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OPERATIONAL GUIDELINES FOR ADVANCED DIGITAL SATELLITE BROADCASTING

ARIB TECHNICAL REPORT

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

Foreword

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

ARIB Technical Report include "government technical regulations" (mandatory standard) that are set for the purpose of encouraging effective use of frequency and preventing interference with other spectrum users, and "private technical standards" (voluntary standards) that are defined in order to ensure compatibility and adequate quality of radio equipment and broadcasting equipment as well as to offer greater convenience to radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

This ARIB Technical Report is developed for operational guidelines for advanced digital satellite broadcasting. In order to ensure fairness and transparency in the defining stage, the standard was set by consensus at the ARIB Standard Assembly with the participation of both domestic and foreign interested parties from radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

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

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Part 1

Operational Guidelines for Advanced BS Digital Broadcasting

Volume 3

Advanced BS Digital Broadcasting

Operational Guidelines for Multimedia Service

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Chapter 1: General Matters

1.1 Purpose

The purpose of the current volume is to define the operational guideline for the multimedia service, which is a general term of closed caption service, superimposition service and data content service in the Advanced BS Digital Broadcasting.

1.2 Scope

This operational guideline is applicable to the multimedia service for the advanced BS Digital Broadcasting.

1.3 Overview

The multimedia service in Advanced BS Digital Broadcasting is provided according to Ordinances and Notifications of the Ministry of Internal Affairs and Communications, and the standards of Association of Radio Industries and Businesses (ARIB) such as “MMT-Based Media Transport Scheme in Digital Broadcasting Systems” of ARIB STD-B60, “Multimedia Coding Specification for Digital Broadcasting (Second Generation)” of ARIB STD-B62, and “Receiver for Advanced Wide Band Digital Satellite Broadcasting (Desirable Specifications)” of ARIB STD-B63. However, in order to practically using this standard widely, it is necessary to specify the details of the operation, and “Advanced BS Digital Broadcasting Operational Guidelines for Multimedia Service” of this main volume has been formulated.

The purpose of the operational guidelines specified here is to serve as a guideline for the signal transmission specifications and the receiver specifications for the reliable operation of multimedia service in Advanced BS Digital Broadcasting, on the premise of ensuring the flexibility of multimedia service programming of each broadcaster and the expandability to future multimedia service development.

The transmission specifications of the multimedia service by broadcasters of Advanced BS Digital Broadcasting shall comply with this operational guideline.

It is recommended that receivers for Advanced BS Digital Broadcasting shall receive signals transmitted in accordance with this operationnal guideline, and that sufficient consideration is given so that malfunctions shall not occur due to signals other than those specified here.

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Chapter 2: References

2.1 Normative references (ARIB standards)

The content of this volume defines the operation of multimedia service in Advanced BS Digital Broadcasting based on the system specified in the following standards.

- ARIB STD-B10 "Service Information for Digital Broadcasting System"
- ARIB STD-B60 "MMT-Based Media Transport Scheme in Digital Broadcasting Systems"
- ARIB STD-B62 "Multimedia Coding Specification for Digital Broadcasting (Second Generation)"
- ARIB STD-B63 "Receiver for Advanced Wide Band Digital Satellite Broadcasting (Desirable Specifications)"

2.2 Normative references (others)

- IETF RFC 1123: Requirements for Internet Hosts
- IETF RFC 3986: Uniform Resource Identifier (URI): Generic Syntax
- IETF RFC 6265: HTTP State Management Mechanism
- IETF RFC 6455: The WebSocket Protocol
- IETF RFC 7159: The JavaScript Object Notation (JSON) Data Interchange Format
- IETF RFC 7230: Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing
- IETF RFC 7231: Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content
- IETF RFC 7232: Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests
- IETF RFC 7233: Hypertext Transfer Protocol (HTTP/1.1): Range Requests
- IETF RFC 7234: Hypertext Transfer Protocol (HTTP/1.1): Caching
- IETF RFC 7235: Hypertext Transfer Protocol (HTTP/1.1): Authentication
- IETF RFC 7236: Initial Hypertext Transfer Protocol (HTTP) Authentication Scheme Registrations
- IETF RFC 7237: Initial Hypertext Transfer Protocol (HTTP) Method Registrations
- IETF RFC 7616: HTTP Digest Access Authentication
- IETF RFC 7617: The 'Basic' HTTP Authentication Scheme
- ISO/IEC 14496-3:2009 Information technology -- Coding of audio-visual objects -- Part 3: Audio
- ISO/IEC 14496-12 Information technology -- Coding of audio-visual objects -- Part 12: ISO base media file format
- ISO/IEC 14496-14:2003 Information technology -- Coding of audio-visual objects -- Part 14: MP4 file format
- ISO/IEC 10646:2014 Information technology -- Universal Coded Character Set (UCS)
- ISO/IEC 23001-8:2013 Information technology -- MPEG systems technologies -- Part 8: Coding-independent code points
- ISO/IEC 23009-1:2014 Information technology -- Dynamic adaptive streaming over HTTP (DASH) -- Part 1: Media presentation description and segment formats
- JIX X0201-1997 7-bit and 8-bit coded character sets for information interchange
- JIS X0208:1997 7-bit and 8-bit double byte coded KANJI sets for information interchange
- JIS X0213:2004 7-bit and 8-bit double byte coded extended KANJI sets for information interchange
- Rec. ITU-R BT.709-6 Parameter values for the HDTV standards for production and international program exchange
- W3C CSS Animations http://www.w3.org/TR/css3-animations/
- Moji Joho Kiban http://mojikiban.ipa.go.jp/mjc/1/List_of_Glyphs.pdf

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Chapter 3: Terminology and Abbreviations

3.1 Terminology

Term	Description
AIFF-C	AIFF is a file format that records uncompressed linear PCM format audio data. AIFF-C is a file format that records lossy compressed data as an extended specification of AIFF.
ARIB	Association of Radio Industries and Businesses: An organization which promotes research and development of technology related to radio waves uses and serves as a Standards Development Organization to develop standards related to radio wave uses in the telecommunications and broadcasting fields.
ARIB-TTML document	A document described by the markup language ARIB-TTML for broadcasting, which is an extension of TTML specified by W3C to describe the display timing, layout, etc. of text.
CBR	Constant bit rate. Coding processing that keeps the bit rate constant when video, audio, etc. are encoded.
CDN	IP communication network that is directly connected to the user's reception environment through the access network while considering conditions such as communication quality.
CSS (Style sheet)	A document or description specified by W3C in order to instruct the method of displaying elements such as HTML.
DOM	API for handling HTML documents in applications specified by W3C.
DRM	A general term for technologies that prevent unauthorized copying and distribution of content such as images, music, and videos by using means such as encryption.
EMT	A table that shows control information for application operations synchronized with broadcasting. General event messages, NPT reference messages, and viewer-participation corner notification messages are transmitted by the table.
GIF	A lossless compression file format that handles images of 256 colours or less.
GOP length	The number of frames or the time between compressed frames regardless of the inter-frame prediction in the compression of the video for which the inter-frame prediction is performed.
H.264/MPEG-4 AVC	Video coding system specified by Recommendation ITU-T H.264 | ISO/IEC 14496-10.
H.265/HEVC	Video coding system specified by Recommendation ITU-T H.265 | ISO/IEC 23008-2.
HTML application	Data contents described in HTML.
HTML browser	Receiver software that acquires and interprets data contents (HTML documents) and presents it to viewers.
Resolution of HTML browser, HTML browser resolution	The maximum HTML document resolution that allows the entire HTML document to be displayed when the HTML browser presents the HTML document using the full screen of the receiver.
HTML documents	Documents or files written in HTML

Term	Description
Resolution of HTML documents, HTML document resolution	The resolution at which the HTML browser renders the HTML document and specified by the viewport of HTML documents.
http header	Various information placed in front of the data body in http connection. This is specified by RFC 7231.
JPEG	One of the image file formats. This is a standard for compressing and decompressing colour still images specified by ITU-T and ISO / IEC.
Media Queries	A function to switch the display style according to the environment of the screen to be displayed, which is specified in CSS version 3.
MH-AIT	A table describes control information that specifies the life cycle, constraints, etc. of an application.
MMT	A multiplexing method that enables integrated transmission over multiple transmission channels. This is specified by ARIB STD-B60.
MNG	Animation graphics file format called "Ming". It contains multiple PNG images, and it is possible to display them sequentially and repeat them.
MP3	MPEG Audio Layer-3: Audio compression technology specified by ISO / IEC 11172-3.
MPEG-2 AAC	Audio coding technology specified by ISO / IEC 13818-7.
MPEG-4 AAC	Audio coding technology specified by ISO / IEC 14496-3.
MPEG-4 ALS	Audio lossless coding technology specified by ISO / IEC 14496-3
MPT	Abbreviation for MMT package table. A table that provides information that makes up a service (package), such as a list of assets and their location.
NPT reference message	It is information showing the time axis of the main part of the broadcasting program, and is given as mapping information between NPT and absolute time UTC. It is transmitted by EMT.
PNG	A lossless compressed file format that supports full-color images. The file format consists of an 8-byte signature followed by a series of chunks.
RAM	A memory device installed in devices such as computers that can rewrite and erase data.
SI information	Information that describes the content of multiplexed information, identification information, etc.
SVG	An XML-based 2D vector image description language specified as a W3C Recommendation in September 2001.
TLS	Protocol for encrypting and sending and receiving information on the Internet. By combining security technologies such as public key cryptography, private key cryptography, digital certificates, and hash functions, it is possible to prevent data eavesdropping, falsification, and spoofing.
TLV stream	A stream that transmits TLV packets.
TLV packets	Packets using the TLV method that efficiently multiplexes IP packets.
UCS	An international coded character set defined by ISO / IEC 10646.

Term	Description
UTF-8	A method of converting a character string described using UCS into a byte string (a string of numbers).
VBR	Variable bit rate. Coding in which the bit rate changes according to the content when encoding video, audio, etc.
viewport	Technology that instructs the resolution and scaling of the document to be displayed which is described in the header part of html.
VOD	Generally, it means a service that distributes video content in response to a request from a receiver. However, in this guideline, it means stream-type video content distribution.
WOFF	A font file format recommended by the W3C as one of the Web standards and developed with the supposition for display on Web pages.
W3C	An international organization that standardizes the technology of the Web
Web Fonts	Technology for displaying fonts placed in a web server, or the fonts placed in the web server
WebGL	A function for displaying 3D data on a browser.
Item	The smallest unit of transmission that constitutes an MPU in application data transmission based on the MMT transmission system. It corresponds to a file.
Asset	Transmission unit for video, audio, etc. multiplexed by the MMT system.
Asset type	It means a type that indicates transmitted contents in each asset.
Asset rate	Transmission rate per asset.
Animation	A function that gives key frames to displayed elements realized by CSS and operates them.
Application engine	A function that presents data content on the browser.
Index item	An item that describes a list of the attributes of the items that MPU consists of.
Event listener	An interface for processing events in a script.
Leap second	Seconds added or removed to absorb the difference between the Universal time coordinated and the clock based on the rotation of the earth.
Origin	Source information consisting of the URI scheme host port of the content resource. The concept is shown in the IETF RFC document.
Color profile	A description of the color characteristics and appearance requirements of a particular device in accordance with the standards published by the International Color Consortium (ICC). It is defined by the color space mapping and profile connection space of input and output of the device.
Colorimetry	A general term for regulations regarding color expression. It is roughly divided into two types: standard primary colors (three primary colors and standard white) and signal processing (gamma characteristics, luminance equation, etc.).
Key frame	A time point that determines the point of movement in animation. The beginning and end of the animation are always specified.

Term	Description
Area code corresponding to the emergency warning signal	A code for identifying the target area of an emergency warning signal. It is shown in Appendix 1 of the Ministry of Posts and Telecommunications Notification No. 405 (Composition of Emergency Warning Signals).
Glyph	The shape of the individual characters. A set of glyphs is a font.
Prefectural code	Code for region designation used to limit the area covered by the superimposition asset. This is based on the provisions in ARIB STD-B60 7.4.3.24 “MH-Target Region Descriptor”, shown in ARIB-B10 Annex G Table G-2.
Container format	A file format that keeps various types of data.
Scroll	A method of displaying information that does not fit on the screen to be displayed by sliding it horizontally or vertically.
Security algorithm	A general term for security technologies in communications that realize encryption, authentication, and falsification prevention of communication contents.
Segment size	A division unit for video and audio to be transmitted by communication.
Type 1 data content service	Data content service that includes broadcasting transmission of application data.
Type 2 data content service	Data content service that does not include broadcasting transmission of application data.
Data asset management table (DAMT)	The table indicates the MPU configuration in the data component (asset) and information related to the MPU.
Data event	The period of time that a particular data component (asset) transmits the application data that makes up a particular set of applications. It is identified by data_event_id.
Data content	Contents presented by documents, etc. described by the multimedia coding method defined by this provision.
Data content service	Service that provides data content
Data content configuration table (DCCT)	The table indicates the presentation unit (PU) configuration for data content and information related to PU.
Data directory management table (DDMT)	The table indicates the directory configuration of the files that make up an application.
Data transmission session	The period in which the transmission data structure and directory configuration of all the data components that make up the service are the same.
Data transmission message	A message that transmits a table (DDMT, DAMT, DCCT) related to application data transmission control.
Node	The location of a particular directory or file in the application data directory configuration.
Boundary	The scope to which the constraint is applied described in AIT.
Fragment size	The time length of the unit divided as a file in video distribution by communication.
Flashing	A method of blinking characters by CSS animations.
Vendor prefix	Description to be given to properties etc. when the browser developer implements the function in advance.

Term	Description
Broadcast audio/video objects	It presents the normal stream of the broadcast service currently tuned described by the object element specified in W3C Recommendation HTML5.
Broadcast-oriented managed applications	Data content that is controlled by application control information included in broadcast signals. It can operate only while a broadcast service is being received. It is allowed to access broadcast resources in accordance with the application control information received.
Multimedia	It means expression media composed of multiple monomedia. They involve interactions between monomedia and often involve interactive actions with users.
Multimedia service	A general term for closed caption service, superimposition service, and data content service.
Multimedia plane	It is a virtual plane based on the resolution of an HTML document, and consists of video, characters/figures, still images, and the presentation of an HTML document.
Monomedia	An indipendent expression medium such as video, still images, figures, sounds, and characters. An expression medium that can be presented only with its own data without referring to other media.
Representation	A unit that provides video and audio with the same content, even if their quality is different.
Root certification	A format based on X.509 for transmitting and storing the public key for encryption onencrypted communication by TLS. A certificate for certifying a certificate authority is called a root certificate.
Rendering	Presenting data content on the browser. Or the function to present data content.
Local storage area	Storage area provided by a localStorage object specified by the W3C Recommendation Web Storage specification. Data content stores information permanently or temporarily in a receiver by it.
General area	Permanent information storage area excluding the broadcast area in the local storage area. Each origin has an independent storage area and stores string values for any key.
Ideographic variation sequence	Ideographic variation sequence is defined by ISO / IEC 10646: 2014.
Hierarchical modulation	A transmission system that uses both a transmission system that enables large-capacity transmission such as 16APSK and a transmission system that can receive even at low C/N such as QPSK.
External resource file	CSS and script files referenced by HTML documents, or monomedia files such as audio and still images.
Base character	Base character defined by ISO/IEC 10646:2014.
Common digital receiver	A receiver that has the function of receiving other media such as terrestrial digital broadcasting and BS digital broadcasting in addition to the receiving function of advanced wide band satellite digital broadcasting.
Route encryption	It means encrypted transmission in the communication transmission path, or its encryption processing.

Term	Description
Alarm	Sounds that are played to give the viewer notice in the closed caption service and superimposition service.
Combining character	Combining character defined by ISO/IEC 10646:2014.
Maximum bit rate	The maximum expected bit rate of video and audio in communication transmission. Or the peak bit rate in VBR.
Variation sequence	Variation sequence defined by ISO/IEC 10646:2014.
Variation selector	Variation selector defined by ISO/IEC 10646:201.4.
Viewer Participation Corner Notification Message	Information to notify the start of the viewer participation corner and promote proper receiver operation. It is transmitted by EMT.
Closed caption	A service that superimposes characters related to the video content on the video of the television broadcasting.
Receiver built-in sound	A sound source pre-installed in the receiver. Or audio play from that sound source.
Ministry of Internal Affairs and Communications Ordinance / Notification	An order enacted by the Minister of Internal Affairs and Communications regarding specific standards, etc. for the law that regulates the basis.
Presentation unit (PU)	A collection of application data that is referenced to be presented or executed simultaneously in each application.
General event message	Information that indicates the timing when an application should behave in sync with the broadcasting. It is transmitted by EMT.
Additional sound	An expression medium that plays music using electronic sounds. The music data to be played is given by the receiver built-in or by another device.
Superimposition	Closed caption service asynchronous with the main video / audio / data. Breaking news, notice about programming, time signal, Earthquake Early Warning, etc.
Graphic character	A general term for the presentation of characters by figures and HTML documents presented by encoding systems such as PNG and GIF. It is distinguished from the still image presented by JPEG.
Average bit rate	An average value of the bit rate per second in the VBR system.
Broadcasting area	Non-volatile storage area in local storage that shall only be used by Broadcast-oriented managed applications. Access scopes and capacities that do not depend on the actual origin are provided for specific keys.
Main line video	Video transmitted by broadcasting.

3.2 Abbreviations

Abbreviation	Complete expression
AAC	Advanced Audio Coding
AIFF-C	Audio Interchange File Format-Compression
ALS	Audio Lossless Coding
ARIB	Association of Radio Industries and Businesses
ARIB-TTML	Association of Radio Industries and Businesses-Timed Text Markup Language
AVC	Advanced Video Coding
CBR	Constant Bitrate
CDN	Contents Delivery Network
CSS	Cascading Style Sheets
DAMT	Data Asset Management Table
DCCT	Data Content Configuration Table
DDMT	Data Directory Management Table
DRM	Digital Rights Management
EME	Encrypt Media Extensions
EMT	Event Message Table
GIF	Graphics Interchange Format
GOP	Group Of Pictures
HEVC	High Efficiency Video Coding
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
JPEG	Joint Photographic Experts Group
MH-AIT	MPEG-H Application Information Table
MMT	MPEG Media Transport
MNG	Multiple-image Network Graphics
MP3	MPEG-1 Audio Layer-3
MPEG-4	Moving Picture Experts Group-4
MPT	MMT Package Table
MPU	Media Processing Unit
MSE	Media Source Extensions
NPT	Normal Play Time
PNG	Portable Network Graphics
RAM	Random Access Memory
SI	Signaling Information
SVG	Scalable Vector Graphics
TLS	Transport Layer Security
TLV	Type Length Value
UCS	Universal Coded Character Set
UTF	UCS Transformation Format
VBR	Variable Bitrate
VOD	Video On Demand
W3C	World Wide Web Consortium
WOFF	Web Open Font Format

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Chapter 4: Basic Functions and Optional Functions

- The basic functions are functions that a receiver equipped with a multimedia service receive/play function should equip.
- All functions other than the basic functions are optional, and this volume specifies the minimum operational guidelines that should be observed when the receiver implements the optional functions.
- Descriptions such as “recommended” in Volume 3 indicates the implementation (specifications) prefered by broadcasters although they are not mandatory.

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Chapter 5: Required Functions to the Basic Receiver

This chapter defines the functions that the basic receiver should implement.

5.1 Configuration of the basic receiver

The basic receiver shall comply with ARIB STD-B62 Volume 1, Part 1, Chapter 5, "5.1 Functions for Broadcast and Broadband". In the following, each processing unit of the basic receiver in the hardware configuration is specified, and the resources inside the receiver are specified by the reference model.

5.1.1 Hardware configuration of the basic receiver

The hardware configuration of the basic receiver is shown in Fig. 5-1.

The digital broadcast signal input to the basic receiver is converted into a TLV stream by the tuner and demodulator. The demodulated TLV stream is separated into video, audio and other data by the MMT/TLV separation processing, and the video stream is input to the video decoding process and the audio stream is input to the audio decoding process. By the above processing, the basic receiver reproduces normal video and audio.

When receiving the multimedia service, the data is once transferred to the main memory or non-volatile memory, etc., and processing by the CPU is required. It may be necessary to transfer data on the main memory to the video and audio decoder at the same time as presenting characters and graphics images and perform video and audio reproduction processing in addition to normal video and audio reproduction processing. In addition, interactive operation may be required by using a broadband netowrk. From the viewpoint of the processing operation of the hardware as described above, it is necessary to specify the following functions.

1 Data that may be received by MMT / TLV separation processing
2 Audio data reproduction from stream and storage
3 Video data reproduction from stream and storage
4 Presentation of videos, still images, graphics images, characters, etc.
5 Intaractive communication function by using broadband netowrk
6 Permanently saved data size
7 Data size for such as fonts that receivers should always implement
8 Memory size for acquiring and decoding data
9 Guidelines for devices operated by users such as remote control

In particular, “1” is defined as MMT / TLV separation processing, “2”, “3” and “4” are defined as the presentation function, “5” is defined as the communication function, “6”, “7” and “8” are defined as the memory capacity, and “9” is defined as the remote control function.

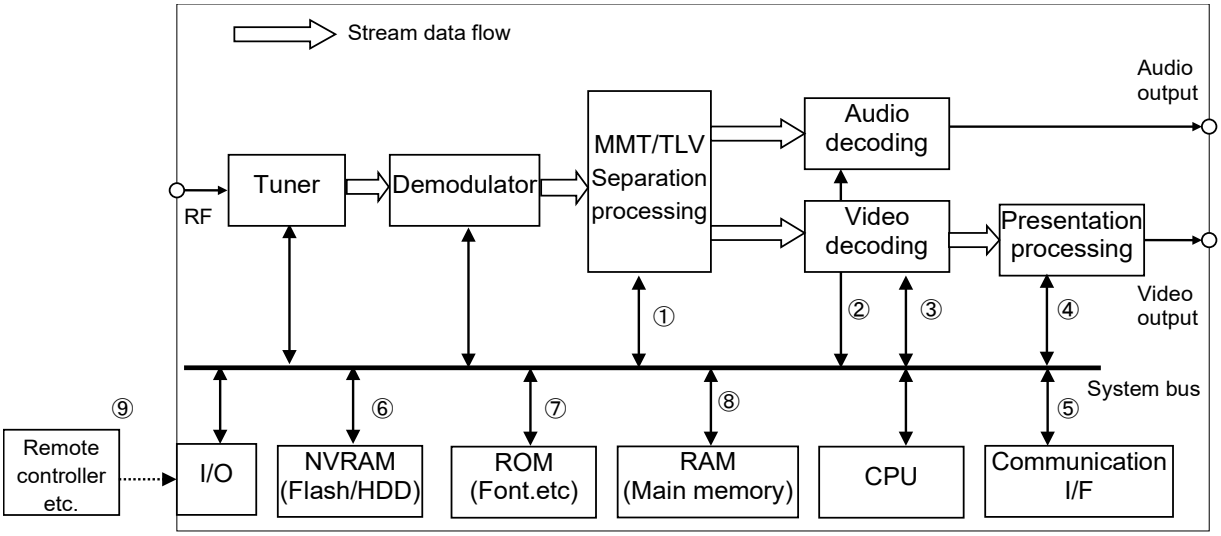

Fig. 5-1 Hardware components of Basic Receiver

5.1.2 Reference model of the basic receiver

The reference model of the basic receiver clarifies the resources inside the receiver and specifies what multimedia service the basic receiver may receive. The reference model of the basic receiver is shown in Fig. 5-2. It should be noted that the model is intended to indicate the viability of multimedia service and does not specify the receiver implementation.

The received TLV stream is divided into various MMT messages, tables, video, audio, closed caption data (ARIB-TTML, etc.), and data for HTML browser presentation by filters After filtering, the video and audio assets are stored in the main buffer Bn via the transport buffer TBn. On the other hand, the transmitted data for presentation by HTML browser is stored in Bcontents after filtering. After storing, it may be temporarily duplicated in RB due to data update processing.

The data for presenting the HTML browser received in this way is executed by an operation of the receiver user and so on. The HTML browser reads the data in Bcontents or RB and executes the data contents according to this start instruction. The monomedia content such as JPEG transmitted at this time passes to each decoder from Bcontents or RB, and the monomedia content transmitted in the stream passes to each decoder from Bn. The audio-based monomedia content is presented by a speaker, which is a presentation device after decoding.

On the other hand, the video-based monomedia content is decoded separately for video, still images, characters, and closed caption (ARIB-TTML), and is buffered in each plane display memory, combined, and then is presented via the monitor which is a presentation device. The combination of each plane is modeled as follows. The multimedia plane is a virtual plane managed by HTML browser, and the presentation screen is composed of any combination of video, still images, and characters. Each element may be transparency displayed. Also, a monochromatic background plane is behind this plane, and it is presented in areas where the multimedia plane is transparent. The pixels of these planes are multiplied by the transmission coefficient and mixed with the closed caption plane and the superimposition plane to form a presentation screen.

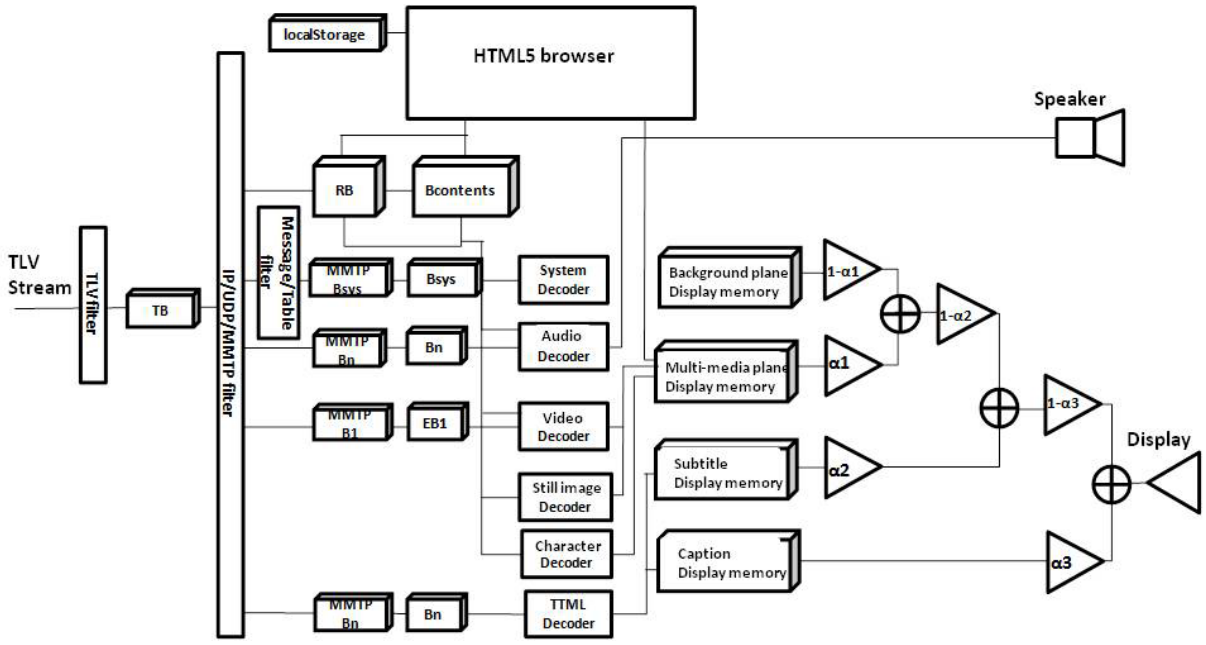

Fig. 5-2 Reference Model of Basic Receiver

TB	TLV packet buffer
MMTP B1	MMTP buffer for video
MMTP Bn	MMTP buffer
EB1	Pre-decoding buffer for video in the decoder
Bsys	Pre-decoding buffer for TLV stream (System) in the decoder
Bn	Pre-decoding buffer for TLV stream n in the decoder
Bcontents	Buffer of multimedia content data, excluding closed caption data transmitted by the TLV stream. Data on the transmission line is stored.
RB	Buffer for processing data of storage specification API
localStorage	Storage buffer for HTML browser data transmitted in a TLV stream

Note : MMTP multiplex buffer and decryption picture buffer are omitted.

5.2 Presentation function

The presentation function of the basic receiver shall comply with ARIB STD-B62 Volume 1, Part 1, "5.2 Presentation Function".

5.2.1 Specifications of each plane that composes the display screen

Table 5-1 shows the basic specifications of each plane that composes the display screen.

Table 5-1 Basic Specifications that compose the Display Screen

Plane	Specifications
Multimedia Plane *1	7680×4320(16:9) RGB : 8bit each or 10bit each α blending with 256 levels
	3840×2160(16:9) RGB : 8bit each or 10bit each α blending with 256 levels
	1920×1080(16:9) RGB : 8bit each or 10bit each α blending with 256 levels
Background Plane	1920×1080(16:9) Monochromatic (Black)
Closed caption / Superimposition Plane	3840×2160(16:9) RGB : 8bit each α blending with 256 levels *2
	1920×1080(16:9) RGB : 8bit each α blending with 256 levels *2

*1 : A virtual plane based on the resolution of the HTML document.
*2 : It allows the occurrence of non-linearity in compositing with multimedia planes or background planes.

Table 5-2 shows the regulations related to the monomedia code that may be presented and the presentation position of the monomedia content and so on, as the restrictions on each plane.

Table 5-2 Presentation Restrictions on the screen plane

Plane	Restrictions	
Multimedia Plane	Presentable monomedia code	H.264, H.265, JPEG, PNG, GIF, SVG, Character (UTF-8)
	Overlapping	No limited *3
Closed caption / Superimposition Plane	Presentable monomedia code	ARIB-TTML
		Image data referenced from ARIB-TTML
	Overlapping	In principle operation, closed caption and superimposition do not overlap in display, but there may be overlapping in some operations.

*3 : It is recommended to create an application that does not require (less) redrawing by changing the overlapping order or moving of still images, characters, and figures. However, in the receiver, the displaying should not be corrupted by redrawing.

5.2.2 Combinations of planes that may be presented and restrictions

5.2.2.1 Resolution of multimedia contents

For the resolution of data content, closed caption content, and superimposition content, a combination according to the resolution of the F shall be used, and the combination shall be used as shown in Table 5-4 when transmitting the main line video at a lower layer in hierarchical modulation, and in other cases, it shall be used as shown in Table 5-3. The character / graphic still image resolution in these tables is the resolution of the still image coded monomedia and the character / graphic coded monomedia. See 5.2.3 for the coding classification of each media type.

The data content service should not be operated in the lower layer.

Table 5-3 Combination of Resolutions of Multimedia Contents

		HTML document resolution and character/graphic still image resolution (Multimedia plane)			Closed caption / Superimposition resolution (Closed caption / Superimposition Plain)	
		7680×4320	3840×2160	1920×1080	3840×2160	1920×1080
Resolution of main line video	7680×4320	○	○	—	○	—
	3840×2160	—	○	○	○	○
	1920×1080	—	—	○	—	○

Table 5-4 Combination of Resolutions of Closed caption/ Superimposition when the Main Line Video is transmitted by Lower Layer of the Hierarchical Modulation

		Closed caption / Superimposition resolution (Closed caption / Superimposition Plain)	
		3840×2160	1920×1080
Resolution of main line video	7680×4320	—	—
	3840×2160	—	—
	1920×1080	○	○

5.2.2.2 Resolution of HTML browser

The resolution of the HTML browser launched by the receiver to present an application follows the document_resolution field of the application service descriptor in general (exceptions will be described later in this section). The resolution of the HTML browser is the maximum resolution of the HTML document that may be displayed at the same time when the HTML browser presents the HTML document using the full screen of the receiver (that is, without using a user interface, such as scrollbars, that switches between visible and invisible areas). The receiver should always display HTML browser with the resolution for full screen of the

receiver[1].

When the resolution of the HTML browser and the resolution of the HTML document are different, the operation is as follows. It should be noted that scaling may result in poor display quality.

- In the case where the HTML document resolution is lower than the HTML browser resolution:
  HTML document should be scaled (enlarged) and displayed so that the resolution of HTML document corresponds to the full screen.
- In the case where the HTML document resolution exceeds the HTML browser resolution:
  The display form depends on optional feature. However, it is recommended that the HTML document is scaled (reduced) and displayed so that the resolution of the HTML document corresponds to the full screen.

When the receiver only launches an HTML browser with a resolution lower than the resolution specified by document_resolution[2], it shall launch the HTML browser with the maximum resolution that may be launched. In addition, depending on optional featureof a receiver, an HTML browser with a resolution higher than the resolution specified by document_resolution may be launched. In both case, the operation of launching HTML browser when the resolution of the launched HTML browser and the resolution of the HTML document are different is as described above.

When the pixel density of the monomedia exceeds the pixel density based on the HTML document resolution, it is recommended that the receiver display the monomedia with the pixel density exceeding the pixel density based on the HTML document resolution. For example, in a situation where a HTML document with 1920 x 1080 resolution is input to HTML browser with 1920 x 1080 resolution and it is assumed that a display area with a width of 1920 pixels and a height of 1080 pixels is set in the HTML document, when a video with a resolution of 3840 x 2160 to be displayed as the monomedia is specified in that area, it is recommended that the receiver should display the video with that resolution when the receiver has the ability to draw the display area with a pixel density of 3840 x 2160.

5.2.2.3 Resolution of closed caption and superimposition

The TTML document resolution of closed caption / superimposition shall follow the resolution field coded as additional identification information in the MH-data coding system descriptor indicating closed caption / superimposition transmission system.

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[1] Since the resolution of the full screen (typically the resolution of the physical display device of a receiver) and the resolution of HTML browser do not always match, it is assumed that the resolution conversion is performed by the receiver. The specifications of this conversion depend on optional featureg of a receiver.

[2] A receiver, that may display HTML document with a resolution higher than the resolution of HTML browser by reducing the HTML document to display with the full screen, claims that the receiver equips HTML browser with a resolution equal to the resolution of the HTML document. For example, when assuming the case where HTML document of 7680 x 4320 is displayed in a reduced resolution with HTML browser of 3840 x 2160 or the HTML document of 7680 x 4320 resolution is displayed without scaling with an HTML browser of 7680 x 4320 resolution, it is not necessary to distinguish between them and the receivers of both cases may be considered having the resolution of the latter case.

5.2.3 Constraints for monomedia coding

Table 5-5 shows the outlines of the constraints for monomedia coding presented in each plane described above. It is premised that broadcasters do not transmit the monomedia data coded by monomedia coding not described here or coded by the operation outside the provisions. The details of the provisions for each coding system are specified in Chapter 7.

Table 5-5 Overview of Constraints of Monomedia coding for Each Screen Plane

Coding System		Provisions		
Coding for Video	H.265	Transmission System	MMT/TLV system : Asset type= hev1, app HTTP(S) (MPEG DASH)	
		Image Size	7680×4320 (16:9) , 3840×2160 (16:9) , 1920×1080(16:9) , 1440×1080 (16:9) , 1280×720 (16:9) , 720×480 (16:9)	
	H.264	Transmission System	MMT/TLV system : Asset type = aapp HTTP(S) (MPEG DASH)	
		Image Size	1920×1080 (16:9) , 1440×1080 (16:9) , 1280×720 (16:9) , 720×480 (16:9)	
Coding for Still Image	JPEG	Transmission System	MMT/TLV system : Asset type = aapp, HTTP(S)	
		Image Size	Arbitrarily selectable from 16 pixels to maximum HTML document resolution both horizontally and vertically.	
		Others	It is assumed to be presented at 4: 2: 0 resolution. However, the displaying of the receiver should not be corrupted even with 4: 2: 2 input.	
Coding for Character/Figure	PNG	Transmission System	MM Coding	MMT/TLV system : Asset type= aapp, HTTP(S)
			Closed caption / Superimposition	MMT/TLV system : Asset type= stpp
		Image Size	Arbitrarily selectable from 2 pixels to maximum HTML document resolution both horizontally and vertically.	
	GIF	Transmission System	MMT/TLV system : Asset type＝aapp, HTTP(S)	
		Image Size	Arbitrarily selectable from 2 pixels to maximum HTML document resolution both horizontally and vertically.	
	SVG	Transmission System	MM Coding	MMT/TLV system : Asset type ＝aapp, HTTP(S)
			Closed caption / Superimposition	MMT/TLV system : Asset type＝stpp
	ARIB-TTML	Transmission System	MMT/TLV system : Asset type = stpp, HTTP(S)*	

* When ARIB-TTML is transmitted via broadband network, it is assumed that it will be presented as data content.

5.2.4 Color gamut

The color space applied to monomedia other than the video to be transmitted is produced by ITU-R Recommendation BT.709 (sRGB). When the color space of the video conformed toBT.2020, the monomedia should be presented by corresponding BT.709 color space of the monomedia other than videos to BT.2020 color space on receiver side according to ARIB STD-B62 Volume 1 Part 1 6.2.2.

5.2.5 Dynamic range

When applying HDR to the video to be transmitted, HDR-TV (i) described in ARIB STD-B32 Part 1, Chapter 2, "2.1.3 Video Signal Characteristics compliant with UHDTV" is applied.*

The adjustment of the dynamic range in mixed displaying of videos, still images, characters and figures with different dynamic ranges depends on optional feature, but it is recommended to maintain the image quality of the video as much as possible and to present the video so that the viewer does not feel uncomfortable.

* The operation of HDR-TV (ii) in ARIB STD-B32 Part 1, Chapter 2, "2.1.3 Video Signal Characteristics compliant with UHDTV" will continue to be considered.

5.2.6 Audio play function

Table 5-6 shows the provisions for audio play. It is premised that broadcasters do not transmit or operate the monomedia data that are coded by the monomedia coding not described here or coded by operation outside the provisions. The details of the provisions for each coding system are specified in Chapter 7.

Table 5-6 Audio Play Function

Coding System	Provisions	
MPEG-4 AAC	Transmission System	MMT/TLV system：Asset type = mp4a or Asset type = aapp, HTTP(S)
	Sampling frequency	48kHz
	Maximum file size that may be played continuously	5MB
	Others	*5 , *6
MPEG-4 ALS	Transmission System	MMT/TLV system：Asset type = mp4a or Asset type = aapp, HTTP(S)
	Sampling frequency	48kHz
	Maximum file size that may be played continuously	5MB
	Others	*5 , *6
AIFF-C	Transmission System	MMT/TLV system：Asset type = aapp, or Asset type =stpp, HTTP(S)
	Sampling frequency	48kHz, 24kHz, 12kHz
	Maximum file size	3MB

	that may be played continuously	
	Others	*5 , *6
MP3	Transmission System	MMT/TLV system：Asset type = aapp, HTTP(S)
	Sampling frequency	48kHz、24kHz(Depends on the encoding system)
	Maximum file size that may be played continuously	3MB
	Others	*5 , *6
Built-in Sound	Transmission System	Built-in sound*7
	Sampling frequency	12kHz
	Maximum file size that may be played continuously	48KB

*5： See "Chapter 7 Monomedia Coding" for restrictions such as whether or not simultaneous decoding with video code data and other audio code data is possible.

*6： When decoding file format data transmitted by a TLV stream, in repeated play, silence is allowed to occur at the seams between repetitions.

*7： The total ROM size for the built-in sound is 480KB.

5.2.7 Fonts

Fonts are restricted within a range that does not interfere with practical use in consideration of the size of the ROM to be implemented on a receiver. The font specifications are shown in Table 5-7.

Table 5-7 Fonts

Item	Provisions
Number of Font Styles	Number of font styles: 3 (assuming mono-spaced font styles equivalent to Round Gothic (Maru Gothic), Round Gothic Bold (Futo Maru Gothic), and Gothic (Kaku Gothic)) *Shared at all resolution Proportional font (optional)
Repertoire	Follow “ARIB STD-B62 Volume 1 Part 2 5.2”
Font Size (Pixel)	Round Gothic (Maru Gothic) From 16 to 288 *8 Round Gothic Bold (Futo Maru Gothic) From 16 to 288 *8 Gothic (Kaku Gothic) From 16 to 288 *8

*8： The method of character implementation is premised on the method based on software processing. However, the implementation method, including the implementation of dedicated fonts, depends on receiver planning. By adopting the provision regarding the character size, there is no problem in the display quality of a receiver, but it may be displayed even if a size other than this is specified.

5.2.8 Operation of multiple video / audio / closed caption

5.2.8.1 Multi asset

Multi asset is defined as the transmission, handling and presentation of multiple assets (video, audio, closed caption) of the same asset type by the MMT system in one service.

Control such as switching of presentation contents in multi asset operation of video is realized by data contents.

In the multi-asset operation of audio and closed caption, control such as switching of presentation contents is realized by the receiver function and data contents. In addition, it is not assumed that multiple audio and closed caption will be presented at the same time.

5.2.8.2 Multi view

Multi view is defined to handle and present a video / audio asset that is broadcast and transmitted, a video file of video / audio that is transmitted by the data transmission system specified in Chapter 6, and a video stream via communication of MPEG-DASH video / audio that is specified in 12.2.

Control such as switching of presentation contents in the multi view is realized by data contents for all presentation targets.

In addition, for video assets and video files / streams, it may be possible to present multiple of them at the same time.

5.2.8.3 Constraints on simultaneous presentation of videos

It depends on optional feature to implement a function of simultaneous reception and play of multiple video signals of video assets and video files / streams. Therefore, when the data content service requires multiple presentation of videos at the same time, it is recommended to specify that simultaneous presentation is performed when the presentation is possible after checking the number of simultaneous play streams shown in 10.7.11 and the Capability based on the combination of the coding system and resolution of each stream of the data content. The simultaneous presentation method with presentation synchronization control between streams by broadcast transmission and communication shall be specified by broadcasters.

5.3 Remote controller

5.3.1 Keys used in multimedia service

Table 5-8 shows the type of remote controller keys used in multimedia service and the guidelines of content production. To avoid user confusion, it should notgive multiple meanings to one button. When giving multiple meanings to one button, it is recommended to present the details of button operation to users within the content. When the device is equipped with free cursor control such as a mouse, it is recommended to use it in multimedia contents. When there are keys in a remote controller, VK events defined in “10.10.2.3.” shall be generated.

Table 5-8 Remote Control Keys used in Multimedia Service

Type of Keys	Guidelines
↑、↓、←、→ (Up, Down, Left and Right Keys)	Move up, down, left and right.
0～9 (Numeric key)	Enter numbers.
Enter Key	Operation break. (Enter)
Return Key	Cancel operation.
	Backspace for user-entered characters. (or bulk deletion)
	(*)HTML documents may be used as return. However, consider whether or not there is a return destination.
Page up, Page down	Page transition
Tab	Transition of operation items
d	Switching of Show / Hide multimedia service
Blue, red, green, yellow (Color Keys)	Operation (execution) selection. (*) Arrange the buttons on the remote controller in the order of blue, red, green, and yellow from the left. Also, provide a means of associating blue, red, green, and yellow letters with the corresponding buttons so that the colors may be distinguished by letters.
Play Key	Start playing VOD etc.
Fast rewind, fast forward	Fast rewind and fast forward in play of such as VOD.
Previous track, Next track	Moving tracks in play of such as VOD.
Pause	Pause play of such as VOD.
Stop	Stop play of such as VOD.
Play control (others)	Operations other than "Play", "Fast Rewind", "Fast Forward", "Previous Track", "Next Track", "Pause", and "Stop" regarding VOD play control.
Closed caption	Switching of Show / Hide closed caption

5.3.2 Key masking

In the data content, it is possible to mask the keys (operation shall not be used, operation is invalid) by the key group. For details, refer to the key groups and control interfaces specified in 10.10.2.3. However, the tuning-related keys (channel up / down key, volume key) should not be masked even in the data content. In addition, the number keys (one-touch tuning button) shall not be masked except when it is necessary to input numbers. When the input is completed, immediately remove the mask of the key group.

5.4 Memory to be equipped in the basic receiver

The memory implementing conditions for the basic receiver are defined separately for the minimum specifications and the recommended specifications from the viewpoint of popularizing receivers. The minimum specification is to realize a receiver that does not cause any trouble in the operation in receiving and presenting all data contents. In addition, the recommended specifications are to realize a receiver that may operate with a practical response in the service assumed as of 2018.

See the Reference Model section in 5.1.2 for the placement and definition of each memory on the receiver.

5.4.1 RAM

As shown in the reference model, various memories are equipped in a receiver. This section specifically specifies the RAM for the cache specified in ARIB STD-B62 Volume 1, Part 1, 5.1. This RAM is called a storage specifiable area. Its capacity corresponds to the sum of Bcontents and RB in Fig. 5-2. The RAM size is shown in Table 5-9.

Table 5-9 RAM

Item	Provisions	
	Minimum Specifications	Recommended Specifications
Storage Specifiable Area *9	10MB or more	20MB or more

*9： When the storage specified directory by API is updated, the old content is retained until the update is completed so that the old and new contents in the directory are not mixed. This area contains the size of RAM for this.

5.4.2 Non-volatile storage area

The main non-volatile storage area implemented in a receiver in relation to multimedia service is the localStorage shown in the reference model. For more information on localStorage, see the Reference Model section in 5.1.2.

NVRAM is one of the possible means of realizing localStorage, but NVRAM is a device with a limited number to write. When the number to write exceeds the limit, these devices mayfail, resulting in shortened receiver life. Therefore, it is recommended to give sufficient consideration to prevent excessive writing to NVRAM.

NVRAM is expected to be implemented using a semiconductor storage device generally called flash memory. This device has a limited number of writes and its limit equivalents to the life of the device.

When it is necessary to storage its information over time of the presentation of multimedia service, it is recommended to use global variables. For temporary data storage such as data transfer between multiple service, it is recommended to use a server or session cookie. It is not recommended to use non-volatile storage for temporary storage of data.

5.5 Communication function

Table 5-10 shows the communication functions assumed for bidirectional communication in multimedia service.

Table 5-10 Communication Functions

Item	Provisions
Interface	A receiver shall be equipped with communication interface for IP communication.
Protocol	Use TCP / IP communication protocol. For details on the TCP / IP communication protocol, refer to Volume 6, “5.1”. Use HTTP 1.1(RFC 7230-7235) as an application layer.
Security Function	When in content a scheme is specified by https:, it follows “TLS1.2 Security”. For details on the operation of TLS, refer to Chapter 7 of Volume 6.

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Chapter 6: Operation of Data Transmission System

This chapter mainly specifies the operation of data transmission system related to data content service based on ARIB STD-B60 Chapters 10 and 11.

6.1 Overview and operation of data content service

6.1.1 Data content service

The data content service is a component of the broadcasting service that accompany the digital TV service indicated by service_type = 0x01 and simultaneously provide application functions such as HTML to TV service based on video / audio.

The application service descriptor allocated in the MPT indicates that the data content service is attached to the service. It does not mean the type of broadcast service identified by service_id and classified by service_type.

6.1.2 Types of data content service

The following two types of data content service are assumed. It should be noted that a type of data content service in which AIT of XML format is directly acquired from communication network by referring from MPT without transmitting MH-AIT is also assumed, but this shall not be operated.

(a) Type 1 (Fig. 6-1)

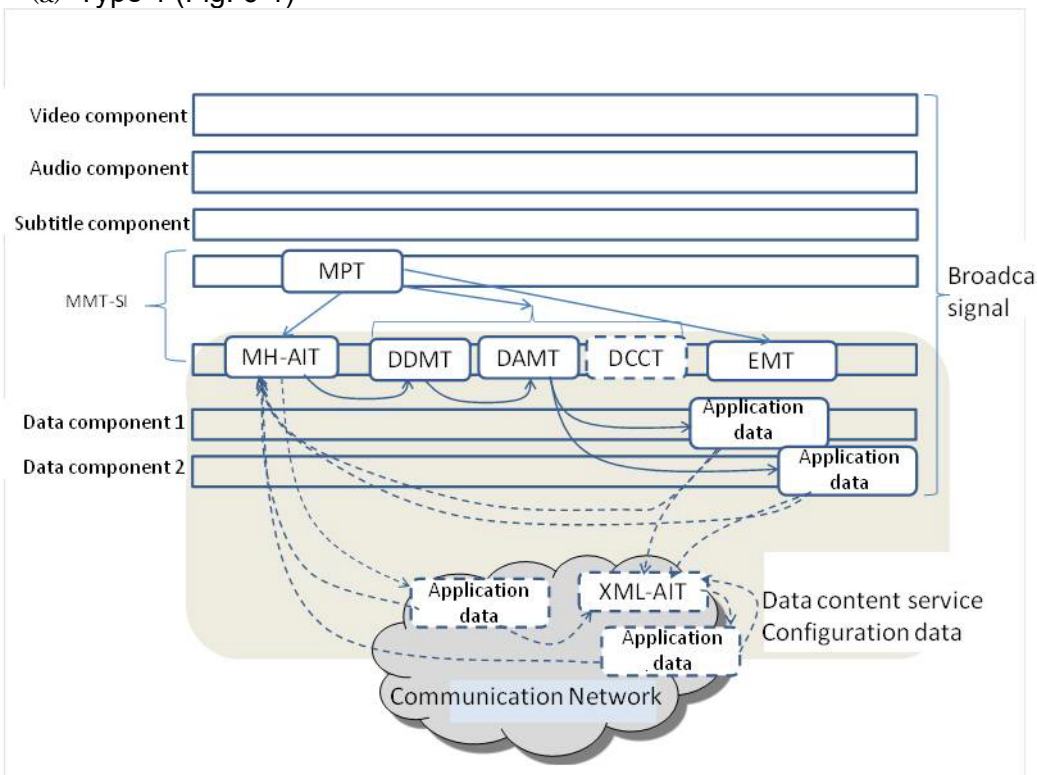

Fig. 6-1 Type 1 Configuration of Data Content Service

This shows a data content service that includes broadcast transmission of application data. Application data transmitted by broadcasting is encapsulated in an asynchronous MPU for each file as one or more data components and transmitted. MMT-SI related to data content service such as MH-AIT, which are application control information, data transmission messages and EMT is also transmitted by broadcasting. In addition to receiving and acquiring the above broadcast signal, it is also assumed that the application data is acquired from the broadband network. In the application transition, it is assumed that not only the application data of the broadcast transmission is acquired by referring to the MH-AIT from the application, but also the application data is acquired by referring to the AIT of XML format by the broadband network access from the application.

(b) Type 2 (Fig. 6-2)

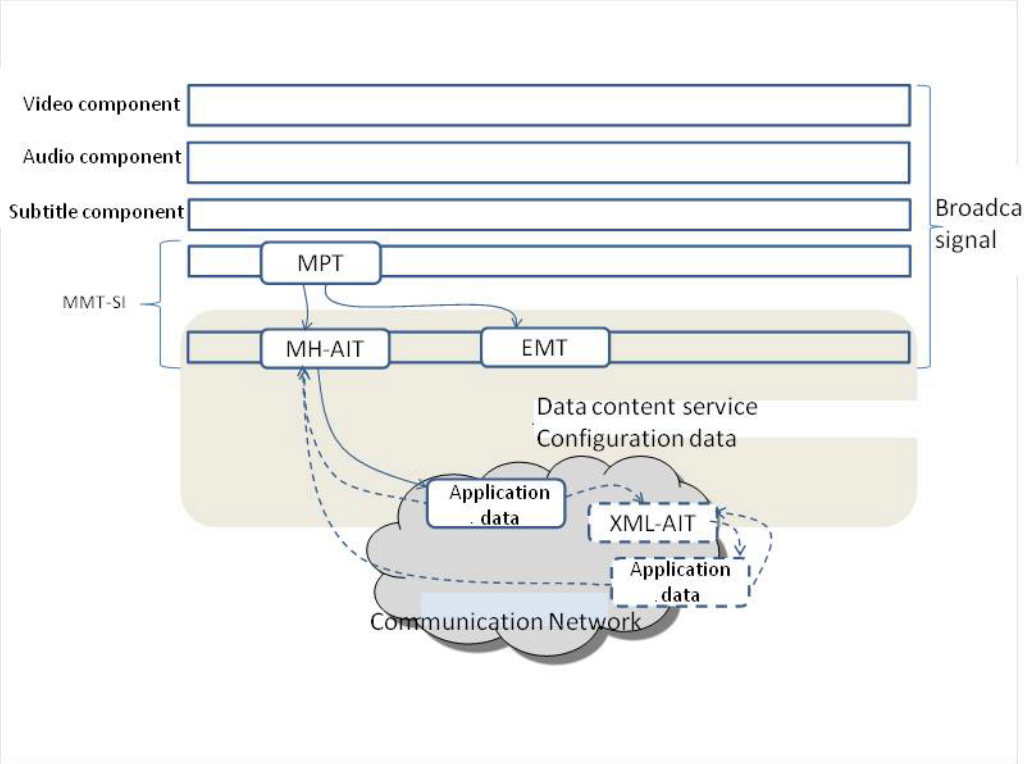

Fig. 6-2 Type 2 Configuration of Data Content Service

MH-AIT and EMT, which are MMT-SI related to data content service, are transmitted by broadcasting, but application data is not transmitted by broadcasting and is acquired from the communication network. Since there is no data component, data transmission message that is used for its control is not transmitted. Application control may be controlled in conjunction with broadcast programs based on MH-AIT. In the application transition, it is assumed that not only the application data is acquired from communication network by referring to the broadcast transmission MH-AIT from the application, but also the application data is acquired from communication network by referring to the AIT of XML format from the application.

6.1.3 Operation of data content service

This specifies the operation related to the entire data content service mainly centering on Type 1.

6.1.3.1 Transmission unit of application data

The transmission unit of application data has a hierarchical structure as shown in Table 6-1. The data asset management table descripts this hierarchical structure.

Table 6-1 Transmission Unit of Application Data

Name	Definition and Operational Assumptions	Identification Information
Component (Asset)	A unit that has the same packet ID in one IP data flow. It is referenced as an asset in MPT. An application set to be transmitted is switched by a data event.	component_tag
MPU	A transmission unit consisting of a set of items contained within one component. The operation on that one MPU consists of all items contained in one directory is only permitted.	MPU_sequence_number (MPU_id)
Item	The smallest unit of transmission that configures MPU. Normally, it corresponds to a file, and its operation is assumed.	item_id

6.1.3.2 Operation of data component

A MH-stream identification Descriptor is allocated in a MPT asset loop for each data component, and a component tag is specified. 0x0040 to 0x007F shall be used as the component tag value. The maximum number of data components is 8.

The default component that transmits the application to be started first is specified by the component tag value obtained by referring from the data transmission message to the URL of the application indicating automatic startup from MH-AIT as the component that transmits the corresponding application data. Therefore, the component tag value is not specified as the default component. Similarly, resources such as HTML documents and monomedia that are appropriately referred to by the application is specified by the component tag value obtained by referring to the specified URL from the data transmission message as the component that transmits the corresponding resource. Resources are treated as items in data transmission.

The transmission control information for each component is included in the data asset management table of the data transmission message. A change in transaction_id indicates an update of the transmitted application data, and a data event and a switchover of the application data to be transmitted are indicated by a change in data_event_id that is part of the download_id.

6.1.3.3 Operation of MPU

MPU is basically a transmission unit of a collection of individual files (items) that composes application data. The operation on that one MPU is configured with all the items contained in one directory is permitted. It should be noted that when the file to be presented is stored in multiple MPUs (directories), it may take time to present the page specified by the entry file of the application.

MPU_sequence_number is specified as MPU identification information and shall consist of the identification value as one directory unit and its version number since its operation is permitted only when one MPU is configured with all items contained in one directory.

Table 6-2 Operation of MPU_sequence_number

Bit Position of MPU_sequence_number	Operation
bit31～bit16	An identifier for a collection of items contained in one directory. It is defined as MPU identifier (MPU_id). Applicable from 0x0000 to 0xFFFF. MPU_id should be unique to all data components in the service at any given time.
bit15～bit0	The version number of the MPU that has the same MPU identifier. When there is any change in the item collection, the version shall be updated. Basically, it is incremented for each update, and it is incremented from 0x0000 to 0xFFFF and returned to 0x0000, but it does not necessarily have to be incremented by 1.

By monitoring the version number in the same MPU_id, it is possible to know that the application data transmitted by the MPU has been updated.

6.1.3.4 Data event and data transmission session

A data event is defined as the period during which application data that conposes a particular application set is transmitted by a particular data component. Data events are identified by the data_event_id, which is part of the download_id contained in the data asset management table of the data transmission message, and this update switches the application data transmitted by the relevant data component and switches the associated data transmission message. The data event does not necessarily have to be the same as the event defined by MH-EIT, and t is assumed to be set independently. Further, the data event does not always coincide with the period of application control based on MH-AIT related to the application set to be transmitted, in other words, the operation period of a specific application set. For example, it is assumed that the previous application display is maintained while acquiring new application data in advance.

On the other hand, a data transmission session is defined as a period in which the transmission data configuration and the directory configuration of all the data components constituting the service are the same. Data transmission session identification (data_transmission_session_id) is set as table_id_extension of each data transmission message, and a reference relationship is established between each table of data transmission messages having the same value.

6.1.3.5 Operation of data_event_id and data_transmission_session_id

1) Details of data_event_id operation
   * data_event_id is updated when the configuration of the application transmitted by the relevant data component is switched. Basically, it is expected to be incremented by 1 in the operation, but there is no problem even if it changes to a different value from the main value before the update. The switching of the application configuration depends on the service operation of broadcasters. The receiver does not need to remember the data_event_id before pause.
   * data_event_id is managed and updated individually for each component.
   * data_event_id is operated with a value other than 0xF.
   * For the operation of receiving the update notification of data_event_id, refer to Section 10.7.13.

2) Details of data_transmission_session_id operation

This value is updated at least in the following cases. It may be updated in cases other than the following.

* In the case when he data_event_id of any data component is updated in the data asset management table.
* In the case when the data component increases / decreases, or the MPU increases / decreases or the items increase / decrease in the data asset management table, or when the MPU configuration in the data component or the item composition in the MPU changes.
* In the case when the base directory increases / decreases, or the directory increases / decreases or the files increase / decrease in the data directory management table, or when the directory configuration in the directory in the base or the file configuration in the directory changes.
* When updating this value, it is updated synchronously so that the reference relationship is maintained between each table transmitted in the data transmission message.
* Basically, it is expected to be incremented by 1 in the operation, but there is no problem even if it changes to a different value from the main value before the update.

Fig. 6-3 shows an example of a data event and a data transmission session. It is shown that the data transmission session is switched at the timing of data event switching and other changes in each component.

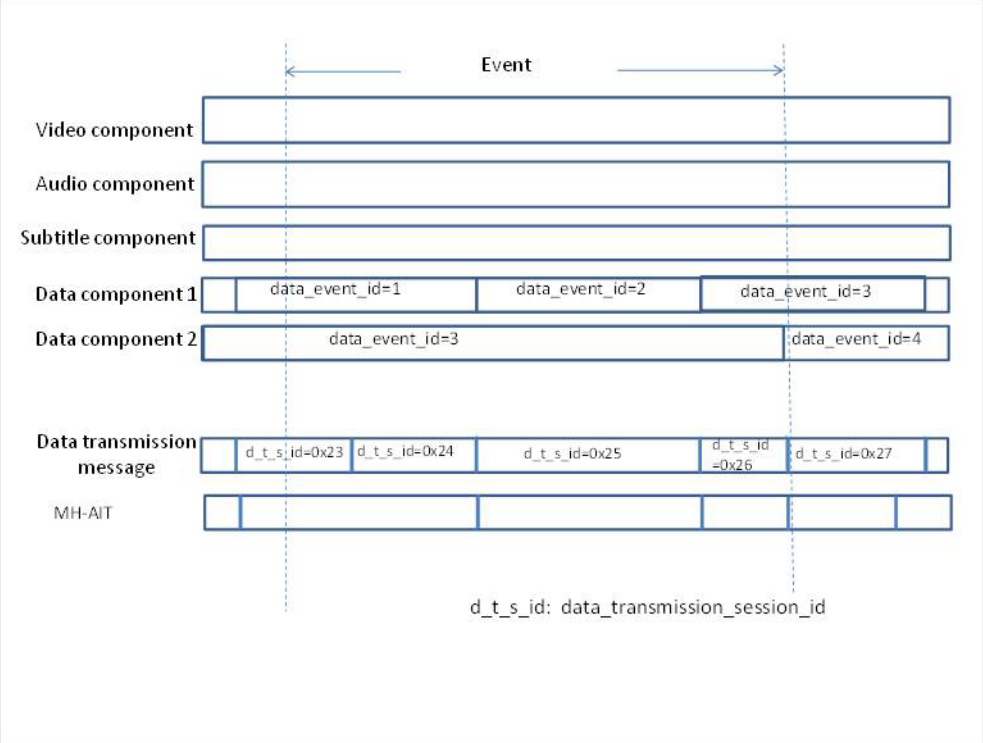

Fig. 6-3 Data Event and Data Transmission Session

6.1.3.6 Application namespace and nodes

When referring to the application data transmitted by broadcasting in the application, the following URL is applied. When referring from an application transmitted by broadcasting, it is also possible to specify by a relative path. However, it is not possible to specify the site root relative path (format starting with "/").

<base_url><base_directory_path><directory_node_path><file_name>

<base_url>: The base URL returned from a receiver by the getSystemInformation function (see 10.7.12 2).
<base_directory_path> : Base directory path described in the data directory management table
<directory_node_path>: Directory node path described in the data directory management table
<file_name> : File name described in the index item

Here, the following rules are applied to the character strings described in <base_directory_path>, <directory_node_path>, and <file_name>.

The characters that may be used are startChar * echar.

```
echar       =   startChar | "-" |  "." | "!" | "~" | "'" |
                "(" | ")" | ";" | "/" | "@" | "=" | "+" | "$" | ","
startChar   =   lowalpha | upalpha | digit | "_"
lowalpha    =   "a" | "b" | "c" | "d" | "e" | "f" | "g" | "h" | "i" |
                "j" | "k" | "l" | "m" | "n" | "o" | "p" | "q" | "r" |
                "s" | "t" | "u" | "v" | "w" | "x" | "y" | "z"
upalpha     =   "A" | "B" | "C" | "D" | "E" | "F" | "G" | "H" | "I" |
                "J" | "K" | "L" | "M" | "N" | "O" | "P" | "Q" | "R" |
                "S" | "T" | "U" | "V" | "W" | "X" | "Y" | "Z"
digit       =   "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" |"8" | "9"
```

* In <base_directory_path> and <directory_node_path>, the end of the string ends with "/".
* In all <base_directory_path> described in the data directory management table, a base directory path that is a prefix match and in which one string is included in the other string shall not be specified.
* In <directory_node_path> in the same data directory management table section where <base_directory_path> is the same, a directory node path that is a prefix match and in which one string is included in the other shall not be specified.
* It should be noted that when different files are referenced by the same path in temporally adjacent data events of the same data component, there is a risk that it may cause a reference from an application different from the expected one and cause a malfunction.
* In the data directory management table, it is possible to set a node tag for the directory node indicated by the URL of <directory_node_path> to which the file belongs and enable mapping with items in the data asset management table and index items and MPU if necessary.
* The node tag is unique to all nodes in the service and in the same data transmission session. The numbering of node tag values is not specified.
* <file_name> should be unique in MPU because it is associated with item_id in the index item.

6.1.3.7 Unit of application data

The unit of application data transmitted by broadcasting is specified by application_id. application_id is specified by application control information (MH-AIT, etc.).

6.1.3.8 Operation of video and audio components in data content service

There are the following two types of video / audio components referenced by the application.

1) TV video audio components
   It is a video / audio component as a component of TV service and is a default component and a component to be switched by a resident application such as EPG. A component_tag of 0x0000 to 0x000F (video) or 0x0010 to 0x002F (audio) is specified.
   It is the target of the video / audio stream specified in Volume 7.
2) Application reference video audio components
   Application reference video audio components that are referenced only from HTML applications are not operated.

When referencing video / audio components from an application, both of the method of directly specifying the component_tag value (hereinafter, direct tag specification) and the method of specifying "-1" as the component_tag and selecting the component selected by the receiver function (default specification) may be specified. However, when the application switches to a component other than the component selected by the receiver function by directly specifying the tag, the play of the component selected by the receiver function is restored when the application is terminated or the application is switched. However, the following rules should be applied for component specification.

* In the HTML document to be executed first, which is specified by MH-AIT, both the video and audio components shall be specified by default.
* In HTML documents other than the above, both default specification and direct tag specification may be referenced, but the default specification is always used when returning to the component selected by the receiver function after the tag is once specified directly.

In addition, video and audio via communication transmission based on the MPEG-DASH system specified in 12.2 will not be treated as a component.

6.1.3.9 Transmission pause period

The following three methods are assumed for handling data components during the period when application data is not transmitted.

1) Data content service suspension
   The application service descriptor is not allocated in the MPT. Note that data transmission messages, MH-AIT and data components that transmit application data may be transmitted even while the data content service is out of service.
2) Type 2 data content service transition
   The application service descriptor is allocated in MPT and MH-AIT is transmitted. The acquisition destination of the application specified in the MH-transmission protocol descriptor of MH-AIT exists on the communication network.
3) Type 1 data content service (partial) suspension
   Basically, it corresponds to the case where some of the existing data assets are not transmitted. The application service descriptor is allocated in the MPT and the data transmission message and MH-AIT are transmitted. As the data transmission message, only the data component being transmitted is described.

6.1.3.10 Note for Type 2 operation

* DT_message_flag = 0 and location_type = 0 in AIT_location_info is set in the MPT application service descriptor.
* Protocol_id to 0x0003 HTTP (S) Transmission in MH-AIT's MH-transmission protocol descriptor.
* Do not operate the API related to data resource storage control specified in 10.7.14.

6.1.3.11 Index item

Index items shall be transmitted in all MPUs. The following are specified as operations related to index items.

* The directory node of the data directory management table is mapped to the MPU by the MPU node descriptor of the data asset management table. In the corresponding directory node of the data directory management table, num_of_files is set to 0 regardless of the number of files.
* The index item shall be firstly transmitted in the transmission order in the MPU.
* The item_id of the index item is a fixed value as 0x00000000.

6.1.3.12 Operation of hierarchical modulation

When operating hierarchical modulation, the data content service is not operated in the lower layer.

Data components, data transmission messages, MH-AIT and EMT are transmitted only in the higher layer. For data components, asset group descriptors are not allocated in the MPT asset descriptor area.

6.2 Operation of Control Information related to Data Content Service

This section specifies the operation of control information such as messages and tables related to data content service. It shouled be noted to see TR-B39 Part 1, Volume 4, Chapter 6 for common operations in advanced wide band satellite digital broadcasting regarding control information such as messages and tables in this section.

6.2.1 Operation of MPT

The following descriptors are operated in the MPT of broadcasting service with data content service.

6.2.1.1 Application service descriptor

Only one application service descriptor should be allocated in the MPT descriptor area of the MPT of the broadcasting service with the data content service.

However, even if multiple descriptors are allocated in the future, a receiver shall operate by applying the descriptor placed at the beginning of the descriptors whose application_format value is 0x1.

Table 6-3 shows the details of the operation of the application service descriptor.

Table 6-3 Operations of Application service descriptor

Field	Operation
application_format	It is fixed at 0x1 indicating that only ARIB-HTML5 is applied.
document_resolution	It is operated according to the standard.
default_AIT_flag	it is fixed at 1 since the MH-AIT referenced by this descriptor is always the default monitoring target.
DT_message_flag	This flag is set to 1 only when the application data is transmitted by broadcasting (type 1).
EMT_num	The maximum of the number is 11. (General event message: 8, NPT reference message :2 (optional), viewer participation type corner notification message: 1)
AIT_location_info()	Location_type = 0 is only operated.
DT_message_location_info()	Location_type = 0 is ony operated. A data transmission message containing DDMT / DAMT individually is transmitted with the same packet ID indicated by this value. DCCT is not operated.
EMT_tag	It is operated according to the standard.
EMT_location_info()	Location_type = 0 is ony operated.

6.2.1.2 MH-Data component descriptor

Only one MH-data component descriptor is always placed in the asset loop that corresponds to the asset that carries the MPT application data for Type 1 data content service. Table 6-4 shows the details of the operation of the MH-data component descriptor.

Table 6-4 Operations of MH-Data component descriptor

Field	Operation
data_component_id	It is set to a value of 0x0021, which indicates a multimedia coding system (second generation) in digital broadcasting.
additional_data_component_info	It is not allocated.

6.2.1.3 MPT Transmission Operation related to Data Content Service

- The application service descriptor is always placed in the broadcasting service that operates the data content service.
- In the asset loop related to the data component, one MH-stream identification descriptor and one MH-data encoding descriptor are always allocated. Otherwise, the following descriptors shall be allocated as needed.
  - Access control descriptor: This is allocated only when the entire service is scrambled and the data component is specified to non-scrambled by the placement of this descriptor with 0xFFFF specified as the ECM packet ID.
- The description of the MPT asset loop may be retained during the transmission pause period of the data component.
- It is possible to switch between type 1 and type 2 data content service by updating the application service descriptor.

6.2.2 Operation of data transmission messages

In data transmission messages, only DDMT and DAMT are operated and DCCT is not operated.

The data transmission message is transmitted in the case of a type 1 data content service that transmits application data as a component. However, the data transmission message in the same service shall be transmitted with the same packet ID indicated by DT_message_location_info in the application service descriptor of MPT no matter which table is transmitted. DDMT and DAMT are transmitted that in a mutual reference relationship with the same data transmission session identification (data_transmission_session_id) set. Each DDMT and DAMT allows transmission in multiple sections, that is, multiple data transmission messages, but each section is transmitted in a maximum of 3MMTP packets. In the case of multiple section transmission, it is possible to transmit in a different retransmission cycle for each section, but the retransmission cycle of the sections of each table that composes the data transmission message is 500 milliseconds at the minimum and 10 seconds at the maximum regardless of whether it is multiple section transmission or not. The upper limit of the sum of the DDMT and DAMT table sizes in the same data transmission session is 16KB. Data transmission messages are not transmitted in excess of 1 Mbit per second regardless of the type of table to be transmitted.

Table 6-5 shows the operational details of the data transmission message.

Table 6-5 Operations of Data transmission message

Field	Operation
message_id	"0x8003" is set.
version	It is fixed to 0 and not operated.
length	The maximum is 4096.
table_id	The identification value of the table to be stored is set.
section_syntax_indicator	"1" is set.
section_length	The maximum is 4093.
data_transmission_session_id	See 6.1.3.5.
version_number	The version number of the table is set.
current_next_indicator	"1" is set.
section_number	The section numbers that compose the table are set.
last_section_number	The last section number that composes the table is set.

6.2.2.1 Operation of data directory management table (DDMT)

It is possible to transmit in multiple sections, but the directory information under a specific base directory shall be completed in each section. The same base_directory_path in different sections shall not be described. Table 6-6 shows details of operation of the data directory management table.

Table 6-6 Operations of Data directory management table

Field	Operation
base_directory_path_length	The maximum is 128.
base_directory_path_byte	See the description provisions shown in 6.1.3.6.
num_of_directory_nodes	It is operated according to the standard. There are no restrictions.
node_tag	See the provisions for node tags shown in 6.1.3.6.
directory_node_version	It is updated when there is a change in the file structure in a directory node where node_tag has the same value. (It shall not be updated when the contents of the configuration file only change)
directory_node_path_length	The maximum is 128.
directory_node_path_byte	See the description provisions shown in 6.1.3.6.
num_of_files	It is fixed to 0, and the file-related description is omitted, and the directory node is referenced by the MPU node descriptor in DAMT.

6.2.2.2 Operation of data asset management table (DAMT)

It is possible to transmit in multiple sections, but the control information for each component should be completed in each section. The same component_tag in different sections shall not be decribed. Table 6-7 shows details of operation of the data asset management table.

Table 6-7 Operations of Data asset management table

Field	Operation
transaction_id	When there is an update in the application data transmitted by the component, this value also is updated.
component_tag	It specifies the component tag value corresponding to the component. See 6.1.3.2.
download_id	Bit31-28 indicates data_event_id. Bit27-0 is all set to 1. See 6.1.3.4 and 6.1.3.5.
num_of_mpus	It is operated according to the standard.
mpu_sequence_number	See 6.1.3.3.
mpu_size	This describes the total number of bytes of all items (MFU_data_byte) that compose the MPU. When the size is indefinite, it is set to 0x00000000.
index_item_flag	It is fixed to 1 and index items are used in all MPUs.
index_item_id_flag	It is fixed to 0, and the item_id of the index item is operated in a fixed value. The item_id of the index item is fixed at 0x00000000.
index_item_compression _type	It sets the compression format of index items. 00: zlib / 11: uncompressed The zlib compression format is shown in Appendix 12.
num_of_items	It is fixed at 0, and file-related descriptions are omitted.
mpu_info_length	It is operated according to the standard. There are no restrictions.
mpu_info_byte	One MPU node descriptor is always allocated. No other descriptors are allocated.
component_info_length	It is fixed at 0 since the component level descriptor is not specified.

6.2.2.3 Operation of data content management table (DCCT)

The data content management table is not used.

6.2.2.4 Operation of descriptors to be allocated in data transmission messages

1) MPU node descriptor

Only one this descriptor should be allocated in mpu_info_byte of the data asset management table (DAMT).

The allocation of this descriptor indicates that the specific directory node specified by DDMT corresponds to the MPU. Table 6-8 shows the operational details of the MPU node descriptor.

Table 6-8 Operations of MPU node descriptor

Field	Operation
node_tag	This specifies the node tag of the DDMT directory node corresponding to this MPU.

6.2.3 Operation of application information table (AIT)

There are two types of description formats for application information table (AIT): section format MH-AIT andAIT of XML format. The former is operated in the case of broadcasting and transmitting application control information, and the latter is operated in the case of acquiring application control information via communication. It is not operated to control external applications.

6.2.3.1 Operation of MH-AIT

1) MH-AIT

MH-AIT is transmitted in a maximum of 3MMTP packets per message, and its retransmission cycle is a minimum of 500 milliseconds and a maximum of 10 seconds. Table 6-9 shows the operational details of MH-AIT.

Table 6-9 Operations of MH-AIT

Field	Operation
section_number	It is fixed to 1.
last_section_number	It is fixed to 1.
common_descriptor_length	It is fixed to 0. Therefore, no descriptor is allocated in the common descriptor area.
application_type	It is fixed to 0x0011 “ARIB-HTML5 application”.
application_loop_length	It is operated according to the standard.
application_identifier()	The upper 16 bits indicates organization identification (organization_id), and the lower 32 bits indicates application identification (application_id). Application identifier is uniquely given within the organization identification. For organization identification, see to ARIB TR-B39 Part 1, Volume 7, Section 8.3.7. However, 0 is reserved as a special value for this value and the case of giving 0 to this value matches all organization_ids. But 0 shall not be used in the description of MH-AIT. Up to 8 application_identifier () may be described in MH-AIT. In addition, operation that uses the value of organization_id assigned to each broadcaster for the broadcasting integrated HTML5 application to organization_id is permitted. The broadcasting integrated HTML5 application is defined by ARIB TR-B14 Volume 3 [Part 2] Chapter 8, ARIB TR-B15 Part 1 Volume 3 Section 8.20, and ARIB TR-B15 Part 2 Volume 3 Section 8.18.
application_control_code	Only AUTOSTART, PRESENT, and KILL may be applied. There shall always be only one application indicating 0x01 (AUTOSTART) in this table. However, it is possible to operate in which 0x01 (AUTOSTART) does not exist and only 0x04 (KILL) exists. Broadcasters should be aware that some receivers do not support the case where only 0x04 (KILL) exists.
application_descriptor_loop_length	There are no restrictions. The only descriptors to be allocated in the subsequent application descriptor area are the MH-application descriptor, the

Field	Operation
	MH-transmission protocol descriptor, the MH-simple application location descriptor, and the MH-application boundary authority setting descriptor.

2) MH-application descriptor

Only one this descriptor should be allocated in the MH-AIT application descriptor loop.

Table 6-10 shows the operational details of the MH-application descriptor.

Table 6-10 Operations of MH-Application descriptor

Field	Operation
application_profiles_length	5
application_profile	0x0010
version.major	It is fixed to 0x01.
version.minor	It is fixed to 0x01.
version.micro	It is fixed to 0x01.
service_bound_flag	It is fixed to 1. (The application is terminated when the service is switched to another service)
visibility	It is fixed to 11.
present_application_priority	It is operated according to the standard.
application_priority	The value 0xFF shall indicate that no priority is specified. It is fixed at 0xFF.
transport_protocol_label	One transport_protocol_label is described for one MH-application descriptor.

3) MH-transmission protocol descriptor

Only one this descriptor should be allocated in the MH-AIT application descriptor loop.

Table 6-11 shows the operational details of the MH-transmission protocol descriptor.

Table 6-11 Operations of MH-Transmission protocol descriptor

Field	Operation
protocol_id	0x0003 HTTP / HTTPS transmission or 0x0005 MMT non-timed transmission.
transport_protocol_label	It is operated according to the standard.
Selector Area (When protocol_id = 0x0003)	
URL_base_byte	The number of URL_bases that may be allocated in the selector area is one. The character string shall end with "/".
URL_extension_count	It is fixed to 0. (URL extension is not used)
Selector Area (When protocol_id = 0x0005)	
URL_base_byte	The number of URL_bases that may be allocated in the selector area is one. base_url is omitted and base_directory_path described in DDMT is described in it.
URL_extension_count	It is fixed to 0. (URL extension is not used)

4) MH-simple application location descriptor

Only one this descriptor should be allocated in the MH-AIT application descriptor loop.

Table 6-12 shows the operational details of MH-simple application location descriptor.

Table 6-12 Operations of MH-Simple application location descriptor

Field	Operation
initial_path_byte	When protocol_id = 0x0003 (HTTP / HTTPS transmission) in the MH-transmission protocol descriptor, the rest of the URL of the application entry file, excluding the URL_base_byte character string in the MH-transmission protocol descriptor, is described. When protocol_id = 0x0005 (MMT non-timed transmission) in the MH-transmission protocol descriptor, the directory_node_path of DDMT, the file_name described in the index item, and the string concatenated with the query string if necessary are described.

5) MH-application boundary and permission descriptor

This descriptor should be allocated in one or more in the application descriptor loop of MH-AIT. The maximum number of MH-application boundary authority setting descriptors to be allocated in each application descriptor loop is two.

Table 6-13 shows the operational details of the MH-application boundary and permisson descriptor.

Table 6-13 Operations of MH-Application Boundary and permisson descriptor

Field	Operation
permission_bitmap_count	It is fixed to 1.
permission_bitmap	See 10.7.1.
managed_URL_count	It is operated according to the standard. The maximum value to be specified is 10.
managed_URL_length	The maximum is 255.
managed_URL_byte	The range of URLs of applications transmitted by broadcasting is not specified.

6) MH-external application control descriptor

This descriptor is not operated.

7) MH-Playback application descriptor

This descriptor is not operated.

8) MH-simple playback application location descriptor

This descriptor is not operated.

9) MH-application expiration descriptor

This descriptor is not operated.

6.2.3.2 Operation of AIT of XML format

AIT of XML format is applied as application control information transmitted via communication in the application transition after once executed based on MH-AIT in data content service.

1) Structure and operation of AIT of XML format

Table 6-14 shows the structure of AIT of XML format. Table 6-15 shows the definition and operation of AIT of XML format.

Table 6-14 Structure of AIT of XML format transmitted via Communication

Element / Attribute Name	Number of appearances (B60)	Number of appearances (Operation)	Limit of number of characters Limit of value
isdb2:ServiceDiscovery	1	1	
isdb2:ApplicationDiscovery	1..∞	1	
@DomainName	1	1	It is described by a character string of up to 255 characters.
@Version	0..1	0	
isdb2:ApplicationList	0..∞	1	
isdb2:Application	1..∞	1	
isdb2:applicationIdentifier	1	1	
isdb2:orgId	1	1	A 16-bit long unsigned integer is described numerically.
isdb2:appId	1	1	A 32-bit long unsigned integer is described numerically.
isdb2:applicationDescriptor	1	1	
isdb2:type	1	1	
isdb2:Isdb2App	1	1	It is operated with a fixed value of "ARIB-HTML5".
isdb2:controlCode	1	1	It is operated with a fixed value of "AUTOSTART".
isdb2:visibility	0..1	0	
isdb2:serviceBound	0..1	0	
isdb2:priority	1	1	An 8-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.) It is operated with a fixed value of "FF".
isdb2:version	1	1	An 8-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.)
isdb2:mhpVersion	0..1	1	
mhp:profile	1	1	A 16-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.)

Element / Attribute Name	Number of appearances (B60)	Number of appearances (Operation)	Limit of number of characters Limit of value
mhp:versionMajor	1	1	An 8-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.)
mhp:versionMinor	1	1	An 8-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.)
mhp:versionMicro	1	1	An 8-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.)
isdb2:icon	0..1	0	
@filename	1	-	
@size	0..1	-	
@aspectRatio	0..1	-	
isdb2:storageCapabilities	0..1	0	
isdb2:applicationTransport	1..∞	1	
@xsi:type	1	1	It is operated with a fixed value of "isdb2:HTTPTransportType".
isdb2:URLBase	1	1	It is described by a character string of up to 255 characters. This string always ends with "/".
isdb2:URLExtension	0..∞	0	
isdb2:applicationLocation	1	1	It is described by a character string of up to 255 characters.
isdb2:autostartPriorityDescriptor	0..1	0	
@autostartPriority	1	-	
isdb2:cacheControlInfoDescriptor	0..1	0	
@isdb2: applicationSize	1	-	
@isdb2:cachePriority	1	-	
@isdb2: packageFlag	1	-	
@isdb2: applicationVersion	1	-	
@isdb2: expireDate	1	-	
isdb2:randomizeLatencyDescriptor	0..1	0	
@isdb2: range	1	-	

Element / Attribute Name	Number of appearances (B60)	Number of appearances (Operation)	Limit of number of characters Limit of value
@isdb2: rate	1	-	
@isdb2:randomaizationEndTime	0..1	-	
isdb2:applicationBoundaryAndPermissionDescriptor	0..1	1	
isdb2:boundaryAndPermission	1..∞	1..2	
isdb2:permissionBitmap	1..∞	1	A 16-bit long unsigned integer of this element is described as a hexadecimal string without "0x". (It is not case sensitive.)
isdb2:managedURL	0..∞	0..10	It is described by a character string of up to 255 characters.
isdb2:applicationExpirationDescriptor	0..1	0	
isdb2:boundaryAndPermission	1..∞	-	
isdb2:permissionBitmap	1..∞	-	
isdb2:managedURL	0..∞	-	
isdb2:ApplicationOnPlayback	0..∞	0	
isdb2:applicationIdentifier	1	-	Same structure as the elements in "isdb2: Application"
isdb2:applicationDescriptor	1	-	Same structure as the elements in "isdb2: Application"
isdb2:applicationTransport	1..∞	-	Same structure as the elements in "isdb2: Application"
isdb2:applicationLocation	1	-	Same structure as the elements in "isdb2: Application"
isdb2:autostartPriorityDescriptor	0..1	-	Same structure as the elements in "isdb2: Application"
isdb2:cacheControlInfoDescriptor	0..1	-	Same structure as the elements in "isdb2: Application"
isdb2:randomizeLatencyDescriptor	0..1	-	Same structure as the elements in "isdb2: Application"

Element / Attribute Name	Number of appearances (B60)	Number of appearances (Operation)	Limit of number of characters Limit of value
isdb2:applicationBoundaryAndPermissionDescriptor	0..1	-	Same structure as the elements in "isdb2: Application"
isdb2:applicationExpirationDescriptor	0..1	-	Same structure as the elements in "isdb2: Application"
isdb2:ExternalApplicationControlDescriptor	0..1	0	
isdb2:externalApplication	0..∞	-	
isdb2:targetApplicationClass	1	-	
isdb2:targetApplicationIdentifier	1	-	
@isdb2:orgId	1	-	
@isdb2:appId	1	-	
isdb2:permissionBitmap	0..∞	-	
isdb2:overLayControl	1	-	
@isdb2:overLayAdmissionPolarity	1	-	
isdb2:overLayControlledArea	0..∞	-	
isdb2:overlayControlledAreaTag	1	-	
isdb2:horizontalPos	1	-	
isdb2:verticalPos	1	-	
isdb2:horizontalSize	1	-	
isdb2:verticalSize	1	-	
isdb2:blockedApplicationIdentifier	0..∞	-	
@isdb2:orgId	1	-	
@isdb2:appId	1	-	

Table 6-15 Definition and Operation of AIT of XML format transmitted via Communication

Name	Definition / Operation
isdb2:ServiceDiscovery	
isdb2:ApplicationDiscovery	
@DomainName	It is operated according to the standard. However, a receiver should not use this value.
isdb2:ApplicationList	
isdb2:Application	Application information
isdb2:applicationIdentifier	Application identifier information
isdb2:orgId	Organization Identification: It indicates the organization that created the application. This

	identification specifies a number that is uniquely assigned worldwide. For the operation of the value, the value assigned to each broadcaster is used for the organization_id specified in ARIB TR-B39 Part 1 Volume 7 Section 8.3.7. In addition, it is possible to use the organization_id for orgId. The organization_id is assigned to each broadcaster for HTML5 applications specified in ARIB TR-B14 Volume 3 [Section 2] Chapter 8, ARIB TR-B15 Part 1 Volume 3 Section 8.20, and ARIB TR-B15 Part 2 Volume 3 Section 8.18.
isdb2:appId	Application Identification: It indicates a number that identifies the application. It is uniquely given within the organization identification.
isdb2:applicationDescriptor	
isdb2:type	
isdb2:Isdb2App	Application Format: It indicates format of the application controlled by AIT. It is operated with a fixed value of "ARIB-HTML5".
isdb2:controlCode	Application control code: It indicates the control code that controls the state of the application. In transmission via communication, it is operated with a fixed value of "AUTOSTART".
isdb2:priority	Application Priority: It indicates the relative priority between applications when multiple applications are running. It is operated with a fixed value of "FF".
isdb2:version	No value is specified. The receiver should ignore this value correctly.
isdb2:mhpVersion	
mhp:profile	Application Profile: It shows the application profile of a receiver on which this application may be executed. The profile value is 0x0010.
mhp:versionMajor	Major version: It indicates the major version of the above profile. Fixed to "1".
mhp:versionMinor	Minor version: It indicates a minor version of the above profile. Fixed to "1".
mhp:versionMicro	Micro version: It indicates a micro version of the above profile. Fixed to "1".
isdb2:applicationTransport	It describes the protocol information that carries the application.
@xsi:type	Protocol identification: It indicates the protocol that carries the application. In transmission via communication, it is operated with a fixed value of "isdb2: HTTPTransportType".
isdb2:URLBase	URL base: It is a base string of the URL to get the application.
isdb2:applicationLocation	Application URL: It is a string that indicates the URL of the entry point of the corresponding application. The relative URL from the URLBase of isdb2:applicationTransport is described.

isdb2:applicationBoundaryAndPermissionDescriptor	
isdb2:boundaryAndPermission	
isdb2:permissionBitmap	Access permission bitmap: Whether or not access to each broadcast resource is possible is composed of a bitmap for each function. See 10.7.1 for operations.
isdb2:managedURL	Access authority management area setting information: It indicates a character string of the URL of the access authority management area. When its description is omitted, it indicates that a URL containing an arbitrary location is specified.

2) Character coding system of AIT transmitted via communication

The coded character set of AIT transmitted via communication is Basic Latin in UCS, and the character coding scheme is UTF-8 without signature.

3) Operation of XML declaration and namespace

The operation of XML declaration and namespace that needs to be described in AIT of XML format is shown below.

```
<?xml version="1.0" encoding="UTF-8"?>
<isdb2:ServiceDiscovery
xmlns:isdb2="urn:arib:isdb2:2014"
xmlns:ipi="urn:dvb:metadata:iptv:sdns:2008-1"
xmlns:mhp="urn:dvb:mhp:2009"
xmlns:tva="urn:tva:metadata:2005"
xmlns:mpeg7="urn:tva:mpeg7:2005"
xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
xsi:schemaLocation="urn:arib:isdb2:2014 isdb2_xmlait.xsd">
```

6.2.3.3 Operation details of application control information

1) Operation of permissionBitmap

See 10.7.1 for permissionBitmap described in MH-application boundary and permission descriptor in MH-AIT and in isdb2:applicationBoundaryAndPermissionDescriptor of AIT of XML format.

6.2.4 Operation of event message

6.2.4.1 Purpose of operating event messages

- An event message (hereinafter referred to as a general event message) is operated by an event message table (EMT) containing an event message descriptor to generate an interrupt event in an application asynchronously or at a specified time and to transmit data with the event at the same time.
- When NPT is used as a time specification in a general event message, or when NPT is used in an application, an event message (hereinafter referred to as NPT reference messages) is operated by an event message table (EMT) containing a UTC-NPT reference descriptor in order to notify a receiver of the association between NPT and UTC. However, the operation of NPT reference messages is optional and will not be operated for the time being.

6.2.4.2 Transmission of event message

Only of the event message descriptors and the UTC-NPT reference descriptor is allocated in the EMT that carries the event message (UTC-NPT reference descriptor is optional).

Event messages may be transmitted in a sequence of up to 10 different packet IDs (up to 8 when the NPT reference message is not used), and these are identified by EMT_tag in the application service descriptor allocated in MPT as messages transmitted by EMT including the viewer participation type corner notification message specified in 6.2.5. Also, the related event message is specified by EMT_tag in the application. The general event message and the NPT reference message shall be transmitted with different packet IDs referenced by different EMT_tags. The EMT that transmits the event message is transmitted in one section and one MMTP packet.

1) Transmission of general event message

- A general event message is transmitted in a series of up to eight packet IDs in a same service. These are referenced by EMT_tag. However, a general event message that may register the event listener at the same time in a receiver is a general event message corresponding to a maximum of three EMT_tags (three packet IDs).
- Multiple EMTs with the same version_number may be transmitted to prevent the mistake of not receiving the general event message. The transmission interval and the number of transmissions in this case are not specified.
- It is recommended to secure a transmission interval of 100 ms or more between EMTs with the same EMT_tag but different versions_number. It shows the recommended interval between the first transmission of EMT of any version_number and the first transmission of the next EMT of a different version_number, and it does not show EMT transmission interval of adjacent different version_number at the time of update.
- In EMT that transmits general event messages, event_msg_group_id = 1 and data_event_id = 0xF are fixed. Regardless of download_id (data_event_id) value in the DAMT at that time, it is processed as a valid event message. However, it needs to be careful to ensure that the application does not respond to false event messages before and after switching applications.
- For general event messages, only one event message descriptor is allocated in the EMT.

2) Transmission of NPT reference message (Optional)

- The NPT reference message is transmitted in a sequence of up to two packet IDs in the same service. These are referenced by EMT_tag. However, it is the NPT reference message corresponding to one EMT_tag (one packet ID) that may register an event listener at the same time in a receiver.
- In NPT reference messages, only one UTC-NPT descriptor is allocated in EMT.
- In EMT that transmits NPT reference messages, event_msg_group_id = 0xFFF and data_event_id = 0xF are fixed. When transmitting an NPT reference message, the transmission interval shall be 1 second (however, an error of 10% is allowed), and the usual minimum update interval of the NPT reference message shall be 5 seconds.
- Stopping in steps is not used. Therefore, scale is always set to 11 in the UTC-NPT reference descriptor.
- The NPT reference message should be updated only when the NPT is reset and a new NPT is set, and the same NPT reference message is retransmitted while the same NPT is operated.

6.2.4.3 Details of EMT operation

1) EMT

Table 6-16 shows the details of EMT operation. See 6.2.5.3 for EMT operation in viewer participation type corner notification messages.

Table 6-15 Details of EMT Operation

Field	Operation
section_length	The maximum value is 1051.
data_event_id	It is fixed to 0xF.
event_msg_group_id	For general event messages, it is fixed to 0x001. For NPT reference messages, it is fixed to 0xFFF.
section_number	Since EMT is to be stored in one section, this value is fixed to 0.
last_section_number	Since EMT is to be stored in one section, this value is fixed to 0.

2) Event message descriptor

Table 6-17 shows the details of operation of event message descriptors.

Table 6-17 Details of Operation of Event Message Descriptor

Field	Operation
event_msg_group_id	It is fixed to 1.
time_mode	Either "0x00: Immediate firing" or "0x02: Firing according to NPT time" is specified.
event_msg_NPT	Operated according to the standard.
event_msg_type	It is fixed to 1.
event_msg_id	Operated according to the standard.
private_data	The maximum is 1024 bytes.

3) UTC-NPT reference descriptor (Optional)

Table 6-18 shows the details of operation of the UTC-NPT reference descriptor.

Table 6-18 Details of Operation of UTC-NPT Reference Descriptor

Field	Operation
UTC_Reference	Operated according to the standard. The format shall be NTP length format.
NPT_Reference	Operated according to the standard. The format shall be NTP length format.
UTC_NPT_leap_indicator	Operated according to the standard.
scale	It is fixed to 11.

6.2.5 Operation of viewer participation type corner notification message

6.2.5.1 Purpose and operation of viewer participation type corner notification message

When performing viewer participation type data content service such as games and viewer voting as a corner in a broadcasting program, it is assumed that the application cannot be operated with a remote control, etc. depending on the operating state of a receive even though the broadcasting service is presented.

This message may be transmitted and operated when the content service is performed in order to enable a receiver to know that the viewer participation type data content service is being performed and to realize the function to easily operate the application according to a viewer' choice. The expected behavior of the receiver for this event message is described in Appendix 1.

The application creator should be aware that an interrupt event does not occur to the application even if this event message is received.

6.2.5.2 Transmission of viewer participation type corner notification message

The viewer participation type corner notification message is transmitted by EMT fixed at event_msg_group_id = 0xF00. No descriptor is allocated in the EMT that transmits this message.

It is possible to transmit one EMT of viewer participation type corner notification message per service. The value of EMT_tag in the application service descriptor is fixed at 0xFF.

EMTs of different versions may notify different viewer participation type corners.

Viewer participation type corner notification messages may be transmitted multiple times to prevent missing reception of the messages. The transmission interval and the number of transmissions are not specified in this case.

It is recommended to secure a transmission interval of 100 ms or more for the same EMT in consideration of missing reception by a receiver. This shows the recommended interval between the transmission of the first EMT of any version and the transmission of the next EMT of the same version and does not indicate the transmission interval of adjacent EMTs of different versions at the time of update. The EMT that transmits the viewer participation type corner notification message is transmitted in one section and one MMTP packet.

6.2.5.3 Operational details of EMT used in viewer participation type corner notification message

Table 6-19 shows the operational details of EMT used in viewer participation type corner notification messages.

Table 6-19 Operation of EMT used in Viewer Participation Type Corner Notification Message

Field	Operation
section_length	It is fixed to 9.
data_event_id	It is fixed to 0xF.
event_msg_group_id	It is fixed to 0xF00.
section_number	It is fixed to 0.
last_section_number	It is fixed to 0.

6.2.6 Details of MMT-SI packet transmission related to data transmission

MMT-SI (data transmission message, MH-AIT, EMT) related to data transmission is transmitted in the range of 4KB ± 100% in units of 32 milliseconds for each packet ID.

Table 6-20 shows the operational details of MMTP packets of MMT-SI related to data transmission. The extension headers are arranged in ascending order of type values.

For the operation of the multi-type header extension in DAMT, the multi-type header extension is not specified, or when it is specified, scramble-related information, download identification information and file fragmentation transmission information shall be specified in combination.

For the operation of the multi-type header extension in DDMT, the multi-type header extension is not specified, or when it is specified, scramble-related information and file fragmentation transmission information shall be specified in combination.

For the operation of the multi-type header extension in MH-AIT, the multi-type header extension is not specified, or when it is specified, scramble-related information and file fragmentation transmission information shall be specified in combination.

For the operation of the multi-type header extension in EMT, the multi-type header extension is not specified.

Table 6-20 Operation of MMTP Packet

Field	Operation
version	It is fixed to 00.
packet_counter_flag	See Volume 7, 5.5.2.1.
FEC_type	See Volume 7, 5.5.2.1.
extension_flag	See Volume 7, 5.5.2.1.
RAP_flag	It is always set to 0.
payload_type	It is set to 0x02.
packet_id	Operated according to the standard.
timestamp	See Volume 7, 5.5.2.1.
packet_sequence_number	See Volume 7, 5.5.2.1.
packet_counter	See Volume 7, 5.5.2.1.
Extension header　Multi-type header extension containing scramble-related information	
hdr_ext_type	0x0001: Specify scramble-related information.
For the operation of each item in this extension header, refer to Volume 5, 4.5.10.	
Extended header　Multi-type header extension with download identification information	
hdr_ext_type	0x0002: Specify the download identification information.
download_id	Operated according to the standard.
Extended header　Multi-type header extension including file fragmentation transmission information	
hdr_ext_type	0x0003: Specify the file division transmission information.
item_fragment_number	Operated according to the standard.
last_item_fragment_number	Operated according to the standard.

6.3 Operation of application data transmission

6.3.1 Operation of data component transmission

The total rate of all data components in the service is up to 8 Mbps.

The maximum rate per data component is 4 Mbps.

6.3.2 Operation of MPU transmission

* The maximum size of the MPU is 8 Mbytes. Here, the size of the MPU indicates the sum of the sizes of each item (MFU_data_byte) composing the MPU.
* When retransmitting data with the same content in application data transmission in a data component, MPU shall be the unit of retransmission. Therefore, the retransmission cycle may be changed for each MPU.
* When the same application data is retransmitted in MPU units, the version information of the lower 16 bits of MPU_sequence_number shall not be changed, and when the application data is updated in MPU units, the version information shall be changed.
* The upper 16 bits (MPU_id) of MPU_sequence_number shall be set to always be unique for all data components in the service at any time.

6.3.3 Operation of index item

Table 6-21 shows the details of index item operation.

Table 6-21 Operation of Index Item

Field	Operation
num_of_items	It is the number of items excluding index items. The maximum value is 1024.
item_id	Item identification value
item_size	It is the number of bytes in the item. When the size is indefinite, set to 0x00000000. When 0x00000000 is specified for the value, it is necessary to specify 0x00000000 for the original_size value as well.
item_version	When the item data is updated, it basically increases by 1, but even if it increases by 2 or more, there is no problem if this value changes.
file_name_length	It is he number of bytes of the file name. The maximum is 40.
file_name_byte	It is the character string of the file name is described. See the description rules shown in 6.1.3.6.
check_sum_flag	It is operated according to the standard.
item_checksum	It is operated according to the standard.
item_type_length	It is operated according to the standard.
item_type_byte	Specified in 10.4. Schema specifies from the item of “http:” or “https:” among the media types.
compression_type	It indicates the compression format of the item. 0x00: zlib / 0xFF: Uncompressed. The zlib compression format is shown in Appendix 12.
original_size	The number of bytes in the item before compression. When the size is indefinite, it is set to 0x00000000. When 0x00000000 is specified for the value, it is necessary to specify 0x00000000 for the item_size value as well.

6.3.4 Operation of MMTP payload

Table 6-22 shows the operational details of the MMTP payload.

Table 6-22 Operation of MMTP Payload

Field	Operation
payload_length	See Volume 7, 5.5.2.3.
fragment_type	It is fixed to 2.
timed_flag	0: Non-timed.
fragmentation_indicator	See Volume 7, 5.5.2.3.
aggregation_flag	See Volume 7, 5.5.2.3.
fragment_counter	See Volume 7, 5.5.2.3.
MPU_sequence_number	See 6.1.3.3 and Volume 7, 5.5.2.3.
data_unit_length	Operated according to the standard.
item_id	It shall be unique within the service and within the data transmission session.
MFU_data_byte	File data corresponding to item_id is stored.

6.3.5 Operation of MMTP packet

Table 6-23 shows the operational details of MMTP packets. The extension headers are allocated in ascending order of type values.

The extension header of the multi-type header extension containing scramble-related information is always allocated in the data component to be scrambled. In the case of non-scramble, this extension header with the MMT scramble control bit set to 00 is always allocated.

The extended header of the multi-type header extension containing the download identifier is always allocated in the MMTP packet of the data component.

The extended header of the multi-type header extension containing the file fragmentation transmission information is always allocated when dividing the MFU, which is each item of the data component, into multiple MMTP packets. When division is not required, it is always allocated by setting item_fragment_number = 0 and last_item_fragment _number = 0.

Table 6-23 Operation of MMTP Packet

Field	Operation
version	It is fixed to 00.
packet_counter_flag	See Volume 7, 5.5.2.1.
FEC_type	See Volume 7, 5.5.2.1.
extension_flag	Always 1: With header extension.
RAP_flag	Always set to 0.
payload_type	0x00: MPU
packet_id	It is operated according to the standard.
timestamp	See Volume 7, 5.5.2.1.
packet_sequence_number	See Volume 7, 5.5.2.1.
packet_counter	See Volume 7, 5.5.2.1.
Extension header Multi-type header extension containing scramble-related information	
hdr_ext_type	0x0001: Specify scramble-related information
For the operation of each item in this extension header, refer to Volume 5, 4.5.10.	
Extended header Multi-type header extension with download identification information	
hdr_ext_type	0x0002: Specify the download identification information.
download_id	It is operated according to the standard.
Extended header Multi-type header extension with file fragmentation transmission information	
hdr_ext_type	0x0003: Specify the file division transmission information
item_fragment_number	It is operated according to the standard.
last_item_fragment_number	It is operated according to the standard.

Chapter 7: Operations of Monomedia Coding

7.1 Coding of video monomedia

7.1.1 Video coding of the stream presented as video and audio object for broadcasting

For the video coding of the stream presented as video and audio object for broadcasting, the definition in Volume 7, 4.1 shall be followed.

7.1.2 Video coding of the stream presented as the video element

7.1.2.1 Video to be stored and used after broadcasting transmission (optional)

The video that is transmitted for broadcasting by the data transmission method specified in Chapter 6 and is referenced as the video element by the application after being cached in the receiver, basically shall comply with MPEG-DASH format specified in 12.2 and is played using the MSE API. A video stream consists of three items, which are MPD, video segment, and audio segment. Three items shall be included in one MPU, and the total size of the three items shall be 5MB in maximum.

Each item follows the constraints below. To access each item, the name space of 6.1.3.6 is used. The MIME type specified by the container format shall be described in item_type_byte of the index item.

1) Video segment file

The format shall be specified in 12.2.2.2, and the maximum size shall be one segment (one file). However, the format is limited to vertical resolution of 1080 or less, and chroma format is only. 4:2:0.

The MIME type shall be video/X-arib-avc or video/X-arib-hevc.

2) Audio segment file

The format shall be specified in 12.2.2.2, and the maximum size shall be one segment (one file). However, the format is limited to only MPEG-4 AAC with 2 channels or less.

The MIME type shall be audio/X-arib-mpeg4-aac. It shall be noted that MPEG-4 AAC file of 7.2.2.2 is identical to the MIME type, but that the format is different.

3) MPD file

The format shall be specified in 12.2.3. The number of adaptation sets, and the number of re-presentations shall be 1 for video and audio respectively. Also, the number of periods shall be 1.

The MIME type shall be application/dash+xml.

The receiver plays these files by using the MPEG-DASH method specified in 12.2. The segment data referenced from the MPD file shall refer to the segment data cached in the receiver.

7.1.2.2 Video transmitted by broadband betwork

The coding scheme and the container format of the video monomedia transmitted by broadband network shall follow the definitions in Chapter 12.

7.2 Coding of audio monomedia

7.2.1 Audio coding of the stream presented as broadcast video and audio objects

For audio coding of the stream presented as broadcast video and audio objects, the definitions in Volume 7, 4.2 shall be followed.

7.2.2 Coding of the stream presented as audio element

When audio monomedia is presented as the audio element by means of broadband network or MMT application transmission, the definitions of this section shall be followed. When MMT transmission is used, the MIME type specified in the audio format shall be described in the item_type_byte of the index item.

7.2.2.1 MPEG-2 AAC

MPEG-2 AAC format is not operated as audio monomedia of the audio element.

7.2.2.2 MPEG-4 AAC

The definitions of ARIB STD-B62, Volume 1, Part 2, 4.2 shall be followed.

1) Coding parameters

Table 7-1: Coding parameters for MPEG-4 AAC

Sampling frequency	Bit length	Number of channels
48kHz	16 bit	1ch, 2ch

2) Other constraints

The maximum size of an MPEG-4 AAC file shall be 5MB. Also, the MP4 container is not used, and only the encoded data is used as the file.

The MIME type of an MPEG-4 AAC file shall be “audio/X-arib-mpeg4-aac”, and the extension shall be “.aac”.

7.2.2.3 MPEG-4 ALS

The definitions of ARIB STD-B62, Volume 1, Part 2, 4.3 shall be followed.

1) Coding parameters

Table 7-2: Coding parameters for MPEG-4 ALS

Sampling frequency	Bit length	Number of channels
48kHz	24 bit	2ch

2) Other constraints

The maximum size of an MPEG-4 ALS file shall be 5MB. Also, the MP4 container shall not be used, and only the encoded data shall be used as the file.

The MIME type of an MPEG-4 ALS file shall be “audio/X-arib-mpeg4-als”, and the extension shall be “.als”.

The playback function of an MPEG-4 ALS shall be optional. The receivers that do not have the function to play MPEG-4 ALS audio of broadcast service, it shall play MPEG-4 ALS files.

7.2.2.4 PCM (AIFF-C)

The definitions of ARIB STD-B62, Volume 1, Part 2, 4.4 shall be followed.

1) Coding parameters

Table 7-3: Coding parameters for AIFF-C

Sampling frequency	Bit length	Number of channels
48kHz, 24kHz, 12kHz	8bit, 16 bit	1ch, 2ch

2) Other constraints

The maximum size of an AIFF-C file shall be 3MB.

The MIME type of an AIFF-C file shall be "audio/X-arib-aiff", and the extension shall be ".aiff".

Private_chunk (chunks other than Format_Version_Chunk, Extended_Common_Chunk, and Sound_Data_Chunk) should not be supported.

Repeated playback using the loop attribute shall be supported, but seamless playback shall not be supported in that case.

7.2.2.5 MP3

The provisions of ARIB STD-B62, Volume 1, Part 2, 4.5 shall be followed.

1) Coding parameters

Table 7-4: Coding parameters for MP3

Coding method	Sampling frequency	Bit length	Number of channels
MPEG-1 Audio Layer 3	48kHz	16bit	1ch, 2ch
MPEG-2BC	24kHz	16bit	1ch, 2ch

2) Other constraints

The maximum size of an MP3 file shall be 3MB.

The MIME type of the MP3 file shall be "audio/X-arib-mp3", and the extension shall be ".mp3".

7.2.2.6 Receiver built-in sound

The coding scheme of the built-in sound of the receiver shall be AIFF-C and shall comply with the definitions of 7.2.2.4. However, depending on the implementation of the receiver, other coding schemes with equivalent functionality may be used. The built-in sounds of the receiver shall be assigned as shown in Table 7-5.

Table 7-5: Assignment of the built-in sounds of the receiver

0: Quick report chime 1	1: Quick report chime 2	2: Quick report chime 3	3: Quick report chime 4
4: Quick report chime 5	5: Button operation sound 1	6: Button operation sound 2	7: Button operation sound 3
8: Button operation sound 4	9: Button operation sound 5	10: Button operation sound 6	11: Button operation sound 7
12: Button operation sound 8	13: Alert sound	14:	15:

To play the built-in sounds of the receiver, 'audio.X-arib-romsound' for the type of attribute in the source element of the audio tag is specified, and the following URI for src shall be specified.

romsound://<sound_id>

The numbers in Table 7-5 indicate the sound_id in the src in the audio tag.

7.2.3 Audio synthesization in the receiver

7.2.3.1 Mix Balance

When sounds delivered in different encodings are mixed at the receiver, the volume should be mixed at a 1:1 ratio.

7.2.3.2 Simultaneously played back Coding Method

Simultaneous playback of two sounds is allowed only in the combination marked with a circle symbol in Table 7-6. In the following, the term "built-in sound (quick report)" refers to the built-in sound played in the superimposition where automatic display is specified. Whether or not the receiver is capable of simultaneous audio playback shall be determined by the hasCapability method specified in 10.7.11. Also, it shall not play more than or equal to three sounds simultaneously.

- When two sounds other than the main line sound (the sound of the Object element) are specified, the main line sound shall be stopped once and the designated sound shall be played back, but after the playback is finished, the main line sound shall be restarted to play back immediately.
- In case that the playback of audio that cannot be played simultaneously is specified in duplicate, the later specification shall take priority in principle.
- In the case of overlapping between the built-in sound (quick report) and other audio playback, the built-in sound (quick report) shall be given priority. (The built-in sound (quick report) shall be played continuously.)

Table 7-6: Combination of audio coding methods which may play back two sounds simultaneously

	Object element sounds	Video element sounds	MPEG-4 AAC	MPEG-4 ALS	AIFF-C	MP3	Built-in sounds	Built-in sounds (Quick report)
Object element sounds	×	×	×	×	○	○	○	○
Video element sounds	—	×	×	×	○	○	○	○
MPEG-4 AAC	—	—	×	×	○	○	○	○
MPEG-4 ALS	—	—	—	×	○	○	○	○
AIFF-C	—	—	—	—	×	○	○	○
MP3	—	—	—	—	—	×	○	○
Built-in sounds	—	—	—	—	—	—	×	○
Built-in sounds (Quick report)	—	—	—	—	—	—	—	×

7.3 Still image and bitmap image coding

7.3.1 JPEG

The definitions of ARIB STD-B62, Volume 1, Part 2, 3.1 shall be complied.

1) Coding parameters

Data format: may process data in JFIF and Exif formats.

Color space: follows ARIB STD-B24, Volume 1, Part 1, 7.2.

Profiles: support for baseline, extended, and progressive profiles.

2) Other constraints

The presented screen size shall be less than or equal to the viewport size specified in the HTML content.

In the case of progressive format, this technical report does not specify whether the progressive display is performed or not.

Set the MIME type of JPEG files to “image/jpeg” and the extension to “.jpg” or “.jpeg”.

7.3.2 PNG

The definitions of ARIB STD-B62, Volume 1, Part 2, 3.2 shall be complied.

1) Coding parameters

All five types (0, 2, 3, 4, 6) including colortype= with alpha-value should be supported. In the case of colortype=3 (indexed-color), PLTE chunk shall be mandatory.

2) Other constraints

The presented screen size shall be less than or equal to the viewport size specified in the HTML content.

Set the MIME type of PNG files to “image/png” and the extension to “.png”.

7.3.3 MNG

MNG format shall not be operated.

7.3.4 GIF

The definitions of ARIB STD-B62, Volume 1, Part 2, 3.4 shall be complied.

1) Other constraints

Transparent GIFs, animated GIFs, and interlaced GIFs shall be supported. However, this technical report does not specify whether the progressive display of interlaced GIFs is performed or not.

The presented screen size shall be less than or equal to the viewport size specified in the HTML content.

Set the MIME type of GIF files to “image/gif” and the extension to “.gif”.

7.3.5 SVG

The definitions of ARIB STD-B62, Volume 1, Part 2, 3.5 shall be complied.

1) Other constraints

It is operated in the format directly described in HTML with the svg element (tag), or in the format that refers to the external file with the object element. The compression format svgz is not operated.

Set the MIME type of SVG files to “image/ svg+xml” and the extension to “.svg”.

7.4 Character coding

For character coding, UCS shall be used as the coded character set, and UTF-8 shall be used as the character coding scheme. The signature <EF BB BF> that represents UFF-8 is not operated. A scalable font shall be available as a display font built in the receiver.

7.4.1 Character set

The character set specified in ARIB STD-B62, Volume 1, Part 2, 5.2 shall be available. However, it should be noted that the characters shown in Table 7-7 shall not be displayed depending on the receiver. Among the additional symbols specified in ARIB STD-B24, the correspondence of characters for which the corresponding characters are not specified in STD-B62 because they are specified in JIS X0213:2004 is shown in Annex 4.

For UCS combined characters, they are not operated except the glyph selector that constitutes the glyph indicator sequence shown in Section 7.4.4. Also, a supplementary note on UCS combined characters is shown in Appendix 5.

Table 7-7: Characters that shall not be displayed

UCS code value	UCS character name
U+32FF	SQUARE ERA NAME REIWA

7.4.2 Control code

The control code specified in ARIB STD-B62, Volume 1, Part 2, 5.3 shall be available.

7.4.3 External character (Gaiji)

The Gaiji characters by Scalable Vector Graphics (SVG) 1.1 and WOFF File Format 1.0 shall be available.

SVG files shall have a MIME type of "image/svg+xml" and an extension of ".svg". The WOFF file shall have a MIME type of "application/font-woff" and an extension of ".woff".

The character encoding scheme used for SVG and WOFF shall be UTF-8.

7.4.4 Operation of Ideographic Variation Sequence

For the ideographic variation sequence specified in ISO/IEC 10646:2014 section 16.6, Kanji character ideographic indicator sequences in the range shown in Table 7-8, which is a subset of the Moji_Joho IVD collection , shall be used. In addition, there are cases where the base character is used independently without using the variation selector of each variation indicator sequence shown in Table 7-8.

An example of the glyph specified by the ideographic variation sequence shown in Table 7-8 is shown in Appendix 11.

Table 7-8: Operational Ideographic Variation Sequence

Ideographic Variation Sequence
<4103, E0101>
<4103, E0103>
<66D9, E0102>
<66D9, E0103>
<6852, E0102>
<6852, E0104>
<6ADB, E0103>
<6ADB, E0104>
<7947, E0102>
<7947, E0103>
<79AE, E0102>
<79AE, E0103>
<845B, E0102>
<845B, E0103>
<84EC, E0102>
<84EC, E0103>
<8755, E0102>
<8755, E0103>
<89D2, E0102>
<89D2, E0104>
<8FBB, E0102>
<8FBB, E0103>
<912D, E0102>
<912D, E0103>
<9903, E0102>
<9903, E0103>
<9BD6, E0102>
<9BD6, E0103>

<Blank Page>

Chapter 8: Operations of Closed caption Coding

8.1 Scope and definition of service

Ultra high definition television broadcasting using Advanced BS Digital Broadcasting shall provide the following service of closed caption synchronized with video and audio.

8.2 Programming and transmission operations

8.2.1 Constraints on programming and transmission

- Transmission system
  Closed caption is transmitted via broadcasting by the closed caption and superimposition transmission system based on ARIB STD-B60, Chaper 9.
- Organization
  Closed caption is transmitted as independent assets.
- Number of assets
  Maximum number of the assets of closed caption simultaneously transmitted via broadcasting shall be two.
- Asset of the special service
  Maximum number of the assets of closed caption for the special service shall be one.
- Transmission of multiple languages
  One language shall be transmitted by the one asset. The number of languages ransmitted by one broadcasting service shall be up to two, and the language is identified by the additional identification information in the MH-data component descriptor. The languages available for closed caption shall be “Japanese (jpn)” and “English (eng)”. *
  * Closed caption-service that display characters synchronized with video and audio in languages other than Japanese and English is assumed to use data contents.
- Available display mode
  For the closed caption, only “Automatic display when received, Selective display when playback” and “Selective display when received, Selective display when playback” shall be operated. In the case of transmitting multiple languages, the display mode for those languages shall be the same. When transmitted contrary to this, the receiver's behavior shall be optional feature, but automatic display shall take priority.
- Still images
  For the closed caption, the still images monomedia may be used.
- Warning sound
  As the warning sound for closed caption, the built-in sound of the receiver and the audio monomedia may be used.
- MFU
  The MFU contains the information needed to display closed caption. Based on the information described in the MFU, ARIB-TTML documents needed to display closed caption and the external resource files referenced by ARIB-TTML documents are acquired from the MPU.
  up to five MFUs at max may be included in one MPU.
- MH-data component descriptor
  Regarding closed caption transmitted using closed caption and superimposition transmission system, MH-data component descriptor is allocated in the MP table and “0x0020” is assigned as data_component_id. Then, “Additional_Arib_Subtitle_Info()” is stored as the additional identification information of MH-data component descriptor.

・Transmission operation of MH-data component descriptor
Since MH-data component descriptor in the MP table contains the information needed to display closed caption, closed caption contents should not be displayed until MH-data component descriptor is received. When normally transmitting closed caption, they are transmitted at the frequency of the transmission of the MP table, but it may be interrupted by CM, etc.
・Operation of MH-target region descriptor
MH-target region descriptor in the MP table is not used for the closed caption service.
・Clear packet
As the start_mpu_sequence_number of the additional identification information of MH-data component descriptor is not used, it is recommended for the broadcaster to transmit a clear packet at the break of the program so that the closed caption of the previous program are not continuously displayed in the next program. Also, for the erase packet, see 8.11.5.

8.2.2 Transmission methodfor closed caption

Applying the closed caption and superimposition transmission system and transmitting using a synchronous MPU, the timing synchronization shall be achieved. The parameters to be set in the MFU are shown in Table 8-1.

- Setting parameters : See Table 8-1
- Maximum total number of assets to be simultaneously transmitted in low layers and high layers : 2 assets
- Maximum number of languages per 1 asset : 1 language
- MPU configuration unit : Conform to definitions
- MPU maximum size : 500KB
- MPU minimum transmission interval : 500msec
- Maximum asset rate : 512Kbit/s

Table 8-1: MFU Setting parameters

Field	Operation
subtitle_tag	Operated according to the standard.
subtitle_sequence_number	Operated according to the standard.
subsample_number	Operated according to the standard.
last_subsample_number	Operated according to the standard.
data_type	“0000”, “0001”, “0011” and “0110” are operated.
length_extension_flag	Operated according to the standard.
subsample_info_list_flag	Only 0 may be specified.
subsample_i_data_type	Not operated.
subsample_i_data_size	Not operated.
data_byte	Operated according to the standard.

Regarding MPU transmission, the following constraints are set.

- MPU metadata and movie fragment data are not allocated.
- MPU consists of one or more MFUs.
- ARIB-TTML document, and still image file, audio file, and external character file that are the external resource files referenced by ARIB-TTML document are stored as one MFU, respectively.
- the ARIB-TTML document is always allocated in the first MFU in the MPU, .
- The subsample_number of MFU in one MPU is transmitted as the continuous value.

- When there is an external resource file referenced by the ARIB-TTML document, it shall be allocated in the subsequent MFU.
- As the transmission shall be completed by the next MPU transmission, the MPU size shall not exceed the maximum transmittable size determined by the maximum asset rate and the transmission interval between MPUs.

8.2.3 Operation of MP table

8.2.3.1 Operation of Component tag

The component tag value of the closed caption asset is set to a value in the range of 0x0030 to 0x0037. However, the component tag value of the default asset for closed caption shall be 0x0030.

8.2.3.2 Update of MP table

The MP table is updated by adding and deleting asset information at the start and end of the closed caption. However, the closed caption asset information may be allocated even during periods when closed caption is not being transmitted.

8.2.3.3 MH-data component descriptor

The parameters to be set for Additional_Arib_Subtitle_Info() which is additional identification information of MH-data component descriptor are shown in Table 8-2.

Table 8-2: Setting parameter for additional identificatuion information of MH-data component descriptor

Field	Opreration
subtitle_tag	Operated according to the standard.
subtitle_info_version	Operated with fixed value of 0.
start_mpu_sequence_number_flag	Only 0 may be specified.
ISO_639_language_code	Language code that is used. Only “jpn” and “eng” are operated.
type	Only 00 may be specified. (Even if a component tag value other than 00 is specified for an asset in the range of 0x0030 to 0x0037, it is regarded as 00.)
subtitle_format	Only 0000 may be specified.
OPM	Only 01 (Segment mode) may be specified.
TMD	Only 0010 (reference start time for the starting point) and 1111 (without time control) are operated.
DMF	Only 0010 (automatic display when received and selective display when playback) and 1010 (selective display when received and selective display when playback) are operated.
resolution	Only 0000(1920×1080) and 0001(3840×2160) are operated.
compression_type	For the operation of compression, see 8.6.
start_mpu_sequence_number	Not operated.
reference_start_time	This field shall not be set to a time in the future with respect to the sending time. Other than that, it is operated according to the standard.
reference_start_time_leap_indicator	Operated according to the standard.

8.2.3.4 Operation of Multi-type header extension

For the transmission of closed caption data, the extension header of the multi-type header extension of the MMTP packet always allocates information related to scramble . In the case of non-scramble, an extension header with the MMT scramble control bit set to 00 is always allocated.

8.2.4 Transmission operation at hierarchical modulation

8.2.4.1 Closed caption transmission only in the higher layer

When performing hierarchical modulation, sending out closed caption assets only in the higher layer shall be operated. When this operation is performed, the asset group descriptor is not allocated in the MPT. Also, when performing this operation, it should be noted that the closed caption service does not be provided when the receiver is receiving and displaying the lower layer due to C/N degradation and so on.

8.2.4.2 Closed caption transmission only in the lower layer

When performing hierarchical modulation, sending out closed caption assets only in the lawer layer shall be performed. When this operation is performed, the asset group descriptor is always allocated in the MPT, and the selection_level shall be set to 0. When performing this operation, by the combined operation of presentation planes shown in 5.2.2, the closed caption service may be provided by the closed caption assets transmitted in the lower layer even when the receiver is receiving and displaying the higher layer.

8.2.4.3 Closed caption transmission in both higher and lower layers

When performing hierarchical modulation, sending out closed caption assets in both higher and lower layers shall be operated. When this operation is performed, the asset group descriptor is always allocated in the MPT, the same value is specified as group_identification, and the selection_level shall be set to 0 for the higher layer side and 1 for the lower layer side.

8.3 Video Resolution and display format of closed caption

8.3.1 Display format

The available closed caption resolutions shall be “1920×1080” and “3840×2160”, and the display formats shall be horizontal writing and vertical writing, respectively. Also, the combination of video resolution and closed caption resolution in Table 8-3 may be displayed.

Table 8-3: Combination of Video resolution and Display format

Video Resolution	Closed caption Resolution	
1920×1080	1920×1080	
1920×1080	3840×2160	*1
3840×2160	1920×1080	
3840×2160	3840×2160	
7680×4320	3840×2160	

*1: Combination to be operated at hierarchical modulation

When the video resolution id different from the closed caption resolution, the closed caption resolution should be enlarged or reduced to match the video resolution and the display is implemented in principle as shown in Fig. 8-1.

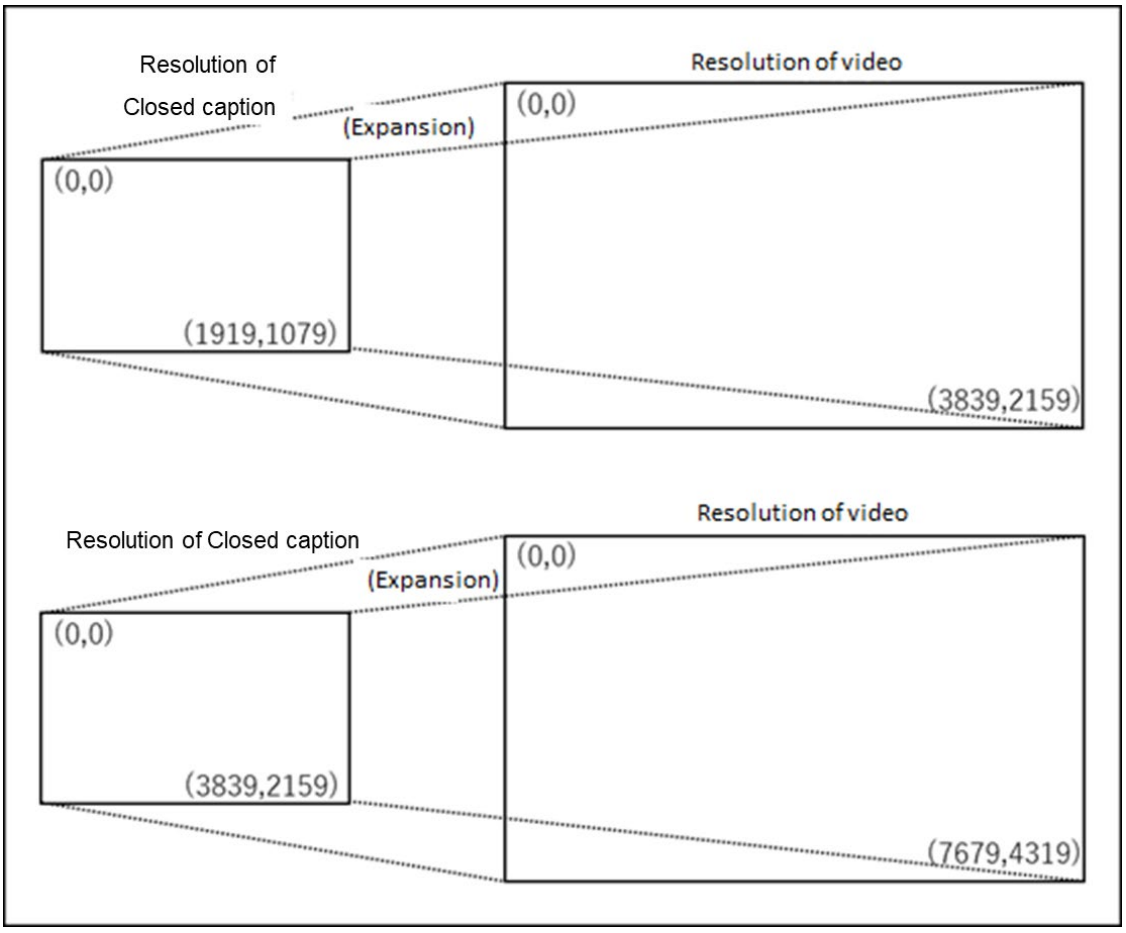

Fig. 8-1: Resolution conversion of Closed caption and Video

8.3.2 Display area

The display area is the area identified by the coordinates from the upper left corner of the closed caption plane. The origin (0, 0) of the coordinate system of the display area is the upper left of the “closed caption plane” regardless of whether the vertical writing or the horizontal writing.

The display area is also valid for the bitmap data. The resolution of the display area is the same as the resolution of closed caption, but in the actual screen display, it shall be enlarged or reduced according to the video resolution.

As for the operation of specifying display position and specifying the display area size in the p element or the span element for displaying characters and the div element for displaying still images, see 8.5.6.3.

The display area shall be the area whose display position and display area size are specified by the p element, the span element, or the origin attribute and the extent attribute that are referenced in the div element.

8.3.2.1 Display area for characters

For specifying the display area of characters, the position designated by tts:origin attribute differs between the horizontal writing direction and the vertical writing direction of characters. The operation for the designation in the horizontal writing mode is shown in Fig. 8-2, and the operation for the designstion in the horizontal writing mode is shown in Fig. 8-3.

The character display zones described in 8.3.4 are allocated in the display area in character order without overlapping each character.

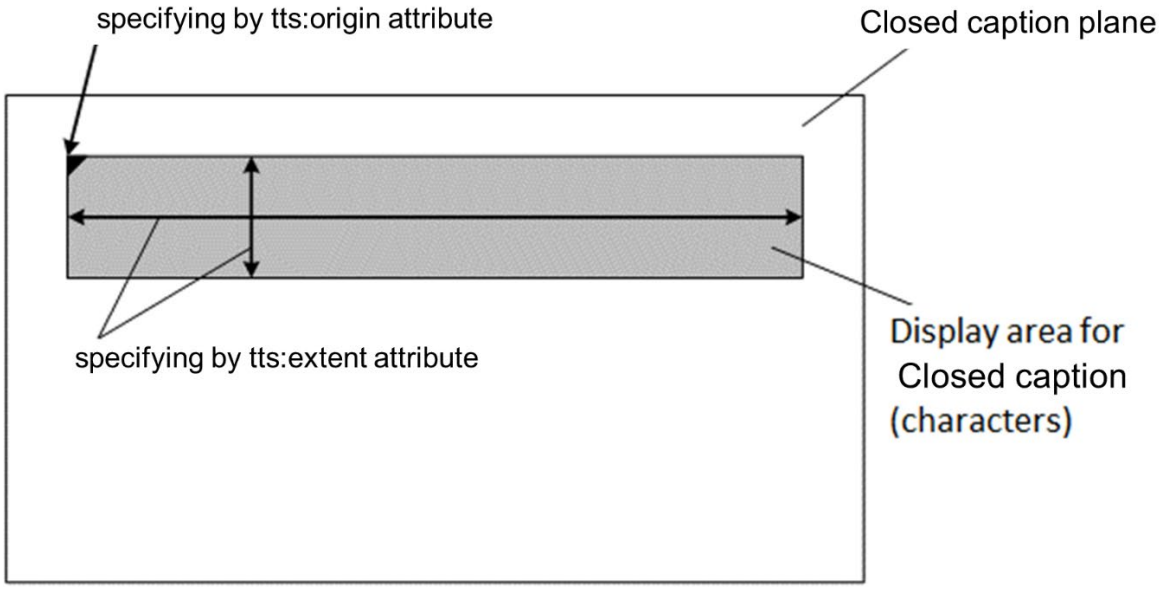

Fig. 8-2: Closed caption plane and Display area for closed caption (characters) in the horizontal writing mode

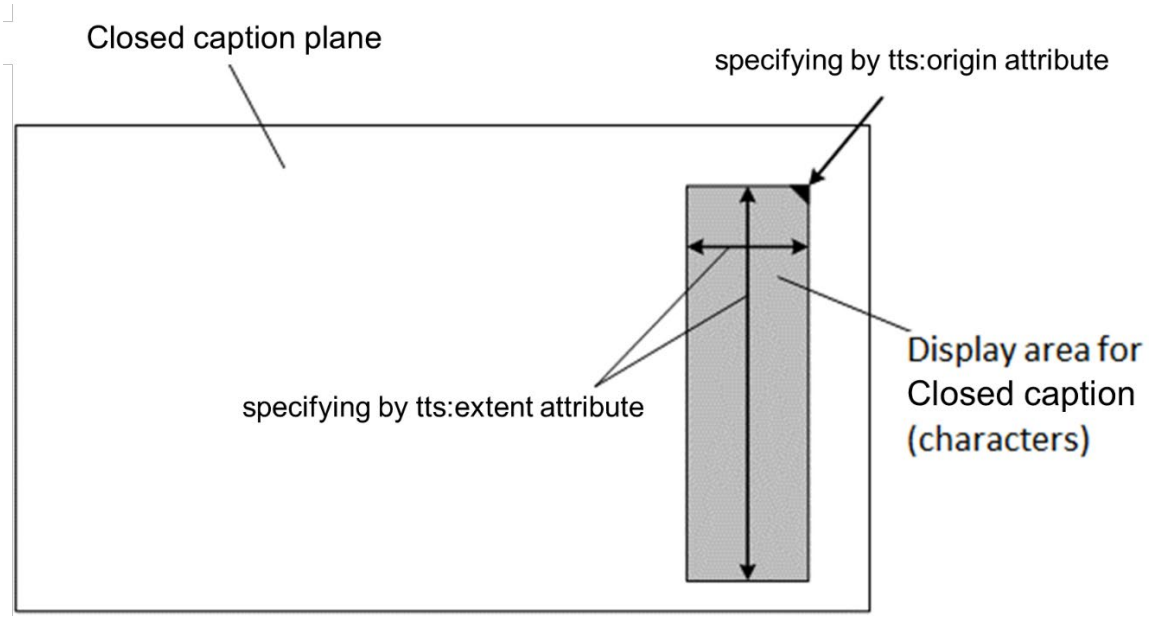

Fig. 8-3: Closed caption plane and Display area for closed caption (characters) in the vertical writing mode

8.3.2.2 Display area for still image

The operation of specifying the display area of a still image is shown in Fig. 8-4. The drawing of still image that exceed the display area shall be optional feature.

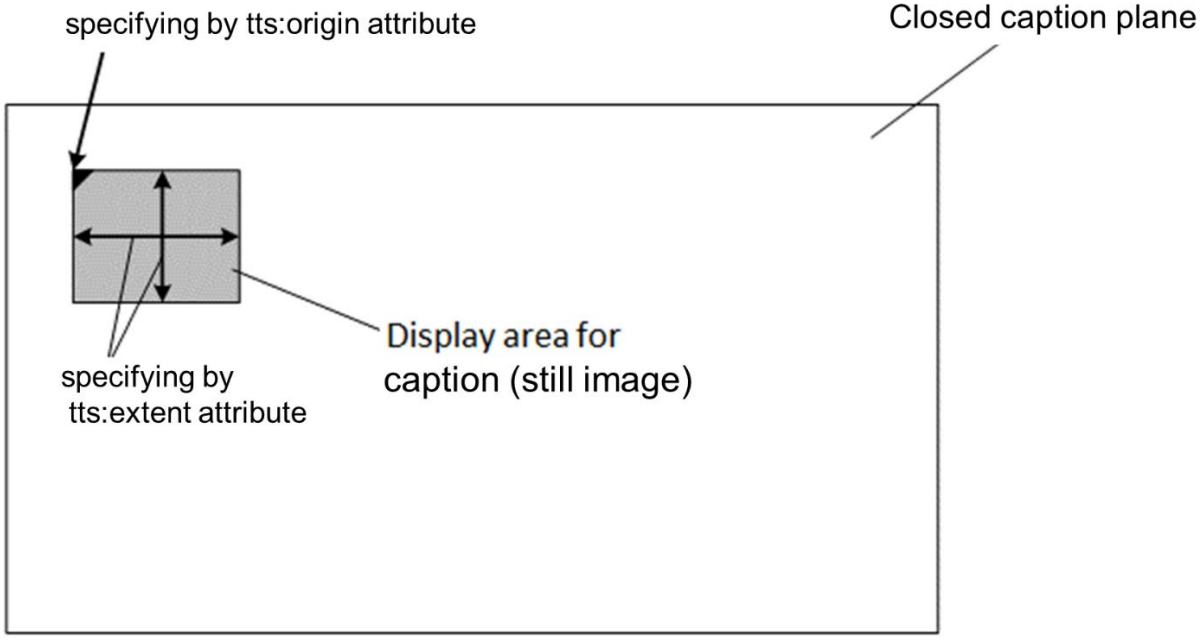

Fig. 8-4: Closed caption plane and Display area for closed caption and caption (still image)

8.3.3 Character operating position

The movement direction of characters in closed caption shall be rightward for horizontal writing and downward for vertical writing. When a line break is made, it should be made downward for horizontal writing and leftward for vertical writing.

8.3.4 Character display zone

The character display zone shall be the area including each character to be displayed in the display area and including the space specified by the lineHeight attribute and the letter-spacing attribute around the character. The definition is shown as follows:

- Character direction size of the display zone
  = character spacing/2 + font size + character spacing/2
- Line direction size of the display zone = Line spacing
  * When the character interval is odd, the value of the character spacing/2 on the front side of the font is truncated in the character direction, and the value of the character spacing of the back side of the font is rounded up in the character direction.

The relationship between the character display zone, the font size, the character spacing (arib-tt:letter-spacing attribute) and line spacing (tts:lineHeight attribute) in horizontal writing mode is shown in Fig. 8-5 and in vertical writing mode is shown in Fig. 8-6 , respectively.

The operating position reference point in the display zone of the first character is the display start position of the display area.

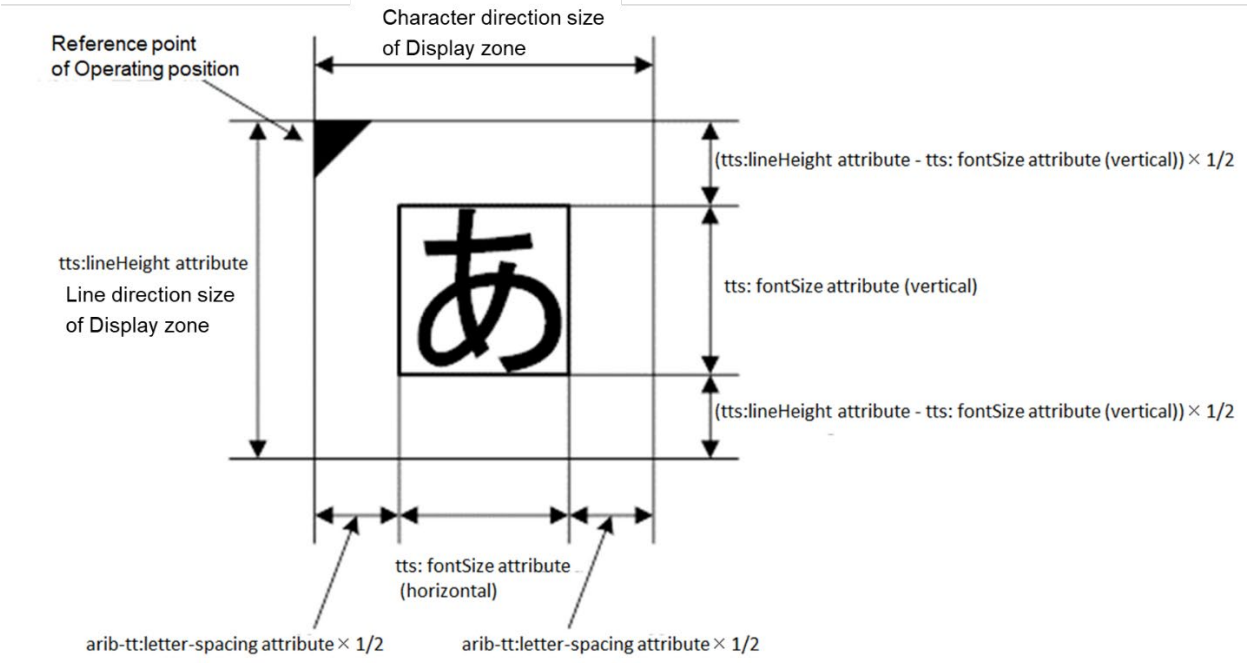

Fig. 8-5: Character display zone and Relationship between font size, character spacing, and line spacing in horizontal writing mode

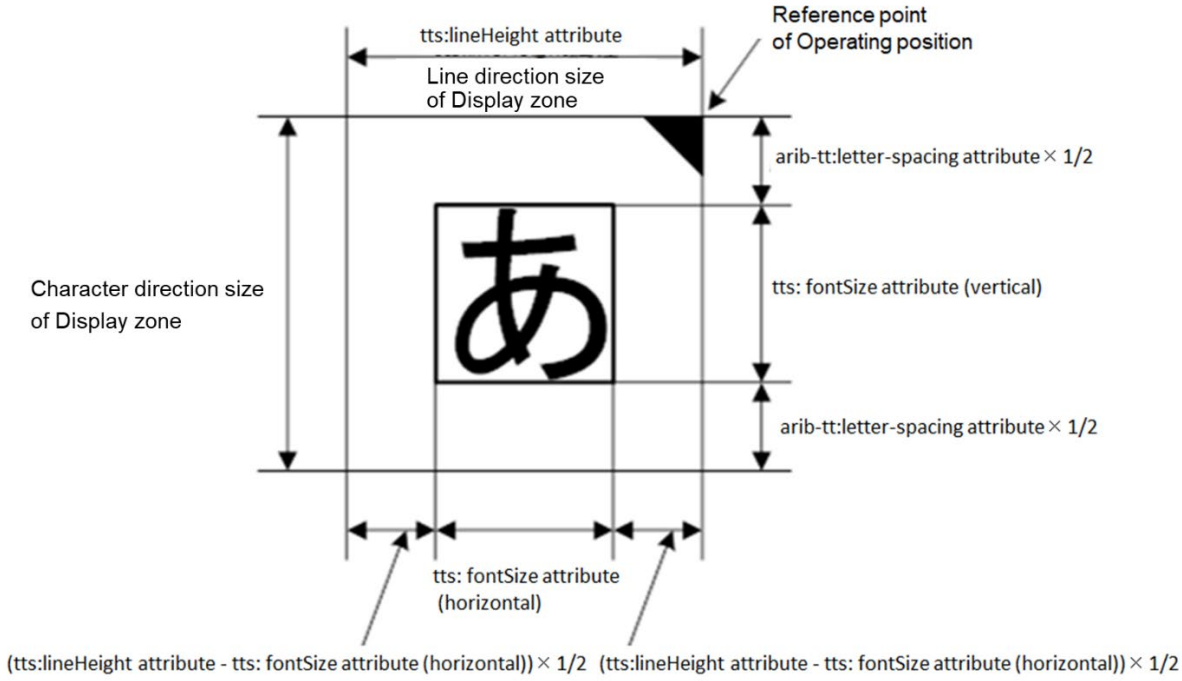

Fig. 8-6: Display zone of Character and Relationship between font size, character spacing, and line spacing in vertical writing mode

8.4 Characters used for closed caption

8.4.1 Character code

UCS is operated as the coded character set used in closed caption, and UTF-8 is operated as the character coding scheme. The code set to be operated is referred to 7.4.

However, the ideographic variation sequence shown in 7.4.4 is not operated. It shall be optional feature whether or not the receiver follows the ideographic variation that the ideographic selector is specified, but it is recommended that malfunctions such as displaying so-called "□ (tofu)" or "garbled characters" do not occur.

8.4.2 Character Font

The character font used in closed caption shall be in accordance with 5.2.7, and when the specification is omitted, round gothic shall be used.

8.4.3 Character Size

The font size that may be used for closed caption is shown as follows:

Minimum character size: 16px

Maximum character size: 144px

8.4.4 Display in vertical writing mode

For the characters shown in Table 8-4, when vertical writing is specified, the characters should be drawn using glyphs suitable for vertical writing as much as possible. The actual glyph to be used is optional feature.

Table 8-4: Characters with different glyphs in vertical display mode

UCS code value	UCS character name
U+2010	HYPHEN
U+2015	HORIZONTAL BAR
U+2016	DOUBLE VERTICAL LINE
U+2025	TWO DOT LEADER
U+2026	HORIZONTAL ELLIPSIS
U+25B6	BLACK RIGHT-POINTING TRIANGLE
U+25C0	BLACK LEFT-POINTING TRIANGLE
U+3001	IDEOGRAPHIC COMMA
U+3002	IDEOGRAPHIC FULL STOP
U+3008	LEFT ANGLE BRACKET
U+3009	RIGHT ANGLE BRACKET
U+300A	LEFT DOUBLE ANGLE BRACKET
U+300B	RIGHT DOUBLE ANGLE BRACKET
U+300C	LEFT CORNER BRACKET
U+300D	RIGHT CORNER BRACKET
U+300E	LEFT WHITE CORNER BRACKET
U+300F	RIGHT WHITE CORNER BRACKET
U+3010	LEFT BLACK LENTICULAR BRACKET
U+3011	RIGHT BLACK LENTICULAR BRACKET
U+3014	LEFT TORTOISE SHELL BRACKET
U+3015	RIGHT TORTOISE SHELL BRACKET
U+3016	LEFT WHITE LENTICULAR BRACKET
U+3017	RIGHT WHITE LENTICULAR BRACKET
U+3018	LEFT WHITE TORTOISE SHELL BRACKET
U+3019	RIGHT WHITE TORTOISE SHELL BRACKET
U+301C	WAVE DASH
U+301D	REVERSED DOUBLE PRIME QUOTATION MARK
U+301F	LOW DOUBLE PRIME QUOTATION MARK
U+3041	HIRAGANA LETTER SMALL A
U+3043	HIRAGANA LETTER SMALL I
U+3045	HIRAGANA LETTER SMALL U
U+3047	HIRAGANA LETTER SMALL E
U+3049	HIRAGANA LETTER SMALL O
U+3063	HIRAGANA LETTER SMALL TU
U+3083	HIRAGANA LETTER SMALL YA
U+3085	HIRAGANA LETTER SMALL YU
U+3087	HIRAGANA LETTER SMALL YO
U+308E	HIRAGANA LETTER SMALL WA
U+3095	HIRAGANA LETTER SMALL KA
U+3096	HIRAGANA LETTER SMALL KE
U+309B	KATAKANA-HIRAGANA VOICED SOUND MARK

UCS code value	UCS character name
U+309C	KATAKANA-HIRAGANA SEMI-VOICED SOUND MARK
U+30A0	KATAKANA-HIRAGANA DOUBLE HYPHEN
U+30A1	KATAKANA LETTER SMALL A
U+30A3	KATAKANA LETTER SMALL I
U+30A5	KATAKANA LETTER SMALL U
U+30A7	KATAKANA LETTER SMALL E
U+30A9	KATAKANA LETTER SMALL O
U+30C3	KATAKANA LETTER SMALL TU
U+30E3	KATAKANA LETTER SMALL YA
U+30E5	KATAKANA LETTER SMALL YU
U+30E7	KATAKANA LETTER SMALL YO
U+30EE	KATAKANA LETTER SMALL WA
U+30F5	KATAKANA LETTER SMALL KA
U+30F6	KATAKANA LETTER SMALL KE
U+30FC	KATAKANA-HIRAGANA PROLONGED SOUND MARK
U+31F0	KATAKANA LETTER SMALL KU
U+31F1	KATAKANA LETTER SMALL SI
U+31F2	KATAKANA LETTER SMALL SU
U+31F3	KATAKANA LETTER SMALL TO
U+31F4	KATAKANA LETTER SMALL NU
U+31F5	KATAKANA LETTER SMALL HA
U+31F6	KATAKANA LETTER SMALL HI
U+31F7	KATAKANA LETTER SMALL HU
U+31F8	KATAKANA LETTER SMALL HE
U+31F9	KATAKANA LETTER SMALL HO
U+31FA	KATAKANA LETTER SMALL MU
U+31FB	KATAKANA LETTER SMALL RA
U+31FC	KATAKANA LETTER SMALL RI
U+31FD	KATAKANA LETTER SMALL RU
U+31FE	KATAKANA LETTER SMALL RE
U+31FF	KATAKANA LETTER SMALL RO
U+32FF	SQUARE ERA NAME REIWA *
U+3303	SQUARE AARU
U+330D	SQUARE KARORII
U+3314	SQUARE KIRO
U+3318	SQUARE GURAMU
U+3322	SQUARE SENTI
U+3323	SQUARE SENTO
U+3326	SQUARE DORU
U+3327	SQUARE TON
U+332B	SQUARE PAASENTO
U+3336	SQUARE HEKUTAARU
U+333B	SQUARE PEEZI
U+3349	SQUARE MIRI
U+334A	SQUARE MIRIBAARU
U+334D	SQUARE MEETORU

UCS code value	UCS character name
U+3351	SQUARE RITTORU
U+3357	SQUARE WATTO
U+337B	SQUARE ERA NAME HEISEI
U+337C	SQUARE ERA NAME SYOUWA
U+337D	SQUARE ERA NAME TAISYOU
U+337E	SQUARE ERA NAME MEIZI
U+FF08	FULLWIDTH LEFT PARENTHESIS
U+FF09	FULLWIDTH RIGHT PARENTHESIS
U+FF1D	FULLWIDTH EQUALS SIGN
U+FF3B	FULLWIDTH LEFT SQUARE BRACKET
U+FF3D	FULLWIDTH RIGHT SQUARE BRACKET
U+FF3F	FULLWIDTH LOW LINE
U+FF5B	FULLWIDTH LEFT CURLY BRACKET
U+FF5C	FULLWIDTH VERTICAL LINE
U+FF5D	FULLWIDTH RIGHT CURLY BRACKET
U+FF5F	FULLWIDTH LEFT WHITE PARENTHESIS
U+FF60	FULLWIDTH RIGHT WHITE PARENTHESIS
U+FFE3	FULLWIDTH MACRON

* Note that some receivers are not able to display these characters.

8.4.5 Number of characters to be displayed

In the normally character size, character spacing, and line spacing shown in Table 8-5, the following number of characters shall be displayed without line breaks. However, it is assumed that the full screen is used as the character display area.

Horizontal writing: Horizontal = 24 characters, Vertical = 9 characters

Vertical writing: Horizontal = 16 characters, Vertical = 11 characters

Table 8-5: Standard character size, character spacing and line spacing

Subtitle resolution	Drawing direction	Character size	Character spacing	Line spacing
1920×1080	Horizontal writing	72px	8px	48px
	Vertical writing	72px	24px	48px
3840×2160	Horizontal writing	144px	16px	96px
	Vertical writing	144px	48px	96px

8.5 Operation of ARIB-TTML

8.5.1 Configuration of ARIB-TTML

For the closed caption service in ultra-high definition television broadcasting using Advanced BS digital broadcasting, the encoded closed caption data by ARIB-TTML format based on ARIB STD-B62 Volume 1, Part 3, Chapter 3 is operated. The overview of configuration about the elements and information to be operated is shown in Fig. 8-7.

XML Schema of ARIB-TTMLis refered to ARIB STD-B62, Volume 1, Part 3, Annex 1.

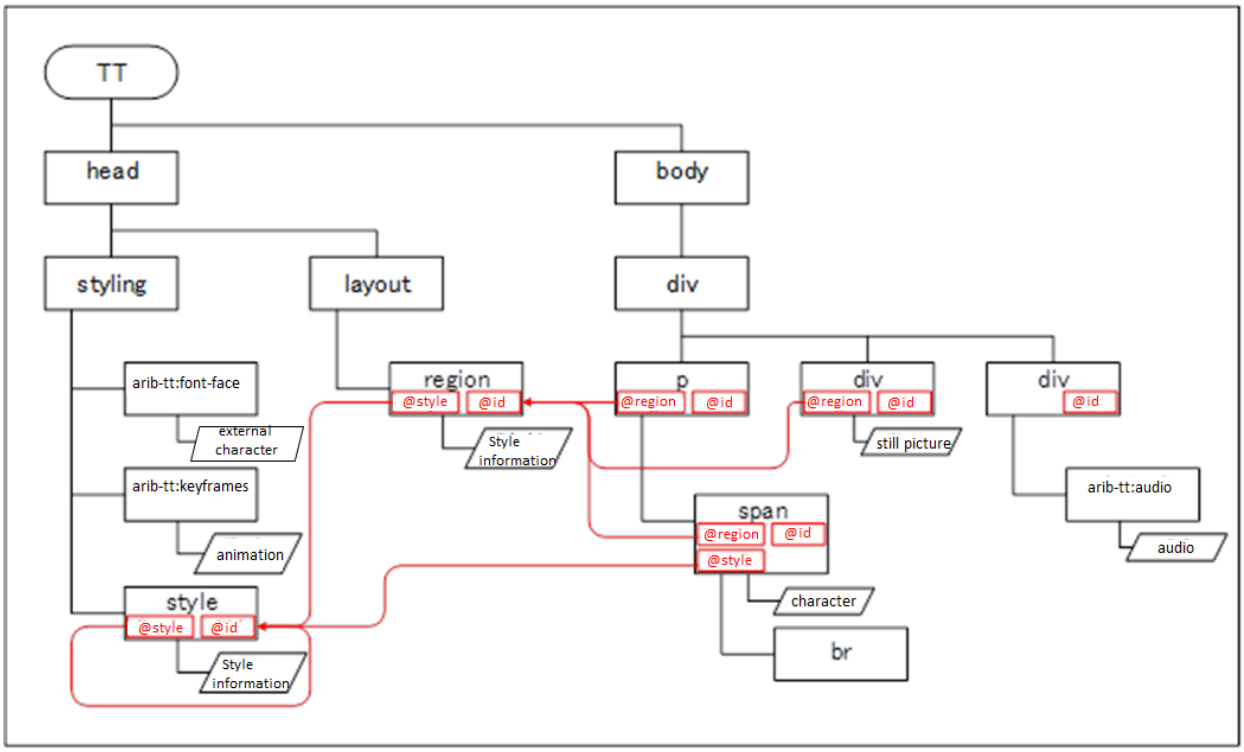

Fig. 8-7: ARIB-TTML Operation Configuration

Also, the term “style information” is used to refer to the general term for information that defines styles related to the display position of character, character decorations, and still image display positions, etc., and the set of attributes that describe the “style information” shall be the “style information attribute group”.

8.5.2 Operation of element and attribute of ARIB-TTML

The information code used for closed caption service is based on ARIB STD-B62, Volume 1, Part 3, 3.3. However, the operational restrictions in Table 8-6 to Table 8-21 are set for each element and attribute.

Table 8-6: Operation of the tt element

Element name			Number of iterations		Description
			STD-B62	Operation	
tt			1	1	
	@xml:id		0..1	×	
	@xml:lang		1	0..1	Not described only in the case of clear packet.
	@xml:space		0..1	×	Not operated. Fixed operation of “default”.
	@ttp:cellResolution		0..1	×	
	@ttp:clockMode		0..1	×	
	@ttp:dropMode		0..1	×	
	@ttp:frameRate		0..1	×	
	@ttp:frameRateMultiplier		0..1	×	
	@ttp:markerMode		0..1	×	
	@ttp:profile		0..1	×	
	@ttp:pixelAspectRatio		0..1	×	
	@ttp:subFrameRate		0..1	×	
	@ttp:tickRate		0..1	×	
	@ttp:timeBase		0..1	×	Not operated. Fixed operation of “media”.
	@tts:extent		0..1	×	
	head		0..1	0..1	Not be described only in the clear packet.
		ttm:agent	0..∞	×	
		ttm:copyright	0..∞	×	
		ttm:desc	0..∞	×	
		ttm:title	0..∞	×	
		metadata	0..∞	×	Not operated. See Table 8-7.
		ttp:profile	0..∞	×	
		styling	0..1	0..1	See Table 8-11.
		layout	0..1	0..1	See Table 8-12.
	body		0..1	0..1	Not be described only in the clear packet.
		@xml:id	0..1	×	
		@xml:lang	0..1	×	

		@xml:space	0..1	×	
		@begin	0..1	×	
		@dur	0..1	×	
		@end	0..1	×	
		@timeContainer	0..1	×	Not operated. Fixed operation of “par”.
		@region	0..1	×	
		@style	0..1	×	
		Style information attribute group	—	×	Not operated. See Table 8-21.
		@agent	0..1	×	
		@role	0..1	×	
		ttm:agent	0..∞	×	
		ttm:copyright	0..∞	×	
		ttm:desc	0..∞	×	
		ttm:title	0..∞	×	
		metadata	0..∞	×	
		set	0..∞	×	Not operated. See Table 8-20.
		div	0..∞	1	Describes display elements such as the character information. See Table 8-14.

Table 8-7: Operation of the metadata element (not operated)

Element name			Number of iterations		Description
			STD-B62	Operation	
metadata					
	@ttm:title		0..1	×	
	@ttm:desc		0..1	×	
	@ttm:copyright		0..1	×	
	@ttm:agent		0..1	×	
	@ttm:name		0..1	×	
	@ttm:actor		0..1	×	
	@xml:id		0..1	×	
	@xml:lang		0..1	×	
	@xml:space		0..1	×	
	@ttm:agent		0..1	×	
	@ttm:role		0..1	×	
	smpte:image		0..∞	×	
		@xml:id	0..1	×	
		@imagetype	1	×	
		@encoding	1	×	
	smpte:data		0..∞	×	
		@xml:id	0..1	×	
		@encoding	1	×	
		@datatype	1	×	
	smpte:information		0..1	×	
		@xml:id	0..1	×	
		@origin	0..1	×	
		@threshold	0..1	×	
		@mode	0..1	×	

Table 8-8: Operation of the styling element

Element name		Number of iterations		Description
		STD-B62	Operation	
styling				
	@xml:id	0..1	×	
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	arib-tt:font-face	0..∞	0..5	Describes the specification of the external character font files. Refeer to Table 8-9.
	arib-tt:keyframes	0..∞	0..99	Describes the specification of the animation definition. See Table 8-10.
	metadata	0..∞	×	
	style	0..∞	0..99	See Table 8-11.

Table 8-9: Operation of the arib-tt:font-face element

Element name			Number of		Description
			STD-B62	Operation	
arib-tt:font-face					
	@font-family		1	1	
	@unicode-range		0..1	1	Specify the character code to assign the external character. Multiple character code may be specified.
	@xml:id		0..1	×	
	arib-tt:src		1..∞	1	
		@url	1	1	Specify the external character file.
		@format	0..1	0..1	Specify the external character file, but may be omitted.
		@id	0..1	×	

Table 8-10: Operation of the arib-tt:keyframes element

Element name			Number of iterations		Description
			STD-B62	Operation	
arib-tt:keyframes					
	@animationName		1	1	
	@xml:id		0..1	×	
	arib-tt:keyframe		2..∞	2..10	
		@position	1	1	
		@tts:backgroundColor	0..1	0..1	
		@tts:color	0..1	0..1	
		@tts:fontSize	0..1	×	
		@tts:extent	0..1	×	
		@tts:opacity	0..1	0..1	
		@tts:origin	0..1	0..1	
		@id	0..1	×	

* For operation, see 8.5.7.

Table 8-11: Operation of the style element

Element name		Number of iterations		Description
		STD-B62	Operation	
style				
	@xml:id	0..1	1	Required for references from other style elements and region elements.
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@style	0..1	0..1	Inherits style information by referring to other style elements.
	style information attribute group	—	0..1	Operates the attribute shown in Table 8-21.

Table 8-12: Operation of the layout element

Element name		Number of iterations		Description
		STD-B62	Operation	
layout				
	@xml:id	0..1	×	
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	metadata	0..∞	×	
	region	0..∞	1..n	See Table 8-13.

Table 8-13: Operation of the region element

Element name		Number of iterations		Description
		STD-B62	Operation	
region				
	@xml:id	0..1	1	Required for reference from the display elements.
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@style	0..1	0..1	Inherits style information by referring to other style elements.
	Style information attribute group	—	0..1	Operates the attribute shown in Table 8-21.
	@begin	0..1	×	
	@dur	0..1	×	
	@end	0..1	×	
	@timeContainer	0..1	×	
	@ttm:role	0..1	×	
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	metadata	0..∞	×	
	set	0..∞	×	
	style	0..∞	×	

Table 8-14: Operation of the div element (under the body element *1)

Element name		Number of iterations		Description
		STD-B62	Operation	
div				
	@xml:id	0..1	×	
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@begin	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@dur	0..1	×	
	@end	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@timeContainer	0..1	×	
	@region	0..1	×	
	@style	0..1	×	
	Style information attribute group	—	×	Not operated. See Table8-21
	@ttm:agent	0..1	×	
	@ttm:role	0..1	×	
	@smpte:backgroundImage	0..1	×	
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	metadata	0..∞	×	
	set	0..∞	×	
	div	0..∞	0..5	See Table 8-15. *2
	p	0..∞	0..10	See Table 8-17. *2
	arib-tt:audio	0..∞	×	

*1 The operation of the div element under the body element differs from that of the div element under the div element.

*2 At least one of the div element and the p element is always operated.

Table 8-15: Operation of the div element (under the div element*1)

Element name		Number of		Description
		STD-B62	Operation	
div				
	@xml:id	0..1	0..1	Not required for closed caption display. It shall be operable when needed to interface with the application.
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@begin	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@dur	0..1	×	
	@end	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@timeContainer	0..1	×	
	@region	0..1	0..1	Links style information.
	@style	0..1	×	
	Style information attribute group	—	×	See Table 8-21.
	@ttm:agent	0..1	×	
	@ttm:role	0..1	×	
	@smpte:backgroundImage	0..1	0..1	*2
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	metadata	0..∞	×	
	set	0..∞	×	
	div	0..∞	×	
	p	0..∞	×	
	arib-tt:audio	0..∞	0..1	See Table 8-16. *2

*1 Used only for specifying still image and audio monomedia.

*2 Either the arib-tt:audio element or the smpte:backgroundImage attribute is always operated.

Table 8-16: Operation of the arib-tt:audio element

Element name		Number of iterations		Description
		STD-B62	Operation	
arib-tt:audio				
	@src	1	1	
	@loop	0..1	0..1	
	@xml:id	0..1	×	

Table 8-17: Operation of the p element

Element name		Number of iterations		Description
		STD-B62	Operation	
p				
	@xml:id	0..1	0..1	Not required for closed caption display.Operated when needed to interface with the application.
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@begin	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@dur	0..1	×	
	@end	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@timeContainer	0..1	×	
	@region	0..1	0..1	Links style information.
	@style	0..1	×	
	Style information attribute group	—	×	See Table 8-21.
	@ttm:agent	0..1	×	
	@ttm:role	0..1	×	
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	metadata	0..∞	×	
	set	0..∞	×	
	br	0..∞	×	
	span	0..∞	1..99	See Table 8-18.
	arib-tt:audio	0..∞	×	See Table 8-16.

Table 8-18: Operation of the span element

Element name		Number of iterations		Description
		STD-B62	Operation	
span				
	@xml:id	0..1	0..1	Not required for closed caption display. Operated when needed to interface with the application.
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@begin	0..1	0..1	Specifies the time in hh (hour): mm (minute): ss (second).fff (millisecond).
	@dur	0..1	×	
	@end	0..1	0..1	Specifies the time in hh (hours): mm (minute): ss (second).fff (millisecond).
	@timeContainer	0..1	×	
	@region	0..1	0..1	Links style information.
	@style	0..1	0..1	Links style information.
	Style information attribute group	—	×	See Table 8-21.
	@ttm:agent	0..1	×	
	@ttm:role	0..1	×	
	ttm:agent	0..∞	×	
	ttm:copyright	0..∞	×	
	ttm:desc	0..∞	×	
	ttm:title	0..∞	×	
	metadata	0..∞	×	
	set	0..∞	×	
	br	0..∞	0..99	See Table 8-19.
	span	0..∞	×	

Table 8-19: Operation of the br element

Element name		Number of iterations		Description
		STD-B62	Operation	
br				
	@style	0..1	×	
	@timeContainer	0..1	×	
	@xml:id	0..1	×	
	@xml:lang	0..1	×	
	@xml:space	0..1	×	

Table 8-20: Operation of the set element

Element name		Number of iterations		Description
		STD-B62	Operation	
set				Not operated.
	@begin	0..1	×	
	@dur	0..1	×	
	@end	0..1	×	
	@xml:id	0..1	×	
	@xml:lang	0..1	×	
	@xml:space	0..1	×	
	@tts:backgroundColor	0..1	×	
	@tts:color	0..1	×	
	@tts:direction	0..1	×	
	@tts:display	0..1	×	
	@tts:displayAlign	0..1	×	
	@tts:extent	0..1	×	
	@tts:fontFamily	0..1	×	
	@tts:fontSize	0..1	×	
	@tts:fontStyle	0..1	×	
	@tts:fontWeight	0..1	×	
	@tts:lineHeight	0..1	×	
	@tts:opacity	0..1	×	
	@tts:origin	0..1	×	
	@tts:overflow	0..1	×	
	@tts:padding	0..1	×	
	@tts:showBackground	0..1	×	
	@tts:textAlign	0..1	×	
	@tts:textDecoration	0..1	×	
	@tts:textOutline	0..1	×	
	@tts:unicodeBidi	0..1	×	
	@tts:visibility	0..1	×	
	@tts:wrapOption	0..1	×	
	@tts:writingMode	0..1	×	
	@tts:zIndex	0..1	×	
	metadata	0..∞	×	

Table 8-21: Operation of the Style information attribute group

Element name		Number of iterations		Description
		STD-B62	Operation	
Style information attribute group				
	@tts:backgroundColor	0..1	0..1	
	@tts:color	0..1	0..1	
	@tts:direction	0..1	×	
	@tts:display	0..1	×	
	@tts:displayAlign	0..1	×	
	@tts:extent	0..1	0..1	Uses to specify the region size.
	@tts:fontFamily	0..1	0..1	
	@tts:fontSize	0..1	0..1	
	@tts:fontStyle	0..1	0..1	
	@tts:fontWeight	0..1	0..1	
	@tts:lineHeight	0..1	0..1	
	@tts:opacity	0..1	×	
	@tts:origin	0..1	0..1	Used to specify the display start position of the region.
	@tts:overflow	0..1	×	
	@tts:padding	0..1	×	
	@tts:showBackground	0..1	×	
	@tts:textAlign	0..1	×	
	@tts:textDecoration	0..1	0..1	
	@tts:textOutline	0..1	0..1	
	@tts:unicodeBidi	0..1	×	
	@tts:visibility	0..1	×	
	@tts:wrapOption	0..1	×	
	@tts:writingMode	0..1	0..1	
	@tts:zIndex	0..1	×	
	@arib-tt:animation	0..1	0..1	
	@arib-tt:border	0..1	0..1	
	@arib-tt:border-top	0..1	0..1	
	@arib-tt:border-bottom	0..1	0..1	
	@arib-tt:border-left	0..1	0..1	
	@arib-tt:border-right	0..1	0..1	
	@arib-tt:letter-spacing	0..1	0..1	
	@arib-tt:marquee	0..1	×	
	@arib-tt:ruby	0..1	0..1	
	@arib-tt:text-shadow	0..1	0..1	

* The detailed operation of style information attribute group is seen 8.5.5.

8.5.3 XML Declaration and namespace declaration

The XML declaration and the namespace declaration in this operation are shown in Fig. 8-8.

```
<?xml version="1.0" encoding="utf-8"?>
<tt xml:lang="ja"
xmlns="http://www.w3.org/ns/ttml"
xmlns:ttm="http://www.w3.org/ns/ttml#metadata"
xmlns:tts="http://www.w3.org/ns/ttml#styling"
xmlns:ttp="http://www.w3.org/ns/ttml#parameter"
xmlns:smpte="http://www.smpte-ra.org/schemas/2052-1/2013/smpte-tt"
xmlns:arib-tt="http://www.arib.or.jp/ns/arib-tt">
```

Fig. 8-8: XML declarations and namespace declarations

Also, for the namespace of SMPTE, it should be noted the following case.

"http://www.smpte-ra.org/schemas/2052-1/2013/smpte-ttml/v1.0"

8.5.4 Operation of elements

The elements of ARIB-TTML transmitted by broadcasting shall be operated as follows

- Either the styling element or the layout element, or both shall be described under the head element.
- The div element may be described both under the body element and under the div element.
- Only one div element shall be described under the body element.
- Multiple p elements for closed caption text shall be described for each display area in the div element under the body element.
- Multiple div elements that are used only for still image and audio monomedia shall be described in the div element under the body element.
- In the div element under the body element, one of the div element and p element shall be described.
- In the div element under the div element, only one of the smpte:backgroundImage attribute for still image monomedia and the arib-tt:audio element for audio monomedia shall be described.
- Under the p element, one or more span elements shall always be described.
- Text information to be displayed as closed caption text shall be described only under the span element.
- Style information related to character decoration shall be described only under the region element, and under the style element.
- Style information related to position (tts:origin attribute, tts:extent attribute) shall be described only under the region element*.
- The style element and the region element shall refer to the style element as the style information related to character decoration.
- The p element shall refer to only the region element as style information.
- The span element shall refer to the style element and the region element as style information.
- The region attribute shall be always described in either the p element or the span element under the p element.
- When a line break occurs in the p element, it may be treated as a blank.
- The div element for still picture shall refer to only the region element as style information, and the referenced region element shall not place any style information other than

position-related style information (tts:origin attribute, tts:extent attribute), and the style element reference shall be also not described.
- In the div element for still image, the region attribute shall be always described.
- In the div element for audio monomedia, the region attribute shall be not described.
- In the styling element, at least one of the arib-tt:font-face element, the arib-tt:keyframes element, and the style element shall be always described.

*However, the tts:origin attribute for the definition of animation should be also placed in the arib-tt:keyframe element.

8.5.5 Operation of style attribute set

Among the attributes of ARIB-TTML, in order to describe the style of characters to be displayed as closed caption, the operation of the style information attribute group is shown as follows:

8.5.5.1 tts:backgroundColor attribute

Use: Specify the background color
Specified value: <color>
Initial value: #00000000
Description example: tts:backgroundColor= “#ffffffff”
Description: See 8.5.6.4 for the operation of the color description format.
The background color is drawn for the charactert display zone.

8.5.5.2 tts: color attribute

Use: Specify the character color
Specified value: <color>
Initial value: #ffffffff
Description example: tts:color= “#ffffffff”
Description: See 8.5.6.4 for the operation of the color description format.

8.5.5.3 tts: extent attribute

Use: Specify the size (horizontal, vertical) of the display zone for characters and still images.
Specified value: <length> <length>
Initial value: none
Description example: tts:extent= “7680px 4320px”
Description: Operated only under the region element and shall be described. The first “<length>” specifies the horizontal size of the drawing area, and the second “<length>” describes the verticall size of the drawing area in pixels. “auto” is not used.
For characters, see 8.3.2.1. For still images, see 8.3.2.2.

8.5.5.4 tts: fontFamily attribute

Use: Specify the character font to use
Specified value: <genericFamilyName>
Initial value: round gothic
Description example: tts:fontFamily= “round gothic”

8.5.5.5 tts: fontSize attribute

Use: Specify the character size
Specified value: <length> <length>?
Initial value: none
Description example: tts: fontSize= “64px 64px”
Description: Always specify in order to display characters.
The first “<length>” specifies the horizontal font size, and the second “<length>” specifies the vertical font size in pixels.
If the second “<length>” is omitted, the vertical font size shall be the same as the horizontal size.
In the notation of “<length>”, the “%” unit is not used.

8.5.5.6 tts: fontStyle attribute

Use: Specify Italic
Specified value: normal | italic
Initial value: normal
Description example: tts: fontStyle= “italic”
Description: Specify “italic” to draw characters in italics. “oblique” is not used.

8.5.5.7 tts: fontWeight attribute

Use: Speify Bold
Specified value: normal | bold
Initial value: normal
Description example: tts: fontWeight= “bold”
Description: Specify “bold” to draw characters in bold.

8.5.5.8 tts: lineHeight attribute

Use: Specify the line spacing
Specified value: normal | <length>
Initial value: normal
Description example: tts:lineHeight = “64px”
Description: Specify the line spacing of the characters to be displayed in pixels. Shall not specify a negative value for the line spacing.

8.5.5.9 tts:origin attribute

Use: Specify the display start position of the character and still image display area, and the operation position reference point of the character display zone of the first character.
Specified value: <length> <length>
Initial value: none
Description example: tts:origin= “64px 128px”
Description: Always specify in order to display characters or still images.
The first “<length>” specifies the horizontal display position and the second “<length>” specifies the vertical display position in pixels.
“auto” is not used. Also, in the notation of “<length>”, the “%” unit is not used.
For characters, as shown in 8.3.2.1, the upper left coordinate of the display area for horizontal writing is specified, and the upper right coordinate of the display area for vertical writing is specified.
Regarding still images, the upper left coordinate of the display area is specified as shown in 8.3.2.2.
For the coordinate value to be specified, the absolute coordinate of the closed caption plane is always specified.

8.5.5.10 tts: textDecoration attribute

Use: Specify the underline.
Specified value: none | underline
Initial value: none
Description example: tts: textDecoration= “underline”
Description: Specify “underline” when drawing an underline on the character.
“noUnderline”, “lineThrough”, “noLineThrough”, “overline”, and “noOverline” are not used.

8.5.5.11 tts:textOutline attribute

Use: Specify the border of characters.
Specified value: none | <color>? <length> <length>?
Initial value: none
Description example: tts: textOutline= “#00ff00ff 2px 0px”
Description: “<color>” specifies the display color of the border. When “<color>” is omitted, the character color is applied.
The second “<length>” specifies the width of the border in pixels, and the third “<length>” specifies the blur width of the border in pixels.

8.5.5.12 tts:writingMode attribute

Use: Specify horizontal writing and vertical writing.
Specified value: lrtb | tbrl
Initial value: lrtb
Description example: tts:writingMode=“tbrl”
Description: “lrtb” specifies horizontal writing.
“tbrl” specifies vertical writing.
“rltb”, “tblr”, “lr”, “rl”, and “tb” are not used.
It shall not be possible to mix horizontal writing and vertical writing within one display area.

8.5.5.13 tts: opacity attribute

Use: Specify the transparency.
Specified value: <alpha>
Initial value: 1.0
Description example: tts: opacity= “0.5”
Description: The value is from “0.0” to “1.0”.
“0.0”: Completely transparent
“1.0”: Completely opaque
Only used in arib-tt:keyframe elements.

8.5.5.14 arib-tt:animation attribute

Use: Specify the animation.
Specified value: <animation-name> <animation-duration> <animation-timing-function> <animation-delay> <animation-iteration-count> <animation-direction>
Initial value: none
Description example: arib-tt:animation="myAnimation1 1000ms linear 0ms 1 normal"
Description: “<animation-name>” specifies the animation name of the animationName attribute value described in the arib-tt:keyframes element, and refers to the animation operation.
“<animation-duration>” specifies the duration time of the animation. The unit to be specified is milliseconds, but when a value less than or equal to the second accuracy is specified, the operation shall be optional feature.
“<animation-timing-function>” specifies the progress rate of the animation. It shall be “linear” and “step-end” that are the specified values, and “ease”, “ease-in”, “ease-out”, “ease-in-out”, “step-start” and “steps” shall not be used.
“<animation-delay>” specifies the delay time between the start time of the animation and the time of the element display. The unit to be specified shall be milliseconds, but the operation when a value less than or equal to the second accuracy is specified shall be optional feature.
“<animation-iteration-count>” specifies the number of iterations when the animation is executed repeatedly. If no repetition is performed, “1” is specified.
“<animation-direction>” specifies the playback direction when performing repeatedly. Only “normal” is operated, and “alternate” shall not be operated.

8.5.5.15 arib-tt:border attribute, arib-tt:border-top attribute, arib-tt:border-bottom attribute,arib-tt:border-left attribute, arib-tt:border-right attribute

Use: Specify character enclosures.
Specified value: <style> <width> <color>
Initial value: none 0px #00000000
Description example: arib-tt:border=”solid 4px #FFFFFF”
Description: Specify “solid” in “<style>” when drawing the character enclosure and specify “none” when not drawing the character enclosure.
“<width>” specifies the width of the character enclosing line in pixels.
“<color>” specifies the display color of the character enclosing line.
The arib:border attribute shall be able to specify on the p element and the span element, and it shall act on the display area and the character display zone.
The arib-tt:border-top attribute, the arib-tt:border-bottom attribute, the arib-tt:border-left attribute, and the arib-tt:border-right attribute shall be able to specify only for the span element, and it shall act on the character display zone.

8.5.5.16 arib-tt:letter-spacing attribute

Use: Specify the character spacing.
Specified value: <length>
Initial value: 0px
Description example: arib-tt:letter-spacing= “0px”
Description: Specify the spacing between characters to be displayed in pixels. It shall not specify a negative value for the character spacing value.

8.5.5.17 arib-tt:marquee attribute

It shal not be operated.

8.5.5.18 arib-tt:ruby attribute

Use: Specify that the character is a furigana.
Specified value: <id>
Initial value: none
Description example: arib-tt:ruby=”c00”
Description: Specify the value of the xml:id attribute of the span element for the character to be treated as a furigana.

8.5.5.19 arib-tt:text-shadow attribute

Use: Specify the shadow of the character
Specified value: <offset_x> <offset_y> <blur-radius> <color>
Initial value: none
Description example: arib-tt:text-shadow=”5px 5px 10px #888888”
Description: Specify the difference of the display position of the shadow with respect to the character to be displayed in pixels by “<offset_x>” and “<offset_y>”.
Specify the width of the shadow blur in pixels by “<blur-radius>”. When the blur is not needed, “0px” is specified.
Specify the color of shadow by “<color>”.

8.5.5.20 tts:overflow attribute

It shall not be operated.

Description: Although the tts:overflow attribute is not used, it shall work as “hidden” is specified and when the displayed content is outside the display area, it is masked and not displayed. Further, it is recommended that the display contents of the child element are masked and not displayed, whose display area is outside the display area of the parent element due to the specification of the display position of the child element and the size of the display area.

8.5.6 Operation of style information

The detailed operation of the information that describes the style of characters to be displayed as the closed caption is shown as follows.

8.5.6.1 Operation of Style information of the body element and the div element directly under the body element

The region attribute is not operated in the body element and the div element directly under the body element, but in order to follow W3C TTML standard, 9.3.2, the region element shown in Fig. 8-9 shall be specified.

```
<region
tts:origin="-0px 0px"
tts:extent="(Resolution specified by the resolution of the additional identitification
            information of the MH-data component descriptor)"
/>
```

Fig. 8-9: region element applied to the body element and the div element directly under the body element

8.5.6.2 Operation of style attribute

The style attribute shall refer to multiple style elements. In the case of referring to multiple style elements, the xml:id attribute of the referenced style element shall be listed and described with a space (blank) as a delimiter.

8.5.6.3 Operation of display position, display area size and character size

Since the origin attribute that specifies the display position, the extent attribute that specifies the display area size, and the fontSize attribute that specifies the character size do not have the initial value when they are not specified, the display position and the display area size shall be always specified in order to display characters and still image monomedia. Also, in order to display characters, the character size shall be always specified.

The operation concerning the specifying the p element and the span element for displaying characters, and the origin attribute, the extent attribute, and the fontSize attribute in the div element for displaying still image monomedia is shown in the following.

- In the p element, or the region element that the span element under the p element refers to, the origin attribute that specifies the display position, and the extent attribute that specifies the display area size shall be always described.
- The operation of the origin attribute and the extent attribute in the region element that the p element and the span element under it refer to is shown in Table 8-22.

Table 8-22: Operation of the origin attribute and the extent attribute in the region element that the p element and the span element refer to

region element that the p element refers to	region element that the span element under the p element described in the left refers to
With a description of the origin and extent attribute.	There is a description of the origin and extent attribute in the region element that is referenced in all span elements. Or there is no description of either the origin attribute or the extent attribute in the region element that is refered in all span elements. Or there is no reference to the region element in all span elements.
Without description of either the origin attribute or the extent attribute.	There is a description of the origin and extent attribute in the region element that is refered in all span elements.
Without reference of the region element.	There is a description of the origin and extent attribute in the region element that is refered in all span elements.

- In the region element that the div element for displaying still image monomedia refers to, the origin attribute which specifies the display position and the extent attribute which specifies the display area size shall be always described.
- When the display position is not specified in the span element, the span element which appears first in the p element is drawn from the display start position of the closed caption display area, and in the second and subsequent cases it is drawn from the right of the last character display zone of the previous drawing in horizontal writing, or from the bottom of the last character display zone of the previous drawing in vertical writing.
- When the origin attribute is described in the region element referenced by the span element under the p element in which the origin attribute is described in the referenced region element, the coordinate value of the display position of the origin attribute described in the region element to which the span element refers shall be the operation position reference point of the first character display zone.
- When characters are drawn outside the display area specified by the p element that is the parent element, by specifying the character display position of the span element, it is recommended that the characters that are outside the display area are masked and not displayed.
- In the style element indirectly referenced through the region element referenced by the p element, or in the style element directly referenced by the span element under the p element, or in the style element indirectly referenced through the region element, the fontSize attribute that specifies the character size shall be always described.
- The operation of the fontSize attribute in the style element which is directly or indirectly referenced by the p element and its underlying span element is shown in Table 8-23.

Table 8-23: Operation of fontSize attribute in the style element which is directly/indirectly referenced by p element and span element

The style element that the p element indirectly refers to	The style element that the span element under the p element described in the left directly/indirectly refers to
With a description of the fontSize attribute.	There is a description of fontSize attribute in the style element that is directly/indirectly referenced in any span element. Or, There is no description of fontSize attribute in the style element that is directly/indirectly referenced in all span elements. Or, There is no direct/indirect reference to the style element in any span element.
Without description of the fontSize attribute.	There is a description of fontSize attribute in the style element that is directly/indirectly referenced in all span elements.
Without indirect reference to the style element.	There is a description of fontSize attribute in the style element that is directly/indirectly referenced in all span elements.

8.5.6.4 Operation of color specification

In ARIB-TTML for closed caption service, “#RRGGBB format” or “#RRGGBBAA format” is operated as the color specification format such as character color and background color. “RR”, “GG”, “BB” and “AA” takes values from “00” to “ff”.

In the case of “#RRGGBB format”, it is treated as having a value of “ff” for transparency, and it shall be completely opaque.

When colorless transparency is specified, the value “#00000000” shall be specified.

8.5.6.5 Operation of underline

The underline is drawn outside the character display zone of the concerned character. Since the drawing to the outside is processed by the drawing function of the receiver, it is not necessary to specify the coordinate values on the outside.

The line width shall be optional feature. When the character is drawn horizontally, it shall be added to the side of the next line, and when it is written vertically, it shall be added to the side of the previous line.

The color of the underline to be drawn is the color specified for the character to be drawn. When there is not enough space between characters and lines, the drawing result shall be optional feature.

8.5.6.6 Operation of hemming

When operating hemming, the character spacing and line spacing should be specified to be at least twice the width of the hemming. When a value larger than “0px” is specified as the width of the “blur”, the drawing result when there is not enough width in the character spacing and line spacing shall be optional feature. In addition, the drawing of tones when “blur” is specified shall also be optional feature.

8.5.6.7 Operation of character enclosing border

The character enclosure is drawn inside the character display zone in the display area. Drawing to the inside is processed by the drawing function of the receiver, so the coordinate values of the inside shall not be specified. In addition, when the character enclosure and the background color are used, priority is given to the character enclosure, and the background color shall be the back.

There are two types of character enclosing border: a drawing format that encloses the entire display area of characters (Fig. 8-10) and a drawing format that encloses only the area where characters are drawn (Fig. 8-11). In the drawing format that encloses the entire display area of characters, characters are enclosed by combining the arib-tt:border attribute, the arib-tt:border-top attribute, the arib-tt:border-bottom attribute, the arib-tt:border-left attribute, and the arib-tt:border-right attribute, and in the drawing format that encloses only the area where characters are drawn, each character is specified to the direction in which enclosing line is required by the arib-tt:border-top attribute, the arib-tt:border-bottom attribute, the arib-tt:border-left attribute, and the arib-tt:border-right attribute. However, when characters that specify the same attribute are consecutive, the arib-tt:border-top attribute, the arib-tt:border-bottom attribute, the arib-tt:border-left attribute, and the arib-tt:border-right attribute may be specified in bulk by enclosing multiple characters. An example of an ARIB-TTML description of a drawing format that encloses the entire character display area using the arib-tt:border attribute is shown in Fig. 8-12, and an example of an ARIB-TTML description of a drawing format that encloses only the area in which characters are drawn is shown in Fig. 8-13.

Also, it should be noted that in a drawing format that encloses only the area where characters are drawn, depending on the settings for character spacing and line spacing, there may be gaps in the enclosing lines, or the enclosing lines may overlap and protrude.

When specifying a character enclosure with the span element, it is necessary to expand the display area by considering the line width of the character enclosure to be drawn inside, so about the value of the display area specified in the extent attribute of the p element, it is necessary to specify the value added by the total pixel of the line widths of the character enclosing border specified on the top, bottom, left, and right.

However, it should be noted that some receivers draw the character enclosure outside the display area and the character display zone, and some lines of the character enclosing border are not drawn.

Fig. 8-10: Character enclosing border drawing Example-1
(a drawing format that encloses the entire character drawing area)

Fig. 8-11: Character enclosing border drawing Example-2
(a drawing format that encloses only the area in which character is drawn)

```
<styling>
  <style
   xml:id="s1"
   tts:color="#ffffff"
   tts:fontSize="60px"
   arib-tt:letter-spacing="20px"
   tts:lineHeight="80px
   arib-tt:border="solid 5px #0000ff"/>
</styling>
<layout>
  <region xml:id="p1"
   tts:origin="100px 100px"
   tts:extent="490px 170px"/>
</layout >
……
<div xml:id="d001">
  <p xml:id="p001" region="p1" begin="00:10:00.000" end="00:10:30.000">
    <span style="s1">あいうえお　<br/>　かきくけこ</span>
  </p>
</div>
```

Fig. 8-12: An example description of Character enclosure drawing Example-1
(a drawing format that encloses the entire character drawing area)

```
<styling>
   <style xml:id="ss"
    tts:color="#ffffff"
    tts:fontSize="60px"
    arib-tt:letter-spacing="20px"
    tts:lineHeight="80px"/>
   <style xml:id="s1"
    arib-tt:border-top="solid 5px #0000ff"
    arib-tt:border-left="solid 5px #0000ff"/>
   <style xml:id="s2"
    arib-tt:border-top="solid 5px #0000ff"/>
   <style xml:id="s3"
    arib-tt:border-top="solid 5px #0000ff"
    arib-tt:border-right="solid 5px #0000ff"/>
   <style xml:id="s5"
    arib-tt:border-top="solid 5px #0000ff"
    arib-tt:border-right="solid 5px #0000ff"/>
   <style xml:id="s6"
    arib-tt:border-bottom="solid 5px #0000ff"/>
   <style xml:id="s7"
    arib-tt:border-bottom="solid 5px #0000ff"/>
   <style xml:id="s8"
    arib-tt:border-top="solid 5px #0000ff"
    arib-tt:border-bottom="solid 5px #0000ff"
    arib-tt:border-right="solid 5px #0000ff"/>
</styling>
<layout>
   <region xml:id="p1" tts:origin="100px 100px" tts:extent="490px 90px"/>
   <region xml:id="p2" tts:origin="185px 100px" tts:extent="490px 90px"/>
</layout >
……
<div xml:id="d001">
   <p xml:id="p001" region="p1" begin="00:10:00.000" end="00:10:30.000">
      <span style="ss s1">あ</span>
      <span style="ss s2">いうえ</span>
      <span style="ss s3">お</span>
      <span style="ss">　</span>
   </p>
   <p xml:id="p002" region="p2" begin="00:10:00.000" end="00:10:30.000">
      <span style="ss s5">　</span>
      <span style="ss s6">か</span>
      <span style="ss s7">きくけ</span>
      <span style="ss s8">こ</span>
   </p>
</div>
```

Fig. 8-13: An example description of Character enclosing border drawing Example-2
(a drawing format that encloses only the area in which character is drawn)

8.5.6.8 Operation of ruby

The arib-tt:ruby attribute has no effect on the drawing size and the display position of characters. It is used only to express clearly that the character specified by id is a ruby.

8.5.6.9 Operation of shadowed

When operating of shadowed, the character spacing and line spacing should be specified to have a value greater than or equal to the width of the shadow. When a value greater than “0px” is specified as the width of the “blur”, the drawing result when there is not enough width in the character spacing and line spacing shall be optional feature. In addition, the drawing of gradation when “blur” is specified shall be also optional feature.

8.5.6.10 Operation of flashing

Flashing action is realized by animation, not by style information. The operation of flashing by animation is shown in 8.5.7.1.

8.5.6.11 Operation of scroll

Scroll movement is realized by animation, not by the arib-tt:marquee attribute. The operation of scroll by animation is shown in 8.5.7.2.

8.5.6.12 Priority of style information application

When multiple pieces of information that may affect the style information each other are specified, the description with the later description order or the later specification order has priority, and the child layer has priority over the parent layer.

8.5.7 Operation of animation

Up to one animation action shall be defined on the same display page.

Regarding the time specification by the position attribute in the arib-tt:keyframe element, the relative time in % notation instead of the real time is specified. In addition, since “0%” shall be always specified for the first frame of the animation key frame and “100%” shall be always specified for the last frame, it is necessary to describe at least two animation key frames. The range of values that shall be specified as the key frame time shall be from “0%” to “100%”, and when a value smaller than “0%” or larger than “100%” is specified, the action is not guarateed.

When the value specified in each key frame are omitted, the value of the previous frame is continued, and when the value is omitted in the first frame or all frames, the value specified for the display element to which the animation is applied or the initial value at the time of omission is taken.

The tts:fontSize attribute which specifies the font size, and the tts:extent attribute which specifies the size of the display area shall be not operated.

The attribute equivalent to the animation-fill-mode attribute that specifies the style state before the animation starts or ends in “CSS Animations” are not operated, but the action specified with the animation-fill-mode attribute “both” shall be performed. Before the animation starts, it is displayed with the value of the position attribute specified as “0%”, and after the animation ends, it is displayed with the value of the position attribute specified as “100%”.

Any workings other than those prescribed in this definition comply with the “CSS Animations” definition of the W3C.

8.5.7.1 Operation of flashing

The flashing action is defined by the arib-tt:keyframes element, and is realized by specifying the animation for flashing defined by the arib-tt:animation attribute. A concrete example of the description is shown in Fig. 8-14.

```
<styling>
<arib-tt:keyframes animationName="blink">
      <arib-tt:keyframe position="0%" tts:opacity="1"/>
      <arib-tt:keyframe position="50%" tts:opacity="0"/>
      <arib-tt:keyframe position="100%" tts:opacity="1"/>
</arib-tt:keyframes>
   <style xml:id=“s001” tts:backgroundColor="#000000"/>
   <style xml:id=“s002” tts:color="#ffffff"/>
   <style xml:id=“s003” arib-tt: animation ="blink 2000ms step-end 0ms 100 normal"/>
</styling>
<layout>
   <region xml:id="r001“ style=“s001 s002 s003”
tts:origin=“-260px 40px" tts:extent="300px 90px"/>
</layout >
...
<div xml:id=”d001”>
<p xml:id=“p001“region="r001" begin=“00:10:01.000“ end=“00:10:25.000”>
      <span>
"To dine!" she shrieked in dragon-wrath.<br/>
"To swallow wines all foam and froth!<br/>
To simper at a table-cloth!"
      </span>
</p>
</div>
```

Fig. 8-14: An example of flashing description

8.5.7.2 Operation of scroll

Scrolling is realized by defining the scrolling behavior with the arib-tt:keyframes element and specifying the animation for scrolling defined by the arib-tt:animation attribute. As examples of scrolling display, Fig. 8-15 shows an example without rollout, and Fig. 8-16 shows an example with rollout. As concrete description examples, Fig. 8-17 shows an example of description example without rollout, and Fig. 8-18 shows an example of description with rollout.

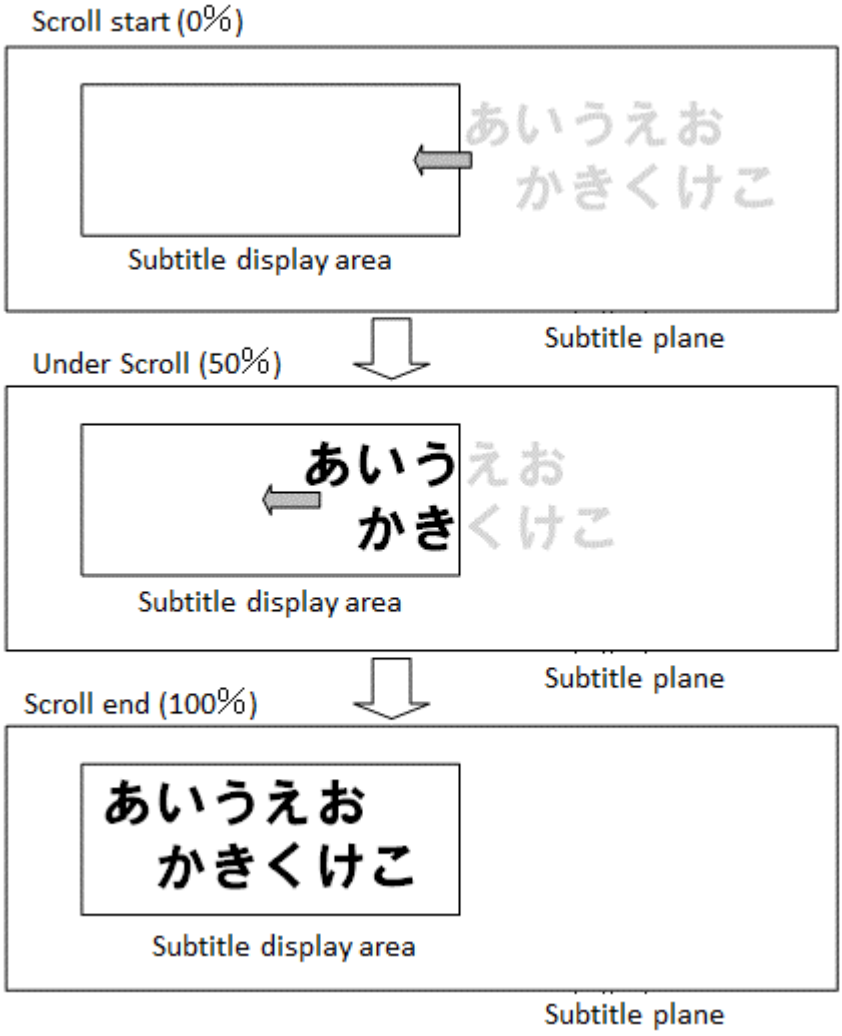

Fig. 8-15: An example of scrolling display (without rollout)

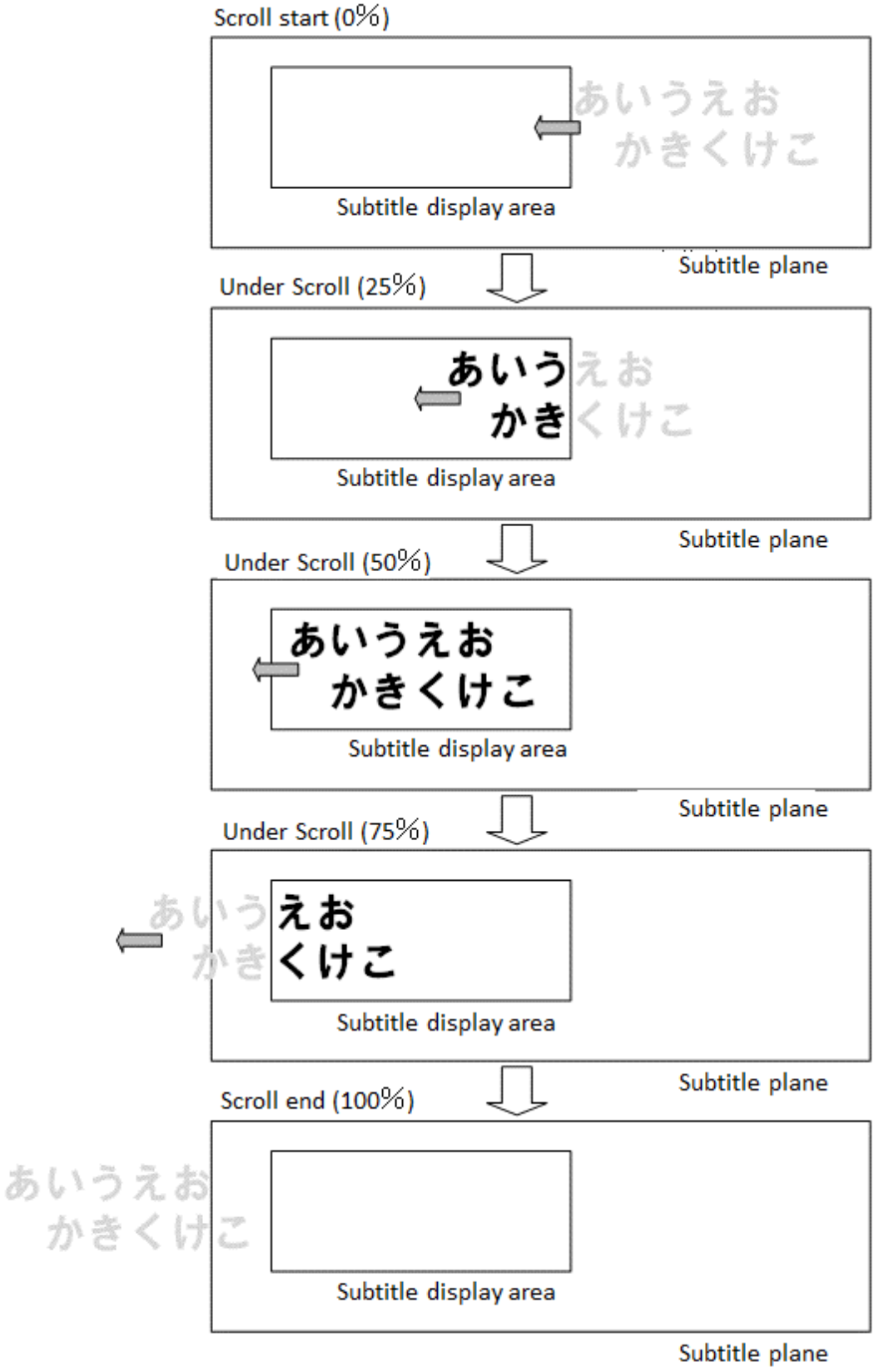

Fig. 8-16: An example of scrolling display (with rollout)

```
<styling>
  <arib-tt:keyframes animationName="scroll">
    <arib-tt:keyframe position="0%" tts:origin="340px 40px"/>
    <arib-tt:keyframe position="100%" tts:origin="40px 40px"/>
  </arib-tt:keyframes>
  <style
   xml:id="s001"
   tts:backgroundColor="#000000"
   tts:color="#ffffff"
   tts:fontSize="46px"
   tts:lineHeight="50px"
   arib-tt:letter-spacing="4px"/>
  <style xml:id="s002" arib-tt:animation ="scroll 1000ms linear 0ms 1 normal"/>
</styling>
<layout>
  <region xml:id="r001" style="s001"
tts:origin="40px 40px" tts:extent="300px 100px"/>
<region xml:id="r002" style="s002"
tts:origin="40px 40px" tts:extent="300px 100px"/>
</layout >
...
<div xml:id="d001" >
<p xml:id="p001" region="r001"begin="00:10:01.000" end="00:10:25.0000">
    <span region="r002">
あいうえお<br/>
  かきくけこ
    </span>
  </p>
</div>
```

Fig. 8-17: An example of scrolling description (without rollout)

```
  <styling>
    <arib-tt:keyframes animationName="slide">
      <arib-tt:keyframe position="0%" tts:origin="340px 40px"/>
      <arib-tt:keyframe position="100%" tts:origin="-260px 40px"/>
    </arib-tt:keyframes>
    <style xml:id=“s001”
     tts:backgroundColor="#000000"
     tts:color="#ffffff"
     tts:fontSize="46px"
     tts:lineHeight="50px"
     arib-tt:letter-spacing="4px"/>
    <style xml:id=“s002” arib-tt: animation =“slide 1000ms linear 0ms 1
normal"/>
  </styling>
  <layout>
    <region xml:id="r001“ style=“s001”
   tts:origin=“40px 40px"   tts:extent="300px 100px"/>
    <region xml:id="r002" style="s002"
   tts:origin="40px 40px"   tts:extent="300px 100px"/>
  </layout >
  ...
  <div xml:id=”d001”>
  <p xml:id=“p001“region="r001" begin=“00:10:01.0000“ end=“00:10:25.000”>
      <span region="r002">
  あいうえお<br/>
    かきくけこ
      </span>
  </p>
  </div>
```

Fig. 8-18: An example of scrolling description (with rollout)

8.5.8 Operation of external characters (Gaiji characters)

External characters (Gaiji characters) are described using a font file whose glyph is defined by SVG. In the arib-tt:font-face element, the code value and the font file to which the glyph is assigned are specified, and in the character notation, the display of Gaiji characters is designated by specifying the assigned code value. A description example using Gaiji characters is shown in Fig. 8-19.

```
<arib-tt:font-face font-family=" Round gothic " unicode-range="U+F000">
   <arib-tt:src url=" subt://1" format="svg"/>
</arib-tt:font-face>
・・・・
<div xml:id=”d001” >
<p xml:id="p001" region="r001" begin="00:00:00.000" end="00:00:10.000">
   <span > Gaiji &#xF000;</span>
</p>
</div>
```

Gaiji character designation

Fig. 8-19: A description example of Gaiji character operation

The arib-tt:font-face element is used only for the operation of external characters. In addition, the animation and the script shall not be used in the definition of SVG.

Up to 188 external characters shall be operated at the same time, and up to 188 definitions per one font file shall be possible.

The specification of external character is described by referring to numeric characters.

With the unicode-range attribute, it is possible to specify not only one character code but also multiple character codes, and a description example of the arib-tt:font-face element when specifying multiple character codes is shown in Fig. 8-20.

```
<arib-tt:font-face font-family="Round gothic" unicode-range="U+F000-F005">
   ・・・・
</arib-tt:font-face>
```

Fig. 8-20: A description example of multiple Gaiji characters operation

When the specification of the format attribute is omitted, it is regarded as “svg” is specified.

The font file is transmitted by broadcasting. In the case of broadcasting transmission, it is necessary that the font file is transmitted with the same asset of closed caption, and is transmitted in the same MPU.

8.5.9 Operation of time information

The time information specified in the begin attribute and the end attribute is described in the format of “hh (hour): mm (minute): ss (second).fff (millisecond)”, and the value of specified time information does not exceed 24 hours. “hh (hour)” is specified as a value from “0” to “23”, “mm (minute)” is specified as a value from “0” to “59”, “ss (second)” is specified as a value from “0” to “59”, and “fff (millisecond)” is specified as a value from “0” to “999”.

8.5.9.1 Operation of reference start time base point (TMD=0010)

The definition of the time information of each element in the case of "reference start time base point" where "0010" is specified in the TMD of the additional identification information of the MH-data component descriptor is shown in the following.

- The start time of the top-level body element that does not specify time information shall be the time specified by reference_start_time, and the end time shall be "undecided".
- The start time of the element for which the begin attribute below the body element is specified shall be the time obtained by adding the relative time indicated by the begin attribute to the start time of the upper-level element.
- The end time of the element for which the end attribute below the body element is specified shall be the time obtained by adding the relative time indicated by the end attribute to the start time of the upper-level element.
- The start time of the element for which the begin attribute below the body element is not specified inherits the start time of the upper-level element.
- The end time of the element for which the end attribute below the body element is not specified inherits the end time of the upper-level element.
- Each element starts the presentation when the start time is reached in the NTP-based clock, and ends the presentation when the end time is reached.
- Each element immediately starts the presentation when the start time has already been reached in the NTP-based clock.
- Each element will not perform the presentation when the end time has already been reached in the NTP-based clock.
- When the end time is "undecided", each element continues to perform the presentation until the next closed caption content is received.
- The begin attribute shall not describe such a value that the start time exceeds the end time of the upper-level element. When described, the behavior shall depend on the receiver.
- The end attribute shall not describe such a value that the end time exceeds the time range of the upper-level element. When described, the behavior shall depend on the receiver.

In order to synchronize the presentation timing of the video and the closed caption, it is necessary to consider the processing delay of the video. An example of presentation synchronization control of the video and the closed caption in the case of "reference start time base point" is shown in Appendix 9.

8.5.9.2 Operation of no time control (TMD=1111)

In the case of "no time control" where "1111" is specified in the TMD of the additional identification information of the MH-data component descriptor, even if time information is described in the begin attribute and the end attribute, the value shall be ignored.

8.6 Operation of compression in the transmission

For closed caption transmission, the compression by the Efficient XML Interchange (EXI) format defined in World Wide Web Consortium (W3C) is specified, but it shall not be available. For the block size among the options, the maximum value shall be "1,000,000". EXI operates W3C Efficient XML Interchange Format 1.0 (Second Edition) (issued on Feb. 11, 2014). The operation of compression_type of EXI and the additional identification information of MH-data component descriptor see ARIB STD-B60, 9.3.

8.7 Closed caption display in the leap second

The timing of closed caption display is processed by the clock in the receiver which is synchronized with the NTP transmitted by the broadcast wave from the broadcasting station. However, since NTP uses UTC, an event called “leap second” occurs. Even when this “leap second” occurs, it is necessary to correct the closed caption display at the exact timing assumed by the broadcasting station.

8.7.1 Operation of additional identification information of MH-Data component descriptor at the time of leap second occurrence

In case that the reference_start_time is 24 hours before the time of leap second occurrence, the value of the reference_start_time_leap_indicator is “0”.

In the case of time addition, when the value of the reference_start_time described in the additional identification information is from 9:00:00 on the day before the leap second occurrence to the first 8:59:59 on the leap second day, the reference_start_time_leap_indicator is “1” as the value, and otherwise it is “0”.

In the case of time erasing, when the value of the reference_start_time described in the additional identification information is from 9:00:00 on the day before the leap second occurrence to 8:59:58 on the leap second day, the reference_start_time_leap_indicator is “2” as the value, and otherwise it is “0”.

In addition, some broadcasters assume that the time correction process for leap second is performed during the service suspension period. In that case, only “0” is used for the reference_start_time_leap_indicator of the additional identification information.

Also, even in case that there is no leap second between the reference_start_time and the presentation control time specified by begin/end in the TTML document that refers to it, the reference_start_time_leap_indicator may be “0” because it is not practically affected by the leap second.

8.7.2 Correction of closed caption display timing at the time of leap second occurrence

The guidelines for correction processing of closed caption display timing by using the additional identification information of MH-data component descriptor are shown in Appendix 2.

8.8 Operation of initialization

The receiver shall execute in the operating conditions of control information shown in Table 8-24, according to the initialization behavior items and the initialization operation contents shown in ARIB STD-B62 Volume 1, Part 3, Chapter 4, Initialization. When being tuned, all initialization operation items related to closed caption are initialized. Also, for the initialization timing, when the TMD is specified as “reference starttime for the starting point”, it is necessary to consider the processing delay of video and audio in the receiver.

Table 8-24: Operating conditions of control information

Operating conditions of control information	Detailed timing of occurrence
Update of additional identification information for closed caption	The point in time when an MP table that any field of additional identification information has been updated is received.
Update of ARIB-TTML document	See Table 8-25.
Clean screen (empty element)	The point in time when an MFU with a subsample_number value of 0 in the MPU is received, and when the received ARIB-TTML document is detected as an clear packet.

Table 8-25: Detailed occurrence timing and behavior of “Update of ARIB-TTML document”

Conditions of ARIB-TTML document		Detailed occurrence timing and behavior
Presenting ARIB-TTML document	Updated ARIB-TTML document	
With specification of end attribute	With specification of begin attribute	The point in time when the earlier specified time is reached between the time specified by the end attribute of the presenting ARIB-TTML documentand the begin attribute in the upgraded ARIB-TTML document, after the MFU with a subsample_number value of 0 in the MPU is received. The updated ARIB-TTML document is presented from the time when the time specified in the begin attribute of the updated ARIB-TTML document is reached.
With specification of end attribute	Without specification of begin attribute	The point in time when the MFU with a subsample_number value of 0 in the MPU is received. Immediately after the initialization operation is completed, the updated ARIB-TTML document is presented.
Without specification of end attribute	With specification of begin attribute	The point in time when the time specified by the begin attribute in the updated ARIB-TTML document is reached, after the MFU with a subsample_number value of 0 in the MPU is received. Immediately after the initialization operation is completed, the updated ARIB-TTML document is presented.
Without specification of end attribute	Without specification of begin attribute	The point in time when the MFU with a subsample_number value of 0 in the MPU is received. Immediately after the initialization operation is completed, the updated ARIB-TTML document is presented.
when erase packet or, ARIB-TTML document is not received.	With specification of begin attribute	The point in time when the time specified by the begin attribute in the updated ARIB-TTML document is reached, after the MFU with a subsample_number value of 0 in the MPU is received. Immediately after the initialization operation is completed, the updated ARIB-TTML document is presented.
when erase packet or, ARIB-TTML document is not received.	Without specification of begin attribute	The point in time when the MFU with a subsample_number value of 0 in the MPU is received. Immediately after the initialization operation is completed, the updated ARIB-TTML document is presented.

Also, for the operation shown in Table 8-25, it is necessary to retain the received closed caption text in addition to the closed caption text being presented. The receiver should retain at least one closed caption text in addition to the closed caption text being presented. In case that the receiver receives the closed caption text that exceeds the number of closed caption text which the receiver may hold, the behavior of the receiver shall be optional feature.

In addition, for the time being, broadcasters should send out closed caption keeping in mind that there are receivers which does not hold any closed caption text other than the one being presented, and which shall perform initialization operation at the timing the ARIB-TTML document has been updated.

8.9 Monomedia used for closed caption

8.9.1 Operation of still image

Still image monomedia may be used for closed caption.

Still image monomedia file is transmitted by broadcasting. Further, still image monomedia file is transmitted with the same asset as the closed caption data and should be transmitted within the same MPU.

The format for still image monomedia which may be operated for closed caption shall be PNG provided in Chapter 7.

8.9.2 Operation of warning sounds and additional sounds

In closed caption, AIFF-C shall be used in addition to the receiver's built-in sound of the receiver as warning sounds and additional sounds. An example of a description for using the receiver's built-in sound is shown in Fig. 8-21, and an example of a description for using AIFF-C is shown in Fig.8-22.

```
<div xml:id="C0001" begin="00:00:00.000" end="00:01:00.000">
  <arib-tt:audio src="romsound://12"/>
</div>
```

Fig. 8-21: An example of a description for using the receiver's built-in sound

```
<div xml:id="C0001" begin="00:00:00.000" end="00:01:00.000">
  <arib-tt:audio loop="true" src="subt://1"/>
</div>
```

Fig. 8-22: An example of a description for using AIFF-C

AIFF-C audio files are transmitted by broadcasting. Also, audio files are transmitted with the same asset as the closed caption data and need to be transmitted within the same MPU.

It is necessary that the time interval specified by the begin attribute and the end attribute of the time information in the div element described in order to specify the AIFF-C audio file is specified to be longer than or equal to the playback length of the AIFF-C audio file to be played.

8.10 Operation of extension API for broadcasting

This section specifies operations related to closed caption in the extension API for broadcasting.

8.10.1 Operation of broadcasting video and audio object

8.10.1.1 Operation of callback function CaptionListener()

When the closed caption listener to obtain the closed caption is added by addCaptionListener(), the callback function CaptionListener() is called every time the receiver receives an MFU in the closed caption MPU of the specified asset. The closed caption data obtained by the argument 'captiondata' shall be in MFU units, and the additional identification information of MH-data component descriptor and the MFU header information of the closed caption are also added to the closed caption text.

After the closed caption listener to obtain the closed caption is deleted by removeCaptionListener(), the callback function CaptionListener() stops to call.

The argument 'captiondata' of the call back function CaptionListener() shall be JSON format specified in RFC7159, its configuration is shown in Fig. 8-23. The operation of each item is shown in Table 8-26.

```
{
    "ISO_639_language_code"          : <string>,
    "TMD"                            : <string>,
    "resolution"                     : <string>,
    "reference_start_time_seconds"   :<number>,
    "reference_start_time_fraction"  :<number>,
    "subtitle_sequence_number"       : <number>,
    "subsample_number"               :<number>,
    "last_subsample_number"          :<number>,
    "data_type"                      :<string>,
    "data"                           :<string>
}
```

Fig. 8-23: Configuration of captiondata

Table 8-26: Operation of each captiondata item

item	operation
ISO_639_language_code	Language code This character string represents the language of the closed caption data to be obtained in three alphabets code specified in ISO639-2. Ex: Japanese is "jpn" in a three alphabets code.
TMD	Time control mode This character string represents the time control mode for the closed caption to beobtained and is specified by the TMD described in ARIB STD-B60 "9.3 Descriptor in Transmission of Closed caption and Superimposition". The value specified "Value of time control mode" of "Table 9-7: Meaning of time control mode" in ARIB STD-B60 shall be specified in text. Ex: TTML description (reference starttime for the starting point) is "0010".

item	operation
resolution	Display resolution This character string represents the display resolution for the closed caption to be obtained and is specified by the resolution described in ARIB STD-B60 “9.3 Descriptor in Transmission of Closed caption and Superimposition”. This means that the value specified in “Value of display resolution” of “Table 9-9: Meaning of display resolution” in ARIB STD-B60 is specified by a text. Ex: 3840×2160 is “0001”.
reference_start_time_seconds	Reference start time This represents the UTC time in NTP length format that is the start point of the time code in the obtained TTML document when TMD is 0010. reference_start_time_seconds shall be the value of a 32-bit field indicating the unit of seconds in NTP length format.
reference_start_time_fraction	Reference start time This represents the UTC time in NTP length format that is the start point of the time code in the obtained TTML document when TMD is 0010. reference_start_time_fraction shall be the value of a 32-bit field indicating less than or equal to one second in NTP length format.
subtitle_sequence_number	Closed caption sequence number This represents the sequence number in the concerned closed caption asset of the closed caption to be acquired.
subsample_number	Subsample number This represents the subsample number in the concerned MPU of the closed caption to be acquired. The subsample number of the ARIB-TTML document file sent by the first MFU in the MPU is 0.
last_subsample_number	Last subsample number This represents the last subsample number of the closed caption data to be sent by the concerned MPU of the closed caption to be acquired.
data_type	Data type The data type of the MFU to be obtained is represented by text according to the value specified by the data_type in the MFU header.
data	Data Closed caption data in text format In case that data_type is “0000” (ARIB-TTML document file) or “0110” (font file in SVG format), the data bytes of the closed caption data of the MFU to be acquired are stored. For other data_type, an empty string is stored.

Using the callback function CaptionListener(), it is recommended for the broadcaster to consider how to deal with the obtained closed caption data, such as releasing the area of the previous closed caption data when the next closed caption body data is acquired not to affect the operating environment of the data content on the receiver.

8.11 Recommended behavior of the receiver

8.11.1 Recommended behavior in the closed caption display

- The number of closed caption languages displayed at the same time shall be one.
- When still image monomedia and text overlap, or when still image monomedias overlap, the latter shall be given priority to display.
- Even if the video screen is reduced due to multimedia content, the display size and the display position of closed caption shall be displayed based on the full screen area.
- The receiver judges whether the closed caption data is sent or not by the presence or absence of asset information of the closed caption in the MP table. The display of marks to inform viewers of closed caption reception, the display and deletion of closed caption are mainly performed based on the concerned data. The display control linked with other dara such as MH-EIT data shall be optional feature.

8.11.2 Recommended behavior in case that closed caption display and superimposition are related

The receiver shall independently control the presentstion of closed caption and superimpositon.

Closed caption and superimpositon should be operated so that their display areas do not overlap in principle, but when the displays overlap, the superimpositon should be prioritized and displayed in front of the closed caption.

8.11.3 Behavior at the start time and end time of closed caption display

The behavior of the receiver at the start time and end time of closed caption shall be as shown in Table 8-27. However, the start means “start of closed caption display specified in closed caption content”, and the end means “clear of closed caption content”.

Table 8-27: Operation of DMF in the additional identification information of MH-data component system descriptor

DMF	Start time	End time
Automatic display when received	Display the relevant closed caption content immediately.	Clear the relevant content immediately.
Selective display when received	It is recommended that some information indicating that there is closed caption is presented. Displayed by viewer’s selection.	Clear the relevant content immediately.

8.11.4 Setting items in the receiver and so on

The receiver displays the closed caption asset with the same component tag value as the previously selected closed caption asset. For example, when the closed caption of the closed caption asset with a component tag value of 0x0031 is selected while viewing a program, when another program with closed caption starts, the closed caption of the closed caption asset with a component tag value of 0x0031 shall be displayed.

In the default setting when the receiver is shipped, the closed caption of the closed caption asset with the smallest component tag value is displayed.

The receiver which may set the language code such as Japanese and English displays the closed caption of the language code which has been set.

When the closed caption of the language or the language code set to the receiver is not transmitted, the receiver displays the closed caption of the closed caption asset with the smallest component tag value.

In the case of “selective display when receiving”, the closed caption shall be displayed or hidden based on the receiver’s closed caption display setting.

8.11.5 Clear packet

An example of erase packet for clearing the displayed closed caption is shown in Fig. 8-24. When the clear packet is received, the receiver immediately clears the displayed closed caption and does not display the closed caption until the next closed caption content is received.

```
<?xml version="1.0" encoding="utf-8"?>
<tt></tt>
```

or

```
<?xml version="1.0" encoding="utf-8"?>
<tt xmlns="http://www.w3.org/ns/ttml"
 xmlns:ttm="http://www.w3.org/ns/ttml#metadata"
  xmlns:tts="http://www.w3.org/ns/ttml#styling"
  xmlns:ttp="http://www.w3.org/ns/ttml#parameter"
  xmlns:smpte="http://www.smpte-ra.org/schemas/2052-1/2013/smpte-ttml/v1.0"
   xmlns:arib-tt="http://www.arib.or.jp/ns/arib-tt">
 <head>
 </head>
 <body>
 <div>
 <p>
 <span/>
 </p>
 </div>
 </body>
 </tt>
```

Fig. 8-24: An example of clear packet

8.11.6 Presentation of closed caption for HDR video

Adjustment of the dynamic range when presenting closed caption for HDR video shall be optional feature, but it is recommended to maintain the quality of the HDR video as much as possible and present closed caption to the viewers without any sense of discomfort.

8.12 Closed caption outscreen display function (optional)

The function to display video at a reduced size for the purpose of viewing without overlapping closed caption and the character telop on the television broadcasting screen is called closed caption outscreen display function. The broadcasting station does not transmit a control signal indicating that the closed caption is intended for this display function. Therefore, the receiver does not automatically recognize that the closed caption broadcasting is intended for outscreen display. The receiver shall be able to be set the display settings shown in the following with one touch of the remote-control key or other operation by the viewer.

In the outscreen mode, video is scaled and arranged according to the preset values (Table 8-28) in the receiver. The viewer shall be able to select the video placement position from two places: the top or bottom of the screen. The selection method shall be optional feature. Operations other than those assumed in Table 8-28 shall be optional feature.

The display of the closed caption content shall be optional feature, and the guidelines about the recommended behavior when converting closed caption content for outscreen use is shown in Appendix 3.

Table 8-28: How to display videos in the outscreen display function

Video resolution *	How to display
1920×1080	Scaled to 96/128, and displayed as (240, 0)-(1679, 809) or (240, 270)-(1679, 1079).
3840×2160	Scaled to 96/128, and displayed as (480, 0)-(3359, 1619) or (480, 540)-(3359, 2159).
7680×4320	Scaled to 96/128, and displayed as (960, 0)-(6719, 3239) or (960, 1080)-(6719, 4319).

*The display resolution of closed caption is displayed at a resolution scaled to match the resolution of the video as described in 8.3.1.

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Chapter 9: Operation of Superimpositon Coding

9.1 Scope and definition of the service

Ultra high definition television broadcasting using Advanced BS Digital Broadcasting shall provide the following service of superimpositon symchronized with video and audio.

9.2 Programming and transmission operation

9.2.1 Constrains on programming and transmission

- Transmission system
  Superimpositon is transmitted via broadcasting by the closed caption and superimposition transmission system based on ARIB STD-B60, Chapter 9.
- Organizations
  Superimpositon is transmitted as independent assets.
- Number of assets
  Maximum number of the assets of superimposition simultaneously transmitted via broadcasting shall be one.
- Assets of the special service
  Maximum number of the assets of superimposition for special servives shall be one.
- Transmission of multiple languages
  One language shall be transmitted by the one asset. The number of languages transmitted by broadcasting shall be up to one, and the language identification is by the additional identification information in the MH-data component descriptor. The languages as available for superimpositon shall be “Japanese (jpn)” and “English (eng).”
- Available display mode
  For superimpositon, only “automatic display when received and automatic display when playback”, “automatic display when received and selective display when playback”, and “selective display when received and selective display when playback” shall be operated.
- Still image
  For superimpositon, the still image monomedia may be used.
- Warning sound
  As the warning sound of superimposition, the built-in sound of the receiver and the audio monomedia may be used.
- MFU
  The MFU contains the information needed to display superimposition. Based on the information described in the MFU, the ARIB-TTML documents needed to display superimposition and the external resource file referenced by ARIB-TTML documents are acquired.
  In addition, it shall be possible that up to five MFUs are operated in one MPU.
- MH-data component descriptor
  Regarding superimposition transmitted using closed caption and superimposition transmission system, MH-data component descriptor is allocated in the MP table, and 0x0020 is assigned as data_component_id. Then, “Additional_Arib_Subtitle_Info()” is stored as the additional identification information of MH-data component descriptor.
- Transmission operation of MH-data component descriptor
  Since MH-data component descriptor in the MP table contains the information needed to display superimposition, superimposition contents should not be displayed until MH-data component descriptor is received. When normally transmitting superimpositon, they are transmitted at the frequency of the transmission of the MP table, but it may be intrrupted by CM, etc.

- Operation of MH-target region descriptor
  MH-target region descriptor in the MP table shall be operated. In the case of limiting the target region for superimposition, MH-target region descriptor is allocated to the asset of superimpositon.
  In case that MH-target region descriptor is allocated in the asset of superimposition and that the region information set to the receiver is not included in the target region, the superimposition should not be displayed. Under that condition, it is not necessary to inform to display the matter for the viewers. Also, when the region information is not set in the receiver, the viewing control is not performed.
  When performing an operation that specifies the target regions, the superimpositon with different target region are transmitted in staggered time.
- Clear packet
  At the start_mpu_sequence_number of the additional identification information of MH-data component descriptor is not operated, it is recommended for the broadcasters to transmit an clear packet at the end of the display so that superimpositon do not continue to be displayed. For the erase packet, see 9.9.5.

9.2.2 Transmission method for superimpositon

Applying the closed caption and superimposition transmission system, and transmitting using synchronous MPU, the timing synchronization shall be achived. The parameters to be set in the MFU are shown in Table 9-1.

- Setting parameters : See Table 9-1
  Maximum total number of assets to be simultaneously transmitted in low layers and high layers : 1 asset
- Maximum number of languages per 1 asset : 1 language
- MPU configuration unit : Conform to definitions
- MPU maximum size : 500KB
- MPU minimum transmission interval : 500msec
- Maximum asset rate : 512Kbit/s

Table 9-1: MFU setting parameters

field	operation
subtitle_tag	Operated according to the standard.
subtitle_sequence_number	Operated according to the standard.
subsample_number	Operated according to the standard.
last_subsample_number	Operated according to the standard.
data_type	“0000”, “0001”, “0011”, and “0110” are operated.
length_extension_flag	Operated according to the standard.
subsample_info_list_flag	Only 0 may be specified.
subsample_i_data_type	Not operated.
subsample_i_data_size	Not operated.
data_byte	Operated according to the standard.

Regarding MPU transmission, the following constrains are set.
- MPU metadata and movie fragment metadata are not allocated.
- MPU consists ofone or more MFU.
- ARIB-TTML document, and still image file, audio file, and external character file that are the external resource files referenced by ARIB-TTML document are stored as one MFU, respectively.

- The ARIB-TTML document is always allocated in the first MFU in the MPU.
- When there is any external resource filereferenced by ARIB-TTML document, it shall be allocatedin the succeeding MFU.
- As the transmission shall be completed by the next MPU transmission, the MPU size shall not exceed the maximum transmittable size determined by the maximum asset rate and the transmission interval between MPUs.

9.2.3 Operation of MP table

9.2.3.1 Operation of component tag

The component tag value of the superimposition asset is set to a value in the range of oxoo38 to 0x003F. However, the component tag value of the default asset for superimposition shall be 0x0038.

9.2.3.2 Update of MP table

The MP table is updated by adding and deleting asset information at the start and end of superimposition. However, superimposition asset information may be allocated even during periods when superimpositon is not being transmitted.

9.2.3.3 MH-data component descriptor

The parameters that are set to Additional_Arib_Subtitle_Info() which is the additional identification information of MH-data component descriptor are shown in Table 9-2.

Table 9-2: Setting parameters of additional identification information of MH-data component descriptor

field	operation
subtitle_tag	Operated as specified.
subtitle_info_version	Operated with fixed value of 0.
start_mpu_sequence_number_flag	Only 0 may be specified.
ISO_639_language_code	Language code to use is used. Only “jpn” and “eng” are operated.
type	Only 01 may be specified. (Even if a component tag value other than 01 is specified for an asset in the range of 0x0038 to 0x003F, it is regarded as 01.)
subtitle_format	Only 0000 may be specified.
OPM	Only 01 (Segment mode) may be specified.
TMD	Only 1111 (without time control) is operated.
DMF	Only 0000 (Automatic display when reveived, Automatic display when playback), 0010 (Automatic display when received, Selective display when playback), and 1010 (Selective display when received, Selective display when playback) are operated.
resolution	Only 0000 (1920×1080) and 0001 (3840×2160) are operated.
compression_type	See 8.6 for compression operations.
start_mpu_sequence_number	Not operated.
reference_start_time	Not operated.

9.2.3.4 Operation of multi-type header expansion

For the transmission of superimposition data, the extension header of the multi-type header extension of the MMTP packet always allocates information related to scramble. In the case of non-scramble, an extension header with the MMT scramble control bit set to 00 shall be always allocated.

9.2.4 Transmission operation at hierarchical modulation

9.2.4.1 Superimpositon transmission only in higher layer

When performing hierarchical modulation, sending out superimposition assets only in higher layer shall be operated. When this operation is performed, the asset group descriptor is not allocated in the MPT. Also, when performing this operation, it should be noted that the superimposition service does not be provided when the receiver is receiving and displaying the lower layer due to C/N degradation, etc.

9.2.4.2 Superimpositon transmission only in low layer

When performing hierarchical modulation, sending out superimposition assets only in lower layer shall be performed. When this operation is performed, the asset group descriptor is always allocated in the MPT, and selection_level shall be set to 0. When performing this operation by the combined operation of the presentation planes shown in 5.2.2, the superimposition service may be provided by the superimposition asset transmitted in the lower layer even when the receiver is receiving and displaying the higher layer.

9.2.4.3 Superimpositon transmission in both higher and lower layers

When performing hierarchical modulation, sending out superimposition assets in both higher and lower layers shall be operated. When this operation is performed, the asset group descriptor is always allocated in the MPT, the same value is specified as group_identification, and selection_level shall be 0 for the higher layer side and 1 on the lower layer side.

9.3 Video resolution and display format of superimpositon

9.3.1 Display format

The available the superimposition resolution shall be “1920×1080” and “3840×2160”, and the display format shall be horizontal writing and vertical writing, respectively. Also, the combination of the video resolution and superimposition resolution in Table 9-3 may be displayed.

Table 9-3: Combination of video resolution and Display format

Video resolution	Superimposition resolution	
1920×1080	1920×1080	
1920×1080	3840×2160	*1
3840×2160	1920×1080	
3840×2160	3840×2160	
7680×4320	3840×2160	

*1 Combination used during hierarchical modulation

When the video resolution is different from the superimposition resolution, the superimposition resolution shall be enlarged or reduced to match the video resolution and display is implemented in principle as shown in Fig. 9-1.

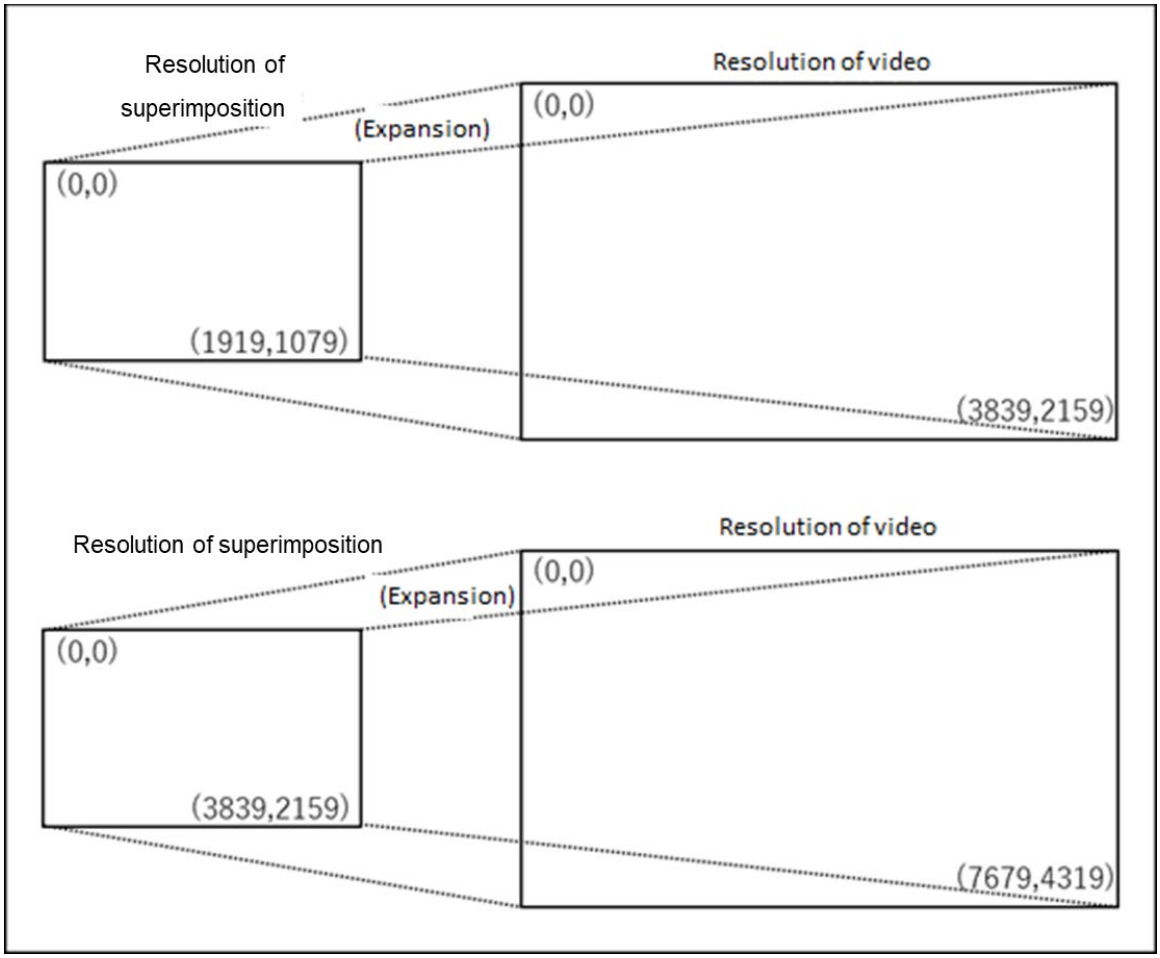

Fig. 9-1: Resolution conversion of superimposition and video

9.3.2 Display area

The display area is the area identified by the coordinates from the upper left corner of the superimposition plane. (See Fig. 9-2.) The origin (0, 0) of the coordinate system of the display area is the upper left of the "superimposition plane" regardless of whether the vertically writing or horizontally writing.

The display area is also valid for bitmap data. The resolution of the display area is the same as the resolution of superimposition, but in the actual screen display, it shall be enlarged or reduced according to the video resolution.

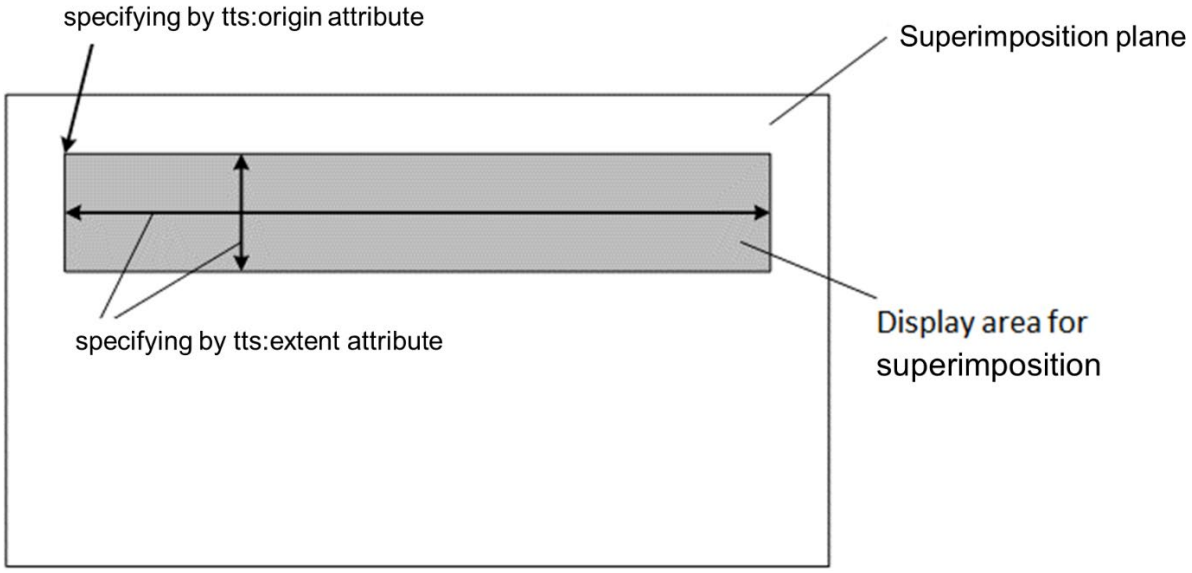

Fig. 9-2: Superimposition plane and Display area for superimposition

9.3.3 Character operating position

The movement direction of characters in the superimposition shall be leftward for horizontal writing and downward for vertical writing. When a line break is made, it should be made downward for horizontal writing and leftward for vertical writing.

9.4 Characters used for superimposition

The operation of characters in the superimposition service shall be the same as in the closed caption service. See 8.4 for details.

9.5 Operation of ARIB-TTML

The operation of ARIB-TTML in the superimposition service shall be the same as in the closed caption service. See 8.5 for details. However, since only “1111” is operated as TMD, the begin attribute and the end attribute are not operated.

9.6 Operation of compression in the transmission

The operation of the compression in the superimposition transmission shall be the same as in the closed caption service. See 8.6 for details.

9.7 Operation of the initialization

The receiver shall execute according to the initialization operation items and the initialization operation contents shown in ARIB STD-B62 Volume 1, Part 3, Chapter 4, Initialization, at the timing shown in Table 9-4. When being tuned, the initialization is performed at all the initialization operation items related to the superimposition.

Table 9-4: Initialization Timing

Timing	Detection method
Update of the additional identification information of superimposition	The point in time when the MP table is received in which some field of the additional identification information has been updated.
Update of ARIB-TTML document	The point in time when the MFU that the value of subsample_number in the MPU is 0 is received.
Clean screen (empty element)	The point in time when the MFU that the value of subsample_number in the MPU is 0 is received, and when the received ARIB-TTML document is detected as an clear packet.

9.8 Monomedia used for superimposition

The operation of monomedia in superimposition service shall be the same as in the closed caption service. See 8.9 for details.

9.9 Recommended behavior of the receiver

9.9.1 Recommended behavior in the superimposition display

- The number of languages for superimposition displayed at the same time shall be one.
- When the still image monomedia and the text overlap, or when the still image monomedias overlap, the latter shall be given priority to display.
- Even if the video screen is reduced due to multimedia content, the display size and the display position of superimposition shall be displayed based on the full screen area.
- The receiver judges whether the superimposition data is sent or not by the presence or absence of asset information of superimposition in the MP table. The display and deletion of the superimposition are mainly performed based on the concerned data. It is recomennded to perform timeout processing when the asset information has not been received for 3 minutes or more.
- Superimposition is recommened to be always displayed in the foreground on the display of the receiver.

9.9.2 Recommended behavior in case that closed caption display and superimposition are related

- The receiver shall independently control the presentation of closed caption and superimpositon.
- Closed caption and superimpositon should be operated so that their display areas do not overlap in principle, but when the display overlaps, the superimposition should be prioritized and displayed in front of the closed caption.

9.9.3 Behavior at the start time and end time of superimposition display

The behavior of the receiver at the start time and end time of the superimposition shall be as shown in Table 9-5. However, the start means "start of the superimposition display specified in the superimposition content", and the end means "clear of the superimposition content".

Table 9-5: Operation of DMF in the additional identification information of MH-data component system descriptor

DMF	Start time	End time
Automatic display when received	Display the relevant superimposition content immediately.	Clear the relevant superimposition content immediately.
Selective display when received	It is recommended that some information indicating that there is superimposition is presented. Displayed by the viewer's selection.	Clear the relevant superimposition content immediately.

9.9.4 Setting items in the receiver and so on

In the case of "selective display when received", superimposition shall be displayed or hidden based on the setting of the superimposition display of the receiver.

9.9.5 Clear packet

An example of the erase packet for clearing the displayed superimposition is shown in Fig. 9-3. When the clear packet is received, the receiver immediately clears the displayed superimposition and does not display the superimposition until the next superimposition content is received.

```
<?xml version="1.0" encoding="utf-8"?>
<tt></tt>
```

or

```
<?xml version="1.0" encoding="utf-8"?>
<tt xmlns="http://www.w3.org/ns/ttml"
xmlns:ttm="http://www.w3.org/ns/ttml#metadata"
 xmlns:tts="http://www.w3.org/ns/ttml#styling"
 xmlns:ttp="http://www.w3.org/ns/ttml#parameter"
 xmlns:smpte="http://www.smpte-ra.org/schemas/2052-1/2013/smpte-ttml/v1.0"
  xmlns:arib-tt="http://www.arib.or.jp/ns/arib-tt">
<head>
</head>
<body>
<div>
<p/>
<span/>
</p>
</div>
</body>
</tt>
```

Fig. 9-3: An example of clear packet

9.9.6 Presentation of superimposition for HDR video

Adjustment of the dynamic range when presentingsuperimposition for HDR video shall be optional feature, but it is recommended to maintain the quality of HDR video as much as possible and to present the superimposition to the viewers without any sense of discomfort.

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Chapter 10: Operation of Multimedia Coding

10.1 Operation of local storage area

The local storage area shall be used the non-volatile storage area shown in Table 10-1 as a storage area for persistent information and the temporary storage area shown in Table 10-2 as a storage area for temporary information based on ARIB STD-B62 Volume 2, 3.3.5.

Table 10-1 Non-volatile storage area

Category		Meaning
Broadcast area	Broadcaster common area	Areas commonly available to all broadcasters
	Broadcaster specific area (guaranteed area / non-guaranteed area)	Independent occupied area for each broadcaster
	Viewer's residence information area	Area that may be commonly used by receivers
General area		Permanent information storage area other than the above

Table 10-2 Temporary storage area

Category	meaning
Ureg	Temporary storage area held only during tuning of the same channel
Greg	Temporary storage area retained from power on to off, commonly available to all broadcasters

The broadcaster specific area shall be classified into a "guaranteed area" in which a certain storage capacity is always installed in the receivers and a "non-guaranteed area" in which the receivers are not guaranteed to be installed. The content of the data other than the viewer residence information area shall depend on the content set by all broadcasters or by the broadcasters. The contents of the data stored in the viewer residence information area shall be as follows.

・Prefectural area code
・Region code corresponding to the emergency warning signal
・Zip code

The non-volatile storage area mounted on the receivers may be implemented by devices with a limited number of writes. When such a device exceeds the number of writes, a failure occurs, resulting in shortening the life of the receivers. Therefore, it is recommended to give sufficient consideration that excessive writing to the non-volatile storage area should be avoided.

10.1.1 Access to local storage area

The access to local storage area shall be used by the localStorage object defined in the W3C Web Storage specification (http://www.w3.org/TR/webstorage/) based on ARIB STD-B62 Volume 2 3.3.5.

10.1.1.1 localStorage API additional rules

The provisions in Table 10-3 shall be added to the localStorage API.

Table 10-3 Additional specifications for localStorage API

Method / property	Additional provisions
length	—
key(*n*)	—
getItem(*key*)	—
setItem(*key,value*)	The key indicating the "prefectural area code" and "area code corresponding to the emergency warning signal" of the viewer residence information shown in 10.1.1.2 shall not be specified. The operation when specified is optional feature of the receivers.
	For the value the character string to be recorded may be specified. When the value is exceeded over the storage capacity specified in 10.1.3, a Quota Exceeded Error occurs, and the method shall not operate. Broadcasters should be aware that some receivers generate QUOTA_EXCEEDED_ERR.
removeItem(*key*)	The keys indicating Greg, Ureg, broadcaster common area, and viewer's residence information shown in 10.1.1.2 shall not be specified. When specified, the operation is optional feature of the receivers.
clear()	—

<Common matters>

- Key names starting with "_" shall be used to access the broadcast area of the non-volatile storage area. Considering the future expanding of the broadcasting area, key names starting with "_" other than the key names specified in 10.1.1.2 should be reserved for future broadcasting area expansion and shall not be used.
- Access to items other than the general area (broadcast area and temporary storage area of the non-volatile storage area) shall be performed only by the method (localStorage.getItem (), localStorage.setItem ()). Therefore, the method of referencing / assigning an item as a property (localStorage.key) of a localStorage object and the method of referencing / assigning it as an associative array (localStorage [key]) shall not be used.

10.1.1.2 Access key

Each area of the local storage area shall be identified by the character string (key name) specified in *key* in the API method that takes *key* as an argument.

1) Ureg

As the key name to access Ureg, the character strings "ureg0", "ureg1",…, "ureg63" are used based on ARIB STD-B62 Volume 2 3.3.5. "ureg0" indicates the first Ureg, "ureg1" indicates the second Ureg, ..., "ureg63" indicates the 64th Ureg, respectively.

2) Greg

As the key name to access Greg, the character strings "greg0", "greg1",…, "greg63" are used based on ARIB STD-B62 Volume 2 3.3.5. "greg0" indicates the first Greg, "greg1" indicates the second Greg, ..., "greg63" indicates the 64th Greg, respectively.

3) Broadcaster common area

As the key name for accessing the broadcaster common area, a character string obtained by concatenating "_common" with a character string expressing the item number of the broadcaster common area in decimal is used. The receivers shall treat all key names starting with "_common" as access to the broadcaster common area. However, the key names that may be operated by broadcasters are from "_common0" to "_common255".

(Example: "_common0", "_common1",…, "_common255")

4) Broadcaster specific area (guaranteed area)

As the key name for accessing the broadcaster specific area (guaranteed area), a character string obtained by concatenating "_wlocal" with a character string expressing the item number of the broadcaster specific area in decimal is used. The receivers shall treat all key names starting with "_wlocal" as access to the broadcaster specific area (guaranteed area). However, the key names that may be operated by broadcasters are from "_wlocal0" to "_wlocal255".

(Example: "_wlocal0", "_wlocal1",…, "_wlocal255")

5) Broadcaster specific area (non-guaranteed area)

As the key name for accessing the broadcaster specific area (non-guaranteed area), a character string obtained by concatenating "_local" with a character string expressing the item number of the broadcaster specific area in decimal is used. The receivers shall treat all key names starting with "_local" as access to the broadcaster specific area (non-guaranteed area). However, the key names that may be operated by broadcasters are from "_local0" to "_local255".

(Example: "_local0", "_local1",…, "_local255")

6) Viewer's residence information area

As the key name for accessing the viewer's residence information area, the character strings shown in Table 10-4 are used according to the type.

Table 10-4 Types and key names of viewer's residence information areas

Category	Key name
Prefecture code	"_prefecture"
Region code corresponding to the emergency warning signal	"_regioncode"
zip code	"_zipcode"

10.1.2 Origin

10.1.2.1 Basic origin

In the operation of the localStorage API, the receivers shall basically determine that the origin of the HTML document is as follows.

・HTML document for broadcast transmission

arib2: // aid_ [app_id] .oid_ [org_id]

* [App_id] is a hexadecimal character string of application_id in AIT. [org_id] is a hexadecimal string of organization_id in AIT. In each case, "0x" is not added at the

beginning and expressed in the minimum number of digits.

・HTML document for communication transmission

Scheme, host, port based on the URI of the HTML document.

10.1.2.2 Replacement of origin

When a key to access the broadcast area is specified in the non-volatile storage area, when the execution data content is a broadcast managed application, and when the application boundary and permission bitmaps indicate to allow access to the broadcast area, the receivers shall replace the origin of the HTML document as shown in Table 10-5. For content that is prohibited to access to the broadcast area, a SecurityError exception shall occur, and the method will not be operated. The accessibility of each broadcast area by a broadcast managed application shall not be affected by the URI-based scheme of the HTML document, host, port, application_id, or organization_id.

When accessing the temporary storage area, the origin of the HTML document shall be determined by the definition based on ARIB STD-B62 Volume 2　3.3.5.

Methods (localStorage.key (), localStorage.clear ()) and properties (localStorage.length) that do not take a key name as an argument shall not replace the origin. The target shall be only the region of the basic origin. The reason is the key name of the item accessed determines whether or not to replace the origin. Therefore, the methods (localStorage.key (), localStorage.clear ()) and properties (localStorage.length) that do not take the key name shown in Table 10-3 as arguments is applied only to the general area, which is the area of the basic origin.

When the document.domain attribute is rewritten, the localStorage objects will be invalidated and the related methods will not work after rewriting according to the definitions of the Web Storage specification.

Table 10-5 Replacement destination origin

Access area		Replacement destination origin
Ureg		arib://localhost (※1)
Greg		arib://localhost (※1)
Broadcast area	Broadcaster common area	arib2://bs_common
	Broadcaster specific area	arib2://bid_[broadcaster_id].nid_[original_network_id]
	Viewer's residence information area	arib2://localhost
General area		No replacing

* 1 Based on ARIB STD-B62 Volume 2, 3.3.5.

* 2 [broadcaster_id] is a hexadecimal character string of the broadcaster_id of the service during tuning.
[original_network_id] is a hexadecimal character string of the original_network_id of the service during tuning.
In each case, "0x" is not added at the beginning, the alphabet is lowercase, and the minimum number of digits is used.

10.1.3 Storage capacity

10.1.3.1 Non-volatile storage area

The storage capacity of the non-volatile storage area is shown in Table 10-6.

Table 10-6 Storage capacity of non-volatile storage area

Category		Capacity per origin	The Number of Origin	Total capacity
Broadcast area	Broadcaster common area	128KB	1	128KB
	Broadcaster specific area (guaranteed area) * 1	512KB	12	6,144KB
	Broadcaster specific area (non-guaranteed area) * 2	Not specified (However, up to 1MB per origin)		
General area		Not specified		

* 1 Refer to 10.1.4.2

* 2 Refer to 10.1.4.3

The storage capacity of the broadcaster common area shall be allocated to only one origin ("arib2: // bs_common") based on 10.1.2.2. The storage capacity of the broadcaster specific area shall be allocated to each origin configured using broadcaster_id and original_network_id based on 10.1.2.2.

The storage capacity of the broadcaster specific area (non-guaranteed area) and the general area is not specified, but the capacity specified in Table 10-7 is recomended to be used. For broadcaster specific areas (non-guaranteed areas), the maximum allocated capacity is 1MB per origin.

Table 10-7 Storage capacity of non-volatile storage area that should be available

Category	Capacity per origin	The Number of Origin	Total capacity
Broadcaster specific area (non-guaranteed area)	128KB or more	12 or more	1,536KB or more
General area	1MB or more	16 or more	16MB or more

In the non-volatile storage area, the length of key name and the number of items that may be used at each origin are not specified. The length of key name and the number of items are trade-offs with the storage capacity of each origin.

10.1.3.2 Temporary storage area

The storage capacity of the temporary storage area is shown in Table 10-8.

Table 10-8 Storage capacity of temporary storage area

Category	Capacity per origin	Number of items	Total capacity
Ureg	512Byte	64	32KB
Greg	512Byte	64	32KB

10.1.4 Broadcaster specific area

The number of origins in the Broadcaster specific area is defined based on the numbers of assumed broadcasters. Therefore, in consideration of the case where the number of broadcasters exceeds this number, the receivers shall provide the user with a function canceling the allocation of the allocated broadcaster specific area.

10.1.4.1 Identification of the same broadcaster

The identity of the broadcaster in the allocation of the broadcaster specific area is identified by the combination of the original_network_id and broadcaster_id of the service provider according to the treatment of the origin specified in 10.1.2.

10.1.4.2 Broadcasters that require allocation

Broadcasters that provide services with remote_control_key_id of "1" to "12" in the remotecontrol key descriptor described in TLV-NIT shall be defined as "broadcasters that require allocation".

Broadcasters that require allocation have allocations for broadcaster specific areas (non-guaranteed areas) within the range of free space, and also have allocations for broadcaster specific areas (guaranteed areas).

The receivers shall secure a broadcaster specific area (guaranteed area) for subsequent reception even if any of "1" to "12" of remote_control_key_id has not been received.

The broadcaster specific area (guaranteed area) once assigned is continuously assigned to the same broadcaster while the broadcaster service is registered in any remote_control_key_id.

That is, even if the remote_control_key_id in which the service provided by one broadcaster is registered changes, the allocation of the broadcaster specific area (guaranteed area) is continued.

10.1.4.3 Broadcasters that do not require allocation

Broadcasters other than "broadcasters that require allocation" in the area dedicated to broadcasters shall be defined as "broadcasters that do not require allocation".

Broadcasters that do not require allocation shall have only non-guaranteed area allocation as a broadcaster specific area.

10.1.4.4 Common matters for allocation

Even if a broadcaster is assigned multiple remote_control_key_ids or a broadcaster that provides multiple services, only one area shall be allocated to the same broadcaster due to the handling of the origin specified in 10.1.2.

When a TLV-NIT update occurs, if the broadcaster that was assigned the broadcaster specific area before the update may still receive it after the update, the same area shall be continue and assign to that broadcaster. The continuation allocating the already allocated area is optional feature, because it is supposed that handling with the allocation is different by the number of broadcaster specific areas provided by the receivers, etc...

When there is no free space in the broadcaster specific area (non-guaranteed area), it is recommended that the receivers provide a function that may release the allocation of the broadcaster specific area (non-guaranteed area) that has already been allocated according to the user operation or the like.

10.1.4.5 Unit and timing of allocation

The broadcaster specific area shall be allocated for each item specified in the first argument key of localStorage.setItem(), and the allocation shall be performed when localStorage.setItem() is executed.

10.1.4.6 Unit and timing of deallocation

Deallocation of the broadcaster specific area is performed by the case as a data content service by executing localStorage.removeItem(), and by the cases as receivers' function by user operation or the like.

In the case performed by localStorage.removeItem(), the item specified in the first argument key is the unit of release. The release shall be performed when each method is executed.

In the case where deallocation is performed as receivers' function, the unit and timing of dealloaction shall be the optional feature of the receivers. However, as a general rule, deallocation of the area allocation for broadcasters who continue to be able to receive is not recommended because it is likely to cause confusion for users except by user operation.

10.1.4.7 Guidelines for content using broadcaster specific area

When using the broadcaster specific area for the first time, if the company's broadcaster_id was used by another company in the past, the broadcaster specific area may have been used by another company, it shall be sure to delete the contents of each key in the broadcaster specific area and cancel the assignment. Specifically, operation shall be to execute localStorage.setItem(key, "") and to execute localStorage.removeItem key) for each key. In addition, in order to judge whether or not the broadcaster specific area has already been used by performing these processes by itself, it is recommended to take measures such as writing some identification information in any key of the broadcaster specific area.

The content shall not use the broadcaster specific area depending on the free capacity. Therefore, it is recommended to describe the error handling with access fails for preventing unnatural movements by.

10.1.5 Viewer's residence information area

This section specifies the data format of the viewer's residence information area via the localStorageAPI.

1) Prefectural area code

The data acquired as the prefecture area code is indicated by a character string written in hexadecimal (lowercase letters are used), as a binary value of the prefecture area designation bitmap shown in ARIB STD-B10 Appendix G Table G-2 based on the data structure specified in target_region_spec of the ARIB STD-B60 7.4.3.24 MH-target area descriptor. Therefore, the character string acquired is a 14-byte character string composed of "" (empty string) and characters in the range of UTF-8 0x30 to 0x39, 0x61 to 66.

Example: When the target area is Tokyo (excluding the islands), the 14th bit from the left is "1" in the prefecture area designation bitmap, so the data that is acquired as the prefecture area code is the character string "00040000000000".

・prefecture_bitmap

0000 0000 0000 0100 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

・Prefectural area code character string stored in the viewer's residence information area
"00040000000000"

2) Region code corresponding to the emergency warning signal

The data acquired as the Region code corresponding to the emergency warning signal is indicated by a character string in hexadecimal notation (lowercase letters are used, as a binary value of the region code according to Article 9-3, No. 5 of the Radio Equipment Regulations, Article 138 of the Radio Station Operation Regulations, and Notification No. 60, No. 405 of the Ministry of Posts and Telecommunications. Therefore, the character string acquired is a 3-byte character string composed of "" (empty string) and characters in the range of UTF-8 0x30 to 0x39, 0x61 to 66.

Example: When the target area is Tokyo, the region code according to Article 9-3, No. 5 of the Radio Equipment Regulations, Article 138 of the Radio Station Operation Regulations, and Notification No. 60, No. 405 of the Ministry of Posts and Telecommunications is the following bit string, so the data acquired as the region code corresponding to the emergency warning signal is the character string "aac".

・Region code according to Article 9-3, No. 5 of the Radio Equipment Regulations, Article 138 of the Radio Station Operation Regulations, and Notification No. 60, No. 405 of the Ministry of Posts and Telecommunications.
1010 1010 1100

・Region code character string corresponding to the emergency warning signal stored in the viewer's residence information area
"aac"

3) Zip code

The data stored in the zip code is indicated by a character string of up to 7 bytes consisting of "" (empty string) and characters in the UTF-8 0x30 to 0x39 range.

4) Common matters

In the content of the viewer's residence information area, "" (empty string) means that the type of information has not been set.

10.2 Use of remote control keys from data content services

10.2.1 Guidelines for content using the d button

The d button shall switch the presentation state of the content of the data content service. Assumed operation by pressing the d button is such as changing display value and visibility value by CSS, transition of HTML5 document, process of enableFullscreen(), process of disableFullscreen() as shown in Fig. 10-1.

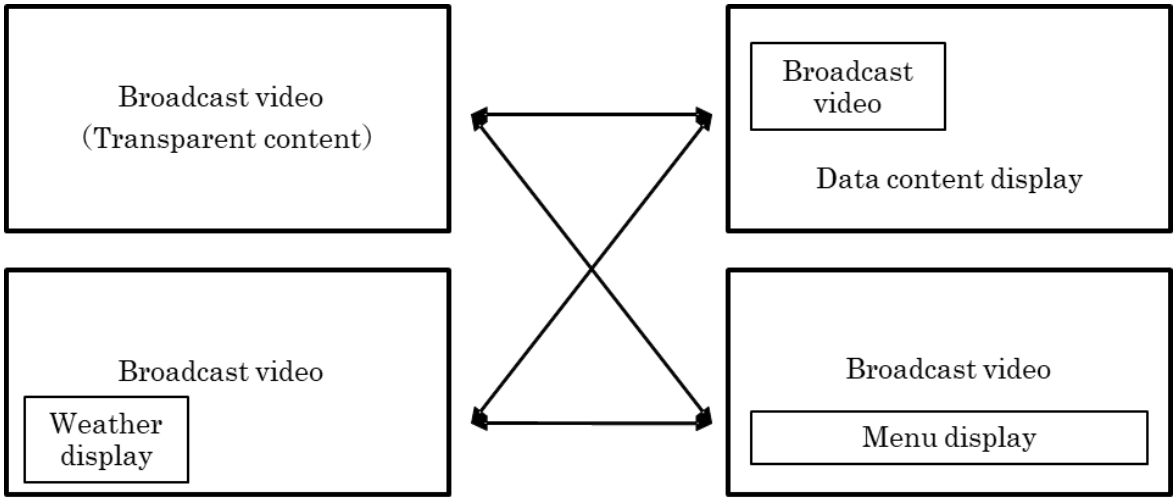

Fig. 10-1 Example of switching the presentation state of the content with the d button

10.2.2 Guidelines for content using the tuning button

Numeric tuning keys and tuning-related keys shall not be used for purposes other than the following.

(1) Tuning on data content and switching of presented content
(2) Inputting Character (including numbers character)
(3) Operations required for inputting character (decision / deletion, etc.)

In case of (3) and of assigning functions such as "execute", "cancel", and "erase" to the numeric keys to improve the operability of character input, functions that have execution and positive meaning should be assigned to the "12" button. Because it is assumed that the subsequent operations of "execute" and "cancel" differ greatly, it is recommended to take care so that the function assignments to the keys do not differ significantly for each content.

10.2.3 Guidelines for content using color keys

For content that has no means of selection other than the color key, the color key to be selected by the viewer shall be identified not only by the color distinction but also by the characters indicating the color.

When assigning functions such as "execute", "cancel", and "erase" to a color key, it is recommended to assign functions having an execute and positive meaning to the "yellow" button. Because it is assumed that the subsequent operations of "execute" and "cancel" will differ greatly, the operability of the viewer should be considered, such as by sharing the minimum function assignments to the keys depending on the broadcasters.

10.3 Operation of character code

The operation of coded character sets, control codes, and external characters used in the data content service shall follow 7.4.

However, the variation selectors in the glyph indicator sequence shown in Section 7.4.4 is not assumed to be operated in principle because gaiji characters may be operated in the data content service, but it should be noted that the glyph indicator string with the glyph selector specified is operated with the return value of the extended API (getCurrentEventInformation) to acquire SI information. Following the glyph indicator string specified by the character selector by receivers is optional feature, and malfunctions such as "□(Tofu)" and "garbled characters" should not occur.

10.3.1 HTML character reference

Numeric character references used in HTML documents shall refer to any code point in either decimal or hexadecimal notation. However, when the reference destination is not an operating character or a gaiji character the operation is optional feature. As character entity references, those listed in Table 10-9 shall be available. Correspondence to other character entity references is optional feature.

Table 10-9 HTML character entity reference to be operated

Character entity reference	Referenced character	Equivalent numeric character reference	
		Decimal notation	Hexadecimal notation
<	LESS-THAN SIGN	<	<
>	GREATER-THAN SIGN	>	>
&	AMPERSAND	&	&
"	QUOTATION MARK	"	"
	NO-BREAK SPACE		

10.4 Operation range of media type and monomedia

Table 10-10 shows the operational guidelines of the media types assumed to be required for basic services and of monomedia coding specified by object element, video element, and audio element.

Table 10-10 Media type / monomedia operation guideline table

Schema	Media type	meaning
http:https:	text/xml; charset="UTF-8"	XML document
	text/html	HTML5 document
	text/css	Cascading Style Sheet
	image/jpeg	JPEG
	image/png	PNG
	image/gif	GIF
	image/svg+xml	SVG
	video/X-arib-avc	H.264/MPEG-4 AVC
	video/X-arib-hevc	H.265/MPEG-H HEVC
	video/mp4	MP4
	audio/X-arib-mpeg4-aac	MPEG-4 AAC
	audio/X-arib-mpeg4-als	MPEG-4 ALS
	audio/X-arib-aiff	AIFF-C
	audio/X-arib-mp3	MPEG-1/2 Audio Layer-3
	application/json	JSON
	application/xml	XML document
	application/javascript	JavaScript
	application/font-woff	Web Open Font Format
	application/dash+xml	MPEG-DASH Media Presentation Description
	application/X-arib-ttml+xml	ARIB-TTML
	application/X-arib-ait+xml; charset="UTF-8"	XML-AIT
arib2:	video/x-arib2-broadcast	Broadcast stream
romsound:	audio/X-arib-romsound	Audio built-in the receivers

10.5 Operation of HTML elements

The elements used in the HTML document follows "W3C Recommendation 28 October 2014". The elements that are not operated are shown in Table 10-11.

Table 10-11 Elements that are not operated

Element	Category
embed	Embedded content
noscript	Scripting

10.6 Operation of CSS

The style sheet (CSS) used in the HTML document follows ARIB STD-B62 Volume 2 "2.4 CSS".

10.6.1 CSS Level

The correspondence to CSS Level should be described. Because CSS Level 3 is described by multiple standards, the corresponding policy should be described according to each standard.

10.6.2 Usage guide

The "Value" column indicates the possible values of the property. "*" means that all the formats and values specified in the corresponding standard are targeted. Table 10-12 shows the meaning of the values in the "Correspondence" column.

Table 10-12 Usage guide of correspondence column

Correspondence	Value	Explanation
Mandatory	M(andatory)	Correspondence is essential
Request	D(esired)	Recommended to implement
Conditional	C(ondtional)	Depends on the function of the receivers
Option	O(ption)	Optional feature of the receivers

10.6.3 CSS Level 2

Table 10-13 shows the correspondence to the properties specified in CSS Level 2. Aural Media groups are not operated.

Normative reference : Cascading Style Sheets Level 2 Revision 1 (CSS 2.1) Specification

http://www.w3.org/TR/CSS2/

Table 10-13 CSS Level 2 operational property correspondence table

Property name	Value	Correspondence	Supplement
list-style	*	M	
list-style-image	*	M	
list-style-position	*	M	
list-style-type	disc	M	The values Armenian, georgian are not operated.
	circle	M	
	square	M	
	decimal	M	
	decimal-leading-zero	M	
	lower-roman	M	
	upper-roman	M	
	lower-latin	M	
	upper-latin	M	
	lower-alpha	M	
	upper-alpha	M	
	none	M	
	inherit	M	
color	<color>	M	
background	*	M	
background-attachment	*	M	
background-color	*	M	

Property name	Value	Correspondence	Supplement
background-image	*	M	
background-position	*	M	
background-repeat	*	M	
direction	*	D	
unicode-bidi	*	D	
font	*	M	
font-family	*	M	
font-size	*	M	
font-style	*	M	
font-variant	*	M	
font-weight	*	M	
letter-spacing	*	M	
line-height	*	M	
text-align	*	M	
text-decoration	none	M	
	underline	M	
	overline	M	
	line-through	M	
	blink	D	
	inherit	M	
text-indent	*	M	
text-transform	*	M	
vertical-align	*	M	
white-space	*	M	
word-spacing	*	M	
content	*	M	
counter-increment	*	M	
counter-reset	*	M	
quotes	*	M	
border	*	M	
border-bottom	*	M	
border-bottom-color	*	M	
border-bottom-style	*	M	
border-bottom-width	*	M	
border-collapse	*	M	
border-color	*	M	
border-left	*	M	
border-left-color	*	M	
border-left-style	*	M	
border-left-width	*	M	
border-right	*	M	
border-right-color	*	M	

Property name	Value	Correspondence	Supplement
border-right-style	*	M	
border-right-width	*	M	
border-spacing	*	M	
border-style	*	M	
border-top	*	M	
border-top-color	*	M	
border-top-style	*	M	
border-top-width	*	M	
border-width	*	M	
caption-side	*	M	
clear	*	M	
empty-cells	*	M	
float	*	M	
margin	*	M	
margin-bottom	*	M	
margin-left	*	M	
margin-right	*	M	
margin-top	*	M	
padding	*	M	
padding-bottom	*	M	
padding-left	*	M	
padding-right	*	M	
padding-top	*	M	
table-layout	*	M	
bottom	*	M	
clip	*	M	
display	*	M	
height	*	M	
left	*	M	
max-height	*	M	
max-width	*	M	
min-height	*	M	
min-width	*	M	
overflow	*	M	
position	*	M	
right	*	M	
top	*	M	
visibility	*	M	
width	*	M	
z-index	*	M	
widows	*	D	
orphans	*	D	
page-break-after	*	D	
page-break-before	*	D	

Property name	Value	Correspondence	Supplement
page-break-inside	*	D	
cursor	*	C	
outline	*	M	
outline-color	*	M	
outline-style	*	M	
outline-width	*	M	

10.6.4 Selector

Table 10-14 shows the selectors that may be operated with CSS in the application engine. The "E" in the selector column indicates the element name, and the Level column indicates the level of the CSS specification corresponding to each selector. The correspondence is as shown in the correspondence column, not referring to each CSS standard.

Normative reference : Selectors Level 3

http://www.w3.org/TR/selectors/

Table 10-14　CSS selector correspondence table

Selector	Level	Correspondence	Supplement
*	2	M	
E	1	M	
E[foo]	2	M	
E[foo="bar"]	2	M	
E[foo~="bar"]	2	M	
E[foo^="bar"]	3	M	
E[foo$="bar"]	3	M	
E[foo*="bar"]	3	M	
E[foo|="en"]	2	M	
E:root	3	M	
E:nth-child(n)	3	M	
E:nth-last-child(n)	3	M	
E:nth-of-type(n)	3	M	
E:nth-last-of-type(n)	3	M	
E:first-child	2	M	
E:last-child	3	M	
E:first-of-type	3	M	
E:last-of-type	3	M	
E:only-child	3	M	
E:only-of-type	3	M	
E:empty	3	M	
E:link	1	M	
E:visited	2	M	
E:active	2	M	
E:hover	2	C	
E:focus	2	M	
E:target	3	M	
E:lang(fr)	2	M	
E:enabled	3	M	
E:disabled	3	M	
E:checked	3	M	
E::first-line	1	M	
E::first-letter	1	M	
E::before	2	M	
E::after	2	M	
E.warning	1	M	
E#myid	1	M	
E:not(s)	3	M	
E F	1	M	
E > F	2	M	
E + F	2	M	
E ~ F	3	M	

10.6.5 Color Module Level 3

The CSS3 Color property follows the following standards. Correspondence to opacity property is mandatory (M). Table 10-15 shows the correspondence of possible values of color.

Normative reference：CSS Color Module Level 3

http://www.w3.org/TR/css3-color/

Table 10-15　CSS Color Value Correspondence Table

Color value	Correspondence	Supplement
#rgb	M	
#rrggbb	M	
rgb(N,N,N)	M	
rgb(%,%,%)	M	
rgba(N,N,N,N)	M	
rgba(%,%,%,N)	M	
transparent	M	
hsl(%,%,%)	M	
hsla(%,%,%,N)	M	
Basic color keywords	O	
Extended color keywords	O	
currentColor	M	

10.6.6 Values and units

The values and units that each property may take follow the following standards. Table 10-16 shows the correspondence.

Normative reference : CSS Values and Units Module Level 3 (Candidate Recommendation 30 August 2013)

http://www.w3.org/TR/css3-values/

Table 10-16 Value and unit correspondence table

Values	Units	Level	Correspondence	Supplement
inherit		2	M	
initial		3	D	
<string>		2	M	
<url>		2	M	
<integer>		2	M	
<number>		2	M	
<percentage>		1	M	
<length>	em	1	M	
	ex	1	M	
	cm	1	D	
	mm	1	D	
	in	1	D	
	px	1	M	
	pt	1	M	
	pc	1	M	
<angle>	deg	2	M	
	grad	2	M	
	rad	2	M	
	turn	3	M	
<time>	s	2	M	
	ms	2	M	
<frequency>	Hz	3	M	
	kHz	3	M	
<color>		2/3	-	Refer to 10.6.5
<position>		2/3	-	Refer to 10.6.7
<image>		3	-	Refer to 10.6.8
attr(X)		2	M	
attr(X,U)		3	D	
attr(X,U,E)		3	D	

10.6.7 Backgrounds and Borders

The background and borders follow the following standards. Table 10-17 shows the correspondence.

Normative reference : CSS Backgrounds and Borders Module Level 3 (W3C Candidate Recommendation 9 September 2012)

http://www.w3.org/TR/css3-background/

Table 10-17 Backgrounds and Border Property Correspondence Table

Property name	value	Correspondence	Supplement
background-attachment	local	D	
background-image	<image>supports 2 or more	M	Supports 3 or more multi-layers
background-position	*	M	Supports 3 or more multi-layers
background-repeat	*	M	Supports 3 or more multi-layers
background-clip	*	M	
background-origin	*	M	
background-size	*	M	
background	*	M	
border-image	*	M	
border-image-repeat	*	*1	
border-image-slice	*	*1	
border-image-source	*	*1	
border-image-width	*	*1	
border-radius	*	M	
border-top-left-radius	*	M	
border-top-right-radius	*	M	
border-bottom-left-radius	*	M	
border-bottom-right-radius	*	M	
box-shadow	*	M	

* 1 This property cannot be used individually, and only supports abbreviated notation by border-image.

10.6.8 Image Values and Replaced Content

The specified value for <image> follows the following standards. Table 10-18 shows the correspondence.

Normative reference : CSS Image Values and Replaced Content Module Level 3 (W3C Candidate Recommendation 17 April 2013)

http://www.w3.org/TR/css3-images/

Table 10-18 <image> value correspondence table

<image>	Correspondence	Supplement
url()	M	
linear-gradient()	M	
radial-gradient()	M	
repeating-linear-gradient()	D	
repeating-radial-gradient()	D	

10.6.9 Text

CSS for characters follows the following standards. Table 10-19 shows the correspondence.

Normative reference : CSS Text Module Level 3 (W3C Last Call Working Draft 10 October 2013)

http://www.w3.org/TR/css3-text/

Table 10-19 Text property correspondence table

Property name	value	Correspondence	Supplement
text-transform	*	M	
white-space	*	M	
tab-size	*	M	
line-break	*	M	
word-break	*	M	
hyphens	*	D	
word-wrap	*	M	At least one of them must be dealt with
overflow-wrap	*	M	
letter-spacing	*	M	
text-align	start	D	
	end	D	
	left	M	
	right	M	
	center	M	
	justify	D	
	justify-all	D	
	match-parent	D	
text-align-last	auto	D	
	start	D	
	end	D	
	left	D	
	right	D	
	center	D	
	justify	D	
text-justify	*	D	
word-spacing	*	M	
text-indent	*	M	
hanging-punctuation	*	D	

10.6.10 Text Decoration

CSS for character decoration follows the following standards. Table 10-20 shows the correspondence.

Normative reference : CSS Text Decoration Module Level 3 (W3C Candidate Recommendation 1 August 2013)

http://www.w3.org/TR/css-text-decor-3/

Table 10-20 Text Decoration Property Correspondence Table

Property name	value	Correspondence	Supplement
text-shadow	*	M	

10.6.11 Transforms

CSS as element deformation follows the following standards. Table 10-21 and table 10-22 show the correspondence.

Normative reference : CSS Transforms Level1 (W3C Working Draft, 26 November 2013)

http://www.w3.org/TR/css3-transforms/

Table 10-21 Transform property correspondence table

Property name	value	Correspondence	Supplement
transform	*	M	
transform-origin	*	M	
transform-style	*	D	
perspective	*	D	
perspective-origin	*	D	
backface-visibility	*	D	

Table 10-22 Transform function correspondence table

transform functions	Correspondence	Supplement
matrix	M	
translate	M	
translateX	M	
translateY	M	
scale	M	
scaleX	M	
scaleY	M	
rotate	M	
skew	M	
skewX	M	
skewY	M	
matrix3d	D	
translate3d	D	
translateZ	D	
scaleZ	D	
rotate3d	D	
rotateX	D	
rotateY	D	
rotateZ	D	
perspective	D	
none	M	A value that specifies that no transformations are applied

10.6.12 Transitions

The expression effect on time follows the following standards. Table 10-23 shows the correspondence. Table 10-24 shows the values of each property.

Normative reference : CSS Transitions (W3C Working Draft 19 November 2013)

http://www.w3.org/TR/css3-transitions/

Table 10-23 Transition property correspondence table

Property name	value	Correspondence	Supplement
transition	*	M	
transition-delay	*	M	
transition-duration	*	M	
transition-property	*	M	
transition-timing-function	*	M	

Table 10-24 List of properties that may be changed in transition

Property	Units	Correspondence	Supplement
background-color	color	M	
border-bottom-width	length	M	
border-left-width	length	M	
border-right-width	length	M	
border-spacing	length	M	
border-top-width	length	M	
border-width	length	M	
bottom	length, percentage	M	
color	color	M	
font-size	length, percentage	M	
height	length, percentage	M	
left	length, percentage	M	
letter-spacing	length	M	
line-height	number, length, percentage	M	
margin-bottom	length	M	
margin-left	length	M	
margin-right	length	M	
margin-top	length	M	
opacity	number	M	
padding-bottom	length	M	
padding-left	length	M	
padding-right	length	M	
padding-top	length	M	
right	length, percentage	M	
text-indent	length, percentage	M	
top	length, percentage	M	
visibility	visibility	M	
width	length, percentage	M	
word-spacing	length, percentage	M	
z-index	integer	M	

10.6.13 Animations

Animation follows the following standards. Table 10-25 shows the correspondence.

Normative reference : CSS Animations

(W3C Working Draft 19 February 2013)

http://www.w3.org/TR/css3-animations/

Table 10-25 Animation property correspondence table

Property	Value	Correspondence	Supplement
animation	*	M	
animation-name	*	M	
animation-duration	*	M	
animation-timing-function	*	M	
animation-delay	*	M	
animation-direction	*	M	
animation-iteration-count	*	M	
animation-play-state	*	M	
animation-fill-mode	*	M	

10.6.14 Fonts

Only Level 2 CSS shall be operated for Font, and additions by Level 3 CSS shall not be operated.

10.6.15 Basic User Interface

The user interface follows the following standards. Table 10-26 shows the correspondence.

Normative reference : CSS Basic User Interface Module Level 3 (CSS3 UI)

(W3C Candidate Recommendation, 7 July 2015)

http://www.w3.org/TR/css3-ui/

Table 10-26 Basic User Interface Property Correspondence Table

Property	Value	Correspondence	Supplement
box-sizing	content-box	M	
	padding-box	M	
	border-box	M	
nav-index	auto	M	
	<number>	M	
nav-up		M	
nav-down		M	
nav-left		M	
nav-right		M	
outline		M	
text-overflow	clip	M	
	ellipsis	M	

10.6.16 Basic Box Model

Specifications regarding screen overflow follows the following standard. Table 10-27 shows the correspondence.

Normative reference : CSS basic box model

(W3C Working Draft 9 August 2007)

http://www.w3.org/TR/css3-box/

Table 10-27 Basic Box Model Property Correspondence Table

Property name	Value	Correspondence	Supplement
overflow-x	visible	M	
	hidden	M	
	scroll	M	
	auto	M	
overflow-y	visible	M	
	hidden	M	
	scroll	M	
	auto	M	

10.6.17 Vendor prefix

10.6.17.1 Type

The vendor prefixes shown in Table 10-28 should be operated. Each support depends on optional feature of the receivers, and items which is not supported shall not affect the screen presentation.

Table 10-28 List of vendor prefixes

Vendor prefix	Properties / values
webkit	-webkit-
o	-o-
ms	-ms-
moz	-moz-

10.6.17.2 Properties to be given a vendor prefix

Table 10-29 shows the properties to which the vendor prefix should be assigned. Assigning the vendor prefix may be determined according to the correspondence status of the receivers.

Table 10-29 Properties to be given a vendor prefix

Property
border-radius
border-top-left-radius
border-top-right-radius
border-bottom-left-radius
border-bottom-right-radius
box-shadow
border-image
line-break
transform
transform-origin
transition
transition-delay
transition-duration
transition-property
transition-timing-function
animation
animation-name
animation-duration
animation-timing-function
animation-delay
animation-direction
animation-iteration-count
animation-play-state

10.6.17.3 Values to be given a vendor prefix

Table 10-30 shows the values to which the vendor prefix should be added. Assigning the vendor prefix may be determined according to the correspondence status of the receivers.

Table 10-30 Values to be given the vendor prefix

Property	Value
<image>	linear-gradient()
	radial-gradient()
	repeating-linear-gradient()
	repeating-radial-gradient()

10.6.17.4 Events that should be given a vendor prefix

Table 10-31 shows the events that should be given a vendor prefix. Assigning the vendor prefix may be determined according to the correspondence status of the receivers.

Table 10-31 Events that should be given a vendor prefix

Event name	webkit	o	ms	moz
animationstart	webkitAnimationStart	Unnecessary	Unnecessary	Unnecessary
animationend	webkitAnimationEnd	Unnecessary	Unnecessary	Unnecessary
animationiteration	webkitAnimationIteration	Unnecessary	Unnecessary	Unnecessary
transitionend	webkitTransitionEnd	oTransitionEnd	Unnecessary	Unnecessary

10.6.18 Initial value

The initial CSS values are the values described in each CSS standard, except for those shown in Table 10-32.

Table 10-32 Initial values for CSS properties

Property	Initial value
color	black
font-family	Round gothic
font-size	64px
quotes	'
line-height	96px
border-top-width	Receivers dependent
border-right-width	Receivers dependent
border-left-width	Receivers dependent
border-bottom-width	Receivers dependent

10.7 Extended API

This section describes the API described in ARIB STD-B62 Volume 2, "3.3 Extension Functions for Broadcasting". This API shall be implemented in a format bound to JavaScript. Unless otherwise stated, the meaning of each object, method, property, and constant shall be followed. These APIs may only be called from the data content service. (It may be prohibited by permission)

Unless otherwise specified, the objects, methods, properties, and constants defined in this section are required and may be used in a data contents.

However, when the extended API is specified independently in operational guidelines, it is defined in accordance with ARIB STD-B62 Volume 2 "3.3.15 Extension of ReceiversDevice Object".

In addition, "X_ <sProviderName> _" is added as a prefix to the defined property. The character string assigned to "<sProviderName>" that identifies the management organization is managed by the management organization shown in Appendix 6.

10.7.1 Permissions

In the operation of application control information, permissions for access to broadcast resources shall be configured with bitmaps for each function.

10.7.1.1 Bitmap

The upper 3 bits of permission_bitmap shall be used to identify the bitmap. Table 10-33 shows the operation of bitmaps.

Table 10-33 Permission Bitmap

(bit15,bit14,bit13)	Name	Operation
(0,0,0)	Bitmap 0	All 0 or all 1 values are used for the lower 13 bits. When a value other than these two values is specified, the receivers are regarded as all 0 and operates. Table 10-34 shows the assignment and operation of each bit and function.
(0,0,1)	Bitmap 1	Table 10-34 shows the assignment and operation of each bit and function.
(0,1,0)～(1,1,1)	For future expansion	In the case that the receivers support only bitmap 0 and bitmap 1, when the bitmap is specified, the operation in which the value of each bit in Table 10-34 is 0 is applied for the operation of the function.

10.7.1.2 Function assignment

The lower 13 bits of permission_bitmap shall be assigned to each function and used to identify whether or not operation is possible. Table 10-34 shows the assignment and operation of functions to each bit in bitmap 0 and bitmap 1.

Table 10-34 Bit values and feature assignment and operation in bitmap 0, bitmap 1.

Usage Guide ○: Operable, ×: Not operational

bit	API or function	bit value	
		1	0
bit12	Enable broadcast video and audio objects	○	×
bit11	Monomedia arrangement on broadcast video	○	×
bit10	SI information acquisition API	－	－
	getCurrentEventInformation	○	×
bit9	localStorage access API	○	×
	Non-volatile storage access API	－	－
	writePersistentArray	○	×
	readPersistentArray	○	×
	X_APAB_setAccessInfoToProviderArea	○	×
bit8	Boundary extension API	－	－
	addPermissionManagedArea	○	×
bit7	Receivers ID acquisition API	－	－
	getDeviceIdentifier	○	×
bit6	API related to TCP / IP communication function	－	－
	confirmIPNetwork	○	○
bit5	API to access other broadcast resources and signals	－	－
	getOwnerApplication	○	○
	replaceApplication	○	×
	destroyApplication	○	○
	exitFromManagedState	○	×
	getOwnerAIT	○	×
	getApplicationBoundaryAndPermissionDescriptor	○	×
	getCurrentBoundary	○	×
	getApplications	○	×
	hasCapability	○	○
	tuneTo	○	×
	addGeneralEventMessageListener	○	×
	removeGeneralEventMessageListener	○	×
	addUTCNPTReferenceMessageListener	○	×
	removeUTCNPTReferenceMessageListener	○	×
	setAlarmByUTCNPT	○	×
	unsetAlarmByUTCNPT	○	×
	getUTCNPT	○	×
	Access to Ureg	○	×
	Access to Greg	○	×
	getSystemInformation	○	×
	addEventIDUpdateListener	○	×
	removeEventIDUpdateListener	○	×
	addAITUpdateListener	○	×

		removeAITUpdateListener	○	×
		addCacheEventListener	○	×
		removeCacheEventListener	○	×
		storeDataResource	○	×
		releaseDataResource	○	×
		sourceIs	○	×
		addDataEventIDUpdateListener	○	×
		removeDataEventIDUpdateListener	○	×
bit4	Viewing scheduling / recording scheduling API		−	−
		isScheduledToTune	○	×
		scheduleToTune	○	×
		unscheduleToTune	○	×
		isScheduledToRecord	○	×
		scheduleToRecord	○	×
		unscheduleToRecord	○	×
bit3	CAS related functions		○	×
bit2	reserved for future use		−	−
bit1	reserved for future use		−	−
bit0	reserved for future use		−	−

The monomedia arrangement on the broadcast video controlled by bit11 indicates that the drawing (including transparent drawing elements) other than the broadcast video by the data content service is overlaid within the coordinate range for displaying the broadcast video. When such a display is specified by the HTML document, but the bit is 0, it is recommended to continue the data content service and display the full-screen broadcast video by hiding all or part of the drawing element. In a broadcast managed application, regardless of the value of bit11, implementation of arranging monomedia on the broadcast video is also allowed according to the specification of the HTML document.

The CAS-related functions controlled by bit3 covers all APIs of the CAS-related functions shown in Section 10.7.16.

All data content transmitted by broadcasting shall be treated as an application within the boundary and shall have all authority.

10.7.2 Exception

In ARIB STD-B62 Volume 2, "3.3 Extension functions for broadcasting", error notification is not defined except for some extension APIs. In this operational guideline, each API shall generate an exception when an error occurs, an exception object shall be the Error object, and the value of a specified character string shall be taken when the following types of errors occur. In the case of converting an exception object to a string, the result is that name, ":", half-width space, and message are connected. Broadcasters should be aware that some receivers have an exception object as a String.

Table 10-35 Error Object Properties

Property name	Style	supplement
constructor	Function	The function that caused the error
name	String	Error name (value is fixed to "Error")
message	String	Error messages (Table 10-36)

Table 10-36 Exceptions and error message values that occur on error

Error name	Contents	Error message value
INVALID_PARAM_ERR	There is an error in the method argument	“Invalid parameter”
TIMEOUT_ERR	A timeout occurred due to communication etc.	“Timeout”
NOT_FOUND_ERR	There is no corresponding file	“File not found”
NOT_AUTHORIZED_ERR	No authority to use the API	“Not authorized”
OUT_OF_RANGE_ERR	Array subscripts are out of range	“Index out of range”
MISC_ERR	Other errors	“Unknown error”

The conditions that cause exceptions and errors are described in the explanation of each API (method). When an undescribed error occurs, MISC_ERR shall be displayed. For asynchronous methods (methods that take a callback function as an argument), the specified callback function shall not be called when an exception occurs.

10.7.3 ISDB resource reference object

The object (ISDBResourceReference) described in ARIB STD-B62 Volume 2, "3.3.1 ISDB resource reference object" shall be used as an argument / return value of the method of the extended API specified in this document. JavaScript represented the object by an object type.

Table 10-37 shows the types of existing properties of the ISDBResourceReference object. Refer to ARIB STD-B62 Volume 2, Section 3.3.1 for each parameter.

Table 10-37　ISDB Resource Reference Object Types

Property name	Style	supplement
original_network_id	Number	The range is [0..65535]
tlv_stream_id	Number	The range is [0..65535]
service_id	Number	The range is [0..65535]
event_id	Number	The range is [0..65535]
component_tag	Number	The range is [0..255]
event_message_tag	Number	The range is [0..255]

10.7.4 EPG related functions

The object (ReceiverDevice) described in ARIB STD-B62 Volume 2, "3.3.2 EPG related functions " shall provide access to program viewing scheduling functions and recording scheduling functions.

JavaScript may access by navigator.receiverDevice.

Regarding the argument start_time, when the start_time obtained by broadcasting reception at the receivers and the start_time specified by the application are different, an exception shall be returned. In this time comparison, fractions less than 1 second are rounded down. Appendix 10 shows the operational guidelines for EPG related functions.

Table 10-38 Check when the specified program is scheduled for viewing

Method	Parameters	Style
isScheduledToTune (event_ref [,start_time])	Return value	Boolean
	event_ref,	ISDBResourceReference object
	start_time	Date object
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No access to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-39 Scheduling to view the specified program

Method	Parameters	Style
scheduleToTune (event_ref [,start_time])	Return value	void
	event_ref,	ISDBResourceReference object
	start_time	Date object
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-40 Canceling a viewing schedule for the specified program

Method	Parameters	Style
unscheduleToTune (event_ref)	Return value	void
	event_ref,	ISDBResourceReference object
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No autority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-41 Check when the specified program is scheduled for recording

Method	Parameters	Style
isScheduledToRecord (event_ref [,start_time])	Return value	Boolean
	event_ref,	ISDBResourceReference object
	start_time	Date object
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No autority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-42 Schedule recording of the specified program

Method	Parameters	Style
scheduleToRecord (event_ref [,start_time])	Return value	void
	event_ref,	ISDBResourceReference object
	start_time	Date object
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No autority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-43 Cancel recording schedule for the specified program

Method	Parameters	Style
unscheduleToRecord(event_ref)	Return value	void
	event_ref,	ISDBResourceReference object
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No autority to use the API		NOT_AUTHORIZED_ERR
Other errvvors		MISC_ERR

10.7.5 Closed caption display control function

ARIB STD-B62 Volume 2 "3.3.3 Closed caption display control function" shall use the method specific to BroadcastVideoObjectElement of the broadcast video / audio object for closed caption display.

10.7.6 Local storage used by the application

An application shall use objects described in ARIB STD-B62 Volume 2 “3.3.5 Local storage area used from application” and objects described in 10.1.1 to access local storage.

When the character string described in 10.1.1.2 is used as an argument by the above means, a SecurityError exception shall be generated when it is disabled by 10.7.1.

10.7.7 Communication function assuming TCP / IP

An application shall check the connection to the IP network by the object (ReceiverDevice) described in ARIB STD-B62 Volume 2 “3.3.6 Communication function with its TCP / IP connection assumed”.

JavaScript may access the object with navigator.receiverDevice.

Table 10-44 Checking the connection status to the IP network

Method	Parameters	Style
confirmIPNetwork(destination, confirmType[,timeout]);	Return value	Boolean
	destination	String
	confirmType	Number
	timeout	Number
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

10.7.8 Application Manager Object

This is the object (Application Manager) described in ARIB STD-B62 Volume 2 "3.3.7 Application manager object" and an object related to application execution control.

JavaScript may access the object with navigator.applicationManager.

Table 10-45 Retrieving Application Objects

Method	Parameters	Style
getOwnerApplication([document])	Return value	Applicaton object
	document	Document object
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

10.7.9 Application object

This is the object (Application) described in ARIB STD-B62 Volume 2 "3.3.8 Application object" and an object that is obtained as the return value of getApplications of the method of the application information table object specified in getOwnerApplication or 10.7.10 above and represents the application. The method properties of the application object are shown below.

1) Operation of type property, organization_id property, application_id property, control_code property, autostart_priority property
Refer to ARIB STD-B62 Volume 2, 3.3.8.2

2) Operation of replaceApplication method
In the case of specifying a file on the network, ait_url shall describe an absolute reference URL. In the case of referring to MH-AIT transmitted by broadcasting, ait_url shall be fixed to null.

organization_id and application_id shall be specified by the organization identification and application identification of the application to be executed.

However, in the case of XML-AIT, or when only one application is described in MH-AIT, 0 may be specified for both organization_id and application_id. In this case, it shall be considered that the organization_id and application_id of the only application described in the AIT specified in the argument ait_url are specified. The operation when the value 0 is specified for only one of both arguments is implementation dependent.

Table 10-46 executing the Data Content Service

Method	Parameters	Style
replaceApplication(organization_id , application_id,ait_url)	Return value	void
	organization_id	Number
	application_id	Number
	ait_url	String (Null value is also possible)
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
AIT acquisition failed (file does not exist)		NOT_FOUND_ERR
AIT acquisition failed (timeout)		TIMEOUT_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

3) destroyApplication Method operation

When destroyApplication is called, the receivers shall operate in the same way as immediately after re-tuning the channnel being selected after finishing the HTML document presented.

Table 10-47 Exiting the currently executing application

Method	Parameters	Style
destroyApplication ()	Return value	void
Exception occurrence condition		code property
Other errors		MISC_ERR

4) Operation of exitFromManagedState method

By using this function, an application shall move to the presentation state of a general website.

It should be noted that the presentation of broadcast video / audio and various broadcast-related functions shall not be used for the document after the transition. In this function, the calling application is destroyed before it becomes possible to acquire the transition document and determine whether it may be presented. When it is not possible to present the transition destination document for some reason, it is recommended that the HTML browser is terminated, and the receivers perform a re-tuning operation. The application creator should be careful not to confuse the viewer when using this function.

Table 10-48 Launch general applications

Method	Parameters	Style
exitFromManagedState(url)	Return value	void
	url	String (Maximum 250 characters)
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

5) Operation of getOwnerAIT() method

Table 10-49 Getting the ApplicationInformationTable object

Method	Parameters	Style
getOwnerAIT()	Return value	AIT object
Exception occurrence condition		code property
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

6) Operation of getApplicationBoundaryAndPermissionDescriptor method

Table 10-50 Retrieving Objects Representing Application Boundary Permission Setting Descriptors

Method	Parameters	Style
getApplicationBoundary AndPermissionDescriptor ()	Return value	ApplicationBoundary AndPermission object
Exception occurrence condition		code property
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

7) Operation of getCurrentBoundary method

Table 10-51 Application boundary and permission acquisition

Method	Parameters	Style
getCurrentBoundary ()	Return value	Array of PermissionManagedArea objects
Exception occurrence condition		code property
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-52 Properties of the PermissionManagedArea object

Property name	Style	supplement
permission	Array of Numbers or null	
urls	Array of Strings or null	

8) Operation of addPermissionManagedArea method

The access authority management area added by this method shall be initialized when the executing application ends.

For the operation of the argument permission, one bitmap shall be located that represents the access authority, or null that represents the "maximum permission" shall be specified.

The maximum number of permission_bitmaps defined by the application boundary permission setting descriptor and API (addPermissionManagedArea()) and held in the receivers shall be 16.

As the operation of the argument urls, the maximum value of the total number of managed_URLs associated with all permission_bitmaps held in the receivers shall be 160.

Table 10-53 Boundary expansion

Method	Parameters		Style
addPermissionManagedArea (pma)	Return value		void
	pma	permission	array of Number ornull
		urls	array of Stringor null
Exception occurrence condition			code property
Argument is abnormal			INVALID_PARAM_ERR
No authority to use the API			NOT_AUTHORIZED_ERR
Other errors			MISC_ERR

10.7.10 ApplicationInformationTable object

The object (ApplicationInformationTable) described in ARIB STD-B62 Volume 2 "3.3.9 ApplicationInformationTable object". The method getApplications() to be operated is described in Table 10-54.

Table 10-54 Retrieving All Application Objects Placed in Current AIT

Method	Parameters	Style
getApplications()	Return value	Array of application objects
Exception occurrence condition		code property
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

10.7.11 Capabilities object

The object described in ARIB STD-B62 Volume 2 "3.3.10 Capabilities object" shall provide information about the features of the application engine and receivers platform.

It may be accessed from JavaScript with navigator.capabilities.

Table 10-55 Acquired the functions of the application engine and receiver's platform

Method	Parameters	Style
hasCapability(query[,param1, ...,paramN])	Return value	Boolean
	query	String
	param1...paramN	String (Take variable arguments)

When unknown query and param are specified, false should be returned as the return value.

Table 10-56 Possible values of hasCapability method

query	param		Motion
Determining the corresponding CA_system_id			
CASystem	param1	Specify the value of CA_system_id described in Volume 5.	When the value of CA_system_id described in Volume 5 is specified for type in getDeviceIdentifier, true when the CAS module ID may be obtained.
Determining the version of the installed CAS API			
CASsystemAPI	param1 or later	Refer to the operation of Volume 5 Appendix 6 1.7 API version acquisition function.	Refer to the operation of Volume 5 Appendix 6 1.7 API version acquisition function.
Judgment of correspondence to "VCR" of key group			
KeyGroup	param1	Specify "VCR".	True when the application may use key events belonging to the key group "VCR"
Determining the resolution supported by the HTML browser			
BrowserResolution	param1	Specify "8K", "4K", "2K". 8K indicates 7680 x 4320, 4K indicates 3840 x 2160, and 2K indicates 1920 x 1080.	Determine the resolution of the HTML browser. True when the corresponding HTML browser is implemented.
Judgment of compatible audio simultaneous playback combinations			
AudioElement	param1	Specify "Supports Simultaneous Playing". (* 1)	true when simultaneous playback with the listed combinations is possible. This

query	param		Motion
	param2 or later	List the pairs of MIME types and their numbers for the combination as wanted to determine. The specified MIME type is one whose top-level type is audio, or video/x-arib2-broadcast.	determination returns a result on the assumption that the broadcast audio is not being played. And make sure that the total number of combinations is 2 or more. Refer to Appendix 8 for operational examples.
Judgment of support for MPEG4-ALS			
AudioElement	param1	Specify "Supports Playing". (* 2)	True when playback of MPEG-4 ALS is supported, false when playback is not supported.
	param2	Specify "audio/X-arib-mpeg4-als".	
Judgment of MSE, EME, DRM supported by MPEG-DASH method for video / audio service by communication			
VideoElement	param1	Refer to 12.2.6.8.	Refer to 12.2.6.8.
Judgment of video monomedia support by MPEG-DASH method in broadcast transmission			
VideoElement	param1	Specify "MPEG-DASH".	True when it supports video monomedia by the MPEG-DASH method in broadcast transmission.
	param2	Specify "broadcast".	
Judgment of compatibility with 8K resolution video of MPEG-DASH method by communication			
VideoElement	param1	Specify "MPEG-DASH".	True when the transmitted 8K resolution video may be played back in the MPEG-DASH method by communication.
	param2	Specify “8K”	
Judgment of support for MMT method for video / audio services by communication			
MMTVideoStream	param1	Refer to 12.3.	Refer to 12.3.
Judgment of input device compatibility			
InputDevice	param1	Specify "SupportsEvent" (* 3)	For the input device specified in param2, when it is "support" in param3, it is true if the receivers support the function. When "available", true when the compatible device is already connected and available from the application.
	param2	Specify one of "keyboard", "mouse", "touch", "gamepad".	
	param3	Specify "support" or "available".	
Judgment of compatible media			
Media	param1	Refer to 14.3.1.	Refer to 14.3.1.

query	param		Motion
Judgment of the combination of simultaneous playback of compatible videos			
SimultaneousPlay	param1	Specify the media schema (arib2 for broadcasting, http or https for communication).	true when simultaneous playback is possible for the amount described in the video format of the combination of the four parameters param1, param2, param3 and param4. Refer to Appendix 8 for operational examples.
	param2	Specify MIME type whose top level type is video	
	param3	Specify the video resolution (2K, 4K, 8K).	
	param4	Specify the video frame frequency and the value (30I, 30P, 60P, 120P) indicating the interlaced or progressive method. Values are based on Volume 7, 4.1.1.	
	Or later	Make one set from param1 to param4, and list only the combinations for which you want to judge simultaneous playback.	
Determining the supported TLS version			
TLS	param1	Specify TLS version	True when it corresponds to the TLS version specified in param1.
Judgment of implementation of viewing reservation and recording reservation interface			
Schedule	param1	“SupportsScheduleToTuneWithUI” or ”SupportsScheduleToRecordWithUI”	When the value specified in param1 is "SupportsScheduleToTuneWithUI", true when the receivers display the viewing reservation confirmation UI when calling ScheduleToTune. “SupportsScheduleToRecord In the case of "WithUI", true when the receivers display the recording reservation confirmation UI when calling ScheduleToRecord.
Judgment of response to NPT reference message			
EventMessage	param1	“NPT”	True if the NPT reference message is supported, false otherwise.
Judgment of API implementation			

query	param		Motion
APIGroup	param1	Refer to Table 10-57 for the strings to specify.	True when the API corresponding to the character string specified in param1 is implemented.

(* 1) Broadcasters should be aware that there are receivers that operate only by specifying "Support Simultaneous Playing".
(* 2) Broadcasters should be aware that there are receivers that operate only by specifying "Support Playing".
(* 3) Broadcasters should be aware that there are receivers that operate only by specifying "Support Event".
Table 10-57 shows the API combinations corresponding to the character string and the character string specified in argument param1 to determine API implementation by hasCapability method.

Table 10-57 Combination of API and string specified by API implementation judgment

Character string specified by param1	Applicable API
“sourceIs”	sourceIs()
“dataEventIDUpdate”	addDataEventIDUpdateListener()
	removeDataEventIDUpdateListener()

10.7.12 ReceiverDevice object

The object described in ARIB STD-B62 Volume 2 "3.3.11 ReceiverDevice object" shall provide means of access to the functions of the application engine and receivers platform.

It may be accessed from JavaScript with navigator.receiverDevice. The ReceiverDevice object has the following methods.

1) Acquisition of receiver’s unique identifier

Table 10-58 Acquisition of receivers-specific identifier

Method	Parameters	Style
getDeviceIdentifier (type, resultCallback)	Return value	void
	type	Refer to Table 10-59
	resultCallback	Callback function (DeviceIdentifierCallback)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
DeviceIdentifierCallback (identifier)	Return value	void
	identifier	String (Null object when acquisition fails)

The type of parameter and the values that may be obtained shall operate those in Table 10-59.

Table 10-59 Acquisition of receiver's specific identifier

Value of type	Value to be retrieved
CA_system_id described in Volume 5	CAS module ID corresponding to CA_system_id specified in type (hexadecimal notation)

2) Obtaining information about the product

Table 10-60 Obtaining information about products

Method	Parameters	Style
getSystemInformation(query)	Return value	SystemInformation object
	query	Array of String In this operation, specify null as the query value.
Exception occurrence condition		Code (property value)
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

The following is specified as the property of the SystemInformation object. The values below the manufacturer ID should ensure uniqueness for each manufacturer.

Table 10-61 SystemInformation Object Properties

Property name	Style	Supplement
makerid	String	Manufacturer ID used to download receivers' software (* 1)
browsername	String	HTML browser name
browserversion	String	HTML browser version
modelname	String	Receivers model name
baseurl	String	Base URL used for referencing application data transmitted by broadcasting in an application. The format shall comply with RFC 3986 and shall end with a "/" character (* 2). As shown in 6.1.3.6, the application is described below, and shall specify the application data transmitted by broadcasting (* 3). They are base URL obtained by this function, base directory path described in the data directory management table, directory node path, and the URL generated by concatenating the file names described in the index item so on.

(* 1) This value shall be returned a character string in hexadecimal notation, but shall not be added a character (string) indicating that it is a hexadecimal character string notation such as "0x" at the beginning of the character string or "h" at the end. The required number of 0s is padded at the beginning of the character string so that it has 2 digits.
(* 2) The schema of the base URL is not specified. But the receivers should return a base URL that enables access to application data transmitted by broadcasting (including acquisition by XMLHttpRequest) , in the case that both broadcast transmitted applications and communication transmitted applications are referenced by the URL in the format shown in 6.1.3.6 . Also, the base URL should be immutable, at least until the application is terminated.
-Example of base URL: "http://localhost: <port_number>/"
(* 3) The application should apply the returned character string to the format shown in 6.1.3.6 as it is without processing. The receivers should be implemented in consideration of preventing access to unintended data from the application.

3) Tuning

Tuning shall be used by the tuneTo method. The application creator should be aware that when the function is executed, the operation of the subsequent script description is not guaranteed. Similarly, the application creator should be aware that when the execution of this function fails, the operation of the HTML document may continue. When tuneTo is called and then other methods of receiverDevice is called while the exception is called, the behavior of those methods is not guaranteed, so the application shall wait for calling the exception before calling the other method.

By calling this function, the contents of the history object of the HTML browser are cleared. The receivers should not present the document presented after calling this function, even if the "back" function of the HTML browser or history.back () is used.

In this operation, the argument resultCallback and the argument options shall not be used.

Table 10-62 Tuning operation

Method	Parameters	Style
tuneTo(service_ref, resultCallback [,options])	Return value	void
	service_ref,	ISDBResourceReference object
	resultCallback	No operate
	options	No operate
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

4) Acquisition of information about EIT [present / following]

Table 10-63 Obtaining information about EIT [present / following]

Method	Parameters	Style
getCurrentEventInformation (resultCallback)	Return value	void
	resultCallback	Callback function (CurrentEventInformationCallback)
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
CurrentEventInformationCallback (info)	Return value	void
	info	CurrentEventInformation object

This method represents event information passed as an argument to Callback function CurrentEventInformation. The CurrentEventInformation object shall have the properties shown in the table below. In addition to the properties shown in the table below, it has content_id, component_tag, channel_id, module_id, module_name, resource_name, but these properties shall not be used in data content because the values are undefined.

Table 10-64 CurrentEventInformation Object Properties

Property name	Style	Supplement
original_network_id	Number	The range is [0..65535]
tlv_stream_id	Number	The range is [0..65535]
service_id	Number	The range is [0..65535]
event_id	Number	The range is [0..65535] Null when indefinite (* 1)
start_time	Date object	Be sure to set 0 for the part less than 1 second. Null when indefinite
duration	Number	Null when indefinite
free_ca_mode	Boolean	Null when indefinite
name	String	Null when indefinite
desc	String	Null when indefinite
f_event_id	Number	The range is [0..65535] Null when indefinite (* 2)
f_ start_time	Date object	Be sure to set 0 for the part less than 1 second. Null when indefinite
f_duration	Number	Null when indefinite
f_free_ca_mode	Boolean	Null when indefinite
f_name	String	Null when indefinite
f_desc	String	Null when indefinite

(* 1) Set event_id to null during the period when no event exists.
(* 2) [following] When there is no information about the event, set f_event_id to null.

10.7.13 Stream event target object

This object is described in ARIB STD-B62 Volume 2 "3.3.12 Stream event target object" and it shall provide a means for applications to use events sent by broadcast signals.

It may be accessed from JavaScript with navigator.receiverDevice.streamEvent. The method properties of the stream event target object in operation are shown below.

1) Receiving event messages

Receiving event message is called by event handlers. Table 10-65 and Table 10-66 describe the methods for adding / deleting event handlers.

Table 10-65 Addition of event message reception handler

Method	Parameters	Style
addGeneralEventMessageListener (param,listener)	Return value	void
	param	GeneralEventMessageListenerParam object
	listener	Callback function (GeneralEventMessageListener)
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
GeneralEventMessageListener (msg)	Return value	void
	msg	GeneralEventMessage object (Table 10-68)

Table 10-66 Delete event message receive handler

Method	Parameters	Style
removeGeneralEventMessageListener (param [,listener])	Return value	void
	param	GeneralEventMessageListenerParamObject (Table 10-67)
	listener	Callback function (GeneralEventMessageListener)
Exception occurrence condition		code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-67 GeneralEventMessageListenerParam Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	(*)
message_group_id	Number	Be sure to omit this property
message_id	Number	The range is [0.255]
message_version	Number	The range is [0.255]

* Specify event_message_tag.

Table 10-68 GeneralEventMessage Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	
message_group_id	Number	
message_id	Number	The range is [0.255]
message_version	Number	The range is [0.255]
private_data_byte	String	

2) Receiving timer events based on UTC-NPT (optional)

This part describes an interface for receiving timer events based on UTC-NPT. Table 10-69 and Table 10-70 describe the methods for adding / deleting event handlers that are executed when the function that uses UTC-NPT becomes available. Table 10-73 and Table 10-74 describe the methods for adding / deleting event handlers that are executed when the specified UTC-NPT value is reached.

For receivers that do not support NPT reference messages, the operation of the receivers with this interface is an optional feature.

Table 10-69 Event listener registration performed when features that utilize UTC-NPT become available

Method	Parameters	Style
addUTCNPTReferenceMessageListener (param, listener)	Return value	void
	param	UTCNPTReferenceMessageListenerParams object
	listener	Callback function (UTCNPTReferenceMessageListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
UTCNPTReferenceMessageListener (param)	Return value	void
	param	UTCNPTReferenceMessageListenerCallbackParams object

Table 10-70 Delete registered event listeners for UTC-NPT acquisition

Method	Parameters	Style
removeUTCNPTReferenceMessageListener (param [,listener])	Return value	void
	param	UTCNPTReferenceMessageListenerParams object
	listener	Callback function (UTCNPTReferenceMessageListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-71 UTCNPTReferenceMessageListenerParams Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	Specify event_message_tag.

Table 10-72 UTCNPTReferenceMessageListenerCallbackParams Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	

Table 10-73 Adding handlers to be executed when the specified UTC-NPT value is reached

Method	Parameters	Style
setAlarmByUTCNPT (param, handler)	Return value	Number[0.. 4,294,967,295]
	param	UTCNPTAlarmParam object (Table 10-76)
	handler	Callback function (UTCNPTAlarmHandler)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
UTCNPTAlarmHandler (msg)	Return value	void
	msg	UTCNPTNotification object (Table 10-77)

Table 10-74 Deleting handlers that will be executed when the specified UTC-NPT value is reached

Method	Parameters	Style
unsetAlarmByUTCNPT (handle)	Return value	void
	handle	Number[0.. 4,294,967,295]
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-75 Getting UTC-NPT Values

Method	Parameters	Style
getUTCNPT (param)	Return value	Number（The value that stores a time stamp in NTP length format up to at least 17 bits after the decimal point.）
	param	UTCNPTQueryParams object (Table 10-78)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-76 UTCNPTAlarmParams Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	Specify event_message_tag.
utcnpt_value	Number	Value that stores up to 21 bits after the decimal point in the NTP length format time stamp. However, the explanation of the part after 18 bits after the decimal point depends on the implementation of the application engine.

Table 10-77 UTCNPTNotification Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	
utcnpt_value	Number	Value that stores a time stamp in NTP length format up to at least 17 bits after the decimal point.

Table 10-78 UTCNPTQueryParams Object Properties

Property	Style	Supplement
source	ISDBResourceReference object	Specify event_message_tag.

3) Receiving event update notification

Tables 10-79 and 10-80 describe the methods for starting / ending monitoring of event updates. Immediately after registering the listener with this function, the callback function shall be called once based on the contents of the latest ISDBResourceReference object at that time. After that, the callback function shall be called every time the event_id of the current program event changes in the receiving stream. When multiple listeners are registered, the above operation shall be performed for each listener.

Table 10-79 Adding a handler to execute when an event is updated

Method	Parameters	Style
addEventIDUpdateListener (listener)	Return value	void
	listener	Callback function (EventIDUpdateListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
EventIDUpdateListener (event_ref)	Return value	void
	event_ref	ISDBResourceReference object (*)

(*) when the event is absent due to the update of the event, the event_id property will be null.

Table 10-80 Deleting handlers to execute when an event is updated

Method	Parameters	Style
removeEventIDUpdateListener ([listener])	Return value	void
	listener	Callback function (EventIDUpdateListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No API usage rights		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

4) Receiving MH-AIT update notification

Tables 10-81 and 10-82 describe the methods for starting / ending monitoring of MH-AIT updates transmitted by broadcasting. The addAITUpdateListener function shall call the event listener when the MH-AIT transmitted by broadcasting is updated regardless of the MH-AIT of the currently presented application. MH-AIT transmitted by broadcasting shall be 1. The case of multiple MH-AITs transmitted by broadcasting will be specified in the future.

Table 10-81 Addition of handler to execute when broadcast transmission MH-AIT is updated

Method	Parameters	Style
addAITUpdateListener (listener)	Return value	void
	listener	Callback function (AITUpdateListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
AITUpdateListener(ait)	Return value	void
	ait	ApplicationInformationTable object

Table 10-82 Delete handler to execute when broadcast transmission MH-AIT is updated

Method	Parameters	Style
removeAITUpdateListener ([listener])	Return value	void
	listener	Callback function (AITUpdateListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

5) Judgment of the source of the broadcast signal (optional)

Table 10-83 describes the methods for confirming the source of the broadcast signal. The sourceIs function shall determine whether the currently presented data content was invoked from the broadcast or from the storage storage. When calling, the function shall always return the value at that time.

Although the method is optional, it is recommended to support this function in the receivers that may operate data contents during recording and playback, for the application creator to operate the content that operates appropriately according to the recording / playback during recording / playback.

When using this function, it is necessary to confirm whether this function is implemented in the receivers by the hasCapability method.

Table 10-83 Check the source of the broadcast signal

Method	Parameters	Style
sourceIs (name)	Return value	Boolean
	name	String (Refer to Table 10-84)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-84 Possible values for the name argument of the sourceIs method

Value of name	Explanation
onair	executing according to the instructions of the stream currently being broadcast

When "onair" is specified for the argument *name*, *true* shall be returned when the broadcasting wave is received and the stream is played directly without going through a storage device, and *false* shall be returned when the stream is not playing directly. *False* shall be always returned when a value other than "onair" is specified in the argument.

6) Receive data event update notification (optional)

Table 10-85 and Table 10-86 describe the methods for starting / ending monitoring of data event updates. The addDataEventIDUpdateListener function shall call the event listener when the data_event_id of the specified data asset is updated.

The component_tag property of the argument component_ref object shall not be omitted. Also, in the component_ref object, the property that specifies the data component transmitted by the MPEG2-TS method shall not be operated.

When using this function, it is necessary to confirm whether this function is implemented in the receivers by the hasCapability method.

Table 10-85 Adding a handler to execute when a data event is updated

Method	Parameters	Style
addDataEventIDUpdateListener (component_ref, listener)	Return value	void
	component_ref	ISDBResourceReference object
	listener	Callback function (DataEventIDUpdateListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR
Callback function	Parameters	Style
DataEventIDUpdateListener (param)	Return value	void
	param	DataEventIDUpdateListenerCallbackParams object (Table 10-87)

Table 10-86 Delete handler to execute when data event is updated

Method	Parameters	Style
removeDataEventIDUpdateListener (component_ref, [listener])	Return value	void
	component_ref	ISDBResourceReference object
	listener	Callback function (DataEventIDUpdateListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-87 DataEventIDUpdateListenerCallbackParams object properties

Property	Style	Supplement
original_network_id	Number	The range is [0..65535]
tlv_stream_id	Number	The range is [0..65535]
service_id	Number	The range is [0..65535]
component_tag	Number	The range is [0..255]
data_event_id	Number	The range is [0..255]

10.7.14 Storage control of data resources

The object described in ARIB STD-B62 Volume 2, "3.3.13 Storage control of data resources" provides a means of access to the functions provided by the application engine and receivers platform.

It may be accessed from JavaScript with navigator.receiverDevice.cacheEvent.

Table 10-88 and Table 10-89 describe the methods for registering / deleting the event listener that is executed when the update / disappearance / store finnished of data resources. In addition, Table 10-90 and Table 10-91 describe the methods for specifying / deleteing the storage target in the cache.

In these API calls, when a directory is specified as *path*, when there is no information that associates the directory indicated by the MPU node descriptor in the data asset management table specified in ARIB STD-B60 "10.3 Control Information for Application Transmission Method" with the MPU, it shall not be executed.

Depending on the receivers, two types are assumed: receivers that may cache all the broadcast resources transmitted, and receivers that caches only the specified resource among the broadcast resources transmitted. Regardless of the receivers, the notification regarding the cache operation of the receivers may be received by executing the storage specification method shown in Table 10-90. By judgment of the receivers, the store of broadcast resources may be started before the method of specifying the store is executed.

When the methods shown in Table 10-90 are executed for any path, if the specified target is a resource being transmitted, *store_finished* shall be returned when the accumulation is completed in the parameter event of the callback function cacheEventListener. When the accumulation fails, *store_failed* shall be returned.

When the storage specification is deleted by the method in Table 10-91, resources other than the target specified by the method may be stored and deleted at the discretion of the receivers.

The path of addCacheEventListener shall be operated for directories that are the same as or lower than the path specified in storeDataResorce shown in Table 10-90.

When executing the methods shown in Table 10-88 or Table 10-90 for any path, the parameter event of the callback function cacheEventListener shall return *updated* when a file appears, an update, a directory appears, or an update occurs for the specified path. Directory updates shall be determined by updating the MPU_sequence_number of the corresponding MPU. When the MPU_id of the MPU corresponding to the directory of directory_node is updated, *deleted* shall be notified. Broadcasters should be aware that there are also receivers that notify *updated*. When the directory disappears, it shall notify *deleted*. The disappearance of the directory shall be determined by the deletion of the corresponding MPU description from the data asset management table. When a file is specified as path, the *deleted* event shall not be notified.

When the method shown in Table 10-88 or Table 10-90 is executed for any path and there is an update during the store of the specified resource, the parameter event of the callback function cacheEventListener, all resource updates in the specified directory are complete if the specified path is a directory, shall return *store_finished* if the accumulation of all resources has been completed at the time of accumulation or at the time when cacheEventListener is set in the receivers that may cache all the broadcast resources being transmitted.

When the specified path is a file, and when an update is detected again during resource accumulation, and the update will be completed and the update will be completed, shall return *store_finished* when the accumulation of all resources has been completed, at the time of accumulation or at the time when cacheEventListener is set in the receivers that may cache all the broadcast resources being transmitted.In either case, *updated* shall not be notified . The operation sequence related to application and cache control is shown in Fig. 10-2 and Fig. 10-3.

Between the start of the update and completing the update, the application may access the resource before the update, and the receivers update the resource just when the acquisition of the update resource is completed.

Table 10-88 Addition of handler to be executed when data resource update / disappearance / accumulation is completed

Method	Parameters	Style
addCacheEventListener (path, listener)	Return value	void
	Path	String
	Listener	Callback function (CacheEventListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Callback function	Parameters	Style
cacheEventListener(path, event)	Return value	Void
	path	String (*)
	event	String (one of [“updated”, ”deleted”, ”store_finished”, ”store_failed”])

* Path is the path name of the directory or file to be monitored.When using an absolute path, it should be specified by the path with base_url. When specifying a directory for path, it should be specified by the directory of directory_node or a directory below it.

Table 10-89 Delete handler to be executed when data resource update / disappearance / accumulation is completed

Method	Parameters	Style
removeCacheEventListener (path, [listener])	Return value	void
	path	String
	listener	Callback function(CacheEventListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-90 Specify the storage target in the cache

Method	Parameters	Style
storeDataResource (path, [listener])	Return value	void
	Path	String
	listener	Callback function(CacheEventListener)
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Table 10-91 Despecify the storage target in the cache

Method	Parameters	Style
releaseDataResource ([path])	Return value	void
	path	String
Exception occurrence condition		Code property
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

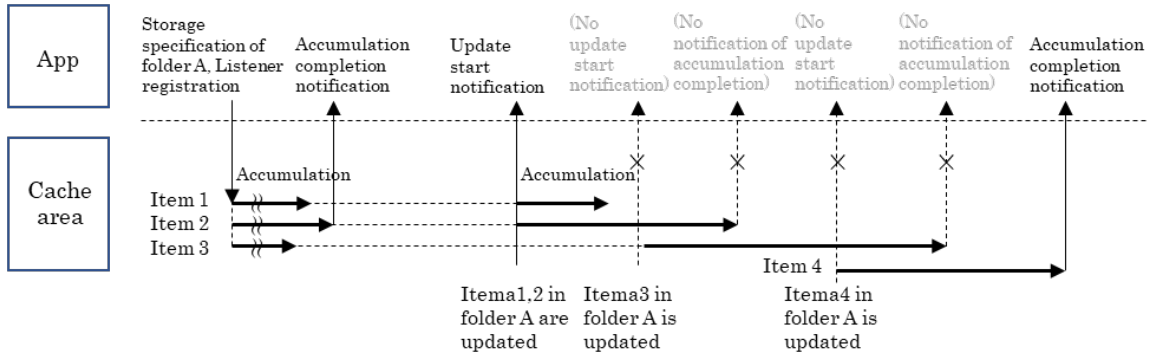

Fig. 10-2 Example of operation when multiple files are updated in a folder

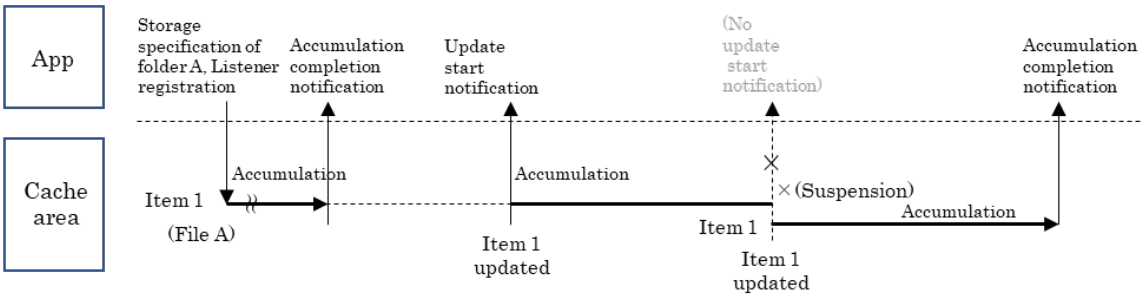

Fig. 10-3 Example of operation when multiple files are updated in a folder

10.7.15 Broadcast video / audio object

In this operational guideline the presentation of broadcast video and audio shall be used by the object element described in ARIB STD-B62 "2.2 Broadcast audio/video object".

When presenting broadcast video / audio in the object element, shall specify "video/x-arib2-broadcast" in the type of attribute of the object element. Of these, the methods specific to BroadcastVideoObjectElement are shown in Table 10-92.

Table 10-92 BroadcastVideoObjectElement specific methods

Method	Parameters	Style
enableFullscreen()	Return value	Boolean
disableFullscreen()	Return value	Boolean
isFullscreen()	Return value	Boolean
enableAudioMute()	Return value	Boolean
disableAudioMute()	Return value	Boolean
isAudioMute()	Return value	Boolean
setAudioSrc(url)	url	String
	Return value	Boolean
getAudioSrc()	Return value	String
setVideoSrc(url)	url	String
	Return value	Boolean
getVideoSrc()	Return value	String
setCaptionSrc(url)	url	String
	Return value	Boolean
getCaptionComponentURL()	Return value	String
isCaptionExistent(url)	url	String
	Return value	Boolean
setCaptionVisibility(flag)	flag	Boolean
	Return value	Boolean
isCaptionVisible	Return value	Boolean
addCaptionListener(listener[,url])	listener	Callback function (CaptionListener object)
	url	String
removeCaptionListener([listener])	listener	Callback function (CaptionListener object)
Callback function	**Parameters**	**Style**
CaptionListener(captiondata)	captiondata	String
Exception occurrence condition		**Code property**
Argument is abnormal		INVALID_PARAM_ERR
No authority to use the API		NOT_AUTHORIZED_ERR
Other errors		MISC_ERR

Refer to 8.10.1.1 for the parameter captiondata of the callback function CaptionListener.

10.7.16 CAS related functions

The specifications and operation of CAS-related functions are defined as unique extended APIs by the CAS management organization shown in Volume 5, 4.15 and Appendix 7. However, the prefix of the APIs is "cas_" instead of "X_ <sProviderName> _" as an exception.

10.8 Operation related to restrictions on HTML document description

10.8.1 Operation related to application description

10.8.1.1 General restrictions on HTML document description

1) Constraints on meta elements

It is recommended to specify the character encoding used by the HTML document.
Refer to 10.8.1.2 for viewport specification.

2) Constraints on link element

By using Media Queries, it is possible to apply the optimum style sheet that differs for each environment by conditional expressions. It is recommended to switch styles according to the size of the drawing area of the device.

3) script element constraints

It is possible to embed a script such as JavaScript in a document or load an external script.

4) Precautions when processing the unload event

When it becomes necessary to switch the specified HTML application due to the switching of the broadcast signal, the HTML application being executed shall be released, and the unload event shall be issued before the release. However, when it takes a long time to execute the event handler of the unload event, the HTML application processing may be forcibly terminated, so the HTML application creator should be careful about the data save timing.

5) Operation of a element

This operational guideline shall not use the target attribute.

6) Operation of text

An HTML browser may download and read in fonts by Web Fonts. It should be noted in use that the amount of data may increase due to download, there may be a time lag in loading and displaying the HTML application, and performance may decrease.

10.8.1.2 Description guideline for application screen configuration

The resolution of the application is specified as follows.

It is recommended to specify the viewport with the meta element. When the application does not specify a viewport, 3840 x 2160 is considered to be specified.

The combinations of values that may be specified for width and height of the content attribute are 7680 x 4320, 3840 x 2160, and 1920 x 1080. However, the application creator should be aware that the actual presented resolution depends on the resolution of the HTML browser provided by the receivers and the resolution of the display device.

The HTML browser shall render to the resolution specified in the viewport of an HTML document. When the resolution of the HTML document specified in the viewport is smaller than the resolution of the HTML browser, the rendered result of the HTML document shall be scaled (enlarged) to match the resolution of the HTML browser (that is, to be full screen). When the resolution of the HTML document specified in the viewport is greater than the resolution of the HTML browser, it is recommended that the rendered result of the HTML document is scaled (reduced) to match the resolution of the HTML browser (that is, to be full screen). However, it should be noted that some of the rendered results shall not be presented on HTML browsers that do not support scaling (reduced).

10.8.1.3 Operation of broadcast video presented using object elements

1) Operational restrictions on the object element used in broadcast video

In HTML applications, it is recommended to statically describe broadcast video / audio objects in HTML. When a broadcast video / audio object is dynamically added by a script, the continuation of broadcast video and audio at the time of page transition shall not be guaranteed.

Regarding the broadcast presentation at the time of transition between documents or applications, it should be noted that the display of the video area may be interrupted when the size and position of the video display area are different between the documents. When the presentation of the broadcast video is continued during and after the transition, it is displayed without failure by declaring the object element that refers to the same broadcast video in the document after the transition.

Regarding the broadcast presentation at the time of transition between documents or applications, when the broadcast video is not presented after the transition, since the drawing during the document loading after the transition and the broadcast video may be displayed overlapping, it is recommended to stop the broadcast presentation in the document before the transition before the transition.

The parameter of setAudioSrc / getAudioSrc / setVideoSrc / getVideoSrc / setCaptionSrc / getCaptionComponentURL function and video_src / audio_src / caption_src. of param element should be operated. However, when a URL other than the received service ("arib2://-1.-1.-1/") is specified, the operation should be implementation-dependent. Also, event_id is not specified.

As the return values of the getAudioSrc / getVideoSrc / getCaptionComponentURL function, the hexadecimal character string indicating <original_network_id>, <tlv_stream_id>, <service_id>, <component_tag> shall not be prefixed with a character (string) indicating that those are hexadecimal character string notation such as "0x" or "h" at the end. A character string with the required number of "0" added to the beginning of the character string shall be set so that the character string length is a fixed length of 4 characters.

The operation to stop the presentation of both broadcast video and audio shall be performed by deleting the object element from the DOM tree after setting the value of the display property to none and calling the enableAudioMute method for the object element. When a broadcast video / audio object is deleted from the DOM tree without setting the display property or calling the enableAudioMute method, it should be noted that it is no guarantee that the presentation of broadcast video / audio will stop immediately.

2) Operation of full screen display of video

To display the broadcast video in full screen when the page is started to be loaded, the name attribute should be set "fullscreen" and the value attribute should be set "enable" by param element.

To switch to full screen display by user operation, the method shown in 10.7 provided by the broadcast video / audio object shall be used.

In the case of full screen display, it should be noted the broadcast video part is displayed in the foreground and the HTML application is placed behind it, so it is hidden behind the broadcast video part and shall not be seen.

Since the HTML browser operation continues even during full-screen display, the content creator should note about event processing associated with operations during full-screen display.

10.8.1.4 Extended API operation restrictions

・Description constraints on iframe elements

By using the iframe element, another HTML document may be incorporated into the HTML application. However, regarding the use of broadcast resources via the extended API and broadcast video / audio objects, the permission provisions shown in 10.7.1 shall be followed.

When the domain of the acquisition source URL of each HTML document in a parent-child relationship is different, the use of broadcasting resources may be restricted, and the HTML application creator should note this point.

When operating the Focus method, it should be noted that when the iframe element is focused, the key event is handled by the DOM in the iframe and shall not be acquired by the parent DOM. However, this is not the case when the HTML browser provides a way to return the focus from the in-frame DOM to the parent DOM.

Using the iframe element from the broadcast resource document, it is possible to perform mixed operation of broadcast and communication resources that refer to the communication resource.

10.9 HTML document presentation control

10.9.1 Control of the video presented by the object element

When displaying the broadcast video in the layout (position, size) specified using the object element, if the aspect ratio of the original broadcast video is different from the HTML browser, scaling shall be performed so that the aspect ratio is maintained without missing the broadcast video as shown below.

As the width of the broadcast video is Wv and the height is Hv as shown in Fig. 10-4, and as the width of the broadcast video object is We and the height is He, the enlargement / reduction ratio scale of the broadcast video at the time of presentation is expressed by the following equation.

The minimum value specified as the scale value is 1/16.

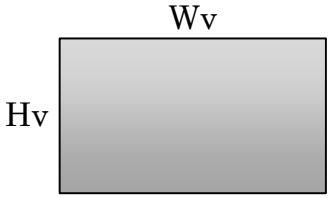

Fig. 10-4 Broadcast video

1) Wv / Hv ≤ We / He (Fig. 10-5)
scale = He/Hv

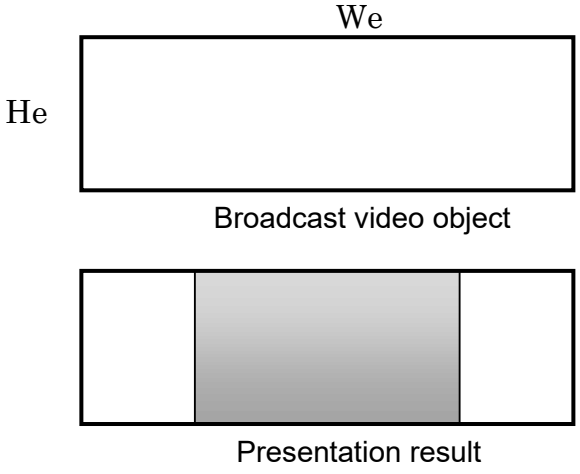

Fig. 10-5 When Wv / Hv ≤ We / He

2) Wv/Hv > We/He (Fig. 10-6)

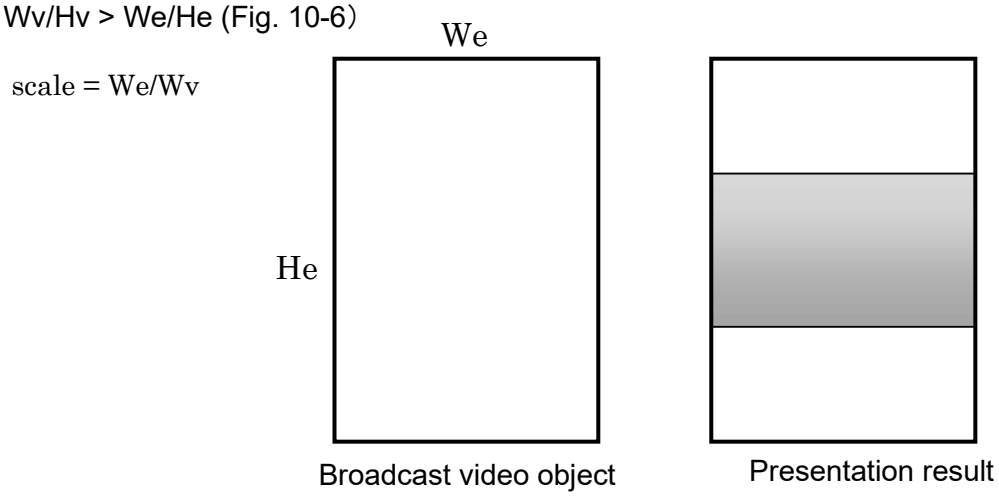

Fig. 10-6 When Wv / Hv> We / He

10.9.2 Control of audio elements

Playback of MPEG-4 AAC, AIFF-C, and MP3 audio files shall be operated by the audio element. In playback of MPEG-4 AAC files, application authors should note that some receivers have implementations that interrupt broadcast or VOD audio playback while playing MPEG-4 AAC files. When changing the src attribute of the audio element, the operation shall not be guaranteed that it is rewritten to a resource of a different MIME type.

10.9.3 Playback control of receiver build-in sound

It should be able to playback the receiver build-in sound by the audio element.

To refer to the receiver built-in sound shall use the namespace (romsound://<sound_id>) specified in ARIB STD-B62 Volume 2 "4.7 Identification of receivers built-in sound" for the src attribute of the audio element.

As the sound source, sound_id = 0 to 15 specified in the receiver built-in sound shown in 7.2.2.6 may be used.

To specify the type of attribute in the source element shall use 'audio/X-arib-romsound'.

10.10 HTML browser behavior

This section describes the HTML browser that is the execution environment of the HTML application installed in the receivers.

10.10.1 Communication protocol specifications

10.10.1.1 HTTP (S)

HTTP (S) is used as the communication protocol according to Volume 6.

1) HTTP header format
   Unless otherwise specified, it conforms to RFC 7231. The date format described in the HTTP header shall be the Preferred format of RFC 7231 7.1.1.1.

2) Content coding
   Content coding operates only identity.

3) Transfer encoding
   The transfer encoding operates in chunk format.

4) Cache-Control header

It is recommended to add the value of cache-control header as no-cache to the request message generated by the HTML browser. On the other hand, when the cache-control value in the response header is no-cache or no-store, it should be processed according to the description in RFC 7234.

5) If-Modified-Since header

It is recommended to add the If-Modified-Since header to the request message generated by the HTML browser according to the description in RFC 7232.

6) HTTP access authentication

The authentication method used in RFC 7235 supports Basic authentication and Digest authentication described in RFC 2617.

7) Cookie

The HTTP state management mechanism by cookies specified in RFC 6265 shall be implemented. It is recommended to keep at least the following size and number of cookies that is used from HTML applications. In addition, it is recommended to implement a means to invalidate and delete cookies by user operation.

・The total number of cookies should keep 300 or more.
・The size of one cookie should be held 4096 bytes or more according to RFC 6265.
・The number of cookies per site should be held 20 or more.

When the size and number of stored cookies exceeds the implementation amount of the HTML browser, they shall be deleted in the following order of priority according to RFC 6265. When multiple cookies have the same deletion priority, the oldest one of the last-access-time shall be deleted.

・Expired cookie
・Same site cookie
・All cookies

8) User-Agent header

The HTML browser shall include the User-Agent header in the format shown in Fig. 10-7 including the space character separator, in the HTTP request header to send. User-Agent shall not contain the character string specified in “<SystemName>” in the User-Agent header of the HTML browser for broadcast-linked HTML5 applications defined in ARIB TR-B14 Volume 3 [Part 2] specified in Chapter 8 and a line feed code.

```
User-Agent:<others>␣<SystemName>/1.0␣(<Capability>;<MakerId>;<ModelId>;<
MajorVer>;<MinorVer>;<reserved>)␣<others>
```

Fig. 10-7 User-Agent header

<SystemName>: "A-PAB"
<Capability>: Indicates the capacity of the receivers.
A comma (",") -separated string representing the capabilities of the receivers shall be listed, from the beginning, HTML browser resolution and video playback resolution. Listed items that follows is specified in the future.

<Capability>=browser_resolution","video_resolution[","reserved]
browser_resolution="2K"|"4K"|"8K"
video_resolution="2K"|"4K"|"8K"

browser_resolution indicates the maximum resolution of the content displayed by the HTML browser, and video_resolution indicates the maximum resolution played by the video element. One of "2K", "4K", and "8K" shall be described, respectively. When there is no description, it is regarded as "2K". In addition, the one corresponding to "4K" corresponds to "2K", and the one corresponding to "8K" corresponds to "4K" and "2K".

<MakerId>: Indicates the manufacturer's identification.
MakerId is a 6-digit character string, and the 24-bit company ID (OUI) specified by the IEEE is represented by a base16 character string. There may be multiple OUIs for a manufacturer, but one specific type should be specified as the MakerId.

<ModelId>: A code indicating the model, which is a character string of up to 10 characters. The operation is left to each manufacturer.

<MajorVer> <MinorVer>: Indicates the version information of the terminal, both of which are character strings of up to 8 characters. Terminals with the same ModelId but different operations are given different versions. The operation is left to each manufacturer.

<reserved>: reserved for future expansion

<others>: This areas is free use for manufacturers. However, in order to distinguish it from the identifier of this guideline, the character string shall not start with <SystemName>. The character string used shall be in accordance with RFC 7231.

10.10.1.2 WebSocket

WebSocket shall be implemented in accordance with RFC 6455s as HTML application transmission protocols and data transmission protocols between HTML applications and servers.

10.10.2 User interface specifications

10.10.2.1 Screen display

The drawing area shall be enlarged / reduced appropriately according to the description in 10.8.1.2.

10.10.2.2 Window tab popup

User interface shall have at least one rendering area. When multiple sheets are available, a switching method shall be provided to the user, but the implementation form (window tab) is not specified.

Pop-up windows such as alert are not specified.

10.10.2.3 Remote control

1) Interface specifications

An HTML browser based on this guideline shall provide KeyboardEvent interface defined in 5.2.5 and B.1 of the W3C Recommendation "Document Object Model (DOM) Level 3 Events Specification" (http://www.w3.org/TR/2012/WD-DOM-Level-3-Events-20120614/). However, it is not mandatory to provide all the functions of the interface.

2) Keyboard events that HTML browsers should support

It is recommended that HTML browsers generate keydown, keyup, and keypress according to W3C Recommendation DOM3 Events 5.2.5.1.

3) Handling of implementation-dependent keyboard events

Depending on the implementation of the HTML browser, keyboard events not specified in 10.10.2 may be generated. Applications should properly ignore these keyboard events. However, it does not prevent the intentional use of these keyboard events.

4) Key code

About the keyCode property that the application uses to retrieve the keycode from the keyboard event, HTML browsers are not subject to W3C Recommendation DOM3 Events provisions, it shall provide the constant shown in Fig. 10-8 as a defined global symbol and shall store its value in the keyCode property. The value of each constant depends on the implementation of the receivers and is not specified in this operational guideline. But all the following conditions shall be satisfied.

- It shall be a non-negative integer value
- No symbol shall have a duplicate value with any other symbol. However, as an exception, only VK_0 may have the same value as either VK_10 or VK_11.

```
[NoInterfaceObject]
interface KeyCodeGlobalSymbols {
   const unsigned short VK_RED;
   const unsigned short VK_GREEN;
   const unsigned short VK_YELLOW;
   const unsigned short VK_BLUE;
   const unsigned short VK_UP;
   const unsigned short VK_DOWN;
   const unsigned short VK_LEFT;
   const unsigned short VK_RIGHT;
   const unsigned short VK_ENTER;
   const unsigned short VK_BACK;
   const unsigned short VK_0;
   const unsigned short VK_1;
   const unsigned short VK_2;
   const unsigned short VK_3;
   const unsigned short VK_4;
   const unsigned short VK_5;
   const unsigned short VK_6;
   const unsigned short VK_7;
   const unsigned short VK_8;
   const unsigned short VK_9;
   const unsigned short VK_10;
   const unsigned short VK_11;
   const unsigned short VK_12;
   const unsigned short VK_DBUTTON;
   const unsigned short VK_SUBTITLE;
   const unsigned short VK_PLAY_PAUSE;
   const unsigned short VK_PLAY;
   const unsigned short VK_PAUSE;
   const unsigned short VK_STOP;
   const unsigned short VK_FAST_FWD;
   const unsigned short VK_REWIND;
  const unsigned short VK_TRACK_NEXT;
  const unsigned short VK_TRACK_PREV;
  const unsigned short VK_VCR_OTHER;
   const unsigned short VK_PAGE_UP;
   const unsigned short VK_PAGE_DOWN;
   const unsigned short VK_TAB;};


Window implements KeyCodeGlobalSymbols;
```

(Note) This description is intended to show a list of symbols and is invalid for IDL.

Fig. 10-8 keyCode property symbol

5) Key group

This section specifies the interface for controlling the range of keys to be used by the application according to the instruction of the application. It is recommended for the application to receive only the necessary and sufficient range of key events using this interface.

```
interface KeySet {
    const unsigned short RED;
    const unsigned short GREEN;
    const unsigned short YELLOW;
    const unsigned short BLUE;
    const unsigned short NAVIGATION;
    const unsigned short NUMERIC;
    const unsigned short VCR;
    const unsigned short DBUTTON;
    const unsigned short SUBTITLE;
};
```

(Note) This description is intended to show a list of symbols and is invalid for IDL.

Fig. 10-9 Key group symbols

Table 10-93 Keys targeted by key groups

Key group	Keys targeted by the group
RED	VK_RED
GREEN	VK_GREEN
YELLOW	VK_YELLOW
BLUE	VK_BLUE
NAVIGATION	VK_UP, VK_DOWN, VK_LEFT, VK_RIGHT, VK_ENTER, VK_BACK, VK_PAGE_UP, VK_PAGE_DOWN, VK_TAB
NUMERIC	VK_0, VK_1, VK_2, VK_3, VK_4, VK_5, VK_6, VK_7, VK_8, VK_9, VK_10, VK_11, VK_12
VCR	VK_PLAY, VK_PAUSE, VK_PLAY_PAUSE, VK_STOP, VK_FAST_FWD, VK_REWIND, VK_TRACK_NEXT, VK_TRACK_PREV, VK_VCR_OTHER
DBUTTON	VK_DBUTTON
SUBTITLE	VK_SUBTITLE;

```
partial interface Application {
    readonly attribute KeySet keySet;
};

partial interface KeySet {
    readonly attribute unsigned long value;
    unsigned long setValue(unsigned long value);

};
```

Fig. 10-10 KeySet interface definition

Table 10-94 KeySet Properties

value	
Explanation	A number that represents the current keygroup setting. It is represented by the logical sum of the key group symbols.

Table 10-95 KeySet methods

setValue		
Explanation	Set the range of keys that should be sent to the application.	
Argument	value	A value that indicates the range of keys to send to the application. It is expressed by the logical sum of the key group symbols.
Return value	A number that represents the new keygroup settings set as a result of the process.	

6) Handling key events

The flow of key event processing in the HTML browser is as follows.

(1) When key of a remote control is pressed, key of the remote control belongs to the set key group shall generate a key event in the HTML browser according to the key group set by the setValue method of the key group object. When it does not belong to the key group, it shall generate a key event by the receiver.
(2) A key event occurs in the element with focus on the application.
(3) The key event propagates in the parent element of the element above. Propagation may be stopped by calling Event.preventDefault() in the corresponding event handler.
(4) A key event occurs in the body element.
(5) When Event.preventDefault () is not called in the body element, the key event shall be passed to the HTML browser and operate the default behavior of the HTML browser.

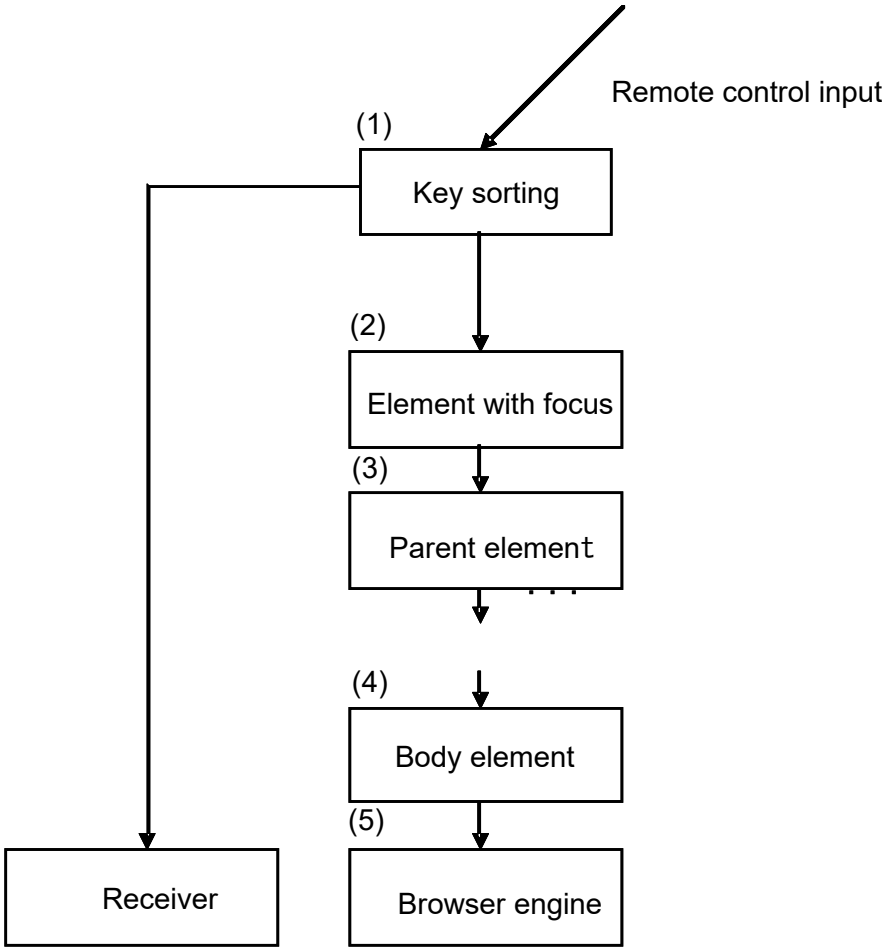

Fig. 10-11 Key event processing flow

Timing of occurrence of keyup and keydown events

- A keydown event occurs when a key of remote control is pressed.
- When the key of remote control is released, keyup occurs only once.
- While holding down the key of remote control, the keydown event may be generated repeatedly, but the keyup event shall not be generated.

10.10.2.4 History function

When the following events occur, HTML browser shall clear the contents of the history object, even if the "back" function of the HTML browser or history.back () are called in the document presented after clear of the history object, the HTML browser shall not view the document before event occur.

1) Termination of broadcast managed application
   The contents of the previous broadcast managed application shall not be displayed by such as "Back" operation, for example, when a broadcast managed application replaces another broadcast managed application by replaceApplication (), or when a broadcast managed application transits to a general application by exitFromManagedState (), or when another service is tuned by the viewer's operation while presenting the broadcast managed application.
2) Executing of broadcast managed application
   The contents of general websites shall not be displayed by such as "Back" operations, for example, when a general website (general application) is viewed and a broadcast video is viewed, and then a managed broadcast application is viewed.

10.10.3 Root certificate

The operation of the root certificate follows Chapter 13.

10.11 Transmission of content and namespace

10.11.1 Namespace operation

The operation of namespace follows ARIB STD-B62 Volume 2 Chapter 4. However, "4.1 Identification of resource obtained by MPEG-2 TS transmission" and "4.5 Identification of closed caption by MPEG-2 TS transmission" shall not be operated.

Chapter 11: Receiver Processing related to Data Content Service

This chapter describes performance specification observed by receivers and an example of processing sequence as operational guidelines relating to data content service. Fig. 11-1 shows receiver's processing flow relating to data content service.

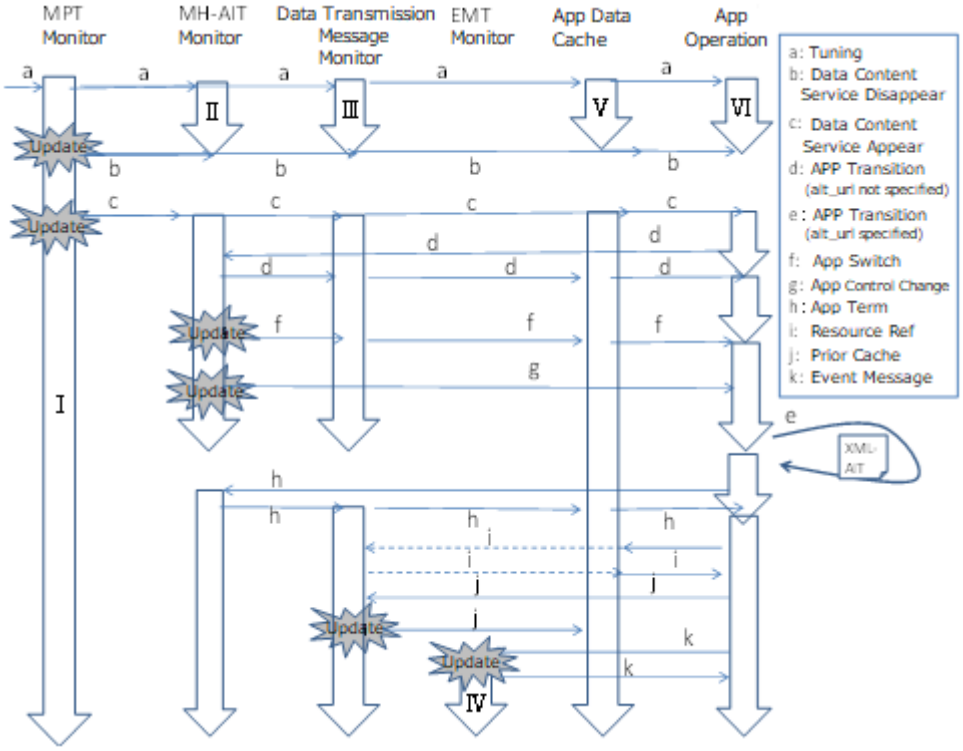

Fig. 11-1: Receiver's processing flow relating to data content service

11.1 Specification of receiver behavior for data content service

This section specifies behavior details to be observed in data content service.

11.1.1 Behavior of tuning

This described tuning behavior indicated with 'a' in Fig. 11-1. Receiver obtains MH-AIT specified by application service descriptor in MPT, and executes application specified by AUTOSTART. When the receiver is unable to obtain MH-AIT or when the obtained MH-AIT does not specify AUTOSTART application, no application shall be executed.

Further, when the specified application is out of boundary, the application shall not be executed.

11.1.2 Behavior of MPT update

This described behavior of updating operation based on MPT monitoring broadcasting service under tuning relating to data content service indicated with 'I' in Fig. 11-1. When MPT updating receiver shall confirm application service descriptor. When the descriptor disappears receiver shall terminate monitoring for MH-AIT and data transmission message and terminate the active application as indicated with 'b' in Fig. 10-1. When the descriptor appears receiver shall initiate the tuning setting operation described in 11.1.1 as indicated with 'c' in Fig. 10-1. When EMT_tag, for monitoring EMT in the operation described in 11.1.10, disappears, the monitoring may be suspended.

11.1.3 Behavior of MH-AIT monitoring

This describes behavior of MH-AIT monitoring indicated with 'II' in Fig. 11-1.

Receiver continuously monitors MH-AIT specified by MPT application service descriptor, and when updating, receiver shall obtain and retain it. During monitoring MH-AIT, even when switching to representation of video/audio obtained over communication or retrieved from storage, receiver shall keep monitoring. However, during the period when application operation based on XML-AIT on the network is going on, byapplication transition initiated by replaceApplication with ait_url specified, monitoring is not needed, and the receiver shall ignore MH-AIT update.

The conditions to start and end MH-AIT monitoring are as follows:

- Conditions to start MH-AIT monitoring
  - ✓ When tuning of broadcasting service, application service descriptor exists in MPT (a)
  - ✓ Application service descriptor appears in MPT (c : data content service starts)
  - ✓ While MH-AIT not being monitored, the specified application is started as a result of replaceApplication execution without ait_url (d)
- Conditions to end MH-AIT monitoring
  - ✓ Application service descriptor disappears in MPT (b : data content service ends)
  - ✓ Tuning to other service
  - ✓ While MH-AIT being monitored, the specified application is started as a result of replaceApplication execution with ait_uri (e)

11.1.4 Behavior of MH-AIT update

This describes behavior of MH-AIT updating. As shown in Table 11-1, when updating MH-AIT, receiver shall evaluate the application_control_code of MH-AIT and the present_application_priority of MH-application descriptor, after application in operation has been updated, and either continue the operation or terminate the application, and then perform tuning setting operation as in 11.1.1 as indicated with 'f' in Fig. 11-1. In case that the application does not execute in evaluating MH-AIT, receiver shall perform process of tuning broadcasting service. Some receivers may evaluate the application_control_code and the present_application_priority not yet updated, and these receivers may behave unexpected process when the updated application_control_codeis PRESENT. Broadcasting operators shall take this point into account and is recommended not to apply updating when the application_control_code is PRESENT.

Updating of data_event_id and data_transmission_session_id does not necessarily indicate change of the application, hence executing application shall be determined by MH-AIT update.

Table 11-1: Processing of application in operation after MH-AIT update

application_control_code / present_application_priority	AUTOSTART	PRESENT	KILL or APP LOST
0	Continue processing	Terminate and Tuning setting	Terminate and Tuning setting
1	Continue processing	Continue processing	Terminate and Tuning setting

In accordance with MH-AIT update, as the change of application control parameter indicated with 'g', the access permission bitmap of the executing application is changed and when the application calls a banned API, an exception process shall be initiated. However, as to changing bit12 and bit11 of bitmap1 implementation that change to the operation is suspended until page transition shall be allowed.

When other control information other than above is changed, the operation shall be based on the control information after the change.

11.1.5 Behavior at application transition

This describes behavior at application transition indicated with 'd' and 'e' in Fig.11-1. At transition from one application to another, i.e., when executing replaceApplication function in HTML document of the application to execute another application (for detail refer to 10.7.9), depending on whether arguments ait_url is specified, operations are divided into the following two cases:

1) ait_url not specified (d)

While application is in operation with monitoring MH-AIT, based on the retained latest MH-AIT information, the current application terminates itself and executes the specified application. While application is in operation without monitoring MH-AIT, the current application terminate itself and executes the specified application as in 11.1.1obtaining the target MH-AIT. And at the same time monitoring MH-AIT shall be started. When specifying type 2 data content service monitoring MH-AIT shall be similarly kept.

2) ait_url specified (e)

Application executes after obtaining AIT of XML format from communication network specified by URL and analyzing the AIT of XML. When MH-AIT is being monitored, the MH-AIT monitoring is terminated after transiting to another application by executing this function. As an implementation of keeping of obtaining MH-AIT without interruption even after end of monitoring, application executing time may be reduced when an application is later invoked with MH-AIT specified by API, etc. as specifying URL out of range of the application boundary, an exception process (INVALID_PARAM_ERR) shall be initiated.

11.1.6 Behavior at autonomous terminating by application itself

This describes behavior at application termination indicated with 'h' in Fig. 11-1. When the application in operation terminates by calling destroyApplication() according to its internal description, the application shall terminate itself and execute the process in 11.1.1.

11.1.7 Behavior when broadcasting service is suspended

When the broadcasting service is suspended, the application shall be terminated. However, the receiver may suspend the above operation while VOD is presented and when the broadcasting is off service at the time when the VOD presentation ends, then the receiver shall terminate the application.

11.1.8 Behavior at application being out of range of application's boundary

When the application is out of range of the application boundary the operation in 11.1.1 shall be executed.

11.1.9 Behavior of monitoring data transmission message and updating

This describes behavior of data transmission message monitor and updating indicated with 'Ⅲ' in Fig. 11-1. When the receiver judges data transmission message is being transmitted according to DT_message_flag described in application service descriptor in MPT, the receiver shall obtain the data transmission message from the specified location. The receiver may perform efficient reception through monitoring data transmission message and obtaining the latest data transmission messages for all sections and retaining them when updating. Tables of DDMT and DAMT are included in separate messages respectively, where the cross reference is formed between tables having the same data_transmission_session_id. Therefore, at detection of data_transmission_session_id update, the receiver shall obtain tables having the same

data_transmission_session_id for all sections of both tables and retain them. Furthermore, during CacheEventListener is set, as indicated with 'j' in Fig. 11-1, the receiver shall monitor MPU updating, which transmits the target directory or file and when it is updated, the receiver shall execute the specified operation. Refer to 10.7.14 for detail.

11.1.10 Behavior of EMT monitoring and event message processing

This describes behavior of processing event message indicated with 'k' in Fig. 11-1. When addGeneralEventMessageListener or addUTCNPTReferenceMessageListener is executed and set in application, using EMT_tag specified as argument for the APIs, the receiver determines one EMT among multiple EMTs referred by MPT application service descriptor, obtains the EMT from the specified location, and starts monitoring. General event message processing and NPT reference message processing are described separately as follows.

General event message processing related specifications are shown as follows:

- When multiple general event message with time mode specified 0 (immediate firing) are received, the receiver fires processes one by one in received order. No timing restriction for processing shall be specified.
- The receiver shall have the capacity to queue up at least 8 general event messages at the same time to be fired.
- In addGeneralEventMessageListener the number of listeners who may be registered at the same time shall be 16 at maximum.

NPT reference message processing related stipulations are shown as follows: Dealing with NPT reference message is optional; however, implementation shall follow the specifications as follows:

- The maximum number of listeners that may be registered in setAlarmByUTCNPT at the same time shall be 8.
- When the specified NPT time is the time already passed at the time received, then it shall be ignited instantaneously.
- Event shall happen by addUTCNPTReferenceMessageListener only when NPT reference message is obtained for the first time, and event shall not happen even when EMT transmitting NPT reference message is updated.
- The receiver, after it started EMT monitoring and before the reference time indicated by NPT reference message obtained for the first time, shall not execute the NPT reference message applied process.
- The receiver shall store successively UTC_Reference(UTCr), NPT_Reference(NPTr), UTC_NPT_leap_indicator, and scale in NPT reference message. When conversion of UTC value (UTCc) corresponding to NPT value (NPTc) or conversion of NPT value (NPTc) corresponding to UTC value (UTCc) for a certain target time is required, the receiver shall calculate the converted time based on stored UTCr, NPTr, etc.

At this time when UTCc is just after the leap second based on UTC_NPT_leap_indicator, apply ±1 second of conversion to UTC value.

11.1.11 Process of signal reception sent through hierarchical modulation

When hierarchical modulation is applied, data component, data transmission message, MH-AIT, and EMT are all transferred at higher layer. Therefore, when switching from higher layer to lower layer application shall terminate when operating based on MH-AIT, while application may continue operation when based on AIT in XML format obtained through communication. When switching from lower layer to higher layer no application is operating then execute tuning setting described in 11.1.1.

11.1.12 Others

- The receiver shall be capable of receiving 8 data components simultaneously at maximum for prior cache using storeDataResource method described in 10.7.14 or for referring respective resources.

11.2 Guideline of receiver processing for data content service

This section describes example sequence as operational guideline concerning receiving process for application data and relating MMT-SI which are transmitted principally in broadcasting.

11.2.1 Process sequence of service selection

This describes receiver process sequence example at tuning setting indicated with 'a' in Fig. 11-1, and also shows relating data reference sequence in Fig. 11-2. Preceding process up to obtaining MPT is omitted. The processes at application switching indicated with 'f' and at application transition indicated with 'd' are almost the same as the following sequence ② and succeeding.

① Obtain MPT and also start monitoring. When the application service descriptor exists in MPT, the receiver judges that data content service accompanies, and extracts MH-AIT specified by the descriptor and packet ID of the data transmission message.
② Obtain MH-AIT and also start MH-AIT monitoring. The receiver obtains the location information of the application based on MH-transmission protocol descriptor and MH-simple application location descriptor, concerning the application indicating AUTOSTART. When the protocol indicator of MH-transmission protocol descriptor is 0x0003 (HTTP/HTTPS transmission), according to the specified URL the receiver obtains the application (HTML document file) from the server in the network, and executes it (the end for this sequence)※. When the protocol identifier is 0x0005 (MMT non-timed transmission), the receiver proceeds to the following process.
③ Obtain the data transmission message and also start data transmission message monitoring. The receiver at least receives DAMT and DDMT having the same data_transmission_session_id for all sections and retains them until update for each table.
④ Applying the URL, extracted from MH-AIT in procedure ②, to DDMT and matching together, extract node_tag corresponding the directory with the URL well-matched.
⑤ Extract the well-matched MPU information from MPU node descriptor allocated in MPU loop of the DAMT by reverse looking-up with the node_tag extracted in process ④.
⑥ Filter the extracted MPU information with packet ID obtained from component_tag of component to which target MPU belongs and receive the result collectively and retain them in the cache.
⑦ Retrieve the cached MPU index item, match file names with the URL of the application extracted from MH-AIT in process ②, and extract item_id of the target application file.
⑧ Retrieving the target application file from the cache, the receiver executes the application

※When the receiver has no connection with communication network, obtaining the HTML document inevitably fails. Assuming such an installation of the receiver, the receiver shall be allocated to have capability to disable the error messages or suppress the subsequent same messages for the situation to avoid the error message disturbs the viewing every time when retuning.

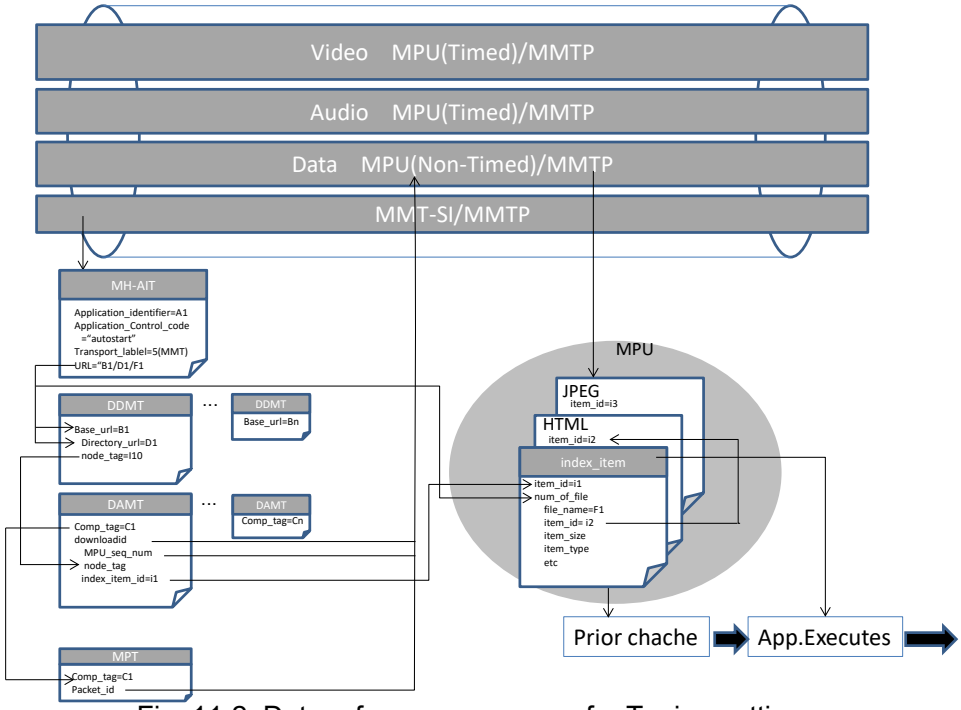

Fig. 11-2: Data reference sequence for Tuning setting

11.2.2 Process sequence of resource referring

This section describes example sequence for obtaining the resource referred with URL in operating application, indicated with 'I' in Fig. 11-1. This sequence is applied for obtaining resources of still pictures referred in HTML document or for transition of HTML document by 'a' tag, etc. within the application.

① When the URL is of full path beginning with http: or https: or of relative path from the application obtained through communication, then the receiver obtains the resource through communication (the end for this sequence). Otherwise proceed to process ②.
② When the referred URL is pointing a file included in the cached MPU, the receiver retrieves the cached resource (the end for this sequence). Otherwise proceed to process ③.
③ Applying URL to DDMT and matching together, the receiver extracts node_tag corresponding to the directory with the URL well-matched.
④ Extract the well-matched MPU information from MPU node descriptor allocated in MPU loop of DAMT by reverse lookup with node_tag.
⑤ Filter the extracted MPU information with packet ID obtained component_tag of component to which target MPU belongs and with MPU_sequence_number and receive the result collectively and retain them in cache.
⑥ Retrieve the cached MPU index item, match file names with the URL for the target resource and extract item_id of the target resource file.
⑦ Retrieve the resource file for the target from the cache.

11.2.3 Process for prior cache

This sectiondescribes an example sequence of the process for prior cache according to the indication from the application in operation, indicated with 'j' in Fig. 11-1.

① When storeDataResource method defined in 10.7.14 is called in the application perform matching operation applying the specified path to DDMT. When the path is pointing a directory, the receiver extracts node_tag of the corresponding directory node. When the path is pointing a file, assuming the file pointing part in place of directory as a directory node, the receiver extracts the node_tag of the directory node.

② Extract the well-matched MPU information by reserse looking-up MPU node descriptor allocated in MPU loop of DAMT using node_tag of the directory node extracted in process ①.

③ Based on component_tag of the component to which the well-matched MPU belongs and MPU_sequence_number of MPU, the receiver receives the target MPU collectively. When the path is pointing a directory retain the whole MPU in cache. When the path is pointing a file, confirming the index item retain the target file only or the whole MPU including the target file in cache. At this time, when listener, optional argument for storeDataResource method in process ①, is specified, or event listener, corresponding to the directory or the file, is specified by addCacheEventListener described in 10.7.14 in advance, then an event shall occur showing "store_finished" when caching completed.

④ Afterwards monitor the target MPU information at DAMT, and when MPU_sequence_number is updated, an event showing "updated" shall occur to event listener and receive another target MPU collectively. When the path is pointing a directory, the receiver replaces the former target MPU in the cache with the updated one. When the path is pointing a file, confirming item_version replace the file only or the whole MPU including target file with the new one. An event shall occur showing "store_finished" when cashing completed.

⑤ When removeCacheEventListener method described in 10.7.14 is called in the application, the receiver shall terminate the monitoring for the target MPU or file when the directory(MPU) or the file corresponding to the specified path is the object of the event. When the application transition occurs, the receiver shall release the standby operation for all events.

11.2.4 Event message processing

11.2.4.1 General event message processing

This describes an example process sequence below concerning general event message, indicated with 'k' in Fig. 11-1.

① In application when addGeneralEventMessageListener method described in 10.7.13 is called, the receiver shall extract the packet ID of corresponding EMT using event_message_tag specified in argument as EMT_tag for application service descriptor arranged in MPT.
② Start EMT monitoring for the packet ID to receive the corresponding EMT (when specified EMT monitoring is already started, the receiver shall keep the monitoring).
③ Analyze the received EMT, after extracting event message descriptor for the first time, which matches with message_id, message_version specified as arguments of the method, at the time specified according to time mode event shall occur corresponding the event listener. When the time mode is 0 (immediate firing), the event shall occur upon receiving the corresponding EMT. The receiver supporting NPT reference message obtains event occurrence timing information through the NPT reference message processing shown in 11.2.4.2 when the time mode is 2 (NPT time)
④ When removeGeneralEventMessageListener method described in 10.7.13 is called in application, the receiver shall release the standby operation for the event messages in ③ corresponding to event_message_tag, message_id and message_version specified as arguments. And when no other stand by operation with the same event_message_tag is required, the receiver shall terminate the corresponding EMT monitoring. While any document transition occurs, the receiver shall release the standby operation for all general event messages and shall terminate EMT monitoring.

11.2.4.2 NPT reference message processing (optional)

This describes an example process sequence below concerning NPT reference message.

① When addUTCNPTReferenceMessageListener method is called described in 10.7.13 in application, the receiver shall extract packet ID of the corresponding EMT referring to, as application service descriptor EMT_tag allocated in MPT, event_message_tag specified in the argument of the method.
② Start EMT monitoring with the extracted packet ID to receive the target EMT. The event shall occur corresponding to the event listener when received the EMT for the first time.
③ Afterwards every time receiving NPT reference message transmitted by EMP the receiver stores the latest UTC_Reference(UTCr), NPT_Reference(NPTr), and UTC_NPT_leap_indicator. For the cases in process ④～⑥, when conversion of NPT value (NPTc) to UTC value (UTCc) or conversion of UTC value (UTCc) to NPT value (NPTc) for a certain target time is needed the receiver shall calculate the time based on stored UTCr, NPTr, etc.
At this time that UTCc is just after the leap second based on UTC_NPT_leap_indicator, the receiver shall apply ±1 second of conversion to UTC value (For detailed conversion algorithm refer to Fig. 11-3, Fig 11-4).
④ Receive EMT transmitting general event message described in 11.2.4.1 ③, and when the time mode is 0x02 (NPT time), the receiver shall calculate the ignition time according to the calculation method described in Fig. 11-4, and then the event relating to the general event message shall occur at the calculated ignition time.
⑤ When the setAlarmByUTCNPT method is executed, according to the calculation method described in Fig. 11-4, the receiver shall calculate the time corresponding to the specified NPT time, and then shall execute the process specified by handler at the calculated time.

⑥ When the getUTCNPT method is executed, according to the calculation method described in Fig. 11-3, the receiver shall calculate the time corresponding to UTC time at the time of execution and shall return the calculated time as the return value.

⑦ When the removeUTCNPTReferenceMessageListener method is called in application, the receiver shall terminate EMT monitoring corresponding to event_message_tag specified as an argument.

```
// leap second conversion (TI denotes the second 23:59:59 (UTC) for addition,
00:00:00 (UTC) for deletion)
if ((UTCc ≧Tl)&&(UTC_NPT_leap_indicator=1)) // just after addition
        UTCc＝UTCc+1(second)
if((UTCc≧Tl)&&(UTC_NPT_leap_indicator=2)) // just after deletion
        UTCc＝UTCc－1(second)

//UTC⇒NPT conversion
NPTc＝NPTr＋(UTCc－UTCr)
```

Fig. 11-3: UTC ⇒ NPT calculate algorithm (getUTCNPT, etc.)

```
//NPT⇒UTC conversion
UTCc＝UTCr＋(NPTc－NPTr)

// leap second conversion (TI denotes 00:00:00 (UTC) for addition,
 23:59:59 (UTC) for deletion)
if ((UTCc ≧Tl)&&(UTC_NPT_leap_indicator=1)) // just after addition
        UTCc＝UTCc－1(second)
if((UTCc≧Tl)&&(UTC_NPT_leap_indicator=2)) // just after deletion
        UTCc＝UTCc＋1(second)
```

Fig. 11-4 NPT ⇒ UTC calculating algorithm (for Event message, Timer, etc.)

Chapter 12: Video and Audio Service Operation via Communication

12.1 Video and audio service via communication

This chapter specifies implementation of video/audio service via communication for multimedia service. Video/audio service via communication means function to receive and display video/audio stream on terminals using IP broadband network such as the Internet or CDN.

This chapter specifies MPEG-DASH system and MMT system defined in ARIB STD-B60 as transmission methods via communication are adopted.

12.2 MPEG-DASH system

MPEG-DASH system should be in accordance with ISO/IEC 23009-1 standard and should apply its “8.4 ISO Base media file format live profile” specification. And this system shall be identified with “urn:mpeg:dash:profile:isoff-live:2011” which is one of the profiles defined in 8.4 of the standard. Video/audio conformed to this system shall be replayed with video element in HTML document.

12.2.1 communication protocol

MPEG-DASH system based content shall be delivered using HTTP(S).

12.2.1.1 Communication stack

- Implementation of http shall conform to HTTP/1.1.
- It shall be essential to support GET, POST and HEAD methods.
- Security operation with https shall follow the provision in Volume 6.

12.2.1.2 http header

- Date/Time within header shall be described according to the format in RFC 1123 with the time zone in GMT.
- This supports ‘range’ request.
- For Content Coding formality, ”identity” shall be exclusively employed.

12.2.1.3 User-Agent

User-Agent described in the form of 10.10.1.1 shall be included and sent within the header of the HTTP request.

12.2.2 Coding system

12.2.2.1 Container format

As container format ISO Base Media File Format described in ISO/IEC 14496-12 shall be operated and terminals shall support decoding content in this format. Furthermore, this supports the following operations.

- moov box is allocated among video/audio segment groups specified by representation component in MPD according to Initialization Segment rule provided in 6.3.3 of ISO/IEC 23009-1. However, it should be noted that for some cases moov shall not be allocated after ftyp.
- Only one traf box shall be included in moof box.
- For trun box a negative value of composition offset may be set for synchronization between video and audio representations.
- Fragment size shall be from 1 to30 seconds, and segment size shall be from 1 to30 seconds. Where only unique value shall be employed within a single adaptation set operation.
- All the representations including ISO Base Media File Format shall employ common track ID value for tkhd box and tfhed box.
- Initialization segment for respective representation arranged within each adaptation is common and shall satisfy the following conditions.
- For video representation “width” and “height” in tkhd box shall be the number of pixels that decoding, cropping, and rescaling have been done.
- Initialization segment shall include adequate information to decode whichever segment.
- Both lengths of a single video segment and single audio segment shall last 1 second or longer unless the concluding segment.
- Either length of a single video segment and single audio segment shall be 30 seconds or shorter.
- Bit rate for the whole system layer of video stream with resolution 2K or less shall not exceed 10Mbps.
- Bit rate for the whole system layer of video stream with resolution more than 2K and less than or equal to 4K shall not exceed 40Mbps.
- It should be noted that all the GOP are not necessarily operated with Closed GOP.

12.2.2.2 Video coding system

As MPEG-DASH based video coding system H.264/MPEG-4 AVC system and H.265/HEVC system shall be operated. Combinations of video format and coding system terminals need to support for H.264/MPEG-4 AVC system are shown in Table 12-1, and also for H.265/HEVC system shown in Table 12-2. Additionally encoding video with optional resolution of 7680 horizontal pixels and 4320 vertical pixels shall comply with ARIB STD-B32 Volume 1 Attachment 5 “4.8 Picture partitioning”.

In H.264/MPEG-4 AVC system dynamic range operation shall be SDR only. While in H.265/HEVC system basically dynamic range operation shall be SDR for Main profile however HDR operation shall also be allowed for Main10 profile.

Table 12-1: Combinations of video format and encoding system for H.264/MPEG-4 AVC

Horizontal resolution	Vertical resolution	Frame rate (Hz)	Scanning method	Screen aspect ratio	Chroma format	Precision (bit)	Profile	Level
720	480	29.97	Interlace	16:9	4:2:0	8	Main, High	3, 3.1, 3.2
720	480	59.94	Sequential	16:9	4:2:0	8	Main, High	3,3.1, 3.2
1280	720	59.94	Sequential	16:9	4:2:0	8	Main, High	3.2, 4
1440	1080	29.97	Interlace	16:9	4:2:0	8	Main, High	4
1440	1080	29.97	Sequential	16:9	4:2:0	8	Main, High	4
1920	1080	29.97	Interlace	16:9	4:2:0	8	Main, High	4
1920	1080	59.94	Sequential	16:9	4:2:0	8	High	4.2

Table 12-2: Combinations of video format and encoding system for H.265/HEVC

Horizontal resolution	Vertical resolution	Frame rate (Hz)	Scanning method	Screen aspect ratio	Chroma format	Precision (bit)	Profile	Level
720	480	29.97	Interlace	16:9	4:2:0	8	Main	3
720	480	29.97	Interlace	16:9	4:2:0	10	Main10	3
720	480	59.94	Sequential	16:9	4:2:0	8	Main	3.1
720	480	59.94	Sequential	16:9	4:2:0	10	Main10	3.1
1280	720	59.94	Sequential	16:9	4:2:0	8	Main	4
1280	720	59.94	Sequential	16:9	4:2:0	10	Main10	4
1440	1080	29.97	Interlace	16:9	4:2:0	8	Main	4
1440	1080	29.97	Interlace	16:9	4:2:0	10	Main10	4
1440	1080	59.94	Sequential	16:9	4:2:0	8	Main	4.1
1440	1080	59.94	Sequential	16:9	4:2:0	10	Main10	4.1
1920	1080	29.97	Interlace	16:9	4:2:0	8	Main	4.1
1920	1080	29.97	Interlace	16:9	4:2:0	10	Main10	4.1
1920	1080	59.94	Sequential	16:9	4:2:0	8	Main	4.1
1920	1080	59.94	Sequential	16:9	4:2:0	10	Main10	4.1
3840	2160	59.94	Sequential	16:9	4:2:0	10	Main10	5.1
7680	4320	59.94	Sequential	16:9	4:2:0	10	Main10	6.1

Assumed bit rate variations for respective video systems, corresponding to combinations of video format and coding system, are shown in Table 12-3 for H.264/MPEG-4 AVC and in Table 12-4 for H.265/HEVC. For CBR the operation shall be within average bit rate and for VBR within assumed bit rate between average and maximum.

Table 12-3: Bit rate assumption for H.264/MPEG-4 AVC

Horizontal resolution	Vertical resolution	Frame rate (Hz)	Scanning method	Average bit rate	Maximum bit rate
720	480	29.97	Interlace	1～3Mbps	abt. 4Mbps
720	480	59.94	Sequential	1～3Mbps	abt. 4Mbps
1280	720	59.94	Sequential	2～4Mbps	abt. 6Mbps
1440	1080	29.97	Interlace	3～8Mbps	abt. 10Mbps
1920	1080	29.97	Interlace	3～8Mbps	abt. 10Mbps
1920	1080	59.94	Sequential	3～8Mbps	abt. 10Mbps

※GOP length is assumed about 0.5 second.

Table 12-4: Bit rate assumption for H.265/HEVC

Horizontal resolution	Vertical resolution	Frame rate (Hz)	Scanning method	Average bit rate	Maximum bit rate
720	480	29.97	Interlace	0.5～2Mbps	abt. 3Mbps
720	480	59.94	Sequential	0.5～2Mbps	abt. 3Mbps
1280	720	59.94	Interlace	1～3Mbps	abt. 5Mbps
1440	1080	29.97	Interlace	2～4Mbps	abt. 6Mbps
1440	1080	59.94	Sequential	2～4Mbps	abt. 6Mbps
1920	1080	29.97	Interlace	2～4Mbps	abt. 6Mbps
1920	1080	59.94	Sequential	2～4Mbps	abt. 6Mbps
3840	2160	59.94	Sequential	15～20Mbps	abt. 25Mbps
7680	4320	59.94	Sequential	50～70Mbps	abt. 80Mbps

GOP length is assumed about 0.5 or 1 second for 2K or coarser resolution and about 1 second for finer than 2K, and detailed operation shall be determined for respective distribution service.

12.2.2.3 Audio coding system

As audio encoding system MPEG-4 AAC system and MPEG-4 ALS system (optional) shall be operated. Assumed bit rate variations corresponding to combinations of audio format and coding system are shown in Table 12-5 for MPEG-4 AAC and in Table 12-6 for MPEG-4 ALS system.

Table 12-5: Bit rate assumption (MPEG-4 AAC)

Sampling rate (KHz)	Audio channel number	Encoding bit rate
48	2	128Kbps
48	2	192Kbps
48	2	256Kbps
48	5.1	256Kbps
48	5.1	384Kbps

Table 12-6: Bit rate assumption (MPEG-4 ALS)

Sampling rate (KHz)	Audio channel number	Encoding bit rate
48	2	2.4Mbps
48	5.1	7.3Mbps

12.2.3 MPD (Media Presentation Description)

This describes operation of MPD, the meta information to be used in MPEG-DASH system. In schema definition essential components and attributes should be described without exception.

12.2.3.1 MPD configuration

Number of periods, adaptation sets, and representations configuring MPD, and file size of MPD shall be operated as shown in Table 12-7.

Table 12-7: MPD configuration values

Item	Operating value
Period number per MPD	1～64
Adaptation set number per period	1～16
Representation number per adaptation set	1～16
MPD file size	100Kbytes (max)

12.2.3.2 Profile

As the profile attribute of MPD component in MPD “urn:mpeg:dash:profile:isoff-live:2011” or character string, described as profile attribute of MPD component in MPD, which is operated in video and audio service via MPEG-DASH system in HTML5 application in coordination with broadcasting, described in ARIB TR-B14 Volume 3 [Part 2] Chapter 8, ARIB TR-B15 Part 1 Volume 3 Section 8.20, and ARB TR-B15 Part 2 Volume 3 Section 8.18, shall be specified.

12.2.3.3 Adaptation set (AdaptationSet element)

Each one of representations in adaptation set shall contain a single media component (video component or audio component). However, a single representation may contain multiple non-media components.

12.2.3.4 Role element

As to Role element allocated in adaptation set role scheme identified with "urn:mpeg:dash:role:2011" shall be operated. When a certain period contains multiple adaptation sets of the same component type, only one Role element among them shall be allocated with @value="main".

12.2.3.5 Representation (Representation element)

For video representation, in addition to the essential attributes in schema, the following attributes should be operated. And more to designate aspect ratio for video representation the aspect ratio should be specified to par attribute in AdaptationSet element which is the parent element of the representation.

- width attribute
- height attribute
- frameRate attribute
- scanType attribute
- bandwidth attribute

For audio representation, in addition to the essential elements and attributes in schema, the following element and attribute should be operated. And more in audio representation as specifying language is essential lang attribute should be operated in AdaptationSet element which is the parent element of the representation.

- audioSamplingRate attribute
- AudioChannelConfiguration element

Setting attribute may be done by inheritance.

It should be noted that in some operation the bit rate with which video file is actually encoded and the bit rate value described as bandwidth attribute shall not be always exactly the same. As bandwidth attribute the value of assumed maximum bit rate shall be described.

However, the value of video resolution shall be, instead of the value of width and height attributes of Representation element, based on the resolution information specified in the respective segments.

And more to specify color range and dynamic range of video specifying EssentialProperty element shall be allowed under Representation element.

12.2.3.6 AudioChannelConfiguration Element

schemeIdUri attribute of AudioChannelConfiguration element for audio coding systems MPEG-4 AAC and MEPG-4 ALS is described by "urn:mpeg:dash:23003:3:audio_channel_configuration:2011" defined in ISO/IEC 23009-1 and value attribute is specified by integer value defined in ISO/IEC 23001-8.

12.2.3.7 EssentialProperty element

schemeIdUri attribute and value attribute shall be described in For EssentialProperty element. Values to be specified as schemeIdUri attribute to specify color range and dynamic range are shown in Table 12-8.

Table 12-8: schemeIdUri attribute

Item to designate	schemeIdUri attribute value
Color range	urn:mpeg:mpegB:cicp:ColourPrimaries
Dynamic range	urn:mpeg:mpegB:cicp:TransferCharacteristics

Operations of value attribute to specify color range are shown in Table 12-9, and operation of value attribute to dynamic range are shown in Table 12-10.

Table 12-9: value attribute for specifying color range

Value	Description
9	Rec. ITU-R BT.2020

Table 12-10: value attribute for specifying dynamic range

Value	Description
18	Rec. ITU-R BT.2100 HLG

When no EssentialProperty element is specified, color range shall be considered as BT.709 and dynamic range shall be considered as SDR. The operation shall depend on optional feature when the description of MPD is different from color range and dynamic range of the actual video stream.

12.2.4 HTML browser

HTML browser should have MSE APL to support streaming and EME API to support security for content as HTMLMediaElement extension, which are defined by World Wide Web Consortium (W3C),.

12.2.5 Security support for content

When security of content to be transmitted is required it may be impremented by operating DRM and channel encryption. DRM and channel encryption are not restricted to exclusive operation, and according to the needs of content protection either one of the means alone or both in combination may be operated.

DRM operation should support Common Encryption to deal with multiple DRMs including encrypted videos and audios in a single encryption system. Varieties and operation detail of DRM shall be out of scope of this operational guideline and transmission service providers shall arrange them, according to terminal implementations, in coordination with receiver manufacturers or distribution service providers when needed.

“Clear Key” shall be used as key system of EME in channel encryption operation. However, encryption system operated shall be out of scope of this operational guideline and transmission service providers shall arrange them, according to terminal implementations, in cooperation with receiver manufacturers or distribution service providers, when needed.

12.2.5.1 ContentProtection element

DRM operation ContentProtection element under representation shall be operated with no exception. schemeIdUri attribute of ContentProtection element shall describe “urn:mpeg:dash:mp4protection:2011” specified in ISO/IEC 23009-7 and value attribute shall describe “cenc”. Moreover, ContentProtection element shall be described depending upon DRM to be actually operated.

In channel encryption ContentProtection element under representation should be operated.

In case of no security operation for content ContentProtection element needs not to be operated.

12.2.6 Receiver behavior

Data content shall be specified by MPDand MSE API on HTML Browser of the receiver interprets its MPD, and the receiver then executes the process of adaptive operation accordingly. EME API executes the process of adaptive operation for content security.

12.2.6.1 Video representation transition

The receiver needs to be able to afford video representation transition accompanying the following change in part or the whole.

- Change of bit rate
- Change of either one of profile or level, or both
- Change of either one of horizontal resolution or vertical resolution, or both
- Change of Scanning scheme

The receiver shall provide seamless transition in combinations listed in Table 12-11, while broadcasting operators need to arrange video fragmentation assuming seamless transition to be realized. Transition quality in combinations other than listed in Table 12-11 shall be optional feature.

Table 12-11: Combinations enabling Seamless transition

Coding system	Horizontal resolution	Vertical resolution	Frame rate (Hz)	Scanning method	Profile
【Combination 1】					
H.264/MPEG-4 AVC	720	480	29.97	Interlace	Main
H.264/MPEG-4 AVC	1920	1080	29.97	Interlace	Main
【Combination 2】					
H.264/MPEG-4 AVC	720	480	59.94	Sequential	Main
H.264/MPEG-4 AVC	1280	720	59.94	Sequential	Main
H.264/MPEG-4 AVC	1920	1080	59.94	Sequential	Main
【Combination 3】					
H.265/HEVC	720	480	29.97	Interlace	Main
H.265/HEVC	1920	1080	29.97	Interlace	Main
【Combination 4】					
H.265/HEVC	720	480	59.94	Sequential	Main
H.265/HEVC	1280	720	59.94	Sequential	Main
H.265/HEVC	1920	1080	59.94	Sequential	Main

12.2.6.2 Audio representation transition

Receivers need to be capable of transition between separate audio representations, such as representations in a single language alternately from multiple language service.

In case that audio coding system, bit rate number of channels and so on are equivalent, seamless transition is mandatory and broadcasters need to arrange audio fragmentation assuming seamless transition to be realized.

12.2.6.3 Video / audio representation

Representations of video / audio transmitted in MPEG-DASH format shall be referred by video element in HTML and presented by HTML browser operating on the receiver. To provide this representation HTML browser should support MSE API and EME API.

12.2.6.4 Operation of video element

When no controls attribute is specified in video element, the receiver shall not enable the function for video representation at its own discretion. In this case the video representation shall be solely carried out utilizing MSE API.

12.2.6.5 Operation of MSE

The version of MSE operated shall depend on the implementation of HTML browser equipped on the receiver.

12.2.6.6 Operation of EME

The version of EME operated shall depend on the implementation of HTML browser equipped on the receiver.

12.2.6.7 Operation of DRM

Varieties and operation detail of DRM shall depend on the implementation of HTML browser equipped on the receiver.

12.2.6.8 Judging basis of applicable receiver

The receiver capability of MPEG-DASH distribution scheme described in this operational guideline and operable versions of MSE, EME, varieties of DRM and so on, should be confirmed through “query” in hasCapability method of Capabilities object, specifying ”VideoElement” as the arguments of the method. The arguments param to be specified for confirming MSE version are listed in Table 12-12, for EME version in Table 12-13. Arguments param1..n to be specified for confirming varieties of DRM are defined by administration entity in Appendix 6.

Table 12-12: MSE versions

param1	param2	Conforming specification
“MSE”	“201210”	W3C Media Source Extensions Editor's Draft 1 October 2012
“MSE”	“201311”	W3C Media Source Extensions Editor's Draft 10 December 2013
“MSE”	“201401”	W3C Media Source Extensions Candidate Recommendation 09 January 2014
“MSE”	“201610”	W3C Media Source Extensions Proposed Recommendation 04 October 2016
“MSE”	“201611”	W3C Media Source Extensions Recommendation 17 November 2016

Table 12-13: EME versions

param1	param2	Conforming specification
“EME”	“201206”	Encrypted Media Extensions Editor's Draft 19 July 2012
“EME”	“201402”	Encrypted Media Extensions Editor's Draft 3 February 2014
“EME”	“201503”	Encrypted Media Extensions Working Draft 31 March 2015
“EME”	“201709”	Encrypted Media Extensions Recommendation 18 September 2017

12.2.6.9 Simultaneous representation of multiple videos with different dynamic range

For receivers capable of simultaneous representation for multiple videos, adaptation of dynamic range for multiple videos in inconsistent dynamic ranges shall be operational feature, yet it is recommended to maintain the quality of HDR video quality as much as possible and to provide natural representation to viewers.

12.2.7 Operation of communication transmission service

Broadcasters providing video and audio communication and transmission service in MPEG-DASH system should consider that there are some viewers unable to utilize communication due to lack of connection by providing service.

Since versions of operated MSE or EME, varieties of equipped DRM, and channel encryption scheme depend on HTML browser installed on the receiver, operators need to provide distribution service, confirming those versions supported by the receiver through checking the installed functions with hasCapability method, checking the receiver version with getSystemInformation method and so on.

Moreover, operators providing videos and audio service in communication shall continuously support distribution service for new API versions or new DRM scheme in cooperation with receiver manufacturers or distribution service providers and the like, if needed.

12.3 MMT system

Video and audio transmitted via MMT system in broadband network are assumed to be played not by HTML browser but using dedicated player.

Detail of transmission operation and specification of dedicated player shall be defined by the service providers in MMT system in their own specification. And the defined operation system shall be registered and administered by administration entity in Appendix 6. However, IP multicast distribution shall follow the description in Volume 6 section 5.2.

Operators providing service in MMT system need to provide service, confirming whether or not receivers may afford the operated system, by specifying ”MMTVideoStream” as “query” of hasCapability method described in 10.7.11. Values of arguments param1..n for hasCapability method are defined by administration entity in Appendix 6.

Chapter 13: Security Operation in Communication

13.1 Secure communication

In transmission of multimedia service content via communication when the transmission scheme with ”https:” is specified TLS shall be applied. For detail operation of TLS refer to Volume 6 subclause 7.2.

It is assumed that the security algorithm for TLS shall be updated to cope with security issues. Consequently, in response to the update of security algorithm, the security algorithm operating on HTML browser also should be updated accordingly by updating the receiver software.

When error occurs in security communication error messages shall be displayed as in Volume subclause 7.2.7 to indicate the user clearly that the security communication is unavailable. Alternatively, implementation not to perform communication shall be possible on occasion of error occurrence in security communication.

Implementation of messaging that the receiver is performing security communication shall be optional feature, however during video and multimedia content being displayed in full screen, the display of the message shall be out of frame not to overlap with the content.

13.2 Route certificate

13.2.1 Use of route certificate

Route certificate employed in security communication should be available with HTML according to TLS operation described in Volume 6 subclause 7.2.

Besides the receiver shall be recommended to has the function to display the varieties of route certificates available with HTML browser.

13.2.2 Required route certificate

For route certificate corresponding to the server certificate employed by broadcasting operator to implement security communication refer to Administration Entity described in Appendix 6. Every route certificate shall be equipped specified by the Administration Entity. Route certificates required to be operated shall be as many as eight.

13.2.3 Update of route certificate

It shall be assumed that some new route certificate shall be operated due to the term of validity of route certificate or update of security algorithm. Hence new route certificate shall be able to be added in HTML browser by updating the receiver software and so on. And also cross route certificate shall be operated by HTML browser.

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Chapter 14: Operational Guidelines for Terrestrial / BS / Wide band CS / Advanced BS Common Digital Receivers

14.1 Introduction

This chapter specifies functions required for data content service in advanced BS digital broadcasting provided by common receivers, those are capable for terrestrial digital television broadcasting, BS / wide band CS digital broadcasting (hereafter, digital broadcasting), and advanced BS digital broadcasting, (hereafter, common receivers).

14.2 Functions required for common receivers

14.2.1 Functions to be equipped to common receivers

Common receivers shall equip functions described in TR-B14, TR-B15 and TR-B39 for at least its receiving capable media (terrestrial / BS / wide band CS / advanced BS).

14.2.2 RAM

Greg, which is temporary memory area described in chapter 10, shall be shared with digital broadcasting and advanced BS digital broadcasting in the common receivers. Greg is recommended to retain the value even when presenting other media which does not support Greg.

When the receivers have no choice not to retain the value in Greg during presenting other media, the receivers should initialize the value in Greg prior to the first time for presenting Greg supporting media.

14.2.3 NVRAM for digital broadcasting

Bookmark area, registration calling area, and general-purpose route certificate area for digital broadcasting shall not be shared area. For NVRAM area for respective digital broadcasting media, accessibility from advanced BS digital broadcasting data content and use of MH-BIT relating broadcaster descriptor are shown in Table 14-1.

To access NVRAM utilize BMLBrowserPseudoObject interface of Navigator object based on the rule on access to permanent storage area managed by permanent storing function described in ARIB STD B24 Volume 2 subclause 7.6.5 referred by ARIB STD-B62 Volume 2 subclause 3.3.5. For operation detail refer to subclause 14.3.3.

Table 14-1: Accessible area from Advanced BS Digital Broadcasting

Media	Area name	Access from advanced BS digital broadcasting	Use of relating broadcaster descriptor
BS	Broadcaster common area	N/A	
	Broadcaster specific area	RW	・ network_id for BS digital broadcasting ・ broadcaster_id for specifying access area
	Broadcaster specific Broadcasting and communication common area	RW	
Wide band CS	Broadcaster common area	N/A	
	Broadcaster specific area	RW	・ network_id for wide band CS digital broadcasting ・ broadcaster_id for specifying access area
	Broadcaster specific Broadcasting and communication common area	RW	
Terrestrial	Broadcaster common area	N/A	
	Broadcaster common area	RW	・ original_network_id for specifying access area
	Broadcaster Specific Broadcasting and communication common area	RW	
	Affiliate specific area	RW	・ affiliation_id or specifying access area

RW : possible both read and write
N/A : neither read nor write

14.2.3.1 Function of setting authority for access to wide band CS broadcaster specific area

In wide band CS broadcaster specific area accessibility information is set block by block. For reading and writing blocks of wide band CS broadcaster specific area the execution is controlled based on this accessibility information. The accessibility information shall not be set in common with digital broadcasting but per each network ID basis.

X_APAB_setAccessInfoToProviderArea() shall be defined for API to set access authority information. The common receiver with wide band CS digital broadcasting should equip this API.

1)X_APAB_setAccessInfoToProviderArea()

Table 14-2: Access authority setting on wide band CS broadcaster specific area

Method	Parameter	Type
X_APAB_setAccessInfoToProviderArea(nvramURI,accessInfo);	Return value	Boolean
	nvramURI	String Character string indicating wide band CS broadcaster specific area URI for setting accessibility (nvrams ://<broadcaster_id >;cs_local/)
	accessInfo	String Character string indicating JSON file URL in which accessibility information is described
Exception condition		code property
Invalid argument		INVALID_PARAM_ERR
Failure to obtain JSON file (No JSON file)		NOT_FOUND_ERR
Not authorized to use API		NOT_AUTHORIZED_ERR
Miscellaneous error		MISC_ERR

Description :

For accessInfo parameter specify a file name of JSON file (hereafter access authority information file) which includes access authority information in a format shown in Fig. 14-1. This access authority information file shall be applied only to transmission via broadcasting. Hence a file name shall be described according to the name space provisions in6.1.3.6. When a URL other than broadcasting transmission is specified in accessInfo, the access authority shall not be set.

```
{
  “Update“ :“YYYYMMDDHHMM“,
  “AccessInfo“ :[
    {“blk”:”0“, ”networkId“:”0xnnnn“, ”broadcasterId“:”0xnn“, ”serviceId“:”0xnnnn“},
    {“blk”:”1“, ”networkId“:”0xnnnn“, ”broadcasterId “:”0xnn“, ”serviceId“:”0xnnnn“},
                  ・ ・ ・
    {“blk”:”46“, ”networkId“:”0xnnnn“, ”broadcasterId “:”0xnn“, ”serviceId“:”0xnnnn“}
  ]
}
```

Fig. 14-1: JSON format for access authority information file

X_APAB_setAccessInfoToProviderArea() shall read access authority information from the file and set the whole access authority, which is managed for each network ID corresponding to respective block in wide band CS broadcaster specific area specified by nvramURI. Access authority information file specified by accessInfo parameter shall be in a fixed format shown in Fig. 14-1 and when a file in another format is specified, X_APAB_setAccessInfoToProviderArea() shall return false. Access authority information file shall describe access authority information corresponding to all blocks of wide band CS broadcaster specific area specified by nvramURI parameter.

When executing this API results change of access authority the access authority information corresponding to the block shall be changed but the value stored in that block shall not be initialized.

Access authority information file should be transmitted whenever the data content for setting access authority is utilized, and access authority information should be set prior to accessing to wide band CS broadcaster specific area. Access authority information once set and stored by the receiver shall possibly be cleared due to service switching accordingly by implementation.

Access authority information file is composed of updating date specified by "Update" key and access authority information specified by "AccessInfo" key. Access authority information consists of arrangement having 47 elements (records corresponding to blocks of wide band CS operator dedicated region allocated for respective operators). In case of elements less than or more than 47 it shall be determined as invalid file.

To each element in access authority information described in JSON file as in Fig. 14-1 information in Table 14-3 shall be applied. When key names in access authority information file include other names than in Table 14-3 or any value other than described in Table 14-3 is applied to the keys, then it shall be determined as invalid file.

When the file specified by accessInfo is a valid file, regardless change of access authority, X_APAB_setAccessInfoToProviderArea() shall return true as a return value. When the file specified by accessInfo is determined as invalid, X_APAB_setAccessInfoToProviderArea() shall not change access authority information and shall return false as a return value. Even when the file specified by accessInfo is a valid file, due to processing failure within the receiver (failure to obtain the current time, etc.), X_APAB_setAccessInfoToProviderArea() may return false as a return value. The file specified by accessInfo may be invalid in case of the followings.

・File format of Access authority information does not conform to Fig. 14-1

・The number of elements described in access authority information is not 47

・The value described in access authority information is not shown in Table 14-3

・The value format described in access authority information does not conform to the definition in Table 14-3

・The updating date format described in access authority information file does not conform to the definition in Fig. 14-1

Table 14-3: Access authority information

Key	Description
blk	Indicates block number of advanced CS broadcaster specific area Value to be described is ”0”to”46”
networkId	Indicates network ID of access allowed service To be described in hexadecimal format with prefix ”0x”
broadcasterId	Indicates broadcaster ID to which access allowed service belongs To be described in hexadecimal format with prefix ”0x”
serviceId	Indicates service ID of access allowed service To be described in hexadecimal format with prefix ”0x” Value ”0xFFFF”, when specified, indicates access is allowed from all the service belonging specified broadcasterID Specify ”0x0000”, not to allow access from any service

File updating date and time indicated by ”Update” shall be set the date and time when the access authority information file is created. When the value described as file updating date passes over the updating date and time of the access authority information stored in the receiver, it shall be determined that the access authority information has been updated and update the stored access authority information. When the value described as file updating date is not passing over the updating date and time of the access authority information stored in the receiver and passes over the current time, it shall be determined that the file format is valid while invalid updating date might be set, hence the access authority information shall not be updated.

File updating date indicated by ”Update” shall be described by character string in 12digits “year/month/day/hour/minute” in creating the file.

14.2.4 Non-volatile storage area for advanced BS digital broadcasting

Non-volatile storage area shall not be the shared area because data broadcasting contents do not handle written data.

14.2.5 Character code conversion function

14.2.5.1 Converting EUC-JP to UCS

Converting characters encoded in EUC-JP, described in STD-B24 Volume 2 subclause 4.1.1, to UCS shall conform to the following rules:

- YEN SIGN (code value 5/12) in JIS X0201 is converted to REVERSE SOLIDUS (code value U+5C) in UCS
- OVERLINE (code value 7/14) in JIS X0201 is converted to TILDE (code value U+7E) in UCS
- Each character of graphic character set for Katakana in JIS X0201 to UCS characters referred by alternative names shown in JIS X0213 Annex 5 Table 1
- Characters of coded Kanji set in JIS X0208 and listed in JIS X0213 Annex 5 Table 2 (considered as Row-Cell in JIS X0208 ignoring Plane in Plane-Row-Cell shown in the table) is converted to UCS characters referred by alternative names defined in the table
- Each character in additional symbol set is converted to UCS characters shown in STD-B62 Volume 1 Part 2 Table 5-2 and this operational guideline Appendix 4 Table A4-1, however :
  - Characters from Cell 26 to 31 and from Cell 56 to 85 in Row 92 shall be converted to GETA MARK (U+3013) in UCS characters respectively

- Characters not described in the preceding items shall be converted to UCS characters referred by those character names

14.2.5.2 Converting UCS to EUC-JP

Converting characters in repertory defined in STD-B62 Volume 1 Part 2 sections 5.2 and 5.3, with EUC-JP described in STD-B24 Volume 2 subclause 4.1.1, shall obey the following rules:

- REVERSE SOLIDUS (code value U+5C) in UCS is converted to YEN SIGN (code value 5/12) in JIS X0201
- TILDE (code value U+7E) in UCS is converted to OVERLINE (code value 7/14) in JIS X0201
- Each character of code value U+FF61～U+FF9F in UCS is converted to characters in JIS X0201 corresponding to character names in JIS X0213 Annex 5 Table 1
- Each character of code value U+FF01, U+FF03～U+FF06, U+FF08～U+FF0C, U+FF0E ～U+FF5D, U+FFE3, U+FFE5 in UCS is converted to characters in JIS X0208 corresponding to character names in JIS X0213 Annex 5 Table 2 (considered as Row-Cell in JIS X0208 ignoring Plane in Plane-Row-Cell in the table)
- Each UCS character described in STD-B62 Volume 1 Part 2 Table 5-2 or this operational rule Appendix 4 Table A4-1 is converted to characters in additional symbol set shown in the table, however :
  - POSTAL MARK (code value U+3012) shall be converted to Row2-Cell9 and not to Row91-Cell8
  - CJK UNIFIED IDEOGRAPH-5E74 shall be converted to Row39-Cell15 and not to Row92-Cell7
  - CJK UNIFIED IDEOGRAPH-6708 shall be converted to Row23-Cell78 and not to Row92-Cell8
  - CJK UNIFIED IDEOGRAPH-65E5 shall be converted to Row38-Cell92 and not to Row92-Cell9
  - CJK UNIFIED IDEOGRAPH-5186 shall be converted to Row17-Cell63 and not to Row92-Cell10
  - SQUARED CJK UNIFIED IDEOGRAPH-4E8C (code value U+1F214) shall be converted to Row90-Cell58 and not to Row93-Cell30
  - BLACK TELEPHONE (code value U+260E) shall be converted Row91-Cell43 and not to Row93-Cell91
- UCS character not described in the preceding items shall be, when a character referred with its character name is an element in coded character set defined in JIS X0201 or JIS X0208, then converted to the character, otherwise converted to Row2-Cell14 (GETA MARK) of JIS X0208.

14.3 Operational guidelines for content assuming common receiver

This section specifies the guidelines for describing content assuming common receiver.

14.3.1 Judging function for common receiver

Data content may determine, specifying ”query” for ”Media” with hasCapability method, that the receiver is capable of other media than advanced BS digital broadcasting as well (i.e. common receiver). Values for specifying media are shown in Table 14-4.

Table 14-4: Media specifying parameter

Value	Media
"1"	BS digital broadcasting
"2"	Wide band CS digital broadcasting(dextrogyration)
"3"	Wide band CS digital broadcasting (levorotation)
"4"	Terrestrial digital television broadcasting
“6”	Advanced BS digital broadcasting
“7”	Advanced wide band CS digital broadcasting

When utilizing the functions particular to common receivers such as tuning other media and so on, it is always required in advance using this judging function to confirm that the receiver is capable of the target media.

And more, the receivers judged as shared receiver with this judging function need to support all operations particular to common receiver described as follows:

14.3.2 Accessing Greg

Greg enables data broadcasting content of digital broadcasting to read data written by data content of advanced BS digital broadcasting and enables data content of advance BS digital broadcasting to read data written by digital broadcasting content of digital broadcasting. It should be noted that character code conversion is performed by the function described in 14.2.5 through reading, hence data shall not be retrieved as they were written due to the difference of respective repertories supported by digital broadcasting and advanced BS digital broadcasting.

There are four possible cases as follows that character codes are unable to be converted or all the characters are unable to be read out by Greg.

1) Characters used only by digital broadcasting

- Characters of Row92-Cell26 - Cell31
- Characters of Row92-Cell56 - Cell85

2) Characters only used by advanced BS digital broadcasting

- Characters in implementation level 3 (excluding characters used as additional symbols by digital broadcasting) and characters in implementation level 4 defined in JIS X0213:2004

3) Characters that multiple character codes are assigned to a single character

- Characters listed in Table 14-5, Table 14-6
- Data content in advanced wide band satellite digital broadcasting retrieve character string that once data broadcasting content in digital broadcasting has written characters having code value listed in column (B) of Table 14-5 and Table 14-6, and write in the same character string as it is, afterwards when data broadcasting content in digital broadcasting retrieve the same character string characters are retrieved having code value corresponding column (A) of the Tables.

Table 14-5: JIS X0208-1990 defined characters and uniquely defined additional symbol set characters

Character	(A)JIS X0208-1990 Row-Cell	(B)additional symbol set Row-Cell
〒	2-9	91-8
年	39-15	92-7
月	23-78	92-8
日	38-92	92-9
円	17-63	92-10

Table 14-6: Additional symbol set characters with multiple Row-Cell assigned

Character	(A)Additional symbol set Row-Cell	(B)Additional symbol set Row-Cell
🈂	90-58	93-30
☎	91-43	93-91

4) Strings consist of written characters exceeding 256 bytes

- Characters 257th and further among character string, when converted to EUC-JP exceeds 256 bytes, that is retrieved by digital broadcasting after written by advanced BS digital broadcasting
- When the 256th byte is the first byte of double byte character 256th and further

In such cases that character code shall not be converted, or all the characters shall not be read out read Greg operation with the common receiver is described as follows.

- When the string has been written by data broadcasting content of digital broadcasting character string including the case 1) character shall be read with the character converted to GETA MARK(U+3013).
- When the string has been written by data content of advanced wide band satellite digital broadcasting, retrieved and written back as it is by data broadcasting content of digital broadcasting, character string including the case 2) character shall be read with the character converted to GETA MARK(Row2-Cell14).
- When the string has been written by data content of advanced wide band satellite digital broadcasting, retrieved and written back as it is by data broadcasting content of digital broadcasting, character string including the case 3) character shall be read with the character in the same character code as having been written.

- For the case 4) when the string has been written by data content of advanced wide band satellite digital broadcasting, retrieved and written back as it is, the whole string shall not be retrieved.
- For character string written by data content of advanced wide band satellite digital broadcasting, being read out but not written, then the whole character string needs to be retrieved without fail as having been written by the data content.

14.3.3 Accessing NVRAM for digital broadcasting

The receiver which supports digital broadcasting is able to access NVRAM area with data content for the respective media within shown in Table 14-1.

However, for advanced BS digital broadcasting data content to be able to access NVRAM area the particular identification value for the intended NVRAM area listed in Table 14-1 should be described to the relating broadcaster descriptor of MH-BIT and sent out in advanced BS digital broadcasting. And also, the receiver should determine the accessibility to NVRAM area according to the operation of MH-BIT related broadcaster descriptor listed in Table 14-1. Here, the maximum value for num_of_affiliation_id in relating broadcaster descriptor shall be 4.

To access NVRAM employ writePersistentArray() and readPersistentArray(), which are BMLBrowserPseudoObject interfaces of Navigator object as described in ARIB STD-B62 Volume 2 subclause 3.3.5. Operation of NVRAM shall follow the rules in ARIB TR-B14 Volume 3 Part 2 “5.2 Operation of NVRAM commonly used in MM service of Terrestrial Digital Television Broadcasting”, ARIB TR-B15 Part 1 Volume 3 “8.2 Operation of NVRAM commonly used in MM service”, and ARIB TR-B15 Part 2 Volume 3 “8.10 Operation of NVRAM commonly used in MM service of BS / CS shared receiver”. The content value of NVRAM shall still be retained during execution of HTML browser which is described in this rule. Conversion of character codes in dealing with Japanese shall follow the description in 14.2.5.

Table 14-7: Store array content in non-volatile storage area

Method	Parameter	Type
writePersistentArray(filename, structure,data);	return value	Number
	filename	String
	structure	String
	Data	Array
Exception condition		code property
Invalid argument		INVALID_PARAM_ERR
Not authorized to use API		NOT_AUTHORIZED_ERR
Miscellaneous error		MISC_ERR

When failed, return NaN as a return value.

Table 14-8: Obtain content as array existing in non-volatile storage area

Method	Parameter	Type
readPersistentArray(filename,structure);	return value	Array
	filename	String
	structure	String
Exception condition		code property
Invalid argument		INVALID_PARAM_ERR
Not authorized to use API		NOT_AUTHORIZED_ERR
Miscellaneous error		MISC_ERR

When failed, return null as a return value.

14.3.3.1 Name space for accessing respective area

Access name spaces to respective area of digital broadcasting are listed in Table 14-9.

Table 14-9: Access name space to NVRAM for digital broadcasting

BS broadcaster specific area	
Access name space	nvram://<broadcaster_id>;bs_local/<block number>
(reference) Data broadcasting operation	nvram://~/<block number> nvram://~/ext/<block number>
BS broadcaster specific broadcasting and communication common area	
Access name space	nvram://<broadcaster_id>;bs_local_web/<block number>
(reference) Data broadcasting operation	nvram://local_web/<block number>
Wide band CS operator dedicated region	
Access name space	nvrams ://<broadcaster_id>;cs_local/<block number>
(reference) Data broadcasting operation	nvrams://~/<block number>
Wide band CS broadcaster specific broadcasting and communication common area	
Access name space	nvram ://<broadcaster_id>;cs_local_web/<block number>
(reference) Data broadcasting operation	nvram://local_web/<block number>
Terrestrial broadcaster specific area	
Access name space	nvram://<original_network_id>;t_local/<block number>
(reference) Data broadcasting operation	nvram://local/<block number>
Terrestrial broadcaster specific broadcasting and communication common area	
Access name space	nvram://<original_network_id>;t_local_web/<block number>
(reference) Data broadcasting operation	nvram://local_web/<block number>
Terrestrial affiliation specific area	
Access name space	nvram://<affiliation _id>;t_group/<block number>
(reference) Data broadcasting operation	nvram://<affiliation _id>;group/<block number>

14.3.3.2 Accessing respective area

1) BS broadcaster specific area

Reading from or writing to BS broadcaster specific area by data content service shall be done in fixed length block. Filename as the argument to identify a fixed length block is specified by the URI as follows:

nvram://<broadcaster_id>;bs_local/<block number>

<broadcaster_id> : broadcaster ID in 2 digits of hexadecimal.
(if less than 2 then pack 0 justified left to fill 2 digits). Cannot be omitted.
<block number> : 0～N. Cannot be omitted.

2) BS broadcaster specific broadcasting and communication common area

Reading from and writing to BS broadcaster specific broadcasting and communication common area by data content service shall be done in fixed length block. Filename as the argument to identify a fixed length block is specified by the URI as follows:

nvram://<broadcaster_id>;bs_local_web/<block number>

<broadcaster_id> : broadcaster ID in 2 digits of hexadecimal.
(if less than 2 then pack 0 justified left to fill 2 digits). Cannot be omitted.
<block number> : 0～N. Cannot be omitted.

3) Wide band CS broadcaster specific area

Reading from and writing to wide band CS broadcaster specific area by data content service shall be done in fixed length block. Filename as the argument to identify a fixed length block is specified by the URI as follows:

nvrams:// <broadcaster_id>;cs_local/<block number>

<broadcaster_id> : broadcaster ID in 2 digits of hexadecimal.
(if less than 2 digits then pack 0 justified left to fill 2 digits). Cannot be omitted.
<block number> : 0～N. Cannot be omitted.

To access wide band CS broadcaster specific area the accessing authority to the target block of that region needs to be set with X_APAB_setAccessInfoToProviderArea() in advance. Accessing without authority is prohibited.

4) Wide band CS broadcaster specific broadcasting and communication common area

Reading from and writing to wide band CS broadcaster specific broadcasting and communication shared region by data content service shall be done in fixed length block. Filename as the argument to identify a fixed length block is specified by the URI as follows:.

nvram://<broadcaster_id>;cs_local_web/<block number>

<broadcaster_id> : broadcaster ID in 2 digits of hexadecimal.
(if less than 2 digits then pack 0 justified left to fill 2 digits). Cannot be omitted.
<block number> : 0～N. Cannot be omitted.

5) Terrestrial broadcaster specific area

Reading from and writing to terrestrial broadcaster specific area by data content service shall be done in a fixed length block. Filename as the argument to identify a fixed length block is specified by the URI as follows:

nvram://<original_network_id>;t_local/<block number>

< original_network_id > : original network ID in 4 digits of hexadecimal.
(if less than 4 digits then pack 0 justified left to fill 4 digits). Cannot be omitted
<block number> : 0～N

6) Terrestrial broadcaster specific broadcasting and communication common area

Reading from and writing to terrestrial broadcaster specific broadcasting and communication shared region by data content service shall be done in a fixed length block. filename as the argument to identify a fixed length block is specified by the URI as follows:

nvram://<original_network_id>;t_local_web/<block number>

< original_network_id > : original network ID in 4 digits of hexadecimal.
(if less than 4 digits then pack 0 justified left to fill 4 digits). Cannot be omitted

<block number> : 0～N

7) Terrestrial affiliation specific area

Reading from and writing to terrestrial affiliation dedicated region by data content service shall be done in fixed length block. filename as the argument to identify a fixed length block is specified bythe URI as follows:

nvram://<affiliation _id>;t_group/<block number>

<affiliation _id> : affiliation ID in 2 digits of hexadecimal.
(if less than 2 digits then pack 0 justified left to fill 2 digits.) Cannot be omitted.

<block number> : 0～N. Cannot be omitted.

14.3.4 Tuning to digital broadcasting service

Receivers capable of digital broadcasting are able to tune to digital broadcasting service using tuneTo method in ReceiverDevice interface.

To tune to the digital broadcasting service, properties need to be specified for ISDB resource reference object as argument according to combination '(B)' among the allowable possible combinations listed in ARIB STD-B62 Volume 2 Table 3-1, and thus the operations are shown in Table 14-10.

Table 14-10: Property usage for ISDB resource reference object in service tuning

Property	Usage
original_network_id	Specifies the original network identification value for service to be selected
transport_stream_id	Specifies the transport identification value for service to be selected
tlv_stream_id	Property shall not exist
service_id	Specifies the service identification value to be selected
content_id	Property shall not exist
event_id	Property shall not exist
component_tag	Property shall not exist
event_message_tag	Property shall not exist
channel_id	Property shall not exist
module_id	Property shall not exist
module_name	Property shall not exist
resource_name	Property shall not exist

When any value is specified to a property to be used with no value as an operational guideline, the result behavior of the receiver shall be unknown.

14.3.5 Viewing / recording reservation for digital broadcasting service

Receivers capable of digital broadcasting are able to utilize the functions relating viewing reservation and recording reservation using isScheduledToTune method, scheduleToTune method, unscheduleToTune method, isScheduledToRecord method, scheduleToRecord, or unscheduleToRecord method in ReceiverDevice interface.

For viewing reservation and recording reservation to the service programs in digital broadcasting, properties need to be specified for ISDB resource reference object as argument to describe event according to combination '(B)' among the allowable possible combinations listed in ARIB STD-B62 Volume 2 Table 3-1, and thus the operations are shown in Table 14-11.

Table 14-11: Property usage for ISDB resource reference object in specifying event

Property	Usage
original_network_id	Specifies the original network identification value for service of event reservation for viewing or recording
transport_stream_id	Specifies the transport identification value for service of event reservation for viewing or recording
tlv_stream_id	Property shall not exist
service_id	Specifies the service identification value of event reservation for viewing or recording
content_id	Property shall not exist
event_id	Specifies the event identification of event reservation for viewing or recording
component_tag	Property shall not exist
event_message_tag	Property shall not exist
channel_id	Property shall not exist
module_id	Property shall not exist
module_name	Property shall not exist
resource_name	Property shall not exist

When any value is specified to a property which is used with no value as an operational guideline, the result behavior of the receiver shall be unknown.

Furthermore, it is not assured that the receiver has successfully obtained the SI information of the target media, when not obtained the reservation shall fail.

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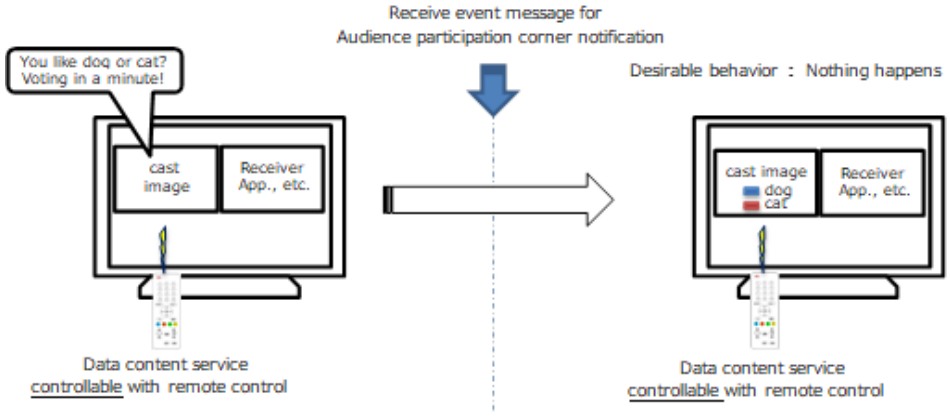
Appendix1 Operation Example Expected when Receiving Viewer Participation Corner Notification Message (informative)

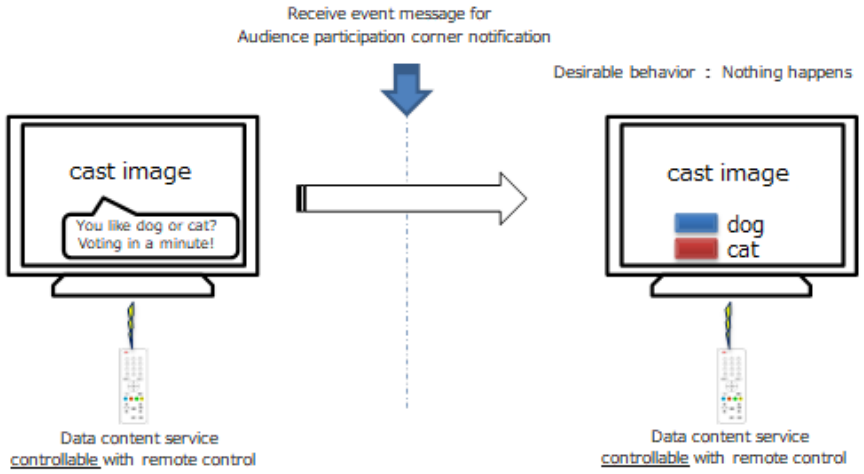
Recommended behavior examples upon receiving event message for viewer participation corner notification are shown as follows:

1) Operation example for data content service being controllable with remote control, etc.

For data content service being controllable with remote control, etc. when event message for viewer participation corner notification is received, nothing is recommended to happen as shown in Fig. A1-1.



(a) Broadcasting service and receiver application, etc. are displayed simultaneously



(b) Broadcasting service is solely displayed

Fig. A1-1: Operation example for data content service being controllable with remote control, etc.

2) Operation example for data content service being uncontrollable with remote control, etc.

When control object of remote control is not directed to the receiver application for data content service being uncontrollable with remote control, receiving event message for viewer participation corner notification, 'Notice' is recommended to be displayed informing data content service will be controllable by simple operation as shown in Fig. A1-2 and to be selected the control object by the viewer.

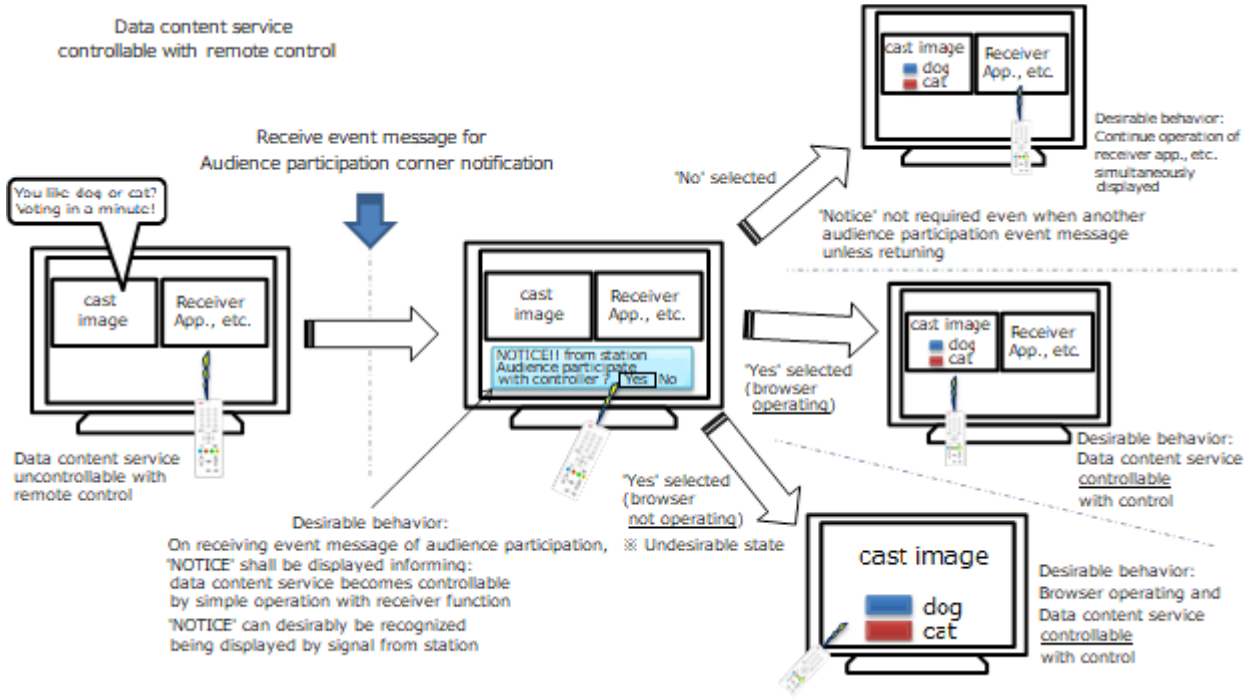


Fig. A1-2: Operation example for data content service being uncontrollable with remote control, etc.

Appendix 2 Guideline for Compensating Display Timing of Closed caption related to Leap Second

This appendix describes guideline for compensating display timing of closed caption when leap second occurs.

1. Assumed operation with receiver built-in clock for leap second

Operation for the receiver built-in clock when leap second occurs, the following two alternatives are assumed.

1) Assumed operation 1

The receiver built-in clock shall be synchronized with NTP time transmitted over broadcasting wave. Therefore, when adding time, 8:59:59 shall last for two seconds, and when deleting time, 8:59:59 shall not exist.

2) Assumed operation 2

Even when leap second occurs, the receiver built-in clock shall keep time stepping every second internally so that no repetition or discontinuity of time shall not occur. As a result after leap second, difference occurs between NTP time transmitted over broadcasting wave and the time in the receiver built-in clock, and thus on occasion of tuning setting, the receiver clock shall be synchronized with NTP time.

2. Compensating display timing of closed caption when leap second occurs

When displaying closed caption if the value of reference_start_time_leap_indicator is not ”0” then the receiver shall detect a leap second will occur within 24 hours, and for the value “1” it shall retain 8:59:59 for two seconds and for the value ”2” it shall operate skipping 8:59:59. The receiver shall discrimimate every second the compensation state for leap second as one of “Need to compensate for leap second within 24 hours”, “No leap second expected”, “2nd 8:59:59 during adding time”, “Leap second compensation completed”, “Not in sync (ahead)”, or “Not in sync (behind)”. In closed caption transmission operation, no future time beyond the current time shall be specified as reference_start_time.

- 2nd 8:59:59 during adding time :
  The state of 2nd 8:59:59 among 8:59:59s retained for two seconds during adding time for leap second compensation.
- Leap second compensation completed :
  With the receiver in assumed operation 1 the state after adding or deleting time compensation until when tuning or power off operation will be done. When tuning or power on operation done after leap second compensation completed the state shall be “No leap second occurs”.
  While with the receiver in assumed operation 2 it should not be in “Leap second compensation completed” state but in “Not in sync (ahead)” or “Not in sync (behind)” state.
- Not in sync (ahead) :
  With the receiver in assumed operation 2, the state, after the leap second passed in case of adding time, that NTP time transmitted over broadcasting and the receiver built-in clock are not synchronized and that the receiver built-in clock is one second ahead. After entering into this state when tuning or power on operation done then it shall become “No leap second expected” state.

- Not in sync (behind) :

  With the receiver in assumed operation 2 the state, after the leap second passed in case of deleting time, that NTP time transmitted over broadcasting and the receiver built-in clock are not synchronized with the receiver built-in clock one second behind. After entering into this state when tuning or power on operation done then it shall be "No leap second expected" state.

Compensation operation of leap second in each assumed receiver operation described above are shown as follows. Symbols in operation description are defined as follows:.

T1: Time obtained from relative time which is described with begin attribute and end attribute of ARIB-TTML document, and reference_start_time_of which is additional identification information for MH-data coding system descriptor
T2: Time one second before T1
T3: Time one second after T1
T0: Time of receiver built-in clock at processing
LI: Value of reference_start_time_leap_indicator
S: State of leap second compensation at every second

For convenience respective states are described as follows.

As the operation detail assumed operation in case of adding time is shown in Fig. A2-1 and in case of deleting time shown in Fig. A2-2.

a: Need to compensate for leap second within 24 hours
b: No leap second expected
c: Leap second compensation completed
d: 2nd 8:59:59 during adding time
e: Not in sync (ahead)
f: Not in sync (behind)

	UTC time	NTP time	Assumed operation 1 receiver		Assumed operation 2 receiver	
			Receiver clock	Compensation state for leap second	Receiver clock	Compensation state for leap second
Day before leap second	8:59:55	8:59:55	8:59:55	b	8:59:55	b
	8:59:56	8:59:56	8:59:56	b	8:59:56	b
	8:59:57	8:59:57	8:59:57	b	8:59:57	b
	8:59:58	8:59:58	8:59:58	b	8:59:58	b
	8:59:59	8:59:59	8:59:59	b	8:59:59	b
	9:00:00	9:00:00	9:00:00	a	9:00:00	a
	9:00:01	9:00:01	9:00:01	a	9:00:01	a
	9:00:02	9:00:02	9:00:02	a	9:00:02	a
	9:00:03	9:00:03	9:00:03	a	9:00:03	a
	9:00:04	9:00:04	9:00:04	a	9:00:04	a
	9:00:05	9:00:05	9:00:05	a	9:00:05	a
Date change						
Current day for leap second	8:59:55	8:59:55	8:59:55	a	8:59:55	a
	8:59:56	8:59:56	8:59:56	a	8:59:56	a
	8:59:57	8:59:57	8:59:57	a	8:59:57	a
	8:59:58	8:59:58	8:59:58	a	8:59:58	a
	8:59:59	8:59:59	8:59:59	a	8:59:59	a
	8:59:60	8:59:59	8:59:59	d	9:00:00	e
	9:00:00	9:00:00	9:00:00	c	9:00:01	e
	9:00:01	9:00:01	9:00:01	c	9:00:02	e
	9:00:02	9:00:02	9:00:02	c	9:00:03	e
	9:00:03	9:00:03	9:00:03	c	9:00:04	e
	9:00:04	9:00:04	9:00:04	c	9:00:05	e
	9:00:05	9:00:05	9:00:05	c	9:00:06	e
	9:00:06	9:00:06	Tuning※	—	Tuning※	—
	9:00:07	9:00:07				
	9:00:08	9:00:08	9:00:08	b	9:00:08	b
	9:00:09	9:00:09	9:00:09	b	9:00:09	b
	9:00:10	9:00:10	9:00:10	b	9:00:10	b

※Inserted tuning time is only exemplary for showing the state after 'Tuning' operation

Fig. A2-1: Assumed operation in adding time due to leap second

	UTC time	NTP time	Assumed operation 1 receiver		Assumed operation 2 receiver	
			Receiver clock	Compensatin state for leap second	Receiver clock	Compensation state for leap second
Day before leap second	8:59:55	8:59:55	8:59:55	b	8:59:55	b
	8:59:56	8:59:56	8:59:56	b	8:59:56	b
	8:59:57	8:59:57	8:59:57	b	8:59:57	b
	8:59:58	8:59:58	8:59:58	b	8:59:58	b
	8:59:59	8:59:59	8:59:59	b	8:59:59	b
	9:00:00	9:00:00	9:00:00	a	9:00:00	a
	9:00:01	9:00:01	9:00:01	a	9:00:01	a
	9:00:02	9:00:02	9:00:02	a	9:00:02	a
	9:00:03	9:00:03	9:00:03	a	9:00:03	a
	9:00:04	9:00:04	9:00:04	a	9:00:04	a
	9:00:05	9:00:05	9:00:05	a	9:00:05	a
Date change						
Current day for leap second	8:59:55	8:59:55	8:59:55	a	8:59:55	a
	8:59:56	8:59:56	8:59:56	a	8:59:56	a
	8:59:57	8:59:57	8:59:57	a	8:59:57	a
	8:59:58	8:59:58	8:59:58	a	8:59:58	a
	9:00:00	9:00:00	9:00:00	c	8:59:59	f
	9:00:01	9:00:01	9:00:01	c	9:00:00	f
	9:00:02	9:00:02	9:00:02	c	9:00:01	f
	9:00:03	9:00:03	9:00:03	c	9:00:02	f
	9:00:04	9:00:04	9:00:04	c	9:00:03	f
	9:00:05	9:00:05	9:00:05	c	9:00:04	f
	9:00:06	9:00:06	Tuning※	—	Tuning※	—
	9:00:07	9:00:07				
	9:00:08	9:00:08	9:00:08	b	9:00:08	b
	9:00:09	9:00:09	9:00:09	b	9:00:09	b
	9:00:10	9:00:10	9:00:10	b	9:00:10	b

※Inserted time is only exemplary for showing the state after 'Tuning' operation

Fig. A2-2: Assumed operation in deleting time due to leap second

1) Compensation processing of the receiver in assumed operation 1

Compensation processing flow of the receiver in assumed operation 1 is shown in Fig. A2-3.

- When reference_start_time_leap_indicator value is ”0” no compensation is needed.
- When reference_start_time_leap_indicator value is ”1” or ”2” and the leap second compensation state is “Need to compensate for leap second within 24 hours”, then no compensation is needed.
- When reference_start_time_leap_indicator value is ”1” and the leap second compensation state is “No leap second expected”, “Leap second compensation completed”, or “2nd 8:59:59 during adding time”, then compensate as time one second before.
- When reference_start_time_leap_indicator value is ”2” and the leap second compensation state is “No leap second expected” or “Leap second compensation completed”, then compensate as time one second after.

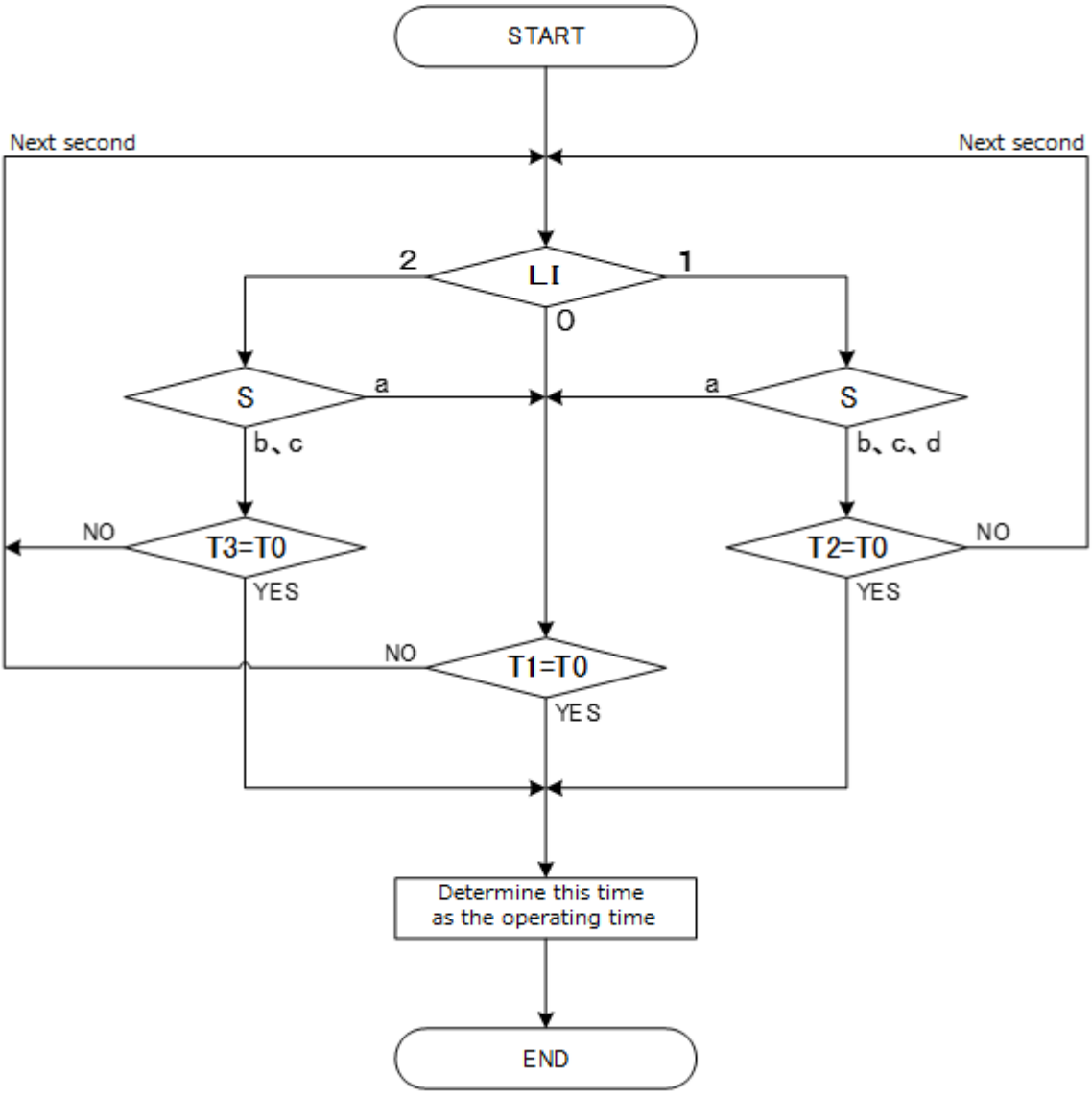


Fig. A2-3: Receiver process flow in assumed operation 1

2) Compensation processing of the receiver in assumed operation 2

Compensation processing flow of the receiver in assumed operation 2 is shown in Fig. A2-4.

- "Leap second compensation completed" state does not exist.
- When reference_start_time_leap_indicator value is "0" and the leap second compensation state is "Need to compensate for leap second within 24 hours" or "No leap second expected", then no compensation is needed.
- When reference_start_time_leap_indicator value is "0" and the leap second compensation state is "Not in sync (ahead)", then compensate as time one second after.
- When reference_start_time_leap_indicator value is "0" and the leap second compensation state is "Not in sync (behind)", then compensate as time one second before.
- When reference_start_time_leap_indicator value is "0" and the leap second compensation state is "2nd 8:59:59 during adding time", it is the case not assumed.
- When reference_start_time_leap_indicator value is "1" and the leap second compensation state is "Need to compensate for leap second within 24 hours" or "Not in sync (ahead)", then no compensation is needed.
- When reference_start_time_leap_indicator value is "1" and the leap second compensation state is "No leap second expected" or "2nd 8:59:59 during adding time", then compensate as time one second before.
- When reference_start_time_leap_indicator value is"1" and the leap second compensation state is "Not in sync (behind)", it is the case not assumed.
- When reference_start_time_leap_indicator value is "2" and the leap second compensation state is "Need to compensate for leap second within 24 hours" or "Not in sync (behind)", then no compensation is needed.
- When reference_start_time_leap_indicator value is "2" and the leap second compensation state is "No leap second expected", then compensate as time one second after.
- When reference_start_time_leap_indicator value is "2" and the leap second compensation state is "Not in sync (ahead)", it is the case not assumed.

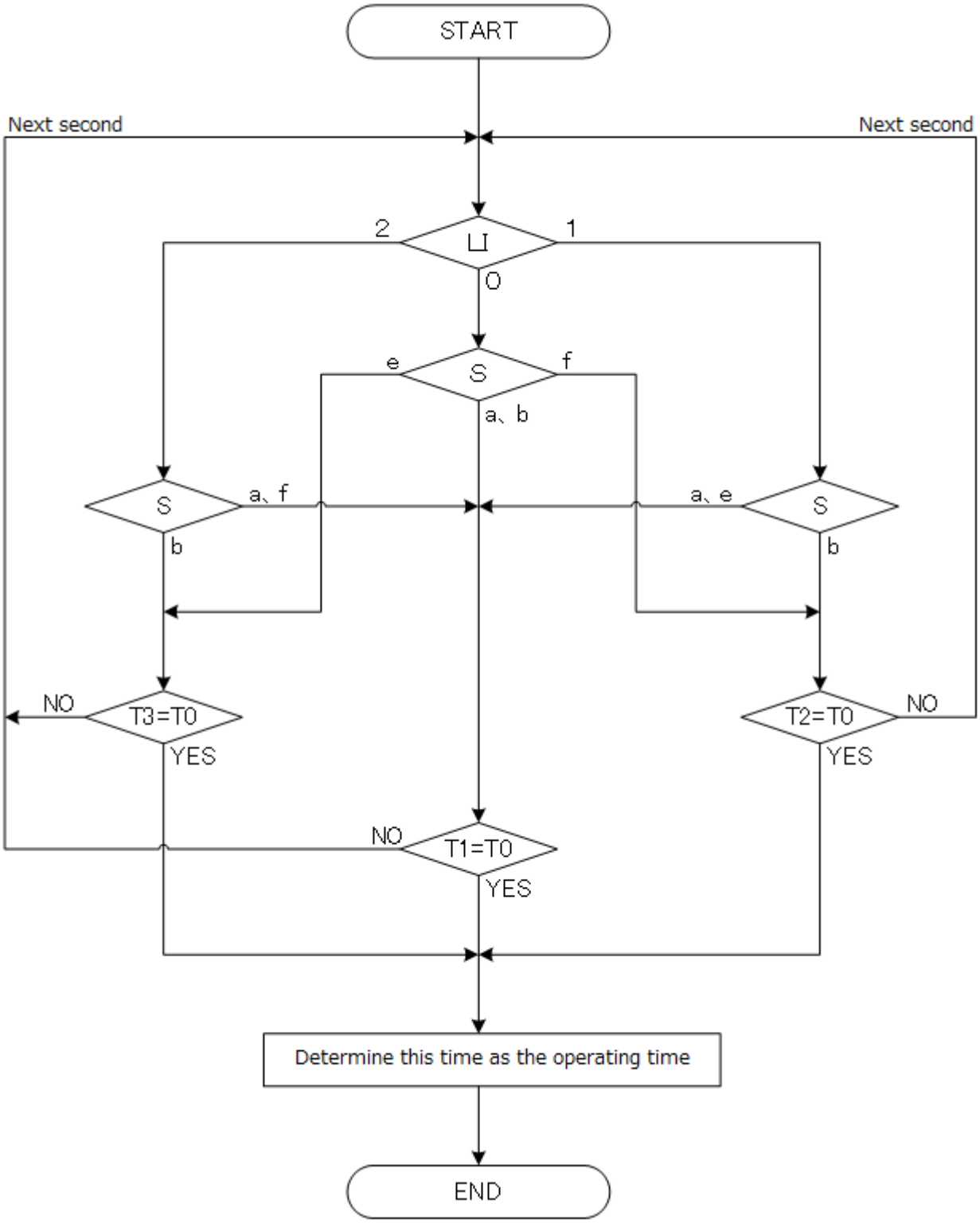


Fig. A2-4: Receiver process flow in assumed operation 2

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Appendix 3 Guideline for Converting Closed caption Text in Closed caption Out Screen Display

Concerning the closed caption display area of out screen display it is assumed that 24 characters by 2 lines of display area shall be available as a standard size. Therefore, the number of characters displayed at one time is 48 characters. Assuming line space setting as 18px, 3 lines are available, and it means 72 characters may be displayed at a glance.

Normally closed caption service consists of 2 or 3 lines, while some exceed 4 lines, and more layout conversion or line feed for out screen display shall result increase of lines accordingly.

Consequently, guidelines for conversion of closed caption to fit into the out screen display area and for dealing with closed caption exceeding the display area are provided as follows:

1) Converting layout

When converting closed caption for out screen display basically closed caption shall be interpreted to be a single sentence from upper left corner to lower right corner horizontally or from upper right corner to lower left corner in vertical lines along text flow uniformly. In case of multiple sentences within a single closed caption screen it is recommended to display those separably.

Methods to interpret multiple sentences separately include to recognize a block of characters adjacent side by side and line by line in the same color as a single context block (character strings configuring a single context), and to recognize characters adjacent only side by side as a single context block, and those methods shall be optional feature.

Multiple sentences within a single closed caption screen may be easily recognized by applying line feed. However, in the out screen display area, line feed may cause some cases that sentence within characters fitting in the area will exceed the area. And also, a single sentence extending over multiple lines may be interpreted as multiple sentences by some methods and then insertion of line feed may cause the case.

In such cases deleting line feed or replacing with a space or other symbols may remove those situations. Decision to use or delete line feed, or to replace it with other symbols shall be left to optional feature.

2) Concerting ruby

Ruby is displayed separately from the main text of closed caption, and the number of characters within out screen display area is assumed not to count the number of characters for ruby. Therefore, ruby is recommended to be deleted.

3) Converting characters with borders and underline

Closed caption shall be displayed by characters with borders or underline, however in out screen display relative position may convert and those shall be recommended to be deleted.

4) Converting Gaiji characters

Gaiji characters used in closed caption shall be displayed without any conversion like other ordinary characters.

5) In case of exceeding display area

When closed caption is converted for out screen display but unable to fall into the display area, closed caption may be divided while the second page and following pages shall be displayed at different timing from the closed caption producer's expectation and also those situation will be unseemly for synchronization timing of video and closed caption. Consequently, for out screen display the converted closed caption may be displayed with its number of characters even if it does not fall into the out screen display area.

Appendix 4 Supplement on Correspondence between Additional Symbol and UCS Symbol in Character Coding of STD-B24

STD-B62 Volume 1 Part 2 Table 5-2 shows corresponding between Row-Cell defined in STD-B24 Volume 1 Part 2 Table 7-10 and UCS code for character/symbol, but characters registered in JIS X0213:2004 is not defined. This Appendix describes correspondence for symbols not included in STD-B62 Volume 1 Part 2 Table 5-2 among additional symbols in STD-B24 Volume 1 Part 2 Table 7-10.

However 70% sized Kanji of Row92-Cell26～Cell31, and Musical Instrument Symbols of Row92-Cell56～Cell85 are not described in the table because UCS codes are not assigned, and these are not operated as monomedia.

Table A4-1: Characters / Symbols defined in STD-B24 and Corresponding UCS Codes (supplement)

Row-Cell in STD-B24	UCS Code	UCS character name	Example Glyph
91-8	U+3012	POSTAL MARK	〒
91-17	U+2668	HOT SPRINGS	♨
91-43	U+260E	BLACK TELEPHONE	☎
92-7	U+5E74	CJK UNIFIED IDEOGRAPH-5E74	年
92-8	U+6708	CJK UNIFIED IDEOGRAPH-6708	月
92-9	U+65E5	CJK UNIFIED IDEOGRAPH-65E5	日
92-10	U+5186	CJK UNIFIED IDEOGRAPH-5186	円
92-11	U+33A1	SQUARE M SQUARED	㎡
92-13	U+339D	SQUARE CM	㎝
92-44	U+3232	PARENTHESIZED IDEOGRAPH HAVE	㈲
92-45	U+3231	PARENTHESIZED IDEOGRAPH STOCK	㈱
92-46	U+3239	PARENTHESIZED IDEOGRAPH REPRESENT	㈹
92-48	U+25B6	BLACK RIGHT-PORTING TRIANGLE	▶
92-49	U+25C0	BLACK LEFT-PORTING TRIANGLE	◀
92-50	U+3016	LEFT WHITE LENTICULAR BRACKET	〖
92-51	U+3017	RIGHT WHITE LENTICULAR BRACKET	〗
92-53	U+00B2	SUPERSCRIPT TWO	²
92-54	U+00B3	SUPERSCRIPT THREE	³
93-9	U+337E	SQUARE ERA NAME MEIZI	㍾
93-10	U+337D	SQUARE ERA NAME TAISYOU	㍽
93-11	U+337C	SQUARE ERA NAME SYOUWA	㍼
93-12	U+337B	SQUARE ERA NAME HEISEI	㍻
93-13	U+2116	NUMERO SIGN	№
93-14	U+2121	TELEPHONE SIGN	℡
93-39	U+2113	SCRIPT SMALL L	ℓ

Row-Cell in STD-B24	UCS Code	UCS character name	Example Glyph
93-40	U+338F	SQUARE KG	㎏
93-43	U+339E	SQUARE KM	㎞
93-48	U+00BD	VULGAR FRACTION ONE HALF	½
93-50	U+2153	VULGAR FRACTION ONE THIRD	⅓
93-51	U+2154	VULGAR FRACTION TWO THIRD	⅔
93-52	U+00BC	VULGAR FRACTION ONE QUARTER	¼
93-53	U+00BE	VULGAR FRACTION THREE QUARTERS	¾
93-54	U+2155	VULGAR FRACTION ONE FIFTH	⅕
93-64	U+2600	BLACK SUN WITH RAYS	☀
93-65	U+2601	CLOUD	☁
93-66	U+2602	UMBRELLA	☂
93-68	U+2616	WHITE SHOGI PIECE	☖
93-69	U+2617	BLACK SHOGI PIECE	☗
93-75	U+2660	BLACK SPADE SUIT	♠
93-72	U+2666	BLACK DIAMOND SUIT	♦
93-73	U+2665	BLACK HEART SUIT	♥
93-74	U+2663	BLACK CLUB SUIT	♣
93-78	U+203C	DOUBLE EXCLAMATION MARK	‼
93-79	U+2049	EXCLAMATION QUESTION MARK	⁉
93-83	U+2603	SNOWMAN	☃
93-90	U+266C	BEAMED SIXTEENTH NOTES	♬
93-91	U+260E	BLACK TELEPHONE	☎
94-1	U+2160	ROMAN NUMERAL ONE	Ⅰ
94-2	U+2161	ROMAN NUMERAL TWO	Ⅱ
94-3	U+2162	ROMAN NUMERAL THREE	Ⅲ
94-4	U+2163	ROMAN NUMERAL FOUR	Ⅳ
94-5	U+2164	ROMAN NUMERAL FIVE	Ⅴ
94-6	U+2165	ROMAN NUMERAL SIX	Ⅵ
94-7	U+2166	ROMAN NUMERAL SEVEN	Ⅶ
94-8	U+2167	ROMAN NUMERAL EIGHT	Ⅷ
94-9	U+2168	ROMAN NUMERAL NINE	Ⅸ
94-10	U+2169	ROMAN NUMERAL TEN	Ⅹ
94-11	U+216A	ROMAN NUMERAL ELEVEN	Ⅺ
94-12	U+216B	ROMAN NUMERAL TWELVE	Ⅻ
94-13	U+2470	CIRCLED NUMBER SEVENTEEN	⑰
94-14	U+2471	CIRCLED NUMBER EIGHTEEN	⑱

Row-Cell in STD-B24	UCS Code	UCS character name	Example Glyph
94-15	U+2472	CIRCLED NUMBER NINETEEN	⑲
94-16	U+2473	CIRCLED NUMBER TWENTY	⑳
94-29	U+3251	CIRCLED NUMBER TWENTY-ONE	㉑
94-30	U+3252	CIRCLED NUMBER TWENTY-TWO	㉒
94-31	U+3253	CIRCLED NUMBER TWENTY-THREE	㉓
94-32	U+3254	CIRCLED NUMBER TWENTY-FOUR	㉔
94-59	U+3255	CIRCLED NUMBER TWENTY-FIVE	㉕
94-60	U+3256	CIRCLED NUMBER TWENTY-SIX	㉖
94-61	U+3257	CIRCLED NUMBER TWENTY-SEVEN	㉗
94-62	U+3258	CIRCLED NUMBER TWENTY-EIGHT	㉘
94-63	U+3259	CIRCLED NUMBER TWENTY-NINE	㉙
94-64	U+325A	CIRCLED NUMBER THIRTY	㉚
94-65	U+2460	CIRCLED DIGIT ONE	①
94-66	U+2461	CIRCLED DIGIT TWO	②
94-67	U+2462	CIRCLED DIGIT THREE	③
94-68	U+2463	CIRCLED DIGIT FOUR	④
94-69	U+2464	CIRCLED DIGIT FIVE	⑤
94-70	U+2465	CIRCLED DIGIT SIX	⑥
94-71	U+2466	CIRCLED DIGIT SEVEN	⑦
94-72	U+2467	CIRCLED DIGIT EIGHT	⑧
94-73	U+2468	CIRCLED DIGIT NINE	⑨
94-74	U+2469	CIRCLED NUMBER TEN	⑩
94-75	U+246A	CIRCLED NUMBER ELEVEN	⑪
94-76	U+246B	CIRCLED NUMBER TWELVE	⑫
94-77	U+246C	CIRCLED NUMBER THIRTEEN	⑬
94-78	U+246D	CIRCLED NUMBER FOURTEEN	⑭
94-79	U+246E	CIRCLED NUMBER FIFTEEN	⑮
94-80	U+246F	CIRCLED NUMBER SIXTEEN	⑯
94-81	U+2776	DINGBAT NEGATIVE CIRCLED DIGIT ONE	❶
94-82	U+2777	DINGBAT NEGATIVE CIRCLED DIGIT TWO	❷
94-83	U+2778	DINGBAT NEGATIVE CIRCLED DIGIT THREE	❸
94-84	U+2779	DINGBAT NEGATIVE CIRCLED DIGIT FOUR	❹
94-85	U+277A	DINGBAT NEGATIVE CIRCLED DIGIT FIVE	❺
94-86	U+277B	DINGBAT NEGATIVE CIRCLED DIGIT SIX	❻
94-87	U+277C	DINGBAT NEGATIVE CIRCLED DIGIT SEVEN	❼
94-88	U+277D	DINGBAT NEGATIVE CIRCLED DIGIT EIGHT	❽

Row-Cell in STD-B24	UCS Code	UCS character name	Example Glyph
94-89	U+277E	DINGBAT NEGATIVE CIRCLED DIGIT NINE	❾
94-90	U+277F	DINGBAT NEGATIVE CIRCLED NUMBER TEN	❿
94-91	U+24EB	NEGATIVE CIRCLED NUMBER ELEVEN	⓫
94-92	U+24EC	NEGATIVE CIRCLED NUMBER TWELVE	⓬
94-93	U+325B	CIRCLED NUMBER THIRTY-ONE	㉛

Appendix 5 Supplement on UCS Combining Character

Some of the characters defined in JIS X0213:2004 are represented as combining characters in UCS(ISO/IEC 10646). Also, some characters are defined as diacritical (combinable) in JIS X0213:2004 Annex 4 Table 4. These characters are listed in Table A5-1 and Table A5-2. These characters are not operated as monomedia.

Furthermore, for combinable devoicing diacritic (U+309A) in UCS there is no corresponding character in JIS X0213 and thus not operated as monomedia as well.

Table A5-1: Characters defined in JIS X0213:2004 represented as combining characters in UCS

JIS X0213:2004 Plane-Row-Cell	UCS sequence	Example Glyph
1-04-87	<304B, 309A>	が
1-04-88	<304D, 309A>	ぎ
1-04-89	<304F, 309A>	ぐ
1-04-90	<3051, 309A>	げ
1-04-91	<3053, 309A>	ご
1-05-87	<30AB, 309A>	ガ
1-05-88	<30AD, 309A>	ギ
1-05-89	<30AF, 309A>	グ
1-05-90	<30B1, 309A>	ゲ
1-05-91	<30B3, 309A>	ゴ
1-05-92	<30BB, 309A>	ゼ
1-05-93	<30C4, 309A>	ヅ
1-05-94	<30C8, 309A>	ド
1-06-88	<31F7, 309A>	プ
1-11-36	<00E6, 0300>	æ̀
1-11-40	<0254, 0300>	ɔ̀
1-11-41	<0254, 0301>	ɔ́
1-11-42	<028C, 0300>	ʌ̀
1-11-43	<028C, 0301>	ʌ́
1-11-44	<0259, 0300>	ə̀
1-11-45	<0259, 0301>	ə́
1-11-46	<025A, 0300>	ɚ̀
1-11-47	<025A, 0301>	ɚ́
1-11-69	<02E9, 02E5>	˩˥
1-11-70	<02E5, 02E9>	˥˩

Table A5-2: Characters as diacritical mark (combinable) in JIS X0213:2004 Annex 4 Table 4

JIS X0213:2004 Plane-Row-Cell	UCS code value	Example Glyph
1-11-50	U+0361	◌͡◌
1-11-55	U+0306	◌̆
1-11-57	U+030B	◌̋
1-11-58	U+0301	◌́
1-11-59	U+0304	◌̄
1-11-60	U+0300	◌̀
1-11-61	U+030F	◌̏
1-11-62	U+030C	◌̌
1-11-63	U+0302	◌̂
1-11-71	U+0325	◌̥
1-11-72	U+032C	◌̬
1-11-73	U+0339	◌̹
1-11-74	U+031C	◌̜
1-11-75	U+031F	◌̟
1-11-76	U+0320	◌̠
1-11-77	U+0308	◌̈
1-11-78	U+033D	◌̽
1-11-79	U+0329	◌̩
1-11-80	U+032F	◌̯
1-11-82	U+0324	◌̤
1-11-83	U+0330	◌̰
1-11-84	U+033C	◌̼
1-11-85	U+0334	◌̴
1-11-86	U+031D	◌̝
1-11-87	U+031E	◌̞
1-11-88	U+0318	◌̘
1-11-89	U+0319	◌̙
1-11-90	U+032A	◌̪
1-11-91	U+033A	◌̺
1-11-92	U+033B	◌̻
1-11-93	U+0303	◌̃
1-11-94	U+031A	◌̚

Appendix 6 Management Organization

General Incorporated Association The Association for Promotion of Advanced Broadcasting Services

Abbreviation : A-PAB

URL: http://www.apab.or.jp/

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Appendix 7 CAS Management Organization

General Incorporated Association Advanced CAS Council

http://www.acas.or.jp/

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Appendix 8 Confirmation of Audio Simultaneous Representation / Video Simultaneous Representation with hasCapability Method

For simultaneous representation the items in 7.2.3.2 for multiple audios and the items in 5.2.8.3 for multiple videos should be noted. Concerning operation of hasCapability method shown in Table 10-56, examples of method operation in application to confirm simultaneous representation capability for audio and also for video are described as follows: Monomedia shall be specified by media type shown in Table 10-10. It should be noted that content obtained by http request may also contain monomedia transmitted through broadcasting.

1. Confirmation of capability of multiple audios for simultaneous representation

Description examples are shown as follows:

- To decide whether or not it is possible to represent simultaneously one broadcasting streaming audio and one MP3 file obtained by http or https :
  hasCapability("AudioElement","SupportsSimultaneousPlaying",
  "video/x-arib2-broadcast", "1", "audio/X-arib-mp3", "1");
- To decide whether or not it is possible to represent simultaneously two AIFF-C audio files obtained by http or https :
  hasCapability("AudioElement", "SupportsSimultaneousPlaying", "audio/X-arib-aiff", "2");
- To decide whether or not it is possible to present simultaneously one MPEG-4 AAC audio file obtained http or https and one AIFF-C audio file obtained by http or https :
  hasCapability("AudioElement","SupportsSimultaneousPlaying",
  "audio/X-arib-mpeg4-aac", "1", "audio/X-arib-aiff", "1");

2. Confirmation of capability of multiple videos for simultaneous representation

- To decide whether or not it is possible to represent simultaneously two 4K60P videos in broadcasting stream and one 4K60P video in H.264/MPEG-4 AVC obtained by http :
  hasCapability(“SimultaneousPlay”, ”arib2”,”video/x-arib2-broadcast” , “4K”, ”60P”, “arib2”,”video/x-arib2-broadcast” , “4K”,”60P”, ”http”, “video/X-arib-avc”, “4K”,”60P”)
- To decide whether or not it is possible to represent simultaneously one 8K60P video in broadcasting stream and four 2K30P videos in H.264/MPEG-4 AVC obtained by http :
  hasCapability(“SimultaneousPlay”, ”arib2”,”video/x-arib2-broadcast”, “8K”,”60P”, “http”, “video/X-arib-avc”, “2K” ,“30P”, “http”, “video/X-arib-avc”, “2K” ,“30P”, “http”, “video/X-arib-avc”, “2K” ,“30P”, “http”, “video/X-arib-avc”, “2K” ,“30P”)

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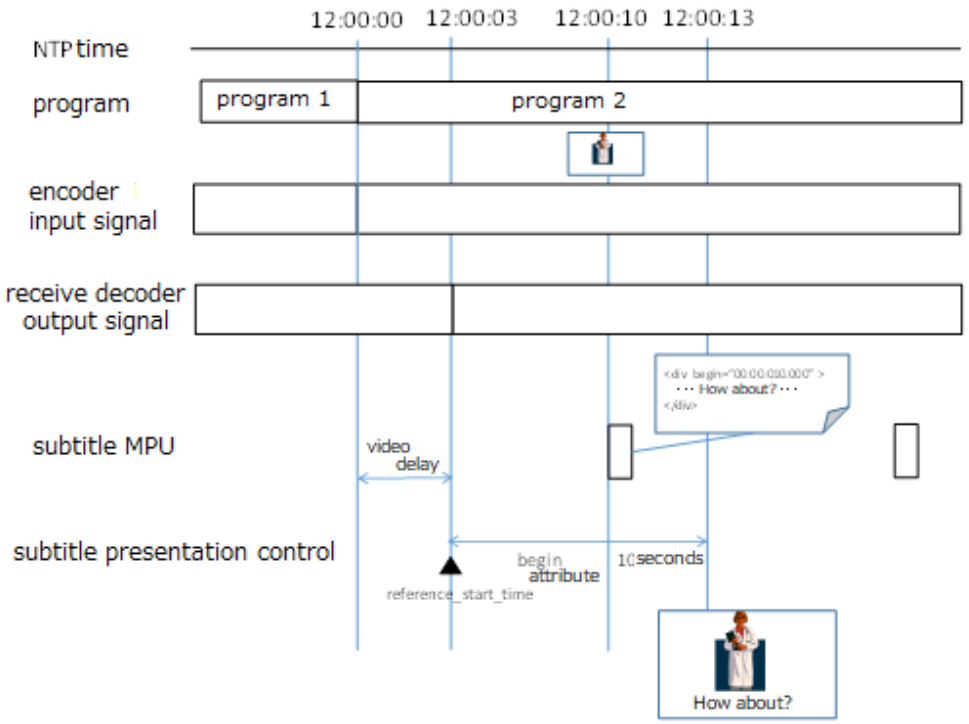
Appendix 9 Example of Control Operation of Synchronizing Closed caption and Video Representation

To arrange closed caption on the previously recorded program, the operation is assumed that specifying TMD with “0010” the additional identifying information of MH-data conding system descriptor and setting the starting time of the program as reference_start_time, the timing of the closed caption adjusted to the video for respective program is specified with begin and end attributes. However, for the timing of video signal, since the processing delay of encoder and decoder are estimated as much as several seconds and those delay time depends on broadcasting facilities of the station, consequently, to synchronize the representation of video and closed caption at the receiver, the broadcasting station facilities need to manage closed caption with video delay time. Hereafter the operation example dealing with the situation is described. This example puts into practice to synchronize the display of closed caption and video representation by setting program start time with video delay time as reference_start_time. Moreover, the transmission timing of closed caption MPU needs to be set involving processing time for preparing representation after the reception so as to be received prior to the representation timing. Yet more since ARIB-TTML document update is “at the time of receiving MFU with subsample_number 0 within MPU”, transmission time needs to be carefully set not for closed caption erased earlier than assumed representation time period.



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Appendix 10 Guideline for EPG related Functions

The guideline of scheduling for viewing, scheduling for recording, and cancellation of recording schedule based on EPG related functions are described as follows:

- Application, which uses scheduleToTune, unscheduleToTune, scheduleToRecord and unscheduleToRecord, shall provide user interface to query whether the user intends to execute the operation to the program specified with the arguments of those API and shall execute the API only when the user shows his will to perform the operation.
- Application shall use isScheduledToRecord and isScheduledToTune only to the program to which the user's intention needs to be confirmed via user interface described above, or to the program to which API have been executed after the confirmation.
- Receivers is recommended to provide function via its built-in user interface to let user confirm the operation before application shall execute the reservation or cancellation indicated through scheduleToTune, unscheduleToTune, scheduleToRecord, or unscheduleToRecord.
- Appplication should note that scheduleToTune, unscheduleToTune, scheduleToRecord, and unscheduleToRecord are unsynchronously executable APIs. Since application has no means to acknowledge the completion timing by the receiver for reservation or cancellation after having executed the APIs, to obtain the result of such operations the application may utilize isScheduledToTune or isScheduledToRecord a certain period of time after calling those APIs.
- It should be noted that action of application may depend on receiver types or installation conditions, such that browser terminates unexpectedly, and thus it may cause the receiver different operation.

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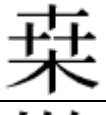
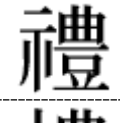
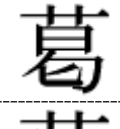
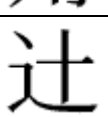
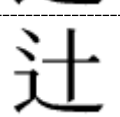
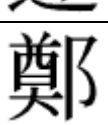
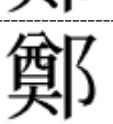
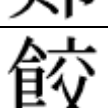
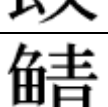
Appendix 11 Glyph Examples specified by Ideographic Variation Sequence

Glyph example selected with the ideographic variation sequence in Table 7-8 is shown in Table A11-1.

Table A11-1: Variation Examples Selected with Variation Sequence

Ideographic Variation sequence	Glyph (example)
<4103, E0101>	
<4103, E0103>	
<66D9, E0102>	
<66D9, E0103>	
<6852, E0102>	
<6852, E0104>	
<6ADB, E0103>	
<6ADB, E0104>	
<7947, E0102>	
<7947, E0103>	
<79AE, E0102>	
<79AE, E0103>	
<845B, E0102>	
<845B, E0103>	

Ideographic Variation sequence	Glyph (example)
<84EC, E0102>	
<84EC, E0103>	
<8755, E0102>	
<8755, E0103>	
<89D2, E0102>	
<89D2, E0104>	
<8FBB, E0102>	
<8FBB, E0103>	
<912D, E0102>	
<912D, E0103>	
<9903, E0102>	
<9903, E0103>	
<9BD6, E0102>	
<9BD6, E0103>	

Appendix 12 Compression Format of zlib

Compression format is applied to the same compression format as PNG, based on RFC-1950 (ZLIB Compressed Data Format Specification version 3.3). See Table A12-1.

Table A12-1: zlib Compression Format Detail

Field	Usage
Compression Method(4bit)	8("deflate") only
Compression Info(4bit)	7 or less (window 32KB or less)
Flags	
FCHECK(5bit)	(RFC-1950 specifying value)
Preset Dictionary(1bit)	0(no preset dictionary) only
Compression Level(2bit)	(any value, ignored for decoding)

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Appendix 13 Update Timing of MH-AIT, Data Transmission Message and MPT

There are some factors such as specifications and configurations of output equipment, or conditions of other messages, asset update and so on, which may cause that update timing cannot be synchronized each other between MH-AIT, data transmission message (DDMT/DAMT) and MPT. Hence broadcasting operators and receiver manufacturers should regard the possible cases that resource of updated asset or asset itself cannot be obtained due to the above reasons. MPT practically includes descriptions for data component.

Assumed major cases that update timing cannot be synchronized are shown as follows:

1. Update timing of data transmission message and MPT

1) Asset disappearing (See Fig. A13-1)

When update occurs for MPT prior to data transmission message, MPT disappears before the asset description shall disappear from data transmission message, then inconsistency shall occur just after detecting MPT update between data transmission message and MPT.

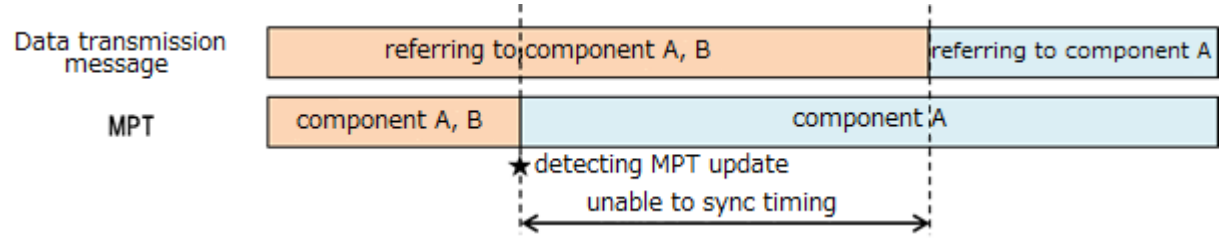

Fig. A13-1: Update Timing of Data Transmission Message and MPT on Asset Disappearing

Even when update timings are not inconsistent each other, when asset disappears just after accessing asset resource then resource shall not be obtained in some cases.

2) Adding component (See Fig. A13-2)

When update occurs for data transmission message prior to MPT, data transmission message refers to added component before described in MPT, then inconsistency shall occur just after detecting data transmission message update between data transmission message and MPT.

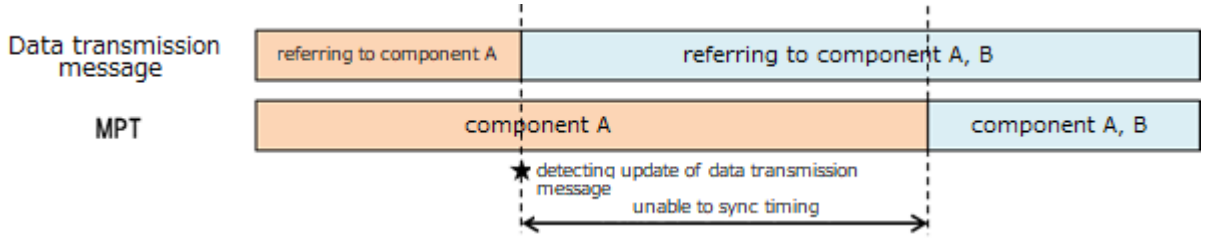

Fig. A13-2: Update Timing of Data Transmission Message and MPT on Component Added

2. Update timing of MH-AIT and data transmission message

1) Directory disappearing (refer to Fig. A13-3)

When update occurs for data transmission message prior to MH-AIT, the directory disappears from data transmission message before switching MH-AIT reference target from disappearing directory to a new directory, then inconsistency shall occur just after re-tuning between MH-AIT and data transmission message.

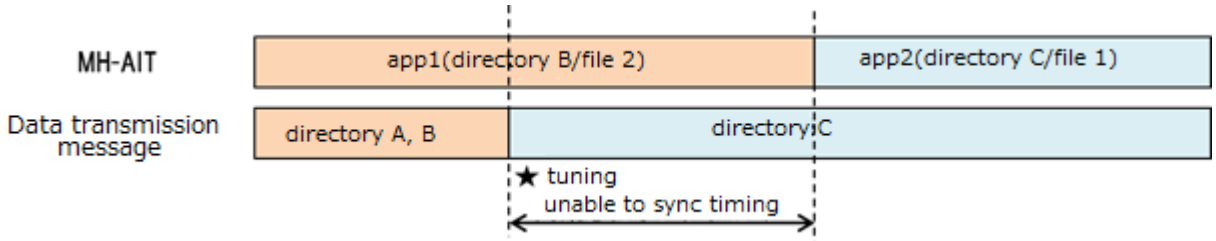

Fig. A13-3: Update Timing of MH-AIT and Data Transmission Message on Directory Disappearing

2) Adding directory (refer to Fig. A13-4)

When update occurs for MH-AIT prior to data transmission message, MH-AIT refers to the resource of the added directory before described in data transmission message, then inconsistency shall occur just after detecting MH-AIT update between MH-AIT and data transmission message.

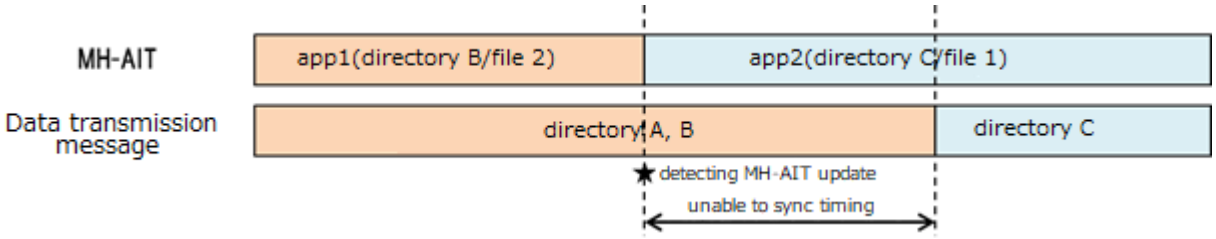

Fig. A13-4: Update Timing of MH-AIT and Data Transmission Message on Directory Added

OPERATIONAL GUIDELINES FOR ADVANCED DIGITAL SATELLITE BROADCASTING

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