a realtime broadcasting service by the EPG has been offered or when the content provided using a realtime broadcasting service is viewed. It then acquires the latest realtime broadcasting license at that point in time. The realtime broadcasting license is not explicitly distinguished between updating and acquisition. Detail information varies depending on the implementation of the receiver or the services offered. This is not specified in this volume.

6.10.2 Automatic updating

A realtime broadcasting license is used for multiple PPV viewing reservations. When the realtime broadcasting license exceeds the number of upper limits, additional PPV realtime broadcasting acquisition requests can be automatically sent to the CAS server after a portion of the PPVs have been used. This function is optionally available.

6.10.3 Updating of realtime broadcasting licenses via broadcasting

A realtime broadcasting license has the same section format for the EMM, regardless whether it is acquired via broadcasting or communication. It can be operated by a broadcaster in consideration of the difference in the specifications of the receiver, the existence of necessary immediacy, and the starting point of processing (license updating via communication is treated as the starting point of the receiver, but license updating via broadcasting can be performed according to the situation on the transmission side). The receiver must have a function for the realtime broadcasting license acquisition via both broadcasting and communication.

See 4.12 in this volume for the transmission of the EMM via broadcasting to the CAS client.

6.11 Time Acquisition

The renderer can use the time acquired by the resident application.

The timer function of a receiver can also be acquired via a broadcast wave and communications line. The time must have enough precision to assure the reliability on broadcasters. In addition, the time cannot be easily falsified by users.

The description relevant to the time-acquiring means is given in Volume 2, 4.1 of this standard.

Note that you must pay attention to the fact that, as for TOT described in Volume 3, 31.4 of this standard, falsification is easy. In particular, it is desirable not to use TOT as a supply source of time information, with the aim of making a judgment as to the utilization of contents by CAS clients.

6.12 Recovery from a Communication Interruption State

Communication interruption indicates that communication is interrupted for some reason, such as due to movement to an out-of-communication area during communication or user operation. Recovery indicates the case where, after communication is interrupted, the communication enable state was returned or communication was restarted.

6.12.1 Acquisition of communication disconnection information

The acquisition of communication disconnection information is not specified in this volume.

6.12.2 Recovery from a communication interruption state

The recovery from a communication interruption state is not specified in this volume.

6.13 Data Transfer between the CAS Client and the Connection Destination

The resident application must be provided with a communication relay function so that the CAS client can acquire a license from the CAS server. It must also have a connection function, data transfer function, and disconnection function. The number of connection destinations to which communication can be simultaneously performed could be one.

Detail information varies depending on the implementation of the receiver, thus it is not specified in this volume.

6.13.1 Notification of a communication connection state to the connection destination

This is not specified in this volume.

6.13.2 Data transfer between the CAS client and a connection destination, and communication disconnection with a connection destination

The data transfer between the CAS client and the connection destination, as well as a communication disconnection with a connection destination, are not specified in this volume.

6.14 Processing of the Receiver to the CAS Client Request

6.14.1 Processing the acquisition request of power-supply control information

Power-supply control is not performed.

6.14.2 Processing the acquisition request of update control information

The processing of the acquisition request of update control information is not specified in this volume.

6.14.3 Processing the request of equipment authentication

The processing of the request of equipment authentication is not specified in this volume.

6.14.4 Processing of the acquisition request of communication disconnection information

The processing of the acquisition request of communication disconnection information is not specified in this volume.

6.14.5 Processing of the request of CAS client replacement

The processing of the request of CAS client replacement is not specified in this volume.

6.14.6 Processing of the request of license updating

The processing of the request of license updating is not specified in this volume.

6.14.7 Processing of the notification of full memory (CAS client storage)

The processing of the notification of full memory (CAS client storage) is not specified in this volume.

6.15 Processing of the Receiver during the Occurrence of Errors

The processing of the receiver during the occurrence of an error is not specified in this volume.

6.15.1 Error processing for the stop of a receiver function

Error processing for the stop of a receiver function is not specified in this volume.

6.15.2 Error processing during communication disconnection

Error processing during communication disconnection is not specified in this volume.

6.15.3 Error processing during the playback and export of content

Error processing during the playback and export of content is not specified in this volume.

6.15.4 Error processing during time acquisition

Error processing during time acquisition is not specified in this volume.

6.16 Implementation Standard of the Receiver

This implementation standard is described for design and manufacturing so that the "receiver renderer processing using the CAS client and renderer usage conditions" (hereinafter referred to as "receiver processing") is properly implemented in the receiver, and so that receiver processing can be prevented from being damaged or bypassed. In addition, various data items to be protected on an access control system can be effectively prevented from leaking or being falsified.

6.16.1 Protection target

The following control signals related to the usage control of content are to be protected.

- Keys related to access control
- Renderer usage conditions

See this technical report of Volume 8 for protection containing the output and export controls of the decoded content.

6.16.2 Definite implementation standard

6.16.2.1 Entire configuration

The receiver must not contain any function that enables an action for bypassing or disabling the receiver processing described in this volume, intentionally disabling the mechanism of protection for each protection target data, or facilitating illegal removal, falsification, or copy.

The following are given as a definite example.

- Switch and jumper that bypass a receiver processing or protection function, or software that has the same function as that for the switch and jumper
- Specific wiring that bypasses a receiver processing and disables the mechanism of protection, or that enables the removal of each protection target data, if disconnected or coupled
- A service menu or a control function of the remote controller that tests and displays receiver processing and protection targets

6.16.2.2 Output

Each protection target data must be locally encrypted when it is output to a user access bus that is not provided as a receiver function. The user access bus is a data bus that is: designed and installed for update or access by a user; designed for update or access by a user as a built-in analog connector facilitating the access of a user, various memory cards with a standard socket, a smart card, PCMCIA, a card bus, or PCI; or that facilitates the access of a user. However, neither a memory bus, a CPU bus, nor a built-in bus that cannot gain access to the protection target data in a user-usable format are contained in the user access bus. See the description in “6.16.2.3” of this volume for local encryption.

6.16.2.3 Local encryption

- During the use of local encryption, manage the key used for encryption algorithms and encryption properly so that it cannot be accessed by a user.
- The intensity exceeding a common key of 128 bits in key length as the intensity of local encryption is recomended.
- Do not output the encryption key used to encrypt each protection target data from the receiver, output it to a user access bus, or store it to a recording media.
- During local encryption, use the key generated from the key or information peculiar to the receiver as a safe key management method.

6.16.2.4 Time management

The time management function used for access control must have proper precision and must be designed so that it cannot be accessed for change by a user.

VOLUME 6

(vacant number)

VOLUME 7

Multimedia Broadcasting

Provisions for Carrier Operations

Contents

Chapter 1 General Terms

1.1 Introduction

This volume stipulates provisions for general operations and transmission operations at broadcasting stations for multimedia broadcasting. It is desired that multimedia broadcasting companies perform broadcasting in accordance with these provisions.

It is also necessary that multimedia broadcasting receivers are able to use signals transmitted in accordance with these provisions in ways expected.

However, depending on the level of facilities installed by each broadcasting company, transmission operations may not be possible in a way to meet all the criteria specified. In this case, receivers may not be able to work in the way that reflects the intention of the sender.

1.2 References

The following shows the documents related to this technical document, Vol. 7:

(1) "Transmission System for Digital Terrestrial Television Broadcasting" ARIB STD-B31

(2) "Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting" ARIB STD-B32

(3) "Service Information for Digital Broadcasting System" ARIB STD-B10

(4) "Receiver for Digital Broadcasting" ARIB STD-B21

(5) "Data Coding and Transmission Specification for Digital Broadcasting" ARIB STD-B24

(6) "Operational Guidelines for Digital Terrestrial Television Broadcasting" ARIB TR-B14

(7) "Operational Guidelines for Digital Satellite Broadcasting" ARIB TR-B15

(8) "Structure and Operation of Closed Caption Data Conveyed by Ancillary Data Packets" ARIB STD-B37

(9) "Coding, Transmission, and Storage Specifications for Broadcasting System based on Home Servers" ARIB STD-B38

(10) "Digital Broadcasting System based on the Home Server" ARIB TR-B27

(11) "Transmission System for Digital Terrestrial Sound Broadcasting" ARIB STD-B29

(12) "Operational Guidelines for the Volume of Digital Television Programs" ARIB TR-B32

1.3 Terminology

The terms used in these provisions are defined as shown below.

1-segment broadcasting	Broadcasts received with the OFDM frame of 1-segment format complying with ARIB STD-B29
13-segment broadcasting	Broadcast received with the OFDM frame of 13-segment format complying with ARIB STD-B31
16QAM	16 Quadrature Amplitude Modulation: a digital modulation scheme to transmit four bits of information by using 16 sinusoidal waves with different amplitudes and phases. Digital terrestrial television broadcasting uses the SP to specify amplitude and phase criteria.
3/1	3/1 is defined as a multi-channel stereo mode that uses three front channels and one rear channel. The front channels are comprised of left (L), right (R) and center (C) channels, while the rear channel is comprised of a mono surround channel (MS).
3/2	3/2 is defined as a multi-channel stereo mode that uses three front channels and two rear channels. The front channels are comprised of left (L), right (R) and center (C) channels, while the rear channels are comprised of left and right stereo surround channels (LS and RS).
5.1 channel	5.1 channel is defined as a multi-channel stereo system that has an LFE (low frequency enhancement) channel added to 3/2 multi-channel stereo and is therefore also expressed as 3/2+LFE.
AAC	Advanced Audio Coding: an audio coding system standardized by the International Organization for Standardization (ISO/IEC13818-7).
AC	Auxiliary Channel: a transmission path for additional transmission control related information on modulated waves.
ADTS	Audio Data Transport Stream.
ARIB	Association of Radio Industries and Business: The ARIB is an organization that standardizes technologies in relation to the use of radio in Japan, with participation by broadcasters, telecommunications operators, and equipment manufacturers.
Layers A, B and C	Hierarchical transmission uses layers called layer A, layer B and layer C (if using three layers) in ascending order of the required CN ratio. If two layers are used for hierarchical transmission, they are called layer A and layer B and if only one layer is used, it is called layer A.
BIT	Broadcaster Information Table: the table that lists configuration information of multimedia broadcasters such as transmission parameters for all stations and each station.
CAT	Conditional Access Table: CAT is used to specify the ID of the TS packet that carries individual information from among relevant information comprising chargeable broadcasting.
CN ratio	The CN ratio is defined as the carrier to noise ratio, which represents the power ratio of the carrier of high frequency signals to the noise within the bandwidth.
component_tag	component_tag is defined as the label used to identify component streams.

DDB	Download Data Block: the message, which together with DII comprises a data carousel, and which contains modularized real data.
DII	Download InfoIndication: the message, which together with DDB comprises a data carousel, and which contains information such as the number of real data (modules), module identifiers, version numbers and whether data are compressed or not.
DTS	Decoding Time Stamp: the time control information for decoding streams.
ECG	Electronic Contents Guide: A tool for enabling presentation of content information provided by multimedia broadcasting, selection of content, etc.
ECM	Entitlement Control Message: the common information that includes program information (program related information and descrambling keys) and control information.
EIT	Event Information Table: the program related information such as program names, air dates and times and brief program descriptions. Multimedia broadcasting uses the N-EIT for display in weak-layer services, the M-EIT for display in strong-layer services, and the W-EIT for display in partial-reception-layer services.
EPG	Electronic Program Guide: A tool for real-time broadcasting services to enable the user to present program information such as a program guide, select a program, etc.
ES	Elementary Stream: This corresponds to the coded video, audio, and independent data in a PES packet. One ES is carried in a sequence of PES packets with the same stream ID.
GOP	Group of Pictures: A coding unit summarizing one I picture and multiple P and B pictures in video compression coding In H.264, this is defined as a GOP shown in ARIB STD-B32, Part 1, Attachment 2.
H.264|MPEG-4 AVC	Advanced encoding and decoding technology jointly developed by the Moving Picture Experts Group (MPEG) of the International Standards Organization/ International Electrotechnical Commission U.S., Inc. (ISO/IEC) and the Video Coding Experts Group (VCEG) of International Telecommunication Union (ITU)
INT	IP/MAC Notification Table: In the stream that configures storage-type broadcasting services, this specifies the platform ID for the transport stream ID/service ID/component tag/target receiver IP address.
LFE	Low Frequency Enhancement: the low frequency enhancement channel in multi-channel stereo mode.
MPEG-2	Moving Pictures Expert Group-2: the compression and coding technology for data (such as moving images and audio data) standardized by the International Organization for Standardization (ISO/IEC 13818).
MPEG-4	Moving Pictures Expert Group-4: the compression and coding technology for data (such as moving images and audio data) standardized by the International Organization for Standardization (ISO/IEC14496).
NIT	Network Information Table: the table that carries information to relate transmission path information such as frequencies to channels and that lists ID numbers for all the channels contained in a distribution system.

OFDM	Orthogonal Frequency Division Multiplexing: a kind of multicarrier transmission system.
OFDM segment	OFDM segment is defined as the basic bandwidth for transmission signals with control signal carriers added to data carriers (1/14 of the TV channel bandwidth) or as the framed signals.
OFDM frame	OFDM frame is defined as the transmission frame comprised of 204 OFDM symbols.
PAT	Program Association Table: PAT is used to specify the ID of the TS packet that carries the PMT.
PCR	Program Clock Reference: the reference for the timing of transmitting an ES with the PTS/DTS for the video, audio, caption and superimpose stream on receivers.
PES	Packetized Elementary Stream: the packetized video, audio and other data with variable lengths.
PID	Packet Identifier: the 13-bit stream identifier information in the TS packet header, which shows the attributes of individual streams of the packet.
PMT	Program Map Table: PMT is used to specify the ID of the TS packet that carries coded signals for each program and the ID of the TS packet that carries common information from among chargeable broadcasting related information.
PSI	Program Specific Information: information (comprised of five tables: PAT, PMT, NIT, CAT and INT) necessary to select specific programs.
PTS	Presentation Time Stamp: the presentation and output time control information in the PES packet header.
QPSK	Quaternary Phase Shift Keying: a modulation scheme to send a carrier in four phases: phase 0, phase 1/2π, phase π and phase 3/2π, which respectively correspond to values, 00, 01, 10 and 11.
QPSK (1/2)	QPSK (1/2) is defined as a QPSK transmission system which involves transmission path coding at the convolutional coding rate of 1/2.
SBR	Spectral Band Replication: SBR is extension technology for ACC low bit rate band.
SDT	Service Description Table: the table that lists channel related information such as channel names and broadcasting company names.
SDTT	Software Download Trigger Table: the table used to download software and to send schedule information about differential data for stored broadcasts.
SFN	Single Frequency Network: the network in which relay stations and the master station use the same frequency, thus allowing efficient use of radio frequencies.
SI	Service Information: various information designed to improve the convenience of program selection, defined by the ordinances of the Ministry of Internal Affairs and Communications and specified by the ARIB standard. The information also includes MPEG-2 PSI information in addition to an expansion of the ARIB standard.
TMCC	Transmission and Multiplexing Configuration Control: the transmission control signal that carries information, for example, about the transmission system and frame structure.

TOT	Time Offset Table: TOT is used to specify the current date and time and to specify the time difference between the actual time and the displayed time when the summer time starts. (In multimedia broadcasting, only TOT is transmitted, and TDT is not transmitted.)
TS	Transport Stream: the transport stream defined by the MPEG-2 system standard (ISO/IEC 13838-1). In multimedia broadcasting, 1TS is assigned to 13-segment broadcasting and 1-segment broadcasting respectively.
TS packet	The TS packet is defined as the 188-byte (four-byte header) data packet used to send PES and sections.
TS remultiplexing	TS remultiplexing is defined as the function to configure multiplex frame structures necessary to transmit the TS to the OFDM modulator.
UTC	Universal Time Coordinated: the time commonly used around the world based on the international agreement.
component	The component is defined as each element that makes up an event (program) such as video, audio, text and other data.
data_component_id	data_component_id is defined as the identifier to indicate the data coding scheme, which is assigned and managed by the ARIB.
duplicate_packet	duplicate_packet is defined as the packet that specifies the duplication of the same content, which can be identified by Duplicate_packet_indicator. This is not used by digital terrestrial television broadcasting.
network	The network is defined as a collection of multiplexed MPEG-2 TS transmitted by a single distribution system.
network_id	Network identifier value: One value is allocated to the overall multimedia broadcasting.
p/f	p/f is defined as the current program information (p) and the next program information (f) of the EIT
service	The service (channel) is defined as a series of scheduled broadcasting programs transmitted by each broadcasting company.
service_id	service identifier is defined as the identifier for each service in the network.
start_end_flag value	The start_end_flag value is defined as an item in the Emergency Information Descriptor. If the value is set to "1", it signifies that an emergency warning is being broadcast and if the value is set to "0", it signifies that a test emergency warning is being broadcast.
transport_stream_id	transport_stream_id (TS_id) is defined as the identifier uniquely assigned to each TS in the network.
Convolutional Inner coding rate	The convolutional coding rate is defined as the rate of the number of bits before coding to the number of bits after convolutional coding.
Access unit	A set of NAL units, which always contains the main coded pictures Decoding the access unit always creates one decoded picture. The access unit where the main coded picture is an IDR picture is referred to as an IDR access unit.
Aspect ratio	The aspect ratio is defined as the ratio of the horizontal dimension to the vertical dimension of the active area of a display screen.
Interleaving	Refer to time interleaving and frequency interleaving.

Countdown	The countdown is defined as changing the transmission parameter switching index on an OFDM frame basis, 15 frames prior to changing the transmission parameters that can be manipulated by the TMCC information (the carrier modulation method, convolutional coding rate, time interleaving length and number of segments).
Current/next	The current information is defined as parameters currently used when changing the transmission parameters that can be manipulated by the TMCC information (the carrier modulation method, convolutional coding rate, time interleaving length and number of segments), while the next information is defined as parameters that will be used after the change of the transmission parameters. The next information is determined when a countdown of the switching index starts.
Guard interval	The guard interval is defined as the data with a specified time length (which comprises a part of data output after IFFT (Inverse Fast Fourier Transform)) added before each effective symbol period. The guard interval is used to solve the problems associated with the multipath phenomenon (caused by time differences) like ghost problems encountered during analog broadcasting.
Component	Component
Service	Service
Service identifier	service identifier
Side panel	The side panel is defined as the system to place black space on both sides of the screen when video with an aspect ratio of 4:3 is displayed on a screen with an aspect ratio of 16:9.
Sampling rate	The sampling rate is defined as the repetition frequency at which samples are taken from the original signal when converting original analog audio signal to the digital signal.
Seamless switching	Seamless switching is defined as a switching technology to ensure that the receiver unit will not freeze or be muted when the broadcasting stations switch to a redundant playout system or change the coding system.
Segment	Same as the OFDM segment.
Downmix coefficient	The downmix coefficient is defined as the coefficient used to calculate each 2-channel stereo component from each multi-channel stereo component when downmixing (converting) from multi-channel stereo to 2-channle stereo for listening.
Data carousel	Format defined by ISO/IEC 13818-6 for repeatedly transmitting data to download various data via broadcasting.
Default maximum bit rate	The default maximum bit rate is defined as the value automatically used when no bit rate value is specified in the Digital Copy Control Descriptor.
Dual mono	Dual mono is defined as an audio mode that allows the use of two mono audio in a single ADTS.
Transport stream identifier	transport_stream_id
Null packet	The null packet is defined as the TS packet that does not include effective information but is used for stuffing purpose.

Network	The network for digital terrestrial television broadcasting is defined as the distribution system for signals transmitted from a single master transmitter.
Network identifier	network identifier
Version No.	The version number is defined as the five-bit area that increments when the MPEG-2 section is updated. To indicate that new PSI/SI data that includes updated information will be transmitted when changing information in the table, a sub-table with the next version number will be transmitted.
Profile	Classification of functional restrictions on the technologies used for the H.264 coding system
Maximum bit rate	The maximum bit rate is defined as the value representing the maximum amount of information of the entire service or each ES. The information is needed to record data on digital recorders.
Multi-channel stereo	Multi-channel stereo is defined as the stereo audio system comprised of at least three channels: for example, a center channel or surround channel is used in addition to the basic stereo channels (L and R).
Mute flag	The mute flag is defined as a control flag used by the sender to mute the sound of the receiver unit.
Mode	The transmission mode can be identified by the OFDM carrier spacing.
Letter box	The letter box is defined as the system to place black space on the top and bottom of the screen when video with an aspect ratio of 16:9 is displayed on a screen with an aspect ratio of 4:3.
One-touch button	The one-touch button is defined as the button pressed by the viewer for one-touch channel selection.
Audio mode	The audio mode is defined as the format used to process audio signals; the mono, stereo, multi-channel stereo, dual audio and multi audio modes are available.
Hierarchical transmission	Hierarchical transmission is defined as simultaneous transmission of OFDM segment groups with different transmission path coding.
Descriptor	The descriptor is defined as the description area placed in the table to list various information.
Partial/High/Low protection layer	Hierarchical transmission uses layers called the High protection layer and Low protection layer (if using three layers) in ascending order of the required CN ratio. The layer that performs partial reception is called the partial reception layer. The partial reception layer uses a modulation system equivalent to the one used by the layer with the lowest required CN ratio among other layers, or a lower-grade modulation system.
Emergency warning broadcasting (Emergency Warning System (EWS))	The Emergency Warning System is used for disaster broadcasts. The start control signal, for example, forces receivers to receive the broadcasts.
Start flag for emergency warning broadcasting	The start flag for emergency warning broadcasting in the TMCC signal is defined as the bit to notify receivers that an emergency warning broadcast will be made.

High quality sound stereo	High quality sound stereo is used for stereo broadcasts that use audio quality equivalent to that of standard TV mode B of current analog satellite broadcasting.
Caption	Of the services that superimpose characters on an image of real-time broadcasting, this service is related to video image contents.
Time interleaving	Time interleaving is defined as the operation to temporally interleave symbol data after modulation to increase fading resistance.
Automatic display/selective display	The automatic display mode is defined as a mode in which the caption and superimpose are displayed regardless of how receivers are set to operate, while the selective display mode is defined as a mode in which the caption and superimpose are not displayed only when the caption and superimpose settings are off on receivers (See Table 4-2, Chapter 4, Part 3 of ARIB STD-B24).
Frequency interleaving	Frequency interleaving is defined as the operation to prevent certain segments from experiencing error bursts by eliminating the periodicity of carrier alignment when the carrier aligning frequency and the frequency selective fading match. Frequency interleaving is a generic term used for inter-segment interleaving, intra-segment carrier rotation and intra-segment carrier randomization.
Required CN ratio	The required CN ratio is defined as the critical reception CN ratio at which the receiver unit can stably demodulate signals.
Switching index	The switching index, specified in the TMCC information, is defined as the signal to show the timing for changing transmission parameters that can be manipulated by the TMCC information (the carrier modulation method, convolutional coding rate, time interleaving length and number of segments).
Multiplex frame	The multiplex frame is defined as a signal processing frame to re-multiplex MPEG-2 TS into one TS with the same time length as the OFDM frame.
Region code	The region code is defined as the code indicating the target area, placed in the Emergency Information Descriptor, during emergency warning broadcasting (ARIB STD-B10 Annex D).
Storage-type broadcasting	Of terrestrial multimedia broadcastings based on connected segment transmission, this broadcasting is provided by downloading.
Transmission parameters	The transmission parameter is defined as a generic term for parameters for transmission path coding. The transmission parameters for digital terrestrial television broadcasting include the carrier modulation scheme, convolutional coding rate, time interleaving length, number of segments, transmission mode and guard interval ratio. The information about the transmission mode and the guard interval ratio is not transmitted by the TMCC signal.
Transmission mode	The transmission mode is defined to classify modulation schemes and error correction systems.
Statistical multiplexing	Statistical multiplexing is defined as the system to use variable bit rates depending on the difficulty of coding and to effectively improve the picture quality within a limited bandwidth when sending multiple video streams over a single channel.

Inner code	The inner code is defined as one of the concatenated codes that use the combination of two types of error correcting systems, which is later coded into the error correcting code. When the sending and receiving systems use digital modulation and demodulation, inner coding and decoding take place. Digital terrestrial television broadcasting uses convolutional coding with the constraint length of 7.
Partial reception	Receiving only the 1OFDM segment at the center of 13 segments.
Superimpose	Superimpose is defined as the caption provided asynchronously to the main video, audio or data streams. It is used for up-to-the-minute news, changes in air times, time signals and Earthquake Early Warning.
Continuity index	The continuity index is defined as a four-bit area in the TS header which increments with each TS packet with the same PID in order to indicate the continuity of the TS packet.
Consigning broadcaster	Same meaning as a “certified key broadcaster”
Consigned broadcaster	Same meaning as a “key broadcast station provider”

<Blank Page>

Chapter 2 Information Source Coding

2.1 Coding system of real-time broadcasting content

The coding system of real-time broadcasting content should also be in common with 13-segment broadcasting and 1-segment broadcasting, and no special restrictions are provided on the partial reception layer in 13-segment broadcasting or for 1-segment broadcasting.

2.1.1 Video

For the video coding system, follow the system specified in ARIB Standard "Video Coding, Audio Coding, and Multiplexing Specifications for Digital Broadcasting" (ARIB STD-B32), Part 1.

2.1.1.1 Video coding system

For video coding, use the system specified in ITU-T Rec. H.264 | ISO/IEC 14496-10.

Table 2-1 shows the restrictions on the coding parameters. For the parameters not included here as restrictions, such as buffer size, follow the provisions in ARIB STD-B32, Part 1, Section 5.2.2 "Restrictions on video coding parameters for low-resolution video services" – "System complying with the MPEG-4 AVC Standard".

Table 2-1: Restrictions on Coding Parameters

Item	Restriction
Signal format	YC_BC_R 4:2:0
Quantization bit rate	8 bit
Scan system	Progressive
Maximum screen size	See Table 2-2
Maximum bit rate	See Table 2-2
Picture time interval	Within 0.7 seconds
Color description	Complying with Rec. ITU-R BT.1361 (Rec. ITU-R BT.709)

As shown in Table 2-2, coding should be performed under conditions complying with the main profile, and the level should be 1.2, 1.3, or 3.

Table 2-2: Screen Size and Maximum Bit Rate

Profile	Level	Screen size [number of macro blocks] (compatible typical number of horizontal pixels × number of vertical lines)	Maximum bit rate (maximum bit rate value in operation)
Main	Level 1.2	240 (320×180)*	384 kbps

	Level 1.3	240 (320×180)*	768 kbps
	Level 3	1620 (720×480)	6 Mbps

* If the screen width or height cannot be divided by 16, dummy video data is added to the right-hand side of the effective sample or the bottom of the effective line, and in fact, the data is subject to a coding process using the number of samples or the number of lines, which are a multiple of 16. The decoder processes the data and outputs the effective sample and effective line video signals with the dummy data removed.

2.1.1.2 H.264 | MPEG-4 AVC operation guidelines

2.1.1.2.1 Video format

Table 2-3 shows the video format and the corresponding syntax.

Table 2-3: Video Format

Format	Screen size	Aspect ratio	seq_parameter_set_rbsp( )		vui_parameters( )	
			pic_width_in_mbs_minus1	pic_height_in_map_units_minus1	aspect_ratio_info_present_flag	aspect_ratio_info
QVGA	320x180	16:9	19	11 *	1	1
525 HHR	352x480	16:9	21	29	1	9
525 SD	720x480	16:9	44	29	1	5

* If the screen width or height cannot be divided by 16, dummy video data is added to the right-hand side of the effective sample or the bottom of the effective line, and in fact, the data is subject to a coding process using the number of samples or the number of lines, which are a multiple of 16. The decoder processes the data and outputs the effective sample and effective line video signals with the dummy data removed.

2.1.1.2.2 Frame Rate

The frame rate is calculated using the variables of VUI parameters, based on frame rate = time_ scale/num_ units_ in_ tick. The frame skip should not be restricted. To operate the video format, the frame rate [Hz] at each level is as shown in Table 2-4.

Table 2-4: Maximum Frame Rate at Each Level [Hz]

	1.2	1.3	3
QVGA	15000/1001	30000/1001	-
525 HHR	-	-	30000/1001
525 SD	-	-	30000/1001

2.1.1.2.3 Color description

The color description should comply with Rec. ITU-R BT. 1361 (Rec. ITU-R BT. 709). When video_ signal_ type_ present_ flag=0 or colour_ description_ present_ flag=0 in the VUI parameters, all values of colour_ primaries, transfer_ characteristics, and matrix_ coefficients will be 2 (Unspecified), but all values should be interpreted as 1 (Rec. ITU-R BT. 709) on decoder units.

2.1.1.2.4 Data structure of bit streams

The sequence parameter set should include VUI.

The borders of pictures should include an access unit delimiter.

The order of the NAL (network abstract layer) unit that comprises the access unit and the SEI message should be as follows respectively at the start of GOP and in another access unit, and the NAL unit or SEI message not described should not be operated. However, the coding reference picture/marking retransmission SEI, filler data, or sequence encode is not mandatory for the access unit.

Access unit at the start of GOP:

- Access unit delimiter (mandatory)
- Sequence parameter set (mandatory)
- Picture parameter set (mandatory)
- SEI (supplemental enhancement information)
  - ➢ Buffering cycle SEI (mandatory)
  - ➢ Recovery point SEI

    Be sure to attach the recovery point SEI to GOP starting with an I picture other than IDR.
  - ➢ Picture timing SEI (mandatory)
  - ➢ Pan-scan rectangle SEI

    The detailed operation method is separately specified in Section 2.1.1.2.10 “Pan-scan rectangle SEI”.
- Slice data (pixel-value-coded data) (mandatory)

  The minimum unit of slice should be one macroblock column.

  For GOP that starts with an I picture other than IDR, when decoding is performed successively from the preceding GOP and when decoding starts from the I picture at the start, it should be possible to decode and display the slice that does not refer to the picture that belongs to the preceding GOP.
- Filler data

- Sequence end

Access unit other than the start of GOP:

- Access unit delimiter (mandatory)
- Picture parameter set (mandatory)
- SEI (supplemental enhancement information)
  - ➢ Picture timing SEI (mandatory)
  - ➢ Pan-scan rectangle SEI

  The detailed operation method is separately specified in Section 2.1.1.2.10 “Pan-scan rectangle SEI”.
- Slice data (pixel-value-coded data) (mandatory)

  The minimum unit of slice should be one macroblock column.

  For GOP that starts with an I picture other than IDR, when decoding is performed successively from the preceding GOP and when decoding starts from the I picture at the start, it should be possible to decode and display the slice that does not refer to the picture that belongs to the preceding GOP.
- Filler data
- Sequence end

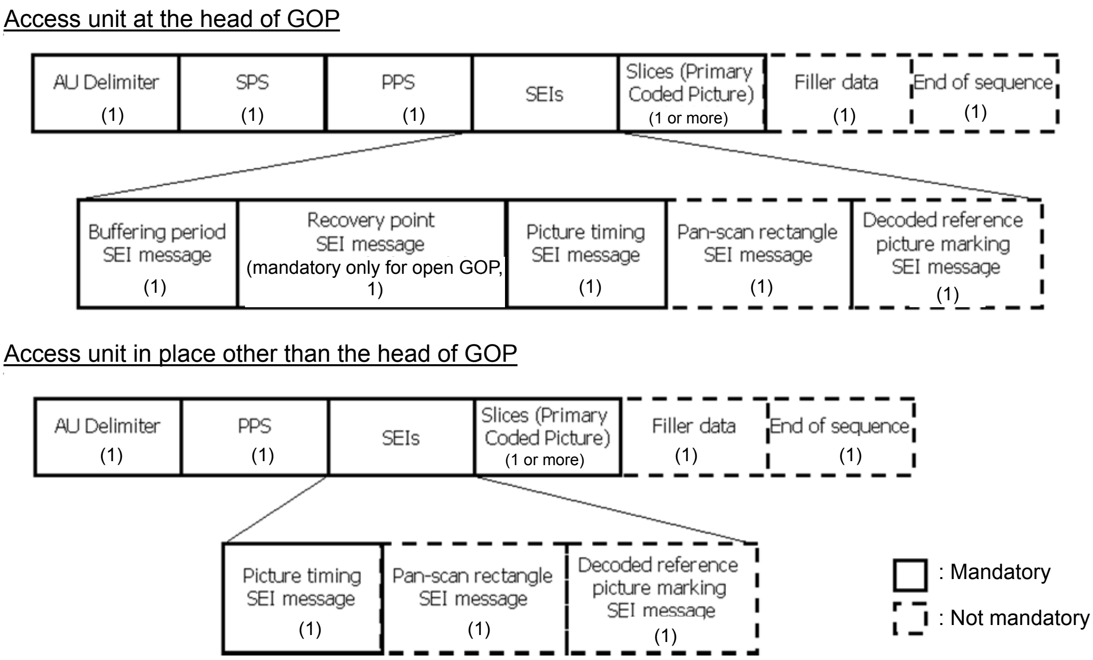


Figure 2-1: Access Unit Configuration

(Explanation)

Since VUI contains critical information such as the aspect ratio, color matrix, and frame rate, it is necessary to include the sequence parameter set that corresponds to the sequence header.

It is stipulated that the access unit delimiter is mandatory when H.264|MPEG-4 AVC is transmitted by MPEG-2 TS (ISO/IEC 13818-1:2000/Amd3).

For H.264|MPEG-4 AVC, the data allocation of the bit stream is free, but it is easier to create a decoder when the data is allocated in the order of processing.

To ensure assured operation of the display system, always set pic_struct_present_flag to 1, and send pic_struct in the picture timing SEI.

To send HRD information of the NAL level, include the HRD parameter in the sequence parameter, send the buffering cycle SEI with the access unit at the start of GOP, and furthermore send the picture timing SEI for every access unit.

To ensure assured channel selection, etc., always attach recovery point SEI to the start of open GOP.

2.1.1.2.5 GOP Structure

Start GOP with the I picture in the order of decoding, and allocate only one sequence parameter set (corresponding to the sequence header) in the relevant I picture. The sequence parameter set must be the one necessary for decoding the relevant sequence. There are two ways to configure an I picture: one is configured only by the IDR slice, and the other is configured only by the I slice.

Closed GOP and open GOP are defined as follows:

- Closed GOP
  - This GOP has the IDR picture for the I picture, which is at the head in the decoding order. When decoding starts from the head of GOP, decoding of all pictures in GOP is ensured.

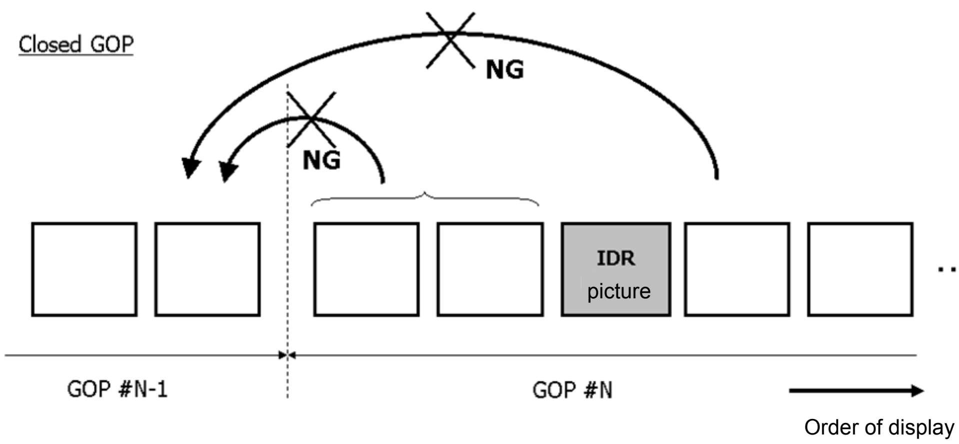


Figure 2-2: Closed GOP

・Open GOP

- This GOP has the non-IDR picture for the I picture, which is at the head in the decoding order. When decoding starts from the head of GOP, pictures whose display order is earlier than the I picture at the head may not be decoded in the normal fashion.
- Pictures whose display order is later than the I picture at the head should be able to be decoded in the normal fashion.

To ensure that pictures whose display order is later than the I picture at the head can be decoded, open GOP should satisfy the following provisions:

- Pictures whose display order is earlier than the I picture at the head can refer to the pictures in the preceding GOP.
- Pictures whose display order is later than the I picture at the head cannot refer to the pictures in the preceding GOP.

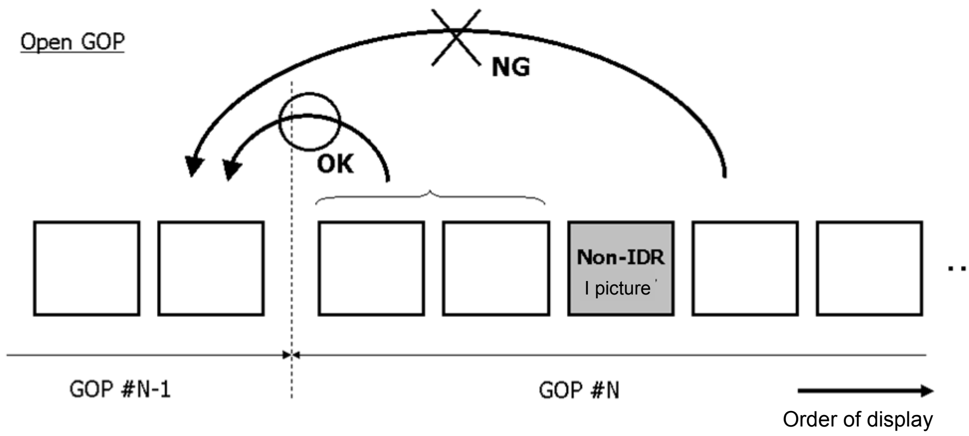


Figure 2-3: Open GOP

The picture parameter set is allocated in the pictures that refer to the relevant parameter set. The pictures should be configured by those of the same slice type.

The I picture and P picture should be only reference pictures (nal_ref_idc is not 0), and the order of decoding and the order of display should match. The P picture should be decodable by referring to only the I picture and P picture in the same GOP (other GOP or B picture should not be referred to).

The order of decoding non-reference B picture and reference B picture should be immediately after the I picture or P picture that is displayed immediately after. Here, the I picture or P picture should be in the same GOP of the non-reference B picture or reference B picture.

The non-reference B picture should refer to only

(a) the frame of the I picture or P picture whose display order is immediately before or immediately after, or

(b) the frame of the reference B picture whose display order is closer than the I picture or P picture, and whose display order is immediately before or immediately after.

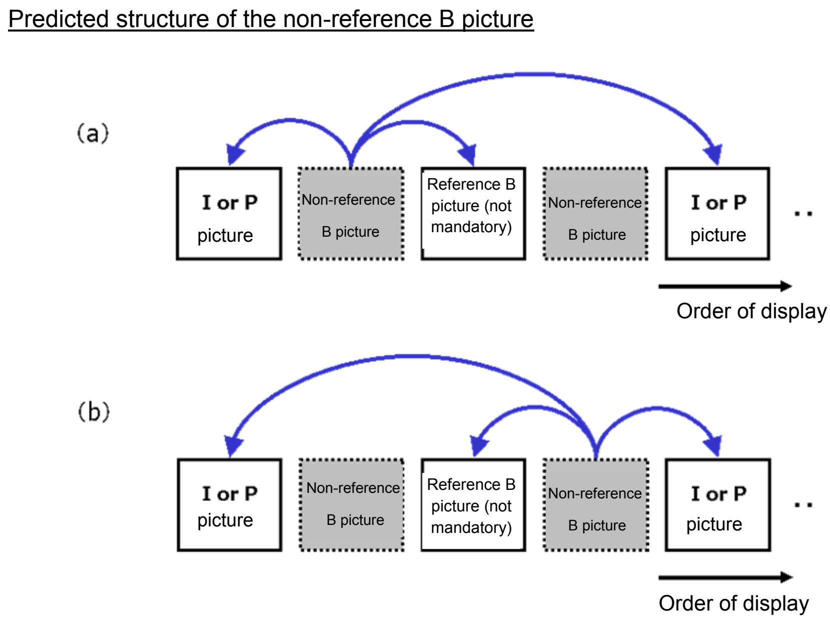


Figure 2-4: Predicted structure of the non-reference B picture

The reference B picture should refer to only

(a) the frame of the I picture or P picture whose display order is immediately before or immediately after.

Predicted structure of the non-reference B picture

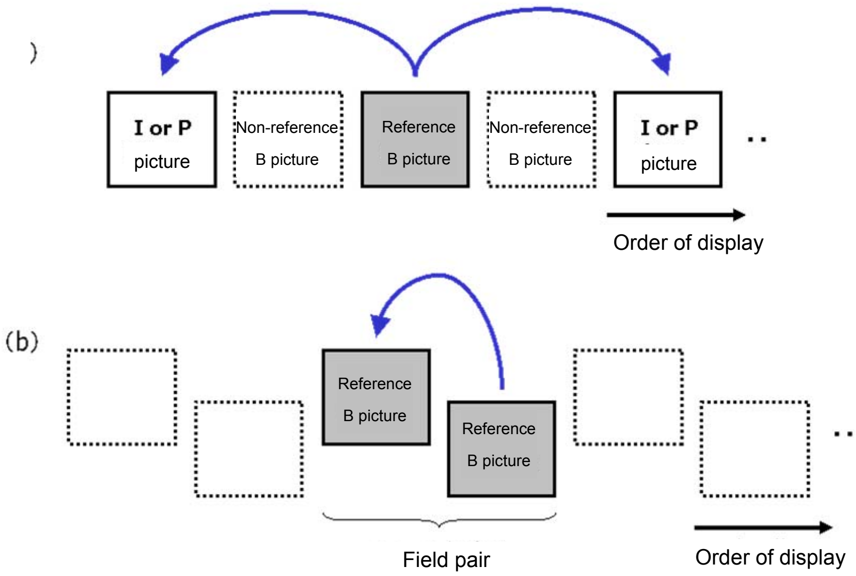


Figure 2-5: Predicted structure of the reference B picture

Here, there are two types of B picture: the one to which other pictures can refer (nal_ref_idc is not 0) and the other to which other pictures do not refer (nal_ref_idc is 0), which are called the reference B picture and non-reference B picture respectively in this document.

Re-ordering should be done between the non-reference B pictures (the decoding order and display order of non-reference B pictures). If decoded reference picture marking has been performed in the reference B picture, in the I picture, or in the P picture that is to be decoded immediately after, the content of the relevant decoded reference picture marking should be re-transmitted by the decoded reference picture marking SEI.

The maximum number of the frames of the successive B pictures (non-reference B pictures or reference B pictures) or field pair is three.

The difference between the decoding time of the I picture whose decoding order in the GOP is first and the display time of the picture whose display order in the GOP is first should be an interval of two frames or less (when decoding is started from the head of GOP, display can be started when up to the interval of two frames is waited).

The GOP length should be 2 s in principle, and 5 s at maximum.

(Explanation)

H.264|MPEG-4 AVC permits a mixture of I, P, and B slices for pictures, and enables the achievement of a flexible predicted structure such that the P picture can use the B picture for prediction. However, because the GOP structure is restricted to the same as in MPEG-2, the achievement of the decoder is easy, and furthermore, when a stream of broadcasting is recorded, functions such as fast-forward playback can be achieved.

One picture parameter set should always be attached to each picture.

(Explanation)

H.264 | MPEG-4 AVC enables transmission of several picture parameter sets in bulk and a stream structure whereby a picture parameter set transmitted earlier is referred to by subsequent pictures. However, since it is operated by attaching a picture parameter set to each picture in the same way as in MPEG-2, the decoder does not need to hold the picture parameter set, simplifying the process.

2.1.1.2.6 Restrictions on coding tools

Set MinLumaBiPredSize to 8 x 8.

Set the maximum number of reference frames (num_ref_frames) to four.

Use 12 Mbits or less for the CPB size.

(Explanation)

A coding tool that supports bidirectional moving compensation with a block size of less than 8 x 8 pixels is inhibited, and the maximum number of reference frames is set to four, which facilitates the achievement of decoders.

The CPB buffer size should be 12 Mbits, which is the maximum value of the main profile, Level 3.

The two variable-length coding systems CAVLC and CABAC should be switchable only when the stop period of broadcasting is sandwiched.

(Explanation)

The packaging for momentarily switching the two variable-length coding systems so that video images are not interrupted is unnecessary, which facilitates the achievement of decoders.

The type of POC (picture order count) should be 0.

(Explanation)

Type 1 is complicated, and the coding amount reduction effect is low with the bit rate for broadcasting. Type 0 includes all types, and to minimize the required syntax element, only type 0 is used.

2.1.1.2.7 HRD conformance

HRD should satisfy the display time conformance (output timing conformance) of type 2 (NAL level).

2.1.1.2.8 Transmission of the identifier indicating the end of the sequence

- Use the End of Sequence NAL unit for the identifier that indicates the end of the sequence (the End of Stream NAL unit is not operated).
- Transmit the End of Sequence NAL unit immediately before the beginning access unit of the closed GOP (GOP starting with the IDR picture).

(Explanation)

It is preferable that when the receiver receives the End of Sequence NAL unit, it freezes the screen of the video data received immediately before the unit, during the period while it decodes and displays the video data to be transmitted subsequently. This means that when the decoder can quickly decode and display the video data that is transmitted to follow the End of Sequence NAL unit, it enables seamless continuation, and does not necessarily mean that the decoder displays the frozen picture for a fixed period.

2.1.1.2.9 Restriction on syntax in H.264/MPEG-4 AVC stream

- NAL unit

Table 2-5: NAL Unit

Syntax element	Operation	Remarks
nal_ref_idc	0, 1, 2 or 3	0: Non-reference picture 1,2,3: Reference picture Non-0 for an I picture or P picture, 0 or non-0 for a B picture
Nal_unit_type	1, 5, 6, 7, 8, 9, 10, 11 or 12	1: Slice of a non-IDR picture 5: Slice of an IDR picture 6: SEI 7: Sequence parameter set 8: Picture parameter set 9: Access unit delimiter 10: End of sequence 11: End of stream 12: Filler data

- Sequence parameter set

Table 2-6: Sequence Parameter Set

Syntax element	Operation	Remarks
profile_idc	77	77: Main profile
level_idc	12, 13 or 30	12: Level 1.2 13: Level 1.3 30: Level 3

seq_parameter_set_id	0	Fixed at 0.
chroma_format_idc	1	1: 4:2:0 format
bit_depth_luma_minus8	0	0: 8 bits for the luma pixel value
bit_depth_chroma_minus8	0	0: 8 bits for the chroma pixel value
qpprime_y_zerotransform_bypass_flag	0	0: Reversible encoding mode is not used.
pic_order_cnt_type	0	0: Mode to show the order of pictures from the difference value with the IDR immediately before
num_ref_frames	1 to 4	The maximum value of the reference pictures is shown.
gaps_in_frame_num_value_allowed_flag	0	0: The decoder operation is not specified when the frame number is discontinued.
pic_width_in_mbs minus 1	See Table 2-3	Shows the number of macroblocks minus 1 in the horizontal direction
pic_height_in_map_unit_minus1	See Table 2-3	Shows the encoding unit quantity of minus 1 in the vertical direction.
frame_mbs_only_flag	1	1: Frame macroblock only
direct_8x8_inference_flag	1	1: Direct-mode predictive coding with a block size of less than 8 x 8 is not used
frame_cropping_flag	See Table 2-12	0: All coded pictures are displayed 1: Part of the coded picture is displayed by cropping
frame_crop_left_offset	See Table 2-12	Shows the half value of the number of pixels on the left-hand edge, which is not displayed by cropping the coded picture.
frame_crop_right_offset	See Table 2-12	Shows the half value of the number of pixels on the right-hand edge, which is not displayed by cropping the coded picture.
frame_crop_top_offset	See Table 2-12	Shows the half or quarter value of the number of pixels on the top edge, which is not displayed by cropping the coded picture.
frame_crop_bottom_offset	See Table 2-12	Shows the half or quarter value of the number of pixels on the bottom edge, which is not displayed by cropping the coded picture.
vui_parameters_present_flag	1	1: VUI is encoded.

・Picture parameter set

Table 2-7: Picture Parameter Set

Syntax element	Operation	Remarks
pic_parameter_set	0	Fixed at 0.

_id		
pic_order_present_flag	1	Fixed at 1.
entropy_coding_mode_flag	0 or 1	0: CAVLC 1: CABAC This value is fixed for all picture parameter sets included in sequence.
num_slice_groups_minus1	0	0: A slice group is not used.
num_ref_idx_l0_active_minus1	0 to 7	Shows the number obtained by subtracting 1 from the maximum value of the number of L0 reference pictures in the num_ref_frames setting value range. I frame: 0 P frame: 0 to 3 B frame: 0 to 1 I field: 0 P field: 0 to 7 B field: 0 to 3
num_ref_idx_l1_active_minus1	0 to 3	Shows the number obtained by subtracting 1 from the maximum value of the number of L1 reference pictures in the num_ref_frames setting value range. I frame: 0 P frame: 0 B frame: 0 to 1 I field: 0 P field: 0 B field: 0 to 3
redundant_pic_cnt_present_flag	0	0: A redundant slice is not used.

• Access unit delimiter

Table 2-8: Access Unit Delimiter

Syntax element	Operation	Remarks
primary_pic_type	0, 1 or 2	I picture: 0 P picture: 1 B picture: 2

• Slice header

Table 2-9: Slice Header

Syntax element	Operation	Remarks
slice_type	7, 5 or 6	I picture: 7

		P picture: 5 B picture: 6
num_ref_idx_l0_active_minus1	0 to 7	Shows the number obtained by subtracting 1 from the maximum value of the number of L0 reference pictures in the num_ref_frames setting value range. I frame: 0 P frame: 0 to 3 B frame: 0 to 1 I field: 0 P field: 0 to 7 B field: 0 to 3
num_ref_idx_l1_active_minus1	0 to 3	Shows the number obtained by subtracting 1 from the maximum value of the number of L1 reference pictures in the num_ref_frames setting value range. I frame: 0 P frame: 0 B frame: 0 to 1 I field: 0 P field: 0 B field: 0 to 3

・Coded picture buffer control (Decoded Reference Picture Marking Syntax)

Table 2-10: Coded Picture Buffer Control (Decoded Reference Picture Marking Syntax)

Syntax element	Operation	Remarks
no_output_of_prior_pics_flag	0	0: A coded picture is displayed (picture not to be displayed is not coded).
long_term_reference_flag	0	Long-hour memory is not used.
adaptive_ref_pic_marking_mode_flag	0	

・VUI

Table 2-11: VUI

Syntax element	Operation	Remarks
aspect_ratio_info_present_flag	1	Information on aspect ratio is mandatory.
aspect_ratio_idc	Table 2-13	The pixel aspect ratio is shown.
sar_width	0	Fixed at 0.
sar_height	0	Fixed at 0.
video_full_range_flag	0	0: Compliant with ITU-R BT.709-5.
colour_primaries	1	1: Compliant with ITU-R BT.709-5.
transfer_characteristics	1	1: Compliant with ITU-R BT.709-5.
matrix_coefficients	1	1: Compliant with ITU-R BT.709-5

chroma_loc_info_present_flag	0	0: Same as the sample position of 4:2:0 format color-difference signal in MPEG-2.
timing_info_present_flag	1	1: Shows the frame rate in case of a fixed frame rate. num_units_in_tick, time_scale, and fixed_frame_rate_flag are included in syntax element Frame-rate = time_scale / num_units_in_tick / 2
num_units_in_tick	1001	Fixed at 1001.
time_scale	30000 or 60000	30000: Frame rate 15000/1001 60000: Frame rate 30000/1001
fixed_frame_rate_flag	1	1: Fixed frame rate
nal_hrd_parameters_present_flag	1	1: The NAL HRD parameter that shows the bit rate and buffer information is included in the syntax element.
vcl_hrd_parameters_present_flag	0	0: The VCL HRD parameter that shows the bit rate and buffer information is not included in the syntax element.
low_delay_hrd_flag	0	0: The receive buffer is not permitted to underflow.
pic_struct_present_flag	1	Fixed at 1.

Table 2-12: Combination of Parameters that Shows Picture Size

Aspect ratio	Number of horizontal pixels	Number of vertical pixels	aspect_ratio_idc	frame_mbs_only_flag	frame_cropping_flag	frame_crop_left_offset	frame_crop_right_offset	frame_crop_top_offset	frame_crop_bottom_offset
16:9	320	180	1	1	1	0	0	0	6
16:9	352	480	9	1	0	0	0	0	0
16:9	720	480	5	1	0	0	0	0	0

2.1.1.2.10 Pan-scan rectangle SEI

When transmitting a video image with an aspect ratio differing from that of the regular video source such as a side panel or a letter box, setting the pan-scan rectangle parameters shown below makes it possible to display a video image without a black edge (frame) caused by the receiver aspect ratio. The display format when pan-scan rectangle is applied should be followed.

When pan-scan rectangle is applied, the pan-scan rectangle SEI should always be coded to the starting I picture of GOP (IDR picture for closed GOP; non-IDR I picture for open GOP). (When the pan-scan rectangle is not applied, the pan-scan rectangle SEI should not be coded.)

The following shows the values of each parameter for the above operation:

Table 2-13: Pan-scan rectangle SEI

			Pan-scan rectangle SEI parameters				
Picture width	Picture height	aspect_ratio_idc	pan_scan_rect_left_offset	pan_scan_rect_right_offset	pan_scan_rect_top_offset	pan_scan_rect_bottom_offset	Reference figure
320	180	1	0	0	0	0	(1)
320	180	1	640	-640	0	0	(2)
352	480	9	0	0	0	0	(1)
352	480	9	656	-656	0	0	(2)
720	480	5	0	0	0	0	(1)
720	480	5	1440	-1440	0	0	(2)

Syntax element	Operation	Remarks
pan_scan_rect_id	0	The pan-scan rectangle information is not distinguished by ID.
pan_scan_rect_cancel_flag	0	The pan-scan rectangle information is always sent.
pan_scan_cnt_minus1	0	The pan-scan rectangle information is of only one type.
pan_scan_rect_repetition_period	1	The pan-scan rectangle information is valid immediately before the subsequent sequence or the subsequent picture to which the pan-scan rectangle SEI is added.

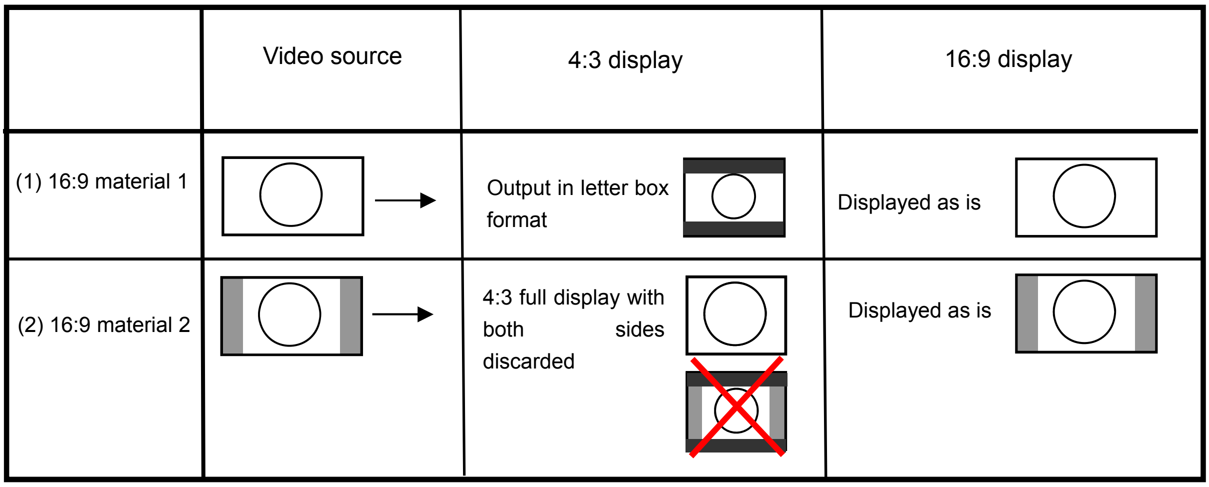


Figure 2-6: Preferable Display Format

2.1.1.2.11 Handling 3D video

A 3D video is handled with the identification method that uses the frame storage allocation SEI (frame packing arrangement SEI) shown in ARIB TR-B15, Vol. 7, Section 10.1 “3D Identification Signal in MPEG-4 AVC”. The 3D image playback function on the terminal is optional. 3D is applicable to all the video formats treated by this TR.

2.1.2 Audio

2.1.2.1 Input signal specifications

<Sampling rate>

(1) The same sampling rate should always be used for each service. This is to prevent the no-sound part from occurring within the same service when the clock signal of D/A converter is changed.

(2) The sampling rates should be 48 kHz, 44.1 kHz, or 32 kHz.

<Quantization bit rate>

Should be at least 16 bits.

<Audio mode>

For the audio mode in 1ADTS, the specifications for the recommended audio mode in ARIB STD-B32, Part 2, Section 5.1 “Input Audio Format Compliant with MPEG-2 AAC System” shall be complied with.

<Downmix coefficient>

The specifications in ARIB STD-B32, Part 2, Section 5.2 “Audio Coding System Compliant with MPEG-2 AAC System” and ARIB STD-B53, Section 5.2.1 “Audio Decoding

Process” shall be complied with.

The downmix coefficient may not be transmitted. At this time, decoding is performed using the default value. When a downmix coefficient other than the default value is used, it should always be transmitted.

<Audio level>

For operation of the audio level, ARIB TR-B32 should be referred to. When multi-channel stereo is downmixed to 2-channel stereo for listening,(Note) clipping may frequently occur due to overflow through downmixing calculation, and the sound quality could be extremely deteriorated. It is preferable that such a source is processed to drecrease the deterioration of the sound quality by downmixing by providing attenuation for the input on the transmission side, transmitting an appropriate downmix coefficient, monitoring downmixed audio, etc.

Note: The calculation formula of the downmix audio signal has been revised in ARIB STD-B53 Version 1.2.

<Channel mapping during program change or at a transmission facility>

Refer to Table 2-14 for mapping to the AES/EBU channels during program change or at a transmission facility.

Table 2-14: Mapping to AES/EBU Channels in Various Audio Modes

Audio mode	AES/EBU_1		AES/EBU_2		AES/EBU_3		AES/EBU_4		No. of ADTS
	ch1	ch2	ch3	ch4	ch5	ch6	ch7	ch8	
M	M								1
S	L	R							1
2M (D)	M1	M2							1
3M (D+M)	M1	M2	M3						2
4M (2D)	M1	M2	M3	M4					2
2S	L1	R1	L2	R2					2
3/1	L	R	C	MS					1
3/2	L	R	C		LS	RS			1
3/2+LFE (5.1)	L	R	C	LFE	LS	RS			1
Stereo/Mono (S+M)	L	R	M						2
Stereo/2 Mono (S+D)	L	R	M1	M2					2
5.1+S	L	R	C	LFE	LS	RS	L2	R2	2
3/1+S	L	R	C	MS			L2	R2	2
3/2+S	L	R	C		LS	RS	L2	R2	2

Note 1: Abbreviations:

MS, LS, RS: Surround audio from rear speakers

Mono surround, left surround, right surround respectively

LFE (low-frequency enhancement): Low-frequency sound-enhancing channel of multi-channel stereo

Table 2-14 specifies the relationship between the audio modes and channel mapping at the input stage of the encoder. If it is not assumed that coding is performed in the corresponding audio mode, blank columns are available according to the judgement of the broadcaster. (Example: MS_{-3dB} is superimposed respectively on ch5 and ch6 in the 3/1 stereo mode.)

2.1.2.2 Audio coding system

The audio coding system shall comply with ARIB STD-B32, Part 2, Section 3.1 “System complying with the MPEG-2 AAC Standard”, and MPEG-2 AAC Audio (ISO/IEC 13818-7), MPEG-4 HE-AAC (ISO/IEC 14496-3:2001/Amd.1), and MPEG-4 HE-AAC v2 (ISO/IEC 14496-3:2005/Amd2:2006) should be available.

In addition, MPEG Surround (ISO/IEC23003-1) may be used. Receivers should be able to receive surrounding audio data, but decoding only the AAC base part is acceptable.

For the elementary stream transmission format, ADTS format is used in accordance with ARIB STD-B32, Part 2, Section 4.1 “System complying with the MPEG-2 AAC Standard”.

For the details of operation, comply with the provisions in ARIB STD-B32, Part 2, Chapter 5 “Restrictions on MPEG-2 AAC Audio Coding Parameters”, and Part 2, Annex 1 “Guidelines on Operation of the MPEG-2 AAC Standard”.

<Coding parameters>

Table 2-15: Major Parameters for Audio Coding Format

Bit stream format	AAC Audio Data Transport Stream (ADTS)
Sampling rates	48 kHz, 44.1 kHz, 32 kHz, 24 kHz, 22.05 kHz, 16 kHz
Profile	Low Complexity (LC)
Maximum number of coding channels	5.1 channels maximum per 1ADTS
PES packet	Asynchronicity with the audio frame is permitted.
Muting flag	Not used. * Muting is applied to input signals.

<Caution during switching of audio parameters>

During switching of audio parameters, muting is inserted on the receiver side in many cases at present, since noise may sometimes be generated during decoding. Therefore, it is preferable that the input signal is provided with a “no-sound” section to avoid instantaneous shutoff of program audio during switching. The no-sound period should be judged by the broadcaster, taking into account the enhancement of future encoding/decoding functions.

< Audio coding rate range>

For the range of audio coding rate (during sampling at 48 kHz and 44.1kHz), the following values are used as a reference of operation. Here, each value of rate should indicate the ADTS rate.

Standard stereo	96 kbit/s to 256 kbit/s
High-quality stereo [†]	192 kbit/s to 256 kbit/s
Multi-channel stereo	288 kbit/s to 384 kbit/s

For the audio of sampling at a frequency of 32 kHz or less, the following values are used as a reference for the time being. Here, each value of rate should indicate the ADTS rate. For operation of the audio mode, Mode 2 or Mode 3 is used by the judgment of broadcasters.

Monaural	24 kbit/s to
Stereo	32 kbit/s to

< High-audio-quality service >

The model 1 audio quality specified in ARIB STD-B32, Part 2, Annex 2 “Audio Quality Indicators” should be complied with. High-audio-quality service is identified by the quality_indicator field in the audio component descriptor included in the EPG/ECG metadata. It does not depend on the coding rate.

<Operation of AAC_SBR>

The operation of SBR stored in the ADTS fill element is enabled. When SBR is operated, the coding sampling rate should be set to a half rate (24 kHz, 22.05 kHz, and 16 kHz). At this time, which is the operation by attaching CRC to sbr_extension_data, it is preferable that sbr_header is inserted at least once every 500 ms.

<Operation of MPEG Surround>

To operate MPEG Surround, the following decoder tools are used.

MPEG Surround Decoder Tools

MPEG Surround tool	Decoder tool used by this operational guideline	Reference: MPEG Baseline Profile
Upmix (M1, M2, M3 as defined by OTT and TTT modules, including decorrelators)	O	O
Residual Coding	O	O

[†] ARIB STD-B32, Part 2, Annex 2 “Audio Quality Indicators” shall be complied with.

Temporal Shaping	O	O
Parameterized External Downmix compensation	O	O
Residual coding-based External Downmix compensation	X	X
Binaural decoding (parametric)	O	O
Binaural decoding (filtering)	X	O
Mono downmix (5151 and 5152 tree configuration)	X	O
Support of stereo output for 515	X	O
Enhanced Matrix Mode decoding	X	O
Matrix compatibility	X	O
3D audio decoding (Binauralization by the MPEG Surround encoder)	X	O

The receiver that handles MPEG Surround playback should support at least one operation mode (level) of the following:

MPEG Surround Decoder Level

Level	Tree Configurations	Max. no. of output channels	Max. sampling rate [kHz]	Residual encoding max. frequency bands [QMF bands]	Assumed scenario of use
A	525	2.0 (binaural)	48	0	Binaural playback on decoder using stereo headphones
B(LP)	525	5.1	48	7	Low-consumption (LP) playback using 5.1 ch speakers
B(HQ)	525	5.1	48	64	High-quality (HQ) playback using 5.1 ch speakers

2.1.3 Caption/Superimpose

For the coding of caption/superimpose in real-time broadcasting, the provisions in this technical document, "Vol. 3 Provisions for Multimedia Coding, Section 3.3 Operation of Closed Caption/Superimpose Coding", shall be complied with.

2.1.4 Data

For the data coding system in real-time broadcasting, the provisions in this technical document, "Vol. 3 Provisions for Multimedia Coding, Section 3.4 Operation of Multimedia Coding", shall be complied with.

2.1.5 Metadata

Since metadata for real-time broadcasting is not operated, no coding system is specified.

Program guides of real-time broadcasting are operated with the EPG/ECG metadata transmitted by storage-type broadcasting.

2.2 Coding system of storage-type broadcasting content

For the coding system of storage-type broadcasting content, the provisions in this technical document, "Vol. 3 Multimedia Broadcasting: Provisions for Multimedia, Section 5.2 Operation of Media Coding", shall be complied with.

2.3 Coding of storage-type broadcasting service

2.3.1 Operation of FLUTE/AL-FEC processing

This technical document, "Vol. 11, 2.1.5 Operation of FLUTE Transmission" and "Vol. 11, 2.1.6 Operation of AL-FEC Transmission", shall be complied with.

2.3.2 Operation of the FLUTE FDT instance

This technical document, "Vol. 11, 2.1.5.3 FDT Instance", shall be complied with.

2.3.3 Operation of UDP/IP

This technical document, "Vol. 11, 2.1.7 Operation of UDP/IP Transmission", shall be complied with.

2.3.4 Operation of ROHC

This technical document, "Vol. 11, 2.1.8 Operation of ROHC Transmission", shall be complied with.

2.3.5 Operation of ULE

This technical document, "Vol. 11, 2.1.9 Operation of ULE Transmission", shall be complied with.

2.3.6 Restrictions on storage-type broadcasting content

2.3.6.1 Transmission bit rate for storage-type broadcasting content

The maximum bit rate for storage-type broadcasting content is 6.7 Mbit/s.

2.3.6.2 File size for storage-type broadcasting content

The maximum file size for storage-type broadcasting content is 4 Gbytes.

2.3.6.3 File name for storage-type broadcasting content

The maximum number of characters of the file name for storage-type broadcasting content is 255 bytes.

2.4 Service patterns

In multimedia broadcasting, the service_type value for all services except engineering service should be 0 x C2, and the upper four bits of the service identifier (service_id) are used to identify the service.

Refer to this volume, Section 7.1.2 for the guideline on the allocation of a service identifier (service_id).

2.4.1 Service patterns in 13-segment broadcasting

(1) Services operated in layers other than partial reception layer

Service name	service_type	Definition of service
Video real-time broadcasting service	0xC2	Real-time broadcasting service that contains at least one video stream of stream_type = “0x1B” and is mainly used for viewing of video streams. 0x8000 to 0x8FFF is used for the service_id.
Audio real-time broadcasting service	0xC2	Real-time broadcasting service that contains at least one audio stream of stream_type = “0x0F” and is mainly used for hearing of audio streams 0x9000 to 0x9FFF are used for the service_id.
Independent data broadcasting service	0xC2	Data broadcasting service that contains at least one data carousel of stream_type = “0x1B” and is mainly used for real-time viewing of data content 0xA000 to 0xBFFF are used for the service_id.
Engineering service	0xA4	Receiver software correction service This is used for bug fixation, correction of failures due to differences in operational interpretation between the transmitter and receiver, and improvement of indications, response speed, operability, etc. The service also updates the genre code table and program property code table, which are common for all receivers. See Vol. 1 for details.
Storage-type broadcasting service	0xC2	Storage-type broadcasting service that contains at least one storage-type broadcasting data of stream_type = “0x91” Differing from general broadcasting service, it transmits content via broadcast waves to the receiver, stores it, and lets the user view or use it, so the transmission time and use time are different. 0x2000 to 0x5FFF are used for the service_id.
EPG/ECG metadata service	0xC2	EPG/ECG metadata service that contains program information of stream_type= “0x91”, for example, information of the third day up to the eighth day 0x1000 to 0x1FFF are used for the service_id.

(2) Services operated in partial reception layer

Service name	service_type	Definition of service
Video real-time broadcasting service	0xC2	Real-time broadcasting service that contains at least one video stream of stream_type = "0x1B" and is mainly used for viewing of video streams 0x8000 to 0x8FFF are used for the service_id.
Audio real-time broadcasting service	0xC2	Real-time broadcasting service that contains at least one audio stream of stream_type = "0x0F" and is mainly used for hearing of audio streams 0x9000 to 0x9FFF are used for the service_id.
Independent data broadcasting service	0xC2	Data broadcasting service that contains at least one data carousel of stream_type = "0x1B" and is mainly used for real-time viewing of data content 0xA000 to 0xBFFF are used for the service_id.
Storage-type broadcasting service	0xC2	Storage-type broadcasting service that contains at least one storage-type broadcasting data of stream_type= "0x91" Differing from general broadcasting service, it transmits content via broadcast waves to the receiver, stores it, and lets user view or use it, so the transmission time and use time are different. 0x2000 to 0x5FFF are used for the service_id.
EPG/ECG metadata service	0xC2	EPG/ECG metadata service that contains program information of stream_type = "0x91", for example, information of the current day up to the second day. 0x0001 to 0x0FFF are used for the service_id.

2.4.2 Service patterns in 1-segment broadcasting

Service name	service_type	Definition of service
Video real-time broadcasting service	0xC2	Real-time broadcasting service that contains at least one video stream of stream_type = “0x1B” and is mainly used for viewing of video streams 0x8000 to 0x8FFF are used for the service_id.
Audio real-time broadcasting service	0xC2	Real-time broadcasting service that contains at least one audio stream of stream_type = “0x0F” and is mainly used for hearing of audio streams 0x9000 to 0x9FFF are used for the service_id.
Independent data broadcasting service	0xC2	Data broadcasting service that contains at least one data carousel of stream_type = “0x1B” and is mainly used for real-time viewing of data content 0xA000 to 0xBFFF are used for the service_id.
Storage-type broadcasting service	0xC2	Storage-type broadcasting service that contains at least one storage-type broadcasting data of stream_type = “0x91” Differing from general broadcasting service, it transmits content via broadcast waves to the receiver, stores it, and lets user view or use it, so the transmission time and use time are different. 0x2000 to 0x5FFF are used for the service_id.
EPG/ECG metadata service	0xC2	EPG/ECG metadata service of stream_type = “0x91” service_id uses 0x0001 to 0x0FFF (for example, program information of the current day to the second day), and 0x1000 to 0x1FFF (for example, program information of the third day to the eighth day).

Note: When the EPG/ECG metadata service is consolidated in the 13-segment broadcasting services, it may not be transmitted in 1-segment broadcasting.

2.5 Each transmission pattern, and video and audio parameters

The following shows the transmission patterns of each layer in 13-segment broadcasting, as well as the video and audio parameters available in 1-segment broadcasting:

Table 2-16: Parameters Used for Each Operation

Pattern	Layer used	No. of segments	Transmission	Video	Audio
(1)	—	1	The parameters in Table 2-17 can be used in all layers.	The parameters in Table 2-18 can be used in all layers.	The p;arameters in Table 2-19 can be used in all layers.
(2)	A	1			
	B	12			
(3)	A	1			
	B	11 to 1			
	C	1 to 11			

Layers used: A, B, and C show the layers described in TMCC.

Table 2-17: Transmission Parameters

Mode/ Guard ratio	Time interleaving	Modulation / Error correction		
Mode 3	(Mode 3)	16QAM	QPSK	
1/4	I=4	1/2	2/3	1/2
O	O	O	O	O

O: Available transmission parameters

Table 2-18: Video Parameters

Coding system	H.264			
	MP@L3	MP@L3	MP@L1.3	MP@L1.2
Size	720×480 p	352×480 p	320×180 p	320×180p
Frame rate	30/1.001Hz	30/1.001Hz	30/1.001Hz	15/1.001Hz
Scan system	Progressive scan	Progressive scan	Progressive scan	Progressive scan
	O	O	O	O

O: Transmittable

Table 2-19: Audio Parameters

MPEG-2 AAC LC/MPEG-4 HE AAC							
48 kHz/44.1 kHz/32 kHz				Multiple ES*1	24 kHz/22.05 kHz/16 kHz		
Mono	Stereo	Multi-channel	Dual mono		Mono	Stereo	Dual mono
O	O	O	O	O	O	O	O

O: Transmittable

*1: Number of audio elementary streams (ES) that are transmitted in the layer to be referred to by one service.

Chapter 3 Multiplexing

3.1 Multiplexing of Service

3.1.1 Overview of multiplexing

The multiplexing method in multimedia broadcasting is based on the provisions in MPEG-2 Systems (ITU-T H.222.0 | ISO 13818-1), and the protocol stack is shown as follows:

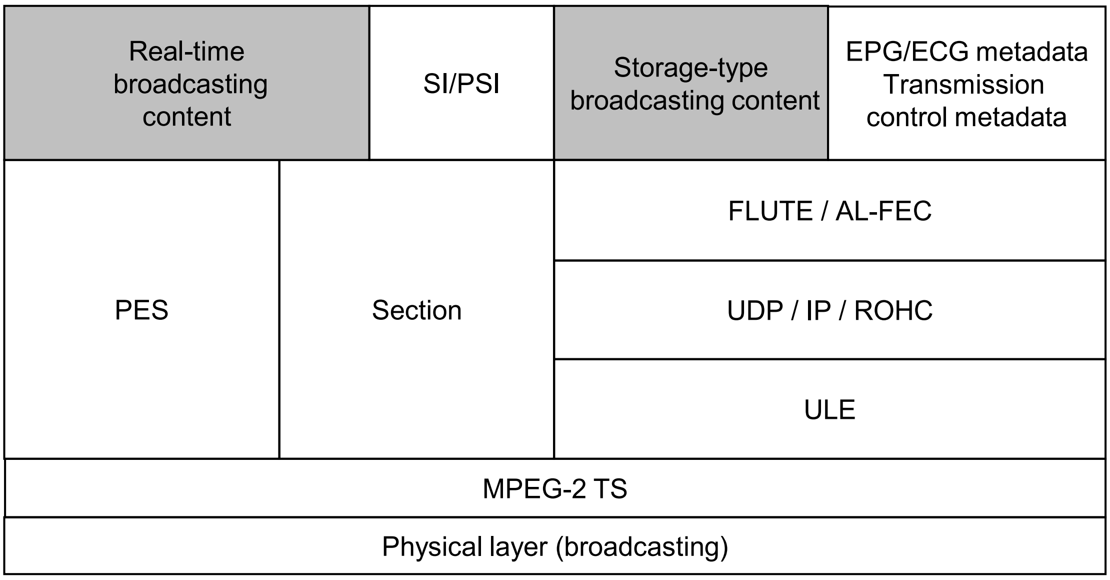


Figure 3-1: Protocol stack of multimedia broadcasting

3.1.2 Definition of the ES

3.1.2.1 Definition of ES in 13-segment broadcasting service

(1) ES' carried in layers other than the partial reception layer

Table 3-1: ESs Carried in 13-Segment Broadcasting

<table>
<tr><th colspan="2">Stream Type</th><th>Stream Type ID</th><th>Component Tag Value</th><th>Data Component Descriptor</th></tr>
<tr><td colspan="2">H.264｜MPEG-4 AVC video</td><td>0x1B</td><td>0x00</td><td>Not to be inserted.</td></tr>
<tr><td>audio</td><td>MPEG-2 AAC audio
MPEG-4 HE-AAC audio</td><td>0x0F</td><td>0x10, 0x11</td><td>Not to be inserted.</td></tr>
<tr><td rowspan="2">Caption and Superimpose</td><td>Caption</td><td rowspan="2">0x06</td><td>0x30</td><td rowspan="2">To be inserted.
The data_component_id value is set to 0x001C.</td></tr>
<tr><td>Superimpose</td><td>0x38</td></tr>
<tr><td rowspan="2">Data broadcasting</td><td>Data carousel (DII, DDB)</td><td rowspan="2">0x0D</td><td>0x40, 0x41</td><td rowspan="2">To be inserted. *1
The data_component_id value is set to 0x000B.</td></tr>
<tr><td>Event message</td><td>0x50, 0x51</td></tr>
<tr><td rowspan="2">Storage-type broadcasting content</td><td>Storage-type broadcasting data</td><td rowspan="2">0x91</td><td rowspan="2">0xC0</td><td rowspan="2">Not to be inserted.</td></tr>
<tr><td>EPG/ECG metadata</td></tr>
</table>

*1 It is optional whether or not to insert the descriptor in the component that only carries an event message.

(2) ES' carried in the partial reception layer

It should be the same as the ESs (Table 3-1) carried in layers other than the partial reception layer.

3.1.2.2 Definition of ES in 1-segment broadcasting services

Table 3-2: ESs Carried in 1-Segment Broadcasting

Stream Type		Stream Type ID	Component Tag Value	Data Component Descriptor
H.264 | MPEG-4 AVC video		0x1B	0x00	Not to be inserted.
audio	MPEG-2 AAC audio MPEG-4 HE-AAC audio	0x0F	0x10, 0x11	Not to be inserted.
Caption and Superimpose	Caption	0x06	0x30	To be inserted. The data_component_id value is set to 0x001C.
	Superimpose		0x38	
Data broadcasting	Data carousel (DII, DDB)	0x0D	0x40, 0x41	To be inserted. *1 The data_component_id value is set to 0x000B.
	Event message		0x50, 0x51	
Storage-type broadcasting content	Storage-type broadcasting data	0x91	0xC0	Not to be inserted.

*1 It is optional whether or not to insert the descriptor in the component that only carries an event message.

3.1.3 Maximum number of ESs per service

3.1.3.1 Real-time broadcasting service

The restrictions regarding the PID filtering resources of receivers limit the number of ES' that can be simultaneously processed to a maximum of 16. This accordingly means that the maximum number of ES' per service that can be simultaneously displayed (including audio replays) and simultaneously recorded is 16. However, the maximum number of ES' that may be scrambled is 12 due to restrictions regarding the conditional access system.

When transmitting PCR data as an independent packet, the PCR packet is counted as one ES.

3.1.3.2 Storage-type broadcasting service

For storage-type broadcasting service, one ES is carried per service. Therefore, the number of ESs that can be stored per service should be one at maximum.

3.1.4 Default ES

The table below specifies which ES will be selected as default when the receiver unit selects a service.

This technical document specifies the component tag value assigned to each ES in "13.2 Assignment of component_tag Values" in Vol. 4. According to this, based on the component tag value described in the Stream Identifier Descriptor inserted in the PMT, the default ES for each stream type is defined as follows.

○ H.264	MPEG-4 AVC video	: ES whose component tag value is set to 0x00
○ Audio	: ES whose component tag value is set to 0x10
○ Caption	: ES whose component tag value is set to 0x30
○ Superimpose	: ES whose component tag value is set to 0x38
○ Data carousel	: ES whose component tag value is set to 0x40
○ Storage-type broadcasting content	: ES whose component tag value is set to 0xC0

In each service, only one ES can be specified as the default for each stream type identifier. However, there is an exception; only when the stream type identifier is set to 0x06, the default ES can be specified for the caption and superimpose, respectively.

3.2 Detailed Operation Information Regarding MPEG-2 Systems

3.2.1 Definitions of Services

For services by service type, see this volume, "Section 2.4 Service patterns".

3.2.2 Synchronization of video, audio, and caption in real-time broadcasting

Since the receiver unit uses both the PTS and DTS or either of them as the base for synchronization, the sender should control the synchronization of the video, audio and caption streams so as to ensure no failures of receivers.

3.2.3 Multiplexing of the SI and Data

The maximum bit rates assigned to the SI and data broadcasting are as shown below.

○ SI	: A maximum of 1 Mbit/s for entire SI (Average per second value.) See this technical document "Vol. 4, Section 9.2 Detailed TS packet transmission".
○ Data broadcasting	: Maximum 650kbit/s See this technical document "Vol. 3, Section 3.1.1.2 Data broadcasting service content configuration and component operation".

3.2.4 Operation of the PAT

The sequential order of services described in the PAT has no meaning and has nothing to do with the operation of receivers. They are usually listed simply in order of service identifier.

3.2.5 Operation of the NIT

(1) A network of multimedia broadcasting consists of one transmission facility that transmits multiple TSs. Accordingly, the NIT only includes one TS loop.

(2) The sequential order of services described in the NIT has no meaning and has nothing to do with the operation of receivers. They are usually listed simply in order of service identifier.

(3) Multimedia broadcasting is operated by an SFN. Therefore, the frequency of the transmitter described in one terrestrial delivery system descriptor is single.

(4) The use of information described in the NIT enables almost automatic setting of receivable services when receivers are installed. For more information on how to set up receivers, see this technical document "Vol. 2, Section 4.2 Initial setting".

(5) For the area code in the terrestrial delivery system descriptor, the area allocation (area common codes) specified in ARIB STD-B10, Part 2, Annex D, Table D-2 should be applied.

(6) The identifier remote_control_key_id in the TS information descriptor should not be used, and association with one-touch buttons 1) to 12) is not performed.

3.2.6 Operation of INT

(1) When a stream of storage-type broadcasting service is included in TS for multimedia broadcasting, INT should always be transmitted.

(2) The INT carriage layer should be layer A.

(3) The INT repetition rate shall comply with the provisions in this technical document "Vol. 4, Section 10.4", and the frequency of updating shall comply with the provisions in this technical document "Vol. 4, Section 10.9".

(4) The INT structure and operation parameters shall comply with the provisions in this technical document "Vol. 4, Section 30.5". The IP/MAC platform name descriptor, IP/MAC platform provider name descriptor, and IP/MAC stream allocation descriptor should always be inserted into the relevant descriptor area. Any other descriptors are arbitrarily insertable.

(5) For specific values of platform ID, refer to Section 7.2.4

3.2.7 How to Handle the PMT and ES

(1) In normal times, if no elementary video or audio stream is present, no description of such an ES should be included in the PMT. However, this does not apply to transient states such as during seamless switching.

(2) The maximum number of elementary caption or superimpose streams should be one. In principle, such ES information in the PMT should be added when the caption or superimpose starts and deleted when they ends. However, it is also possible to always keep the ES information in the PMT.

3.2.8 Default Maximum Bit Rate

Digital recorders may record only certain services (partial TS) contained in the TS. If this happens, it is necessary to ensure the availability of bandwidth of the interface (IEEE1394) and set the maximum bit rate to calculate the recording time.

If the maximum bit rates at which the services are transmitted are greater or significantly lower than the values shown below, the sender uses the Digital Copy Control Descriptor for transmission.

Shown below are the default maximum bit rates for each component (however, for data, the sum total of the additional data related components is used) and for each service. For more information on how to set the maximum bit rate in the descriptor, see Vol. 4 of this technical document.

Table 3-3: Default Maximum Bit Rate for Each Component (TS Rate)

Video	QVGA	Up to 800kbit/s
	525HHR, 525SD	Up to 4Mbit/s
Audio	Standard stereo	Up to 330kbit/s
	High quality sound stereo	Up to 330kbit/s
	5.1ch stereo	Up to 458kbit/s
Additional data		4Mbit/s
Caption		256kbit/s
Superimpose		256kbit/s
Storage-type broadcasting		4Mbit/s

Table 3-4 Default Maximum Bit Rate for Each Media Type (TS Rate)

TV	QVGA	1Mbit/s
	525HHR, 525SD	5Mbit/s
Data		2.2Mbit/s

3.2.9 Operation of the PCR

(1) Regarding the PCR of each service, the TS should be so configured that the time interval between the byte containing the last bit of the PCR base field is 100 msec or

lower.

However, the PCR of partial reception service and the PCR of 1-segment broadcasting, while adding the condition above, should also be multiplexed at the same location in the same pattern on a multiplexed frame. In multimedia broadcasting that is operated in Mode 3, therefore, the PCR is inserted four times into one multiplexed frame period.

(2) Transmission should be performed, while making sure that the PCR jitter reaching receivers is within 500 nsec.

3.2.10 Operation of Partial Reception

Since the partial reception layer has a limited bandwidth for transmission, MPEG-2 can be used in a non-standard manner as shown below in order to ensure the capacity for transmitting contents. Incidentally, the method (2) below should be used by all broadcasting companies that use the partial reception layer. However, whether or not to use methods other than (2) is up to each broadcasting company.

(1) PCR repetition rate/transmission layer

Regarding the PCR mentioned in Section 3.2.9, the PCR inserted four times consecutively can be reduced to a minimum of once when it is used for partial reception service. However, the interval between PCRs should not be larger than one multiplexed frame period in multimedia broadcasting that is operated in Mode 3. If the PCR cycle exceeds 100 msec, services in non-partial reception layers should not be allowed to reference the PCR for partial reception.

(2) PAT transmission layer

In 13-segment broadcasting, the PAT should be transmitted in the partial reception layer (layer A). The maximum number of services transmitted in the partial reception layer is not specified.

(3) PMT repetition rate

The PMT for partial reception layer can be transmitted at time interval of a maximum of 500 msec.

3.2.11 Operation of 1-segment broadcasting

Since the transmission band is limited in 1-segment broadcasting, operation outside the MPEG-2 provisions can be carried out to secure the transmission capacity of the content. It is also possible that operation outside the provisions is not undertaken, according to the broadcaster’s judgment.

(1) PCR repetition rate/transmission layer

For the PCR operation of 1-segment broadcasting specified in Section 3.2.9, up to three PCRs of four consecutive PCRs can be reduced. However, the interval between PCRs should not be larger than one multiplexed frame period in multimedia broadcasting that is operated in Mode 3.

(2) PAT transmission layer

The PAT for 1-segment broadcasting can be operated with the maximum transmission layer set to 500 msecs.

(3) PMT repetition rate

The PMT for 1-segment broadcasting can be operated with the maximum repetition rate set to 500 msecs.

3.3 Multiplexing of Services

3.3.1 Maximum Number of Services

3.3.1.1 Maximum number of services in 13-segment broadcasting

The maximum number of sub-services of each service in the 13-segment frequency band is not specified.

3.3.1.2 Maximum number of services in 1-segment broadcasting

The maximum number of sub-services of each service in the 1-segment frequency band is not specified.

3.3.2 Statistical multiplexing

When statistical multiplexing is operated using multiple video images, the individual bit rates should be in the range specified in this volume, Section 2.1.1. The maximum number of video ESs is not specified.

3.4 Assignment of TS'

Each individual TS is assigned to the OFDM frames of 13-segment and 1-segment formats.

3.5 TS Operation Guidelines

Guidelines regarding seamless switching to redundant transmission system are given below. To ensure seamless switching, the senders should, whenever possible, perform transmission in accordance with the guidelines below. It is also preferable that receivers are able to make reception in accordance with the guidelines below.

3.5.1 Guidelines for Senders

Guideline T1.1

Redundant transmission systems should use, whenever possible, the same GOP phase and PCR value as those of the main transmission system in each service unit.

Guideline T1.2

To prevent a situation where the version number will not change due to switching to a redundant system when the type of processing changes, the sender should ensure the change of the version number.

Guideline T1.3

The partial reception layer should use the high protection layer and should not use duplicate_packet.

Guideline T1.4

Whenever possible, switching between systems should be performed when the audio is muted.

3.5.2 Guidelines for Receivers

Guideline R1.1

If no error has been detected in the transmission system and transport_error_indicator is not set, the video or audio should not be muted even when a discontinuity has been found in the continuity index (continuity_counter).

Guideline R1.2

If the type of decoding process remains unchanged despite the change in the version number, no processing other than what is required should be performed.

Guideline R1.3

Even in the presence of a deviation up to 2 times of PTS differences of the audio PES packet before and after the switching between systems, mute or other operations should be avoided whenever possible. Instead, the problem should be lessened, for example, by controlling the pace of the replay clock and performing skipping and repeating processing.

Guideline R1.4

Incomplete sections such as sections stopped or started halfway through should be discarded and a complete section received next should be used.

Chapter 4　Transmission

The signal format for transmitting multimedia broadcasting signals to STL, the method of synchronization establishment, and the method of signal transmission between broadcasters (senders) to configure a network, including SFN, will be separately specified, taking into account the relevant ARIB Standards.

<Blank Page>

Chapter 5 Transmission Path Coding/Modulation

5.1 IFFT sampling frequency

The allowable deviation of the IFFT sampling frequency for OFDM should be within the value below when assuming that n is the number of connected segments:

± 0.3 ppm$\times$ (13/n)

(Explanation)

With this deviation, the frequency deviation of the band-edge carrier caused by the deviation of the IFFT sampling frequency is 1 Hz.

It is assumed that the entire SFN network with TS remultiplexing also included has a deviation uniformly; this provision was established so that receivers can receive signals even if the frequency deviation of the band-edge carrier due to the deviation of the IFFT sampling frequency is 1 Hz.

5.2 Configuration and arrangement of super segments

5.2.1 Number of connected segments

For the number of segments to be connected, refer to ARIB STD-B46 Part 1, Attachment, Chapter 2.

5.2.2 Center frequency

For the center frequency of the carrier, refer to ARIB STD-B46 Part 1, Attachment, Chapter 2.

5.2.3 Arrangement of super-segments

For the arrangement of super-segments, use pattern (C) of the three arrangement patterns specified in ARIB STD-B46 Part 1, Attachment, Chapter 2.

5.2.4 Sub-channel numbers of 1-segment format

Refer to ARIB STD-B46 Part 1, Attachment, Chapter 2 for the sub-channel number of each unit transmission wave of a super-segment consisting of seven connected segments of the 1-segment format.

The sections below describe the transmission path coding and modulation systems of each OFDM segment format of the 13-segment format and 1-segment format. The mode and guard interval are common for all segments.

5.3 Hierarchical Transmission

(1) The transmission of single TS using multiple transmission methods is called hierarchical transmission.

(2) In multimedia broadcasting, the 13-segment format should always be operated with partial reception, and hierarchical transmission by the second layer or the third layer should be performed.

(3) The layer that performs partial reception in layer transmission is called the partial reception layer. When transmission is done using three layers in the order of the lower required CN ratio due to the differences in the transmission path coding system, they are called the partial reception layer / strong layer / weak layer; and when transmission uses two layers, they are called the partial reception layer / reception layer. The partial reception layer uses the same modulation system as that used by the strong layer when there are three layers or by the weak layer when there are two layers, or the modulation system of the lower required CN ratio.

(4) Regardless of the layer number. the three layers are also called the layer A, layer B and layer C in ascending order of the required CN ratio.

5.4 Partial Reception

For the OFDM segments at the center of the 13-segment format, transmission path coding for frequency interleaving only within each segment should be enabled.

In multimedia broadcasting, the 13-segment format should always be operated in the partial reception layer.

For layers other than the partial reception layer, a modulation system with the lower required CN ratio than for the layer of partial reception is not applied.

5.5 Transmission Parameters

5.5.1 Mode

Multimedia broadcasting is operated in Mode 3. See Table 5-1.

Table 5-1: Operation Modes

Mode	Carrier Interval	Total Number of Carriers	
		1 Segments	13 Segments
Mode 3	125/126kHz =0.99206･･･kHz	433	5617

5.5.2 Guard Interval

Since multimedia broadcasting performs the countrywide SFN, it uses a guard interval of 252 μ secs (Mode 3, guard interval ratio 1/4) to suppress interference by SFN.

5.5.3 Modulation, error correction, and transmission capacity

Refer to Table 5-2 for the modulation system and the error correction system (coding ratio of intracode), which can be used for multimedia broadcasting. For hierarchical transmission with layers, the parameters in Table 5-2 are selected and combined for use.

Table 5-2: Usable Modulation System and Intracode Coding Ratio (Mode 3, Guard Interval 1/4)

Modulation system	Intracode coding ratio	Transmission capacity (kbit/s)
QPSK	1/2	280.85
	2/3	374.47
16QAM	1/2	561.71

5.5.4 Interleaving

For time interleaving, I=4 (Mode 3) is used.

5.6 How to Change Transmission Parameters

Transmission parameters, more specifically, the carrier modulation method, convolution coding rate, time interleaving length and number of segments, are transmitted by the TMCC information in the TMCC carrier. To change these transmission parameters, the transmission parameter switching index in the TMCC carrier should be used (For more specific procedures, see Section 5.9.2).

When switching transmission parameters including the mode and guard interval ratio, it is desirable to pay consideration for minimizing the effect on receivers by switching the transition parameter.

5.7 Transmission Delays

The transmission delay time that occurs in the part of transmission path coding of multimedia broadcasting is generally as shown in Table 5-3.

Table 5-3: Upper Limits of Transmission and Reception Delay Time in the Part of Channel Coding (Examples of Estimates)

Mode	Time Interleave	Number of Delayed Frames	Delay Time [ms]
Mode 3	I=4	5	1285.2

5.8 TS Remultiplexing

5.8.1 Provisions Regarding TS Remultiplexing

TS remultiplexing is a processing specified by ARIB STD-B31 for 13-segment broadcasting and by ARIB STD-B29 for 1-segment broadcasting. This function is performed by the TS remultiplexing block in ARIB STD-B31 (Figure 3-2) and ARIB STD-B29 (Figure 3.1-1), which show the function that configures the multiplexed frame structure needed to transmit TS to an OFDM modulator.

5.8.2 Remultiplexed TS Structure

(1) A specific example of how packets are arranged when the TS is remultiplexed is shown below. This is based on the segment construction model.

Example:

mode 3, GI 1/8, QPSK (1/2) x 1 segment (Layer A) + 16QAM (1/2) x 12 segments (Layer B)

Notes:

. In each frame, 1280 packets are repeatedly transmitted four times as shown below.

. A and B respectively represents the TS packet in each layer and N represents the null packet.

. The numerical values are the location indices.

```
      0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8
      +---------+---------+---------+---------+---------+---------+---------+---------
0000: BNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBN
0080: BNBNBNNNNNNNNNNNNNANBNBNBNBNBNNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNB
0160: NNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNANBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNN
0240: NNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNABNBNBNBNBNBNNNNNNNNNN
0320: NNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNN
0400: ABNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNB
0480: NBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNABNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBN
0560: BNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNANNBNBNBNBNBNNN
```

0640 : NNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNN
0720 : NNNNNNABNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNN
0800 : NNBNBNBNBNBNBNNNNNNNNNNNNNABNBNBNBNBNBNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBN
0880 : BNBNBNBNBNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNANBNBNBNB
0960 : NBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNB
1040 : NNNNNNNNNNNNANBNBNBNBNBNNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNN
1120 : NNNNNNNNNNBNBNBNBNBNNNNNNNNNNNNNNNABBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNN
1200 : NNNNNBNBNBNBNBNBNNNNNNNNNNNNNNNBNBNBNBNBNBNNNNNNNNNNNNNNANBNBNBNBNBNNNNNNNNNNNNN

(2) The PCR should be added again based on the locations of the TS packets with the multiplex frame structure during remultiplexing.

(3) The TS packets which contain the PCR to be referenced by the partial reception service should always be present in the same locations in the frame.

5.9 Use of TMCC

The TMCC signal is used to transmit the information related to the decoding operation of the receiver, such as configuration of layers and transmission parameters of each OFDM segment. The TMCC signal is transmitted on the TMCC carrier.

5.9.1 System Identification

The two bits for system identification are set to “00” for 13-segment broadcasting, or “01” for 1-segment broadcasting.

5.9.2 Switching of Transmission Parameters

(1) To switch transmission parameters, more specifically, parameters that can be manipulated by the TMCC information (the carrier modulation method, convolution coding rate, time interleaving length and number of segments), a countdown of the four-bit transmission parameter switching index should be done.

(2) If no changes to these transmission parameters are necessary, the transmission parameter switching index is set to “1111” and a countdown by one for each frame takes place, starting from the 15th frame prior to switching. New parameters begin when the index, after reaching “0000”, is set to “1111” again.

(3) The next parameters use the values changed before a countdown starts. No changes to current or next parameters should take place during a countdown.

(4) The moment the transmission parameter switching index is set to “1111”, the next

parameter becomes the current parameter.

(5) The changes to the current parameters made up to immediately before a countdown starts become valid in the next parameters.

(6) If no changes to the current parameters take place, a countdown does not start.

(7) The problems with the receiving environment or problems met by senders make it impossible to receive the transmission parameter switching index, which performs a one-by-one countdown. If parameters have been changed despite the presence of such problems, the receivers obtain the TMCC information again and operate in accordance with the current values obtained. Until correct values are obtained, the receivers are not guaranteed to work properly.

5.10 Use of Emergency Warning Broadcasting (Emergency Warning System (EWS))

5.10.1 Transmission of Emergency Warning Broadcasting

The following steps should be used to start and stop the EWS.

(When starting the EWS)

(1) The Emergency Information Descriptor that specifies EWS conditions (start_end_flag, the classification of Type 1 and Type 2, and region code) should be carried in the PMT.

(2) Broadcasting companies should set the start flag for emergency warning broadcasting in the TMCC signal to 1 for transmission.

(3) Contents that can be recognized as emergency warning broadcasting should be used to start the broadcasting.

(When stopping the EWS)

(1) The start flag for emergency warning broadcasting should be set to 0 for transmission.

(2) The Emergency Information Descriptor should be deleted from the PMT.

5.10.2 How to Handle the Start Flag for Emergency Warning Broadcasting in the TMCC Signal

Senders should keep the start flag for emergency warning broadcasting in the TMCC signal set to 1 while emergency warning broadcasting is provided on a channel carried by the TS under the emergency warning system, regardless of the transmission layer in which the service that provides the EWS is carried. The receivers with automatic startup function periodically monitor the start flag for emergency warning broadcasting in the TMCC signal.

5.10.3 Multiplexing Locations of the Emergency Information Descriptor

The Emergency Information Descriptor should be included in the first descriptor's loop of the PMT for the emergency warning broadcasting service. In order to clearly indicate that the emergency warning broadcasting is being provided for EWS-compatible receivers, it is mandatory to include this descriptor in the PMT for the emergency warning broadcasting service. It is up to each broadcaster as to which PMT (or which service) to use to include the Emergency Information Descriptor. Please note that when services in different layers are described, they may be ignored on receivers.

Table 5-4: PMT Used to Include the Emergency Information Descriptor

	PMT for the non-emergency warning broadcast on a service carried by the TS under the emergency warning system	PMT for the emergency warning broadcast
Information in the Emergency Information Descriptor	Optional	Mandatory

5.10.4 Modification of the Information in the Emergency Information Descriptor

If a necessity to change the information (for example, the area code) in the Emergency Information Descriptor arises during emergency warning broadcasting, the procedure to end the EWS should be performed (which specifically involves setting the start flag for emergency warning broadcasting in the TMCC signal to 0 and deleting the Emergency Information Descriptor from the PMT). Then, after inserting the modified Emergency Information Descriptor into the PMT, the start flag for emergency warning broadcasting in the TMCC signal should be set to 1 again. Alternatively, the start flag for emergency warning broadcasting in the TMCC signal should be set to 0, and then, after modifying the information while the Emergency Information Descriptor remains in the PMT, the same flag should be set to 1.

In either case, the duration from when the start flag for emergency warning broadcasting is set to 0 to when the same flag is set to 1 should be a minimum of one second (if the length of the 4 OFDM frame is less than one second) and four OFDM frames (if the length of the 4 OFDM frame is more than one second). The receivers continuously perform ESW processes for 90 seconds after the start flag for emergency warning broadcasting switches to 0 (See 4.18.1 Reception of Emergency Warning Broadcasting (under the Emergency Warning System (EWS)) in Vol. 2). To change, for example, the target area, without ending the EWS processes, therefore, the broadcaster should switch the start flag for emergency warning broadcasting to 1 within 90 seconds.

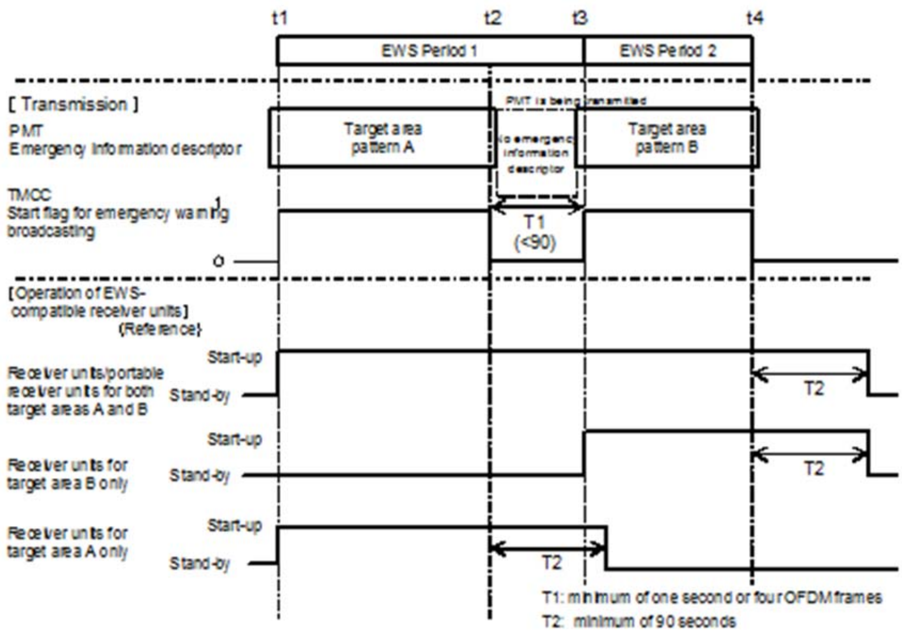


Figure 5-1: Modification of the Emergency Information Descriptor
and An Example of Operation of the Receiver Unit

5.10.5 Use of Emergency Warning Broadcasting Test Signals

During the test emergency warning broadcasting, the start_end_flag value in the Emergency Information Descriptor should be set to 0 (meaning an end) from the beginning. During the test broadcasting period, the descriptor should continuously be included in the PMT. After the end of the test broadcasting, when the start flag for emergency warning broadcasting in the TMCC signal switches to 0, the Emergency Information Descriptor should be deleted from the PMT.

5.11 Use of the AC (Auxiliary Channel)

5.11.1 Picture of operation

The AC can be used by broadcasting companies as the transmission path to carry the additional transmission control related information. It is up to each broadcasting company as to how the AC should be used. The receivers should not decode the AC for output.

5.12 Operation of connected segment transmission

For the operation of connected segment transmission, ARIB STD-B46, Part 1, Chapter 4 shall be complied with.

Chapter 6 Operation

6.1 Hierarchical Transmission

The purpose of hierarchical transmission is to perform transmission using the channel coding system that suits the characteristics of each service when a single TS carries multiple services. Hierarchical transmission should be operated as explained below

6.1.1 TS Structure during Hierarchical Transmission

(1) TS packets with the same PID should be carried in the same layer.

(2) When providing scrambled services, the ECM should be carried in the same layer as the PMT or in the layer with a higher resistance to interference.

(3) The PCR should be transmitted in the same layer as the ES (which references the PCR) or in the layer with a higher resistance to interference.

(4) The PAT, NIT, INT, CAT, TOT, SDT, and BIT should be transmitted in the strongest layer (A-layer).

(5) For the hierarchical transmission of the PMT, refer to this volume, Sections 6.1.2 and 6.1.3.

(6) The transmission layer the SDTT and CDT are shown in Table 6-1. (Refer to this technical document, "Vol. 1, 3.1 Download transmission model for multimedia broadcasting", for details.)

(7) The transmission layer of the EIT is shown in Table 6-2. (Refer to this technical document, "Vol. 4, 12.1 Definitions of EIT related terms and outline of EIT transmission operation", for details.)

(8) Regarding partial reception services, it is desirable not to frequently change the ES structure of each service and the PID value of each component. If changes are necessary, the following matters should be taken into consideration.

- The post-change PID value should not be the same as the PID value used for components, carousels or sections with different stream type identifiers. This also applied to other services in the same TS. However, if the use of the same PID values is unavoidable, it is desirable that a sufficient time period should be set in between.
- It is desirable that the PID value used prior to the change be not used for components of other services although the components have the same stream type identifier.

- If there is no change to the default ES when the number of ES' increases or decreased (when there is no change to the description of the ES loop in the default ES of the PMT), it is desirable that the PID value of the default ES will remain unchanged.

Table 6-1: SDTT Transmission Layers

<table>
<tr><th rowspan="2">Pattern</th><th rowspan="2">Layer</th><th rowspan="2">Number of Segments</th><th colspan="2">SDTT</th></tr>
<tr><th>SDTT for low protection layer</th><th>SDTT for Partial reception layer</th></tr>
<tr><td>(1)</td><td>—</td><td>1</td><td>O</td><td>O</td></tr>
<tr><td>(2)</td><td>A
B</td><td>1 (Partial reception)
12</td><td>X
O</td><td>O
X</td></tr>
<tr><td>(3)</td><td>A
B
C</td><td>1 (Partial reception)
11 to 1
1 to 11</td><td>X
X
O</td><td>O
X
X</td></tr>
</table>

O: Means that the data can be transmitted. X: Means that the data cannot be transmitted.

Table 6-2 : Transmitting Layer of the EIT

・Pattern (1)

Segment configuration / Service layer	Layer A (Low protection layer)
Low protection layer	Service layer ○N-EIT[p/f], N-EIT[p/f after](note) ●N-EIT[p/f after]

・Pattern (2)

Segment configuration / Service layer	Layer A (Partial reception layer)	Layer B (Low protection layer)
Partial reception layer	Service layer ○W-EIT[p/f], W-EIT[p/f after] (note) ●W-EIT[p/f after]	
Low protection layer		Service layer ○N-EIT[p/f], N-EIT[p/f after] (note) ●N-EIT[p/f after]

Pattern (3)

Segment configuration / Service layer	Layer A (Partial reception layer)	Layer B (High protection layer)	Layer C (Low protection layer)
Partial reception layer	Service layer ○W-EIT[p/f], W-EIT[p/f after] (note) ●W-EIT[p/f after]		
High protection layer		Service layer ○M-EIT[p/f], M-EIT[p/f after] (note) ●M-EIT[p/f after]	
Low protection layer			Service layer ○N-EIT[p/f], N-EIT[p/f after] (note) ●N-EIT[p/f after]

(○ Basic delivering EIT type; ●:Extended delivering EIT type)

(Note: EIT[p/f after] is transmitted when the number of events to be transmitted as the common operation SI is two or more.)

6.1.2 Component Arrangement Patterns during Hierarchical Transmission

Based on the transmission layer of a group of components constituting a service (arrangement methods), the three basic patterns shown below are available for classification.

[Condition 1] Transmission of a group of components constituting a service entirely in the same layer

Thirteen-segment broadcasting is a pattern whereby all groups of components constituting a service are transmitted in one layer. Since the group of components described in the PMT is transmitted entirely in the same layer, a service can be made available through the reception of a single layer. Since the partial reception service (which refers to the service intended for reception by narrowband receivers that can receive only the partial reception layer) should be made available using only the partial reception layer, transmission according to [Condition 1] should be used for partial reception service. Since 1-segment broadcasting needs to establish a service using only a single layer, it should always be transmitted under this [Condition 1].

[Condition 2] Transmission of a group of components constituting a service in multiple layers (Part 1: When inserting the Hierarchical Transmission Descriptor in the PMT)

This pattern is used, for example, to make step-by-step changes in service quality such as video quality according to the reception conditions and to receive only the audio component of a service comprised of video and audio components when the reception conditions are poor. For example, a high quality video stream with a high bit rate may be carried in the low protection layer and a low quality video stream with a low bit rate may be carried in the partial reception layer. If the receivers, depending on the reception conditions, are no longer able to receive the low protection layer, they can automatically switch to the partial reception layer to receive the same video stream at a reduced quality level.

[Condition 3] Transmission of a group of components constituting a service in multiple layers (Part 2: When allowing a group of PMTs placed in multiple layers to reference a single ES (When not inserting the Hierarchical Transmission Descriptor)) This pattern is used to define, in multiple layers, services comprised of identical ES': for example, to allow one PCR to be referenced from multiple services (services transmitted in multiple different layers) and to allow the same audio stream to be referenced from the service transmitted in the low protection layer and from the service transmitted in the partial reception layer (the audio stream is transmitted in the partial reception layer). While [Condition 2] refers to the transmission of a group of components constituting a service in multiple different layers, [Condition 3] refers to the transmission of services (PMTs) (using identical ES') to be selected by viewers in multiple different layers.

A conceptual diagram of how layers are configured for different conditions is shown in Fig 6-1.

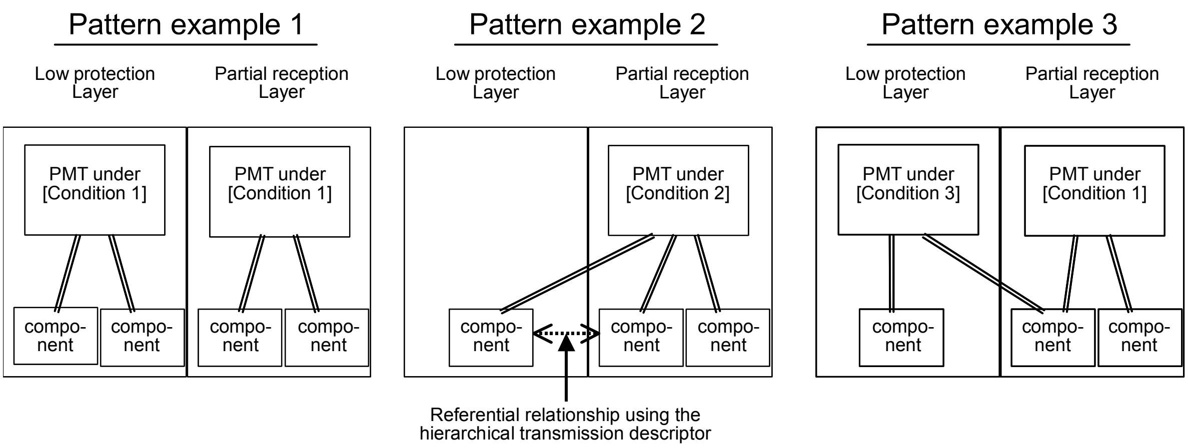


Figure 6-1: Conceptual diagram of layer configuration for different conditions in 13-segment broadcasting

If, under [Condition 2] and [Condition 3], different time interleaving lengths are used in multiple different layers that transmit a group of components constituting a service, a delay occurs during reception. Therefore, to place components across multiple different layers, it is important for all layers concerned to use the same time interleaving length.

6.1.3 PMT Transmission Layers during Hierarchical Transmission

PMT transmission layers under conditions 1 to 3 mentioned in Section 6.1.2 are shown in Table 6-3.

Table 6-3 : PMT Transmission Layers

Condition	PMT Transmission Layer
Condition 1	The PMT is transmitted in the same layer as the layer carrying the group of components referenced.
Condition 2	The PMT is transmitted in the layer with the highest resistance to interference among all layers carrying the group of components referenced.
Condition 3	The PMT is transmitted in the layer with the lowest resistance to interference among all layers carrying the group of components referenced.

Under Condition 1, the PMT should be transmitted in the same layer as the layer carrying the group of components constituting a service.

Under Condition 2, it should be made sure that the PMT be received even under difficult reception conditions (for example, when only the high protection layer can be received among multiple different layers collectively carrying a group of components). It is therefore essential that the PMT is transmitted in the layer with the highest resistance to interference among all layers used for transmitting components. Since incompatibility occurs between the components described in the PMT and the components that can actually be received depending on the reception conditions, it is necessary to insert the Hierarchical Transmission Descriptor in the PMT to allow the receivers to detect transmission problems and deterioration of reception conditions. Incidentally, the Hierarchical Transmission Descriptor can define a referential relationship across a maximum of two layers; it cannot define a referential relationship across three layers.

Under Condition 3, it should be made sure that all components described in the PMT be received. This means in other words that the PMT can be transmitted in the layer with the lowest resistance to interference among all the layers collectively carrying a group of components; if the PMT can be received, all the components described in the PMT can be received.

Table 6-4 shows specific combinations of layers transmission layer components and the layer for transmitting the PMT under Condition 2 and Condition 3.

Table 6-4: Combinations of ES Transmission Layers and the PMT Transmission Layer

Condition	Combina-tion	ES Transmission Layer			PMT Transmission Layer		
		Low protection layer	Middle protection layer	Low protection layer	Middle protection layer	Low protection layer	Middle protection layer
2	a	●	●			●	
	b	●		●			●
	c		●	●			●
3	d	●			●		
	e		●			●	
	f	●	●		●		
	g			●			●
	h	●		●	●		
	i		●	●		●	
	j	●	●	●	●		

6.1.4 Use of Condition 2

Multimedia broadcasting should not use Condition 2 (which involves inserting the Hierarchical Transmission Descriptor in the PMT) as a pattern for placing components.

6.1.5 Use of Condition 3

Multimedia broadcasting should not use Condition 3 (when one ES is referred to by the PMT groups arranged in multiple layers) as a pattern for placing components.

6.2 Use of Multiple Video Formats

6.2.1 Simultaneous Use of Multiple Video Formats

(1) Multiple different video formats such as 525SD, 525HHR, and QVGA can be simultaneously used in a single TS.

(2) 525SD, 525HHR, and QVGA that can be simultaneously broadcast should have different service identifier and each service should be independent.

(3) Identical components are not operated using multiple service identifiers.

6.2.2 How to Switch between Video Formats

(1) With regard to switching between different video formats, it is desirable to implement certain processing to prevent, for example, image fading and freezing and black frame

insertion, to reduce the impairing effect on the image display.

6.3 How to Handle Broadcasting Suspensions

The use of PSI/SI regarding on/off service is as follows.

- A valid PAT and PMT should be transmitted without fail to the service.
- The service description in the SDT should not be changed depending on the broadcasting status.
- If all services in the relevant TS are suspended, the PAT should be emptied irrelevant to other PSI/SI.
- Although PMT_PID is described in the PAT, the status that does not transmit the PMT is permitted (MPEG-unspecified operation).
- Broadcasting on/off service belongs to one of the status categories shown in Table 6-5.

Table 6-5: Types of Broadcasting in Progress and Suspension

Status	Whether the NIT is in the TS	Whether the Description is Found in the Service List of the NIT	Whether the Target Service is Described in the PAT	Whether the PMT of the Target Service is Present	Remarks
Broadcasting in progress	Yes	Yes	Yes	Yes	Regular program broadcasting
Broadcasting in suspension	Yes	Yes	No	No	Should be possible in all services
	Yes	Yes	Yes	No	
No signal	No	No	No	No	RF only/ Suspension of radio waves

The receiver unit operations are assumed to be as follows.

- The presence of a valid PAT and PMT indicates that broadcasting is in progress.
- The SDT is not used to determine whether broadcasting is on/off service.
- When the PAT is empty, all services in the relevant TS are considered suspended, irrelevant to other PSI/SI.

6.4 Use of the Clock

6.4.1 Absolute Delay Time

Absolute delay time in digital terrestrial broadcasting is considered to take place mainly due to:

(1) Delay along the transmission and relay line

(2) Delay caused by the encoder at senders

(3) Delay caused by the multiplexer

(4) Delay caused by the receiver unit (decoder)

(5) Delay caused by encoding and decoding over the terrestrial network

The absolute delay time is assumed to be a total of one second to several seconds. However, deviations occur associated with the types of equipments installed and parameter settings done by each broadcasting company. It is, therefore, important for each broadcasting company to have accurate information on the absolute delay time expected at their stations. The TOT should also be transmitted in a way so that the deviations from the JST (Japan Standard Time) are within ±500 ms when standard receivers (which refer to receivers assumed to directly receive radio waves from transmitting stations) receive inputs.

6.4.2 Event Issue Time (Such as Starting and Ending Time)

The senders should issue all events (broadcasts) according to the station clock. Events should not be issued earlier in consideration of the absolute delay time.

6.4.3 Time Superimpose and Time tone

To provide an on-screen time superimpose service or time tone service, it is desirable that senders transmit the data earlier in consideration of the absolute delay time to minimize as much as possible the difference with the correct time on receivers.

6.4.4 Summer Time Adjustment

Summer time adjustment should use the TOT to control the offset time. More specifically, while the time value equals the UTC time + 9 hours in normal times, Local_time_offset_descriptor with an offset value should be inserted in the TOT for transmission when summer time applies.

Incidentally, whether or not to change the station system clock depends on each station.

6.5 Caption and Superimpose

6.5.1 General terms

(1) The caption and superimpose should be available; the former is used during programs and the latter is used for up-to-the-minute news.

(2) The caption display area (effective screen area) should be provided by taking into account the picture size and aspect ratio.

(3) Regarding the character type, font, size and color, they should be used for transmission in consideration of restrictions on the display capability of receivers.

6.5.2 Caption

(1) The caption should be transmitted using the independent PES system and synchronized with the program.

(2) The caption should be displayed when selected to do so by receivers.

(3) A maximum of two languages should be handled and transmitted by one ES.

(4) In principle, when the caption is transmitted, the PID of the elementary caption stream should be described on the PMT but can also remain always described on the PMT.

6.5.3 Superimpose

(1) Superimpose should be transmitted using the independent PES system. It does not synchronize with the program. It is transmitted in auto display mode and displayed automatically on receivers.

(2) Regarding the use of superimpose, it can be described on the PMT regardless of whether an ES is transmitted. For more information on how to handle the superimpose in multi-view mode, see 5.2.6(2).

6.6 Transmission of the TS during the Inspection Broadcast

6.6.1 Definition of the Inspection Broadcast

The inspection broadcast is defined as the inspectional and test broadcast not designed for viewers to select or view services. The broadcast is transmitted during the inspection after a transmitting station is completed, during the inspection of the reception area and radio interference, and during the inspection after the maintenance of transmission system. The broadcast is not provided as the service targeting an unspecified number of viewers in the reception area but is solely designed for inspection. Since there are no restrictions to viewing the inspection broadcast, attention should be paid to the fact that it is possible that the broadcast contents such as the video and audio may be viewed by viewers.

6.6.2 TS' Transmitted during the Inspection Broadcast

The TS' transmitted during the inspection broadcast are shown in the Table 6-6.

Table 6-6: TS' Transmitted during the Inspection Broadcast

Classification of the Inspection Broadcast	Transmitted TS
When the area that can receive the inspection broadcast includes the area where the provision of the service has not started (For more information, see Section 6.6.5.)	Inspection TS
When the transmission parameters are temporarily modified while the regular programs are suspended and the inspection broadcast is provided (For more information, see Section 6.6.4.)	Inspection TS
Inspection broadcast other than above	TS transmitted according to the provisions for operations or Inspection TS

As shown in the table above, there are cases where broadcasting the inspection TS is required. The inspection TS is explained more in detail in the next section.

Incidentally, broadcasts other than the inspection broadcast (broadcasts designed for viewing by viewers) should be transmitted in accordance with the provisions for operation, excluding cases where broadcaster facilities are damaged as specified in Section 6.8.

6.6.3 Inspection TS

How the inspection TS is operated is explained below.

(1) Use of PSI/SI

The inspection TS should only transmit the PAT and PMT. It should not transmit other tables (NIT, INT, CAT, TOT, BIT, SDT, EIT[p/f], EIT[p/f after] and DTT[partial reception/Low]). However, the TOT can be transmitted only when it is guaranteed that the TOT does not deviate not more than ±1 second from the JST time. For more information on the CAT and EMM, see (3).

The PAT and PMT should be transmitted in accordance with the provisions for operation.

Using TS_id and service identifier assigned to each broadcasting station, the service loop of the PAT and the relevant service PMT should be transmitted in accordance with the provisions for operation.

(2) Use of components

In accordance with the information listed in the PMT, various components (video, audio, caption and data broadcast, storage-type broadcast) can be transmitted. Each component should be transmitted in accordance with the provisions for operation. Components can also be scrambled. In this case, a correct ECM and PMT should be transmitted as they are necessary to descramble the components.

(3) Use of the CAT and EMM

In principle, the inspection TS should not transmit the CAT and EMM. However, if transmitting them is absolutely necessary, only a correct CAT and EMM can be transmitted.

(4) Transmission of the TS

Broadcasting is performed based on the transmission system specified in ARIB STD-B46. The number of segments and transmission parameters shown in Table 5-1 and Table 5-2 shall be complied with.

6.6.4 Temporary Modification of Transmission Parameters for Inspection Purpose

To temporarily modify the parameters shown below while regular programs are suspended and to provide the inspection broadcast, the inspection TS should be transmitted without fail.

[The inspection TS should be transmitted when the parameters below are temporarily modified]

- Transmission mode ・GI ratio ・Service configuration ・Increases or decrease of the transmission parameter types
- Transfer of services between transmission parameter types ・Modulation system

Temporary modification of parameters refers to temporary provision of the inspection broadcast using different parameters to those used for regular broadcasts designed for viewer viewing during late night hours when no programs are provided.

6.6.5 When the Area that can Receive the Inspection Broadcast Includes the Area where the Provision of the Service has not Started

The inspection broadcast should always involve the transmission of the inspection TS when the reception area includes the area where the provision of the service has not started (including the cases where the area where the provision of the service has started and the area where the provision of the service has not started are both present), excluding during the period of the preparatory broadcast mentioned in Section 6.7. This is due to the following reason; when viewers perform a scan of channels in the area where the provision of the service has not started (referring to a state where the TS is only partially transmitted or an incorrect NIT is transmitted), the NIT information to be stored in the receiver unit will be incorrect, and the reception of the broadcast in this state may cause problems regarding service selection operation.

6.7 Test Broadcast Prior to the Start of the Broadcasting Service

The test broadcast referred to here generally means the test broadcast prior to the start of the provision of the broadcasting service. The test broadcast in the area where the provision of the service has not started is classified into two types: the inspection broadcast (See Section 6.6) not designed for viewing by viewers and the preparatory broadcast designed for receivers to obtain the correct NIT, SDT and other tables prior to the start of the provision of the broadcasting service. The preparatory broadcast refers to the broadcast that does not cause any problems with the reception when the provision of the service starts even if viewers perform a channel scan on their receivers during the test broadcast period. However, during the test broadcast period, if viewers perform a channel scan while the TS to be transmitted when the provision of the service starts is only partially received, and then after the test broadcast period, viewers receive the broadcast without performing a channel scan again, the viewers can only partially receive the TS like during the test broadcast period. Accordingly, prior to the start of the provision of the broadcasting service, if the broadcast is only temporarily provided or the entire TS to be transmitted when the provision of the service starts cannot be transmitted all at once, and thus only incorrect information regarding the TS (such as the NIT) can be transmitted, the broadcast should be transmitted as the inspection broadcast. Since the TS transmitted then refers to the TS transmitted “when the area that can receive the inspection broadcast includes the area where the provision of the service has not started” mentioned in Table 6-6, the inspection TS should be transmitted without fail. Moreover, regarding the preparatory broadcast, broadcasts in accordance with the provisions for operation should in principle be transmitted simultaneously by all stations. This means, in other words, that when the test broadcast is provided, it is important to clearly differentiate whether the broadcast is the inspection broadcast or preparatory broadcast.

The preparatory broadcast may not be used when the provision of the service by a relay station or a mini satellite station starts (when a relay station or mini satellite station starts the broadcasting service, only the inspection broadcast may be used without using the preparatory broadcast prior to the start of the provision of the service). This is due to the following reason; immediately prior to the start of the provision of the service from a relay station, the station is unable to transmit the same information (for example, the event information) as the master station and it is assumed difficult for the relay station to independently build facilities to transmit the TS in accordance with the provisions for operation.

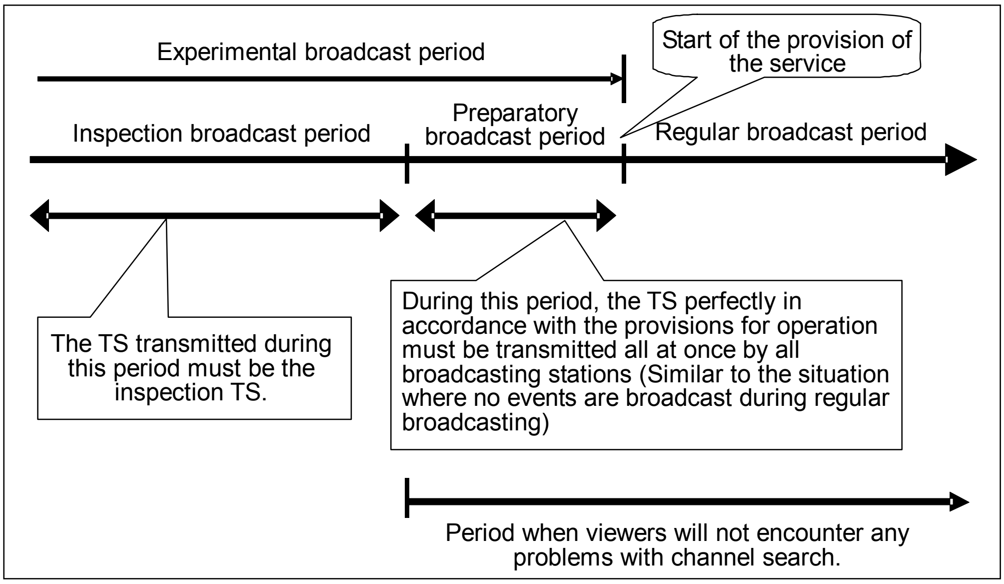


Figure 6-2 : Use of the Test Broadcast Prior to the Start of the Provision of the Broadcasting Service

6.8 Use of the TS when Broadcaster Facilities are Damaged

When a disasters, for example, has damaged the broadcasting facilities of broadcasting companies, making it difficult to maintain the transmission service in accordance with the provisions for operation, TS' in other areas can be used for transmission under the following conditions for the purpose of providing information as much as possible to the disaster affected area.

(1) The network identifier, service identifier and area_code values different from the values originally assigned to the broadcasters providing the broadcasting services in the

affected area may be used for transmission. However, there should be no overlap of values used among these broadcasting companies and the values are assumed to be the ones already assigned to certain broadcasters listed in the provisions for operation. Compatibility should, therefore, be maintained among tables to be transmitted.

(2) The TOT should be transmitted in the same manner as the inspection TS mentioned in Section 6.6.

(3) If using different transmission parameters from the ones previously used for transmission when the broadcasting service starts under a disaster situation, the countdown of the transmission parameter switching index of the TMCC is not necessarily required.

(4) There may be cases where version_number of each table is the same as immediately preceding version_number. However, no consideration is required in this regard because a re-scan is a prerequisite for service reception.

(5) To use a scramble mode, a correct ECM and PMT should be transmitted in accordance with the provisions for operation. When ending a scramble mode to make a shift to a non-scramble mode under a disaster situation and when resuming a scramble mode when normal operation is restored from a disaster situation, the procedures for starting and ending a scramble mode mentioned in "Vol.5, 4.10 ECM" of this technical document should be observed.

(6) Operations other than those mentioned above should be performed in accordance with the provisions for operation.

To receive channels transmitted by broadcasters based on the conditions above, it is a prerequisite that receivers perform a re-scan. Accordingly, a notification to prompt a re-scan should be given to viewers using the services provided by other broadcasters or other media.

To resume transmission in accordance with the provisions for operation following the operation under a disaster situation, a notification to prompt an initial scan should be given before the operation under a disaster situation ends. However, it should be noted that an initial scan may clear the recording schedule information and information on NVRAM (including the information on the broadcasters not affected by the disaster) previously stored in the receiver unit.

<Blank Page>

Chapter 7 List of Assignment of Various Values

7.1 Guideline for Assignment Method of each value

7.1.1 Guidelines for transport_stream_id assignment

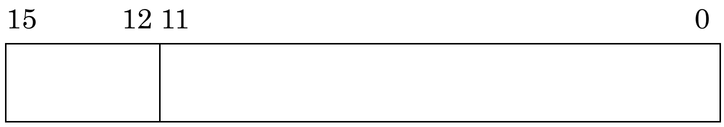


Figure 7-1: Assignment of bits for the transport stream identifier

The 16 bits of transport_stream_id are divided as shown above, and values are assigned with the rule below.

Table 7-1: Bit Assignment for the Transport Stream Identifier

bit (15-12)	Fixed at 0x2.
bit (11-0)	Broadcaster, and TS used by broadcaster 0x000: Unused 0x001: mmbi 0x002: Animax Broadcast Japan Inc., AXN Japan Inc., SKY Perfect Entertainment Corporation, Nihon Eiga Broadcasting Corp., Fuji Television Network Inc. 0x003 to 0xFFF: Reserve

7.1.2 Guideline for assignment of service identifiers (service_id) for each service

The basic concept of service_id assignment is shown below.

(1) Since the service_id arrangement order is related to the arrangement order of stations selected by the channel up/down and the program guide list display, the broadcasters and the service number within the broadcaster group are assigned to the lower bits.

(2) Considering the user convenience of selecting only real-time broadcasts by zapping, the service types are assigned to the upper bits.

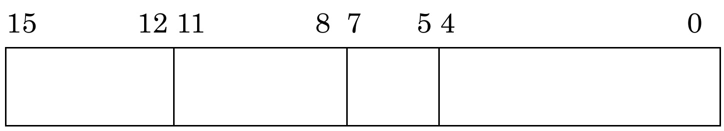


Figure 7-2: Bit assignment for the service identifier

The 16 service_id bits are divided as shown above, and the values are assigned using the rule below.

The service type “01x: EPG/ECG metadata service (transmitted in a layer other than the partial reception layer)” is assumed to be for those broadcasters that do not perform a storage-type broadcasting service.

Since the broadcasters engaged in storage-type broadcasting service transmit the EPG/ECG metadata as storage-type broadcasting content in a layer other than the partial reception layer, the EPG/ECG metadata is identified using the transmission control metadata or the media type of the EDT instance.

Table 7-2: Bit Assignment for Service Identification

bit (15-12)	Service type 0x0 : EPG/ECG metadata service (transmitted in parcel reception layer) 0x1: EPG/ECG metadata service (transmitted in a layer other than parcel reception layer) 0x2 to 0x5: Storage-based broadcasting service 0x6 to 0x7: Reserve 0x8: Video real-time broadcasting service 0x9: Audio real-time broadcasting service 0xA to 0xB: Independent data broadcasting service 0xC to 0xF: Reserve
bit (11-8)	Broadcaster group type 0x0: Unused 0x1: mmbi 0x2: Animax Broadcast Japan Inc., AXN Japan Inc., SKY Perfect Entertainment Corporation, Nihon Eiga Broadcasting Corp., Fuji Television Network Inc. 0x3 to 0xF: Reserve
bit (7-5)	Broadcaster ID within the broadcaster group Broadcaster group type 0x1: “000”' - “001”: mmbi “010”' - “111”: Reserve Broadcaster group type 0x2: “000”: Fuji Television Network Inc. “001”: Nihon Eiga Broadcasting Corp. “010”: AXN Japan Inc. “011”: Animax Broadcast Japan Inc. “100”: Reserve “101”: Reserve “110”: Reserve “111”: SKY Perfect Entertainment Corporation
bit (4-0)	Service number within the broadcaster group Determined by each broadcaster

7.1.3 Broadcaster identifier (broadcaster_id) assignment

The identifier broadcaster_id is provided to divide the groups of broadcasters and services of multimedia broadcasting.

The broadcaster ID is uniquely assigned to the entire multimedia broadcasting.

The guidelines for assignment specify that:

1) 0x00 is not assigned;

2) Values are consecutively assigned from 0x01;

3) Binary values are used.

7.1.4 Identifier values

The identifiers use the values shown below.

Table 7-3: Values of Identifiers

Identifier		Value	Remarks
Network name (network_name)		Multimedia broadcasting	
Network identifier (network_id)		0x0200	
Limited-reception system identifier (CA_system_id)		0x000F	
Data coding format identifier (data_component_id)			
	XML base coding system	0x001B	
	Caption/Superimpose coding system	0x001C	
System control identifier (system_management_id)		0x0A01	

7.1.5 Connected segment transmitter group identification

The connected segment transmission group ID is set to 0x0001.

7.1.6 PID of transmission control information (IIP)

The PID for transmitting the transmission control information (IIP) is set to 0x1FF0.

7.1.7 PID of connected segment transmission (CIP)

The PID for transmitting the connected segment transmission information (CIP) is set to 0x1FF2.

7.2 List of identifiers

For the identifiers to which the values are uniquely assigned in the network of multimedia broadcasting, the following shows a list of those values:

7.2.1 TS_id List

Table 7-4: TS_id List

Super segment	Segment type	TS_id	Center frequency	Consigning broadcaster	p_channel

			(MHz)		
1	13	0x2002	210+3/7	Animax Broadcast Japan, AXN Japan, SKY Perfect Entertainment, Nihon Eiga Broadcasting, Fuji Television Network	0002
2	13	0x2001	216	mmbi	0001
3	1	0x2003	219		0003
3	1	0x2004	219+3/7		0004
3	1	0x2005	219+6/7		0005
3	1	0x2006	220+2/7		0006
3	1	0x2007	220+5/7		0007
3	1	0x2008	221+1/7		0008
3	1	0x2009	221+4/7		0009

7.2.2 service_id list

The identifiers service_id is uniquely assigned to the entire multimedia broadcast, according to "Section 7.1.2 Guideline for assignment of service identifiers (service_id)".

Table 7-5: List of service_id

Consigning broadcaster	Video real-time type	Audio real-time type	Independent data broadcast	Storage-type broadcast	EPG/ECG metadata
mmbi	0x8100 to 0x813F	0x9100 to 0x913F	0xA100 to 0xA13F, 0xB100 to 0xB13F	0x2100 to x213F, 0x3100 to 0x313F, 0x4100 to 0x413F, 0x5100 to 0x513F	0x0100 to 0x013F (partial reception layer) 0x1100 to 0x113F (layers other than partial reception layer)
Fuji Television Network	0x8200 to 0x820F (0x8210 to -0x821F: Reserve)	0x9200 to 0x920F (0x9210 to 0x921F: Reserve)	0xA200 to 0xA20F, 0xB200 to 0xB20F (0xA210 to 0xA21F, 0xB210 to 0xB21F: Reserve)	N/A(*)	N/A(*)
Nihon Eiga Broadcasting	0x8220 to 0x822F (0x8230 to	0x9220 to 0x922F (0x9230 to	0xA220 to 0xA22F, 0xB220 to 0xB22F	N/A(*)	N/A(*)

	0x823F: Reserve)	0x923F: Reserve)	(0xA230 to 0xA23F, 0xB230 to 0xB23F: Reserve)		
AXN Japan	0x8240 to 0x824F (0x8250 to 0x825F: Reserve)	0x9240 to 0x924F (0x9250 to 0x925F: Reserve)	0xA240 to 0xA24F, 0xB240 to 0xB24F (0xA250 to 0xA25F, 0xB250 to 0xB25F: Reserve)	N/A(*)	N/A(*)
Animax Broadcast Japan	0x8260 to 0x826F (0x8270 to 0x827F: Reserve)	0x9260 to 0x926F (0x9270 to 0x927F: Reserve)	0xA260 to 0xA26F, 0xB260 to 0xB26F (0xA270 to 0xA27F, 0xB270 to 0xB27F: Reserve)	N/A(*)	N/A(*)
SKY Perfect Entertainment	0x82E0 to 0x82EF (0x82F0 to 0x82FF: Reserve)	0x92E0 to 0x92EF (0x92F0 to 0x92FF: Reserve)	0xA2E0 to 0xA2EF 0xB2E0 to 0xB2EF (0xA2F0 to 0xA2FF,	N/A(*)	N/A(*)

(*) Because the type is television broadcasting

Even if service identifiers (service_id) not listed in Table 7-5 are used, receivers should perform channel select operation, using the NIT and related information.

7.2.3 Broadcaster_id list

Table 7-6: Broadcaster_id List

broadcaster_id	Consigning broadcaster
0x01	mmbi
0x02	Animax Broadcast Japan Inc.
0x03	AXN Japan Inc.
0x04	SKY Perfect Entertainment Corporation
0x05	Nihon Eiga Broadcasting Corp.
0x06	Fuji Television Network Inc.

7.2.4 Platform_id list

Table 7-7: Platform_id List

Platform_id	Platform name
0xFFF000	Multimedia broadcasting

7.2.5 Identifier described in SDTT

(1) original_network identifier

0x7FFF may be used as an original_network identifier described in the SDTT, apart from the network identifier already being used. In this case, it is considered to refer to all the Digital Terrestrial Television Broadcasting.

(2) transport_stream_id

When the original_network identifier value described in SDTT is 0x7FFF, 0xFFFC to 0xFFFF shall be used as the transport_stream_id. Refer to 3.3 of Vol. 1 for the operation details of this identifier.

(3) service identifier

As the service identifier described in SDTT, when a Download Contents is not delivered, this identifier is operated at value 0xFFFF. Refer to 3.3 of Vol. 1 for the operation details of this identifier.

7.2.6 List of segments to be assigned to each broadcaster

The following shows the segments assigned to each broadcaster service listed in the certificate of consigning broadcasting service.

Table 7-8: List of Segments Assigned to Each Broadcaster

Super segment	Segment type	Assignment in super segment	Consigning broadcaster	Content of service
1	13	2	Animax Broadcast Japan	Real-time broadcasting program
1	13	2	AXN Japan	Real-time broadcasting program
1	13	2	SKY Perfect Entertainment	Real-time broadcasting program
1	13	2	Nihon Eiga	Real-time broadcasting program

			Broadcasting	
1	13	2×2	Fuji Television Network	Real-time broadcasting program
2	13	13	mmbi	Real-time broadcasting program, storage-type broadcasting program
3	1			
3	1			
3	1			
3	1			
3	1			
3	1			
3	1			

<Blank Page >

Description

Description 1　Transmission of “Earthquake Early Warning”

As of October 1, 2007, the Japan Meteorological Agency started providing earthquake early warning information for the general public. Broadcasters started transmission using the method of superimposing map images and characters on broadcast video images. To shorten the delay time further, the operation shown in this section is feasible.

However, note that there is a case where, in any of the operations shown in this section, an earthquake early warning with the delay time reduced cannot be viewed, depending on the receiver’s function and viewing status, even though an appropriate channel is selected. Taking this note into account, the broadcasters can select an appropriate method and transmit a warning.

1　Example of operation using character superimpose

- As soon as broadcasters receive an earthquake early warning, they transmit character superimposed data. To ring a warning tone (receiver built-in sound), the corresponding control code may be transmitted with the superimposed text.
- The DMF of caption control data during transmission uses the “automatic display mode during reception”.
- For transmission, care should be exercised so that an appropriate presentation is given, considering the point of the earthquake early warning. For the order of priority of screen display, refer to the related description in Vol. 2, Section 5.13.1. Also refer to the related description in Vol. 5, Section 5.20.2 for the display of superimposed text in the ES group scrambled status.
- For other operations, comply with this volume and the provision on superimposed data in Vol. 3.

2　Example of operation using an event message of data broadcasting

- The broadcasters superimpose the character data and the image and audio files concerning earthquake on a data broadcast and transmit them in advance, and then, as soon as they receive an earthquake early warning, they send an event message.
- To always enable the presentation of earthquake early warning, it is preferable for the operation with an event message that a process whereby the relevant event message is received and the earthquake early warning is presented is incorporated into the BML documents configuring the content. Also, considering the point of the earthquake early warning, care should be exercised so that an appropriate presentation is given.

For other operations, comply with the provision on superimposed data in Vol. 3.

VOLUME 8

Multimedia Broadcasting

Provisions for Contents Protection

Basic Concept for the Entire System to Protect Contents

To protect contents of multimedia broadcasting, provisions regarding broadcast signals to be transmitted and receiver unit functions must be introduced as well as provisions regarding conditions associated, for example, with interfaces that connect receiver units and recorders and other peripheral equipment, and recording media. This means, in other words, to ensure the protection of rights during processes where the signals (contents) to be received by receiver units are transmitted or recorded, the information related to contents protection transmitted by broadcasting stations must be reflected on the interface connecting equipment other than receiver units and recording on the recording media.

This volume provides provisions for the broadcast signals to be transmitted and receiver unit functions in order to protect contents for the entire system, including provisions regarding the storing function that enables replays only on the built-in receiver in multimedia broadcasting receiver units and high-speed digital interfaces.

Contents

Chapter 1 General Terms

1.1 Preface

The contents of multimedia broadcasting must be protected in accordance with "Service Information for Digital Broadcasting System" (ARIB STD-B10) and "Receiver for Connected Segments for Terrestrial Mobile Multimedia Broadcasting" (ARIB STD-B53) of the Association of Radio Industries and Businesses (hereafter referred to as "ARIB") standards.

However, provisions are required for actual application of these standards. Since no discrepancies must be allowed regarding the interpretation of the basic use of contents protection functions among multimedia broadcasting companies (hereafter referred to as "companies") and receiver units, this volume was put together.

Companies must observe the transmission criteria set out in this volume.

Multimedia broadcasting receiver unit manufacturers, on the other hand, must observe the provisions in this volume and ensure contents protection in terms of recording signals to be transmitted, making various outputs such as on-screen display and storing contents.

It is also desired that thorough consideration be given not to allow malfunctions to be caused by signals not specified in this volume.

1.2 Scope

This specification incorporates the transmission criteria concerning the functions to protect the contents of multimedia broadcasting, receiver unit specifications and receiver unit installation criteria.

1.3 References

(1) ARIB STD-B10 "Service Information for Digital Broadcasting System"

(2) ARIB STD-B53 "Receiver for Connected Segments for Terrestrial Mobile Multimedia Broadcasting"

(3) Part 4, ARIB STD-B25 "Conditional Access System Specifications for Digital Broadcasting"

(4) ARIB TR-B14 "Operational Guidelines for Digital Terrestrial Television Broadcasting"

(5) ARIB TR-B15 "Operational Guidelines for Digital Satellite Broadcasting"

(6) ARIB TR-B27 "Digital Broadcasting System based on Home Server"

1.4 Terminology

The terms used in this technical report are defined as shown below.

Stored broadcasts	Terrestrial mobile multimedia broadcasting based on connected segment transmission that are provided through downloads
Chargeable program	Chargeable programs. free_CA_mode of these programs described in the SDT and EIT is set to 1.
Free program	Non-chargeable programs. free_CA_mode of these programs described in the SDT and EIT is set to 0.

Copyright-protected free programs	Copyright-protected free programs are defined as free programs that are protected by copyright. The contents are carried by broadcast waves.
Contents protection system	The contents protection system is defined as the technique that uses, for example, encryption, to prevent the illegal modification and copying of contents, for the purpose of protecting the rights on contents.
Storing function	The storing function is defined as the recording and replaying function to enable replays only on the equipment that have recorded the contents.
DTCP	Abbreviation for Digital Transmission Content Protection. DTCP is a standard for the content transmission and recording control system using a digital interface for authentication and encryption.
HDCP	Abbreviation for the High-bandwidth Digital Content Protection System. The HDCP is a standard for the copyright protection system used when transmitting digital video signals and digital video/audio signals in DVI/HDMI.
Re-copy disabled	Re-copy disabled" is defined as the state where contents with digital copy control information indicating that "copy is enabled for one generation" has been stored (recorded), and indicates that further copying is prohibited.
Temporary storage	Temporary storage is defined as temporary storing of contents into the recording media for viewing at different times.
Move	Move is defined as the transfer of the re-copy disabled contents stored in a recording media, which involves copying the contents to another recording media and then disabling the replay of the pre-move contents.
Disabling the replay	"Disabling the replay" is defined as disabling replays, for example, by deleting the contents themselves or by deleting the encryption key.
Re-transmission to the Internet	Re-transmission to the Internet is defined as the transmission of received contents to the Internet, for example, via e-mail or web-based forms.
Local encryption	Local encryption is defined as encryption used to record contents for protection and control signals for broadcasting viewing on recorders and output them to user access buses.
Confidential information	Confidential information is defined as the information including cryptographic algorithms, keys used for local encryption, receiver unit-specific keys and restricted data, which affect the safety of contents protection when they are leaked, as well as information regarding copying and use described in the digital copy control descriptor or content availability descriptor.
Removable recording media	Removable recording media is defined as independent recording media such as tapes and disks, which can be removed from receiver units and have replay function on other equipment.
Digital recording	Digital recording is defined as the recording of digital signals on recording media.
Analog recording	Analog recording is defined as the recording of analog signals on recording media.

Recording format	Recording format is defined as the specification of the physical and logical recording format on recording media, including the specification of recording and replay requirements.
Bluetooth	Close-proximity wireless communication technology in such devices as mobile phones, etc., specified by Bluetooth SIG
MPEG_PS	Program Stream defined by ISO/IEC 13818-1 MPEG-2 Systems

<Blank Page>

Chapter 2 Rules on Transmission and Use

Each company shall stipulate the rules for copy controls and recording functions.

2.1 Use of the Contents Protection System Received through the Real-time Broadcasting Service

2.1.1 Service forms and use of available copy control information

- When copy_control_type of the digital copy control descriptor is set to '01', the use must be in accordance with the provisions shown in Table 2-1.

Table 2-1: Provisions for operations regarding contents protection

Service form	Restrictions Regarding Copy Generation Using Digital Copy Control Information			Output Protection	Copy is enabled for a limited number
	Copy is enabled unconditionally	Copy is enabled for one generation	Copy is disabled		
PPV (Pay per view) Payment must be made for viewing a program or a group of programs.	Applicable	Applicable	Applicable	Applicable*2	Applicable *3
PPM (Pay per month)/as-used basis Charged broadcasting, for example, on a monthly basis	Applicable	Applicable	Non-applicable	Applicable*2	Applicable *3
Copyright-protected free programs	Applicable	Applicable	Non-applicable	Applicable*2	Applicable *3
Other than above*1	Applicable	Non-applicable	Non-applicable	Non-applicable	Non-applicable

*1: Refers to free programs whose contents are not protected.

*2: Applicable only when "Copy is enabled unconditionally" for the digital copy control information.

*3: Applicable only when "Copy is enabled for one generation" for the digital copy control information.

- The digital copy control information in Table 2-1 refers to the digital_recording_control_data information of the digital copy control descriptor used for copy generation control. (See Vol. 4 of this technical report.)
- Output protection in Table 2-1 refers to the use of the output protection bit (encryption_mode) of the content availability descriptor in "Copy is enabled unconditionally" to protect the unconditionally copy-enabled contents from being output to the high-speed digital interface. (See Vol. 4 of this technical report for encryption_mode.)
- "Copy is enabled for a limited number" in Table 2-1 refers to the use of the copy

restriction mode bit (copy_restriction_mode) of the content availability descriptor in "Copy is enabled for one generation" to allow copies of the recorded contents within the specified number (9) after the recording (storing) of the content. (See Vol. 4 of this technical report for copy_restriction_mode.)

- When copy_control_type of the digital copy control descriptor is set to '11' and copy control information other than "Copy is enabled unconditionally" is used, the output of MPEG_TS is not possible (MPEG_PS is also not possible in case of IP interface), as explained in Chapter 3 of this volume. In this case, the digital interface of receiver units only outputs digital audio such as IEC60958. When copy_control_type is set to '11', conformance to Table 2-1 is not always necessary regarding the use of digital copy control information and service form. However, it is desirable that conformance to Table 2-1 be observed for the purpose of safely transmitting contents over broadcast waves.

2.1.2 Use of copy control related descriptors

- Regarding the use of the output protection bit of the digital copy control descriptor and content availability descriptor and copy restriction mode bit, real-time broadcasting service must be provided in accordance with Table 2-2, while data service must be provided in accordance with Table 2-3. Combinations not defined in these tables must not be used.
- For more information on CGMS-A, see Vol. 2 of this technical report.
- Macrovision requires contracts between broadcasting companies and Macrovision. For more information, see Vol. 2 of this technical report.
- Regarding the setting of the copyright protection bit indicating the channel status specified by IEC60958 and the category code, see Vol. 4 of this technical report.
- The resolution limiting bit (image_constraint_token) of the content availability descriptor must not be used. image_constraint_token must always be set to '1'. For more information, see Vol. 4 of this technical report.
- The temporary storage control bit (retention_mode) and temporary storage permission time (retention_state) of the content availability descriptor must be fixed for use; more specifically, retention_mode and retention_state must always be set to '0' and '111' respectively. For more information, see Vol. 4 of this technical report.

Table 2-2: Use of descriptors when providing real-time broadcasting service

Digital Copy Control	Analog Copy Control*3	Use of the Digital Copy Control Descriptor	Use of the Content Availability Descriptor

<table>
<tr><th></th><th></th><th>copy_ control_ type</th><th>digital_ recording_ control_data</th><th>APS_ control_ data</th><th>encryption _mode[*6]</th><th>copy_ restriction _mode[*6]</th></tr>
<tr><td>Copy is enabled unconditionally[*5]</td><td rowspan="2">Copy is enabled unconditionally</td><td rowspan="8">01</td><td rowspan="2">00</td><td rowspan="2">00</td><td>0</td><td rowspan="2">Don’t care</td></tr>
<tr><td>Copy is enabled unconditionally</td><td>1</td></tr>
<tr><td rowspan="2">Copy is disabled[*1]</td><td>Copy is disabled but Macrovision protection is not added. Therefore, copy is enabled only by conventional analog input recorders.</td><td rowspan="2">11</td><td>00</td><td>Don’t care</td><td>Don’t care</td></tr>
<tr><td>Copy is disabled[*4]</td><td>Other than 00</td><td>Don’t care</td><td>Don’t care</td></tr>
<tr><td>Copy is enabled for one generation[*2 *7]</td><td rowspan="2">Copy is enabled for one generation but Macrovision protection is not added. Therefore, copy is enabled only by conventional analog recorders.</td><td rowspan="4">10</td><td rowspan="2">00</td><td rowspan="2">Don’t care</td><td>1</td></tr>
<tr><td>Copy is enabled for one generation[*2]</td><td>0</td></tr>
<tr><td>Copy is enabled for one generation[*2 *7]</td><td>Copy is disabled after one generation copy.[*4 *8]</td><td rowspan="2">Other than 00</td><td rowspan="2">Don’t care</td><td>1</td></tr>
<tr><td>Copy is enabled for one generation[*2]</td><td>Copy is disabled after one generation copy.[*4]</td><td>0</td></tr>
</table>

*1: When outputting to the high-speed digital interface, the Copy Never protection of the Source function specified by DTCP must be applied. However, when outputting only audio streams in the IEC60958 conformant format, the No More Copies protection must be applied.

*2: When outputting to the high-speed digital interface, the Copy One Generation protection of the Source function specified by DTCP must be applied.

*3: Applicable to composite and component video output. Also applicable to the cases where received video signals are format converted and output. Macrovision copy protection is applied to 480i composite and component video signals.

*4: For more information on analog video output, see Section 3.3 and 3.5.1.2 in this volume

*5: When outputting to the high-speed digital interface, encryption must be performed in accordance with the DTCP specifications. However, when outputting only audio streams in the IEC60958 conformant format, no encryption must be performed.

*6: In the absence of the content availability descriptor, refer to Vol. 4 of this technical report.

*7: Available for recording (storing) as “Copy is enabled for a limited number”.

*8: Refer to Section 3.8 of this technical report if recorded (stored) as “copy is enabled for a limited number”.

Table 2-3: Use of descriptors when providing independent data service

<table>
<tr><th rowspan="2">Digital Copy Control</th><th rowspan="2">Analog Copy Control[*3]</th><th colspan="3">Use of the Digital Copy Control Descriptor</th><th colspan="2">Use of the Content Availability Descriptor</th></tr>
<tr><th>copy_control_type</th><th>digital_recording_control_data</th><th>APS_control_data</th><th>encryption_mode[*6]</th><th>copy_restriction_mode[*6]</th></tr>
<tr><td>Copy is enabled unconditionally[*5]</td><td rowspan="3">Copy is enabled unconditionally</td><td rowspan="2">01</td><td rowspan="2">00</td><td rowspan="2">00</td><td>0</td><td rowspan="3">Don't care</td></tr>
<tr><td rowspan="2">Copy is enabled unconditionally</td><td>1</td></tr>
<tr><td>11</td><td>00</td><td>00</td><td>1</td></tr>
<tr><td rowspan="2">Copy is disabled[*1]</td><td>Copy is disabled but Macrovision protection is not added.
Therefore, copy is enabled only by conventional analog input recorders.</td><td rowspan="2">01</td><td rowspan="4">11</td><td>00</td><td rowspan="2">Don't care</td><td rowspan="2">Don't care</td></tr>
<tr><td>Copy is disabled[*4]</td><td>Other than 00</td></tr>
<tr><td rowspan="2">Copy is disabled and the output of MPEG_TS is disabled.[*9]</td><td>Copy is disabled but Macrovision protection is not added.
Therefore, copy is enabled only by conventional analog input recorders.</td><td rowspan="2">11</td><td>00</td><td rowspan="2">Don't care</td><td rowspan="2">Don't care</td></tr>
<tr><td>Copy is disabled[*4]</td><td>Other than 00</td></tr>
<tr><td>Copy is enabled for one generation[*2 *7]</td><td rowspan="2">Copy is enabled for one generation but Macrovision protection is not added. Therefore, copy is enabled only by conventional analog recorders.</td><td rowspan="4">01</td><td rowspan="6">10</td><td rowspan="2">00</td><td rowspan="4">Don't care</td><td>1</td></tr>
<tr><td>Copy is enabled for one generation[*2]</td><td>0</td></tr>
<tr><td>Copy is enabled for one generation[*2 *7]</td><td>Copy is disabled after one generation copy.[*4 *8]</td><td rowspan="2">Other than 00</td><td>1</td></tr>
<tr><td>Copy is enabled for one generation[*2]</td><td>Copy is disabled after one generation copy.[*4]</td><td>0</td></tr>
<tr><td>Copy is enabled for one generation but the output of MPEG_TS is disabled.[*7 *9]</td><td rowspan="2">Copy is enabled for one generation but Macrovision protection is not added. Therefore, copy is enabled only by conventional analog recorders.</td><td rowspan="2">11</td><td rowspan="2">00</td><td rowspan="2">Don't care</td><td>1</td></tr>
<tr><td>Copy is enabled for one generation but the output of MPEG_TS is disabled.[*9]</td><td>0</td></tr>
</table>

Copy is enabled for one generation but the output of MPEG_TS is disabled.*7 *9	Copy is disabled after one generation copy. *4 *8			Other than 00		1
Copy is enabled for one generation but the output of MPEG_TS is disabled.*9	Copy is disabled after one generation copy. *4					0

*1: When outputting to the high-speed digital interface, the Copy Never protection of the Source function specified by DTCP must be applied. However, when outputting only audio streams in the IEC60958 conformant format, the No More Copies protection must be applied.

*2: When outputting to the high-speed digital interface, the Copy One Generation protection of the Source function specified by DTCP must be applied.

*3: Applicable to composite and component video output. Also applicable to the cases where received video signals are format converted and output. Macrovision copy protection is applied to 480i composite and component video signals.

*4: For more information on analog video output, see Section 3.3 and 3.5.1.2 in this volume.

*5: When outputting to the high-speed digital interface, encryption must be performed in accordance with the DTCP specifications. However, when outputting only audio streams in the IEC60958 conformant format, no encryption must be performed.

*6: In the absence of the content availability descriptor, see volume 4 of this technical report.

*7: Available for recording (storing) as “Copy is enabled for a limited number”.

*8: Refer to Section 3.8 of this volume if recorded (stored) as “Copy is enabled for a limited number”.

*9: In case of IP interface, MPEG_PS is also disabled.

Reference information:

As for the combination of identifiers used for real-time broadcasting, the operation shall be conducted only by either one of the following combinations for the time being, irrespective of service forms.

- Combination 1

copy_control_type: 01

digital_recording_control_data: 11

APS_control_data: 01

encryption_mode: (Identifiers not placed)

copy_restriction_mode: (Identifiers not placed)

- Combination 2

copy_control_type: 01

digital_recording_control_data: 10

APS_control_data: 01

encryption_mode: 0

copy_restriction_mode: 0

2.2 Use of the Contents Protection System for Real-time Broadcasting

2.2.1 Definition of the contents protection system for broadcasting

- The contents protection system for broadcasting described in this volume refers to a general system comprised of the scrambling system for safely protecting contents carried over broadcast waves and the transmission system for confidential information including key information. Related explanations are provided in Description 1 in this volume.
- The contents protection system for broadcasting, identified by CA_system_id, is recognized by receiver units as one of the conditional access system.
- Since chargeable programs use the conditional access system specified in Vol. 5 in this technical report, even if scrambling takes place when the conditional access system is used, control information for contents protection can be transmitted for use.
- Regarding the contents protection system used for the broadcasting of free programs, provisions are provided in Section 2.5 in this volume.

2.2.2 Use of multiple contents protection systems for broadcasting

- Multiple contents protection systems within the same TS can be used for broadcasting. For more information on the use of multiple contents protection systems for broadcasting, see Vol. 5 of this technical report. (In Vol. 5, this is described as the use of multiple conditional access systems.)
- General information regarding the use of multiple contents protection systems for broadcasting is given below.
- Each system uses only one CA_system_id.
- Multiple conditional access system descriptors used to transmit an EMM can be placed in the CAT.
- Multiple conditional access system descriptors used to transmit an ECM can be placed in the PMT.
- When multiple conditional access system descriptors are placed in the CAT or PMT, receiver units only interpret the descriptor of the conditional access system they have installed and ignore descriptors of other systems.
- To protect contents, an ECM is always transmitted. Multiple conditional access system descriptors indicating a valid ECM of CA_system_id of the system applicable to the contents are placed in the first loop of the PMT.

- Even when multiple contents protection systems are used for broadcasting, contents are scrambled using the same single scrambling key (Ks). In this case, the Ks is transmitted by the ECM of each of the multiple systems used in parallel.
- When using multiple systems for the purpose of contents protection, the ECM of the system used when multimedia broadcasting started must be used without fail (operations on already released receiver units are guaranteed).

2.2.3 Use of scramble

- In order for receiver units to determine whether scramble is used or not, the transport_scrambling_control field in the TS packet header must be correctly set.
  In this case, since free_CA_mode is used to determine whether content is chargeable or free, it does not necessarily match the scramble mode. (For example, copyright-protected free programs have free_CA_mode set to 0.)
- Even when components are chargeable or content-protected, the components are not always scrambled when the relationship between the ES and ECM specified in Vol. 5 of this technical report changes.
- To apply a non-scramble mode to components other than default ESs, an invalid ECM with PID set to 0x1FFF must be placed in the second loop of the PMT.
- For more information, see Vol. 5 of this technical report.

2.2.4 Use of chargeable programs, free programs and copyright-protected free programs

2.2.4.1 Definition

- Free programs are defined as those comprised of non-chargeable default ESs, while chargeable programs are defined as those comprised of chargeable default ESs.
- Copyright-protected free programs are defined as free programs scramble broadcast to safely transmit contents over broadcast waves.

2.2.4.2 Operation

- Regardless of whether scramble is used or not, free programs must have free_CA_mode set to 0 and chargeable programs must have free_CA_mode set to 1 in the EIT.
- Regarding copyright-protected free programs, an ECM must always be transmitted. In the first loop of the PMT, one PID indicating a valid ECM must be assigned for each contents protection system used for broadcasting.
- Regarding copyright-protected free programs, no CA contract information descriptor needs to be placed in the SDT or EIT.

- Services charged on an as-used basis normally have the CA contract information descriptor placed in the SDT. When services charged on an as-used basis include content-protected free programs during certain time zones, it is desirable that these programs can be scheduled for recording unconditionally using the EPG on receiver units because they are free programs. Since it is not necessary that copyright-protected free programs have the CA contract information descriptor placed, these chargeable services give priority to the CA contract information descriptor in the SDT. However, if copyright-protected free programs have the EIT with free_CA_mode set to 0, they can be recognized as programs that can be scheduled for recording unconditionally by receiver units.
- For more information on the use of chargeable programs, see Vol. 5 of this technical report.
- For more information on matters other than those described above, see Vol. 5 of this technical report.

2.3 Use of the Contents Protection System for Stored Broadcasting Service

2.3.1 Service form

Multimedia broadcasting service contents that require protection include stored broadcasting contents indicated in “Vol. 5 Multimedia Broadcasting Conditional Access System (CAS) Operation and Receiver Specifications” of this technical report. Stored broadcasting contents, which are protected in accordance with conditional playback system, are transmitted via broadcasting or broadcasting with a supplemental function via communication and stored in receiver units with contracts with the service without decoding the encryption. See Section 3.5.2 in this volume for detailed information on the storing method.

For stored contents, receiver units shall determine the usage conditions indicated in the RMPI (Refer to “2.4.3 RMPI Use Method” of this volume for license contents usage conditions (RMPI)”) included in the stored broadcasting license corresponding to the applicable contents upon every use. If the usage conditions match, contents are decoded using the content key included in the stored broadcasting license. Receiver units will implement the replay process and output the contents via their internal/external output devices in accordance with the usage conditions. However, with contents which are processed or used by functions outside of the multimedia broadcasting range available to the multimedia broadcasting receiver unit, the contents are taken over by the applicable function section after decoding with the content key after the determination of RMPI usage conditions. The contents in the function section taking over the aforesaid contents shall be operated by each company and not stipulated in this volume.

2.3.2 Use of copy control related descriptors

Stored broadcasting contents are assumed to be stored in the optional recording media available to the receiver unit as shown in Section 3.6.2 of this volume. Therefore, it must be made possible that contents data, which have been protected using the methods indicated in "Vol. 5", can be copied, by accessing the file system of the aforesaid recording media.

Use of the aforesaid contents is controlled by appropriate actions by receiver units as indicated in Table 2-4 based on the content storage information management function available for the receiver units included in "Vol. 2: Function Specification for the Receivers" and "Vol. 5".

Table 2-4: Concept for content storage information management function and copy control

Content type	Issuance record of valid license for the applicable CAS client	Status of storage information DB available for the receiver (CAS client bind)	Operation if contents were copied to a different CAS client environment (No changes of the receiver required)	Operation if contents were copied using a different receiver unit (Same CAS client as the copy source)	[Reference] No charge for CAS client/receiver unit (For example, picture removing an SD card once to copy and inserting the copied card)
Fixed receiver ID/CAS client ID	Yes	W/ storage	-	-	Available License is reissued
		W/O storage	Unavailable Receiver unit controls license issuance requests Issuance control is available at the server	Unavailable Receiver unit controls license issuance requests Issuance control is available at the server	-
	No	W/ storage	-	-	Available License is issued after the product purchase
		W/O storage	Unavailable Receiver unit controls license issuance requests Issuance control is not available at the server	Unavailable Receiver unit controls license issuance requests Issuance control is not available at the server	-
Fixed CAS client ID	Yes	W/ storage	-	-	Available License is reissued
		W/O storage	Unavailable Receiver unit controls license issuance requests Issuance control is available at the server	Available License is reissued	-
	No	W/ storage	-	-	Available License is issued after the product purchase
		W/O storage	Unavailable Receiver unit controls license issuance requests Issuance control is not available at the server	Available License is issued after the product purchase	-
No restrictions	Yes	W/ storage	-	-	Available License is reissued
		W/O storage	Available License is reissued	Available License is reissued	-
	No	W/ storage	-	-	Available License is issued after the product purchase
		W/O storage	Available License is issued after the product purchase	Available License is issued after the product purchase	-

2.4 Use of Contents Protection System for Stored Broadcasting

2.4.1 Encrypted contents

Encrypted contents refer to contents which have been encrypted in accordance with “Vol. 5” of this technical report.

2.4.2 Transmission use method

- Refer to "Vol. 5" of this technical report for transmission use method for encrypted contents.
- More than one license is provided for encrypted contents to make the contents available. Refer to "2.4.3 RMPI Use Method" of this volume for license contents usage conditions (RMPI).
- The resolution limiting bit (image_constraint_token) of the content availability descriptor and contents usage conditions (RMPI) must not be used. image_constraint_token must always be set to '1'. For more information, see "ARIB TR-B14 Vol. 4", "ARIB TR-B15 Vol. 4", and "Vol. 4" of this technical report.

2.4.3 RMPI use

In the applicable service, encrypted contents stored within the receiver unit must be protected in accordance with the contents usage conditions (RMPI) even during the processes of decoding, replaying, and external output.

2.4.3.1 Availability using service forms

Follow Table 2-5 for the use of RMPI items regarding external outputs upon replays and writing for each service form.

Table 2-5: RMPI transmission use

Contents of Control	Usage Condition (RMPI) Items	General Information
Replay	Viewing start period	Starting time for content viewing/usage expiration
	Viewing completion period	Completion time for content viewing/usage expiration
	Viewing period	Number of seconds available for viewing after the start of viewing/usage
	Viewing time	Number of available viewing/usage time
	Viewing time control information	Information regarding count control for viewing time
Trick play	Trick play availability	Set trick play availability
	Fast-forward unavailable duration identification information	Flags corresponding to SceneID*1

External output upon replay	Output control information for replay	Output control information during content replays*2
	Rating information	Rating information for parental control

*1 SceneID is information contained in manifest files included in stored broadcasting contents

*2 Expression forms are based on Section 2.3.8.4 in ARIB TR-B27 Vol. 5.

2.4.3.2 RMPI use regarding output during replays and output control during writing

No output is used during writing in multimedia broadcasting, so RMPI involved with output control is not used during writing.

2.4.3.3 RMPI use regarding fast-forward unavailable duration identification information

Fast-forward unavailable duration identification information shall correspond with the SceneID stipulated in the manifest file included in "Vol. 11" of this technical report.

2.5 Detailed Information on the Use of the Contents Protection System Received through the Real-time Broadcasting Service

This section provides detailed information on the use of contents protection system for broadcasting of copyright-protected free programs. To protect the contents of chargeable programs, scramble must be used based on the conditional access system explained in Vol. 5 of this technical report. So, for more information in this regard, see Vol. 5.

2.5.1 Use of copyright-protected free programs in layers other than the partial reception layer

- The "scrambled free program" function based on the ARIB STD-B25 compliant conditional access system must be used.
- An ECM must be transmitted without fail. Accordingly, the conditional access system descriptor of CA_system_id specified below must be placed in the first loop of the PMT. To apply a non-scramble mode to ES other than default ESs, a PID set to 0x1FFF indicating an invalid ECM must be placed in the second loop of the PMT.
- Copyright-protected free programs can transmit EMMs for the purpose of updating Kw, etc. Therefore, even when ARIB STD-B25 compliant contents protection is used, the conditional access system descriptor may be placed in the CAT.

2.5.1.1 Use of the ECM

- For more information on the use of the ECM based on the ARIB STD-B25 compliant system, see ARIB STD-B25 and 4.11 in Vol. 5 of this technical report.

2.5.1.2 Use of the EMM

- For more information on the transmission of the EMM, see 4.12 in Vol. 5 of this technical report.

2.5.2 Use in the partial reception layer

- Scramble is not used in the partial reception layer, so the ECM and EMM are not used to protect contents.

<Blank Page>

Chapter 3 Function Requirements for Receiver Units

The target equipment stipulated in Section 3.1 of this volume must not have the following functions for the contents specified for protection by the digital copy control descriptor and content availability descriptor: the storing function not stipulated in Section 3.5 of this volume, the output function not stipulated in Section 3.3 of this volume and the recording function to the removable recording media not stipulated in Sections 3.6 and 3.7 of this volume.

3.1 Target Equipment

- Multimedia Broadcasting Receiver Units
- If installing the storing function in multimedia broadcasting receiver units to be used for stored broadcasting service, the function must be installed in accordance with the provisions regarding the storing function described in this volume. If installing the storing function to the removable recording media, the function must be installed in accordance with the provisions regarding the recording function described in this volume. However, each company is to determine which removable recording media to be used.
- The recording function to removable recording media must include the recording function via other recording media. Related information is provided in Description 9 2 of this volume.

3.2 Available Copy Control Function and Use Restriction Function

- The digital copy control descriptor and content availability descriptor must be used to perform these controls. For more information on the copy control of stored contents, see Section 3.5 in this volume.
- In the absence of the digital copy control descriptor or content availability descriptor, refer to Vol. 4 of this technical report.

3.3 Output Control

3.3.1 Function requirements for output

- Copy control specified in Vol. 2 of this document must be applied to the analog video output.
- Copy control must be applied to the digital audio output in accordance with Table 3-1.

- In order to output digital audio using the Bluetooth interface, connection authentication, encrypted communication, A2DP (Advanced Audio Distribution Profile), and SCMS-T must be installed. Moreover, the audio must not be output to equipment not corresponding to the above.
- The analog audio can be output with no restrictions in cases other than where the digital audio output is prohibited in Table 3-1.
- Protection must be applied to the high-speed digital interface output in accordance with the DTCP specifications.
- IP interface output must comply with DTCP Volume 1 Revision 1.4 (or newer) or DTCP Volume 1 Supplement E "Mapping DTCP to IP" Revision 1.1 (or newer). The communication system shall be unicast. While the number of streams to be simultaneously output must be 8 or less per receiver, this does not apply to replays and outputs after the storing of the contents. Moreover, it can only be output as long as the destination IP address for the transmit packet exists within the same subnet as the IP address for the receiver.
- The RGB analog video can be output in accordance with the specifications in Vol. 2 of this document. However, to output HD contents other than those that are unconditionally copy enabled, the resolution must be limited to a maximum of 520,000 pixels per frame.
- The unconditionally copy-enabled contents can be output through the digital video output or digital video/audio output.
- To output the video and audio which are content-protected by the digital copy control descriptor and content availability descriptor through the digital video output or digital video/audio output, proper protection technology must be applied in accordance with the HDCP (Revision 1.x or Revision 2.x) specifications.
- Note that, as for the digital video and audio output, it is desirable to output the video and audio with the protection provided by HDCP, but it is allowed to output the video only with protection provided by HDCP. However, in this case, protection must be properly provided to the audio. A description relevant to this is given in Description 13 of this volume. In addition, when the digital video output or the digital video and audio output using an IP interface are output with the protection provided by HDCP (Revision 2.x), the output is possible only when the destination IP address in a transmission packet is in existence within the same subnet as the receiver IP address.

3.3.2 Output control by the digital copy control descriptor and content availability descriptor

- Output conditions applicable to each output terminal in accordance with copy_control_type and digital_recording_control_data of the digital copy control descriptor and encryption_mode of the content availability descriptor must be as per Table 3-1.
- Regardless of the value, image_constraint_token, retention_mode, and retention_ state of the content availability descriptor must be assumed as image_constraint_token = '1', retention_mode = '0', and retention_state = '111'. For more information, see Vol. 4 of this technical report.
- To use DTCP for real-time broadcasting service and data service, DTCP_descriptor must be inserted for MPEG_TS output. In case of MPEG_PS output for IP interface, PCP-UR must be inserted with UR Mode = '10' and Content Type = '00'.

Table 3-6: Output control by the digital copy control descriptor and content availability descriptor

Digital Copy Control Descriptor		Content Availability Descriptor	High-speed Digital Interface			Analog Video Output	Digital Audio Output
			Serial Interface		IP Interface		
copy_ control_ type	digital_ recording_ control_ data	encryption_ mode	MPEG_TS	IEC60958	MPEG_TS/PS		
01	00	1	No encryption	No encryption	No encryption	CGMS-A: 00 Macrovision: off[*3]	SCMS: Copy is enabled unconditionally
		0	Mode B	No encryption	Mode D0	CGMS-A: 00 Macrovision: off[*3]	SCMS: Copy is enabled unconditionally
	10[*7, *8]	Don't care	Mode B	Mode B	Mode B0	CGMS-A: 10 Macrovision: off[*3]	SCMS: Copy is enabled for one generation
	01[*4]	Don't care	Mode C	Mode C	Mode C0	CGMS-A: 11 Macrovision: APS[*6]	SCMS: Copy is disabled
	11[*8]	Don't care	Mode A	Mode C	Mode A0	CGMS-A: 11 Macrovision: APS[*6]	SCMS: Copy is disabled
11[*1]	00	Don't care	No encryption	No encryption	No encryption	CGMS-A: 00 Macrovision: off[*3]	SCMS: Copy is enabled unconditionally
	10[*7]	Don't care	Output disabled	No encryption	Output disabled	CGMS-A: 10 Macrovision: off[*3]	SCMS: Copy is enabled for one generation
	01[*4]	Don't care	Output disabled	No encryption	Output disabled	CGMS-A: 11 Macrovision: APS[*6]	SCMS: Copy is disabled
	11	Don't care	Output disabled	No encryption	Output disabled	CGMS-A: 11 Macrovision: APS[*6]	SCMS: Copy is disabled

10*5	Don't care	Don't care	Output disabled	Output disabled	Output disabled	Output disabled	Output disabled
00*2	Don't care	Don't care	Output disabled	Output disabled	Output disabled	Output disabled	Output disabled
No descriptor		Don't care	No encryption	No encryption	No encryption	CGMS-A: 00 Macrovision: off	SCMS: Copy is enabled unconditionally

*1: Regarding the real-time broadcasting service, the high-speed digital interface output and the output of all the videos and audios specified by this technical report are not allowed. (T.B.D.)

*2: Also regarding the combinations not defined by the provisions for operations, the high-speed digital interface output and the output of all the videos and audios specified by this document are not allowed. (T.B.D.)

*3: No matter what value is given to APS_control_data, Macrovision is set off.

*4: A combination not defined by the provisions for operations. It can be outputted in accordance with the table.

*5: A combination not defined by the provisions for operations. The high-speed digital interface output and the output of all the videos and audios specified by this volume are not allowed. However, it can be output in accordance with Table 3-1. (T.B.D.)

*6: For receiver units without Macrovision, analog video output is not allowed unless APS_control_data is '00'.

*7: Regardless of the value for copy_restriction_mode, it must be output in accordance with the table.

*8: Reference Information: Combinations that are assumed to be operated for the time being

- For more information on the high-speed digital interface output mode A to C, see Table 3-2 and, for mode A0, B0, C0, and D0, Table 3-3 and the DTCP specifications.
- For more information on CGMS-A under the Analog Video Output column, see Table 3-9. The APS under the Analog Video Output column must reflect the APS_control_data value.
  However, if digital_recording_control_data is set to '00' or APS_control_data is undefined, APS under the Analog Video Output column must be set to '00'. For more information on CGMS-A and APS, see ARIB TR-B14 Vol. 8 and Vol. 2.
- For more information on Macrovision, see ARIB TR-B14 Vol. 8 and Vol. 2. For more information on Macrovision, related explanations are provided in Description 11 of this volume.
- SCMS, the abbreviation of the Serial Copy Management System, refers to the copy generation control information using the copyright protection bit indicating the channel status specified by IEC60958 and the category code. For more information on these settings, see Vol. 4 of this technical report. The same copy control must be applied for SCMS-T as the digital audio output SCMS. SCMS-T refers to the copy generation control information using the same copyright protection bit indicating the channel status and the category code as SCMS specified by the Assigned Numbers on the Bluetooth SIG, Inc. website.

Table 3-7: Definition of the high-speed digital interface output (serial interface)

Output Mode	EMI	Definition	
Mode A	11	Encryption output	Copy-never
Mode B	10	Encryption output	Copy-one-generation
Mode C	01	Encryption output	No-more-copies
No encryption	00	No encryption	Copy-free

Table 3-8: Definition of the high-speed digital interface output (IP interface)

Output Mode	E-EMI	Definition
Mode A0	1100	Encryption output Copy-never
Mode B0	1000	Encryption output Copy-one-generation [Format-non-cognizant recording permitted]
Mode C0	0100	Encryption output No-more-copies
Mode D0	0010	Encryption output Copy-free with EPN asserted
No encryption	0000	No encryption Copy-free

Table 3-9: Definition of CGMS-A

CGMS-A	Definition
11	Copy is disabled
10	Copy is enabled for one generation
01	(No definition)
00	Copy is enabled unconditionally

3.3.3 Output control using the output protection bit

- When the digital copy control descriptor and content availability descriptor are placed, the high-speed digital interface output must be processed in accordance with Table 3-1 by the information from the output protection bit of the content availability descriptor and the digital copy control descriptor.
- The output protection bit becomes valid because of the combination where copy_control_type of the digital copy control descriptor is ‘01’ and where digital_recording_control_data is ‘00’. In this combination, the high-speed digital interface output goes through encryption processing according to Table 3.1. The designation of the output protection bit shall be ignored for combinations other than the above.

- When the content availability descriptor is placed, and in addition, when copy_control_type of the digital copy control descriptor is '01', and when the partial TS is output in the high-speed digital interface, the information regarding the output protection bit must be reflected also in the EPN bit of DTCP_descriptor.

3.3.4 Output control of storage-based contents

- The output control of storage-based contents shall be conducted by control that is equivalent to the output control of real-time type contents.
- The mechanism for the output control of storage-based contents is not stipulated in this standard, but shall be stipulated by each company on an individual basis.

3.4 Function Restrictions Regarding Re-transmission to the Internet

- Receiver units must not have the function to enable outputs that may lead to re-transmission to the Internet, regarding the contents copy-restricted by digital_recording_control_data of the digital copy control descriptor and contents copyright-protected by encryption_mode of the content availability descriptor. However, the function must be enabled for the outputs specified in Section 3.3 in this volume.
- In order not to allow re-transmission to the Internet through the user access bus and recording media, the user access bus and recording media must also control contents in accordance with the criteria stipulated in Chapter 4 of this volume.

3.5 Recording of Contents

3.5.1 Recording of real-time broadcasting contents

3.5.1.1 Provisions regarding recording of real-time broadcasting contents

- (The operation is not conducted for the time being.)
  When digital_recording_control_data of the digital copy control descriptor is set to '00' and copy is enabled unconditionally, contents can be stored with no copy restrictions. However, when encryption_mode of the content availability descriptor is set to '0', the contents must be protected using local encryption specified in Section 4.2.2 of this volume.
- When digital_recording_control_data of the digital copy control descriptor is set to '10' and copy is enabled for one generation (copy_restriction_mode='0'), the copy control information on the recording media must be set to "re-copy disabled" specified in Section 3.5.1.2 of this volume for storage. When digital_recording_control_data is set to '10' and copy is enabled for one generation (copy_restriction_mode='1'), the contents can

be stored as copy is enabled for a limited number as provided in Section 3.8 of this volume. Even when contents are stored as re-copy disabled contents or copy is enabled for a limited number, changes to the value of digital_recording_control_data of the digital copy control descriptor are not required. Regarding the copy control information on the recording media, related explanations are provided in Description 3 1 of this volume. However, the operation according to the combination of digital_recording_control_data being '10' and when "a copy is enabled for one generation" (copy_restriction_mode='1') is not conducted for the time being.

- When digital_recording_control_data of the digital copy control descriptor is set to '10' and copy is enabled for one generation (copy_restriction_mode='0'), multiple copies must not be generated. This restriction applies to each broadcasting receiver. In the presence of multiple broadcasting receivers, the above restriction applies to each of these broadcasting receivers. This does not apply to data storage for backup purpose in the area that cannot be accessed by users. Refer to Section 3.8 of this volume if copy is enabled for a limited number. However, the operation of "copy is enabled for a limited number" is not conducted for the time being.
- When digital_recording_control_data of the digital copy control descriptor is set to '11' and copy is disabled, contents must not be stored using methods other than temporary storage specified in Section 3.5.1.3 of this volume.
- For more information on the priority of the digital copy control descriptor information, see Vol. 4 of this technical report.

3.5.1.2 Disabling of re-copy

- The contents stored as re-copy disabled contents must not be copied. However, this does not apply to "move" specified in Section 3.5.1.4 of this volume.
- To replay and output the contents stored as re-copy disabled contents, the high-speed digital interface must use the No More Copies protection specified by the DTCP for output. More specifically, DTCP_CCI of DTCP_descriptor must be set to No-more-copies and encryption must be used for output in MPEG_TS. When outputting to IP interface in MPEG_PS, PCP-UR must be inserted with UR Mode as '10' and encryption must be used before outputting as No-more-copies. In addition, regarding the analog video output and digital audio output, these shall be output by conducting processing identical to that used when digital_recording_control_data in Table 3-1 is '11', namely by conducting the "copy prohibition" processing of CGMS-A and SCMS. Furthermore, when APS_control_data is "other than 00", these shall respond to Macrovision.

3.5.1.3 Temporary storage

- When digital_recording_control_data of the digital copy control descriptor is set to '11' and copy is disabled, temporary storage must be allowed for up to the temporary storage permission time.
- When the temporary storage time exceeds the temporary storage permission time, the contents must be replay-disabled.
- In principle, contents must be replay-disabled within one minute after the temporary storage permission time. Even when conditions that make it difficult to perform accurate time control have occurred such as when power supply to the equipment is interrupted, replay must be disabled within an appropriate time period. Incidentally, regarding the disabling of the replay of contents, related explanations are provided in Description 3 2 of this volume.
- To replay and output temporarily stored contents, the contents must be copy-disabled before output. The high-speed digital interface must apply the Non-Retention-mode protection specified by the DTCP before output.

3.5.1.4 Move function

- If the copy control information after data storage is set to "re-copy disabled" or "copy is enabled for a limited number", the contents can be moved in accordance with the following conditions. For information regarding moving of "copy is enabled for a limited number" contents, see Section 3.8 of this volume. However, the operation of "copy is enabled for a limited number" is not conducted for the time being.
- The move function is enabled only on a single built-in recording media or a digitally connected single recording media. To enable a move to another recording media connected by the high-speed digital interface, the function must be performed in accordance with the DTCP specifications. The move function must not be used, for example, when the analog video output is used (so that the number of recording media that can be connected cannot be managed).
- While a move is in progress, it must be ensured that contents exceeding one minute cannot be replayed simultaneously at both the move source and destination.
- After a move is completed, it must be ensured that contents that can be replayed are not present simultaneously at both the move source and destination. This means, in other words, after a move is completed, the contents at the move source must be

replay-disabled. Regarding the disabling of the replay of the contents, related explanations are provided in Description 3 2 of this volume.

- Regarding the output to somewhere other than the move destination during a move operation, conformance to provisions of Section 3.5.1.2 of this volume must be ensured.

3.5.2 Storing of stored broadcasting contents

3.5.2.1 Provisions regarding storing of stored broadcasting contents

- Stored broadcasting contents shall be directly recorded without processing the information received by the receiver unit. In other words, contents which have been encrypted using content keys (Kc) are stored without processes such as local encryptions, etc.
- Even if the received information is fragmented due to the reception status, the fragmented information is stored as is. The fragmented information must be managed by using FLUTE/FEC processing functions possessed by the receiver unit. However, the placement method of fragmented information in the file system of recording media is not stipulated here.
- If the contents remain fragmented at the completion of the broadcast, the fragmentation can be resolved by using the broadcasting supplement system.
- When the file storage is completed properly or fragmentation is resolved, the storage of the aforesaid contents along with the CRID must be recorded in the content storage information management function which is available for the receiver unit.

3.5.2.2 Re-copy

- Re-copy of stored broadcasting contents is not defined.

3.5.2.3 Temporary storage

- Temporary storage of stored broadcasting contents is not defined.

3.5.2.4 Move function

- Move function for stored broadcasting contents is not defined.

3.6 Digital Recording of Contents to the Removable Recording Media

3.6.1 Recording of real-time broadcasting contents

The recording function is not to be used for the time being.

(1) The recording format and the Contents Protection System to receive real-time

broadcasting contents, which are copyright-protected by the digital copy control descriptor and content availability descriptor, and to digitally record these contents to the removable recording media shall be defined separately.

(2) To digitally record copy-enabled contents for one generation (copy_restriction_mode='0') when digital_recording_control_data of the digital copy control descriptor is set to '10', more than three copies must not be generated. Multiple copies with the same recording format must not be generated either. This does not apply to digital recording for backup purpose to the area that cannot be accessed by users. See (5) of this clause and 3.8 of this volume if copy is enabled for a limited number. Related explanation is provided in Description 9 1 of this volume. The recording restriction to the digital recording media applies to each broadcasting receiver. In the presence of multiple broadcasting receivers, the above restriction applies to each of these broadcasting receivers. However, the operation of "copy is enabled for a limited number" is not conducted for the time being.

(3) (The operation is not conducted for the time being.) When receiver units use the recording format not compatible with encryption_mode or the Contents Protection System for recording, the contents which are copyright-protected by the digital copy control descriptor with copy_control_type and digital_recording_control_data set to '01' and '00' respectively and the content availability descriptor with encryption_mode set to '0' can be digitally recorded by the recorder as the copy-enabled contents for one generation (copy_restriction_mode='0').

(4) (The operation is not conducted for the time being.) The contents which are not copyright-protected by the digital copy control descriptor and content availability descriptor can be, in principle, digitally recorded in any format.

(5) (The operation is not conducted for the time being.) When receiver units use the recording format not compatible with copy_restriction_mode or the Contents Protection System for recording, the contents which are copyright-protected by the digital copy control descriptor with copy_control_type and digital_recording_control_data set to '01' and '10' respectively and the content availability descriptor with copy_restriction_mode set to '1' can be digitally recorded by the recorder as the copy-enabled contents for one generation (copy_restriction_mode='0'). The restriction in (2) of this clause is applied to the number of copies.

3.6.2 Storing of stored broadcasting contents

Removable recording media for stored broadcasting contents are not defined in this volume. Each company is to define them.

3.6.3 Method for recording to media

3.6.3.1 Real-time broadcasting contents

- The operation of the copy control-related descriptor to be conducted at the moment is limited to the combinations that are described in the reference information in Section 2.1.2 of this volume. Namely, when digital_recording_control_data is '11', recording must absolutely not be made to any media, with the exception of the temporary storage that is stipulated in 3.5.1.3 of this volume. On the other hand, when digital_recording_control_data is '10', recording is permitted after providing for the protection of contents by using the method described below.
  - When making a recording to removable media, all of the contents that are recorded using an encryption key with both the CAS client ID and receiver ID described in Volume 5 of this standard set to seeds shall be encrypted.
  - The intensity of the encryption shall be equivalent to or more than AES with 128 bits in block length and 128 bits in key length.
  - Even when a recording is made to a non-volatile memory device that is not removable from receivers, there is a need to provide protection for the contents using the encryption described in the above two items.
  - The encoding system for the contents (video and audio) at the time of recording and the types of removable media shall be treated as product planning.
  - In the resolution algorithm of the encryption key for the protection of contents, there is a need for both the CAS client ID and receiver ID to be set to seeds, but this algorithm shall not be one that is possible to easily recall. For example, hash value that derives only both values as a pre-image, along with the harsh value such as one that is derived with a character string possible to easily recall, etc., added to the pre-image, in addition to the previously mentioned pre-image, shall not be used as the encryption key. Note that this resolution algorithm for the encryption key shall be treated as product planning, and its details shall not be stipulated in this document.

  Note: When the above-mentioned requirements are met, making a change of recording destination media after recording shall not be prohibited for the contents that have been recorded already via a certain other media.

3.6.3.2 Stored broadcasting content

The method for recording stored broadcasting content to media shall not be stipulated in this volume. Each company shall stipulate this separately.

3.7 Analog Recording of Contents to the Removable Recording Media

The analog recording to removable recording media is not used for either real-time broadcasting contents or stored broadcasting contents.

3.8 Copy for a Limited Number

- Each company shall stipulate the copy control.
- Up to 9 copies of contents recorded (stored) as "copy is enabled for a limited number" can be generated with digital recording (copying) to recording media or via the high-speed digital interface output, in addition to the original recorded (stored) contents. However, this does not apply to the data recording (storage) during or after the recording for backup purpose in the area that cannot be accessed by users. The original contents after the generation of the specified number (9) of copies can be moved in the same manner as contents which are re-copy disabled. The above must be performed in accordance with the provisions specified in Section 3.5.1.4 of this volume or the provisions of the Contents Protection System for the removable recording media.
- Generation of up to 9 copies can only be performed by each broadcasting receiver and when the number of copies can be managed. To generate copies via high-speed digital interface output, utilize the move function specified by DTCP.
- Recording (copying) of contents stored as "copy is enabled for a limited number" to removable recording media for analog recording can be performed without restrictions.
- To replay and output contents which are recorded (stored) as "copy is enabled for a limited number" to high-speed digital interface, the No More Copies protection specified by DCTP must be applied.
- To replay and output contents recorded (stored) as "copy is enabled for a limited number" through the analog video output or digital audio output, output the contents as "copy is enabled for one generation". APS when outputting through analog video output must inherit the APS_control_data value of the received digital copy control descriptor.
- Copy for a limited number is only performed for the real-time broadcasting service.
- Related explanations are provided in Description 12 of this volume for copy for a limited number.

Chapter 4 Function Installation Criteria for the Receiver Unit

4.1 Contents Protection Function Installation Criteria

The installation criteria is set out in order to ensure that receiver units are designed and manufactured in such a way so that the function requirements specified in Chapter 3 of this volume will be successfully fulfilled by receiver units and that the acts of ignoring or evading the function requirements will be effectively prevented.

4.1.1 Basic requirements of installation criteria

- Receiver units must be designed and manufactured in such a way so that the contents protection function including output control and copy control specified as part of function requirements will not be easily ignored.
- Receiver units must also be designed and manufactured in such a way so that contents, limited replay, and control signals regarding conditional reception described in Section 4.2.6 of this volume will not be illegally extracted, modified or copied.
- Receiver units must be designed and manufactured in such a way so that all confidential information including cryptographic algorithms used to protect the received contents will not be extracted to the outside.

4.1.2 Protection targets

- Protection targets include the contents which are copy-restricted by digital_recording_control_data of the digital copy control descriptor, the contents which are copyright-protected by encryption_mode of the content availability descriptor, and stored broadcasting contents which are protected by the conditional playback system described in Volume 5.
- The control signals regarding CAS broadcasting described in Section 4.2.6 of this volume are also included in the protection targets.

4.2 Specific Installation Criteria

4.2.1 Overall configuration

- Receiver units must not incorporate the following functions that enable the evasion or disabling of the contents protection function specified as part of function requirements or easily enable illegal extraction, modification or copying of contents in compressed digital signal format and control signals which must be protected.

－ A switch, jumper or similar function that enables the bypassing of the protection function.

- Specific wiring (which involves breaking and connecting) that enables the evasion of the protection function.
- The function to control the service menu and remote controller, etc. to test the protection function and content output.

Incidentally, regarding installation methods, related explanations are provided in Description 6 of this volume.

4.2.2 Recording and storing of contents in recording media

- Contents provided via the real-time broadcasting service, which are targets of protection described in Section 4.1.2 of this volume, can be recorded in recording media in accordance with the function requirements for receiver units described in Chapter 3 of this volume if they are encrypted using the local encryptions described in Section 4.2.5 of this volume. For specific installation method, related explanation is provided in Description 6 2 of this volume.
- Contents provided via the stored broadcasting service, which are targets of protection described in Section 4.1.2 of this volume, can be recorded in optional recording media in accordance with the function requirements for receiver units described in Chapter 3 of this volume. However, receiver units must control the use of copied contents by using the methods described in Sections 2.3 and 3.5.2 of this volume if the copy is disabled for the contents.

4.2.2.1 Prohibition of the re-use of the copy

- With contents provided via the real-time broadcasting service, it must be ensured that even when the contents on the recording media are copied, for example, by bit-by-bit copying, the copied contents cannot be re-used. Incidentally, regarding the prohibition of the re-use of the copied contents, related explanations are provided in Description 7 of this volume.
- The use of copied contents for contents provided via the stored broadcasting service must be controlled by using the methods described in Sections 2.3 and 3.5.2 of this volume.

4.2.2.2 Time control requirements for temporary storage

- The time control function used to control the temporary storage time must ensure appropriate time accuracy and reject user access.

- Fixed use is applied to contents provided via the real-time broadcasting service. Also refer to "Vol. 4" of this technical report.

4.2.2.3 Control of other information

- When storing on the recording media the information regarding the copy and use restrictions described in the digital copy control descriptor or content availability descriptor or the information regarding the copy and use restrictions generated from these information, encryption or other similar methods must be used, in order to prevent users from adding modifications. Incidentally, regarding the examples of acts that must be prohibited to prevent users from adding modifications, related explanations are provided in Description 8 of this volume.

4.2.3 Replay and output of contents

- The replay and output of contents targeted for protection, which are specified in Section 4.1.2 of this volume, are allowed only when so specified in Section 3.3 of this volume.
- The contents encrypted using local encryption specified in Section 4.2.5 of this volume can be output in compressed digital signal formats to the user access bus which must be protected.

4.2.4 Writing of contents

With the real-time broadcasting service, the protection targets described in Section 4.1.2 of this volume, which are encrypted using local encryption described in Section 4.2.5 of this volume, or for which a protection method is followed so that illegal extracting or copying by users cannot be made, can be stored in the recording media in accordance with the function requirements for receiver units described in Chapter 3 of this volume. Regarding the specific installation method, related explanations are provided in Description 6 2 of this volume.

Incidentally, writing of contents is not executed for stored broadcasting contents. However, only deliveries of decoded contents with contents keys (Kc) are assumed for deliveries of information to processing functions other than multimedia broadcasting available to the receiver unit. Delivery interface for information to other processing functions shall be separately provided by the company.

4.2.4.1 Prohibition of the re-use of the copy

It must be ensured that even when the contents on the recording media are copied, for example, by bit-by-bit copying, the copied contents cannot be re-used.

Incidentally, regarding the prohibition of the re-use of the copied contents, related explanations are provided in Description 7 of this volume.

Contents provided via stored broadcasting service are explained in Sections 2.3 and 3.5.2 of this volume.

4.2.4.2 Control of other information

When storing on the recording media the information regarding the copy and use restrictions described in the output control information for replays/writing or the information regarding the copy and use restrictions generated from these information, encryption or other similar methods must be used, in order to prevent users from adding modifications.

Incidentally, regarding the examples of acts that must be prohibited to prevent users from adding modifications, related explanations are provided in Description 8 of this volume.

4.2.5 Local encryption

When local encryption is used to store the contents targeted for protection, which are specified in Section 4.1.2 of this volume, in the recording media specified in Section 4.2.2 of this volume, cryptographic algorithms and keys used for encryption must be placed under appropriate control to prevent user access.

4.2.5.1 Strength of local encryption

Local encryption must be equal or stronger than common key encryption with a 128-bit long key, and use cryptographic algorithms that can guarantee sufficient safety. Incidentally, in case of systems widely utilized by external memory devices, etc., systems matching the contents requirements cannot be prevented.

4.2.5.2 Control of keys

The keys used for content encryption must not be output from the receiver unit or output to user access bus or stored in the recording media as they are.

It must also be ensured that safe key control methods must be used, including the use of receiver unit-specific keys and keys generated from receiver unit-specific information, so that when the recording media is connected to other receiver units or other equipment or when contents are illegally copied onto the recording media of other equipment, the replay of the contents will be disabled.

4.2.6 Control signals regarding CAS broadcasting

ECM and EMM must not be output without being encrypted.

<Blank Page>

Annex 1 Certification Criteria for the Recording Format and Contents Protection System for Recording

The contracts concluded between the manufacturers (including sellers) of digital content recorders of and all equipment that can replay recorded contents and the licensors of recording formats and contents protection system for recording must clearly indicate the effect that the manufacturers (including sellers) have the obligation to observe the certification criteria shown below.

(1) Basics of copy control: Appropriate copy control must be used in accordance with the copy control information specified by the digital copy control descriptor and content availability descriptor.

(2) Inheritance of the copy control information: The copy control information described above must, in principle, be inherited after recording and become valid during replays.

(3) Protection during recording: The contents protected by the digital copy control descriptor or content availability descriptor must be recorded in the state where they are appropriately protected by encrypted recording.

(4) Protection during replays: The contents protected by the digital copy control descriptor or content availability descriptor must also be protected during replays and outputs.

(5) Restrictions regarding re-transmission to the Internet: The contents protected by the digital copy control descriptor or content availability descriptor must not be output to the terminals that may make the re-transmission of the contents in an unprotected state to the Internet.

(6) Installation criteria: Receiver units must functionally be so built as to prevent the acts of bypassing or disabling the contents protection function or the acts of easily illegally extracting, modifying and copying the contents in the compressed digital signal format or control signals that must be protected.

<Blank Page>

Description

Description 1 **Contents Protection System for Broadcasting**

1 Differentiated Use of the Contents Protection System for Broadcasting and Conditional Access System

While the conditional access system is aimed at controlling viewing by viewers, the contents protection system for broadcasting is originally aimed at safely transmitting contents over broadcast waves and enabling receiver units to perform control in conformance with the provisions in this volume. This volume, therefore, used an expression to differentiate the contents protection system for broadcasting from the conditional access system. This means that the contents protection system for broadcasting, unlike the conditional access system, does not necessary involve viewing control for each viewer. Moreover, even when an exclusive contents protection system is introduced in future, the conditional access system and the contents protection system for broadcasting may not necessarily be the same. Based on this precondition, this volume differentiated the two systems.

2 Use of Multiple Contents Protection Systems for Broadcasting

To protect the contents of multimedia broadcasting, this volume described provisions on the system using conditional access in compliance with ARIB STD-B25.

When the provisions were prepared, the main focus was placed on ensuring that even when multiple conditional access system descriptors are used when the exclusive contents protection system is introduced, receiver units will not operate incorrectly at the initial stage of digital broadcasting start. Since the provisions regarding the exclusive contents protection system will be established through future reviews, this technical report did not include the description of the exclusive contents protection system but instead stated that multiple conditional access system descriptors can be placed in the CAT and PMT. For more information on actual use, see Vol. 5 of this technical report, which includes relevant information.

For reference, see also Vol. 5 of this technical report, which includes relevant explanations such as the relationship between the STD-B25 compliant systems and the exclusive contents protection system anticipated for introduction in the future.

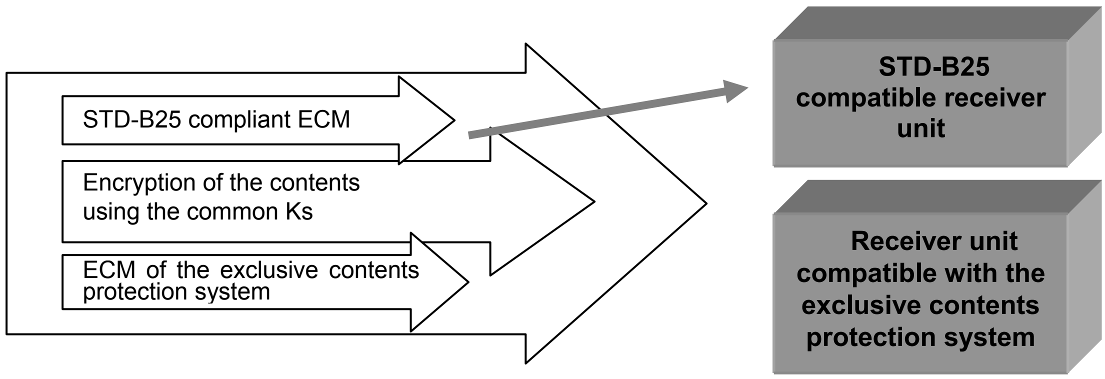


Fig. C1-1: An Image of Using Multiple Conditional Access Systems for the Purpose of Protecting the Contents

Description 2 Function Restrictions Regarding Contents Protection

With the digital audio service outputs, copy_control_type can be set to 01. However, at present, contents cannot be output to the serial interface of the high-speed digital interface as partial TS.

<Blank Page>

Description 3 Storing of Contents in Recording Media

1 Copy Control Information on Recording Media

Regarding contents provided via real-time broadcasting service, the copy control information on the recording media described in Section 3.5.1.1 of this volume refers to the information used for copy control of contents stored on the recording media. The copy control information can be managed by a voluntary method. However, it is necessary to at least identify two status types, “copy is enabled unconditionally” status and "Re-copy disabled” status. Moreover, when installing the copying for a limited number or temporary storing function, it is necessary to identify the status types, including “copy is enabled for a limited number” or “temporary storage” status.

Copy control information does not apply to contents provided via the stored broadcasting service.

2 Disabling of the Replay of the Contents

Temporary storage of contents provided via the real-time broadcasting service must involve at least minute-by-minute management of the contents, and in principle, the replay must be disabled within one minute after the temporary storage permission time. Limit of use is provided in Temporary Storage of Contents in Vol. 4 of this technical report. If the temporary storage permission time is one hour and 30 minutes, for example, the replay of the content received (stored) at 1:00 and 1:01 must be disabled by 2:31 and 2:32 respectively.

This concept is not applied to the contents provided via the stored broadcasting service.

<Blank Page>

Description 4 **Processing upon Reception/Storing**

This clause provides comprehensive explanations on how receiver units compatible with the multimedia broadcasting should operate during reception/storing processing.

1 Determining Multimedia Broadcasting Service

If the service type is not the multimedia broadcasting service, receiver units shall process in accordance with the provisions for operations for the applicable service.

2 Storage Control

Automatic storage and manual storage are specified for each of the used contents for stored broadcasting contents.

Receiver units without basic contracts, etc. stipulated by companies must not receive/store the stored broadcasting contents service with storage control. For detailed information regarding storage control, refer to "2.4.2 Determining Storage Availability" in Vol. 2 of this technical report.

3 Storage as Multimedia Broadcasting

To store the stored broadcasting contents, whose service type is specified as 0xC2, conduct the reception process as per the conditional playback system defined in Vol. 5 of this technical report and store them without releasing the content encryption.

<Blank Page>

Description 5 **Function Restrictions Regarding Re-transmission to the Internet**

The output that may lead to re-transmission to the Internet described in Section 3.4 of this volume refers to the output that may be connected to the Internet or other equipment such as modems and LAN interfaces that may make access to the Internet.

<Blank Page>

Description 6 Specific Installation Method to Meet the Contents Protection Function Criteria

The specific installation method to meet the contents protection function criteria described below is based on the level of resistance that does not allow evasion or modification by general users using generally available tools and technologies.

1 Function Configuration of the Receiver Unit

- When the contents and control signals targeted for protection described in Section 4.1.2 of this volume run through each internal component of the receiver unit (regardless of whether it is an integrated circuit, software module or complex of both), the contents and control signals targeted for protection running through such components must be appropriately protected against illegal extraction or copying. For this reason, the contents protection function including output control and copy control as part of function requirements as well as the MPEG decoder and other components of the receiver unit must be designed and manufactured in a way not to allow illegal acts such as evasion and modification. This specifically includes building special-purpose components, which are coupled or integrated for operation.

2 Level of Contents Protection

- It must be ensured that main functions for contents protection including the encryption function, decoding function and cryptographic algorithms cannot be easily disabled or bypassed by widely available inexpensive tools (for example, drivers, jumpers and soldering irons) or electronic tools and software tools (for example, EEPROM writers, debuggers and decompilers).

<Blank Page>

Description 7 **Prohibition of the Re-use of the Copy**

Even when the recorded contents are copied, for example, by bit-by-bit copying, the copied contents cannot be used on other equipment as long as encrypted by local encryption specified by Section 4.2.5 of this volume. However, there is still a concern that multiple copies may be illegally generated, for example, by moving the contents from the copy source after they are copied onto another recording media, returning the copied contents to where they were originally located, and then moving the contents again. Accordingly, appropriate measures to disable re-use must be taken to prevent such illegal acts.

<Blank Page>

Description 8 **Other Examples of Acts that must be Prohibited Regarding Information Control**

The examples of acts that must be prohibited to prevent users from adding modifications described in Section 4.2.2.3 of this volume include the modification of the copy control information such as digital_recording_control_data and DTCP_descriptor of the digital copy control descriptor and the copy control information on the recording media; more specifically, changing “Copy is disabled: Copy Never” and “Re-copy is disabled: No More Copies” to “Copy is enabled unconditionally: Copy Freely” and “Copy is enabled for one generation: Copy One Generation” in order to enable copying, or changing “Copy is enabled for one generation: Copy One Generation” to “Copy is enabled unconditionally: Copy Freely” in order to enable unconditional copying. Moreover, it also includes acts such as modifying the copy number management information for “copy is enabled for a limited number” contents to increase the number of copies.

<Blank Page>

Description 9 Digital Recording of Contents to the Removable Recording Media

1 Limit to the Number of Copies that can be Recorded to the Removable Recording Media

The limit to the number of copies specified here does not apply to the number of contents to be stored mentioned in Section 3.5 of this volume. Recording for backup purpose is designed to restore contents when the media or drive is damaged and the contents recorded for backup purpose cannot be accessed by users for purposes other than restoration. One example of this is the RAID system that records data on multiple hard disks to improve data safety.

2 Recording Function to the Removable Recording Media

Receiver units that incorporate the recording function to the removable recording media may be able to digitally record received contents directly to the removable recording media as well as to first store contents, then replay the stored contents and digitally record the contents to the removable recording media. The provisions described in this volume also apply to such receiver units.

<Blank Page>

Description 10 **Wireless LAN Security**

4.2 Guidelines Concerning Security Function Setting for Wireless LAN Equipment in "Guidelines Concerning Wireless LAN Security" (JEITA) provides specifications regarding wireless LAN security.

<Blank Page>

Description 11 **Triggers for the Macrovision Function**

Macrovision is only triggered when APS_Control_data is other than ‘00’ and digital_recording_control_data is either ’11’ or ‘10’. If it is set to’10’, Macrovision is triggered during replays and outputs after the contents are stored or recorded.

<Blank Page>

Description 12 **Copy for a Limited Number**

Figure C12-1 shows the output control for the contents stored in representative output destinations as "copy is enabled for a limited number" contents.

The management of copy numbers for copies of "copy is enabled for a limited number" contents in internal recording media as well as copies via the high-speed digital interface is the same as when there are 10 movable contents. Copies of analog video outputs and digital audio outputs are enabled for one generation, and the restriction of the number of copies does not apply to them.

Moreover, the restriction of the number of copies does not apply to those only used for the management purpose of the contents (such as thumbnails).

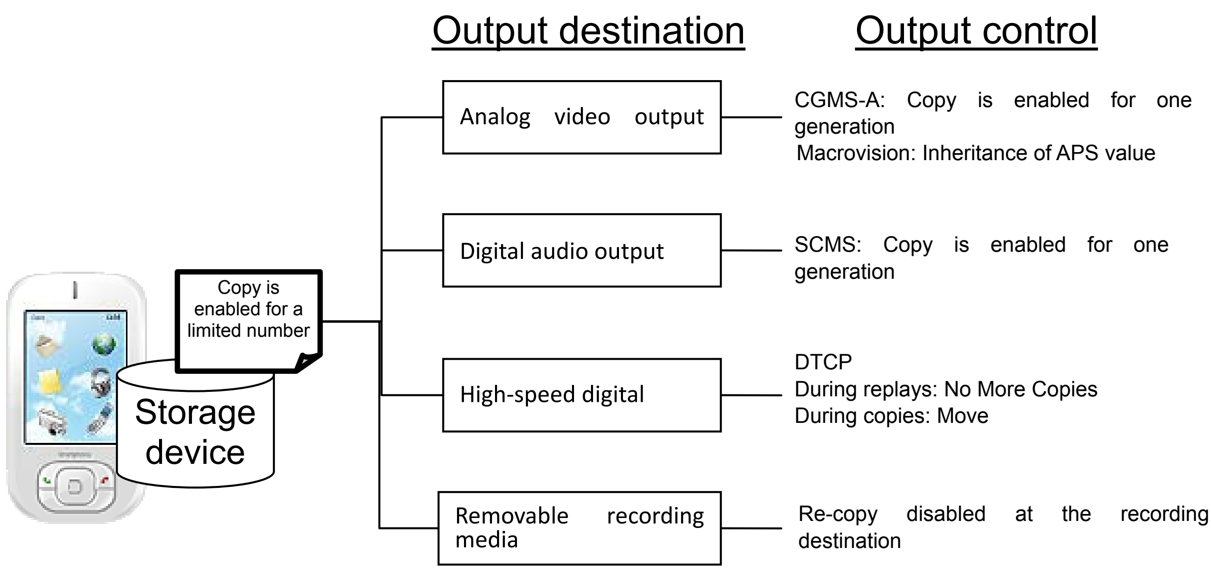


Fig. C12-1: Representative output destinations and control for contents stored as "copy is enabled for a limited number" contents

<Blank Page>

Description 13 **Digital Video and Audio Output**

When only the video out of the digital video and audio output that is described in Section 3.3.1 of this volume is output with the protection provided by HDCP, the audio needs to be properly protected as well, for example, by protection that prevents users from gaining access during transmission and by copy control by means of SCMS at the time of re-output as a digital audio signal, etc.

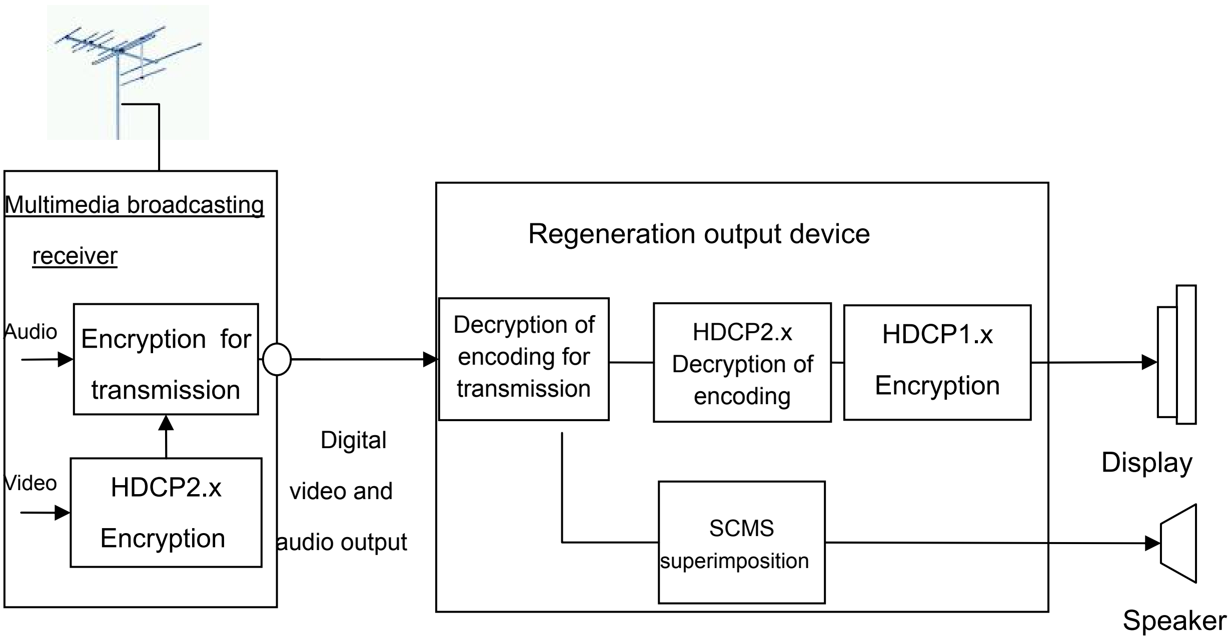


Fig. C13-1: Example of the digital video and audio output assumed in Description 13

OPERATIONAL GUIDELINES FOR
TERRESTRIAL MOBILE MULTIMEDIA BROADCASTING BY
TRANSMISSION SYSTEM BASED ON CONNECTED SEGMENTS
FOR VHF-HIGH BAND

ARIB TECHNOCAL REPORT

ARIB TR-B33 VERSION 2.3-E2
(Fascicle 2)
(September 30th, 2015)

This Document is based on the ARIB technical report of "Operational Guidlines for Terrestrial Multimedia Broadcasting by Transmission System Based on Connected Segments for VHF-HIGH Band" in Japanese edition and translated into English in October 2015.

Published by

Association of Radio Industries and Businesses

Nittochi Bldg. 11F
1-4-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-0013, Japan

TEL 81-3-5510-8590
FAX 81-3-3592-1103

Printed in Japan