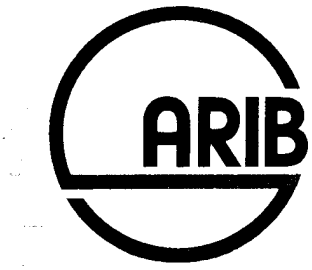

ENGLISH TRANSLATION

OPERATIONAL GUIDELINES FOR DIGITAL TERRESTRIAL TELEVISION BROADCASTING

ARIB TECHNICAL REPORT

ARIB TR-B14 Version 2.8

(Fascicle 1) (1/2)

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Association of Radio Industries and Businesses

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http://www.arib.or.jp/english/index.html

Preface

The ARIB (Association of Radio Industries and Businesses) establishes the "ARIB Standards" and “ARIB Technical Reports” for the basic technical conditions such as standard specifications for a variety of radio communication equipment and broadcast transmission and reception equipment with the participation of broadcasting companies, broadcast equipment manufacturers, telecommunications carriers, radio communication equipment manufacturers and users.

This technical report encompasses materials related to “ARIB standards” which combine governmental technical standards and optional private sector standards.

This technical report stipulates provisions for general operations at broadcasting stations for digital terrestrial television broadcasting and functional specifications for digital terrestrial television receiver units.

We hope that this technical report will be put to practical use by broadcasting companies, broadcast equipment manufacturers, telecommunications carriers, radio equipment manufacturers and users.

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ARIB TR-B14
Version 2.8-E2

DIGITAL TERRESTRIAL TELEVISION BROADCASTING

General Information of the Technical Report

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1 Introduction

Digital terrestrial broadcasting shall comply with the ordinances and notifications of the Ministry of Internal Affairs and Communications and with the Association of Radio Industries and Businesses (hereafter referred to as ARIB) standards. The standards cover a wide range of technical areas, including hierarchical transmission and available parameters. This technical document, therefore, specifies technical parameters for the actual operation and stipulates detailed operation procedures.

This General Information of the Technical Report shows the outline of the digital terrestrial broadcasting services by describing available parameters at hierarchical transmission and signals transmitted in each layer.

For more information on specific provisions for operations, see Vol. 1 to Vol. 9.

2 References

(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) “Data Coding and Transmission Specification for Digital Broadcasting” ARIB STD-B24
(5) “Conditional Access of Digital Broadcasting” ARIB STD-B25
(6) “Receiver for Digital Broadcasting” ARIB STD-B21

3 Definitions

The terms used in the document are defined as shown in the table below. The table is a comprehensive list of all the terms defined in each volume and the volumes in which each term is mainly included are shown in the "Volume" column.

Term	Description	Volume
Encoding rate	Ratio in the number of bits before encoding to the number of bits after convolutional coding.	2, 7, 9
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 reference.	2, 7, 9
16 : 9	Horizontal to vertical ratio of the display screen: 16 horizontal by 9 vertical	3
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).	7
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).	7
4 : 3	Horizontal to vertical ratio of the display screen: 4 horizontal by 3 vertical	3
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.	7
64QAM	64 Quadrature Amplitude Modulation: a digital modulation scheme to transmit six bits of information by using 64 sinusoidal waves with different amplitudes and phases. Digital terrestrial television broadcasting uses the SP to specify amplitude and phase reference.	2, 7, 9
8bit character code set	8bit-coded character code set is a code system that has lower overhead for switching collections of character codes than the one of the 7 unit codes to enable more efficient character transmission.	3, 4
AAC	Advanced Audio Coding: an audio coding system standardized by the International Organization for Standardization (ISO/IEC13818-7).	7
AC	Auxiliary Channel: a transmission path for additional transmission control related information on modulated waves.	7
ADSL	Asymmetric Digital Subscriber Line: Asymmetric digital subscriber transmission method. A high speed transmission method using pre-existing phone lines.	6
ADTS	Audio Data Transport Stream.	7
AD conversion quantization noise	Noise element caused by quantization roughness when analog signals are converted into digital signals (AD conversion).	2, 9

Term	Description	Volume
ARIB	Association of Radio Industries and Business: ARIB is an organization which standardizes technologies in relation to use of radio in Japan with participation by broadcasters, telecommunication operators, equipment manufacturers.	3, 4, 5, 6
AtoD interference	Interference from analog broadcasting signals to digital broadcasting signals.	2, 9
AT command	Command for controlling modems.	6
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.	7
BASIC PROCEDURE	Basic Mode Data Transmission Control Procedure: Communication procedure developed for basic hosting of data transmission control procedures and for terminal-terminal use. It features communication procedures to minimize inaccurate transmission of data.	3, 6
BCD	Binary Coded Decimal	4
BER	Bit Error Rate: the rate of the number of error bits in a digital signal to the total number of bits transmitted.	2, 7, 9
BIT	Broadcaster Information Table: BIT is defined as the table that lists broadcaster information such as All-station applied transmission parameter and each station.	4, 7
CA	Conditional Access system: CA is a system that controls reception of services (service channels) and events (programs).	4
CA system	Conditional Access System: A system that controls the reception of services (channels) and events (programs).	5
CAT	Conditional Access Table: CAT is used to specify the packet ID of the TS packet that carries individual information from among relevant information comprising chargeable broadcasting.	4, 5, 7
CATV	Cable and Tele-communication Television System: System that distributes television signals to each household through transmission paths such as coaxial cables. It is available for use as a bi-directional transmission path.	6
CA alternative service	CA alternative service is a service that directs viewers to “Information channels” operated by broadcasting companies when scrambled channels are selected and the viewer is not a subscriber to the service.	5
CBC mode	Cipher Block　Chaining Mode:　IV value (initial value) for the results of operating the code use mode for symmetric cipher, the encryption result and the following input with exclusive-OR in the CBC mode (code use mode)	6
CDT	Common Data Table: Table to transmit download contents. Only logos will be operated for the time being.　(Refer to 5.4 “CDT Method Transmission”).	1,7
CLUT	Color Look Up Table:　Table to convert color information from an index value to a physical value.	3
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.	2,7,9

Term	Description	Volume
CRC	Cyclic Redundancy Check: CRC is a code to check cyclic redundancy to verify the accuracy of data.	4, 6
DAVIC	Digital Audio-Visual Council: Name of the association whose objective was to define a standard method to transmit MPEG-digitized information reciprocally.	3
DDB	Download Data Block: the message, which together with DII comprises a data carousel, and which contains modularized real data.	7
DDWG	Digital Display Working Group: an industry group that promotes the standardization of digital display interfaces.	2
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.	7
DIT	Discontinuity Information Table: the table inserted at the transition point where the partial transport stream becomes discontinuous.	2
DLNA	Digital Living Network Alliance: a group that formulates and promotes guidelines for home network equipment implementation.	2
DNS	Domain Name Service [RFC1034, RFC1035]: Protocol used to provide services for hostnames on the network and the mapping of Internet Protocol addresses.	6
DQPSK	Differential Quaternary Phase Shift Keying: a digital modulation scheme to transmit two bits of information by using sinusoidal waves with different phases. While QPSK uses the SP to specify phase criteria, DQPSK uses the immediately preceding symbol in each carrier as the phase criterion to specify four phase states for transmission. DQPSK is not used for digital terrestrial television broadcasting.	7
DRCS	Dynamically Redefinable Character Sets: DSCS is a system to transmit external characters in patterns. Used in character coding standards for text broadcasting and data broadcasting.	3, 4
DSU	Digital Service Unit: Digital line end terminal device. Device to provide interfaces for digital networks and terminals for digital communication.	6
DTCP	Digital Transmission Content Protection: the Content Protection System for transmitting content using a digital interface.	2, 8
DTS	Decoding Time Stamp: the time control information for decoding streams.	7
DU ratio	The DU ratio is defined as the desired to undesired ratio, which represents the power ratio of electrical power in preferred waves (Desired) of high frequency signals to interference waves (Undesired).	2, 9
DVI	Digital Visual Interface: an interface standard specified by the DDWG.	2
ECM	Entitlement Control Message: ECM is defined as the common information that includes program information (program related information and descrambling keys) and control information.	4,5,7

Term	Description	Volume
EIT	Event Information Table : EIT is defined as the table in which program related information such as program titles, air dates and times and brief program descriptions is described.	4,5,7
EIT[p/f]	Information on the current event (p:present) and next event (f:following) in the EIT.	4
EIT[p/f after]	Information that follows after the present and following in M-EIT and L-EIT.	4
EIT type delivering flag	Collective term for H-EIT_flag/M-EIT_flag/L-EIT_flag specified within the service loop of the SDT.	4
EMM	Entitlement Management Message: EMM is individual information that includes work Key to decipher a contract information and common information of each subscriber.	4, 5
EMM message	EMM message is individual and common messages carried in the EMM.	4, 5
EPG	Electronic Program Guide : EPG is defined as the program information displayed by receiver units using the SI information transmitted by each broadcasting station to be used when selecting a program.	4,7
ERT	Event Relation Table: ERT is the table in which the relation between an event and local event is described.	4
ES	Elementary Stream: ES is defined as the coded video, audio or independent data in PES packet. One ES is carried in a sequence of PES packets with the same stream ID.	3,4,5,7
EUC-JP	Japanese character code encoded in accordance with ISO 2022	3
EWS	Emergency Warning Signal	4
Ethernet	One of the LAN communication methods.	6
FEC	Forward Error Correction	6
FFT	Fast Fourier Transform: a method of converting time axis signals into frequency axis elements. The opposite conversion from the frequency axis into the time axis is IFFT (Inverse FFT).	2, 9
FFT window	Processing duration for a certain period of time in which the time axis signal is taken in order to calculate the FFT.	2, 9
FTP	File Transfer Protocol [RFC959]: Protocol for sharing and forwarding files between two hosts on TCP/IP.	6
FTTH	Fiber To The Home: Service to provide a communication transmission path to the homes of users with optical fiber.	6
GOP	Group Of Pictures: the MPEG video frame structure and a coding unit for one I picture and multiple P and B pictures.	7
H.264|MPEG-4 AVC	Advanced encoding/decrypting technology co-developed by the Moving Pictures Expert Group (MPEG) of the International Organization for Standardization/International Electro-technical Commission U.S., Inc.(ISO/IEC) and the Video Encoding Expert Group (VCEG) of the International Telecommunication Union(ITU).	3
H-EIT	Collective term for EITs for display on fixed receiver units.	4
HDCP	High-bandwidth Digital Content Protection System: the Content Protection System for transmitting digital video signal and digital video/audio signal.	2, 8
HDLC protocol	High-level Data Link Control: Mainly a highly secure transmission control protocol for communication between computers in a LAN and on the Internet.	6

Term	Description	Volume
HDMI	High-Definition Multimedia Interface: a digital interface standard specified by the HDMI founder, is under the control of HDMI Licensing and LLC (Limited Liability Company) for standard and licensing.	2
HTTP	HyperText Transfer Protocol: Application layer protocol. This protocol (RFC2616) is used for the transfer of data over the World Wide Web.	3, 6
I frame	Intra Frame: Frames built from compressed data embedded within an initial frame.	3
ICMP	Internet Control Message Protocol [RFC792]: Protocol for message transmission such as various error notifications and operation confirmations generated during protocol data transfers.	6
IEC	International Electrotechnical Commission	4, 6
IEC60956	IEC60958 is the Digital audio interface standard defined by the IEC(International Electrotechnical Commission)	4
IEEE1394	IEEE Std 1394-1995: a serial bus interface suited for high-speed, real-time transfer, standardized by the IEEE Standard for a High Performance Serial Bus.	2
IIP	ISDB-T Information Packet: a special null packet inserted, only once, during one multiplex frame period in order to transmit modulation information and SFN information.	7
IP	Internet protocol: Network layer protocol which defines Internet addressing and distribution processing of data.(RFC791)	3, 6
IPCP	IP Control Protocol [RFC1332]: Protocols which set various settings when using IP in the PPP network layer protocol phase.	6
IPv4	International standard protocol that is used as a base for the current LAN and Internet.	6
IPv6	Successive protocol to IPv4. Protocol that extends the address part and adds security functions, etc.	6
ISDN	Integrated Services Digital Network	6
ISO	International Organization for Standardization	3, 4, 6
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”)	4
ISP	Internet Service Provider: Company that offers various content services on the Internet.	6
ISP connection information	Information such as ISP access point telephone numbers and authentication protocols, etc. It is set by viewers and maintained in the receiver.	6
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.	4
JST	Japan Standard Time: (Defined as „UTC+9 hours“ by ARIB STD-B10)	4
JTC	Japan Time Code: JST in BCD	4
L-EIT	Collective term for EITs for display on partial receiver units.	4
LFE	Low Frequency Enhancement: the low frequency enhancement channel in multi-channel stereo mode.	7

Term	Description	Volume
LIT	Local Event Information Table: LIT is the table which includes all the descriptions regarding local events of a single program.	4
M-EIT	Collective term for EITs for display on mobile receiver units	4
MAC	Message Authentication Code: Symbol to confirm that the message was sent to the other party without being altered and without any transmission errors.	6
MFN	Multi-Frequency Network: the network in which different frequencies are assigned to transmitting stations whose service areas overlap. Although existing broadcast wave relay technologies suffice to construct the network, a large amount of frequency resources is required.	7
MJD	Modified Julian Date: MJD is the date accumulated starting from at 0:00 on Nov 17th, 1858 (UT).	4
Multimedia service	Data broadcasting service based on XML-based multimedia encoding methods.	3
MNG	Multiple-image Network Graphics: File format for animation graphics. It is pronounced “MING”. It includes multiple PNG images of which sequential displaying and repetition are possible.	3
MNP4	Error correction method for modem communication.	6
MP@H14L	Main Profile at High-1440 Level.	7
MP@HL	Main Profile at High Level used to code 1080i HDTV signals.	7
MP@LL	Main Profile at Low Level used for low resolution coding.	7
MP@ML	Main Profile at Main Level used to code 480i SDTV signals.	7
MPEG-1	Moving Pictures Expert Group –1: MPEG1. Data compression coding technology including video and audio, which is standardized by the International Organization for Standardization (ISO/IEC 11172)	3
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).	3,4,7
MSB	Most Significant Bit.	6,7
MVTV	Multi-view TV: the Method of switching between each combination of images that a broadcaster intends and transmit multiple images and voice in one service, using the component group descriptor.	7
M affiliate	Numerical rows with a comparatively long time period used when simple pseudo-random numbers are generated.	6
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.	4,7
NNTP	Network News Transfer Protocol [RFC977]: Application layer protocol used to distribute, post, and acquire NetNews on the Internet.	6
NPT	Normal Play Time: Absolute coordinates on time axis that show the positional relationship of events in a stream.	3
NVOD	Near Video On Demand: NVOD provides the same service at different times.	4

Term	Description	Volume
OFDM	Orthogonal Frequency Division Multiplexing: a kind of multi-carrier transmission system.	2,7,9
OFDM segment	The 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.	7
OFDM frame	The OFDM frame is defined as the transmission frame comprised of 204 OFDM symbols.	7
PAT	Program Association Table: PAT is used to specify the ID of the TS packet that carries the PMT.	4,7
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.	4
PCR	Program Clock Reference	4,7
PDC	Personal Digital Cellular: Digital automobile and cellular phone method. 9600bit/s data communication is possible.	6
PDC-P	Personal Digital Cellular Packet: Communication with the PDC packet data exchange method. 9600bit/s-28800bit/s communication is possible.	6
PES	Packetized Elementary Stream: PES is defined as the packetized video, audio and other data with variable lengths.	3,4,7
PHS	Personal Handy-phone System	6
PIAFS	PHS Internet Access Forum Standard: Data communication methods of 32kbits/s, 64kbits/s using PHS.	6
PID	Packet Identifier: PID is defined as the 13-bit stream identifier information, which shows the attributes of individual streams of the packet.	3,4,5,7
PIN	Personal ID Number: Individuals are identified/recognized by using a secret number allocated beforehand to obtain access to certain systems.	6
PKCS	Public-Key Cryptography Standard: Cryptographic systems are centered on public key cryptography and include symmetric-key cryptography, the hash function, and pseudo-random number functions, etc.	6
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.	4,5,7
PNG	Portable Network Graphics: Graphics file format succeeding GIF. It is pronounced “PING” and is capable of lossless compression. The file format is comprised of an 8-byte signature followed by a series of “chunks”.	3
PN signal	Pseud Noise: Signal with a property of appearing randomly at 1 and 0. Used for energy diffusion etc. of digital signals. The M sequence is often used.	6
POP3	Post Office Protocol version3 [RFC1939]: Protocol used to delete, acquire e-mail lists and e-mail from the SPOOL on the mail server.	6

Term	Description	Volume
PPP	Point to Point Protocol [RFC1661]: Protocol to enable the forwarding of multiple protocols in Point to Point links. It is used for dial-up connections.	6
PPP in HDLC-like Flaming	Frame composition to stack high level ppp protocols. Construction method for headers and footers as a frame configuration used by HDLC protocols.	6
PPV	Pay Per View: PPV is the system for chargeable broadcasting, in which viewers pay for individual program or program group according to their viewing style.	4, 5
PSI	Program Specific Information: PSI is defined as information (comprised of four tables: PAT, PMT, NIT and CAT) necessary to select specific programs and defined by the MPEG-2 system standard and the ordinances of the Ministry of Internal Affairs and Communications	4,7
PSTN	Public Switched Telephone Network	6
PTS	Presentation Time Stamp: PTS is defined as the presentation output time control information.	4,7
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.	2,7,9
QPSK (1/2)	A QPSK transmission system which involves transmission path coding at the convolutional coding rate of 1/2.	7
RFC	Request for Comments: Technological information made public to the Internet community by the Network Working Group.	3
RSA encryption	Most popular public key cryptography system at present. Has a code/decoding function and signature/verification function.	6
RST	Running Status Table: RST is the table that shows running status of a program at the current time and is not used in terrestrial digital broadcasting.	4
SBR	Spectral Band Replication: SBR is extension technology for ACC low bit rate band.	7
SDT	Service Description Table: SDT is defined as the table that lists service channel related information such as service channel names and broadcaster names.	4,5,7
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.	1,4,7
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.	2,7,9
SFN reception disturbance	Situation in which broadcasting signals cannot be properly received due to delay waves originating in the SFN.	2, 9
SI	Service Information: SI is defined as 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.	4,7

Term	Description	Volume
SIT	Selection Information Table: the table that lists partial TS stream information and the information regarding services and events transmitted in the stream.	2
SMTP	Simple Mail Transfer Protocol [RFC821]: Protocol for e-mail relay and delivery.	6
SP	Scattered Pilot: Pilot signal inserted to show the standard phase and reference level of QAM.	2,7,9
SP interpolation LPF	The filter that carries out interpolation processing in order to speculate on the data carrier phase between the SPs and the amplitude correction component from the demodulated SP signal. It is handled as the equivalent of a low pass filter (LPF:Low Pass Filter)	2, 9
SSL	Secure Socket Layer: It is located midway between the TCP layer and application layer, and provides encryption, decoding and authorization.	6
ST	Stuffing Table: ST is defined as the table to invalidate a table.	4
STD	Standard.	4, 6
TA	Terminal Adapter: Device that converts protocols to allow analog communication terminal, etc. connections with ISDN.	6
TCP	Transmission Control Protocol: Protocol for the transport layer in end-end. Offers highly reliable connection transmission that includes error detection and correction. (RFC793)	3, 6
TCP/IP application setup information	Information related to application protocols used in the TCP/IP protocol. It is set by viewers and maintained in the receivers.	6
TDT	Time and Date Table: TDT indicates the current date and time. This is not transmitted in terrestrial digital television broadcasting.	4
TLS	Transport Layer Security: One of the protocols used to send/receive encrypted information via the Internet. This can prevent wire tapping, tampering of data, and Web spoofing by using a combination of security technologies such as public key encryption and secret key encryption, and digital certification. (RFC2246)	3, 6
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.	4,7
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 digital terrestrial television broadcasting, only EOT is transmitted and not TDT).	4,7
TS	Transport Stream: TS is defined as the transport stream defined by the MPEG-2 system standard (ISO/IEC 13838-1) (in digital terrestrial television broadcasting, one TS is assigned to a master transmitter).	3,4,7

Term	Description	Volume
TS_id	TS_id is defined as the identifier assigned to each TS. Same as network_id.	4,7
TS packet	The TS packet is defined as the 188-byte (four-byte header) data packet used to send PES and sections.	7
TS remultiplexing	TS remultiplexing is defined as the function to configure multiplex frame structures necessary to transmit the TS to the OFDM modulator.	7
Telnet	Protocol that offers virtual terminals where certain servers can be remotely operated from terminals on a [RFC854, RFC855] TCP/IP network.	6
UDP	User Datagram Protocol [RFC768]: Transport layer protocol between two hosts without a confirmation function but which does minimize protocol overhead and is a connectionless type of communication suitable for services with high transmission efficiency.	6
UTC	Universal Time Coordinated: UTC is defined as the time commonly used around the world based on the international agreement.	4,6,7
V.22bis	Modulation method for all double-layered telephone modems up to 2400bit/s specified by an ITU-T advisory	3, 6
V.34	Modulation system for full duplex modems for telephones up to 33.6kbits/s provided by ITU-T recommendations.	6
V.42 bis	Data compression method and error correction method for communication between modems provided by ITU-T recommendations.	6
V.90	Standard specifications for 56Kbits/s analog modems provided by ITU-T recommendations.	6
VESA	Video Electronics Standards Association: a group that formulates and promotes the standards for displays and display interfaces.	2
X.28	Communication protocol to convert non-packet receivers equipped with modems, etc. to enable connections with packet switching networks, etc.	6
Basic	Schedule basic: program information based on transmission criteria in common operation SI. Extended event descriptor not included.	4
bslbf	Bit string, left bit first.	4
closed network provider	Providerthat manages closed networks not connected to the Internet.	6
component	Component is defined as each element that makes up an event (program) such as video, audio, text and other data.	4,5,7
component_tag	Component_tag is defined as the label used to identify component streams	4,7
current_next_indicator	Current_next_indicator is used to show whether each section is “currently” valid or will be valid in the “future”.	4
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.	7
descriptor	Descriptor is defined as the description area placed in the table to list various information.	4, 5

Term	Description	Volume
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.	7
event	Event (or program) is defined as a collection of streams with a preset starting and ending time within the same service (service channel) such as news and dramas.	4,5,7
event_id	Event_id is defined as the id number of an event that is uniquely assigned within a single service.	4
extended	Schedule extended: Information on program extended information based on the transmission criteria in individually operated SI.	4
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”.	4
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.	4
index	(Program) index is defined as additional information associated with a program to be used for digest reception, multi-scenario reception, etc.	4
network	Network is defined as a collection of multiplexed MPEG-2 TSs transmitted by a single distribution system.	4,7
network_id	Network_id is defined as the identifier assigned to each master transmitter.	4,7
original_network_id	Original_network_id is the identifier unique to each network.	4
p/f	p/f is defined as the current program information (p) and the next program information (f) of the EIT.	7
payload	Payload is defined as a stream of bytes following the header within the packet.	4
program_number	Program_number is equal to service_id.	4
remote_control_key_id	remote_control_key_id is defined as the identification numbers used to assign the main broadcasting service by each broadcaster to the one-touch buttons on the remote controller or as default values for one-touch buttons carried in the NIT.	2, 7
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”.	4, 6
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”.	4, 6
rpchof	Remainder polynomial coefficients, highest order first.	4, 6
running status	Running status shows the running status of events and services such as “in execution” and “under suspension”.	4
schedule	EIT schedule is time-series schedule information regarding events.	4
section	Section is defined as the syntax structure used to map SI in the TS packet	4

Term	Description	Volume
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.	4
segment （EITsegment）	Segment (EITsegment) is the EIT schedule syntax structure that includes up to 8 sections and information on event that will start within 3 hours.	4
service	Service (service channel) is defined as a series of scheduled broadcasting programs transmitted by each broadcaster.	4,7
service_id	Service_id is defined as the identifier for each service in the network.	4,7
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.	7
sub_table	Sub-table is a collection of sections with the same table ID (identifier) and same table id extension.	4
table	Table is composed of multiple sub-tables with the same table ID (identifier).	4
table_id	Table_id is defined as the identifier to specify a table to which a section belongs.	4
table_id_extention	Table_id_extension is used to identify a sub-table.	4
time stamp	The recycling detection of communication data is possible by adding the communication time and random numbers to important communication data.	6
uimsbf	Unsigned integer, most significant bit first	4, 6
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.	4
8-bit character codes for C-profile	The character encoding method for closed caption used in C-profile, this is subset by restricting the use of control codes based on the “8-bit character codes” used in Profile A.	3
Kana-Kanji conversion	Process to convert input kana characters to appropriate kanji	3
access point	Communication equipment that receives call-outs from receivers.	6
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.	7
Adaptation field	Adaptation field is defined as the field with the information transmission function (such as PCR) and stuffing function.	4
Up/down channel selection	Up/down channel selection is defined as a method for selecting a channel using the UP/DOWN buttons on the remote controller. Pressing the UP/DOWN buttons switches between channels in ascending/descending order of three-digit numbers used for direct channel selection.	2, 7
Application information	Information on access point telephone number and circuit types, etc. specified by broadcasting stations.	6
Event	Program.　Event in ARIB STD-B10	3

Term	Description	Volume
Event relay	Event relay is defined as the function to enable continuous viewing of programs (events) among different services.	4,7
Event Common	Event Common is to specify the same ES_PID for the PMTs of multiple services to share the same event among multiple services.	4
Internet Retransmission	Internet Retransmission is defined as the transmission of received contents to the Internet, for example, via e-mail or web-based forms.	8
Interleaving	Refer to time interleaving and frequency interleaving.	7
Echo back	Means characters that are received are sent back or is an operation to confirm the transmission characters on the sending side.	6
Engineering service	Service type 0xA4 information updating service in receivers notified by the SDTT procedure and transmitted by the data carousel.	1
Entry component, entry carousel	Component whose component tag value is specified as 0x40 in the 2nd loop of the PMT is called “entry component”. Also, the data carousel transmitted in this component is called “entry carousel”.	3
Card ID	Number or symbol allotted uniquely beforehand to cards installed in receivers.	6
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).	7
Cut thru call	Call to connect with centers whose call is specified partially from receivers in network services that receive a large amount of calls.	6
Cut call	Call for communication from the receivers that end at the switchboard on the sending side and in network services that receive a large amount of calls.	6
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.	7
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.	2,7,9
Clip noise	Noise component generated by limiting (clipping) the amplitude of the signal.	2, 9

Term	Description	Volume
Code independent mode	Improvement method to make it possible to also transmit binary data with the BASIC mode data transmission.	6
Copy control	Control copy generations. Limits when the program and other copyright objects are copied for the recording equipment connected with the broadcasting receiver.	6
Content Protection System	Content Protection System is defined as the technology that uses, for example, encryption, to prevent the illegal modification and/or copying of content, for the purpose of right management.	8
Protected Free Program	Protected Free Program is defined as the free program which is not under customer management but is protected (scrambled) for the purpose of right management.	2, 5, 8
Component	Same as the “component.”	7
Service	Same as the “service.”	7
Service code(SC)	Service division code for network services offered by communications carriers that are identified with 00XY, etc.	6
Service type	Service types include digital TV, digital audio, digital broadcasting, and special service.	4
Service list	Service list is a list of services with service identifiers and service types.	4
Service identifier	service identifier	7
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.	7
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.	7
Sequence header	Sequence header is the header to show the start of the highest layer (sequence layer) which includes MPEG video coded streams.	4
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.	7
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.	4
Single shift (Character coding control)	Single shift is the control that calls only one code following this temporarily to the 8-bit-code table.	4
Genre code	Code used in content_nibble_level_1 (4 bit) and content_nibble_level_2 field (4 bit) that specify genre. This is used in Content Descriptors, etc.	1
Schedule information	Download start time and download duration time stored in the SDTT schedule loop.	1
Startup module	Module where moduleID=0	3
Startup document	Among all BML documents transmitted by the data carousel, this is the document that is presented first by default. Included in the startup module.	3
Stuffing	Stuffing is to fill the remaining part in a TS packet with “0xFF”.	4
Stream format identification	Stream format identification specified in ISO/IEC 13818-1	3

Term	Description	Volume
Security level	Index used when security strength is defined and operated in stages according to the necessary confidentiality level for the handled data, etc.	6
Security communication related information	Security communication related information is maintained in the receivers by information related to the security type and root CA certificate installed in the receivers.	6
Section	Section	4
Segment	Segment (“Segment” used in this chapter is different from the OFDM segment)	4
Segment	The segment (OFDM segment) is defined as the basic bandwidth for transmission signals with a control signal added to the data carrier (1/14 of the TV channel bandwidth) or as the framed signals.	7
Session key	Key used from the perspective of security strength maintenance for one session only (disposable).	6
Center	Equipment including the necessary host to provide bi-directional transmission services.	6
Time stamp	time stamp	6
Tamper resistant	Physical casing used for those handling devices to read internal data functions so that functions cannot be analyzed.	6
Direct channel selection	Direct channel selection is defined as one of the methods for selecting a channel on the receiver. To select a channel, number buttons on the remote controller of the receiver are used to specify a three-digit decimal number, which is assigned to identify each channel.	2, 7
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.	7
Information updating service in receivers	Service that distributes and stores receiver software, Common Data to All Receivers ,logos, etc. in non-volatile memory, etc.	1
Chunk	Blocked information found in the PNG and MNG file formats.	3
Channel information	Channel information is defined as the information displayed following the selection of a channel. It includes a three-digit number used for direct channel selection, branch identifier, TS name, service name and logos.	2
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.	4
Data event	Period of time during which a BML document or a group of BML documents are transmitted in a component. Unrelated to SI events. Data events are switched based on the updating of the DII “data_event_id” transmitted in the component.	3
Data carousel	Method specified by ISO/IEC 13818-6 whose objective is to distribute data repeatedly in order to download various data via broadcasting.	3,7
Data transmission function	Directions described in the BML contents and it is a function for data transmission between the receivers and the center.	6

Term	Description	Volume
TV programs with additional data	TV programs where additional data is broadcast along with an event in which video/audio are primary. Here, primarily audio programs are also considered “TV Programs”.	3
Visual component of TV programs with additional data	Parts other than data in TV programs with additional data.	3
BML-engine	Receiver software which receives and interprets multi-media data (BML documents) in order to present it to viewers.	3
Data broadcasting reception status	Status where receiver is receiving data broadcasting and playing it back.	3
Debit	Settlement in which the cost is transferred between the user's bank account and the bank account of the member store at the time of use.	6
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.	4,7
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.	7
Dual mono	Dual mono is defined as an audio mode that allows the use of two mono audio in a single ADTS.	7
Token	Electronic voting card used for electronic ballots.	6
Traffic	Communication traffic added in lines and exchange plants of PSTN, etc.	6
Transport stream	TS	3, 4
Transport identifier	Same as “transport_stream_id.”	7
Null packet	The null packet is defined as the TS packet that does not include effective information but is used for stuffing purpose.	7
Negotiation	For modems that have multiple modulation systems, error correction functions and re-sending functions, negotiation will be conducted first in order to search for methods and functions shared by both modems.	6
Network	The network for digital terrestrial television broadcasting is defined as the distribution system for signals transmitted from a single master transmitter.	7
Network services	Value added services for aggregrate data and data processing, etc. done on the network between receivers and the center.	6
Network identifier	network identifier	7
Network representative accounting	Accounting method that communications carriers claim to users by using information fee accounting instead of information providers.	6

Term	Description	Volume
Bathtub characteristics	It is an abbreviation of the characteristic that displays the relationship between the delay time of the delay wave and the guard interval in demodulation of the OFDM. Although the demodulation characteristic of the OFDM deteriorates due to the delay wave which exceeds the guard interval, it is called a bathtub characteristic since it resembles the shape of a bathtub when the characteristic is showed in the delay time of the delay wave and the necessary DU ratio.	2, 9
Hash function	Mathematical function used to map large (very large in some cases) areas to smaller areas. Quality functions need to be simultaneously interaction channel and collision free.	3, 6
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.	7
Vernam cipher	An encryption method. The random number sequence and the exclusive-OR of correspondence held by the sending and receiver side are transmitted as cipher text and the receiver side decodes it by taking this random number sequence and exclusive-OR for the received correspondence. If true random numbers are used, this is theoretically a safe communication encryption method.	6
Value	Information on money and value used by the prepaid method.	6
Partial transport stream	Partial transport stream is defined as a bit stream obtained by excluding TS packets which are not related to specially selected single or some programs from a transport stream.	2,3,4
Viterbi decoding	Viterbi decoding is one of the decoding methods of convolutional coding. It is a decoding method that corrects mistakes by observing received digital data rows and requesting data rows assumed to be the most correct.	2,9
Fading	Fading is a change in the strength of the received radio waves. A physical change in the meteorological conditions etc. and reception condition of are thought to be the cause.	2, 9
Font	Set of printed characters. Classified by style and size.	3
Font size	Same as design frame.	3
Flat rate-charging system	Flat rate-charging system is defined as the system in which viewers pay for service channels they subscribe to.	4,5
Fringe area	Area located near the outer limits of the service area.	3,7
Bookmark list service	Service to broadcast “bookmark list display contents” which have the following features. Display bookmarked items as a list. When viewers select a desired bookmark from the list, and selects the channel to broadcast detailed information obtained in the URI from NVRAM bookmark information. Provides functions which manage bookmarks for viewers. The bookmark list service is not a service restricted by service type, but it refers to the service specified by bookmark list display contents.	3
Bookmark list data service	Service broadcast by service type 0 x AA whose primary contents are “Bookmark list display contents”	3

Term	Description	Volume
Bookmark writing service	Service to broadcast “bookmark write contents” with the following features. Present bookmark icons with the timing that has been specified in the contents, following the broadcast contents. According to the buttons pressed by the viewer, write the URI etc. of the communication site providing related information to contents that are currently displayed to the bookmark area of NVRAM. In C-profile, refer to the “TVlink”.	3
Broadcaster	Broadcaster is defined as a broadcaster or a collection of broadcasting companies operated under the common operation system.	4
Prepaid ID	When network type prepaid payments are used, identifiers are associated with each user corresponding to the pre-paid card.	6
Pre-list service	Service to broadcast “pre-list display contents” with the following features. List of services that provide the bookmark list service (organized channels). When the viewer selects the desired channel from the list, the specified service (composing channel) should be selected and the bookmark list service displayed.	3
Profile	The profile is defined as the classification of functional restrictions of technologies used for the MPEG-2 coding system.	7
BASIC mode data transmission(Code Independent Mode)	Communication protocol that has been developed for the basic host and terminal of the data transmission control protocol. A communication protocol is installed to minimize data transmission mistakes.	6
Base URI directory	Identifier to recognize communication contents as one document group.	3
Payload	Payload	4
host	Necessary access point device and server device for bi-directional transmission services.	6
Pointer field	Pointer field is defined as the field that exists in the payload in a TS packet and shows a number of bytes till the first byte in the first section.	4
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.	7
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.	4
Mass calling service	Mass calls reception services, etc. are included by one of the network services.	6
Master key	Compared with the session key, the master key is used. It is a key used in order to share the session key.	6
Multi-sectionization	Multi-sectionization is to transmit a single packet with more than two sections inserted in it.	3, 4
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).	7

Term	Description	Volume
Multi-path	Radio waves that come to the receiving antenna arrive through multiple routes (multi-path) from the transmission point.	2, 9
Multi-view	Multi-view TV. Multiple video and audio are broadcast within one service. Combinations of video/audio intended by broadcasting stations can be switched by using this method.	3
Multi-view Television	A system to transmit multiple video and audio streams within a single service and to switch the video and audio components grouped together by the broadcasting station.	4,7
Mute flag	The mute flag is defined as a control flag used by the sender to mute the sound of the receiver unit.	7
Move	Move is defined as the transfer of the No more copies content stored in a bound recording media, which involves copying the content to another recording media and then rendering unusable of the original content.	8
Mail	Mail is defined as a message that is stored in a receiver unit and that can be arbitrarily called through an operation by the user among EMM messages that are sent to each IC card.	5
Message digest	Summarizes (digesting) optional data length to a constant length, or the summarized data.	6
Message authorization code	MAC	6
Mode	The transmission mode can be identified by the OFDM carrier spacing.	7
Mall	Electronic store or collection of stores.	6
Module information	Information regarding downloaded modules that is set in module_info_byte in DII.	1
Mono media	The mono media is defined as an independent media such as video, audio, text and still pictures.	7
Real-time viewing	To acquire data for display from the data carousel in real time (i.e. while viewing).	3
Remote control key identifier	remote_control_key_id	7
Link state	Status where receiver units can receive/play both BML contents from a server managed by a broadcasting station and video/audio resources which are being broadcast, together.	3
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.	7
Route certificate	When encrypting communication by TLS, format pursuant to X.509 which is used to send and store public keys. In particular, certificates to authenticate the authorizer are called route certificates.	3, 6
Module for storing route certificates	Modularised route certificate used when transmitted by a data carousel. In the module for route certificate storage, a maximum of two route certificates are stored.	3
Local Contents	Data carousel transmitted in a data event of a given component.	3
Local encryption	Local Encryption is defined as the encryption used for protecting content and/or control signal in case of the bound recording or transmission on the user-accessible bus.	8

Term	Description	Volume
Roll-up mode	Closed caption service to display additional, prepared closed caption data sent as page data into areas of 3 lines, gradually line-by-line. Rolls up vertically at line breaks.	3
Log collection accounting	The data broadcasting use charge is recorded for each user. It is an accounting method that does collective adjustments later.	6
Logo	Logo mark used by receivers for EPG, program selection, etc. that is defined for each broadcaster or service.	1
Logo ID	ID given to logo data used by each broadcaster. They are unique for each network, and are managed by each broadcaster. The Logo ID is common for all 6 logo types.	1
Logo type	Logo data prepared for different display formats such as SDTV, HDTV, etc. There are 6 of them defined.	1
Logo transmission descriptor	Record of logo transmission type, pointing of a logo in CDT style, string for simple logos, etc.	1
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.	4
One-touch button	The one-touch button is defined as the button pressed by the viewer for one-touch channel selection.	3,7
One-touch button number	The one-touch button number is defined as the number of the button pressed by the viewer for one-touch channel selection.	7
One-touch channel selection	One-touch channel selection is defined as one of the methods for selecting a channel on the receiver. Pressing a button (one-touch button) on the remote controller enables direct, one-touch selection of the service assigned to the button.	2, 7
Retention	Retention is defined as temporary storing of content into the bound recording media for the purpose of time-shift viewing.	8
General header	Header added to messages, which is used with request/response messages.	3
Uni-direction	Impossible or very difficult characteristics with which to do inverse operations in a mathematical operation.	6
Branch identifier	Branch identifier is defined as a one-digit number used to differentiate services when the same three-digit numbers are used for different services in fringe areas.	2
VIDEO PES	Data component used to transmit encoded video as standardized in ISO/IEC 13818-1.	3
Response header	Header added to response messages, which is used only for response messages.	3
Response message	Unit of response received by HTTP/1.1 client.	3
Audio PES	Data component used to transmit encoded audio as standardized in ISO/IEC 13818-1.	3
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.	7
Circuit class	Displays different types of telecommunication lines such as PSTN, cellular lines, and PHS.	6
Hierarchical transmission	Hierarchical transmission is defined as simultaneous transmission of OFDM segment groups with different transmission path coding.	4,7

Term	Description	Volume
Diffusion	When, in digital signals, 1 or 0 or a constant pattern continues, an emission line spectrum is generated to cause interference or else clock recovery becomes impossible. In order to prevent this problem, a known PN signal is provided to make the signal random.	6
Management server	In the management of private information, it is a server that concentrates and manages private information, and has a function to return private information in response to inquiries from the host.	6
Simple encryption	Simple encryption is used for conditions that are not necessary that have not been decoded by a third party.	6
Simple authentication	To authenticate other parties, simple authentication is an authentication protocol used when security strength is not really necessary, and which can be realized by using symmetric cipher.	6
Related service	Related service is defined the service style which broadcasts programs related to each other in different multiple services.	4
Related data broadcast	Collective term for the additional data area of TV programs with additional data, and is a data broadcasting service assumed to be viewed alongside video.	3
Well-known plain text attack	Already known plaintext is input and cipher text is generated, and is a method of attacking encryption algorithms by leading the encryption key from plaintext and cipher text.	6
Descriptor	Descriptor	4, 7
Pseudo-random number	In general, since the generation of true random numbers is difficult, a numerical row with very long periodicity and uniformity (difference) often substitutes random numbers.	6
Confidential information	Confidential Information is defined as the information which affect the safeness of contents protection such as cryptographic algorithms and keys for local encryption, and the information regarding copy control or content protection described in the Digital Copy Control Descriptor or Content Availability Descriptor.	8
Approval information	Information that describes whether or not mandated downloading can be performed unconditionally depending on the implementation approval function of the receiver.	1
Common operation SI	Commonly operated SI is defined as the SI transmitted in common operation by all broadcasting companies	4
Common key encryption	Also called secret key encryption/symmetrical encryption. Using common key encryption owned secretly by the sender/receiver, encryption on the sender side and decryption on the receiver side. The common key itself needs to be shared via other methods.	3, 6
Common fixed color	Color specified as common on the receiver unit color palette for things such as logo display.	3
Common information	Information set depending on the viewer and is maintained in receiver units with information on the priority use line type and the outside line acquisition number, etc.	6

Term	Description	Volume
High/Middle/Low protection layer	Hierarchical transmission uses layers called the High protection layer, Middle protection layer and Low protection layer (if using three layers) in ascending order of the required CN ratio. If two layers are used for hierarchical transmission, they are called layer with a strong resistance to noise and the layer with a weak resistance to noise and if only one layer is used, it is called the layer with a weak resistance to noise for the sake of convenience.	7
High protection layer	Layer whose CN ratio is the lowest at the time of layered transmission. (Refer to Vol. 7, 7.1.)	1
SDTT for high protection layer	SDTT transmitted in high protection layer or transmitted through transmission routes whose layer number are 1. No downloading contents transmission is performed along with SDTT for the high protection layer of receiver software.	1
Mandated downloading	Downloading that requires mandated implementation	1
Emergency warning broadcasting (EWS)	Emergency Warning System is used for disaster broadcasts. The start control signal, for example, forces receiver units to receive the broadcasts.	4,7
Start flag for emergency warning broadcasting	The start flag for emergency warning broadcasting in the TMCC signal is defined as the bit to notify receiver units that an emergency warning broadcast will be made.	7
Emergency broadcasting cut-in	Cut-in news. In emergency situations, the current program is suspended and news, etc. is transmitted.	4
Empty section	Empty section is defined as the section that has CRC32 after the section header and in which no descriptor is described.	4
Portable (partial) receiver unit	The portable (partial) receiver unit is defined as a receiver unit that mainly receives partial reception services.	7
Verifier	Person who verifies whether or not the signee and the content are certain.	6
Strict authorization	Authorization measure that uses public key cryptography.	6
Excuses	To disavow after the sender themself transmits the contents of the communication.	6
Conditional access broadcasting	Broadcasting using the Conditional Access Descriptor. In conditional access broadcasting, there are pay programs, broadcasts using EMM messages and protected free program.	5
Free Program with Right Management	Free Program with Right Management is defined as the free program in the partial reception layer which is not scrambled but copy-controlled in accordance with the information described in the Digital Copy Control Descriptor and Content Availability Descriptor.	5,8
Private information	Excluding the name and address, etc., the bank account number and credit card number, etc. may be included.	6
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.	4
Call	Call unit	6

Term	Description	Volume
Call control (Character coding control)	Call control is to call G0, G1, G2 and G3 to GL and GR in the 8-bit character code control.	4
Fixed IP connection information	Information that is set depending on the viewer and which is saved in the receiver units with information in a fixed format to allocate internet protocol addresses, etc.	6
Fixed noise	Noise component that is not related to size of the signal, and exists in regular thermal noise and city noise.	2, 9
Priority carrier roiuting	By registering the communications carrier to a regional communications carrier, a connection is always connected to the selected communucation carrier by a priority connection option which makes the connection possible without dialing the communications carrier's IDnumber (00XY, etc.).	6
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.	7
Notification information	Information used for notifications such as downloading service_id, schedule information, receiver models for updating. Transmitted using SDTT.	1
No More Copies	No More Copies is defined as the state where content with copy control information indicating that it is originated as Copy One Generation and recorded, therefore no more copies are permitted.	8
Rendering unusable	Rendering unusable is defined as disabling reproduction, for example, by deleting the contents themselves or by deleting the encryption key.	8
repetition rate	Repetition rate is a cycle at which the same table is repeatedly transmitted regardless of whether it is updated or not.	4
Participation rate	Value in which the number of users of certain interactive data broadcasting service programs are divided by the number of viewers.	6
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.	4
Viewer setup information	Collective term for information that be decided by individual viewers for common information, ISP connection information, fixed IP connection information, connection type information, and TCP/IP application setup information.	6
Viewing reservation	Used to make reservations to view programs by event, based on SI information.	3
Broadcaster color setup	Colors per broadcaster that can be set by CLUT index values and color combinations.	3
Route certificate exclusively for broadcasters	Route certificate transmitted by a data carousel which is used temporarily by receiver units.	3
Bound Recording	Bound Recording is defined as the recording function to enable recorded content to reproduce only on the equipment that has recorded the content.	5,8
Subtitle	Subtitle is defined as the service of superimposing related text on the video broadcast on TV.	3,4,7

Term	Description	Volume
Closed caption out-screen display function	Function to reduce the video size in order to prevent overlapping of closed caption with captions within the broadcast image.	3
Time Interleaving	Time interleaving is defined as the operation to temporally interleave symbol data after modulation to increase fading resistance.	7
Automatic display/selective display	The automatic display mode is defined as a mode in which the caption and superimpose are displayed regardless of how receiver units 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 receiver units (See Table 4-2, Chapter 4, Section 3 of ARIB STD-B24).	7
Automatic display of message	Among EMM messages that are sent to each IC card, messages stored in IC cards (including the case of playing signals received by receiver units with storage and receiving functions) and messages are displayed at the same time programs are received.	5
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.	4
Entity-header	Header added in order to indicate data attributes in case data is included in request/response messages.	3
Low protection layer	Layer whose CN ratio is the highest upon layered transmission. (Refer to Vol. 7, 7.1.)	1
SDTT for low protection layer	SDTT transmitted in low protection layer or transmitted through transmission routes whose layer number are 1.	1
Receiver software	Structures receiver software. Application, library, OS, driver, data, etc.	1
Receiver dependent color	Colors per receiver that can be set by CLUT index values and color combinations.	3
Receiver setup information	Collective term for information that is set and maintained in receivers that consists of communication relevant information, communication device information, security communication related information, common information, ISP connection information, fixed IP connection information, connection type information, and TCP/IP application setup information.	6
Collection network	Network where data from many receivers is collected.	6
Repetition Rate Group	A collection of tables transmitted at the same repetition rate. Tables are grouped by table type and the EIT[schedule] is grouped by information span layer.	4
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.	7
Frequency list change information	Frequency list information and modification information, etc. of nationwide transmitting stations to correspond to frequency repacking. (Date of change, changed frequency, etc.)	1

Term	Description	Volume
Frequency repacking	To change the current transmitting station's frequency in order to structure an optimized network.	1,7
Required CN ratio	The required CN ratio is defined as the critical reception CN ratio at which the receiver unit can stably demodulate signals.	2,7,9
Required DU ratio	The required DU ratio is defined as the critical reception DU ratio at which the receiver unit can stably demodulate signals.	2, 9
Signature	Makes the calculated results into electric signatures by using operation characteristics which can be generated only by those who have a private key for public key cryptography.	6
Product planning	Receiver functions or actions which depend on the hardware design, the software design of the receiver planed by each manufacturer.	1, 2, 3, 4, 5, 6, 7
Conflict free	Necessary quality for hash function. The probability that the output result is different from 2 optional different inputs is sufficient.	6
Certificate	Necessary for verifying the authorization and signatures that use public key cryptography. It is electronically issued by a reliable third party (certifying body).	6
Uplink	Line used to connect to center equipment by using modems, etc.	3, 6
Information fee accounting	Instead of having users pay information providers for information services such as telephone information services, etc. carried out through telephone lines, the communication carriers pay the information providers (information charge, etc.) and then charge the users.	6
Amplitude proportion noise	The AD conversion quantization noise etc. corresponds to the noise component considered to be proportional to the size of the equivalent signal.	2, 9
2 displays of horizontal vertical picture element	Displays 1 pixel data in a 4 pixel area (horizontally and vertically).	3
Still picture	The still picture is defined as one of the video formats used to reduce the amount of information; more specifically, only I picture is periodically transmitted.	7
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).	7
Connection type information	Information set and saved by the viewers in the receiver units with protocols related to IP address acquisition when connecting by ethernet.	6
Select (optional) downloading	Download that is implemented according to the viewer's selection after displaying downloads that can be implemented.	1
Common data to all receivers	Data stored in the receiver and commonly used in the receiver. Logo data, Genre Code Table, Program Characteristics Code Table, Reserved Word Table, Frequency List and Modification Information, etc.	1
Server	Web server capable of handling HTTP/1.1 on TCP/IP networks.	3
Other party authorization	The other party is authorized by using the security function when it is necessary to confirm the other communication party.	6

Term	Description	Volume
Transmission frequency	Repetition rate	4
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.	7
Across-the-board program	Across-the-board program is defined as a program broadcast according to the same schedule over consecutive days.	4
Mass calls reception service	Service that can receive a large volume of calls in a very short time by using the switchboard function.	6
Type 1/Type 2 start signals	Type 1/Type 2 start signals are defined to classify signals for emergency warning broadcasting. While Type 1 start signal is defined by the Special Measures Law concerning Large Earthquakes and the Disaster Measures Basic Law, while Type 2 start signal is defined by the Weather Service Law.	7
First (2nd, 3rd, 4th) level kanji	Standard levels of character codes. Specified by JIS X0208, etc.	3
Convolutional code	Error correction code in which bit rows of consecutive digital data is consecutively encoded by constant width. A superior correction ability is showed for random mistakes in digital data.	2, 9
Single shot program	Single shot program is defined as a program that is not broadcast as a series or an across-the-board program. Irregular program.	4
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 Appendix D).	4,7
Digital terrestrial tuner	Digital terrestrial tuner is defined as the equipment with the function to extract a channel from RF signals, demodulate the carrier, select and decode a program and output baseband signals. It is also known as the STB or IRD.	2
Terrestrial broadcaster	Terrestrial broadcaster is defined as a collection of networks in digital terrestrial television broadcasting and is assigned for each broadcaster.	4
Terrestrial broadcaster group	Grouping of broadcasters for digital terrestrial television broadcasting	4
Terrestrial broadcaster identifier	The terrestrial broadcaster identifier is defined as the number to identify each terrestrial broadcaster.	7
Toll free	Accounting method to absorb communication charges on the receiving side.	6
Additional code	Additional code is so called external character and placed in different locations from Kanji and alphanumeric characters such as signs and composite glyphs.	4
Communication contents	BML contents located on servers	3
Communication device information	Information saved in the receivers by information that be provided between network terminal devices installed in access points and receivers.	6

Term	Description	Volume
Communication related information	Information such as the circuit class installed in the receivers and protocols, etc., and information that is maintained in the receivers.	6
Communications carrier	Class 1 telecommunications carrier and class 2 telecommunications carriers that offer telecommunication services.	6
Communications carrier ID number	Number to identify broadcasters specified in each communications carrier by their telephone number.(00XY)	6
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.	7
Transmission mode	The transmission mode is defined to classify modulation schemes and error correction systems.	6,7
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.	7
Special number	Short number that begins with one in the telephone number. 1XY number.	6
Registration transmission	Function to store/save telegrams in receiver units and send stored/saved telegrams per user instruction.	3
Registration transmission information	Term to refer to telegrams stored/saved in registration transmission and related information.	3
Independent data program	Data program principally involving multi-media data. In some cases, the video/audio components of TV programs are shared.	3
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.	7
Certificate Authority	Third-party organization that guarantees the reliability of the certificate.	6
Location dispersion	Statistically handles the distribution of electrical field strength as decentralized locations because the electrical field strength in the vicinity of the reception point is regularly distributed.	2, 9
Call	Call with a telephone.	6
Call (sending) limit	Limit on the receivers for sending on the receiver side to prevent congestion at the access point.	6
Call function	Instructions described in BML contents and a function for calls for the center.	6
Transmission delay	Transmission is delayed only on the receiver side arbitrarily to prevent congestion at the access point.	6

Term	Description	Volume
General-purpose route certificate	Route certificate that is stored in the receiver unit and is sent by a data carousel. When performing encrypted communication, the receiver unit refers to the general-purpose route certificate.	3
General-purpose route certificate storage number	Number to specify storage location of general-purpose route certificates and is location specified for storing general-purpose route certificates transmitted by data carousels.	3
General-purpose route certificate storage area	Area allocated to NVRAM of receiver units to store general-purpose route certificates.	3
General-purpose route certificate ID	ID to recognize the different types of general-purpose route certificates. The values are set by the certificate management group stated in section 6.	3
General-purpose route certificate version	Value to indicate the version of general-purpose route certificates. The values are set by certificate management group stated in section 6.	3
Program extended information	Program extended information is defined as detailed information included in program information that is basically transmitted in Commonly operated SI.	4
Program group index	Program group index is used to provide information on grouping of programs and support series definition and search using this grouping information.	4
caption	Program subtitle is defined as information and service to supplement the audio with texts.	4
Program characteristics code	Code used in user_nibble field (8 bit) that describes program characteristics. Used in Content Descriptors, etc.	1
Program segment index	In-program index provides information to support selection and search of part of a program (events in a program).	4
Service information	SI	4
Unlinked status	Status where the receiver unit only receives and plays communication contents. In this state, receiver units cannot refer to broadcast video or audio resources.	3
Additional data	Data section of TV programs with additional data.	3
Partial reception	Partial reception is defined as the reception of the one central OFDM segment only.	7
Superimpose	Superimpose is defined as the subtitle provided asynchronously to the main video, audio and data. It is used for up-to-the-minute news, changes in air times and time signals.	3, 4, 7
Plaintext	Data displayed before encryption.	6
Personal ID	Method for confirmation on whether it is a person (person in question) with authority to access receivers and IC cards. Uses a password (phrase) and PIN.	6
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.	4
Free Procedure (TTY Procedure)	Communication without providing protocols such as re-sending of the physical layer or higher. The simplest communication method that began from text communication of teleterminals with remote hosts.	6

Term	Description	Volume
Free program	Free Program is defined as the program whose default ES' are non-chargeable. This means the program whose free_CA_mode described in the SDT and EIT is set to 0.	5,8
Yagi Antenna	General receiving antenna for terrestrial television broadcasting. Antenna that sharpens direction by arranging multiple waveguide elements and reflection elements in parallel. They are also called Yagi-Uda antennas.	2, 9
Priority use net	Circuit class selected by the viewer when multiple circuit class (PSTN and mobile phones, etc.) use is possible in receivers.	6
Pay Program	Pay Program is defined as the program whose default ES' are chargeable. This means the program whose free_CA_mode described in the SDT and EIT is set to 1.	5,8
Programs to record confirmation number	The issued number of programs to record to manage cancellations, changes, issuing and inquiries for one reservation, etc., when reservation such as tickets are purchased on the network.	6
Reserved word	Set terms such as "starring", "producer", "summary", etc. regarding program.	1, 4
Reservation transmission	A function of registration transmission. Sends telegrams stored/saved by the registration transmission function at the time specified by the receiver unit. Registration (programming) of reservation transmission is done by the viewer.	3
Request header	Header given to request messages used only for request messages.	3
Request message	Unit of request for HTTP/1.1 servers.	3
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.	4,7
Temporary service	Service to create temporary SDTV channels by creating an extra bandwidth by lowering the bit rate of but keeping the fundamental component service. Emergency news services, etc.	3
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.	7
Recording	To record broadcasting services in the transport stream or partial transport stream format on D-VHS or HDD. Recording function is optional for basic receiver units. (In case of referring to analog recording, write "analog recording" explicitly)	3
Programmed recording	To reserve (program) recording of programs by event unit, based on SI information.	3
Congestion	The phenomenon of the telephone not connecting due to the concentration of communication that exceeds the unit time processing performance in the switchboard. The congestion increases due to the repeated re-dialing of the other party until a connection is made.	6

4 Hierarchical Configuration for Operation and Available Parameters

Digital terrestrial television broadcasting allows hierarchical transmission – the simultaneous transmission of signals with multiple transmission parameters.

Each layer of the hierarchy consists of independent or grouped OFDM segments (a maximum of 13 segments in total) with one transmission parameter and hierarchical transmission is possible in up to three layers.

Fig. 1 shows an example of how segments are configured at hierarchical transmission in three layers.

The 13 OFDM segments to which three different types of transmission parameters are assigned independently or collectively are transmitted using frequency interleaving, as specified in ARIB STD-B31.

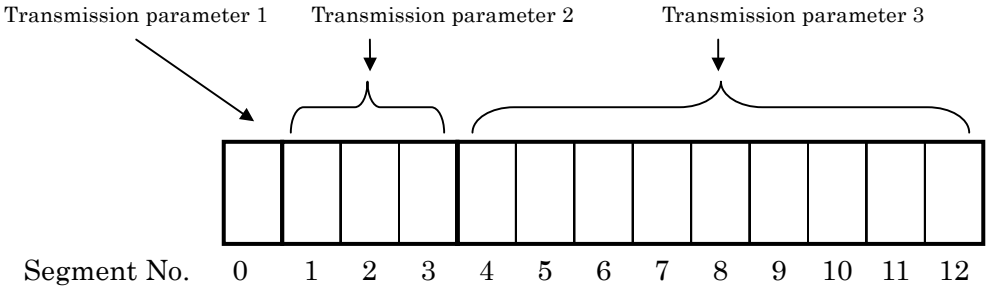

Fig. 1 An Example of Hierarchical Transmission

4.1 Transmission Parameters in Each Layer

Table 1 shows transmission parameters that can be specified in each layer and transmission parameters that are assigned collectively to the 13 segments.

Table 1 Specification Using Transmission Parameters

Parameters specified using the 13 segments	Parameters that can be specified in each layer
Transmission mode Guard interval ratio	Carrier modulation Convolution coding rate Time interleaving length

4.2 Available Parameters According to Hierarchical Transmission Mode

Table 2 Available Parameters According to Hierarchical Transmission Mode

Pattern	Layer	Layer Name	Number of segments	Transmission (Note) (See Table 3)	Television Service		Download (See Table 6)	SI/EPG (See Table 7)	Data and interactive (See Table 8)	CAS (See Table9)
					Video (See Table 4)	Audio (See Table 5)				
(1)	A	Low Protection Layer	13	a	A	a	B	a	a	c
(2)	A	Low Protection Layer	13	b	A	a	B	b	a	c
(3)	A	High Protection Layer	1 (Partial reception)	c	−	b	C	c	c	d
	B	Low Protection Layer	12	a	A	a	A	a	a	b
(4)	A	High Protection Layer	8 to 2	b	B	a	C	e	a	c
	B	Low Protection Layer	5 to 11	a	A	a	A	a	a	a
(5)	A	High Protection Layer	1 (Partial reception)	c	−	b	C	d	c	d
	B	Low Protection Layer	12	b	A	a	A	b	a	b
(6)	A	High Protection Layer	1 (Partial reception)	c	−	b	C	d	c	d
	B	Middle Protection Layer	7 to 1	b	b	a	−	e	a	b
	C	Low Protection Layer	5 to 11	a	a	a	a	a	a	a

(Note) With regard to combinations of transmission parameters, Type c of transmission mode shall take transmission parameters with an equal or lower CN ratio than Type b of transmission mode and Type b of transmission mode shalltake transmission parameters with a lower CN ratio than Type a of transmission mode. The required CN ratios are shown in Table 3-2 in 3.2 in Chapter 3 of ARIB STD-B31 Appendix (Operation Guidelines for Digital Terrestrial Television Broadcasting). For example, if layer A in (5) uses 16QAM and 1/2, layer B mayuse only 16QAM and 1/2, or 16QAM and 2/3 as shown in b in Table 3 as modulation and error correction parameters.

Layers: A, B and C represent layers described in the TMCC signal.
Layer name: The name of the layer usedin the document.
Number of segments: In the case of (4) and (6), the number of segments (=5) which can ensure a maximum rate of 8 Mbit/s shallbe the minimum number of segments in the low protection layer.
Video: MP@HL shallbe availablefor the layers that can ensure a maximum rate of 10 Mbit/s. The partial reception layer shall be able to carry low-frame-rate and low-resolution picture as part of data broadcasting. See Vol. 3 for more information on provisions for low-frame-rate and low-resolution picture. For audio transmission, transmission mode (Type c) in Table 5 shallbe used.

The services provided by the layers to which transmission mode (Type a), transmission mode (Type b) and transmission mode (Type c) shown in Table 2 are respectively applied may be called the “fixed service”, “mobile service” and “portable service”, respectively.
No digital audio service will be provided.

Table 3 Transmission Parameters

Type	Mode and Guard Ratio (Note 1)					Time Interleave (Note 2)				Modulation and Error Correction (Note 3)														
	Mode 3			Mode 2		(Mode 3, Mode 2)				64QAM					16QAM (Note 4)					QPSK				
	1/4	1/8	1/16	1/4	1/8	I=0,0	I=1,2	I=2,4	I=4,8	7/8	5/6	3/4	2/3	1/2	7/8	5/6	3/4	2/3	1/2	7/8	5/6	3/4	2/3	1/2
a	O	O	Δ	O	Δ	X	O	O	O	O	O	O	O	O	X	X	X	O	O	X	X	X	X	X
b	O	O	Δ	O	Δ	X	O	O	O	X	X	X	X	X	X	X	X	O	O	X	X	X	O	O
c	O	O	Δ	O	Δ	X	O	O	O	X	X	X	X	X	X	X	X	X	O	X	X	X	O	O

O: Transmission parameters that can be used
X: Transmission parameters that cannot be used
Δ: The use of mode 3 with 1/16 guard ratio and mode 2 with1/8 guard ratio is considered difficult when considering the current location of stations. It is assumed, therefore, that the use of these combinations will be possible following frequency reorganization in the future.

Note 1: The mode and guard ratio are specified and applied to all layers and they cannot be individually specified for each layer.
Note 2: The use of "no time interleaving (I=0)" shallbe restricted even in fixed reception, considering the tolerance to pulse noise.
Note 3: DQPSK shall not be used.
Since the application of Type b and c is mainly assumed for mobile reception, processing such as interpolating the SP (scattered pilot) in the time domain is expected to improve receiving performance in mobile reception.
Note 4: The use of 16QAM and 2/3 combination and 16QAM and 1/2 combination in Type a shallbe limited to emergency situations, such as during accidents and disasters.

Table 4 Video

Type	Coding system	MPEG-2							
		MP@HL			MP@14L	MP@ML			MP@LL
	Size	1920 x 1080 I	1440 x 1080 I	1280 x 720 P	720 x 480 P	720 x 480 I	544 x 480 I	480 x 480 I	352 x 240 P
	Frame rate	30/1.001 Hz	30/1.001 Hz	60/1.001 Hz	60/1.001 Hz	30/1.001 Hz	30/1.001 Hz	30/1.001 Hz	30/1.001 Hz
a		O	O	O	O	O	O	O	O
b		X	X	X	O	O	O	O	O

O: Means that the data can be transmitted.
X: Means that the data cannot be transmitted.

Table 5 Audio

Type	MPEG-2 AAC LC							
	48kHz Audio and 24kHz Audio				Multiple ES' *1	24kHz Audio Half-rate		
	Mono	Stereo	Multi-channel	Dual mono		Mono	Stereo	Dual mono
a	O	O	O	O	O	X	X	X
b*2	O	O	X	O	O	O	O	O

O: Means that the data can be transmitted.
X: Means that the data cannot be transmitted.
*1: The number of audio ES' that can be referenced by a service carried in the layer.
*2: The sampling rates are only 48kHz and 24kHz (half rate).

Table 6 Download

Type	Download contents	SDTT for the low protection layer		SDTT for the high protection layer		Logo	
		For software for the receiver unit	For common data (Note 2)	For software for the receiver unit	For common data (Note 3)	Simple logo	PNG logo
A	Δ (Note 1)	O	O	X	X	X	O
B	Δ (Note 1)	O	O	O	O	O	O
C	X	X	X	O	O	O	X

O: Means that the data can be transmitted.
Δ: Means that the data is carried by at least one TS in the target broadcast area, although not mandatory for all broadcasting companies.
X: Means that the data cannot be transmitted.

Note 1: Download contents are transmitted by at least one transport stream (1TS) in the target broadcast area. Transmitting of download contents is not mandatory for all broadcasters.
Note 2: SDTT for data used by all receiver units such as genre code tables, program characteristic code tables and reserved word tables.
Note 3: SDTT for frequency lists and modification information are assumed.

Table 7 SI/EPG

Type	Layer Used		Other Layers
	Basic	Extended	Extended
a	H-EIT	X	X
b	M-EIT	H-EIT	X
c	L-EIT	M-EIT	H-EIT
d	L-EIT	X	M-EIT, H-EIT
e	M-EIT	X	H-EIT

X: Means that the data cannot be transmitted.

Table 8 Data broadcasting and interactive service

Type	Multi Media service transmission		Multi Media service transmission system	Mono-media for transmission					Interactive service protocol	caption and superimpose
	Data coding and identification	BML version		MPEG-1 Video	MPEG-2 Video	H.264 (Note 1)	MPEG-2 AAC	Other		
a	0x000C	3.0	-Data carousel -Event message -NPT reference message	O	O	X	O	-MPEG-2 AAC (file) -AIFF-C -JPEG -PNG/MNG -8-bit character codes	-TCP/IP (HTTP, TLS1.0, SSL3.0) -BASIC procedure (Note 2)	O
c	0x000D	12.0	-Data carousel -Event message	X	X	O	O	-MPEG-2 AAC (file) -JPEG -PNG/MNG	-TCP/IP (HTTP)	O*1.

O: Means that the data can be transmitted.
X: Means that the data cannot be transmitted.
*1: Superimposes shall not be operated.

Note 1: See Vol. 3 for more information on low-frame-rate and low-resolution picture.
Note 2: BASIC procedure is mandatory for the receiver units with an internal modem.

Table 9 CAS

Type	CAT	EMM		ECM
		EMM	EMM message	
a	X	X	X	O
b	Xx	O	O	O
c	O	O	O	O
d	O	Δ	X	Δ

O: Means that the data can be transmitted.
X: Means that the data cannot be transmitted.
Δ: Transmission is available in the case of pay program.

4.3 Types and Desired Functions of Receivers

This section describes examples of functions of receivers and desired receiving functions.

Table 10 does not show actual regulatory requirements for the types and receiving functions of receivers. It shows the types and receiving functions of receivers assumed to be necessary to provide services discussed in section 4.2.

For more information on the provisions for receivers, see Vol. 2.

Table 10 Desired Receiving Functions

Classification of receivers		13-segment receiver	1-segment receiver
Download	Contents	O	Optional
	SDTT (Low Protection Layer)	O	–
	SDTT (High Protection Layer)	O	O
	Logo (PNG)	O	–
	Logo (Simple)	O	O
Data	Profile	A	C
SI/EPG	H-EIT	O	–
	M-EIT	Optional	–
	L-EIT	Optional	O
	Displayed by all stations	O	Optional
Content protection		O	Δ
CAS		O	–
Interactive program		O	Optional
Demodulator	Number of segments	13	1
	Mode	2, 3	2, 3
	Guard ratio	1/4, 1/8, 1/16	1/4, 1/8, 1/16
	Interleaving	Mode 3: I=1,2,4 Mode 2: I=2,4,8	Mode 3: I=1,2,4 Mode 2: I=2,4,8
	Modulation and correction	QPSK: 1/2, 2/3 16QAM: 1/2,2/3 64QAM: All	QPSK: 1/2, 2/3 16QAM: 1/2
Video	MP@HL	O (including down-converting of resolution)	–
	MP@14L	O (including down-converting of resolution)	–
	MP@ML	O	–
	MP@LL	O	–
	H.264	Optional	O
Audio	Mono	O	O
	Stereo	O	O
	Multi-channel	O	–
	Dual mono	O	O
	Multiple ES'	O	O
	Mono (Half-rate)	Optional	O
	Stereo (Half-rate)	Optional	O
	Dual (Half-rate)	Optional	O

O : Means that it is strongly required that the function is installed in the receivers to provide service.
Optional : Means that the installation of the function is not always required.
– : Means that the installation of the function is not required.
Δ :Copy Control Information is transmitted but contents are not scrambled.

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Vol. 1

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Provisions for Download Operation

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1 Introduction

The information updating service in receivers in terrestrial digital television broadcasting is implemented according to the provisions of ministerial ordinance and notification, as well as the Association of Radio Industry and Businesses (hereinafter ARIB) standard criteria “Receiver for Digital Broadcasting” (ARIB STD-B21), “Data Coding and Transmission Specification for Digital Broadcasting” (ARIB STD-B24), and “Service Information for Digital Broadcasting System” (ARIB STD-B10). However, it is necessary to separately establish provisions for detailed operations in order to design receiver details, thus this “Digital Terrestrial Television Broadcasting Provisions for Download Operation” was established. Also, refer to service stipulations of downloading business regarding further detailed operations.

2 References

(1) “Service Information for Digital Broadcasting System” ARIB Standard, ARIB STD-B10

(2) “Receiver for Digital Broadcasting” ARIB Standard (Desirable Specification), ARIB STD-B21

(3) “Data Coding and Transmission Specification for Digital Broadcasting” ARIB Standard, ARIB STD-B24

(4) “Conditional Access System Specifications for Digital Broadcasting” ARIB Standard, ARIB STD-B25

3 Definitions

Terms used in this Volume shall be defined as follows:

CDT	Common Data Table: Table to transmit download contents. Only logos will be operated for the time being. (Refer to 5.4 “CDT Method Transmission”).
Engineering service	Service type 0xA4 information updating service in receivers notified by the SDTT procedure and transmitted by the data carousel.
Genre code	Code used in **content_nibble_level_1** (4 bit) and **content_nibble_level_2** field (4 bit) that specify genre. This is used in Content Descriptors, etc.
Schedule information	Download start time and download duration time stored in the SDTT schedule loop.
Information updating service in receivers	Service that distributes and stores receiver software, Common Data to All Receivers ,logos, etc. in non-volatile memory, etc.
Module information	Information regarding downloaded modules that is set in **module_info_byte** in DII.
Logo	Logo mark used by receivers for EPG, program selection, etc. that is defined for each broadcaster or service.
Logo ID	ID given to logo data used by each broadcaster. They are unique for each network, and are managed by each broadcaster. The Logo ID is common for all 6 logo types.
Logo type	Logo data prepared for different display formats such as SDTV, HDTV, etc. There are 6 of them defined.
Logo Transmission Descriptor	Record of logo transmission type, pointing of a logo in CDT style, string for simple logos, etc.
Approval information	Information that describes whether or not mandated downloading can be performed unconditionally depending on the implementation approval function of the receiver.
High protection layer	Layer whose CN ratio is the lowest at the time of layered transmission. (Refer to Vol. 7, 7.1.)
SDTT for high protection layer	SDTT transmitted in high protection layer or transmitted through transmission routes whose layer number are 1. No downloading contents transmission is performed along with SDTT for the high protection layer of receiver software.
Mandated downloading	Downloading that requires mandated implementation
Notification Information	Information used for notifications such as downloading **service_id**, schedule information, receiver models for updating. Transmitted using SDTT.
Low protection layer	Layer whose CN ratio is the highest upon layered transmission. (Refer to Vol. 7, 7.1.)
SDTT for low protection layer	SDTT transmitted in low protection layer or transmitted through transmission routes whose layer number are 1.
Frequency list change information	Frequency list information and modification information, etc. of nationwide transmitting stations to correspond to frequency repacking. (Date of change, changed frequency, etc.)
Frequency repacking	To change the current transmitting station’s frequency in order to structure an optimized network.
Receiver software	Structures receiver software. Application, library, OS, driver, data, etc.

Product planning	Receiver functions or actions which depend on the hardware design, the software design of the receiver planed by each manufacturer.
Selective (optional) downloading	Download that is implemented according to the viewer's selection after displaying downloads that can be implemented.
Common Data to All Receivers	Data stored in the receiver and commonly used in the receiver. Logo data, Genre Code Table, Program Characteristics Code Table, Reserved Word Table, Frequency List and Modification Information, etc.
Program characteristics code	Code used in **user_nibble** field (8 bit) that describes program characteristics. Used in Content Descriptors, etc.
Reserved word	Set terms such as "starring", "producer", "summary", etc. regarding program.

4 Use and Premise of Downloading

Software update for receivers

This makes correction in software for receivers. It performs bug-fixing, correction of defects due to differences in understanding regarding operation between the transmitter and receiver, improvement of display, improvement in operation, etc.

Updating Common Data to All Receivers

(1) Updating Genre Code Table and Program Characteristics Code Table

a Does not change already defined domains but only makes additions.

b Record of contents to define each table shall be 20 characters maximum and less than 40 bytes. The standard maximum value for updating data character numbers shall be the same.

c Regarding the Program Characteristics Code Table, only the ones whose **content_nibble** is 0xE0 are targeted. Also, information shall use wording that presumes actual display.

(2) Updating the Reserved Word Table

a Does not change already defined domains but only makes additions.

b The maximum reserved word length shall be 8 characters and less than 16 bytes. The standard for updating data shall be the same.

c Since reserved words are item names that are coded in the Extended Event Descriptor of Service Information, there shall be no coding of it.

(3) Updating logo data

This updates logo data for broadcasting stations that can be received at the receiver's location. Receivers should not carry logo data in its initial status of shipment. Each broadcasting station downloads logo data of the service that they wish to be displayed onto the receiver.

a For logo data, changes may occur for already defined data.

b Logo data is compressed on the broadcaster side. However, for data size prior to compression, 1/2 for large logos and 3/4 for small logos shall be the maximum data size for each logo type. Also, it shall also be possible to share one logo data among multiple numbers of **service_id**'s. Considering the number of broadcasters and services presumed in terrestrial broadcasting, receivers can delete and/or update data in non-volatile memory. Also, 480 service numbers and 180 logo data can simultaneously be stored in non-volatile memory. Logo data shall be managed in

the receiver by using combinations of network ID's and logo ID's (9 bit). The logo ID is common for all 6 logo types.

c The logo size pattern is shown in Table 4-1[1,2]. Also, logo data that is not on the NIT cannot be transmitted.

Table 4-1 Logo Mark Size Pattern for Transmission (logo type)

Logo type	Vertical dot No.	Horizontal dot No.	Vertical / horizontal ratio of presumed pixels	Vertical/horizontal ratio of display	logo_type value	Memory necessary per logo (byte)
HD large	36	64	Square pixel	9 : 16	0x05	1152
HD small	27	48	Square pixel	9 : 16	0x02	972
SD4:3 large	36	72	1.118 : 1	9 : 16	0x03	1296
SD4:3 small	24	48	1.118 : 1	9 : 16	0x00	864
SD16:9 large	36	54	1.118 : 1.333	9 : 16	0x04	972
SD16:9 small	24	36	1.118 : 1.333	9 : 16	0x01	648

In the service, the design and color shall be the same even if the size pattern is different. Colors that can be used for logo data designs shall only be the common fixed colors (128 colors) and any other color than this shall not be used.

For logo mark data before compression, 1 dot color shall be described with 8 bit. Use a fixed color pallet where common fixed colors are provided, and convert values of 1 dot colors into colors to be actually displayed. Follow Vol. 3, Appendix-1 "Receiver unit common fixed colors" for common fixed colors and the color pallet.

Use "PNG" for logo mark compression. PNG shall be provided by "W3C Recommendation 1996/10/01 Version 1.0", and operated in the following formats.

1) Chunks used for it shall only be IHDR, IDAT, and IEND.

2) Set as follows for IHDR.

Width:	4 byte	Set dot of logo.
Height:	4 byte	Set vertical dot of logo.
Color depth:	1 byte	Set to "8"
Color type:	1 byte	Based on Vol. 3
Compression Procedure:	1 byte	Set to "0"
Filtering Procedure:	1 byte	Set to "0"

[1] HD logo size pattern presumes 960 x 540 pixels for screen resolution.
[2] Use the same one as the HD for 720P format.

Interlace Procedure: 1 byte Set to “0”

3) Standards for parameters other than those described above shall be based on Vol. 3.

d Simple logos shall be the ones that can display 5 alphanumeric characters maximum, and other parameters for displays shall be up to product planning. Useable fonts shall be the ARIB STD-B24 Vol. 1 Part 2, Table 7-5 “Alphanumeric set and proportional alphanumeric set” only.

(4) Update Frequency List and Modification Information

With digital terrestrial television broadcasting, implementation of so-called frequency repacking is presumed. That refers to when frequency used in digital broadcasting is changed upon completion of analog broadcasting.

Upon this, corresponding to frequency change is presumed to be possible causing as little trouble as possible for the viewers by notifying the changing frequency information to the receiver prior to the event, using an engineering service. Refer to each chapter in this volume for contents of SDTT, downloading contents and transmission procedure regarding the Frequency List and Modification Information for repacking correspondence. Also, refer to Vol. 2 for receiver operations regarding the Frequency List and Modification Information.

5 Download Transmission Guidelines

5.1 Download Transmission Model for Digital Terrestrial Television Broadcasting

In this chapter, an overview of download transmission for terrestrial digital television broadcasting is given. Also, refer to the corresponding chapters for the format of each signal, transmission procedure, etc.

5.1.1 Download Contents

There are 2 types of transmission procedures for download contents in terrestrial digital television broadcasting. They are both based on transmission in the low protection layer within layers used by each broadcaster (excluding simple logo). If the transmission route layer number is 1, it shall be transmitted in that layer.

(a) In the broadcasting target area, Common Data to All Receivers such as receiver software and genre, reserved words, frequency list are transmitted by at least 1 TS (specified by Service List Descriptor of the NIT).

(b) Each broadcaster transmits their own logo with each TS.

Above (a) is transmitted as an engineering service by using data carousels. For (b) logos, logo data transmitted as PNG data shall be distributed by using CDT (Common Data Table). Also, characters used in simple logos (5 characters maximum in alphanumeric symbols) shall be set in the Logo Transmission Descriptor of the SDT.

5.1.2 Notification Information

There are the following 2 types of SDTT (Software Download Trigger Table) that conduct downloading notification in above (a), and are transmitted in a different PID. The transmission layer and transmission rate for each SDTT are according to Table 5-1.

Table 5-1 Transmission Layer and Transmission Rate

SDTT Type	Transmission layer	Model number	Standard description length (bytes)	Standard schedule number	Standard section size (bytes)	Cycle (seconds)	Maximum transmission rate (kbit/s)
SDTT for low protection layer	Low protection layer or transmission route whose layer number is 1	180	800	24	1287 *1 (Equivalent to 7TSPs)	180	10.5
SDTT for high protection layer	High protection layer or transmission route whose layer number is 1	240	100	1	183 *1 (Equivalent to 1 TSP)	180	2.0

*1: Considering pointer field 1 byte.

(Supplemental Explanation)

- The SDTT for low protection layer is transmitted in the low protection layer, and the SDTT for high protection layer is transmitted in the high protection layer in the TS (refer to Vol. 7, 7.1). If it is transmitted through a transmission route whose layer number is 1, both the SDTT for the low protection layer and the SDTT for the high protection layer are transmitted in the layer.
- The SDTT for high protection layer of receiver software shall only perform notifications, and transmission of download contents shall not be accompanied. The SDTT for low protection layer, as the SDTT for BS/wideband CS digital broadcasting, carries a function to notify receivers of the download content distribution date and such as well as automatically conduct downloading. Refer to 5.3.1 “Transmission of Notification Information” for details.
- For Common Data to All Receivers, the Genre CodeTable, Program Characteristic Code Table, and Reserved Word Table shall use the SDTT for low protection layer, and the Frequency List and Modification Information shall use the SDTT for high protection layer. Refer to 5.3.1 “Transmission of Notification Information” for details.
- Model numbers here refer to model numbers when the SDTT section is transmitted in standard section size by all models at the maximum transmission rate. It is possible to transmit SDTT sections larger than the standard section size (4,096 bytes maximum), but the model number is reduced in that case. Refer to 5.3.1 “Transmission of Notification information” for details.

While a logo is being distributed using the above (b) CDT, the Logo Transmission Descriptor is placed in the service loop of the SDT to refer the logo, making logo distribution detectable while pointing to the CDT.

Table 5-2 describes the transmission pattern for signals regarding downloading. Also, Table 5-3 describes the transmission pattern for Common Data to All Receivers.

Table 5-2 Transmission Pattern for Signals Regarding Downloading

Pattern	Layer used	Segment No.	Download pattern *4	Download contents *1	SDTT				Logo	
					SDTT for the low protection layer		SDTT for the high protection layer		Logo Transmission Descriptor (including simple logo)	CDT(PNG logo data)
					Receiver software	Common data *2	Receiver software	Common data *3		
(1)	A *5	13	b	□	○	○	○	○	○	○
(2)	A *5	13	b	□	○	○	○	○	○	○
(3)	A	1	c	×	×	×	○	○	○	×
	B	12	a	□	○	○	×	×	×	○
(4)	A	2-8	c	×	×	×	○	○	○	×
	B	5-11	a	□	○	○	×	×	×	○
(5)	A	1	c	×	×	×	○	○	○	×
	B	12	a	□	○	○	×	×	×	○
(6)	A	1	c	×	×	×	○	○	○	×
	B	1-7	-	×	×	×	×	×	×	×
	C	5-11	a	□	○	○	×	×	×	○

○: Transmittable

□: Not required for all broadcasters, but transmitted at a minimum of 1 TS in the broadcasting target area

×: Not transmitted

*1: For download contents, 1 TS is transmitted in the broadcasting target area, but not necessarily transmitted by all broadcasters.

*2: SDTT for data used by all receivers such as the Genre Code Table, Program Characteristics Code Table, Reserved Word Table, etc.

*3: SDTT for the Frequency List and Modification Information for frequency repacking.

*4: Refer to Table 2 and Table 6 for the operation summary of download patterns.

*5: Pattern (1) modulation is 64QAM and pattern (2) modulation is 16QAM or QPSK. Refer to Table 2 and Table 3 for the operation summary.

Table 5-3 Transmission Pattern for Common Data to All Receivers

Pattern	Layer used	Segment No.	Download pattern	Engineering service	Each station TS		High protection layer SDTT
				Genre, reserved words, program characteristics, frequency list and modification information	method	method	Repacking information for portable receivers
(1)	A *	13	b	○	○	○	○
(2)	A *	13	b	○	○	○	○
(3)	A	1	c	×	×	○	○
	B	12	a	○	○	×	×
(4)	A	2-8	c	×	×	○	○
	B	5-11	a	○	○	×	×
(5)	A	1	c	×	×	○	○
	B	12	a	○	○	×	×
(6)	A	1	c	×	×	○	○
	B	1-7	-	×	×	×	×
	C	5-11	a	○	○	×	×

*: Pattern (1) modulation is 64QAM, and pattern (2) modulation is 16QAM or QPSK. Refer to Table 2 and Table 3 for the operation summary.

5.1.3 Engineering Services for Multiple TS Transmission at Different Times

When implementing the terrestrial digital broadcasting engineering service in specified TS as BS and wideband CS, the difficulty of engineering services where the TS cannot be received is expected at some point in some area. It is ideal to implement the engineering service in multiple or all TS's in order to resolve this. When implementing the engineering service in multiple or all TS's, reception precision will improve by each TS transmitted by differing the transmission time rather than transmitting the download contents at the same time due to the fact there are more opportunities for reception. Refer to corresponding chapters for operations of PSI/SI, SDTT, and download contents in case of engineering services for multiple TSs transmission at different times.

5.1.4 Downloading Frequency List and Modification Information

The Frequency List and Modification Information shall use both of the 2 following transmission procedures to distribute to receivers.

5.1.4.1 SDTT for the High Protection Layer

This transmits the minimum amount of necessary information that can be corresponded by portable receivers (target area, change start date, change operation duration, etc.) and transmit link information to the below engineering service as well as promoting frequency scanning to receivers (viewers).

5.1.4.2 Engineering Service

This enables automatic tuning in frequency changes without troubling viewers as much as possible, by transmitting further detailed information (frequency list before and after the change, change date, etc.) to fixed receivers, etc.

The Frequency List and Modification Information can not only be used for repacking correspondence but also in the cases as follows.

- Corresponding to situations where a station, previously performing a master station through transmission (relay station operation, which re-transmits TS from a master station) starts transmissions as a local station in MFN.
- Sub ordinance with receiver corresponding to situations where new broadcasting business joins or starts broadcasting in transmission sites where there already have the station and transmission.
- Supporting to add stations to the reception table in the receiver whose broadcasting was on pause in installation scanning.

For details, refer to the corresponding chapters of this volume and Vol. 2, 7.11 “Download“.

5.2 Transmission of PSI/SI Regarding Downloading

5.2.1 Operation of the Engineering Service

The engineering service shall always perform the following operation in networks where it exists.

(1) “Engineering service type (0xA4)” shall be placed in the second loop of Service List Descriptor of the NIT.

(2) **Data_component_id** in Data Component Descriptor in PMT is 0x0009 (ARIB-data download procedure). Additional_data_component_info is not transmitted.

(3) The service_id of the engineering service shall be operated with the same ID value nationwide while transmitting engineering services with a single TS. However, the **service_id** is distributed for each schedule if a transmission at different times is performed from multiple TS’s. The **network_id** and **transport_stream_id** value shall be the value per network transmitted. Refer to 5.3.2.1 “Transmission of Download Contents” for details on the **service_id** distribution.

(4) The **original_network_id** and **transport_stream_id** values, set in the NIT, PAT and BIT that describe the engineering service transmitted in the concerned network, shall be the values for each network transmitted. Therefore, in order to omit replacement operations by each broadcasting station of **original_network_id** and **transport_stream_id** values in the SDTT, the value is unique for digital terrestrial television broadcasting for the **original_network_id** and **transport_stream_id** in the SDTT in case of transmission routes A and B provided in 5.3.1.2 “Operation of SDTT”. Refer to 5.3.1.2 “Operation of SDTT (Software Download Trigger Table)” for details.

(5) There may be cases where PCR is not transmitted in engineering service.

(6) A maximum of 1 second is permitted for the PMT repetition rate of engineering services.

5.2.2 Operation of the Logo Transmission Descriptor

5.2.2.1 Logo Transmission Descriptor Syntax and logo_transmission_type

Table 5-4 describes the Logo Transmission Descriptor syntax. As it can be observed, the syntax is made so that only necessary data is set for each **logo_transmission_type**. Also, in digital terrestrial television broadcasting, this Logo Transmission Descriptor is placed when a logo is defined in the service in the service loop of the SDT. Also, no multiple numbers of Logo Transmission Descriptors shall

be set in the same service loop.

Also refer to ARIB STD-B10, STD-B21 for Logo Transmission Descriptors.

Table 5-4 Logo Transmission Descriptor Syntax

Syntax	No. of bits	Mnemonic
Logo_transmission_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
logo_transmission_type	8	uimsbf
if(logo_transmission_type == 0x01){		
reserved_future_use	7	bslbf
logo_id	9	uimsbf
reserved_future_use	4	bslbf
logo_version	12	uimsbf
download_data_id	16	uimsbf
}		
else if(logo_transmission_type == 0x02){		
reserved_future_use	7	bslbf
logo_id	9	uimsbf
}		
else if(logo_transmission_type == 0x03){		
for(i=0;i<N;i++){		
logo_char	8	uimsbf
}		
}		
else {		
for(j=0;j<M;j++){		
reserved_future_use	8	bslbf
}		
}		
}		

logo_transmission_type : Describes the logo transmission type. Only the 3 types described in Table 5-5 are operated in digital terrestrial television broadcasting. Other types of Logo Transmission Descriptors may be ignored.

Table 5-5 Logo Transmission Type

logo_transmission_type value	Definition
0x01	CDT transmission type 1
0x02	CDT transmission type 2
0x03	Simple logo type
Other than above	For future use

logo_id : ID values for the service logo defined in the concerned service are set.

download_data_id : Matches the CDT **table_id_extension** value where the concerned service logo data is placed. Also, the **download_data_id** shall be unique in the network, as well as given a different **download_data_id** value per **logo_id**.

logo_version : Sets the concerned **logo_id** version number. The same value as **data_module_byte()** logo version number in CDT shall be given.

logo_char : This 8 bit sets 8-bit character code string for simple logos.

reserved_future_use : For future use. “1” is set for all concerned bits.

5.2.2.2 If the logo_transmission_type is CDT Transmission Type 1

This type of Logo Transmission Descriptor shall always be set in the service loop of the SDT that fits the following as well as transmitting logo data in the CDT.

(1) If the logo defined in the service is not used in another service for the concerned TS.

(2) If the logo defined in the service is also used in a multiple number of services for the concerned TS, and is the first service of the service loop order of the SDT.

5.2.2.3 If the logo_transmission_type is CDT Transmission Type 2

If it transmits logo data in CDT style and the logo defined in the service is also used in a multiple number of services in the concerned TS, as well as the service being the second service of the service loop order of the SDT. Receivers can acquire the rest of the parameters from the Logo Transmission Descriptor in CDT transmission style 1 where the same **logo_id** is set.

5.2.2.4 If the logo_transmission_type is a Simple Logo Type

Only sets 8-bit character code of alphanumeric 100 bytes or less and 5 characters or less. Initial status shall be based on the Vol. 4. 11 bytes, the sixth character and after, and character codes that are not useable may be omitted for display. Receivers use the string for processing to display as logos for expediency, but its procedure and such are up to product planning.

Note) Because the **logo_transmission_descriptor** is placed in the SDT, the code shall be set in 8-bit character code as the string field of Vol. 4. Useable font types shall only be ARIB STD-B24 VOLUME 1 Part 2, Table 7-5 “Alphanumeric set and proportional alphanumerical set”. Operations of control code SP and DEL shall also be based on ARIB STD-B24 Vol. 1. However, not only 1-byte but also 2-byte alphanumeric codes can be used. Initial status shall also be based on the Vol. 4 of the document. Also, to presume presenting simple logo to match the 6 logo size types shown in Table 4-1, the font size provided in Vol. 3 of the document will not match (for example, to present in SD16:9 small logo size, the size is 24×36 dots. If you use the 20 pixel font provided in Vol. 3, you will end up using 20×10 characters even if they are displayed in half width characters, resulting in only being able to display 3 characters maximum. It is necessary to use special fonts whose width is 6 dots, in order

to present 5 characters). Therefore, receivers are presumed to use special fonts for simple logos. Useable characters are limited to alphanumeric.

5.2.3 Transmission Existence Judgment of Download Related Tables

5.2.3.1 SDTT Transmission Judgment

There are 2 types of SDTT, for the low protection layer (PID=0x0023) and for the high protection layer (PID=0x0028), but they are both transmitted in case of transmission, and the repetition rate is same as well.

In case of SDTT transmission in the concerned network, set SDTT (0xC3) for the **table_id** value of “SI Transmission Parameter Descriptor” placed in the second loop of the BIT. Therefore, receivers can detect the fact that the SDTT is transmitted in the TS in the concerned network by the fact that 0xC3 is set there.

5.2.3.2 CDT Transmission Judgment

In case of CDT transmission in the concerned network, set CDT (0xC8) for the **table_id** value of “SI Transmission Parameter Descriptor” placed in the second loop of the BIT. Therefore, receivers can detect the fact that the CDT is transmitted in the TS in the concerned network by the fact that 0xC8 is set there. Also, the CDT for logo transmission should be transmitted in case Logo Transmission Descriptor of CDT transmission type 1 was placed in the service loop of the SDT.

5.3 Transmission of the SDTT Procedure

5.3.1 Transmission of Notification Information

5.3.1.1 Transmission Route

In principle, in all TS's, transmit the SDTT for low protection layers in its low protection layer and the SDTT for high protection layers in its high protection layer (refer to Vol. 7, 7.1). If transmitted in a transmission route whose layer number is 1, transmit both the SDTT for low protection layers and the SDTT for high protection layers in the layer. Also, it is possible that there may be some TSs whose notification information is not transmitted. The SDTT for low protection layers is transmitted in a PID of 0x0023, and the SDTT for high protection layers is transmitted in a PID of 0x0028.

5.3.1.2 Operation of SDTT (Software Download Trigger Table)

(1) Operating SDTT for low protection layers and SDTT for high protection layers

Operation of SDTT for low protection layers and SDTT for high protection layers are shown in Table 5-1. Table 5-1 is shown again as Table 5-6 below.

Table 5-6 SDTT Transmission Layer and Transmission Rate

SDTT Type	Transmission layer	Model number	Standard description length (bytes)	Standard schedule number	Standard section size (bytes)	Cycle (seconds)	Maximum transmission rate (kbit/s)
SDTT for low protection layer	Low protection layer or transmission route whose layer number is 1	180	800	24	1,287*1 (worth 7 TSPs)	180	10.5
SDTT for high protection layer	High protection layer or transmission route whose layer number is 1	240	100	1	183*1 (Worth 1 TSP)	180	2.0

*1: Considering 1 byte for pointer field.

Receiver software's SDTT for low protection layers shall be used for transmission of information necessary for the reception of download contents, and the SDTT for high protection layers shall be used to notify guides of receiver software update and updating procedure for users of receivers that cannot receive low protection layers and receivers in status that cannot receive low protection layers. Standard section size and schedule number for both SDTT are shown in Table 5-6. This "section size of standard SDTT" refers to the section length when divided evenly by model number at the maximum transmission rate (refer to later estimate).

However, it is possible to transmit sections whose size exceeds this (4,096 bytes maximum). Also, a standard schedule number is a rough idea; operation of schedule numbers over this is also possible in the restriction range of the maximum transmission rate.

When the **original_network_id** of download contents transmission routes set in the SDTT is 0x7FFF, it shall correspond to content transmission A and B described in Table 5-7. In other cases, it implies that the download contents are being transmitted via a transmission route specified by the SDTT **original_network_id**, **transport_stream_id**. Also, when the **original_network_id** is 0x7FFF, the **transport_stream_id** shall indicate the following meanings.

transport_stream_id:

0xFFFF; high protection layer SDTT, as well as content transmission route specification B

0xFFFE; low protection layer SDTT, as well as content transmission route specification B[*2]

0xFFFD; high protection layer SDTT, as well as content transmission route specification A

0xFFFC; low protection layer SDTT, as well as content transmission route specification A

[*2]: Not operated in digital terrestrial television broadcasting.

Table 5-7 Content Transmission Route Specifications

Transmission route specification	Type of content transmission specification	service_id set in SDTT	Meaning
0	Content transmission route specification A	0xFFF0 (Refer to 5.3.2.1 "Transmission Route" for details)	Download contents are transmitted in the service specified by the service_id of TS that conducts terrestrial digital engineering service for each area.
1	Content transmission route specification B	0xFFFF	Download contents are not transmitted in broadcasting.

SDTT sub-table of Common Data to All Receivers shall be a maximum length of 1 section and 4,096 bytes maximum, and shall only be transmitted in the SDTT for low protection layers. Also, multiple sections are possible in each sub-table in case of receiver software updates, but the entire section number including receiver software update and Common Data to All Receivers shall be 180 maximum in the SDTT for low protection layers and 240 maximum in the SDTT for high protection layers.

(2) SDTT operation upon multiple TS transmission at different times

When conducting transmission at different times with multiple numbers of TS, the

service_id set in the SDTT shall be operated in 0xFFF0 for the time being. For schedule information, set the schedule information of download contents whose **service_id** is 0xFFF0. Also, operate SDTT schedule time-shift information (refer to ARIB STD-B21).

Operation of schedule time-shift information shall be as follows.

4bit	Meaning
0	This shows that although engineering service is being implemented in multiple numbers of TS, download contents are being distributed at the same schedule for everything with no time shift.
1 - 12	This shows that engineering service is implemented in multiple numbers of TS, and schedule time shift unit is 1 to 12 hours.
13 - 14	Reserved
15	Engineering service is implemented in single TS.

(3) For receiver software update

Set one of “today“, “today and tomorrow” and “tomorrow” for the SDTT schedule information with download contents distribution. SDTT schedule information content without download contents distribution shall be for the private use of receiver makers that implement downloading. For example, use of a start date of information updating service in receivers through different communication lines and start dates of version upgrading service for stores can be expected. There are no provisions for the schedule loop number, the Download Content Descriptor number that describes, the types of information in the Download Content Descriptor, text length, module number, etc. However, schedule restrictions are added for loop number of schedule. Also, the **download_id** shall all be the same regardless of the Download Content Descriptor number. Also, it is possible to set the download content number as except 1 in order to display different messages for each group by using the **group_id** and such, but the schedule and **download_id** shall be the same.

Furthermore, use distributed id’s for the **maker_id** (numbered by ARIB). Also, operations of **model_id**, **version_id**, **and group_id** in case of downloads such as receiver software updates, etc. based on application by receiver makers shall be managed by each receiver maker and content shall not be provided.

Also, multiple sections are enabled in each sub-table in order to transmit download content that is different for each group by operating the **group_id**.

Table 5-8 Id’s for Update Target

	No. of bits	
maker_id	8	Value to discriminate makers

model_id	8	Value to discriminate receiver models
group_id	4	Value to group download
version_id	12	Value of system version

Refer to ARIB STD-B21 for the structure and meaning of SDTT.

Refer to ARIB STD-B21 for examples of notification information operations.

(4) For common data in all receivers

Operation of the SDTT for common data in all receivers is as follows. Furthermore, specific operations for the Genre Code Table, Program Characteristics Code Table and Reserved Word Table is described in (a), and specific operations for Frequency List and Modefication Information shall be described in (b).

SDTT sub-table of common data in all receivers is structured from 1 section. The loop number of schedule information shall be “0”, and the SDTT shall only be transmitted while the carousel transmitting the download contents are being transmitted. Operation of the **version_id** is described in 5.3.1.6 (2). The **group_id** shall always be “0”, and the **group_id** is not operated for common data in all receivers.

Also, the **num_of_contents** shall be “1”. The **compatibility_flag** and **text_info_flag** in the Download Content Descriptor shall be based on “0”, and this information can be ignored by receivers. The data in **module_info_byte** shall be the same as **module_info_byte** in DII. The private data length shall also be based on “0”, and this information can be ignored by receivers. Furthermore, **add_on** of the Download Content Descriptor shall also always be “0” and not operated.

(a) For the Genre Code Table, Program Characteristics Code Table and Reserved Word Table

Use the SDTT for low protection layers and the **maker_id** and **model_id** fields shall use 0xFFFA. Based on the description of only the Name Descriptor in **module_info_byte**, and receivers can ignore everything other than that. Also, the Download Content Descriptor number shall be 1.

(b) For Frequency List and Modification Information

Use the SDTT for high protection layers, and the **maker_id** and **model_id** fields shall use (0xFFF8). Along with that, **version_id** of the Frequency List and Modification Information shall be managed separately from the above, and its operation shall be according to the

description in 5.3.1.6 (2).

The Frequency List and Modification Information shall give different a **module_id** for each area that describes the targeted service area. Specifically, modules are divided and transmitted with control for all broadcasting whose service area is the same, after differentiating wide-range broadcasting and prefecture broadcasting. Meaning, the **module_id** value in the Download Content Descriptor shall be the value gained by adding 64 to the area discrimination value in the **service_id** of Vol. 7. Therefore, receivers can specify their own service area from the Terrestrial Distribution Descriptors and **service_id** value of broadcasting being received, and the monitor **module_id** information only describes the related area.

Based on the description of only Control Descriptor in **module_info_byte**, and receivers can ignore all descriptors other than that. In case that the broadcasting which covers the concerned area as its service area is scheduled to be changed due to the placement of a new station or frequency repacking etc., or even when there is no such schedule, Control Descriptor shall be transmitted as information that describes all broadcasting stations of the concerned service area. If new station placement or a frequency change is scheduled in the area, set the same schedule information as the corresponding download contents in the **module_info_byte**. Also, set the same version number that is given to the corresponding download contents. The **module_id** shall always be set in ascending order and separated into several descriptors and set in a row if the **download_content_descriptor** length exceeds 254 bytes. Also, the Control Descriptor number per one area (module) shall be 1. Also, the maximum value of the schedule loop set in the Control Descriptor shall be 8. Furthermore, even if there is no change in the area (module), the descriptor length shall be 2 and the **download_data_type** and **module_data_version** shall be transmitted. The syntax of the Control Descriptor is described in Table 5-9.

Table 5-9 Control Descriptor

Syntax	No. of bits	Mnemonic
Control_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
download_data_type	8	uimsbf
module_data_version	8	uimsbf
for(i=0; i< N; i++){		
start_date	16	uimsbf
duration	8	uimsbf
}		
}		

download_data_type : Content is as follows:

download_data_type	Meaning
0x01	To use the Control Descriptor in the frequency list change information
Other than 0x01	Reserved

module_data_version : Version value of frequency number information applied to the area specified by the **module_id**. This value is the same as the value given to download contents.

start_date : Specifies the start date of changing operations.

Duration : Duration required for modification is displayed in a number of days (1-254) and 0x00 and 0xFF are reserved.

5.3.1.3 Transmission Layer, Repetition Rate and Bandwidth

The transmission cicle of the SDTT shall be once per 3 minutes. The Bandwidth shall be 10kbit/s or less for the low protection layer, and 2kbit/s for the high protection layer (refer to the below Bandwidth estimate).

However, no transmission is performed if there is no downloading schedule. If receivers cannot receive the SDTT after 3 minutes of waiting period in the TS that transmits the SDTT in the second loop of the BIT, the SDTT for the day can be considered non-existent. However, it should be operated supposing that the SDTT may not be transmitted due to a device failure, etc.

- Bandwidth estimate

Low protection layer	High protection layer
○ Calculation premise	
- Standard length for each section of SDTT is 1,288 bytes	- Standard length for each section of SDTT is 184 bytes
- Maximum number of sections is 180	- Maximum number of sections is 240
- Multi section transmission in TS packet is not performed.	
- Transmitted once every 3 minutes	
○ TS packet number necessary in each section is	
1,288/184 = 7 TS packets	184/184 = 1 TS packets
○ TS packet number necessary for the entire table is	
7×180 = 1,260 TS packets	1×240 = 240 TS packets
○ Average TS rate to transmit this once every 3 minutes is	
(1,260×188×8)÷180=10.53kbit/s	(240×188×8)÷180=2.01kbit/s

Note) Standard section length here includes pointer field 1 byte.

(1) For receiver software updates

Schedule information in the SDTT shall be set so that it will correspond to the sub-table maximum size and repetition rate and Bandwidth.

(2) For Common Data to All Receivers

Schedule information loop number shall be 0, and the SDTT will be transmitted only while the carousel transmitting the download content is being transmitted.

5.3.1.4 SDTT Update

Fundamentally, the SDTT shall only be updated once a day at AM 0:00. However, whenever there is need for urgent switching, it shall be updated as necessary.

5.3.1.5 Provisions for SDTT TS Packeting and Transmission

This shall be based on Vol. 4 of the document.

5.3.1.6 Download Content Version Number

(1) For receiver software updates

Version numbering procedure, management and such are not provided.

(2) For Common Data to All Receivers

Regarding **version_id** operation, use the common version number of Common Data to All Receivers that is managed by broadcasters which download Common Data to All Receivers. However, version numbers of the Genre Code Table, Program Characteristics Code Table, and Reserved Word Table, and version numbers of the Frequency List and Modification Information are differently managed and given. The version management structure for version numbers of the Genre Code Table, Program Characteristics Code Table, and Reserved Word Table is described in Figure 5-1. For the Frequency List and Modification Information, all Frequency List and Modification Information nationwide is transmitted, and the version number is incremented by 1 in case of any change in transmission content. It's up to product design for how much information should be stored in receivers at the time of shipment.

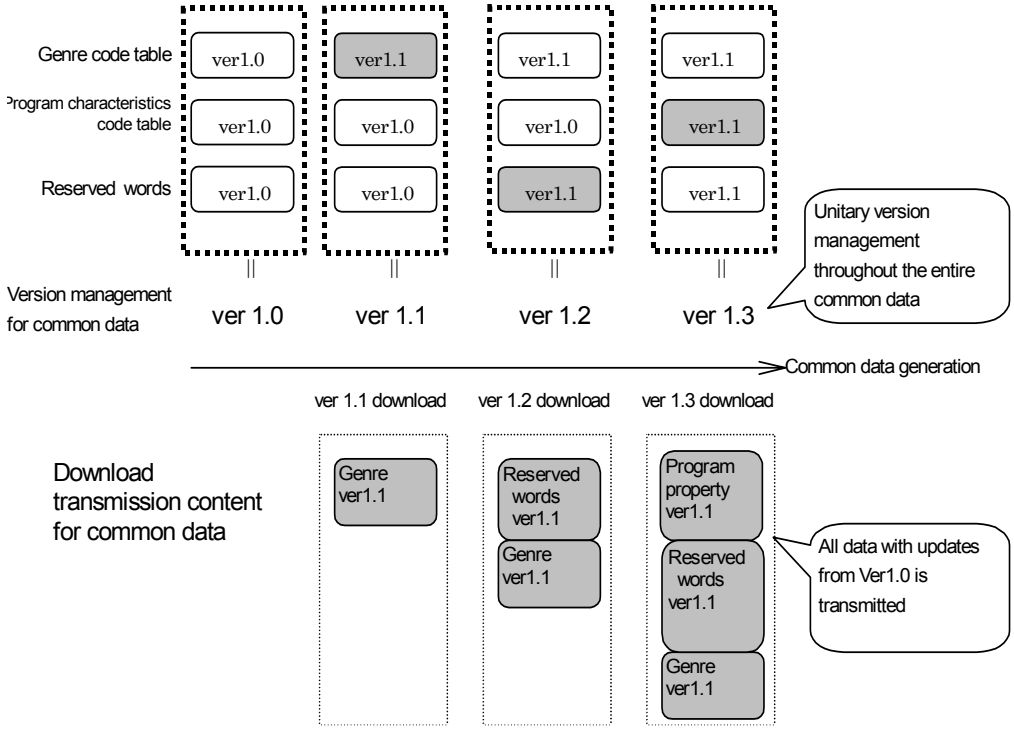


Figure 5-1 Common Data Version Management and Fundamental Downloading Principles

When the **version_id** exceeds 4,095, it shall be wrapped around to 0. In that case, divide the **version_id** into domains that are from 0 to 2,047 and 2,048 to 4,095 in order to manage the version value from 0 again. If the current version value is in the domain from 2,048 to 4,095 and the downloaded common data version value is between 0 and 2,047, the receivers shall consider that it is higher than the current version value and implement downloading.

5.3.2 Transmission of Download Content

Refer to ARIB STD-B21 for additional provisions to the DSM-CC data carousel.

Refer to ARIB STD-B21 for DII Module Info operation.

Also, multi-section transmission is possible for transmission of download content.

5.3.2.1 Transmission Route

The layer that transmits download content shall be the low protection layer, and it shall be transmitted in different transmission routes other than the **original_network_id** and **transport_stream_id** set in the SDTT. Refer to 5.3.1.2 “Operation of SDTT” for details. The **service_id** distributed for the download content by this procedure shall be

0xFFF0-0xFFF5.

The **service_id** for single TS transmission is operated in 0xFFF0 nationwide. Receivers acquire download content based on the **service_id** set in the SDTT. Even when transmission at different times is performed with the multiple **service_id** by multiple TS's, the **service_id** set in the SDTT shall be operated in 0xFFF0 nationwide. The maximum number for the **service_id** distributable in transmission at different times shall be 6. Meaning, it can be operated from 0xFFF0 to 0xFFF5. Receivers extract the engineering service transmitted in the **service_id** +5 or less that includes the **service_id** set in the SDTT. With engineering services transmitted in **service_id**'s that are different from the one set in the SDTT, operation of presumed transmission at different times for that difference is being conducted.

If there is an engineering service whose **service_id** is other than 0xFFF0-0xFFF5, receivers may ignore this. Refer to Figure 5.5 "Transmission model for multiple TS transmission at different times".

5.3.2.2 Bandwidth

The Bandwidth shall be 0.35207Mbit/s at maximum and 0.1Mbit/s at minimum for the TS rate (corresponds to 0.25/0.38 segment amount in a transmission model that is 64/16QAM, convolution 3/4, and guard ratio 1/8). Broadcasters can select specific values in this range related to downloading. When transmitting engineering services with multiple TS's, bandwidth shall be the same for all.

[Bandwidth estimate]
Estimate formula of transmittable model numbers in transmission models that are 64QAM, convolution 3/4, guard ratio 1/8, and used segment 0.25 is shown below. Download content is assumed to be 10MB.
Because the net bandwidth in 1segment form is 1,404.29 kbit/s (from Telecommunications Technology Council report),
Useable bandwidth = useable bandwidth in 1 segment × used segment
= 1,404.29×0.25 = 351.07 [kbit/s]
Time needed for one transmission = Download content/useable bandwidth
=10×1,024×1,024×8 / (351.07×1,000) = 238.94 s
Transmittable model number (times)= 24 hr./time needed for one transmission/carousel times
=86,400/238.94/2 = 180.8 times
(In actual transmission in the TS, it will include a TS header section, adaptation field, etc., so the value will be smaller than the calculated value.)

5.3.2.3 Transmission Time, Period and Repetition Time

Downloaded content should be transmitted in succession during the airtime on a repetition rate of 24 hours at maximum.

Single downloaded content should be transmitted using more than one unit and the duration of one unit is 10 seconds.

(1) For receiver software updated

An example of a downloaded content transmission schedule is shown in Figure 5-2. Receiver makers that would like to download content apply to a download organization for the transmission term, desired number of times of transmission, and duration (in units of 10 seconds). The transmission time changes depending on the number of models for which content is downloaded. The download organization will decide the schedule after adjustments are made between all receiver makers that will download the content. A carousel is transmitted for the number of maximum transmittable cycles (integer) within the duration (in units of 10 seconds) applied by a receiver maker. After the downloaded content is transmitted, dummies are inserted until the duration ends. Dummy is to be a null packet or an empty carousel packet, or the content of dummy is to be only an adaptation field.

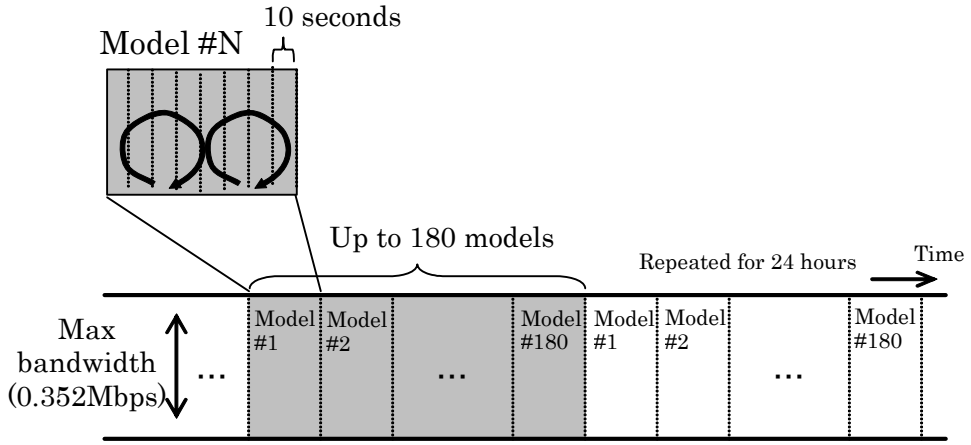


Figure 5-2 Reference Model for Downloaded Content Transmission Schedule (When there is no Common Data to All Receivers)

(2) For Common Data to All Receivers updated

An example of a downloaded content transmission schedule is shown in Figure 5-3. When Common Data to All Receivers needs to be updated, a broadcaster or an organization that would like to download content will apply to a download organization for the transmission period. The transmission time changes depending on the number of models for which content is downloaded. The download company will decide the schedule after adjustments are made between all receiver makers that will download the content.

A carousel is transmitted for more than two cycles and data for receiver software is transmitted at the same time. After the downloaded content is transmitted, dummies are inserted until the duration ends. Dummy is to be a null packet or an empty carousel packet, or the content of dummy is to be only an adaptation field.

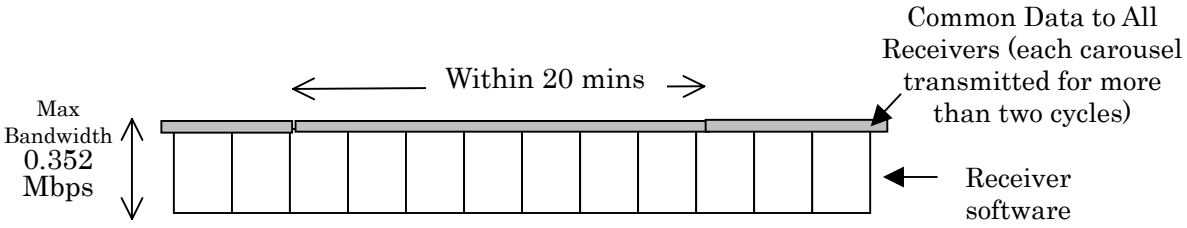
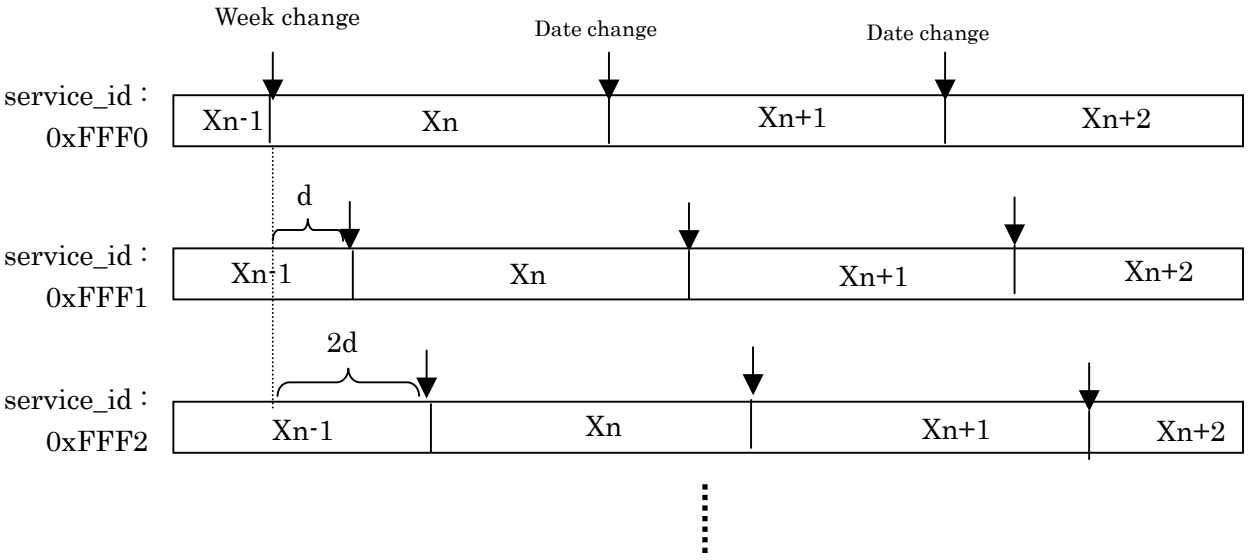


Figure 5-3 Reference Model for Downloaded Content Transmission Schedule

(3) For more than 1 TS transmitted at different times



Xn : Downloaded content transmitted on n day.

d : Time shift unit (Specified with **schedule_time_shift_information** (Tentative name) in the SDTT)

Figure 5-4 Transmission Model of Multiple TS Transmission at Different Times

Figure 5-4 shows a transmission model when downloded content is transmitted in more than 1 TS at different times. The schedule whose **service_id** is 0xFFF0 is the basic schedule and its schedule information is descirbed in the SDTT. When the time shift unit specified with **schedule_time_shift_information** in the SDTT is d hours,

transmission of the TS whose **service_id** is 0xFFF1 starts d hours, 0xFFF2 is 2d hours and 0xFFF3 is 3d hours respectively, after transmision of the TS in the 0xFFF0 schedule has started.

In the 0xFFF0 schedule information, the 0xFFF0 schedule for the day and the next day is described. The transmission start time of the 0xFFF1 schedule is worked out by adding d hours to the transmission start time of the 0xFFF0 schedule.

The product of the number of **service_id**'s and the amount of time shifted should be within 12 hours.

5.3.2.4 Allocation of PIDs and Component_tag Values to Downloaded Content

In order for receivers to capture downloaded content without fail, a total of 12 different pairs of a PID and a **component_tag** value, i.e. 4 different pairs of a PID and a **component_tag** value for Common Data to All Receivers ([Frequency List and Modification Information] and [Genre Code Table, Program Characteristics Code Table, Reserved Word Table] for actual broadcasting and test broadcasting before the actual broadcasting respectively) and 8 different types for receiver software, are applied to downloaded content.

8 different pairs of a PID and a **component_tag** value are allocated to receiver software in a circular order of transmission.

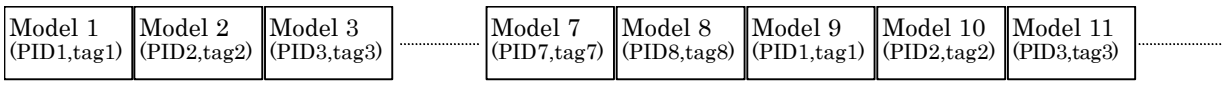


Figure 5-5 Allocation of PIDs and component_tag Values (without Common Data to All Receivers)

The following figure shows an example of when data for receiver software and Common Data to All Receivers is transmitted simultaneously.

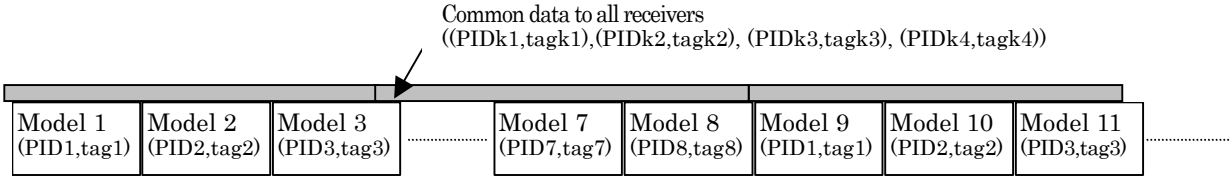


Figure 5-6 Allocation of PIDs and component_tag Values

(when data for receiver software and Common Data to All Receivers is transmitted simultaneously)

When software for less than 8 models is updated, dummies are inserted as shown below. 1 dummy is transmitted for 10 seconds and a dummy is to be a null packet or an empty carousel packet, or the content of dummy is to be only an adaptation field.

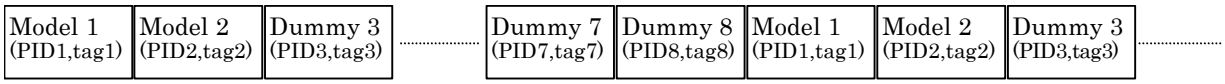


Figure 5-7 Allocation of PIDs and component_tag Values When Software of Less Than 8 Models Is Updated

When the number of models for which data is transmitted is not in multiples of 8, dummies should be transmitted so that the number will become multiples of 8 and this should be repeated.

Ex) When software for 70 models is updated, two dummies should be transmitted (PID 7 and PID 8) and this cycle is repeated for the number of 72 models.

Additionally, when the day changes, adjustments should be made using dummies as shown above, so that PIDs and **component_tag** values are allocated in circular route.

5.3.2.5 Module and Carousel Structures

(1) For receiver software updated

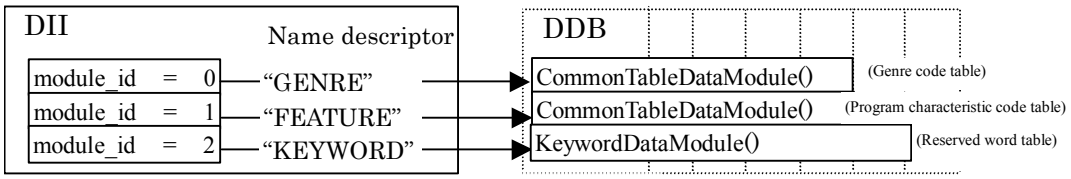
A module that makes up a carousel is not specified.

(2) When Common Data to All Receivers updated (Genre Code Table, Program Characteristic Code Table and Reserved Word Table)

All data that has been updated since Ver 1.0 should be downloaded and transmitted. Data must not be downloaded for each downloaded content type such as Genre Code Table and Program Characteristic Code Table, and should be put in a single carousel together.

The Genre Code Table, Program Characteristic Code Table and Reserved Word Table must have one module each.

An example of a carousel structure of Common Data to All Receivers is shown in Figure5-8.



Common Data to All Receivers is put into a single

Figure 5-8 Example of a Carousel Structure of Common Data (Genre Code Table, Program Characteristic Code Table and Reserved word Table)

(3) For Common Data to All Receivers (Frequency List and Modification Information)

Data of all networks for digital terrestrial television broadcasting should be downloaded and transmitted. Additionally, modules are divided for each service area but are put together in a single carousel.

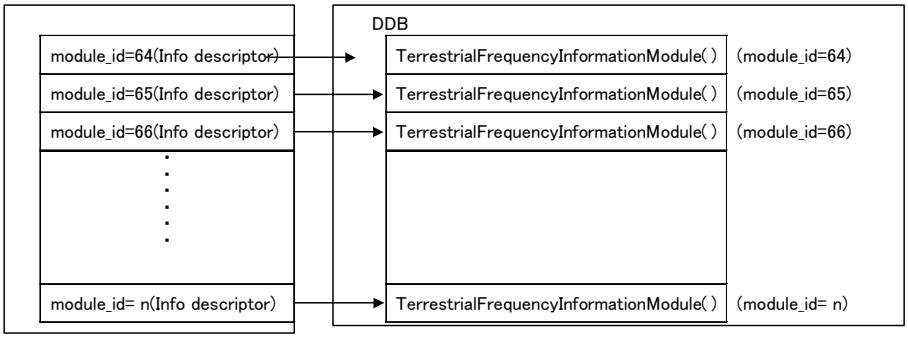


Figure 5-9 Example of a Carousel Structure of Common Data (Frequency List and Modification Information)

5.3.2.6 Operation of DII(DownloadInfoIndication)

(1) When receiver software updated

For the purpose of reliable downloading, transmission of the Compatibility Descriptor that specifies the model for which data is downloaded is mandatory. The values of **maker_id**, **model_id**, **version_id**, **group_id** and **download_id** should be the same as the ones of the id's in the SDTT. Other details are not specified.

(2) When Common Data to All Receivers updated (Genre Code Table, Program Characteristic Code Table and Reserved Word Table)

For the purpose of reliable downloading and transmission of module information, transmission of the Compatibility Descriptor that specifies the model for which data is downloaded is mandatory. The values of **maker_id**, **model_id**, **version_id**, **group_id**

and **download_id** should be the same as the ones of the id's in the SDTT. For descriptors in **module_info_byte**, the type descriptor can be omitted and the Name Descriptor is mandatory. Additionally, the description in 5.3.1.6 (2) should be followed for the versions. The naming convention of the Name Descriptor is shown in Table 5-10.

Table 5-10 Name Descriptors and Downloaded Data

Download Contents	Name Descriptor	Remarks
Genre Code Table	GENRE	Refer to Table 5-11
Program Characteristic Code Table	FEATURE	Refer to Table 5-11
Reserved Word Table	KEYWORD	Refer to Table 5-12

(3) Common Data to All Receivers (Frequency List and Modification Information)

For the purpose of reliable downloading and transmission of module information, the transmission of the Compatibility Descriptor that specifies the model for which data is downloaded is mandatory. The values of **maker_id**, **model_id**, **version_id, group_id** and **download_id** should be the same as the ones of id's in the SDTT. The description in **module_info_byte** should be identical as the one in **module_info_byte** in the SDTT and only the description of the Control Descriptor is mandatory.

5.3.2.7 Operation of DDB(DownloadDataBlock)

(1) When receiver software is updated

The details are not specified.

(2) When Common Data to All Receivers updated

The data formats for the Genre Code Table, Program Characteristic Code Table and Reserved Word Table are shown in Table 5-11 and Table 5-12 respectively. Also, the data format of the Frequency List and Modification Information are shown in Table 5-13.

Table 5-11 Syntax of the Genre Code Table and Program Characteristic Code Table

Syntax	No. of bits
CommonTableDataModule(){	
number_of_loop	8
for(i=0; i< number_of_loop; i++){	
table_code	8
level_1_name_length	8
for(j=0; j<level_1_name_length; j++) {	
name_char	8
}	
level_2_name_length	8
for(k=0; k< level_2_name_length; k++) {	
name_char	8
}	
}	
}	

number_of_loop : The number of loops of the following code information.

table_code : A newly defined content code.

For example, for the Genre Code Table, 1 byte data including Major Genre and Medium Genre. For the Program Characteristic Code Table, 1 byte data including Major Characteristics and Medium Characteristics.

level_1_name_length : The number of bytes of the following major item names. When only a medium item is added, “0” is set and the major item name is not coded.

name_char : A series of character information fields describes each major item name. The coding rules for character strings should be followed for character coding in Service Information. For character coding, refer to Vol. 4 of the document.

level_2_name_length : The number of bytes of the following medium item names.

name_char : A series of character information fields describes each medium item names. The coding rules for character strings should be followed for character coding in Service Information.

Table 5-12 Syntax of the Reserved Word Table

Syntax	No. of bits
KeywordTableDataModule(){	
number_of_loop	8
for(i=0; i< number_of_loop; i++){	
name_length	8
for(j=0; j<name_length; j++) {	
name_char	8
}	
}	
}	

number_of_loop : The number of loops of the following reserved word information.

name_length : The number of bytes of the following reserved word names.

name_char : A series of character information fields describes the details of a reserved word. The coding rules for character strings should be followed for character coding in Service Information.

Table 5-13 Syntax of the Frequency List and Modification Information

Syntax	No. of bits	Mnemonic
TerrestrialFrequencyInformationModule(){		
area_code	8	bslbf
module_length	16	uimsbf
module_data_version	8	uimsbf
reserved	4	bslbf
num_of_network_loop	12	uimsbf
for(i=0; i< num_of_network_loop; i++){		
network_id	16	uimsbf
transport_stream_id	16	uimsbf
version_number	8	uimsbf
terrestrial_broadcaster_id	16	uimsbf
reserved_future_use	4	bslbf
number_of_affiliation_id	4	uimsbf
for(j=0; j< number_of_affiliation_id; j++) {		
affiliation_id	8	uimsbf
}		
num_of_schedule	8	uimsbf
for(k=0; k< num_of_schedule; k++) {		
start_date	16	uimsbf
duration	8	uimsbf
num_of_detail_information	16	uimsbf
for(l=0; l< num_of_detail_information; l++) {		
transmitter_id	24	uimsbf
zip_code	24	uimsbf
change_date	8	uimsbf
change_time	8	uimsbf
simul_duration	8	uimsbf
old_physical_ch	8	uimsbf
old_transmission_power	8	uimsbf
new_physical_ch	8	uimsbf
new_transmission_power	8	uimsbf
}		
}		
num_of_unchange_transmitter	16	uimsbf
for(m=0; m< num_of_unchange_transmitter; m++) {		
transmitter_id	24	uimsbf
zip_code	24	uimsbf
physical_ch	8	uimsbf
transmission_power	8	uimsbf
}		
text_info_length	8	uimsbf
for(n=0; n< text_info_length; n++){		
text_char	8	uimsbf
}		
}		
for(p=0; p< N; p++){		
reserved_future_use	8	bslbf
}		
}		

area_code : Area identification value that shows the service area. Area identification value in the **service_id** described in Vol. 7 plus 64 (0x40).

module_length : Data length after the **module_data_version** field (in bytes)

module_data_version : The version number of the module data. Incremented by one each time the content is changed. Same as the value described in **module_info_byte** in the SDTT.

num_of_network_loop : Number of broadcasters in the broadcasting area. Including the number of stations in operation and the number of new stations to be opened.

network_id : Network identification of the relevant digital terrestrial television broadcasting. Same as the value set in the NIT.

transport_stream_id : Identification of a TS for the relevant digital terrestrial television broadcasting. Same as the value described in the NIT.

version_number : Version number of the frequency information for the relevant network.

terrestrial_broadcaster_id : Same value as the terrestrial broadcaster identification value described in the BIT. It can be used to identify a broadcasting service provider. For example, when a station that transmitted data passing through the master station starts transmission as a local station, both can be identified as the same station.

number_of_affiliation_id : Number of identifications of affiliations to which the relevant network belongs.

affiliation_id : Same value as the affiliation identification value described in the BIT. Can be used to identifify such as affiliation station enabling successive reception of services provided by affiliation station while moving.

num_of_schedule : Describes the number of schedules such as frequency change and establishment of a new station. “0” is set when there is no change.

start_date : Modification start date (in MJD notation).

duration : The duration of time that is required to make a change is shown in the number of days (in Hex notation. 1 to 254 in decimal). 0x00 is set when the duration of time is unknown. 0xFF is set when the duration of time is 255 days or more.

num_of_detail_information : The number of transmitters to which changes are made regarding operation during the above duration of time in the relevant network.

transmitter_id : The identification of a transmitter to which changes are made. However, transmitters that re-transmit in low power in the same frequency due to the restrictions on the size of memory of receivers can be omitted. A unique value is set to the **transmitter_id** in Japan.

zip_code : Describes the zip code value of a transmitter to which changes are made in 7 digits (in decimal notation) in binary form.

change_date : Describes a specific work day using a difference value (in Hex notation) from the **start_date**. However, receivers must take into consideration the actual work date is maybe a little different from the described work date. Additionally, 0xFF is set when unknown. The **change_date** is not a day when test signal is transmitted and is a day

when the construction is completed, and it should be transmitted continuously and stably after **change_date** as a rule.

change_time : Describes change time in units of hours (in Hex notation). However, receivers must take into consideration the actual change time may be a little different from the described change time. 0xFF is set when unknown.

simul_duration : In simultaneous operations, when data is transmitted in the old frequency for a certain period of time, this period of time is described by the number of days (in Hex notation. 0 to 254 in decimal). 0xFF is set when unknown. Please note that the simul operation duration after the **change_date** should be described.

old_physical_ch : A physical channel number before change (in Hex notation). 0xFF is set for a newly established station, and when a station that transmitted data passing through the master station starts transmission as a local station and is changed to another network, 0xFE is set in the information for the new network.

old_transmission_power : Transmission power before change in dBm (in Hex notation). The value is rounded off. 0xFF is set for a newly established station and 0dBm does not mean output is nothing.

new_physical_ch : A physical channel number

after change (in Hex notation). 0xFF is set when broadcasting ends due to a broadcaster merger, etc. When a station that transmitted data passing through the master station starts transmission as a local station and is changed to another network, 0xFE is set in the information for the old network.

new_transmission_power : Transmission power after change in dBm (in Hex notation). The value is rounded off. 0xFF is set for a station that stopped transmission such as when broadcasting ends. Please note that normal broadcasting with reduced power (for example, when the transmission power is changed temporarily as the transmitting site in Tokyo Tower is changed to a backup one due to maintenance) is not regarded as a transmission power change.

num_of_unchange_transmitter : The number of transmitters to which no changes are made regarding operation during the above duration of time in the relevant network.

transmitter_id : Identification of a transmitter to which no change is made regarding operation during the above duration of time. However, transmitters that re-transmit in low power in the same frequency can be omitted due to the restrictions on the size of memory in receivers. A unique value is set to the **transmitter_id** in Japan.

zip_code : Describes the zip code value of a transmitter to which no change is made in 7 digits (in decimal notation) in binary form.

physical_ch : A physical channel number of a transmitter to which no change is made (in Hex notation).

transmission_power : Transmission power of a transmitter to which no change is made in dBm (in Hex notation). The value is rounded off. 0xFF is set when a station that stopped transmission needs to be described.

text_char : When establishment of a new station or frequency repacking, etc. is planned in the relevant network, character strings for notification to viewers can be described but this will not be used for some time, and receivers must skip this even if the value of **text_info_length** is other than 0.

It is presumed that when receivers have the GUI to present these strings in the future, they will be able to present information such as that a new station will be established or frequency will be changed in the area. Therefore, receivers must safely ignore any strings in this field as of now.

5.3.3 Timing for Transmitting Notification Information and Download Contents

5.3.3.1 When Receiver Software Is Updated

The transmission start time of download contents is specified with the **start_time** in the SDTT. However, it is desirable that control is performed so that schedule confirmation by re-acquiring the SDTT and receiver control to acquire download contents, etc. are completed before **start_time** and no data in the first time download contents is missing.

5.3.3.2 When Common Data to All Receivers Updated

Whether download content is being transmitted can be judged by whether the SDTT is being transmitted. However it is desirable that control is performed so that re-acquisition of the SDTT and receiver control to acquire download contents, etc. are completed before acquiring the DII and no data in the first time download content is missing.

5.3.4 Emergency Suspension of the Receiver Built-in Information Update Service (SDTT Method)

Transmission of download contents may be stopped due to an emergency stop of downloading. There are cases where the SDTT is transmitted even under an emergency suspension, so it is desirable for receivers to perform a timeout process.

5.3.5 Suspension of Receiver Built-in Information Update Service (SDTT Method)

When there are no download contents at all, transmission of the SDTT and download contents other than the content transmission route specification B shown in Table 5-7 is suspended. However, even in such a case, transmission of the PMT for the engineering service will continue and the **PMT_PID** will remain in the PAT. Furthermore, in both content transmissions specification A and B, regardless of whether download contents exists or not,

when SDTTs for both receiver software and Common Data to All Receivers are not transmitted, sections whose **maker_id** and **model_id** are 0xFF00 are transmitted, in order to make full-time monitoring of the SDTT transmission function easier. Receivers may ignore this information.

5.3.6 Trial Transmission of Receiver Built-in Information Update Service (SDTT Method)

For receiver software updates, targets that are not in the market can be specified using the **model_id**, **version_id**, etc. to be used for testing.

To test Common Data to All Receivers for the Genre Code Table, Program Characteristic Code Table and Reserved Word Table, 0xFFF9 shall be used as the **maker_id** and **model_id**, and for the Frequency List and Modification Information, 0xFFF7 shall be used. Common Data to All Receivers for actual broadcasting and for test broadcasting before actual broadcasting may be transmitted simultaneously.

5.3.7 Operation of Day Light Savings (SDTT method)

The **start_time** in SDTT and the time management in related transmission systems shall be based on the “UTC (Coordinated Universal Time) + 9 hours” regardless of whether or not daylight savings time has been introduced.

5.3.8 SDTT Method Security

5.3.8.1 Receiver Software Updates

Encryption of downloaded content in relation to receiver software updates for confidentiality shall be up to product planning.

For guidelines regarding security, refer to ARIB STD-B21.

5.3.8.2 When Common Data to All Receivers Updated

Security is not particularly considered and contents are not encrypted.

5.4 CDT Method Transmission

5.4.1 Transmission of the CDT

5.4.1.1 Transmission Path

Only when the Logo Transmission Descriptor of the CDT transmission type 1 is placed in the SDT service loop, the CDT for broadcasting service provider logo data is transmitted. For the CDT, also refer to ARIB STD-B21.

5.4.1.2 Operation of the CDT

The CDT (Common Data Table) is used to transmit downloaded content in a section-style table. In digital terrestrial television broadcasting, only service logo data is transmitted for now. The CDT syntax is shown in Table 5-14.

Additionally, the syntax of **data_module_byte()** in case of the Logo Transmission Descriptor of the CDT transmission type 1 is shown in Table 5-15.

Table 5-14 CDT Syntax

Syntax	No. of bits	Mnemonic
common_data_section(){		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
reserved	2	bslbf
section_length	12	uimsbf
download_data_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
data_type	8	uimsbf
reserved_future_use	4	bslbf
descriptors_loop_length	12	uimsbf
for(i=0;i<N;i++){		
descriptor()		
}		
for(j=0;j<M;j++){		
data_module_byte	8	uimsbf
}		
CRC_32	32	rpchof
}		

table_id : This field shall be set to 0xC8.

section_syntax_indicator : This field shall be set to “1”.

section_length : It specifies the number of bytes of the section, starting immediately following the section length field and including the CRC. The value in this field shall not exceed 4,093 so that the entire CDT section has a maximum length of 4,096 bytes.

download_data_id : This field identifies downloaded data that is being transmitted. The value of **download_data_id** is uniquely allocated within an **original_network_id**. For the service logo, the value of the field shall be the same as the value of the **download_data_id** in the corresponding Logo Transmission Descriptor in the SDT.

version_number : This field is the version number of sub-table. The version number shall be incremented by 1 when a change in the information carried in the sub table occurs when it reaches value 31, it wraps around to 0.

current_next_indicator : This field shall be set to “1”.

section_number : This field gives the number of the section. Sections are placed in order starting from section number 0 and all sections until the section **last_section_number** exist. When service logo data is transmitted, a logo in each size is transmitted in sections with **section_numbers** that are the same as the **logo_type** value.

last_section_number : This field specifies the number of the last section (that is, the section with the highest **section_number**) of the **sub_table** of which this section is part.

original_network_id : This field gives the label identifying the **network_id** from which the data is being transmitted.

data_type : This field specifies the type of data that is being transmitted. In digital terrestrial television broadcasting, CDT transmission method service logos are used for now.

descriptors_loop_length : This field gives the total length in bytes of the following descriptors. When there is no data in the descriptor loop, this field shall be set to “0”.

data_module_byte() : Downloaded data is described using a syntax defined for each **data_type**.

Table 5-15 data_module_byte() Syntax in Case of the Logo Transmission Descriptor of the Transmission Type 1

Syntax	No. of bits	Mnemonic
data_module_byte(){		
logo_type	8	uimsbf
reserved_future_use	7	bslbf
logo_id	9	uimsbf
reserved_future_use	4	bslbf
logo_version	12	uimsbf
data_size	16	uimsbf
for(i=0;i<data_size;i++){		
data_byte	8	uimsbf
}		
}		

logo_type : This field specifies the type of logo. Refer to Table 4-1 for **logo_type**. The same value as the **section_number** value in the CDT shall be used.

logo_id : The value in this field is used to identify logo data in a receiver (uniquely allocated within an **original_network_id**).

logo_version : This field is the version number of the logo identified by the **logo_id**. This value shall be the same as the **logo_version** value in the Logo Transmission Descriptor in the SDT.

data_size : The number of bytes in the following logo data. “0” may be set for reasons such as the logo shown with **logo_id** is no longer used.

data_byte : Logo data itself.

5.4.1.3 Transmission Layer, Repetition Rate and Bandwidth

When the Logo Transmission Descriptor of the CDT transmission type 1 is placed in the service loop of the SDT, the corresponding CDT must always be transmitted into the same TS. When a TS is transmitted in a single layered transmission path, the CDT should be transmitted in this layer and when the TS is transmitted in multiple layers, the CDT should be transmitted only in a low protection layer, and must not be transmitted in multiple layers.

When **data_type** is the CDT transmission type service logo, the repetition rate should be set to less than 10 minutes when transmitted in any layer, but it may be extended by up to 200% only when the version is changed. (Refer to Vol. 4, 12.8 “Rules When Sub-Tables Are Updated” of these provisions for operation).

5.4.1.4 Update of the CDT

When the content of the CDT is changed due to reasons such as a change of the logo pattern or service ID that is being used, it should be updated on a sub-table basis. When updated, the description of this logo in the Logo Transmission Descriptor of the CDT transmission type 1 in the service loop of the SDT should be updated almost at the same time so that the consistency can be maintained.

5.4.1.5 CDT-Packetization and Transmission Rules

In one sub-table, sections should be placed in order of section number starting from section number 0 and all sections until the **last_section_number** should be transmitted.

5.4.1.6 Version Number

A table version number must always be incremented by one and the same version number value should be set to each section in the same sub-table.

In addition, a logo version must always be incremented by one and it wraps around to “0” when it reaches value 4,095. Logos with the same **logo_id** should be operated under the same version number and the same value should be set to this logo version number and **logo_version** in the Logo Transmission Descriptor of the CDT transmission type 1 in the service loop of the SDT.

5.4.2 Emergency Suspension of the CDT

There are cases where transmission of the CDT is temporarily stopped in an emergency, but this does not mean that the service logo is not being used in the network.

A receiver can detect the emergency suspension of CDT transmission when it cannot receive the CDT for a certain period of time based on the repetition rate described in 5.4.1.3., when more than one Logo Transmission Descriptor of the CDT transmission type 1 in the service loop of the SDT is defined.

6 Receiver Guidelines for Receiving Download Content

6.1 Receiver Guidelines (SDTT Method)

6.1.1 Provisions for Memory

(1) Memory buffers that are capable of keeping pace with the transmission speed should be ensured to receive notification information and download contents.

(2) As a memory area for Common Data to All Receivers, a 10kB of memory shall be reserved for the Genre Code Table, Program Characteristic Code Table and Reserved Word Table. As for receivers capable of receiving Terrestrial, BS, and Wideband CS Digital Broadcasting, a 40kB of memory shall be reserved for Genre Code Table, Program Characteristic Code Table and Reserved Word Table. The memory for the Genre Code Table and Reserved Word Table that is commonly used for all broadcasting media may be shared with digital broadcasting such as BS and Wideband CS. Please refer to 6.3. “Guidelines for Receiving Common Data with a Common Receiver” for details. Furthermore, the Frequency List and Modification Information need 10kB per 1 prefectural area identification and 20kB per 1 area identification for wide-area broadcasting area as estimated below (Note 1). The number of area identifications to be stored in a receiver is up to product planning, but it should be taken into consideration that more than 4 areas (including wide-area broadcasting) may be viewed using multiple antennas in fringe areas.

(3) To deal with an accidental failure in the downloading process when receiver software is updated, a memory configuration of either the 2 bank method that enables returning to the status before downloading using two non-volatile memory banks, or the 1 bank + α method which has one memory bank to be updated when downloading and which always has a specific program on the memory should be used.

Please refer to ARIB STD-B21 12.3.2 for the size and performance of the hardware.

Please refer to ARIB STD-B21 for how to implement flash memory.

(Note 1) Estimation of memory requirements for Frequency List and Modification Information

The size of memory required to store Frequency List and Modification Information in receiver is estimated under the following conditions at the frequency repacking peak time.

1) Conditions

Number of area identifications: 59

Number of networks per area: 8

Number of affiliations per network: 2

Number of changed schedules per network: 1

Number of detailed descriptions per change schedule: 50

Number of transmitters (satellites) to which no change is made per network: 50

Number of bytes of characters used for explanations per network: 200

2) Estimation

Under the above conditions, the data amount per area identification is approximately 10kB. For wide-area broadcasting areas, 20kB, which is double the value under the above conditions, is assumed.

6.1.2 Provisions for Operation

6.1.2.1 Reservation Function

Function to receive Notification Information in accordance with the operation status and to reserve download software to be received.

(1) The content of received Notification Information is analysed, and whether Common Data to All Receivers will be downloaded or receiver software that agrees with receiver information will be downloaded is decided and then, whether downloading can be reserved is decided.

(2) When the content of Notification Information is a “mandated downloading” and when the user’s permission has been set up, downloading is reserved while the user is not aware of that.

(3) When the content of Notification Information is an “optional downloading”, the details of downloading options are presented to the user with possible operating methods being provided, and based on the user’s selection, downloading is reserved. However, the influence on program viewing should be kept to a minimum, for example, the user is notified with a small mark on the screen when operation using a menu becomes available and when the viewer operates the menu after recognizing the mark, options are displayed for the first time.

(4) When the download content transmission path described in the Notification Information is other than broadcasting (specifically, content transmission specification B in Table 5-7), information, such as that receiver built-in information update service is provided in another transmission path e.g. in telecommunication line, is presented. In such a case, the influence on program viewing should be kept to a minimum as in case (3).

(5) Function to make a list of **service_id**’s of engineering services receivable in the NIT as well as to work out all the start times for downloading data that can be received, based on the schedule information and time shift units described in the SDTT and to reserve more than 1 TS, when more than 1 TS is transmitted at different times.

(6) Function to select a TS such as a TS with good reception C/N, and to acquire download content, when the engineering services with the same **service_id** can be received in more than 1 TS.

Please also refer to ARIB STD-B21 for functions required for receivers.

Please also refer to ARIB STD-B21 for examples of download availability and result judgments.

6.1.2.2 Reception Function

Function to receive download content transmitted in a DSM-CC data carousel based on Notification Information and to store the downloaded content in non-volatile memory.

(1) The validity and adequateness of the content of the received downloaded content are evaluated, and the downloaded content is stored in non-volatile memory based on the Notification Information.

(2) Content is downloaded based on Notification Information. When there is schedule information[3], it is downloaded based on the schedule information during stand-by. When there is no schedule information [3], downloading is attempted when the power is turned off. However, reception of download content must not affect program viewing (including reserved viewing). Additionally, when the writing of data into non-volatile memory starts, operation of the receiver by a viewer may be rejected until the writing is completed.

(3) Function to receive download content starting from the TS that will be transmitted at the nearest time based on Notification Information and the current time, when more than 1 TS is transmitted at different times.

Please also refer to ARIB STD-B21 for functions required for receivers.
Please refer to ARIB STD-B21 for operational scenarios.

6.1.2.3 Execution Permission Function

Function to provide operational methods to permit execution of downloading functions in the initial setting, and to keep permission information of viewers.

Please also refer to ARIB STD-B21 for functions required for receivers.

6.1.2.4 Status Recovery Function When Abnormalities Occur

Function to identify abnormal status such as turning on/off the power, interruption of the process, identification of data abnormalities while receiving download content, and to recover a receiver to normal status.

[3] "When there is schedule information" is when the number of loops of schedule information in the SDTT is not 0, and "when there is no schedule information" is when the number is 0. However, in either case, the SDTT is of the content transmission path specification A, not for the content transmission path specification B.

(1) When an abnormality is identified while receiving download content, the content of the downloaded content that has been stored in memory is made invalid and settings required to re-acquire the download content is ensured.
(2) When the two-bank method, in which two areas are kept for downloaded data when the receiver software is updated to secure safety, the receiver software before downloading should be executed when an abnormality occurs. When the 1 bank+α method that has a specific program area that is not updated and an area to be updated with downloaded data is applied, the specific program is executed and the minimum function should be ensured when an abnormality occurs.
(3) For the downloading process of Common Data to All Receivers, measures should be taken so that data before downloading will not be lost at least when an abnormality occurs.

Please also refer to ARIB STD-B21 for functions required for receivers.
Please refer to ARIB STD-B21 for operational scenarios.

6.1.2.5 Power Control Function

Power control function to turn on the power of the circuits needed to download using a timer based on Notification Information, download software and turn off the power when downloading is completed. Also, power control function to keep required circuits energized when the power is OFF, download software and turn off the power when downloading is completed. These functions should be operated in the same way as the power control function to acquire EMMs.

Please also refer to ARIB STD-B21 for functions required for receivers.

6.1.2.6 Version Display Function

Function to display valid versions for receiver makers and broadcasters to refer to when they support viewers over the phone when the downloading function did not work normally.

(1) It is desirable to provide protection such as that valid versions are not displayed through normal operation by the users and are displayed for the first time after going through more than one step when the power is turned on.
(2) It is desirable to display versions using numbers that are difficult for the users to identify.

6.2 Receiver Guidelines (CDT Method)

6.2.1 Provisions for Memory

(1) Size of memory that will be required for logo data should be ensured. Which logo data will be acquired among 6 types of logos that will be transmitted is up to product planning. Required size of memory for each logo type is shown in Table 6-1.

(2) The area where logo data of other services that is no longer needed may be overwritten with additional logo data for new services in the future.

(3) When logo data that has been used is no longer needed due to reasons such as moving a receiver to another prefecture, the old logo data will be deleted to store the new logo.

Table 6-1 Logo Data Size

(Logo types 180, number of services 480)

HD Large	211kB
HD Small	179kB
SD4:3 Large	237kB
SD4:3 Small	159kB
SD16:9 Large	179kB
SD16:9 Small	120kB

Note: Rounded off to the nearest kB.

Calculation method: The number of bytes per 1 logo shown in Table 4-1 “Size patterns of transmitted logo (logo types)” multiplied by 180 plus 8 bytes (**original_network_id**, **service_id**, **logo_id** and **logo_version**) multiplied by 480 as a reference table.

Please refer to ARIB STD-B21 for the size and performance of the hardware.

Please refer to ARIB STD-B21 for how to implement flash memory.

6.2.2 Provisions for Implementation

6.2.2.1 Reception Functions

New logo data is received/stored/displayed according to the following procedure.

1 Detect that the Logo Transmission Descriptor of the CDT tranmission type 1 is placed in the service loop in the SDT.

2 When the **logo_id** and **logo_version** values are different from the ones currently stored in the receiver, **download_data_id** described in the Logo Transmission Descriptor is used as a sub-table and at the same time, the CDT of the section of **logo_type** used in the receiver is received.

3 When the **logo_version** value described in **data_module_byte()** in the received CDT is different from the one stored in the receiver, the logo data and its **logo_version** value are stored in the receiver.

4 After all the types of logos needed for the receiver are stored, presentation of a new logo starts at any time.

6.2.2.2 Execution Permission Function

There is no need to provide operational methods to permit receiving and storing logo data to viewers.

6.2.2.3 Status Recovery Function When Abnormalities Occur

When all the data of **logo_type** required for a receiver to present could not be received and stored because the power of the receiver was turned off or a channel was switched to another network during the service logo data reception process, it is desirable not to present the logo until this network is re-selected and all the data of **logo_type** required for a receiver to present is acquired.

When a new CDT cannot be received due to an emergency CDT stop, etc., it is desirable that the receiver maintain the current status.

When the parameters in the SDT and the CDT are not consistent (**logo_id** or version), it is predicted that the receiver will think that the logo has been changed and will repeat the reception process of this logo. Such inconsistency will not last for a long time, but it is desirable that a series of logo data reception processes in relation to the same service is performed once an hour or so as a cautionary measure.

6.3 Guidelines for Receiving Common Data with a Common Receiver

6.3.1 Operation of Genre Code Table, Program Characteristic Code Table and Reserved Word Table across Broadcasting Media

As described in Vol. 4, Genre Code, Program Characteristic Code, Reserved Words are managed centrally in Terrestrial and BS/Wideband CS broadcasting. However, the codes can be used individually in each transmission media. Furthermore, a code that is used only in one media is “reserved” in the other media, and the same code must not be used for different contents.

6.3.2 Version Management of Common Data with a Receiver

When common data is downloaded, i.e. when a new code that will be commonly used in Terrestrial/BS/Wideband CS broadcasting is added, dedicated receivers are taken into consideration and the data is downloaded from transmission paths of both types of media. Additionally, when a new code that will be used in one of the media is added, it is downloaded in the transmission path of that media. Then, version numbers are managed as part of the whole common data, which includes logos, the Genre Code Table, Program Characteristic Code Table and Reserved Word Table, in BS/Wideband CS broadcasting, and they are managed as part of the overall common data, which includes the Genre Code Table, Program Characteristic Code Table and Reserved Word Table, in Terrestrial broadcasting, so common data/version numbers are different in Terrestrial broadcasting and BS/Wideband CS broadcasting. Therefore, in receivers for Terrestrial broadcasting, only versions for Terrestrial broadcasting are managed, but for common digital receivers for Terrestrial/BS/Wideband CS broadcasting, common data and versions should be individually managed.

6.3.3 Downloading

For receivers in Terrestrial broadcasting, common data and versions for Terrestrial broadcasting are managed and when upgraded content is distributed, it is downloaded. For common digital receivers for Terrestrial/BS/Wideband CS broadcasting, common data/versions for both Terrestrial/BS/Wideband CS broadcasting are managed, and when upgraded content is distributed, it is downloaded from the corresponding transmission media.

For common data tables in a receiver, only one common table to all media is stored, and downloaded common data is merged, managed and stored in a receiver. However, when a code used only in Terrestrial broadcasting is used in Service Information for

BS/Wideband CS broadcasting by mistake, or vice versa, the receiver operation is up to product planning.

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Vol. 2

DIGITAL TERRESTRIAL TELEVISION BROADCASTING

Function Specification for the Receiver

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1 Introduction

This volume describes function specifications for the digital terrestrial television receiver. The broadcasters that provide digital terrestrial television broadcasting services should assume that the function specifications for the receiver described here are the standard. The priorities set by broadcasters regarding receiver functions are shown in the table below (mandatory: A, optional: B, not provided: -- and only indicated: blank).

It depends on the product planning policy of each manufacturer whether or not to install functions as defined, to provide equivalent functions using methods other than that specified, or to install functions beyond those specified in this specification. There are no restrictions in this regard. However, if a problem occurs as the result, broadcasters may not be able to provide solutions.

Broadcasting programs in Japan provided through various services involves various rights such as copyrights and neighboring copyrights. It is important to establish a comprehensive system to protect these rights to the contents for the purposes of providing high quality programs and promoting sound development and progress of broadcasting. From this perspective, it is desired that receivers ensure the uniqueness of broadcasting programs and that programs are presented as intended.

For more information about ensuring uniqueness, see "9.3 Broadcasting Programs and Guarantee of Uniqueness of Contents" in this volume.

Table 0-1 Priority of Receiver Functions

Contents of Function Specification for the Receiver	Priority for the fixed receiver	Priority for the mobile receiver (T.B.D)	Priority for the portable receiver	Comment
6 User interface requirements				
6.1 Time Management	A		A	
6.2 Initial Settings				
6.2.1 Initial Scan	A		B	
6.2.2 Re-scan	A		B	
6.2.3 Installation Procedure for the Digital Terrestrial Receiver	A		B	
6.2.4 Receiver Functions				
6.2.5 User Settings				
6.2.5.1 Antenna Settings	A		A	
6.2.5.2 Aspect Ratio of the Connecting Television Set	A		B	
6.2.5.3 Communication Line Settings	A		B	
6.2.5.4 Settings of the Location of the Viewer's Residence	A		B	

Contents of Function Specification for the Receiver	Priority for the fixed receiver	Priority for the mobile receiver (T.B.D)	Priority for the portable receiver	Comment
6.2.5.5 Settings for Whether or Not to Allow Download	A		B	
6.2.5.6 Selection of Whether or not to Display Superimpose	B		--	
6.2.5.7 Clear Function of User Defined Information	A		A	
6.3 Selection of Programs	A		A	
6.3.1 How to Select Programs	A		B	
6.3.2 Switching between Analog Terrestrial Television Broadcasting and Digital Terrestrial Television Broadcasting	B		B	
6.3.3 Continuous Mobile Reception	--		B	
6.4 ES Switching				
6.4.1 Default ES	A		--	
6.4.2 Selection of Video Elementary Streams	A		--	
6.4.3 Selection of Audio Elementary Streams	A		A	
6.4.4 Selection of Caption and Superimpose Display	A		(A)	"A" when caption capability is installed in the portable receiver.
6.5 Remote Controller	A		B	
6.6 EPG				
6.6.1 Modeling of Three Types of EPG Screen				
6.6.2 Specifications and Guidelines for the EPG	A		(A)	"A" for common items only, if installing the EPG in the portable receiver.
6.6.3 Program Table and Program List	A		B	
6.6.4 Program Search	B		--	
6.6.5 Program Information Display	B		B	
6.7 Scheduling of Program Recording				
6.7.1 Presetting of Recording Schedules	B		B	
6.7.2 Confirmation of Programs Scheduled for Recording	B		B	
6.7.3 Execution of Scheduled Recording	B		B	
6.7.4 Scheduling of Program Recording Using Timer Function	B		B	
6.8 Conditional Access System (CAS) Service	See Vol. 5.			
6.8.1 TS Name Display Function	A		--	
6.9 Contents Protection Function	A		A	
6.10 Reception of Data Broadcasting Service				See Vol. 3, Part 4, Chapter 9 for the portable receiver that receives only video and audio data.
6.10.1 Requirements for the Receiver	A		A*	
6.10.2 Startup and Shutdown of Data Broadcasting Service Processing	A		A*	
6.10.3 Reception of Interaction Channel Data Broadcasting Service	A*1		B	

Contents of Function Specification for the Receiver	Priority for the fixed receiver	Priority for the mobile receiver (T.B.D)	Priority for the portable receiver	Comment
6.10.4 Reception of Caption and Superimpose	A		B	
6.11 Adaptation to Various Television Broadcasting Modes				See Vol. 3 for data broadcasting.
6.11.1 Reception between Different Layers	A		--	
6.11.2 Mobile Reception	A		--	Dealt as TBD until the content of this section becomes definite.
6.11.3 Partial Reception	A		A	The reception of low-frame-rate and low-resolution pictures and audio (half-rate) is optional for the fixed receiver.
6.11.4 Reception of Emergency Warning Broadcasting (under the Emergency Warning System (EWS))	B		(A)	"A" if TMCC signals can be received when power is off (standby).
6.11.5 Reception of Special Service	A		--	
6.11.6 Reception Using the Event Relay Function	(A)		--	"A" if installing an interface presumably used for recording
6.11.7 Reception of the Multi-view Television Broadcast	B		--	
6.11.8 Reception of Bookmark Service				
6.11.8.1 Reception of Bookmark Storage Service	A		(A)*4	Recording to NVRAM is mandatory. "A" if using a portable receiver that complies with 6.10.3.
6.11.8.2 Reception of Bookmark Listing Service	A		-- *4	Optional if the application is installed in the receiver.
6.11.8.3 Bookmark Function Provided by the Receiver Application	B		(A)*4	"A" if using a portable receiver that complies with 6.10.3.
6.12 Messages	A		A	
7 Requirements for Hardware and Software				
7.1 Front End	A		A	
7.2 TS Decoder	A		A	
7.3 Video Decoding Process and Output	A		B	
7.4 Audio Decoding Process and Output	A		A	SBR decoding in the portable receiver is optional.
7.5 Memory				
7.5.1 RAM	A		A	
7.5.2 NVRAM	A		A*	
7.6 Character Font				
7.6.1 Data Broadcasting Service	A		A*	

Contents of Function Specification for the Receiver	Priority for the fixed receiver	Priority for the mobile receiver (T.B.D)	Priority for the portable receiver	Comment
7.6.2 EPG	A		(A)	"A" if EPG is installed in the portable receiver.
7.7 Built-in Sounds of the Receiver	A		A*	
7.8 High-speed Digital Interface				
7.8.1 Restriction of Partial TS Output	(A)		(A)*3	"A" if installing a high-speed digital interface.
7.8.2 Specifications for the Operation of the PSI/SI Table for Partial TS Output	(A)		(A)*3	"A" if installing a high-speed digital interface.
7.8.3 IEEE1394 Control Command	(A)		(A)*3	"A" if a serial interface is installed as a high-speed digital interface.
7.8.4 IP interface specifications	(A)		(A)*3	"A" if an IP interface is installed as a high-speed digital interface.
7.9 CA Module Interface	A		--	See Vol. 5.
7.10 Copy Control				
7.10.1 Analog Video Output	A		(A)	"A" if installing analog video output function
7.10.2 Digital Audio Output	(A)		(A)	"A" if installing digital audio output function
7.10.3 High-speed Digital Interface Output	(A)		(A)*3	"A" if installing a high-speed digital interface.
7.10.4 Digital Video Output	(A)		(A)	"A" if installing digital video outout function
7.10.5 Digital Video/Audio Output	(A)		(A)	"A" if installing digital video/audio outout function
7.11 Download	A		B	
7.11.1 Frequency Repacking				
7.11.1.1 General Information on Downloading the Frequency List and Modification Information				
7.11.1.2 Guidelines for Receiving the Frequency List and Modification Information	A		B	
7.12 System Tests				
7.12.1 IC Card Test	A		--	
7.12.2 Telephone Line Connection Test	A*1		(A)	"A" if installing a modem.
7.13 Bound Recording	B		B	
7.14. Other				
7.14.1 Screen Display Priority	A		A	
7.14.2 Processing to Take Place in Power Stand-by Mode	A*2		B	
7.14.3 Reset Button	B		B	
7.14.4 RGB Analog Terminal	B		B	
7.14.5 Digital Video Terminal	B		B	
7.14.6 Digital Video/Audio Output Terminal	B		B	
8 ANNEX				
8.1 Specifications for the Operation of PSI/SI for Partial TS Output	(A)		(A)*3	"A" if installing a high-speed digital interface.

Contents of Function Specification for the Receiver	Priority for the fixed receiver	Priority for the mobile receiver (T.B.D)	Priority for the portable receiver	Comment
8.2 Specifications for the Operation of Tables	(A)		(A)*3	"A" if installing a high-speed digital interface.
8.3 Specifications for the Operation of the IP Interface	(A)		(A)*3	"A" if an IP interface is installed as a high-speed digital interface.

Note) For more provisions for low-frame-rate and low-resolution picture, see Vol. 3 of the document.
The priority level "A*" for the portable receiver is dealt as "A" in the portable receiver that can receive data broadcasting service.

*1) The priority level "B" is assigned to mobile receivers that are mainly intended to be installed in automobiles and other mobile units. For the receiver without interaction channel communication, bidirectional broadcasting contents should be presented and an appropriate incompatibility message should be displayed when a communication function is called by the content. The users should be informed of the functional restrictions through the catalog and instruction manual of the receiver. After displaying the incompatibility message, the receiver should desirably continue to display the relevant content.
Even if the mobile receiver has a bidirectional capability, the receiver's interaction channel communication may be unstable in a mobile environment. It is also desired in this case that the receiver has the capability to easily continue or resume the presentation of the relevant content.

*2) In the mobile receivers that are mainly intended to be installed in automobiles and other mobile units, power supply from the mobile units may be interrupted. Because the standby operation of power supply is difficult in this case, the users should be informed of the functional restrictions and the way to deal with the situation through the catalog and instruction manual of the receiver.

*3) When copy_control_type in the Digital Copy Control Descriptor is "10" in the portable receiver, it should be noted that MPEG_TS output from the high-speed digital interface is prohibited regarding contents other than "copy free" contents. See Part 2 of Vol. 8 of the document for details.

*4) For portable receivers, see the relevant provisions in Part 4 of Vol. 3 of the document, "C profile broadcasting bookmark."

2.References

This volume specifies requirements for the user interface, hardware and software, based on ARIB STD-B21 "RECEIVER FOR DIGITAL BROADCASTING SERVICE (DESIRABLE SPECIFICATION) ".

Related standards are listed below.

(1) "Receiver for Digital Broadcasting Service (Desirable Specification)" ARIB STD-B21

(2) "Transmission System for Digital Terrestrial Television Broadcasting" ARIB STD-B31

(3) "Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting" ARIB STD-B32

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

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

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

3. Definitions

The terms used in this specification is defined as shown below.

DIT	Discontinuity Information Table : the table inserted at the transition point where the partial transport stream becomes discontinuous.
IEEE1394	IEEE Std 1394-1995 : a serial bus interface suited for high-speed, real-time transfer, standardized by the IEEE Standard for a High Performance Serial Bus.
SIT	Selection Information Table : the table that lists partial TS stream information and the information regarding services and events transmitted in the stream.
remote_control_key_id	remote_control_key_id is defined as the identification numbers used to assign the main broadcasting service by each broadcaster to the one-touch buttons on the remote controller or as default values for one-touch buttons carried in the NIT.
Up/down channel selection	Up/down channel selection is defined as a method for selecting a channel using the UP/DOWN buttons on the remote controller. Pressing the UP/DOWN buttons switches between channels in ascending/descending order of three-digit numbers used for direct channel selection.
Direct channel selection	Direct channel selection is defined as one of the methods for selecting a channel on the receiver. To select a channel, number buttons on the remote controller of the receiver are used to specify a three-digit decimal number, which is assigned to identify each channel.
Partial TS	The partial transport stream (Partial TS) 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.
One-touch channel selection	One-touch channel selection is defined as one of the methods for selecting a channel on the receiver. Pressing a button (one-touch button) on the remote controller enables direct, one-touch selection of the service assigned to the button.
Product planning	Receiver functions or actions which depend on the hardware design, the software design of the receiver planed by each manufacturer.
Digital terrestrial tuner	Digital terrestrial tuner is defined as the equipment with the function to extract a channel from RF signals, demodulate the carrier, select and decode a program and output baseband signals. It is also known as the STB or IRD.
Channel information	Channel information is defined as the information displayed following the selection of a channel. It includes a three-digit number used for direct channel selection, branch identifier, TS name, service name and logos.
Branch identifier	Branch identifier is defined as a one-digit number used to differentiate services when the same three-digit numbers are used for different services in fringe areas.
VESA	Video Electronics Standards Association : a group that formulates and promotes the standards for displays and display interfaces.

DVI	Digital Visual Interface : an interface standard specified by the DDWG.
DDWG	Digital Display Working Group : an industry group that promotes the standardization of digital display interfaces.
HDCP	High-bandwidth Digital Content Protection System : the Content Protection System for transmitting digital video signal and digital video/audio signal.
HDMI	High-Definition Multimedia Interface : a digital interface standard specified by the HDMI founder, is under the control of HDMI Licensing and LLC (Limited Liability Company) for standard and licensing.
DTCP	Digital Transmission Content Protection : the Content Protection System for transmitting content using a digital interface.
DTLA	Digital Transmission Licensing Administrator : the licenser of the DTCP standard.
Protected free program	Protected free program is defined as the free program which is not under customer management but is protected (scrambled) for the purpose of right management.
SBR	Spectral band replication: a technology to enhance the bandwidth at AAC low bit-rate coding.
DLNA	Digital Living Network Alliance :a group that formulates and promotes guidelines for home network equipment implementation.
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 reference.
64QAM	64 Quadrature Amplitude Modulation: a digital modulation scheme to transmit six bits of information by using 64 sinusoidal waves with different amplitudes and phases. Digital terrestrial television broadcasting uses the SP to specify amplitude and phase reference.
AD conversion quantization noise	Noise element caused by quantization roughness when analog signals are converted into digital signals (AD conversion).
A to D interference	Interference from analog broadcasting signals to digital broadcasting signals.
BER	Bit Error Rate: the rate of the number of error bits in a digital signal to the total number of bits transmitted.
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.
DU ratio	The DU ratio is defined as the desired to undesired ratio, which represents the power ratio of electrical power in preferred waves (Desired) of high frequency signals to interference waves (Undesired).
FFT	Fast Fourier Transform: a method of converting time axis signals into frequency axis elements. The opposite conversion from the frequency axis into the time axis is IFFT (Inverse FFT).

FFT Window	Processing duration for a certain period of time in which the time axis signal is taken in order to calculate the FFT.
OFDM	Orthogonal Frequency Division Multiplexing: a kind of multi-carrier transmission system.
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.
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.
SFN reception disturbance	Situation in which broadcasting signals cannot be properly received due to delay waves originating in the SFN.
SP	Scattered Pilot: Pilot signal inserted to show the standard phase and reference level of QAM.
SP interpolation LPF	The filter that carries out interpolation processing in order to speculate on the data carrier phase between the SPs and the amplitude correction component from the demodulated SP signal. It is handled as the equivalent of a low pass filter (LPF:Low Pass Filter)
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.
Clip noise	Noise component generated by limiting (clipping) the amplitude of the signal.
Fixed noise	Noise component that is not related to size of the signal, and exists in regular thermal noise and city noise.
Required CN ratio	The required CN ratio is defined as the critical reception CN ratio at which the receiver unit can stably demodulate signals.
Required DU ratio	The required DU ratio is defined as the critical reception DU ratio at which the receiver unit can stably demodulate signals.
Amplitude proportion noise	The AD conversion quantization noise etc. corresponds to the noise component considered to be proportional to the size of the equivalent signal.
Convolutional code	Error correction code in which bit rows of consecutive digital data is consecutively encoded by constant width. A superior correction ability is showed for random mistakes in digital data.
Location dispersion	Statistically handles the distribution of electrical field strength as decentralized locations because the electrical field strength in the vicinity of the reception point is regularly distributed.

Bathtub characteristic	It is an abbreviation of the characteristic that displays the relationship between the delay time of the delay wave and the guard interval in demodulation of the OFDM. Although the demodulation characteristic of the OFDM deteriorates due to the delay wave which exceeds the guard interval, it is called a bathtub characteristic since it resembles the shape of a bathtub when the characteristic is showed in the delay time of the delay wave and the necessary DU ratio.
Viterbi decoding	Viterbi decoding is one of the decoding methods of convolutional coding. It is a decoding method that corrects mistakes by observing received digital data rows and requesting data rows assumed to be the most correct.
Fading	Fading is a change in the strength of the received radio waves. A physical change in the meteorological conditions etc. and reception condition of are thought to be the cause.
Encoding rate	Ratio in the number of bits before encoding to the number of bits after convolutional coding.
Multi-path	Radio waves that come to the receiving antenna arrive through multiple routes (multi-path) from the transmission point.
Yagi antenna	General receiving antenna for terrestrial television broadcasting. Antenna that sharpens direction by arranging multiple waveguide elements and reflection elements in parallel. They are also called Yagi-Uda antennas.

4. System Requirements

Regarding the standard and operation of broadcast signals received by the receiver described in this specification, a reference shall be made to "Transmission System for Digital Terrestrial Television Broadcasting" (ARIB STD-B31), "Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting" (ARIB STD-B32) and Vol. 7 of the document. It shall also be ensured to have the function to classify broadcast signals defined in accordance with "Fig. 13-1 Identification Flow for Broadcasting and Non-broadcasting" in Chapter 13 of ARIB STD-B21 by using System Management Descriptor carried in PSI.

5 Receiver Profiles

This section provides the conceptual definition of each category of receivers.

This specification provides guidelines for product development. However, it depends on the product planning policy of each manufacturer whether or not to install functions as defined, to provide equivalent functions using methods other than that specified, or to install functions beyond those defined in this specification. There are no restrictions in this regard. Should a problem occur as the result, however, broadcasters may not be able to provide solutions. Regarding desired receiving functions, a reference shall be made to "4.3 Types and Desired Functions of Receivers" in the General Operation Information of the document.

5.1 Fixed receivers (such as the tabletop television, portable television and STB)

When it comes to fixed receivers, it is most important to ensure the stability of receiving radio waves.

Fixed receivers refer to the receiver units that are designed to be permanently installed and used indoors as well as the receiver units that are designed to be installed and used at various locations (the installation locations may change from time to time). They do not necessarily come with a display (such as the CRT, LCD and PDP).

It is expected that high performance fixed receiver models are developed. However, functions may be limited with the product planning policy.

5.2 Mobile receivers (such as the car TV set, portable television and PDA) (T.B.D.)

5.3 Portable receivers (such as the portable receiver unit)

1-segment receiver.

Portable receivers, carried by people and used at various locations, are expected to be made smaller, lighter and more power saving than mobile receivers.

With priority given to creating compact, lightweight and power-saving portable receivers, there will be limited functions for installation.

6. User interface requirements

6.1 Time Management

The Japan Standard Time (JST = Coordinated Universal Time (UTC) + 9) information transmitted in the TOT can be used to set current Japan standard time, with an error of ±500 ms (If a leap second adjustment is to be made, a discrepancy of up to about 1.5 sec from JST may occur during a few minutes before and after the leap second insertion.). If a method other than the TOT is available to set Japan standard time, there is no problem with the use of the method.

If the shift to summer time takes place, receiving Local Time Offset Descriptor in the TOT and adding an offset value is required to display offset time.

(The time information other than Local Time Offset Descriptor in the TOT shows Japan Standard Time.)

6.2 Initial Settings

Receiver shall have a screen to enable Initialization described below. All the set values shall be recorded in NVRAM. Chapter 11 of this volume includes related information.

6.2.1 Initial Scan

Digital terrestrial television broadcasting uses different network_id for each TV master control equipment and it is assumed that information on services provided by other broadcasters are not included in the NIT. The digital terrestrial television receiver, therefore, shall search through all receivable channels at the reception location in order to create a service list (receivable frequency table) using service_id. Because of the MFN, areas where the same network_id is assigned to different physical channels (receivable) are assumed to be present. In that case, the channel with a better C/N or BER should be recorded in the receivable frequency table.

It should be noted, however, that when using a mobile or portable receiver, the state that can be received will change frequently. Manufacturers may therefore use multiple receivable frequency tables, depending on the reception location and on which channels are receivable, or create the receivable frequency table based on physical channels. However, it is solely up to the product planning policy of each manufacturer as to which data storage method should be used for the mobile and portable receivers.

6.2.2 Re-scan

In anticipation of changes in the reception environment, for example, the launch of a new station, the construction of a new relay station, and the relocation of the receiver, the receiver shall have the

function to allow users to perform a re-scan. If modifying information already set by users, the receiver shall have the function to tell users to that effect. Mobile and portable receivers are expected to have an auto scan function because the radio waves that can be received change frequently. However, it is up to the product planning policy of each manufacturer as to which scan timing and which data storing method should be used.

6.2.3 Installation Procedure for the Digital Terrestrial Receiver

When installing a receiver, the following steps should be taken to obtain a service list.

(1) First, the user specifies the location of the viewer's residence.

(2) When prompted to start a scan, the receiver searchs through channels (Channel 13 to Channel 62) to obtain a service list.

(3) The remote_control_key_id in the NIT is described in order to assign transport streams to the number buttons, 1 to 12, on the remote controller (how the number buttons are assigned to broadcasters is preliminarily agreed upon among them). Through this step, the most representative broadcast services of broadcasters are assigned to number buttons on the remote controller.

(4) If transport streams with the same number are detected, the receiver checks the C/N or BER to select a carrier with a better C/N or BER.

(5) Provisions are provided separately regarding how to perform setting on the receiver when services assigned to the same number button on the remote controller are detected.

The above steps are shown in Fig. 6-1 (an example flow chart).

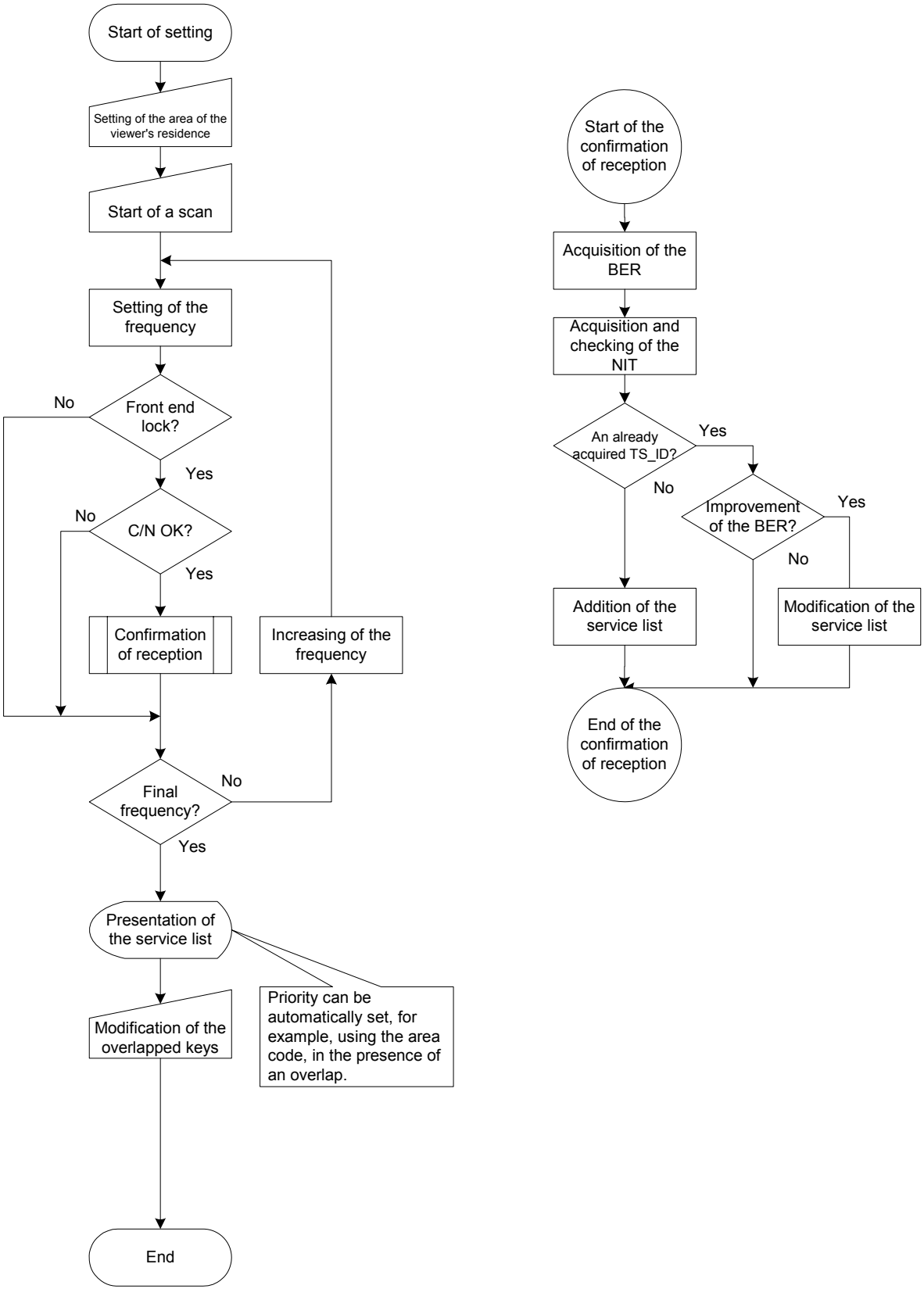


Fig. 6-1 An Example of How to Obtain a Service List when Installing a Receiver

6.2.4 Receiver Functions

(1) The UP/DOWN buttons on the remote controller are used to switch from one channel to another.

(2) It is difficult to automatically assign analog and digital services provided by the same broadcasters to the same number button on the remote controller. A different one-touch button assignment of broadcasters may therefore be occurred by a button to enable switching to other modes: for example, terrestrial analog broadcasting, BS digital broadcasting and CS digital broadcasting.

(3) A scan should be performed for terrestrial analog broadcasting (separately from terrestrial digital broadcasting) for channel assignment.

6.2.5 User Settings

6.2.5.1 Antenna Settings

To adjust the direction of the antenna for receiving terrestrial digital broadcasts, antenna receiving level shall be indicated to ensure easy antenna installation. One possible example of a reference antenna value is the value equivalent to twice the C/N value (dB, 5.6 MHz band) of the input carrier. However, absolute values to be indicated will follow the product planning policy.

One example of antenna settings for mobile and portable receivers includes a chart-based display of reception status (which radio waves can be received or not). However, how reception status will be displayed will follow the product planning policy.

6.2.5.2 Aspect Ratio of the Connecting Television Set

The aspect ratio for fixed receivers shall be 4:3 or 16:9 (wide).

For operation specifications, see "6.1.2 Video Signal Output Mode" of ARIB STD-B21.

The aspect ratio for mobile and portable receivers when connecting a TV set will follow the product planning policy.

6.2.5.3 Communication Line Settings

For communication line settings, see "7.4 Desired Receiver Functions" of Vol. 6 of the document.

6.2.5.4 Settings of the Location of the Viewer's Residence

The following steps shall be taken to define the location of the viewer's residence.

(1) Region ID code

The region ID code is used, for example, for the identification of the broadcast area, display of the EPG and determination of the three-digit number+branch identifier. This accordingly means that changing the region ID code may also change the order of display of EPGs and the three-digit number+branch identifier. An initial scan is therefore necessary following a change in the region ID code.

For specific values for the region ID code, see "9.1.3 Service Identifiers" in Vol. 7 of the document.

(2) Prefectural code

The prefectural code corresponds to the Target Area Descriptor.

The prefectural code is used for data broadcasting service in the area of the viewer's residence (such as weather forecasting service and up-to-the-minute election news service).

For specific values for the prefectural code, see Appendix G of ARIB STD-B10.

(3) Area code

The area code corresponds to the emergency information signal (Article 9-3, Item 5 of the Radio Equipment Regulations, Article 138 of the Radio Station Operation Regulations and the Ministry of Posts and Telecommunications Notification No. 405 of 1985).

The area code is used for emergency warning broadcasting (under the emergency warning system (EWS)).

For specific values for the area code, see Appendix D of ARIB STD-B10

It is desirable that the receiver has an automatic function to internally set the area code if the viewer sets the prefectural code in (2).

(4) Postal code (Seven-digit number)

The postal code is used for data broadcasting service in the area of the viewer's residence (such as weather forecasting service and up-to-the-minute election news service). The code is also used for interactive service in order to locate the nearest access point from the location of the viewer's residence.

6.2.5.5 Settings for Whether or Not to Allow Download

The viewer specifies whether or not to allow download for updating receiver software and whether or not to allow automatic updating of receiver settings using the frequency list and modification information. For more information, see Vol. 1 of the document. It depends on each manufacturer's product planning whether to set "Yes" or "No" as default for allowing download. Regardless of these settings, all receivers shall be capable of downloading common data including the frequency list and modification information, and reflecting common data downloaded in their settings other than frequency list and modification information.

6.2.5.6 Selection of Whether or not to Display Superimpose

Superimpose display modes include "Selective Display upon Reception" and "Selective Display during Replay" (see "4. Caption and superimpose coding" in Part 2 of Vol. 3 of the document). Since superimpose transmission is not synchronous with video, audio and data (main information) transmission, the receiver shall have the function to allow the user to specify "Yes" or "No" for

superimpose display during initialization. The default is "Yes".

6.2.5.7 Clear Function of User Defined Information

For the purposes of ownership transfer and disposal, the digital terrestrial receiver shall have the initialization function to completely clear private information recorded in NVRAM during broadcasting such as those listed below.

- Information in all the following areas used for data broadcasting including: memory area for the specified broadcaster, memory area for the all broadcasters, memory area for the affiliation, memory area of communication purpose for the specified broadcaster, memory area for bookmark service (*Note), memory area for root CA certificates and memory area for registration transmissions.
  *Note: This means the TVlink area in the case of a portable receiver.
  For more information, see "5.2 Use of NVRAM Commonly Used for the MM Service of Digital Terrestrial Television Broadcasting" in Part 2 of Vol. 3 and "7.2 Use of NVRAM commonly used for the C profile MM service" in Part 4 of Vol. 3 of the document.
- Entire the EMM mail storage area used for CAS.
  For more information, see "5.3 Memory" of Vol. 5 of the document.

In addition to the function mentioned above, the digital terrestrial receiver shall also have the function to clear viewer-defined private information (see "7.4.7.1 Protection Function of Viewer-defined Information" of Vol. 6 of the document); including information (such as mail addresses) in the interaction channel connection setting information area and information in the receiver-exclusive area, so as to enable a reset to the factory default settings. It is desirable to install this function in a relatively hidden level of the operation menu to prevent operation errors by users.

6.3 Selection of Programs

The basics regarding how to select programs and channels are shown below. However, these are not mandatory, meaning that other methods can also be used. It depends on each manufacturer's product planning to decide which method to use to select programs and channels.

Basically, one-touch buttons should be used to enable one-touch channel selection. For the purpose of improving user convenience, it is also advised to install other functions (to ensure an excellent user interface) including: up/down channel selection and direct channel selection, which uses ten keys to specify three-digit numbers for direct selection of a desired channel. Following the selection of a

channel, the receiver should display the information regarding the selected channel (including the three-digit number used for direct channel selection, branch identifier, TS name, service name and logos), using, for example, banners. Regarding portable receivers, on the other hand, it is likely that more simple methods may be used for channel selection, including the specification of the physical frequency channel. Therefore, it depends on each manufacturer's product planning to decide which method to use for channel selection for portable receivers. When using portable receivers, it presumably takes longer to select a channel. It is therefore desirable that a program name (title), for example, is displayed prior to video and audio display, by first obtaining the L-EIT.

It is also advisable to keep the immediately previous PMT in memory so as to accelerate video and audio display.

It should be noted that because the PMT_PID of the default portable service is uniquely defined by 0x1FC8 in the partial reception layer, channel selection time can be reduced in portable receivers by acquiring PMT_PID directly.

The PSI is used for channel selection. If receivers are able to easily detect service suspension, they should be able to display a message to that effect.

For the definition of service suspension, see "8.6 How to Handle Service Suspension" of Vol. 7 of the document.

6.3.1 How to Select Programs

(1) One-touch channel selection

- One-touch channel selection means the selection of service_id specified by remote_control_key_id.
- Specify the previous mode and display the information on the selected channel.

(2) Up/down channel selection using the UP/DOWN buttons

- Use the UP/DOWN buttons on the remote controller to select a channel in ascending/descending order of three-digit numbers used for direct channel selection.
- Pressing the UP button selects the adjacent channel in ascending order of three-digit numbers. However, if the presently set three-digit number is the largest on the service list, the channel represented by the three-digit number that is the smallest on the list will be selected.
- Pressing the DOWN button selects the adjacent channel in descending order of three-digit numbers. However, if the presently set three-digit number is the smallest on the service list, the channel represented by the three-digit number that is the largest on the list will be selected.
- Specify the previous mode and display the information on the selected channel.

(3) Direct channel selection

- Selecting the ten key causes a switching to the stand-by mode to prompt three-digit number input.
- Unless the input of a three-digit number is completed within a certain period of time (about five seconds), the mode switches back to the normal mode and current channel information used for direct channel selection is displayed.
- Following the completion of the input of a three-digit number, the receiver checks whether the channel represented by the three-digit number is found in the service list (receivable frequency table). If the channel is not found, a message appears to the effect that the channel is not found. See Table 6-3 for more information on the message.
- If the channel is found, the receiver selects the channel. Finally, specify the last mode and display the information on the selected channel.
- Receivers, if used in fringe areas where the same three-digit numbers may be assigned to different channels, should have the function to individually select these channels.

6.3.2 Switching between Analog Terrestrial Television Broadcasting and Digital Terrestrial Television Broadcasting

During the period of simultaneous analog and digital broadcasting, TV sets with a built-in digital tuner should receive both terrestrial analog and digital broadcasts. These TV sets shall therefore have a function to switch between terrestrial analog and digital broadcasting.

6.3.3 Continuous Mobile Reception

Mobile and portable receivers may be used within the multiple frequency network (MFN) areas. While moving from one place to another, it is possible to continuously receive the same network broadcasts for video and audio display. However, the location information of each receiver is required in this case. Therefore, it depends on each manufacturer's product planning as to whether or not to install this function (See Part 5 Appendix, PSI/SI Receiver Function Guidelines, C. PSI/SI Receiver Function Guidelines and C.11.6 Fringe Areas of Vol. 4 of the document.)

6.4 ES Switching

Although the functions specified in this section are mandatory, it depends on each manufacturer's product planning as to how to integrate these functions.

6.4.1 Default ES

Regarding how to select the first ES (default ES) to be decoded from among multiple ES' in the absence of a specification when a receiver has selected a service, see "5.1.3 Default ES" of Vol. 7 of the

document.

6.4.2 Selection of Video Elementary Streams

Since multiple video elementary streams may be carried simultaneously, receivers shall come with a user interface that can extract target video streams. It is desired that when switching between channels, receivers can select a default ES and enables cyclic switching using the video button on the remote controller. Regarding the function to simultaneously decode multiple elementary streams, it depends on each manufacturer's product planning as to how to integrate this function as well as how to make video display. Receivers with simultaneous decoding function shall have a user interface that enables the selection of video elementary streams for specific channels and at the same time enables simultaneous display mode. When using a multi-view television screen, elementary video, audio and caption streams grouped together by Component Group Descriptor shall be linked and switched all together. When using a multi-view television screen, the last settings made after the selection of video elementary streams shall not be stored in memory.

6.4.3 Selection of Audio Elementary Streams

Since multiple audio elementary streams may be carried simultaneously, receivers shall come with a user interface that can extract a target audio stream. It is desired that when switching between channels, receivers can select a default ES and enables cyclic switching between mono/SAP and audio elementary stream using the audio button on the remote controller. The user interface that enables the viewer to select an audio mode on the menu shall display audio information in accordance with the Audio Component Descriptor information.

In receivers having a portable receiver capability, selection from mono/SAP and audio ES shall be allowed for component tag values ranging between 0x83 and 0x86.

6.4.4 Selection of Caption and Superimpose Display

A maximum of one caption elementary stream and one superimpose elementary stream each may be present in some cases. Regarding the caption elementary stream, receivers shall be able to enable the selection of one of two modes: no display of the caption or the display of one of the languages present in the caption elementary stream. The default shall be set to "no display of caption". It is desired that cyclic switching is enabled using the caption button on the remote controller. If using a user interface that allows the viewer to select the caption elementary stream on the menu, language information shall be displayed in accordance with selector_byte of the information in Data Content Descriptor. Whether or not to display superimpose will be selected from the initialization menu. However, the superimpose is automatically displayed when specified so by the broadcaster. The caption and superimpose elementary streams shall be displayed at the same time.

Because superimpose is not handled in the partial reception layer, portable receivers do not have to cope with superimpose.

6.5 Remote Controller

It is desired that main functions of receivers can be controlled by the remote controller. The buttons on the remote controller should be able to perform the functions described below in addition to the functions specified in "5.2.17 Remote Controller and Channel Access, (1) Required Buttons", of ARIB STD-B21. This section shows examples of recommended remote controllers. However, this does not place limitations regarding the installation of other buttons. For portable receivers, see "3.3 Buttons (remote controller)" in Part 4 of Vol. 3 of the document.

(1) Basic Remote Controller Operations

- Power button to switch the receiver on and off (stand-by mode).
- Buttons to move the cursor horizontally and vertically (arrow buttons)
  (A joystick and a similar device can also be used.)
- A button to select/confirm the item pointed by the cursor (select/confirm button)

(2) Channel Selection

- Number buttons (ten keys)
- UP/DOWN buttons that allows channel selection in ascending/descending order
- One-touch button that allows one-touch selection of preset service_id *1

(3) Operation of the EPG Button and Other Buttons

- A button that allows the display of program tables (EPG button)
- A button that allows the display of the system menu (Menu button)

(4) Data Broadcasting Service

See "1.3.1 Buttons Used for Receiving Data Broadcasts" in Part 2 of Vol. 3 of the document.

The following buttons are used for receiving data broadcasts.

"d" button, arrow buttons, Select/Confirm button, ten keys, color buttons and Back button

Regarding color buttons, blue, red, green and yellow buttons should be placed from left to right for the display of characters in corresponding colors.

(5) Other

- A button that allows the selection of a target video (Video button) *2
- A button that allows the switching of audio elementary streams and to bilingual mode (Audio button)
- A button to turn the caption on and off and switch the language for the caption (Caption button)

*1 One-touch buttons

Regarding one-touch buttons, it is desirable that receivers have the function to enable the viewer, after purchase, to reconfigure buttons.

To use one-touch buttons also as number buttons, switching between the two modes shall be enabled by the channel selection button as shown in "Fig. 6-2 Example of Remote Controllers".

*2 Video button

The video button shall have the following switching functions. It depends on each manufacturer's product planning as to how to install these functions.

a. Switching between multiple channels provided by the same broadcaster

The video button has the function to switch between the channel currently viewed and other channels simultaneously broadcast by the same broadcaster using other service_id in the same TS, using toggle mode.

b. Switching to the Special Service

The video button has the function to switch from the channel currently viewed to another special service simultaneously broadcast by the same broadcaster in the same TS, using toggle mode.

c. Switching between the main channel and sub-channels on the multi-view television display

The video button has the function to switch, all at once, all the components grouped together by the Component Group Descriptor on the currently viewed multi-view service.

d. Switching of video components

The video button has the function to switch between video components on the currently viewed channel when component groups are not specified or during layered transmission.

An Example of A Remote Controller 1
(Remote Controller for the Digital Tuner)

An Example of A Remote Controller 2
(Remote Controller for the built-in Digital TV set)

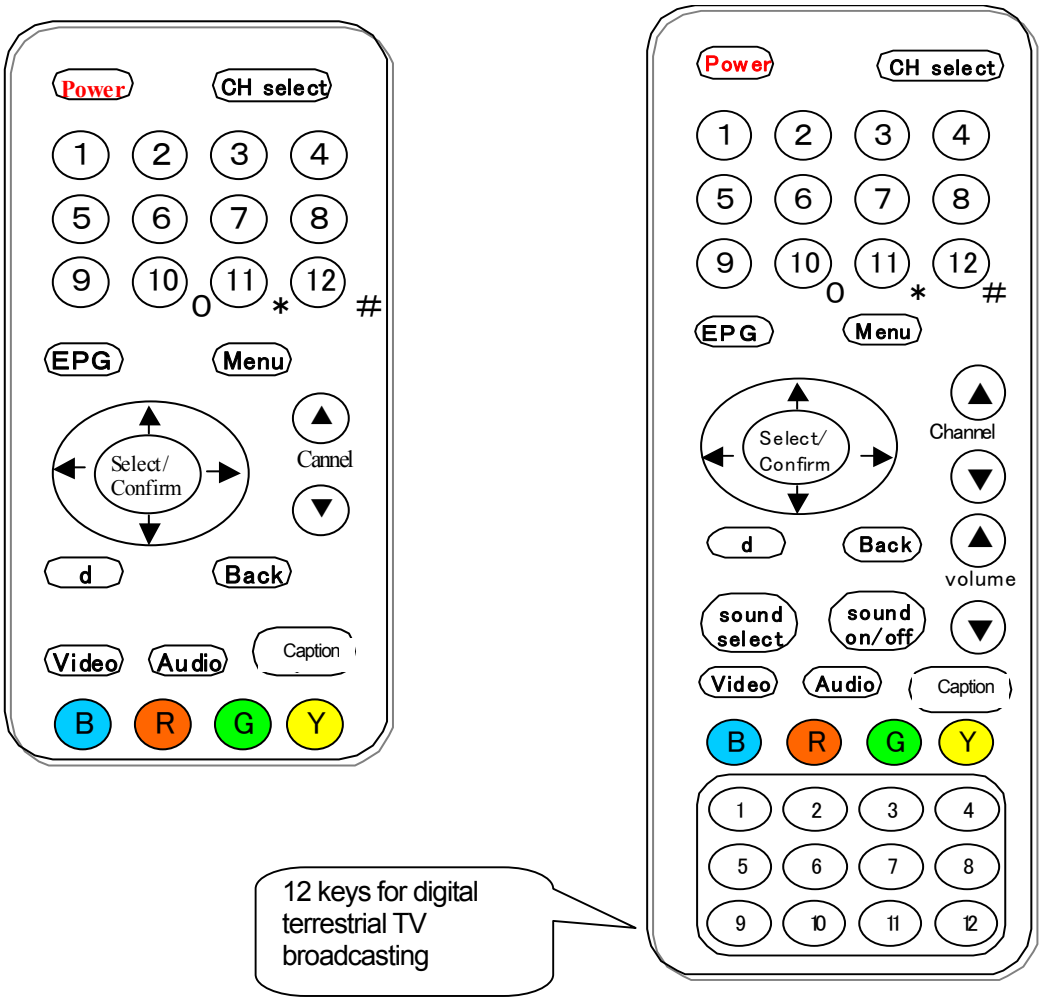


Fig. 6-2 Examples of Remote Controllers

6.6 EPG

Regarding EPG functions (such as program table display, program search and scheduling of program recording) using SI and the EPG user interface, it depends on each manufacturer's product planning as to how these functions are designed in principle. Nonetheless, to improve user convenience and in consideration of guidelines for SI production, examples of EPG display are shown below.

6.6.1 Modeling of Three Types of EPG Screen

6.6.1.1 Definitions of Three Types of EPG Screens

It is assumed that various types of receivers will become available for digital terrestrial television broadcasting. Accordingly, three types of EPG screen models were created for suitable use for various types of receivers. Broadcasters transmit program information, assuming that the information will be displayed as shown by these models. It is therefore necessary to formulate EPG's to be displayed on receivers based on these models. Nonetheless, it should be noted that these are only models and that it depends on each manufacturer's product planning as to how EPG screens to be actually installed on receivers and EPG functions are designed. Three types of EPG screen models are defined as described below.

(1) TYPE-H (High-Level) EPG Screen

This screen model (which resembles, for example, the TV and radio program tables in newspapers) is suitable for application to receivers for fixed setting. Program information for all receivable channels are obtained through channel search (for example, when the power is off) and entered into the memory of receivers in order to provide most detailed information across all services. Receivers for BS digital broadcasting use this type of EPG.

(2) TYPE-M (Middle-Level) EPG Screen

This screen model (which, for example, uses a list format) is suitable for application to receivers for mobile reception such as car TV sets and PDAs. From among the programs contained in the TS currently received, only the program information for the channels that can be received by mobile receivers are extracted and displayed when the receivers are used. This model allows the display of relatively detailed information on each program.

(3) TYPE-L (Low-Level) EPG Screen

This screen model (which, for example, uses a list format) is suitable for application to receivers such as portable receivers that can only demodulate partial reception (one segment). From among the programs contained in the TS currently received, only the program information for the channels that

can be received by partial receivers are extracted and displayed when the receivers are used. This model allows only simple display, for example, the display of program title.

Table 6-1 shows an example of functions of each EPG screen type. However, it should be noted that this only shows EPG screen models assumed for use by broadcasters when they transmit program information and that this does not place any restrictions regarding EPG functions that can be installed in receivers.

Table 6-1 An Example of Functions of Each EPG Screen Type

Function \ EPG Screen Type		TYPE-H EPG Screen	TYPE-M EPG Screen	TYPE-L EPG Screen
Acquisition of service information (SI) through channel search when the power is off		O	x	x
Storage of SI in memory		O	x	x
Display of program tables across various services		O	x	x
Display of the description of each program selected from the program tables		O	--	--
	Program title (Number of characters displayed (as a guide)) *2	O (40 characters)	--	--
	Broadcasting date and time	O	--	--
	Program description (Number of characters displayed (as a guide)) *2	O (80 characters)	--	--
	Extended description	O	--	--
	Program attribute *1	O	--	--
On-screen display of the name of the program currently viewed (Number of characters displayed (as a guide)) *2		O (40 characters)	O (20 characters)	O (10 characters)
Display of the description of the program currently viewed		O	O	O
	Program title (Number of characters displayed (as a guide)) *2	O (40 characters)	O (40 characters)	O (40 characters)
	Broadcasting date and time	O	O	O
	Program description (Number of characters displayed (as a guide)) *2	O (80 characters)	O (80 characters)	x
	Extended description	O	x	x
	Program attribute *1	O	O	x
Display of the program list (Only for the programs contained in the TS currently received)		x	O	O
Number of programs displayed in the program list		--	Two to ten programs	Two to ten programs
Program title in the program list (Number of characters displayed (as a guide)) *2		--	O (20 characters)	O (10 characters)
Display of the description of each program selected from the program list		--	O	O
	Program title (Number of characters displayed (as a guide)) *2	--	O (40 characters)	O (40 characters)
	Broadcasting date and time	--	O	O
	Program description (Number of characters displayed (as a guide)) *2	--	O (80 characters)	x
	Extended description	--	x	x
	Program attribute *1	--	O	x
Scheduling of recording using the program table and program list		O	x	x
Scheduling of viewing using the program table and program list		O	x	x
Search function by category		O	x	x
Serialized program recording function		O	x	x
Event relay function		O	O	x
Display of component description/language during signal switching (audio mode, for example)		O	O	x
Selection of service from the list of service names		O	O	O
Selection of service from the list of TS names		O	x	x
Display of logos on the EPG screen		O	O (Simple logos)	O (Simple logos)

O: Means that appropriate information is transmitted by broadcasters on the assumption that this function is available.

x: Means that appropriate information is not transmitted by broadcasters on the assumption that this function is not available.

*1: Program attribute refers, for example, to the video mode, audio mode, whether or not caption is available, whether or not the conditional access system (CAS) is used, whether or not copy control is used, whether or not linked data broadcasting is available and data content description.

*2: (Number of characters displayed (as a guide)) refers to the maximum number of double-width characters that can be displayed.

6.6.1.2 EPG Information that Should be Received by Receivers

Table 6-2 shows the EPG information that should be received by each type of receivers.

Table 6-2 EPG Information that Should be Received by Each Type of Receivers

	Examples of Receivers	H-EIT	M-EIT	L-EIT
Fixed receivers	Tabletop receiver units Portable indoor receiver units	Mandatory	Optional	Optional
Mobile receivers	Vehicle-mounted receiver units PDAs	T.B.D.	T.B.D.	T.B.D.
Portable receivers	Portable receiver units (One segment reception)	None	None	Mandatory

Program information is broadcast, if to be more specific, using an SI table called the Event Information Table (EIT). The EIT is classified into three types, H-EIT, M-EIT and L-EIT, for digital terrestrial television broadcasting. These three types of EITs respectively contain information corresponding to TYPE-H EPG screen, TYPE-M EPG screen and TYPE-L EPG screen, shown in Table 6-1. This means that these three types of EITs are defined in the way that strongly reflects the characteristics of each EPG screen type.

For example, L-EIT is transmitted to carry program information only for channels that can be received by partial receivers and SI for common operation (mandatory SI) is transmitted only for two programs (current and next programs) (though it is possible to broadcast SI for independent operation for three or more programs). Since L-EIT is assumed to be displayed only on the TYPE-L EPG screen, it carries a limited amount of information such as the program title and broadcasting time (information such as the program description, program attribute and category is not included). Partial receivers, therefore, are able to display the TYPE-L EPG screen, only by receiving L-EIT.

On the other hand, fixed receivers are capable of displaying, on the TYPE-H EPG screen, program information (program information for channels that can be received by fixed receivers) carried by H-EIT. (Eight days' worth of program information can be carried for TV broadcasting.) Fixed receivers are also capable of receiving channels designed for reception by partial receivers. Displaying the program information (carried by L-EIT) simultaneously next to the program information carried by H-EIT on the TYPE-H EPG screen may cause a viewer's confusion; a significantly less number of programs and less amount of information will be displayed.

Accordingly, models for display screens based on L-EIT and H-EIT were separately created and

defined.

Services designed for reception by fixed receivers and by partial reception receivers use fairly different picture formats and display modes. To prevent viewer confusion, therefore, it was considered necessary to use different modes when displaying navigation to these channels.

It was decided, therefore, to use the following assumption: the TYPE-H EPG screen, TYPE-M EPG screen and TYPE-L EPG screen should only use H-EIT, M-EIT and L-EIT, as the information source, respectively, when these screens are displayed.

Table 6-2 shows that the reception of the EPG by fixed receivers is either "Mandatory" or "Optional". This only means that if three types of EITs -- H-EIT, M-EIT and L-EIT -- are received, the information carried by them should be displayed on the EPG screen using a certain method. It depends on each manufacturer's product planning as to how receivers are designed to display information carried by each EIT with different characteristics. So, for example, it is not at all prohibited to develop a fixed receiver with the function to only display the TYPE-H EPG screen that displays three kinds of program information with different data amount simultaneously next to each other.

It should be noted that if, for example, a broadcaster wishes to have the information on a program on the channel designed for reception by partial reception receivers displayed on the TYPE-H EPG screen on fixed receivers as well as on other types of screens, the broadcaster is able to transmit H-EIT that carries the information on that program as well as L-EIT if opting to do so (SI for independent operation). This means that multiple types of EITs may be transmitted for the same program. Since H-EIT is assumed to be displayed on the TYPE-H EPG screen as a matter of course, H-EIT is transmitted at the rate, carrying the amount of information, suitable for reception by fixed receivers. In this case, receivers that have separate TYPE-H EPG and TYPE-L EPG screens display the same information on each screen in different style. On the other hand, receivers that have an integrated TYPE-H EPG/TYPE-L EPG screen should be designed, for example, in the following manner: the program information only carried by L-EIT should be displayed based on L-EIT and the program information carried by both H-EIT and L-EIT should be displayed based on H-EIT.

Regarding the transmission of EITs, see Vol. 4 of the document.

6.6.2 Specifications and Guidelines for the EPG

6.6.2.1 Common Restrictions to All Types of EPG Screens

(1)It shall be ensured that problems with program selection caused by problems with SI table transmission be avoided. Even if SI information is not correctly transmitted, it shall be ensured that the use of PSI information enable proper channel selection and display.

(2)It shall be ensured that when displaying program information across all service (all media types ---TV/data broadcasting/partial reception), the media type be identifiable.

(3)EPG screen display methods include, for example, reduced video display and alpha blending of the EPG screen with the video. For data broadcasting service, while an EPG screen is being displayed, interruption of the data broadcasting screen within the range of not causing a sense of incompatibility will be allowed.

(4)When an EPG screen is displayed based on the SI information, it is desirable that when superimpose is broadcast on the selected channel, the EPG screen is displayed accordingly.

(5)The default character string when the text_char area in the Component Descriptor and Audio Component Descriptor is left out shall be "video" and "audio", respectively. However, it shall be "First Audio CR (carriage return code) Second Audio" for dual mono.

6.6.2.2 Receivers with the TYPE-H EPG Screen

(1)It is desirable that the information on the currently selected (received) channel be displayed in the most eye-catching location on the screen when program information across all channels carried by broadcasters are displayed.

(2)It is desirable that the service logo is displayed on the EPG screen whenever possible and that the service logo, when displayed, is true to the original design as much as possible and remains unchanged in terms of aspect ratio, although the size (the number of vertical and horizontal dots) can be changed. It is also desirable that the colors are also true to the original.

The colors that can be commonly used for service logos include transparent colors (α value = 0) and translucent colors (α value = 128). To display service logos using these colors on the EPG screen on receivers, the following processing is allowed.

- Transparent colors shall be processed as non-plotted pixels. This means that pixels for which transparent colors were specified will not be plotted. The OSD of the background EPG will be seen through.
- Translucent colors shall be processed as pixels plotted in non-transparent colors. This means that pixels for which translucent colors (α value = 128) were specified will be plotted on the assumption that α equals 255.

(3)If displaying the EPG on a caption plane using 8-bit CLUT index colors, 32 receiver-specific colors and 128 receiver-non-specific common colors shall be used as explained in "1.2 Presentation Function" in Part 2 of Vol. 3 of the document. It depends on each manufacturer's product planning as to how the 32 receiver-specific colors are assigned. It should be noted, however, that since the text and graphic plane has only 17 receiver-non-specific common colors, thus being unable to correctly reproduce logos, they shall not be independently used as display plane of the EPG.

(4)Since the program information for channels other than those carried in the currently received TS cannot be received, channel search is performed when the power is off to receive and store in memory the program information for other channels. Accordingly, the difference between the time when information was entered into memory and the current time may cause the display of outdated EPG information. It is therefore desirable that the operation manuals for receivers include a note, for example, to the effect that since the program information may change without prior notice, the EPG information may be different from actual broadcasts.

(5)When viewers wish to display, on the EPG screen, program information for services other those carried in the TS currently received, previously stored information or if such information is not available, a message to that effect will be displayed. Only when viewers wish to receive program information for services in the TS currently received, a switching to the target TS will be made. However, to prevent viewers from switching from the TS currently received to another TS while they are watching a program, the function to receive program information should be installed in a location not pressed by mistake on the remote controller or the EPG screen.

(6)To receive the latest program information for all receivable services while the power is on, it is desirable that channel search function is installed. However, viewers should be made aware of the fact that since the execution of the function involves the search across all channels, it takes a considerable time to update the information to the latest. At the same time, it should be ensured that the function be installed in a way so that it is not executed by mistake. The interruption of video and audio display will be inevitable when channel search is performed.

6.6.3 Program Table and Program List

(1)The display of all the program information transmitted in SI shall be possible. This means that if SI has been acquired, there shall be no omission of information on certain broadcasters or on certain services when the information is displayed. Nonetheless, this does not apply to program information for data broadcasting not designed for reception.

(2)Regardless of how short a program may be, the presence of the program shall be indicated in some form.

(3)For long programs and over 24-hour long programs, the presence of such programs shall be clearly indicated, regardless of the broadcast time zones shown in the EPG.

(4)If planning to display a program table in the style used by general newspapers to list TV and radio program tables, it is desirable to use a format similar to that (10 double-width characters/line) to display program information.

(5)The program titles (program title and subtitle) shall be comprised of 40 characters if they are long programs. It should be noted, however, that only 20 characters may be used (with the remaining part curtailed) in some cases due to limitations of display (a maximum of 20 characters are used for 30-minute long or shorter programs.)

(6)It is desirable that if program attribute information is found in the EIT, the information be displayed. The attribute here refers to the information transmitted in SI including the video mode, audio mode, whether or not additional data is present and whether or not a caption is present.

(7)It is desirable that if program information is updated, the information displayed in the program table be corrected as soon as possible.

(8)Loop scrolling is desirable for scrolling through channels in the program table.

(9)The following points should be noted when displaying a data broadcasting program table.

- It depends on each manufacturer's product planning to display the data broadcasting program table together with the TV program table or to display the data broadcasting program table separately from the TV program table.
- For programs for which additional data are available, the presence of linked data service should be indicated in the program table.
- If data programs and local contents targeted for CA are present, a message to that effect should be indicated in the program table.

(10) It is desirable, when displaying a program table using the region ID contained in service_id, to give priority to local channels in the area of the viewer's residence, and if channels not intended for reception in the area of the viewer's residence can also be received (cross-border reception), to give the second priority to channels in order of having a better C/N or BER. When displaying a program

table, it is preferred to sort channels based on the "service type", "region broadcaster ID" and "service No." contained in service_id. In this case, it should be noted that the sorting order is not the same as the order of three-digit numbers used for direct channel selection.

With regard to the NHK-G (News and Entertainment) channels in the Kanto, Chukyo and Kinki regions, it is essential that priority should be given to the prefectural NHK-G channel in Ibaraki in the Kanto region and in the entire Chukyo and Kinki regions. However, if the perfectural NHK-G channel intended for reception in the area of the viewer's residence cannot be received, priority should be given to another NHK-G channel with a better C/N or BER when displaying a program table. When, as a result of a re-scan or frequency repacking, the prefectural NHK-G channel intended for reception in the area of the viewer's residence becomes receivable, it is desirable that priority should be given to the channel now receivable and the NHK-G channels intended for reception in other areas will be displayed as cross-border channels.

If multiple TS' with different second TS flags but with the same region ID and region broadcaster ID are received, it is desirable to give priority to the service with a better C/N or BER and other services are displayed after the services intended for reception in the area of the viewer's residence.

6.6.4 Program Search

It is preferable that receivers have the function to search through programs using the program genre information transmitted in content_nibble_1 (primary classification) and content_nibble_2 (secondary classification) of Content Descriptor. In this case, program search shall be enabled only using primary classification information.

6.6.5 Program Information Display

(1) For broadcasters to design the layout for the display of detailed program information, guidelines are needed regarding how program information should be displayed on receivers. When displaying detailed program information on receiver, a maximum of 20 double-width characters should be used per line.

* A maximum 20 characters per line are equivalent to a 480-dot area in the horizontal direction (half of the horizontal width) when 24-dot fonts are used at high-definition TV picture resolution (960x540).

(2) It is desired that the display of the detailed program information currently viewed is easy.

6.7 Scheduling of Program Recording

6.7.1 Presetting of Recording Schedules

(1)If the program scheduled for recording is formed by multiple elementary streams, the selection of certain streams shall be allowed when the program is scheduled.

(2)If the program scheduled for recording has caption, the selection of caption service shall be allowed when the program is scheduled.

(3)If a program is copy-protected, a message to that effect shall be displayed.

(4)If the program to be scheduled for recording is pay program (free_CA_mode=1), whether the program can be viewed shall be checked during the presetting of the recording schedule. However, it should be noted that if the PPV system, which is not scheduled to be operated in the initial stage of the commencement of digital terrestrial television broadcasting, is operated in the future, PPV-non-compatible receivers shall display a message to the effect that they are not compatible with the PPV system during the presetting of the recording schedule.

(5)If the program to be scheduled for recording is free (free_CA_mode=0), the scheduling of recording is considered possible. However, to view protected free programs, an IC card shall be inserted. It will be desirable, therefore, to check whether an IC card has been inserted during the scheduling of recording, and if a valid IC card has not been inserted (no IC card has been inserted or an invalid IC card has been inserted), to display a message promoting the insertion of a valid IC card.

For more information, see"5.8 Scheduling of the Recording of Protected Free Programs and Pay Programs" in Vol. 5 of the document.

6.7.2 Confirmation of Programs Scheduled for Recording

(1)Receivers shall have a user interface that allows the checking of the programs preset for recording.

(2)It is desirable that receivers have the function to display the list of programs scheduled for recording.

(3)Receivers shall allow the cancellation of the programs preset for recording.

6.7.3 Execution of Scheduled Recording

(1)Receivers shall start the scheduled recording in accordance with the EIT [p/f] (actual) in the TS carrying the program scheduled for recording. However, since the starting and ending time of the program may come about four seconds after the TOT, this fact should be taken into consideration when executing the scheduled recording. Programs broadcast continuously in time sequence (though by different broadcasting stations), which are scheduled for recording using the EPG, may partially overlap due to a problem associated with channel switching. It depends on each manufacturer's

product planning as to how priority should be assigned in this case. It is desirable that a message regarding how priority is assigned be displayed so that users will be able to make selections that better suit their priority. (See "16 Operation of Time Information" in Part 1 of Vol. 4 and "7.6 Transmission Delays" in Vol. 7 of the document.)

(2)Receivers shall automatically delete the preset recording schedule once the recording is complete.

(3)Change of the broadcasting time of the programs preset for recording

See "19.5 Guidelines for Transmitting Modification Information Regarding Event Programming" in Part 2 of Vol. 4 of the document.

- It depends on each manufacturer's product planning as to how receivers are designed regarding the follow-up function: more specifically, whether or not to use the follow-up mode to execute the scheduled recording in accordance with the change (delay) of the program starting time (when the program starts later than originally scheduled). However, if no definite event information is received within three hours from the originally scheduled starting time, the program is considered to have been cancelled. In this case, the follow-up mode can be disabled.
- It depends on each manufacturer's product planning as well as to how receivers are designed regarding the follow-up function: more specifically, whether or not to use the follow-up mode to execute the scheduled recording in accordance with the change (move forward) of the program starting time (when the program starts earlier than originally scheduled). The follow-up function is triggered by the event information made available one hour and 30 seconds earlier than the originally scheduled starting time. The follow-up function can not be triggered by the event information made available less than one hour and 30 seconds earlier than the originally scheduled starting time. The follow-up function can be disabled if the program scheduled for recording starts over one hour earlier than the originally scheduled starting time.
- There will be no change to event_id due to the change of time (unique for each channel).
- Time shall be displayed in minutes.
- There may be a cancellation of a program (the loss of event_id) due to the reprogramming or modification of the program preset for recording.

6.7.4 Scheduling of Program Recording Using Timer Function

To schedule the recording of a program that is broadcast in case a live sport broadcast, for example, is cancelled due to rain, receivers should come with EIT-independent recording control function using, for example, channel number and recording time, like the analog videotape recorder.

6.8 Conditional Access System (CAS) Service

For information regarding how the conditional access system service is provided, see "5 Required Specifications for Receivers" in Vol. 5 of the document.

6.8.1 TS Name Display Function

Receivers shall have the function to display the name of the TS (comprised of 10 characters) carrying the currently viewed service in order to check the TS carrying the EMM. However, the function to display the EPG or detailed program information can also be used to display the TS name.

6.9 Contents Protection Function

For information regarding the contents protection function, see "5 Function Requirements for Receivers" in Part 1 of Vol. 8 and "5.1 Functional requirements on segment receivers" in Part 2 of Vol. 8 of the document.

6.10 Reception of Data Broadcasting Service

Conformance to the following specifications is required in the reception of data broadcasting service. For the specifications of portable receivers that receive only video and audio data, see "9. C profile receivers that receive only video and audio data" in Part 4 of Vol. 3 of the document.

6.10.1 Requirements for the Receiver

(1) Fixed receivers

Fixed receivers shall satisfy the following functions and specifications mentioned in "1 Functions that Must be Installed in Basic Receivers to Receive Data Broadcasting Service" in Part 2 of Vol. 3 of the document.

* Section 1.2: Display Function
* Section 1.3: Remote Controller
* Section 1.4: Memory that Must be Installed in the Receiver

(2) Mobile receivers (T.B.D)

(3) Portable receivers

Portable receivers shall satisfy the following functions and specifications mentioned in "3 Functions that Must be Installed in Basic Receivers to Receive Video, Audio and Multimedia Data" in Part 4 of Vol. 3 of the document.

* Section 3.2: Display Function
* Section 3.3: Buttons (Remote Controller)
* Section 3.4: Memory that Must be Installed in the Receiver

6.10.2 Startup and Shutdown of Data Broadcasting Service Processing

(1) Fixed receivers: See "2.3.6 Related Receiver Operations" in Part 2 of Vol. 3 of the document.

(2) Mobile receivers: (T.B.D)

(3) Portable receivers: See "4.1.5 Related Receiver Operations" in Part 4 of Vol. 3 of the document.

6.10.3 Reception of Interaction Channel Data Broadcasting Service

For more information on how to receive interaction channel data broadcasting service, see Vol. 6 of the document.

6.10.4 Reception of Caption and Superimpose

(1) Fixed receivers

See the following sections in "4 Caption and Superimpose Coding" in Part 2 of Vol. 3 of the document.

* Section 4.3: Video Resolution and Caption and Superimpose Display Format
* Section 4.4: Caption and Superimpose Characters
* Section 4.5: Caption and Superimpose Control Codes
* Section 4.6: Operation of the DRCS
* Section 4.7: Initialization Operations
* Section 4.8: Caption and Superimpose Mono Media
* Section 4.9: Desired Receiver Operations

(2) Mobile receivers (T.B.D)

(3) Portable receivers

See "6 Caption and Superimpose Coding" in Part 4 of Vol. 3 of the document.

6.11 Adaptation to Various Television Broadcasting Modes

6.11.1 Reception between Different Layers

See "8.1 Layered Transmission" in Vol. 7 of the document.

* Functions needed for reception

(1) Demodulation of carrier signals modulated by various methods

(2) Decode of video and audio streams in all layers transmitted. It depends on each manufacturer's product planning as to whether to install the function to simultaneously output video streams in different layers (such as the window display for the partial reception layer).

(3) A group of components constituting a single broadcast service are basically present in the same layer. However, since components, for example, for audio and data broadcasting, may need to be carried in a layer using higher protection modulation, streams transmitted in different layers shall be

displayed simultaneously.

6.11.2 Mobile Reception (T.B.D)

6.11.3 Partial reception

It depends on each manufacturer's product planning as to how streams are displayed on receivers, as long as it does not deviate from what is expected by broadcasters.

- The demodulation of 16QAM and QPSK modulated signals shall be possible.
- The decoding of low-frame-rate and low-resolution pictures and audio (half-rate sampling) is optional for fixed receivers.
- Regarding portable receivers, there are limits to the reception of TV broadcasts. However, portable receivers shall be able to receive broadcasts (a mix of low-frame-rate and low-resolution pictures and audio) within the limits of data broadcasting.

6.11.4 Reception of Emergency Warning Broadcasting (under the Emergency Warning System (EWS))

See "7.9 Operation of Emergency Warning Broadcasting (under the Emergency Warning System (EWS))" in Vol. 7 of the document.

The following steps (1) to (4) should be taken for fixed receivers.

(1) After the start flag for emergency warning broadcasting of the TMCC signal changes from 0 to 1, receivers start monitoring the Emergency Information Descriptor in the descriptor area 1 in the PMT of the TS received.

(2) If area_code matches the area code set in the receiver when start_end_flag of the Emergency Information Descriptor is 1, the channel described in the Emergency Information Descriptor is selected for reception.

(3) Receivers continuously monitor the PMT while the start flag for emergency warning broadcasting of the TMCC signal remains 1.

(4) When the start flag for emergency warning broadcasting of the TMCC signal has switched to 0 or when the Emergency Information Descriptor in the PMT has been deleted, emergency warning broadcasting comes to an end. However, it should be noted that as described in "7.9.4 Modification of the Description of the Emergency Information Descriptor" in Vol. 7 of the document, there is a possibility that emergency warning broadcasting may be resumed. Receivers must, therefore, continuously stay in the emergency warning broadcasting (EWS) reception mode for at least 90 seconds after the end of emergency warning broadcasting, and then, restore the pre-start state (note

that the information regarding EWS reception service is not put into memory as the last service). If channel switching takes place during the reception of emergency warning broadcasting (EWS), the reception of emergency warning broadcasting (EWS) comes to an end. However, when the start flag for emergency warning broadcasting of the TMCC signal switches from 0 to 1, receivers start the reception of emergency warning broadcasting (EWS).

- Receivers shall not process the emergency warning broadcast when start_end_flag of the Emergency Information Descriptor is 0 since it is a test broadcast.
- If receivers are unable to receive TMCC signals when the power is off (stand-by mode), the receivers shall, after the power is switched on, monitor the Emergency Information Descriptor in the descriptor area 1 in the PMT of the TS received and start the reception of emergency warning broadcasting (EWS) when the start flag for emergency warning broadcasting of the TMCC signal is 1.
- If receivers are able to receive TMCC signals when the power is off (stand-by mode), the receivers shall receive abovementioned emergency warning broadcasting (EWS) when the power is off (stand-by mode).
- If the PMT in question becomes no longer present during the reception of emergency warning broadcasting, receivers can end the reception of emergency warning broadcasting.

In the case of portable receivers, startup operation shall be done regardless of area_code in the above step (2) for fixed receivers, because the area code set in the receiver may differ from the actual location. This does not apply when the reception area can be identified by any other means. The other steps for portable receivers are basically the same as the above-mentioned steps for fixed receivers. As an alternative to the reception process of emergency warning broadcasting (EWS), a flashing light may be provided on the portable receiver to give effective warning to the viewers.

Regarding the modification of the Emergency Information Descriptor and the operation of receivers, see Fig. 6-3.

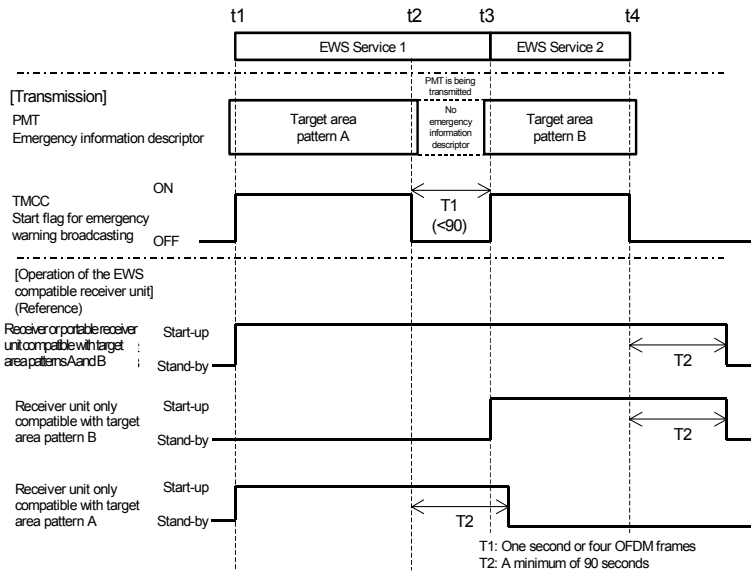


Fig. 6-3 Modification of the Emergency Information Descriptor and An Example of Operation of the Receiver

6.11.5 Reception of Special Service

See "8.3 Special Service" in Vol. 7 of the document.

(1) Decision for special service

- Special service refers to those whose service_type is special service (0xA1, 0xA3) in the NIT.
- The start of special service is marked by the appearance of service_id of special service in the PAT.

(2) Notification of the start of special service

The notification of the start of special service is made to viewers, for example, using superimpose or an announcement during a program.

(3) Channel switching during the broadcasting of special service

- Channel switching shall be enabled as usual during the broadcasting of special service. In addition, channel selection may be enabled using the video button. If no special service is broadcast, channel skipping takes place. When using the UP/DOWN buttons to switch between channels while special service is broadcast, channels are switched in ascending/descending order of three-digit numbers used for direct channel selection. Accordingly, for example, under the following condition: 011, 012 (special service), 013 (special service), switching from 013 (special service) to 021 (carried by another broadcaster) (by pressing the UP button) and then vice versa (by pressing the DOWN button) causes a return to 013 (special service).

- Receivers shall display channel information when channels have been switched.

(4) EPG display

It depends on each manufacturer's product planning as to whether to display the EPG. However, it is desirable that the EPG be displayed when SI for special service is transmitted.

(5) End of special service

If service_id of special service is no longer present in the PAT, a return shall be made to the service_id of regular service carried in the TS that contains special service or the regular service of the same service type.

(6) Scheduling for recording

Unless the event relay function is used for continuous recording, special service cannot be scheduled for recording.

6.11.6 Reception Using the Event Relay Function

See "8.5 Event Relay" in Vol. 7 of the document.

(1) General service information

- To continuously broadcast the same program (event) using a different service_id, for example, to broadcast the high school baseball tournament longer than originally scheduled, or when a live broadcast does end at the scheduled time, the broadcast can continue as special service using a different service_id. In this case, SI can be used to notify viewers that the same program will be continuously broadcast using different service_id or to continuously record the same program using the event relay function.
- The event relay function can also be used using same service_id. However, seamless switching is not guaranteed in this case.

(2) Criteria regarding whether the event relay function can be used

If the EIT [p/f] of the selected event has the Event Group Descriptor and its group_type is event relay type, it is considered possible that the event relay function can be used. When the currently selected event ends on a channel, switching will take place to another channel (described in the Event Group Descriptor) on which to continuously broadcast the same event for automatic recording. In this case, the event sequentially broadcast on a different channel may be carried by a different TS from the TS originally carrying the event.

(3) Notification to viewers and event switching

In principle, the notification of a scheduled event relay will be sent to viewers using superimpose or an announcement during a program broadcast. Switching to another channel on which to continuously broadcast the same program (event) will be done by individual viewers, who have

received the prior notification.

(4) Recording

When an event for which the event relay function is enabled is scheduled for recording, it is desirable that when the channel is switched to another to continuously broadcast the same event, the channel for recording is also switched accordingly. The recording of special service ends with the disappearance of PMT_PID from the PAT, which signifies the end of an event relay.

6.11.7 Reception of the Multi-view Television Broadcast

See "8.4 Multi-view Television Broadcast" in Vol. 7 of the document.

(1) The 1 service_id/multiple ES system is used. Among multiple SDTV services, one is used as the main service and the other remaining services are used as sub-services. There is a clear difference in how they are used.

(2) When receiving a multi-view television (MVTV), receivers shall display the main service first.
The PID of the main service in the PMT shall be the default ES.
The relationship between the main service and sub-services is defined by Component Group Descriptor.
When an MVTV event ends, a shift is made to the default video and audio streams of the next event.

(3) The notification of the start of service is made to viewers, for example, using superimpose or an announcement. Service switching is done manually by each viewer, using the video button (or a similar function) on the remote controller. If Component Group Descriptor cannot be obtained, for example, within a few seconds from the start of the broadcast, switching by group cannot be done and video and audio components are separately switched.

(4) Each component of MVTV has the same attribute. Whether a component is an MVTV component is determined using the EIT [p/f].

(5) Externally connected digital recorders (such as D-VHS and hard disk recorders) can be able to record all services if doing so is required. However, recorders connected via an analog terminal can suffice as long as they record the main service.
It depends on each manufacturer's product planning as to whether to install the function to record only the main service when using digital recorders or whether to install the function to record all services (including the switching between the main service and sub-services) viewed when using digital and analog recorders. The installation of the function to simultaneously display multiple SDTV is not mandatory.

(6) Processing by event is a prerequisite for MVTV. No starting/ending takes place in the midst of an event.

(7) It is desirable that the EPG displays a message to the effect that a MVTV is now running.

6.11.8 Reception of Bookmark Service

Note: "bookmark" in this chapter shall mean "C profile broadcasting bookmark" in Part 4 of Vol. 3 of the document in the case of portable receivers.

6.11.8.1 Reception of Bookmark Storage Service

See Vol. 2, Appendix-1 of ARIB STD-B24 for fixed receivers.

See Vol. 3 of the document for portable receivers.

6.11.8.2 Reception of Bookmark Listing Service

See Vol. 3 of the document.

6.11.8.3 Bookmark Function Provided by the Receiver Application

It is possible to install the bookmark function as a resident application unique to receivers.

Since it depends on each manufacturer's product planning as to how to install the bookmark function. An example of how the function is installed is shown below.

(1) Bookmark storage function

The bookmark storage function is used, for example, to store the address information on the data broadcasting service currently received in the bookmark area of NVRAM, using the receiver application. However, it should be ensured that the information can be merged with the information stored by bookmark storing service.

(2) Bookmark list display function

- The bookmark list display function is used to display, in list format, the bookmark information recorded in the bookmark area of NVRAM, using the receiver application.
- The function enables the viewer to select a target bookmark from the list so that the URI can be obtained from the bookmark information and a channel is automatically selected.
- Management functions including bookmark deletion.

6.12 Messages

If an error has occurred due to causes shown in the "Cause" column of Table 6-3, the screen shall display an error message. Since the error message displayed regarding the problem shown in Table 6-3 prompts the user to identify the cause as the first action, see each message example in the table (the use of the same messages as those shown in the table is not mandatory). It depends on each manufacturer's product planning as to how the error message is displayed. For CAS-related messages, see Vol. 5 of the document.

Table 6-3 Error Message List

Cause	An Example of An Error Message Shown on the Screen	Error Code	Problem Solving Action
A program not broadcast has been selected.	Unable to view the program because the channel is not broadcast.	E200	The channel (program) cannot be viewed.
There is a temporary down in the reception level. Antenna cable or connector connection is poor. The antenna direction is wrong.	The signal level is reduced.	E201	Check the antenna line. Check the antenna direction.
There is a temporary interruption to reception. The antenna cable or connector is broken.	Unable to receive signals.	E202	Check the antenna line. Check the receiver settings.
The broadcasting time has already ended.	Note 1	E203	Check the broadcasting time, for example, using the program guide.
The selected channel cannot be found.	The channel does not exit.	E204	Check the channel, for example, using the program guide.
The functions of the receiver are not compatible with the service on the channel.	The receiver is unable to receive the selected channel.	E210	Select a channel different from the one selected.
The telephone line is incorrectly wired.	Could not connect to the center.	E301	Check the telephone line connection and settings and test the line for continuity.
(During the display of a data broadcast) The BML document cannot be obtained.	Unable to receive data.	E400	First, select a channel different from the one currently viewed and then, select the data broadcasting channel on which an error has occurred again.
(During the display of a data broadcast) The BML engine of the receiver does not support the version of the BML document obtained.	The receiver is unable to display data.	E401	Select another channel (give up viewing the selected data broadcasting channel.)
(During the dsplay of a data broadcast) During the display of the contents, an execution error has occurred and external reference data cannot be obtained.	Data display has failed.	E402	First, select a channel different from the one currently viewed and then, select the data broadcasting channel on which an error has occurred again.

Note 1: The suspension of broadcasting is considered to take place when the cases shown in the "State" column of Table 6-4 take place. The examples of error messages displayed in these cases are shown in the "Message" column of Table 6-4.

Table 6-4 Examples of Messages when Broadcasting is Suspended

State	service_type	Layer	Message	Remarks
Although the channel list is in the NIT, no corresponding service is in the PAT (or a similar table)*2.	Digital TV service	Layers other than partial reception layer	Suspended	Not transmitted in the partial reception layer.
	Special video service		The channel does not exist.	Not transmitted in the partial reception layer. Skipped during UP/DOWN channel selection
	Data service	All layers	Suspended	
	Special data service	Layers other than partial reception layer	The channel does not exist.	Not transmitted in the partial reception layer. Skipped during UP/DOWN channel selection
Although the channel list is in the table similar to PAT*2, no corresponding service is in the NIT.	Data service	Partial reception layer	The channel does not exist.	
Although the description of the corresponding service is in the PAT (or a similar table)*2, the PMT does not exist (or the PMT cannot be obtained).	Digital TV service	Layers other than partial reception layer	Suspended	In the absence of an error*1 (Abnormal state)
	Special video service		The channel does not exist.	In the absence of an error*1 (Abnormal state)
	Data service	All layers	Suspended	In the absence of an error*1 State assumed possible (in terms of provisions for operations)
	Special data service	Layers other than partial reception layer	The channel does not exist.	In the absence of an error*1 State assumed possible (in terms of provisions for operations)
Although physical carriers are received, only null packets are transmitted; PSI and other information do not exist.			Suspended	In the absence of an error*1
Suspension of waves (no physical waves are received)			Unable to receive waves	

*1: The absence of an error refers to when transport_error_indicator on the 9th bit (the 2nd byte MSB) from the header of the TS packet is set to 0 or refers to a similar state.
In the absence of an error, see Table 6-3 (E201, E202).

*2: No PAT is transmitted in the partial reception layer. Instead, portable receivers have the PMT and a table similar to the PAT with fixed PID.

7 Requirements for Hardware and Software

7.1 Front End

- The front end should have at least one RF input.
- The front end shall be able to receive UHF frequencies (UHF channels, 13 to 62).
- For tuner specifications, see 5.2.1 to 5.2.5 of ARIB STD-B21.
- For front-end signal processing, see 5.2.6 of ARIB STD-B21.

7.2 TS Decoder

See "5.2.7 Transport Processing in Chapter 5 of ARIB STD-B21".

7.3 Video Decoding Process and Output

For more information on video decoding and output when using fixed receivers, see "6.1 Video Decoding Process and Output" of ARIB STD-B21 and "Appendix-1 How to Switch between Video Formats" of ARIB STD-B21. For more information on RGB analog terminals and digital video terminals, see "7.14.4 RGB Analog Terminal" and "7.14.5 Digital Video Terminal" in this volume. For more information on video output from the digital video/audio output terminal, see "7.14.6 Digital Video/Audio Output Terminal" in this volume.

See ARIB STD-B24, Vol. 1, Part 2, Appended Specification G, "Operational guidelines on H.264|MPEG-4 AVC video coding" regarding video decoding for portable receivers.

7.4 Audio Decoding Process and Output

For fixed receivers, see "6.2 Audio Decoding and Output" of ARIB STD-B21 and "Appendix-4 AAC Decoder Downmixing" of ARIB STD-B21. However, receivers with optional downmixing functions for external pseudo-surround processors and for widening the stereo sound field (both methods are described in "6.2 Audio Signal Processing and Output" of ARIB STD-B21) should be able to display, for example, the specified downmix setting, so that the users can understand the downmix setting.

In designing an AAC audio decoding circuit, precautions on the implementation of MPEG-2 AAC scheme in Section 9.5 of this volume shall be taken into account. As for the use of AAC coding tools and maximum instantaneous rate, sufficient discussion and consideration are desired regarding both the transmission operation of broadcasters and the decoding circuit design of manufacturers on the basis of a practical perspective on future progress in the coding technology.

When installing the digital audio output function, compliance to "AAC expansion" in IEC 60958 and IEC 61937 shall be observed. For more information on audio output from the digital video/audio output terminal, see "7.14.6 Digital Video/Audio Output Terminal" in this volume.

For audio decoding of portable receivers, see "4.3.3 Provisions Regarding Audio Coding" in Vol. 7 of the document. It should be noted, however, that SBR decoding is optional.

When handling AAC_SBR in partial reception, the output sample rate of AAC_SBR decoding signals is 48 kHz, which is twice the sample rate described in the AAC stream (24 kHz). Therefore, the receiver shall be designed with due consideration for the noise generated by sample rate switching during SBR data reception.

7.5 Memory

7.5.1 RAM

- To receive data broadcasting service, see 1.4 in Part 2 and "3.4 Memory that should be installed in the receivers" in Part 4 of Vol. 3 of the document.
- To receive notification information and downloaded software, a memory buffer size enough to support the transmission speed should be allocated.
- It depends on each manufacturer's product planning to determine the size of RAM to be allocated to resident programs in receivers, the most representative of which are SI/EPG.

7.5.2 NVRAM

7.5.2.1For Downloading

For more information on memory for downloading software on fixed and mobile receivers and common data for receivers, see "6.1.1 Memory Provisions" in Vol. 1 of the document.

7.5.2.2For Data Broadcasting

(1) Fixed receivers

See "5.2 Operation of NVRAM, which is commonly used for Multimedia services in Digital Terrestrial Television Broadcasting" in Part 2 of Vol. 3 of the document.

- (2) Mobile receivers (T.B.D)
- (3) Portable receivers

See "3.4.2 NVRAM" in Part 4 of Vol. 3 of the document.

7.5.2.3For Receiving Mail

See "5.3 MEMORY" in Vol. 5 of the document.

-

It depends on each manufacturer's product planning as to whether to install NVRAM other than that described above.

7.6 Character Font

The following character fonts are available on receivers for data broadcasting service and SI/EPG display.

7.6.1 Data Broadcasting Service

(1) Fixed receiver

See "1.2.5 Fonts" and "4.6 Operation of the DRCS" in Section 2 of Vol. 3 of the document. It is desirable that the font transmitted in four gradations is displayed as intended by the sender. Steps of gradations that receiver displays depends on each receiver.

(2) Mobile receiver (TBD)

(3) Portable receiver

See "3.2.5 Fonts" in Part 4 of Vol. 3 of the document.

7.6.2 EPG

It depends on each manufacturer's product planning as to which font type and size to use for EPG display. For more information on character sets, see "4.1 Character Sets" in Part 1 of Vol. 4 of the document.

7.7 Built-in Sounds of the Receiver

(1) Fixed receivers

See "3.3.5 Sound built-in the receiver" in Part 2 of Vol. 3 of the document.

(2) Mobile receivers (T.B.D)

(3) Portable receivers

See "5.3.3 Receiver built-in sounds" in Part 4 of Vol. 3 of the document.

7.8 High-speed Digital Interface

To install a high-speed digital interface, see "Chapter 9 -- High-speed Digital Interface Specifications and Appendix 2 High-speed Digital Interface" of ARIB STD-B21.

7.8.1 Restriction of Partial TS Output

- When outputting digital terrestrial television programs, components that cannot be descrambled should not be output. When outputting digital terrestrial television programs, components that cannot be descrambled should not be output.
- See "5.3 Copy control restriction" in Part 2 of Vol. 8 of the document for portable receivers.

7.8.2 Specifications for the Operation of the PSI/SI Table for Partial TS Output

Assuming a connection with equipment that record MPEG streams, there are stipulated specification for the partial TS to be received by receivers through a high-speed digital interface. For more information, see "8.1 Specifications for the Operation of PSI/SI for Partial TS Output" in this volume.

7.8.3 IEEE1394 Control Command

See ARIB STD-B21. The configuration of bouquet_id in which to insert a three-digit number and branch identifier is shown below.

Table 7-1 bouquet_id

Configuration of bouquet_id	Description

{
remote_control_direct_key (12 bits),
redundancy_solution_id (4 bits)
}
	A three-digit number is expressed by a 12-bit hexadecimal number
	A branch identifier is expressed by a 4-bit hexadecimal number.

bouquet_id in Table 7-1 should be configured as follows; remote_control_direct_key should be located in the upper 12 bits of bouquet_id so that the Most Significant Bit (hereafter referred to as the M.S.B.) of the bouquet_id field and the M.S.B. of remote_control_direct_key that represents the three-digit number are aligned and redundancy_solution_id should be located in the lower 4 bits of bouquet_id so that the Least Significant Bit (hereafter referred to as the L.S.B.) of bouquet_id field and the L.S.B. of redundancy_solution_id that represents the branch identifier are aligned.

7.8.4 IP interface specifications

When installing an IP interface as a high-speed digital interface, refer to "9.2 IP interface specifications" of ARIB STD-B21 and "High-speed digital interface" in Appendix-2 of ARIB STD-B21. See "8.3 Specifications for the operation of the IP interface" in this volume for operational details.

When using wireless LAN, trouble may be caused by the connection of equipment not recognized by the users. When installing an IP interface, therefore, care should be taken to avoid disturbance to the users.

7.9 CA Module Interface

See Conditional Access of Digital Broadcasting of ARIB STD-B25 and "5 Required Specifications to the Receivers" in Vol. 5 of the document.

- CA interface
- Descrambler

  A descrambler described in the abovementioned specifications should be installed.
- CAS related controls

  The details are described in the abovementioned specifications. Apart from CAS related user interface controls, following control functions are required.

  ECM/EMM receiving function

  Communications function

7.10 Copy Control

7.10.1 Analog Video Output

- Copy control systems specified for each analog video output format shown in Table 7-2 shall be available.
- The following control information should be used: service_type (service type identifier information) in the Service List Descriptor, copy_control_type (copy control type information), digital_recoding_control_data (digital copy control information) and APS_control_data (analog output copy control information) in the Digital Copy Control Descriptor. (See "30.3.2.2 Digital Copy Control Descriptor" in Vol. 4 of the document.)

More specifically, for pseudo-sync pulses Macrovision and color stripes, APS_control_data (analog output copy control information) should be used, while for CGMS-A as the video ID signal, digital_recoding_control_data (digital copy control information) shall be used and for APS as the video ID signal, APS_control_data (analog output copy control information) should be used.

Copy Control for Each Analog Video Output Format

Table 7-2 Copy control systems specified for each analog video output format

Analog video output **1		Macrovision **2	Video ID signal **3
	480i composite	Seudo-sync pulses and color stripes	CGMS-A APS
	480i component	Seudo-sync pulses	CGMS-A APS
	480p component	--	CGMS-A APS
	720p component	--	CGMS-A APS
	1080i component	--	CGMS-A APS
RGB analog output **4		--	--

**1) Including cases where received video signals are format-converted by the receiver and output as analog video signals of various formats.

**2) A contract between broadcasters and Macrovision is required to use Macrovision's copy protection technology. No parameters are transmitted in this case.

**3} The video ID signal refers to signals transmitted in convoluted identification signal waveform carried by VBI, which include information including CGMS-A information and APS information.

**4) For more information on RGB analog output, see 7.14.4 in this volume. For more information on the operation of RGB analog output, see Vol. 8 of the document.

7.10.2 Digital Audio Output

Whether to install the digital audio output function or not is optional. If installing the function, however, the copy control is performed using: service_type (service type identifier) in the Service List Descriptor, copy_control_type (copy control type information) and digital_recoding_control_data (digital copy control information) in the Digital Copy Control Descriptor, and APS_control_data (analog output copy control information).

- The output of linear pulse code modulated (PCM) audio shall conform to IEC 60958 and the output of AAC streams shall conform to AAC audio format specified in IEC 61937.

7.10.3 High-speed Digital Interface Output

Whether to install a high-speed digital interface or not is optional. If installing the function, however, the following requirements shall be conformed.

- Control shall be performed based on: service type, copy_control_type and digital_recording_control_data.
- There will be cases where the MPEG_TS output is restricted during data service and temporary data service.
- See "30.3.2.2 Digital Copy Control Descriptor" in Vol. 4 of the document.
- Broadcasters apply the DTCP technology to protect copyrights. When applying the DTCP technology, DTCP Descriptor should be inserted. For more information, see DTCP specifications.

To separately output only audio streams for a high-speed digital interface which is serial interface, the following requirements shall be conformed.

- Compliance to the IEC60958 conformant format (including the IEC61937 conformant format) of IEC61883-6 shall be ensured.
- Channel_status inserted in the IEC60958 conformant format of IEC61883-6 shall be set in accordance with digital_recording_control_data of the Digital Copy Control Descriptor.
- Control shall be performed based on: copy_control_type and digital_recording_control_data.
- See "30.3.2.2 Digital Copy Control Descriptor" in Vol. 4 of the document.
- Broadcasters should use DTCP as the copyright protection scheme.
- There will be cases where the MPEG_TS output is restricted during data service and temporary data service.
- When applying the DTCP technology, DTCP descriptor should be inserted. For more information, see DTCP specifications.
- When copy_control_type is set to '11' during data service and temporary data service, the MPEG_TS output is also enabled in compliance with IEC61883-4.

7.10.4 Digital Video Output

- To output contents which are copy-restricted by the Digital Copy Control Descriptor and contents which are copy-protected by the Content Availability Descriptor when a DVI is installed, protection technology shall be applied appropriately in accordance with the HDCP specifications. For more information, see Vol. 8 of the document.

7.10.5 Digital Video/Audio Output

- To output contents which are copy-restricted by the Digital Copy Control Descriptor and contents which are copy-protected by the Content Availability Descriptor when an HDMI is installed, protection technology shall be applied appropriately in accordance with the HDCP specifications. For more information, see Vol. 8 of the document.

7.11 Download

For more information, see "Chapter 6 Receiver guidelines for Receiving Download Contents" in Vol. 1 of the document. Related information is also available in Chapter 11 of this volume.

7.11.1 Frequency Repacking

7.11.1.1 General Information on Downloading the Frequency List and Modification Information

Information concerning frequency repacking is transmitted to receivers using the combination of the two methods shown below.

(1) High protection layer SDTT

Minimum required information (including the target area, change start date and change operation duration) is transmitted to all receivers. At the same time, information on the link to the following engineering service that can be used on fixed receivers is transmitted.

(2) Engineering service

More detailed information (including the pre and post modification frequency lists and modification date) is transmitted to fixed receivers to perform automatic tuning of frequencies, saving viewer's troubles.

The frequency list and modification information can also be used for the following purposes in addition to frequency repacking.

- Tuning of receivers when a station (relay station) that had relayed broadcasts from the master station has started transmitting broadcasts as a local station.
- Tuning of receivers when a new broadcaster has started broadcasting from an existing transmitting station.

- Tuning to the station which had its broadcasts suspended when the scan was made during the installation of receivers.

For more information on the SDTT for the frequency list and modification information, contents data format and transmission, see Vol. 1 of the document.

7.11.1.2 Guidelines for Receiving the Frequency List and Modification Information

Shown below are examples of operations required to receive the frequency list and modification information.

(a) Frequency modification has taken place as a result of frequency repacking.

- Receivers estimate the target reception area based on 'service_id' being received and the specified information on location of the viewer's residence.
- Receivers periodically monitor the SDTT and check whether module_data_version_code of module_id, which includes the information on the target reception area, has been modified.
- If above information has been modified, receivers obtain relevant frequency information contents.
- Receivers extract obtained contents and check information concerning the channel currently received.
- If both the 'old_physical_ch' and 'new_physical_ch' are valid in the frequency information, it is considered that frequency repacking information is contained.
- Receivers, by comparing the values for start_date, the duration and the current date, can determine whether frequency repacking will take place in the future, is currently underway, or has already taken place.
- If frequency repacking will take place in the future, receivers store relevant information in NVRAM, and if necessary, give a notification to users.
- It is considered highly likely that frequency repacking has already taken place when tuning to a desired channel on the conventional frequency is not possible during the repacking period. Further evidences of completed frequency repacking include: that there are descriptions about the transmitting station from which broadcasts are received (estimated from transmitter_id) and that tuning became impossible after change_date.
- When it is considered highly likely that frequency repacking has already taken place, receivers tune to 'new_physical_ch'. If they can successfully receive the same channel, frequency repacking is considered to have taken place. If automatic tuning is set to "yes" by users, receivers update the reception settings.
- If simul_duration includes the effective duration information, tuning to a channel is still possible on the old frequency during the period. However, to be more careful, receivers also

try to tune to the same channel on the new frequency. If they can successfully receive the same channel, they perform the same processing as mentioned above on the assumption that frequency repacking has already taken place.

(b) A station that had relayed broadcasts from the master station has started transmitting broadcasts as a local station.

- Receivers estimate the target reception area based on service_id being received and the specified information on location of the viewer's residence .
- Receivers periodically monitor the SDTT and check whether module_data_version_code of module_id, which includes the information on the target reception area, has been modified. It is important in this instance to check both the prefectural area and the wide area that includes the prefectural area.
- If above information has been modified, receivers obtain relevant frequency information contents.
- Receivers extract obtained contents and check information concerning the channel currently received.
- If either 'old_physical_ch' or 'new_physical_ch' is set to 0xFE in the frequency information and if a new network with the same 'terrestrial_broadcaster' information as an existing network is found in the relevant wide (prefectural) area information, it is considered that a former relay station has started transmitting broadcasts as a new local station.
- If automatic tuning is set to "yes" by users, receivers update the reception settings.

(c) A new broadcaster has started broadcasting from an existing transmitting station.

- Receivers estimate the target reception area based on service_id being received and the specified information on location of the viewer's residence .
- Receivers obtain contents concerning the relevant area and compare the contents and the network and physical channel received to estimate the transmitting station (transmitter_id) from which broadcasts are being received.
- Receivers periodically monitor the SDTT and check whether module_data_version_code of module_id, which includes the information on the target reception area, has been modified.
- If above information has been modified, receivers obtain relevant frequency information contents.
- Receivers extract the information on the target reception area from the obtained contents and check whether information on the transmitting station (transmitter_id) which is physically receivable but is not available according to the information, is contained.

- If such information is found, the date of frequency repacking is stored in memory. If tuning to a channel previously stored in memory is successful after the date, it is considered that the new channel is now receivable.
- If automatic tuning is set to "yes" by users, receivers update the reception settings.

(d) Tuning to the station which had its broadcasts suspended when the scan was made during the installation of receivers.

- Receivers estimate the target reception area based on service_id being received and the specified information on location of the viewer's residence .
- Receivers obtain frequency information contents for the relevant area, and if channels which receivers are not set to receive are found in the frequency information, periodically scan through such channels to check whether they have become receivable. However, it is desirable to perform a scan when the EIT is obtained; it is not recommended to perform a scan more often than necessary.
- The success of receiving a channel, which has not been previously received, means a detection of a new broadcasting channel. If automatic tuning is set to "yes" by users, receivers update the reception settings.

Modification information regarding transmission output power (transmission_power) is also transmitted as part of the engineering service. When transmission output power has been modified, there is a possibility that channels which have not been received may become receivable for some viewers. It is, therefore, preferable that receivers prompt viewers to perform a re-scan.

With regard to mobile receivers, it depend on each manufacturer's product planning as to whether to install the automatic tuning function in response to frequency repacking. If installed, the function will only need to have the ability to perform the abovementioned processing (a) to (d). If not installed, however, it is desirable that receivers display information (including the target area, commencement date of modification and modification work period) transmitted by the high protection layer SDTT as well as a message that prompts users to perform a re-scan. In either case, it depends on each manufacturer's product planning as to what kind of information is included in the message to be displayed and as to how to install the re-scan function and automatic tuning function in response to frequency repacking.

With regard to portable receivers, it is likely that download is not possible. This means that the automatic tuning in response to frequency repacking (as mentioned in (a) to (d) above) may not be possible. Nonetheless, since portable receivers are able to receive the high protection layer SDTT, it is desirable that they display information (including the target area, commencement date of modification and modification work period) transmitted by the high protection layer SDTT and as well

as a message that prompts users to perform a re-scan. However, it depend on each manufacturer's product planning as to what kind of information is included in the message to be displayed and as to how to install the re-scan function.

If identical remote_control_key_id are found during a re-scan, see "Appendix 10.1 Examples of One-touch Button Assignment" in this volume regarding how to assign one-touch buttons and "Appendix 10.3 Examples of Direct Channel Selection" in this volume regarding how to assign branch identifiers.

7.12 System Tests

7.12.1 IC Card Test

See "5.17.1 IC Card Test" in Vol. 5 of the document.

7.12.2 Telephone Line Connection Test

(1) Scope of the line connection test

The telephone line connection test should be performed when a receiver is installed: more specifically, communication between the receiver and the center should be checked.

* The checking of the dial tone (a sound that indicates that dialing is possible) on the PSTN line alone does not allow checking whether the dialing setting (PB (touch-tone) or DP (pulse)) has been done correctly.

The scope of the line connection test target is shown in Fig. 7-1.

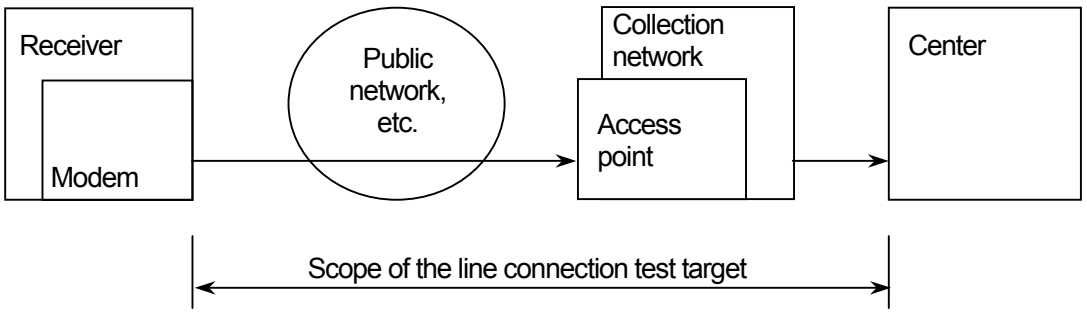


Fig. 7-1 Scope of the Line Connection Test Target

(2) Line connection and settings

A line should be connected and set up in accordance with the type of PSTN lines.

(a) Connect a PSTN line to the receiver.

(b) Check that the following initialization has been done.

- Postal code
- High priority line type
- Common carrier identification number
- Number to cancel the access code to each telephone company
- Caller number display
- Prefix numbers

- Dialing method

(3) Line connection and settings

- For example, using an existing service, the receiver connects to the center.
- Confirm a message to the effect that a connection was successfully made displayed on the screen.
- If an error message has appeared, actions are taken in accordance with the message.

7.13 Bound Recording

Whether to install the bound recording in receivers or not is optional. If installing the function, however, provisions mentioned in Vol. 8 of the document shall be followed. It is desirable to ensure observance of the matters mentioned in "9.3 Broadcasting Programs and Guarantee of Uniqueness of Contents" in this volume.

7.14 Other

7.14.1 Screen Display Priority

In case various displays appear in the same area on the screen, the priority is as follows.

(1) Error message

(2) Automatic message

(3) Superimpose

(4) Caption

7.14.2 Processing to Take Place in Power Stand-by Mode

The following processing takes place in power stand-by mode.

(1) Various scheduling actions by viewers (Including program recording scheduling etc)

(2) It depends on each manufacturer's product planning to decide to which to give priority: power control or download. However, it should be noted that power control is always given priority over the download of common data for all receivers.

(3) Acquisition of the EIT information

7.14.3 Reset Button

In anticipation of a situation where the receivers have been rendered inoperable, it is desirable to install a button (e.g. reset button) on the units to reset them.

7.14.4 RGB Analog Terminal

- Whether to install a VGA terminal or not is optional. If installing the terminal, however, a connector in compliance with the specifications in "4. Physical Connections in the Enhanced

Display Data Channel Standard (Version 1)" issued by VESA should be installed and signals should be output in the format specified in "2. VESA Video Signal Definition in the Video Signal Standard (Version 1, Rev. 1)" also issued by VESA.

- Whether to install a DVI terminal with analog output or not is optional. If installing the terminal, however, it is recommended that a connector in compliance with "5. Physical Interconnect Specification in the Digital Visual Interface DVI (Revision 1.0)" issued by DDWG should be installed. On the other hand, signals shall be output in the format specified in "2.5 Analog" in "2. Architectural Requirements" in the Digital Visual Interface DVI (Revision 1.0).
- For more information on the operation of RGB analog output, see Vol. 8 of the document.

7.14.5 Digital Video Terminal

- Whether to install a DVI terminal or not is optional. If installing the terminal, however, it is recommended that a connector in compliance with "5. Physical Interconnect Specification" in the Digital Visual Interface DVI (Revision 1.0) issued by DDWG should be installed. On the other hand, signals shall be output in the format specified in "2. Architectural Requirements" in the Digital Visual Interface DVI (Revision 1.0).
- For more information on copyright protection technology, see "7.10.4 Digital Video Output" in this volume as well as Vol. 8 of the document.

7.14.6 Digital Video/Audio Output Terminal

- Whether to install an HDMI terminal or not is optional.
  If installing the terminal, however, the compliance of the terminal to the High-Definition Multimedia Interface Specification issued by HDMI Licensing, LLC. shall be ensured.
- For more information on copyright protection technology, see "7.10.5 Digital Video/Audio Output" in this volume as well as Vol. 8 of the document.

8 ANNEX

8.1 Specifications for the Operation of PSI/SI for Partial TS Output

8.1.1 Definitions of Tables and Descriptors

8.1.1.1Type and Identification of Tables

To partially output the TS for digital terrestrial television broadcasting, the tables as shown in Table 8-1 are inserted for use. For more information on each table, see ARIB STD-B10 and STD-B21.

Table 8-1 PSI/SI Tables Used for Digital Terrestrial Television Broadcasting

Table Name	General Information on the Function
PAT (Program Association Table)	Specifies the packet identifier of the TS packet that carries the PMT related to the partial TS.
PMT (Program Map Table)	Specifies the packet identifier of the TS packet that carries coding signals for each broadcasting program.
DIT (Discontinuity Information Table)	Indicates the transition point where the service information for the program carried by the partial TS may be discontinuous.
SIT (Selection Information Table)	Indicates the information concerning the program carried by the partial TS.

The PID values for transport stream packets that carry partial TS sections are shown in Table 8-2.

Table 8-2 Assignment of PID to PSI/SI

PID	Table
0x0000	PAT
Specified indirectly by the PAT	PMT
0x001E	DIT
0x001F	SIT

Regarding the values (table_id) assigned for the identification of tables of partial TS sections output by digital terrestrial receivers, the following values are used from among those that are specified in Section 4.1 in Part 1 of ARIB STD-B10. These values are shown in Table 8-3.

Table 8-3 Assignment of table_id

table_id	Table
0x00	PAT
0x02	PMT
0x7E	DIT
0x7F	SIT

8.1.1.2 Type and Identification of Descriptors

Regarding descriptors used in the partial TS, the descriptors shown in Table 8-4 are used from among those that are specified in "5.2 Type and Identification of Descriptors" in Part 1 of Vol. 4 of the document. Descriptors not listed in Table 8-4 are not used in the partial TS.

Table 8-4 Descriptors Used in the Partial TSs

Descriptor Name	General Information on the Function
Stuffing Descriptor	See Vol. 4.
Service Descriptor	Same as above
Short Event Descriptor	Same as above
Extended Event Descriptor	Same as above
Component Descriptor	Same as above
Stream Identifier Descriptor	Same as above
Content Descriptor	Same as above
Digital Copy Control Descriptor	Same as above
Audio Component Descriptor	Same as above
Emergency Information Descriptor	Same as above
Data Component Descriptor	Same as above
Data Contents Descriptor	Same as above
Video Decode Control Descriptor	Same as above
Event Group Descriptor	Same as above
Component Group Descriptor	Same as above
Series Descriptor	Same as above
TS Information Descriptor	Same as above
Extended Broadcaster Descriptor	Same as above
Content Availability Descriptor	Same as above
Partial Transport Stream Descriptor	Description regarding the partial TS
Network Identification Descriptor	Description regarding network identifiers
Partial TS Time Descriptor	Description regarding partial TS time
Broadcast ID Descriptor	Description regarding various broadcast IDs necessary for the replay of data contents

8.1.2 Operation of Common Items to All Tables

8.1.2.1 Operation of version_number

(1) Addition of version_number

version_number is independently added to each table.

Regarding the PMT carried by the partial TS, only when the PMT used for a broadcast can be inserted as it is as the PMT for the partial TS, the same version_number as that for the broadcast can be output. On the other hand, regarding version_number of the table when receivers reconfigure the PAT, DIT, SIT and PMT, any value specified by each receiver can be set as the initial value.

(2) Modification timing

When outputting the PMT for a broadcast as it is in the partial TS, the same modification timing as that used for the broadcast can be used. However, if using a table reconfigured by a receiver, modification should take place only when the necessity to modify the table information occurs. For more information on cases where the modification of a stream should be accompanied by DIT insertion, see DIT related information. If the modification of a stream is not accompanied by DIT insertion, it should be ensured that a delay in the modification of a stream should be kept to a minimum.

(3) Modification of the version number

Receivers should basically perform the management of version_number and can output any value as an initial value. The updating and modification of version_number usually involves adding 1. Although the PMT for broadcasting may not be updated correctly, it is still recommended that in such a case, correct version_number is used for output.

Adding 1 is also recommended when making modifications which are accompanied by DIT insertion.

8.1.2.2 Operation of current_next_indicator

In all tables, current_next_indicator shall be set to '1' for output. Tables with the current_next_indicator value set to '0' shall not be output. It shall be ensured that when receivers configure tables, the current_next_indicator value shall be always set to '1'.

8.1.2.3 Operation of running_status

The SIT shall be so configured that the running_status value is set to (0x0) (meaning "undefined") in all cases for output.

8.1.2.4 Operation of Reserved, ISO_reserved and reserved_future_use Items

All bits shall be set to '1' for output.

8.1.3 Repetition Rate of Each Table (Cycle of Re-transmission)

The maximum cycle of transmitting each table in the partial TS is shown in Table 8-5.

Table 8-5 Maximum Cycle of Outputting Each Table (Cycle of Repetition)

Table_id	Table	Value of the Recommended Maximum Cycle of Insertion
0x00	PAT	120 ms
0x02	PMT	120 ms
0x7E	DIT	Inserted when it will be necessary
0x7F	SIT	3.6 s

With regard to the interval for inserting each table, it is recommended that each table be inserted in a way to replace the table previously inserted in the broadcast stream. This means, more specifically, that the recommendation is that the PAT replaces the PAT previously transmitted in the broadcast stream in the same location and that the PMT replaces the PMT previously transmitted in the broadcast stream in the same location. However, it should be noted that since the partial reception layer is unable to receive the PAT and the PMT is transmitted at long intervals, the PAT and PMT shall be created when necessary within receivers. With regard to the SIT, it is desirable that the SIT is inserted at the same interval as the EIT [p/f] transmitted in the broadcast stream. The values of maximum cycles indicated in the table include 10% margin over maximum cycles stipulated for broadcasting. However, the exception is the SIT; the maximum cycle of transmitting the SIT specified for BS digital broadcasting receivers was applied instead. For more information on the output of each table in the partial TS, see "11.1. Detailed Rules Pertaining to TS Packet Section Alignment" and "11.2. TS Packet Transmission Details" in Vol. 4 of the document in order to ensure compliance.

8.2 Specifications for the Operation of Tables

8.2.1 PAT

8.2.1.1 Structure and Operation of the PAT

[Application]

The PAT specifies the identifier of the TS packet that carries the PMT and SIT related to the contents inserted in the partial TS.

[Structure]

The structure of the PAT is shown in Table 8-6.

Table 8-6 Structure of the PAT (Program Association Table)

Data Structure	Number of Bits	How the Bit Stream is Expressed
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]

The semantics of each field shall conform to the provisions in Section 5.2.1 in Part 2 of ARIB STD-B10 and the definitions in Section 2.4.4 of ISO/IEC13818-1.

[Output operation rules]

- Regarding the output repetition rate, provisions in Section 8.1.3 in this volume shall be followed.
- The partial TS shall output one PAT.
- It is desirable, for example, that the PAT is output in a way to replace the PAT previously inserted in the broadcast stream.

Output operation rules of each field are shown in Table 8-7.

Table 8-7 Output operation rules of the PAT

Output operation rules of Each Field	
table_id	Set to "0x00".
section_syntax_indicator	Set to "1".
section_length	This field describes the section length of the PAT. Since the maximum length of the entire section is 1024 bytes, the maximum value for this field is 1021.
transport_stream_id	This field describes transport_stream_id of the original transport stream that contained the PAT in question. The value used by the original broadcast stream that included the partial TS is inserted for use as it is. However, since the PAT is not transmitted to the partial reception layer, the information obtained from the NIT is inserted.
version_number	This field is set to a value, which is incremented by one for every update. This field can be set to any value when the output of the partial TS starts.
current_next_indicator	Set to "1".
section_number	Set to "0x00".
last_section_number	Set to "0x00".
[program_loop]	This field describes the service in the target transport stream but does not specify the maximum number of loops.
program_number	This field describes service_id of the target service, and at the same time without fail, describes only one program_loop with program_number set to "0x0000" (the PID field that follows subsequently describes the PID ["0x001F"] of the SIT) in the PAT. However, since the PAT is not transmitted to the partial reception layer, the information obtained from the PMT is inserted.
network_PID	This field describes the PID ("0x001F") of the SIT.
program_map_PID	This field describes the PID of the PMT of the target service.

8.2.2 PMT

8.2.2.1 Structure and Operation of the PMT

[Application]

The PMT specifies the PID of the TS packet that transmits every program coding signal output in the partial TS.

[Structure]

The structure of the PMT is shown in Table 8-8.

Table 8-8 Structure of the PMT (Program Map Table)

Data Structure	Number of Bits	How the Bit Stream is Expressed
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]

The semantics of each field shall conform to the provisions in Section 5.2.3 in Part 2 of ARIB STD-B10 and the definitions in Section 2.4.4 of ISO/IEC13818-1.

[Output operation rules]

- When a stream is contained in the partial TS, the PMT shall be output without fail regarding the service described in the PAT in accordance with the repetition rate specified in Section 8.1.3 of this volume.
- If the service output in the partial TS is configured in the same way as the original broadcast and meets the conditions set out by this specification, the PMT output for the broadcast can be transmitted as it is. When outputting an overwritten PMT, however, it is desirable, for example, that the PMT is output in a way to replace the PMT previously inserted in the broadcast stream. However, if a multi-section PMT, which is differently from the PMT output in the partial TS, is transmitted in the broadcast stream, the multi-section PMT shall not be output without being modified. A PMT suited for output in the partial TS shall be structured.
- If a broadcasting service is suspended, the PMT may not be output. In this case, the partial TS that only contains the service is not output, and like the broadcasting service, no PAT is output.

Output operation rules of each field are shown in Table 8-9.

Table 8-9 Output operation rules of the PMT

Output operation rules of Each Field	
table_id	Set to "0x02".
section_syntax_indicator	Set to "1".
section_length	This field describes the section length of the PMT. Since the maximum length of the entire section is 1024 bytes, the maximum value for this field is 1021.
program_number	This field describes service_id of the target service. The value output in the broadcast stream is used as it is.
version_number	In normal times, this field is set to a value, which is incremented by one for every version update. However, if an abnormal system condition occurs while the PMT used for the broadcast is being inserted as it is, the value may be incremented by 1 or more. Even so, the value can be output as it is.
current_next_indicator	Set to "1".
section_number	Set to "0x00".
last_section_number	Set to "0x00".
PCR_PID	This field describes the PID of the TS packet that transmits the target PCR packet.
program_info_length	This field describes the loop length of 1st_loop. The maximum loop length is limited by section_length.
[1st(program) loop]	
[2nd(ES)_loop]	The maximum number of loops is 16.
stream_type	This field describes the stream type identifier of the target ES (specified in Vol. 4).
elementary_PID	This field describes the PID of the TS packet that transmits the related ES or payload.
ES_info_length	This field describes the length of the ES Descriptor that follows subsequently.

8.2.2.2Descriptors Inserted in the PMT

The descriptors inserted in the PMT are shown in Table 8-10.

Table 8-10 Descriptors Inserted in the PMT

Tag	Descriptor	Propriety of Insertion	loop
0x09	Conditional Access System Descriptor	X	--
0xDE	Content Availability Descriptor	#	1
0x42	Stuffing Descriptor	O	D
0x52	Stream Identifier Descriptor	*	2
0xC1	Digital Copy Control Descriptor	#	D
0xC8	Video Decode Control Descriptor	#	2
0xFC	Emergency Information Descriptor	O	1
0xFD	Data Component Descriptor	#	2

\# : Means that the descriptor shall be inserted in the table without fail when it is inserted in the broadcast stream and relevant components are output.

O : Means that the descriptor should be inserted in the table if doing so is considered necessary.

X : Means that the descriptor shall not be inserted in the table.

* : Means that inserting the descriptor in the table is recommended.

1 : Means that the descriptor is inserted in the 1st loop.

2 : Means that the descriptor is inserted in the 2nd loop.

D : Means that the descriptor can be inserted either in the 1st or 2nd loop.

8.2.2.3Descriptors Inserted in the 1st Loop of the PMT (Program Loop)

The following section provides explanations of descriptors. For more information of the structure of each descriptor as well as the semantics, and basic output operation rules of each field, see Vol. 4 of the document.

(1) Digital Copy Control Descriptor

See "30.3.2.2 Digital Copy Control Descriptor" in Vol. 4 of the document.

[Application]

This descriptor is used to provide control information regarding the digital copy or to describe the maximum transmission rate, or when both apply, for the entire service concerned. The descriptor in the broadcast stream is inserted as it is.

[Output operation rules]

This descriptor shall be inserted exactly as it was described in the original broadcast stream if the ES concerned is the digital copy control target and if the descriptor is described in the broadcast stream.

(2) Emergency Information Descriptor

[Application]

This descriptor means that the service is an emergency warning broadcasting or that an emergency warning signal test is underway.

[Output operation rules]

- Although the output of the descriptor is optional, it is desirable to delete this descriptor.

(3) Content Availability Descriptor

[Application]

See "30.3.2.4 Content Availability Descriptor" in Vol. 4 of the document.

[Output operation rules]

This descriptor shall be used to provide control information regarding bound recording and output in combination with the Digital Copy Control Descriptor for the entire service concerned.

8.2.2.4Descriptors Inserted in the 2nd Loop of the PMT (ES Loop)

The following section provides explanations of descriptors. For more information of the structure of each descriptor as well as the semantics, and basic output operation rules of each field, see "30.3.3 Descriptors Inserted in the 2nd Loop of the PMT (ES Loop)" in Part 3 of Vol. 4 of the document.

(1) Stream Identifier Descriptor

[Application]

This descriptor is used to attach a label to the ES concerned and use the label to reference what is described in the Component Descriptor in the SIT.

[Output operation rules]

If the Component Descriptor and Audio Component Descriptor are found in the service loop of the SIT, links should be created with component_tag to establish a relationship with the ES concerned.

Output operation rules of the Stream Identifier Descriptor are shown in Table 8-11.

Table 8-11 Output operation rules of the Stream Identifier Descriptor

	Output operation rules of Each Field
descriptor_tag	Set to "0x52".
descriptor_length	This field describes the length of the Stream Identifier Descriptor.
component_tag	This field describes the tag value of the component, which is unique in the program concerned and which matches the tag value of the component of the Component Descriptor in the SIT.

(2) Data Component Descriptor

[Application]

This descriptor is used to indicate the data coding scheme for the ES concerned.

[Output operation rules]

This descriptor is always transmitted in the broadcast stream during data broadcasting (including caption and up-to-the-minute superimpose news). When data contents are inserted in the partial TS for output, it is mandatory that this descriptor be inserted in the SIT.

(3) Digital Copy Control Descriptor

See "30.3.2.2 Digital Copy Control Descriptor" in Vol. 4 of the document.

[Application]

This descriptor is used to provide control information regarding the digital copy or to describe

the maximum transmission rate, or when both apply, for the ES concerned. The descriptor in the broadcast stream is inserted as it is.

[Output operation rules]

This descriptor shall be inserted exactly as it was described in the original broadcast stream if the ES concerned is the digital copy control target and if the descriptor is described in the broadcast stream.

(4) Video Decode Control Descriptor

[Application]

This descriptor is used to control the video decode when the video coding scheme changes in same service_id as well as to indicate whether the ES concerned is comprised of MPEG-I framed still pictures.

[Output operation rules]

This descriptor should be inserted when it is described in the original broadcast stream and when the operation specified by this descriptor is requested in the video that forms the partial TS.

[Other special notes]

The Video Decode Control Descriptor contains information for the purpose of performing the following reception control.

1. Seamless video switching during video format change
2. Identification of MPEG-I framed still picture broadcasting

To perform the same control during a replay as that during the reception of a broadcast, it is recommended that information for the purpose of performing the two items above be output. Certain types of receivers are considered to use information particularly regarding 2. above to identify still picture broadcasting. It is therefore mandatory to insert this descriptor when the components of a still picture broadcast are output in the partial TS.

8.2.3 DIT (Discontinuity Information Table)

8.2.3.1 Structure and Operation of the DIT

[Application]

This DIT describes the points at which the partial TS becomes discontinuous. The DIT is inserted by receivers when a problem encountered by the receivers that output the partial TS causes a discontinuity in the partial TS.

[Structure]

The DIT contains a single section that uses the data structure shown in Table 8-12. This DIT section

is transmitted in the transport stream packet with its PID value set to 0x001E. The table identification number is set to 0x7E.

Table 8-12 Structure of the DIT (Discontinuity Information Table)

Data Structure	Number of Bits	How the Bit Stream is Expressed
discontinuity_information_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
Reserved_future_use	1	bslbf
Reserved	2	bslbf
section_length	12	uimsbf
Transition_flag	1	uimsbf
Reserved_future_use	7	bslbf
}		

[Semantics of each field]

The semantics of each field shall conform to the provisions in 9.1.8.2(2)1 in Chapter 9 of ARIB STD-B21 and the definitions in 7.1.1 of ETS 300 468.

[Output operation rules]

- The DIT shall be inserted at the following points: the point at which a discontinuity in the system time base of the stream occurs during the output of the partial TS (more specifically, a discontinuity of the PCR) and the point at which a discontinuity of continuity_counter in the transport packet header occurs in one of the packets that form the partial TS. The discontinuity of continuity_counter occurs when an ES is added or deleted. This kind of discontinuities, which usually occur in broadcast streams, are caused by broadcasters and the insertion of a DIT is not required in these cases.

  The DIT is inserted by receivers when a problem encountered by the receivers that output the partial TS causes a discontinuity in the partial TS.
- Discontinuities that cause the insertion of a DIT in the partial TS take place in the following cases.

  (1) When the output of the partial TS is started or stopped.

  (2) When channel switching, for example, during the output of the partial TS, changes the service in the stream, and this may be accompanied by a discontinuity of the ES/PCR.

  (3) When certain factors cause a change of the ES (such as the increase and decrease in the number of ES), though with no change to the output service, during the output of the partial TS.
- When switching between streams, a DIT shall be inserted only once between the old and new streams. It is desirable that the DIT be inserted when the output is stopped and that the DIT be not inserted again when the output is started.

- During the output of the partial TS, a DIT shall not be inserted at a transition point (for example, point at which only the SI information changes) in the stream if the conditions above do not apply.
- When inserting a DIT, it shall be ensured that two transport packets in specified format be inserted consecutively. No other transport packet shall be allowed to intervene between these two packets. If a change of the stream is accompanied by the insertion of a DIT, the pre-DIT-insertion stream and table information shall not be present in the post-DIT-insertion stream. It shall also be made sure, whenever possible, that contradictions are not allowed to occur; for example, the post-DIT-insertion stream and table information should not be present in the pre-DIT-insertion stream.

<The first packet>

The adaptation field shall be inserted into the transport packet with its PID set to 0x001E. The value of payload_unit_start_indicator in the transport packet header shall be set to "0". The value of adaptation_field_control shall be set to "10" (adaptation_field only, no payload).

Only discontinuity_indicator in the adaptation field shall be set to "1" and all other flags shall be set to "0". The remaining field of the transport packet shall be designated as stuffing_byte.

<The second packet>

The DIT table defined by this specification shall be inserted. The PID of the transport packet header shall be set to 0x001E and the value of payload_unit_start_indicator shall be set to "1".

Output operation rules of each field are shown in Table 8-13.

Table 8-13 Output operation rules of the DIT

Output operation rules of Each Field	
table_id	Set to "0x7E".
section_syntax_indicator	Set to "0".
section_length	This field describes the section length of the DIT and is set to a fixed value of 0x001.
transition_flag	For more information on the operation of bits, see 9.1.8.2.(2)1 in ARIB STD-B21.

8.2.4 SIT (Selection Information Table)

8.2.4.1 Structure and Operation of the SIT

[Application]

The SIT provides the partial TS information as well as a summary of SI information necessary to provide information on the service available in the stream.

[Structure]

The structure of the SIT is shown in Table 8-14.

Table 8-14 Structure of the SIT (Selection Information Table)

Data Structure	Number of Bits	How the Bit Stream is Expressed
selection_information_section () {		
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
reserved_future_use	1	bslbf
ISO_reserved	2	bslbf
section_length	12	uimsbf
reserved_future_use	16	bslbf
ISO_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
transmission_info_loop_length	12	uimsbf
for (i = 0;i< N;i++) {		
descriptor()		
}		
for (i = 0;i< N;i++) {		
service_id	16	uimsbf
reserved_future_use	1	bslbf
running_status	3	bslbf
service_loop_length	12	uimsbf
for (j = 0;j< M;j++) {		
descriptor()		
}		
}		
CRC_32	32	rpchof
}		

[Semantics of each field]

The semantics of each field shall conform to the provisions in 9.1.8.2(2)2 in Chapter 9 of ARIB STD-B21 and the definitions in 7.1.2 of ETS 300 468.

[Output operation rules]

During the output of the partial TS, the SIT should insert, when necessary, the stream information as well as the SI information for the service offered, and shall be output in the repetition rate specified in Section 8.1.3 of the document.

Output operation rules of each field are shown in Table 8-15.

Table 8-15 Output operation rules of the SIT

Output operation rules of Each Field	
table_id	Set to "0x7F".
section_syntax_indicator	Set to "1".
section_length	This field describes the section length of the SIT. Since the maximum length of the entire section is 4096 bytes, the maximum value for this field is 4093.
version_number	In normal times, this field is set to a value, which is incremented by one for every version update.
current_next_indicator	Set to "1".
section_number	Set to 0x00.
last_section_number	Set to 0x00.
transmission_info_loop_length	This field describes the loop length of 1st_loop. The maximum loop length is limited by section_length.
service_id	This field describes service_id of the target program. The value transmitted in the broadcast stream is used as it is.
running_status	This field must be set to 0x0.
service_loop_length	This field describes the loop length of 2nd_loop. The maximum loop length is limited by section_length.

(1) Operation of running status

In the SIT, running status shall be set to "(0x0)" (meaning undefined) in all cases.

(2) Updating of the table

The table information includes the description of only the event currently output and no description of other events (service) in the partial TS. When the event changes, the table should be updated and modified if necessary, and when any change to the SIT information takes place, version_number should be incremented.

The updating or modification of the table information is synchronous with the increment of version_number by 1. The value that comes after 0x1F should be 0x00. Any number can be assigned to version_number for transmission when the output of the partial TS is started.

It is also desirable that when a modification is accompanied by the insertion of a DIT, version_number is incremented by 1. However, the continuity of values is not always mandatory.

When inserting the Partial TS Time Descriptor in the 1st loop of the SIT, JST_time can be used to

indicate the present time of transmitting the stream. In this case, however, every time a table to update JST_time is inserted, version_number of the SIT should be incremented. However, if the information of other descriptors in the SIT remains unchanged, the other_descriptor_status bit of the Partial Transport Time Descriptor should be set to "0" in order to indicate that the information of other descriptors has not changed.

8.2.4.2 Descriptors Inserted in the SIT

The descriptors inserted in the SIT are shown in Table 8-16.

Table 8-16 Descriptors Inserted in the SIT

Tag	Descriptor	Propriety of Insertion	Loop
0x42	Stuffing Descriptor	O	D
0x48	Service Descriptor	O	2
0x4D	Short Event Descriptor	*	2
0x4E	Extended Event Descriptor	O	2
0x50	Component Descriptor	*	2
0x54	Content Descriptor	O	2
0x63	Partial Transport Stream Descriptor	@	1
0x85	Broadcast ID Descriptor	#	2
0xCE	Extended Broadcaster Descriptor	#	2
0xCD	TS Information Descriptor	*	1
0xC2	Network Identification Descriptor	@	1
0xC3	Partial TS Time Descriptor	* *1	D
0xC4	Audio Component Descriptor	*	2
0xC7	Data Contents Descriptor	#	2
0xD5	Series Descriptor	O	2
0xD6	Event Group Descriptor	O	2
0xD9	Component Group Descriptor	O	2

@ : Means that the descriptor shall be inserted in the table without fail.

O : Means that the descriptor should be inserted in the table if doing so is considered necessary.

* : Means that the descriptor should be inserted in the table in principle.

: Means that the descriptor shall be inserted in the table without fail when it is inserted in the broadcast stream and data are transmittted.

1 : Means that the descriptor is inserted in the 1st loop.

2 : Means that the descriptor is inserted in the 2nd loop.

D : Means that the descriptor can be inserted either in the 1st or 2nd loop.

*1: Means that the insertion of the Partial TS Time Descriptor in the 1st loop (transmission_info_loop) is optional.

In principle, the program starting time and the program duration time of the EIT should be inserted in the 2nd loop (service_loop) of the SIT. If inserting data contents to the partial TS, JST time should be used.

8.2.4.3Descriptors Inserted in the 1st Loop of the SIT (transmission_info Loop)

(1) Partial Transport Stream Descriptor

[Application]

This descriptor describes the partial TS information.

[Structure]

The structure of the Partial Transport Stream Descriptor is shown in Table 8-17.

Table 8-17 Structure of the Partial Transport Stream Descriptor

Data Structure	Number of Bits	How the Bit Stream is Expressed
partial_transport_stream_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
reserved_future_use	2	bslbf
peak_rate	22	uimsbf
reserved_future_use	2	bslbf
minimum_overall_smoothing_rate	22	uimsbf
reserved_future_use	2	bslbf
maximum_overall_smoothing_buffer	14	uimsbf
}		

[Semantics of each field]

The semantics of each field shall conform to the provisions in 9.1.8.3(1) in ARIB STD-B21.

[Output operation rules]

This descriptor shall be inserted in the 1st loop of the SIT without fail.

Output operation rules of each field are shown in Table 8-18.

Table 8-18 Output operation rules of the Partial Transport Stream Descriptor

Output operation rules of Each Field	
descriptor_tag	Set to "0x63".
descriptor_length	This field describes the length of the descriptor.
peak_rate	This field describes the maximum momentary partial TS packet rate. The description of the upper limit of the peak rate is required as a minimum. This 22-bit field is coded by the positive integer in 400 bits/second units.
minimum_overall_smoothing_rate	This field describes the minimum overall smoothing buffer leak rate of the entire partial transport packets. This 22-bit field is coded by the positive integer in 400 bits/second units. The field is set to 0x3FFFFF; 0x3FFFFF represents an undefined state.
maximum_overall_smoothing_buffer	This field describes the maximum smoothing buffer size of the entire partial transport packets. This 14-bit field is coded by the positive integer in 1-bit units. The field is set to 0x3FFF; 0x3FFF represents an undefined state.

(2) Network Identification Descriptor

[Application]

This descriptor specifies the source network from which the partial TS was created.

[Structure]

The structure of the Network Identification Descriptor is shown in Table 8-19.

Table 8-19 Structure of the Network Identification Descriptor

Data Structure	Number of Bits	How the Bit Stream is Expressed
network_identification_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
country_code	24	bslbf
media_type	16	bslbf
network_id	16	uimsbf
for (i = 0;i< N;i++) {		
private_data	8	bslbf
}		
}		

[Semantics of each field]

The semantics of each field shall conform to the provisions in 9.1.8.3(2) in ARIB STD-B21.

[Output operation rules]

The insertion of this descriptor in the SIT is mandatory.

Output operation rules of each field are shown in Table 8-20.

Table 8-20 Output operation rules of the Network Identification Descriptor

	Output operation rules of Each Field
descriptor_tag	Set to "0xC2".
descriptor_length	This field describes the length of the Network Identification Descriptor.
country_code	This field describes the country code of the country where the distribution system which created the partial TS is located. This field is set to 0x4A504E (the code for Japan).
media_type	This field describes the media type of the distribution system which created the partial TS. This field is set to 0x5442 (the code for terrestrial digital broadcasting).
network_id	This field describes the network identification value of the distribution system which created the partial TS. This field uses the value specified in the NIT.
private_data	This field is left blank.

(3) Partial TS Time Descriptor

[Application]

This descriptor, when inserted in the first loop of the SIT, describes time information regarding the creation of the partial TS.

[Structure]

The structure of the Partial TS Time Descriptor is shown in Table 8-21.

Table 8-21 Structure of the Partial TS Time Descriptor

Data Structure	Number of Bits	How the Bit Stream is Expressed
partialTS_time_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
event_version_number	8	uimsbf
event_start_time	40	bslbf
duration	24	uimsbf
offset	24	bslbf
reserved	5	bslbf
offset_flag	1	bslbf
other_descriptor_status	1	bslbf
JST_time_flag	1	bslbf
if (JST_time_flag ==1) {		
JST_time	40	bslbf
}		
}		

[Semantics of each field]

The semantics of each field shall conform to the provisions in 9.1.8.3(3) in ARIB STD-B21.

[Output operation rules]

- It is desirable that this descriptor is inserted.
- It is desirable that the JST_time insertion interval does not exceed 10 seconds.
- When inserting this descriptor in the SIT of the partial TS that carries one service, it is desirable to insert this descriptor in only one of the two loops. However, if inserting this descriptor a multiple number of times, the descriptor in the 1st loop shall describe JST_time and the descriptor in the 2nd loop shall describe time information regarding the service, instead of describing JST_time.
- If modifying only the Partial TS Time Descriptor and not modifying other descriptors in the SIT, other_descriptor_status shall be set to 0.
- If this descriptor is inserted in the 1st loop of the SIT, event_version_number, event_start_time and duration in this descriptor are invalid.

- The insertion time error of JST_time shall be within two seconds.
- Output operation rules of each field are shown in Table 8-22.

Table 8-22 Output operation rules of the Partial TS Time Descriptor

Output operation rules of Each Field	
descriptor_tag	Set to "0xC3".
descriptor_length	This field describes the length of the Partial TS Time Descriptor.
event_version_number	If the Partial TS Time Descriptor is inserted in the 1st loop of the SIT, this field is invalid.
event_start_time	If the Partial TS Time Descriptor is inserted in the 1st loop of the SIT, this field is invalid. This field is set to 0xFFFFFFFFFF.
duration	If the Partial TS Time Descriptor is inserted in the 1st loop of the SIT, this field is invalid. This field is set to 0xFFFFFF.
offset	When summer time is applied to JST_time, the offset time must be inserted in this field. The value of local_time_offset in the Local Time Offset Descriptor of the TOT is expressed in 24 bits. More specifically, one byte (0x00) must be added, following 16-bit local_time_offset. If no offset time is applied, this field is set to 0x000000. For more information on the operation of summer time, see Vol. 4 of the document.
offset_flag	This field indicates whether to add or subtract the offset time to or from JST_time. "0": The value of the offset time is added to JST_time. "1": The value of the offset time is subtracted from JST_time.
other_descriptor_status	This field describes the state of descriptors other than the Partial TS Time Descriptor inserted in the SIT. "0": No changes have occurred in other descriptors. "1": Some changes have occurred in other descriptors.
JST_time_flag	This field describes whether JST_time will appear in the field that follows. If this field is set to "1", it means that the JST_time field will appear.
JST_time	This descriptor describes the time of the output of the partial TS. JST_time described in the TOT is used as it is. The time error when updating JST_time must be within two seconds.

(4) TS Information Descriptor

[Application]

This descriptor describes information associated with the source TS from which the partial TS was created.

[Output operation rules]

- It is desirable that this descriptor is inserted.
- If inserting this descriptor, the descriptor transmitted in the broadcast stream shall be used as it is.

8.2.4.4Descriptors Inserted in the 2nd Loop of the SIT (service Loop)

The following section provides explanations of descriptors. For more information of the structure of each descriptor as well as the semantics, and basic output operation rules of each field, see Vol. 4.

(1) Service Descriptor

[Application]

This descriptor describes basic information regarding the service inserted in the partial TS such as the service name and broadcaster name.

[Output operation rules]

- This descriptor shall be inserted only once for the target service.
- The broadcaster name and service name obtained from the broadcast stream shall be inserted as they are.

(2) Short Event Descriptor

[Application]

This descriptor describes the event name and short character-type information regarding the event.

[Output operation rules]

- In principle, this descriptor should be inserted.
- This descriptor shall be output only once for each event.
- The descriptor obtained from the broadcast stream shall be used as it is.

(3) Extended Event Descriptor

[Application]

This descriptor describes detailed character-type information regarding the event.

[Output operation rules]

- The Extended Event Descriptor transmitted in the broadcast stream shall be inserted into the SIT.
- There is a possibility that this descriptor may be transmitted a multiple number of times (a maximum of 16 times) in the broadcast stream. They can all be inserted into the SIT or only selected ones (for example, the first two) can be selected for insertion and transmission.

(4) Component Descriptor

[Application]

This descriptor describes the information regarding the video component stream in the event.

[Output operation rules]

This descriptor is always output for each video component in the event in the broadcast stream. Therefore, when the Stream Identifier Descriptor is inserted in the PMT, the descriptor for the video component that was transmitted in the broadcast stream should be inserted as it is into the SIT, in

principle.

[Other special notes]

A change in event mode during a broadcast, for example, may cause an inconsistency with actual component description. In this case, it is desirable to ensure a follow-up so as not to cause a contradiction in the partial TS structure, but the value transmitted in the broadcast stream can be set up as it is in the SIT. (In the broadcast stream, component_type of this descriptor describes the representative component type of the program and the mode change in the course of the program is not accompanied by the real-time change of this value. Therefore, special attention should be paid to this point during the output of the partial TS.)

(5) Audio Component Descriptor

[Application]

This descriptor describes the information regarding the audio component stream in the event.

[Output operation rules]

This descriptor is always output for each audio component in the event in the broadcast stream. Therefore, when the Stream Identifier Descriptor is inserted in the PMT, the descriptor for the audio component that was transmitted in the broadcast stream should be inserted as it is into the SIT, in principle.

[Other special notes]

A change in event mode during a broadcast, for example, may cause an inconsistency with actual component description. In this case, it is desirable to ensure a follow-up so as not to cause a contradiction in the partial TS structure, but the value transmitted in the broadcast stream can be set up as it is in the SIT. (In the broadcast stream, component_type of this descriptor describes the representative component type of the program and the mode change in the course of the program is not accompanied by the real-time change of this value. Therefore, special attention should be paid to this point during the output of the partial TS.)

(6) Data Contents Descriptor

[Application]

This descriptor describes the information regarding the data component stream in the event.

[Output operation rules]

This descriptor is optionally transmitted for the data component in the event in the broadcast stream. To insert data with this descriptor in the partial TS for output, it is mandatory that this descriptor be inserted into the SIT.

(7) Content Descriptor

[Application]

This descriptor describes the information regarding the event category.

[Output operation rules]

- The insertion of this descriptor in the SIT is optional.
- When this descriptor is inserted, one Content Descriptor is optionally transmitted for each program in the broadcast stream. When this descriptor is transmitted, the value of this descriptor shall be inserted as it is.

(8) Event Group Descriptor

[Application]

This descriptor describes related services, service grouping during switching between SD and HD mode and relay service links.

[Output operation rules]

If inserting this descriptor in the SIT, the descriptor transmitted in the broadcast stream shall be used as it is.

(9) Component Group Descriptor

[Application]

This descriptor defines and identifies component combinations in the event. This descriptor is used, for example, for multi-view televisions (MVTVs).

[Output operation rules]

If inserting this descriptor in the SIT, the descriptor transmitted in the broadcast stream shall be used as it is.

(10) Series Descriptor

[Application]

This descriptor is used to identify serialized programs.

[Output operation rules]

If inserting this descriptor in the SIT, the descriptor transmitted in the broadcast stream shall be used as it is.

(11) Partial TS Time Descriptor

[Application]

This descriptor, when inserted in the second loop of the SIT, describes time information regarding the event inserted in the SIT.

[Structure]

For more information on the structure of the Partial TS Time Descriptor, see Table 8-18.

[Semantics of each field]

The semantics of each field should conform to the provisions in 9.1.8.3(3) in ARIB STD-B21.

[Output operation rules]

- In principle, this descriptor should be inserted.
- If inserting JST_time, it is desirable that the JST_time insertion interval does not exceed 10 seconds.
- When inserting this descriptor in the SIT of the partial TS that carries one service, it is desirable to use one descriptor. However, if inserting this descriptor a multiple number of times in the partial TS, the descriptor in the 1st loop shall describe JST_time and the descriptor in the 2nd loop shall describe time information regarding the service, instead of describing JST_time.
- If modifying only the Partial TS Time Descriptor and not modifying other descriptors in the SIT, other_descriptor_status shall be set to 0.
- The insertion time error of JST_time shall be within two seconds.

Output operation rules of each field are shown in Table 8-23.

Table 8-23 Output operation rules of the Partial TS Time Descriptor

Output operation rules of Each Field	
descriptor_tag	Set to "0xC3".
descriptor_length	This field describes the length of the Partial TS Time Descriptor.
event_version_number	If the Partial TS Time Descriptor is inserted in the 2nd loop of the SIT, this field is valid. A change in the event information included in the specified service is accompanied by count increase by 1. Any value can be set as the initial value. It is desirable that the continuity of the version number is guaranteed when a change in the stream with a DIT inserted occurs and when the continuity of the service before and after the inserted DIT is maintained.
event_start_time	If the Partial TS Time Descriptor is inserted in the 2nd loop of the SIT, this field indicates the starting time of the broadcast of the specified event. start_time described in the EIT should be used. To set an invalid value, this field is set to 0xFFFFFFFFFF.
duration	If the Partial TS Time Descriptor is inserted in the 2nd loop of the SIT, this field indicates the duration time of the specified event. duration described in the EIT should be used. To set an invalid value, this field is set to 0xFFFFFF.
offset	When summer time is applied to event_start_time, the offset time is inserted in this field. The value of local_time_offset in the Local Time Offset Descriptor of the TOT is expressed in 24 bits. More specifically, one byte (0x00) is added, following the end of 16-bit local_time_offset. If no offset time is applied, this field is set to 0x000000. For more information on the operation of summer time, see Vol. 4 of the document.

offset_flag	This field indicates whether to add or subtract the offset time to or from event_start_time and JST_time. "0": The value of the offset time is added to event_start_time and JST_time. "1": The value of the offset time is subtracted from event_start_time and JST_time.
other_descriptor_status	This field describes the state of descriptors other than the Partial TS Time Descriptor inserted in the SIT. "0": No changes have occurred in other descriptors. "1": Some changes have occurred in other descriptors.
JST_time_flag	This field describes whether JST_time will appear in the field that follows. If this field is set to "1", it means that the JST_time field will appear.
JST_time	This descriptor describes the time of the output of the partial TS. JST_time described in the TOT is used as it is. The time error when updating JST_time is within two seconds. It is desirable that JST_time is inserted in the 1st loop.

[Other special notes]

When inserting multiple services into the partial TS, same descriptors may be inserted in the 2nd loop multiple numbers of times. If, in this case, JST_time is inserted in some descriptors but not inserted in other descriptors, processing may become complex. It is, therefore, desirable that JST_time is inserted in the 1st loop and only the time information regarding the service, instead of JST_time, is inserted in the 2nd loop. It is also possible that JST_time is inserted in all descriptors. However, in this case, the same value should be inserted in all these descriptors.

(12) Extended Broadcaster Descriptor

[Application]

This descriptor describes extended broadcaster information necessary for the replay of data broadcasts.

[Output operation rules]

If inserting this descriptor in the SIT, the descriptor transmitted in the broadcast stream shall be used as it is.

This descriptor is always transmitted in the broadcast stream. When data contents are inserted in the partial TS for output, it is mandatory that this descriptor be inserted in the SIT.

(13) Broadcast ID Descriptor

[Application]

This descriptor describes various broadcast IDs necessary for the replay of data broadcasts.

[Structure]

The structure of the broadcast ID Descriptor is shown in Table 8-24.

Table 8-24 Structure of the Broadcast ID Descriptor

Data Structure	bit	Identifier
broadcast_id_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
original_network_id	16	uimsbf
transport_stream_id	16	uimsbf
event_id	16	uimsbf
broadcaster_id	8	uimsbf
}		

[Semantics of each field]

The semantics of each field should conform to Vol. 4 of the document.

[Output operation rules]

- If output data components (component tag values, 0x40 to 0xDF) via partial TS, this descriptor shall be inserted in the 2nd loop of the SIT.

Output operation rules of each field are shown in Table 8-25.

Table 8-25 Output operation rules of the Broadcast ID Descriptor

Output operation rules of Each Field	
descriptor_tag	This field must be set to "0x85".
descriptor_length	This field describes the length of the descriptor.
original_network_id	This field describes original_network_id to which the service output in the partial transport stream belongs.
transport_stream_id	This field describes transport_stream_id to which the service output in the partial transport stream belongs.
event_id	This field describes event_id of the event output in the partial transport stream.
broadcaster_id	This field describes the ID of the broadcaster to which the service output in the partial transport stream belongs. This field must be set to a fixed value of 0xFF for digital terrestrial television broadcasting, and this value has no significance for operation.

[Supplementary explanation]

- Regarding the multimedia data service, the identification of data transmission modules and video and audio components may use the following fields: original_network_id, transport_stream_id, service_id and event_id. An example is shown below.

  arib://<original_network_id>.<transport_stream_id>.<service_id>
  [;<event_id>]/component_tag

- Also, regarding the multimedia data service, broadcaster-specific areas are assigned in NVRAM in order to enable the storage and retrieval of information on each broadcaster.

Digital terrestrial television broadcasting uses original_network_id for the identification of each area in NVRAM.

- To ensure that the abovementioned functions of the multimedia data service operate normally not only during the reception of a broadcast but also during the replay of the partial transport stream, it is mandatory that the Extended Broadcaster Descriptor and this descriptor (broadcast ID Descriptor) are described in the SIT of the partial transport stream and that desired IDs can be acquired. Since service_id is described in the SIT, IDs, not including service_id and terrestrial_broadcaster_id described in the Extended Broadcaster Descriptor, are selected from the Broadcast ID Descriptor for description.

●

8.3 Specifications for the Operation of the IP interface

8.3.1 Packet Format

For digital terrestrial receivers, the protected content packet (PCP) described in DTCP Vol. 1, Supplement E (DTCP V1SE) shall be used instead of the packet format described in "9.2.2.2 Packet format" of ARIB STD-B21.

The contents contained in one PCP shall be adjusted so that the time of content reception by the receiver would be in the range between 0.3 and 2 sec. However, the PCP immediately before Nc renewal and the last PCP of HTTP response are exceptions. When the entire content is shorter than 0.3 sec or when the content within the HTTP response is shorter than 0.3 sec for access involving content range specification, the entire content within the HTTP response is dealt as one PCP.

8.3.2 Operation of Partial TS Output

Operation of partial TS output from the IP interface shall comply with "8.1 Specifications for the operation of PSI/SI for partial TS output" and "8.2 Specifications for the use of tables" in this volume. In the case of content transmission by HTTP, however, DITs shall not be inserted for the start and end of each HTTP response. For instance, no new DIT is inserted when discontinuity with respect to the preceding response is generated by access involving content range specification.

8.3.3 Operational Rules on Tuner Description

For digital terrestrial receivers, tuner containers and channel items shall be inserted according to the provisions in "9.2.3 Specifications on tuner description" in ARIB STD-B21. See also the relevant descriptions in the Digital Living Network Alliance Home Networked Device Interoperability

Guidelines (DLNA Guidelines) for details. Described below are the property operational rules on tuner containers and channel items in digital terrestrial receivers.

8.3.3.1 Operational Rules on Tuner Description in General

The properties that belong to the name space
xmlns:arib="urn:schemas-arib-or-jp:elements-1-0/"
defined in "9.2.3 Specifications on tuner description" in ARIB STD-B21 shall not be handled with no values inserted or with values consisting only of blank characters. Handling of the other properties shall comply with the DLNA Guidelines.

8.3.3.2 Operational Rules on Tuner Containers and Channel Items

The operational rules on the properties of tuner containers are listed in Table 8-26. For digital terrestrial receivers, the properties of "mandatory" implementation level (denoted by @) shall be implemented without fail according to this table. The implementation of the properties of "optional" implementation level (denoted by O) shall also comply with this table.

Table 8-26 Operational rules on the properties of tuner containers

Property name	Implementation level	Property type	Property description
dc:title	@	String	Indicates the name of each broadcasting system. For digital terrestrial receivers, a notation of "terrestrial digital(地上デジタル)" shall be given in double-width characters.
arib:objectType	@	String	Indicates that the tuner container complies with "9.2 IP interface specifications" in ARIB STD-B21 and "8.3 Specifications for the operation of the IP interface". For digital terrestrial receivers, a notation of "ARIB_TB" shall be given in single-width characters.

@: mandatory

O: optional

The property of "dc:" is defined by the Dublin Core Metadata Initiative.

The operational rules on the properties of channel items are listed in Table 8-27. For digital terrestrial receivers, the properties of "mandatory" implementation level (denoted by @) shall be

implemented without fail according to this table. The implementation of the properties of "optional" implementation level (denoted by O) shall also comply with this table.

Table 8-27 Operational rules on the properties of channel items

Property name	Implementation level	Property type	Property description
arib:objectType	@	String	Indicates that the channel item complies with "9.2 IP interface specifications" in ARIB STD-B21 and "8.3 Specifications for the operation of the IP interface". For digital terrestrial receivers, a notation of "ARIB_TB" shall be given in single-width characters.
dc:title	@	String	Indicates the event name. In principle, the event_name_char information contained in the first loop of the Short Event Descriptor within the EIT event loop is inserted. It is desirable that the inserted information be updated simultaneously with the update of EIT information. When event_name_char is unknown, the same character string of upnp:channelName shall be inserted according to the rule of the DLNA Guidelines.
upnp:genre	@	String	Indicates the genre to which the event belongs. In principle, the value of content_nibble_level_1 (primary classification) contained in the Content Descriptor in the EIT event loop is converted into the corresponding character string described in "Content of description" in the table of the primary classification of genre in Appendix A of Part 4 of Vol. 4 of the document, and the character string is inserted. When content_nibble_level_1 is 0xC, 0xD, or 0xE, the character string "undefined(未定義)" shall be inserted. When content_nibble_level_1 is unknown, the character string "unknown(不明)".shall be inserted.
upnp:channelName	@	String	Indicates the name of service (service channel). In principle, the "char" information contained in the second loop of the Service Descriptor in the SDT service group is inserted. When "char" is unknown, it is desirable to insert the name of the previously set service channel.
upnp:channelNr	@	Integer	Indicates the channel number given by the following equation: upnp:channelNr = (one-touch channel selection number) x 10000 + (three-digit

			number) x 10 + (branch identifier) [One-touch channel selection number] The values set for the services (service channels) in the receiver are used. The value of 0 shall be used when no one-touch channel selection number is assigned to the service. [Three-digit number] In principle, the value generated by using the equation defined in 9.1.3(d) of Vol. 7 of the document from service_id of the Service List Descriptor contained in the second loop (TS loop) of NIT and remote_control_key_id of the same TS Information Descriptor is used. If the NIT cannot be acquired, it is desirable to insert the previously set three-digit number.
upnp:scheduledStartTime	O	String	Indicates the start time of the relevant event. In principle, the start time (start_time) of the relevant event in the EIT event loop is inserted after converting it from the MJD+BCD format into the following format, which is the same as the format for dc:date defined in the DLNA Guidelines. When TOT is not present, it is described as follows. CCYY-MM-DDTHH:MM:SS When the time offset value for implementing summer time is set in the TOT, TimeOffset (+/-HH:MM) is added as follows: CCYY-MM-DDTHH:MM:SS+09:00 if summer time is not implemented; CCYY-MM-DDTHH:MM:SS+10:00 if summer time (1 hour) is implemented. This property is not prepared if start_time is unknown value.
upnp:scheduledEndTime	O	String	Indicates the end time of the relevant event. In principle, the end time to be inserted is generated from start_time in the EIT event loop and the length (duration) of the relevant event, and then converted from the BCD format into the following format, which is the same as the format for dc:date defined in the DLNA Guidelines. When TOT is not present, it is described as follows. CCYY-MM-DDTHH:MM:SS When the time offset value for implementing summer time is set in the TOT, TimeOffset (+/-HH:MM) is added as follows: CCYY-MM-DDTHH:MM:SS+09:00 if summer time is not implemented; CCYY-MM-DDTHH:MM:SS+10:00 if summer time (1 hour) is implemented. This property is not prepared when upnp:scheduledEndTime cannot be

			generated because of the variability of start_time or duration.
dc:description	O	String	Indicates program description. In principle, text_char contained in the second loop of the Short Event Descriptor in the EIT event loop is inserted.
arib:longDescription	O	String	Indicates the details of the event. In principle, the item name expressed by item_description_char and the item description expressed by item_char in the Extended Event Descriptor contained in the EIT event loop are used. Presence of more than one arib:longDescription is allowed. Multiple arib:longDescription's are inserted in ascending order of descriptor_number for each Extended Event Descriptor. When multiple item descriptions are given consecutively for one item name, they shall be combined and inserted as one arib:longDescription. An item name shall be given in the first 24 bytes of arib:longDescription, and item description in the 25th and subsequent bytes. If the length of the item name is less than 24 bytes, blank characters shall be inserted to fill the 24-byte space.
res@resolution	O	Pattern string	Indicates the resolution of the content to be output. The resolution is expressed as follows by using the numbers of horizontal and vertical pixels in single-width characters. (Number of horizontal pixels) x (Number of vertical pixels) Example: 1920 x 1080
upnp:rating	O	String	Indicates the age restriction of viewers. In principle, the rating value of the Parental Rating Descriptor is inserted after converting it to a hexadecimal number in the form of 0xXX. For example, "0x10" is inserted when the rating value is 10. This property is used for display only and the use of the property for other purposes is not guaranteed.
upnp:icon	O	URI	Indicates the URL of the logo of the relevant service (service channel).
upnp:icon@arib:resolution	O	Pattern string	Indicates the size of the logo of the relevant service (service channel). The form shall comply with res@resolution. The numbers of horizontal and vertical dots of the relevant logo listed in "Table 4-1 Size pattern of logo mark to be transmitted" in "4(3) Updating of logo data" of Vol. 1 of the document shall be inserted. (Number of horizontal dots) x (Number of vertical dots) Example: 64 x 36

arib:videoComponentType	O	Unsigned integer	Indicates the type of video component. In principle, the value of component_type in the Component Descriptor contained in the EIT is inserted after converting it to a decimal number. This property can be multiple when multiple video ESs are contained in one service_id; the default ES shall be described first in this case.
arib:audioComponentType	O	Unsigned integer	Indicates the type of audio component. In principle, the value of component_type in the Audio Component Descriptor contained in the EIT is inserted after converting it to a decimal number. This property can be multiple when multiple audio ESs are contained in one service_id; the default ES shall be described first in this case.
arib:audioComponentType@qualityIndicator	O	Unsigned integer	Indicates the tone quality mode of audio component. In principle, the value of quality_indicator in the Audio Component Descriptor contained in the EIT is inserted after converting it to a decimal number.
arib:copyControlInfo	O	CSV string	Indicates information on the control of program recording and output. In principle, encryption_mode of the Content Availability Descriptor, digital_recording_control_data of the Digital Copy Control Descriptor, APS_control_data, and a bit value that either permits or denies output are separated by commas and are inserted as a character string. The permission and denial of output correspond to bit values of 0 and 1, respectively. This property is used for display only and the use of the property for other purposes is not guaranteed.
arib:dataProgramInfo	O	Boolean	Indicates the presence of data broadcasting. In principle, "1" is inserted when data_component_id is "000C" and entry_component equals the component_tag value of the relevant caption ES (0x40 to 0x7F), and "0" is inserted in the other cases.
arib:dataProgramInfo@sync	O	Boolean	Indicates the program linkage of data broadcasting. In principle, "1" is inserted when arib:dataProgramInfo@sync="1" and associated_contents_flag="1" in the selector area of the Data Contents Descriptor, and "0" is inserted in the other cases.
arib:multiViewInfo	O	Boolean	Indicates the operation of multi-view television (MVTV). In principle, "1" is inserted when there is a Component Group Descriptor with

			component_group_type="000" in the EIT, and "0" is inserted in the other cases.
arib:captionInfo	O	Boolean	Indicates the operation of caption and superimpose. In principle, "1" is inserted when data_component_id="0008" in the Data Contents Descriptor or when there is a corresponding ES, and "0" is inserted in the other cases. This property can be multiple when multiple caption ESs are contained in one service_id; the default ES shall be described first in this case.
arib:multiESInfo	O	Boolean	Indicates the presence of multiple video or audio ESs. In principle, "1" is inserted when multiple Component Descriptors/Audio Component Descriptors are placed in the EIT, and "0" is inserted when only one descriptor is placed.
arib:caProgramInfo	O	Boolean	Indicates whether the program is charged or free. In principle, "1" is inserted when free_CA_mode="1" (pay program) in the EIT, and "0" when free_CA_mode="0" (free program).
arib:caProgramInfo@price	O	CSV string	Indicates the price of pay program (viewing only or recording included). The price is indicated when arib:caProgramInfo="1" (pay program). This attribute does not exist when arib:caProgramInfo="0" (free program). The prices shall be inserted in single-width digits in yen in the order of "viewing only" and "recording included." Example (viewing only): @price="500" Example (recording included): @price="500,700"
arib:caProgramInfo@available	O	Boolean	Indicates the purchase contract of pay program. Indicates whether the default ESs are contracted (purchased) when arib:caProgramInfo="1" (pay program). This attribute does not exist when arib:caProgramInfo="0" (free program). Insert "1" when the default ESs are contracted (purchased).

@: mandatory

O: optional

The properties of "upnp:" are defined by the UPnP Forum.

8.3.3.3 Properties to be Implemented for Bound Recorded Contents

When a receiver capable of bound recording outputs its bound recorded contents according to "8.3 Specifications for the Operation of the IP interface", the properties listed in Table 8-28 shall be

implemented. For digital terrestrial receivers, the properties of "mandatory" implementation level (denoted by @) shall be implemented without fail according to this table. The implementation of the properties of "optional" implementation level (denoted by O) shall also comply with this table.

Table 8-28 Properties of bound recorded contents

Property name	Implementation level	Property type	Property description
arib:objectType	@	String	Indicates that the properties of the bound recorded contents comply with "8.3 Specifications for the operation of the IP interface". For digital terrestrial receivers, a notation of "ARIB_TB" shall be given in single-width characters.
dc:title	@	String	Indicates the event name. In principle, the event_name_char information contained in the first loop of the Short Event Descriptor within the EIT event loop is inserted. When event_name_char is unknown, the same character string of upnp:channelName shall be inserted according to the rule of the DLNA Guidelines.
upnp:genre	@	String	Indicates the genre to which the event belongs. In principle, the value of content_nibble_level_1 (primary classification) contained in the Content Descriptor in the EIT event loop is converted into the corresponding character string described in "Content of description" in the table of the primary classification of genre in Appendix A of Part 4 of Vol. 4 of the document, and the character string is inserted. Presence of more than one upnp:genre is allowed. Insert a character string "undefined(未定義)" when content_nibble_level_1 is 0xC, 0xD, or 0xE. Insert a character string "unknown(不明)" when content_nibble_level_1 is unknown.
upnp:channelName	@	String	Indicates the name of service (service channel). In principle, the "char" information contained in the second loop of the Service Descriptor in the SDT service group is inserted. When "char" is unknown, it is desirable to insert the name of the previously set service channel.
upnp:channelNr	@	Integer	Indicates the channel number given by the following equation: upnp:channelNr = (one-touch channel selection number) x 10000 + (three-digit number) x 10 + (branch identifier) [One-touch channel selection number] The values set for the services (service channels) in the receiver are used. The value of 0 shall be used when no one-touch channel selection number is assigned to the service. [Three-digit number]

			In principle, the value generated by using the equation defined in 9.1.3(d) of Vol. 7 of the document from service_id of the Service List Descriptor contained in the second loop (TS loop) of NIT and remote_control_key_id of the same TS Information Descriptor is used. If the NIT cannot be acquired, it is desirable to insert the previously set three-digit number.
dc:date	@	String	Indicates the start time of the bound recording of the relevant content. The format to be used shall be the same as that for upnp:scheduledStartTime of the channel item. For example, 2005-06-17T07:00:00 means that the bound recording started at 7 a.m. on June 17, 2005.
res@duration	@*1	String	Indicates the duration of the bound recording of the relevant content.
upnp:scheduledStartTime	O	String	Indicates the start time of the relevant event. In principle, the start time (start_time) of the relevant event in the EIT event loop is inserted after converting it from the MJD+BCD format into the following format, which is the same as the format for dc:date defined in the DLNA Guidelines. When TOT is not present, it is described as follows. CCYY-MM-DDTHH:MM:SS When the time offset value for implementing summer time is set in the TOT, TimeOffset (+/-HH:MM) is added as follows: CCYY-MM-DDTHH:MM:SS+09:00 if summer time is not implemented; CCYY-MM-DDTHH:MM:SS+10:00 if summer time (1 hour) is implemented. This property is not prepared if start_time is unknown value.
upnp:scheduledEndTime	O	String	Indicates the end time of the relevant event. In principle, the end time to be inserted is generated from start_time in the EIT event loop and the length (duration) of the relevant event, and then converted from the BCD format into the following format, which is the same as the format for dc:date defined in the DLNA Guidelines. When TOT is not present, be specified as follows. CCYY-MM-DDTHH:MM:SS When the time offset value for implementing summer time is set in the TOT, TimeOffset (+/-HH:MM) is added as follows: CCYY-MM-DDTHH:MM:SS+09:00 if summer time is not implemented; CCYY-MM-DDTHH:MM:SS+10:00

			if summer time (1 hour) is implemented. This property is not prepared when upnp:scheduledEndTime cannot be generated because of the variability of start_time or duration.
dc:description	O	String	Indicates program description. In principle, text_char contained in the second loop of the Short Event Descriptor in the EIT event loop is inserted.
arib:longDescription	O	String	Describes the details of the event. In principle, the item name expressed by item_description_char and the item description expressed by item_char in the Extended Event Descriptor contained in the EIT event loop are used. Presence of more than one arib:longDescription is allowed. Multiple arib:longDescription's are inserted in ascending order of descriptor_number for each Extended Event Descriptor. When multiple item descriptions are given consecutively for one item name, they shall be combined and inserted as one arib:longDescription. An item name shall be given in the first 24 bytes of arib:longDescription, and item description in the 25th and subsequent bytes. If the length of the item name is less than 24 bytes, blank characters shall be inserted to fill the 24-byte space.
res@resolution	O	Pattern string	Indicates the resolution of the content to be output. The resolution is expressed as follows by using the numbers of horizontal and vertical pixels in single-width characters. (Number of horizontal pixels) x (Number of vertical pixels) Example: 1920 x 1080
upnp:rating	O	String	Indicates the age restriction of viewers. In principle, the rating value of the Parental Rating Descriptor is inserted after converting it to a hexadecimal number in the form of 0xXX. For example, "0x10" is inserted when the rating value is 10. This property is used for display only and the use of the property for other purposes is not guaranteed.
upnp:icon	O	URI	Indicates the URL of the logo of the relevant service (service channel).
upnp:icon@arib:resolution	O	Pattern string	Indicates the size of the logo of the relevant service (service channel). The form shall comply with res@resolution. (Number of horizontal dots) x (Number of vertical dots) Example: 64 x 36
arib:videoComponentTy	O	Unsigned	Indicates the type of video component. In

pe		integer	principle, the value of component_type in the Component Descriptor contained in the EIT is inserted after converting it to a decimal number. This property can be multiple when multiple video ESs are contained in one service_id; the default ES shall be described first in this case.
arib:audioComponentType	O	Unsigned integer	Indicates the type of audio component. In principle, the value of component_type in the Audio Component Descriptor contained in the EIT is inserted after converting it to a decimal number. This property can be multiple when multiple audio ESs are contained in one service_id; the default ES shall be described first in this case.
arib:audioComponentType@qualityIndicator	O	Unsigned integer	Indicates the tone quality mode of audio component. In principle, the value of quality_indicator in the Audio Component Descriptor contained in the EIT is inserted after converting it to a decimal number.
arib:copyControlInfo	O	CSV string	Indicates information on the control of program recording and output. In principle, encryption_mode of the Content Availability Descriptor, digital_recording_control_data of the Digital Copy Control Descriptor, APS_control_data, a bit value that either permits or denies output, and a bit value for copy_no_more are separated by commas and are inserted as a character string. The permission and denial of output correspond to bit values of 0 and 1, respectively. The effectiveness and ineffectiveness of copy_no_more correspond to bit values of 1 and 0, respectively. This property is used for display only and the use of the property for other purposes is not guaranteed.
arib:dataProgramInfo	O	Boolean	Indicates the presence of data broadcasting. In principle, "1" is inserted when data_component_id is "000C" and entry_component equals the component_tag value of the relevant caption ES (0x40 to 0x7F), and "0" is inserted in the other cases.
arib:dataProgramInfo@sync	O	Boolean	Indicates the program linkage of data broadcasting. In principle, "1" is inserted when arib:dataProgramInfo@sync="1" and associated_contents_flag="1" in the selector area of the Data Contents Descriptor, and "0" is inserted in the other cases.
arib:multiViewInfo	O	Boolean	Indicates the operation of multi-view television (MVTV). In principle, "1" is

			inserted when there is a Component Group Descriptor with component_group_type="000" in the EIT, and "0" is inserted in the other cases.
arib:captionInfo	O	Boolean	Indicates the operation of caption and superimpose. In principle, "1" is inserted when data_component_id="0008" in the Data Contents Descriptor or when there is a corresponding ES, and "0" is inserted in the other cases. This property can be multiple when multiple caption ESs are contained in one service_id; the default ES shall be described first in this case.
arib:multiESInfo	O	Boolean	Indicates the presence of multiple video or audio ESs. In principle, "1" is inserted when multiple Component Descriptors/Audio Component Descriptors are placed in the EIT, and "0" is inserted when only one descriptor is placed.
arib:caProgramInfo	O	Boolean	Indicates whether the program is charged or free. In principle, "1" is inserted when free_CA_mode="1" (pay program) in the EIT, and "0" when free_CA_mode="0" (free program).
arib:caProgramInfo@price	O	CSV string	Indicates the price of pay program (viewing only or recording included). The price is indicated when arib:caProgramInfo="1" (pay program). This attribute does not exist when arib:caProgramInfo="0" (free program). The prices shall be inserted in single-width digits in yen in the order of "viewing only" and "recording included." Example: @price="500,700"
arib:caProgramInfo@available	O	Boolean	Indicates the purchase contract of pay program. Indicates whether the default ESs are contracted (purchased) when arib:caProgramInfo="1" (pay program). This attribute does not exist when arib:caProgramInfo="0" (free program). Insert "1" when the default ESs are contracted (purchased).

@: mandatory

O: optional

*1 This attribute is not required when the length is unknown, such as during bound recording, or the item does not have "res" attributes.

8.3.4 Control of Content Selection

8.3.4.1 protocolInfo and MIME-Type

In stream output by HTTP from the digital media server (DMS) of a digital terrestrial receiver, the control of content selection is expressed as follows by using protocolInfo defined in the Media Management of the DLNA Guidelines and the recommended MIME-Type described in the DTCP V1SE.

protocolInfo consists of four fields
<protocol>':'<network>':'<contentFormat>':'<additionalInfo>
First field <protocol>: protocol used for the output of content.
Second field <network>: the definition of this field depends on the output protocol. Asterisk "*" is described in the case of HTTP.
Third field <contentFormat>: the definition of this field depends on the output protocol. The format of the content itself is indicated in the case of HTTP.
Fourth field <additionalInfo>: additional information is given.

For example, when MPEC content of the TS format with time stamp that complies with "8.3.1 Packet Format" in this volume is transmitted by using HTTP as the protocol of stream output, protocolInfo is expressed as follows:

http-get:*:application/x-dtcp1DTCP1HOST=(host)DTCP1PORT=(port)CONTENTFORMAT="video/vnd.dlna.mpeg-tts":ARIB.OR.JP_PN=MPEG_TTS_CP

Each field shall be inserted as follows according to the protocolInfo specifications given in the Media Management of the DLNA Guidelines.

First field: "http-get," which indicates that the output protocol is HTTP, is inserted.
Second field: asterisk "*" is inserted.
Third field: MIME-Type, explained below, is inserted.
Fourth field: ARIB.OR.JP_PN=MPEG_TTS_CP, defined in "9.2.4 Control of content selection" of ARIB STD-B21, is inserted. Parameters specified in the DLNA Guidelines and manufacturer-specific parameters can also be inserted in the fourth field. See the DLNA Guidelines for rules on inserting multiple parameters.

In the third field, the recommended MIME-Type described in the DTCP V1SE is used as MIME-Type, and the MIME-Type of the TS format with time stamp defined by "MPEG-2 MIME-Type Definition" in the DLNA Guidelines[3] is used as CONTENTFORMAT in the following format:

application/x-dtcp1DTCP1HOST=(host)DTCP1PORT=(port)CONTENTFORMAT="video/vnd.dlna.mpeg-tts"

Here, "(host)" represents the address of the host that performs AKE, and "(post)" represents the port of the host that performs AKE.

Although "DTCP1HOST=(host)" and "DTCP1PORT=(port)" are optional, they shall always be inserted if the content needs to be protected by DTCP-IP from the beginning or midstream of the content.

The MIME-Type of the content transmitted as the payload of PCP is specified for CONTENTFORMAT. When transmitting the TS format with time stamp described in "8.1.4 Carousel transmission of MPEG video/audio by the TS format with time stamp" in Vol. 2 of ARIB STD-B24, "video/vnd.dlna-mpeg-tts" shall be specified. In the third field of protocolInfo of "Out" in CMS:GetprotocolInfo(), "DTCP1HOST=(host)" and "DTCP1PORT=(port)" are optional because the address and port of the host that performs AKE may vary with contents.

When describing the above-defined protocolInfo as an attribute of "res" (res@protocolInfo), the problem of double quoting arises. To evade this problem, either the outside quotation marks are expressed as single quotes or the inside quotation marks are escaped by using """ according to the XML syntax. The description of res@protocolInfo then becomes as follows.

protocolInfo='http-get:*:application/x-dtcp1DTCP1HOST=(host)DTCP1PORT=(port)CONTENTFORMAT='video/vnd.dlna.mpeg-tts':ARIB.OR.JP_PN=MPEG_TTS_CP'

or

protocolInfo='http-get:*:application/x-dtcp1DTCP1HOST=(host)DTCP1PORT=(port)CONTENTFORMAT=&quotVideo/vnd.dlna.mpeg-tts":ARIB.OR.JP_PN=MPEG_TTS_CP'

8.3.4.2 URL of Content Protected by DTCP-IP

For the URL of content protected by DTCP-IP and described as a "res" value in the tuner description of a digital terrestrial receiver, use of the recommended URI described in the DTCP V1SE is not

[3] In the DLNA Guidelines 1.0, a description is given in Digital Living Network Alliance Home Networked Device Interoperability Guidelines Version:1.0 Errata

mandatory.

8.3.4.3 Content-Type Header Field of HTTP Header

In an HTTP request or HTTP response related to content protected by DTCP-IP, the address and port of the host that performs AKE shall be included in the Content-Type header field inserted in the HTTP header, as specified in the DTCP V1SE. This MIME-Type is the same as the one given in 8.3.4.1 in this volume.

Content-Type:application/x-dtcp1DTCP1HOST=(host)DTCP1PORT=(port)CONTENTFORMAT='video/vnd.dlna.mpeg-tts'

8.3.4.4 Access Involving Content Range Specification

When the digital terrestrial receiver supports range-specified access by TimeSeekRange.dlna.org described in the DLNA Guidelines, the relevant provisions in the Guidelines shall be complied with.

When supporting range-specified access by Range.dtcp.com described in the DTCP V1SE, the following requirements shall be satisfied.

When the digital terrestrial receiver supports range-specified access by Range.dtcp.com, "ARIB.OR.JP_OP=1" shall be inserted in the fourth field of res@protocolInfo of the relevant content. Do not insert the ARIB.OR.JP_OP parameter in contents that do not support range-specified access.

The format of Range.dtcp.com is as follows:

- Range.dtcp.com = "Range.dtcp.com" ":" range-specifier
- range-specifier = byte-range-specifier
- byte-range-specifier = bytes-unit "=" byte-range-set
- bytes-unit = "bytes"
- byte-range-set = byte-range-spec
- byte-range-spec = first-byte-pos "-" [last-byte-pos]
- first-byte-pos = 1*DIGIT
- last-byte-pos = 1*DIGIT

The "first-byte-pos" item indicates the position of the first byte in the unencrypted content, and "last-byte-pos" indicates the position of the last byte in the unencrypted content.

Examples of Range.dtcp.com description are given below:

- Range.dtcp.com: bytes=1539686400-
- Range.dtcp.com: bytes=1539686400-1541710655

When the range requested by Range.dtcp.com for content of the TS format with time stamp in a digital terrestrial receiver does not match with the 192-byte-unit packet boundary of the TS format with time stamp, the response range is extended as follows to make it match with the 192-byte-unit packet boundary.

- When the start position of the requested range does not match with the start of the packet of the TS format with time stamp, the start position of the response range shall be changed to the start position of the packet of the TS format with time stamp so that the changed range includes the requested start position.
- When the end position of the requested range does not match with the end of the packet of the TS format with time stamp, the end position of the response range shall be changed to the end position of the packet of the TS format with time stamp so that the changed range includes the requested end position.

With regard to responding to the Range.dtcp.com request, refer to Table 8-29 for HTTP response codes in different situations.

Table 8-29 HTTP response codes for Range.dtcp.com request

Situation	Response code
When responding normally to the Range.dtcp.com request	200 (OK); 206 (Partial Content) shall not be used
When the range requested by Range.dtcp.com is invalid (e.g., the start position of the requested range exceeds the end of the content.)	416 (Requested Range Not Satisfiable)
When the Range.dtcp.com request is grammatically invalid	400 (Bad Request)
When the Range.dtcp.com request is not supported for the relevant content.	406 (Not Acceptable)

When responding with the response code of "200 (OK)," insert the Content-Range.dtcp.com header field described in the DTCP V1SE in the HTTP response header.

The format of Content-Range.dtcp.com is as follows:

- Content-Range.dtcp.com = "Content-Range.dtcp.com" ":" content-range-spec
- content-range-spec = byte-content-range-spec
- byte-content-range-spec = bytes-unit SP byte-range-resp-spec "/" (instance-length | "*")
- bytes-unit = "bytes"
- byte-range-resp-spec = first-byte-pos "-" last-byte-pos
- first-byte-pos = 1*DIGIT
- last-byte-pos = 1*DIGIT
- instance-length = 1*DIGIT

The "first-byte-pos" item indicates the position of the first byte in the unencrypted content, and "last-byte-pos" indicates the position of the last byte in the unencrypted content.

The "instance-length" item indicates the entire size of the unencrypted content. When the entire size is difficult to calculate, "*" may be used as allowed in Content-Range.

An example of Content-Range.dtcp.com description is given below:

- Content-Range.dtcp.com: bytes 1539686400-1541710655/9238118400

When using Range.dtcp.com to access the content of the TS format with time stamp in a digital terrestrial receiver, it is desirable to access the content by specifying a range that matches with the 192-byte-unit packet boundary of the TS format with time stamp.

8.3.5 Conversion Rules Used for Tuner Description

The character codes used for tuner description in digital terrestrial receivers shall comply with "9.2.3 Specifications on tuner description" in ARIB STD-B21. Among the 8-bit character codes, the additional symbol set defined in Section 7.1 of ARIB STD-B24, Vol. 1, Part 2 shall comply with Table 7-19 of ARIB STD-B24, Vol. 1, Part 2.

9 Commentary

9.1 An Example of Criteria Regarding Whether the Partial TS can be Recorded in the D-VHS

To record terrestrial digital broadcasting programs in a fixed rate such as when using the D-VHS, the following information, for example, is important; whether recording can be done on the recording media (tape), whether the extended recording mode can be selected, and how much recording time is left. Several methods are available to determine whether recording can be done. One representative example of these methods is the method that uses the maximum bit rate (maximum_bit_rate) transmitted by the Digital Copy Control Descriptor. An example of how to use the maximum bit rate is given below.

(1) Definition of the maximum bit rate

The maximum bit rate is defined as the average value of the transmission rate within the 1/60 second period.

(2) Default value of the maximum bit rate

The maximum bit rate value, described in the maximum_bit_rate field of the Digital Copy Control Descriptor, is inserted in the PMT, SDT and EIT. However, if the bit rate of each component transmitted falls within the ranges specified in "5.2.7.Default Maximum Bit Rate" in Vol. 7 of the document, transmission of this descriptor is not always necessary. If the descriptor is not found, a default value for each component type listed in the abovementioned provisions for transmission operations can be used.

Digital terrestrial receivers, using the maximum bit rate value of each component as the base to calculate the total maximum bit rate of all components to be recorded, determine the D-VHS recording mode.

Based on the selected recording mode, the D-VHS recording mode can be controlled, for example, using the IEEE1394 command.

Reference: An example of the D-VHS recording mode

In the D-VHS mode, the six types (listed below) of main data input rates (including all recording data) are available. Viewers can enjoy the benefit of reduced length of the tape used, by using automatic switching of the recording mode. More specifically, instead of recording all programs in the HS mode, different recording modes are used for different programs; for example, a program comprised of a combination of 1080i and standard stereo audio streams is recorded in the HS mode and a program comprised of a combination of 480i and standard stereo audio streams is recorded in the STD mode.

HS mode 28.2 Mbit/s

STD mode 14.1 Mbit/s

LS2 mode 7.0 Mbit/s

LS3 mode 4.7 Mbit/s

LS5 mode 2.8 Mbit/s

LS7 mode 2.0 Mbit/s

The bit rate values listed above are the values of total bit rates at which recording can be done on the tape. When recording an MPEG2 transport stream, headers and other information are contained. Therefore, an MPEG2 transport stream that can be actually recorded is between 70 and 80% of the values listed above. For example, if using the STD mode, the bit rate of an MPEG2 transport stream that can be actually recorded is about 12 Mbit/s.

9.2 Copy Generation Control for Analog Video Output (Copy Generation Management System – Analog (CGMS-A))

To output analog video signals from the digital terrestrial tuner, CGMS-A based copy control shall be used.

Regarding 480i (525i) streams and related copyright information, conformance to CPR-1204 of JEITA (EIAJ) and IEC 61880, respectively, shall be ensured. Regarding 480p (525p) streams and related copyright information, conformance to CPR-1204-1 of JEITA (EIAJ) and IEC 61880, respectively, shall be ensured. Regarding 720p (750p) and 1080i (1125i) streams and related copyright information, conformance to CPR-1204-2 of JEITA (EIAJ) and IEC 61880, respectively, shall be ensured.

9.2.1 Definition of CGMS-A

The definition of CGMS-A and recording control applicable to recording media is shown in Table 9-1.

Table 9-1 Definition of CGMS-A and Recording Control Applicable to Recording Media

CGMS-A	Definition	Recording Method
0 , 0	Copy freely	Recording is done with the CGMS mode set to 0 , 0.
0 , 1	Not defined	
1 , 0	Copy One generation	Recording is done with the CGMS mode set to 1 , 1.
1 , 1	Copy Never	No recording can be done.

9.2.2 Transmission Method When Using CGMS-A

Copy generation control information shall be transmitted using the 1H of the vertical blanking interval of luminance signals. Reference signals, reduced to 70% of the white peak level, and 20-bit digital signals with an amplitude of 70% or 0%, shall be assigned to the 1H of the active video area, and using the 20 bits, the copy generation control information and video-related information are coded

for transmission.

9.2.2.1Analog Output using the Composite System (480i)

Analog transmission using the composite system (480i) shall conform to the specifications for the identification signal waveform in the following standard.

- EIAJ CPR-1204 "Video ID Signal Transmission Method Using a VBI (525 Line System)"

9.2.2.2Analog Output using the Component System (480i)

Multiplex line The 20H and 283H vertical blanking interval of luminance signals

Multiplex level Logic 1: 70% ± 10% of the white peak level

Logic 0: +10% and –5% of the black level

Clock frequency fsc/8 = (455/16) fH = 447 kHz

It should be noted that fH represents the horizontal scanning frequency.

The transmission signal waveform is shown in Fig. 9-1. The cumulative time error from the rise of Ref bit to each bit shall be below 0.44μs.

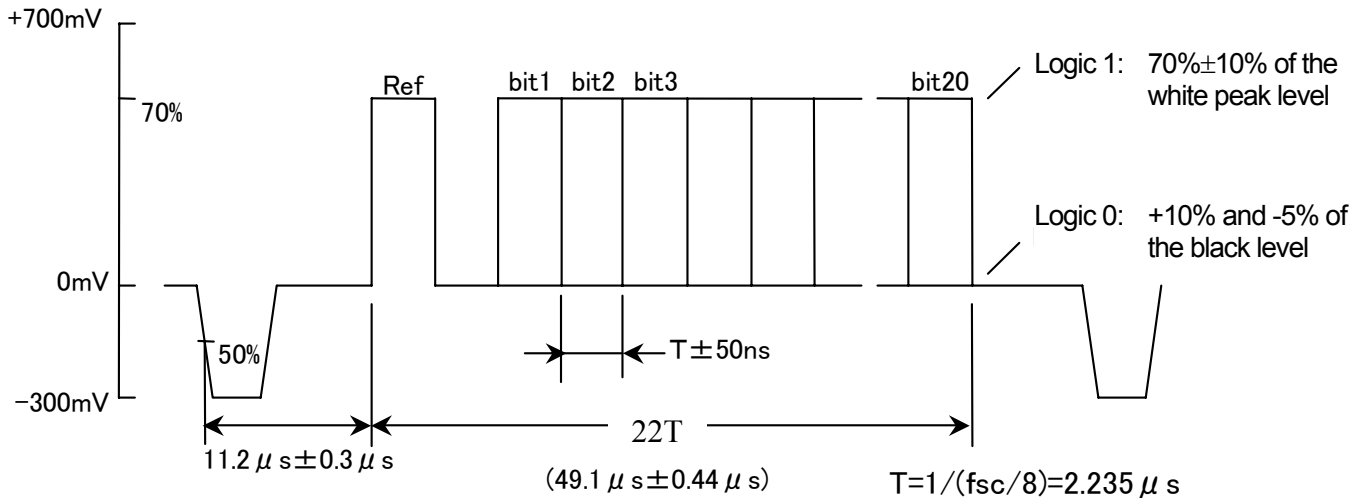


Fig. 9-1 Identification Signal Waveform When Using the Component System (480i)

9.2.2.3Analog Output using the Component System (480p)

Analog transmission using the component system (480p) shall conform to the specifications for the identification signal waveform in the following standard.

- EIAJ CPR-1204-1 "Video ID Signal Transmission Method and System Using a VBI (525p System)"

9.2.2.4Analog Output using the Component System (720p)

Analog transmission using the component system (720p) shall conform to the specifications for the identification signal waveform in the following standard.

- EIAJ CPR-1204-2 "Video ID Signal Transmission Method Using a VBI (750p and 1125i System)"

9.2.2.5Analog Output using the Component System (1080i)

Analog transmission using the component system (1080i) shall conform to the specifications for the identification signal waveform in the following standard.

- EIAJ CPR-1204-2 "Video ID Signal Transmission Method Using a VBI (750p and 1125i System)"

9.2.3 Assignment of Identification Signals

The identification signal is comprised of 20-bit information, and the 20-bit data is comprised of WORD0=2-bit, WORD1=4-bit, WORD2=8-bit and CRCC=6-bit.

The detailed structure is shown below. The unspecified bits are considered not in use ("0").

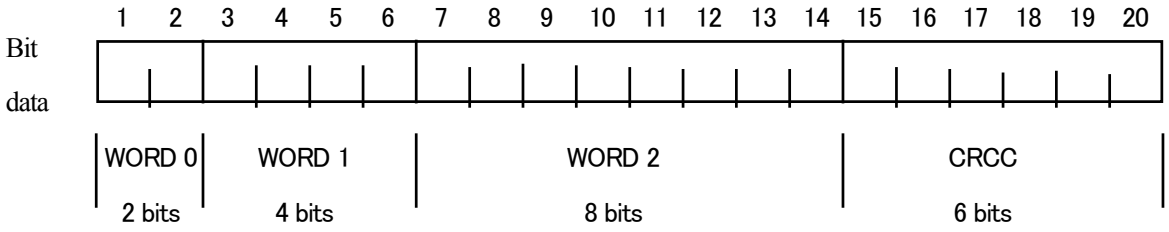


Fig. 9-2 Assignment of Identification Signals

(1) WORD0 -- Information concerning the aspect ratio

Table 9-2 WORD0 -- Information Concerning the Aspect Ratio

WORD 0		Detail
Bit 1	Bit 2	
0	0	Signal for a picture with an aspect ratio of 4:3
0	1	Signal for a letter box with an aspect ratio of 4:3
1	0	Signal for a picture with an aspect ratio of 16:9
1	1	Reserved

(2) WORD 1 – Header that indicates the information to be transmitted in WORD2

Table 9-3 WORD 1 – Header that Indicates the Information to be Transmitted in WORD2

WORD 1				Information Transmitted in WORD2
Bit 3	Bit 4	Bit 5	Bit 6	
0	0	0	0	CGMS-A information
1	1	1	1	No information
Other than above				Not defined

(3) WORD2 – Information in bits 7, 8, 9 and 10

When bits 3 to 6 in WORD1 are set to 0000, CGMS-A information and analog output copy control information shall be respectively assigned to bits 7 and 8 and bits 9 and 10 in WORD2.

Table 9-4 WORD2 – Information in Bits 7 and 8

b7 b8	CGMS-A
0 0	0, 0
0 1	0, 1
1 0	1, 0
1 1	1, 1

Table 9-1 WORD2 – Information in Bits 9 and 10

b9 b10	Analog Output Copy Control Information
0 0	Copy Freely
0 1	A seudo-sync pulse is present
1 0	Seudo-sync pulse + 2 line inverted and split burst insertion
1 1	Seudo-sync pulse + 4 line inverted and split burst insertion

(4) WORD2 – Information in bits 11 to 14

These bits shall be left undefined (Logic 0).

(5) CRCC – Information in bits15 to 20

The CRC code is the error check code.

Generator polynomial G(x) is expressed as follows: $G(x) = X^6+X+1$.

In Fig. 9-3, all preset values are "1".

SW1 is closed and SW2 is placed to the "a" position. Then, the first 14-bit data are entered.

From the 15th bit, SW1 is open and SW2 is placed to the "b" position to output CRCC.

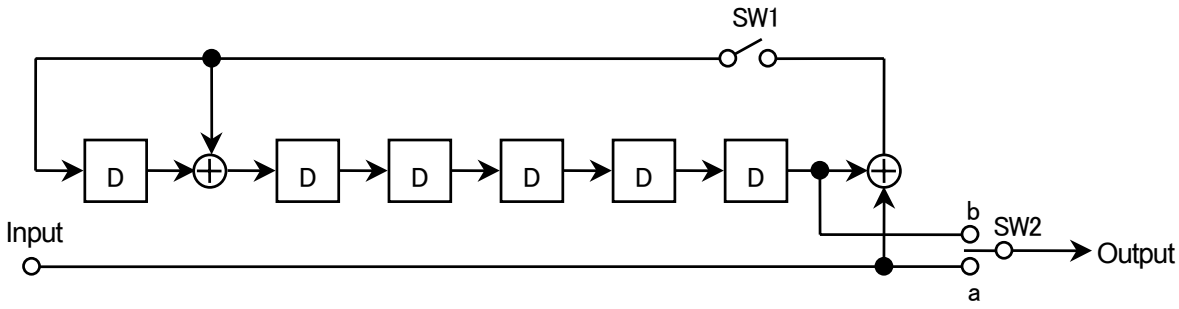


Fig. 9-3 CRCC

9.3 Broadcasting Programs and Guarantee of Uniqueness of Contents

In order to guarantee the uniqueness of broadcasting programs and entire contents, it is desirable to observe the following matters for receivers. It is also desirable to observe the following matters for receivers with the bound recording and the external recorder control function.

- The function to automatically cut or skip, for example, notifications or advertisements, using broadcast signals or descriptors or data contained in broadcast signals, should not be installed. The bound recording or the automatic external recorder control function should not be used, either. However, fast-forward or pause operations by users are not included among these functions prohibited for use.
- During the display of a broadcasting program or certain contents, totally unrelated contents, for example, should not intentionally be added for display. Examples of this kind include: that a broadcasting program being displayed is added by contents, notifications or advertisements, all of which are totally unrelated to the program, in order to intentionally create an impression on viewers that the contents, notifications or advertisements are an integral part of the broadcasting program, and that a function is installed to give viewers a wrong understanding that the television broadcast screen and the Internet browser screen are integrated. Incidentally, the following receiver function is not including among the functions prohibited for use: the multi-screen function (double screen and small screen display), not designed to lead viewers to the misunderstanding as mentioned above, but allows viewers to simultaneously display multiple contents on the same screen.

●

9.4 Restrictions regarding the Functions for Using SI Information on Receivers

Regarding the use of SI information on receivers, the following restrictions should not be violated without the permission of broadcasters.

- Receivers should not come with the function to output only the SI information extracted from multiplexed broadcast signals. However, this does not apply to the output of the SI information related to the contents intended for private copy.
- Receivers should not come with the function to simultaneously display the SI information and the similar information from the other networks not specified in this document as if the information are identical. However, this does not apply to the cases where the SI information is present for the BS/wideband CS on common receivers.

- Receivers should not come with the function to display the SI information together with the contents other than those related to the SI information. One example of this is the display of advertisements issued via the Internet not related to the programs on the program table.

- It is desirable that when displaying a broadcast program that includes recorded contents using the search function, information regarding the program broadcasting source such as channel information is displayed in a way that is readily understood by the viewers.
-

9.5 Precautions for implementation of MPEG-2 AAC

Refer to "Appendix 4: Precautions associated with implementation of MPEG-2 AAC standard" in ARIB STD-B32, Part 2. The appendix is quoted here for the convenience of designers who may use this volume as a guide.

(Start of quotation from Appendix 4 of ARIB STD-B32, Part 2)

This reference explains the characteristics of coding tools used in the MPEG-2 AAC standard and presents precautions associated with the implementation of the standard.

(1) Treatment of AAC coding tools

The MPEG-2 AAC standard specifies three coding tools that can be used in the AAC LC profile: M/S Stereo, Intensity stereo, and TNS. Note that "Prediction" and "Gain Control," which are beyond the usable range in the LC profile, cannot be used and that use of "Coupling Channel" is prohibited in Section 5.2.2 of Part 2 of the present standard.

The AAC standard stipulates that these three coding tools shall be treated in the decoder according to bit streams. Namely, decoding shall be carried out according to the bit stream no matter which coding tool is being used. This specification should be taken into account when designing and implementing decoders.

(2) TNS

When designing and implementing decoders, care should be taken on TNS, which may require a large number of steps for decoding. Although the highest TNS filter order in long window mode is restricted to 12 in the LC profile, compared with 20 in the Main profile, it is still possible that a large number of processing steps will be required. The factors that directly affect the number of steps for TNS decoding include the number of filters, filter order, filter length, and the number of channels.

In the case of a decoder DSP that performs fixed-point calculation, the required precision of operation may not be ensured when a high scaling level is adopted to avoid overflow or underflow

caused by filtering (i.e., TNS may not be effective in improving sound quality). When designing and implementing decoder systems, therefore, care should be taken on overflow and underflow caused by filtering.

(3) Huffman decoding

The processing load of Huffman decoding tends to increase with bit rate. When designing and implementing decoders, theoretical maximum instantaneous rate should be taken into account in reference to the buffer model of the AAC standard.

In the case of encoders, care should be taken to avoid excessively high maximum instantaneous rate when bit rate is relatively high.

(End of quotation from ARIB STD-B32, Part 2)

10 Appendix A

10.1 Examples of One-touch Button Assignment

The one-touch button assignment function is used to assign, by default, broadcasters to the (1) to (12) buttons on the remote controller of the receiver. Each broadcaster is assigned to a number described in remote_control_key_id. However, this function does not necessarily disable viewers to make unique settings of their own. It depends on each manufacturer's product planning as to whether to install a function that allows viewers to use the default settings for the purpose of changing the button assignment on the remote controller.

Pressing a button to which a broadcaster has already been assigned causes the display of the representative service of each TS.

10.1.1 An example of settings in the absence of overlaps of remote_control_key_id

As shown in the example in Table 10-1, remote_control_key_id and the button number on the remote controller are the same.

Table 10-1 An example of one-touch button assignment (in the absence of overlaps)

remote_control_key_id	Button Number on the Remote Controller	Broadcaster	Service Number to be Selected
1	1	A	011
2	2	B	021
3	3	C	031
4	4	D	041
5	5	E	051
6	6	F	061
7	7	G	071
8	8	H	081
9			
10	10	I	101
11			
12			

10.1.2 An example of settings in the presence of overlaps of remote_control_key_id

In principle, remote_control_key_id is unique in each target area for broadcasting and relevant adjustments to maintain the uniqueness are scheduled to be made with neighboring areas. Nonetheless, the reception of channels from other areas may cause overlaps of remote_control_key_id.

An example of the receiver's movement in this case is shown below.

Table 10-2 shows an example where in addition to the nine stations originally intended for reception (as shown in the example of Table 10-1), another four stations intended for reception in other areas can be received. In this case, remote_control_key_id overlaps between broadcasters, B and L, and between broadcasters, I and K. If a situation like this occurs, broadcasting stations, A to I, are given first priority (meaning that they are assigned to number buttons first) based on the setting of location of the viewer's residence in the receiver. Then, after the channel settings and overlapping station list are displayed, viewers manually assign other channels. In this example, 13 transport streams are received. Since there are not enough number buttons on the remote controller to which to assign all these transport streams, the viewer excluded station L (a station occupying a channel not intended for reception in the viewer's area of residence).

Table 10-2 An example of one-touch button assignment (in the presence of 13 or more stations that can be received)

remote_control_key_id	Button Number on the Remote Controller	Broadcaster	Service Number to be Selected
1	1	A	011
2	2	B	021
2	Excluded	L (Station intended for reception in other areas)	(021)*
3	3	C	031
4	4	D	041
5	5	E	051
6	6	F	061
7	7	G	071
8	8	H	081
9	9	J (Station intended for reception in other areas)	091
10	10	I	101
10	12	K (Station intended for reception in other areas)	101 (Channel intended for reception in other areas)
11	11	M (Station intended for reception in other areas)	111 (Channel intended for reception in other areas)
12			

*) Means that the one touch button selection of this channel is not possible. However, by direct channel selection, this channel can be selected as well as Channel B.

10.1.3 Re-scan Operation

If a new TS not on the list in the receiver is found during a re-scan, the following action is considered to take place. On the other hand, even if a station already on the list is not found during the re-scan, the station will not automatically be deleted.

(1) In the absence of an overlap of remote_control_key_id of the newly detected TS

A dialog will appear to prompt viewers to make a confirmation. Unless otherwise specified, the TS will be assigned to an appropriate one-touch button.

(2) In the presence of an overlap of remote_control_key_id of the newly detected TS

The present assignment list will appear to allow, if necessary, the modification or deletion of TS assignment.

However, if remote_control_key_id of a newly opened station intended for reception in the prefecture of the viewer's residence is the same as remote_control_key_id of an existing station intended for reception in wide areas, first priority will be given to the newly opened station intended for reception in the prefecture like during the initial scan; in other words, remote_control_key_id of the newly opened station will be assigned to the one-touch button in this case. It is up to each user as to whether to assign the station (previously received) intended for reception in wide areas to another button, to which no TS has been assigned. If the assignment of TS to one-touch buttons is scheduled to change, a notification to that effect should be given to users.

10.1.4 Reception of a greater number of transport streams than can be assigned to one-touch buttons

Remote controllers generally expected to become available have 1 to 12 buttons. This means that when 13 or more transport streams can be received, one-touch channel selection cannot be used for all transport streams. Therefore, in this case, transport streams not assigned to one-touch buttons should be selected, using, for example, the following methods: direct channel selection, channel selection from the EPG and up/down channel selection. It depends on each manufacturer's product planning to determine which function to use to enable the selection of 13 or more channels.

An example of how the receiver works is shown in a flow chart.

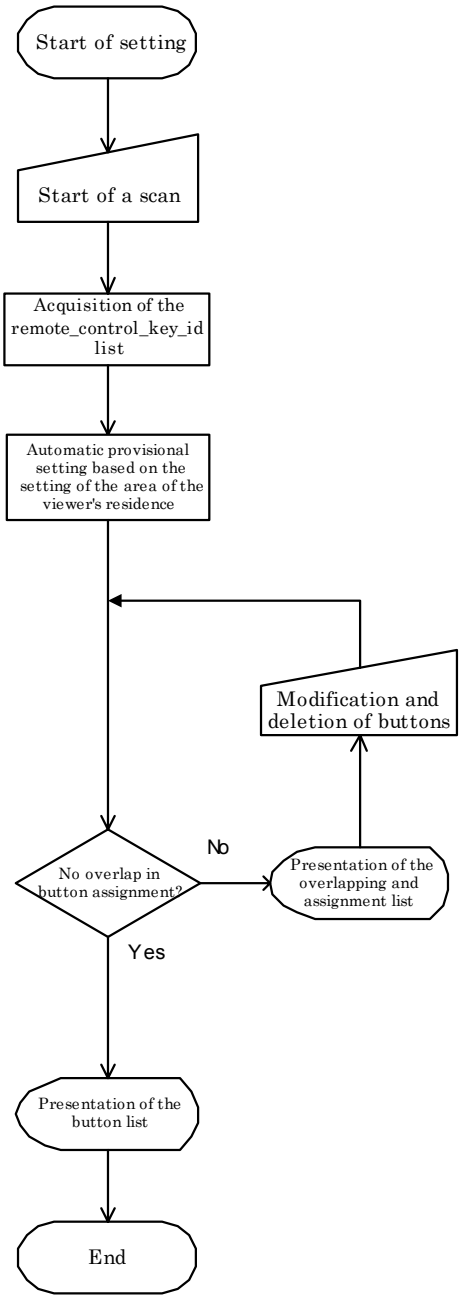


Fig. 10-1 An example of how the receiver works when one-touch button selection is used.

10.2 Examples of Up/Down Channel Selection

Regarding the program selection method, it basically depends on each manufacturer's product planning to decide which methods should be made available. Naturally, program selection using the UP/DOWN buttons is not an exception, meaning that it is considered as one of the options of the channel selection method. Nonetheless, guidelines regarding up/down channel selection are considered necessary for the development of receivers. This section, therefore, lists matters for consideration when performing up/down channel selection in accordance with the examples shown in this document (containing the provisions for operations).

(1) Order of program selection and EPG display when using the UP/DOWN buttons

- When the EPG is displayed, priority is given to services intended for reception in the area of the viewer's residence specified using the "region ID" contained in service_id. This means that in areas where services intended for reception in other areas can be received, the program table may not be displayed in ascending/descending order of three-digit numbers.
- In this document (containing the provisions for operations), pressing the UP/DOWN buttons causes switching between channels in ascending/descending order of three-digit numbers. It should be noted, however, that when using up/down channel selection, the order of programs to be selected is different from the order of display on the EPG.

(2) In the presence of services with the same three-digit numbers

- In fringe areas, there is a possibility that different services (with different contents) but with the same three-digit numbers may be received. In this case, data on multiple different services with the same three-digit numbers are entered in the service table. If up/down channel selection using the UP/DOWN buttons is used under a circumstance like this, services will be selected in order of service branch identifiers in the service list and in TS units (pressing the UP button switches between channels in ascending order and pressing the DOWN button switches between channels in descending order). In this case, it is desirable for product planning to install a function to skip channels not generally searched through.

  More specially, if using an example as shown in Table 10-4, which shows the assignment of three-digit number+branch identifier, pressing the UP button, starting from 011 [0], causes a switching to 012 [0] and then to 013[0] in the same TS, and then, switching to 011 [1], 012 [1] and to 013 [1] in the next TS.

(3) Selection of services that cannot be received

- If receivers are unable to receive services selected by pressing the UP/DOWN buttons (for example, fixed receivers which are unable to receive contents such as low-frame-rate and low-resolution pictures designed for partial reception), it is desirable that in order to avoid viewer confusion, a message is displayed to the effect that the services cannot be received or such services is skipped.

10.3 Examples of Direct Channel Selection

Regarding the three-digit numbers used for direct channel selection, it is essential that unique numbers are set up in receivers in anticipation of situations where D-VHS recorders and other similar devices are used to schedule program recording using the IEEE1394 command. However, there may be overlaps of three-digit numbers used for direct channel selection in fringe areas. This makes it necessary to set up one-digit branch identifiers within receivers to eliminate overlaps of services with the same three-digit numbers. The end result is unique four-digit numbers. The section below shows examples of how the branch identifiers in the 4th digit are assigned.

10.3.1 Channel Selection on the Digital Terrestrial Receiver

On digital terrestrial receivers, channels are selected using the three-digit numbers specified as shown below, based on the service type, service number and remote_control_key_id specified in Vol. 7 of the document.

Three-digit number = Service type x 200 + remote_control_key_id x 10 + (Service number + 1)

These three-digit numbers do not overlap within each prefectural zone or within each wide-area coverage zone because different remote_control_key_id are assigned. However, there are cases where overlaps of remote_control_key_id may occur between prefectures and between a prefectural zone and wide-area coverage zone, thus suggesting the possibility of overlaps of three-digit numbers. To differentiate these overlapping three-digit numbers, one more digit should be added as the branch identifier in order to enable channel selection.

The branch identifiers mentioned above are assigned using the method explained below. In this case, it is a prerequisite that the location of the viewer's residence is already set up in the receiver. (See "6.2.3 Installation Procedure for the Digital Terrestrial Receiver" in this volume.)

10.3.2 How to Assign Branch Identifiers

(1) During the initial scan

First, regarding services intended for reception in each area of the viewer's residence, the branch identifier number [0] is assigned to each station (TS). However, in the presence of overlaps of remote_control_key_id, the branch identifier number [0] is assigned to the station whose region ID shows that the station (TS) is intended for reception in the (prefectural) area and the branch identifier number [1] and branch identifier numbers that follow in ascending order are assigned in order of region IDs. Then, regarding services with same remote_control_key_id, which are not intended for

reception in the area of the viewer's residence, branch identifier numbers are assigned to each service in ascending order. These branch identifier numbers follow the branch identifier numbers already assigned to services intended for reception in the area of the viewer's residence.

(2) During a re-scan

For services that could not be received during a re-scan, branch identifier numbers for these services are reserved.

If a new service is detected through a re-scan and the service is transmitted by a registered station, a branch identifier number, which follows the three-digit number (for the station), will be assigned to the service. If a new service detected through a re-scan is transmitted by an unregistered station, which is intended for reception in the area of the viewer's residence, the branch identifier number [0] is assigned, on the condition that there is no overlap of remote_control_key_id with another station also intended for reception in the same area. In the presence of an overlap of remote_control_key_id and if a new service detected is intended for reception in other areas, branch identifier numbers that follow, in ascending order, the branch identifier numbers already assigned to the services with same remote_control_key_id, are assigned.

However, if remote_control_key_id of a newly opened station intended for reception in the prefecture of the viewer's residence is the same as remote_control_key_id of an existing station intended for reception in wide areas, first priority is given to the newly opened station like during the initial scan; in other words, the branch identifier number 0 is assigned to the newly opened station intended for reception in the prefecture and the next branch identifier number in descending order is assigned to the existing station intended for reception in wide areas. If the assignment of branch identifier numbers is scheduled to change, a notification to that effect should be given to users.

Regarding modifications other than those mentioned above and modifications accompanying frequency repacking such as adding and deleting stations intended for reception in other areas and stations with different remote_control_key_id, and changes in transmission patterns, branch identifiers are assigned like during a re-scan.

(3) Overflow of branch identifier numbers

The highest branch identifier number that can be assigned is 9. This means that services not assigned to 0 to 9 cannot be selected using direct channel selection. (However, they can be selected using the EPG and up/down channel selection.) If a situation like this occurs, the initial scan must be performed to re-assign branch identifiers. If the number of services to which branch identifier numbers should be assigned exceeds nine, it depends on each manufacturer's product planning as to how to solve this problem.

If using the method mentioned above, all services transmitted by a station have the same branch

identifier.

10.3.3 Examples of Branch Identifier Assignment

10.3.3.1 Branch Identifier Assignment During the Initial Scan

An example is shown in Table 10-3. This example in Table 10-3 shows the presence of three-digit number services in the area of the viewer's residence and in other areas: more specifically, Station A, B, C and A' intended for reception in the area and Station E, F and G intended for reception in other areas. An explanation is given below regarding the branch identifiers to be assigned in this case. First, services transmitted by stations intended for reception in the area of the viewer's residence are given the branch identifier number [0]. However, there is an overlap of remote_control_key_id between Station A and A'. Therefore, the branch identifier number [0] is assigned to Station A', which is intended for reception in the prefecture (region ID: 24) and the branch identifier number [1] is assigned to Station A, which is intended for reception in wide areas (region ID: 01).

A look at stations intended for reception in other areas indicates that there is an overlap of remote_control_key_id ([1]) between Station E and G. Since first priority is given to stations intended for reception in the area of the viewer's residence regarding branch identifier assignment, the service transmitted by Station E is given the branch identifier number [2] and the service transmitted by Station G is given the branch identifier number [3]. Since Station F (though there is no overlap of remote_control_key_id or overlap of three-digit number with other stations intended for reception in the area) is intended for reception in another area, the station is given the branch identifier number [1].

Table 10-3 An example of branch identifier assignment during the initial scan

Station Name	Region Type (Region ID)	remote_control_key_id	Three-digit Number Assigned to the Broadcasting Service [Branch Identifier Assigned]		
Station A	Within the targeted service area (the station is intended for reception in the area) (01)	1	011 [1]	012 [1]	013 [1]
Station B	Within the targeted service area (the station is intended for reception in the area) (01)	2	021 [0]	022 [0]	
Station C	Within the targeted service area (the station is intended for reception in the area) (24)	3	031 [0]	032 [0]	033 [0]
Station A'	Within the targeted service area (the station is intended for reception in the area) (24)	1	011 [0]	012 [0]	013 [0]
Station E	Outside the targeted area (the station is intended for reception outside the area) (25)	1	011 [2]		
Station F	Outside the targeted area (the station is intended for reception outside the area) (35)	12	121 [1]		123 [1]
Station G	Outside the targeted area (the station is intended for reception outside the area) (35)	1	011 [3]	012 [3]	

10.3.3.2 Branch Identifier Assignment During a Re-scan

An example where several stations and services were added as a result of a re-scan is shown in Table 10-4. Explanations are given below regarding different cases of branch identifier assignment.

(1) When a new station and service intended for reception in the area of the viewer's residence have been added

In Table 10-4, Station D is the newly added station as a result of a re-scan, which is intended for reception in the area of the viewer's residence.

Since Station D has remote_control_key_id of 4, which means no overlap with other stations, it should be given the branch identifier number [0].

(2) When a new station and service intended for reception in an area other than the area of the viewer's residence have been added

In Table 10-4, Station H is the newly added station as a result of a re-scan, which is intended for reception outside the area of the viewer's residence.

Station H has remote_control_key_id of 1, which means an overlap with other stations (Station A, A', E and G). In this case, Station H is added after other stations with same remote_control_key_id. More specifically, Station H is given the branch identifier number [4].

(3) When a new service is additionally transmitted by an already received station

This refers to an example shown in Table 10-4 where a re-scan detected a new service (012)

additionally transmitted by Station E, an already received station. In this case, this service is given the branch identifier number [2] like the other service transmitted by the same station.

Table 10-4 An example of branch identifier assignment during a re-scan

Station Name	Region Type (Region ID)	remote_control_key_id	Three-digit Number Assigned to the Broadcasting Service [Branch Identifier Assigned]		
Station A	Within the targeted service area (the station is intended for reception in the area) (01)	1	011 [1]	012 [1]	013 [1]
Station B	Within the targeted service area (the station is intended for reception in the area) (01)	2	021 [0]	022 [0]	
Station C	Within the targeted service area (the station is intended for reception in the area) (24)	3	031 [0]	032 [0]	033 [0]
Station D	Within the targeted service area (the station is intended for reception in the area) (24)	4	041 [0]		
Station A'	Within the targeted service area (the station is intended for reception in the area) (24)	1	011 [0]	012 [0]	013 [0]
Station E	Outside the targeted area (the station is intended for reception outside the area) (25)	1	011 [2]	012 [2]	
Station F	Outside the targeted area (the station is intended for reception outside the area) (35)	12	121 [1]		123 [1]
Station G	Outside the targeted area (the station is intended for reception outside the area) (35)	1	011 [3]	012 [3]	
Station H	Outside the targeted area (the station is intended for reception outside the area) (23)	1	011 [4]		

10.3.4 Receivers' Reaction in the Presence of an Overlap of Services

It is recommended to install a user interface in receivers to allow viewers to select channels using branch identifiers when they make direct channel selection of services with the same remote_control_key_id.

If viewers select an invalid branch identifier number, receivers should display an error message to the effect that the channel does not exist or that this number has not been set.

If viewers are unable to select a channel for one reason or another although the channel was specified using the three-digit number and branch identifier and the service specified by the branch identifier could be selected immediately before, receivers should display an error message to the effect that receiving the service is not possible.

However, it depends on each manufacturer's product planning as to what kind of error message is used.

11 Appendix B Guidelines on the CATV Pass Through System

11.1 Introduction

These guidelines provide models for operating receivers that receive signals transmitted on CATV facilities by the digital terrestrial pass through system; in this case, the same digital terrestrial TV broadcast modulation system is used. The transmission system shown in these guidelines are specified in "Digital Cable TV Broadcasting, Digital Terrestrial Television Broadcasting, Pass Through System" JCTEA STD-011 of Japan Cable Television Engineering Association (JCTEA).

11.2 References

(1) "RECEIVER FOR DIGITAL BROADCASTING SERVICE (DESIRABLE SPECIFICATION)" ARIB STD-B21

(2) "Digital Cable TV Broadcasting, Digital Terrestrial Television Broadcasting, Pass Through System" JCTEA STD-011

11.3 Definitions

Term	Description
Pass through system	A method for transmitting, to the CATV system, the broadcast signals received without making any changes to them at the same or converted frequencies.
Equivalent CN ratio	The CN ratio when various characteristics of transmission devices and transmission paths that cause the degradation of the CN ratio is expressed in the equivalent of Gaussian noise that causes the same level of CN ratio degradation (the same error rate)
Equivalent CN ratio degradation (dB)	Equivalent CN ratio degradation (dB) concerning transmission devices and transmission paths is expressed by the following equation. Equivalent CN ratio degradation = $-10\log_{10}$ [1- (C/Nideal)/(Equivalent C/Ntransmission)] [dB] Here, the C/Nideal refers to an ideal CN ratio given a specific error rate and the equivalent C/Ntransmission refers to the equivalent CN ratio of transmission devices and transmission paths.
Equivalent noise degradation (END)	Equivalent Noise Degradation One of the digital transmission system assessment methods. The equivalent noise degradation is expressed by the difference between the actual CN value at which a specific BER value (for example,$1x10^{-4}$ before error correction using the shortened Reed – Solomon (204,188) code) can be obtained and the theoretical CN ratio at which the same BER value can be obtained.
Phase noise (Phase jitter)	Phase noise or phase jitter refers to the fluctuating component in carrier phase caused, for example, by the noise of locally oscillating signals. A large phase noise component may cause bit errors in phase-modulated digital signals. Although the phase noise and phase jitter may be differently defined elsewhere, they must be considered synonyms in these guidelines. The phase noise is measured and expressed (for example, in xx - dBc/Hz@yy kHz) as the noise level ratio per Hz at the point of offset frequency from the carrier frequency relative to the carrier level. The phase noise is also expressed by the rms value (phase noise θ rms) of the value obtained by performing an integration over a certain range of offset frequencies.
CATV	Community Antenna TV or Cable TeleVision is a TV broadcasting system that transmits broadcasts to limited areas connected to wire telecommunication equipment that uses coaxial cables and optical fibers. The CATV system includes: a multi-channel cable TV system designed to provide video services and communications services as well as re-transmit broadcasts: facilities to solve reception problems caused by surrounding buildings, and common reception facilities for the purpose of solving the local reception problems.
CTB (Composite Triple Beat)	Composite triple beat refers to the composite triple distortion. A composite beat of three signals with different frequencies caused by the triple distortion. The multi-channel cable TV system faces the CTB problem regarding analog TV video carriers.
Channel scan (Scan)	It is unknown which broadcasting stations can be received to watch digital terrestrial broadcasts in the area of the viewer's residence. Therefore, receivers search through all channels to determine the presence or absence of broadcast waves. When a broadcast wave (a broadcasting station) is detected, the information on the station will be registered in the receiver (channel list).

Term	Description
Initial scan	Initial scan refers to the scanning of channels performed during the first installation of a receiver after purchase or after the relocation to a new place of residence. During the initial scan, the area of the viewer's residence will be initially registered (or re-registered) in the receiver and the channel list in the receiver will be updated. The initial scan resets all channel information registered in the receiver (meaning that previously registered information will be deleted).
Re-scan	Re-scan refers to the scanning of channels performed in order to register a new station in the channel list, for example, when a broadcasting station opens a new station. After a re-scan, pre-scan information on broadcasting stations will be retained.
Channel number	Channel number refers to the numbers specified by broadcasting stations to enable receivers to pick up their stations (1 to 12). These numbers should, in principle, correspond to the numbers of one-touch buttons on the remote controller. Pressing these buttons allows users to select the representative program of each broadcasting station corresponding to the number of the button pressed.
Three-digit channel number	Three-digit channel number refers to the three-digit numbers used for direct channel selection. Entering these three-digit numbers using the ten keys (number buttons) on the remote controller allows users to select a specific program of each broadcasting station. Example: Channel number, 2 Numbers such as "021" and "022" are assigned to TV programs. Numbers such as "221" and "622" are assigned to data programs.
Branch identifier	When broadcasts intended for reception in areas outside the area of the viewer's residence (other prefectures) can be received, there may be an overlap of the channel number between a broadcasting station intended for reception in the area of the viewer's residence and a broadcasting station intended for reception in another area. In this case, these two stations have the same three-digit channel number. To differentiate these broadcasting stations, therefore, receivers add a one-digit number after the three-digit number. This one-digit number is called the branch identifier. The branch identifier number 0 is given to the broadcasting station intended for reception in the area of the viewer's residence and the branch identifier number 1 (or a higher number) is given to the broadcasting station intended for reception outside the area of the viewer's residence. An example of a number given to a broadcasting station intended for reception in the area of the viewer's residence: 0210 An example of a number given to a broadcasting station intended for reception outside the area of the viewer's residence: 0211

11.4 General Information on the Pass Through System

The pass through system mentioned in these guidelines is classified into two types shown below.

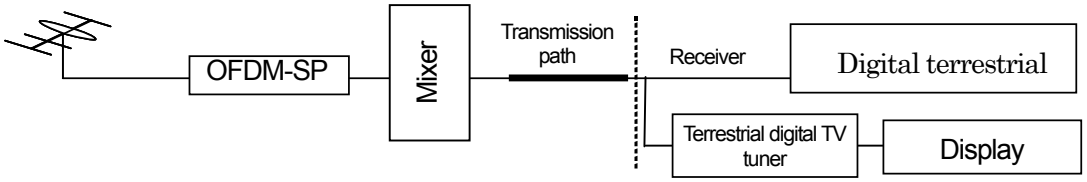
Type (1): Involves the bandwidth selection and level adjustment of various digital terrestrial television broadcast signals transmitted, which come in from the terrestrial TV antenna, and the transmission of these signals to CATV facilities at the same frequency as the transmitted signal frequency.

Type (2): Involves the bandwidth selection and level adjustment of various digital terrestrial television broadcast signals transmitted, which come in from the terrestrial TV antenna, and the transmission of these signals to CATV facilities at the frequency specified by the CATV facility operator.

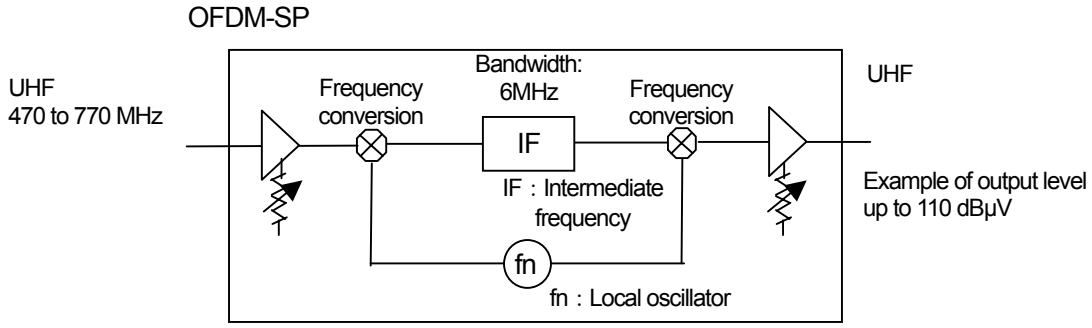
The precondition is that the pass through system, Type (1) or Type (2) above, should be used. The receiving amplifier used for head-end signal processing in Type (1) or the combination of the receiving amplifier and frequency converter used for signal processing in Type (2) is called the OFDM signal processor (hereafter abbreviated as the "OFDM-SP") in JCTEA-STD-011. An example of system configuration and OFDM-SP block configuration of Type (1) is shown in Fig. 11-1, while an example of system configuration and OFDM-SP block configuration of Type (2) is shown in Fig. 11-2.

In Type (1), the input and output frequencies are the same and the frequency mapping of the CATV pass through signals from multiple OFDM-SPs in Type (1) is exactly the same as that of broadcast signals (radio waves). In Type (2), however, the broadcast signals (radio waves) received in the UHF band are frequency-converted and output in the band (VHF, MID, SHB or UHF band) specified by the CATV facility operator.

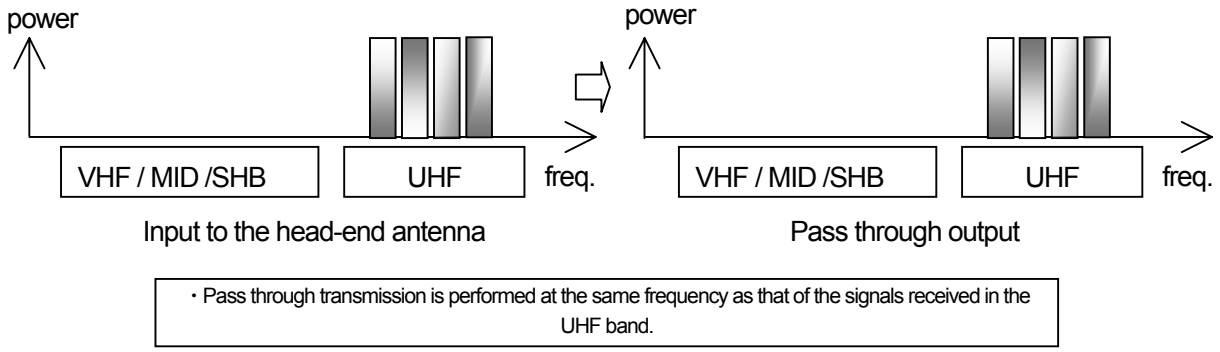
It should be noted that each CATV facility never uses Type (1) and Type (2) in combination to perform CATV pass through transmission.



(a) An Example of System Configuration in Type (1)

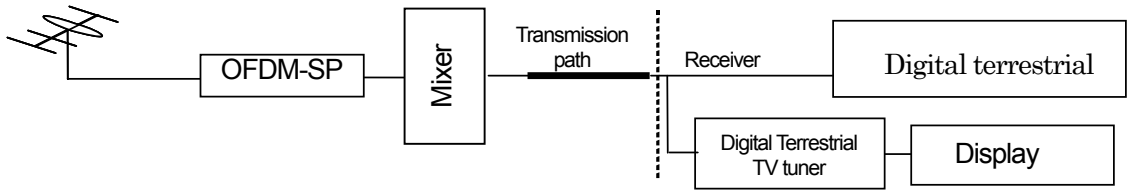


(b) An Example of Basic Configuration of the OFDM-SP in Type (1)

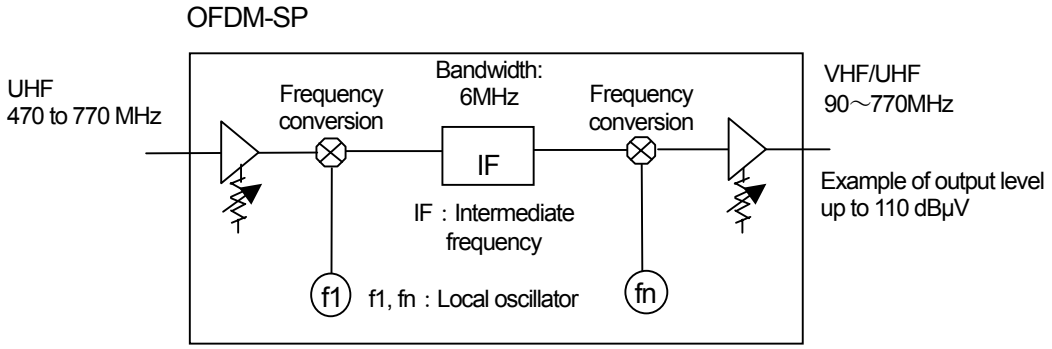


(c) An Example of Pass Through Transmission Band in Type (1)

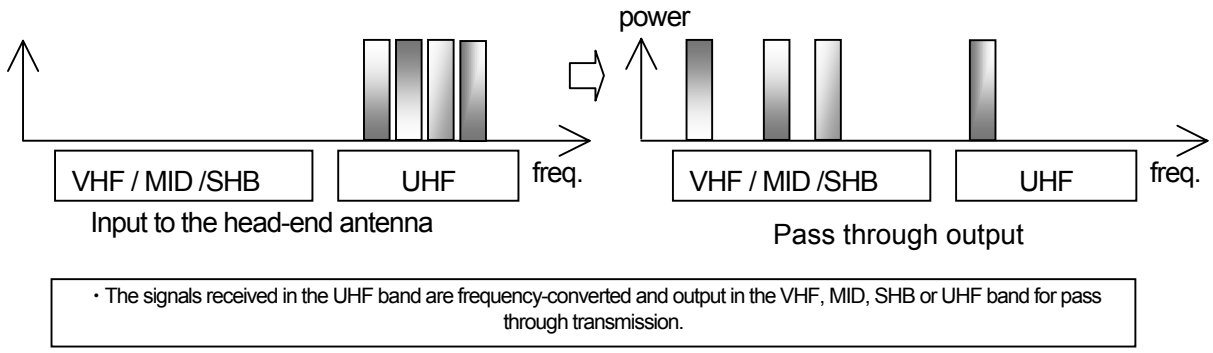
Fig. 11-1 An Example of Configuration in Type (1)



(a) An Example of System Configuration in Type (2)



(b) An Example of Basic Configuration of the OFDM-SP in Type (2)



(c) An Example of Pass Through Transmission Band in Type (2)

Fig. 11-2 An Example of Configuration in Type (2)

11.5 Operation Guidelines for Receivers Compatible with the Pass Through System

11.5.1 Carrier Frequency

JCTEA STD-011 defines carrier frequencies in the VHF, MID, SHB and UHF band output from the OFDM-SP as shown below. This reflects the frequency specifications set out in the current Enforcement Regulations for the Cable Television Law. It is desirable that receivers are able to receive the frequencies shown below.

Table 11-1 Center Frequencies (VHF Band)

Transmission Channel	Center Frequency
VHF 1ch	93 + 1/7 MHz
VHF 2ch	99 + 1/7 MHz
VHF 3ch	105 + 1/7 MHz
VHF 4ch	173 + 1/7 MHz
VHF 5ch	179 + 1/7 MHz
VHF 6ch	185 + 1/7 MHz
VHF 7ch	191 + 1/7 MHz
VHF 8ch	195 + 1/7 MHz
VHF 9ch	201 + 1/7 MHz
VHF 10ch	207 + 1/7 MHz
VHF 11ch	213 + 1/7 MHz
VHF 12ch	219 + 1/7 MHz

Table 11-2 Center Frequencies (MID Band)

Transmission Channel	Center Frequency
C 13ch	111 + 1/7 MHz
C 14ch	117 + 1/7 MHz
C 15ch	123 + 1/7 MHz
C 16ch	129 + 1/7 MHz
C 17ch	135 + 1/7 MHz
C 18ch	141 + 1/7 MHz
C 19ch	147 + 1/7 MHz
C 20ch	153 + 1/7 MHz
C 21ch	159 + 1/7 MHz *
C 22ch	167 + 1/7 MHz *

* There is a 2 MHz discontinuity between C 21ch and C 22ch.

Table 11-3 Center Frequencies (SHB Band)

Transmission Channel	Center Frequency
C 23ch	225 + 1/7 MHz
C 24ch	231 + 1/7 MHz
C 25ch	237 + 1/7 MHz
: :	: :
C 62ch	459 + 1/7 MHz
C 63ch	465 + 1/7 MHz

Table 11-4 Center Frequencies (UHF Band)

Transmission Channel	Center Frequency
UHF 13ch	473 + 1/7 MHz
UHF 14ch	479 + 1/7 MHz
UHF 15ch	485 + 1/7 MHz
: :	: :
UHF 61ch	761 + 1/7 MHz
UHF 62ch	767 + 1/7 MHz

11.5.2 Carrier Input Level of the Receiver

In the bands where direct reception of TV signals is not possible (the VHF, MID and SHB band), the reception of TV signals should be made possible within the input range shown below (as a guide), in consideration of signal loss through home network wires. This is based on the values specified in the Enforcement Regulations for the Cable Television Law. The minimum input level in the UHF band should conform to "1.3 Minimum Input Level" in Appendix-10 of ARIB STD-B21.

Table 11-5 Carrier Level

	Minimum Value	Maximum value
Level specified by the Enforcement Regulations for the Cable Television Law applicable to the recipient terminal	47 dBμV (75Ω)	81 dBμV (75Ω)
Input level of the receiver specified by these guidelines (outside the UHF band)	-67 dBm	-28 dBm

11.5.3 Radio Interference Suppression Level

Information in the table below should be used as a guide of the radio interference suppression level in the bands where direct reception of TV signals is not possible (the VHF, MID and SHB band). This is based on the values specified in the Enforcement Regulations for the Cable Television Law. The radio interference suppression level in the UHF band should conform to "1.4 Radio Interference Suppression Level" in Appendix-10 of ARIB STD-B21.

Table 11-6 Radio Interference Suppression Level

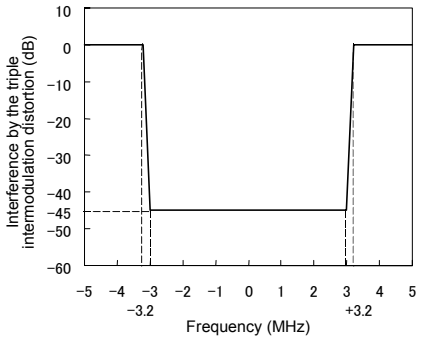
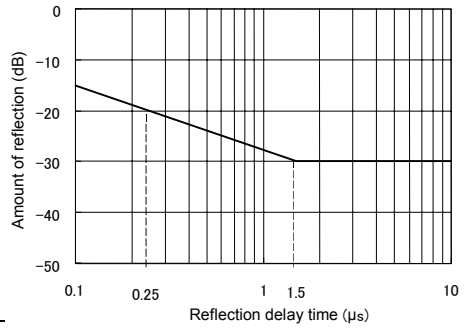
Radio Interference	Condition	Interference Suppression Ratio
Analog television (NTSC-AM)	Adjacent lower channel interference (Radio interference has occurred at a lower frequency location at a minimum of 7.869 MHz away)	-21 dB or below
	Adjacent upper channel interference (Radio interference has occurred at an upper frequency location at a minimum of 4.085 MHz away)	-24 dB or below
Digital television (64QAM)	Adjacent lower channel interference (Radio interference has occurred at a lower frequency location at a minimum of 6.119 MHz away)	-20 dB or below
	Adjacent upper channel interference (Radio interference has occurred at an upper frequency location at a minimum of 5.835 MHz away)	-19 dB or below
Single carrier	Within the same channel	35 dB or below

Measuring conditions: 13 segments, mode 3, guard ratio of 1/8, 64QAM modulation, convoluted signals of 7/8, I=2 and radio interference of one wave only.

11.5.4 Other Various Characteristics

It is desirable that TV signals can be received within the ranges shown below by the recipient terminal (protector output) that re-transmits digital terrestrial television broadcast signals (OFDM signals) specified in the Enforcement Regulations for the Cable Television Law.

Table 11-7 Other Various Characteristics Required for the Receiver

Item	Condition (Range within which Reception is Expected to be Possible)
Allowable variation of the carrier frequency	Within ±20 kHz
Difference between the carrier level and noise level	CN ratio of 24 dB or higher
General frequency characteristics at the input to the receiver	Within ±3 dB in a 6 MHz band
Carrier level fluctuation	Fluctuation of within 3 dB in one minute
Difference between the carrier level and the carrier levels of other adjacent standard digital television channels	10 dB or lower
Extent of carrier modulation by the electromagnetic wave caused by the AC power supply	The value produced by the following equation must be -30 dB or lower and reception must be possible. $20 \log_{10}\{(a - b)/ a\}$ [dB] In the equation above, "a" represents the value at the maximum amplitude point of the carrier modulation envelope, while "b" represents the value at the minimum amplitude point.
Interference by the triple intermodulation distortion	In comparison with desired wave, radio interference must be below the level shown by the solid line in the figure below and normal reception must be possible. (On the horizontal axis, the figure of 0 MHz represents the center carrier frequency.) 
Carrier level and the level of the electromagnetic wave generated by the reflection of the carrier (Adjacent multipath characteristics)	The reflected wave level must be below the level shown by the solid line in the figure below and reception must be possible. 
Difference between the carrier level and analog TV (NTSC-AM) carrier level (other than adjacent transmission)	The OFDM signal must be within the –6 to -16 dB range against the NTSC signal.

11.5.5 Factors for deteriorating the receiver characteristics (Reference)

See Commentary 5 of JCTEA STD-011

For the purpose of maintaining the signal quality in the recipient terminal, JCTEA STD-011 was established. However, factors that cause the deterioration of receivers have not been discussed. Nonetheless, factors for deteriorating the signal quality can be calculated by adding the equivalent CN ratio degradation (the method for assessing transmission path quality). Thus, the factors for causing deterioration inside receivers can be calculated.

11.5.5.1 CTB

The CTB is the main cause of deterioration of CATV transmission characteristics. The results of measured characteristics of the BER relative to the CTB of digital terrestrial television broadcasting (OFDM signal) are shown in Fig. 11-3. This figure, which is an excerpt from the JCTEA STD-011, suggests that the equivalent CN ratio degradation caused by the CTB generated in receivers is also considered to have the same deterioration characteristics. The equivalent CN ratio (Table 11-8) obtained from Fig. 11-3 and the equivalent CN ratio degradation caused by the CTB calculated from Equation 1 are shown in Fig. 11-4 (on the assumption that the ideal C/N is 22.35 dB).

Incidentally, pass through transmission of digital terrestrial television broadcasting uses the same transmission path as that used by analog broadcasting and the level of the digital wave (OFDM wave) then is considered to be the -10 dB ± 6 dB level of analog broadcast waves, thus suggesting that analog waves have a very grave impact on digital waves.

For more information, see JCTEA STD-011.

Equivalent CN ratio degradation = -10log$_{10}$[1 - (C/N$_{ideal}$)/(Equivalent C/N$_{transmission}$)]

= -10log$_{10}$[1 - 10 ({ 22.35 (dB) – Equivalent C/Ntransmission (dB)}/10)] [dB]

(Equation 1)

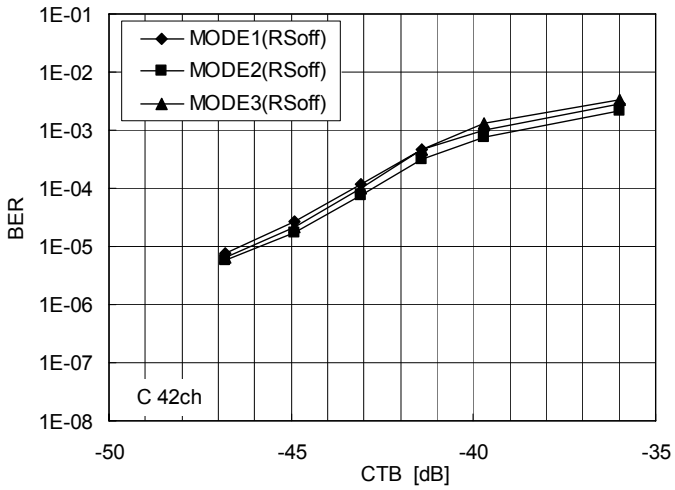


Fig. 11-3 Results of Measured Characteristics of the BER Relative to the CTB

Table 11-8 The BER Relative to the CTB and the Equivalent CN Ratio

CTB	BER	Equivalent CN Ratio
-43 dB	1 x 10-4	22.35 dB
-46 dB	1 x 10-5	23.3 dB
-49 dB	1 x 10-6	24.25 dB
-52 dB	1 x 10-7	25.2 dB

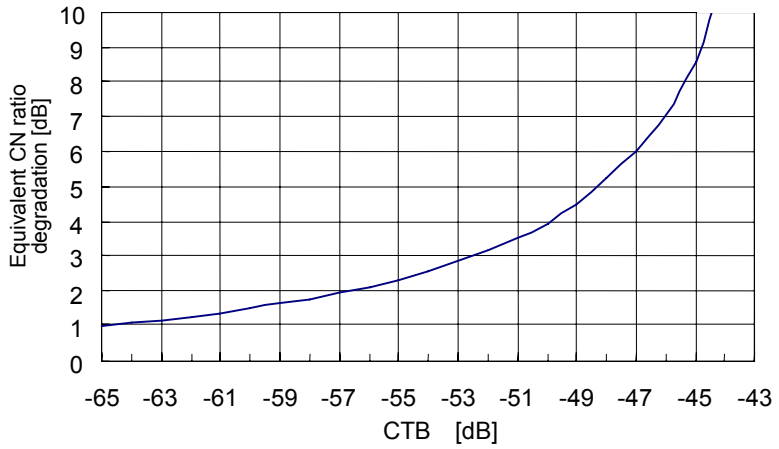


Fig. 11-4 Equivalent CN Ratio Degradation Caused by the CTB

11.5.5.2 Phase Noise

The phase noise of local signals of receivers is also a cause of character degradation. The BER caused by the phase noise when receiving digital terrestrial television broadcasting and the equivalent CN ratio are shown in Table 11-9. The equivalent CN ratio degradation caused by the phase noise of the OFDM obtained from Table 11-9 and Equation 1 is shown in Fig. 11-5 (on the assumption that the ideal C/N is 22.35 dB).

For more information, see JCTEA STD-011.

Table 11-9 BER Caused by the Phase Noise and the Equivalent CN Ratio

Phase Noise		BER	Equivalent CN Ratio
-73 dBc/Hz@1 kHz offset	1.81 deg	1×10^{-4}	22.35 dB
-74 dBc/Hz@1 kHz offset	1.62 deg	1×10^{-5}	23.3 dB
-75 dBc/Hz@1 kHz offset	1.44 deg	1×10^{-6}	24.25 dB
-76 dBc/Hz@1 kHz offset	1.28 deg	1×10^{-7}	25.2 dB

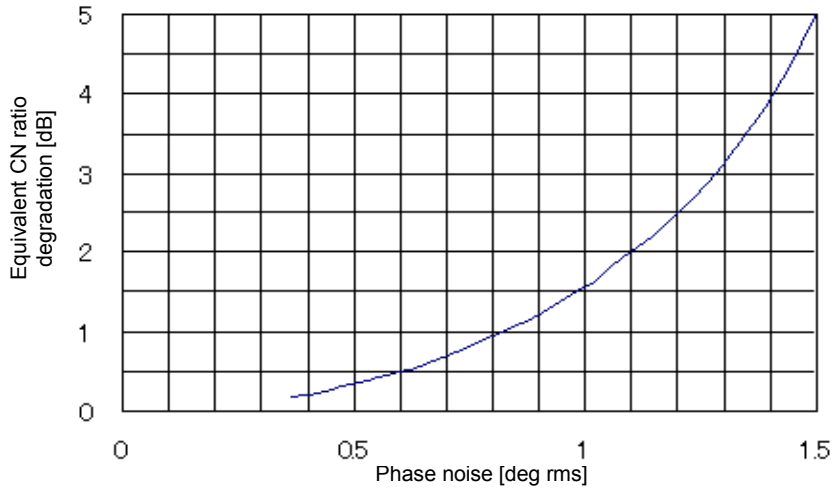


Fig. 11-5 Equivalent CN Ratio Degradation Caused by Phase Noise

11.5.5.3 Performance of the Transmission Path

JCTEA STD-011 calculates the performance allocation of the transmission path by considering, from an overall viewpoint, the factors for the equivalent CN ratio degradation in the transmission path as mentioned above. An example is shown in Table 11-10. In this table, the receiver degradation margin is set to 3 dB. It is necessary, when designing a circuit as shown in the table, to contain the degradation inside the receiver to within 3 dB.

Accordingly, if the level of the CTB-induced degradation is set to 2.5 dB and the level of the phase noise-induced degradation is set to 0.5 dB, for example, the CTB performance required from the receiver is calculated to be –54 dB and the phase noise performance is calculated to be 0.6 degree rms in terms of phase deviation from Fig. 11-4 and Fig. 11-5. However, other various degradation factors are actually considered to exist in addition to the two degradation factors mentioned above and the extent of degradation that will occur will also vary depending on the performance of the OFDM demodulator and the state of performance allocation to each degradation factor. It is therefore up to each manufacturer as to how receivers are designed in this regard.

It will be necessary, through future experiments and verifications, to determine the required CN ratio at the receiver and receiver degradation margin.

Table 11-10 An Example of a CATV Transmission Facility and an Example of the Total CN Ratio at the Recipient Terminal

Performance of the CATV Transmission Path and Other	CATV Facility An Example of Measured Values 1	Equiv-alent CN Ratio	CATV Facility An Example of Measured Values 2	Equiv-alent CN Ratio	Values Specified in the Enforcement Regulations for the Cable Television Law
CN ratio (dB) at the recipient terminal (Including radio waves)	30 dB	--	35 dB	--	24 dB or higher
Deviation within the bandwidth (dB)	Measured value	--	Measured value	--	Within ±3 dB
Carrier level (dBμV) (Included in the receiver margin)	Measured value	--	Measured value	--	47 to 81 dBμV @75Ω
CTB (dB) (See Fig. 11-4 for more information on the equivalent CN ratio degradation.)	-69 dB	29.2 dB	-57 dB	26.7 dB	-45 dB or lower
Reflection (dB)	-30 dB	--	-30 dB	--	-30 dB or lower
Hum modulation (dB)	Measured value	--	Measured value	--	-30 dB or lower
Phase noise arising during frequency conversion (See Fig. 11-5 for more information on the equivalent CN ratio degradation.)	0.6 degree rms	32 dB	0.6 degree rms	32 dB	--
Total CN ratio (dB) along the transmission path	--	25.5 dB	--	25.1 dB	--
Required CN ratio (dB) for the input to the receiver	25				
Receiver margin (dB)	3				
Required CN ratio (after convolution correction) BER = 2×10^{-4}	22				

11.5.6 Re-transmission Frequency

- When using the pass through system Type (1) (Fig. 11-1)

When using the pass through system Type (1) (See Fig. 11-1), the frequency of the broadcast signal (radio wave) and the frequency of the re-transmitted CATV signal are the same and the frequency mapping of the pass through signals from multiple OFDM-SPs in Type (1) is exactly the same as that of broadcast signals (radio waves). Accordingly, when frequency modification of the broadcast signal (radio wave) such as repacking takes place, the frequency of the re-transmitted CATV signal is also modified to the same frequency. In this case, if the broadcast signal (radio wave) is simultaneously broadcast, the re-transmitted CATV signal will also be broadcast simultaneously.

- When using the pass through system Type (2) (Fig. 11-2)

When using the pass through system Type (2) (See Fig. 11-2), the frequency of the broadcast signal (radio wave) and the frequency of the re-transmitted CATV signal are usually different, but they may be the same in some cases. However, in Type (2), frequency modification of the broadcast signal (radio wave) such as repacking is not accompanied by frequency modification of the re-transmitted CATV signal: the CATV signal will continuously be re-transmitted at the same frequency. Incidentally, frequency modification of the re-transmitted signal will be preceded by the notification to viewers to that effect (For more information on the notification method, see "11.4.4 Notification Method"). Frequency modification of the re-transmitted signal will not take place during the period when frequency modification of the broadcast wave (radio wave) is scheduled to take place or when the broadcast signal is simultaneously broadcast. If frequency modification is to take place, the CATV facility operator will not allow a simultaneous broadcast using two different frequencies.

As already mentioned in Section 11.4.3.1, each CATV facility never uses Type (1) and Type (2) in combination to perform pass through transmission. However, there is a possibility that CATV operators using the pass through system Type (2) may use the same frequency as that of the broadcast signal (radio wave) in some channels for re-transmission. In this case, the re-transmission frequency is defined in same manner as that for the pass through system Type (2).

11.5.7 Operation Guidelines Regarding Channel Selection on the Receiver

This section is designed to provide guidelines regarding the operation of receivers to minimize inconveniences to viewers when they connect signals transmitted by the digital terrestrial CATV pass through system Type (1) (Fig. 11-1) or Type (2) (Fig. 11-2) to compatible receivers so that they can watch digital terrestrial television broadcasts.

11.5.7.1 Initial Scan by the Receiver that Receives Pass Through Signals

When installing receivers that receive signals transmitted by the pass through system, viewers should make the residential area setting during initialization like they do when installing the regular digital terrestrial television receivers. The residential area refers to the areas where individual viewers reside but not to the area where the CATV facility operator receives broadcast signals (radio waves).

The digital terrestrial television receiver should search through all receivable channels at the reception location in order to create a service list (receivable frequency table) using service_id. However, since the received NIT only lists frequencies transmitted by transmitting stations of broadcasters, this sometime causes differences between the frequencies received via pass through transmission and the frequencies listed in the NIT. Even in this case, however, it is desired that the receiver operate properly. This problem can be solved, for example, by giving first priority to the service list (receivable frequency table).

11.5.7.2 Acquisition of engineering service via pass through transmission

When directly receiving engineering service (receiver software, frequency list modification information and so forth) can be acquired as follows. The receiver that receives signals transmitted by the pass through system Type (1) (Fig. 11-1) should perform the following operations.

(1) Among receivable transport streams, the receiver will choose those which contain the NIT whose Service List Descriptor includes the description of the engineering service, and store the receiving frequency, network_id, and service_id of engineering service of such transport streams on a reception table.
(2) To acquire download contents of abovementioned service_id based on the SDTT information.

When receiving signals transmitted by the pass through system Type (2) (Fig. 11-2), the receiving frequency is different from the one described in the Terrestrial Distribution Descriptor in the NIT. However, by using the service list (receivable frequency table) which has the actually received frequencies shown in 11.5.7.1 kept in the reception table, engineering service can be acquired in the

same manner as by regular direct reception.

11.5.7.3 Guidelines for Receiving the Frequency List and Modification Information via Pass Through Transmission

This section provides guidelines regarding the operation of receivers via pass through transmission, with regard to examples below of using the frequency list and modification information.

(1) Tuning to new frequencies as a result of frequency repacking

(2) Frequency tuning when a new broadcaster has started broadcasting from an existing transmitting station.

(3) Frequency tuning when a station that had relayed broadcasts from the master station has started transmitting broadcasts as a local station.

(4) Tuning to the station which had its broadcasts suspended when the scan was made during the installation of receivers.

(5) Tuning to a station that has become receivable at the head-end, for example, as a result of the change in the transmission power and the opening of a new station.

- When using the pass through system Type (1) (Fig. 11-1)

In all cases, (1) to (5), above, the receiver that receives signals transmitted by the pass through system Type (1) must be able to perform the same operations as the regular digital terrestrial television receiver. However, to guarantee the proper operation of the receiver, the CATV facility operator must perform operations similar to direct reception operations including simultaneous broadcasting.

- When using the pass through system Type (2) (Fig. 11-2)

Regarding (1) – tuning to new frequencies, when frequency modifications, for example, as a result of frequency repacking, have taken place, this causes changes to the frequencies that can be received by the CATV head-ends. In this case, therefore, it is necessary to adjust to the modified frequencies in the head-ends and common reception facilities. However, even when modifications of frequencies of directly received carriers have taken place, for example, as a result of frequency repacking, the receiver will continuously be able to perform reception in the same manner because the changes to take place to local OFDM-SP frequencies work to maintain the frequencies of CATV pass through carriers as before. However, if some unavoidable causes have forced a change to re-transmission frequencies, it is necessary to perform the initial scan to search through all receivable channels as explained in 11.6 Notification Method.

However, regarding (2) to (5), the downloaded frequency information are different from the

frequencies that can be actually received. Since it is difficult for the receiver to estimate transmitting stations that are received by the head-end including broadband CATV stations, automatic tuning of the receiver is difficult. To add frequencies that have become receivable to the receiver, it is necessary to perform a re-scan to search through all receivable channels as explained in 11.6 Notification Method.

Incidentally, when using the pass through system Type (2) for transmission, various factors such as modifications of frequencies of broadcast signals (radio waves) cause the download of wrong frequency modification information. It is, therefore, necessary to ensure the elimination of malfunction; in other words, the receiver, even when receiving wrong frequency modification information, must operate properly. When using the pass through system Type (2), the receiver does not perform automatic tuning to new frequencies. However, assuming cases where it is not clear which pass through system (Type (1) or (2)) is used for transmission, the following mechanisms must be incorporated in the receiver; to prevent the receiver from failing to work properly, the presence of simultaneous information and simultaneous broadcasting based on the information must be confirmed; and if a network that could be received can no longer be received and frequency modification information regarding the network exists, tuning must take place for the first time after the confirmation that the network has become receivable at a new frequency (meaning that frequency repacking has taken place).

11.5.7.4 Settings of the Location of the Viewer's Residence

To make the location setting of the receiver during initialization, priority should be given to the area of the viewer's residence for setting.

11.5.7.5 Number of Pass Through Networks

It is mandatory that the receiver should store in memory 12 stations as the pass through networks of digital terrestrial television. It depends on each manufacturer's product planning as to whether to design the receiver in such a way to store more than 12 stations in memory.

11.6 Method for Notification by the CATV Facility Operator

- When using the pass through system Type (1) (Fig. 11-1)

When using the pass through system Type (1) for transmission, the increases in the number of re-transmitted signals or frequency modifications take place when the number of broadcast signals (radio waves) receivable in the area of the viewer's residence has increased or when frequencies have been modified. Therefore, the receiver works in the same manner as the regular digital terrestrial television receiver. No special notification by the CATV facility operator is required in this case. However, if the CATV facility operator is scheduled to change the transmission method from the pass through system Type (1) to the pass through system Type (2) because of reasons of its own, it is the responsibility of each CATV facility operator to issue a message to that effect to viewers prior to the change to ensure no reception problems for viewers. The notification method must be the same as that used for the pass through system Type (2).

- When using the pass through system Type (2) (Fig. 11-2)

When using the pass through system Type (2) for transmission, if the increases in the number of re-transmitted signals or frequency modifications take place, the receiver will not perform automatic tuning, using, for example, information in the broadcast signals (radio waves). Therefore, it is necessary to issue a notification to request individual viewers to perform a channel scan, which involves one-by-one selection of all channels to check the presence of broadcast waves. When the increases in the number of re-transmitted signals take place, it will be necessary to issue a notification requesting viewers to perform a re-scan and when frequency modifications take place, it will be necessary to issue a notification requesting viewers to perform the initial scan.

The notification methods include the use of paper-based information such as program guide pamphlets and leaflets issued to viewers by cable TV companies and the use of electronic information through CATV community channels or Internet homepages. Notifications should not be sent directly to the receiver, for example, using information in broadcast signals (radio waves) of digital terrestrial television broadcasting.

Notifications to viewers are necessary when the following changes have taken place in CATV facilities.

- CATV facilities have increased the number of frequency-converted pass through signals.
- CATV facilities have been forced to change the frequencies of re-transmitted signals.

In the cases listed below, there may be broadcasting stations that have their services suspended

during a scan. It is, therefore, necessary to ensure that viewers can always check the receivable channel list.

- When viewers perform a scan when notified to do so.
- When viewers have installed a new digital terrestrial television receiver.
- When viewers have subscribed to a CATV service that uses the frequency-converted pass through system.

11.7 Appendix

11.7.1 Commentary-1 Scope of These Guidelines and Problems with Receivers

Shown in the table below are the positioning of the pass through transmission system for digital terrestrial television broadcasting specified in these guidelines, and problems that may occur when other transmission systems are used or when no facility operator is present.

Pass through transmission system	In the presence of a facility operator	In the absence of a facility operator
A method for transmitting TV signals that come in from the head-end terrestrial TV antenna to the CATV facility without modifying the signals	• The installation of a common reception facility is expected, for example, in apartment buildings. • If the signal quality at the recipient terminal meets the criteria specified in these guidelines, normal reception is possible. • However, it is difficult to maintain the signal quality. • The receiver works in the same manner as the digital terrestrial television receiver during initial scan, channel selection, frequency list modification and other operations.	• Electromagnetic interference countermeasures and the installation in apartment buildings are expected. • Since the signal quality at the recipient terminal cannot be guaranteed, normal reception may not be possible. • The receiver works in the same manner as the digital terrestrial television receiver during initial scan, channel selection, frequency list modification and other operations.
When using the pass through system Type (1) (Fig. 11-1) in these guidelines Involves the bandwidth selection and level adjustment of various digital terrestrial television broadcast signals transmitted, which come in from the terrestrial TV antenna, and the transmission of these signals to CATV facilities at the same frequency as the transmitted signal frequency.	• Scope specified by these guidelines • Operation by the CATV facility operator is expected. • The receiver works in the same manner as the digital terrestrial television receiver during initial scan, channel selection, frequency list modification and other operations.	• Countermeasures for poor broadcasting reception, electromagnetic interference countermeasures and the installation in apartment buildings are expected. • The receiver works in the same manner as the digital terrestrial television receiver during initial scan and channel selection. • During the frequency list modification, the head-end facility is unable to change the transmission frequency. Therefore, the receiver does not work normally.

When using the pass through system Type (2) (Fig. 11-2) in these guidelines Involves the bandwidth selection and level adjustment of various digital terrestrial television broadcast signals transmitted, which come in from the terrestrial TV antenna, and the transmission of these signals to CATV facilities at the frequency specified by the CATV facility operator.	• Scope specified by these guidelines • Operation by the CATV facility operator is expected. • During initial scan, channel selection, frequency list modification and other operations, the receiver works specifically in pass through system Type (2) mode.	• Countermeasures for poor broadcasting reception, electromagnetic interference countermeasures and the installation in apartment buildings are expected. • Receivers that can cover the re-transmission frequency band are required. • During initial scan, channel selection, frequency list modification and other operations, the receiver works specifically in pass through system Type (2) mode. • During the frequency list modification, the headend facility is unable to change the transmission frequency. Therefore, the receiver does not work normally (No notification information is available).

11.7.2 Commentary-2 How to Handle VHF Carriers

The carrier frequencies defined in Section 11.5.1 in these guidelines conform to the frequencies specified in the present Enforcement Regulations for the Cable Television Law, which also cover the VHF band. It is, therefore, desirable that receivers compatible with the pass through system can receive the VHF band. However, July 25, 2011 marks the end of analog broadcasting and the applications for which to use the VHF band after that date have not been decided. There is a possibility that when receiving VHF signals transmitted by the pass through system, radio waves transmitted in the VHF band may enter tuners and cause interference. To prevent this anticipated problem from occurring in the future, it is necessary to pay thorough and careful considerations for operation regarding VHF immunity.

12 Appendix C: Reception system model envisaged by terrestrial digital television broadcasting transmitter station installation inspections

This reference restates the reception system model postulated in the discussion of the setup of transmission stations specified in Vol. 9 "Provisions for Transmission operations" for reference purposes. The reception system model is used for discussing the setup of transmission stations and shall not be applied to the characteristics of commercial receivers.

12.1 Forward

When terrestrial digital television broadcasting transmission stations are set up, it is necessary thorough inspections are carried out on the impact of interference from other transmission stations and on the interference conditions to other stations, to promote the optimisation of transmission patterns, etc. It is also necessary to optimize the transmission delay adjustment for SFN configurations. Since the best transmission conditions for the transmission pattern and transmission delay adjustment, etc., depend on reception conditions, standard reception conditions are considered in the design of the transmission stations and the best transmission conditions are provided for this feature. Specifications in Chapter 12 provide the calculation method for promoting the optimization of parameter values for transmission delays, etc. of transmission stations with the envisaged reception system model in the design of transmission stations.

12.2 Scope

Specifications in Chapter 12 apply to the reception system model envisaged in the calculation method to optimize transmission conditions of the relevant transmission station and the calculation method for the construction of transmission stations in terrestrial digital television broadcasting network configurations.

12.3 Calculation method for optimizing transmission conditions

The received signal of each reception point in the broadcasting area is difficult to accurately forecast due to the influence of geographical features, buildings in the vicinity of the reception point, and trees etc., and it is impossible to assess in advance whether digital reception is possible in all areas. Therefore, in the design of transmission stations, multiple representation points are installed in the area, and the rate of possible reception (hereinafter, reception rate) in the vicinity of the

representation point is calculated as criteria for the reception rate of various locations in order to promote the optimisation of transmission. Although maximizing the reception rate of various locations is conducted to optimize the transmission conditions, in general, the optimisation of transmission conditions should be assessed individually while considering the possibility of reception of other transmission stations, and the scale and regional characteristics, etc. of the relevant transmission station.

The reception system model envisaged by this calculation method is shown in figure 12-1. In this calculation, SFN waves, same channel digital waves (different program type), and same channel analog waves are raised as sources of interference jamming. Additionally, since the use of boosters is required in regions with weak electric current fields, the noise index and the lowest input voltage characteristic of the receiver units should not be related to the judgement on reception posibility. The 4 items of "Amplitude proportion noise", "FFT window setting margin", "SP interpolation LPF band", and "AtoD interference exclusion characteristic" (Refer to section 12.3.2) should provide the numerical values by the envisaged receiver units.

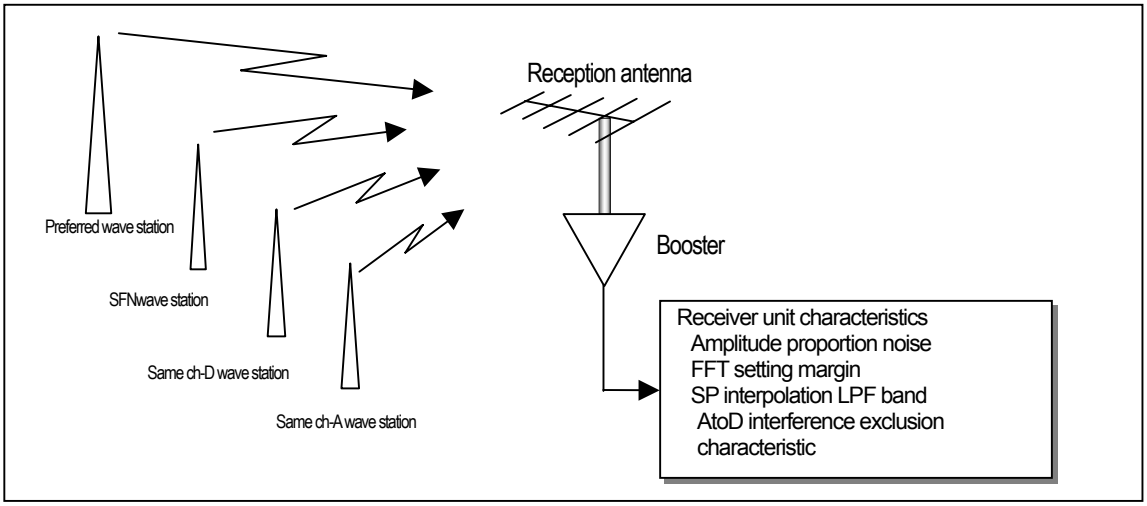


Fig. 12-1 Reception system model in the design of transmission stations

12.3.1 Calculation method for determination of reception possibility

The judgment on reception possibility of each location in the area is based on the following calculation when transmission stations are set up.

Required CN ratio (power ratio): $CN_0 \cdot CN_{up}\left(U_{eq}^2 / D^2\right)$ (1)

Equivalent component in the GI: $U_{eq}^2 = \sum_k (1-\tau_k) U_k^2$ (2)

Equivalent noise:

$$N_{eq}^2 = N_{fix}^2 + N_{amp}^2 + \sum_k \tau_k U_k^2 + \sum_k \tau_k (1-\tau_k) U_k^2 + 1.5 \cdot \sum_k (1-\tau_k)(1-LPF(DL_k))^2 U_k^2 + \sum_m CoD^2 + \sum_n CoA^2 / AtoD \quad (3)$$

CN_0 is the required CN ratio (Dependent only on the modulation scheme and encoding rate) in the white Gaussin noise environment, and $CN_{up}(*)$ is a mathematical function that shows the necessary CN increasing amount when SFN waves exist. τ_k is the part that exceeded the guard interval of each SFN wave delay time, and as shown in equation (2), U_{eq}^2 is the power of the component effectively considered to be the SFN wave in the guard interval, and D^2 is the preferred wave power. In equation (3), N_{fix}^2 is the fixed noise power, N_{amp}^2 is the amplitude proportion noise power, term 3 is the interference power between symbols, term 4 is the interference power between carriers, and term 5 is the scattered pilot (hereinafter, SP) interpolation error margin power. $LPF(*)$ is the SP interpolation LPF characteristic and DL_k is the delay time of the SFN wave. Additionally, CoD^2 is the power of the same channel digital wave (different program type), CoA^2 is the same channel analog wave power, and AtoD is a coefficient to convert into the equivalent digital wave which puts out the same interference as analog interference.

Equations (1)-(3) above are calculated for all interference waves and the reception possibility is judged from the relationship of the required CN ratio noise and equivalent noise.

Specially,

(Required CN ratio)$^{-1}$ > *For equivalent noise:* Reception possible

(Required CN ratio^{-1} < *For equivalent noise:* Reception not possible

Here, the required CN increasing mathematical function (dB mark) in equation (1) is as shown in equation (4) and table 12-1.

$$CN_{up}(U_{eq}dB) = \alpha \cdot \exp\left\{-\left|\beta \cdot U_{eq}dB\right|^{\gamma}\right\} \quad (U_{eq}dB \le 0)$$
$$= \alpha \cdot \exp\left\{-\left|\beta \cdot U_{eq}dB\right|^{\gamma}\right\} - U_{eq}dB \quad (U_{eq}dB > 0) \quad (4)$$

Table 12-1 Coefficient for the required CN increasing mathematical function (dB)

Coefficient	Modulation method	Encoding rate:7/8	Encoding rate:5/6	Encoding rate:3/4	Encoding rate:2/3	Encoding rate:1/2
α	64QAM	27.749	20.257	12.090	8.1386	3.8797
	16QAM	29.800	22.163	13.874	9.8342	5.4002
	QPSK	32.255	24.378	15.953	11.827	7.2391
ß	64QAM	0.5592	0.4117	0.2953	0.2527	0.2074
	16QAM	0.6074	0.4453	0.3171	0.2702	0.2251
	QPSK	0.6702	0.4876	0.3450	0.2922	0.2437
γ	64QAM	1.0662	0.7253	0.9096	1.0341	1.2100
	16QAM	0.5954	0.6936	0.8616	0.9776	1.1378
	QPSK	0.5710	0.6608	0.8115	0.9172	1.0662

In the above calculation, it is assumed that all interference sources have been considered. Therefore, the ones requested as receiver unit models are characteristic values when each interference source exists individually.

In the equivalent noise equation, the ones related to receiver unit performance are N_{fix}^2, N_{amp}^2, $AtoD$ and definitions of τ, and LPF characteristics. The definition of τ is the FFT window setting margin. Other terms are caused by the mathematical calculation of the OFDM modulation, and ones with the same characteristics in all receiver units. Refer to appendix A "Transmission provisions" for technological explanations in this volume for details on derivations, etc., of this calculation method.

12.3.2 Standard value of assumed receiver units

Figure 12-2 is a description of the bathtub characteristic derivation of the assumed receiver units. Figure 12-2(A) is the required DU ratio from intersymbol interference, and this is the same characteristic (mathematical calculation related to OFDM modulation only) with all receiver units. Figure 12-2(B) is the SP interpolation characteristic, the LPFbw or less bandwidth in the figure is a flat characteristic, and the LPFbw-nyquist band (168μs).is the transition bandwidth. For the delay wave in the region where the LPF is flat, the required DU ratio is the same as the one with intersymbol interference since SP interpolation has been correctly carried out. On the other hand, for the delay wave in the transition band region, the required DU ratio increases by that amount only to cause a SP interpolation error. This is shown in figure 12-2.

In actual receiver unit operation, it is necessary to set the FFT window position to "Appropriate" for multiple input delay waves. However, the type of algorithm for assessing "Appropriate" is a design matter of the receiver units. Therefore, although not provided here, eventually as shown in Figure 12-2(C), whether a main wave (preferred waves) can be close to the edge of the FFT window and up to what extent becomes a problem. In the figure this was written as Tm. In this case, it becomes a

characteristic described in this figure if the delay time of each wave for the main waves is expressed. For example, when Tm is 6μs, the bottom of the bathtub becomes -6μs ~ +120μs.

Figure 12-2(D) is figure of when the SP interpolation characteristic is optimized independently of the FFT window position. The band setting of interpolation LPF can be adaptively changed according to the input delay wave (Specifically, since the sampled SP signal is a complex mathematical function, the base band is not limited to the lower component). When the post delay wave (wave that lags behind the main wave) is assessed as larger than the pre delay wave (wave that comes before the main wave), the influence of the SP interpolation error margin can be reduced by shifting the LPF characteristic in the direction of the delay as shown in figure.

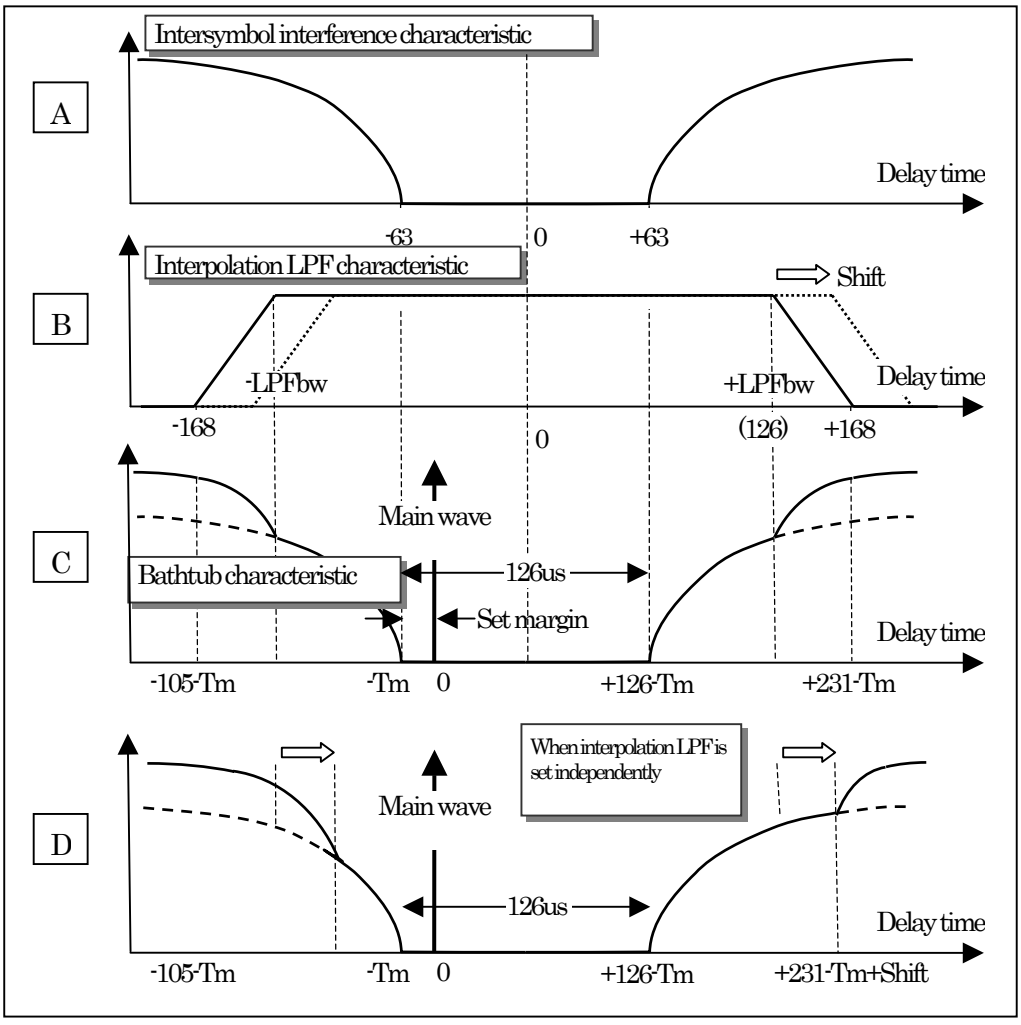


Fig. 12-2 Assumed bathtub characteristic (for GI=126 μs)

This type of processing is not included in receiver units used with this calculation because it becomes an adaptive process that depends on input waves. Additionally, although the required DU ratio also depends on decoding methods for the convolutional code (Viterbi decoding disappearance

processing, etc.) in addition to the above, this is not included either.

Fixed noise: N_{fix}^2 does not depend on receiver unit characteristics since booster use is a condition in this calculation.

Amplitude proportion noise: N_{amp}^2 is -35 dB from the measurement result of the receiver units.

LPF characteristics: Flat area:-126 ~ +126μs

Transition region:-168 ~ -126μs or +126 ~ +168μs

Damping characteristic: Straight line descent characteristic

FFT window setting margin: Tm = 6μs

AtoD interference exclusion characteristic: 5dB (64QAM-3/4) or 13dB (7/8) from the measurement results. Thus, coefficient AtoD of equation (3) is 15dB (64QAM-3/4) or 9.5dB (7/8).

The standard value of the receiver units above is 64QAM-3/4 or 64QAM-7/8, and the guard interval length is 126μs. For other modulation schemes, encoding rates and guard interval lengths will be provided in the future.

12.3.3 FFT window position setting

Figure 12-3 shows the relationship between the incoming wave and the FFT window. The Mt. Fuji-like curve recorded in the figure as "Exceeding GI mask characteristic" is a reciprocal of the bathtub characteristic (the one with positive and negative dB value reversed in Figure 12-2), and shows the maximum value of the acceptable delay wave. Reception becomes impossible when a delay wave that is larger than this mask exists. Therefore, the receiver units will appropriately set the FFT window so that each delay wave will not exceed this mask, but when there are multiple delay waves close to the size of the mask value, reception is not necessarily possible even if individual delay waves settle in the mask. In addition to achieving the delay wave in the mask, it is important to achieve a delay wave in the mask with a margin that is as large as possible.

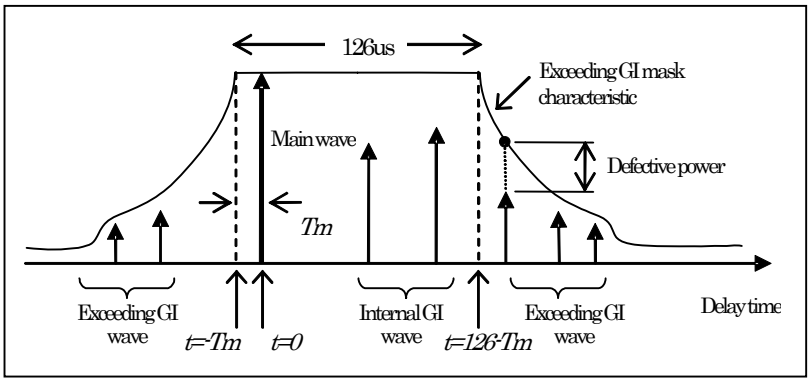


Fig. 12-3 FFT window optimal setting

As an index that shows the amount of room with the mask, the dB difference between each delay wave and the mask is defined, as "Defective power". When this defective power (PdB) becomes 0dB or more, reception becomes impossible because the delay wave will exceed the mask value. Additionally, when the total for the defective power for each delay wave becomes 0dB or more, it can be considered that the delay wave aggregate total exceeds the mask. Therefore, defective power is calculated for each delay wave, and a mask position where the total (P_{und}) becomes the minimum (specifically, FFT window position) should be the optimum position. Specifically,

$$\begin{aligned} PdB_k &= UdB_k - MaskdB\left(DL_k\right) \quad \text{(dB)} \\ P_{und} &= \sum_k 10^{PdB_k/10} \rightarrow \text{Minimized} \end{aligned} \tag{5}$$

In the design and research of transmission stations, for each reception point in the region, the transmission station parameters should be optimized based on the fact that the FFT window position of the receiver units will be set according to equation (5) above.

12.3.4 Reception Antenna installation, etc.

Appropriate assumptions are required in the design and research of transmission stations since the judgment on reception possibility in each reception point depends a lot on reception antenna installation conditions (optimal antenna direction etc.). However, because the installation of reception antennas is up to the individual receiver, setting numerical provisions is not appropriate. In the installation inspection of transmission stations, assumed antennas and antenna directions are

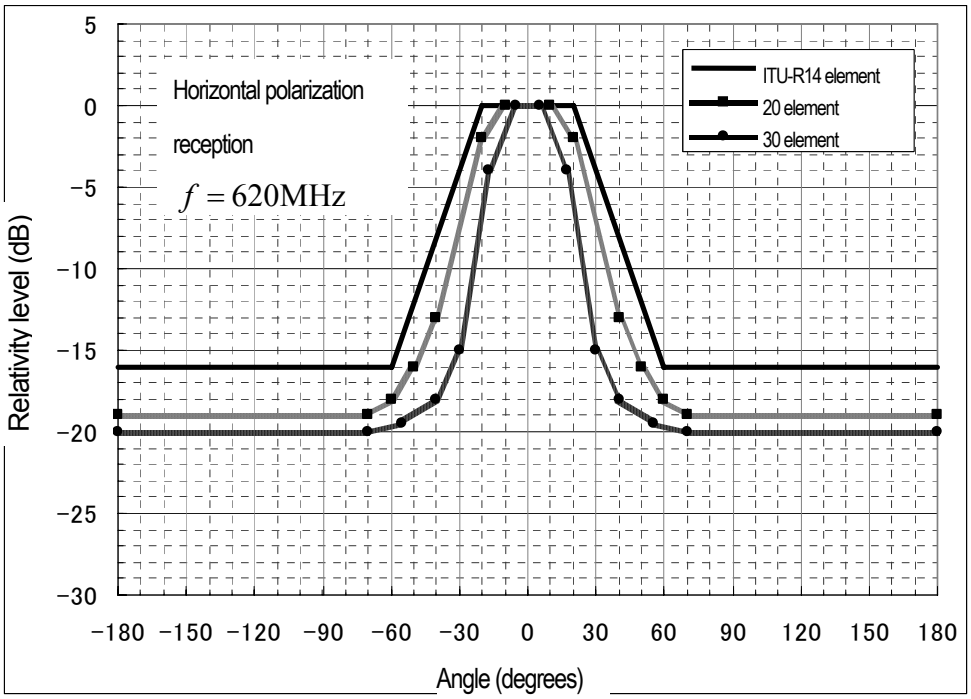
hypothesized as follows. Consider turning the antenna towards the best transmission station location together with a super-direction antenna such as stack antennas in regions where there is a lot of interference.

Reception antenna: 20 device Yagi Antennas
Antenna direction: Direction of transmission station location which provides the maximum field in the same program wave.

Model characteristics of Yagi antennas have been inspected in the Nationwide Conference for Promotion of Terrestrial Digital Broadcasting. These provisions refer to these characteristics. The following is an excerpt.

Nationwide Conference for Promotion of Terrestrial Digital Broadcasting (Excerpt)

In committees for measures and digital reception WG's, the horizontal directivity of all commercially available UHF Yagi antennas of 14 element, 20 element, and 30 element classes (30 elements from 25 elements) were inspected, and a characteristic model for efficient reception antennas was settled on to perform unified armchair simulations on reception measures. Because the direction characteristic changes by frequency, the characteristics of central frequency (620MHz) for UHF were adopted as model characteristics. Therefore, there is a possibility that real characteristics of antennas will become broader than the model characteristic in simulations with UHF raw channels. For more accuracy in simulations in UHF raw channels, a 20 element Yagi characteristic model as 30 element raw channel characteristic and a 14 element Yagi characteristic model (ITU-R model) as a 20 element raw channel characteristic are supposed to be used.



Reference Fig. 1 Model characteristic of reception antennas (Horizontal direction characteristics)

Super-directional antenna (stack antenna) case

Figure 12-4 is one example of a super-directional antenna that improved direction characteristics with a household reception antenna. Use in regions, etc. where interference is severe is assumed.

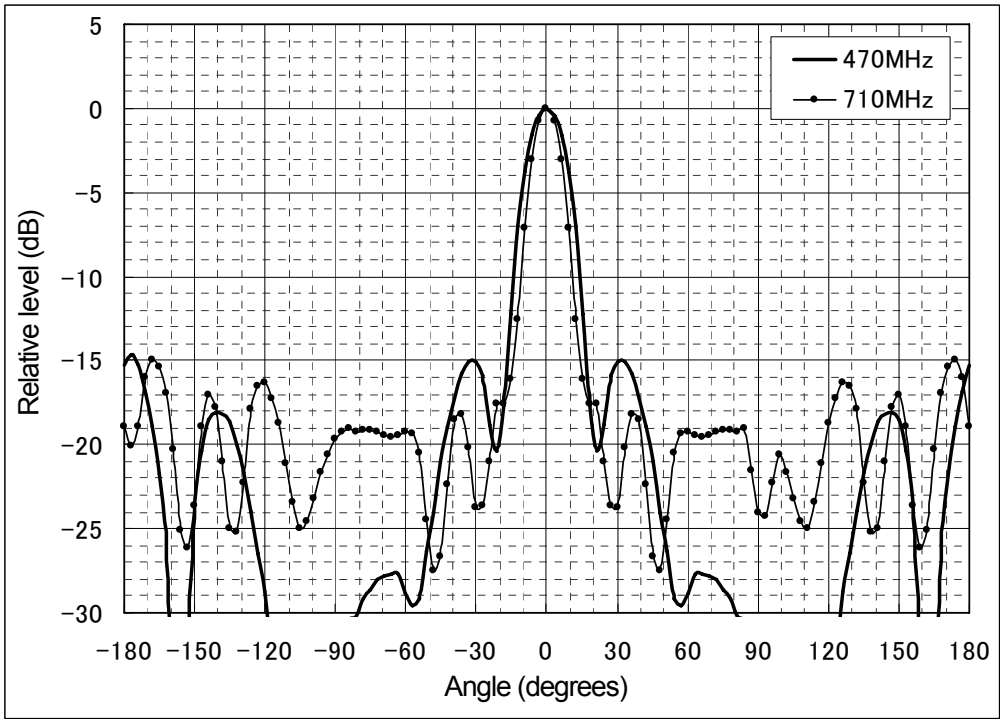


Fig. 12-4 Example of super-directional antenna characteristics

12.3.5 Other characteristics

Depend on Chapter 5 of ARIB STD-B21 "Ratings and specifications for each part of terrestrial digital television broadcasting receivers".

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