

Release note

The purpose of this document is to provide overview of Multimedia Broadcasting using ISDB-Tmm. It is expected to help understanding of ISDB-Tmm.

ISDB-Tmm is standardized by ARIB. There are several STDs and TR(Technical report). ARIB-TR-B33 is a operational technical report, then it describes detail of ISDB-Tmm services and technical components. Currently ARIB-TR-B33 is a Japanese version only, but its Chapter 0 is describes overview of ISDB-Tmm.

This document is an English version of previous TR-B33's Chapter 0 on February 2011. You should refer the latest version of ARTB-TR-B33 on website.

ARIB has responsibility of STDs, so this document is the position of information.

The latest version is open to the public, though there is Japanese version only. You can download the latest version in Japanese from ARIB's Website.

http://www.arib.or.jp/tyosakenkyu/kikaku_tushin/index.html

The following are standards for ISDB-Tmm.

- STD-B46
(http://www.arib.or.jp/english/html/overview/doc/2-STD-B46v1_1.pdf)
- STD-B53
(http://www.arib.or.jp/english/html/overview/doc/2-STD-B53v1_0.pdf)
- TR-B33
(http://www.arib.or.jp/english/html/overview/doc/4-TR-B33v1_0-1p3.pdf)

Volume 0.0

Basic Concept and Common Elements of
Multimedia Broadcasting

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Chapter 1 General Items

1.1 Introduction

This volume describes the overview of multimedia broadcasting for mobile devices planned for the VHF band (207.5 MHz - 222 MHz), which is scheduled to be unused after the full transition from terrestrial to digital broadcasting (hereinafter referred to as Multimedia Broadcasting).

Chapter 2 Service Overview

2.1 Multimedia broadcasting

Multimedia broadcasting enables access to contents and services without caring about broadcast schedule or place of use, by expanding digital terrestrial television broadcasting through the combination with communications, based on the premise of the use of mobile receivers. There are two types of multimedia broadcasting: high-quality real-time broadcasting (conventional broadcasting using video, audio, data, or combination of these elements) and storage-based broadcasting which can store various types of contents in the receiver. Contents to be handled are video, audio, images, texts, data, or combination of these elements.

2.2 Broadcasting types

2.2.1 Real-time broadcasting

Real-time broadcasting is a content transmission system which is primarily intended to enable all users to view broadcasted contents “concurrently” as with digital terrestrial television broadcasting.

2.2.2 Storage-based broadcasting

Unlike digital terrestrial television broadcasting, storage-based broadcasting delivers contents to the receiver via broadcast waves. Contents are stored in the receiver before viewed/utilized, hence they are sent and used at different times. This broadcasting system (multimedia broadcasting using the transmission system based on connected segments which is provided in a download format is called Storage-based Broadcasting in this technical report) enables users to view/utilize stored contents without caring about time or place of use. When stored contents are incomplete, transmission of contents can be complemented by compensating for missing data via communication (hereinafter referred to as Compensation of Stored Contents).

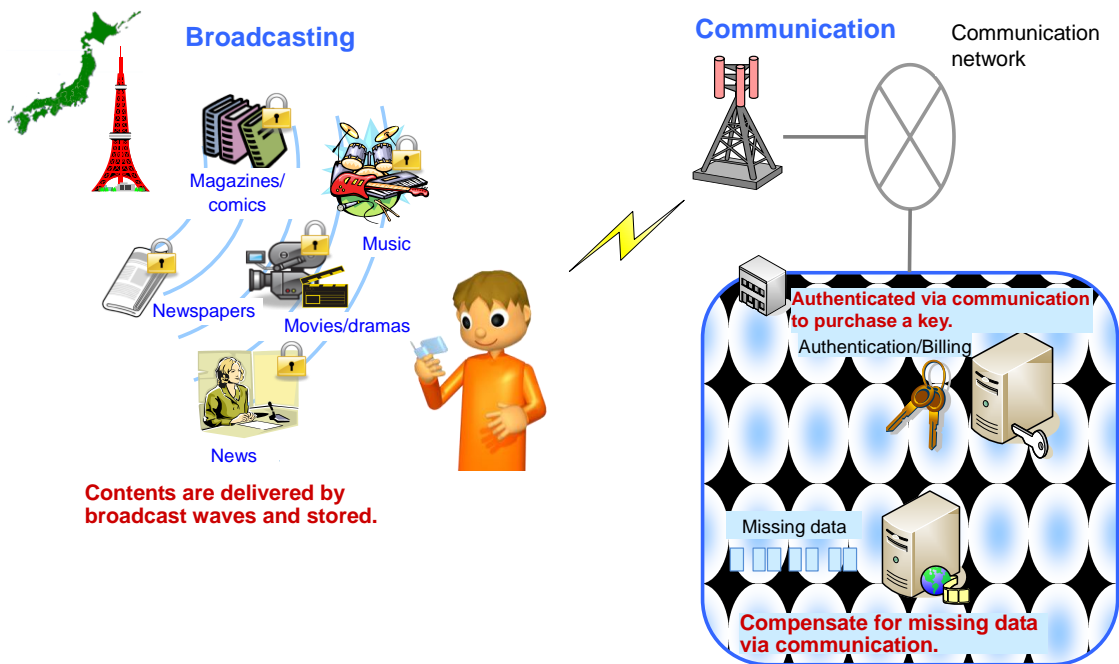


Fig. 2-1 Image of storage-based broadcasting linking broadcasting and communication

2.3 Available bandwidth

The frequency band applied in multimedia broadcasting is the VHF band (207.5 MHz - 222 MHz). Specifically, there are 33 segments in total including two 13-segment bands and up to seven 1-segment bands.

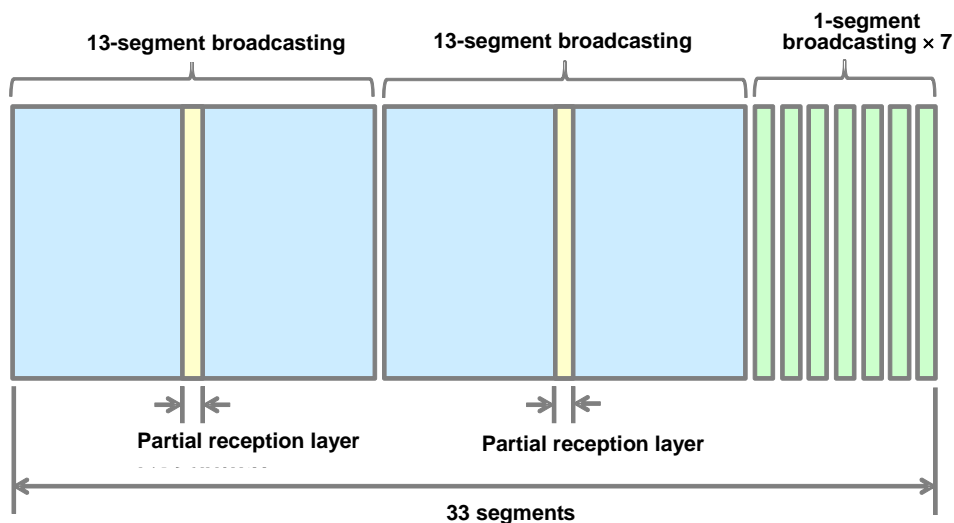


Fig. 2-2 Image of available bandwidth

2.4 Image of frequency band utilization

To deliver more contents efficiently within the multimedia broadcasting band with a limited transmission rate, transmission capacities used for real-time broadcasting and storage-based broadcasting always need to be set at optimal rates. For this reason, permanent transmission rates are not set for each service, or specific segments are not allocated to individual services.

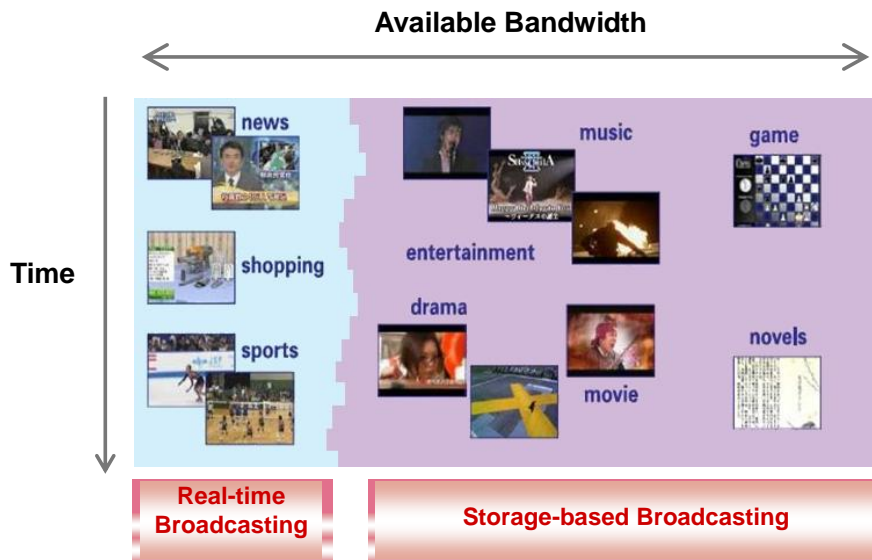


Fig. 2-3 Image of frequency band utilization (Utilization image in 13 segments)

2.5 System image

A system image for multimedia broadcasting is shown below.

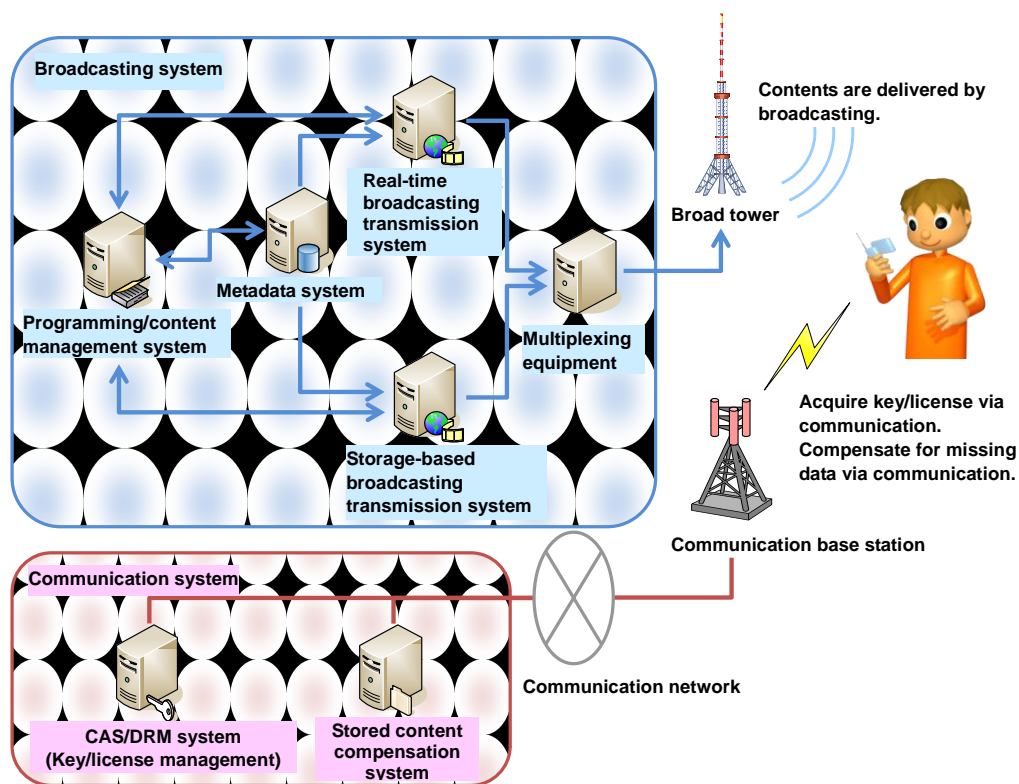


Fig. 2-4 System image for multimedia broadcasting

2.6 Content types

2.6.1 Real-time broadcasting content types

Contents handled in real-time broadcasting are the same as those handled in digital terrestrial television broadcasting.

Table 2-1 Real-time broadcasting content types

Item No.	Type
1	Video (including audio and closed captions)
2	Audio
3	Data

2.6.2 Storage-based broadcasting content types

Storage-based broadcasting also handles still images and contents written in markup language in addition to video and audio. It should also be capable of handling complex contents in which one content includes several content elements. The manifest file defines scenario playback control for complex contents.

Table 2-2 Storage-based broadcasting content types

Item No.	Type
1	Video (including audio and closed captions)
2	Image
3	Markup languages
4	Other contents

Chapter 3 Technologies and Service Types

3.1 Technologies

Multimedia broadcasting adopts the ISDB-Tmm system, an extended standard of ISDB-T for mobiles employed in digital terrestrial television broadcasting.

Real-time broadcasting contents		SI/PSI	Storage-based broadcasting contents	ECG/EPG metadata Transmission control metadata
PES	Section		FLUTE / AL-FEC	
			UDP/IP / ROHC	
			ULE	
MPEG-2 TS				
Physical layer (broadcasting)				

Fig. 3-1 Protocol stack for multimedia broadcasting

3.1.1 Real-time broadcasting

Real-time broadcasting offers high-quality broadcasting at 720×480 pixel / 30 fps (frames per second). The video coding system is H.264 and the audio coding system is AAC. The assumed maximum number of audio channels is 5.1.

3.1.2 Storage-based broadcasting

Storage-based broadcasting uses the FLUTE protocol (RFC 3926) to multiplex IP packets using ULE (RFC 4326). After compiling the contents or metadata into a file, the system divides the file, generates FEC packets, adds the FLUTE header, and converts them into UDP/IP packets. Then, the UDP/IP packet header is compressed using the ROHC, and then encapsulated using the ULE in order to be transmitted in the MPEG-2 TS, and transmitted through the transmission channel for multimedia broadcasting. See *Fig. 3-1 for the protocol stack* for storage-based broadcasting in broadcast transmission channels.

3.2 Service types

3.2.1 Real-time broadcasting

The following table shows service types in real-time broadcasting. See *14.3 Parameter used for the operation of hierarchical transmission* for coding.

Table 3-1 Service types in real-time broadcasting

Item No.	Service type	Definition
1	Video real-time broadcasting service	Real-time broadcasting service mainly aimed for viewing video streams, which contains at least one video stream of stream_type = "0x1B."
2	Audio real-time broadcasting service	Real-time broadcasting service mainly aimed for viewing audio streams, which contains at least one audio stream of stream_type = "0x0F."
3	Independent data broadcasting service	Data broadcasting service mainly aimed for viewing data contents in real time, which contains at least one data carousel of stream_type = "0x0D." * When the partial reception layer contains a simplified moving image stream of stream_type="0x1B," data carousel may not be contained.
4	Engineering service	Service for fixing receiver software, which performs bug fix; correction of failures caused by difference in interpretations on operations between the transmitter and the receiver; and improvement of display, response speed, and operability. It also updates program genre code lists, program characteristic code lists, and reserved words common to all receivers. See Volume 1 for more details.

3.2.2 Storage-based broadcasting

The following table shows service types in storage-based broadcasting.

Table 3-2 Service types in storage-based broadcasting

Item No.	Service type	Definition
1	Storage-based broadcasting service	Storage-based broadcasting service which contains at least one storage-based broadcasting data of stream_type = "0x91." Unlike general broadcasting services, this service delivers contents to the receivers via broadcast waves, which are viewed/utilized after stored. The contents are sent and utilized at different times.
2	EPG/ECG metadata service	Service to broadcast EPG/ECG metadata including program information up to eight days after stream_type = "0x91."

Chapter 4 Access Control System

4.1 Basic functions of the access control system in multimedia broadcasting

The access control system in real-time broadcasting enables access control of contents which are broadcasted in a scrambled state in accordance with the access right information of each content based on the contract information of each subscriber stored in the receiver.

The access control system in storage-based broadcasting enables access control of contents when they are viewed/utilized by storing the contents which keep the encryption made at the time of broadcasting.

This function is achieved when the IC card or CAS Client, which is provided as a security module in the receiver, extracts the key and decrypts the encrypted contents with it according to the conditions issued by the license server.

Chapter 5 Utilization of Networks

5.1 Basic rules for network utilization in multimedia broadcasting receivers

Contents acquired by broadcasting are basically presented and utilized in multimedia broadcasting, but various types of other services utilizing characteristics of multimedia broadcasting receivers equipped with communication functions can also be provided by acquiring various resources (e.g. access right information of each content based on various keys and contract information, compensated data of storage-based broadcasting) via communication to compensate for the broadcasting.

5.1.1 Issuing licenses and keys

Contents broadcasted in real-time broadcasting and storage-based broadcasting are basically transmitted after encrypted. Responding to the request of the receiver, the license server which exists in the communication network issues licenses and keys based on the service conditions of contents. The receiver decrypts the contents using them.

5.1.2 Compensating for missing data in storage-based broadcasting

In storage-based broadcasting, contents are decrypted after stored to enable viewing/utilization. However, occurrence of missing reception data is also estimated depending on broadcast wave reception environment. For this reason, missing data is compensated for using the communication function to store contents securely in order to complement transmission by broadcasting.

Chapter 6 Multimedia Broadcasting Receivers

6.1 Multimedia broadcasting receivers

Multimedia broadcasting receivers would include cellular phone receivers mounted in cellular phones, mobile receivers mounted in car navigation systems, and reception terminals exclusive to multimedia broadcasting. These receivers must be capable of receiving 13-segment broadcasting (including reception at the partial reception layer) or 1-segment broadcasting, or both of them. To enjoy multimedia broadcasting services, communication functions are also necessary.

Chapter 7 EPG and ECG in Multimedia Broadcasting

7.1 Concept of EPG and ECG

In multimedia broadcasting receivers, broadcasting services can be changed or program viewing/recording can be scheduled using the EPG as with conventional digital broadcasting receivers. The ECG also enables scheduled storage and selection of contents available in storage-based broadcasting.

The EPG is a receiver application, which displays relevant information including broadcast schedule of contents broadcasted in real-time broadcasting.

The ECG is also a receiver application, which displays contents to be broadcasted in storage-based broadcasting and stored contents together with their relevant information.

Both the EPG and the ECG can also display a list of all contents or part of the contents using search, filtering, or sort function or according to user attributes etc. The EPG and the ECG can also be displayed comprehensively on the same screen.

Service conditions of each content are displayed according to the license reference information and the acquired license.

7.2 Role sharing between SI and metadata

In multimedia broadcasting, display of the EPG and the ECG, scheduled viewing/recording and channel selection of real-time broadcasting, and scheduled storage/playback and storage of storage-based broadcasting are performed in accordance with metadata.

On the other hand, to respond to potential changes in programming just before real-time broadcasting is delivered, program information for a few of the forthcoming programs is transmitted through SI.

Chapter 8 Content Protection

8.1 Basic concept of content protection in multimedia broadcasting

To enable content protection, storage-based broadcasting contents are basically stored in the receiver in an encrypted state. Receivers to which a license (encryption key and service conditions – RMPI) was issued can decrypt the content before it is used in accordance with the RMPI and enable to play back (use) the content (conditional playback). Receivers which do not have playback conditions complying with the RMPI or a proper license cannot play back (use) the content, whereby a protection platform for multimedia broadcasting contents is realized.

8.2 Output control using RMPI

Protection in accordance with the output control conditions using the RMPI is also provided to external output using an interface which connects the receiver with a peripheral device, removable media, or a network to prevent unauthorized use such as duplication.

Chapter 9 Recommend

9.1 Recommend function

The recommend function in multimedia broadcasting is enabled by communication between the receiver and the recommend server.

The recommend function would include automatic storage by the storage direction from the recommend server and preferred presentation in the ECG or the EPG by the display direction from the recommend server. Recommend would be classified into two methods: a method to recommend contents utilizing user attribute information, contract, access history, etc.; a method to recommend contents in accordance with the preset rules.

Chapter 10 Ads

10.1 Ads in contents

Multimedia broadcasting also enables ads in contents as with conventional digital broadcasting.

10.2 Banner ads

Banner ads (individual) displayed in the receiver user interface in multimedia broadcasting can be transmitted by storage-based broadcasting. Targeting ads are also available by linking banner ads (individual) with the recommend function.

Chapter 11 Operator and System Models

11.1 Operator model

An operator model in multimedia broadcasting is shown below.

The following figure shows the relationship among platform providers who provide metadata aggregation functions and CAS/DRM key management functions for entire multimedia broadcasting; paid broadcasting administrators, main body of CAS/DRM operation, who issue and manage licenses; and program providers. It does not indicate that the operator shown with each frame combines the functions of the operators included in the frame; it represents that one platform provider supervises four paid broadcasting administrators, each of which supervises several program providers.

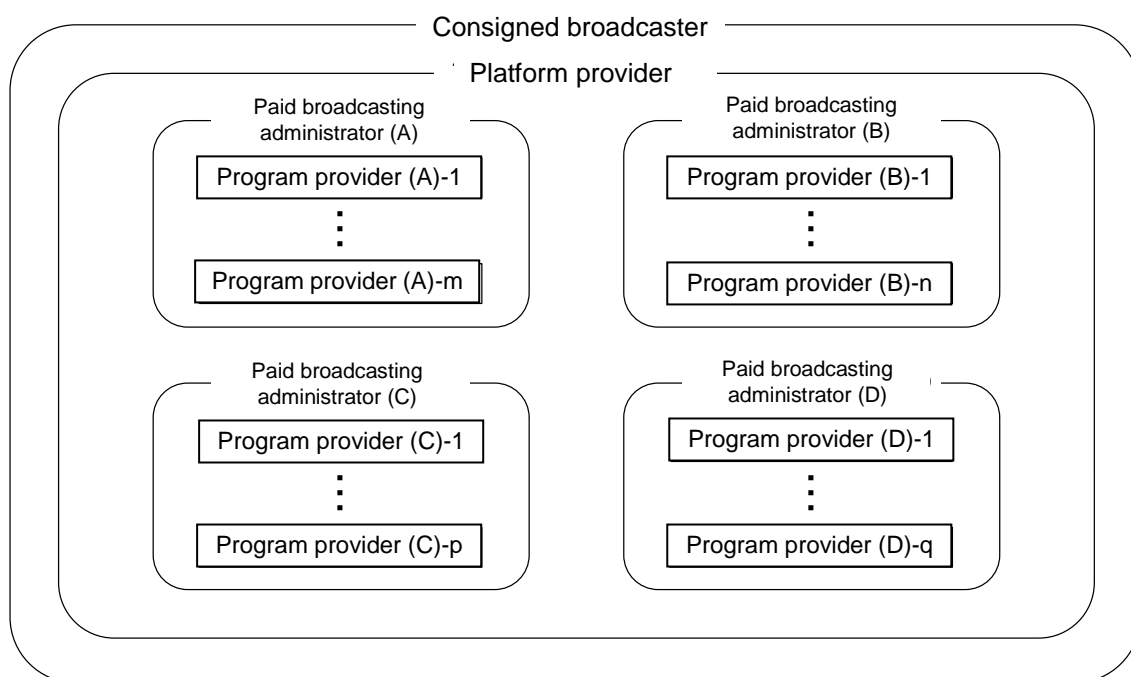


Fig. 11-1 Operator model in multimedia broadcasting

Platform provider: Unlike a conventional platform provider, it is supposed to supervise paid broadcasting administrators and program providers and provide metadata aggregation and CAS/DRM key management functions.

Paid broadcasting administrator: Main body to operate CAS/DRM, which is supposed to issue and manage licenses.

11.2 System model

A system model in multimedia broadcasting is shown below.

The following figure shows the linkage between the receiver and the system which would be operated by a platform provider, the system which would be operated by a paid broadcasting administrator, and the system which would be operated by a program provider in multimedia broadcasting.

Arrows without any description show exchanges of information via communication.

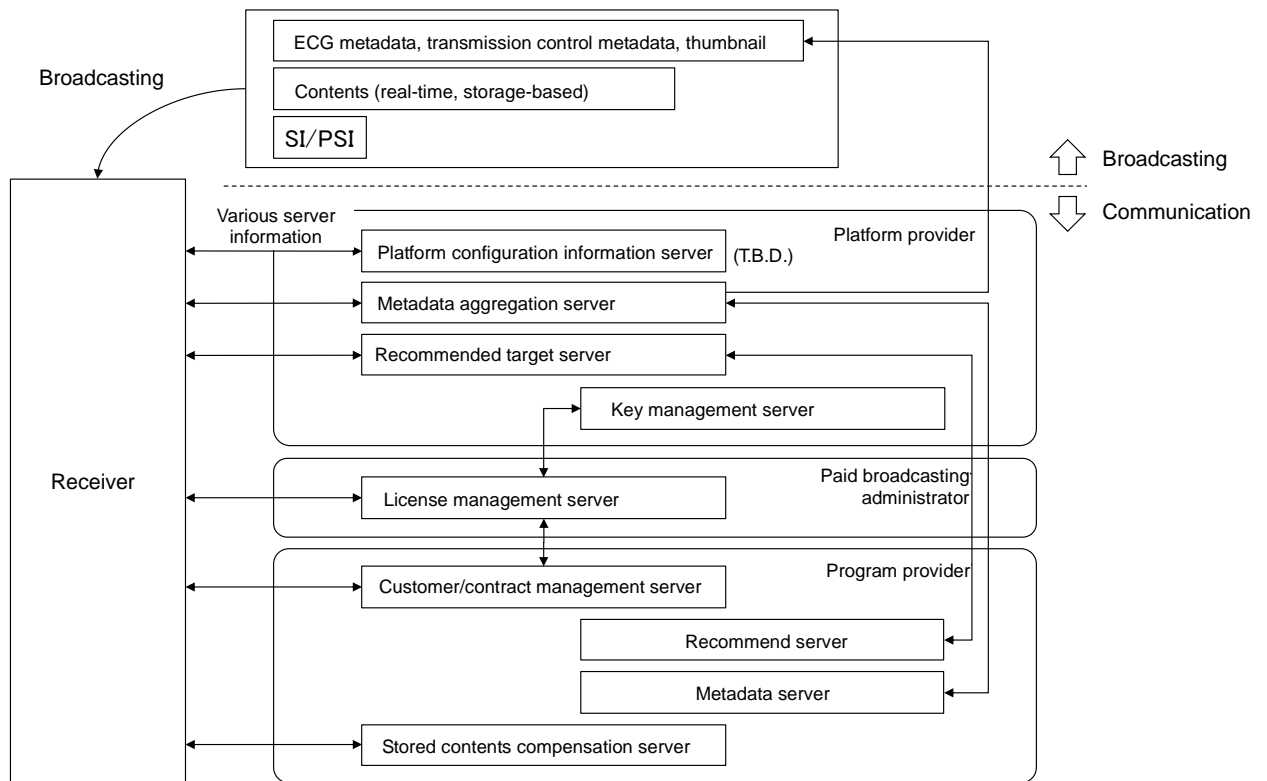


Fig. 11-2 System model in multimedia broadcasting (T.B.D.)

Platform configuration information server: Delivers address information, segment allocation information, etc. of server groups necessary for multimedia broadcasting to the receiver.

Metadata aggregation server: Aggregates and transmits ECG metadata, transmission control metadata, etc. from each program provider.

Recommend target server: Target server when the receiver receives recommend information.

Chapter 12 Receiver Process Flow

12.1 Overview

A typical pattern to enjoy multimedia broadcasting services is shown below. A basic flow would involve the following four steps: (1) metadata acquisition; (2) scheduled storage; (3) receipt/storage of contents, and (4) viewing/utilization of contents. Contract to view/utilize contents (purchase of viewing/utilization right), acquisition of license, or compensation process when storage by broadcasting is incomplete would be required during these four steps depending on the content provision or reception conditions.

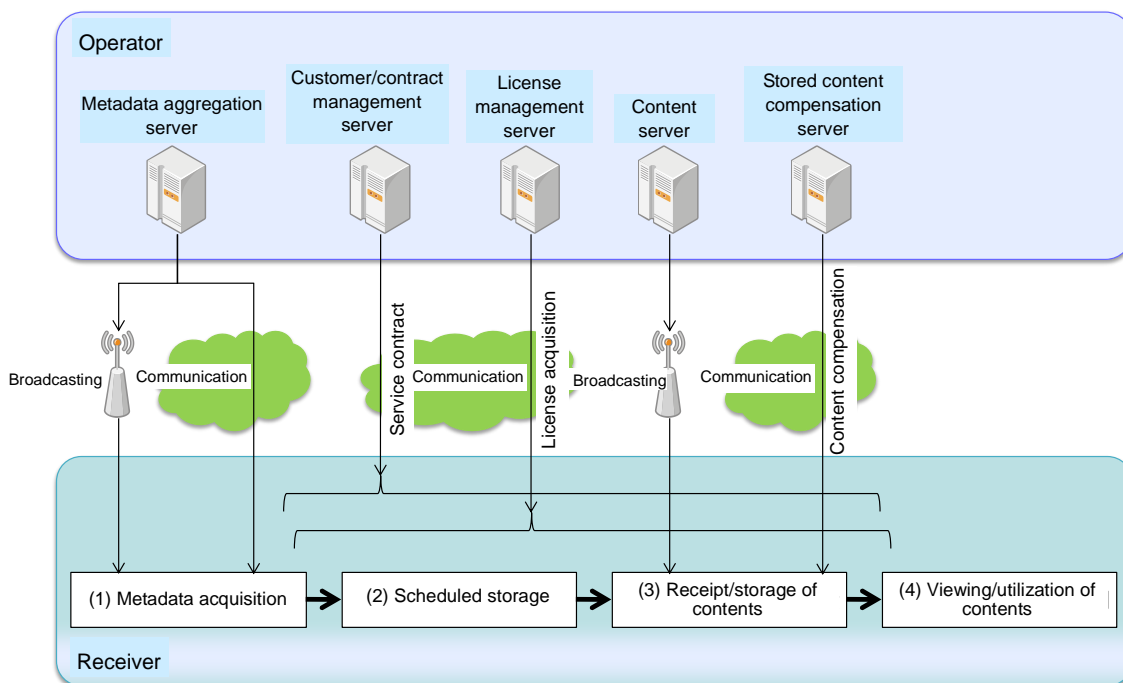


Fig. 12-1 Typical service flow

The receiver process flow in multimedia broadcasting is described from *12.2 Initial setting*. Multimedia broadcasting can be received by covering each process flow.

12.2 Initial settings

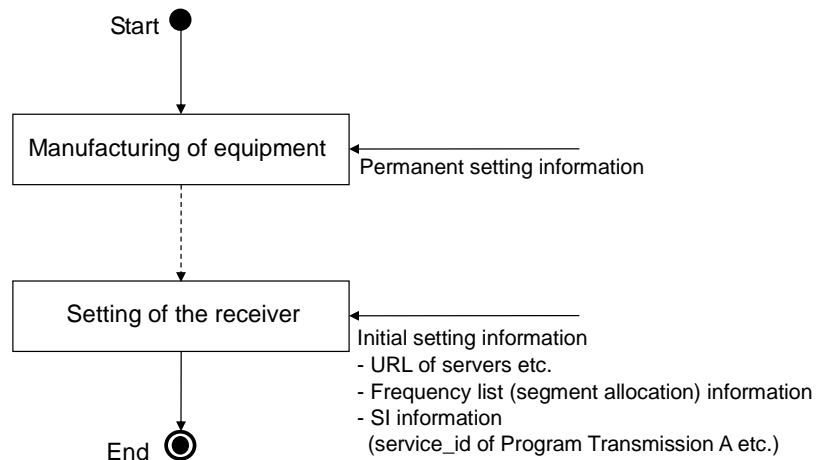


Fig. 12-2 Initial settings

12.3 Receiver contract (reception setting)

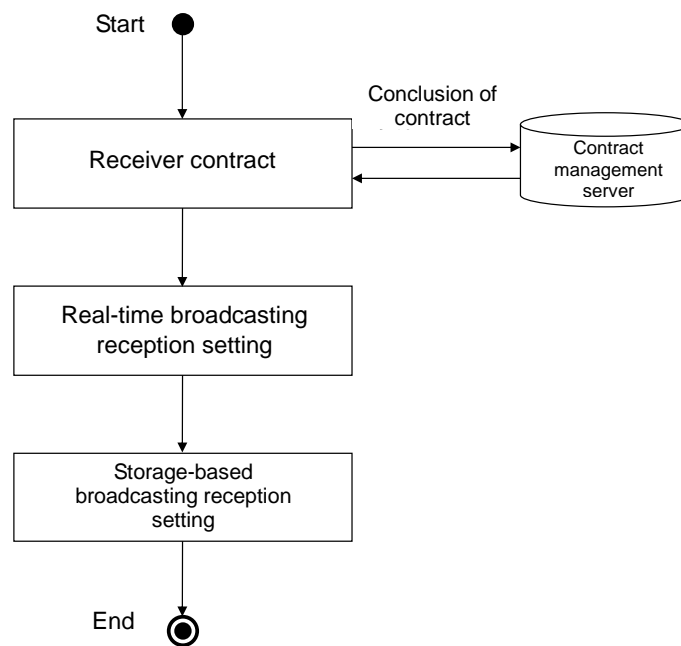


Fig. 12-3 Receiver contract (reception setting)

12.3.1 Real-time broadcasting reception setting

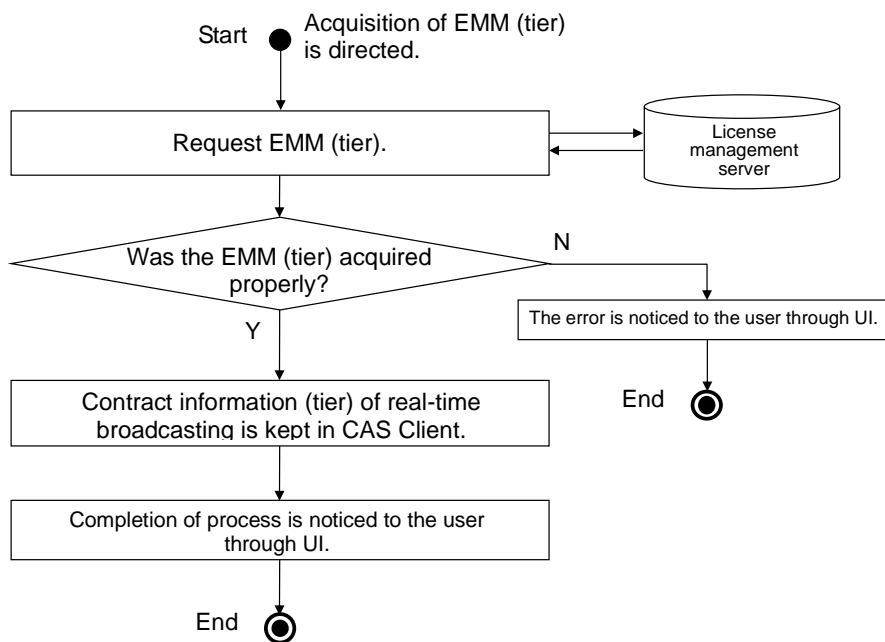


Fig. 12-4 Real-time broadcasting reception setting (acquisition of license information)

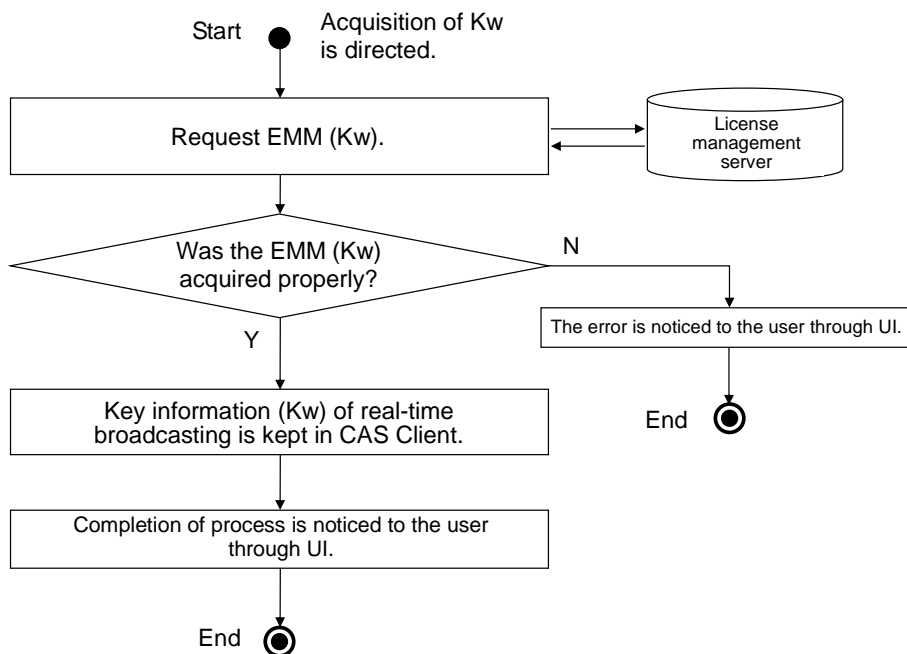


Fig. 12-5 Real-time broadcasting reception setting (acquisition of key information)

12.3.2 Storage-based broadcasting reception setting (CAS Client activation)

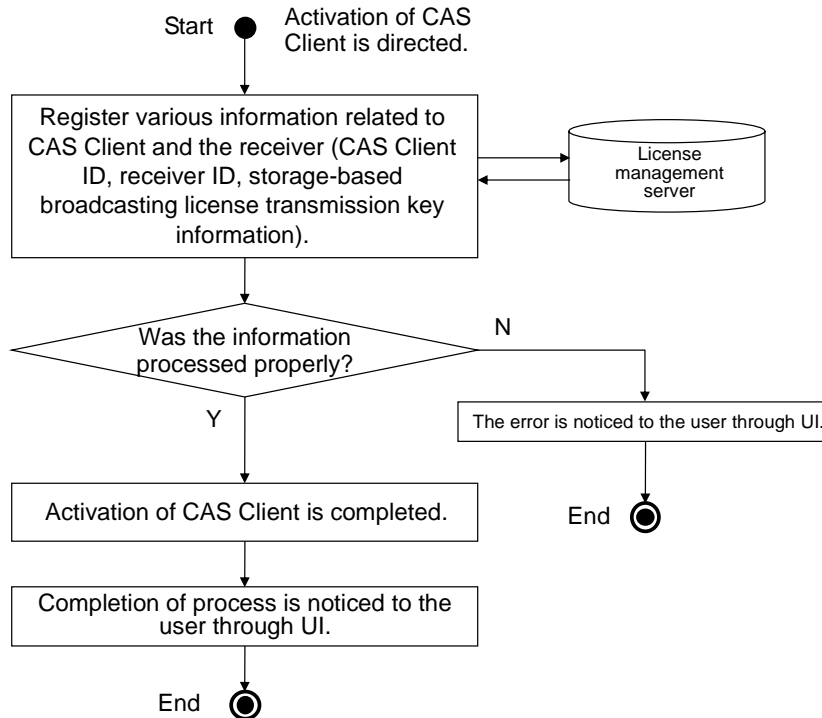


Fig. 12-6 Storage-based broadcasting reception setting (CAS Client activation)

12.4 Acquiring frequency list

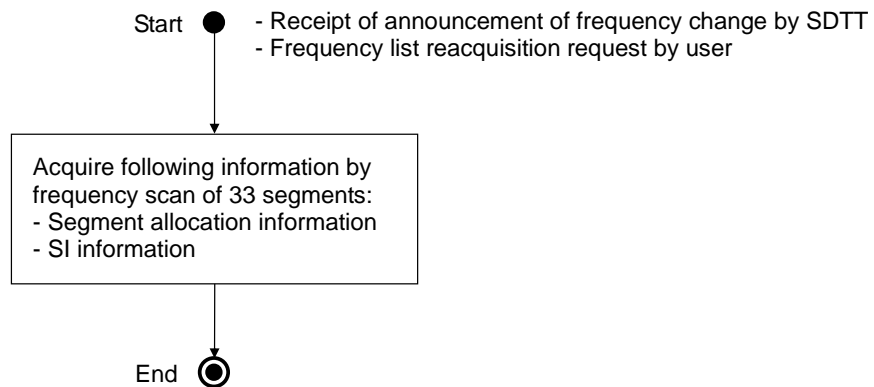


Fig. 12-7 Acquiring frequency list

12.5 Acquiring CS (Classification Scheme) dictionary

CS dictionary file should be basically embedded when the receiver is manufactured as described in the technical report *Volume 10, Appendix A.21 Guidelines for acquiring/managing classification*

scheme. However, for receivers equipped with communication functions, the file should be embedded when the receiver is manufactured, or it should be acquirable by the following method: access the directory which manages the CS dictionary file in the metadata aggregation server using its information, which is included in the server information that can be acquired at the initial settings, and acquire a set of CS dictionary in the directory using the HTTP GET method.

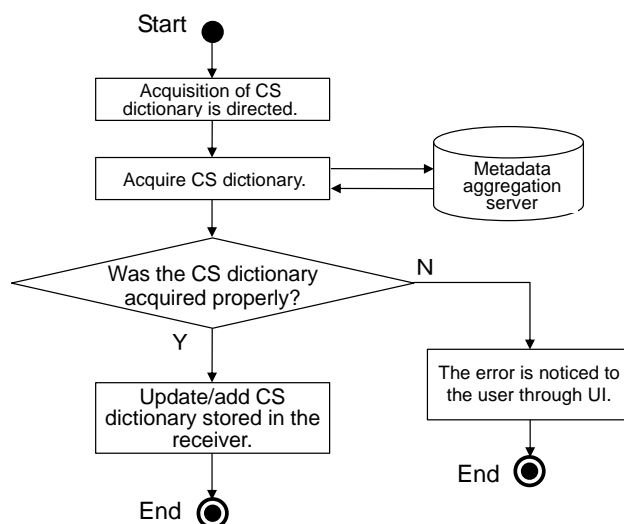


Fig. 12-8 Acquiring CS (Classification Scheme) dictionary

12.6 Receiving ECG metadata (Program Transmission A)

Metadata (ECG, EPG, transmission control) is transmitted by “Program Transmission A” which uses Layer A and “Program Transmission B” which uses Layer B. Here, “Program Transmission A” transmits priority metadata (for example, metadata for two days from the present time).

At the frequency scan after the initial settings and receipt of real-time broadcasting during normal use, the metadata transmitted by “Program Transmission A” is acquired based on service_id included in “SI information” which was acquired at the aforementioned initial settings. For more details of “Program Transmission A” and its acquisition process, see the technical report *Volume 11, 4.2.2 Program Transmission A*.

Reception of “Program Transmission A” is basically performed once a day. When broadcast waves cannot be received or no real-time broadcasting is received, necessary metadata should also be acquirable from the metadata aggregation server using communication. For more details of metadata acquisition process using communication, see the technical report *Volume 10, Chapter 6 Operation of metadata delivery system via communication*.

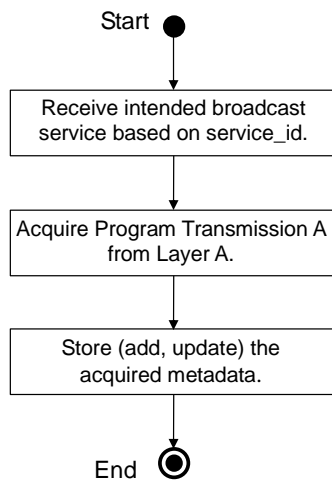


Fig. 12-9 Receiving ECG metadata (Program Transmission A)

12.7 Acquiring ECG metadata (Program Transmission B)

Metadata is transmitted as one of storage-based broadcasting contents by aforementioned “Program Transmission B.” Here, in “Program Transmission B,” metadata excluding that transmitted by “Program Transmission A” (for example, metadata after two days have passed from the present time) is transmitted every day. For more details of “Program Transmission B,” see the technical report *Volume 11, 4.2.3 Program Transmission B*.

When the receiver receives the ECG metadata supported by “Program Transmission B” (ISDBTMMContentTypeCS:1.7 <metadata set> is provided to PI/BD/ContentProperties/ContentType; for more details, see the technical report *Volume 10, Appendix A.15 Operation of ISDBTMM Content Type CS dictionary*), it refers to the transmission control metadata indicated by the ECG metadata, and automatically schedules the storage of storage-based broadcasting contents of “Program Transmission B.” For more details of scheduled storage of storage-based broadcasting contents, see the technical report *Volume 2, 10.4.4 Scheduled storage of storage-based broadcasting contents using ECG*.

Then, the receiver receives storage-based broadcasting contents of “Program Transmission B,” and acquires the metadata contained in the storage-based broadcasting contents. For more details of the metadata storage control in the receiver, see the technical report *Volume 10, Section 7 Metadata storage control*.

The storage-based broadcasting reception scheduler is set in accordance with the broadcast schedule of Program Transmission B based on the stored ECG metadata. At the reception of Program Transmission B, newly added or upgraded contents can be independently stored using the CRID or FragmentVolume information of the received metadata.

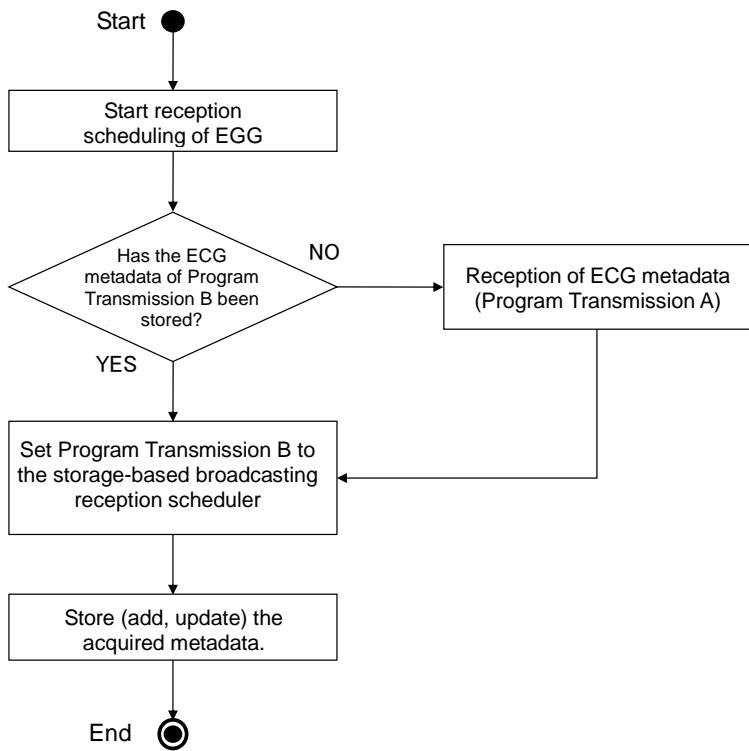


Fig. 12-10 Acquiring ECG metadata (Program Transmission B)

12.8 Basic contract

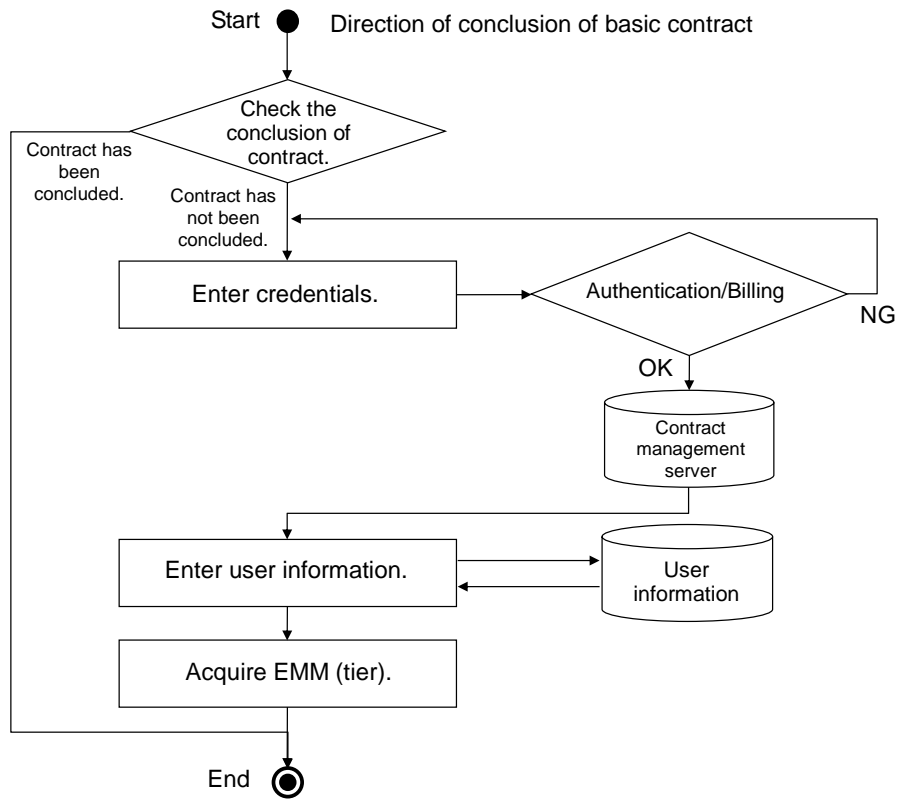


Fig. 12-11 Basic contract

12.9 Premium contract

12.9.1 Real-time broadcasting

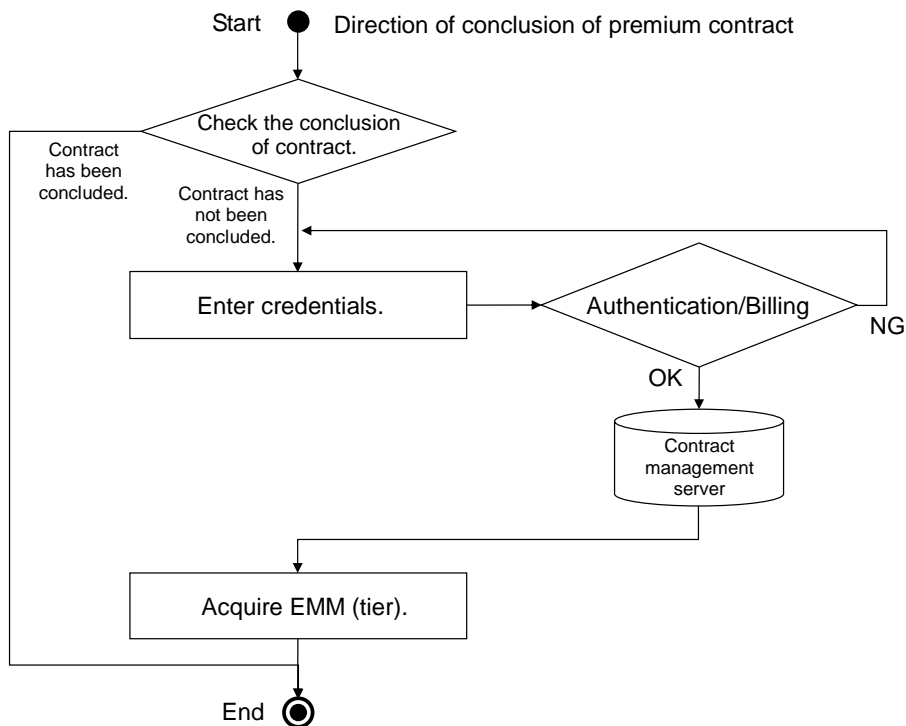


Fig. 12-12 Premium contract (real-time broadcasting)

12.9.2 Storage-based broadcasting

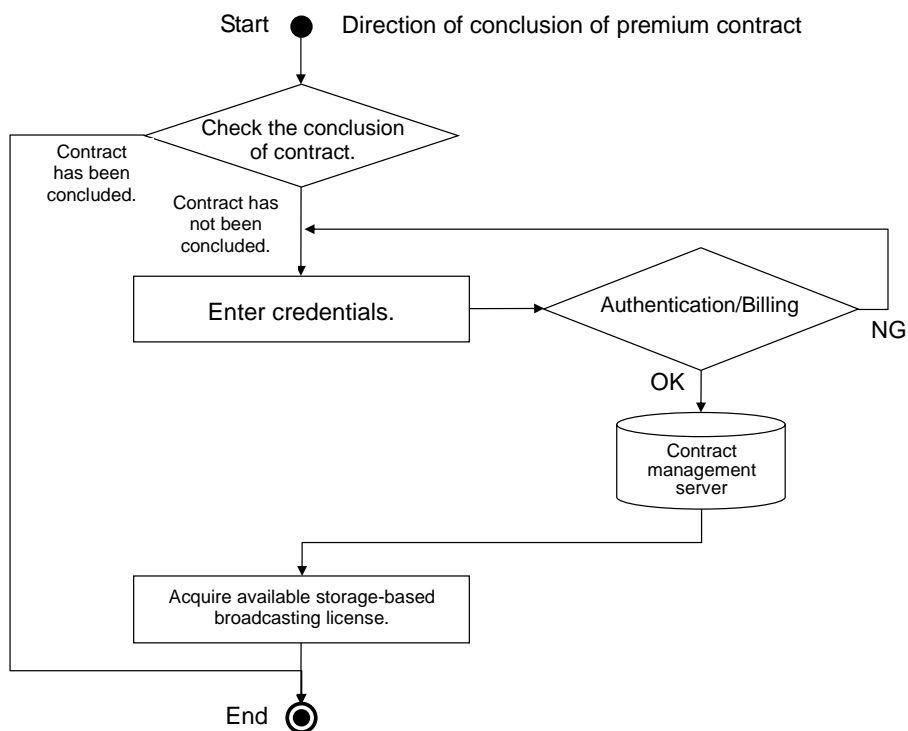


Fig. 12-13 Premium contract (storage-based broadcasting)

12.10 Scheduled storage of storage-based broadcasting

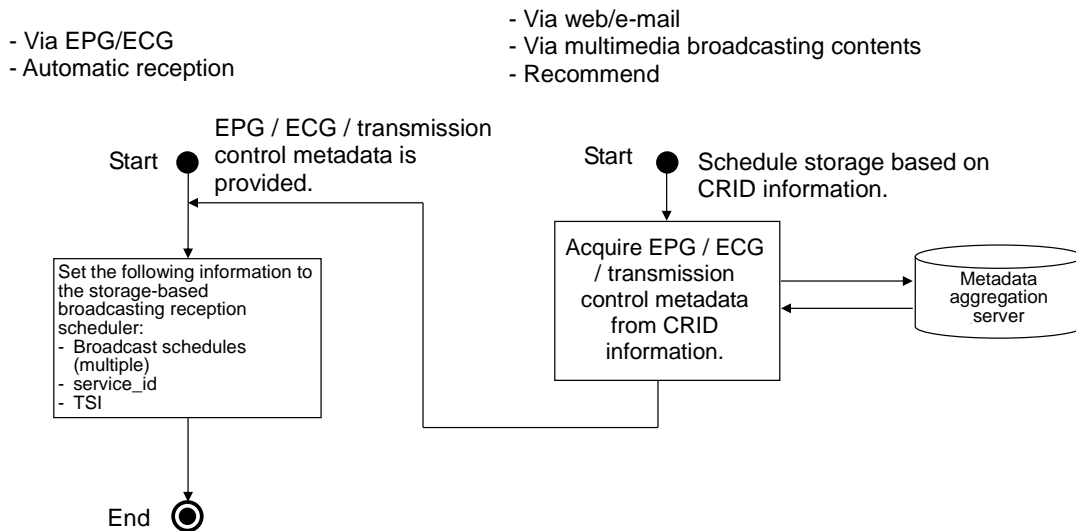


Fig. 12-14 Scheduled storage of storage-based broadcasting (service ID base)

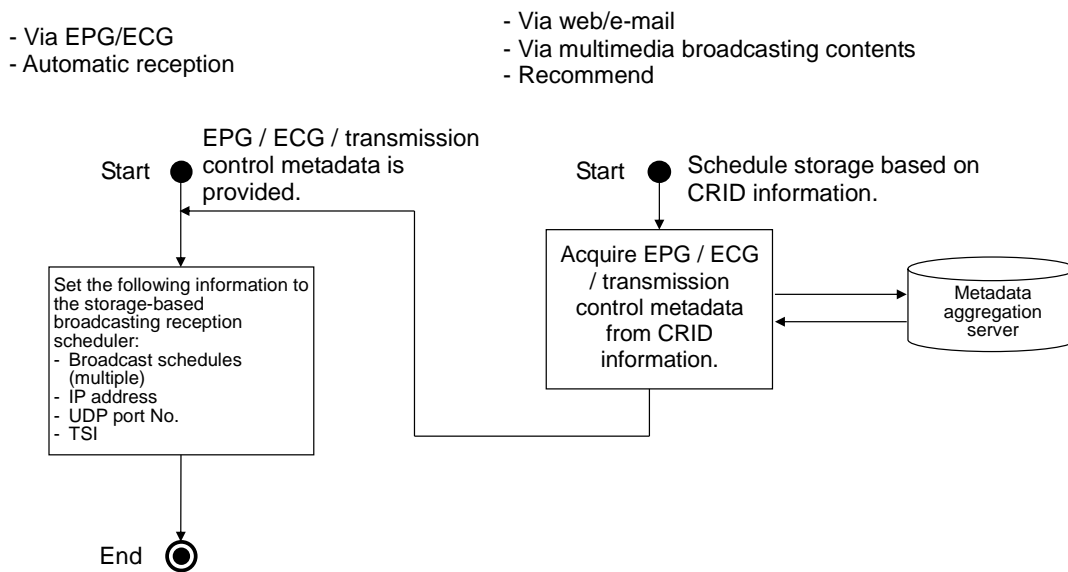


Fig. 12-15 Scheduled storage of storage-based broadcasting (IP base)

12.11 Receiving storage-based broadcasting / Storing contents

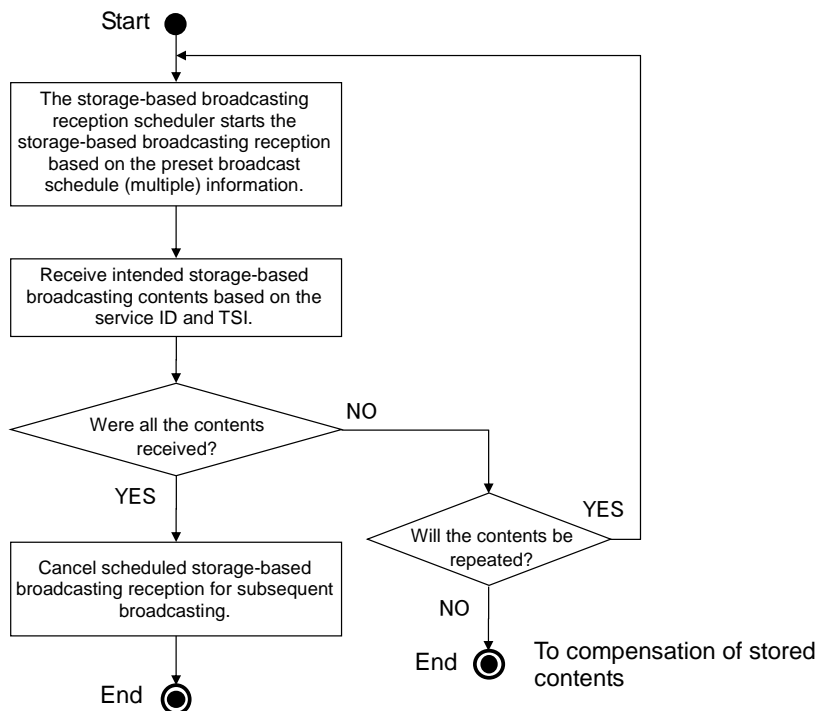


Fig. 12-16 Receiving storage-based broadcasting / Storing contents (service ID base)

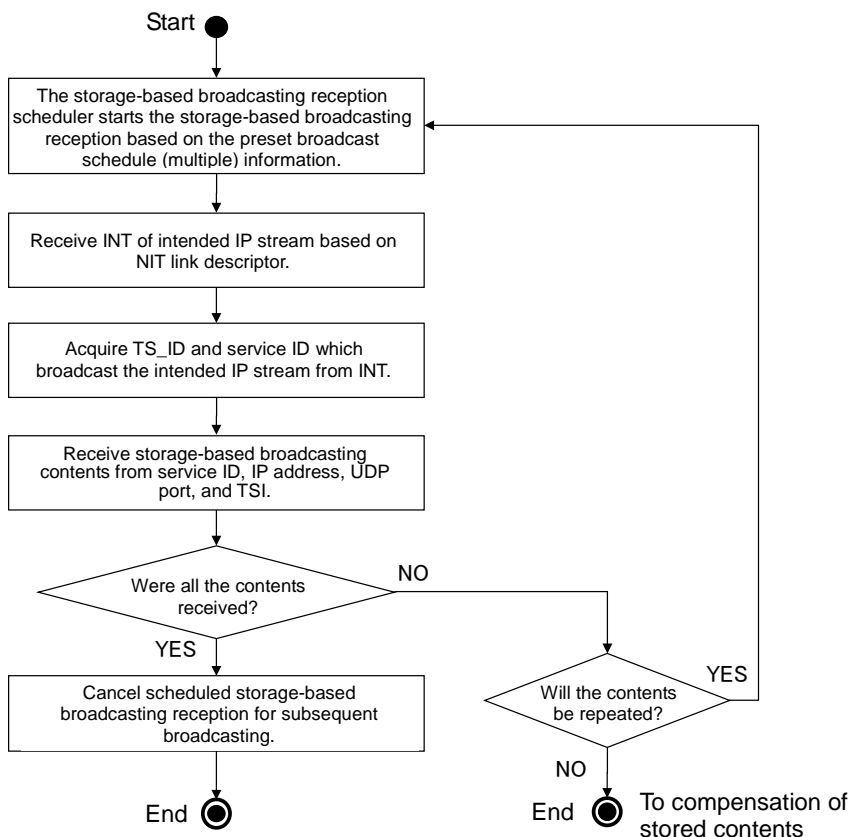


Fig. 12-17 Receiving storage-based broadcasting / Storing contents (IP base)

12.12 Compensating for stored contents

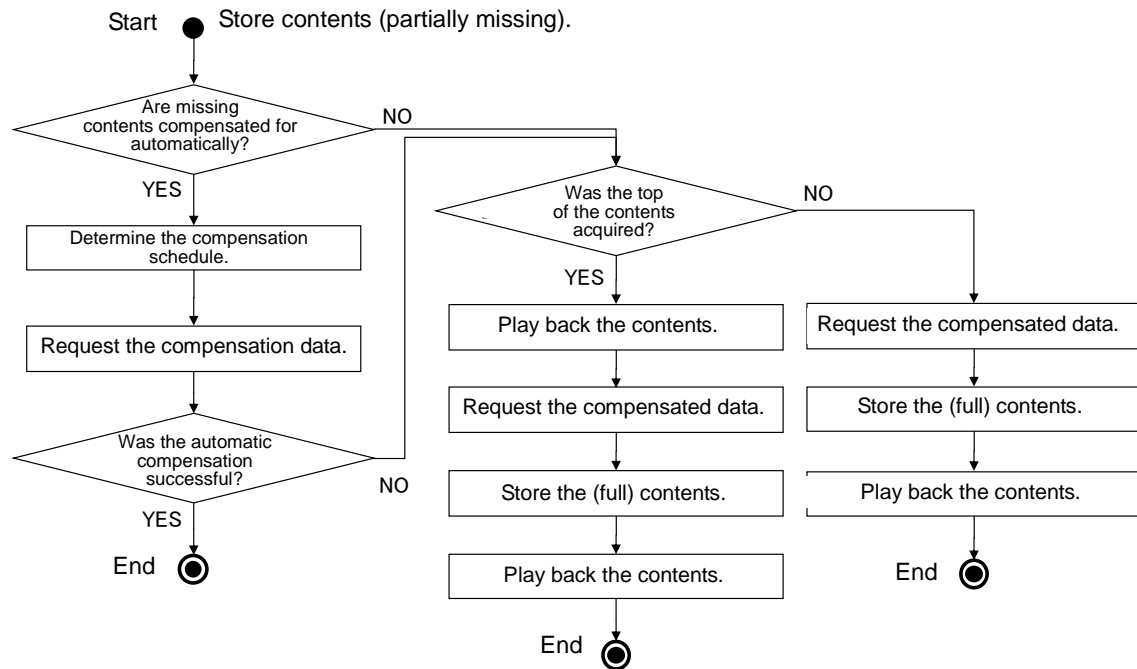


Fig. 12-18 Compensating for stored contents

12.13 Acquiring storage-based broadcasting license

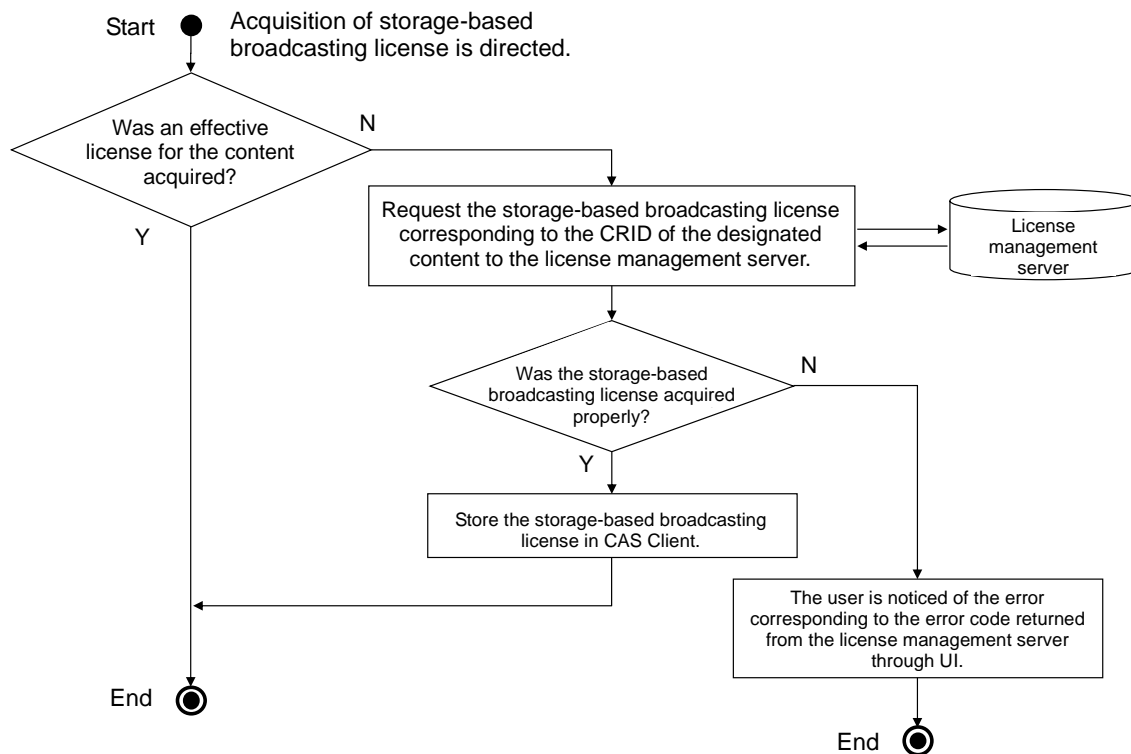


Fig. 12-19 Acquiring file-casting license

12.14 Viewing/utilizing storage-based broadcasting contents

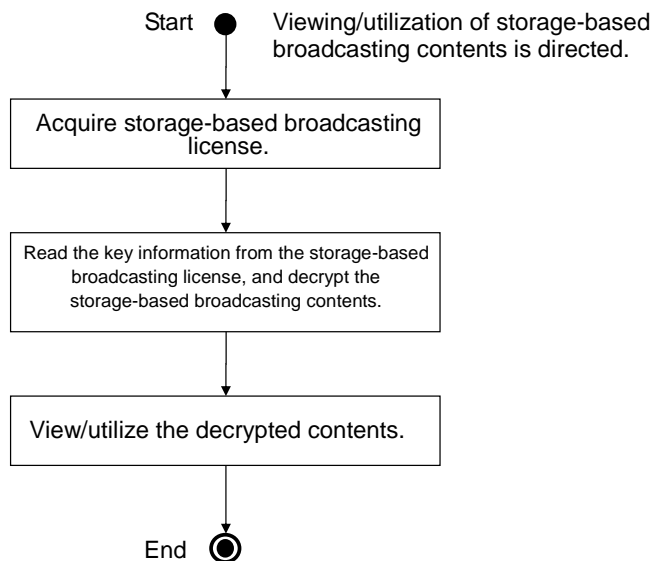


Fig. 12-20 Viewing/utilizing storage-based broadcasting contents

12.15 Scheduled viewing/recording of real-time broadcasting

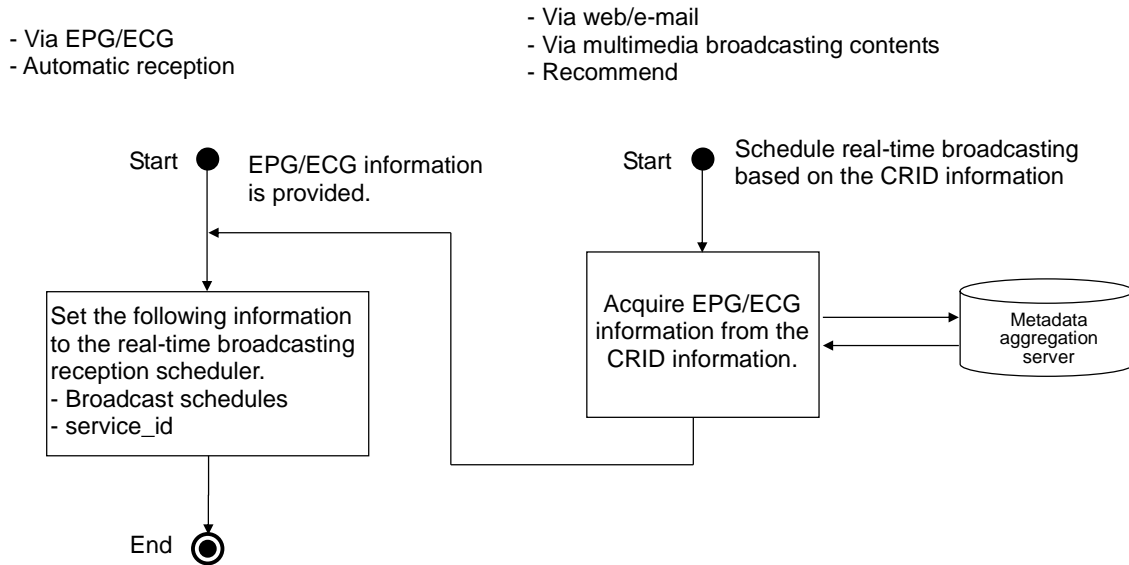


Fig. 12-21 Scheduled viewing/recording of real-time broadcasting

12.16 Receiving (viewing) real-time broadcasting

12.16.1 Viewing with EPG

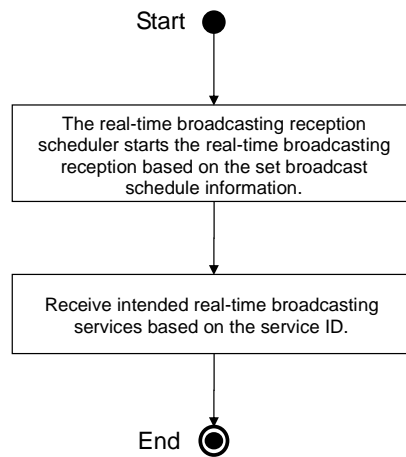


Fig. 12-22 Viewing with EPG

12.16.2 Zapping (viewing by channel selection)

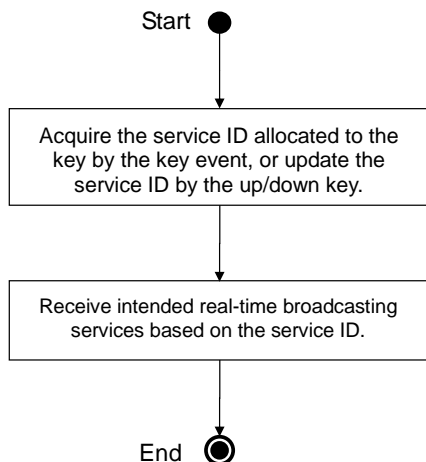


Fig. 12-23 Zapping (viewing by channel selection)

12.17 Updating real-time broadcasting key/license information

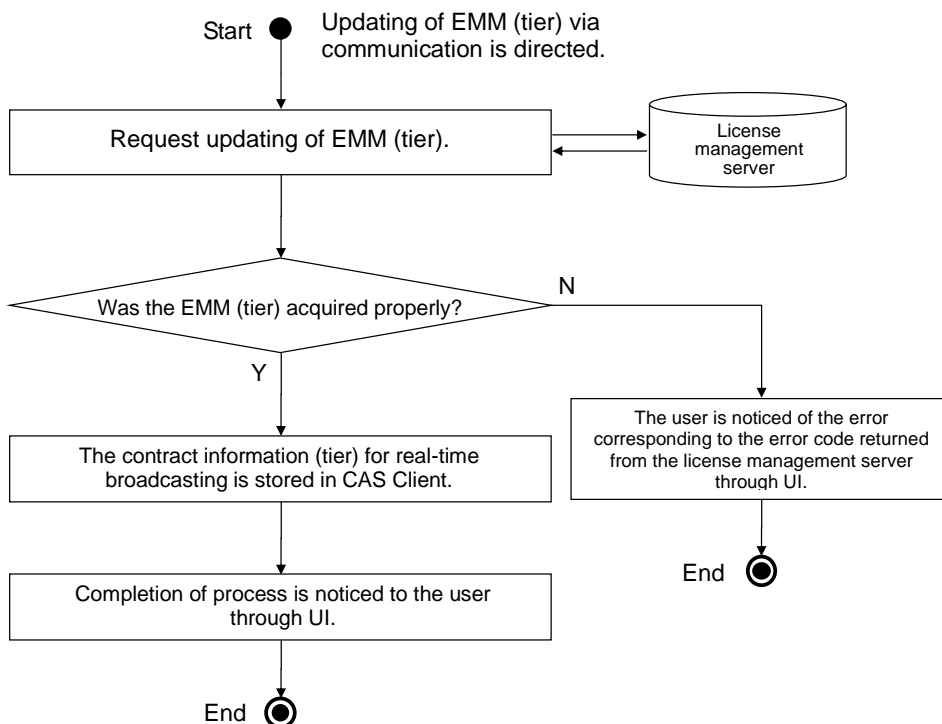


Fig. 12-24 Updating real-time broadcasting license information (communication)

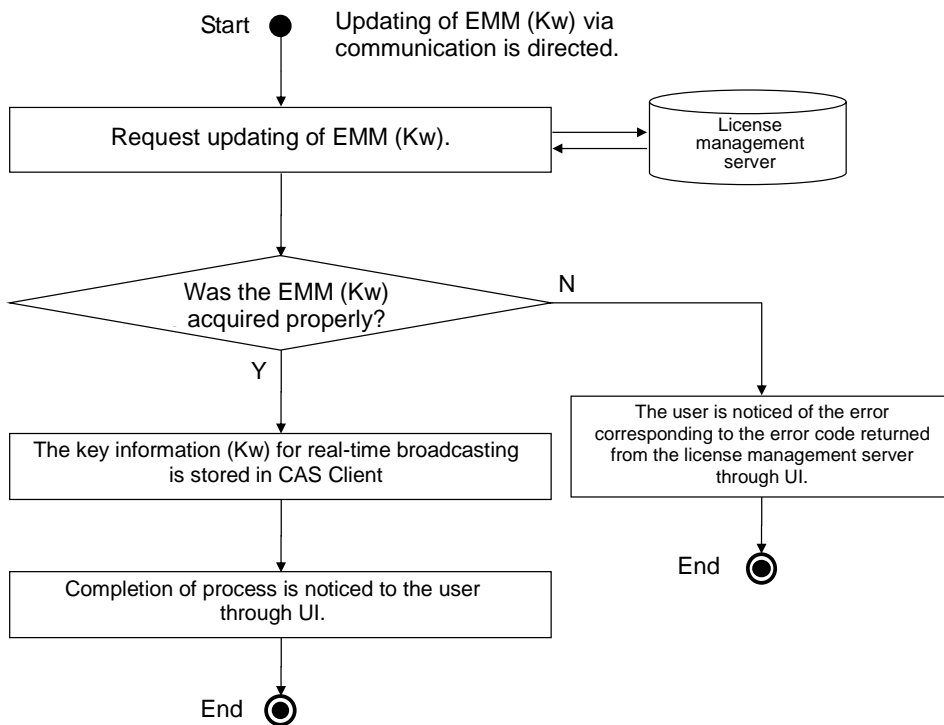


Fig. 12-25 Updating real-time broadcasting key information (communication)

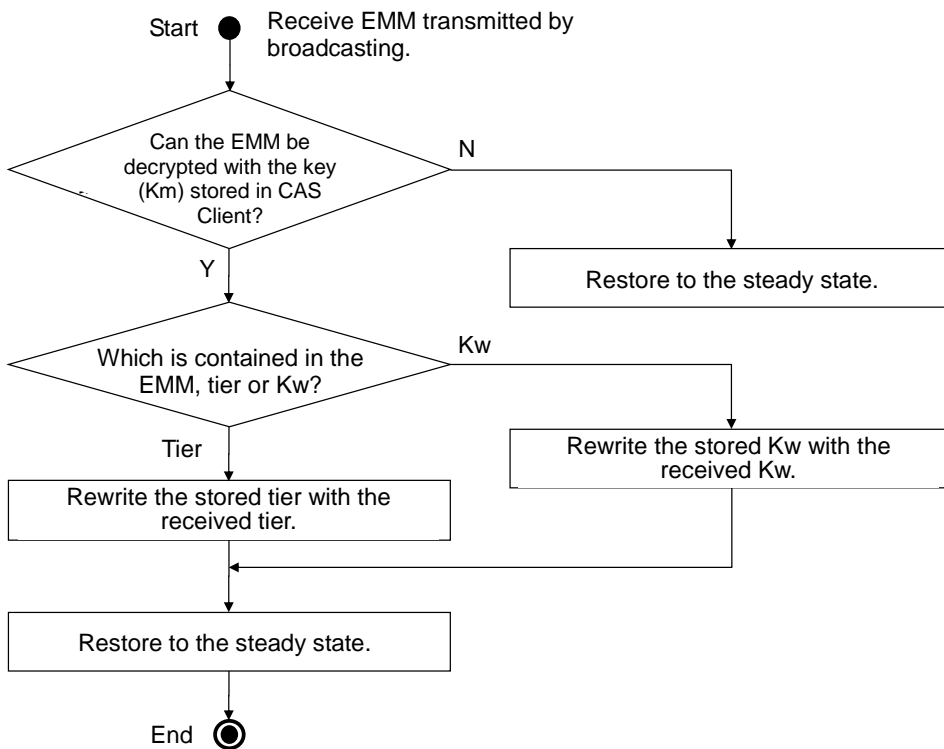


Fig. 12-26 Updating real-time broadcasting key/license information (broadcasting)

12.18 Reception associated with programming changes

12.18.1 Real-time broadcasting

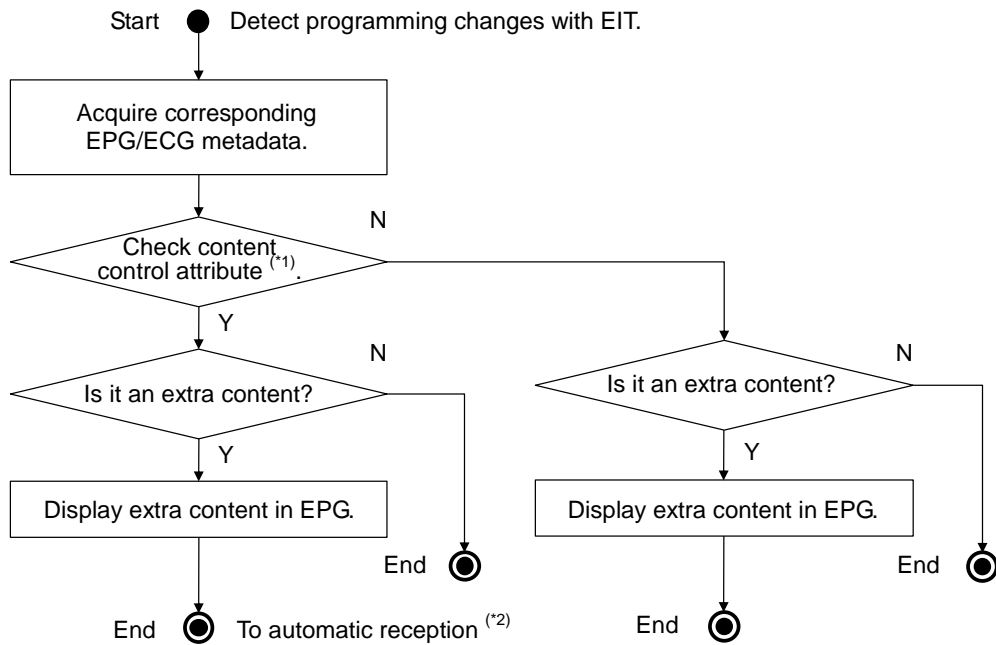


Fig. 12-27 Reception associated with programming changes (real-time broadcasting)

*1 Check whether auto_receive:ON or force_receive:ON is set to the contents.

*2 See 12.5 Acquiring CS (Classification Scheme) dictionary.

12.18.2 Storage-based broadcasting

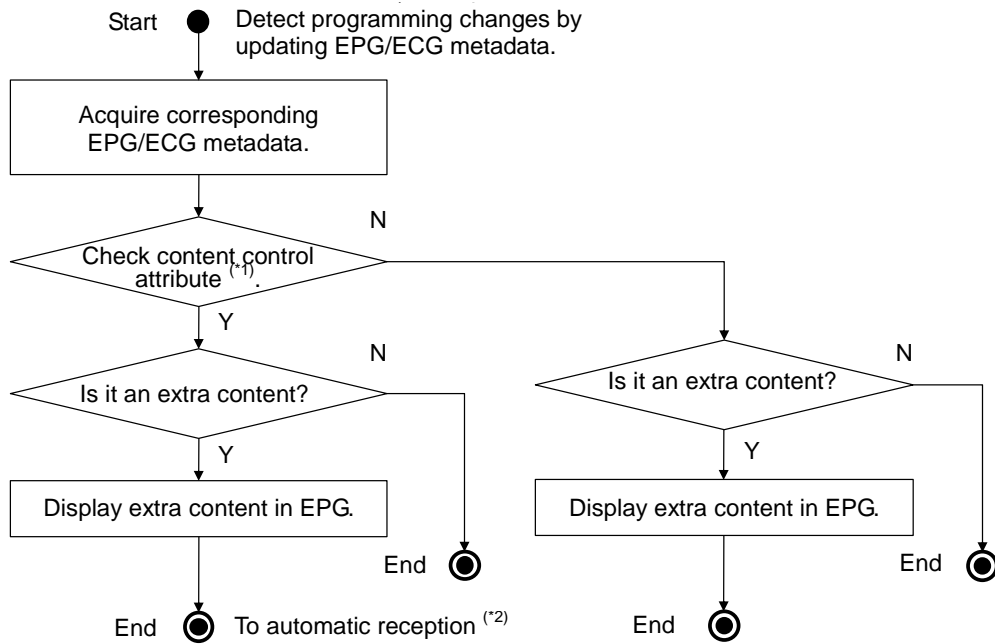


Fig. 12-28 Reception associated with programming changes (storage-based broadcasting)

* 1 Check whether auto_receive:ON or force_receive:ON is set to the contents.

* 2 See 12.10 Scheduled storage of storage-based broadcasting.

12.19 Cancellation

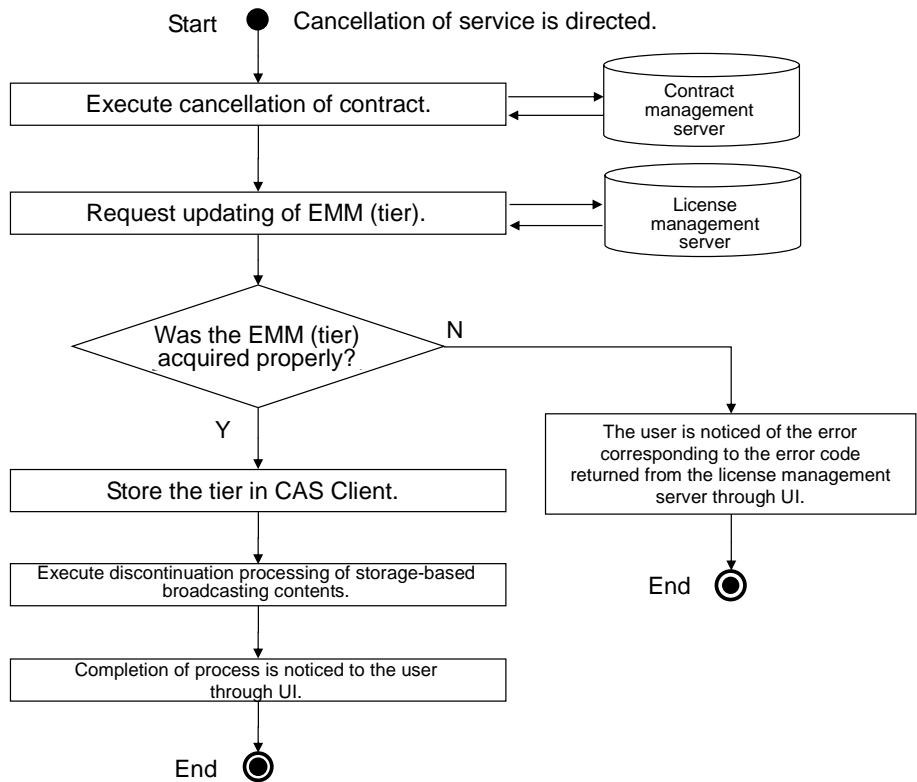


Fig. 12-29 Cancellation (communication)

12.20 Engineering service

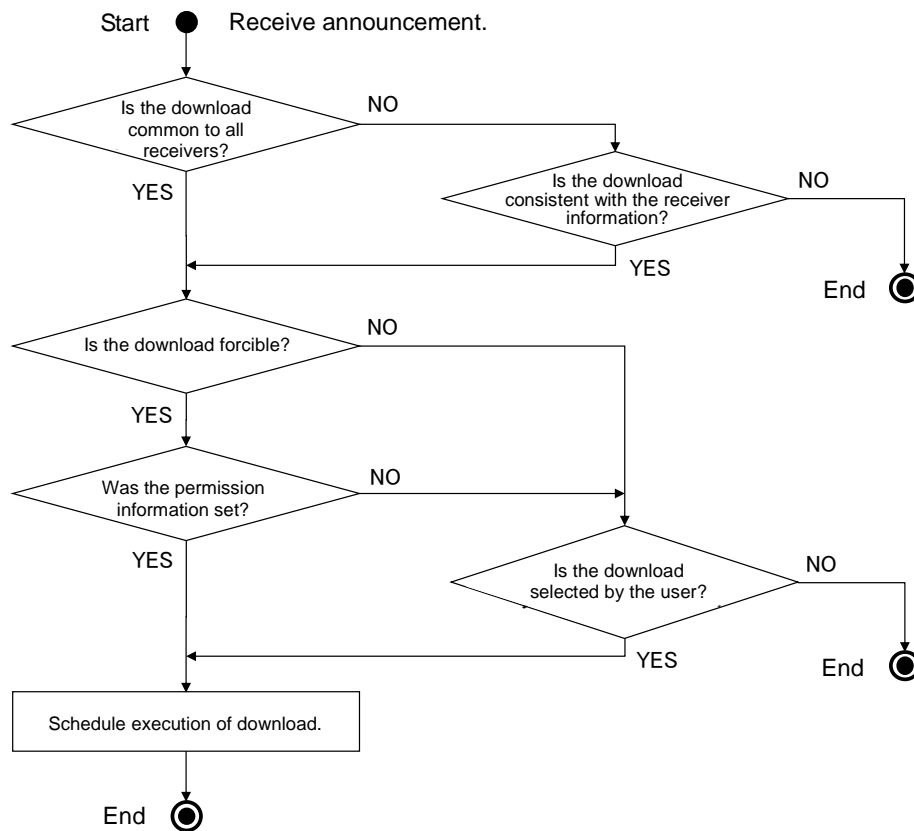


Fig. 12-30 Engineering service

Chapter 13 Description of the Technical Report

13.1 Composition of the technical report

The technical report is composed of the following volumes (Volume 0 to 12). Outline of each volume is described below.

- (1) Volume 1: Basic concept and common elements of multimedia broadcasting

Prior to each subsequent volume below, this volume clarifies the basic concept and common elements of multimedia broadcasting.

- (2) Volume 1: Operational guidelines for downloading

Updating services of information in the receiver are provided in accordance with ARIB STD-B21, ARIB STD-B24, and ARIB STD-B10. This volume sets forth operations of detailed sections for reception design in detail.

- (3) Volume 2: Functional specifications for receivers
This volume summarizes receiver functions, and describes how to handle multimedia broadcasting contents received by broadcasting in the receiver and which user interface is required.
- (4) Volume 3: Guidelines for multimedia coding
This volume mainly describes media coding used in multimedia broadcasting and sets forth the guidelines for signal transmission and receiver specifications for secure operations of multimedia broadcasting.
- (5) Volume 4: Operational guidelines for PSI/SI
Service information used in multimedia broadcasting is operated in accordance with ARIB STD-B10. To ensure secure operations on the sending and receiving sides, this volume sets forth configurations of PSI and SI, signal types, basic data structure, operation of identifiers, and transmissions.
- (6) Volume 5: Operational guidelines for conditional access system (CAS) and receiver specifications
This volume describes technical requirements necessary for content protection and access control systems in multimedia broadcasting. All the requirements set forth in this volume should be fulfilled before multimedia broadcasting receivers are implemented. This volume, however, does not refer to specific implementing procedures in receivers.
- (7) Volume 6: Operational guidelines for bidirectional communication
(Not applicable in this report.)
- (8) Volume 7: Operational guidelines for transmission
This volume mainly sets forth source coding, multiplex, transmission channel coding systems for operations and transmissions at broadcast stations. Broadcasters should be engaged in broadcasting in accordance with this guideline. Receivers need to be capable of using signals transmitted in accordance with this guideline in the assumed operational manner.
- (9) Volume 8: Guidelines for content protection
Multimedia broadcasting contents are recorded in the recorder directly after received. To view or use the contents, the receiver reads these contents and decrypts them inside it. This volume describes the concept of decrypted content protection.
- (10) Volume 9: Operational guidelines for sending
(Not applicable in this report.)
- (11) Volume 10: Operational guidelines for metadata
This volume specifies metadata types, models, and utilization to be operated actually out of the metadata set forth in ARIB STD-B38.

(12) Volume 11: Operational guidelines for storage-based broadcasting

This volume sets forth the operation of storage-based broadcasting transmission systems in multimedia broadcasting.

(13) Volume 12: Compensation of stored contents

This volume sets forth the operation of compensation of stored contents utilized in storage-based broadcasting out of communication-related operations to deliver multimedia broadcasting services.

Compensation of stored contents is a function used when a file is not received fully by broadcast waves in storage-based broadcasting by compensating for missing data from the server via communication to complete the file. Compensation of stored contents includes automatic compensation method and manual compensation method by users.

13.2 Reference documents

This technical report specifies requirements for broadcasting for mobile devices based on the broadcasts described in the following documents. Relevant standard specifications are listed below. (Standard specifications to be reviewed are also included.)

- (1) “Data Multiplex Broadcasting System for The Conventional Television Using The Vertical Blanking Interval” Standard specifications; ARIB STD-B5
- (2) “Service Information for Digital Broadcasting System” Standard specifications; ARIB STD-B10
- (3) “Receiver for Digital Broadcasting” Standard specifications; ARIB STD-B21
- (4) “Application Execution Engine Platform for Digital Broadcasting” Standard specifications; ARIB STD-B23
- (5) “Data Coding and Transmission Specification for Digital Broadcasting” Standard specifications; ARIB STD-B24
- (6) “Conditional Access System Specifications for Digital Broadcasting” Standard specifications; ARIB STD-B25
- (7) “Transmission System For Digital Terrestrial Sound Broadcasting” Standard specifications; ARIB STD-B29
- (8) “Transmission System for Digital Terrestrial Television Broadcasting” Standard specifications; ARIB STD-B31
- (9) “Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting” Standard specifications; ARIB STD-B32
- (10) “Structure and Operation of Closed Caption Data Conveyed by Ancillary Data Packets” Standard specifications; ARIB STD-B37
- (11) “Coding, Transmission and Storage Specification for Broadcasting System Based on Home Servers” Standard specifications; ARIB STD-B38

Chapter 14 Parameters to Operate

14.1 Layer structure to operate and parameters to use

As with digital terrestrial television broadcasting, multimedia broadcasting enables hierarchical transmission which transmits signals having several transmission parameters concurrently.

Each layer consists of one or multiple OFDM segments (up to 13) having a transmission parameter, enabling hierarchical transmission up to three layers.

14.1.1 Transmission parameters which can be designated for each layer

The following table shows parameters out of transmission parameters which can be designated for each layer and for 13 segments entirely.

Table 14-1 Specified range of transmission parameters

Item No.	Item	Designated portion	
		Designated for 13 segments	Designated for each layer
1	Transmission mode	○	–
2	Guard interval ratio	○	–
3	Carrier modulation system	–	○
4	Convolutional encoding ratio	–	○
5	Time-interleaving length	–	○

14.2 Physical layer operational parameters

Table 14-2 List of assumed operational parameters

Item No.	Item	Draft standard range	Assumed operational parameters
1	Transmission mode	1, 2, 3	3
2	Guard interval ratio	1/4, 1/8, 1/16, 1/32	1/4
3	Carrier modulation system	QPSK, 16QAM, 64QAM, DQPSK	QPSK, 16QAM
4	Convolutional encoding ratio	1/2, 2/3, 3/4, 5/6, 7/8	16QAM: 1/2 QPSK: 1/2, 2/3
5	Time-interleaving length	(Mode 1) I=0, 4, 8, 16 (Mode 2) I=0, 2, 4, 8 (Mode 3) I=0, 1, 2, 4	(Mode 3) I=4

14.3 Parameters used for the operation of hierarchical transmission

Table 14-3 Parameters used for the operation of hierarchical transmission

Pattern	Layer used	Layer name	No. of segments	Transmission (See Table 14-4.)	TV broadcasting		Download (See Table 14-7.)	SI/EPG (See Table 14-8.)	Data / bidirectional (See Table 14-9.)	CAS (See Table 14-10.)
					Video (See Table 14-5.)	Audio (See Table 14-6.)				
(1)	A	Weak layer (for HDTV broadcasting)	1	Parameters in Table 14-4 are available in all layers.	Parameters in Table 14-5 are available in all layers.	Parameters in Table 14-6 are available in all layers.	c	c	Parameters in Table 14-9 are available in all layers.	b
(2)	A	Partial reception layer	1 (Partial reception)				b	c		b
	B	Weak layer (for HDTV broadcasting)	12				a	a		a
(3)	A	Partial reception layer	1 (Partial reception)				b	c		b
	B	Strong layer (for mobiles)	11 to 1				-	b		a
	C	Weak layer (for HDTV broadcasting)	1 to 11				a	a		a

Layer used: A, B, and C indicate layers set forth in TMCC.

Layer name: Layer name used in this operational guideline for convenience

Table 14-4 Transmission

Mode/guard ratio ^(Note 1)	Time interleaving	Modulation / Error correction		
	(Mode 3)	16QAM	QPSK	
1/4	I=4	1/2	2/3	1/2
○	○	○	○	○

○: Available transmission parameters

Note 1: The mode and the guard ratio are designated in common for all layers, and cannot be designated for each layer.

Table 14-5 Video

Coding system	H.264			
Level	MP@L3	MP@L3	MP@L1.3	MP@L1.2
Size	720×480 p	352×480 p	320×180 p	320×180 p
Frame rate	30/1.001 Hz	30/1.001 Hz	30/1.001 Hz	15/1.001 Hz
Scanning mode	Sequential	Sequential	Sequential	Sequential

	scanning	scanning	scanning	scanning
Transmission ability	○	○	○	○

○: Transmittable.

Table 14-6 Audio

MPEG-2 AAC LC / MPEG-4 HE AAC							
48 kHz / 44.1 kHz / 32 kHz				Multiple ES (Note 1)	24 kHz / 22.05 kHz / 16 kHz		
Mono	Stereo	Multichannel	Dual Mono		Mono	Stereo	Dual Mono
○	○	○	○	○	○	○	○

○: Transmittable.

Note 1: The number of sound ES referred to by each service sent in the layer.

Table 14-7 Download

Type	Download contents	SDTT for weak layer (for HDTV broadcasting)		SDTT for strong layer (for mobiles)	
		For receiver software	For common data	For receiver software	For common data (Note 2)
a	△ (Note 1)	○	×	×	×
b	×	×	×	○	○
c	×	○	×	○	○

○: Transmittable.

△: Not obligatory to all operators, but transmitted at least at 1 TS.

×: Not transmitted.

Note 1: Download contents are transmitted at least 1 TS, but not always transmitted by all operators.

Note 2: SDTT of frequency list and change information is assumed.

Table 14-8 SI/EPG

Type	Corresponding layer
	Basic
a	N-EIT
b	M-EIT
c	W-EIT

Table 14-9 Data/Bidirectional

Transmission of MM services		MM service transmission system	Transmitted monomedia					Bidirectional protocol	Closed caption / superimposed text
Data coding identification	BML version		MPEG-1 Video	MPEG-2 Video	H.264	MPEG-2 AAC	Others		
0x0016 (T.B.D)	14.0 (T.B.D)	- Data carousel - Event message	×	×	○	○	- MPEG-2 AAC (file) - JPEG - PNG/MNG	- TCP/IP (HTTP)	○

○: Transmittable.

×: Not transmitted.

Table 14-10 CAS

Type	CAT	EMM	ECM
a	×	○	○
b	○	○	○

○: Transmittable.

×: Not transmitted.

14.4 Source coding system in real-time broadcasting

14.4.1 Video coding system

The video coding system employs the system set forth in ITU-T Rec. H.264|ISO/IEC 14496-10. Corresponding video formats are shown below.

Table 14-11 Video formats operated in real-time broadcasting

Profile	Level	Format	Image size	Aspect ratio	Frame rate [1.001Hz]	Scanning mode	Maximum bit rate
Main	1.2	QVGA	320 × 180	16:9	15	P	384 kbps
	1.3	QVGA	320 × 180	16:9	30	P	768 kbps
	3	525HHR	352 × 480	16:9	30	P	6 Mbps
	3	525SD	720 × 480	16:9	30	P	

14.4.2 Audio coding system

The audio coding system should be capable of using MPEG-2 AAC Audio (ISO/IEC 13818-7), MPEG-4 HE-AAC (ISO/IEC 14496-3:2001/Amd.1), and MPEG-4 HE-AAC v2 (ISO/IEC 14496-3:2005/Amd2:2006).

MPEG Surround (ISO/IEC23003-1) may be used, but surround sound using it should not be operated for the time being. Even if the receiver receives MPEG Surround, it should be ignored.

Table 14-12 Key parameters for audio coding system in real-time broadcasting

Item	Value
Bitstream format	AAC Audio Data Transport Stream (ADTS)
Sampling rate	48 kHz, 44.1 kHz, 32 kHz, 24 kHz, 22.05 kHz, 16 kHz
Profile	Low Complexity (LC)
Maximum number of encoded channels	Up to 5. 1 channels per ADTS
PES packets	Asynchronous with sound frame is permitted.
Mute flag	Not used. (Muted by input signal.)

14.5 Source coding system in storage-based broadcasting

14.5.1 Video coding system

The video coding system should employ the system set forth in ITU-T Rec. H.264|ISO/IEC 14496-10. Corresponding video formats are shown below.

Table 14-13 Video formats operated in storage-based broadcasting

Profile	Level	Format	Image size	Aspect ratio	Frame rate [/.001Hz]	Scanning mode	Maximum bit rate
High	3.1	QVGA	320 × 240	4:3	15	P	10 Mbps
					30	P	
			320 × 180	16:9	15	P	
					30	P	
		VGA	640 × 480	4:3	30	P	
					30	P	
		525SD	720 × 480	4:3	30	P	
					60	P	
	16:9			30	P		
			60	P			
			30	P			
	4.0		720HD	1280 × 720	16:9	60	P
		30				I	
		1080HD	1440 × 1080	16:9	30	I	
30					P		
4.2	1080HD	1920 × 1080	16:9	60	P	20 Mbps	

14.5.2 Audio coding system

The audio coding system complying with MPEG-4 audio (ISO/IEC 14496-3) should be used. However, HE-AAC v1 (ISO/IEC 14496-3: 2003:Amd.1), HE-AAC v2 (ISO/IEC 14496-3: 2005:Amd.2), and MPEG Surround (ISO/IEC 23003-1) should be added.

As optional, MPEG-4 ALS (ISO/IEC 14496-3: 2005:Amd.2:2006) and MPEG-4 SLS (ISO/IEC 14496-3: 2005:Amd.3:2006) may also be used.

MPEG Surround should not be operated for the time being. Though the receiver must be capable of receiving audio data with surround, decryption may be limited to the ACC base.

The coding sampling frequencies should be 16 kHz, 22.05 kHz, and 24 kHz in addition to the input sampling frequencies (32 kHz, 44.1 kHz, and 48 kHz).

The reception terminal should be capable of playing back all the above audio coding formats. Playback of part of its functions is also allowed depending on the number of channels which can be played back by the terminal.

Chapter 15 Appendix

15.1 Service image

Basic functions of multimedia broadcasting are viewing of real-time broadcasting and storage of storage-based broadcasting contents including metadata. By achieving scheduled storage of storage-based broadcasting contents using recommend information received via communication or viewing/utilization of contents by clicking links in e-mail or browser for terminal (media scheme), scheduled storage/viewing, and transfer to EPG/ECG, multimedia broadcasting aims for a smooth transition to contents. Additionally, real-time broadcasting contents, storage-based broadcasting contents, browsers for terminal, and EPG/ECG can also be linked mutually.

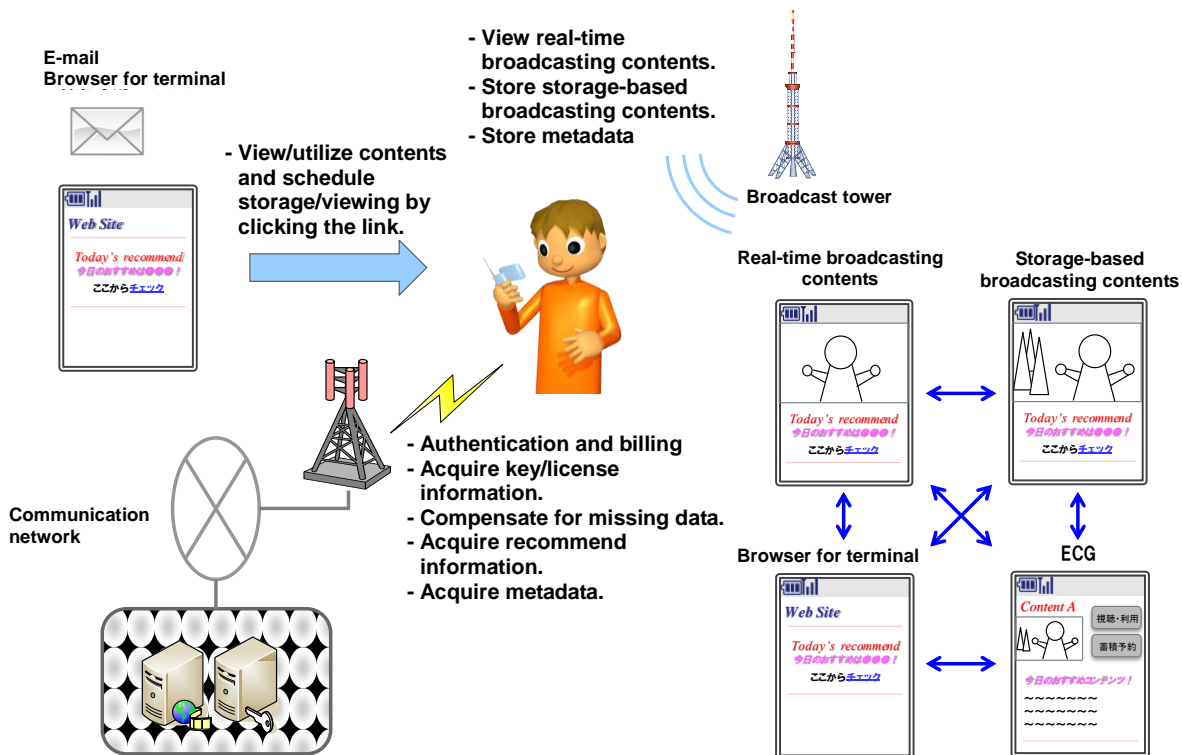


Fig. 15-1 Service image