ENGLISH TRANSLATION

CONDITIONAL ACCESS SYSTEM SPECIFICATIONS

FOR DIGITAL BROADCASTING

ARIB STANDARD

ARIB STD-B25   Version 6.7

Association of Radio Industries and Businesses

General Notes to the English Translation of ARIB

Standards and Technical Reports

1. Notes on Copyright

- The copyright of this document is ascribed to the Association of Radio Industries and Businesses (ARIB).

- All rights reserved. No part of this document may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without the prior written permission of ARIB.

2. Notes on English Translation

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

- ARIB Standards and Technical Reports, in the original language, are made publicly available through web posting. The original document of this translation may have been further revised and therefore users are encouraged to check the latest version at an appropriate page under the following URL: 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 Standards 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 Standard is developed for "Conditional Access System Specifications for Digital 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 Standard will be widely used by radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

NOTE:

Although this ARIB Standard contains no specific reference to any Essential Industrial Property Rights relating thereto, the holders of such Essential Industrial Property Rights state to the effect that the rights listed in the Attachment 1 and 2, which are the Industrial Property Rights relating to this standard, are held by the parties also listed therein, and that to the users of this standard, in the case of Attachment 1, such holders shall not assert any rights and shall unconditionally grant a license to practice such Industrial Property Rights contained therein, and in the case of Attachment 2, the holders shall grant, under reasonable terms and conditions, a non-exclusive and non-discriminatory license to practice the Industrial Property Rights contained therein. However, this does not apply to anyone who uses this ARIB Standard and also owns and lays claim to any other Essential Industrial Property Rights of which is covered in whole or part in the contents of the provisions of this ARIB Standard.

Attachment 1 (selection of option 1)

  (N/A)

Attachment 2 (Selection of option 2)

Patent applicant	Title of the invention	Application/Patent No.	Remarks
Nippon Hoso Kyokai (NHK)	Broadcasting System	JP Application H3-141770 JP Kokai H4-365227 JP 3103617	Japan
	Data Broadcast System	JP Application H2-221796 JP Kokai H4-104559 JP 3068634	Japan
Matsushita Electric Industrial Co., Ltd.	Broadcast Receiver	JP Application H10-098217 JP Kokai H11-284976	Japan
	Broadcasting System and Data Communication Method from Receiver	JP Application H10-253323 JP Kokai 2000-69108	Japan
	Message Transmission Method in Broadcast System	JP Application H10-313928 JP Kokai 2000-125272	Japan
	Message Transmission Method in Broadcast System	JP Application H10-316999 JP Kokai 2000-134666(134166)	Japan
	Comprehensive confirmation submitted for ARIB STD-B25 Version 5.0 (*6).		
Victor Company of Japan Ltd.	Reproduction Protection Method and Protection Reproducing Apparatus (*1)	JP 2853727	Japan, USA, Germany, UK, France, Korea, India, China
	Information Recording Method and Information Recording Medium (*1)	JP 3102416	Japan
Hitachi Ltd. Hitachi Control Systems Ltd.	Enciphering Method (*2)	JP Application S63-103919	Japan, USA
	Enciphering Method and Decoding Device (*2)	JP Application H9-329841	Japan, USA
	Encoding and Decoding Device (*2)	JP Application H 9-329842	Japan, USA
Toshiba Corp.	Satellite Broadcast Reception System (*3)	JP 2941398	Japan
	Broadcast Receiver and Contract Management System (*5)	JP Kokai H11-243536	Japan, USA
	Comprehensive confirmation submitted for ARIB STD-B25 Version 5.0 (*6).		
Nippon Hoso Kyokai (NHK)	Contents Transmitting Device, Contents Receiving Device, Contents Transmitting programe and Contents Receiving Program (*4)	JP 2001-307559	Japan, USA, Germany, UK, France

	Contents Utilization Control Transmitting Method, Contents Utilization Control Receiving Method, Contents Utilization Control Transmitting Device, Contents Utilization control receiving Device, Contents Utilization Control Transmitting Program, and Contents Utilization Control Receiving Program (*4).	JP 2001-349539	Japan, USA, Germany, UK, France
Motorola Inc.	A comprehensive confirmation form has been submitted with regard to ARIB STD-B25 Ver.4.0. (*4).		
QUALCOMM Incorporated	Submitted comprehensive confirmation of patents for ARIB STD-B25 Version 6.0 (*7)		
QUALCOMM Incorporated	Apparatus and method for installing a decryption key (*8)	JP4597513	US7,203,319; BR; CN; EP; HK; IN; KR; MX
	System and method for controlling broadcast multimedia using plural wireless network connections (*8)	JP2006523386	JP; JP; US7,925,203; US201101436 53; BR; CN; EP; HK; IL; IN; KR; MX
	Apparatus and methods for securing architectures in wireless networks (*8)	JP2009-515251	US200701909 77; CN; EP; HK; IN; KR; KR; TW
Sony Corporation	Submitted comprehensive confirmation of patents for ARIB STD-B25 Version 6.4 (*9)		
Fujitsu Ltd.	Communications System and Communications Methods (*10)	JP4603570 JP Application 2007-228363	JP
	Receiver and Method performed by it (*11)	JP4791521 JP Application 2008-312279	JP
	Communications System (*12)	JP4791583 JP Application 2010-073798	JP

(*1) Applicable from Version 1.3 (Submitted: March 15, 2001)
(*2) Transferred from ARIB STD-B20 at the time of revision for ARIB STD-B25 Version 3.0.
(*3) Applicable from Version 3.0 (Submitted: May 21, 2001)
(*4) Applicable to the revised part of Version 4.0
(*5) Applicable to the revised part (Chapter 6, Part 1) of Version 4.1
(*6) Applicable to the revised parts of Version 5.0. (Received March 7, 2007)
(*7) Applicable to the revised parts of Version 6.0. (Received on March 18, 2011)
(*8) Applicable to the revised parts of Version 6.0. (Received on October 7, 2011)
(*9) Applicable to the revised parts of Version 6.4. (Received on July 24, 2014)
(*10) Applicable to the revised parts of Version 5.1. (Received on October 19, 2018)

(*11) Applicable to the revised parts of Version 6.0. (Received on October 19, 2018)
(*12) Applicable to the revised parts of Version 6.0. (Received on October 19, 2018)

Contents

Foreword

Part 1

Reception Control System
(Conditional Access System)

Part 1 Contents

Chapter 1 General Matters

1.1 Purpose

This standard addresses an access control system for use in digital broadcasting, defining scrambling and associated information specifications as well as related reception specifications for a system that provides control during signal reception ("conditional access system").

1.2 Scope

This standard applies to standard television broadcasts, high-definition television broadcasts, VHF broadcasts, and data broadcasts by satellites basic broadcasting stations in the frequency band of 11.7 GHz to 12.2 GHz ("BS digital broadcasts"); digital 34.5 MHz bandwidth standard television broadcasts, high-definition television broadcasts, VHF broadcasts, and data broadcasts by satellites basic broadcasting stations operating in the frequency band of 12.2 GHz to 12.75 GHz ("wide-area CS digital broadcasts"); digital and high-definition standard television broadcasts by terrestrial basic broadcasting stations ("terrestrial digital television broadcasts"); digital VHF broadcasts by broadcasting stations ("digital terrestrial audio broadcasts").

This standard generally assumes the use of a receiver with a low-speed CA interface.

For information about the applicability of this standard to digital broadcasts utilizing high-capacity storage functionality and to other media and reception formats, see Part 2 and Part 1 Chapter 5, respectively.

The following terminology substitutions apply when applying the provisions of this standard to digital terrestrial audio broadcasts:

View (Viewer) → Listen (Listener)
Preview → Sample
PPV (Pay Per View) → PPL (Pay Per Listen)
Display → Display (including audio presentations)
Recoding → Audio Recoding

1.3 References
1.3.1 Normative References
The following documents are documents in which some of the items specified in the document are referred to or cited as part of the standard in this standard.

> (1) Ordinance of the Ministry of Internal Affairs and Communications: "Standard transmission system for digital broadcasting among standard television broadcasting and the like" (No.87, 2011)
>
> (2) Notification of the Ministry of Internal Affairs and Communications: "On defining the information especially notified by the Minister for Internal Affairs and Communications among associated information" (No.298, 2011)
>
> (3) Notification of the Ministry of Internal Affairs and Communications: "On defining the configuration of the associated information and the procedure of transmission, the procedure of transmitting PES packet, section format, TS packet, IP packet, ULE packet, MMTP packet, compressed IP packet and TLV packet, the configuration of transmission control signal and identifier and the configuration of emergency information descriptor and emergency warning broadcasting message" (No.233, 2014)
>
> (4) Notification of the Ministry of Internal Affairs and Communications: "On defining the system for scrambling" (No.235, 2014. Hereinafter referred to as "Notification")

1.3.2 Informative References
> (1) Telecommunications Technology Council Inquiry Report No. 17
>
> (2) Telecommunications Technology Council Inquiry Report No. 74
>
> (3) Information and Communications Council Inquiry Report 2003
>
> (4) ARIB STD-B1 "Digital Receiver For Digital Satellite Broadcasting" Standard
>
> (5) ARIB STD-B10 "Service Information for Digital Broadcasting System" Standard
>
> (6) ARIB STD-B16 "Standard Digital Receiver Commonly Used for Digital Satellite Broadcasting Services Using Communication Satellite" Standard
>
> (7) ARIB STD-B20 "Transmission System for Digital Satellite Broadcasting" Standard
>
> (8) ARIB STD-B21 "Receiver for Digital Broadcasting" Standard
>
> (9) ARIB STD-B24 "Data Coding and Transmission Specification for Digital Broadcasting" Standard
>
> (10) ARIB STD-B29 "Transmission System For Digital Terrestrial Sound Broadcasting" Standard
>
> (11) ARIB STD-B30 "Receiver For Digital Terrestrial Sound Broadcasting" Standard
>
> (12) ARIB STD-B31 "Transmission System for Digital Terrestrial Television Broadcasting" Standard
>
> (13) ARIB STD-B32 "Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting" Standard
>
> (14) ARIB STD-B38 "Coding, Transmission and Storage Specification for Broadcasting System Based on Home Servers" Standard

(15)   ISO 7816-1: 1987
ISO 7816-2: 1988
ISO 7816-3: 1997
ISO 7816-4: 1995

(16)   ETSI TS 100 977 V8.14.0 (2007-06): "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) Interface (3GPP TS 11.11 version 8.14.0 Release 1999)"

1.4 Terminology and Abbreviations

CAI	Conditional Access Interface
CAS	Conditional Access System
CAS-R	Conditional Access System for Reception
CGMS	Copy Generation Management System
DIRD	Digital Integrated Receiver Decoder
ECM	Entitlement Control Message
EMM	Entitlement Management Message
IPPV	Impulse Pay Per View
PID	Packet Identifier
PPL	Pay Per Listening
PSI	Program Specific Information
SI	Service Information
TS	Transport Stream

Chapter 2 Functional Specification

2.1 Scrambling and Associated Information specifications

2.1.1 Overall Functionality

    (1) Contract Scope

        The system can be expanded in stages and is capable of providing customer management functions for a maximum number of households defined by 100% membership.

    (2) System lifetime

        The system can be managed by supporting applicable broadcast media.

    (3) Security

        The system offers advanced security functionality and can take measures in the event of a security breach.

    (4) Operation of multiple conditional access systems

        The system can execute parallel operation of multiple conditional access systems. The system can execute parallel operation with the content protection system specified in Part 3. The system can execute parallel operation with new access control system in the future.

2.1.2 Broadcast Service Formats

2.1.2.1 Supported Digital Broadcast Service Formats

    This standard can be applied to the following service formats:

    (1) Broadcast service consisting of video and audio program in the transmission frequency band (Service channels); for example:

        a. Standard television broadcasts (MP@ML, etc.)

        b. High-definition television broadcasts (MP@HL)

        c. VHF broadcasts

        d. Data broadcasts

            Data broadcasts use a dual billing structure consisting of stream (channel) and file (content) billing. The conditional access system (CAS-R) described in Part 1 of this standard addresses stream services. For file services, see Part 2.

    (2) Integrated digital broadcasts that combine a variety of information including video, audio, and data in a flexible format.

        (ISDB; Integrated Services Digital Broadcasting)

    (3) Reception formats

        a. Realtime reception

        b. Stored reception (non-realtime reception)

            The conditional access system described in Part 1 of this standard addresses the

storage of data following descrambling. For storage of data in scrambled form, see Part 2.

c. Recorded reception (including reserved reception)

Must comply with standards for digital interface functionality used in receivers, in order to manage copy protection issues.

2.1.2.2 Compatibility with Multiple Broadcast Media Types

The system shows consideration of the need to be expandable for integrated operation with a variety of broadcast media.

2.1.3 Fee Structure

The system can be applied to the following fee structures.

2.1.3.1 Scrambled

(1) Flat/tier

    a. The system supports the following fee structures:

        i. Flat viewing by service channel

        ii. Service channel-defined tiers

        iii. Provider-defined tiers

        iv. Business entity-defined tiers

        (Available operating formats include Call Ahead PPV, PP Series, PP-Weekend, PP Season, etc.)

    b. Fees can be set by day, month, 6-month period, year, etc.

    c. Series purchases

    Multiple PPV programs can be grouped as series for viewing under tier contracts.

(2) Pay per view (Impulse PPV [IPPV])

    a. Pay-per-view by service channel and event.

        i. Preview: The system automatically enters preview mode when the user tunes into a PPV program that supports previewing.

        ii. Preview time: The system allows fixed preview times to be set, including a "no preview" setting, within the same channel, from the beginning of the program, or from the start of the program.

        iii. Purchase: Purchases require viewers to confirm their intention to purchase before the transaction is processed.

    b. Viewing data call-in function (support for IPPV where viewing-based charges are stored for later payment)

        i. Periodic call-in: The system can call in during a specified period of time, generally once per month.

ii. Call-in when viewing data full: System can automatically call in once a certain amount of viewing data has been stored.

iii. Forced call-in control: Forced call-ins can be initiated and stopped by ID.

iv. User call-in: Viewers can initiate call-ins by operating their receivers.

c. Setting recording fees

Separate fees can be set for recordable programs (recording fees), with support for the following capabilities:

i. General recording control refers to digital copy control descriptor in service information.

Descriptor symbol content defines application of "5C DTCP system" and other systems.

ii. Other copy protection functionality supports the trend toward standardization, including of receiver functionality.

(3) Free

The system provides a means of authorization of viewing and is separate from viewing fee transactions.

2.1.3.2 Unscrambled

(1) Free

2.1.3.3 Data Broadcast Billing System

(1) Billed targets

The system provides a means of billing at the TS level in the same way as video and audio (for stream-type data services) as well as a means of billing by file (for file-type data services: stored content). For data broadcasts, billing for these 2 services is treated separately. The conditional access system (CAS-R) described in Part 1 of this standard addresses stream services. For file services, see Part 2.

(2) Billing formats

a. Flat/tier

Fees are assessed by single program (event) and can be set for 1-month, 6-month, 1-year, and other time periods. The system can use either the same billing entity as television or a separate billing entity specifically for data broadcasts.

Example: Flat billing

Economic data, electronic newspapers, television guide magazines, electronic publications, weather forecasts, software distribution, website collections

Example: Tier billing

Applications where billing targets more detailed information or the display of data in easier-to-view formats.

b. PPV (Pay Per View) support

The system supports Impulse PPV (IPPV). This billing method requires a user

agreement accepting "on-demand" purchasing by single program (event).

Example: Sales of single copy of newspaper, software and database distribution.

2.1.4 Fee Payment Systems

The system supports the following fee payment systems:

(1) Payment at time of contract

For flat and tier billing formats, payment is at time of contract.

(2) Viewing-based payment (pay later): Supports IPPV.

(3) Lump sum payment (pay first): Supports IPPV with prepaid card or similar.

Note: This standard does not define the prepaid card interface.

2.1.5 Contract Formats

The system supports implementation of the following contract formats.

2.1.5.1 Contracting Entity

Contracts are made by business entities.

2.1.5.2 Contracts can be made based on the selection of the desired individual fee structure or of a combination thereof.

(1) Flat/tier billing contract by business entity.

(2) PPV billing contract by business entity.

(3) Integrated flat/tier and PPV billing contract by business entity.

When multiple providers are involved in a joint operation as a single business entity and integrated into single EMMs, the system supports contracts between viewers and providers on the operational level, for example by distinguishing between providers based on the allocation of tier flags inside EMMs.

For flat/tier billing, the system also supports package contracts.

2.1.6 Collection of Viewing Log

The system also enables the following functionality and operations by means of terminal power-on call-in control and a separately defined viewing log collection network protocol.

(1) The system supports the following viewing log collection operations:

a. Viewing log from terminal is collected in the central station.

b. Collected viewing log is distributed in a secure way to individual business entities and to their respective customer databases.

c. Viewing log is collected from terminals by means of the public telephone network, cellular telephones, or PHS telephones (unless it is necessary to distinguish among these alternatives, they are collectively referred to as the "public network").

(2) The system provides the following functionality required for implementing call-ins to the viewing log collection center.
  a. Support for specifying regular call-in dates and times for individual IC cards using EMMs.
  b. Support for issuing forced call-in instructions to individual IC cards using EMMs.
  c. Support for call-ins when memory available for storing viewing log falls below a certain point.
  d. Support for ability of viewers to initiate call-ins by operating their receivers.

(3) The system provides the following functionality required for uploading viewing log to the Viewing Log Collection Center.
  a. Authentication of the receiver's IC card by the Viewing Log Collection Center.
  b. Authentication of the Viewing Log Collection Center by the receiver's IC card.
  c. Encryption and transfer of viewing Log to the Viewing log Collection Center.
  d. Distribution of viewing log by the Viewing Log Center to the appropriate business entities.

2.1.7 EMM Transmission

The system can send EMMs from individual providers and business entities and supports the following operations:

(1) Individual provider delivery: For individual operation (single business entity consisting of a single provider), EMMs are sent using only the provider's own channels.

(2) Joint provider delivery: For joint operation (single business entity consisting of multiple providers), the same EMM is delivered using all channels operated by providers participating in the business entity.

(3) Mixed operation: A mix of individual and integrated delivery.

(4) EMM transmission by specific channel:
Related digital broadcast EMMs are collected and delivered on a specific channel in order to improve transmission efficiency. Under this approach, EMMs sent in batches such as those for contract renewal are sent on a specific channel, while EMMs sent online by Customer Center operators and other personnel are sent using individual provider's channels.

(5) When operating multiple conditional access systems, EMMs corresponding to each conditional access system are sent.

2.1.8 ECM Transmission

Although ECMs can be delivered at a minimum interval of 100 ms, this value only defines the minimum time between ECM transmissions. The standard leaves room for the interval and transmission capacity to be balanced in light of service content.

When operating multiple conditional access systems, ECMs corresponding to each

conditional access system are sent.

2.1.9 Program Operation Management System

Scrambling and ECM delivery can be performed according to the program schedule. Program operation management is performed within individual provider's organizations (by their program delivery personnel).

2.1.10 Security Functionality

2.1.10.1 Associated Information Encryption

(1) Encryption system

The encryption system uses three layer architecture with DES-equivalent or more and private keys. From the point of view of implementation, it is desirable to be able to process with the CPU for IC card.

(2) Administration functionality

system provides support for dealing with piracy, for example by changing the encryption protocol.

2.1.11 Previewing

(1) Viewers can preview a PPV program for a fixed amount of time from the start of the program, after which the preview is no longer available. It is possible to disable previewing at the climax of the program. It is also possible to allow previewing up to the end of the program by not setting an area where previewing is prohibited.

(2) A cumulative preview time limit is defined for PPV programs, and the program can be viewed within the preview period described above until this cumulative time is reached. Time spent viewing other channels and periods during which the receiver is turned off do not count toward this cumulative preview time.

Section 7 of Reference 1, "Explanation of the Conditional Access System," includes an example of preview operation.

2.1.12 Repeat Broadcast Billing Control

When broadcasting a program with the same content on the same channel or multiple channels more than once, the system can be controlled so that all showings can be viewed with a single billing (purchase).

Section 8 of Reference 1, "Explanation of the Conditional Access System," includes an example of repeat broadcast billing control.

2.2 Receiver Specifications

2.2.1 IC Card

(1) Card ID

IC cards have a unique ID number (called the card ID). Although the decoder (digital

broadcast receiver) may also be assigned a unique ID (the decoder ID), control under these CAS-R specifications is performed by transferring the card ID to the decoder. The decoder ID is not used.

When changing cards, the new card is enabled after the old card has been disabled. Although it is desirable that this switch be accomplished in as short a time as possible, security considerations make it necessary to perform processing to permanently invalidate the old card. For this reason, card IDs are refreshed without sharing numbers.

(2) Support for contracts with multiple receivers
    a. Store multiple card IDs and Km areas on <u>IC cards</u>.
    b. Use the card ID for each card's first Km area as its standalone ID (called the individual card ID).
    c. Use second and subsequent card IDs to store IDs originating in applications from within the same group. These card IDs, which are shared within a group, are called group IDs.

(3) Mutual authentication system
When using the CAS module card to eliminate receivers that do not respond to rights protection information in applications using this conditional access system as a rights protection technology for digital broadcasting, a system is provided for mutual authentication between this card and the receiver<u>.</u>

2.2.2 Receiver

For more detailed information about the following specifications, see also Reference 2, "Explanation of the Receiver Functional Specification."

2.2.2.1 Power Saving
- The receiver minimizes power consumption in the standby state when the user has turned off the sub power supply by controlling the power supplies for different receiver circuits separately.

2.2.2.2 Timer
- The receiver counts up the date and time and uses broadcast signals to correct this information for use in power-on control, power-on call-in control,<u> </u>and other functionality.

2.2.2.3 Basic User Input and Display
- The receiver provides basic key input functionality using a remote control or similar means in order to facilitate channel selection, configuration of system settings, display of messages, and other functions. Characters can be displayed on the screen in full-screen and superimpose modes.

- Automatic display messages are shown in superimpose mode.
- A LED or similar lamp illuminates during power-on control and while the receiver is communicating with the center.

2.2.2.4 Descrambler

- The receiver descrambles transport stream packets using the MULTI2 system.

2.2.2.5 IC Card Communications Control

- The receiver monitors the IC card state and sends and receives CA-related commands and responses to and from the card based on the ISO 7816 T=1 protocol and technical specifications.

2.2.2.6 Basic Communications with Modem or Similar Device

- The receiver provides a modem, cellular telephone data communications data adapter, or PHS data communications adapter (unless it is necessary to distinguish among these alternatives, they are collectively referred to as "modem or similar device") for communicating with the Viewing log Collection Center and DIRD Data Collection Center via telephone lines.
- During communications with the Viewing log Collection Center and DIRD Data Collection Center, the receiver operates upper layer protocol for the modem or similar device.

2.2.2.7 Transmission of Viewing History Information

- When it receives a call-in request from the IC card, the receiver connects to the Viewing log Collection Center and sends PPV viewing log information from the IC card to the center.

2.2.2.8 Power-on Call-in Control

- The receiver accepts call-in requests from the IC card at the call-in date and time specified by the card by detecting that date and time. If the receiver is in the standby state at that time, the receiver powers on the circuits required for telephone communications and starts up the IC card.

2.2.2.9 Transmission of DIRD Data

- As an extended receiver function for applications with two-way functionality, the receiver can connect to the DIRD Data Collection Center via the IC card and transmit DIRD data.

2.2.2.10 ECM Reception

- When an ECM is found to exist while referencing PMT information, the receiver receives the ECM, sends it to the IC card, and performs processing and descrambling control according to the IC card's response.

- When implementing the mutual authentication system described in 2.2.1 (3), the receiver encrypts the descrambling key Ks that is output from the IC card to the receiver based on confidential information shared between the IC card and the receiver during the authentication process.

2.2.2.11 Reception of EMMs and EMM Messages

- The receiver reads individual card ID and group IDs from the IC card and filters EMMs and EMM messages using multiple IDs.

- A single section contains multiple EMMs, which the receiver filters using multiple IDs and table_ID data. The receiver sends EMMs to the IC card.

- A single section contains 1 EMM common messages or multiple EMM individual messages, which the receiver filters using multiple IDs and table_ID data. The receiver additionally references table_ID_extension data and differentiates between EMM common messages and EMM individual messages.

- The receiver transfers received EMM individual messages to the IC card or stores them as DIRD data, depending on the control information they contain.

- When an EMM common message (IC card storage message) is received by a receiver with stored reception functionality, that EMM common messages and the CAT contained by the TS being received is included in the signal stored on the receiver. Any EMMs or EMM individual messages contained in signals being played on receivers that have stored reception functionality are ignored.

2.2.2.12 Power-on Control

- When the sub power supply is off during a power-on control period as specified by the IC card, at a minimum circuit whose operation is required for EMM reception is powered on at the specified time. The receiver then selects the transport stream corresponding to the specified network ID and receives EMMs.

- In the event that redundant power-on control is specified for multiple business entities, the receiver can be controlled so that all EMM reception proceed in the same way.

2.2.2.13 Specific Channel Reception Control

- When a specific channel is designated by the NIT, the sub power supply is powered on at the specified time if off. The receiver then selects the specified transport stream for the specific channel and receives EMMs.

2.2.2.14 EMM Message Control

- The receiver can display automatic display messages on the screen during program viewing (including when a receiver with stored reception functionality is playing a received signal).
- The receiver provides functionality so that users can select, display, and manage mail.

2.2.2.15 Program Selection and Viewing

- The receiver can display unscrambled free program, scrambled free program, pay program requiring a flat/tier contract, pay program requiring a PPV contract, and pay program requiring a flat/tier contract or PPV contract by selecting the program from PSI/SI, selecting the corresponding transport stream, and referencing the scrambling control and ECM using the IC card.
- Unscrambled program can be selected and viewed regardless of the IC card.
- The receiver can link if a no-contract response is received from the IC card when attempting to view a pay program for which the PSI/SI specifies a link to an alternate CA service.
- The receiver can preview and invite the viewer to purchase PPV pay program depending on responses from the IC card.
- The receiver implements copy control based on recording control information from the IC card and PSI/SI.
  Note: This standard does not address copy control.

2.2.2.16 Program Reservations

- The receiver can reserve program based on information from SI.
- The receiver can determine whether a reserved program can be viewed by providing SI contract verification information to the IC card and judging whether the appropriate contract is in place.

2.2.2.17 EMM-based Receiver Control

- The receiver can erase passwords based on instructions from the IC card when password erasure control is implemented by EMM.

2.2.2.18 Parental Control

- The receiver compares each program's parental level as obtained from PSI/SI with the set parental level and restricts viewing by requiring the entry of a password.

2.2.2.19 Display of Card Information

- Based on user operation, the receiver can obtain and display card information, the card identifier, and the card ID from the IC card.
- The card identifier consists of 1 ASCII character and 3 decimal digits.

- The card ID consists of the ID identifier (a decimal digit), the ID (14 decimal digits), and a check code (5 decimal digits) and is displayed as a total of 20 digits separated into 5 blocks of 4 digits each.
- When applicable, the group ID is displayed in the same way as the card ID.

2.2.2.20 Control to Limit PPV Monthly Purchases

- The receiver allows a monthly PPV program purchase limit to be set and calculates a running total of purchases. If a comparison of the set limit and total purchases indicates that the limit has been exceeded, the receiver performs PPV program purchase control by requiring entry of a password.

2.2.2.21 Control to Limit Single-program PPV Purchases

- A single-program PPV purchase limit can be set. If a comparison of the set limit and the PPV program fee at the time of purchase indicates that the limit would be exceeded, the receiver performs PPV program purchase control by requiring entry of a password.

2.2.2.22 Recording and Display of Purchased PPV Programs

- The receiver stores content, date, fee, and other information for purchased PPV programs and displays recorded purchased PPV content based on user operation.

2.2.2.23 Telephone Line Connection Test

- The receiver can verify whether the telephone line is connected to the public network and display the results of that test based on user operation.

2.2.2.24 Display of Error History

- The receiver logs and can display a history of errors experienced when communicating with the IC card, communicating with the center, reserving and viewing program, etc.

2.2.25 System Settings

- A parental level can be set to allow parental control of children's viewing.
- Passwords for parental control and PPV program purchase limits can be set, changed, and deleted.
- The telephone line can be selected and configured.
- A PPV monthly purchase limit can be set.
- A PPV single-program purchase limit can be set.

2.2.2.26 Screen Display

The receiver provides functionality that is equivalent to applications providing subtitle service processing.

2.2.2.27 Copy Control

The receiver can implement copy control based on instructions from the system.

2.2.2.28 Display at Power-on

The receiver displays a message at power-on and when the viewer has selected a service for which the DIRD requires the IC card.

2.2.2.29 Display of Retry Timeout Messages

When a retry timeout message has been set by an IC card instruction from the IC card, the receiver displays a message indicating that it is unable to communicate over the telephone line.

2.2.2.30 User Call-in Requests

The viewer can initiate a call-in from the IC card to the Viewing log Collection Center by displaying the operation menu and selecting the appropriate command.

Chapter 3 Technical Specifications for Scrambling and Associated Information

3.1 Scrambling Subsystem

3.1.1 Scrambling Method

The system uses the following method to scramble content when it is necessary to protect rights associated with the broadcasting program, for example when broadcasting pay program (scrambling refers to an electric process applied to a signal to make it unintelligible except by receivers owned by domestic viewers or receivers that protect rights associated with the broadcasting program).

Specifically, the scrambling procedure is as shown in Section 3.1.2 and consists of a combination of the following 2 electric processes:

1) For 64-bit encoded sequences, the original encoding is replaced with another binary code string using 64- and 256-bit variables.

2) For code strings of less than 64 bits, the method described in 1) is used to generate a series of pseudo-random encoded sequences, which are combined to create the scrambled signal.

Figure 3-1 provides an overview of a typical conditional access system.

Figure 3-1 Conditional Access System

3.1.2 Scrambling Procedure

64-bit key

CBC mode

MULTI2
Cipher

Block length = 8

reg

Unencrypted TS data

Encrypted TS data

MULTI2
Cipher

Block length ≠ 8

reg

OFB mode

Notes
1. The MULTI2 cipher is described in section 3.1.3 and 3.1.4
2. (reg) indicates a register
3. ⊕ indicates an exclusive OR operation

(Notification Annexed Table 1)

3.1.3 MULTI2 Cipher

Key schedule

Data key (D_K) (64-bit)

System key (S_K)
(256-bit)

π_1

Expanded key (W_K)

(256-bit)

$S1$ → π_2

a_1 w_1

$S2$
$S3$ → π_3 w_2

a_2 w_3

$S4$ → π_4

a_3 w_4

π_1

a_4

$S5$ → π_2

a_5 w_5

$S6$
$S7$ → π_3 w_6

a_6 w_7

$S8$ → π_4

a_7 w_8

π_1

a_8

Encryption

Plaintext (P) (64-bit)

π_1 N=1

π_2 N=2

π_3 N=3

π_4 N=4

π_1 N=5

π_2 N=6

π_3 N=7

π_4 N=8

π_4

Ciphertext (C) (64-bit)

$S_K = s_1 \mathbin{/\!/} s_2 \mathbin{/\!/} \cdots \mathbin{/\!/} s_8$
$a_1 = \pi_{2s_1} \cdot \pi_1(D_K)$
$w_1 = a_1[\text{left}]$
$a_2 = \pi_{3s_2,s_3}(a_1)$
$w_2 = a_2[\text{right}]$
$a_3 = \pi_{4s_4}(a_2)$
$w_3 = a_3[\text{left}]$
$a_4 = \pi_1(a_3)$
$w_4 = a_4[\text{right}]$
$a_5 = \pi_{2s_5}(a_4)$
$w_5 = a_5[\text{left}]$
$a_6 = \pi_{3s_6,s_7}(a_5)$
$w_6 = a_6[\text{right}]$
$a_7 = \pi_{4s_8}(a_6)$
$w_7 = a_7[\text{left}]$
$a_8 = \pi_1(a_7)$
$w_8 = a_8[\text{right}]$
$W_K = w_1 \mathbin{/\!/} w_2 \mathbin{/\!/} \cdots \mathbin{/\!/} w_8$

$W_K = w_1 \mathbin{/\!/} w_2 \mathbin{/\!/} \cdots \mathbin{/\!/} w_8$
$N = 8m + \alpha (0 \leqq \alpha \leqq 7)$
$f_{WK} = \pi_{4W_8} \cdot \pi_{3W_6,W_7} \cdot \pi_{2W_5} \cdot \pi_1 \cdot \pi_{4W_4} \cdot \pi_{3W_2,W_3} \cdot \pi_{2W_1} \cdot \pi_1$
$F_{WK} = f_{WK} \cdot f_{WK} \cdot \cdots \cdot f_{WK}$
Function fwk is repeated m times.
When $\alpha = 0$,
$C = F_{WK}(P)$
When $\alpha = 1$,
$C = \pi_1 \cdot F_{WK}(P)$
When $\alpha = 2$,
$C = \pi_{2W_1} \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 3$,
$C = \pi_{3W_2,W_3} \cdot \pi_{2W_1} \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 4$,
$C = \pi_{4W_4} \cdot \pi_{3W_2,W_3} \cdot \pi_{2W_1} \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 5$,
$C = \pi_1 \cdot \pi_{4W_4} \cdot \pi_{3W_2,W_3} \cdot \pi_{2W_1} \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 6$,
$C = \pi_{2W_5} \cdot \pi_1 \cdot \pi_{4W_4} \cdot \pi_{3W_2,W_3} \cdot \pi_{2W_1} \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 7$,
$C = \pi_{3W_6,W_7} \cdot \pi_{2W_5} \cdot \pi_1 \cdot \pi_{4W_4} \cdot \pi_{3W_2,W_3} \cdot \pi_{2W_1} \cdot \pi_1 \cdot F_{WK}(P)$

Notes
1. π_1 to π_4 are elementary functions and are described in Section 3.1.4.
2. N represents the cipher stage.
3. // indicates a block concatenation.
4. $a_x[\text{left}]$ represents the leftmost 32 bits of block a_x.
5. $a_x[\text{right}]$ represents the rightmost 32 bits of block a_x.

(Notifications, Annexed Table 1, Appendix 1)

3.1.4 Elementary Encryption Function

π_1

32-bit   32-bit

$\pi_1(T) = T[\text{left}] \, /\!/ \, (T[\text{left}] \oplus T[\text{right}])$

π_2

32-bit   32-bit

k_1

$x+k_1$

32-bit

y

$\text{Rot}_1(y)+y-1$

z

$\text{Rot}_4(z) \oplus z$

$x = T[\text{right}]$
$y = x+k_1$
$z = \text{Rot}_1(y)+y-1$
$\pi_2 k_1(T) = (T[\text{left}] \oplus (\text{Rot}_4(z) \oplus z)) \, /\!/ \, T[\text{right}]$

π_3

32-bit   32-bit

x

k_2

$x+k_2$

32-bit

y

$\text{Rot}_2(y)+y+1$

z

$\text{Rot}_8(z) \oplus z$

a

k_3

$a+k_3$

32-bit

b

$\text{Rot}_1(b)-b$

c

$\text{Rot}_{16}(c) \oplus (c \vee x)$

$x = T[\text{left}]$
$y = x+k_2$
$z = \text{Rot}_2(y)+y+1$
$a = \text{Rot}_8(z) \oplus z$
$b = a+k_3$
$c = \text{Rot}_1(b)-b$
$\pi_3 k_2, k_3(T) = T[\text{left}] \, /\!/ \, (T[\text{right}] \oplus (\text{Rot}_{16}(c) \oplus (c \vee x)))$

π_4

32-bit   32-bit

x

k_4

$x+k_4$

32-bit

y

$\text{Rot}_2(y)+y+1$

$x = T[\text{right}]$
$y = x+k_4$
$\pi_4 k_4(T) = (T[\text{left}] \oplus (\text{Rot}_2(y)+y+1)) \, /\!/ \, T[\text{right}]$

Notes
1. T represents elementary function input.
2. T[left] represents the leftmost 32 bits of block T.
3. T[right] represents the rightmost 32 bits of block T.
4. (+) indicates an exclusive OR operation.
5. + indicates an addition operation using a modulus of 2^{32}.
6. − indicates a subtraction operation using a modulus of 2^{32}.
7. Rot_s indicates a circular bit shift by s bits to the left.
8. V indicates a bitwise OR operation.
9. $/\!/$ indicates a block concatenation.

(Notifications, Annexed Table 1, Appendix 2)

3.1.5 Scrambling layer

Transport stream.

3.1.6 Scrambling Area

The area of the scrambling operation extends to the TS packet payload (excluding packets used to be PSI/SI and associated information).

3.1.7 Scrambling Unit

The scrambling is performed per a TS packet.

3.1.8 Period when the Same Key is Used

Minimum of 1 second per ECM.

3.2 Associated Information Subsystem
3.2.1 Types of Associated Information

Associated information includes ECMs (program and control information), EMMs (individual information), EMM common messages, and EMM individual messages.

Figure 3-2 provides an example flowchart depicting EMM/ECM reception and conditional access.
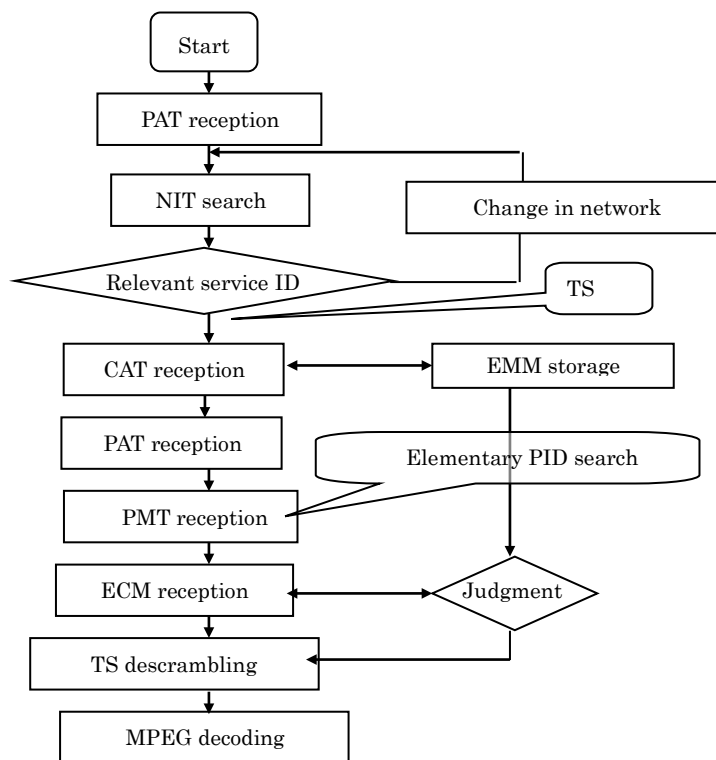
Figure 3-2 Example Flowchart Depicting EMM/ECM Reception and Conditional Access

3.2.2 Format of Associated Information

Broadcasters can select an integrated or independent format for individual information.

3.2.3 ECM

3.2.3.1 Basic ECM structure

(1) Each TS (transport stream) packet contains an ECM section.

Figure 3-3 illustrates the basic structure of the TS packet for ECM.

TS Packet (188Bytes)		
TS Header*	ECM Area	
	ECM Section	Stuffing
5		
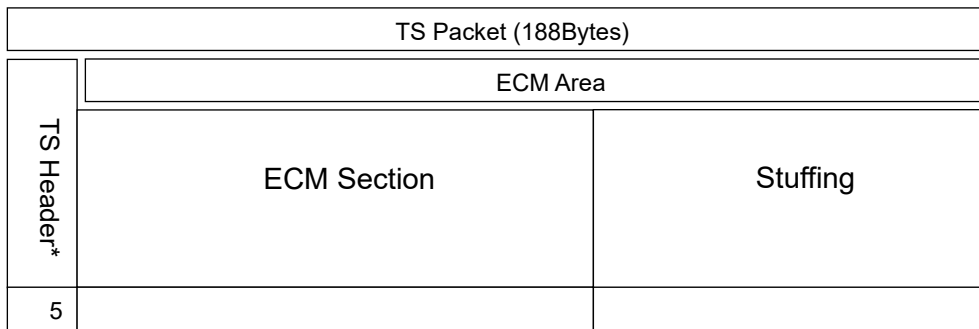
*Includes pointer field.

Figure 3-3 TS Packet Structure

(2) The following describes the ECM section and the basic structure of the ECM payload:

- The entire ECM section is subject to a section CRC.
- The ECM payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.
- Only necessary ECM function information is inserted into the variable part of the ECM.

Figure 3-4 illustrates the ECM Section Structure.

ECM Section				
ECM Section Header	ECM payload			Section CRC
	Unencrypted Part	Encrypted Part		
	ECM Fixed Part	ECM Variable Part	Tamper Detection	
8 Bytes	26 Bytes		4 Bytes or more	4 Bytes
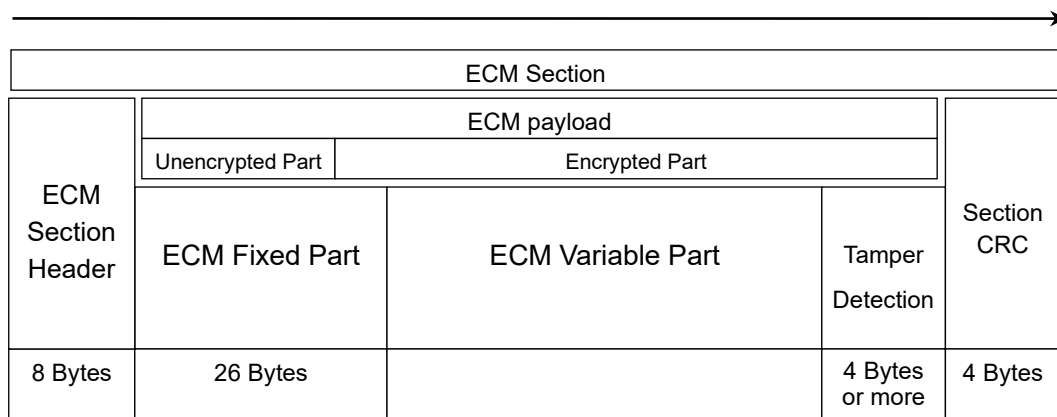
Figure 3-4 ECM Section Structure

3.2.3.2 ECM Details

　　　(1) ECM section structure

　　　Table 3-1 details the ECM Section Structure.

<div align="center">

Table 3-1 ECM Section Structure

</div>

Structure				Notes
ECM section	ECM payload	ECM section header (Table identifier 0x82)		8 Bytes
		Fixed part	Protocol number	1 Byte
			Broadcaster identifier	1 Byte
			Work key identifier	1 Byte
			Scrambling key (odd)	8 Bytes
			Scrambling key (even)	8 Bytes
			Program type	1 Byte
			Date/time (Date MJD + Time BCD)	5 Bytes
			Recording control	1 Byte
		Variable part		Capable of accommodating various functional information
		Tamper detection		4 Bytes or more
	Section CRC			4 Bytes

　　(2) ECM fixed part

　　1) Protocol number

　　　　Code that serves to process common information.

　　2) Broadcaster identifier

　　　　Code used to identify broadcaster groups in conditional access system operation.

　　　　Combined with the work key identifier, specifies individual information.

　　3) Work key identifier

　　　　Specifies the work key used to decrypt common information.

　　4) Scrambling key (odd/even)

　　　　Sends pair of scrambling keys including the current and next keys.

　　5) Program type

　　　　Indicates the viewing program type (free, tier, PPV, etc.).

　　6) Date/time

　　　　Indicates the current date/time to check authorization of viewing. Use MJD format as
　　　　described in ARIB STD-B10 Part 2 Appendix C.

　　7) Recording control

Indicate the recording conditions for the program in question (recordable, not recordable, recordable by subscribers only, etc.).

8) Tamper detection

Code used to detect tampering with the ECM payload.

(3) ECM variable part

The variable part of the ECM payload accommodates only necessary function information depending on the transmission objective of the associated common information. Functional information uses a descriptor format. Below is an example of function information:

1) Functional information related to tier authorization

Indicate the reference registration code for programs.

2) Functional information related to PPV

Indicates program attributes required to check an eligibility of viewing, the program number, the PPV viewing fee, and other information for programs.

3) Functional information related to erasure

Erases specific individual information from the specified IC card. Equivalent to the "control information" described in Telecommunications Technology Council Inquiry Report No. 17.

3.2.4 EMMs

3.2.4.1 EMM Overview

(1) The following describes the basic EMM structure:

- The EMM section can carry multiple payloads.
- The entire EMM section is subject to a CRC error detection.

(2) The following describes the basic structure of the EMM payload:

- The EMM payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.
- Only necessary EMM functional information is inserted into the variable part of the EMM.
- The card ID (6 bytes) and the associated information byte length (1 byte) are sent at the beginning of the EMM fixed part (unencrypted part). The receiver filters this area to identify EMM payloads addressed to itself.

(3) Figure 3-5 provides an example of the EMM section structure. (The figure shows a single EMM section with 3 EMM payloads.)
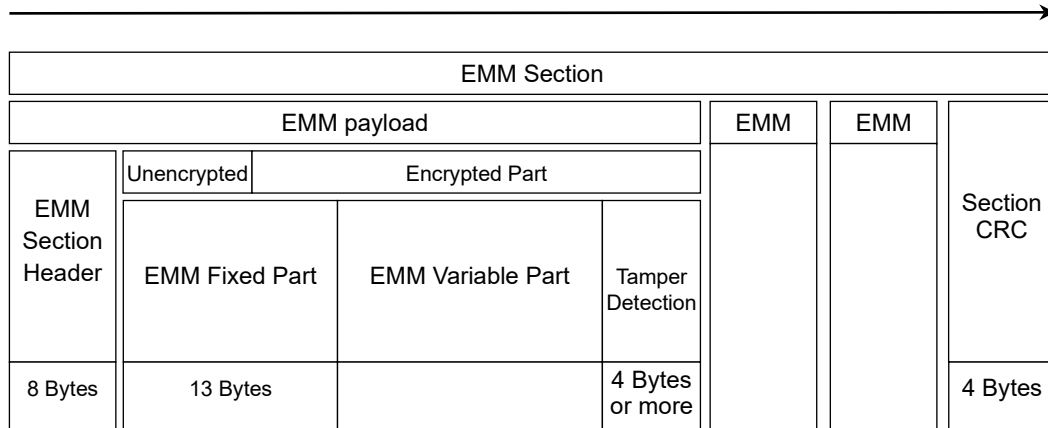
Figure 3-5 EMM Section Structure

3.2.4.2 EMM Details

(1) EMM section structure

Table 3-2 details the EMM Section Structure.

Table 3-2 EMM Section Structure

Structure				Notes
EMM section	EMM section header (Table identifier 0x84)			8 Bytes
	EMM payload 1	Fixed part	Card ID	6 Bytes
			Associated information byte length	1 Byte
			Protocol number	1 Byte
			Broadcaster identifier	1 Byte
			Update number	2 Bytes
			Expiration date	2 Bytes
		Variable part		Capable of accommodating various functional information
		Tamper detection		4 Bytes or more
	Payload 2	(Same as above)		
	Payload 3	(Same as above)		
	⋮	⋮		
	Payload n	(Same as above)		
	Section CRC			4 Bytes

(2) EMM fixed part

1) Card ID

- Number identifying the target IC card.
- Of the card ID's 6 bytes (48 bits), the upper N bits are used as the ID identifier, and the same ID identifier is used throughout the section.
- Specifically, the number of ID identifier bit N values is 3.

2) Associated information_byte length

Describes the byte length from the protocol number to the tamper detection field_and serves as an offset that points to the next card ID of EMM payload when sending multiple EMM payloads in a single section.

3) Protocol number

Code that serves to identify processing functions on the IC card, encryption algorithms, etc.

4) Broadcaster identifier

Code used to identify broadcaster groups in conditional access system operation.

5) Update number

Number that is increased when individual information is updated.

6) Expiration date

Expiry date of individual information.

7) Tamper detection

Code used to detect tampering with the EMM payload.

(3) Example EMM variable part

The variable part of the EMM payload accommodates only necessary function information depending on the transmission objective of the associated EMM. Functional information uses a descriptor format. Below is an example of function information:

1) Function information related to the work key

Sends the work key identifier and the work key.

2) Function information related to tiers

Sets information of authorization.

3) Functional information related to PPV settings

Sets PPV information of authorization. Also used to specify the next regular call-in date/time and other data.

4) Function information related to power-on control

Sets when to perform power-on control and other data used to lower power consumption.

5) Function information related to overall control

Performs control operations (password deletion, etc.) shared among all broadcaster groups with the decoder.

6) Functional information related to forced call-ins

Instruct the decoder to perform a forced call-in.

3.2.5 Message Information (EMM/ECM)

3.2.5.1 EMM Common Messages

(1) Basic structure of EMM Common Messages

EMM common messages are transmitted using the MPEG-2 system section format (EMM Message Section). The following describes the basic structure of the EMM Message Section:

- The entire EMM Message Section is subject to a CRC error detection.
- Each section is used to send a single message.
- Table_id_extension of the EMM Message Section header signifies the Fixed Message Sentence number and ranges from 0x0001 to 0xFFFF.
- EMM Common Message Sections are not encrypted.
- EMM Common Messages are sent by broadcaster groups.

Figure 3-6 illustrates the EMM Common Messages Section structure.
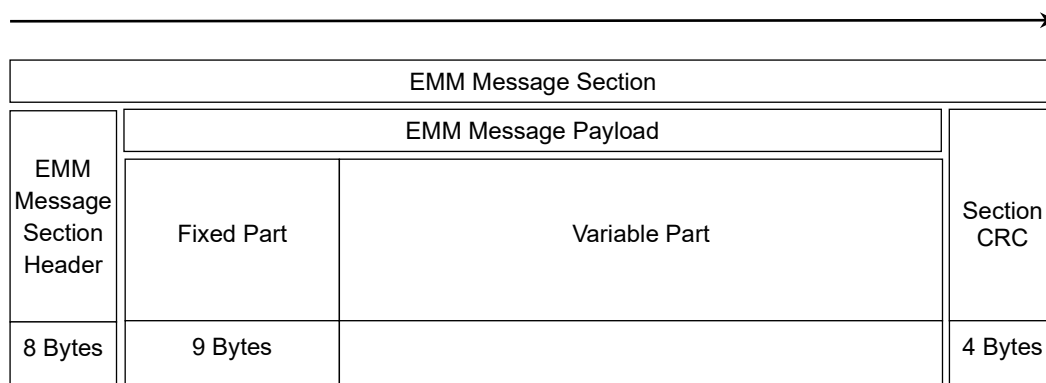
Figure 3-6 EMM Common Messages Section Structure

(2) EMM Common Messages Section Structure

Table 3-3 details the section structure of EMM Common Messages.

Table 3-3 EMM Common Messages Section Structure

Structure				Notes
EMM message section			EMM message section header	8 Bytes
	EMM message payload	Fixed part	Broadcaster identifier	1 Byte
			Kind of Automatic display deletion	1 Byte
			Automatic display duration time 1	1 Byte
			Automatic display duration time 2	1 Byte
			Automatic display duration time 3	1 Byte
			Number of times for Automatic display	1 Byte
			Format number	1 Byte
			Message length	2 Bytes
		Variable part	Message code payload	N Bytes
			CRC error detection	4 Bytes

(3) EMM Common Messages Section Details

Table 3-4 EMM Common Messages Section Details

Syntax	Description	No. of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	Fixed message sentence number (0x0001 to 0xFFFF)	16
reserved		2
version_number		5
current_next_indicator		1
section_number		8
last_section_number		8
ca_broadcaster_group_ID	Broadcaster identifier	8
deletion_status	Kind of Automatic display deletion	8
displaying_duration1	Automatic display duration time 1	8
displaying_duration2	Automatic display duration time 2	8
displaying_duration3	Automatic display duration time 3	8
displaying_cycle	Number of times for Automatic display	8
format_version	Format number	8
message_length	Message length	16
message_area	Message code payload	N
EMM_message_section_CRC	CRC error detection	32

(4) EMM Common Messages field details

The following provides more detailed information for principal EMM common message fields:

1) Fixed Message Sentence Number (table_id_extension)

Indicates the Fixed Message Sentence Number (0x0001 to 0xFFFF) being sent by the EMM common messages in question.

2) Broadcaster identifier

Code used to identify broadcaster groups in conditional access system operation.

3) Kind of Automatic Display deletion

- Indicates the following type for the display of messages stored on the IC card (automatic display messages):

    a. 0x00: Deletable; message can be deleted by viewer.

    b. 0x01: Not deletable; message cannot be deleted by viewer.

    c. 0x02: erase; indicates one of the following display control operations: (see note 1)

        i. When the deletion_status for the EMM common messages being

automatically displayed is 0x02, the automatic display message is not displayed.

ii. When the deletion_status for the EMM common messages currently being used for an automatic display in progress is updated to the value 0x02 (see note 2), display of that automatic display message is cancelled.

Note 1: The displaying_duration (1, 2, and 3), format_version, message length, displaying_cycle, and message code payload are ignored.

Note 2: While an automatic display message is being displayed, the receiver monitors the version_number field for the EMM common messages being displayed to detect updates. The version_number field is also monitored, even though the deletion_status field is set to "erase 0x02."

- For messages stored on the DIRD (mail messages), the deletion_status field is ignored.

4) Automatic display duration time 1, 2, and 3

- After channel selection for the display of messages stored on the IC card (automatic display messages), specifies the duration of the automatic display in 0.1-minute increments (for a total of 0 to 25.4 minutes). The setting 0xFF is a special value used to indicate indefinite display of the message.

- For messages stored on the DIRD (mail messages), the automatic display duration is ignored.

5) Number of times for Automatic display

- Specifies the automatic display count as defined by displaying_duration1, 2, and 3 for the display of messages stored on the IC card (automatic display messages).

- For messages stored on the DIRD (mail messages), the display cycle is ignored.
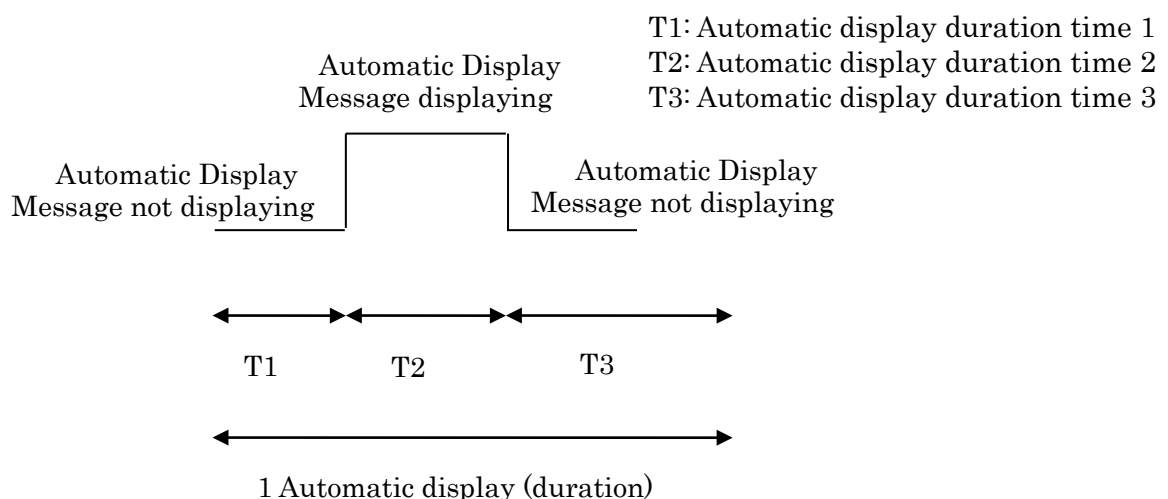
Figure 3-7 Automatic Display Duration Time and Receiver Automatic Message Display

6) Format number

Indicate the format of the message code payload.

7) Message length

Indicate the number of bytes in the message code area described below.

8) Message code payload

Store the specific contents of the message (fixed message).

3.2.5.2 EMM Individual Messages

(1) Basic Structure of EMM Individual Messages

EMM individual messages are transmitted using the MPEG-2 system section format (EMM message section). The following describes the basic structure of the EMM message section:

- Multiple messages can be sent using a single section.
- The entire EMM message section is subject to CRC error detection.
- The table_id_extension of an EMM message section header is 0x0000.
- The EMM message payload consists of a fixed message header that is always transmitted and a variable-length message code.
- The card ID number and message byte length are sent at the beginning of the EMM message header. The receiver filters this area to identify EMM message payloads addressed to itself.
- In the EMM individual message, the message code area can be encrypted, although encryption is not required.
- EMM individual messages are sent by broadcaster groups.
- When EMM individual messages are stored on the IC card, a maximum of 20 bytes of differential information in the message code region are available for each broadcaster group.
- There is only 1 storage region on the IC card for broadcaster groups, and existing content is overwritten when new messages arrive.

Figure 3-8 illustrates the EMM Individual Message Section structure.

EMM Message Section					
EMM Message Section Header	EMM Message Payload 1		EMM Message Payload 2	･ ･ ･	Section CRC
	Unencrypted	Encrypted Part（Encryption is not required）			
	Message Header	Message Code			
8 Bytes	12 Bytes				4 Bytes
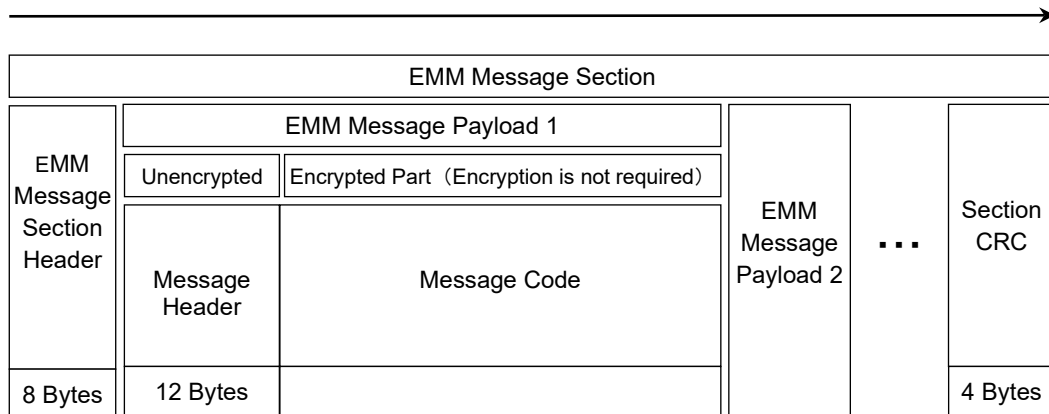
Figure 3-8 EMM Individual Message Section Structure

(2) EMM individual message section structure

    Table 3-5 details the EMM individual message section structure.

Table 3-5 EMM Individual Message Section Structure

Structure				Notes
EMM message section	EMM message section header			8 Bytes
	EMM message payload 1	EMM message unencrypted header	Card ID	6 Bytes
			Message byte length	2 Bytes
			Protocol number	1 Byte
			Broadcaster identifier	1 Byte
			Message ID	1 Byte
			Message control	1 Byte
		Message code region		N Bytes
	Payload 2	(Same as above)		
	⋮	⋮		
	Payload N	(Same as above)		
	CRC error detection			4 Bytes

(3) EMM individual message section details

Table 3-6 EMM Individual Message Section Details

Syntax	Description	No. of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	0x0000	16
reserved		2
version_number		5
current_next_indicator		1
section_number		8
last_section_number		8
for (i=1 ; i<N ; i++) {		
card_ID	Card ID	48
message_length	Message byte length	16
protocol_number	Protocol number	8
ca_broadcaster_group_ID	Broadcaster identifier	8
message_ID	Message ID	8
message_control	Message control	8
message_area	Message code region	N
}		
EMM_message_section_CRC	CRC error detection	32

(4) EMM individual message field details

The following provides more detailed information for principal EMM common messages fields:

1) table_id_extension

In an EMM message (table_id = 0x85), sections with a table_id_extension of 0x0000 are EMM individual messages. Other messages are EMM common messages.

2) Card ID

- Number used to identify the target IC card.
- Of the card ID's 6 bytes (48 bits), the upper N bits are used as the ID identifier, and the same ID identifier is used throughout the section.
- Specifically, the number of ID identifier bit N values is 3.

3) Message byte length

Describes the byte length from the message protocol number to the end of the message code region and serves as an offset that points to the position of the next EMM message payload's card ID number when sending multiple EMM message payloads in a single section.

4) Protocol number

- Indicates the encryption algorithm type. The value 0xFF indicates no encryption.
- When using encryption, the message code region is sent to the IC card. Long messages are divided and sent. When not using encryption, messages are processed exclusively by the DIRD and are not sent to the IC card.

5) Broadcaster identifier

Code used to identify broadcaster groups in conditional access system operation.

6) Message ID

Together the broadcaster identifier and message ID form a unique identifier that is used by the DIRD to check for retransmission of the same message (only 1 message is received when multiple copies of the same message are sent).

7) Message control

Indicates either IC card (0x01) or DIRD (0x02) storage.

The message control and protocol number fields combine to create the following 3 types of messages:

(1) Unencrypted mail

Protocol number = 0xFF and DIRD storage

(2) Encrypted mail

Protocol number ≠ 0xFF and DIRD storage

(3) Automatic display message

Protocol number ≠ 0xFF and IC card storage

Messages stored on the IC card must be encrypted.

8) Message code region

- Stores a message code sent to an individual viewer.
- Table 3-7 describes the format used in the code region. Field meanings differ slightly for messages stored on the IC card and messages stored on the DIRD.

Table 3-7 Message Code Region Contents

Syntax in message code region	Description	No. of bits
alternation_detector(or reserved)	1) Tampering check or reserved	16
limit_date (or reserved)	2) Expiration date or reserved	16
fixed_message_ID	3) Fixed Message Sentence Number	16
extra_message_format_version	4) Differential format number	8
extra_message_length	5) Differential information length	16
extra_message_code	6) Differential information	N
stuffing	7) Stuffing	M

Messages stored on the IC card

1) Tampering check

Specifies the byte sequence used to perform the tampering check.

2) Expiration date

Indicates the message expiration date using the MJD format.

3) Fixed Message Sentence Number (0x0000 to 0xFFFF)

Specifies the code of the fixed sentence to display. Meaningful messages stored on IC cards should specify a fixed sentence number other than 0 (see note below).

4) Differential format number

Indicates the number of the differential information format.

5) Differential information length

Indicates the number of bytes in the differential information field described below. A value of 0x0000 indicates that there is no differential information (see note below).

6) Differential information

Stores the differential information.

7) Stuffing

Stuffing is used from the end of the valid differential information indicated by the differential information length to the last byte of the message code region and is ignored by the receiver.

Note: In exceptional cases, a Fixed Message Sentence Number of 0 and a differential information length of 0 are used to signify deletion of an automatic display message.

Messages stored on the DIRD

As a rule, the same format is used for the message code region as for messages stored on the IC card, described above.

1, 2) Reserved bytes

Reserved bytes (4 bytes) are provided to allow the format to be shared with messages stored on the IC card. For messages stored on the DIRD, these fields are set to 0x00000000.

3) Fixed Message Sentence Number (0x0000 to 0xFFFF)

Specifies the code of the fixed sentence to display. A value of 0x0000 signifies "no fixed sentence".

4) Differential format number

Indicates the number of the differential information format.

5) Differential information length

Indicates the number of bytes in the differential information field described below. A value of 0x0000 indicates that there is no differential information.

6) Differential information

Stores the differential information.

7) Stuffing

Stuffing is not sent for messages stored on the DIRD (0 bytes).

3.2.5.3 ECM Messages (Program Messages)

ECM messages are not defined for the conditional access system.

3.2.6 Associated Information Transmission Method

3.2.6.1 ECMs (Program Information, Control Information)

ECMs (Entitlement Control Message) are transmitted using the MPEG-2 system section format at a minimum interval of once every 100 ms in order to improve the receiver's tuning response speed.

3.2.6.2 EMMs (Individual Information)

EMM (Entitlement Management Message) is transmitted using the MPEG-2 system section format.

Multiplexing method:
A single section can contain multiple EMMs.

The CAS includes a system for concentrating EMM for batch transmission on a specific channel due to transmission efficiency considerations. (For more information, see Chapter 2 Section 2.2.2.13, Chapter 4 Section 4.7.1, and Reference 3 Section 8.)

Chapter 4 Receiver Technical Specifications

4.1 Receiver Overview

1) Digital broadcast receivers should be capable of providing built-in CAS-R functionality (capable of interfacing with a CA module).

2) Receivers should provide support for a conditional access system that is shared among broadcasters. Specifications should not obstruct expandability for accommodating new (conditional access system) broadcasters.

3) Receivers should minimize standby current use.

4) Receivers should provide functionality to allow effective use of broadcast signals.

4.2 User Interface

4.2.1 Virtual User Interface

The following describes the user interface:

- MENU key

  This button can be pressed at any time to display the menu on the screen.

- EPG key

  This button can be pressed at any time to display the EPG on the screen.

- Arrow (cursor) keys

  These buttons are used to select items displayed on the screen. The arrow keys include four keys: left, right, up, and down.

- ENTER key

  This button is used to accept items selected with the cursor and to enter numbers. It is also used to confirm user responses.

- Number keys

  These buttons are used to enter the numbers 0 to 9.

4.2.2 Power-on

- When the user turns the sub-power supply on, the receiver checks the IC card and, when receiving a channel (specified by the CAT's CA_service_descirptor) with automatic display message service (including when playing a program previously received and stored by a receiver with stored reception functionality), displays the default automatic display message for a fixed period of time if either no IC card has been inserted or the inserted IC card is not valid. The same check is performed by the receiver when a new channel is selected.

- This standard does not define processing to be performed following power-on (for example, displaying the last channel viewed, displaying the menu, etc.).

[Input/display items]

- When no IC card has been inserted, the receiver displays the default automatic display message for a fixed period of time.

- When the inserted IC card is not valid, the receiver displays the default automatic display message for a fixed period of time.

[Procedure]
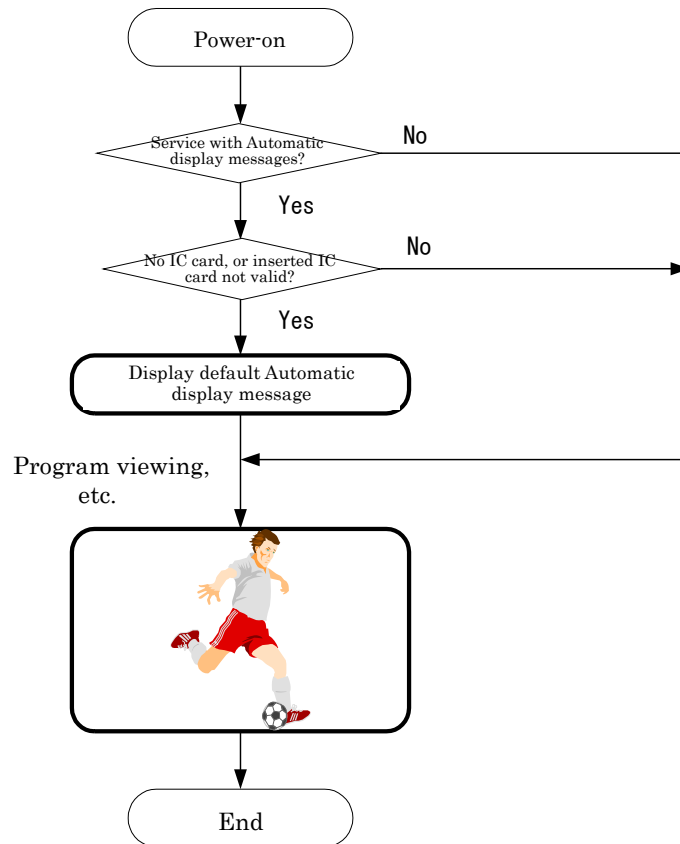
Figure 4-1 Power-on Processing

4.2.3 Program Viewing

- As a rule, programs are selected using an EPG or similar guide based on the SI. The method for selecting programs using the EPG is defined by the receiver standard. This standard describes the processes used to perform the following tasks: select the corresponding transport stream after a program has been selected, reference the scrambling control, receive and decode ECMs with the IC card, and perform processing based on the results of those actions.
- Program viewing processing for program attributes by referencing the scrambling control and referencing ECMs using the IC card can be categorized as described below:

(1) Free viewing processing

- Unscrambled free programs.

(2) Contract viewing processing

- Scrambled free programs.
- Flat/tier contract pay programs.
- Flat/tier contract or PPV contract pay programs when the IC card contains a flat/tier

contract.

(3) PPV viewing processing

- PPV contract pay programs.
- Flat/tier contract or PPV contract pay programs when the IC card contains no flat/tier contract.
- This processing category also needs to be used when changes in the attributes or state of the selected broadcast program require receiver action.
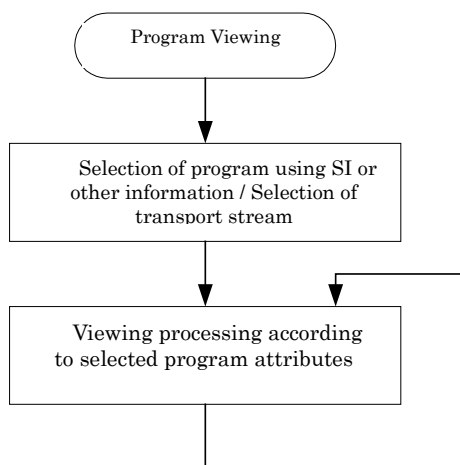
Figure 4-2 Program Viewing Flow

4.2.3.1 Free Viewing Processing

- Although this type of viewing processing is not directly related to the CA system, this section describes the viewing processing and screen display flow for unscrambled free programs.

[Input/display items]

- If the receiver's parental control level has been set, the receiver compares the parental level for the selected program as specified in the PSI/SI and requires the entry of the password as necessary.

[Procedure]
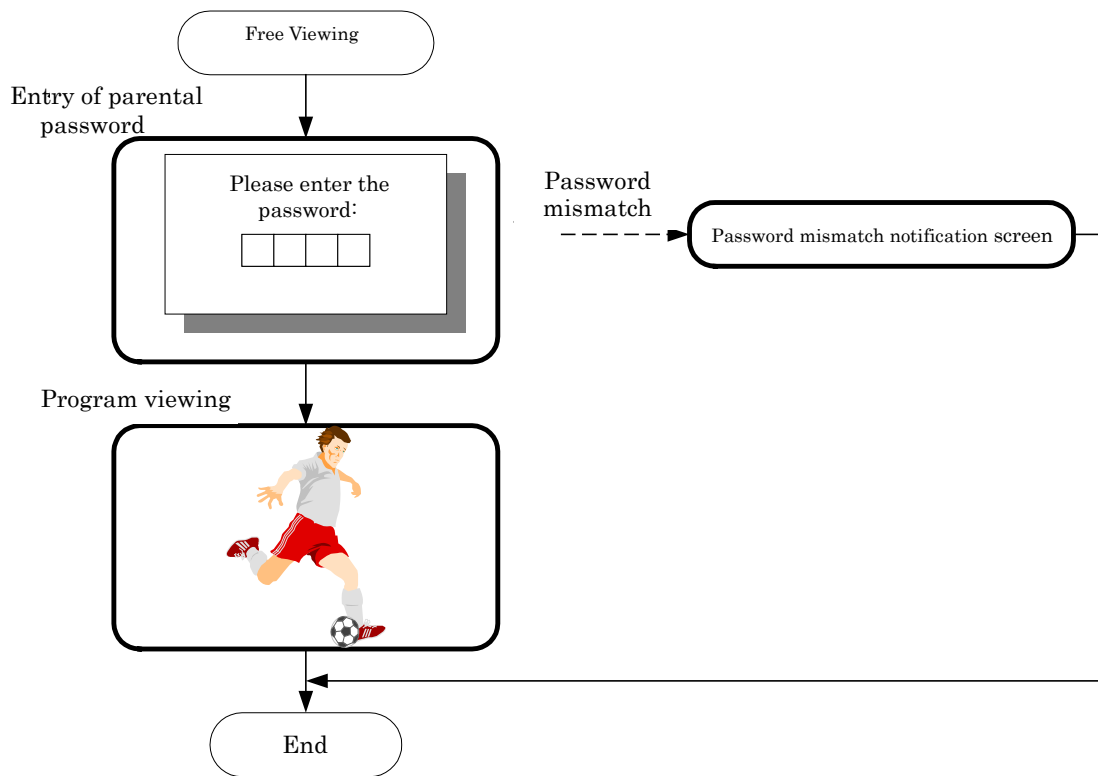
Figure 4-3 Free Viewing Processing Flow

(1) Parental password input screen

[Functionality]

- As a parental control when a program with a parental level is received, the receiver requires the entry of the password when the parental level specified in the PSI/SI is higher than the set parental control level.

[Input/display items]

- The receiver displays a message asking for password input.
- The receiver displays the password input field (blind display) and accepts password input.

4.2.3.2 Contract Viewing Processing

- This section describes the flow for program viewing processing as well as the screen display flow for scrambled free programs, flat/tier contract pay programs, and flat/tier contract or PPV contract pay programs with a flat/tier contract.

[Input/display items]

- If no IC card has been inserted, the receiver displays a message indicating this fact.
- If the inserted IC card is not valid, the receiver displays a message indicating this fact.
- If the response from the IC card indicates that viewing is not available, the receiver displays a message indicating this fact. However, if the PSI/SI includes a link to an

alternate CA service, the receiver displays a message indicating that it is linking to the alternate service.

- If the receiver's parental control level has been set, the receiver compares the parental level for the selected program as specified in the PSI/SI and requires the entry of the password as necessary.
- If a recording of the selected program is prohibited, the recorder displays a message indicating this fact.

[Procedure]

Figure 4-4 Contract Viewing Processing Flow

(1) Parental password input screen
- Same as Section 4.2.3.1 (1).

(2) Program viewing screen

[Functionality]
- The receiver displays a screen for viewing the selected program.

[Input/display items]
- If a recording of the selected program is prohibited, the receiver displays a message indicating this fact (for a fixed period of time).

4.2.3.3 PPV Viewing Processing

- This section describes the flow for program viewing processing as well as the screen display flow for PPV contract pay programs and flat/tier contract or PPV contract pay programs without a flat/tier contract.

[Input/display items]

- If no IC card has been inserted, the receiver displays a message indicating this fact.
- If the inserted IC card is not valid, the receiver displays a message indicating this fact.
- If the response from the IC card indicates that viewing is not available due to the lack of a PPV contract, the receiver displays a message indicating this fact. However, if the PSI/SI includes a link to an alternate CA service, the receiver displays a message indicating that it is linking to the alternate service.
- If the receiver's parental control level has been set, the receiver compares the parental level for the selected program as specified in the PSI/SI and requires the entry of the password as necessary.
- If the response from the IC card indicates that preview viewing is possible, the receiver plays the preview and displays a message indicating that the displayed content is a preview. User input during preview viewing displays the purchase invitation screen.
- If the response from the IC card indicates that preview viewing is not available, or the user ends preview viewing, the receiver displays the purchase invitation screen and accepts purchase invitation input.
- If a PPV fee allowance has been set and the proposed purchase would exceed the PPV fee allowance, the receiver requires the entry of the password. (See note below.)
- If the response from the IC card indicates that the program is no longer available for purchase, the receiver displays a message indicating that the program cannot be purchased.
- If the response from the IC card indicates that the card's viewing history memory is full, the receiver displays a message indicating that the program cannot be purchased.
- If a recording of the selected program is prohibited, the receiver displays a message indicating this fact.

   Note: If password entry is required due to both parental control and the purchase limit, the receiver does not require the input of both passwords.

[Procedure]

Figure 4-5 PPV Viewing Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1).

(2) Preview screen

[Functionality]

- If the response from the IC card indicates that preview viewing is available, the receiver plays the preview. If the user ends the preview, the receiver displays the purchase invitation screen.

 [Input/display items]

- Preview of the program.
- Display indicating that a preview is being viewed.
- Display and input to end the preview and go to the purchase invitation screen.

(3) Purchase limit password input screen

[Functionality]

- If a PPV monthly fee allowance or PPV unit fee allowance has been set and the proposed purchase would exceed the limit, the receiver requires the entry of the password.

 [Input/display fields]

- Display of a message instructing the viewer to enter the password.
- Display of the password input field (blind input) and password input.

(4) Purchase invitation screen

[Functionality]

- If the user ends preview viewing or the IC card judgment indicates that preview viewing is not available, the receiver displays the PPV contract pay program's viewing fee, invites the user to purchase the program, and confirms the user's intention to do so.

 [Input/display fields]

- Display indicating confirmation of purchase of a PPV contract pay program.
- Display of the program's title.
- Display of the viewing fee.
- When recording control indicates that recording is available for a separate fee, display of the viewing fee when recorded.
- Confirmation input asking whether the user wants to purchase the program.
- When recording control indicates that recording is available for a separate fee, selection input indicating whether the user wants to record the program.
- When recording control indicates that the recording is available or not available, display of this fact.

(5) Program viewing screen

- Same as Section 4.2.3.2 (2).

4.2.4 Program Reservations (Optional)

- The receiver can reserve programs using an EPG or similar functionality based on the SI. As a rule, program reservations using an EPG are defined by the SI standard. This standard describes the flow of reservation operation based on specific program attributes.
- The receiver references the SI for the program being reserved, verifies that the necessary contract is in place with the IC card if the program is scrambled, and performs reservation processing depending on the response from the IC card.

(1) Free viewing reservation processing

- Unscrambled free programs (programs for which no contract verification information exists in the SI)

(2) Contract viewing reservation processing

- Scrambled free programs.
- Flat/tier contract pay programs.
- Flat/tier contract or PPV contract pay programs when the IC card contains a flat/tier contract.

(3) PPV viewing reservation processing

- PPV contract pay programs.
- Flat/tier contract or PPV contract pay programs when the IC card does not contain a flat/tier contract.
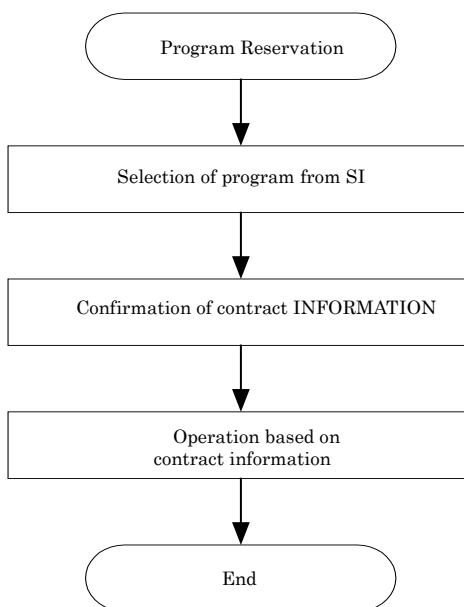
Figure 4-6 Program Reservation Flow

4.2.4.1 Free Viewing Reservation Processing

- Although this type of viewing processing is not directly related to the CA system, this section describes the processing and screen display flow for reserving unscrambled free programs.

[Input/display items]

- If the receiver's parental control level has been set, the receiver compares the parental level for the selected program as specified in the SI and requires the entry of the password as necessary.

- The receiver displays detailed program information and confirms the user's intention to reserve the program.

- After selecting the program to reserve, the receiver notifies the user that the program reservation has been made.

[Procedure]
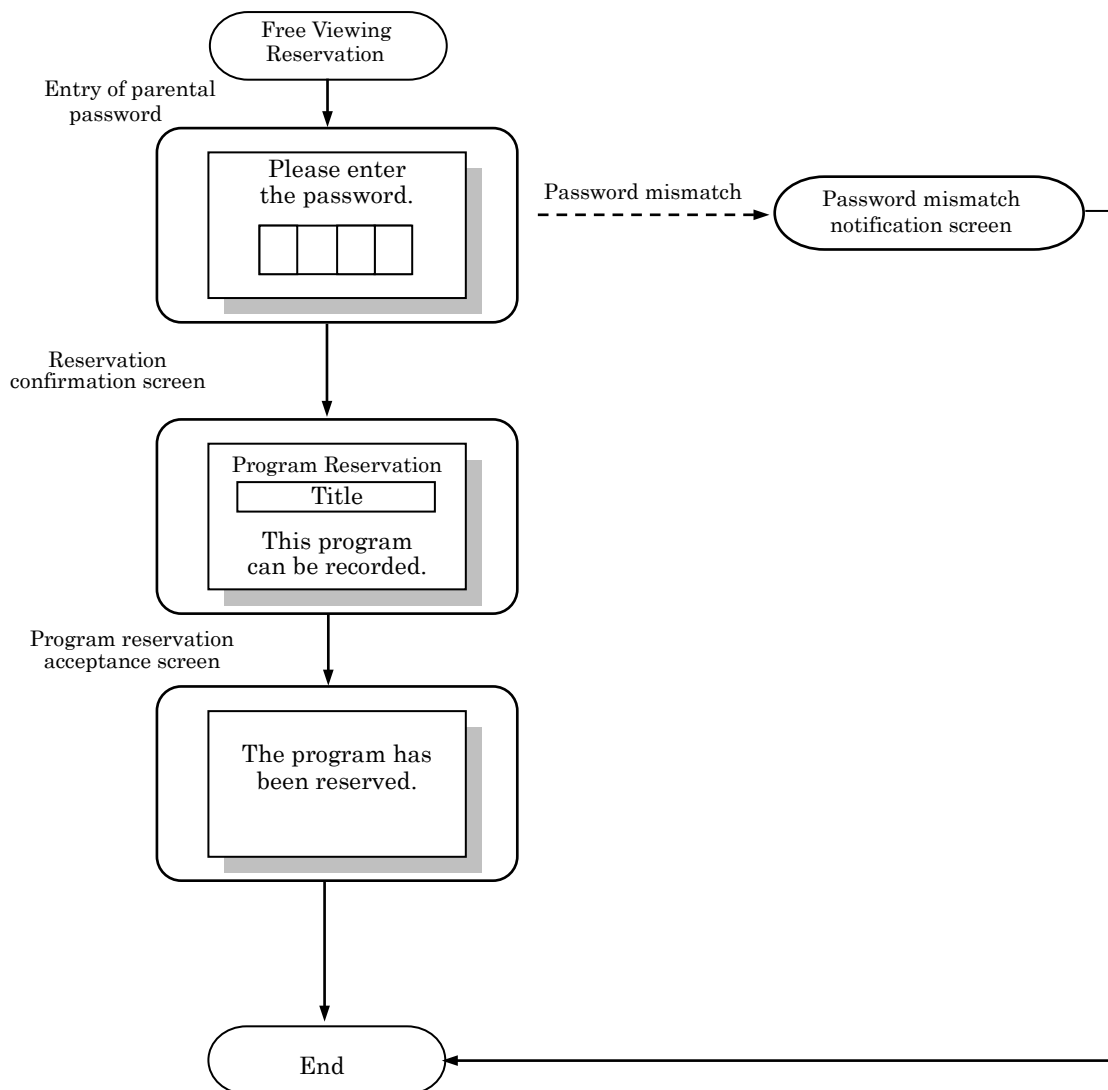
Figure 4-7 Free Viewing Reservation Processing Flow
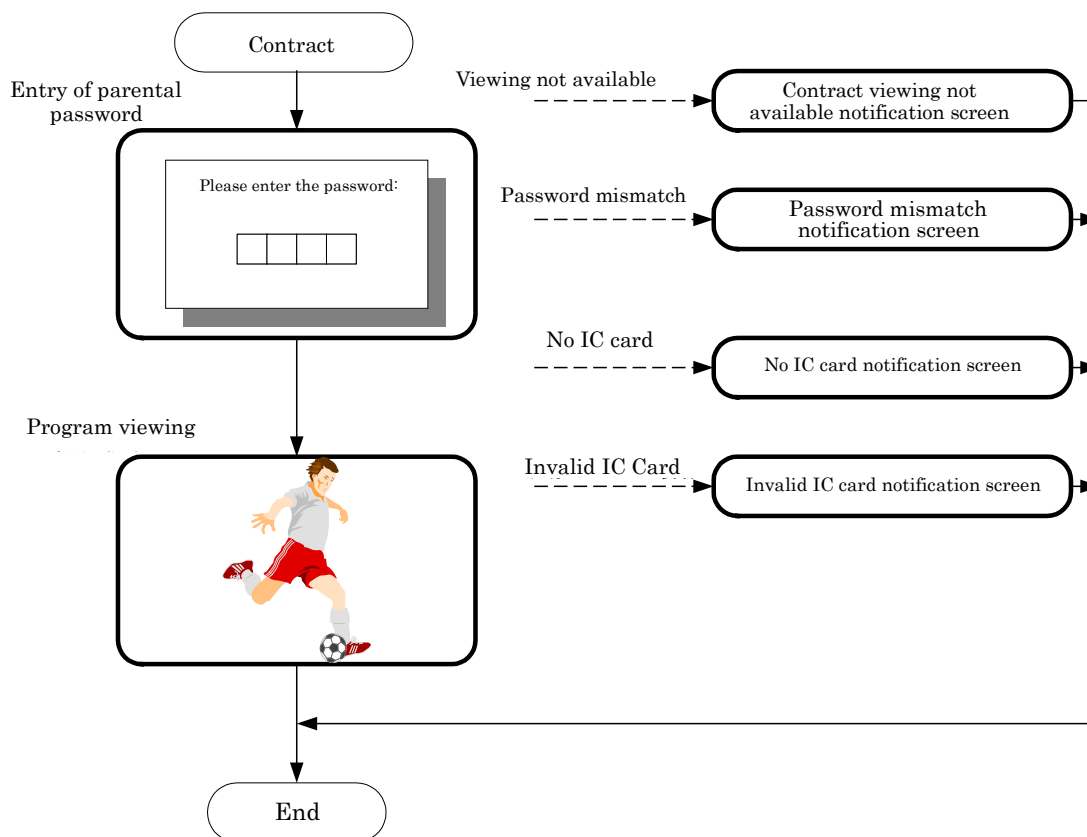
(1) Parental password input screen

- Same as Section 4.2.3.1 (1).

(2) Program confirmation screen

[Functionality]

- If unable to display in list form, the receiver displays detailed information for the reserved program as necessary.

[Input/display items]

- Display indicating that the screen is a program reservation.
- Program's title.
- Display indicating whether the reserved program can be recorded (recording is always available for free viewing).

(3) Program reservation acceptance screen

[Functionality]

- This screen notifies the user that the program reservation has been accepted.

[Input/display fields]

- Display of a message indicating that the program has been reserved.

4.2.4.2 Contract Viewing Reservation Processing

- This section describes the operation and screen display flow for reserving scrambled free programs, flat/tier contract pay programs, and flat/tier contract or PPV contract pay programs when there is a flat/tier contract.

[Input/display fields]

- If no IC card has been inserted, the receiver displays a message indicating this fact.
- If the inserted IC card is not valid, the receiver displays a message indicating this fact.
- If the response from the IC card indicates that viewing is not available due to the lack of the necessary contract, the receiver displays a message indicating this fact.
- If the receiver's parental control level has been set, the receiver compares the parental level for the selected program as specified in the SI and requires the entry of the password as necessary.
- The receiver displays detailed information for the program and confirms the user's intention to reserve it.
- After the program to reserve has been selected, the receiver displays a message indicating that the program reservation was accepted and encouraging the user to insert an IC card since a card is required to view the program.

[Procedure]
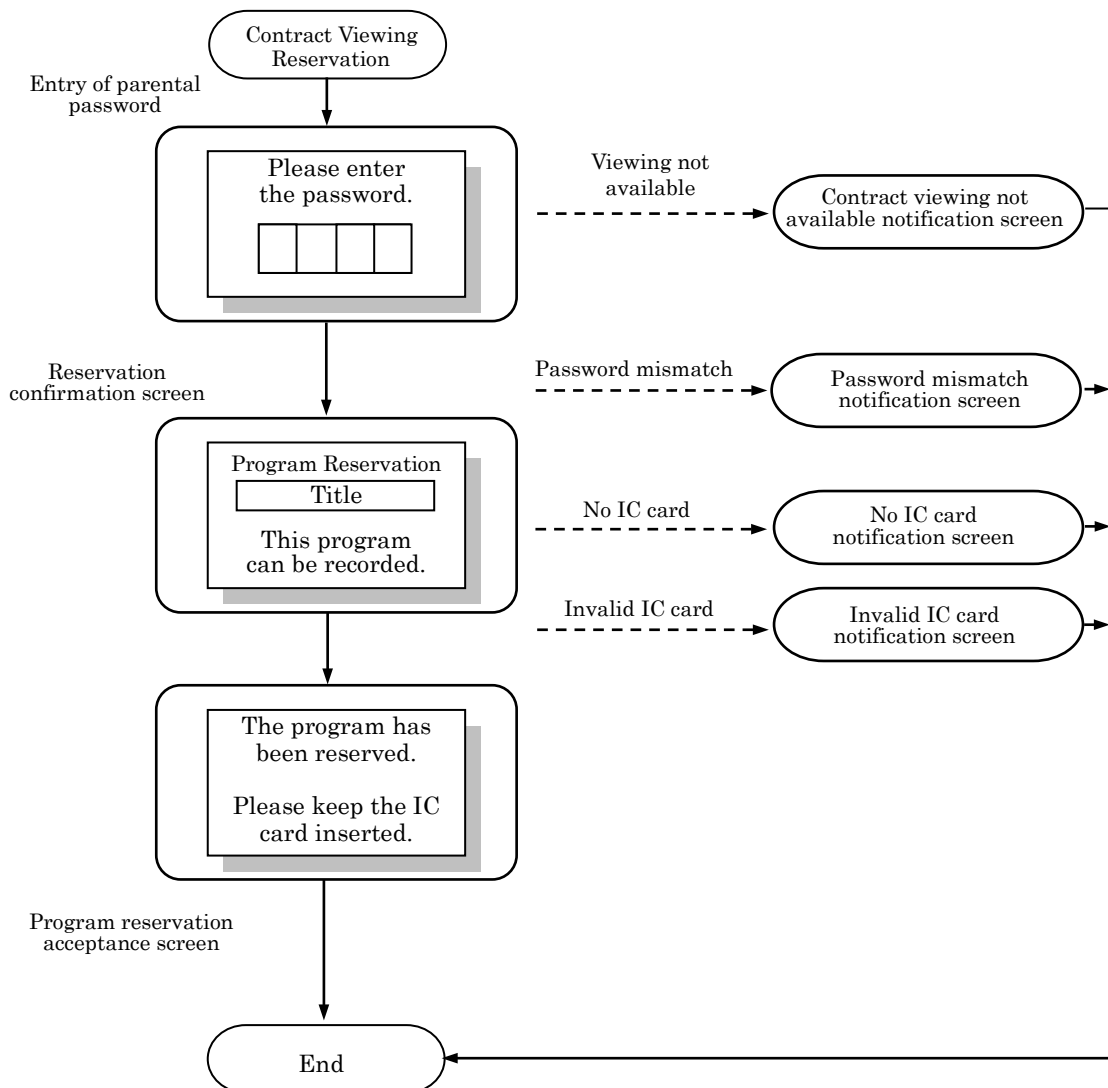
Figure 4-8 Contract Viewing Reservation Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1).

(2) Program confirmation screen

- Same as Section 4.2.4.1 (2).

(3) Program reservation acceptance screen
[Functionality]

- This screen notifies the user that the program reservation has been accepted.

[Input/display fields]

- Display of a message indicating that the program has been reserved.
- Display of a message encouraging the user to insert an IC card when viewing.

4.2.4.3 PPV Viewing Reservation Processing

- This section describes the operation and screen display flow for reserving PPV contract pay programs and flat/tier contract or PPV contract pay programs when there is no flat/tier contract.

[Input/display fields]

- If no IC card has been inserted, the receiver displays a message indicating this fact.
- If the inserted IC card is not valid, the receiver displays a message indicating this fact.
- If the response from the IC card indicates that PPV viewing is not available due to the lack of the necessary contract, the receiver displays a message indicating this fact.
- If the receiver's parental control level has been set, the receiver compares the parental level for the selected program as specified in the SI and requires the entry of the password as necessary.
- If a PPV unit fee allowance has been set and the proposed purchase would exceed the PPV unit fee allowance, the receiver requires the entry of the password. (See note below.)
- The receiver displays the program purchase invitation screen and confirms the user's intention to purchase the program.
- If the response from the IC card indicates that the card's viewing history memory is full when viewing the program, the receiver displays a message indicating that the program cannot be purchased and encouraging the user to connect the receiver to a telephone line.
- After the program to reserve has been selected, the receiver displays a message indicating that the program reservation was accepted and encouraging the user to insert an IC card since a card is required to view the program.

Note: If password entry is required due to both parental control and the purchase limit, the receiver does not require the input of both passwords.
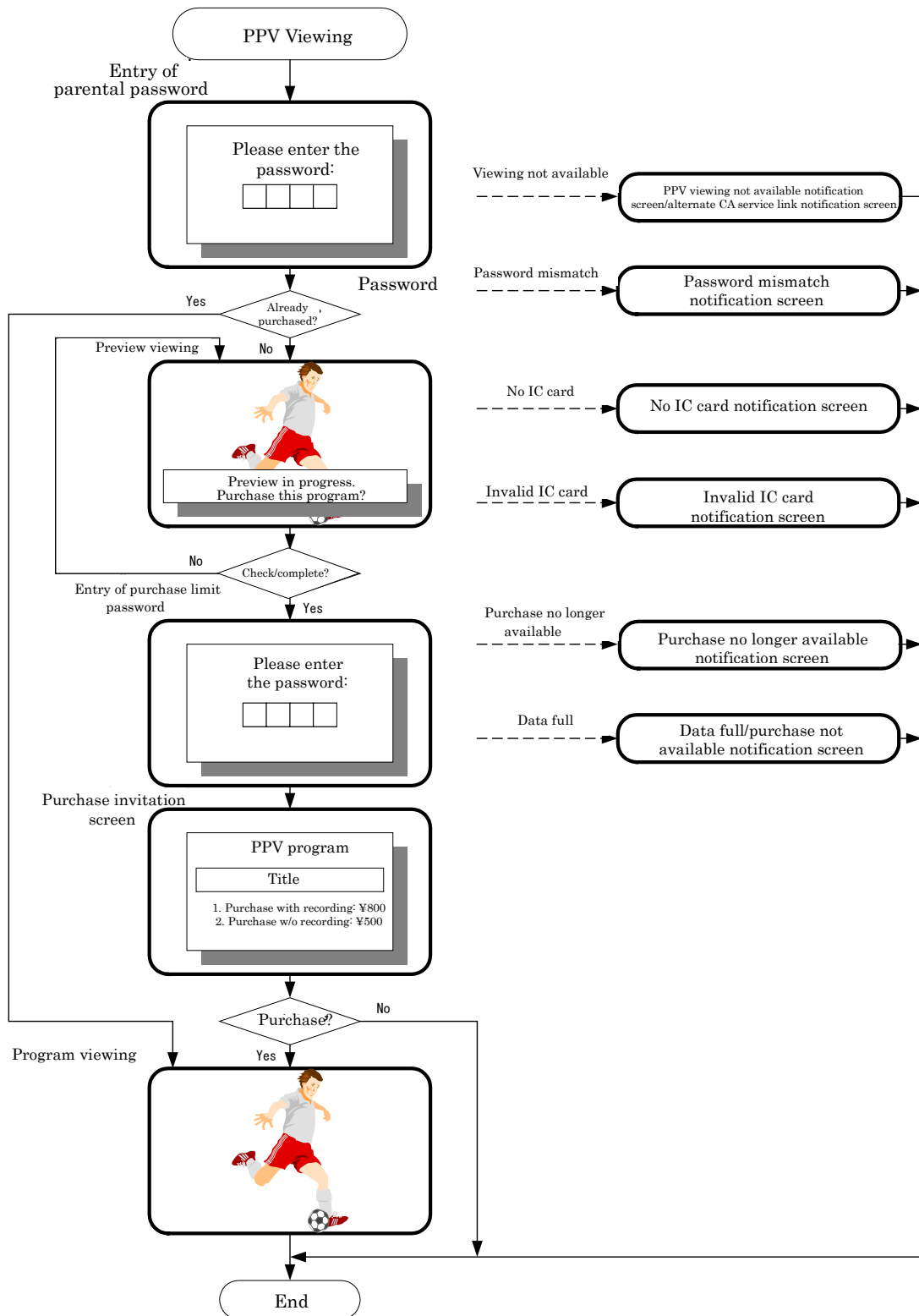
[Procedure]
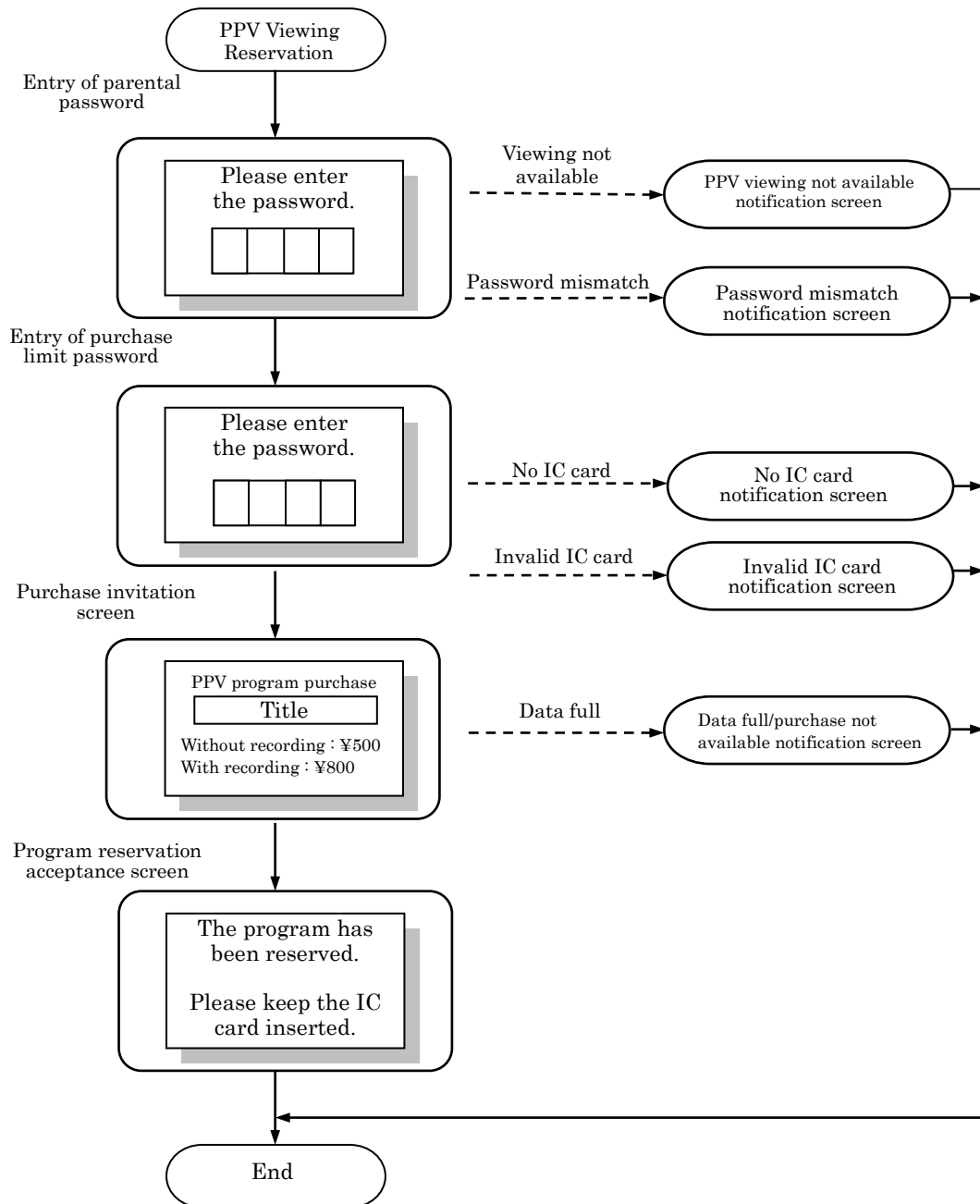
Figure 4-9 PPV Viewing Reservation Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1).

(2) Purchase limit password input screen

- Same as Section 4.2.3.3 (3).

(3) Purchase invitation screen

- Same as Section 4.2.3.3 (4).

(4) Program reservation acceptance screen

- Same as Section 4.2.4.2 (3).

4.2.5 Error Notification Screen

4.2.5.1 Password Mismatch Notification Screen

[Functionality]

- This screen indicates that program viewing is not available due to a password mismatch.

[Input/display fields]

- Display of a message indicating that program viewing is not available due to a password mismatch.

4.2.5.2 No IC Card Notification Screen

[Functionality]

- This screen is displayed when no IC card has been inserted into the receiver.

[Input/display fields]

- Display of a message indicating that no IC card has been inserted into the receiver.

4.2.5.3 Invalid IC Card Notification Screen

[Functionality]

- This screen is displayed when the receiver is unable to confirm the presence of a proper IC card.

[Input/display fields]

- Display of a message indicating that the IC card is invalid or otherwise unavailable for use.

4.2.5.4 Contract Viewing Not Available Notification Screen

[Functionality]

- This screen notifies the user that viewing is not available due to the contract judgment made by the IC card.
- It is displayed under the following circumstances:
    o When there is no contract (no Kw).
    o When the expiration date has been passed.
    o When there is no contract for the viewing flat/tier program.

[Input/display fields]

- Display indicating that the program is contract program.
- Display of a message indicating the reason that viewing is not available depending on

the response from the IC card.

- o If the response from the IC card is "No Kw": No contract.
- o If the response from the IC card is "Contract expired": Contract expired.
- o If the response from the IC card is "No tier contract": No viewing contract.
- Display of a message encouraging the user to contact the Customer Center or other office for more information.

4.2.5.5 PPV Viewing Not Available Notification Screen

[Functionality]

- This screen notifies the user that viewing is not available due to the contract judgment made by the IC card.
- It is displayed under the following circumstances:
  - o When the expiration date has been passed
  - o When there is no PPV viewing contract

[Input/display fields]

- Display of a message indicating that the program is PPV program.
- Display of a message indicating that viewing is not available due to the absence of the necessary contract.
- Display of a message encouraging the user to contact the Customer Center or other office for more information.

4.2.5.6 Program No Longer Available for Purchase Notification Screen

[Functionality]

- This screen is displayed when the PPV program becomes unavailable for purchase during preview viewing or while the user is being invited to purchase it.

[Input/display fields]

- Display indicating that the program is PPV program.
- Display of a message indicating that the program is no longer available for purchase.

4.2.5.7 Data Full/Purchase Not Available Notification Screen

[Functionality]

- This screen indicates that purchase of a PPV pay program is not available when the viewing history information stored on the IC card exceeds a fixed storage area.

[Input/display fields]

- Display indicating that the program is PPV program.
- Display of a message indicating that the program is not available for purchase because the viewing history memory is full.
- Display of a message encouraging the user to connect the receiver to a telephone line.

4.2.5.8 Communications Failure Notification (Retries Exceeded) Screen

[Functionality]

- This screen indicates that the receiver's attempt to send the collected PPV viewing history failed, including retry calls. It is displayed when the power is turned on and during PPV purchases.

[Input/display fields]

- Display of a message asking the user to check the telephone line connection and encouraging them to request a call.

4.2.5.9 IC Card Replacement Notification Screen

[Functionality]

- This screen indicates that an error occurred while writing to the IC card and that the IC card has failed. It encourages the user to replace the card in a timely manner due to the fact that PPV viewing and other receiver functionality will be compromised without it.

[Input/display fields]

- Display of a message encouraging the user to contact the Customer Center or other office for a replacement card.

4.2.6 Automatic Display Messages

- When an automatic display message is sent from a broadcaster group, the receiver superimposes the message on the viewing screen when the user selects one of that broadcaster group's programs.
- Automatic display messages consist of EMM individual messages that are transmitted to a designated receiver and indicate a message pointer, and EMM common messages that indicate a message payload that is shared by all receivers. EMM individual messages are received in advance and stored on the IC card. EMM common messages are generally received when they are displayed.
- Whether a message display can be erased depends on the control information contained in the message.

[Input/display fields]

- When an automatic display message is received, display of the message by superimposing it on the viewing screen when viewing programs from the broadcaster group that sent the message.
- When the message display can be erased, display indicating confirmation and input.

4.2.7 CA Function Main Menu

- Although functions are listed in a single menu as an example, the structure of functions is not defined by this document.
- The menu provides the following functionality:
    (1) Display of the PPV purchase record.
    (2) Display of card information

(3) Display of mail messages
- Display of mail message details

(4) System settings
- Password setting
- Parental level setting
- PPV unit fee allowance program setting
- PPV monthly fee allowance setting
- Line selection
- Telephone line setting
- Telephone line test

(5) Display of the error history

4.2.8 PPV Purchase Record Display (Optional)

[Functionality]
- This function displays information about PPV programs purchased in the past as stored by the receiver.

   Note: All information to be displayed must have been stored by the receiver.

[Input/display fields]
- Display indicating that the PPV purchase record is being viewed.
- Information about purchased programs (date viewed, program title, program fee)

[Optional fields]
- Total fee of programs purchased to date.
- Scroll functionality as necessary.

4.2.9 Display of mail messages

4.2.9.1 Display of list of mail messages

[Functionality]
- This function displays a list of mail messages that have been sent using EMM messages and stored by the receiver.
- The user can select individual messages and display detailed information for each.

   Note: All information to be displayed must have been stored by the receiver.

[Input/display fields]
- Display indicating that a list of mail messages is being viewed.
- Display of the title and date received for each mail message.
- Selection input for displaying detailed information for each mail message.
- Scroll functionality as necessary.

4.2.9.2 Detailed display of mail messages

[Functionality]
- This function displays detailed information for mail messages that have been sent using

EMM messages and stored by the receiver.

[Input/display fields]

- Display indicating that detailed information for mail messages is being viewed.
- Display of the mail message's title, date received, and text.
- Selection input for deleting the mail message.
- Input for returning to the list of mail messages.
- Scroll functionality as necessary

  Note: All information to be displayed must have been stored by the receiver.

4.2.10 Display of Card Information

[Functionality]

- This function displays IC card information acquired from the IC card.

[Input/display fields]

- Display indicating that card information is being viewed.
- Display of a card identifier consisting of the manufacturer identifier (1 ASCII character) and version (3-digit decimal number).
- Display indicating that the card identifier is being viewed.
- The receiver displays a 20-digit decimal card ID consisting of the ID identifier, the individual card ID, and a check code, separated into groups of 4 digits. This information is displayed as the ID identifier (1 digit), the individual card ID (14-digit decimal number), and a check code (5 digits), separated into groups of 4 digits.
- Display indicating that the card ID is being viewed.
- When there is a group ID, the receiver displays it as a 20-digit decimal number consisting of the ID identifier, the group ID, and a check code separated into groups of 4 digits.
- Display indicating that the group ID is being viewed.
- Display of the group ID number (group ID number including the ID identifier number) corresponding to the selected ID identifier.
- When the group ID number corresponding to the selected ID identifier has not been set, display of a message indicating this fact.

4.2.11 System Settings

4.2.11.1 Password Settings

- This function sets the passwords. When a password has already been registered, it changes or deletes the existing password. When no password has been registered, it registers a new password.

[Input/display fields]

- When no password has been registered, new password registration.
- When a password has already been registered, modification of the existing password after confirming the user's intention to do so.

- When the passwords do not match, display of a password mismatch notification.

[Procedure]
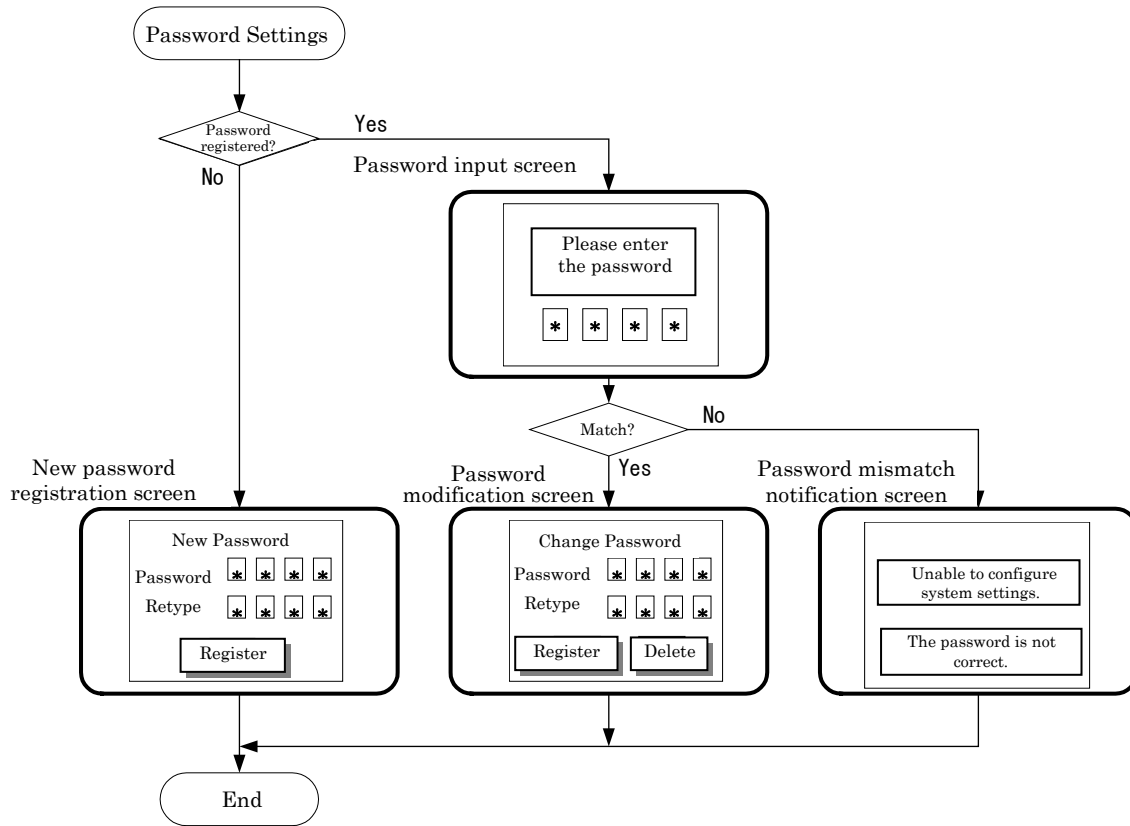
Figure 4-10 Password Setting Flow

(1) New Password Registration Screen

[Functionality]

- This screen registers a new password when no password has been registered.

[Input/display fields]

- Display indicating that a new password is being registered.
- Input of the new password and display (blind display).
- Input to confirm the new password.
- Input to accept and register the new password.

(2) Password Input Screen

[Functionality]

- This screen accepts password input in order to perform system settings.

[Input/display fields]

- Display of a message instructing the user to enter the password.
- Display of the password input field (blind display) and password input.

(3) Password Mismatch Notification Screen

[Functionality]

- This screen notifies the user that the password input is not correct, and that configuration of the system settings cannot be done.

[Input/display fields]

- Display indicating that configuration of the system settings cannot be done due to the password mismatch.

(4) Password Modification Screen

[Functionality]

- When a password has already been registered, this screen modifies the existing password and registers it, or deletes the existing password.

[Input/display fields]

- Display indicating that the password is being changed.
- Input of the new password and display (blind display).
- Input to confirm the new password.
- Input to change the password.
- Input to delete the password.

4.2.11.2 Parental Level Setting

- This screen sets the parental level after accepting password input if a password has been registered.

[Input/display fields]

- When a password has been registered, password input before setting the parental level.
- When no password has been registered, new password registration.
- Parental level settings when the passwords match or when a password has been registered.
- When the passwords do not match, display of a password mismatch notification.

[Procedure]
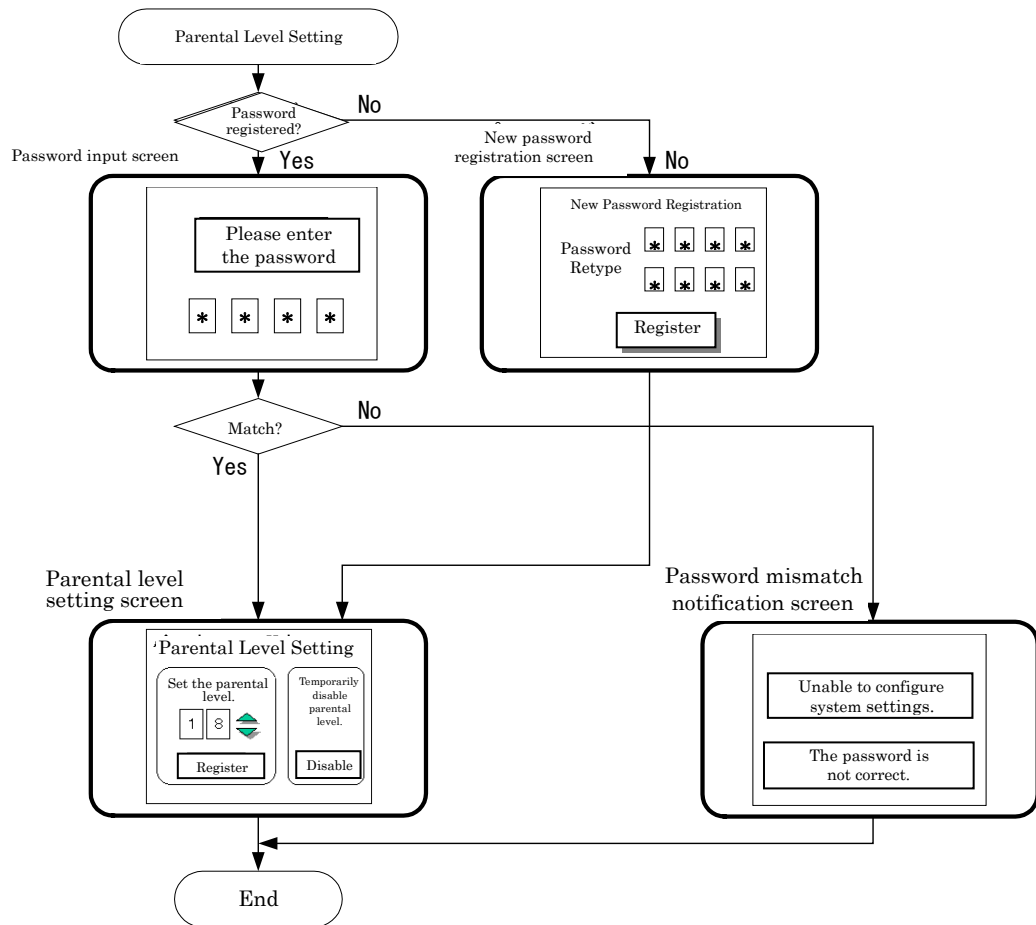
Figure 4-11 Parental Level Setting Flow

(1) Password Input Screen

- Same as Section 4.2.11.1 (2).

(2) New Password Registration Screen

- When no password has been registered, this screen registers a new password as described in Section 4.2.11.1 (1).

(3) Parental Level Setting Screen

[Functionality]

- This screen sets the parental level stored by the receiver for use with the parental control function.

[Input/display fields]

- Display indicating that the parental level is being set.
- Parental level input and display of the set parental level (2-digit integer).
- Input to register the parental level.

[Optional field]

- Selection input to temporarily disable the parental control function.

(4) Password Mismatch Notification Screen

- Same as in Section 4.2.11.1 (3).

4.2.11.3 PPV Unit Fee Allowance Setting (Optional)

- This function sets the maximum allowable fee of a single program when purchasing PPV program.

[Input/display fields]

- When a password has been registered, password input confirmation before setting the allowance.
- When no password has been registered, new password registration.
- If and only if a password has been registered and the passwords match, PPV unit fee allowance setting.
- When the passwords do not match, display of a password mismatch notification.

[Procedure]
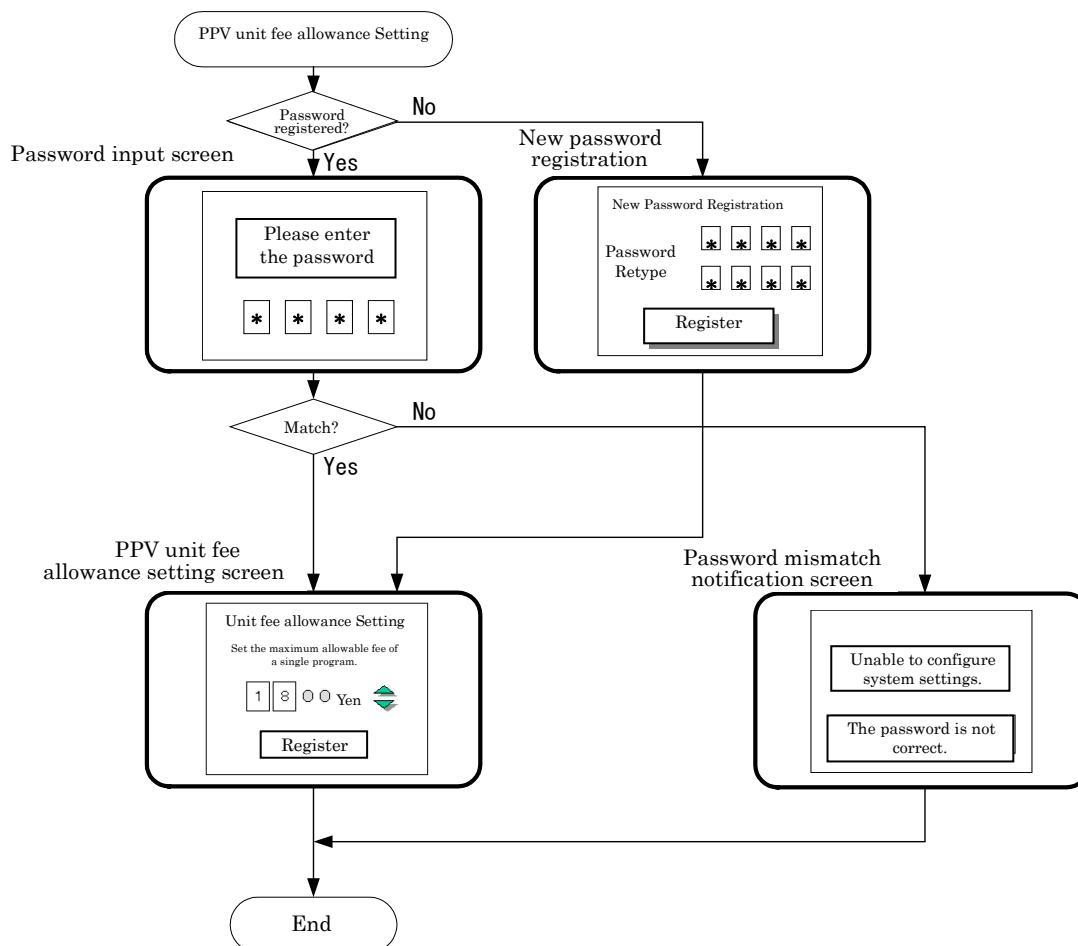
Figure 4-12 PPV Unit Fee Allowance Setting Flow

(1) Password Input Screen

- Same as Section 4.2.11.1 (2).

(2) New Password Registration Screen

- When no password has been registered, this screen registers a new password as described in Section 4.2.11.1 (1).

(3) PPV Unit Fee Allowance Setting Screen

[Functionality]

- This screen sets the maximum viewing fee for a single program when purchasing PPV program.

[Input/display fields]

- Display indicating that the PPV unit fee allowance is being set.
- Maximum allowable fee input and registration input.

(4) Password Mismatch Notification Screen

- Same as Section 4.2.11.1 (3).

4.2.11.4 PPV Monthly fee allowance Setting (Optional)

- This screen sets the maximum allowable monthly amount of fees when purchasing PPV programs.

[Input/display fields]

- When a password has been registered, password input confirmation before setting the allowance.
- When no password has been registered, new password registration.
- If and only if a password has been registered and the passwords match, PPV monthly fee allowance setting.
- When the passwords do not match, display of a password mismatch notification.

[Procedure]
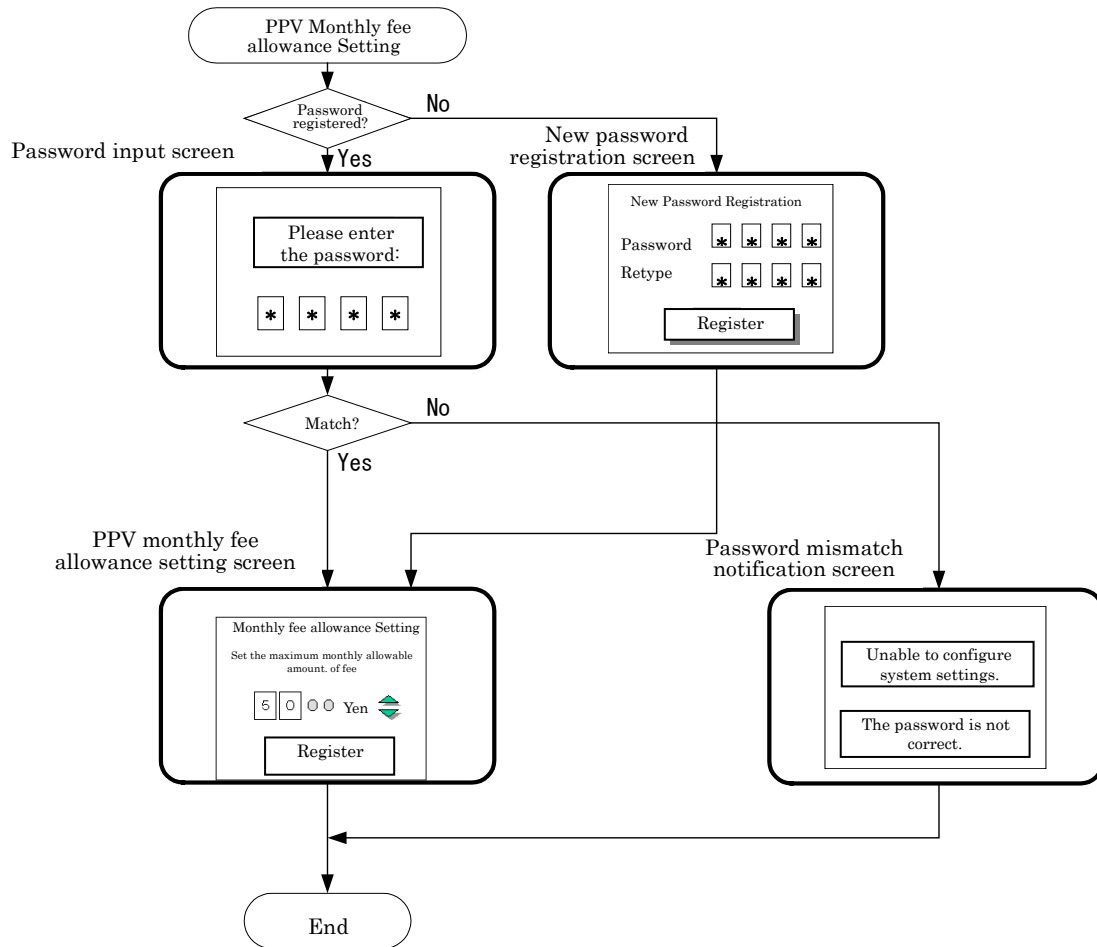
Figure 4-13 PPV Monthly Fee Allowance Setting Flow

(1) Password Input Screen
- Same as Section 4.2.11.1 (2).

(2) New Password Registration Screen
- When no password has been registered, this screen registers a new password as described in Section 4.2.11.1 (1).

(3) PPV Monthly Fee Allowance Setting Screen
 [Functionality]
- This screen sets the maximum allowable amount of fees during a single month when purchasing PPV programs.
 [Input/display fields]
- Display indicating that the PPV monthly fee allowance is being set.
- Maximum fee input and registration input.
 (4) Password Mismatch Notification Screen

- Same as Section 4.2.11.1 (3).

4.2.11.5 Line Selection and Settings
[Functionality]
- This function selects and configures settings for the line used when transmitting the PPV viewing history information and other receiver data (only when multiple public networks are available for selection).

[Input/display fields]
- Display indicating that the line is being selected and configured.
- Display and input to select the following information:
  o Public network to which connection can be made.

[Optional fields] (The following examples apply to telephone lines.)
- Display and input to select settings necessary to make a connection.
  o Dial settings
    Configures dial settings. User can select one of "Touch-tone," "10 pps (pulse)," or "20 pps (pulse)."
  o Extension setting/pause (seconds)
    Configures the extension. If the extension setting is necessary, enter the number used to access an outside line. Otherwise, select "None." Also sets how many seconds to pause.
  o On-hook detection
    Configures on-hook detection. Select either "Enable" or "Disable."
  o Tone detection
    Configures tone detection. Select either "Enable" or "Disable."

4.2.11.6 Public Network Or Other Line Test (Optional)
- This function verifies whether the line is connected and notifies the user of the result.

[Input/display fields]
- Display of start of line connection test and start input.
- If the test was able to verify the connection, display of test complete message.
- If the test was not able to verify the connection, display of error message.

[Procedure]
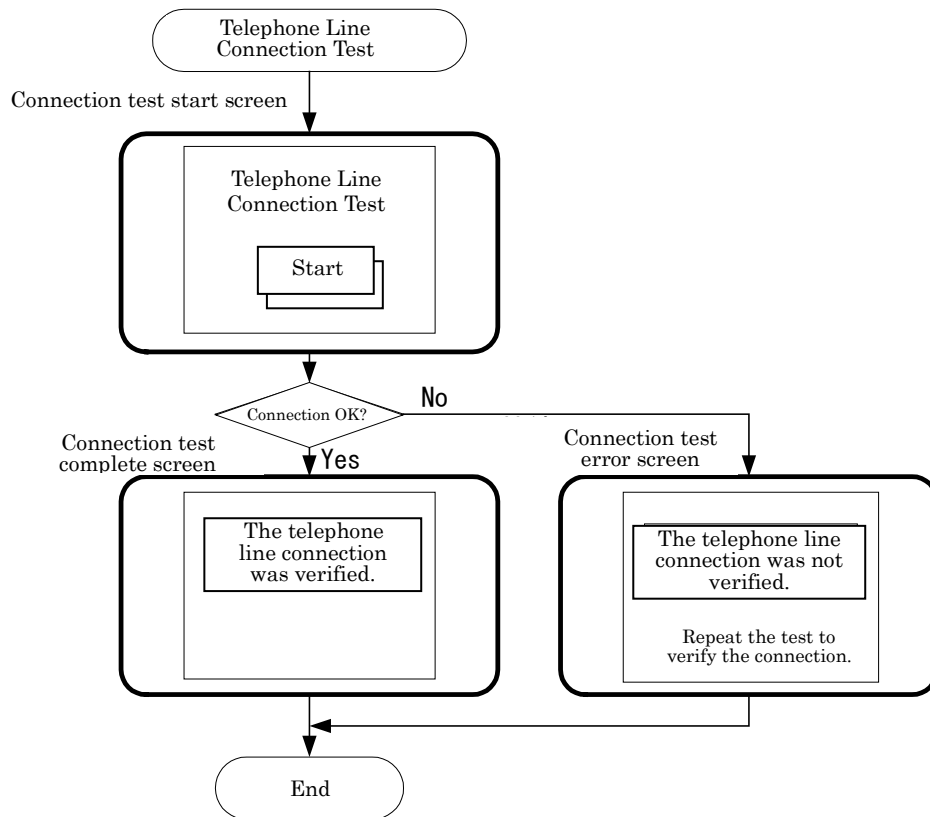
Figure 4-14 Line Connection Test Flow (Telephone Line)

(1) Connection test start screen

[Functionality]

- This screen indicates the start of the line test and accepts a connection test start instruction.

[Input/display fields]

- Display indicating that a line connection test is being performed.
- Test start confirmation input.

(2) Connection test complete screen

[Functionality]

- This screen notifies the user that the line connection test completed normally.

[Input/display functionality]

- Display of a message indicating that the line connection test completed normally.

(3) Connection test error screen

[Functionality]

- This screen notifies the user that the line connection test was unable to verify the connection.

[Input/display fields]

- Display of a message indicating that the line connect test was unable to verify the connection.
- Display of a message encouraging the user to repeat the test.

4.2.12 Display of the Error History (Optional)

- The receiver stores a record of errors and can display that information.
- The following CA system errors can be stored:
    - Errors occurring when a failure or invalid card is detected due to an IC card problem.
    - Errors occurring when the receiver is unable to connect to the center over the public network or other line.
    - Errors occurring when unable to view a reserved program.

[Input/display fields]

- Display indicating that the error history is being viewed.
- Display of error type and date of occurrence.
- Display of error description.

(For IC card errors)

- Display indicating that an invalid IC card was detected.
- Display of a message encouraging the user to contact the Customer Center or other office for more information.

(For errors involving the public network or other line)

- Display indicating that the receiver was unable to properly perform communications over the public network or other line.
- Display encouraging the user to verify the connection between the receiver and the public network or other line.
- Display of a message encouraging the user to contact the Customer Center or other office for more information.

(For errors when viewing reserved programs)

- Display indicating that the reserved program was not available for viewing.
- Display of the title, broadcaster group (station) name, and date for the program that was not available for viewing.

- Scroll or page changing input and display as necessary.

4.3 CA Interface

4.3.1 Interface Functionality

4.3.1.1 Interface Type and Selection

This interface standard (CA interface: CAI) defines a low-speed CA interface between the receiver and the CA module that provides conditional access security functionality. The low-speed CAI uses an IC Card as its CA module.

4.3.1.2 Mutual Authentication System and Ks Encryption

Mutual authentication between the IC card and the receiver is performed using the following method:

(1) The broadcast receiver and IC card interface includes an authentication system.

(2) The following authentication information is used to perform the authentication:

- Device identifiers managed by receiver manufacturer, receiver model, and lot.
- Device keys identified using the device identifiers.

(3) The authentication procedure is as follows:

- Multiple pairs of authentication information are distributed to each receiver.
- All authentication information used in the overall authentication system is distributed to the IC cards.
- When the receiver and IC card start operating, the receiver and IC card authenticate one another using the authentication information described above. At this point, the security module specifies which of the authentication information pairs that were previously distributed to the receiver to use (authentication information specification).

(4) The encryption algorithm, for example a common key block cipher with 128-bit keys, should offer sufficient security.

(5) The system should allow the authentication information specification that is sent to the IC card from the broadcaster via the broadcast signal and used in authentication operation to be changed in the event of its exposure to an unauthorized third party.

(6) The descrambling key Ks is encrypted based on the confidential information shared between the receiver and the IC card during the authentication process performed in step (3).

4.3.2 IC Card Interface Specifications

4.3.2.1 IC Card Dimensions and Physical Specifications

IC card physical specifications should comply with ISO 7816-1:1987.

Note: Although ARIB STD-B1 specifies an R value of 3.00 ±0.12, this standard uses an R value of 3.18 ±0.30.
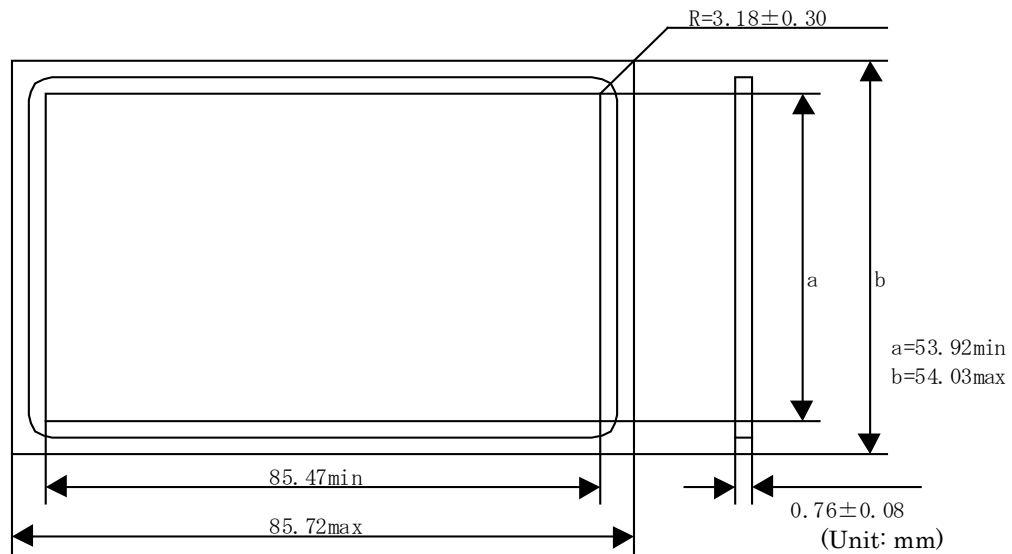
Figure 4-15 Shape of IC Card

4.3.2.2 Pin Assignments and Dimensions

IC card pin specifications should comply with ISO 7816-2:1988 (see Figure 4-16(a)). However, the IC card pin may be modified so that it can be used in a form equivalent to the Plug-in SIM specified in ETSI TS 100 977 (see Figure 4-16(b)).

Note: Although the ARIB STD-B1 specifies b value of 12.2, this standard uses b value of 12.25.

a=10.25max   b=12.25min
c=17.87max   d=19.87min
e=19.23max   f=20.93min
g=21.77max   h=23.47min
i=24.31max   j=26.01min
k=26.85max   l=28.55min (Unit: mm)
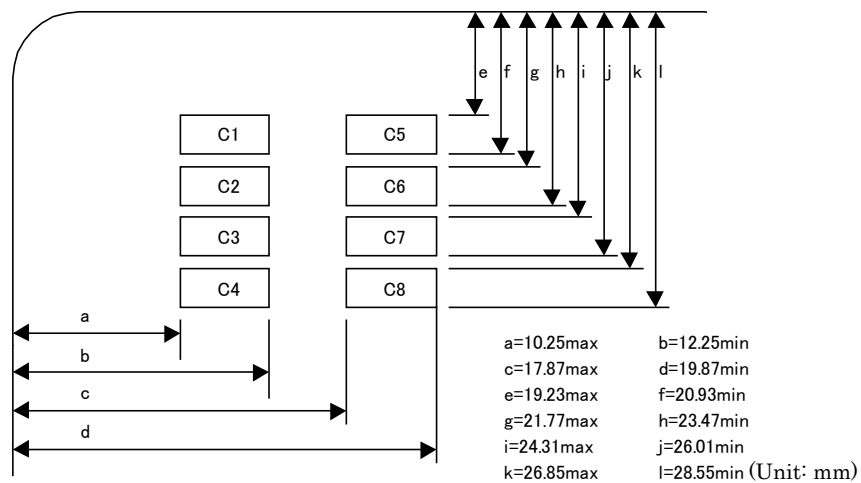
Figure 4-16 (a) Pin Assignments and Numbers
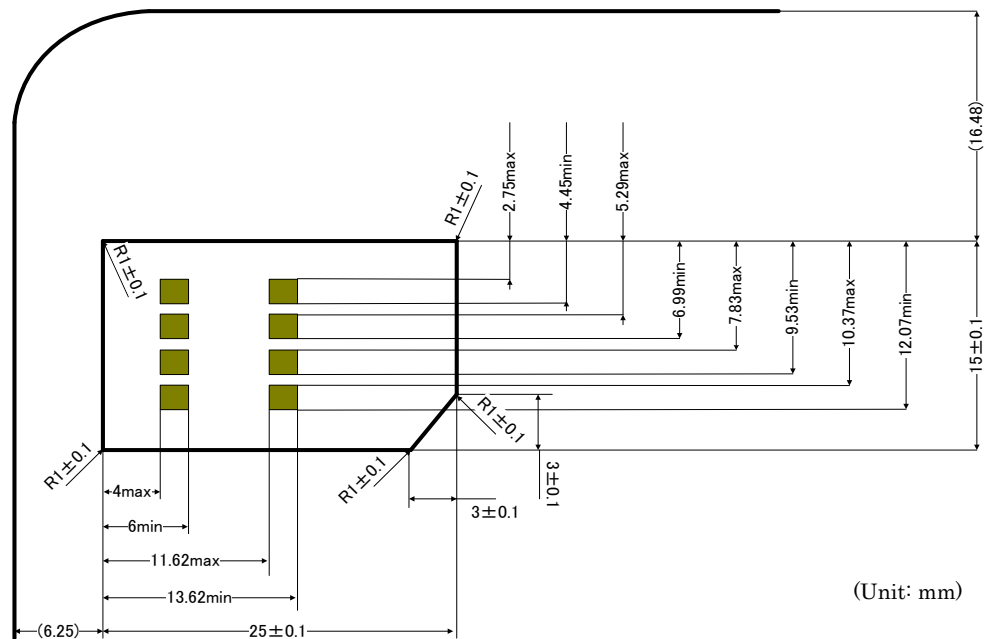
Figure 4-16 (b) Shape of Plug-in SIM

4.3.2.3 Electric Signals and Protocols

　IC card electric signal and protocol specifications should comply with ISO 7816-3:1997.

　(1)　VCC pin

　　　The VCC pin should satisfy 5 V single power supply (Class A) specifications.

　(2)　Vpp pin

　　　The Vpp pin acts as the NC (Not Connect) pin.

　(3)　CLK pin

　　　The CLK pin can be supplied both 4 MHz and 8 MHz signals.

　　　The pin is supplied a 4 MHz signal after being reset for the first time after the IC card
　　　is inserted. As the ATR response f_s maximum value FI (TA1) is to 3, the pin can be reset
　　　again and switched to 8 MHz.

　(4)　ATR (Answer To Reset)

　　　The ATR should comply with ISO 7816-3:1997.

　　　The card automatically transitions to ATR from 400 to 40,000 [1/f] clock cycles after an
　　　external reset and sends the reset response. Control information characters (historical
　　　bytes) are not sent.

　(4-1) Character format

　　　The character format is defined as half-duplex synchronous transmission with 1 start bit,
　　　8 data bits, even parity, and 2 guard time bits. Data logic is positive, and data is sent
　　　LSB-first.
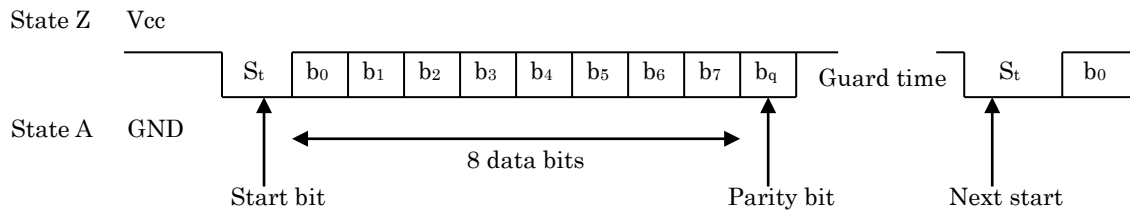
Figure 4-17 Character Format

(4-2) External clock transmission speed during ATR

The transmission speed during ATR is $etu^{-1} = f/372$ [bps].

The baud rate margin while sending and receiving is $(n - 0.2) \leq Tn \leq (n + 0.2)$ [etu].

Note: The etu refers to the transmission time for 1 bit. Tn refers to the time from the leading edge of the start bit to the leading edge of the nth bit.

(4-3) Block level

1)   Block structure

The block structure is expressed by T0 and TD_i. For this reason, the block termination method used at the DIRD consists of analyzing the format at the same time the reset response is received and applying logical termination.

2)   Character interval

The leading edges of successive characters should be delayed by the following interval:

$12 \leq$ leading interval $\leq 9,600$ [etu]

3)   Error detection

Character level: Vertical parity check

Block level: Horizontal parity check

4)   Error recovery

The only form of error recovery is a reset resulting in the retransmission of all characters.

(4-4) ATR transmission data

The initial response data consists of the initial character TS followed by other characters in the following order.

• The values of the respective bits of the Y_{i+1} element indicate the presence of the interface characters (TA_{i+1}, TB_{i+1}, TC_{i+1}, and TD_{i+1}) that follow TDi.

b_4: Presence of TA_{i+1}

b_5: Presence of TB_{i+1}

b_6: Presence of TC_{i+1}

b_7: Presence of TD_{i+1}

(Present: 1; absent: 0)

Initial character	TS	'3B'	Set the order. Logic 1 is set to state Z, and b0 is set to LSB.
Format character	T0	'F0'	Upper 4 bits: Set Y_1, used to indicate presence of interface characters following T0, to F. Lower 4 bits: Set the number of control information characters K to 0.
Interface characters	TA_1	'1x' '3x'	Upper 4 bits: Set the integer value FI to 1 (F = 372, f_{max} = 5 MHz) or 3 (F = 744, f_{max} = 8 MHz). Lower 4 bits: Set the integer value DI to 2 (D = 2), 3 (D = 4), or 4 (D = 8).
	TB_1	'00'	The Vpp pin serves as the not connect (NC) pin.
	TC_1	'xx'	Set the special character guard time integer (N). An N value of FF signifies a guard time (see Figure 4-17) of 1.
	TD_1	'91'	Upper 4 bits: Set Y_2, used to indicate the presence of following interface characters, to 9. Lower 4 bits: Set protocol used to exchange the following data to T = 1.
	TA_2	'81'	[b_7] Set to 1 to disallow multiple resets. [$b_6 b_5$] Fixed at 00. [b_4] Set to 0 to set the transmission parameter to the specified interface character. [b_3-b_0] Set the protocol used to exchange the following data to T = 1.
	TD_2	'B1'	Upper 4 bits: Set Y_3, used to indicate the presence of following interface characters, to B. Lower 4 bits: Set the protocol used to exchange the following data to T = 1.
	TA_3	'xx'	Set the data field length integer (IFSI). Initial value for the maximum length of the data field that can be received by the card (IFSC).
	TB_3	'xx'	Upper 4 bits: Block wait time integer (BWI) Lower 4 bits: Character wait time integer (CWI)
	TD_3	'1F'	Upper 4 bits: Set Y_4, used to indicate the presence of following interface characters, to 1. Lower 4 bits: Set to T = 15 to indicate that the following data is a non-protocol-dependent interface character.

	TA$_4$	'01'	[b$_7$b$_6$] Set to disallow use of clock stops (XI = 0).
		'03'	Normal IC card
			[b$_5$-b$_0$] Set the power supply specification to Class A only (U = 1) or Class AB (U = 3).
			Plug-in SIM-shaped IC card
			[b5-b0] Set power supply specification to ClassAB(U=3).
Check character	TCK	'xx'	Exclusive OR of T0 to TA$_4$.

(5) Protocol and parameters selection (PPS)

   The interface complies with ISO 7816-3:1997 and uses specific mode. For this reason, the protocol and parameters selection character is not used to select a protocol.

(6) Transmission protocol format

   The interface complies with the T = 1 (ISO 7816-3:1997) protocol.

(6-1) External operating clock transmission speed

   The external operating clock transmission speed is etu^{-1} = f*D/F [bps]. (D and F are determined by the FI/DI values of the ATR response TA$_1$.) The baud rate margin while sending and receiving is $(n - 0.2) \leq Tn \leq (n + 0.2)$ [etu].

(6-2) Block level

   a. Block structure

Table 4-1 Block Structure

Initial field			Information field	End field
Node address	Protocol control byte	Length	Send/receive data	Error detection code LRC
NAD	PCB	LEN	INF	EDC
1 byte	1 byte	1 byte	$0 \leq n \leq$ IFSC or IFSD byte	1 byte

   The block structure consists of the following fields:

   1) Initial field (required; 3 bytes)

      The initial field consists of the node address, the protocol control byte, and the number of data bytes for the information field.

   2) Information field (user-selectable)

      The information field consists of the data to be sent and received. The number of data bytes is indicated by the initial field.

   3) End field (required; 1 byte)

      A longitudinal redundancy check code (LRC) is used as an error detection code for the transmission block. The LRC is applied from the initial field to the information field.

b. Character interval
  1) CWT (Character Waiting Time)
     The CWT defines the maximum value between the leading edges of the start bits for 2
     characters sent consecutively within 1 block.

     CWT = 2^{CWI} + 11 [etu]

     If the next character is not received once the period defined by CWT elapses, the receive
     node will treat the situation as a transmission error and enter error recovery
     processing.
  2) BWT (Block Waiting Time)
     The BWT defines the maximum value between the leading edges of the start bits of the
     last character received by the IC card and the first character sent by the IC card in
     response.

     BWT = 2^{BWI} * 960 * 372 / f + 11 [etu]

     If the next character is not received once the period defined by BWT elapses, the DIRD
     will treat the situation as a transmission error and enter error recovery processing.
  3) BGT (Block Guard Time)
     The BGT defines the minimum value between the leading edges of the last character
     received by the IC card or DIRD and the first character sent by the IC card or DIRD in
     response.

     BGT = 22 [etu]

     Each node must reverse input/output within this time period.

T0[etu] : 11≤T0<CWT
T1[etu] : BGT≤T1<BWT
T2[etu] : BGT≤T2
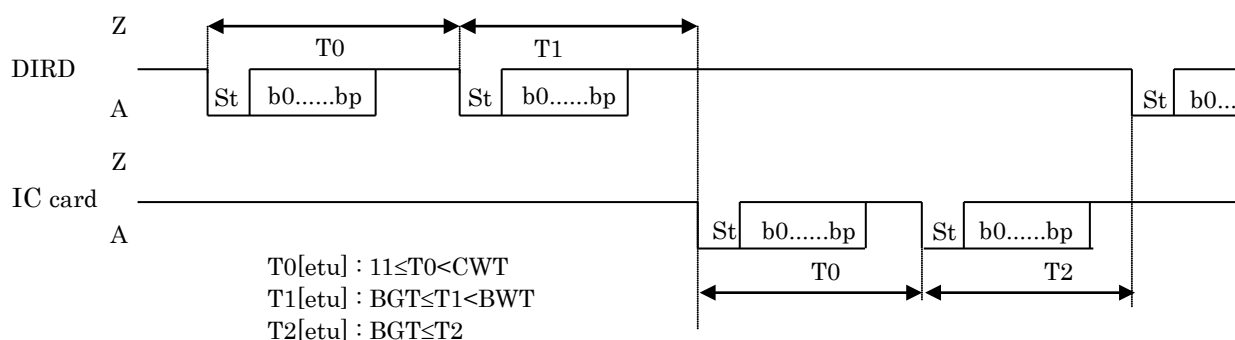
Figure 4-18 Character Interval

(6-3) Subfield coding method
  1) NAD (Node ADdress)
     The NAD is a 1-byte field that identifies the block's source node address (SAD) and
     destination node address (DAD). It is coded as follows:
     NAD is fixed at 00h (SAD = DAD = 0).
     For applications that have multiple slots and require simultaneous communications
     with multiple IC cards, each slot should be independently controlled by a separate
     interface.

2) PCB (Protocol Control Byte)

The PCB is a 1-byte field that carries transmission control information. It is coded as follows:

Table 4-2 I Block PCB Coding

PCB coding								Meaning
b7	b6	b5	b4	b3	b2	b1	b0	
0								I block identifier
	A							N(S)
		0						M; fix at 0.
				0	0	0	0	0	Fix at 0

N(S): Send sequence no.
M: More data bit; fix at 0.

Table 4-3 R Block PCB Coding

PCB coding								Meaning
b7	b6	b5	b4	b3	b2	b1	b0	
1	0							R block identifier
			A					N(R)
		0		0	0	0	1	Parity or EDC error
		0		0	0	1	0	Other error (sequence error, protocol violation, etc.)

N(R): Receive sequence no.

Table 4-4 S Block PCB Coding

PCB coding								Meaning
b7	b6	b5	b4	b3	b2	b1	b0	
1	1							S block identifier
		A						Block type 0: Request 1: Response
						B	C	Control (0, 0): RESYNCH (0, 1): IFS (1, 1): WTX
			0	0	0			Fix at 0.

S(ctrl, REQ): REQuest block
S(ctrl, RES): RESponse block

3) LEN (LENgth)

The LEN is a 1-byte field describing the length of the information field. It is always less than or equal to IFSC (IFSD).

(7) Protocol control

(7-1) Sequence checks

Block sequence checks are performed in accordance with the following rules for the I and R blocks in order to test for escape from the protocol level:

a. I blocks

I blocks are checked using N(S), which is managed independently by the IC card and the DIRD. N(S) is a modulo 2 counter and is managed according to the following rules:

1) The initial value at the protocol start point is 0. N(S) is incremented each time an I block is sent.

2) Nodes receiving I blocks for which N(S) = X(X = YXOR1) recognize that previously sent blocks for which N(S)=Y have properly received .

b. R blocks

Sequence check is performed by using the N(R) value which is coded from N(S) for the next I block expected to be received. This counter is managed according to the following rule:

1) N(R) during a retransmission request codes the N(S) value of the I block that should be received next.

	DIRD		IC card	
Step 1	I(0,0)	→		
Step 2		←	I(0,0)	
Step 3	I(1,0)	→		Incremented in Step 1.
Step 4		←	I(1,0)	Incremented in Step 2.

Figure 4-19 Example of Sequence Control During Normal Communications

	DIRD		IC card	
Step 1	I(0,0)	→	×	
Step 2		←	R(0)	Step 1 send block is expected.
Step 3	I(0,0)	→		Retransmission
Step 4		←	I(0,0)	

Figure 4-20 Example of Sequence Control When a Transmission Error Occurs

	DIRD			IC card	
Step 1	I(0,0)		→		
Step 2		×	←	I(0,0)	
Step 3	R(0)		→	×	Step 2 send block is expected.
Step 4			←	R(1)	Step 3 send block is expected.
Step 5	R(0)		→		Additional retransmission request
Step 6			←	I(0,0)	Retransmission
Step 7	I(1,0)		→		

Figure 4-21 Example of Sequence Control When a Multiplex Transmission Error Occurs

(7-2) Chaining

This feature is not used.

(7-3) Changing IFSD

Before exchanging the first I block, the DIRD must change the IC card's IFSD (including after resynchronization processing using S blocks) to allow data with a maximum size of 254 bytes (INF) to be received.

(7-4) RESYNC

In the event that multiple transmission errors occur, the DIRD must support RESYNC control as necessary.

(7-5) ABORT

This feature is not used.

(7-6) Error recovery

The protocol classifies transmission errors into 2 types and performs appropriate processing.

a. The following 3 error types, which are likely to represent simple transmission errors:

1) Parity/framing (character-level)

2) EDC errors (block-level)

3) Timer monitoring errors

b. The following 3 error types, which are likely to represent field coding errors:

1) NAD coding errors

2) PCB coding errors

3) S and R block information field coding errors

In the event that one of the errors described above is detected, the following error recovery processing is performed depending on the last block sent and the node detecting the error.

a. When the last block sent was an S block (ctrl, REQ)

1) When the node detecting the error is the DIRD

    i. Retransmission request using the same block.

    ii. Resynchronization request using an S block (RESYNCH, REQ)

    iii. Reset

2) When the node detecting the error is the IC card

    i. Retransmission request using the same block.

b. When the last block sent was not an S block (ctrl, REQ)

1) When the node detecting the error is the DIRD

    i. Retransmission request using an R block.

    ii. Resynchronization request using an S block (RESYNCH, REQ)

iii.   Reset

2)   When the node detecting the error is the IC card

      i.   Retransmission request using an R block.

	DIRD		IC card
Step 1	S(IFS,REQ)	→ ×	
Step 2	×	←	R(0)
Step 3	S(IFS,REQ)	→	
Step 4		←	S(IFS,RES)

Figure 4-22 Example of Error Recovery During S Block Exchange

	DIRD		IC card	
Step 1	I(0,0)	→		
Step 2	×	←	I(0,0)	
Step 3	R(0)	→ ×		
Step 4	×	←	R(1)	
Step 5	R(0)	→ ×		
Step 6	×	←	R(1)	Unable to recover despite 2 retries
Step 7	S(RESYNCH,REQ)	→		
Step 8		←		
			S(RESYNCH,RES)	
Step 9	I(0,0)	→		

Figure 4-23 Example of Error Recovery During Multiple Errors

4.3.3 Commands/Responses

4.3.3.1 Basic Command/Response Architecture

The command/response architecture should comply with ISO 7816-4:1995.

Command and response data is exchanged in accordance with the APDU (Application Protocol Data Unit) format.

(1) Command APDU

The command APDU consists of a 4-byte header (required) followed by a body (optional) and is coded as follows:

Table 4-5 Command APDU

Field name			Length	Notes
Classification	Abbreviation	Official Name		
Header	CLA	Class	1 byte	0x90
	INS	Instruction	1 byte	
	P1	Parameter 1	1 byte	0x00
	P2	Parameter 2	1 byte	0x00
Body	Lc	Length	1 byte	Data length (if 0, no Le/DATA)
	DATA	Data	Lc bytes	

	Le	Length	1 byte	Always 0 (Response length is variable.)

1) CLA

CLA is used for dedicated commands and differs from the common commands defined by ISO 7816-4. Its coding and meaning are defined privately by this standard. Additionally, the logic channel and secure messaging functions are not used.

CLA should always be set to 0x90.

Table 4-6 CLA Coding

Bit coding								Meaning
b7	b6	b5	b4	b3	b2	b1	b0	
1	0	0	1					Structure is standard-compliant, but coding and meaning have been privately defined.
				0	0			Secure messaging is not used.
						0	0	The logic channel is not used.

2) INS

With the exception of the invalid INS values established by ISO 7816-4:1995, the values defined by this standard are identical to those set out in ARIB STD-B1.

Table 4-7 Invalid INS Values

Bit coding								Meaning
b7	b6	b5	b4	b3	b2	b1	b0	
x	x	x	x	x	x	x	1	Odd number
0	1	1	0	x	x	x	x	'6x'
1	0	0	1	x	x	x	x	'9x'

3) P1, P2

Currently both P1 and P2 are fixed at 0.

They may be used in the future when expandability is required within the same command functions.

4) Lc, Le

In accordance with the original standard, Lc is not coded when the data length is 0.

Because the response data length varies depending on the result of internal IC card processing, the value is fixed at 0 in accordance with the original standard, allowing the use of any response length.

As noted in "Section 4.3.2.3 (7-2) Chaining" above, extended Lc and extended Le functionality is not used.

(2) Response APDU

The response APDU consists of a body (optional) followed by a 2-byte trailer (required) and is coded as follows:

Table 4-8 Response APDU

Field name			Length	Notes
Classification	Abbreviation	Official Name		
Body	DATA	Data	N bytes	Not mandatory
Trailer	SW1	Status Byte 1	1 byte	Mandatory
	SW2	Status Byte 2	1 byte	Mandatory

1) SW1, SW2

SW1 and SW2 are used within the scope defined by ISO 7816-4:1995. Because the IC card's internal processing results and status have been standardized, it is necessary for this standard to define separate detailed command status information in the data field. SW1 and SW2 serve as carriers of supplementary status information.

4.3.3.2 Detailed Response Data Field Architecture

The protocol unit's payload is only defined when the protocol unit number is 0.

The data field contents are as follows:

1) Protocol unit

- The protocol unit serves as the basic unit of function information. Additional units can be added if functions need to be extended.
- Protocol units are identified by protocol unit numbers.

2) Protocol unit number

The protocol unit number indicates the version number of the IC card interface specifications.

3) Unit length

The unit length indicates the number of bytes in the protocol unit payload.

4) IC card instruction

The IC card instruction indicates instructions from the IC card to the DIRD.

5) Return code

The return code indicates the result of internal IC card processing such as viewing judgment.

6) Data (protocol unit payload data)

The data field indicates response data specific to each command.

■ Data field architecture
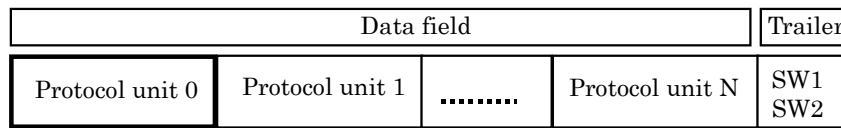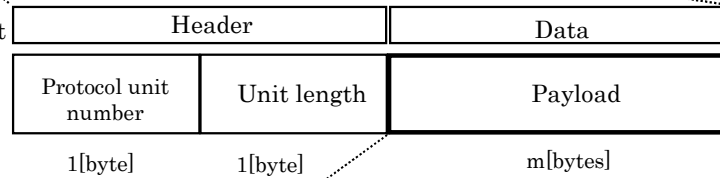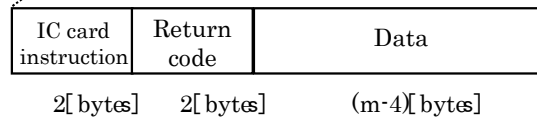
Figure 4-24 Detailed Data Field Architecture

4.3.3.3 Command/Response Details

The following defines the format used to send commands and responses between the IC card and the DIRD.

Only protocol units for which the IC card protocol unit number is 0 show a data field.

(1) Initial Setting Conditions command

a) Function overview

- The Initial Setting Conditions command acquires conditions that are shared between the DIRD and the IC card, such as information used in filtering ECM and EMM data, the IC card type, etc.

- The card ID acquired by this command is the individual card ID. The "acquire card ID information" response IC card instruction will be issued when the IC card has a group ID. In this case the group ID can be acquired by issuing the Acquire Card ID Information command.

b) Command

Table 4-9 Initial Setting Conditions Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	30
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Le	Response data length	1	00

c) Response

Table 4-10 Initial Settings Conditions Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		CA_system_id	2	
11		Card ID (1) *1)	6	
17		Card type	1	*2)
18		Message division length	1	
19		Descrambling system key	32	
51		Descrambler CBC initial value	8	
59		System_management_id count	1	N
60		System_management_id(1)	2	
		...		
		System_management_id(N)	2	
60+2N	SW1		1	
61+2N	SW2		1	

*1) Individual card ID

*2) Card type   0x00: Prepaid (although the system does not include prepaid operation)

0x01: Standard

(2) ECM Receive command

  a) Function overview

    The ECM Receive command transfers ECM data and acquires Ks and other data.

  b) Command

Table 4-11 ECM Reception Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	LC	Command data length	1	n *1)
8	Data	ECM	n	*2)
N+8	Le	Response data length	1	00

*1) n: Length of ECM_section_data_byte

*2) ECM payload in ECM section

  c) Response

Table 4-12 ECM Reception Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Ks (odd)	8	*1)
17		Ks (even)	8	*1)
25		Recording control	1	*2)
26	SW1		1	
27	SW2		1	

*1) Unless viewing is available, all 0.

*2) 0x00: Recording not available; 0x01: Recording available; 0x10: Recording by purchaser only

(3) EMM Receive command

    a) Function overview

        The EMM Receive command transfers EMM data.

    b) Command

Table 4-13 EMM Reception Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	LC	Command data length	1	n *1)
8	Data	EMM data	n	*2)
N+8	Le	Response data length	1	00

    *1) n: Length of 1 EMM payload in EMM_section

    *2) Corresponding EMM payload in the EMM section

    c) Response

Table 4-14 EMM Reception Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9	SW1		1	
10	SW2		1	

(4) Contract Confirmation command

a) Function overview

- The Contract Confirmation command confirms channel and program contracts in order to confirm whether viewing of reserved program is available when displaying the contract status list and reserving programs.

- The command transfers contract confirmation information for the contract confirmation target and acquires information describing the contract status, program fee, and other information.

b) Command

Table 4-15 Contract Confirmation Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	LC	Command data length	1	n+2
8	Data	Program broadcast date	2	*1)
10		Contract confirmation info.	n	
N+10	Le	Response data length	1	00

*1) MJD: Year/month/day; year, month, and day of end time for the program being confirmed as obtained from the SI

c) Response

Table 4-16 Contract Confirmation Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Broadcaster identifier	1	
10		Recording control	1	*1)
11		PPV program number	2	*2)
13		PPV viewing fee 1	2	*2), *3)
15		PPV viewing fee 2	2	*2), *4)
17		Reservation purchase limit	2	*2), *5)
19		Min. prepaid balance	2	*2)
21	SW1		1	
22	SW2		1	

*1) 0x00: Recording not available; 0x01: Recording available; 0x10: Recording by purchaser only

*2) Return code is valid only when the PPV program judgment is "purchase available," "already purchased," or "purchase not available." For all other cases, the return code is 0.

*3) PPV program viewing fee: Base fee

*4) Purchase viewing fee for programs allowing recording requests when the recording request was purchased: Base fee + additional fee

*5) BCD/hour-min: Time offset from program starting time when reservation and purchase are
available

(5) EMM Individual Message Receive command

a) Function overview

- The EMM Individual Message Receive command causes the DIRD to partition an EMM
individual message's message code region, transfer it to the IC card, and acquire the
response message code.

- The DIRD displays the message depending on the contents of the response message
code returned by the IC card.

b) Command

Table 4-17 EMM Individual Message Reception Command

Offset	Field	Data	Length (Bytes)		Value (Hex)
+3	CLA	CLA code	1		90
4	INS	INS code	1		
5	P1	Parameter 1	1		00
6	P2	Parameter 2	1		00
7	Lc	Command data length	1		n+9
8	Data	Card ID	6		
14		Protocol number	1		
15		Broadcaster identifier	1		
16		Message control	1	*1)	
17		Message code	n	*2)	
n+17	Le	Response data length	1		00

*1) 0x01: Message stored on the IC card
0x02: Message stored on the DIRD

*2) Message code length conditions

- Represents the length of the message partition (multiple of 8). However, for the
final partition, must be less than or equal to the partition's byte length.

- The message partition length refers to the value acquired by the response to the
Initial Settings Conditions command.

c) Response

Table 4-18 EMM Individual Message Reception Response

Offset	Field	Data	Length (Bytes)		Value (Hex)
+3	Data	Protocol unit number	1		00
4		Unit length	1		
5		IC card instruction	2		
7		Return code	2		
9		Response message code	n	*1)	
n+9	SW1		1		
n+10	SW2		1		

*1) Contents are identical to the message code region in the EMM individual message.

For messages stored on the IC card, display of automatic display messages is cancelled when the fixed message sentence number is 0 and when the differential information length is 0.

⑹ Automatic Display Message Display Information Acquire command

a) Function overview

- The Automatic Display Message Display Information Acquire command causes the DIRD to acquire automatic display message display information when selecting a program.
- The DIRD displays automatic display messages according to the acquired display information.

b) Command

Table 4-19 Automatic Display Message Displaying Information Acquisition Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	04
8	Data	Current date	2	*1)
10		Broadcaster identifier	1	*2)
11		Delay interval	1	*2)
12	Le	Response data length	1	00

*1) MJD: Year/month/day; year, month, and day acquired from the SI

*2) Automatic display message control information acquired from ca_service_descriptor

c) Response

Table 4-20 Automatic Display Message Displaying Information Acquisition Response

Offset	Field	Data		Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number		1	00
4		Unit length		1	
5		IC card instruction		2	
7		Return code		2	
9		Expiration date	*1)	2	
11		Fixed Message Sentence Number	*2)	2	
13		Differential format number	*3)	1	
14		Differential info. length	*4)	2	
16		Differential control information	*5)	n	
n+16	SW1			1	
n+17	SW2			1	

*1) to *5) See EMM message code region content for more information.

(7) PPV Status Request command

   a) Function overview

- The PPV status Request command acquires detailed information for PPV program.
- When the ECM for a program being broadcast is received indicating that the program is available for PPV purchase, this command is issued and detailed program information is acquired. To purchase the program, the Purchase PPV Program command is then issued.
- When reserving a program, this command is not issued.

   b) Command

<div align="center">

Table 4-21 PPV Status Request Command

</div>

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	LC	Command data length	1	n
8	Data	ECM	n	
n+8	Le	Response data length	1	00

   c) Response

<div align="center">

Table 4-22 PPV Status Request Response

</div>

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Broadcaster identifier	1	
10		PPV program number	2	
12		Recording control	1	*1)
13		PPV viewing fee 1	2	*2)
15		PPV viewing fee 2	2	*3)
17		Min. prepaid balance	2	*4)
19	SW1		1	
20	SW2		1	

*1) 0x00: Recording not available; 0x01: Recording available; 0x10: Recording by purchaser only

*2) PPV program viewing fee: Base fee

*3) Purchase viewing fee for programs allowing recording requests when the recording request was purchased: Base fee + additional fee

*4) Prepaid operation is not supported.

(8) PPV Program Purchase command

a) Function overview

- The PPV Program Purchase command is used to purchase PPV program.

- To purchase a program being broadcast, confirm the user's intention to purchase the program on the purchase invitation screen after the PPV Status Request command completes and issue this command if the user wishes to purchase the PPV program.

- When receiving a reserved program, issue this command immediately after starting to receive the reserved program. Continue to issue it until receiving a return code of "Purchase complete: Deferred-payment PPV" or "Purchase complete: Prepaid."

- It is not necessary to issue the ECM Receive command while issuing this command.

b) Command

Table 4-23 PPV Program Purchase Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	n+4
8	Data	Broadcaster identifier	1	
9		PPV program number	2	
11		Recording request	1	*1)
12		ECM	n	
n+12	Le	Response data length	1	00

*1) 0x01: Request; 0x00: No request

Use a value of 0x00 when unable to select the recording request (recording available/not available)

c) Response

Table 4-24 PPV Program Purchase Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Ks (odd)	8	*1)
17		Ks (even)	8	*1)
25		Recording control	1	*2)
26	SW1		1	
27	SW2		1	

*1) Unless viewing is available, all 0.

*2) 0x00: Recording not available; 0x01: Recording available

ARIB STD-B25
Version 6.7-E1

(9) Card Request Confirmation command

a) Function overview

The Confirm Card Request command reports the current time every 15 seconds in order to confirm the viewing history information upload time.

b) Command

Table 4-25 Card Request Confirmation Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	05
8	Data	Current time	5	*1)
13	Le	Response data length	1	00

*1) MJD + BCD: Year/month/day + hours/minutes/seconds

c) Response

Table 4-26 Card Request Confirmation Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9	SW1		1	
10	SW2		1	

(10) Call-in Connection Status Report command

a) Function overview

The Call-in Connection Status Report command accepts a call-in instruction from the IC card
and reports the status of the telephone line connection with the center to the IC card.

b) Command

Table 4-27 Call-in Connection Status Report Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	02
8	Data	PDU number	1	00
9		Connection status	1	*1)
10	Le	Response data length	1	00

*1) 0x00: Connection complete: Line connection complete.

0x01: Call-in failed: The line connection failed (including or failure of a call-in for the
transmission of DIRD data).

0x02: Call-in disconnected: Line was disconnected while communicating after the
establishment of a connection.

c) Response

Table 4-28 Call-in Connection Status Report Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	1	00
10		Final PDU number	1	00 *2)
11		Upload data	n	
n+11	SW1		1	
n+12	SW2		1	

*2) This response signals the completion of upload data.

(11) Data Request command

a) Function overview

If the final PDU number in a response to the Center Response command is n (n ≥ 1), issue this command n times to acquire the upload data.

b) Command

<p align="center">**Table 4-29 Data Request Command**</p>

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	01
8	Data	PDU number	1	*1)
9	Le	Response data length	1	00

c) Response

<p align="center">**Table 4-30 Data Request Response**</p>

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	1	*1)
10		Final PDU number	1	*1)
11		Upload data	m	*1)
m+11	SW1		1	
m+12	SW2		1	

*1)

i) When this command is issued n times following the Center Response command, the result is as follows:

ii) The command PDU number transferred to the IC card is incremented. An out-of-sequence number results in the response triggering a sequence error.

Command/response	Field	Command issue: value from 1 time to n times
Command	PDU number	1 to n
Response	PDU number	1 to n
	Final PDU number	Fixed at n
	D(*)	D(1) to D(n)

D(*): Upload data

(12) Center Response command

a) Function overview

- The Center Response command transfers a response from the center.
- If a sequence of upload data follows this command's response, issue the Data Request command to acquire the upload data.

b) Command

Table 4-31 Center Response Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	n+1
8	Data	PDU number	1	00
9		Response data	n	
n+9	Le	Response data length	1	00

c) Response

Table 4-32 Center Response Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	1	00
10		Final PDU number	1	
11		Upload data	m	
m+11	SW1		1	
m+12	SW2		1	

(13) Call-in Date/Time Request command

a) Function overview

The Call-in Date/Time Request command is issued to acquire the date and time for uploading viewing history information upon receiving an "acquire call-in date/time" instruction after inserting an IC card, turning on the receiver, or receiving an EMM (via broadcast or center communications).

b) Command

Table 4-33 Call-in Date/Time Request Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Le	Response data length	1	00

c) Response

Table 4-34 Call-in Date/Time Request Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Call-in date/time	5	*1)
14	SW1		1	
15	SW2		1	

*1) MJD + BCD: Year/month/day + hours/minutes/seconds

(14) Call-in Destination confirmation command

a) Function overview

The Call-in Destination confirmation command is issued after receiving the "call in" IC card instruction. It obtains the call-in destination telephone number.

b) Command

Table 4-35 Call-in Destination Confirmation Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Le	Response data length	1	00

c) Response

Table 4-36 Call-in Destination Confirmation Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Host number	8	*1)
17		Telephone number	7	*2)
24	SW1		1	
25	SW2		1	

*1) From the first byte in order, the 8 bytes from N1 to N8 (JIS C6220, 8 alphanumeric characters) are allocated for storing the host number. See Table 4-65.

*2)

- A telephone number of up to 14 digits is expressed by the 4-bit BCD (0 to 9) code.
- The phone number is stored from the first byte with the 4 LSB bits following the 4 MSB bits.
- The value 0xF is invalid. Values are valid through the value immediately preceding the first 0xF.
- For example, the telephone number "012-345-6789" would be stored as follows:

	MSB side	LSB side
Byte 1	0	1
Byte 2	2	3
Byte 3	4	5
Byte 4	6	7
Byte 5	8	9
Byte 6	F (Invalid)	F (Invalid)
Byte 7	F (Invalid)	F (Invalid)

(15) User Call-in Request Command

   a) Function overview

- The User Call-in request command requests a call-in to collect PPV viewing information from the DIRD.
- This command is issued in response to viewer operation of the DIRD after the "retries exceeded notification" of IC card instruction.

   b) Command

Table 4-37 User Call-in Request Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	05
8	Data	Current time	5	*1)
13	Le	Response data length	1	00

*1) MJD + BCD: Year/month/day + Hours/minutes/seconds

   c) Response

Table 4-38 User Call-in Request Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9	SW1		1	
10	SW2		1	

(16) DIRD Data Communications Start command

  a) Function overview

- The DIRD Data Communications Start command requests the transmission of DIRD data.
- Operation following the issue of this command is identical to the viewing information collection procedure, and subsequent commands are issued sequentially (Call-in Connection Status Report command, Center Response command).

  b) Command

Table 4-39 DIRD Data Communications Start Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	LC	Command data length	1	02
8	Data	Broadcaster identifier	1	*1)
9		Center ID	1	*1)
10	Le	Response data length	1	00

*1) Acquired from application providing DIRD data communications.

  c) Response

Table 4-40 DIRD Data Communications Start Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Partition byte length	2	*3)
11	SW1		1	
12	SW2		1	

*3) Multiple of 8.

(17) DIRD Data Encrypt command

 a) Function overview

- The DIRD Data Encrypt command partitions DIRD data, sends it to the IC card, and acquires the encrypted equivalent of the data.
- This command is issued after the DIRD Data Communications Start, Call-in Connection Status Report, and Center Response commands have terminated normally.

 b) Command

Table 4-41 DIRD Data Encrypt Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	L+6
8	Data	Broadcaster identifier	1	*1)
9		Center ID	1	*1)
10		Transmission data length	2	
12		PDU number	1	*2)
13		Final PDU number	1	*3)
14		DIRD data	L *4)	
L+14	Le	Response data length	1	00

*1) Acquired from application providing DIRD data communications.

*2) 0 to (m − 1): Indicates the number of the data partition (m: number of data partitions).

*3) (m − 1) (fixed): Indicates number of the final data partition.

*4) Support for "partition byte length" acquired with the "L" Start DIRD Data Communications command

PDU number	L value
0 to (m − 2)	Partition byte length
(m − 1)	Less than or equal to the partition byte length

 c) Response

Table 4-42 DIRD Data Encrypt Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	1	*1)
10		Upload data	n	
n+10	SW1		1	
n+11	SW2		1	

*1) Same value as the command's PDU number

(18) DIRD Response Data Decode command

a) Function overview

    The DIRD Response Data Decode command partitions DIRD response data acquired from the center, transfers it to the IC card, and acquires the decoded equivalent of the data.

b) Command

Table 4-43 DIRD Response Data Decode Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	L+4
8	Data	Broadcaster identifier	1	*1)
9		Center ID	1	*1)
10		PDU n umber	1	*2)
11		Final PDU number	1	*3)
12		Download data	L *4)	
L+12	Le	Response data length	1	00

*1) Acquired from application providing DIRD data communications.

*2) 0 to (m – 1): Indicates the number of the data partition (m: number of data partitions).

*3) (m – 1) (fixed): Indicates number of the final data partition.

*4) Support for "partition byte length" acquired with the "L" DIRD Data Communications Start command

PDU number	L value
0 to (m – 2)	Partition byte length
(m – 1)	Less than or equal to the partition byte length (multiple of 8)

c) Response

Table 4-44 DIRD Data Decode Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	1	*1)
10		DIRD response data	n	
n+10	SW1		1	
n+11	SW2		1	

*1) Same value as the command's PDU number

(19) DIRD Data Communications End command

a) Function overview

- The DIRD Data Communications End command notifies the IC card that the reception of DIRD response data has completed.
- The response from the center acquired by sending the upload data for this command's response to the center is transferred to the IC card with the Center Response command, after which the normal center communications state obtains.

b) Command

Table 4-45 DIRD Data Communications End Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	02
8	Data	Broadcaster identifier	1	*1)
9		Center ID	1	*1)
10	Le	Response data length	1	00

*1) Acquired from application providing DIRD data communications.

c) Response

Table 4-46 DIRD Data Communications End Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	1	00
10		Final PDU number	1	
11		Upload data	n	
n+11	SW1		1	
n+12	SW2		1	

(20) Power-on Control Information Request command

a) Function overview

The Power-on Control Information Request command is issued after receiving a "acquire power-on information" instruction as a result of card insertion, receiver power-on, or EMM reception (via broadcast or center communications). It acquires all power-on control information.

b) Command

Table 4-47 Power-on Control Information Request Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Lc	Command data length	1	01
8	Data	Power-on control info. no.	1	*1)
9	Le	Response data length	1	00

*1) Start at 0x00.

c) Response

Table 4-48 Power-on Control Information Request Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Power-on control info. no.	1	*1)
10		Final power-on control info. no.	1	*1)
11		Broadcaster identifier	1	
12		Power-on start reference date	2	*2)
14		Power-on start date offset	1	*3)
15		Power-on period	1	*4)
16		Power supply hold time	1	*5)
17		Reception network	2	*6)
19		Reception TS	2	*7)
21	SW1		1	
22	SW2		1	

*1)

i) If there are n blocks of power-on control information, issue this command n times as indicated below:

Command/ response	Field	Command issue: value from 1 time to n times
Command	Power-on control information number	0 to (n − 1)
Response	Power-on control information number	0 to (n − 1)
	Final power-on control information number	Fixed at (n − 1)
	D(*)	D(0) to D(n − 1)

D(*) = (Power-on start reference date, power-on start date offset, power-on period, power supply hold time, receive network, receive TS)

*2) Year/month/day: MJD

*3) Number of days: Calculate using the formula (Power-on start date = Power-on start reference date – power-on start date offset).

*4) Number of days: Power-on period from the power-on start date

*5) Time: Time for which to keep the power supply active for EMM reception after the viewer operates the DIRD power off

*6) original_network_id: Network containing the TS on which EMMs are received

*7) transport_stream_id: TS on which EMMs are received

(21) Prepaid Balance Confirmation command (prepaid operation is not recognized in the general operation information)

a) Function overview

- The Prepaid Balance Confirmation command acquires the prepaid balance.
- This command is only used with prepaid cards. It is not used with standard cards.

b) Command

Table 4-49 Prepaid Balance Confirmation Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Le	Response data length	1	00

c) Response

Table 4-50 Prepaid Balance Confirmation Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Character code	n	*1)
n+9		Prepaid balance	2	
n+11	SW1		1	
n+12	SW2		1	

*1) Broadcaster group character code

　　Max.: 21 [bytes] (including 1 [byte] null termination)

(22) Card ID Information Acquire command

a) Function overview

The Card ID Information Acquire command acquires card ID information for display.

b) Command

Table 4-51 Card ID Information Acquire Command

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	CLA	CLA code	1	90
4	INS	INS code	1	32
5	P1	Parameter 1	1	00
6	P2	Parameter 2	1	00
7	Le	Response data length	1	00

c) Response

Table 4-52 Card ID Information Acquire Response

Offset	Field	Data	Length (Bytes)	Value (Hex)
+3	Data	Protocol unit number	1	00
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		Number of card IDs	1	M
10		Display card ID (1) *1)	10	
		...		
10M		Display card ID (M) *1)	10	
10M+10	SW1		1	
10M+11	SW2		1	

*1)

Item		No. of bits	Note
Card type	Manufacturer identifier	8 bits	Note 1)
	Version	8 bits	
Card ID	ID identifier	3 bits	Note 2)
	ID	45 bits	
Check code		16 bits	

Note 1) 1 ASCII character (all other items are binary)

Note 2) M = 1: Individual card ID; M ≥ 2: Group ID

(23) Mutual authentication commands

The adoption of a mutual authentication system is made possible by expanding the content of the Initial Settings Conditions command and adding 3 new command types. Currently the adoption of these command changes remains tentative, and detailed decisions regarding formats and receiver operation will be made once operation begins. See "10. Mutual Authentication System and Ks Encryption" in Reference 1 for more information.

4.3.3.4 Parameter Chart

(1) INS list

The following table provides a list of INS parameters.

Table 4-53 INS Parameters

Function type	Command name		INS value (HEX)	Note
	Name	Code		
Initial settings	Initial Setting Condition	INT	30	
Basic processing	ECM Reception	ECM	34	
	EMM Reception	EMM	36	
Contract confirmation	Contract Confirmation	CHK	3C	
EMM messages	EMM Individual Message Reception	EMG	38	
	Automatic Display Message Displaying Information Acquisition	EMD	3A	
PPV purchase	Request PPV Status	PVS	40	
	Purchase PPV Program	PPV	42	
	Confirm Prepaid Balance	PRP	44	
Center communications	Confirm Card Request	CRQ	50	
	Report Call-in Connection Status	TLS	52	
	Request Data	RQD	54	
	Center Response	CRD	56	
	Request Call-in Date/Time	UDT	58	
	Confirm Call-in Destination	UTN	5A	
	Request User Call-in	UUR	5C	
	Start DIRD Data Communications	IRS	70	
	Encrypt DIRD Data	CRY	72	
	Decode DIRD Response Data	UNC	74	
	End DIRD Data Communications	IRR	76	
Power saving	Power-on Control Information Request	WUI	80	
Display of card ID	Card ID Information Acquisition	IDI	32	

(2) SW1/SW2

SW1 and SW2 are based on ISO/IEC 7816-4 and use values shown in the following table within the range of that standard.

- They return common responses related to normal command execution and errors.
- No response data is returned when a command terminates with an error.

<div align="center">Table 4-54 SW1/SW2</div>

Classification	SW1, SW2	Meaning
Normal termination	0x9000	Command terminated normally.
Termination with error	0x6400	Memory error (memory scrambling detected)
	0x6581	Memory write error
	0x6700	Command length error Lc/Le coding error
	0x6800	Undefined CLA (CLA lower nibble ≠ 0)
	0x6A86	Incorrect P1/P2 value
	0x6D00	Undefined INS
	0x6E00	Undefined CLA (CLA upper nibble ≠ 9)

(3) IC card instruction

- The IC card instruction parameter reports instructions from the IC card to the DIRD.

- Allocation of [b15, …, b0] is as follows:

    b0: Acquire power-on control information: 1

    b1: Acquire call-in date/time: 1

    b2: Delete password: 1

    b3: Call in: 1

    b4: Reserved

    b5: Retries exceeded notification

    b6: Disconnect call: 1

    b7: Acquire initial settings conditions: 1

    b8: Acquire card ID information: 1

    b9: Replace card: 1

    b10 to b15: Spare

Operating modes

IC card instructions have the following operating modes:

- The IC card responds to various commands by setting the corresponding IC card instruction bits to issue an instruction to the DIRD. See Table 4-55, "IC Card Instructions by Command," for a list of the instructions that may be issued in response to each command.

- The corresponding IC card instruction bits remain set until being reset. See Table 4-56, "Bit Reset Conditions," for a description of the conditions under which the bits are reset.

Table 4-55 IC Card Instructions by Command

Command	IC card instruction									
	b0	b1	b2	b3	b4	b5	b6	b7	b8	b9
Initial Setting Conditions									○	○
Receive ECM	○							○		○
Receive EMM	○	○	○					○	○	○
Purchase PPV Program	○							○		○
Confirm Card Request		○		○		○		○		○
Report Call-in Connection Status		○				○	○	○		○
Request Data							○	○		○
Center Response	○	○	○				○	○	○	○
Confirm Call-in Destination							○	○		○
Request User Call-in				○			○	○		○
Start DIRD Data Communications							○	○		○
Encrypt DIRD Data							○	○		○
Decode DIRD Response Data							○	○		○
End DIRD Data Communications							○	○		○

*) For all other commands, only b9 is set.

Table 4-56 Bit Reset Conditions

Bit	Instruction description	Reset condition
b0	Acquire power-on control information	Bit is reset once all power-on control information has been uploaded to the DIRD by the Request Power-on Control Information command.
b1	Acquire call-in date/time	Bit is reset once a normal response is returned for the Request Call-in Date/Time command.
b2	Delete password	This instruction is issued only once.
b3	Call in	Bit is reset when the Report Call-in Connection Status command is received by the IC card.
b4	Reserved	
b5	Retries exceeded notification	Bit is reset once communications with the center complete normally.
b6	Disconnect call	This instruction is issued only once.
b7	Acquire initial settings conditions	Bit is reset once a normal response is returned for the Acquire Initial Settings Conditions command.
b8	Acquire card ID information	Bit is reset once a normal response is returned for the Acquire Card ID Information command.
b9	Replace card	This bit is not reset.

4.3.3.5 Return Codes

Return codes report IC card processing results and statuses for commands to the DIRD.

(1) Command Common return codes

The following table provides a list of return codes that are common by all commands.

Table 4-57 Return Codes and SW1/SW2 Parameters That Are Shared by All Commands (HEX)

Command name		Return	SW1	Detailed status	
Name	Code	Code	/SW2	Category	Subcategory

■ Return codes and SW1/SW2 parameters shared by all commands

			SW1/SW2	Category	Subcategory
			6700	Nonstandard command	Command length error
			6800		Undefined CLA
			6A86		Incorrect P1/P2 value
			6D00		Undefined INS
			6E00		Undefined CLA
			6400	Memory error	Memory error (memory scrambling detected)
			6581		Memory write error
		A1FF	9000	Card error	Unusable card
		A1FE	9000	Other error	

(2) Return codes by command

The following table provides a list of return codes by command.

Table 4-58 Return Codes (1) and SW1/SW2 Parameters by Command (HEX)

Command name		Return	SW1	Detailed status	
Name	Code	Code	/SW2	Category	Subcategory

■ Initial settings conditions

Initial Settings Conditions	INT	2100	9000	Normal termination	

■ ECM reception

Receive ECM	ECM	A102	9000	Non-operational card	Non-operational protocol number
		A103		No contract	No Kw
		8901		No contract:	Tier
		8501		Outside contract	Prepaid PPV
		8301			Payment-deferred PPV
		8902		No contract:	Tier
		8502		Expired	Prepaid PPV
		8302			Payment-deferred PPV
		8903		No contract:	Tier
		8503		Viewing restriction	Prepaid PPV
		8303			Payment-deferred PPV
		0800		Purchased:	Tier
		0400		Viewing	Prepaid PPV
		0200			Payment-deferred PPV
		4480		Available for purchase:	Prepaid PPV
		4280		Previewing	Payment-deferred PPV
		8500		Available for purchase:	Prepaid PPV
		8300		Outside preview	Payment-deferred PPV
		8108		Purchase refused	Purchase prohibited period
		8109			Viewing history memory full
		850F			Insufficient prepaid balance
		A106		Security error	ECM tampering error

■ EMM reception

Receive EMM	EMM	2100	9000	Normal termination	
		A102		Non-operational	Non-operational protocol number
		A107		Security error	EMM tampering error

Table 4-59 Return Codes (2) and SW1/SW2 Parameters by Command (HEX)

Command name		Return	SW1	Detailed status	
Name	Code	Code	/SW2	Category	Subcategory

■ Contract confirmation

Command name		Return	SW1	Detailed status	
Confirm Contract	CHK	A102	9000	Non-operational card	Non-operational protocol number
		A103		No contract	No Kw
		8901		No contract:	Tier
		8501		Outside contract	Prepaid PPV
		8301			Payment-deferred PPV
		8902		No contract:	Tier
		8502		Expired	Prepaid PPV
		8302			Payment-deferred PPV
		8903		No contract:	Tier
		8503		Viewing restriction	Prepaid PPV
		8303			Payment-deferred PPV
		0800		Purchased:	Tier
		0400		(*1)	Prepaid PPV
		0200			Payment-deferred PPV
		8500		Available for purchase:	Prepaid PPV
		8300		(*2)	Payment-deferred PPV
		8109		Purchase refused	Viewing history memory full
		850F			Insufficient prepaid balance
		A104		Security error	Contract confirmation information tampering error

(*1) Same code as the "Purchased: Previewing" ECM return code.

(*2) Same code as the "Available for purchase: Outside preview" ECM return code.

■ EMM message reception

Command name		Return	SW1	Detailed status	
Receive EMM Individual Message	EMG	2100	9000	Normal termination	
		A102		Non-operational	Non-operational protocol number
		A105		Security error	EMM message tampering error
Acquire Automatic Display Message Display Information	EMD	2100		Normal termination	
		A101		No corresponding data	

Table 4-60 Return Codes (3) and SW1/SW2 Parameters by Command (HEX)

Command name		Return	SW1	Detailed status	
Name	Code	Code	/SW2	Category	Subcategory

■ PPV purchase

Command name		Return	SW1	Detailed status	
Name	Code	Code	/SW2	Category	Subcategory
Request PPV Status	PVS	2100	9000	Normal termination	
		A102		Non-operational card	Non-operational protocol number
		A103		No contract	No Kw
		A106		Security error	ECM tampering error
Purchase PPV Program	PPV	8141		PPV program number mismatch	Viewing not available
		4040			Viewing available
		A102		Non-operational card	Non-operational protocol number
		A103		No contract	No Kw
		8901		No contract: Outside contract	Tier
		8501			Prepaid PPV
		8301			Payment-deferred PPV
		8902		No contract: Expired	Tier
		8502			Prepaid PPV
		8302			Payment-deferred PPV
		8903		No contract: Viewing restriction	Tier
		8503			Prepaid PPV
		8303			Payment-deferred PPV
		0800		Purchased: Viewing	Tier
		0400			Prepaid PPV
		0200			Payment-deferred PPV
		8108		Purchase refused	Purchase prohibited period
		8109			Viewing history memory full
		850F			Insufficient prepaid balance
		A106		Security error	ECM tampering error
Confirm Prepaid Balance	PRP	2100		Normal termination	

Table 4-61 Return Codes (4) and SW1/SW2 Parameters by Command (HEX)

Command name		Return Code	SW1 /SW2	Detailed status	
Name	Code			Category	Subcategory

■ Center communications: Collection of viewing information/DIRD data transmission

Command name		Return Code	SW1 /SW2	Detailed status	
Confirm Card Request	CRQ	2100	9000	Normal termination	
Report Call-in Connection Status	TLS	2100		Normal termination	
		9104		Center communications error	
		9105		Sequence error	Command error
Request data	RQD	2100		Normal termination	
		9105 9106		Sequence error	Command error PDU number error
Center Response	CRD	2100		Normal termination	
		1102		DIRD data transmission possible	
		9105 9106		Sequence error	Command error PDU number error
		9104		Center communications error	
Request Call-in Date/Time	UDT	2100		Normal termination	
		A101		No corresponding data	
Confirm Call-in Destination	UTN	2100		Normal termination	
		9105		Sequence error	Command error
Request User Call-in	UUR	2100		Normal termination	
		9105		Sequence error	Command error
		11FF		Call-in impossible	
Start DIRD Data Communications	IRS	2100		Normal termination	
		9103		Center communications conditions error	
		9105		Sequence error	Command error
Encrypt DIRD Data	CRY	2100		Normal termination	
		9105 9106		Sequence error	Command error PDU number error
Decode DIRD Response Data	UNC	2100		Normal termination	
		9104		Center communications error	
		9105 9106		Sequence error	Command error PDU number error
End DIRD Data Communications	IRR	2100		Normal termination	
		9105 9106		Sequence error	Command error PDU number error

■ Power saving

Request Power-on	WUI	2100	9000	Normal termination	
Control Information		A101		No corresponding data	

■ Display of card ID

Acquire Card ID	IDI	2100	9000	Normal termination	
Information					

4.4 EMM Reception Function (Streamlining Message Reception)

This standard defines the receiver functionality along with an EMM multiplexing method in order to streamline access for the number of customers likely to subscribe to digital pay broadcasting as a means of using wavelength effectively while reducing standby power use for environmental reasons.

4.4.1 EMM Filtering

Receivers filter multiple EMM data blocks that are multiplexed in a single section.

EMM data includes a single card ID, and each receiver filters the data to identify only the EMM data blocks that are addressed to it. When the IC card has both an individual and group ID, the receiver filters EMM data blocks addressed to both.

4.4.2 EMM Reception Function

Regular contract updates are accomplished by specifying an EMM reception period for each receiver (about 2 weeks for each broadcaster group). During this period, the receiver performs power-on control for a specific time range and receives EMMs.

Power-on control refers to a process that controls the receiver so that it automatically receives the EMM transmission channel for 2 hours after the user turns it off, following which it turns itself off. In addition to dramatically reducing the receiver's standby power consumption, this function significantly reduces the frequency band required for EMM transmission.

Because the period during which each receiver performs power-on control depends on when the viewer began their contract, receivers can be divided into groups. The period of time for which power-on control is performed is determined for each group, and EMMs are used to specify the group to which each receiver belongs.

4.5 Communications Function

This section makes the following assumptions for the sake of brevity:

- The public telephone network is used as the representative network providing connectivity to the center.
- The Viewing Information Collection Center includes the collection network.

4.5.1 Receiver Operation During Viewing Information Collection Communications
4.5.1.1 Function Overview
- Viewing history information collection function

    Viewing history information (the view log) stored on the IC card is sent via a modem and public telephone line to the Viewing Information Collection Center. At the same time, EMM data is sent to the receiver's IC card as necessary.

4.5.1.2 Communications Phase
The following diagram illustrates the processing performed when collecting viewing information. For the purposes of this discussion, the process is divided into 5 communications phases, each described from the standpoint of receiver operation and based on the data sent and received directly between the Viewing Information Collection Center and the IC card.
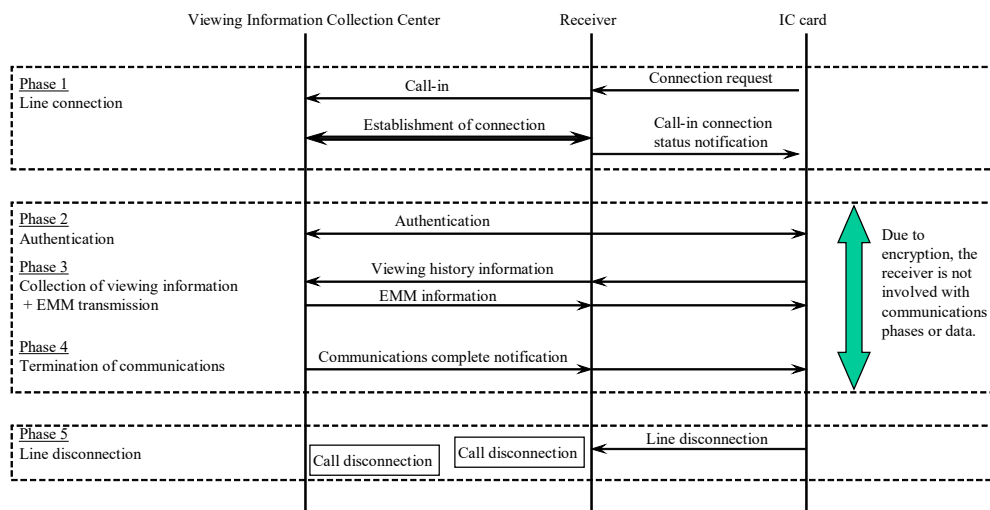
Figure 4-25 Processing Flow During Viewing Information Collection

(1) Network connection (phases 1 and 5)
- The modem is used to communicate between the receiver and the center, establishing a network connection.
- Once communications are complete, the line is disconnected.

(2) Data transfer (phases 2, 3, and 4)
- After the network connection has been established, the center authenticates the receiver, collects viewing information, and sends out EMMs.
- In the event of an error while communications are active, processing to terminate communications is performed.
- The receiver itself is not concerned with these phases.

4.5.1.3 Communications level
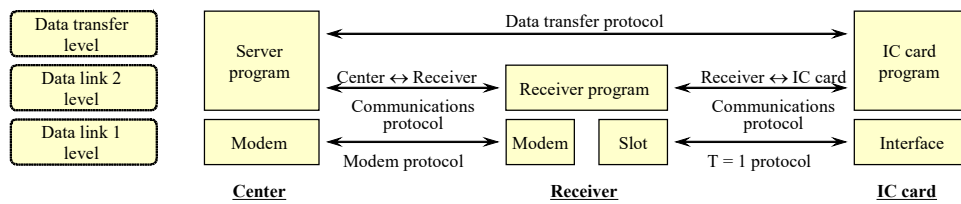
Figure 4-26 Protocol Stack

(1) Data link 1 level
- This protocol facilitates communications between the receiver and the center as well as between the receiver and its IC card.
- A standard communications protocol is used to transmit data link 2 level packet data.

(2) Data link 2 level
- The data link 2 level defines the communications interface for the center, receiver, and IC card and provides the data transfer protocol that underlies communications between the server and IC card.
- Phases 1 and 5 described above are processed by this level's protocol.

(3) Data transfer level
- The data transfer level allows the IC card and center to communicate directly using the communications interface defined in data link 2 level.
- The receiver's role is limited to transferring data between the IC card and the center.

4.5.1.4 Communications Between the Receiver and the Center
(1) Communications protocol overview

The scope for which this communications protocol relating to the collection of viewing information is defined is as follows:
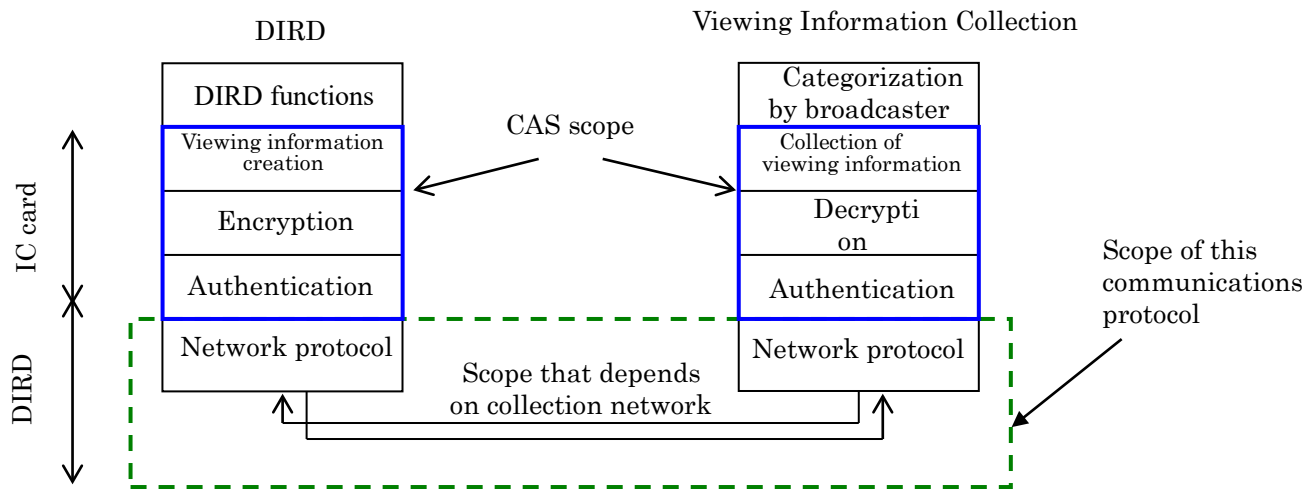
Figure 4-27 Overview of the Communications Protocol Defined by This Standard
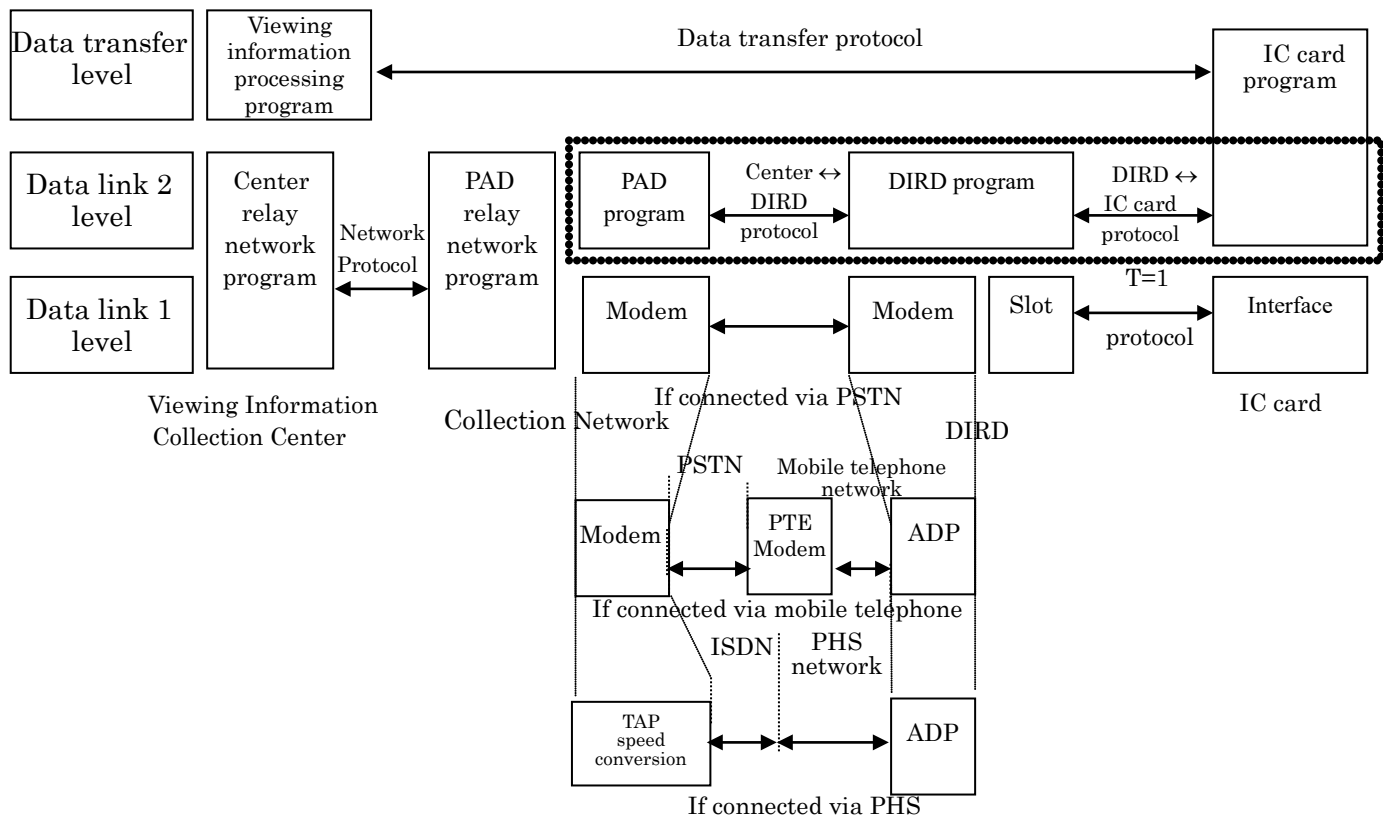
ADP: Data communications adapter

PTE modem: Protocol-converting modem

TAP speed conversion: PIAFS protocol/speed conversion.

Network protocol

Figure 4-28 Communications Protocol

Table 4-62 below outlines the protocol stack for collecting viewing information.

The network protocol corresponds to the data link 2 level of the data link establishment and release (termination) phase as well as the information transfer phase (the area indicated by the thick line below).

<p align="center">Table 4-62 Protocol Stack for Communications
Between the DIRD and the Viewing Information Collection Center</p>

| Protocol stack	Data link establishment/release phase	Information transfer phase
Data transfer level	-	Data transfer protocol
Data link 2 level	X.28 (See section 4.5.1.4 [3] above.)	Basic procedures (Code-independent mode)
Data link 1 level	V.22bis or later, MNP4 or better	

The basic transfer transmission control procedure can be divided into the following 5 phases: line connection, data link establishment, information transfer, data link release, and line disconnection. Data link establishment and release are performed in compliance with X.28. The information transfer phase uses a code-independent mode capable of transferring binary data.

An error-free data transfer protocol can be implemented for the information transfer phase thanks to support for simple delivery confirmation and retransmission request function using ACK (acknowledge) and NAK (negative acknowledge) structures.

(1-1) Viewing information collection network protocol specifications.

a. Application

This section defines the sequences for connecting the DIRD and the collection network and transferring data when collecting viewing information using a collection network that connects the DIRD and the Viewing Information Collection Center.
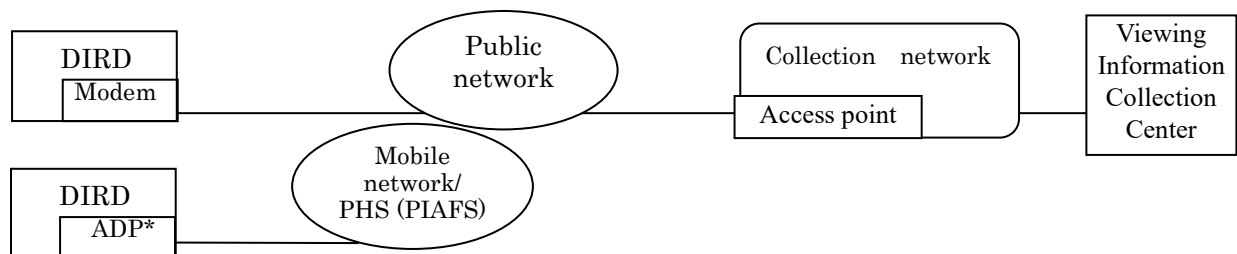
* (Mobile data communications adapter)
Below, the public network and mobile network/PHS (PIAFS) are referred to as the "public network."
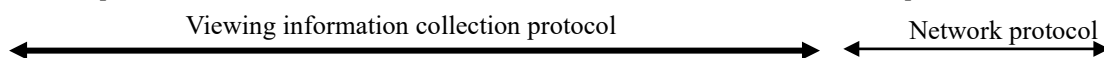
Figure 4-29 Viewing Information Collection System

b. Protocol conditions

Table 4-63 Protocol Conditions

Item	Setting condition
Transmission format	Reciprocal communications using ENQ and EOT codes
Delivery confirmation	ACK and NAK structures are returned following each data transmission.
Retransmission control	Retransmission is triggered by a NAK or the absence of a response.
Max. transmission text length	2,048 bytes
No-communications monitoring	Monitored by timer

c. Communications conditions

Table 4-64 outlines the data transfer and modem communications conditions when connecting.

Table 4-64 DIRD Communications Conditions

Item	Setting condition	Note
Data length (character length)	8 bits	Communications conditions when connecting
Parity	None	
Stop bits	1 bit	
Transmission encoding	JIS C6220 (8-unit code)	
Local echo back	None (with remote echo back)	
Line feed control	DIRD $\rightarrow$ Collection Network: CR only Collection network $\rightarrow$ DIRD: CR + LF	
Transmission delimiter	CR (0D H) code	
Carriage return code	LF (0A H) code	
Input correction code	BS (08 H) code	
LSB/MSB (bit)	LSB first	Communications conditions when transferring data
Data transfer sequence	See section 4.5.1.4 (3-3).	Modem communications conditions
Communications method	Asynchronous, full-duplex	
Communications speed	V.22bis (2,400 bits/sec) or higher	
Flow control	RS/CS	
MNP class	Class 4 or higher	

(2) Data link 1 level

  a. Line network

    The receiver and center communicate via a built-in and a connected modem, respectively. The specific architecture used is determined by the broadcaster and is not addressed by this standard.

  b. Modem

    The modem should be compliant with V.22bis or higher (for example, V.22bis, V.32, V.32bis) and should offer at least MNP4 error correction capabilities (for example, MNP4, MNP5, V.42, V.42bis).

(3) Data link 2 level

(3-1) Overview

  The data link 2 level performs the following required tasks:

    1. Connection/disconnection of the line and call control
    2. Monitoring of call connections
    3. Transfer of data to the upper layer (data transfer level)
    4. Monitoring for upper layer data reception/transmission timeouts

(3-2) Host numbers

    In order for the DIRD to connect to the Viewing Information Collection Center via the collection network, it must connect to the collection network and send a host number command that identifies the Viewing Information Collection Center.

    This standard refers collectively to the collection network and the Viewing Information Collection Center as the host.

a. Connection sequences

   1) Normal sequence
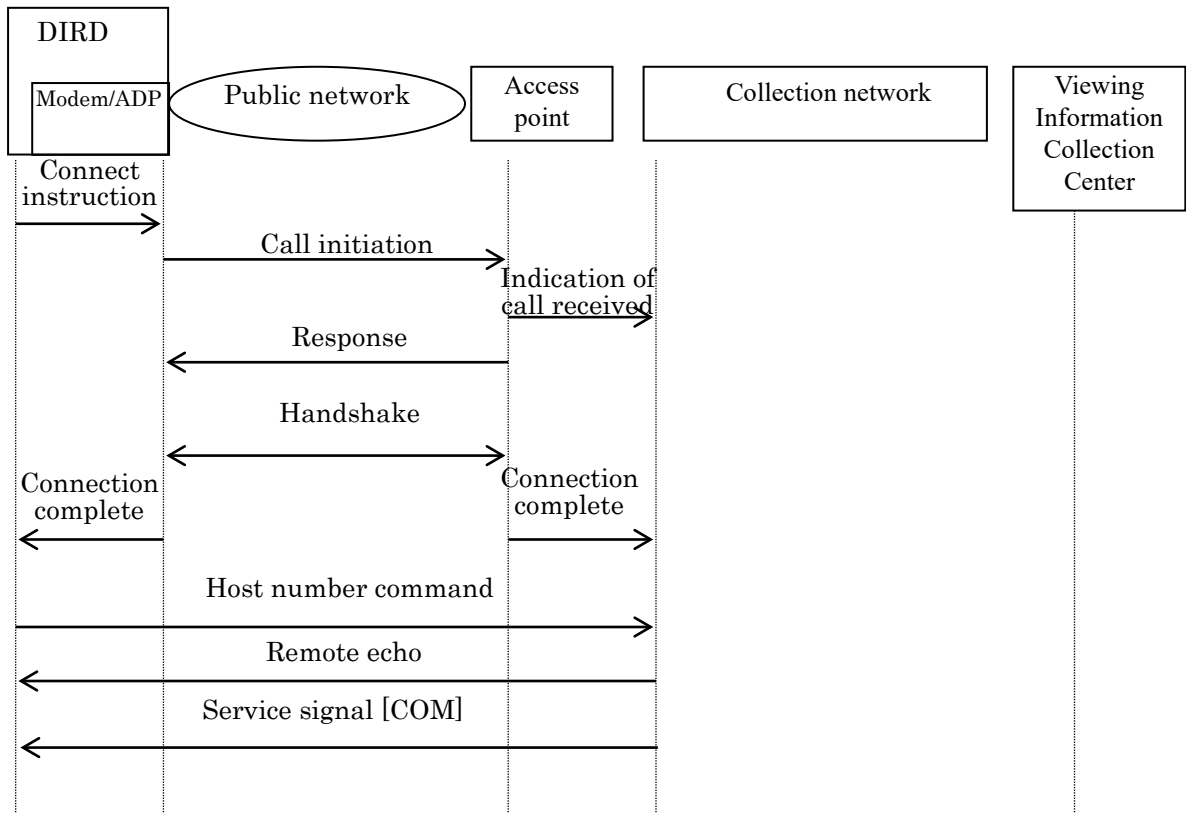
Figure 4-30 Normal Sequence

   2) Error sequence (host number command error)
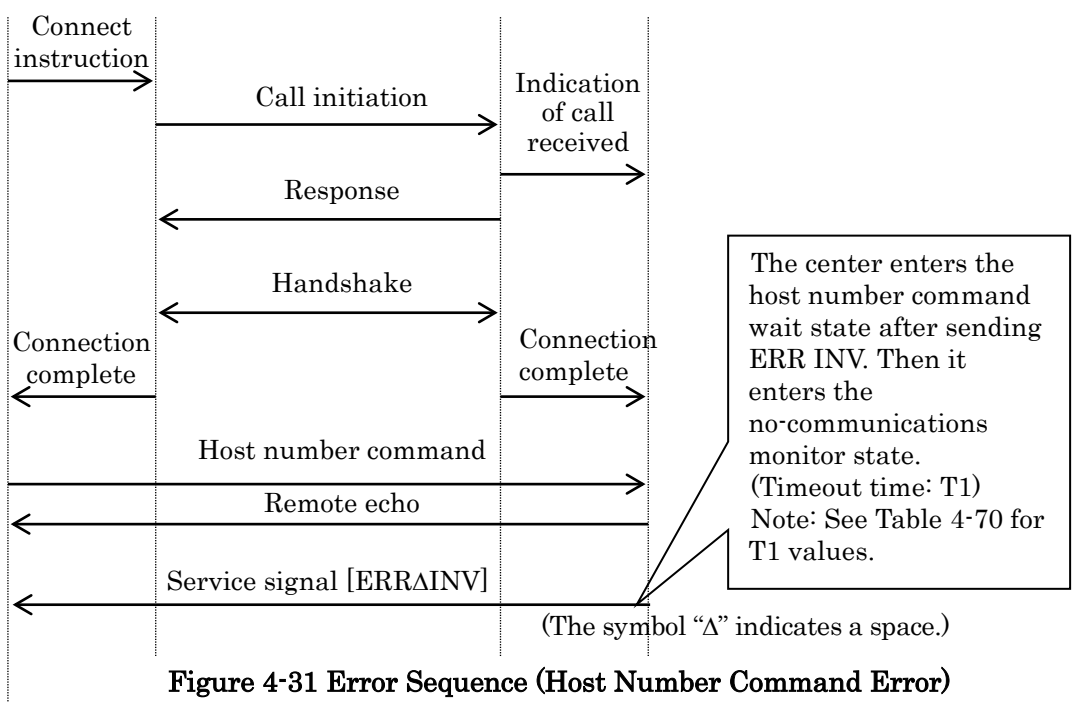
Figure 4-31 Error Sequence (Host Number Command Error)

3) Error sequence (host timeout while waiting for host number command)
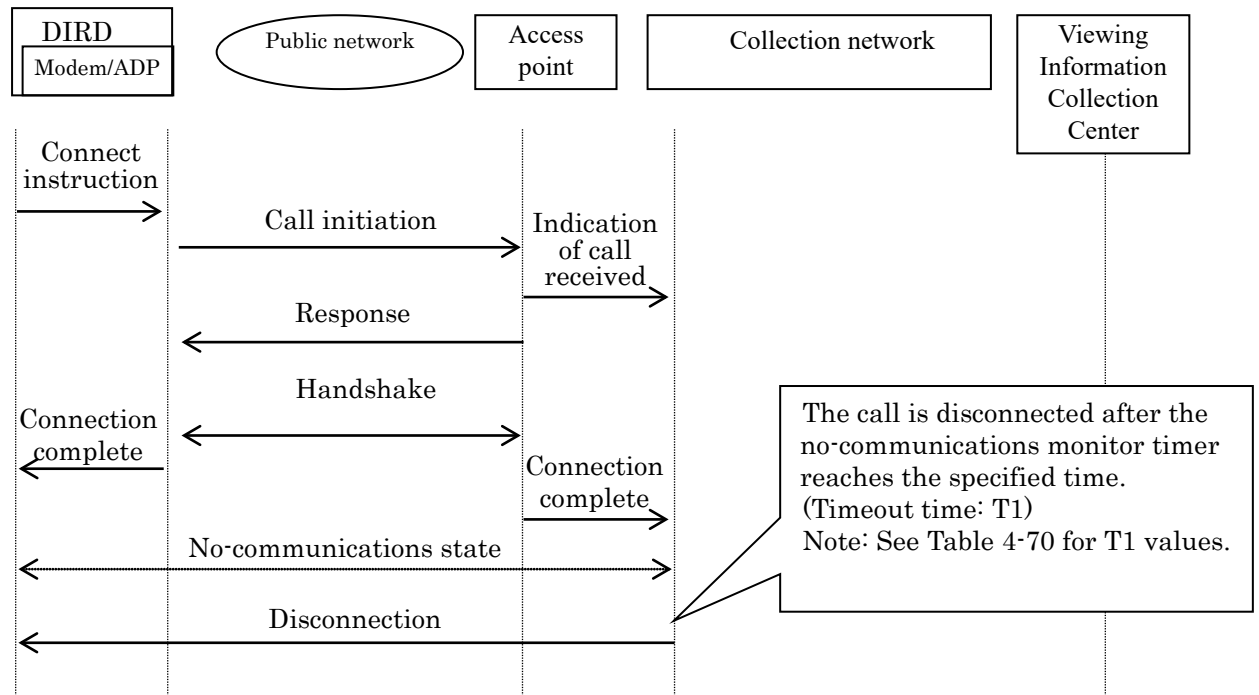
Figure 4-32 Error Sequence (Host Timeout While Waiting for Host Number Command)

4) Error sequence (call rejected by host)
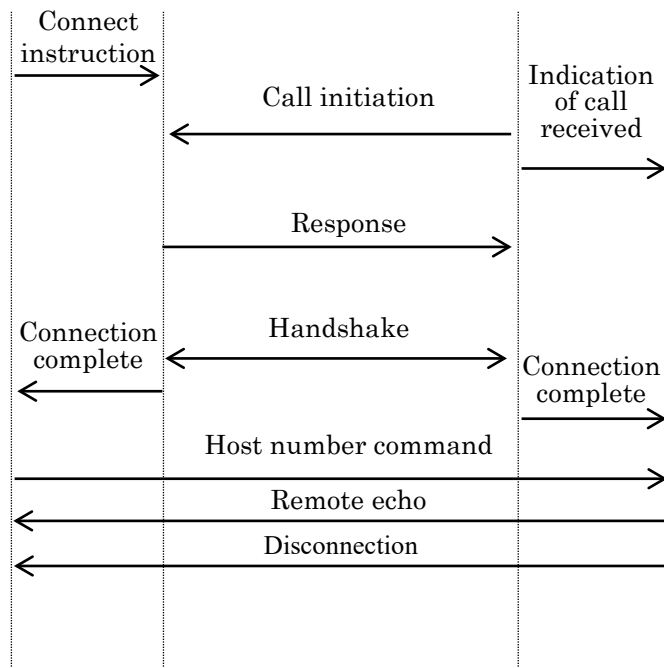
Figure 4-33 Error Sequence (Call Rejected by Host)

5) Error sequence (remote echo error)

See Table 4-66, "Receiver Operation While Waiting for Remote Echo."
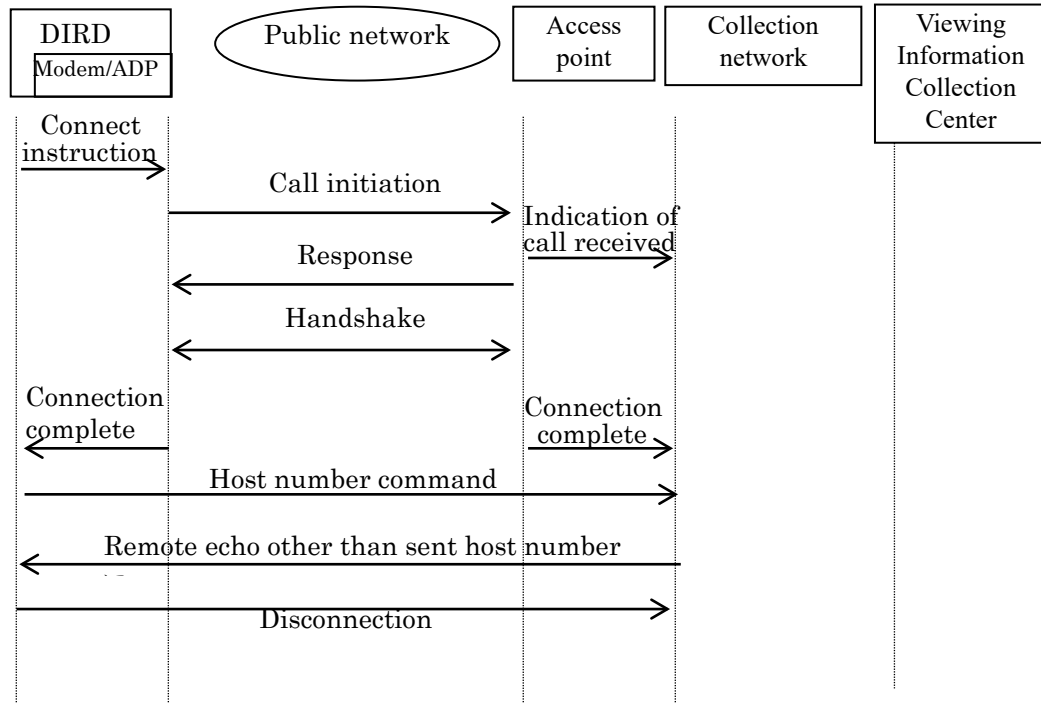
Figure 4-34 Error Sequence (Remote Echo Error)

6) Error sequence (DIRD timeout while waiting for remote echo)

See Table 4-66, "Receiver Operation While Waiting for Remote Echo."
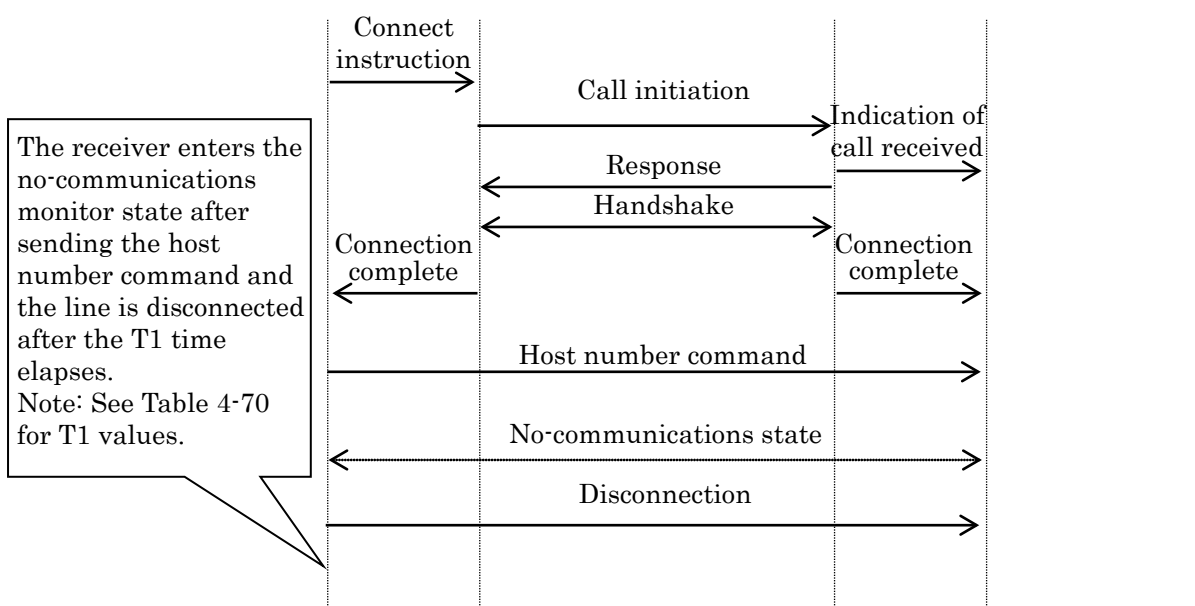
Figure 4-35 Error Sequence (DIRD Timeout While Waiting for Remote Echo)

7) Error sequence (service signal error)

See Table 4-67, "Receiver Operation in the Service Signal Wait State."
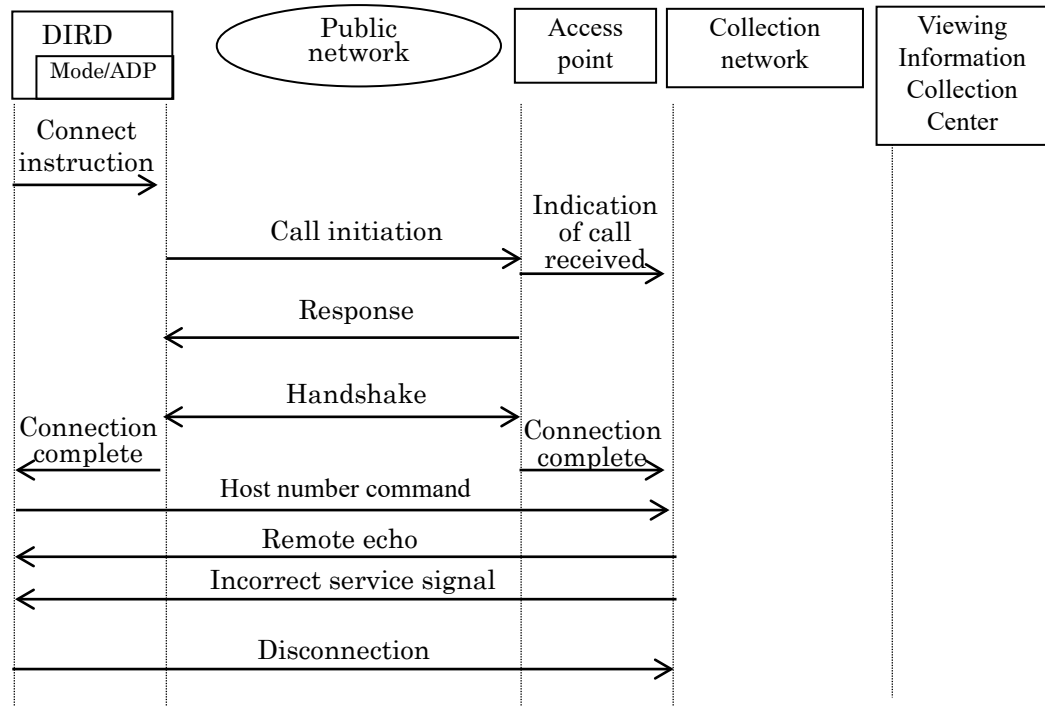
Figure 4-36 Error Sequence (Service Signal Error)

8) Error sequence (DIRD timeout while waiting for the service signal)

See Table 4-67, "Receiver Operation in the Service Signal Wait State."
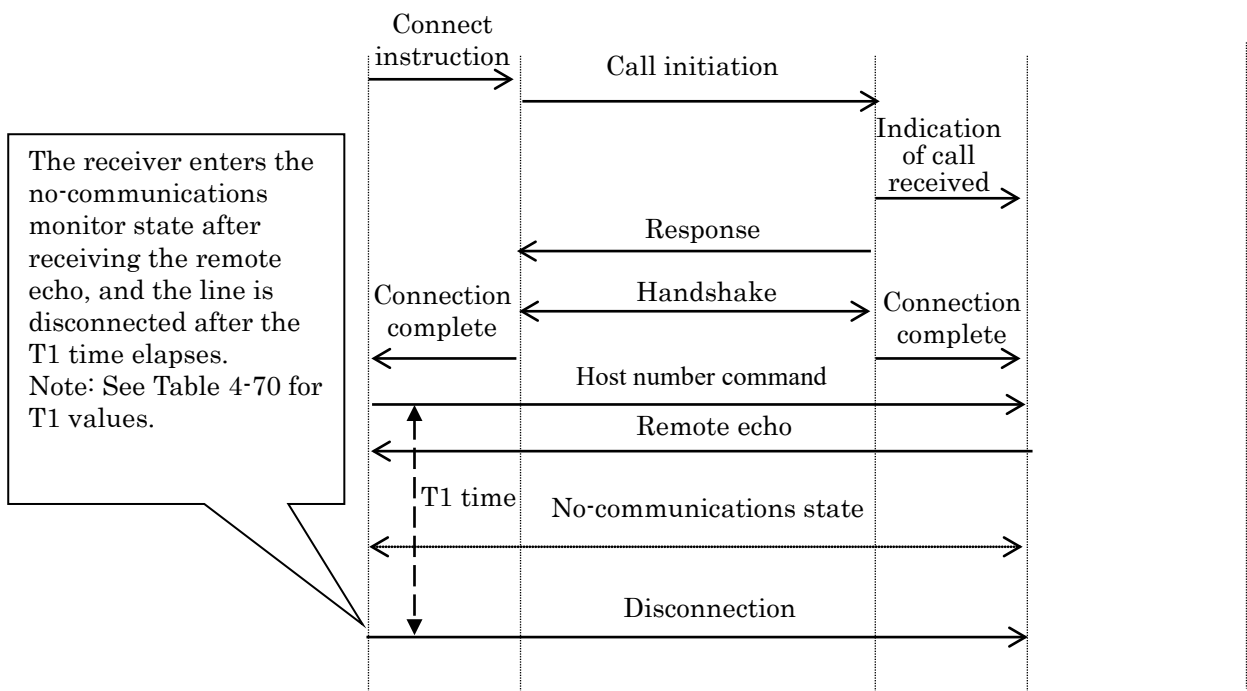
Figure 4-37 Error Sequence (DIRD Timeout While Waiting for the Service Signal)

b. Disconnect sequences

1) Disconnect by DIRD
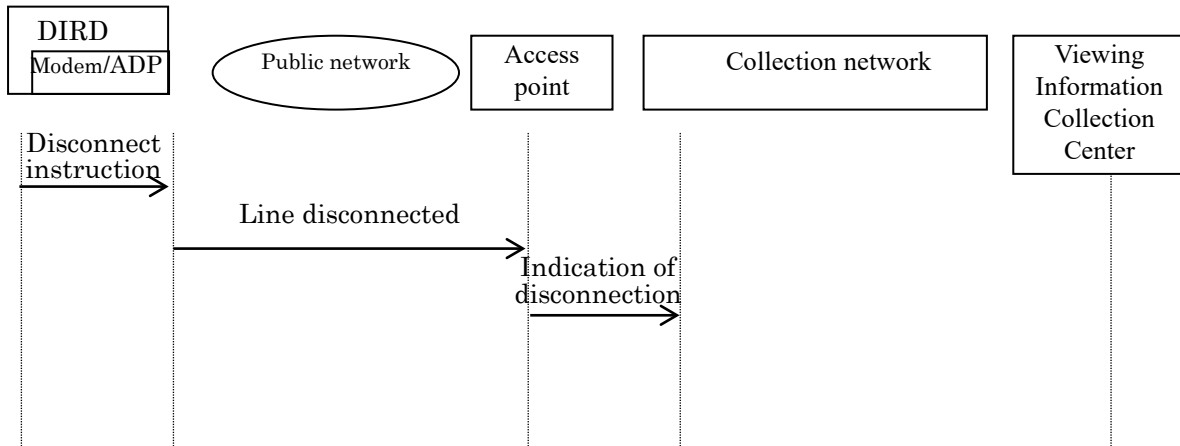
2) Disconnect by Viewing Information Collection Center
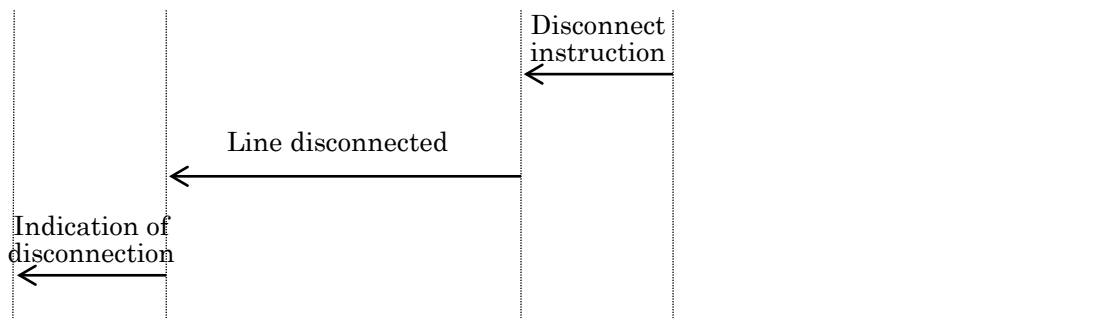
Figure 4-38 Disconnect by DIRD

The following table describes the host number command and service signal format.

Table 4-65 Command and Service Signal Format

Item		Format	Description
Host number command		N1N2N3N4N5N6N7N8 CR (Echo back characters) N1N2N3N4N5N6N7N8 CRLF	8 alphanumeric digits (JIS 8-unit code) are echoed back.
Service signal	Connection complete	CR LF COM CR LF	CR: Transmission delimiter code LF: Line feed code
	Command error	CR LF ERRΔINV CR LF	The symbol "Δ" indicates a space.

c. Receiver operation after sending the host number command

   1) Sent host number remote echo wait state

     After sending the host number, the receiver transitions to the remote echo reception wait state. Table 4-66 describes receiver operation while in the remote echo wait state.

Table 4-66 Receiver Operation While Waiting for Remote Echo

Received signal	Receiver operation following signal reception
Remote echo matches sent host number. Receive: N1N2N3N4N5N6N7N8 CRLF (Only the 8 characters N1 to N8 preceding the CRLF are compared. Text from the 9th character on is ignored.)	Transition to service signal wait state.
Remote echo differs from sent host number. Receive: ■■■■CRLF (The string "■■■■" represents a variable-length code of 0 or greater bytes other than N1N2N3N4N5N6N7N8.)	Disconnect immediately.
CRLF is not received within the specified time (within the timeout time T1) following transmission or retransmission of the host number. (See Note 1.)	Disconnect immediately.

   Note 1: The receiver's no-communications monitor timer starts following the transmission or retransmission of the host number command. See Table 4-70 for T1 values.

2) Service signal wait state

     The receiver transitions to the signal wait state after receiving a remote echo ($N_1N_2N_3N_4N_5N_6N_7N_8$ CRLF) that matches the sent host number. Table 4-67 describes receiver operation while in the service signal wait state.

Table 4-67 Receiver Operation in the Service Signal Wait State

Received signal	Receiver operation following signal reception
Proper service signal (connection complete) (See Note 1.) Receive: CRLF COM CRLF	Transition to data transfer sequence.
Proper service signal (command error) (See Note 1.) Receive: CRLF ERRΔINV CRLF (The symbol "Δ" indicates a space.)	Resend host number command immediately. Number of resend attempts: 3 (Disconnect upon receiving the 4th "CRLF ERRΔINV CRLF.")

Erroneous service signal (See Note 1.)
    Receive: CRLF COM◊
        CRLF ERR○
        CRLF□□□□CRLF
(The symbol "◊" indicates a code other than CR, the symbol "○" indicates a code other than a space, and the symbol "□□□□" indicates a variable-length code of 0 or greater bytes other than "COM" or "ERRΔINV.")
	Disconnect immediately.

Proper service signal is not received within the specified time (within the timeout time T1) following transmission or retransmission of the host number. (See Note 2.)	Disconnect immediately.

Note 1: After transitioning to the service signal wait state, all data up to the first CRLF received is discarded.

Note 2: The receiver's no-communications monitor timer starts following the transmission or retransmission of the host number command. See Table 4-70 for T1 values.

d. Remote echo

There is no need for the receiver to implement echo back locally. The host echoes transmissions to the receiver when the host number command is sent from the receiver.

After receiving and echoing the host number command from the receiver, the host sends the service signal.

e. Host no-communications monitor timer start timing.

The host no-communications monitor timeout value T1 starts counting up after the line connection is complete (after the modem negotiation completes) and is reset after the service signal "CRLF ERRΔINV CRLF" is sent.

(3-3) Data transfer sequence

a. Text sequence

The following provides an example of a data transfer sequence between the DIRD and the collection network:
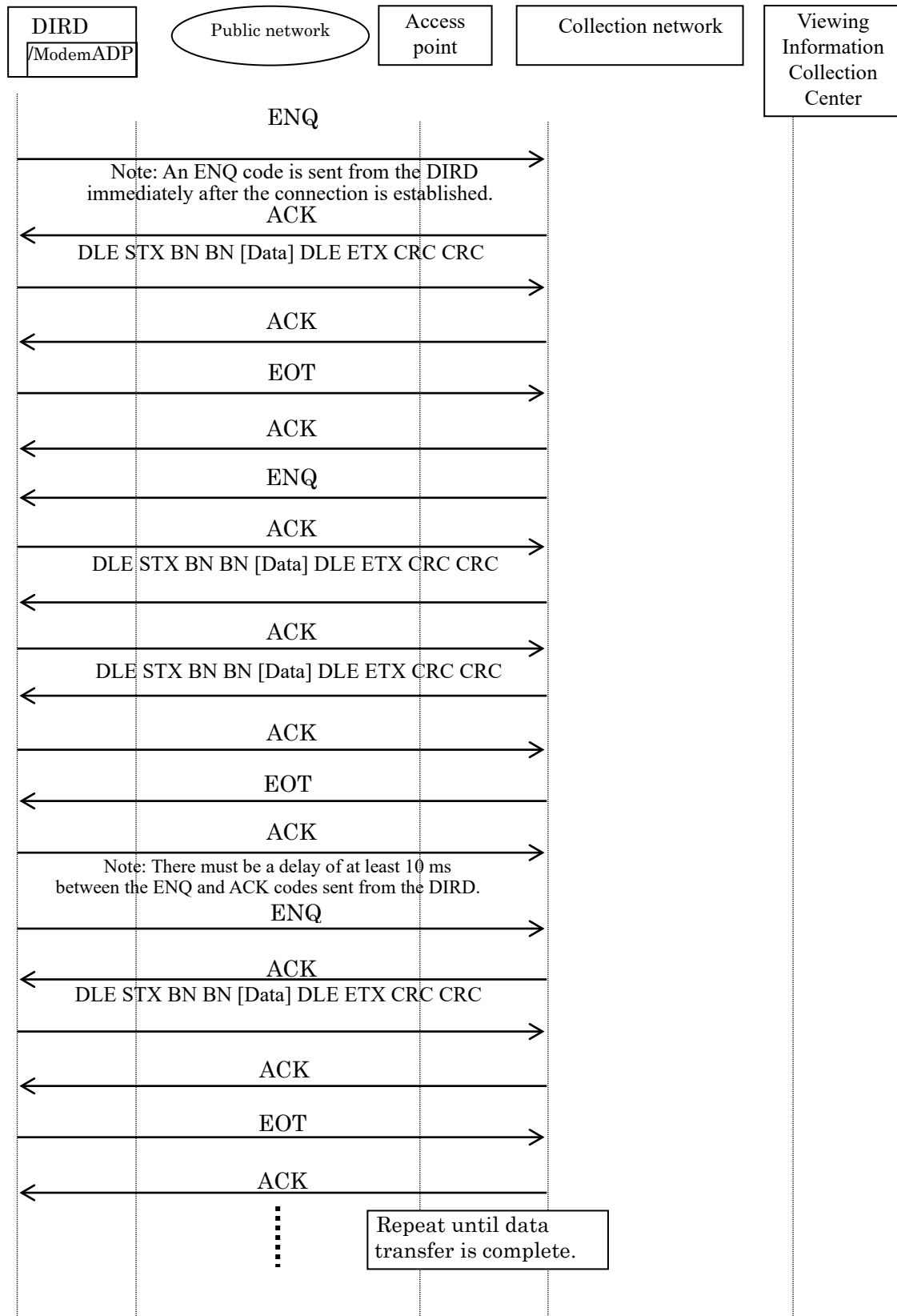
Figure 4-39 Example Data Transfer Sequence Between the DIRD and Collection Network

b. Text format

1) Text transmission format

D L E	S T X	B N	B̲ N̲	Data	D L E	1 0	Data	D L E	E T X	C R C	C R C

Max. 2,048 bytes

(Not including inserted DLE code)

Note: Variable length

No DLE code is inserted into the BN (see note below).

If the same code as DLE occurs in the data, a DLE code is inserted immediately before that code.
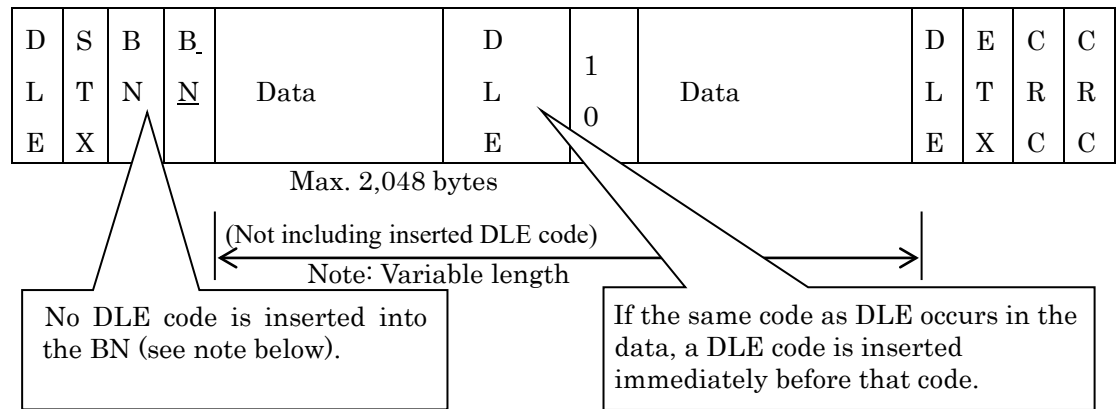
Figure 4-40 Text Transmission Format

Note: BN: Block number (0 to 255)

B̲N̲: One's complement of block number (BN)

2) CRC calculation scope

D L E	S T X	B N	B̲ N̲	Data	D L E	1 0	Data	D L E	E T X	C R C	C R C

CRC calculation scope

Note: DLE codes inserted in the data are excluded from the calculation.
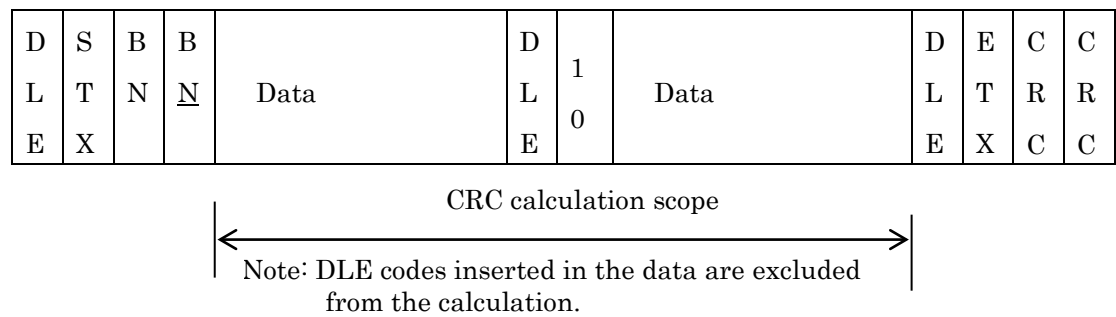
Figure 4-41 CRC Calculation Scope

3) CRC calculation method

A 16-bit CRC calculation is used.

> CRC-16
> The CRC is defined as the remainder resulting from multiplying a polynomial obtained by rearranging the target data in descending order from the least significant bit of the first byte to the most significant bit of the last byte by X^{16} and dividing by the generator polynomial $X^{16} + X^{15} + X^2 + 1$.

Although the remainder (16-bit) is aligned as upper and lower bits in 8-bit blocks, the viewing information collection protocol rearranges all bits in descending order—so that the CRC's most significant bit becomes the remainder's least significant bit, and the CRC's least

significant bit becomes the remainder's most significant bit—for increased security.

Example calculation

Target data: 10_H

Multiplying X^3 after rearrangement into descending order by X^{16} and dividing by $X^{16} + X^{15} + X^2 + 1$ yields $X^{15} + X^5 + X^4 + X + 1$ (8033_H).

When using the viewing information collection protocol, reordering 8033_H (1000 0000 0011 0011) in 16-bit blocks yields a CRC of $CC01_H$ (1100 1100 0000 0001).

Using the typical CRC-16 method, the CRC would be $01CC_H$.

 4) Block numbers

Block numbers (BN) start at the value 01. In this case, the one's complement ($\underline{BN}$) of the block number would be FE (254). The block number is incremented by 1 when sending text continuously from 1 side (from ENQ to EOT). When the block number reaches FF (255), the next block number will start again at 00.

Figure 4-42 illustrates the flow of Block numbers and Figure 4-43 illustrates the example of Block numbers.

| BN | | 01 | ⇨ | 02 | ⇨ | 03 | ……… | FF(255) | ⇨ | 00 | ⇨ | 01 | ……… |
| $\underline{BN}$ | | FE | ⇨ | FD | ⇨ | FC | ……… | 00 | ⇨ | FF | ⇨ | FE | ……… |
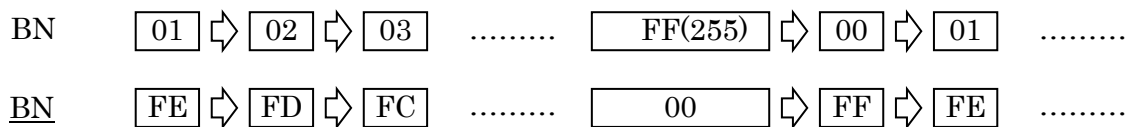
Figure 4-42 Block Number Flow
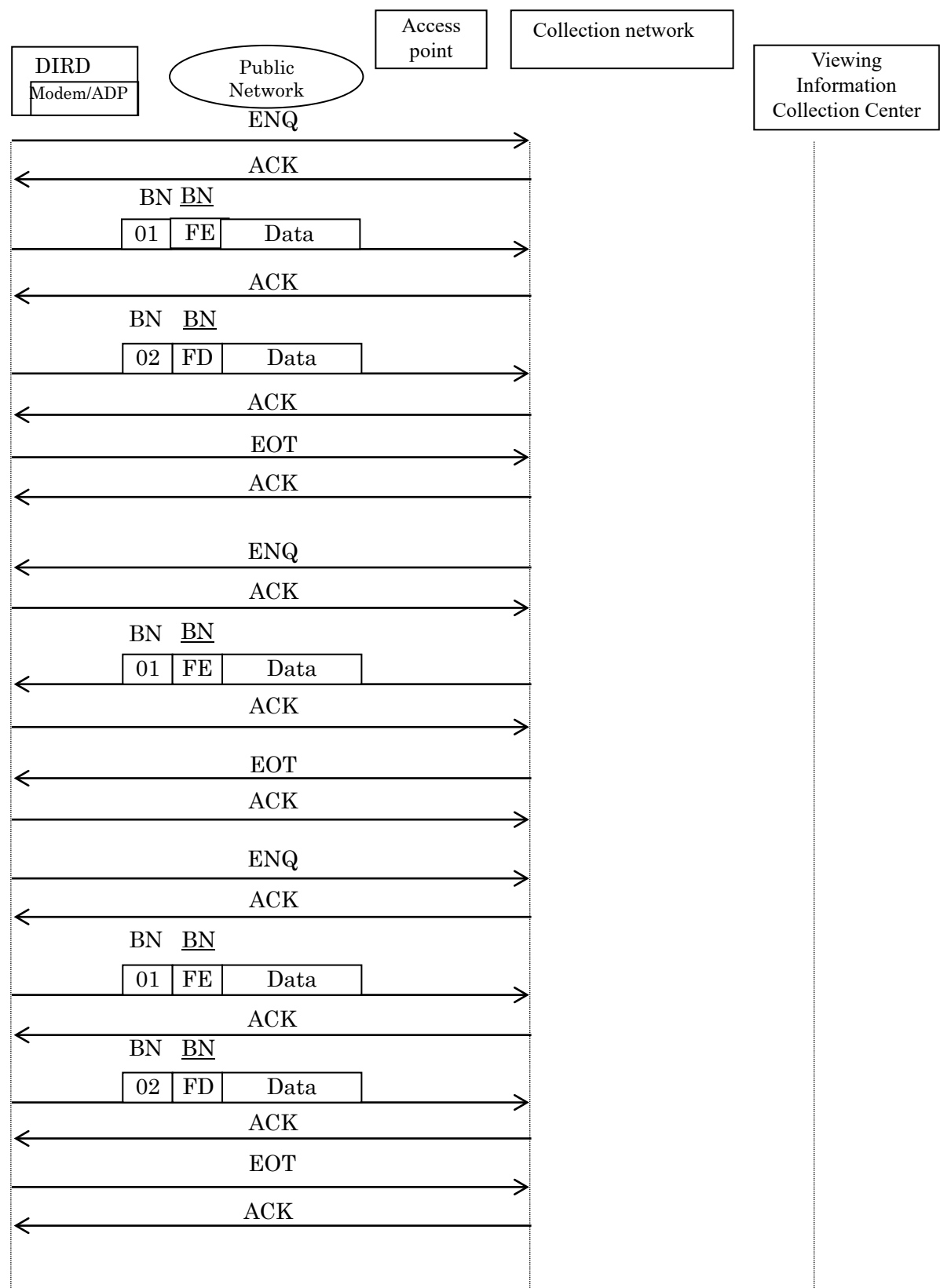
Figure 4-43 Example of Block Number sequence

5) Control code format

Table 4-68 Control Code Format

Control code	Hex code	Meaning	Description
DLE STX	1002H	Data start	
DLE ETX	1003H	Data end	
ENQ	05H	Line control privilege	1-byte send/receive
ACK	06H	Acknowledge	Same as above
NAK	15H	Negative acknowledge	Same as above
EOT	04H	Transmission end	Same as above
DLE	10H	Transmission control	Inserted immediately before 10H in data

6) State transitions

6-1) State transition chart

Table 4-69 State Transitions

State / Received code	Sending side				Receiving side	
	S0 Send ENQ [S1]	ACK wait S1 After sending ENQ	S2 After sending data	S3 After sending EOT	R1 Wait for ENQ	R2 Wait for data
ENQ					Send ACK [R2]	
ACK		Send data [S2]	(If data) Send data [S2] (If no data) Send EOT [S3]	[R1]		
NAK		Resend ENQ [S1]	Resend data [S2]	Resend EOT [S3]		
Data						(If OK) Send ACK [R2] (If BAD) Send NAK [R2]
EOT						Send ACK [S0]
Timeout [T2]		Resend ENQ [S1]	Resend data [S2]	Resend EOT [S3]	Send NAK [R1]	Send NAK [R2]
Retries exceeded [C1]	Disconnect				Disconnect	

Note: Blank cells are ignored.
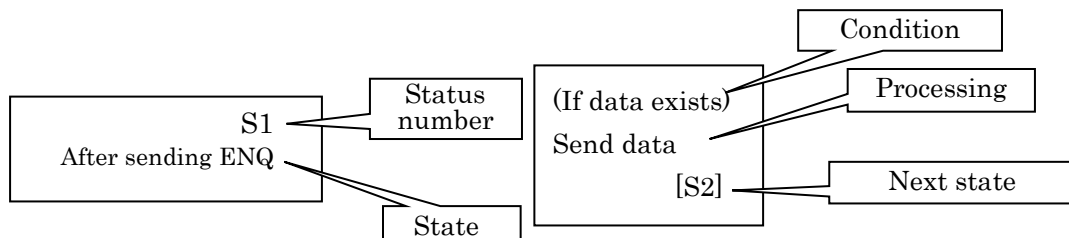
6-2) Errors during data reception

The following patterns characterize errors during data reception (when R2 data reception in the state transition chart is bad):

a) When BN and <u>BN</u> (one's complement) are not properly related, send NAK.

b) When BN and <u>BN</u> are properly related but differ from the expected value:

 b-1) When the previous BN and <u>BN</u>, discard the data and send ACK.

 b-2) Otherwise, disconnect.

c) When there is a CRC error, send NAK.

d) When there is no DLE STX, send NAK.

e) When there is no DLE ETX, send NAK.

Otherwise, when the data conforms to a non-standard format, send NAK.

 7) Timeout and retries exceeded values

The timeout and retries exceeded values when using the collection network are as follows:

Table 4-70 Timeout and Retries Exceeded Values

Timeout values	T1	30 sec
	T2	10 sec
Retries exceeded value	C1	3 attempts

(3-4) Error processing

  This section describes receiver operation when an error occurs.

Table 4-71 Receiver Operation When an Error Occurs

Receiver state / Receiver event	Idle	Call-in in progress	Communications in progress
No IC card detected	Disable PPV program purchase.	Notify upstream level that communications between IC card and receiver are impossible; cancel call-in and transition to idle state.	Notify upstream level that communications between IC card and receiver are impossible; perform call disconnect processing and transition to idle state.
IC card error detected	Disable PPV program purchase.	Notify upstream level that communications between IC card and receiver are impossible; cancel call-in and transition to idle state.	Notify upstream level that communications between IC card and receiver are impossible; perform call disconnect processing and transition to idle state.
Initiated call but was unable to establish connection		Notify upstream level of inability to establish connection and transition to idle state.	
No carrier detected by receiver		Notify upstream level of inability to establish connection and transition to idle state.	Notify upstream level that call has been disconnected and transition to idle state.
Unconnected telephone line detected	Enable PPV program viewing until the IC card's viewing history information area becomes full. Disable PPV purchase after it becomes full.	Notify upstream level of inability to establish connection and transition to idle state.	Notify upstream level that call has been disconnected and transition to idle state.

4.5.1.5 Communications Between the IC Card and the Receiver

(1) Data link 1 level

As a rule, data link 1 level communications are based on the T = 1 protocol. For more information, see the T = 1 protocol standard.

(2) Data link 2 level

(2-1) Conventions

- The receiver acts as the master station, while the IC card acts as the slave station. These roles are never switched.
- "Command" refers to information transmitted by the master station, while "response" refers to information transmitted by the slave station. Commands and responses always occur in pairs.

(2-2) Command/response specifications
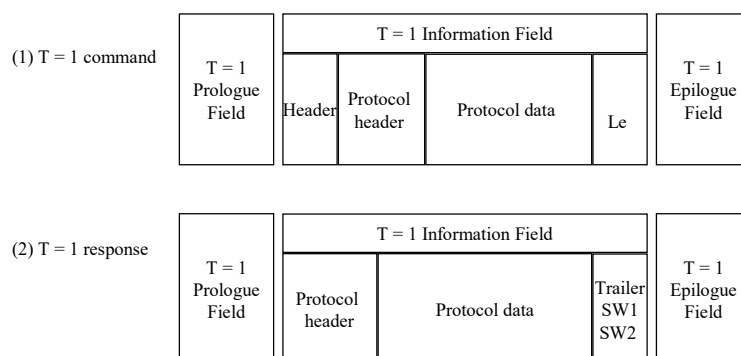
Figure 4-44 Command/Response

a. Command protocol 1: Protocol header specifications

Table 4-72 Command Protocol 1: Protocol Header Specifications

Item	Length [bytes]	Description
Lc	1	Command data length
PDU number	1	Requested PDU (Protocol Data Unit) number; the value 0x00 is ignored.

b. Response protocol 1: Protocol header specifications

Table 4-73 Response Protocol 1: Protocol Header Specifications

Item	Length [bytes]	Description
IC card interface protocol number (protocol unit)	1	Indicates the type of protocol unit.
Unit length (data length)	1	Length from the card status to the final byte of data
IC card instruction	2	Instruction from IC card
Return code	2	Detailed response information
PDU number	1	PDU number currently being sent
Final PDU number	1	Final PDU number

(2-3) PDU numbers

- When transferring a large amount of data from the IC card to the receiver, the data is partitioned at the IC card and then sent to the receiver.
- The IC card specifies the number of partitions (=final PDU number) based on the response to the IC card command. When the receiver recognizes that the final PDU number is not 0, it receives the partitioned data as a single data block, receiving multiple data blocks in order (in order of increasing PDU numbers) and integrating the received data partitions until the PDU number equals the final PDU number.

- The PDU number field is used with the Request Data, Center Response, Report Call-in Connection Status, Encrypt DIRD Data, and End DIRD Data Communications commands.
- When using the Decode DIRD Response Data command, the data from the center is partitioned by the receiver and transferred to the IC card.
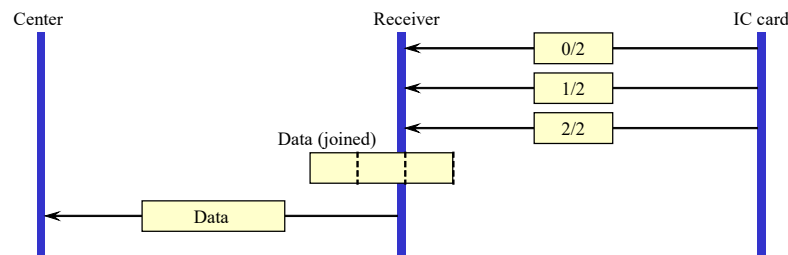
Figure 4-45 PDU Mechanism (Data from IC Card)

4.5.1.6 Viewing History Collection Operation Overall Flow

(1) Call-ins and connections

- When the call-in start conditions have been satisfied, the IC card issues a call-in request to the receiver. The start conditions are as follows:
  1) When a previously configured scheduled call-in time is reached (regular call-in)
  2) When a forced call-in request is sent via EMM (forced call-in)
  3) When the number of history information records stored on the IC card reaches capacity (memory full call-in)
  4) When a call-in confirmation is requested from the receiver using the Request User Call-in command after the "retries exceeded notification" has been set by an IC card instruction (user call-in)
- Call-ins by IC card instruction are specified at varying times by the IC card. Since the IC card issues IC card instructions until a Report Call-in Connection Status command is received, the receiver can ignore unnecessary IC card instructions.
- When the IC card issues a call-in instruction to the receiver, the receiver's modem dials the number and connects to the center. Once a connection has been established, the receiver responds to the IC card to indicate this fact using the Report Call-in Connection Status command's "connection complete" message.
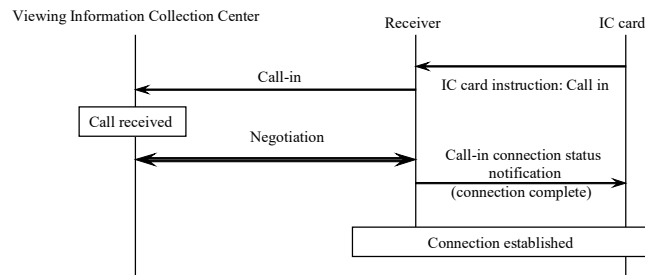
Figure 4-46 Normally Terminated Call-in Processing Flow

- If a call-in fails, for example as a result of the line being busy, the receiver returns the "call-in failed" message to the IC card using the Report Call-in Connection Status command. If the receiver is unable to establish a call-in connection following a certain number of retries, the IC card issues "retries exceeded notification" as an IC card instruction.
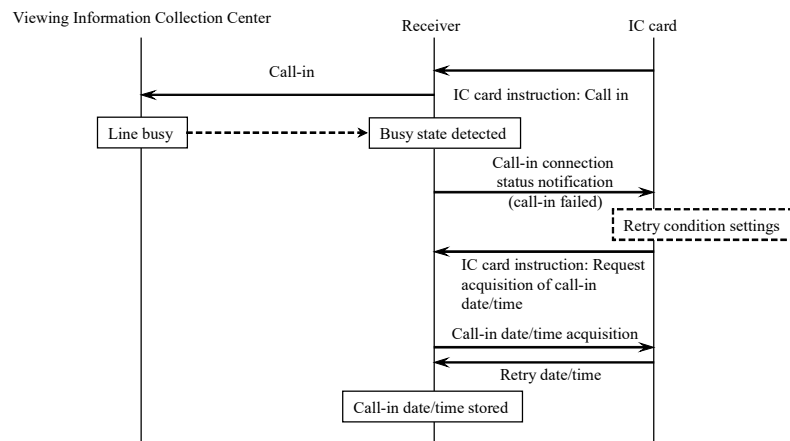
Figure 4-47 Failed Call-in Processing Flow

- When the viewer initiates a call-in using the on-screen user interface, the receiver issues the Request User Call-in command to the IC card, and the IC card issues the "call in" IC card instruction to start the call. However, user call-ins can only be performed when the "retries exceeded notification" IC card instruction has been issued.
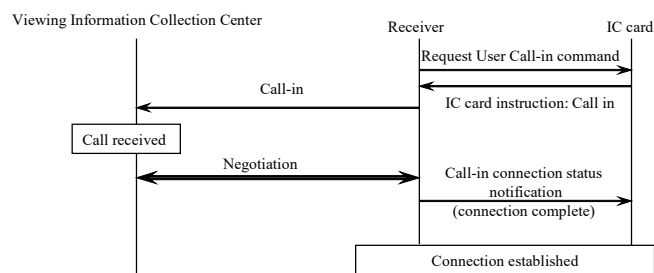
Figure 4-48 User Call-in Processing Flow

(2) Authentication/data transfer

　　As a rule, the receiver is not aware of the content of the data exchanged during authentication processing.

(3) Disconnecting calls

- Calls are disconnected when the IC card reports "disconnect call" as a response IC card instruction to the receiver. However, the IC card returns "center communications error" in the event it has detected a data transfer protocol error during the communications.
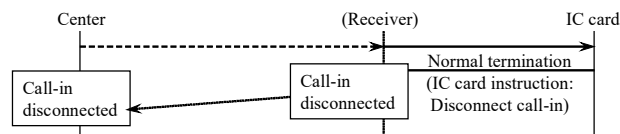
Figure 4-49 Call-in Disconnect processing Flow

- When the receiver detects a communications error such as a communications timeout, it issues "call-in disconnected" to the IC card with the Report Call-in Connection Status command. The receiver performs call disconnect processing when the IC card returns "disconnect call" as a response IC card instruction.
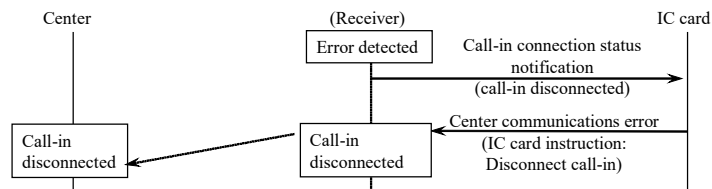
Figure 4-50 Processing Flow When the Receiver Has Detected an Error

4.5.1.7 Receiver State Transitions

The following table describes receiver state transitions.

Table 4-74 Receiver State Transitions

Receiver state \\ Receiver event	Idle	Call-in in progress	Communications in progress
Normal events — "Start call-in" instruction from IC card	Start call-in and transition to call-in in progress state.		
Connection complete		Return "connection complete" to IC card with Report Call-in Connection Status command and transition to communications in progress state.	
Call-in performed but unable to connect (busy state, etc.)		Return "connection failed" to IC card with Report Call-in Connection Status command and transition to idle state.	
Data transfer protocol data acquired from center with Center Response command response (final PDU number = 0)			Transfer data transfer protocol data to center.
Data transfer protocol data acquired from center with Center Response command response (final PDU number ≠ 0)			Acquire data from IC card with the Request Data command until the final PDU number equals the PDU number.
Data transfer protocol acquired data from center			Transfer data transfer protocol data to IC card with the Center Response command.
"Disconnect call" IC card instruction acquired	Ignore IC card instruction.	Cancel call-in and transition to idle state.	Disconnect call and transition to idle state.

Error events	IC card error detected by receiver	Disable PPV program purchase.	Cancel call-in and transition to idle state.	Return "call-in disconnected" to IC card with Report Call-in Connection Status command, disconnect call, and transition to idle state.
	No IC card detected by receiver	Disable PPV program purchase.	Cancel call-in and transition to idle state	Return "call-in disconnected" to IC card with Report Call-in Connection Status command, disconnect call, and transition to idle state.
	Unconnected telephone line detected	Enable viewing of PPV programs until the IC card's viewing history information area becomes full; then disable PPV purchase.	Return "call-in failed" to IC card with Report Call-in Connection Status command and transition to idle state.	Return "call-in disconnected" to IC card with Report Call-in Connection status command, disconnect call, and transition to idle state.
	Response timeout (no response to command) detected			Return "call-in disconnected" to IC card with Report Call-in Connection status command, disconnect call, and transition to idle state.
	No carrier detected		Return "call-in failed" to IC card with Report Call-in Connection Status command and transition to idle state.	Return "call-in disconnected" to IC card with Report Call-in Connection status command, disconnect call, and transition to idle state.
	PDU number error detected by receiver			Return "call-in disconnected" to IC card with Report Call-in Connection status command, disconnect call, and transition to idle state.
	Communications timeout (no data transfer from center) detected			Return "call-in disconnected" to IC card with Report Call-in Connection status command, disconnect call, and transition to idle state.

4.5.2 Receiver Operation During DIRD Data Communications

4.5.2.1 Function Overview

- When sending data (DIRD data) from the receiver to the center via a public line, the receiver transfers the DIRD data to the IC card, and then the IC card performs encryption processing and sends the data to the center. When receiving data (DIRD response data) sent to the receiver from the center, the IC card decodes the encrypted data and transfers it to the receiver.

- Data transfers during DIRD data transmission are performed directly between the IC card and the center, and the receiver only delivers the data transferred between the IC card and the center. Given this role, the receiver is not directly involved in the data transfer protocol.

4.5.2.2 Communications Phase

The following figure illustrates the processing flow during DIRD data communications.
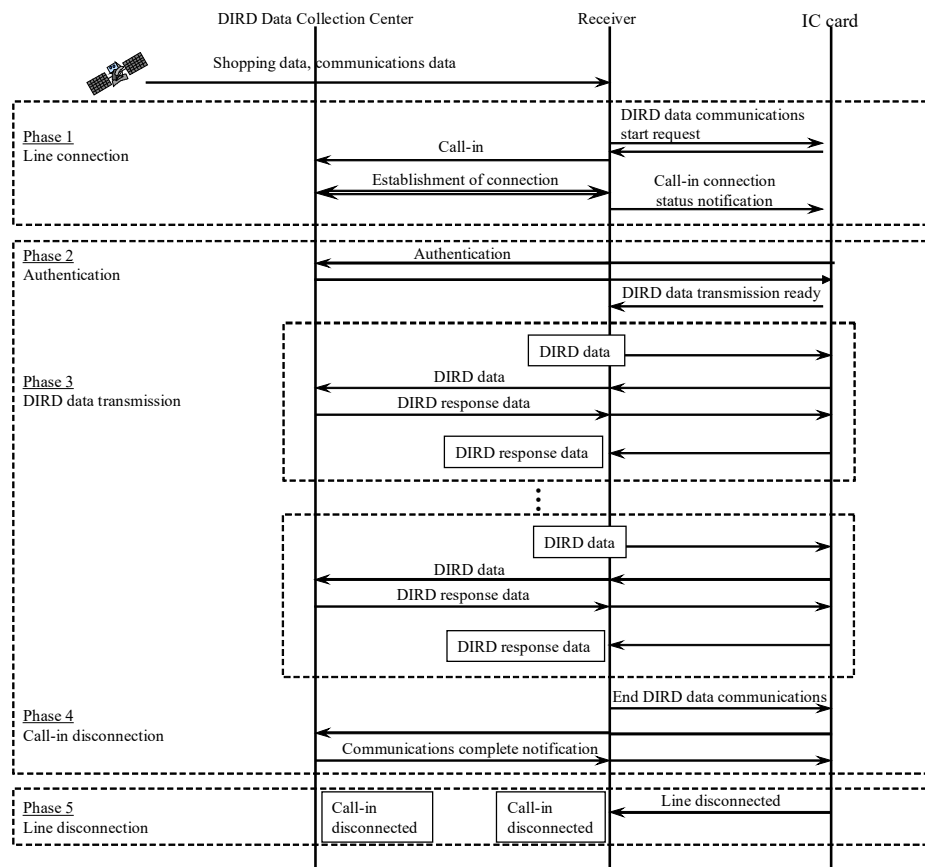
Figure 4-51 Processing Flow During DIRD Data Communications

4.5.2.3 Communications Levels

Communications levels are the same as communications during viewing history collection.

（1）Data link 1 level

Same as communications during viewing history collection.

（2）Data link 2 level

Procedures other than Phase 1 and Phase 2 are the same as communications during viewing history collection. During Phase 3, the receiver enters DIRD data communications mode and requests that the IC card perform DIRD data encryption and DIRD response data decoding.

（3）Data transfer level

Phases other than Phase 3 use the same protocols as communications during viewing history collection.

4.5.2.4 Error Processing by the Receiver

Error processing is the same as communications during viewing history collection.

4.5.2.5 Data Link 1 Level During DIRD Data Communications

The data link 1 level protocol is the same as that used when communicating with the Viewing Information Collection Center.

4.5.2.6 Data Link 2 Level During DIRD Data Communications

- Telephone line communications interface communications protocol (between receiver and center)

  The communications protocol used between the receiver and the DIRD Data Collection Center is the same protocol used when communicating with the Viewing Information Collection Center.

- IC card/receiver communications interface

  As a rule, the interface between the IC card and receiver uses the same communications protocol used when communicating with the Viewing Information Collection Center.

  However, the following commands are used when making call-ins:

  1) Start DIRD Data Communications command

     Requests that the IC card start DIRD data communications.

     The following command is used in Phase 3:

  2) Encrypt DIRD data command

     Encrypts DIRD data (data being sent to the center).

  3) Decode DIRD Response Data command

     Decodes DIRD response data (data received from the center). The following command is used to end Phase 3:

  4) End DIRD Data Communications command

Reports the termination of DIRD data communications to the IC card.

4.5.2.7 Overall Processing Flow During DIRD Data Communications

(1) Call-in

- During DIRD data communications, the call-in instruction is issued to the IC card from the receiver with the Start DIRD Data Communications command. If the IC card determines that it is possible to conduct encrypted communications with the specified center, it returns "normal termination" with the return code (IC card instructions are not used to issue instructions in this case).

- During a DIRD data transmission call-in when the call-in instruction is received via a data broadcast, the SI, or a similar source, values stored in the receiver memory are used for the call-in destination telephone number, broadcaster identifier, and center ID.

- The maximum number of retries and the retry interval are both set to 0 so that no call-in retries are attempted.

- When the IC card instructs the receiver to perform a call-in, the receiver's modem dials the number and connects to the center. Once a connection has been established, the receiver returns "connection complete" to the IC card with the Report Call-in Connection Status command.

- When a call-in fails, for example as a result of the line being busy, the receiver returns "call-in failed" to the IC card using the Report Call-in Connection Status command.
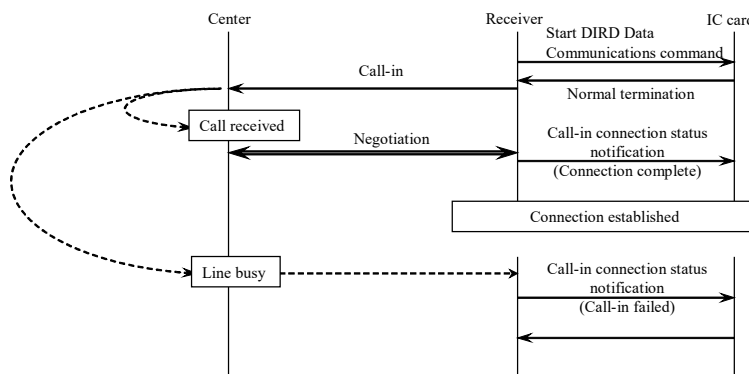
Figure 4-52 Connection Flow During DIRD Data Transmission

(2) Authentication

The communications processing performed during authentication is the same as when communicating with the Viewing Information Collection Center.

(3) Processing in DIRD data communications mode

1) When the receiver receives the "DIRD data transmission ready" return code in the IC card's response to the Center Response command, it enters DIRD data communications mode and sends DIRD data by issuing the Encrypt DIRD Data command to the IC card. If necessary due to the DIRD data's byte size, the receiver partitions the data into

multiple blocks for transmission.

2) The IC card encrypts the DIRD data sent from the receiver and returns the result to the receiver.

3) The receiver sends the encrypted DIRD data received from the IC card to the center.

4) The center receives the encrypted DIRD data, processes it, encrypts the resulting DIRD response data, and sends it back to the receiver.

5) The receiver passes the received DIRD response data to the IC card with the Decode DIRD Response Data command. If necessary due to the DIRD response data's byte size, the receiver partitions the blocks into multiple blocks, which it passes to the IC card.

6) The IC card decodes the encrypted DIRD response data received from the receiver and returns the decoded DIRD response data to the receiver.

7) The cycle of DIRD data/DIRD response data processing described above is repeated as necessary.

8) When DIRD data communications are complete, the IC card returns "normal termination" in response to the End Data Communications Command, and the receiver returns to normal mode.
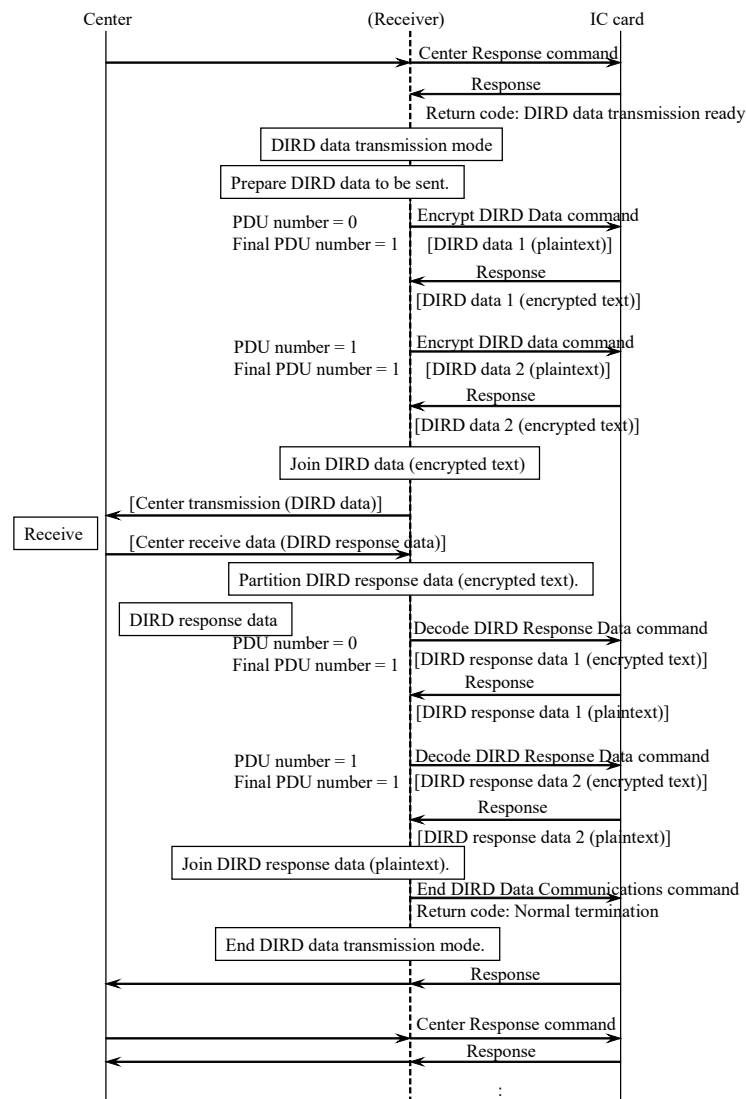
Figure 4-53 Data Transfer

(4) Disconnecting the call-in

The communications processing performed when disconnecting the call-in is the same as when communicating with the Viewing Information Collection Center.

4.5.2.8 Receiver State Transitions (DIRD Data Communications)

The following table augments the receiver state transitions described in the table listing state transitions during viewing information collection.

Table 4-75 Receiver Operation during DIRD Data Communications

Receiver state / Receiver event		Idle	During call-in	During communications
Normal events	Call-in is requested by an application	Start call-in with Request Start of DIRD Communications command and transition to the call-in in progress state.		
	Connection complete		Return "connection complete" with Report Call-in Connection Status command and transition to communications in progress state.	
	Call-in performed but unable to connect (busy state, etc.)		Return "connection failed" to IC card with Report Call-in Connection Status command and transition to idle state. Receive "normal termination" from IC card.	
	"DIRD data transmission ready" acquired via return code from Center Response command response			Transition to DIRD data communications mode and start DIRD data communications.
	DIRD data transmission request occurs at receiver			Partition DIRD data and request encryption by IC card with Encrypt DIRD Data command.

Encrypted data acquired from IC card via the Encrypt DIRD Data command response. (Final PDU number = 0) (Final PDU number = PDU number)			Transfer data transfer protocol data to center.
Encrypted data acquired from the IC card via the Encrypt DIRD Data command response. (Final PDU number ≠ 0)			Request encryption by IC card with the Encrypt DIRD Data command until the final PDU number equals the PDU number.
DIRD response data received from center			Partition the DIRD response data and transfer to the IC card with the Decode DIRD Response Data command.
Decoded data acquired from the IC card via the Decode DIRD Data command response. (Final PDU number = 0) (Final PDU number = PDU number)			Join data.
Decoded data acquired from the IC card via the Decode DIRD Data command response. (Final PDU number ≠ 0)			Request decoding by IC card with the Decode DIRD Data command until the final PDU number equals the PDU number.
All DIRD data sent and all DIRD response data received (end DIRD data communications)			Issue the End DIRD Data Communications command and transition to normal mode.
Disconnect call-in instruction acquired using IC card instruction	Ignore IC card instruction.	Cancel call-in and transition to idle state.	Perform call-in disconnect processing and transition to idle state.

4.6 Display of EMM Messages

(1) Display of "EMM automatic display messages" (those messages were stored on the IC card)

- When a received "EMM individual message" is targeted for storage on the IC card, the DIRD transfers the message code region to the IC card and acquires a response. At this time, the display information for the automatic display message is stored on the IC card.

The DIRD acquires the Fixed Sentence transmitted by the "EMM common messages" according to the display information contained in the response from the IC card and creates/displays the automatic display message.

- When selecting a program, the DIRD acquires automatic display message display information from the IC card for the broadcaster group whose selecting program is being received. The DIRD acquires the Fixed Sentence for the specified EMM common messages according to the acquired display information, combines the automatic display message, and repeats a "display on/display off/display on" cycle as specified by automatic display durations 1, 2, and 3 for the number of times specified by the automatic display count. When playing a stored program on a DIRD with recording function, the DIRD acquires the "EMM automatic display message" display information from the IC card for the broadcaster group whose program is being played, acquires the specified EMM common messages * according to the acquired display information, and displays them as described above, if and only if display of automatic display messages has been specified during playback viewing of the stored program. If the display of automatic display messages is not specified during playback viewing, the receiver does not display the message. (See Chapter 4 Section 4.7.3.)

- There are three "EMM automatic display message" erasure types: erasable, non-erasable, and display-erasable. The display of erasable type messages on the screen can be erased by the user, while non-erasable type messages cannot be erased by the user. The display messages consisting of "EMM common messages" for which the automatic display erasure type is display-erasable are not displayed. When the automatic display message consisting of "EMM common messages" that is being automatically displayed is updated to display /erase-erasable type, the display of that automatic display message is cancelled. While an "EMM automatic display message" is being displayed, the receiver monitors update of the version_number in a field of the "EMM common messages". The version number field is also monitored when the automatic display erasure type is set to display-erasable, and the message in question is automatically displayed if its type is changed to erasable or non-erasable.

- When the "EMM automatic display messages" of "Fixed Message Sentence Number = 0" and "differential information length = 0" are received while an "EMM automatic display message" is being displayed, the display of that "EMM automatic display message" is cancelled.

(2) Mail display (messages stored on the DIRD)
- When a received "EMM individual message" is targeted for storage on the DIRD and is encrypted, the DIRD transfers the message to the IC card, acquires the response, stores the message on the DIRD, and displays it in response to user operation.
- When a received EMM individual message is targeted for storage on the DIRD but is not encrypted, the message is stored as-is on the DIRD and displayed in response to

user operation.

*" EMM common messages" consist of information contained in the signal played back on DIRD with recording function and/or of information transmitted via the program signal being broadcast by the broadcaster group at the time of user playback. The latter definition applies when the user is viewing real-time program of the broadcaster group.

4.7 SI

4.7.1 Specific-channel EMM Transmission

A descriptor is defined in the NIT for specifying the channel when transmitting EMMs on a specific channel (see Chapter 3 Section 3.2.6.2, "EMM (Individual Information)" and Reference 3, "8. EMM Transmission").

   a. Descriptor name

      CA_EMM_TS descriptor（CA_emm_ts_descriptor）

   b. Location

      NIT descriptor field first loop

   c. Data structure

Table 4-76 CA_EMM_TS Descriptor Data Structure

Data structure	No. of bits	Mnemonic
CA_emm_ts_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_id	16	uimsbf
transport_stream_id　*1)	16	uimsbf
original_network_id　*2)	16	uimsbf
power_supply_period　(Note)	8	uimsbf
}		

*1) Identifies the transport stream being used to transmit the EMM.
*2) Identifies the original distribution system network.
    Note: Power-on time　　　Unit: Minutes

4.7.2 PPV

A descriptor is defined in either the SDT or EIT for checking whether a program scheduled for broadcast is a flat/tier type service or event, or a PPV event, and for checking whether it is possible to reserve the program for viewing (recording) in advance.

   a. Descriptor name

      CA contract information descriptor (CA_contract_info_descriptor)

   b. Descriptor location

      SDT and/or EIT. In the event that both descriptors are present for a single event, the descriptor in the EIT is effective. One descriptor must be allocated and sent for each distinct billing unit (ECM).

c. Data structure

Table 4-77 CA Contract Information Descriptor Data Structure

Data structure	No. of bits	Mnemonic
CA_contract_info_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_id	16	uimsbf
CA_unit_id	4	uimsbf
num_of_component	4	uimsbf
for(i = 0;i<num_of_component;i++) {		
component_tag	8	uimsbf
}		
contract_verification_info_length	8	uimsbf
for(i=0;i<contract_verification_info_length ;i++) {		
contract_verification_info	8	uimsbf
}		
fee_name_length	8	uimsbf
for (i = 0;i< fee_name_length ;i++) {		
fee_name	8	uimsbf
}		
}		

1) CA_unit_id

- This 4-bit field is used to distinguish between the billing unit/non-billing unit to which the component belongs. The value 0x0 is not used with this descriptor.

  0x0: Non-billing unit group

  0x1: Billing unit group including default event ES group

  0x2 to 0xF: Billing unit group other than above

2) contract_verification_info (contract verification information)

- When allocated to the SDT, this field is used to confirm whether the service (or ES group comprising a service) in question can be reserved for viewing (recording). In order to perform this advance confirmation, the receiver provides contract verification information and the planned viewing date to the IC card, which responds with the result of a judgment of whether the program can be viewed on the specified date.

- When allocated to the EIT, this field is used to determine whether the event in question is a flat/tier type event (or ES group comprising an event) or a PPV type event (or ES group comprising an event). If the event in question is a PPV type event (or ES group comprising an event), the descriptor is used to determine the viewing fee and recording request information as well as to confirm whether the event in question (or ES group comprising an event) can be reserved for viewing (recording). In order to perform this advance confirmation, the receiver provides contract verification information and the planned viewing date to the IC card, which responds with the result of a judgment of whether the program can be viewed (recorded) based on the preceding information and specified date.

3) fee_name (fee name)

- This field provides information about the fee for the ES group being described. For a pay data broadcast associated with a cooking show, for example, it might describe a "Cooking Data Service."

4.7.3 EMM Message Reception

A descriptor is defined in the CAT to facilitate the display of "EMM automatic display messages" by indicating the broadcaster group providing the service, the "EMM automatic display message", and the delay time for the display of the "EMM automatic display message".

   a. Descriptor name

      CA service descriptor (CA_service_descriptor)

   b. Data structure

Table 4-78 CA Service Descriptor Data Structure

Data structure		No. of bits	Mnemonic
CA_service_descriptor () {			
descriptor_tag		8	uimsbf
descriptor_length		8	uimsbf
CA_system_id		16	uimsbf
ca_broadcaster_group_id	*1)	8	uimsbf
message_control	*2)	8	uimsbf
for(i=0;i<N;i++) {			
service_id		16	uimsbf
}			
}			

*1) ca_broadcaster_group_id: Broadcaster identifier
*2) message_control: Delay time

   Indicates the delay time in days before the automatic display message previously embedded in the IC card is displayed. A value of 0xFF indicates that the delay time is disabled (that the start of the delay time has been put on hold).

- 0x00 to 0xFE: Delay time (in days) until the display of the automatic display message
- 0xFF: Start of delay time has been put on hold.

   When playing a previously received and stored program on a receiver with stored reception functionality, a least significant bit of 1 for the delay time indicates that the automatic display message will not be displayed.

4.8 Scrambling Detection

The DIRD references the transport scrambling control and adaptation field control in the TS packet header for each stream to determine whether the stream is scrambled. The following table details this process:

Table 4-79 Scrambling Detection Details

Transport Scrambling Control	Adaptation field control	Description
00	01　or　11	Not Scrambled
01		Reserved
10		Scrambled (even key)
11		Scrambled (odd key)
XX	00　or　10	Reserved

4.9 Number of Scrambling Keys That Can Be Processed Simultaneously

The number of scrambling keys that can be processed simultaneously must be one or more pairs of odd and even keys per a tuner.

4.10 Number of PIDs That Can Be Processed Simultaneously

This conditional access system must be capable of simultaneously processing12 PIDs or more.

Chapter 5 Application of This CAS-R System to Other Media and Reception Formats

5.1 Application of This CAS-R System to BS Digital Broadcasting, Wide-area CS Digital Broadcasting, Terrestrial Digital Television Broadcasting, and Terrestrial Digital Audio Broadcasting Stationary Reception Formats

The provisions of Chapters 2 through 4 of this standard apply.

5.2 The Application of This CAS-R System to Terrestrial Digital Television Broadcasting and Terrestrial Digital Audio Broadcasting Mobile and Portable Reception Formats

5.2.1 Overview

Chapters 2 through 4 of this standard assume a reception environment characterized by the using screen of a receiver with a certain minimum resolution. The terrestrial digital television broadcasting and terrestrial digital audio broadcasting industries are currently investigating the possibility of providing service for mobile terminals such as onboard vehicle displays and portable handsets, and the utilization of a variety of receivers other than the type assumed by chapters 2 through 4 to provide reception of digital broadcasts on devices such as low-resolution satellite navigation system screens and mobile telephones is taken to be a possibility. Accordingly, it may be difficult for all receivers to implement the provisions of Chapters 2 through 4.

This section details additions and changes to the specifications laid out in Chapters 2 through 4 when this standard is applied to mobile and portable reception of terrestrial digital television broadcasts and terrestrial digital audio broadcasts.

5.2.2 Functional Specifications

5.2.2.1 Specifications Related to Scrambling and Associated Information

(1) Viewing information Call Function for Pay-Per-View

When using an onboard or portable receiver to receive terrestrial digital television broadcasts and terrestrial digital audio broadcasts, it may be difficult to establish line connectivity or provide a power supply at all times for information collection purposes. In such applications, information collection by user-request call should be substituted for the viewing information call-in function for PPV program.

It will be necessary to notify for the subscriber before calling when the IC card's viewing information memory becomes full, for example by using a LED or similar indicator lamp.

(2) Collecting viewing information

Viewing information should be collected from the terminal via either the public telephone network or the Internet.

Note: The collection of viewing information via the Internet will be considered in response

to specific broadcaster requests for such functionality. The interface and other means used to implement collection via the Internet will be defined by separate documentation.

(3) Billing control in mobile reception applications

When receiving program on a mobile device such as an onboard or portable receiver, the system must perform control to avoid inconveniencing viewers with double-billing due to factors such as changing reception conditions and line disconnections during the collection of viewing information.

5.2.2.2 Receiver Specifications

(1) Basic user input and display

When the use of a mobile or portable receiver makes it difficult to display by full-screen or to show-in superimposed graphics (including "EMM automatic display messages"), data should be shown to the user using a simple text display or audio guidance. Screenless receivers that are incapable of displaying messages should use an LED or similar indicator lamp or audio guidance to display such data to the user.

(2) Basic communications by modem

When it is difficult to include a built-in modem or similar communications device into a portable receiver, the device should include a built-in interface for use with an external modem or other device for connecting to the Internet to enable communications with the customer center.

Note: The interface for use with an external modem or other device for connecting to the Internet will be defined by separate documentation.

(3) Transmitting viewing history information

When it is difficult to communicate with Viewing Information Collection Center such as mobile or portable receiver, according to request from the IC card, the device should display an LED or similar indicator lamp to inform the viewer of call-in requests from the IC card or instruct the viewer to initiate a user call-in.

(4) Power-on call-in control

When it is difficult to perform power-on control such as mobile or portable receiver according to request from call-timer of the IC card to communicate, the receiver should display an LED or similar indicator lamp to inform the viewer of call-in requests from the IC card or instruct the viewer to initiate a user call-in.

(5) Power-on control

When it is difficult to control such as mobile or portable receiver according to request power-on from the IC card to reception EMM, the receiver should display an LED or similar indicator lamp to inform the user, there was power-on control request from the IC card for the purpose of EMM receiving or request to receive EMM data by user operation.

(6) Screen display

When it is difficult to display subtitle service such as mobile or portable receiver, the

device should display an LED or similar indicator lamp or reads out audio guidance
these data to the user.

5.2.3 Technical Specifications

5.2.3.1 Receiver Specifications

(1) Receiver overview

A variety of receivers ranging from portable handsets to home using DIRDs can be used
with terrestrial digital television broadcasts and terrestrial digital audio broadcasts.
For more information about such receiver models, see ARIB STD-B21 and ARIB
STD-B30.

(2) User interface

A variety of receivers ranging from portable handsets to stationary reception DIRDs can
be used with terrestrial digital television broadcasts and terrestrial digital audio
broadcasts. For this reason, this section defines neither the processing required to
implement various device functionality nor the user interface required to perform
conditional access for receivers other than DIRDs designed for home using.

(3) CA interface (IC card interface specifications)

IC card dimensions, physical specifications, pin layout and dimensions should comply
with Section 4.3.2 in this document.
Note: The use of CA modules with different figure will be considered as future
consideration according to request from broadcaster for such functionality.

(4) EMM receiving function

Due to the fact that mobile and portable receivers may not be powered on at all times,
those receivers are not required to provide power-on control functionality for use in
regular contract updates.

Part 1

Appendix

Appendix 1   Commentary on the Conditional Access System

1. Overview

1.1 System
1.1.1 Billing system
    (1) Flat or tier rate billing
    (2) Pay per view (PPV)
      1) IPPV
      2) Advance PPV

1.1.2 Unit of identification of broadcasters
    Unit of identification in the operation of Conditional Access System (hereinafter "CAS") of broadcaster is a group (hereinafter "broadcaster group") of outsourcing broadcaster (hereinafter "broadcaster," each of which is operated under identical information).

1.1.3 Contract scope
    The system can be expanded in phases, and is capable of customer management for the contracts of all households at maximum.

1.1.4 System lifetime
    The system is capable of controlling in line with the applied media.

1.1.5 Security functions and countermeasures against piracy
    The system is equipped with advanced security functions. In case of piracy, relevant countermeasures can be taken without interfering with ordinary paid broadcast.

1.2 Business and operating environments
1.2.1 Business environment
    1) Suitable for paid broadcast, coexisting with free programs supported by commercial spots
    2) Suitable for simultaneous broadcast

1.2.2 Key management
    Key management is under joint operation in principle.

1.2.3 System operation of customer management
    The system is capable of joint and independent operations.

1.2.4 System operation of EMMs transmission
    (1) EMMs for Flat or tier

1) EMMs shall be generated by broadcaster group:

If a broadcaster group consists of a single enterprise, individual operation applies;

If a broadcaster group consists of multiple broadcasters, joint operation shall apply. (Individual broadcaster should share the same tier bits.)

2) In the case of joint operation, each broadcast enterprise comprising the broadcaster group shall transmit the generated EMMs.

3) If batch processing is available for updating contract or other EMMs, this system is capable of concentrating such EMMs with a specified stream, thereby enabling efficient transmission.

(2) EMMs for PPV

1) For generation, multiplex the information in flat or tier EMMs.

2) For transmission, the same applies as the flat or tier EMMs.

1.2.5 System operation for program control

Each broadcaster shall undertake the scrambling and ECMs transmission.

1.2.6 Viewing information collection center

Collects viewing information using pay phone lines, cell phones, and/or PHS.

Under joint operation in principle.

2. Overview of EMM message

2.1 Basic concepts of EMM message

2.1.1 Overview

There are two transmission patterns for EMM message:

1) EMMs common message, and

2) EMMs individual message.

● The "EMMs individual message" transmits designated information for individual viewers, and the "EMMs common message" transmits messages common to all receiver units (fixed sentence).
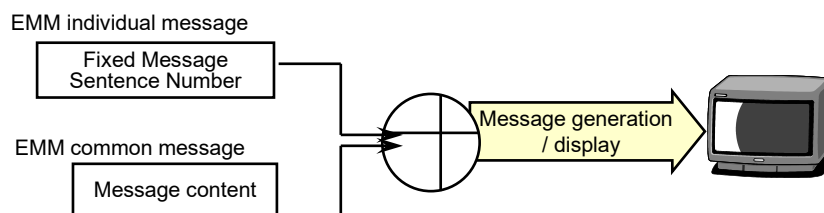
Figure A1-1. Overview of EMM Message

● By sending the difference from the message content (fixed sentence) of EMMs common message in EMMs individual message, a message consisting of the fixed sentence and the difference is displayed.

● Any combination of fixed sentence and differences would be possible. If you transmit with EMMs individual message only, without using any fixed sentence, a 100% individual message would be displayed.

2.1.2 EMM common message

● Receivable at all receiver units.
● Transmits such message information as fixed sentence, type of display/erase, time of display duration, and the frequency of displays.
● This message is not encrypted.

2.1.3 EMM individual message

● This message is transmitted to individual viewers, and is receivable at a specific receiver unit.
● Transmits such information as the number of message transmitted by EMM common message (the Fixed Message Sentence Number), the message difference information, and the message control information.
● Encryption is not essential.

2.1.4 Type of message

There are two types of messages displayed to viewers:

1) Automatic display message (accumulated on IC card)
2) Mail (accumulated on DIRD)

(1) Automatic display message

● Automatic display message is displayed automatically, when the viewer tunes in the channel of the relevant broadcast enterprise, or when he or she receives, accumulates and plays a program of the relevant enterprise on a receiver unit with the accumulated reception function. The timing of displaying automatic display message on TV screen is either immediately following the reception, or at the time of channel selection. The channel identification between broadcaster is based on the CA service descriptor in the CAT.

● Until its expiration, message is displayed automatically in the designated frequency, in the cycle of "not displayed - displayed - not displayed." This cycle is determined by the display duration for automatic display (T1, T2 and T3), designated by the transmitting station.

T1: Automatic Display duration time 1
T2: Automatic Display duration time 2
T3: Automatic Display duration time 3

Automatic Display
Message displaying

Automatic Display
Message not displaying

Automatic Display
Message not displaying

T1   T2   T3

One session (duration) of Automatic display
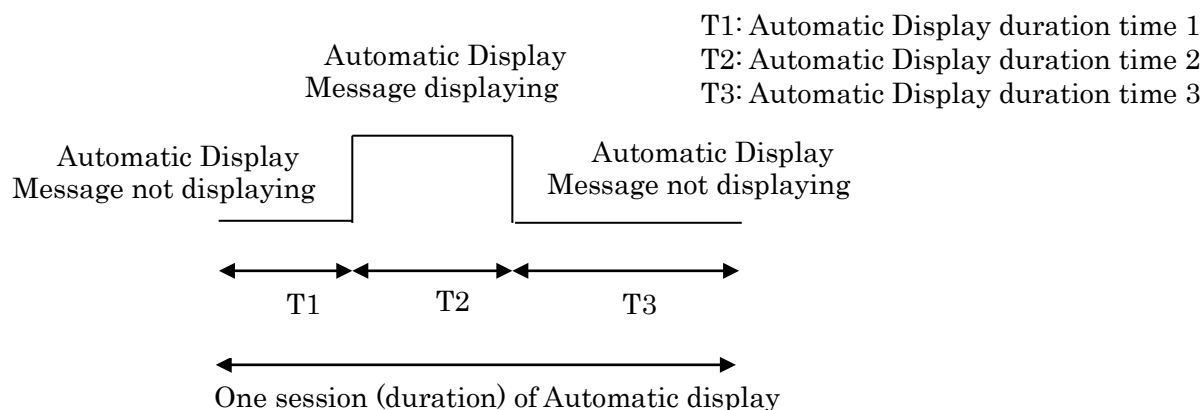
Figure A1-2. Automatic Display Duration time
and the Automatic Display Message status on receiver unit

- The information of automatic display message is accumulated on the IC card.
- The deletion of automatic display messages accumulated on the IC card shall be performed by the instruction of the relevant station.
- There are three types of deletion status for automatic display messages: Erasable, Not erasable, and Display/erase. "Erasable" messages can be deleted from the screen by the viewer's operation, while "Not erasable" ones cannot. EMMs common message categorized as "Display/erase" is not displayed as automatic display message. If the category of message on automatic display is updated to "Display/erase," the relevant EMMs common message will be excluded from the display list of automatic display. DIRD shall monitor the version number of EMMs common messages on automatic display, and detect any updates.
- If automatic display message with the Fixed Message Sentence Number = 0, and the difference information length = 0, is received during automatic display, the display of the relevant message shall be suspended.
- The transmitted content shall be encrypted.

(2) Mail

- Mails are accumulated on the DIRD (in mail boxes, etc.) following their reception, and can be displayed or deleted by the viewer's operation.
- The DIRD notifies the viewer of the reception of a new mail (by lighting LED, etc.). (DIRD's local function)
- The mail may be also displayed while the viewer is tuning in other channels than the transmitter's, at any time by his or her own operation.

3. Power-on control

Different EMMs include real-time ones in response to complaints, etc., ones at the new contract, updating and cancellation. Among these, planned transmission is available for updating-related EMMs, enabling the conservation of channels and power consumption of receiver unit.

The basic operations of DIRD, and the overview of related channel operations are as follows.

3.1 Basic operations of DIRD

a) Receiver unit

   i) Ask IC card whether the EMMs reception function is required (Power-on information requiring command), through the power on command. If it is required, take that information into the receiver unit. If there are multiple pieces of power-on information, take in all of them.

   ii) If the IC card indicates, in response to the reception, the "obtainment of power-on control information," read in and update all pieces of power-on information.

   iii) If the power is going to be turned off by the remote controller, the receiver unit shall utilize the EMMs reception function for a certain period of time, according to the above information, before it switches to the standby mode. If multiple updating statuses are identified in the updating detection following the power off by the remote controller, the receiver unit shall switch to the EMMs reception mode, according to the following procedure it retains.

   iv) If the viewer turns on power on the remote, the selection status of service stream that he or she last viewed shall be reproduced, even though the designated TS stream is introduced for the EMMs reception.

   v) If the number of EMM reception commands (hereafter "power-on information") is, for example, 32 at maximum on the system, the EMMs reception operation is performed for each of the multiple commands one by one. For example, if the power off time is twelve hours, and if there are eight pieces of two-hour power-on information, then up to six of them shall be performed, while the seventh and eighth should wait until the following off time. In such cases, the receiver unit shall retain the information of which of the above power-on information has been received, if the updating periods overlap for multiple commands.

   vi) If an IC card is inserted, power-on information shall be inquired for that IC card, for the purpose of updating contract.

b) IC card

   i) IC card shall have, as the power-on information data for receiver unit, the start date of updating (identified in the EMMs), power-on time, completion date of updating,

power retention time, and transmission network ID and stream ID unique to the
EMMs.

ii) Power-on information data should be output to the receiver unit, by the command
sent from it when the power is turned on (Power-on control information requiring
command).

iii) If the power-on information data is retained by multiple sets of IC card, the "final
power-on control information number" is notified in response to the command from
receiver unit (Power-on information requiring command), and the receiver unit
obtains all the relevant information.

3.2 Transmission example for contract modification EMMs

(1) Basic procedure

 i) When you generate EMMs for the initial contract, the following updating information
shall be multiplexed as power-on control descriptors.

 a) Start of updating (Power-on start standard date - Power-on start date offset) Date,
month, year

 b) Completion date of updating (Power-on start standard date - Power-on start date
offset + Power-on time) Date, month, year

 c) Power retention time: hours

 d) Transmission network ID unique to the EMMs

 e) Transmission stream ID for the EMMs

 ii) Transmission capacity and retention time for the updated EMMs

 a) In principle, the transmission capacity of EMMs relating to the updating should be
able to take a tour of during the power retention time.

 b) A shortest transmission route for the above shall be secured, with the minimum
retention time.

 c) In doing so, take account of the speed of filtering action on the DIRD, as well as the
adjacency layout of ID numbers and the encryption processing speed. (See Appendix
2, 3.11.3.3, Conditions for EMMs transmission.)

(2) Updating information (Example of default values)

 i) Start date of updating: Two weeks prior to the expiration date of updating

 ii) Completion date of updating complete: Expiration date of updating

 iii) Power retention time: About two hours at maximum

 iv) Transmission stream ID for the EMMs: ID number of the relevant or specified stream

(3) For independent broadcaster group:

 i) Generate the power-on control information according to the basic procedure, and
transmit it by the relevant or specific stream.

(4) For joint broadcaster group:

 i) Streams for individual broadcaster

 a) If the EMMs are shared by multiple broadcasters, divide it equally between related

broadcaster, based on the ID of the entire EMMs, so that the transmission capacity of individual broadcaster' streams should be leveled.

  b) For the divided EMMs, generate the power-on control information according to the basic procedure, and transmit it by the relevant stream.

  c) The updating EMMs corresponding to the above ID should be transmitted by the same enterprise's stream at the time of updating.

 ii) Specific streams

  a) Generate the power-on control information according to the basic procedure, and transmit it by the specific stream.

 iii) Contract period

  a) If multiple outsourcing broadcasters cooperate to form an broadcaster group, a contract period for the broadcaster group should be set, to identify its updating time.

  b) Therefore, if the viewer applies to multiple stations on different timings, the terms of the second application and on should be modified so that multiplexing of the power-on control descriptors is unnecessary in principle.

3.3 Transmission by the specific stream
(1) Benefits

  i) Efficient transmission and reception of EMMs are possible, due to the absence of switches between broadcaster' streams.

 ii) Therefore, the reception time is shortened, and energy consumption is reduced.

 iii) It is also possible that transmission capacity enhances, and the power retention time is shortened.

 iv) In the case of joint broadcaster group operation, the process of dividing EMMs equally between related broadcaster, to keep the transmission capacity of individual broadcaster' streams level, can be omitted.

  v) The above benefits are significant in the updating of Kw, exchange of IC card, and other cases of massive EMMs transmission.

(2) Challenges

  i) Operation in adjustment with high-speed EMMs transmission, receiver unit's filtering function, and decryption time

 ii) Management broadcaster group for the specified stream

 iii) Updating requirements and the allocation of expenses

4. Global ID

Global ID is added to the filtering conditions for EMMs on the receiver unit. If the receiver unit receives EMM with its own card ID, group ID and/or global ID, the unit transfers it to the CA module. Therefore, EMMs with the global ID should be received at all CA modules. As a consequence, the number of EMMs sent by the center could be reduced, with significant

benefits in a broadcasting system targeted at a large scale of users.

4.1 Application examples

Here are some examples with potential outstanding effects, generated by developing a global ID system.

If you set additional filtering conditions in the variable area of EMMs equipped with global ID, you may, for example, transmit the same controlling EMMs to all subscribers to Channel X at a time. This would enable the updating of security control parameter (telephone numbers, etc.) inside the CA module, under a certain subscription condition for the enterprise or broadcaster group, with a small number of EMMs. This will also enable the generation transfer of security measures in a shorter time.

It is expected that the range of application would further expand, to the simultaneous updating of database (parameter) inside the CA module, depending on the setting of filtering conditions developed in it.

[Example: For subscribers to Channel X]
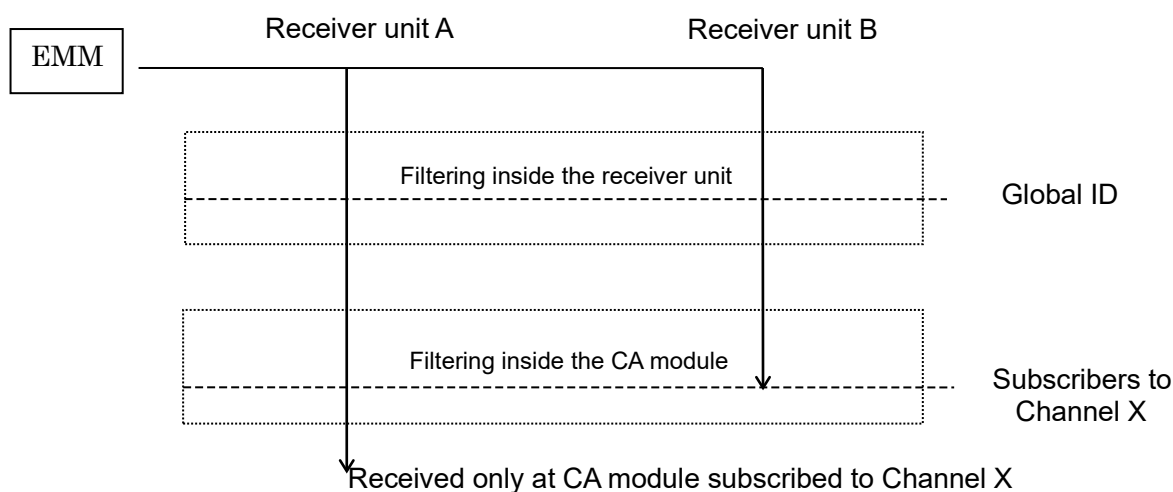
Figure A1-4. Example of applying global ID

4.2 Points of notice
4.2.1 Applicable service

EMMs equipped with global ID (hereafter "global EMMs") is filtered at all receiver units. Therefore, a system must be developed so that the transmission of global EMMs by a certain enterprise or broadcaster group should not affect the services for other broadcaster or entities. For example, if a certain enterprise or broadcaster group is going to transmit global EMMs, it should be restricted to information common to all CA modules. If the security controlling

broadcaster group transmits global EMMs, it should be restricted to the updating of parameters such as telephone numbers. In this manner, attention must be paid to the applicable services and operation styles. If there are multiple types of CA module, care is also required so that the global EMMs transmitted to CA modules of a certain CAS should not affect the modules of other CAS.

To prevent piracy, parameters of CA modules, especially security-related ones, should not be altered easily. From this viewpoint, program downloading or other services in the CA module using global EMMs should not be included in the applicable services. This viewpoint is not restricted to global EMMs only, and particular attention must be paid to restrictions on usage for security reasons, to ensure piracy prevention.

4.2.2 Burden on the receiver unit

Filtering conditions for global EMMs include the global ID (fixed value), in addition to the filtering conditions obtained from the CA module. The burden would not expand in particular, because the use of global EMMs should stay within the specifications of normal DEMUX at present.

As for the burden on the receiver unit, attention must be paid to the frequency of EMMs, given from the receiver unit to the CA module as a result of filtering. For example, some currently available receiver units seem to get frozen, or their operating buttons seem to get locked, when receiving 30 to 50 EMMs continuously at about 50 ms interval. This is because the processing at these receiver units does not catch up. To prevent such phenomenon, a systematic control of EMMs transmission is required.

4.2.3 Burden on the system

The use of global EMMs would lead to the reduction in EMMs transmitted, and thus to the reduced burden of EMMs transmission. Consequently, the transmission capacity of EMMs will be used more efficiently. The power-on time following the operation of turning off the receiver unit will become shorter as well because the transmission cycles of EMMs will be also shortened.

On the other hand, management or a system is required to prevent the rise of EMMs frequency, given from the receiver unit to the CA module. This point should be taken care of in the original system, not restricted to the use of global EMMs. For example, a system could be developed at the center to prevent the continuous reception of EMMs in a high frequency by specific receiver units as their own.

5. Identification of scrambled and non-scrambled programs

By nature of digital broadcasting, it is expected that the viewer would switch frequently between scrambled and non-scrambled programs. On a non-contractual receiver unit, non-scrambled programs should be viewable. Smooth switch between scrambled and non-scrambled programs is also required. At present, the following switching methods are available. All of them have room for improvement in response speed.

● Identifying by the existence of conditional access system descriptor or access control descriptor, based on the identification of PMT

・Room for improvement in response speed (transmission interval: minimum 0.1 second)

・Because the transmission of ECMs is started more than one second earlier than the start of a scrambled program, the final part of the non-scrambled program is muted.

● Designating with the SDT or EIT of SI information

・Room for improvement in response speed (transmission interval: minimum 2 seconds)

Therefore, the method described in 4.8 above is adopted.

6. Operation examples of the preview function for PPV programs

(Example 1) Preview is available for the first five minutes following the tuning in by the user.

A total five-minute preview is made available to the user, regardless of the time he or she tunes in the relevant program, by the following setting:

Total preview time: 5 minutes

Preview ending time: Ending time of the program.

(Example 2) Preview is available for the first five minutes of the program.

The preview of the first five minutes of a program is made available to the user, by the following setting. Preview is not available at other time zones. The user can preview a program for five minutes at maximum. If he or she starts viewing late, the preview ends before five minutes. (For example, if the user starts viewing after three minutes have passed from the start of the program, the available preview time would be only two minutes.)

Total preview time: 5 minutes

Preview ending time: 13:05:00 (The program starts at 13:00:00.)

(Example 3) Preview is available for five minutes within the first 30 minutes of a program.

The preview for a total five minutes is made available within the first 30 minutes of a 120-minute program, for example, by the following setting:

Total preview time: 5 minutes

Preview ending time: 13:30:00 (The program starts at 13:00:00, and ends at 15:00:00.)
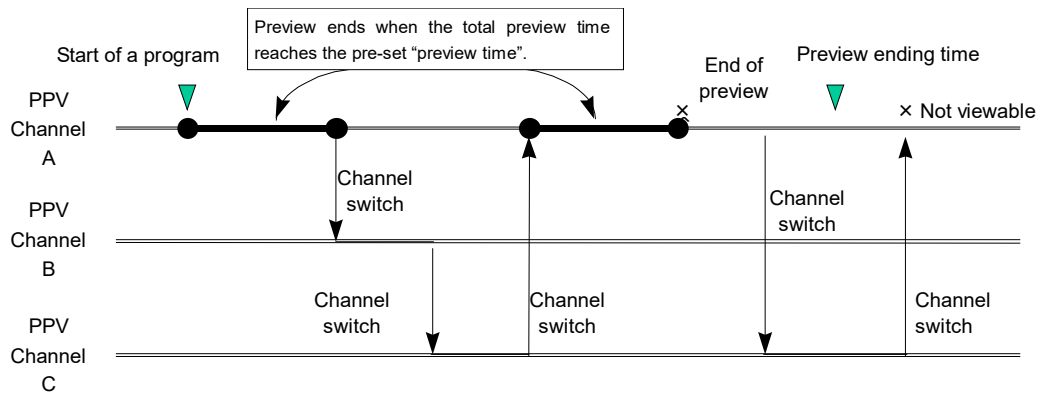
Figure A1-5. Example of preview patterns

(Example 4) Preview is unavailable.

Preview is made unavailable, by the following setting:

Total preview time: 0 minute

7. Operation examples of the billing control for rebroadcasting

This system is equipped with a function to make repeated broadcasting of the same program in a single channel or multiple channels viewable with being charged (paying) only once. Applying this system, such operations as Pay per Day would become available.

Some examples follow.

Example 1: Paying only once for repeated viewing of the same PPV program
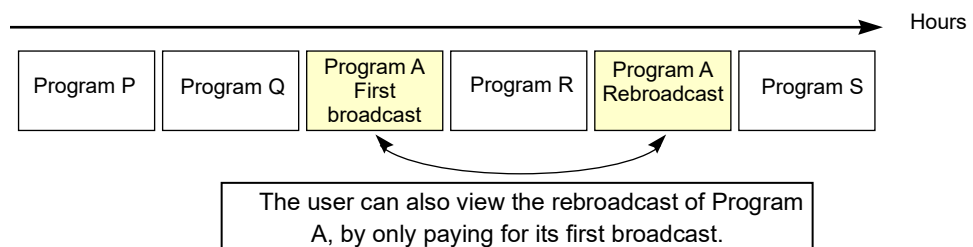
Figure A1-6. No charge for rebroadcasting of the same PPV program

Example 2: Paying in package for a series of PPV programs
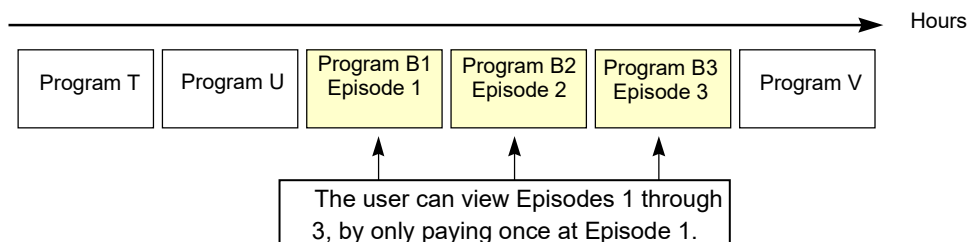
Figure A1-7. Paying in package for a series of PPV programs

8. Operation scenarios for the commands and responses of IC card

Examples of the following operation scenarios are provided below.

1) Card insert & power on

2) Updating group ID

3) ECMs reception (tier)

4) Purchase of PPV program

5) EMMs reception

6) Confirming the contract

7) EMM message reception / display (Automatic display message)

8) EMM message reception / display (Mail)

9) Communication call to the viewing information collection center (if the viewing history is not accumulated on the IC card)

10) Communication call to the viewing information collection center (if the viewing history is accumulated on the IC card)

11) DIRD data transmission

12) Confirming the balance of advance payment

13) Display of card ID

14) User call-in

In the description of each operation scenario,
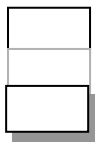
indicates the operation of IC card or DIRD;

indicates the operation of DORD by the viewer; and

indicates the command or response.

8.1 Card insert / power on
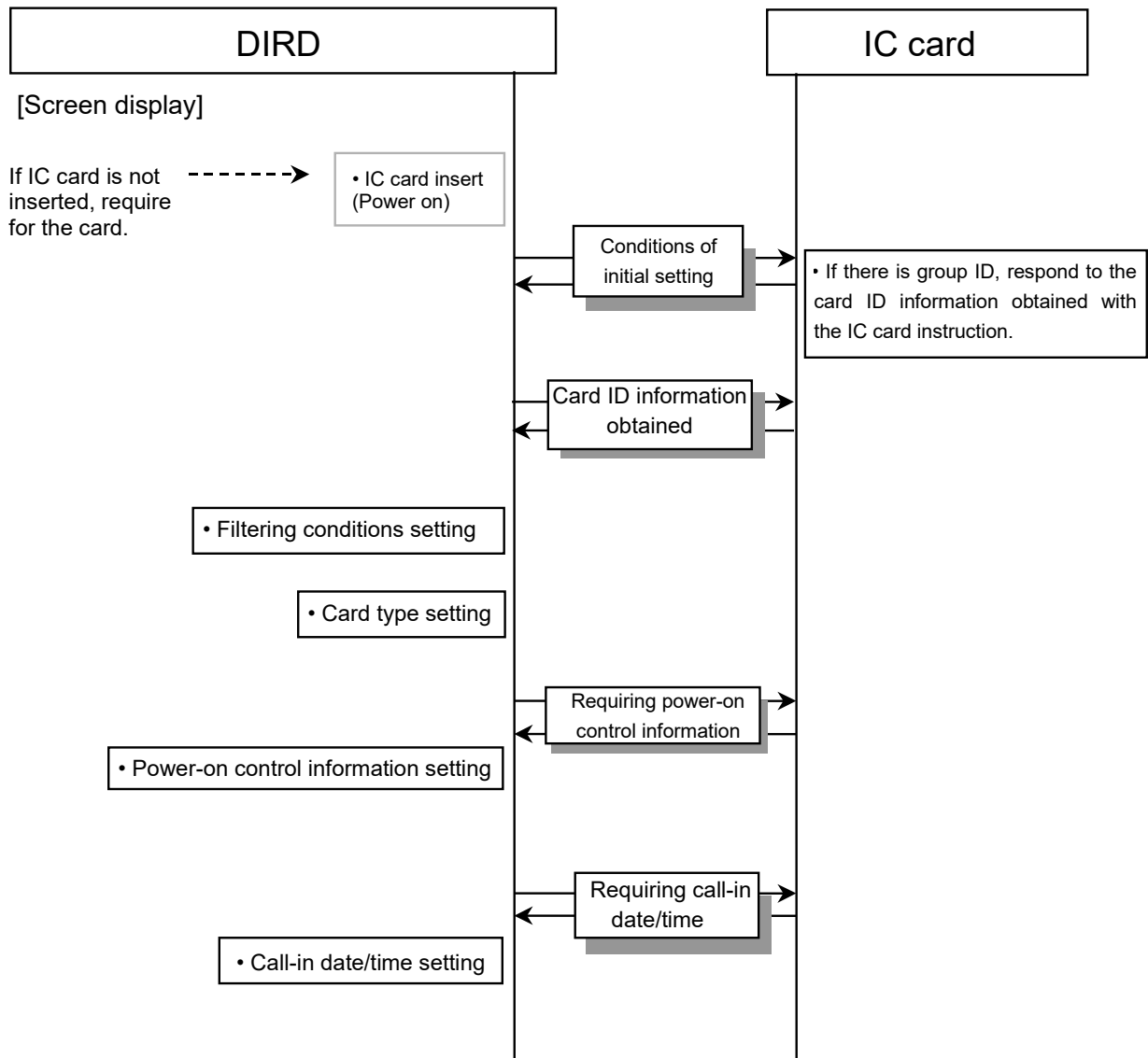
Figure A1-8. Card insert / power on

8.2 Updating group ID
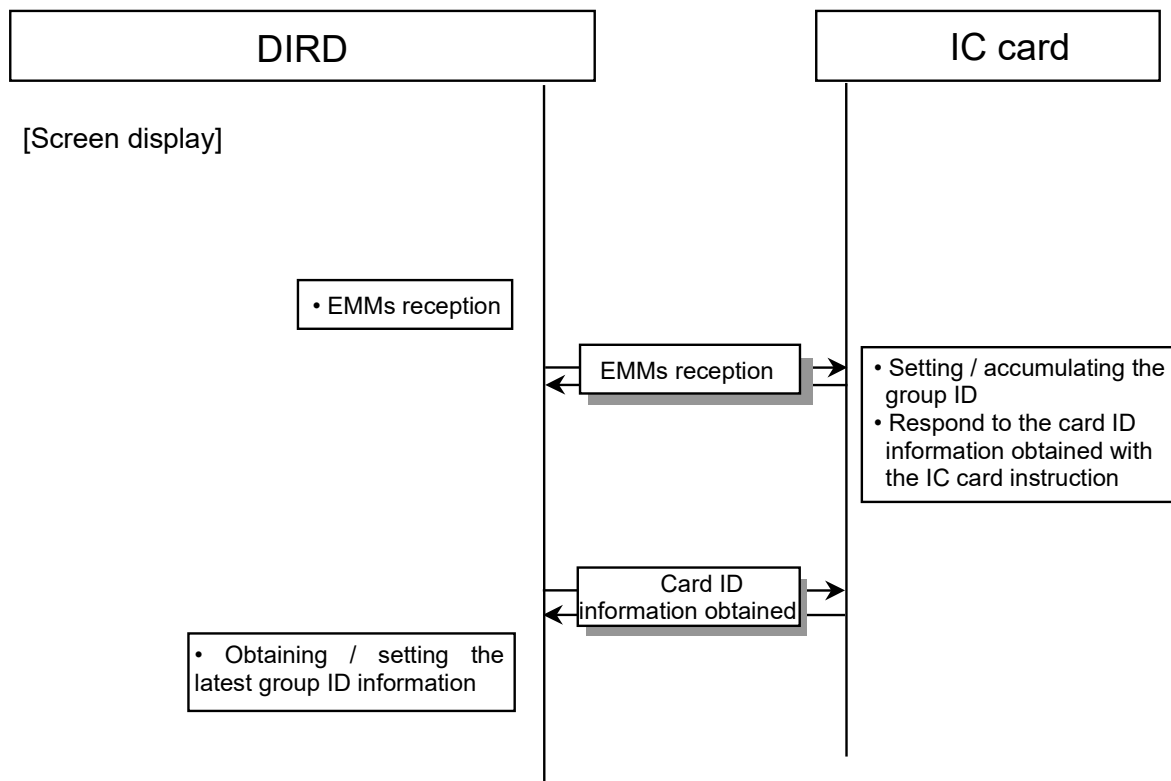
Figure A1-9. Updating group ID

8.3 ECMs reception (tier)

Note: For operations following the IC card instruction in ECM reception, see "9.5 EMM reception."
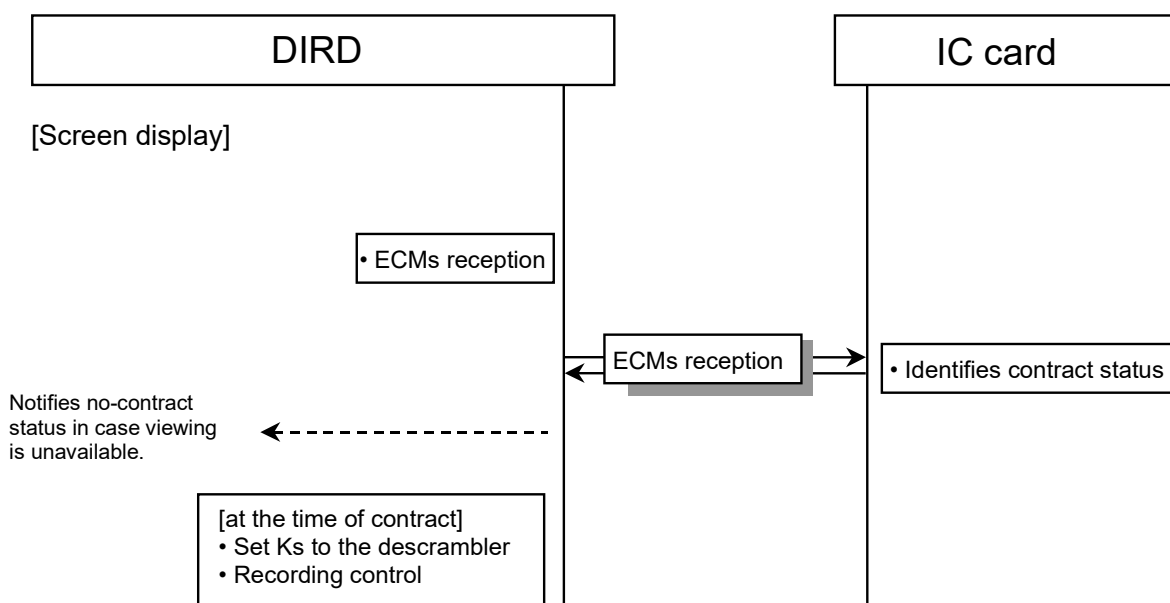
Figure A1-10. ECMs reception (tier)

8.4 Purchase of PPV program

Note: For operations following the IC card instruction in ECMs reception, see "9.5 EMMs reception.
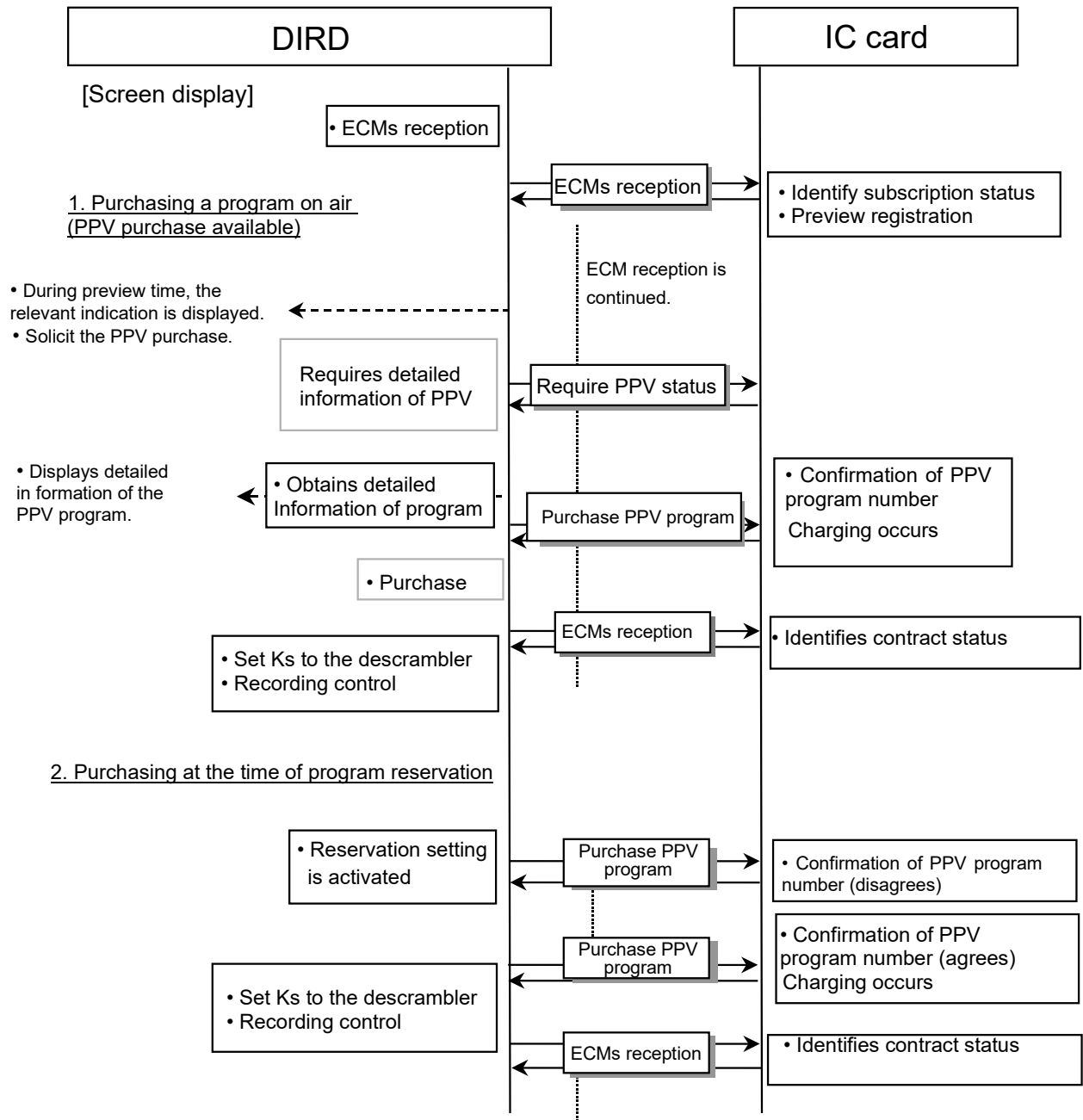
Figure A1-11. Purchase of PPV program

8.5 EMMs reception
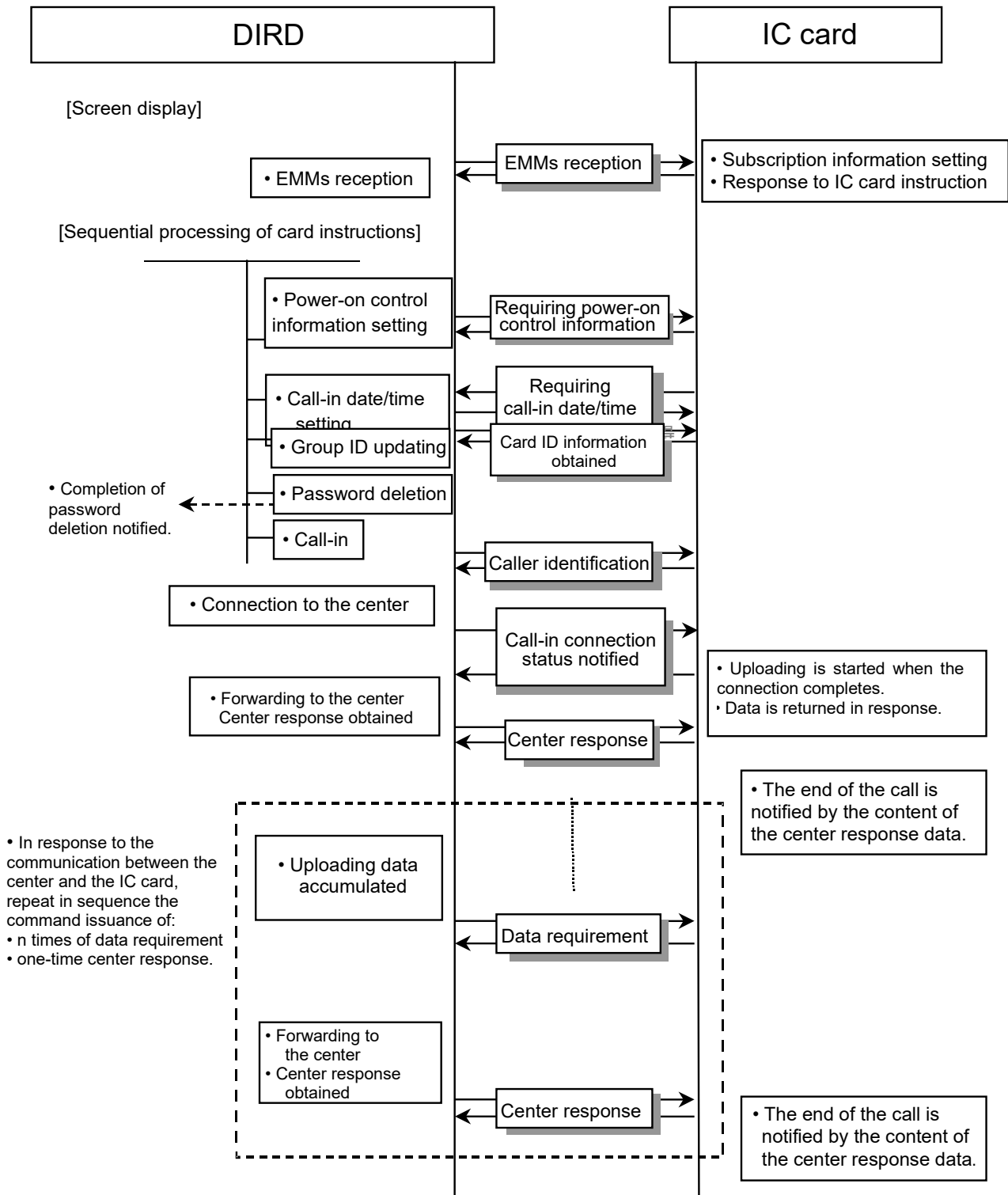
Figure A1-12. EMMs reception

8.6 Confirming subscription

DIRD

IC card

[Screen display]

1. Confirming with the contract

• Contract confirmation data is obtained from SI.

• Contract status is indicated in a list.

• Contract confirmation results obtained.

Contract status confirmed.

• Identification of subscription status

Contract status confirmed.

• Identification of subscription status

2. Reserving a program

• Select a program to reserve.

• Reservation menu is displayed.

Contract status confirmed.

• Identification of subscription status

• The availability of reservation is indicated, based on the contract status.

• Contract Confirmation results obtained.

Figure A1-13. Contract Confirmation

8.7 EMM message reception / display (Automatic display message)
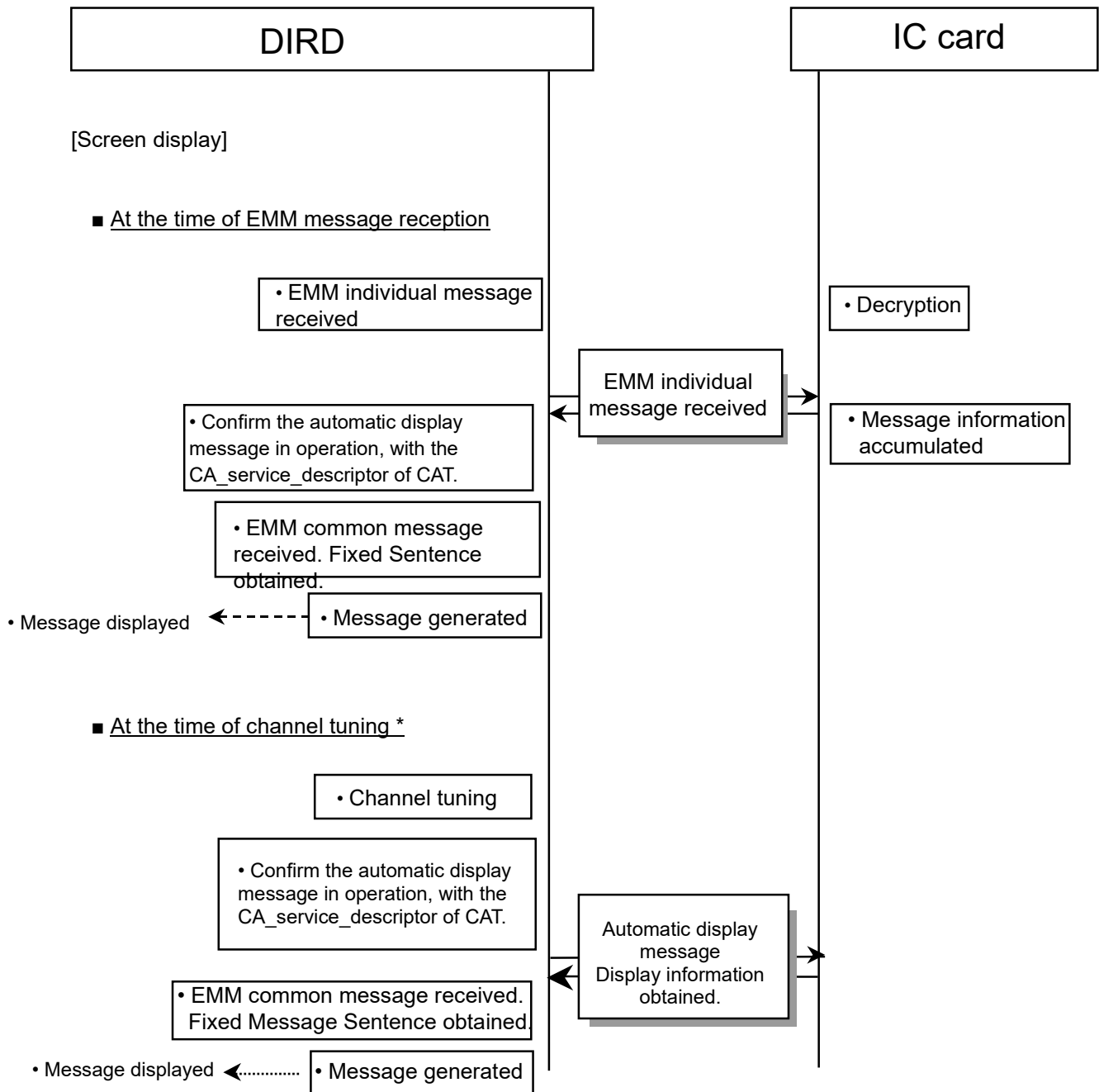
* Note: Including the cases of reproducing on a receiver unit with the Accumulated reception function.

Figure A1-14. EMM message reception / display (Automatic display message)

8.8 EMM message reception / display (Mail)
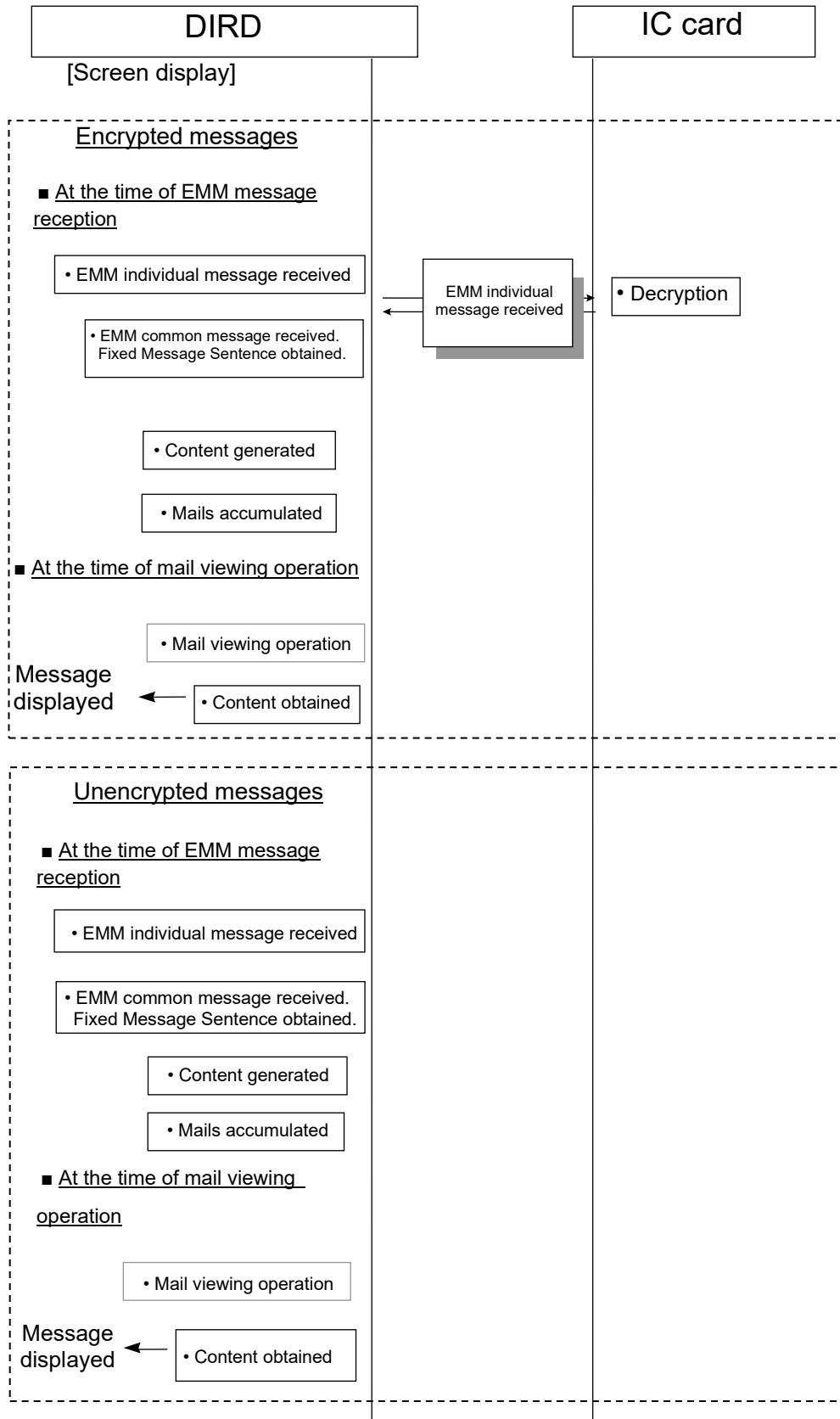
Figure A1-15. EMM message reception / display (Mail)

8.9 Communication call to the viewing information collection center (if there is uploading data)

If there is uploading data, the following operation scenario applies.
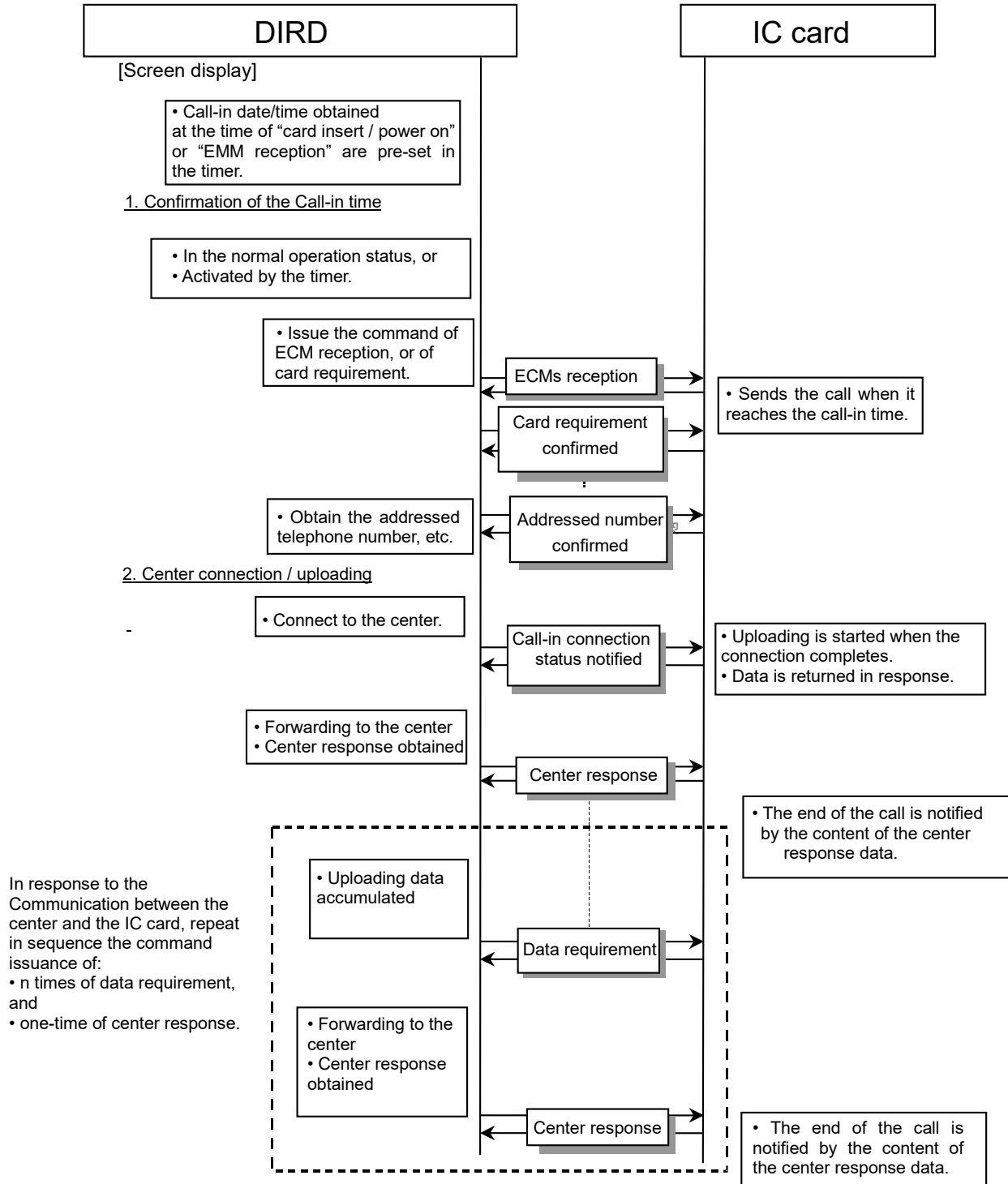
Figure A1-16. Communication call to the viewing information collection center (if there is uploading data)

8.10 Communication call to the viewing information collection center (if there is no uploading data)

・If there is no uploading data, the following operation scenario applies.

・The call-in does not take place, but the next call-in date / time information is obtained by the instruction of IC card.

DIRD

IC card

[Screen display]

・Call-in date/time obtained at the time of "card insert / power on" or "EMM reception" are pre-set in the timer.

1. Confirmation of the Call-in time

・In the normal operation status, or
・Activated by the timer.

・Issue the command of ECM reception, or of card requirement.

ECMs reception

・Returns the requirement for call-in date/time when it reaches the call-in time.

Card requirement confirmed

・Call-in date/time information obtained

Requiring call-in date/time

Figure A1-17. Communication call to the viewing information collection center (if there is no uploading data)

8.11 DIRD data transmission
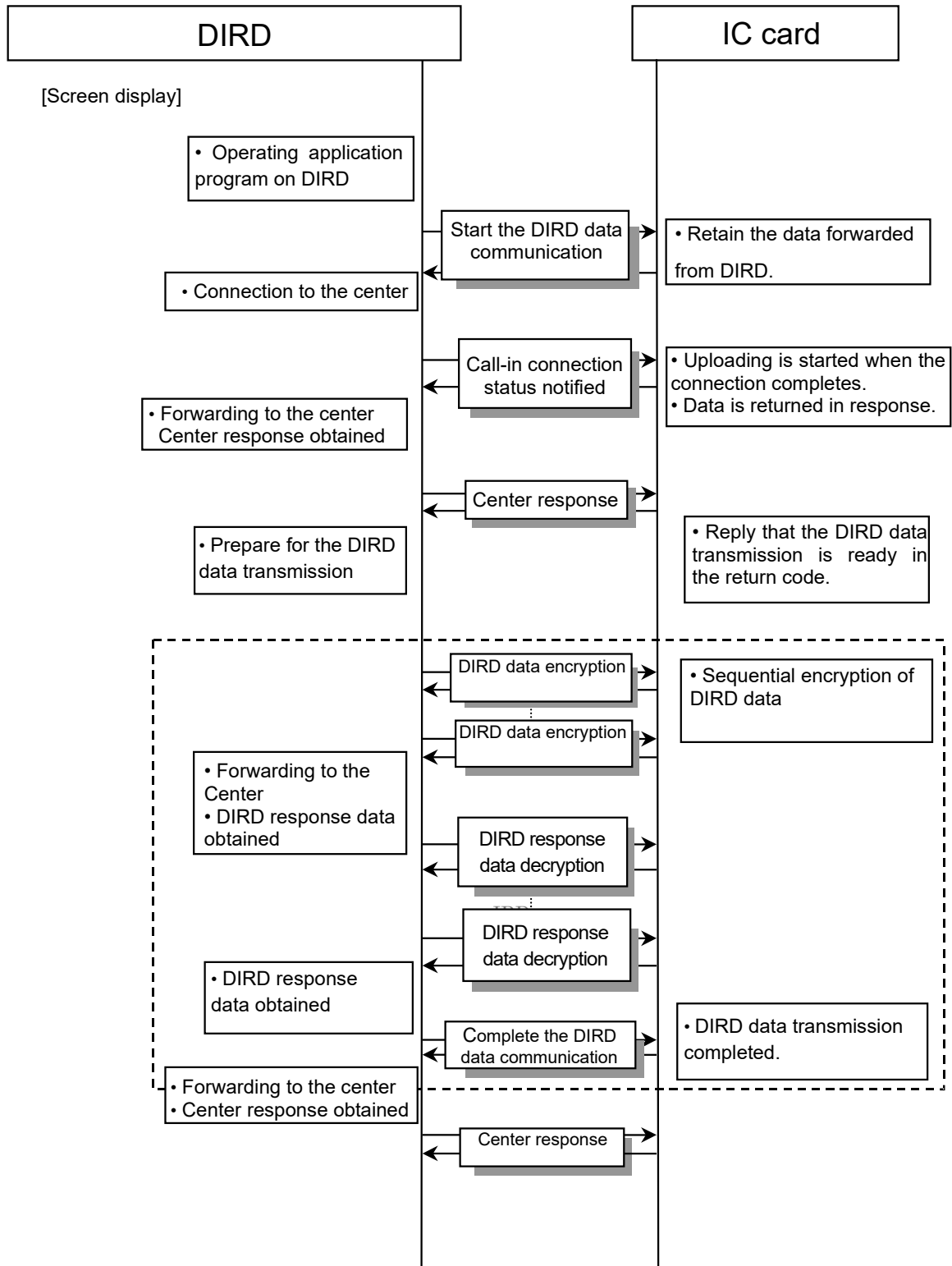
Figure A1-18. DIRD data transmission

8.12 Confirming the balance of advance payment
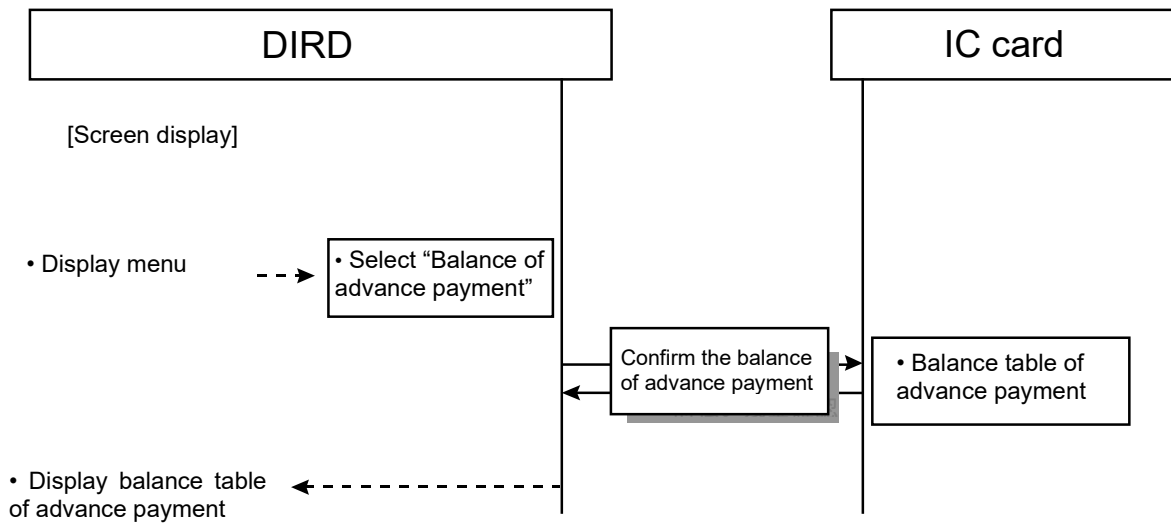
Figure A1-19. Confirming the balance of advance payment

8.13 Obtaining card ID information
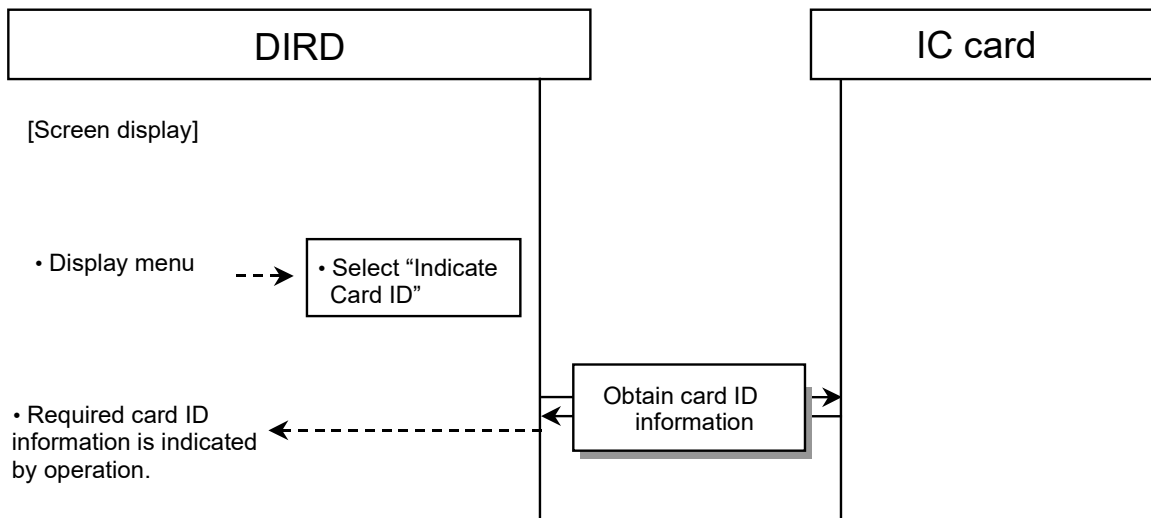
Figure A1-20. Obtaining card ID information

8.14 User call-in
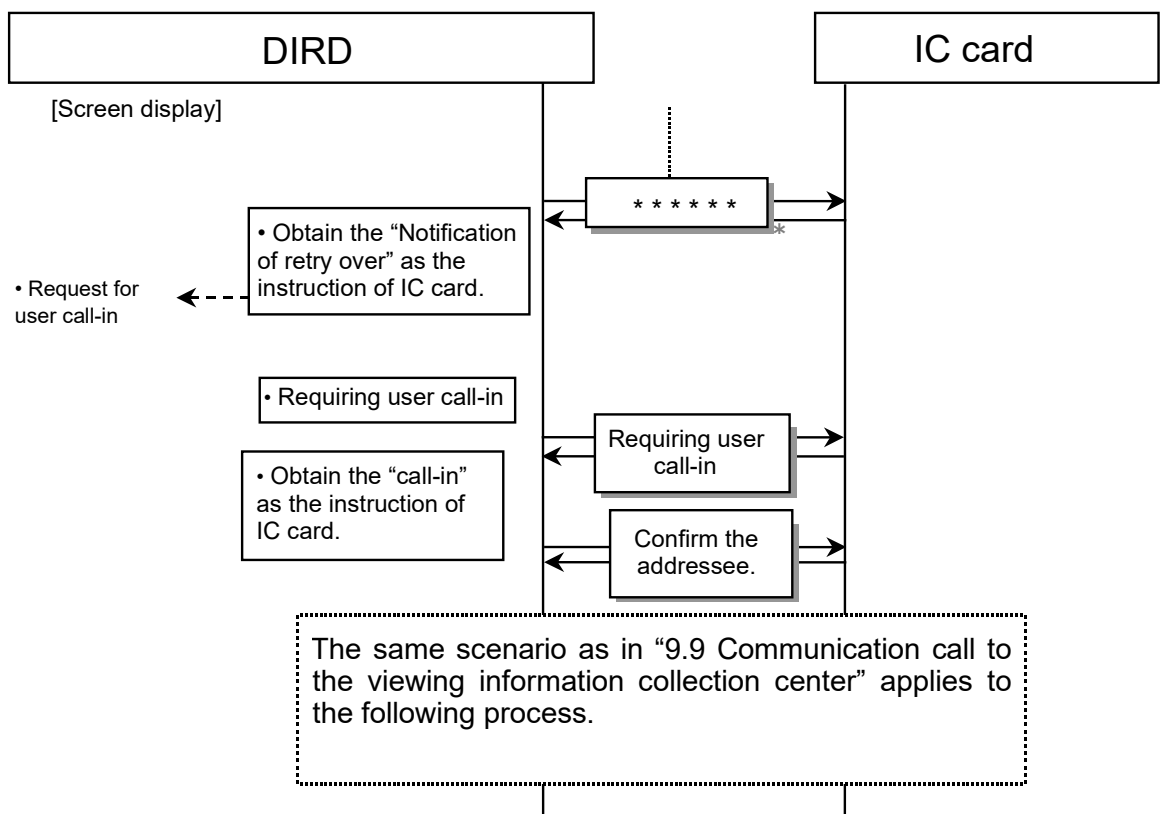
Figure A1-21. User call-in

9. Two-way authentication system and the Ks encryption

In digital broadcasting, scrambling is likely to be applied to free programs as well, for copyright protection purposes. In this system, the installation of copyright protection function will be enforced through the IC card subscription, the use of which will become essential on every receiver unit. However, if the number of resident idle IC cards increases, due to the disposal of receiver unit or other reasons, there arise risks of receiver units insensitive to copyright protection information in case such resident cards are used. To eliminate the risks of such insensitive receiver units, and to bolster the copyright protection, it is required to introduce two-way authentication system between the receiver unit and the IC card. The IC card shall identify whether the receiver unit conforms with the copyright protection, and when it is inserted in an insensitive receiver unit, the card suspends the decryption action of ECM, thereby canceling the descrambling process.

If an inappropriate IC card is inserted into a receiver unit, the unit should deny the card.

Insensitive receiver units may be designated by stations in their radio waves (ECM and EMM), so that whenever an inappropriate receiver unit is identified anew, it could be canceled flexibly. The designation of receiver units may be given by manufacturer, by model, by lot or by other units.

If the two-way authentication system is introduced between the receiver unit and the IC card, secret information may be shared during the authentication process. The encryption of scrambling keys (Ks) should be also introduced at the same time, to bolster its security.

The following IC card commands are added to introduce the above two-way authentication system.

Table A1-2. Commands for the two-way authentication system

Command name	Category	Overview	INS code
Initial setting	Extended	Extend the type of cards to identify cards equipped with the two-way authentication system. Specific methods for extension shall be determined at the start of operation.	0 x 30
Two-way authentication	New	Command for the two-way authentication between the IC card and the receiver unit	Undetermined (To be determined at the start of operation)
Extended ECMs reception	New	Forwards the ECMs data and obtains the Ks or other encrypted data as secret information given in the process of two-way authentication between the IC card and the receiver unit. This command replaces the existing ECMs reception command.	Undetermined (To be determined at the start of operation)
Extended PPV program purchase	New	At the purchase of a PPV program, forwards the ECM data and obtains the Ks or other encrypted data as secret information given in the process of two-way authentication between the IC card and the receiver unit. This command replaces the existing PPV program purchase command.	Undetermined (To be determined at the start of operation)

In the assignment of these INS codes, the following methods are available, from which the methods for actual code assignment shall be selected when determining the above commands.

- Simply adding new INS codes. (INS addition method)
- Adding a single new INS code, and defining new commands by adding "INS extension" to the position following the "Command length." (INS extension method)
- Assigning the areas P1 and P2 equivalent to new commands. (P1 & P2 method)

Table A1-3. Assignment of INS codes

	INS addition method	INS extension method	P1 & P2 method
Overview	Simply adds new INS codes. Uses 22 of 112 combinations.	Capable of responding to the future increase in commands. Systematic classification is also available by sharing the INS codes.	Capable of responding to the future increase in commands. Systematic classification is also available by sharing the INS codes.
Compatibility with the old versions of IC card	New commands are always processed as "6D00 (Undefined INS)" on old versioned cards.	If INS codes are undefined, "6D00" is used. If the "INS extension area" is added, a new error code is required in the "return code area."	If INS codes are undefined, "6D00" is used. If P1 & P2 areas are added, they are processed as "6A86 (different P1 & P2)."

Appendix 2 Explanation of the Receiver Unit

This part describes the functional specifications of the receiver unit, identified in Part I. The aim of this section is to provide uniform understanding of the specifications, by describing operations of a modelized receiver unit for each item of the functional specifications. This part comprises three sections: Sections 1 and 2 define terminology and statuses for the modelized receiver unit, and Section 3 describes operations of the modelized receiver unit. The modelized receiver unit is intended to help understand the functional specifications and is not binding on actual design and manufacturing of receiver units. The operations of the modelized unit are descripted focusing on basic receiver operations, rather than detailed or transitional operations. Please bear this in mind when actually designing and/or manufacturing receiver units.

1. Configuration of the receiver unit

Figure A2-1 indicates a model configuration of the receiver unit, included in the CAS. Please note that this figure representing the model configuration is provided only for the purpose of describing the specifications, and the actual configuration depends on the design of individual units.

(1) Tuner

Receives and selects required broadcast signals, and undertakes transmission signal packet processing and error correction, in response to an instruction from the Controls.

(2) Descrambler

Descrambles specified packets by using the MULTI2 method, in response to an instruction from the Controls.

(3) Demux

Separates required packets from TS-multiplexed signals, selects specific broadcast program signals, and divides them into different groups of multiplexed data (e.g. SI data, ECM, EMM).

(4) Video and audio decoder

Decodes video and audio, and outputs them to the monitor.

(5) Display

Controls display of user menus, lists, messages, etc., and outputs them to the monitor.

(6) Key input

Processes input from a Remote Controller or Keyboard manipulated by the user.

(7) Controls

Controls the receiver unit as a whole. Under the CAS, the Controls communicates with the IC card, processes different types of data separated from broadcast signals, controls the Descrambler, controls the phone modem （processes communications with the viewing information collection center), counts the time, and processes display instructions as well as key inputs.

(8) Phone modem

Connects to the viewing information collection center and the DIRD data collection center via public phone lines, etc., and processes telephone communications.

(9) IC card

Communicates with the Controls of the receiver unit when inserted into the unit. The IC card undertakes such core CAS processing of the receiver unit as decryption of encrypted EMMs it receives, subscription data control, decryption of encrypted ECMs, pay program viewing control, viewing history information control, transmission of viewing history information to relevant entities and decryption of encrypted EMM messages.

(10) Remote controller / Keyboard

Input user operation data as a user interface.
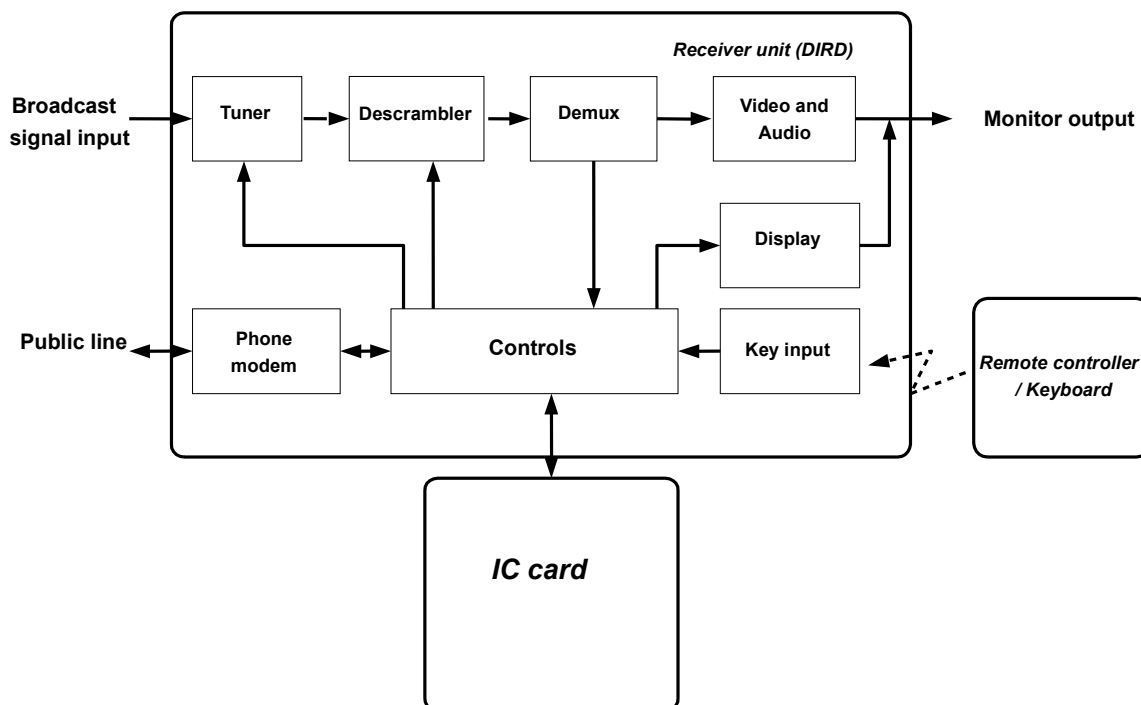
Figure A2-1. Basic configuration of the receiver unit

2. Statuses and status transitions of the receiver unit

2.1 Basic statuses and status transitions of the receiver unit

For the purpose of power consumption reduction, the basic statuses of the receiver unit are defined as in Figure A2-2.
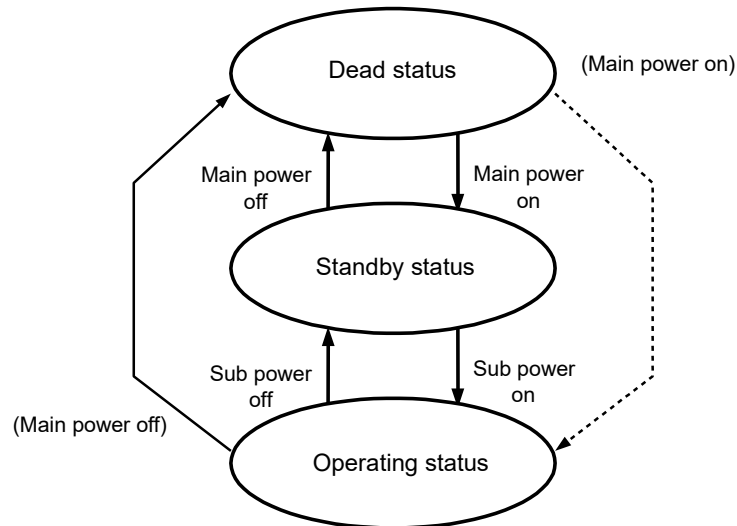
Figure A2-2. Statuses of the receiver unit

2.1.1 Dead status

(Operations in this status)

● The main power switch is off, and no electricity is provided to the receiver unit.

(Transition to this status)

● Turning off the main power switch and/or disconnecting the AC plug causes transition from any status to this status.

(Transition from this status)

● Turning on the main power switch causes transition to the Standby status. Some receiver models that are designed to recall the last channel viewed and return to the previous status may cause transition to the Operating status.

2.1.2 Standby status

(Operations in this status)

● The main power switch is on, and the user has turned off the sub power. In this status, the receiver unit determines power-on control processing, receives an EMM based on the power-on control processing, determines whether to receive an EMM via a specified channel, and receives EMMs. The receiver unit also determines a call-in timing and processes communications with the center, by regularly referring to the timer.

(Transition to this status)

● Turning on the main power switch causes transition from the Dead status to this status.

● User's turning off the sub power causes transition from the Operating status to this status.

(Transition from this status)

● Turning on the sub power causes transition from this status to the Operating status.

2.1.3 Operating status

(Operations in this status)

● All functions of the receiver unit become executable in the operating status. The user chooses an application to be executed, for example program viewing.

● Specific EMMs and ECMs are received and processed according to a selected program.

● Communications with the center is processed based on an instruction from the IC card or an application of the receiver unit.

(Transition to this status)

●User's turning on the sub power causes transition from the Standby status to this status.

(Transition from this status)

● User's turning off the sub power causes transition from this status to the Standby status.

● Turning off the main power switch causes transition from this status to the Dead status.

2.2 Statuses and status transitions of IC card

The statuses of the IC card to be recognized by the receiver unit are listed below.

2.2.1 "No IC card" status

● No IC card is inserted.

● No programs other than non-scrambled free programs can be selected.

● No EMM, EMM messages or ECM can be received for processing, and no communications are exchanged with the center.

2.2.2 "Invalid IC card" status

● The inserted IC card is not one of those designated.

● The receiver unit cuts off power supply to the IC card.

●No programs other than non-scrambled free programs can be selected.

●No EMM, EMM messages or ECM can be received for processing, and no communications are exchanged with the center.

2.2.3 "Valid IC card" status

● A valid IC card is inserted.

● Within the scope of the IC card and receiver unit versions, all applications, including viewing of free and paid programs, are executable.

● EMM, EMM messages and ECMs are received for processing, and communications are

exchanged with the center.

2.2.4 "Power off" status
- The inserted IC card is not activated because its power is turned off.

2.2.5 "Fail" status
- No reply is sent by the inserted IC card, or a logical error has been detected in communications with the IC card.
- The receiver unit cuts off power supply to IC card.
- No programs other than non-scrambled free programs can be selected.
- No EMM, EMM messages or ECM can be received for processing, and no communications are exchanged with the center.
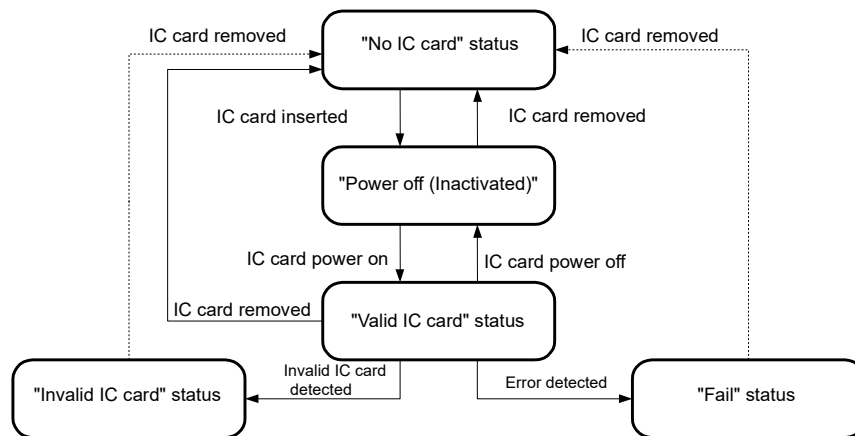
Figure A2-3. Statuses and status transitions of IC card

3. Detailed functions of the receiver unit

3.1 Power saving
- A digital broadcast receiver system requires minimum power consumption by using such systematic controls as power-on control and power-on call-in control, as described hereinafter, and shall provide minimum power to the receiver unit when its sub power is off.

3.2 Timer
- A Timer (calendar) function is required in the CAS to keep the absolute time, for the purpose of executing systematic power-on control and call-in to the center.
- The time counter must be valid in all statuses but the Dead status. The time shall be adjusted regularly with a TOT multiplexed in broadcast signals while the broadcast signals are being received.

● A status transition from Dead to Standby should turn on the receiver power so that the time can be initialized by referring to time information on a TOT multiplexed in broadcast signals, which are obtained by the receiver in the process of selecting the last channel viewed or the default channel, or searching different channels for broadcasting signals. If the timer is activated in the Dead status by battery backup, the time initialization is not required.

3.3 Basic user input and display

● The receiver unit should have capabilities of basic key inputs via a Remote controller or Keyboard, so as to allow the user to select programs, make a variety of settings, etc.

● Full-screen display of text and other representation, as well as superimposed messages, should be available to display EPG, menus, and other diverse messages.

● Automatic display messages should be displayed in superimposition.

3.4 Descrambler
3.4.1 Control of Descrambler

●Descrambling by the MULTI2 method, at the transport stream packet level is performed.

● As default values for the descrambling, the Controls provides a Descrambler with system keys and CBC initial values, which should be read in from an IC card.

● The Descrambler receives the ID of a TS packet to be descrambled and the scrambling / descrambling key from the Controls. The Descrambler then performs descrambling based on the scrambling control and values of the adaptation field control in the TS packet header to be input.

3.4.2 Processing scrambling control on Descrambler

● If the scrambling control indicates "Not scrambled," the stream should be released regardless of the TS packet ID and the scrambling key provided.

● The state of the scrambling control after the descrambling is rewritten to "Not scrambled."

3.5 Communication control of IC card
3.5.1 Basic standards

● The IC card should conform with the ISO7816 and the ARIB standard, and adopts the half-duplex start-stop transmission based on the T=1 protocol.

3.5.2 Basic communication with IC card

● The receiver unit controls the IC card by transmitting commands to and receiving responses from the IC card over the T=1 protocol.

● If an ECM is received during reception of a paid program, "ECM reception command/response" are issued.

● The receiver unit regularly polls the IC card with "Card request confirmation command /response" to respond to a request for processing from the IC card.

● For future extensibility, IC card protocol unit numbers should be stored and managed for possible version upgrades.

Note: For further details, see Chapter 4, "4.3 CA Interface."

3.5.3 Inputting default data from IC card

● IC card default data is input to the receiver unit when an IC card is inserted in the unit with the "No IC card" status and in the Standby or Operating status, or when the main power switch is turned on.

● In the IC card initialization process, the receiver unit reads in the information of call-in time, power-on control, an individual card ID, group IDs, etc.

3.5.4 Status control of IC card

● The receiver unit regularly monitors the status of the IC card inserted.

● If the receiver unit determines that the IC card is out of order, by detecting an error code, no reply or other reasons, the unit insulates the IC card from the system.

● If an IC card which is invalid for the CAS is inserted, the unit insulates the IC card from the system.

● Relevant messages should be displayed when necessary.

3.5.5 Commands/responses

(1) Default settings command/response

This command and response is executed when an IC card is inserted, obtaining the data of an individual card ID, a CA_system_ID, a system key for descrambling, CBC initial values, System_Management_ID, etc.

(2) ECM reception command/response

Provides the IC card with an encrypted ECM received by the receiver unit, and obtains information to judge viewability, decrypted scrambling key (Ks), etc.

(3) EMM reception command/response

Provides the IC card with an encrypted EMM received by the receiver unit.

(4) EMM individual message reception command/response

Provides the IC card with an encrypted EMM individual message data received by the receiver unit, and obtains decrypted EMM messages. If the EMM messages are set to be displayed automatically, the IC card is instructed to store them.

(5) Obtaining information of automatically displayed messages command/response

Obtains entity-specific information for messages that are stored in the IC card and displayed automatically.

(6) PPV status request command and response

Provides the IC card with an ECM for PPV programs, and obtains detailed information

for such programs, including viewing fees.

(7) PPV program purchase command/response

Instructs the IC card to purchase a PPV program.

(8) Confirming the balance of advance payment command/response

Confirms the balance of advance payment, in the case of prepaid viewing of PPV programs, but this will not be used at least for some time to come.

(9) Card request confirmation command/response

Notifies the IC card of the current time, and obtains processing requests made by the IC card as a general polling command.

(10) Notifying call-in connection status command/response

Notifies the IC card of a connection result if a call-in to the center is requested by the IC card. Also, the upload data to be sent from the IC card to the center are transmitted to the receiver unit.

(11) Data request command/response

If the upload data to be sent from the IC card to the center are divided into multiple blocks, the IC card is requested to transmit the second and subsequent blocks.

(12) Center reply command/response

Transmits the data from the center to the IC card via the receiver unit. Also, the upload data to be sent to the center are transmitted from the IC card to the receiver unit.

(13) Call-in date/time request command/response

Obtains a scheduled date/time of the next call-in to the center.

(14) Addressee confirmation command/response

Obtains a telephone number and host number of the center called in.

(15) Starting the DIRD data transmission command/response

When sending data to the center for shopping and other purposes, the receiver unit notifies the IC card of the start of transmission.

(16) Ending the DIRD data transmission command/response

Notifies the end of DIRD data transmission.

(17) DIRD data encryption command and response

Sends the DIRD data to the IC card and encrypts the data for DIRD transmission.

(18) DIRD reply data decryption command/response

Sends to the IC card the response data received from the center, and decrypts the encrypted data for DIRD data transmission.

(19) Requesting the power-on control information command/response

Obtains such power-on control information as power-on start standard dates, power-on start date offset, power-on duration, original network IDs and transport stream IDs.

(20) Obtaining the card ID information command/response

Obtains an individual card ID and group IDs to be displayed on the screen of the receiver unit. To obtain group IDs, this command is used.

(21) Contract confirmation command/response

Confirms a contract status for reserved programs, and obtains program information.

(22) User call-in request command/response

Performs call-in by user request, in respond to a call-in request for collecting viewing history by a cellular phone, etc.

Note: For further details, see Chapter 4, "4.3 CA Interface."

3.5.6 Processing requests from IC card

(1) Request for call-in

Requests call-in to the center.

(2) Request for terminating call-in

Requests termination of a call-in to the center.

(3) Request for obtaining power-on control information

Requests the receiver unit to obtain power-on control information if the IC card receives the power-on control information in an EMM.

(4) Request for obtaining the call-in date/time

Requests the receiver unit to obtain call-in control information, etc. if the IC card receives the call-in control information, etc. in an EMM.

(5) Request for password deletion

Requests the receiver unit to delete a password if the IC card is requested to delete the password in an EMM.

(6) Request for default settings

Requests the receiver unit to issue a command of default settings.

(7) Request for notification of retry over

Notifies the receiver unit of a communication failure between the IC card and the viewing information collection center.

(8) Request for obtaining card ID information

Requests the receiver unit to obtain a group ID set by the IC card in an EMM.

(9) Request for card exchange

Detects the "Fail" status of the IC card, and requests for IC card change.

Note: For further details, see Chapter 4, "4.3 CA Interface."

3.5.7 Basic operating conditions for IC card control

● Basic operating conditions for the control of an IC card are listed in Attached Table 1, Chapter 4.

3.6 Phone modem or similar device, and basic communications

3.6.1 Basic protocol stack

Figure A2-4 indicates the protocol stack between the center, the receiver unit and the IC card. "Center" refers to the viewing information collection center, or the DIRD data collection center.

[1] Data link level 1 protocol

（1) Protocol for modem or similar device

Protocol between the center, the modem or similar device of the receiver unit, etc., which executes data transmission, call-in initiation and termination at Data link level 2. This protocol conforms with the ARIB standard. The details shall be specified by individual business enterprises.

（2) T=1 protocol

Basic interface protocol between the IC card slot and the IC card. This protocol conforms with the T=1 protocol of ISO-7816.

[2] Data link level 2 protocol

（1) Protocol between the center and the receiver unit

Protocol between the center and the receiver unit, which executes data transmission of upper layer (data between the IC card and the center) and call-in control. The details shall be specified by individual business enterprises.

（2) Protocol between the receiver unit and IC card

Protocol to transmit commands and responses between the receiver unit and the IC card. The details are stated in Chapter 4, "4.3 CA Interface."

[3] Data transfer protocol

Protocol for data transmission between the IC card and the center, and between the IC card and entities, in the upper layer of Data link level. The transferred data includes encrypted viewing history information, DIRD data, etc. The receiver unit does not identify the content of transferred data.

3.6.2 Transmitted data

● The data transmitted between the IC card and the center include data for authenticating the IC cards and the center, viewing history information, and DIRD data generated by the receiver unit when the user engages in shopping or other activities.

Data transfer level	Data transfer protocol	
Data link level 2	Protocol between the center and the receiver unit	Protocol between the receiver unit and IC card
Data link level 1	Protocol for modem or similar device	T=1 protocol

Center side　　　　　　　Receiver unit side　　　　　　　IC card

Figure A2-4. Communication protocol stack

3.7 Transmission of viewing history information

[1] Basics of communications

● In response to a request from the IC card, the receiver unit calls up the viewing

information collection center, transmits data between the center and the IC card, thereby sending viewing history information stored on the IC card to the center. If the receiver unit obtains date/time information for the next call-in, it controls the circuit power-on so as to initiate communications when necessary.

- The IC card issues a call-in request for sending viewing history information in the following cases. The receiver unit does not need to identify the cases.

    (1) Regular call-in by regular communications control

    (2) Forced call-in by forced call-in control in an EMM

    (3) Overflowing call-in, which is a call-in issued when the memory area for storing viewing history information on the IC card has been filled up (a specified storage level exceeded).

    (4) User call-in, which is a call-in requested by the user with a call-in request command (The call-in may be issued even when the retry over notification is issued.)

[2] Procedures for communication

- If the IC card requests the receiver unit to obtain call-in date/time information, the receiver unit obtains the information for the next call-in, and executes the required power-on call-in control.

- The receiver unit starts communications, in response to the call-in request from the IC card.

- In response to the call-in request by the IC card, the receiver unit obtains from the IC card the phone number of the viewing information collection center, and calls up the center. If the connection is successfully established, the receiver unit notifies the IC card of the successful connection. If the connection fails, the receiver unit notifies the IC card of the failed connection, and does not go to the following operations.

- The IC card and the viewing information collection center authenticate each other and exchange viewing history information by way of the receiver unit. Once the communications are completed, the IC card issues a call termination request to the receiver unit, which in turn terminates the call to complete the communication session. (The receiver unit does not identify the content of the transmitted data.)

- After terminating the communication session, the receiver unit obtains the date/time information for the next call-in, in response to a request by the IC card.

[3] Data transmission

- The receiver unit relays data back and forth between the viewing information collection center and the IC card. The unit does not identify the content of data transmitted between the IC card and the viewing information collection center.

- In principle, data in the upper layer is exchanged between the IC card and the receiver unit by issuing the "Center reply command/response".

- If the data length of the upper layer data sent by the IC card to the viewing information collection center is longer than that receivable by the IC card interface, the "Data request command/response" is issued several times to the IC card, so that the relevant

data are received in segments. Then, the receiver unit combines the segmented data back into one, which is then sent to the center.

● The receiver unit monitors the call-in status during a session. If the call ends for some reason, the receiver unit terminates the process by issuing the "Notifying calling communication status" command. If the upper layer data are not sent or received for a certain period, or if a logical error is detected, the receiver unit terminates the call to finish the process.

3.8 Power-on call-in control

[1] Overview of power-on call-in control

If the receiver unit has obtained from the IC card a scheduled call-in date/time for the next call-in, it calls up the viewing information collection center at the specified timing, in response to the call-in request from the IC card. If the receiver unit is in the Standby status, it provides enough power to the circuit so as to enable communications with the IC card and at least with the viewing information collection center.

[2] How to obtain call-in date/time

● The receiver unit obtains the call-in date/time information from the IC card, in response to an instruction sent by the IC card with the "Call-in date/time request command/response ".

● If the call-in date/time obtained is invalid, the power-on call-in control is not executed.

● With the main power switch turned on and an IC card inserted, the receiver unit reads in a scheduled call-in date/time from the IC card and initializes the data. If the call-in date/time is stored on EEPROM, the main power switch needs not to be on.

[3] Comparison of the call-in date/time, and activation of the receiver unit

● If the call-in date/time is valid, the receiver unit regularly compares it with the current time (even in the Standby status). If the current time is past the call-in date & time, the unit provides power to the circuit so as to enable communications with the IC card and at least with the viewing information collection center. The receiver unit then waits for a call-in request sent by the IC card. The unit must be capable of establishing communications with the viewing information collection center, whenever the current time is past the call-in date/time. (*Note)

● In some cases, the IC card does not issue a call-in request due to no data to be transmitted. In such cases, the IC card updates the call-in date/time for the next call-in, and issues a request for obtaining the call-in date/time. The receiver unit reads in the call-in date/time for the next call-in from the IC card, by issuing the "Call-in date/time request command/response".

● If the IC card does not issue a call-in request for a certain time period (30 seconds) after activated, the receiver unit reads in the call-in date/time for the next call-in from the IC card, by issuing the "Call-in date/time request command/response".

● If the IC card issues a request for obtaining the call-in date/time, during or after

communications, by exchanging commands and responses between the IC card and the receiver unit, the receiver unit reads in the call-in date/time for the next call-in from the IC card, by issuing the "Call-in date/time request command/response".

● During a call-in, the receiver unit indicates that the call-in request is being executed, by lighting an LED lamp, etc.

  Note: Because call-in retry may occur due to an error, the receiver unit must always be capable of establishing communications with the viewing information collection center whenever the current time is past the call-in date/time.

[4] Completion of the process

● Once the communications are completed and if the IC card does not provide any other instructions, the receiver unit returns to the status before the call-in. If the unit has been activated from the Standby status, it cancels the current power supply to the circuit and the IC card, which enabled the communications with the viewing information collection center. If the IC card provides other instructions, the receiver unit follows the instructions.
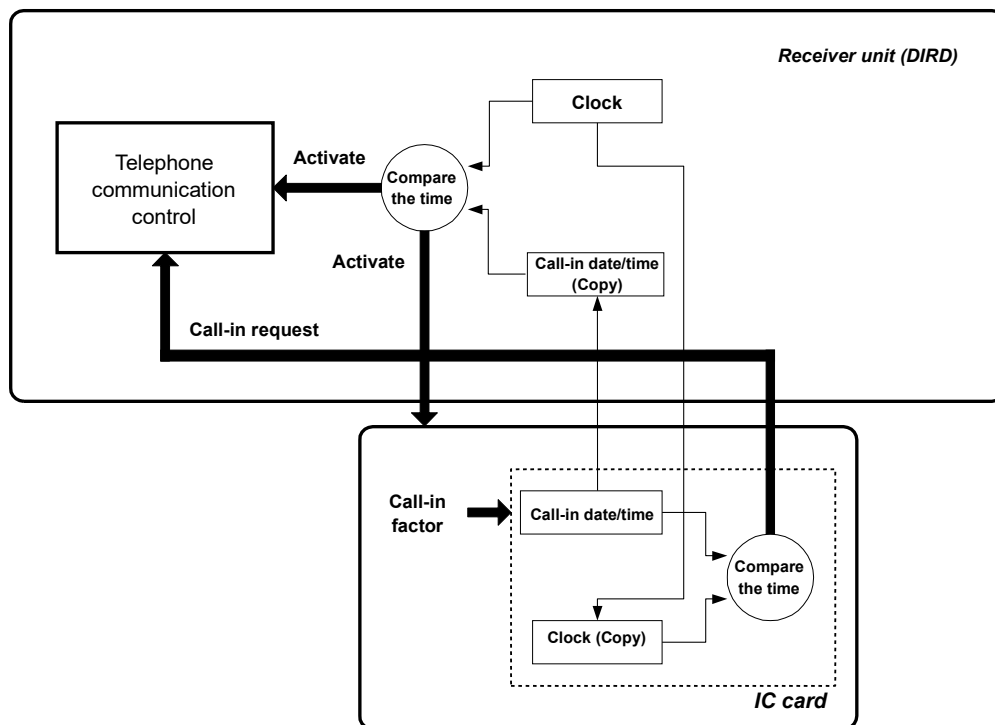
Figure A2-5. Power-on call-in current control

3.9 Transmission of DIRD data

[1] Basics of communications

● DIRD data is transmitted for shopping and other application activities. The receiver unit issues a DIRD data transmission request to the IC card, calls up the DIRD data

collection center, and sends the DIRD data to the center by way of the IC card.

[2] Procedures for communications

- Prior to the transmission of DIRD data, the receiver unit issues the "Starting the DIRD data transmission command/response ", thereby requesting the IC card to start communications.

- Following the response from the IC card, the receiver unit calls up the DIRD data collection center designated by an application, and connects with it. If the connection is established, the unit notifies the IC card of completion of the connection. If the connection fails, the unit notifies the IC card of connection failure and does not execute the following operations.

- The IC card and the DIRD data collection center authenticate each other and exchange DIRD data and DIRD reply data, with the "Center reply commands/response" , the "DIRD data encryption commands/response", and the "DIRD reply data decryption commands/response".

- Once the communications are completed, the receiver unit issues to the IC card the "Ending the DIRD data transmission command/response", thereby requesting termination of the communication session. The unit then completes the session with the "Center reply command/response".

[3] Data transmission

- The receiver unit relays data back and forth between the DIRD data collection center and the IC card. The unit does not identify the content of data that is being transmitted between the IC card and the DIRD data collection center.

- If the data length of transmitted data is longer than that receivable by the IC card interface, the "DIRD data encryption command/response", or the "DIRD reply data decryption command/response", is issued several times to the IC card, so that the relevant data are received in segments.

- The receiver unit monitors the calling status during a session. If the call ends for some reason, the unit terminates the process. If the upper layer data is not sent or received for a certain period, or if a logical error is detected, the unit ends the call and terminates the process.

- When DIRD data and DIRD reply data are transmitted in multiple segment groups, the "DIRD data encryption command/response", and the "DIRD reply data decryption command/response" are issued alternately several times.

3.10 Reception of ECM, and control of Descrambler
3.10.1 Reception of ECM
- If the user selects and receives a scrambled program, the receiver unit obtains the PID of an ECM from the PMT in broadcast signals, and receives an ECM.
- The receiver unit decrypts the received encrypted ECM, by feeding it to the IC card, with the "ECM reception command/response", thereby receiving a scrambling key, viewing control information, etc.

3.10.2 Control of Descrambler
- If the received viewing control information indicates that the selected program (stream) is viewable, the receiver unit provides the Descrambler with the packet ID and the scrambling key of the TS stream to be descrambled.

3.10.3 Conditions for ECM transmission
- The conditions and other details for ECM transmission are shown in Attached Table 2, Chapter 4.

3.11 Reception of EMM and EMM messages
3.11.1 ID control
- ID information represents both individual card IDs and group IDs, which are read in from an IC card, and used as an IC card ID for filtering of the received EMM and EMM messages.
- A single individual card ID is assigned uniquely to each IC card. Up to seven group IDs may exist, depending on the IC card setting specified in an EMM.

3.11.1.1 Individual card ID
- An individual card ID with the ID code of "0"is uniquely assigned to each IC card. The individual card ID should be defined in every single IC card without fail.
- The receiver unit reads in the individual card ID from an IC card, by issuing the command and response of default settings, and uses it for filtering of the received EMM and EMM messages.

3.11.1.2 Group ID
[1] Purpose of group IDs
- The receiver unit receives EMM and EMM messages under different group IDs, for controlling multiple ID groups of receiver terminals in a household, etc.
- Therefore, the receiver unit must be capable of simultaneously filtering EMM and EMM messages under an individual card ID and several different group IDs.

[2] Setting group IDs
- Group IDs are stored on the IC card, as with the individual card ID. In principle, group

IDs are set by individual entities using EMMs. Up to seven different group IDs can be set on a single IC card.

[3] Default setting of group IDs on the receiver unit

● The receiver unit reads in from the IC card the pre-set group IDs, together with the individual card ID, by issuing the command and response of obtaining the card ID information.

[4] Identification of group IDs, and filtering control

● The upper bits of the six-byte ID sequence represent ID codes that identify different group IDs. Several different numbers except "0" are used to identify different group IDs.

● The receiver unit filters EMM and EMM messages under all the group IDs read in from the IC card.

● Although multiple EMMs exist in the same section, the same ID should be assigned to all EMM and EMM messages in the same section.

3.11.1.3 Operating conditions for ID control

● Operating conditions for ID control are indicated in Attached Table 3, Chapter 4.
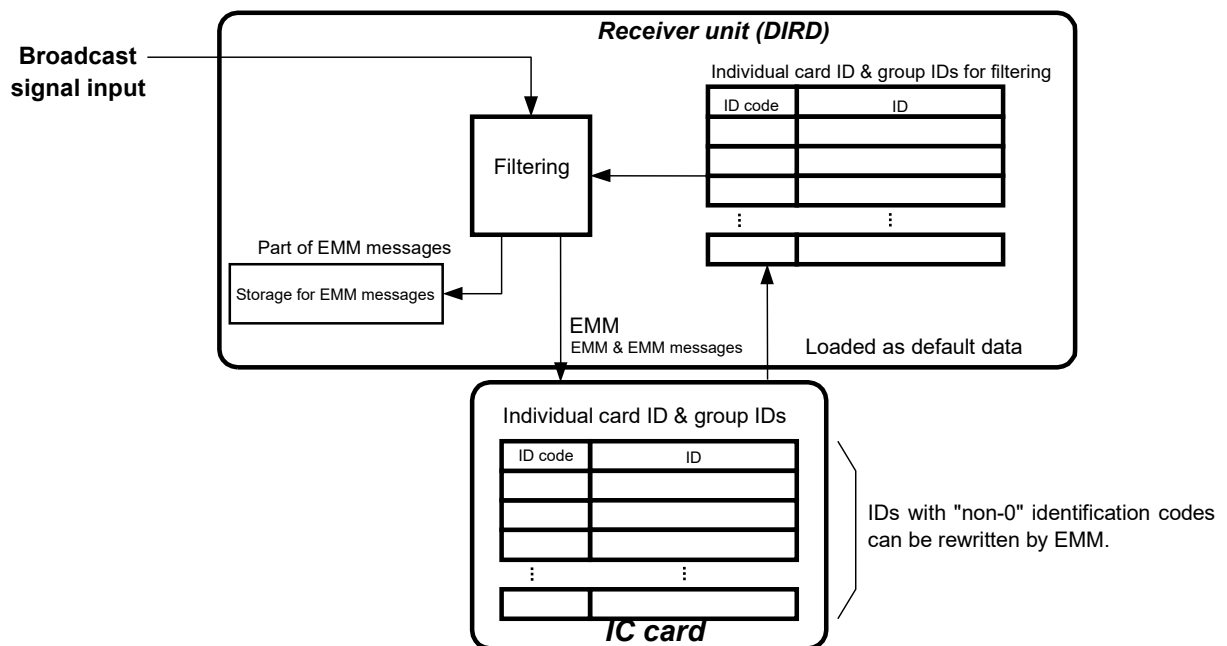
Figure A2-6. ID control

3.11.2 Different forms of EMM and EMM message reception

Different forms of EMM and EMM message reception are indicated below.

- Reception while selected transport streams are being received (e.g. during viewing of a selected program), where the PID of an EMM is designated by the CAT. (If a stream recorded on a receiver unit with the accumulated reception function is being played back, the receiver unit obtains an EMM common message only from replay signals, but does not obtain EMM and EMM individual messages. The PID of an EMM, designated by the CAT in a replay signal, is not used to receive EMM or EMM messages from broadcast waves.)
- Reception by power-on control. (*Note)
- Reception of a specified channel (Designated by the CA_emm_ts_descriptor of NIT.) (*Note)
  *Note: If the reception by power-on control and the reception of a specified channel occur at the same time, the receiver unit carries out the reception of a specified channel with its power off before the reception by power-on control.

3.11.3 Reception of EMM

3.11.3.1 Filtering EMM

- While selected transport streams are being received, the receiver unit receives an EMM if the CAT designates the PID of an EMM. (If a stream recorded on a receiver unit with the accumulated reception function is being played back, the receiver unit does not obtain an EMM in replay signals. The PID of an EMM, designated by the CAT in the replay signals, is not used to receive an EMM from broadcast waves.)
- The receiver unit reads in from the IC card an individual card ID by issuing the command of default settings, and group IDs by issuing the command of obtaining ID information, and filters EMMs under all of the obtained IDs.
- The table ID for an EMM section is 0x84.
- Multiple EMMs exist in the EMM section.

3.11.3.2 Processing the received EMM

- Encrypted EMMs received are sent to the IC card by issuing the command and response of EMM reception, and are processed by the IC card.
- If the IC card issues a process request based on the content of the EMM, the receiver unit executes the requested process, such as displaying ID information, obtaining power-on control and/or call-in date/time information, calling up the center, etc.

3.11.3.3 Conditions for EMM transmission

- Conditions for EMM transmission are indicated in Attached Tables 4 and 6, Chapter 4.

3.11.4 Reception of EMM messages

3.11.4.1 Filtering EMM messages

- While selected transport streams are being received, the receiver unit receives EMM

messages if the CAT designates the PID of an EMM. (If a stream recorded on a receiver unit with the accumulated reception function is being played back, the receiver unit obtains an EMM common message only from the replay signal, but does not obtain EMM individual messages. The EMM common message may be received from the information transmitted in broadcast waves by a relevant entity during the playback, not from the information included in the playback signals.)

● The receiver unit reads in, from the IC card, the individual card ID by issuing the command of default settings, and the group IDs by issuing the command of obtaining ID information, and filters EMM messages under all of the obtained IDs.

● The table ID for the EMM section is 0x85.

● Filtering is executed by the table_ID_extension of the EMM section.

Table A2-1.   table_ID_extension

table_ID_extension	Type of message
0x0000	EMM individual messages
0x0001 - 0xFFFF	EMM common message

● One EMM common message, and multiple EMM individual messages, exist in the EMM section.

3.11.4.2 Input process of EMM messages

[1] Input process of EMM common message

● Reads in the value of table_ID_extension as a fixed sentence number.

[2] Input process of EMM individual messages

● Performs the input process, based on the protocol numbers in the headers of EMM individual messages, and the message control.

Table A2-2. Input process of EMM messages

Protocol number	Message control	Input process
0xFF	0x02	Stored on the receiver unit as a mail message (not encrypted)
Except "0xFF"	0x02	Stored on the receiver unit, after a mail message (encrypted) is decrypted, as a mail message, by issuing the command and response of EMM message reception to the IC card.
Except "0xFF"	0x01	Stored on the IC card as an automatic display message, after the content of a message is handed over to the IC card from the receiver unit, by issuing the command and response of EMM message reception.

● If the EMM individual message is a mail message and it is encrypted, it is decrypted by the

IC card, and stored on the receiver unit.

● If the EMM individual message is a mail message and a fixed sentence is designated, the receiver unit receives the corresponding EMM common message, combines it with the individual message, and stores the combined message on the receiver unit.

3.11.4.3 Conditions for EMM message transmission

● The conditions for EMM message transmission are indicated in Attached Tables 5 and 6, Chapter 4.

3.12 Power-on control
3.12.1 Power-on control process

[1] Overview of power-on control

● If the status of the receiver unit changes to the Standby status due to sub power off during a designated power-on control period, in which the power-on control is preset by an EMM, the receiver unit provides power to the circuit so as to receive at least EMMs, select a designated transport stream for a designated period of time, and receives EMMs.

[2] Procedures for power-on control

● Information required for power-on control is designated in advance by an EMM from an entity, and the receiver unit reads in that information from the IC card. The information includes power-on control timing, reception duration, a receiving transport stream ID, etc.

● If the receiver unit is in the Standby status due to sub power off, during a designated power-on control period, it provides power to the circuit so as to receive at least EMMs, select a designated transport stream for a designated period of time, and receive EMMs.

● Following the EMM reception, the receiver unit reads in and updates all power-on control information, if the IC card instructs it to obtain information for the next power-on control.

● The power-on control is canceled, if the user turns on the sub power in the power-on control mode.

● Once the power-on control processing ends, the receiver unit cancels the power supply to the circuit, and returns to the Standby status, where the minimum power supply is provided.

● During the designated power-on control period, the receiver unit receives EMMs for the pre-set time period, whenever the sub power is turned off. If a new EMM is received, the receiver unit receives EMMs in accordance with the new EMM.

● During the power-on control, the receiver unit indicates the power-on control status to the user, by lighting an LED lamp, etc.

[3] Power-on controls for different entities

● Power-on control settings are specified by respective entities. If power-on control periods designated for multiple entities overlap, the receiver unit performs reception control

sequentially for all entities. Schedule management is required to enable uniform power-on controls for all entities. The requirements for the schedule management are listed below.

☐ The maximum number of entities is 32.

☐ If the power-on control is canceled halfway for a certain entity, the next power-on control process for that entity should be performed during a designated time period first.

☐ The schedule management for power-on control should not be reset by turning off the main power switch. The schedule management must be performed uniformly for all entities.

☐ Even if the timing for the next power-on control is updated, the schedule management must be performed uniformly for all entities without reset.

3.12.2 Specific examples of power-on control

Specific examples of the schedule management provided below are to avoid partial EMM reception by particular entities, if power-on control timings for different entities overlap.

[1] Management data for power-on control, etc.

● Set a power-on control management table (up to 32 records) on the memory.

● Set an execution pointer on the memory, which indicates execution in the power-on control management table.

● Set a power-on control execution table on the memory, which indicates the status of "power-on control in execution."

[2] Initialization of the power-on control management table

● When the main power switch is on and/or the IC card is inserted, the receiver unit reads in the power-on control information from the IC card, and creates a power-on control management table. If the power-on control management table is on a non-volatile memory, the read-in of the information is not necessary with the main power turned on.

[3] Power-on control process

(1) While the sub power is off, the memory pointer is copied to the starting and execution pointers in the power-on control execution table.

(2) The execution pointer is incremented, and referring to the power-on control management table the receiver unit searches for records with a power-on period in which the current time falls. The execution pointer value exceeding 31 shall be converted to 0. The search continues until the execution pointer value agrees with the starting pointer value. In this process, undefined power-on control management records shall be ignored.

(3) If such records with valid power-on control periods are identified after searching the power-on control management table, then the received information is copied to the power-on control execution table, and the time counter is initialized so as to count the power-on control execution time.

(4) A designated transport stream is selected based on the power-on control execution

table. An EMM with a designated time period is received based on the time counter.

(5) Following the EMM reception with a designated time period, the execution pointer value is copied to the memory pointer in the power-on control execution table.

(6) The steps from (2) to (5) are repeated to search for other entities requiring power-on control.

(7) If the execution pointer value agrees with the starting pointer value, complete the power-on control process, cancel the power supply for EMM reception, and return to minimum power supply in the Standby status.
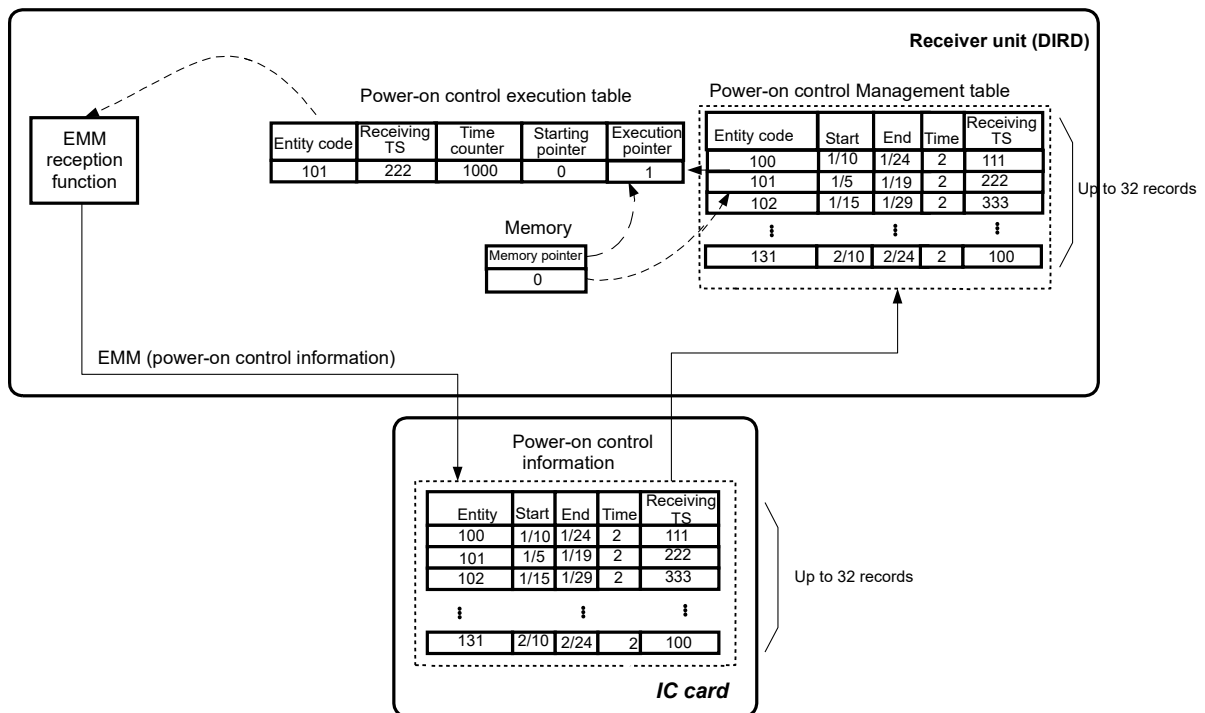
Figure A2-7. Example of the schedule management for power-on control

3.13 Receiving and processing EMMs by the specified channel

- If EMM transmission by a specified channel is instructed by NIT, the receiver unit selects a designated channel and transport streams for a designated time span to receive EMMs, whenever the status of the unit changes to the Standby status due to sub power off. The sub power superficially remains off.

- The encrypted EMMs received is sent to and processed by the IC card, by issuing the command and response of EMM reception.

- If the IC card issues a processing request based on the content of an EMM, the receiver unit executes the required process, such as obtaining the power-on control information, obtaining the call-in date/time, calling the center, etc.

3.14 EMM message control

3.14.1 Types of messages

- EMM messages are categorized by their transmission type into "EMM common messages," which are common to all receiver units, and "EMM individual messages," which are sent to individual receiver units.

- By display format type, they are categorized into "Automatic display messages," which are superimposed on a program to be viewed, and "Mail messages," which are selectively displayed by the user using a separate application program.
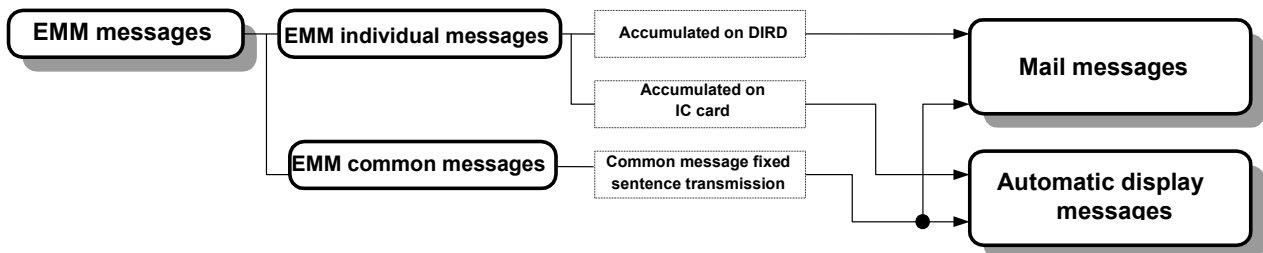
Figure A2-8. EMM message scheme

[1] Automatic display message

- An automatic display message is superimposed automatically on a program to be viewed.

- As a rule, the automatic display message is displayed as a composite message consisting of a) an EMM individual message, which is accumulated on an IC card and conveys a pointer to the fixed sentence and difference data, and b) an EMM common message, which conveys the fixed sentence.

- The EMM individual message includes a unique identifier which comprises "Broadcaster identifier + Message ID," and enables message reception only once even if the same message has been sent for multiple times.

- The EMM common message is not encrypted, while the EMM individual message is encrypted prior to transmission.

- A single type of EMM individual message is assigned as an automatic display message for each entity, and is recorded on an IC card.

- As a rule, the EMM common message is transmitted repeatedly, and is taken in at the execution of display process.
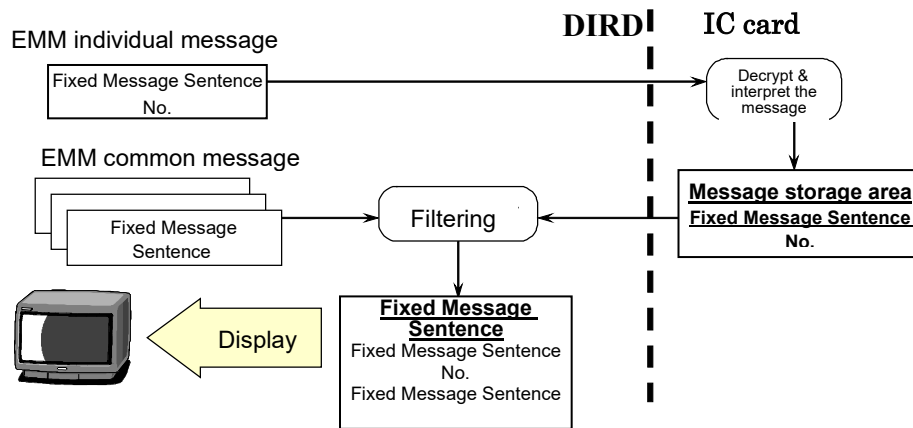
Figure A2-9. Automatic display message

[2] Mail message

● Mail message is a message sent to individual receiver unit, and is selectively displayed by the execution of an application program on the unit.

● There are two types of mail transmission: 1) Transmitting a full message by issuing the EMM individual message accumulated on DIRD, without designating a fixed sentence; and 2) Transmitting both a) the EMM individual message, which is accumulated on DIRD and conveys a pointer to a fixed sentence and difference data, and b) the EMM common message, which conveys the fixed sentence.

● The EMM individual message includes a unique identifier which comprises "Broadcaster identifier + Message ID," and enables message reception only once even if the same message has been sent repeatedly.

● The EMM individual message is encrypted or not encrypted depending on the cases.

● If the EMM individual message is encrypted, it shall be decrypted by an IC card, and then stored on a receiver unit.

● As a rule, the EMM common message is transmitted repeatedly, and is taken in at the execution of memory process.
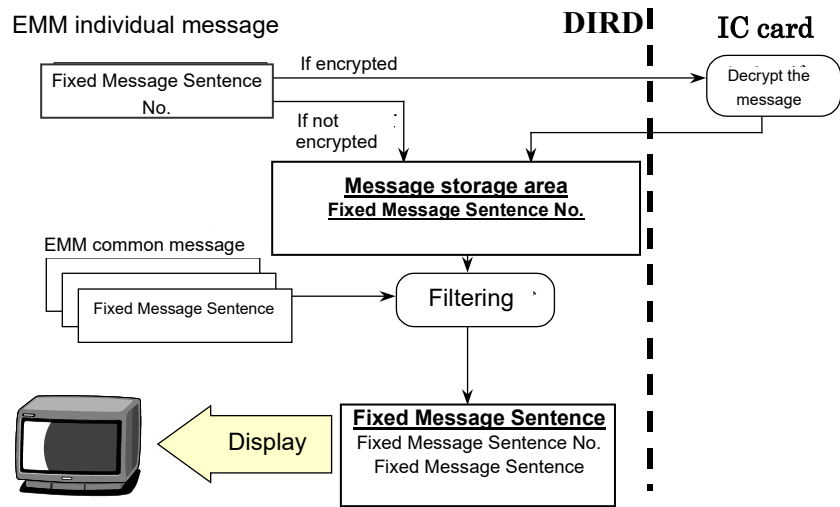
Figure A2-10. Mail message (With fixed sentence and encrypted)

3.14.2 Display of automatic display message

[1] Availability of automatic display message service

● The availability of automatic display message service for each broadcaster is identified based on a CA service descriptor in the CAT.

[2] Display of automatic display message

● When the user selects a program provided by a broadcaster that implements the automatic display message service (including the cases of playing streams recorded on a receiver unit with the accumulated reception function) and if there is a valid automatic display message, or if the automatic display message is received during program viewing, the message is displayed on the screen.

● The receiver unit issues "Obtaining display information for automatic display messages command/response" to the IC card, and receives the information of the EMM individual message for automatic display, which is stored on the IC card. If no such information is stored on the IC card, no message is displayed on the screen.

● The receiver unit identifies a pointer to the fixed sentence which is included in the EMM individual message obtained from the IC card, and receives the information of the EMM common message (fixed sentence) corresponding to that pointer (including the cases of obtaining such information from streams recorded on a receiver unit with the accumulated reception function). The receiver unit then adds the difference information included in the EMM individual message, and repeats the cycle of "not displayed - displayed - not displayed" a designated number of times. The cycle is determined by the duration of automatic display (T1, T2 and T3). The display message is superimposed on the screen of a selected program.

*Note: The coding of message sentence, difference information and others are specified separately.

[3] Canceling the display of automatic display message

● According to the automatic display / erasure type included in the EMM common message information (cancelable or not cancelable operations), the user may or may not be able to cancel the display of an automatic display message on the screen by user operation.

● If message display is cancelable according to the automatic display / erasure type included in the EMM common message information, the relevant message being displayed on the screen shall be cancelled. If the cancelability status changes from "Display cancelled" to "Display cancelable" or "Display not cancelable," the relevant message that is being cancelled shall be displayed again automatically.

```
                    ( Display process of automatic display messages )
                                        │
                                        ▼
                        ┌───────────────────────────────┐
                        │    Start program selection     │
                        └───────────────────────────────┘
                                        │
                                        ▼
                        ┌───────────────────────────────┐
                        │          Refer to CAT          │
                        └───────────────────────────────┘
                                        │
        No                              ▼
   ◄─────────────────────        Execute
                        automatic display message
                                service?
                                        │ Yes
   ( End of the service )               ▼
                        ┌───────────────────────────────┐
                        │ Obtaining display information for │
                        │ automatic display messages command │
                        └───────────────────────────────┘
                                        │
        No                              ▼
   ◄────────────          Receive automatic display
                                messages?
                                        │ Yes
                        ┌───────────────────────────────┐
                        │ Command of EMM individual message reception │
                        └───────────────────────────────┘
                                        │
        No                              ▼
   ◄────────────           Valid automatic display
                                messages?
                                        │ Yes
                        ┌───────────────────────────────┐
                        │ Reception process of common messages │
                        └───────────────────────────────┘
                                        │
                                        ▼
                        ┌───────────────────────────────┐
                        │ Display process of automatic display messages │
                        └───────────────────────────────┘
                                        │
        No                              ▼
   ◄────────────           Display automatic display
                                messages?
                                        │ Yes
        No                              ▼
   ◄────────────              Display cancelable?
                                        │ Yes
        No                              ▼
   ◄────────────             User input cancellation?
                                        │ Yes
                        ┌───────────────────────────────┐
                        │ Cancel display of the automatic message │
                        └───────────────────────────────┘
                                        │
                                        ▼
```

Figure A2-11. Display process of Automatic Display Messages

3.14.3 Display of mail message

● Mail message is displayed as message data memorized on the receiver unit.

● If necessary, the receiver unit notifies the user of arrival of a mail message, by lighting a lamp of the unit, indicating it on the screen, etc.

● The receiver unit stores the EMM individual message without a designated fixed sentence as a full message, while the EMM individual message with a designated fixed sentence is stored as a mail message after combined with a separately received EMM common message.

● When the user selects and executes the application to display mail message, the receiver unit displays the stored mail message.

● Mail message may be displayed in a list or in details. The arrival date and time, title and message sentence of the mail message are displayed.

● The method of deleting mail messages on the application to display mail message is not designated.

3.15 Program viewing

3.15.1 Basic operation of program selection and viewing.

[1] Basic operation of program selection and viewing.

● The receiver unit selects a program to be viewed based on PSI/SI, a relevant transport stream, and the components of the selected program.

● While feeding received ECMs to the IC card sequentially, the receiver unit refers sequentially to scrambling control and executes viewing control based on a response from the IC card. During the viewing process, the receiver unit also refers sequentially to the scrambling control of the selected transport stream, feeds sequentially received ECMs to the IC card, and executes viewing control based on a response from the IC card. (*Note)

● The receiver unit also responds to changes in the program, such as modification of the stream composition.

*Note: The receiver unit can detect part of such changes in program properties by referring to the SDT and EIT. However, the reference to scrambling control and ECMs is required in principle, so as to improve the response speed and to ensure a response to changes of partial scramble status and PPV status.
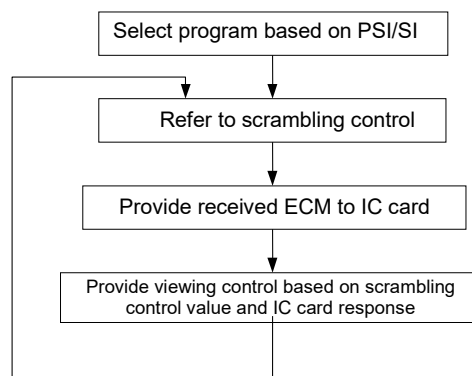
Figure A2-12. Basic operation of program selection and viewing

3.15.2 Reference to program information

[1] Information to be referred to before the program selection.

● The following information shall be referred to, so that program information can be displayed and selected on the screen with EPG, etc.

(1) SDT

Required to obtain broadcast service information.

(2) EIT

Required to obtain program information. In case of subscribed PPV programs, relevant PPV program numbers are obtained.

[2] Information to be referred to after the program selection.

● The following information shall be referred to, after selection of a program and a corresponding transport stream.

(1) PMT

Required to obtain program stream information and to detect PID of an ECM.

(2) ECM

Required to identify the viewing control information of a selected program (The receiver unit receives an ECM, feeds it to the IC card, and refers to a response from the IC card).

(3) Scrambling control and Adaptation field control in TS header

Required to determine whether all or part of the components of a program are free and not scrambled, and to respond to any changes. If the adaptation field control value is 00 or 10, the judgment of scrambling control should be ignored.

Table A2-3. Scrambling Control in TS header: Adaptation field control

Transport Scrambling Control	Adaptation field control	Description
00	01 or 11	Not Scrambled
01		Reserved
10		Scrambled (even number keys)
11		Scrambled (odd number keys)
XX	00 or 10	Reserved

● Based on the above reference data, one of the following three types of viewing process is executed.

(1) Free viewing

● For free unscrambled programs

(2) Contract viewing

● For free scrambled programs

● Flat / tier contract pay programs

● For flat / tier contract or PPV contract pay programs when the IC card contains a flat / tier contract

(3) PPV viewing

● For PPV contract pay programs

● For flat / tier contract or PPV contract pay programs when the IC card contains no flat / tier contract

3.15.3 Program selection and viewing process.

3.15.3.1 Program selection process

● In principle, a program is selected based on PSI/SI, and then the transport stream that contains the desired program is selected.

● The receiver unit obtains component information for the selected program from a PMT of the relevant transport stream. The receiver unit then selects the required components, and detects the existence of an ECM.

● The receiver unit refers to a CAT corresponding to the selected program. If a CA service descriptor is contained and the IC card is not valid, the receiver unit displays an automatic display message notifying the invalidity of the IC card.

3.15.3.2 Program viewing process

● If all the scrambling control in TS headers for the selected components are "Not scrambled," the selected program is played back as a free unscrambled program.

● If the IC card is valid, the receiver unit receives an ECM, decrypts it on the IC card by issuing "ECM reception command and response", and obtains a response from the IC card. Based on the response, the receiver unit executes contract viewing process or PPV viewing process. If the program is viewable based on the user's contract, the receiver unit executes the descrambling process.

● If the program is viewable and includes components with partial scrambling control being "Not scrambled", the receiver unit provides viewing of the relevant stream without descrambling.

● The receiver unit repeats the above process, so as to respond to changes in the program component structure, scrambling control, and ECM status.

● If there is a sub-program (component) defined by the PSI/SI, the similar viewing process as the main program is applied to the sub-program.

● If the IC card responds "no contract" and there is a link instruction to the CA switch service on PSI/SI, the receiver unit displays the message of linking operation.

  *Note: "Scrambling control" hereof refer to the flags included in transmitted TS packets, and serve as scrambling control prior to the descrambling process, or provides equivalent determination.

Program selection and viewing process

Select TS of desired program from SI or others

ca_service_descriptor — No

Valid IC card? — Yes

Yes → Display automatic display messages

No

Obtain component information from PMT

Select component as necessary

Obtain scrambling control from TS header

Are all scrambling control "Not scrambled"? — Yes → Free viewing process

No

Valid IC card? — No

Yes

Any unreceived ECM? — Yes

No

If there are, send the latest ECM to IC card, and update the response

CA switch service? — Yes → To CA switch service

No

Response: No contract? — Yes

No

Display message

Is selected stream "Not scrambled"? — No

Yes → Partial free viewing process

Response: Flat / tier contract? — Yes → Contract viewing process

No

PPV process

Figure A2-13. Program selection and viewing process

3.15.4 Free viewing process

Free viewing refers to a viewing process in the cases of all scrambling control being "Not scrambled".

● Free unscrambled programs may be viewed independent of the CAS.

*Note: An ECM may be sent in advance, due to a switch from a free unscrambled program to a scrambled program or other reasons. Therefore, if the receiver unit receives an ECM, it should execute the descrambling process.

3.15.5 Contract viewing process

Contract viewing refers to a viewing process in the cases of IC card returning a response regarding a scrambled free program or a flat / tier contract pay program.

[1] Applicable programs

● Scrambled free program

● Flat / tier contract pay program

● Flat / tier contract or PPV contract pay program when the IC card contains a flat / tier contract

[2] Operation

● The receiver unit obtains decrypted Ks and recording control information from the IC card by issuing the "ECM reception command/ response ".

● The receiver unit executes descrambling with the Ks obtained from the IC card.

● If the program includes components with partial scrambling control being "Not scrambled", the receiver unit provides viewing of the relevant stream without descrambling.

[3] Recording control

● If the IC card returns the recording control information of "Not recordable," the receiver unit executes the copyguard process.

Note: This standard does not stipulate copy control specifications.
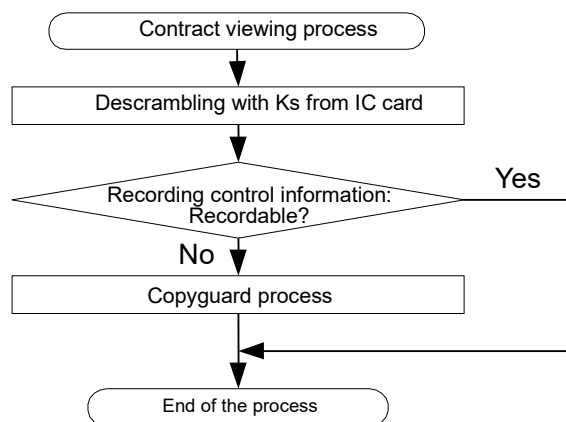
Figure A2-14. Contract viewing process

3.15.6 PPV viewing process

PPV refers to a viewing process in the case of IC card returning a response regarding a PPV contract pay program.

[1] Applicable programs

● PPV contract pay program

● Flat / tier contract or PPV contract pay programs, without flat / tier contract subscription contained on the IC card

[2] Basic operation of viewing pay programs under a PPV contract.

● The basic operation flow from purchase to viewing of PPV programs is shown below. Actual operation for the viewing of a contracted PPV contract pay program varies, depending on change in status by user operation, and a response to an ECM from the IC card.
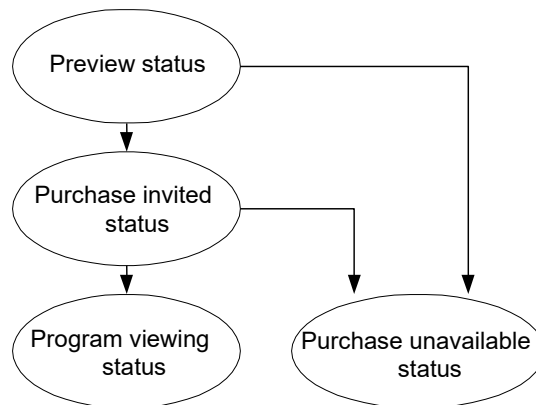
Figure A2-15. Basic operation of PPV

(1) Preview status

● If the IC card responds "Preview available" and the user has not selected the termination of a preview, the preview service is executed.

● The IC card determines the availability of previews, based on the preview expiration information and total preview time included in an ECM.

● If a preview becomes expired, or if the user selects the termination of a preview, the program transits to "Purchase invited" status.

● If the response by the IC card notifies that the program purchase period is over, the program transits to "Purchase unavailable" status.

(2) "Purchase invited" status

● If the user selects the termination of a preview while the IC card is responding "Preview available," or if the response from the IC card is "Preview unavailable," the receiver unit displays the "Purchase invited" pane.

● If the user selects the purchase of a program while the receiver unit displays the "Purchase invited" pane, the receiver unit instructs the purchase to the IC card. The IC

card then refers to the PPV purchase section in the ECM, and determines whether the user can purchase the requested PPV program. If the purchase is available, the IC card records the viewing history in its memory and returns the purchase information to the receiver unit, which in turn transits to the "Viewing "status.

● If the response from the IC card notifies that the program purchase period is expired, the program transits to "Purchase unavailable" status.

(3) "Program viewing" status

● The user confirms whether the program purchase is allowed on the "Purchase invited" pane, and views the program if available. If the user selects a program already purchased, the receiver unit provides its viewing without purchase invitation.

(4) "Purchase unavailable" status

● If the response from the IC card notifies that the purchase of the PPV program is unavailable (denied), due to an expired purchase period, no space in the memory, or other reasons, the receiver unit displays a relevant message.

[3] Recording control and purchase fee

● The receiver unit determines whether a program is recordable based on the recording control information in PSI/SI and "ECM reception command/response " .

● The receiver unit obtains the PPV program number, recording control information, and viewing fee, by issuing the "PPV status requirement command/response " . The recording control information has three types of control: 1) Recordable, 2) Not recordable, and 3) Recordable for purchaser only. The viewing fee system has two types of fees: Type 1 and Type 2.

● If the recording control information is either "Recordable" or "Not recordable," the receiver unit instructs the IC card to purchase the PPV program by issuing the "PPV program purchase command/response". The IC card then charges the PPV viewing fee Type 1 to the user. If the program is not recordable, the receiver unit applies copyguard control. (*Note)

● If the recording control information is "Recordable for purchaser only," the receiver unit displays the viewing fee Type 2, which is applied to recording of program in the "Purchase invited" status. The user selects to record or not to record the program.

● If the user select not to record the program with the "Recordable for purchaser only" status, the receiver unit instructs the IC card to purchase and not to record the program, The IC card then charges the PPV viewing fee Type 1 to the user. The receiver unit applies copyguard control. (*Note)

● If the user selects to record the program with the "Recordable for purchaser only" status, the receiver unit instructs the IC card to purchase and record the program. The IC card then charges the PPV viewing fee Type 2 to the user.

*Note: This standard does not stipulate copy control specifications.

[4] Operation

(1) Process from preview status

● If the IC card responds "Purchase denied," the receiver unit displays the "Purchase unavailable" message, and transits to "Purchase unavailable" status.

● If the IC card responds "Already purchased," the receiver unit transits to "Purchase" status, and executes the descrambling process to provide viewing of the program.

● If the IC card responds "Preview time over," or if the user selects the termination of the preview, the receiver unit reads in the viewing fee and other information from the IC card by issuing the "PPV status requirement command/response". The receiver unit then displays the "Purchase invited" pane, and transits to "Purchase invited" status.

● If the IC card responds "Within preview time," the receiver unit executes the descrambling process without status transition, and provides viewing.

● If the program includes components with partial scrambling control being "Not scrambled", the receiver unit provides viewing of the relevant stream without descrambling.

● If the IC card returns the recording control information of "Not recordable," the receiver unit executes the copyguard process.

This standard does not stipulate copy control specifications.

Process from preview status

Check the response from IC card

Response:
Purchase denied (unavailable)? — **Yes**

No

Indicate "Purchase unavailable" message

Transit to "Purchase unavailable" status

End of the process

Response: Already purchased? — **Yes**

No

Transit to "Purchase" status

Response: Preview time over? — **Yes**

No

User ended the preview? — **Yes**

No

Read in viewing fee, etc. from IC card
with the PPV status requirement command

Display "Purchase invited" screen

Transit to "Purchase invited" status

End of the process

Descrambling process

Recordable? — **Yes**

No

Copyguard process

End of the process
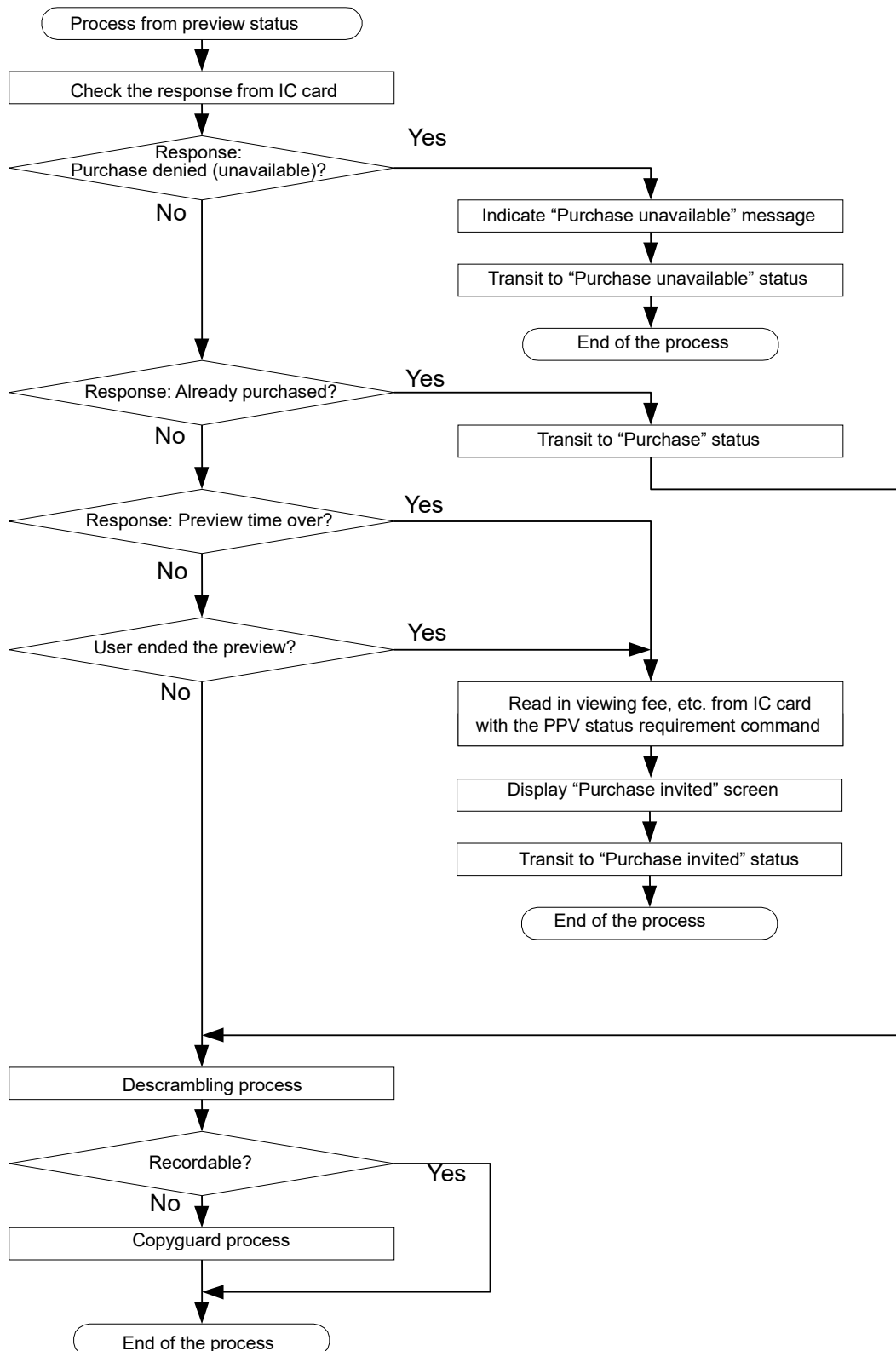
Figure A2-16. Process from preview status

(2) Process from "Purchase invited" status

● If the IC card responds "Purchase denied," the receiver unit displays the "Purchase unavailable" message, and transits to "Purchase unavailable" status.

● If the IC card responds "Already purchased," the receiver unit transits to "Purchase" status, and executes the descrambling process to provide viewing of the program.

● If the user inputs purchase confirmation, the receiver unit instructs the IC card to purchase the program by issuing the "PPV program purchase command/response ", and transits to "Purchase" status.

● If the program includes components with partial scrambling control being "Not scrambled", the receiver unit provides viewing of the relevant stream without descrambling.

● If the IC card returns the recording control information of "Not recordable", the receiver unit executes the copyguard process.

This standard does not stipulate copy control specifications.
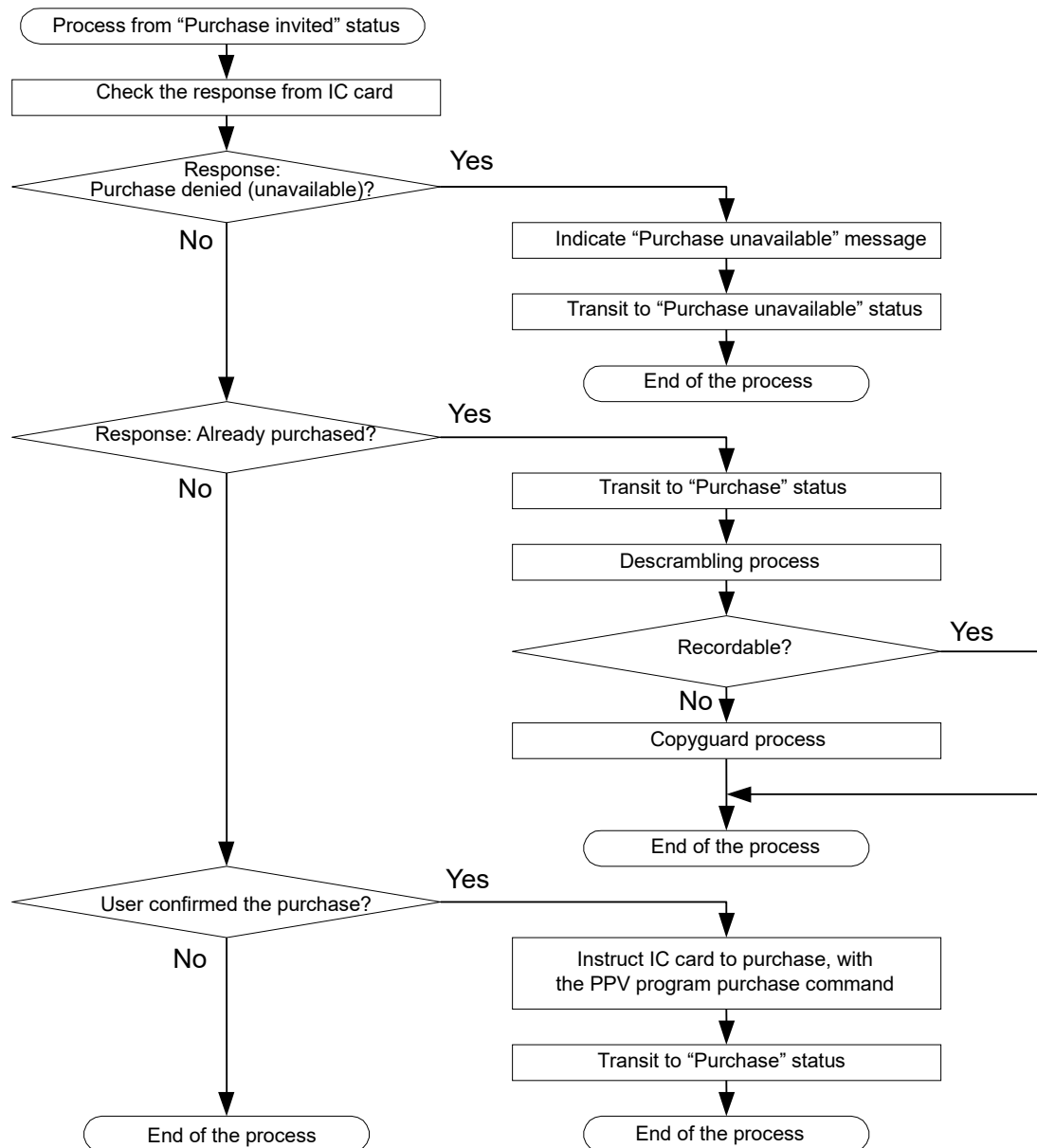
Figure A2-17. Process from "Purchase invited" status

(3) Process from "Purchase" status

● If the IC card responds "Purchase denied," the receiver unit displays the "Purchase unavailable" message, and transits to "Purchase unavailable" status.

● If the IC card responds "Within preview time," the receiver unit transits to the preview status and executes the descrambling process to provide viewing.

● If the IC card responds "Preview time over," the receiver unit reads in the viewing fee and other information from the IC card, by issuing the "PPV status requirement Command/response ". The receiver unit then displays the "Purchase invited" pane, and transits to "Purchase invited" status.

● If the IC card responds "Already purchased," the receiver unit executes the descrambling process to provide viewing of the program without status transition.

● If the program includes components with partial scrambling control being "Not scrambled", the receiver unit provides viewing of the relevant stream without descrambling.

● If the IC card returns the recording control information of "Not recordable," the receiver unit executes the copyguard process.

This standard does not stipulate copy control specifications.

```
      ╭─────────────────────────────╮
      │  Process from "Purchase" status │
      ╰─────────────────────────────╯
                    │
                    ▼
      ┌─────────────────────────────┐
      │  Check the response from IC card │
      └─────────────────────────────┘
                    │
                    ▼
              ◇ Response:                     Yes
           Purchase denied (unavailable)? ────────────┐
                    │                                  ▼
                   No                    ┌──────────────────────────────────┐
                    │                    │ Indicate "Purchase unavailable" message │
                    │                    └──────────────────────────────────┘
                    │                                  │
                    │                                  ▼
                    │                    ┌──────────────────────────────────┐
                    │                    │ Transit to "Purchase unavailable" status │
                    │                    └──────────────────────────────────┘
                    │                                  │
                    │                                  ▼
                    │                         ╭──────────────────╮
                    │                         │  End of the process  │
                    │                         ╰──────────────────╯
                    ▼
              ◇ Response:                     Yes
            Within preview time?  ───────────────────────┐
                    │                                     ▼
                   No                    ┌──────────────────────────────────┐
                    │                    │ Transit to "Preview available" status │
                    │                    └──────────────────────────────────┘
                    │                                     │
                    ▼                                     │
              ◇ Response:            Yes                  │
             Preview time over? ──────────────┐          │
                    │                          ▼          │
                   No          ┌──────────────────────────────────┐
                    │          │ Read in viewing fee, etc. from IC card with │
                    │          │  the PPV status requirement command │
                    │          └──────────────────────────────────┘
                    │                          │          │
                    │                          ▼          │
                    │          ┌──────────────────────────────────┐
                    │          │  Display "Purchase invited" screen │
                    │          └──────────────────────────────────┘
                    │                          │          │
                    │                          ▼          │
                    │          ┌──────────────────────────────────┐
                    │          │ Transit to "Purchase invited" status │
                    │          └──────────────────────────────────┘
                    │                          │          │
                    │                          ▼          │
                    │                 ╭──────────────────╮│
                    │                 │  End of the process  ││
                    │                 ╰──────────────────╯│
                    │                                     │
                    ▼◄───────────────────────────────────┘
      ┌─────────────────────────────┐
      │     Descrambling process     │
      └─────────────────────────────┘
                    │
                    ▼
              ◇ Recordable?  ──────────── Yes ───┐
                    │                            │
                   No                            │
                    ▼                            │
      ┌─────────────────────────────┐           │
      │      Copyguard process       │           │
      └─────────────────────────────┘           │
                    │◄──────────────────────────┘
                    ▼
          ╭──────────────────╮
          │  End of the process  │
          ╰──────────────────╯
```
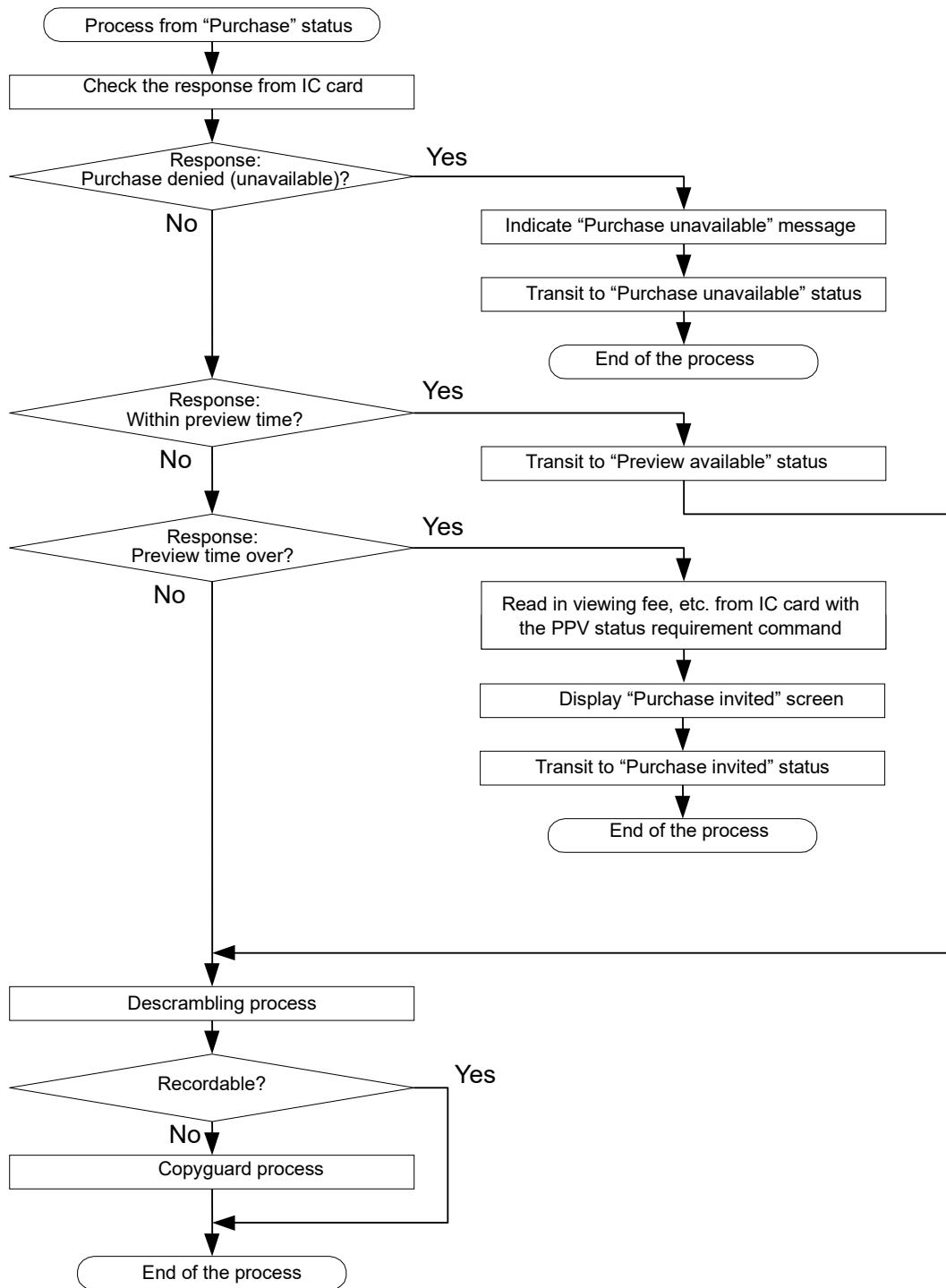
Figure A2-18. Process from "Purchase" status

（4) Process from "Purchase unavailable" status

● If the IC card responds "Already purchased," the receiver unit transits to "Purchase" status, and executes the descrambling process to provide viewing.

● If the IC card responds "Within preview time," the receiver unit transits to the preview status, and executes the descrambling process to provide viewing.

● If the IC card responds "Preview time over," the receiver unit reads in the viewing fee and other information from the IC card, by issuing the "PPV status requirement command/response ". The receiver unit then displays the "Purchase invited" pane, and transits to "Purchase invited" status.

● If the IC card responds "Purchase denied," there is no status transition.

● If the program includes components with partial scrambling control "Not scrambled", the receiver unit provides viewing of the relevant stream without descrambling.

● If the IC card returns the recording control information of "Not recordable," the receiver unit executes the copyguard process.
This standard does not stipulate copy control specifications.

Process from "Purchase unavailable" status

Check the response from IC card

Response: Already purchased? — Yes → Transit to "Purchase" status

Response: Within preview time? — Yes → Transit to preview status

No

Descrambling process

Recordable? — Yes

No → Copyguard process

End of the process

Response: Preview time over? — Yes → Read in viewing fee, etc. from IC card with the PPV status requirement command

No

Cancel the descrambling process

Display "Purchase invited" screen

Transit to "Purchase invited" status

End of the process

End of the process
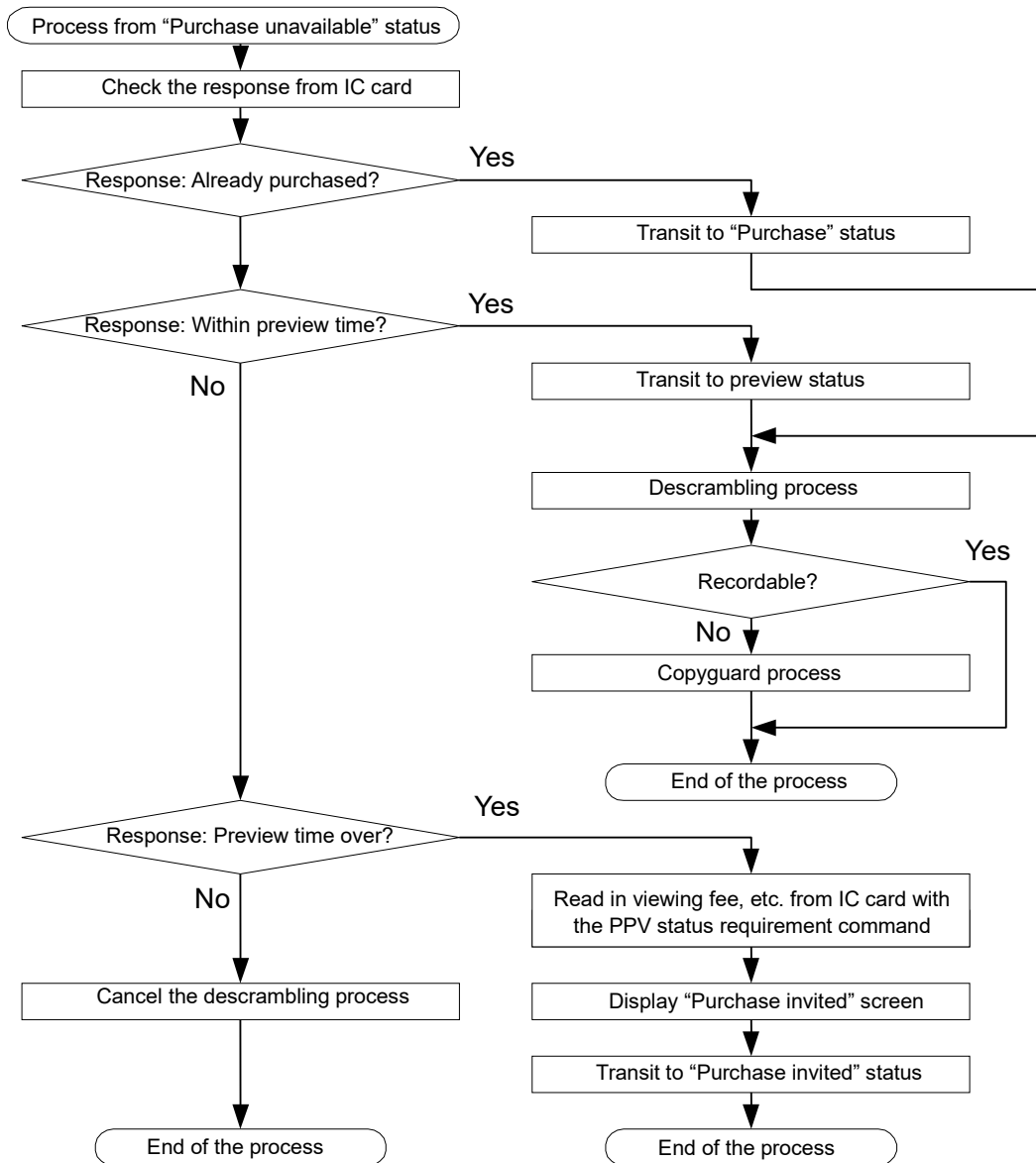
Figure A2-19. Process from "Purchase unavailable" status

3.16 Program reservation

3.16.1 Basics of reserved program viewing

- In principle, program reservation is made on the receiver unit, based on the SI. The basic program reservation procedure should conform to the SI standards. In this standard, reservation processes based on program properties are described.

- The receiver unit obtains the contract verification information from the SDT and EIT, sends the information to the IC card. Based on the contract status and other information returned from the IC card, the receiver unit determines whether the program is viewable. The receiver unit also obtains a response from the IC card which is determined by the program properties and contract status, based on which the receiver unit executes the viewing reservation process.

- If neither the SDT nor EIT carries the contract verification information, the receiver unit makes reservations unconditionally.

- If reserved viewing cannot be executed, the receiver unit displays the "Reserved viewing unavailable" message.

- The receiver unit initiates the viewing of a reserved program, referring to the SI and the clock. For programs other than free unscrambled programs, the receiver unit receives ECMs, and determines the contract status to provide viewing.

3.16.2 Referring to contract verification information

- The receiver unit refers to the SDT and EIT at the time of program reservation.

- The contract verification information is defined by the CA contract verification information descriptor on the SDT and EIT. The SDT conveys the contract verification information for the entire service, while the EIT conveys the contract verification information for individual programs. If both SDT and EIT convey descriptors, EIT's definition precedes.

- The contract verification information is defined for an entire service, entire program, or partial components of a service or program. Undefined components should have the "Reservation available" status unconditionally as free unscrambled components (program).

- If there is the contract verification information for the program reservation, the receiver unit sends it to the IC card by issuing the "Contract verification information command/response ". Based on a response from the IC card, the receiver unit obtains the information of viewing availability, recording control information, viewing type and others. If the viewing type is PPV, the IC card response also includes information on the program viewing fee, and the viewing fee of a program with the "Recordable for purchaser only" status defined in the recording control information and the reserved purchase period.

- Viewing types are categorized as follows. The reservation process is executed for each viewing type.
  (1) Free viewing
  - For free unscrambled programs
  (2) Contract viewing

- For free scrambled programs
- Flat / tier contract pay programs
- For flat / tier contract or PPV contract pay programs when the IC card contains a flat / tier contract

(3) PPV viewing

- For PPV contract pay programs
- For flat / tier contract or PPV contract pay programs when the IC card contains no flat / tier contract

3.16.3 Reservation and viewing process for free viewing programs

[1] Program reservation

- In principle, the program reservation is made based on the SI, without direct interaction with the CAS.

[2] Program viewing

- The receiver unit selects a reserved program when the program starts.
- Free viewing of programs is provided, without direct interaction with the CAS.

3.16.4 Reservation and viewing process for contract viewing programs

[1] Program reservation

- The receiver unit confirms that an IC card is inserted. If an IC card is not inserted or the inserted IC card is not valid, the receiver unit displays a relevant message, and cancels the reservation process.
- If viewing of a program to be reserved is unavailable, the receiver unit displays a relevant message, and cancels the reservation process.
- The receiver unit displays the program title, and the "Not recordable" message if applicable.
- The receiver unit displays the message that the reservation has been accepted, when the reservation is made completely.

[2] Program viewing

- The receiver unit selects a reserved program when the program starts.
- The receiver unit confirms that an IC card is inserted. If an IC card is not inserted, the receiver unit cancels the viewing process.
- Contract viewing of the reserved program is provided.

3.16.5 Reservation and viewing process for PPV programs

[1] Program reservation

- The receiver unit confirms that an IC card is inserted. If an IC card is not inserted or the IC card is not valid, the receiver unit displays a relevant message, and cancels the reservation process.
- If viewing of a program to be reserved is unavailable, the receiver unit displays a

relevant message, and cancels the reservation process.

● The receiver unit displays a viewing fee on the "Purchase invited" pane to confirm purchase. If recording control information is "Recordable for purchaser only," the receiver unit also displays a viewing fee with the recording option. The user selects to record or not to record the program to confirm the purchase. If recording is unavailable, the receiver unit displays the "Not recordable" message.

● The receiver unit displays the message that the reservation has been accepted, when the reservation process is made completely.

[2] Program viewing

● The receiver unit selects a reserved program when the program starts.

● The receiver unit confirms that an IC card is inserted. If an IC card is not inserted, the receiver unit cancels the viewing process.

● In principle, PPV viewing of reserved programs is provided, without inviting the user to purchase programs.

● The receiver unit sends a PPV purchase instruction and ECM to the IC card by issuing the "PPV program purchase command/response". If the return code is neither "Purchased: Pay later PPV" nor "Purchased: Pay first PPV," the receiver unit sends the " PPV program purchase command/response " to the IC card, every time it receives an ECM. (*Note)

● The IC card compares the PPV program number in the ECM and the purchased PPV program number received from the receiver unit. If the two numbers agree, the IC card finalizes the purchase, sends Ks to the receiver unit, which in turn initiates the descrambling process.

● If the receiver unit receives an ECM after the purchase is finalized, it issues the "ECM reception command/response" sequentially, and executes the descrambling process with the Ks obtained.

● If the reserved program is not viewable after the reserved purchase period, the receiver unit displays the history or message of "Viewing unavailable."

*Note: The timing of selecting a reserved program on the receiver unit, the actual start time of the program, and the ECM content changes do not always agree. Therefore, the receiver unit must keep sending the "PPV program purchase command/response ", until the purchase is finalized, or the "Viewing unavailable" status is confirmed.
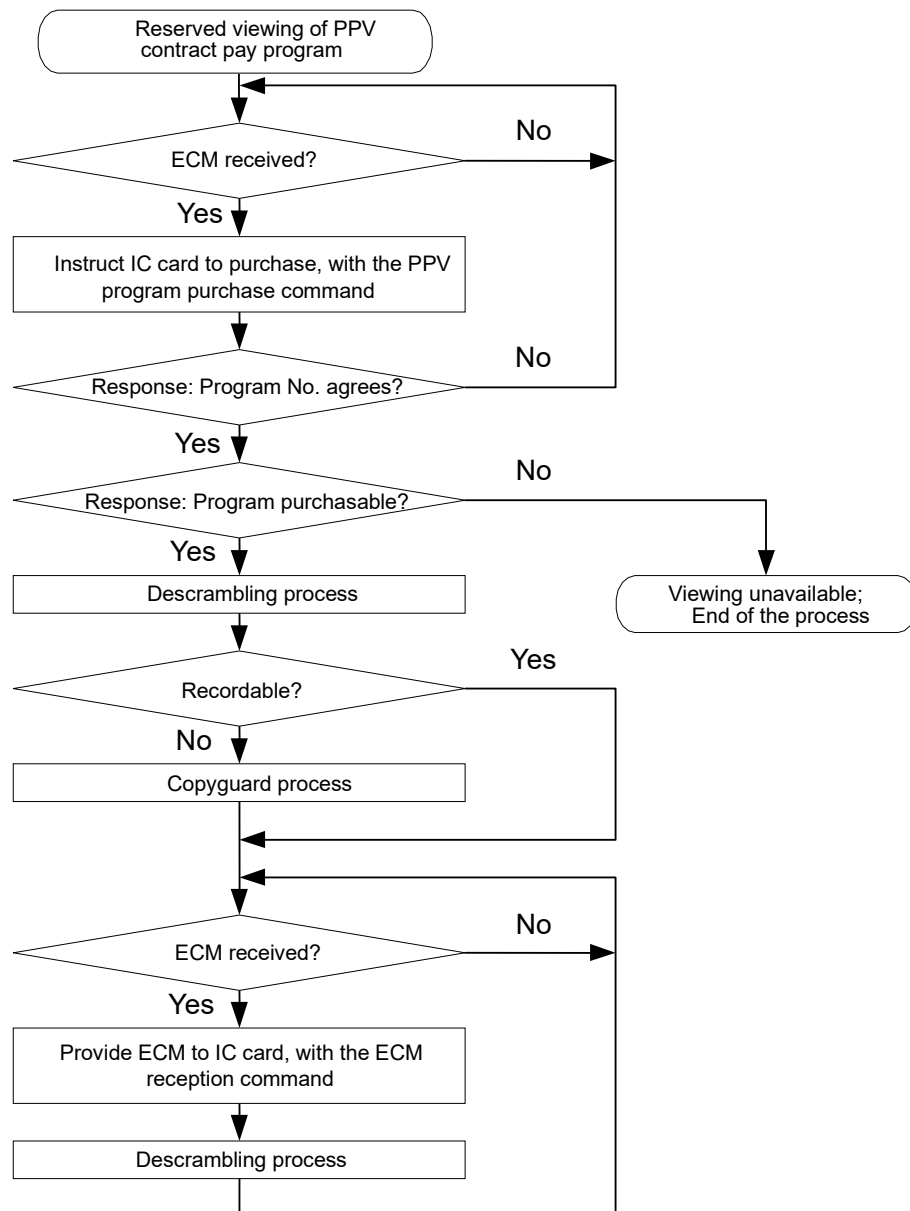
Figure A2-20. Operation for reserved viewing of PPV contract pay program

3.16.6 Cancellation of program reservation

● A reserved program may be canceled after reservation, if it has not yet viewed. If the program is canceled, the receiver unit displays the information of the canceled program, the confirmation of cancellation, and the message that the cancellation has been accepted.

3.16.7 Automatic cancellation of program reservation

● If a reserved program is a PPV contract pay program and the viewing of the program does not start after the reserved purchase period on the SI, due to broadcasting service interruption or some other reason, the receiver unit cancels the reservation and displays

the cancellation message, or records the cancellation history.

3.17 Password deletion

- If the user has registered a password for parental control or other purposes to view a program by entering the password and the password is to be deleted based on an instruction of the EMM control, the IC card instructs the receiver unit to delete the memorized password.
- The receiver unit then deletes the memorized password, and makes itself password-free.

3.18 Parental control

- Based on the parental control level set by the user, the receiver unit executes the parental control, by comparing the set level with the one assigned to a selected program on the PSI/SI. If the parental level for the selected program is higher than the one set by the user, the user is requested to enter the password. If the passward agrees with the pre-set password, the user is allowed to view the program.
- The receiver unit should have a function to cancel the parental level setting temporarily.

3.19 Indication of ID information

- By user operation, the receiver unit reads in the ID information (including the check code) to be displayed from the IC card. The receiver unit then displays the individual card ID and the card type.
- If group IDs are memorized, the receiver unit also displays them (including group identifiers and check codes).

3.20 PPV purchase record and its indication

- The receiver unit memorizes the information of purchased PPV programs, their time and fees, the total charge, and other purchase information.
- The receiver unit displays the recorded information by user operation.

3.21 Control of monthly PPV purchase ceiling

- The receiver unit compiles the total monthly charge for PPV programs, and executes the PPV purchase control by comparing the total charge and the pre-set ceiling.
- If the purchase control is in place, the user may input the password and purchase a program, as long as the input agrees with the pre-set password.
- At the time of program reservation, the receiver unit refers to the viewing fee on the SI.

3.22 Control to limit PPV program purchase

- The user may set a purchase ceiling for a single program. The receiver unit executes the PPV purchase control by comparing the pre-set ceiling and a listed program fee.
- If the purchase control is in place, the user may input the password and purchase a

program, as long as the input agrees with the pre-set password.

● At the time of program reservation, the receiver unit refers to the viewing fee on the SI.

3.23 Line connection test

● The receiver unit tests whether the phone line is connected, by detecting tone signals by user operation.

3.24 Display of history

● The receiver unit memorizes and displays the history of errors experienced in the IC card communications, telephone communications, and viewing in reserved programs, and other problems.

3.25 System setting

● The following settings should be provided, as required by the specifications of the receiver unit.

[1] Password

● A password should be pre-set, changed or deleted to validate the parental control, PPV program purchase and other operations that require a password to be input.

● The password should be deleted from the center side as well, by the EMM control.

[2] Telephone line

● The type and other properties of the telephone line should be set (e.g. tone, dial 10 pps, dial 20 pps).

● The extension, pause time and application of tone detection should be set as well.

[3] Parental control level

● To enable the parental control, the parental level to allow viewing must be set in advance.

[4] Monthly PPV purchase ceiling

● To enable the monthly PPV purchase control, set the monthly ceiling in advance.

[5] PPV program purchase ceiling

● To enable program-based PPV purchase control, set the purchase ceiling for a single program in advance.

3.26 Notification of retry over

● If the "Notification of retry over" is set under the instruction of the IC card, the receiver unit displays the message of "Communication failed" when the power is turned on or a PPV program is purchased.

3.27 User call-in request

● If the "Notification of retry over" is set under the instruction of the IC card, the receiver unit displays menu or other information when the power is turned on or a PPV program is

purchased, and instructs the IC card to call up the viewing information collection center by user operation.

4. Attached Tables

Attached Table 1. Operating conditions for IC card control

Item	Standard
Maximum interval of polling time, with "Card request confirmation command and response" (Regular polling regardless of ECM reception)	15 S

Attached Table 2. Conditions for ECM transmission

Item	Standard
Minimum interval of ECM update time (per each ECM)	1 S
Minimum interval of ECM resend time	100 mS

Attached Table 3. Operating conditions for group ID control

Item		Standard
Number of IDs	Individual card ID	1
	Group IDs	0 to 7
Bit length of identifier (higher-order bits of the 6 byte identifier)		3 bits

Attached Table 4. Conditions for EMM transmission

Item	Standard
Section length	Up to 4096 Bytes
Minimum and maximum numbers of EMMs in a section	1 to 256
Number of EMMs in the same section under the same ID	1
Minimum interval of EMM transmission to the same receiver unit	1 second

Attached Table 5. Conditions for EMM message transmission

Item		Standard
Section length		Up to 4096 Bytes
Minimum and maximum numbers of EMMs in a section	EMM individual messages	1 to 256
	EMM common messages	1
Number of EMMs in the same section under the same ID, for EMM individual messages		1
Minimum interval of EMM transmission to the same receiver unit, for EMM individual messages		1 second
Maximum length of a complete message body (the individual and preset parts combined) in a mail message		800 Bytes
Maximum length of the body of automatic display message (the individual and preset parts combined)		400 Bytes
Maximum length of the difference information accumulated on IC card for automatic display messages		20 Bytes

Attached Table 6. Frequency of EMM section transmission

Item	Standard
Transmission frequency of EMM section and EMM individual message section, at the TS packet level	[1] Type A One or more EMM bodies are included in the EMM section, which is a single section. 1) Program TS In the transmission of the EMM section and EMM message section, the TS packet of the relevant PID should be sent out in the range of 1.28 kB ± 100%, on a 32 msec basis. The TS packet conveying the EMM section and EMM message section should not be transmitted over 320 kbit per second in the same PID. (In the above 320 kbit transmission, the data volume of a single EMM section and EMM message section is considered to be 4 kB.) 2) Dedicated TS (for specified channel) In the transmission of the EMM section and EMM message section, TS packet of the relevant PID should be sent out in the range of 5.2 kB ± 100%, on a 32 msec basis. The TS packet conveying the EMM section and EMM message section should not be transmitted over 1.3 Mbit per second in the same PID. (In the above 1.3 Mbit transmission, the data volume of a single EMM section and EMM message section is considered to be 4 kB.) [2] Type B A single EMM body is included in the EMM section, which comprises multiple sections. Regardless of Program TS or Dedicated TS (specified channels), TS packet of the relevant PID, in the transmission of the EMM section and EMM message section, should be sent out in the range of 8.0 kB ± 100%, on a 32 msec basis. The TS packet conveying the EMM section and EMM message section should not be transmitted over 2.0 Mbit per second in the same PID. (In the above 2.0 Mbit transmission, the respective data volumes of a single EMM section and EMM message section are considered to be 4 kB.)
Transmission frequency of EMM common message section	A specified preset No. (Table ID Extension) is assigned. The transmission frequency for the EMM common message section should be up to one section per 200 msec.

*A method to identify the difference between the EMM transmission Types A and B should be defined by respective enterprises according to their operational guidelines.

Appendix 3 Operations of the CAS

1. Operation style

As integrated by enterprises joining in each operation.

2. Key management

2.1 Management of ID, Kmi, etc.

Establishment of a system to generate the master key (Kmi), linked to the ID No. of the CA module (IC card, etc.); Development of rules for the output and manage the above information.

2.2 Management of CA module

Production of the CA module, distribution of the module to suppliers, etc.
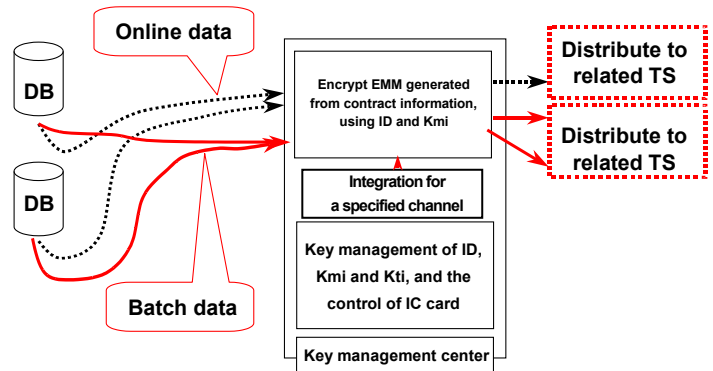
Figure A3-1. Key management center (Common and secret keys)

2.3 Encryption

Establishment and operation of a system for the encryption of EMM and other data

2.4 Management of system parameters

Management of system parameters, required for the joint operation of CAS, such as broadcaster identifier.

3. Collection of viewing information

1) Collect the viewing information transmitted from individual terminals at a center.
2) The collected information is distributed to the customer database of each enterprise while retaining its security.
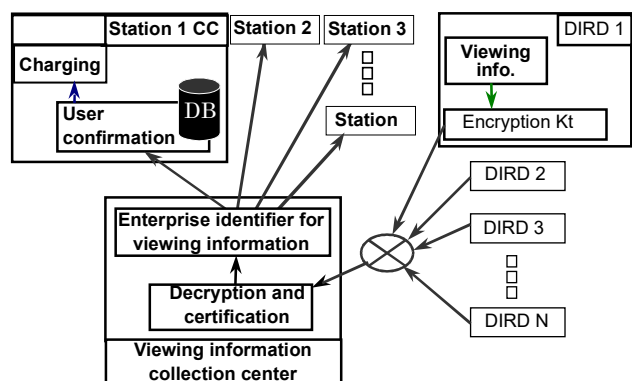
Figure A3-2. PPV viewing information collection center

The outline of the viewing information collection system, connecting the DIRD and the viewing information collection center with a

collection network, is indicated in Figure A3-2.

PAD: Packet assembly and disassembly function
PMX: Packet multiplexer equipment
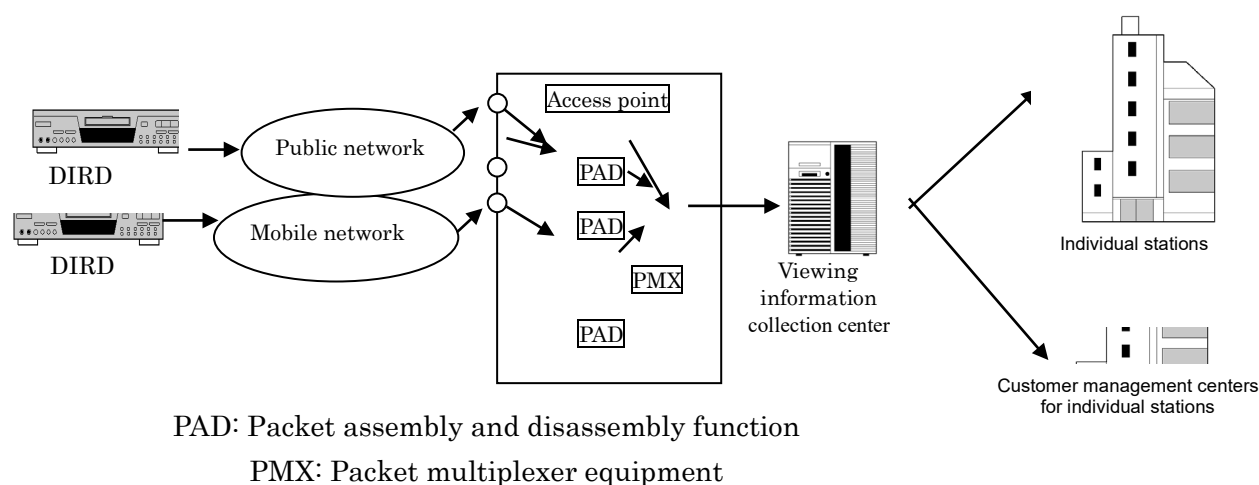
Figure A3-3. Viewing information collection system

3.1 Encryption of viewing information

When viewing information is communicated, communication data shall be encrypted for the protection of viewer's privacy, prevention of information leak, and security assurance. For this purpose, the following functions are required:

1) "CA module certification" at the viewing information collection center, using information unique to the CA module

2) "Center certification" at the CA module, using information unique to the viewing information collection center

3) Encryption of information to transmit by using Kti

4) Prevention of the fixing of encrypted area by assigning different information in each communication session

3.2 Prerequisites for the network protocol

The following prerequisites are required of the enterprises.

・ Information must be collectable in a relatively short time period, even with the modems of 2,400 bps: Must reduce communication fees.

・ The protocol must be free of errors in terms of data forwarding levels: Must perform the transmission confirmation and request for re-transmission at the Data Link 2 level and below.

・ The data forwarding protocol must be capable of binary communication: Must enable a protocol capable of binary communication at the Data Link 2 level.

3.3 Use of data transmission functions for high-speed modems or cell phones and PHS (PIAFS)

It is expected that different types of DIRD will co-exist, equipped with data transmission functions for low-speed modems, high-speed modems, or cell phones and PHS (PIAFS). In the collection of viewing information, the collection of small amount of data must be completed in a short time period, even with low-speed modems. It is desirable as well that the unified modulation standards are used for modems at access points for the viewing information collection center so that the negotiation time with modems on DIRD will be minimized. For this purpose,

- It is desirable that modems on the network side support the unified modulation standards and error corrections, of at least V.22bis and MNP4, for the data transmission by DIRD modems or cell phones / PHS (PIAFS), which is targeted by the viewing information collection.

Among high-speed modems on the market, V.34 modems (33600bps - 2400bps) support V.32bis, V.32, V.22bis, etc.

The above description about the cell phones / PHS (PIAFS) refers to the cases of protocol conversion of digital data into analog modulation to enable the communication with modems.

4. Customer management

4.1 Operation for flat / tier charging

Customer management will be operated by each entity. The following process is expected at this point.

(1) In the case of individual operation (One enterprise forms one entity)

1) The enterprise operates the customer center, etc. on its own, and accepts purchase requests.

2) The enterprise operates the customer management system on its own and controls its contractor data.

3) The enterprise generates and transmits EMM in its own channel.
(The encryption of EMM is processed at the key management center.)

(2) In the case of joint operation (Multiple enterprises forms one entity)

1) The entity operates the customer center, etc., and accepts subscription requests.

2) The entity operates a single customer management system and manages the contractor data. Although the contracts of all enterprises joining the entity are managed unifiedly, contractor information with a certain enterprise is only disclosed to the relevant enterprise (For confidentiality reasons).

3) The enterprises jointly generate a single EMM (Note: contracts for each enterprise are controlled by a part of the tier bits) which is transmitted in all channels of the joining enterprises. (The encryption of EMM is processed at the key management center.)

4.2 Operation for PPV charging

(TBD)

4.2.1 Accepting the applications

4.2.2 Data management

4.2.3 EMM transmission

The EMM is sent by each enterprise or entity.

5. Operation of customer center

(TBD)

5.1 Response to inquiries

5.2 Accepting the applications for "Call Ahead PPV"

5.3 Instruct the transmission of online EMM to the customer management system.

6. Operation for billing and payment collection

(TBD)

6.1 Integrated billing by enterprises

6.2 Entity-based billing

6.2.1 Joint billing

6.2.2 Independent billing

7. CAS certification system

Assuming the production of CA modules (e.g. IC cards) by contract broadcast enterprises, a certification system is required to verify the coordination of performances between such modules and the receiver units designed in accordance with the interface standards.

Examination is required on the establishment and operation of a minimal system required for the above verification.

This system comprises the two sub-systems for (1) the certification of CA module, and (2) the certification of DIRD.

(1) The sub-system for the certification of CA module shall send to the module the interface command between the CA module and the DIRD as appropriate, and verify the performance of the CA module.

(2) The sub-system for the certification of DIRD shall comprise the transport stream and CA module for the certification, and verify the performance of the DIRD.

8. Transmission of EMM

(1) Individual transmission by enterprise: In the case of individual operation (One enterprise forms one entity), the enterprise transmits EMM in its own channel only. (Figure A3-4)

(2) Joint transmission by enterprises: In the case of joint operation (Multiple enterprises forms one entity), the same EMM is transmitted in all channels of the enterprises joining the same entity. (Figure A3-5)
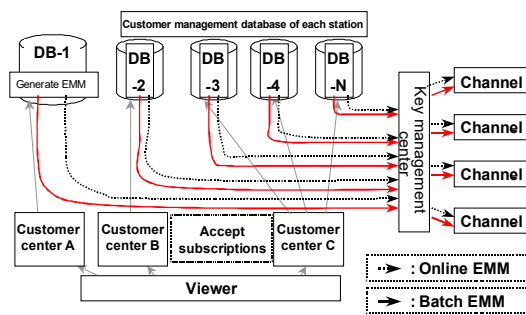
Figure A3-4. Individual transmission of EMM (station-based EMM)
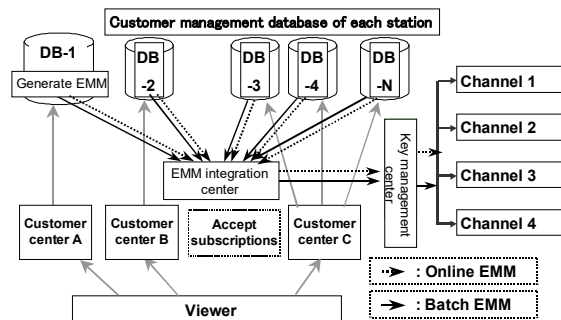
Figure A3-5. Integrated transmission of EMM (all-station EMM)

(3) Mixed operation: Example of mixed operation of individual and integrated transmissions (Figure A3-6)
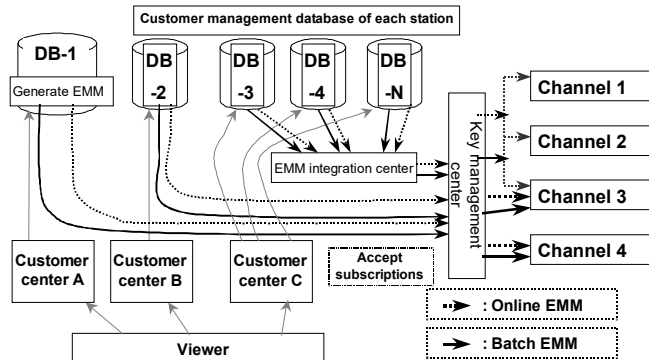
Figure A3-6. Example of mixed operation of individual and integrated transmissions of EMM

(4) EMM transmission by a dedicated channel

There is an idea to gather and send the EMM of related digital broadcast in a dedicated channel to increase the efficiency of EMM transmission. In this case, subscription update and other EMM in a batch-like pattern are sent in that dedicated channel while online EMM sent by the operators of customer centers, etc. are sent in individual entity channels. (Figure A3-7)
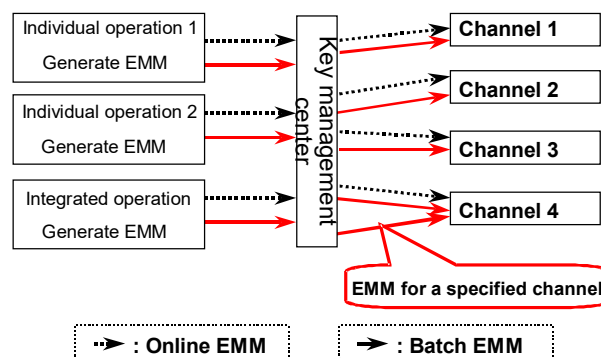
Figure A3-7. Example of EMM transmission by a dedicated   channel

(5) Multiplexing and filtering of EMM

The following shows the desirable conditions for multiplexing and filtering of EMM, but various other factors must be considered, including those dependent on the functions of the receiver unit, and the load of SI/EPG at the time of operation.

・EMM multiplex: Multiplex multiple EMM data in a single section
・Capacity of EMM transport stream   500kbps - 1Mbps
・Number of EMM filtered on the DIRD (Number of IDs)   8
・Number of EMM sent to the same DIRD at a time (Number of IDs)   8
・Cycle of the above   Minimum time (for EMM decryption) x Number of EMM sent at a time
・Number of EMM in a TS packet   3 to 6.5

Based on the above desirable conditions, the following restricting factors must be considered in the actual operation, not to exceed the loading capacity of the receiver unit.

・Interval of sending EMM   Max. 1.3 Mbps or so, in the entire bit rate
・Interval of sending to the same DIRD   Min. 1 second
・Relationship with the ECM transmission
  Convergence between the ECM decryption process and other command processes
・Relationship with the SI/EPG process
・ Relationship with other broadcast service forms, involving the TS process at the receiver unit.

9. Frequency of ECM transmission

Min. 100 msec or so

Designate the minimum interval, and reserve room for balancing between the interval and the capacity of transmission, depending on the service.

10. Program operation management system

The program operation management system executes the scrambling and transmission of ECM, in accordance with the program schedule.

The ECM to send the scrambling key is transmitted prior to the scrambling process. The ECM is encrypted before transmission, and decrypted by the receiver unit. Therefore, time for encryption and decryption shall be considered in advance.

The program operation management shall be undertaken by each enterprise as part of the program transmission system.

Appendix 4 Supplementary Explanation on CA Interface

Supplementary explanations are provided below, on the reasons for selecting specifications indicated in this Standard, as well as other related information. See items under "4.3.2.3 Electrical Signals and Protocols" under 4.3.2 IC Card Interface Specifications, 4.3 CA Interface, Chapter 4; and the CLA standards indicated in "4.3.3 Commands / Responses."

1. VCC pin (4.3.2.3 (1), Chapter 4)

Specification: The receiver shall meet the 5V single power supply (Class A) specification. When the receiver supports an IC card in the form of a plug-in SIM, in addition to the 5V single power supply (Class A) specification, the 3V single power supply (Class B) specification is also acceptable. The IC card shall meet either a 5V single power supply (Class A) specification or a specification that satisfies both 5V and 3V power supply (Class AB). However, Plug-in SIM-shaped IC cards shall meet the specification (Class AB) that satisfy both 5V and 3V power supplies.

Explanation: In the original standard, the specifications for 3V single power supply (Class B), or for both (Classes AB) were listed, for low-voltage performance on mainly mobile devices, in addition to the specifications for 5V single power supply (Class A) . However, this Standard only adopt the specifications for 5V single power supply (Class A), considering the advantage of 5V operation over 3V in card chip, due to high-speed encryption and other processes by higher clock frequency, as well as the disadvantages, such as more complex power switching on the DIRD side and associated cost increase. However, the Class AB specification has been allowed for the card side since the initial development of this standard, taking into account the possibility of dramatic improvements in the performance of IC card chips. Since the Plug-in SIM format was introduced in Version 5.1 of this standard, it was decided to guarantee the Class AB specification only for cards with the Plug-in SIM format, and to allow the introduction of the Class B specification for the relevant DIRD-side power supply specification.

2. Vpp pin (4.3.2.3 (2), Chapter 4)

Specification: The Vpp pin acts as the NC (Not Connect) pin.
Explanation: IC card chips with Vpp pin as NC (internally generating Vpp power supply from Vcc) are the mainstream. Furthermore, the Vpp pin is changed to RFU in the Class B specifications so that NC is considered appropriate from the viewpoint of future applications.

3. CLK pin (4.3.2.3 (3), Chapter 4)

Specification: The CLK pin can be supplied both 4 MHz and 8 MHz signals.
The pin is supplied a 4 MHz signal after being reset for the first time after the IC card is inserted. As the ATR response fs maximum value FI (TA1) is to 3, the pin can be reset again and switched to 8 MHz.

Explanation: To avoid the destruction of an IC card which is inserted in wrong direction, the terminal must confirm the response in 4 MHz (considering the power specifications of Class B), as specified in the original standard, following the initial reset. The terminal is also capable of supply in 8 MHz in accordance with the ARIB STD-B16. The terminal is so designed as to enable the unique setting of clock frequency based on the ATR response to avoid the supply of 4 MHz by some receiver units to the cards capable of 8 MHz.

4. ATR (Answer To Reset) (4.3.2.3 (4), Chapter 4)

Specification: The ATR should comply with ISO 7816-3:1997.
The card automatically transitions to ATR from 400 to 40,000 [1/f] clock cycles after an external reset and sends the reset response while control information characters (historical bytes) are not sent.

Explanation: Although the control information characters (historical bytes) are stipulated by the ISO 7816-4, it is not considered that it is appropriate to transmit them. Because they assume command sets that are not used in this Standard and their purposes are not clear at this point. If they become necessary in the future, it is possible to supply the relevant information to the DIRD, using the relevant commands.

4.1 ATR transmission data (4.3.2.3 (4-4), Chapter 4)

Specification: The initial response data consists of the initial character TS followed by other characters in the following order.

- The values of the respective bits of the Y_{i+1} element indicate the presence of the interface characters (TA_{i+1}, TB_{i+1}, TC_{i+1}, and TD_{i+1}) that follow TDi.

  b_4: Presence of TA_{i+1}

  b_5: Presence of TB_{i+1}

  b_6: Presence of TC_{i+1}

  b_7: Presence of TD_{i+1}

  (Present: 1; absent: 0)

Initial character	TS	'3B'	Set the order. Logic 1 is set to state Z, and b0 is set to LSB.
Format character	T0	'F0'	Upper 4 bits: Set Y_1, used to indicate presence of interface characters following T0, to F. Lower 4 bits: Set the number of control information characters K to 0.
Interface characters	TA_1	'1x' '3x'	Upper 4 bits: Set the integer value FI to 1 (F = 372, f_{max} = 5 MHz) or 3 (F = 744, f_{max} = 8 MHz). Lower 4 bits: Set the integer value DI to 2 (D = 2), 3 (D = 4), or 4 (D = 8).
	TB_1	'00'	The Vpp pin serves as the not connect (NC) pin.
	TC_1	'xx'	Set the special character guard time integer (N). An N value of FF signifies a guard time (see Figure 4-17) of 1.
	TD_1	'91'	Upper 4 bits: Set Y_2, used to indicate the presence of following interface characters, to 9. Lower 4 bits: Set protocol used to exchange the following data to T = 1.
	TA_2	'81'	[b7] Set to 1 to disallow multiple resets. [b6b5] Fixed at 00. [b4] Set to 0 to set the transmission parameter to the specified interface character. [b3-b0] Set the protocol used to exchange the following data to T = 1.
	TD_2	'B1'	Upper 4 bits: Set Y_3, used to indicate the presence of following interface characters, to B. Lower 4 bits: Set the protocol used to exchange the following data to T = 1.
	TA_3	'xx'	Set the data field length integer (IFSI). Initial value for the maximum length of the data field that can be received by the card (IFSC).
	TB_3	'xx'	Upper 4 bits: Block wait time integer (BWI) Lower 4 bits: Character wait time integer (CWI)
	TD_3	'1F'	Upper 4 bits: Set Y_4, used to indicate the presence of following interface characters, to 1. Lower 4 bits: Set to T = 15 to indicate that the following data is a non-protocol-dependent interface character.
	TA_4	'01' '03'	[b7b6] Set to disallow use of clock stops (XI = 0). Normal IC card [b5-b0] Set the power supply specification to Class A only (U = 1) or Class AB (U = 3). IC card with Plug-in SIM shape [b5-b0]Set power supply specification to Class AB (U=3).
Check character	TCK	'xx'	Exclusive OR of T0 to TA_4.

Explanation: The FI value for TA1 was set to '1' or '3'.

The DI value for TA1 was set to '2', '3' or '4'.

For TB1, the instruction that "Vpp pin should be Not connected (NC) " was added.

For TC1, the function was added to set the protection time for special characters.

As TC1 was added, the Y1 for T0 was set to 'F'.

For TA4, the function was added to set the clock stop and the class of power supply specifications.

As TA4 was added, TD3 was inserted, and the Y4 was set to '1'.

As TD3 was added and the Y3 for TD2 was set to 'B'.

Reasons: Considering the short updating cycles of ECM, it is effective to make the communication rate as high as possible. Therefore, we enabled the setting of 'DI=4' (D=8), to provide double baud rate compared to D=4. At the same time, we enabled free combination of FI and DI, thereby providing six different combinations of clocks and baud rates. We also added TC1, which was introduced in the ARIB STD-B16.

Based on the new stipulations of power supply specifications in the ISO 7816-3: 1997, we added 'T=15' as the connection information character independent of the communication protocol under TD3 (designated by TA4). The power supply specifications for cards were so designed as to enable the switching between 'Class A' and 'Classes AB', based on the concept described in "3. CLK pin." The clock stop function was added to reduce power consumption of mobile devices while they are not in operation. In this Standard, deactivation of the card (i.e. shut off of power supply) is sufficient for this purpose, and therefore the above function is not applied, avoiding complex control of DIRD. Specific values of TC1, TA3 and TB3 shall be examined with reference to the structure of ECM and EMM, the process performance of encryption algorithm, and other related factors.

5. Transmission protocol format (4.3.2.3 (6), Chapter 4)

5.1 Subfield coding method (4.3.2.3 (6-3), Chapter 4)

(1) NAD (NodeADress)

Specification: The NAD is a 1-byte field that identifies the block's source node address (SAD) and destination node address (DAD). It is coded as follows:

NAD is fixed at 00h (SAD = DAD = 0).

For applications that have multiple slots and require simultaneous communications with multiple IC cards, each slot should be independently controlled by a separate interface.

Explanation: Although it is possible to identify multiple IC cards in the same interface using NAD, we adopted independent control using separate interfaces to avoid complex operation in the case of different clock frequencies and communication rates , and the inescapable possibility of collision between responses in the case of communication error.

(2) PCB coding of the R block

Specification:

Table A4-1. PCB coding standards for the R block

PCB coding								Meaning
b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0	
1	0							R block identifier
			A					N(R)
		0		0	0	0	1	Parity or EDC error
		0		0	0	1	0	Other error (sequence error, protocol violation, etc.)

N(R): Receive sequence no.

Explanation: This coding was originally stipulated as below, in the ARIB STD-B1 and ARIB STD-B16. In the ARIB STD-B25, however, the coding is corrected in conformity with the ISO standards, taking account of existing receiver units with chaining, as in the ARIB STD-B16.

1) ARIB STD-B1

　・"Without chaining" and "b1, b0＝00 (Fixed)".

　・This did not conform with the ISO standards, but probably focused on the simplicity of receiver units.

2) ARIB STD-B16

　・"With chaining" and "b1, b0＝00". (ARIB STD-B1 applies to the unstipulated factors.)

　・In the case "With chaining." "b1, b0＝00" indicates the request for continuation during chaining (no errors). The above stipulation was therefore wrong, and we should have conformed with the ISO standards for the coding of R block at this point.

6. Protocol control (4.3.2.3 (7), Chapter 4)

6.1 Chaining (4.3.2.3 (7-2), Chapter 4)

Specification: This feature is not used.

Explanation: The chaining function enables segregated communication of commands and responses in the case of insufficient communication buffer capacity of IC card. However, other commands cannot interrupt this segregated data exchange process using the chaining function, resulting in significant restriction of the ECM updating cycle. Therefore, the data exchange for a single command and response should be completed in a single transmission. If data is too large and cannot be exchanged in a single transmission, other measures shall be taken, such as dividing a single command and response into multiple sessions.

6.2 Changing of IFSD (4.3.2.3 (7-3), Chapter 4)

Specification: Before exchanging the first I block, the DIRD must change the IC card's IFSD to allow data with a maximum size of 254 bytes (INF) to be received.

Explanation: The default value of IFSD (=32 byte), set by the original standard, must be modified to enable the conclusion of a single command and response in a single transmission without using the chaining function.

6.3 RESYNC (4.3.2.3 (7-4), Chapter 4)

Specification: In the event that multiple transmission errors occur, the DIRD must support RESYNC control as necessary.

Explanation: The ARIB STD-B1/B16 did not stipulate this item. The original standard shall apply.

6.4 ABORT (4.3.2.3 (7-5), Chapter 4)

Specification: This feature is not used.

Explanation: Not used because it is the control function for chaining.

6.5 Error recovery (4.3.2.3 (7-6), Chapter 4)

Specification: In the event that one of the errors described above is detected, the following error recovery processing is performed depending on the last block sent and the node detecting the error.

(1) When the last block sent was an S block (ctrl, REQ)

  1) When the node detecting the error is the DIRD

      i. Retransmission request using the same block.

      ii. Resynchronization request using an S block (RESYNCH, REQ)

iii. Reset

2) When the node detecting the error is the IC card

   i. Retransmission request using the same block.

(2) When the last block sent was not an S block (ctrl, REQ)

1) When the node detecting the error is the DIRD

   ii. Retransmission request using an R block.

   iii. Resynchronization request using an S block (RESYNCH, REQ)

   iv. Reset

2) When the node detecting the error is the IC card

   i. Retransmission request using an R block.

Explanation: If errors are not resolved by the error recovery process by the T=1 protocol, due to the overdrive of IC card chip, loose connection or other reasons, resetting is essential. This necessity was only stated ambiguously in the original standard. In this Standard, we instructed "Reset" expressly, as the error recovery process on the DIRD side.

7. Items under "Command APDU" Commands and Responses (4.3.3.1 (1), Chapter 4)

(1) CLA

Specification: CLA is used for dedicated commands and differs from the common commands defined by ISO 7816-4. Its coding and meaning are defined privately by this standard. Additionally, the logic channel and secure messaging functions are not used.
CLA should always be set to 0x90.

Explanation: To avoid the insertion and malfunction of an ARIB STD-B1-based card, clear identification is required. Because the range of values for INS admitting private use is restricted by the original standard, it is appropriate to use CLA in the earlier bits. Therefore, we set the first 4 bits to '9', based on the original standard.

Appendix 5 Examples of Identifier Information

The concepts of using and assigning identifier information in this Standard are indicated below.

1. Scheme of identifier information

The scheme of identifier information used in this Standard are indicated below. This figure indicates, for example, that the card ID is controlled uniquely in the identical CA_system_id .

CA_system_id

- Protocol number
- Broadcaster identifier
  - Work key identifier
  - Update number
  - Fixed message sentence number *
  - Message ID
  - PPV program number
- Card ID
- Center ID
- Difference format No.
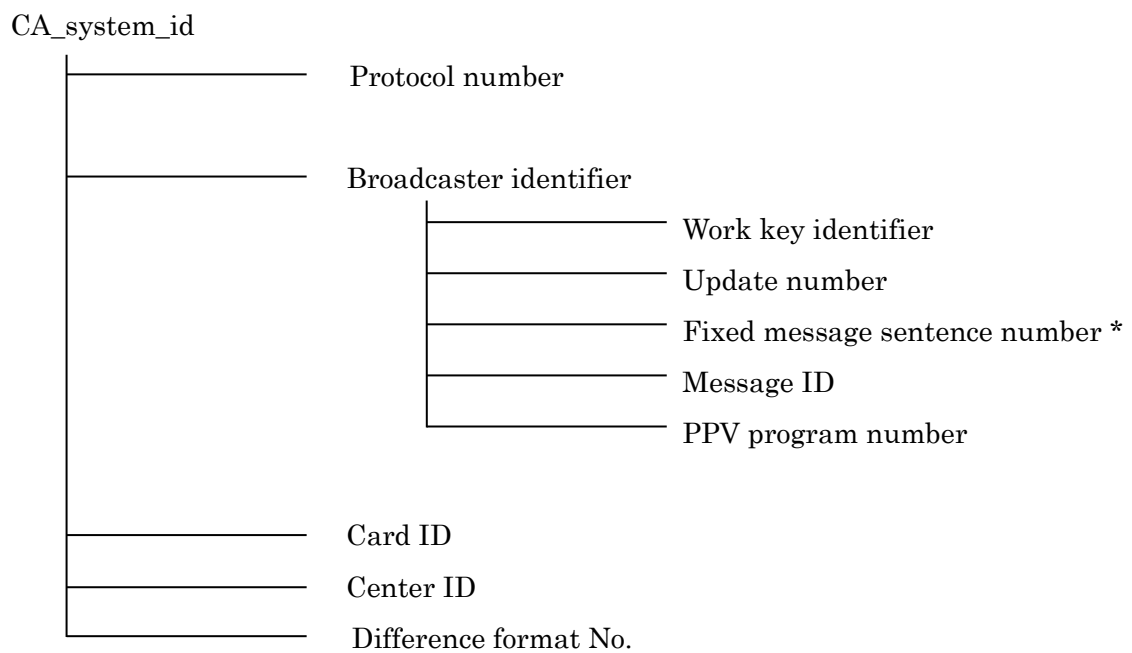
* The Fixed Message Sentence Number can be defined independently of the broadcaster identifier. In the above example, the first eight bits of the Fixed Message Sentence Number (2B) are identical to those of the broadcaster identifier, and its last eight bits are unique to the broadcaster identifier, thereby avoiding the overlap of fixed message sentence number used by different entities.

Figure A5-1. Scheme of identifier information used in this Standard

2. Concepts for assigning major identifiers

2.1 CA_system_id

It is expected that a new CA_system_id will be issued, if:

- ・ The specific implementation, the encryption method used, the security module, etc. of associated information (ECM and EMM) are completely new or totally different; or
- ・ Following the alteration of the specific implementation, the encryption method used, the security module, etc. of the variable part of associated information (ECM and EMM), they lose upward compatibility with the previous methods.

Also, the conditional access system identification is referenced from the conditional access system descriptor and the access control descriptor, and is assumed to be uniquely assigned between the two descriptors.

2.2 Protocol number

It is expected that a new protocol number will be issued, if:

- ・ Following the upgrading or alteration of associated information (ECM and EMM) or encryption method, they retain upward compatibility.

2.3 Broadcaster identifier

It is expected that a new broadcaster identifier will be issued:

- ・ For each transmission unit of associated information,
- ・ Due to restrictions of associated information, and for other reasons.

In the same broadcaster identifier, you may allocate freely the sub-identifiers such as:

- ・ Work key identifier,
- ・ Update number,
- ・ Message ID, and
- ・ Fixed Message Sentence Number (the last 8 bits)

Part 2

Playback Control System
(Conditional Playback System)

Part 2 Contents

Chapter 1 General Matters

1.1 Purpose

Part 2 of this standard addresses an access control system for use in digital broadcasting utilizing high-capacity storage functionality (broadcasting based on home servers), defining scrambling and associated data specifications as well as related receiver specifications for a system that provides control during playback ("conditional playback system").

1.2 Scope

This standard applies to BS digital broadcasts, wide-band CS digital broadcasts, and terrestrial digital television and audio broadcasts described in clause 1.2 of Chapter 1, Part 1.

This standard applies to cases of server type broadcasting in which conditional playback of the following are carried out: the content transmitted by means of the "stream-type transmission system" where the interval between the time of the transmission of content and the time of viewing/listening to the said content are always constant ("stream-type content"), and content transmitted by means of the "file-type transmission system" where the interval between the time of the transmission of content and the time of viewing/listening to the said content are not always constant ("file-type content").

See Chapter 2 for the conditional playback system for stream-type content or Chapter 3 for the conditional playback system for file-type content.

When applying those stipulated in these standards to terrestrial digital audio broadcasting, the following changes apply.

View (Viewer) → Listen (Listener)
Preview → Sample
PPV (Pay Per View) → PPL (Pay Per Listen)
Display → Display (including audio presentations)

1.3 References

1.3.1 Normative References

The following documents are documents in which some of the items specified in the documents are referenced or cited as part of the standard in this standard.

(1) Ordinance of the Ministry of Internal Affairs and Communications: "Standard transmission system for digital broadcasting among standard television broadcasting and the like" (No.87, 2011).

(2) Notification of the Ministry of Internal Affairs and Communications: "On defining the information especially notified by the Minister for Internal Affairs and Communications among associated information" (No.298, 2011)

⑶ Notification of the Ministry of Internal Affairs and Communications: "On defining the configuration of the associated information and the procedure of transmission, the procedure of transmitting PES packet, section format, TS packet, IP packet, ULE packet, MMTP packet, compressed IP packet and TLV packet, the configuration of transmission control signal and identifier and the configuration of emergency information descriptor and emergency warning broadcasting message" (No.233, 2014)

⑷ Notification of the Ministry of Internal Affairs and Communications: "On defining the transmission procedure for video signals in a section format and sound signals in a section format" (No.301, 2014)

⑸ Notification of the Ministry of Internal Affairs and Communications: "On defining the system for scrambling" (No.235, 2014. Hereinafter referred to as "Notification")

1.3.2 Informative References

⑴   Telecommunications Technology Council Inquiry Report No. 17

⑵   Telecommunications Technology Council Inquiry Report No. 74

⑶   Information and Communications Council Inquiry Report 2003

⑷   ARIB STD-B1 "Digital Receiver for Digital Satellite Broadcasting Services Using Communication Satellite" Standard

⑸   ARIB STD-B10 "Service Information for Digital Broadcasting System" Standard

⑹   ARIB STD-B16 "Standard Digital Receiver Commonly Used for Digital Satellite Broadcasting Services Using Communication Satellite" Standard

⑺   ARIB STD-B20 "Transmission System for Digital Satellite Broadcasting" Standard

⑻   ARIB STD-B21 "Receiver for Digital Broadcasting" Standard

⑼   ARIB STD-B24 "Data Coding and Transmission Specification for Digital Broadcasting" Standard

⑽   ARIB STD-B29 "Transmission System for Digital Terrestrial Audio Broadcasting" Standard

⑾   ARIB STD-B30 "Receiver for Digital Terrestrial Audio Broadcasting" Standard

⑿   ARIB STD-B31 "Transmission System for Digital Terrestrial Television Broadcasting" Standard

⒀   ARIB STD-B32 "Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting" Standard

⒁   ARIB STD-B38 "Coding, Transmission and Storage Specification for Broadcasting System Based on Home Servers" Standard

⒂   ISO7816-1：1987
     ISO7816-2：1988
     ISO7816-3：1997
     ISO7816-4：1995

1.4 Terminology and Abbreviations

ACG   Access Control Group

ACI   Account Control Information

CAI   Conditional Access Interface

CAS   Conditional Access System

CAS-P   Conditional Access System for Playback

CGMS   Copy Generation Management System

DIRD   Digital Integrated Receiver Decoder

ECM   Entitlement Control Message

EMM   Entitlement Management Message

IPPU   Impulse Pay Per Use

IPPV   Impulse Pay Per View

LLI   License Link Information

PID   Packet Identifier

PPL   Pay Per Listen

PPU   Pay Per Use

PPV   Pay Per View

PSI   Program Specific Information

SI   Service Information

TS   Transport Stream

Encrypt   This means process of encryption of resource unit addressed in ARIB STD-B24 Volume 3, and differs from scrambling for encryption of payload part of the TS packet.

Chapter 2 Access Control System for Stream-type Content

2.1 General Matters

The standard stipulated in this Chapter applies to conditional playback of stream-type content.

2.2 Functional Specifications

2.2.1 Scrambling and Associated Data Specifications

2.2.1.1 General Functions

This conditional playback system contains the following functions:

1) Functions whereby the contract information can be operated independently of the content and charging control information, and playback can be done only by the contractant.

2) Functions to set up control information independently and control it, in the case that the licensed use / charging differs between the time of reception and playback.

3) Functions to control the licensed use / charging per content at the time of playback.

4) Functions to control the terminals, other than the receiving terminal, where playback is allowed.

5) Functions to receive and control more than one receiving terminals, such as per household as one group.

6) Functions of realtime viewing enabled by compatibility with the existing conditional access system.

7) Advanced security functionality, which can address piracy in parallel with broadcast operation.

2.2.1.2 Service Scenarios of Broadcast Service

2.2.1.2.1 Broadcast Service

This standard shall be applied to the following services:

(1) Playback and viewing service of video and audio program that is transmitted in the transmission frequency band (service channel) after the time of storage; for example:

　　a. Standard television broadcasts (MP@ML, etc.)

　　b. High-definition television broadcasts (MP@HL)

　　c. VHF broadcasts

　　d. Data broadcasts (details are for further study)

　　　Data broadcasts use a dual charging structure consisting of stream (channel) and file (content) charging. The conditional access playback system (CAS-P) described in this chapter addresses stream-type services. For file-type services, see Chapter 3.

(2) Playback and viewing service of integrated digital broadcasts that combine a variety of information including video, audio, and data in a flexible format (ISDB; Integrated Services Digital Broadcasting) after the time of storage.

(3) Viewing scenarios

a.   Conditional playback

Stored without unscrambling, and viewed after descrambling at the time of playback. Stored content after charging are subject to administration.

b.   Simplified conditional playback.

Current realtime broadcasts are temporarily stored without unscrambling before charging, and viewed after descrambling and being charged at the time of playback. Restoring after charging is handled as private recording, and is not subject to administration.

2.2.1.3 Fee Structure

The system shall be applied to the following fee structures.

(1)   Pay per view (Impulse PPV [IPPV])

   a.   Pay-per-view by service channel and event

 i.   Preview: The system automatically enters preview mode when the user tunes into a PPV program that supports previewing.

 ii.   Preview time: The system allows fixed preview times to be set, including a "no preview" setting, within the same channel, from the beginning of the program, or from the start of the program.

 iii.   Purchase: Purchases require viewers to confirm their intention to purchase before the transaction is processed.

 iv.   Timing for charging: Charged at the time of playback.

 v.   Setting of expiration date / period: The following expiration date and period can be set:

  a. Expiration date for purchase

  b. Expiration date for / period of playback

   b. Viewing data call-in function

 i.   Periodic call-in: System shall call in during a specified period of time, generally once per month.

 ii.   Call-in when viewing data full: System shall automatically call in once a certain amount of viewing data has been stored.

 iii.   Forced call-in control: Forced call-ins shall be initiated and stopped by ID.

 iv.   User call-in: Viewers shall be allowed to initiate call-ins by operating their receivers.

 v.   Call-in per view: Call-ins shall be initiated at the time of each viewing.

   c.   Setting recording fees

Separate fees can be set for recordable programs after descrambling, with support for the following capabilities:

 i.   General recording control uses the Digital Copy Control Descriptor and Content Availability Descriptor contained in SI.

The contents of these descriptors describe the applicability of "5C DTCP system" etc.

ii. Other copy protection functionality supports the trend toward standardization, including receiver functionality.

(2) Free

The system provides a means of judging viewability that includes operability, and is separate from viewing fee transactions.

2.2.1.4 Fee Payment Systems

The system shall support the following fee payment systems:

(1) Viewing-based payment (pay later): Supports IPPV.

(2) Lump-sum payment (pay first): Supports IPPV with prepaid card or similar.

2.2.1.5 Contract schemes

The system shall support implementation of the following contract formats.

1) PPV charging contract by broadcaster group

2.2.1.6 Collection of Viewing Information

The system also shall be able to provide the following functionality and operations by means of terminal power-on call-in control and a separately defined viewing information collection network protocol.

(1) The system shall support the following viewing information collection operations:

a. Viewing information for terminals calling in is collected in the center-defined format.

b. Collected information is distributed in a secure way to individual broadcaster groups and to their respective customer databases.

c. Viewing information is collected from terminals by means of the public telephone network, cellular telephones, or PHS telephones (hereinafter, unless it is necessary to distinguish among these alternatives, they are collectively referred to as the "public network").

(2) The system shall provide the following functionality required for implementing call-ins to the Viewing Information Collection Center:

a. Support for specifying regular call-in dates and times for individual IC cards using EMMs.

b. Support for issuing forced call-in instructions to individual IC cards using EMMs

c. Support for call-ins when memory available for storing viewing information falls below a defined volume.

d. Support for ability of viewers to initiate call-ins by operating their receivers.

(3) The system shall provide the following functionality required for uploading viewing information to the Viewing Information Collection Center:

a. Authentication of the receiver's IC card by the Viewing Information Collection Center

b. Authentication of the Viewing Information Collection Center by the receiver's IC card

c. Encryption and transfer of viewing information to the Viewing Information Collection Center

d. Distribution of viewing information by the Viewing Information Collection Center to the appropriate broadcaster groups

2.2.1.7 EMM Transmission

The system shall be able to send EMMs by individual broadcasters and broadcaster groups and support the following operations:

(1) Individual broadcaster delivery: For individual operation (single broadcaster group consisting of a single broadcaster), EMMs are sent using only the broadcaster's own channels.

(2) Joint broadcaster delivery: For joint operation (single broadcaster group consisting of multiple broadcasters), the same EMM is delivered using all channels operated by broadcasters participating in the broadcaster group.

(3) Mixed operation: A mix of individual and integrated delivery.

(4) EMM transmission by specific channel:

Related digital broadcast EMMs are collected and delivered on a specific channel in order to improve transmission efficiency. Under this approach, EMMs sent in batches such as those for contract renewal are sent on a specific channel, while EMMs sent online by Customer Center operators etc. are sent using individual broadcaster's channels.

2.2.1.8 ECM Transmission

What is stored as ECM once and is used for access control of playback can be transmitted.

Although ECMs can be delivered at a minimum interval of 100 milli seconds, this value only defines the minimum interval time of EMC transmissions. The operation shall be allowed to balance the interval time and transmission capacity in light of service content shall be allowed.

2.2.1.9 Program Operation Management System

Scrambling and ECM delivery can be performed according to the program schedule. Program operation management is performed within individual broadcaster's organizations (by their program delivery personnel).

2.2.1.10 Security Functionality
2.2.1.10.1 Information Encryption

(1) Encryption system

In order to maintain the security of signals stored and played back as well as programs received real-time, the encryption system uses the content key (Kc) controlled per program (content), in addition to three layer architecture-equivalent (with scrambling key (Ks), work key (Kw), and master key (Km)), which is as with the conditional access system described in Part 1.

Furthermore, the encryption system uses a specific key (Km') on the side of reception, in order to control playback of stored signals.

As associated information, it uses ECM encrypted with Kc (ECM-Kc), ECM for Kc transmission, EMM for Kc transmission, and EMM for Km' transmission, in addition to ECM (encrypted with Kw: ECM-Kw) and EMM (encrypted with Km).

(2) Administration functionality

In parallel with operation, the system provides support for dealing with piracy, for example by changing the encryption protocol.

2.2.1.11 Previewing

Viewers can preview a PPV program for a fixed amount of time from the start of the program. After that, the previewing shall be unavailable. It shall be possible to disable previewing at the climax of the program. It shall also be possible to allow previewing up to the end of the program by not setting an area where previewing is prohibited.

2.2.1.12 Repeat Broadcast Charging Control

When broadcasting a program with the same content on the same channel or multiple channels more than once, the system shall be controlled so that all showings can be viewed with a single charging (purchase).

2.3 Technical specifications for scrambling and associated information

2.3.1 Scrambling subsystem

2.3.1.1 Algorism for scrambling

The algorism for scrambling is by the MULTI2 cipher as with the conditional access system stipulated in Part 1 so that it is compatible also with the conventional receivers for reception and playback.

In other words, scrambling procedure is as shown in 2.3.1.2, and the following two systems are combined.

(1) For 64-bit encoded sequences, the original encoding is replaced with another binary code string using 64- and 256-bit variables.

(2) For code strings of less than 64 bits, the method described in (1) is used to generate a series of pseudo-random encoded sequences, which are combined to create the scrambled signal.

2.3.1.2 Scrambling Procedure

Notes
1. The MULTI2 cipher is described in section 2.3.1.3 and 2.3.1.4
2. (reg) indicates a register
3. ⊕ indicates an exclusive OR operation

(Notification Annexed Table 1)

2.3.1.3 MULTI2 Cipher

Key Schedule

Encryption

Data Key (D_K) (64-bit)

System Key (S_K)
(256-bit)

π 1

Plaintext (P) (64-bit)

π 1   N=1

S1 → π 2

Expanded key (W_K)
(256-bit)

π 2   N=2

a_1   w_1

S2
S3 → π 3

w_2

π 3   N=3

a_2   w_3

S4 → π 4

π 4   N=4

a_3   w_4

π 1

π 1   N=5

a_4

S5 → π 2

w_5

π 2   N=6

a_5

S6
S7 → π 3

w_6

π 3   N=7

a_6   w_7

S8 → π 4

π 4   N=8

a_7   w_8

π 1

π 4

a_8

Ciphertext (C) (64-bit)

$S_K = s_1 // s_2 // \cdots // s_8$
$a_1 = \pi_2 s_1 \cdot \pi_1(D_K)$
$w_1 = a_1[\text{left}]$
$a_2 = \pi_3 s_2, s_3(a_1)$
$w_2 = a_2[\text{right}]$
$a_3 = \pi_4 s_4(a_2)$
$w_3 = a_3[\text{left}]$
$a_4 = \pi_1(a_3)$
$w_4 = a_4[\text{right}]$
$a_5 = \pi_2 s_5(a_4)$
$w_5 = a_5[\text{left}]$
$a_6 = \pi_3 s_6, s_7(a_5)$
$w_6 = a_6[\text{right}]$
$a_7 = \pi_4 s_8(a_6)$
$w_7 = a_7[\text{left}]$
$a_8 = \pi_1(a_7)$
$w_8 = a_8[\text{right}]$
$W_K = w_1 // w_2 // \cdots // w_8$

$W_K = w_1 // w_2 // \cdots // w_8$
$N = 8m + \alpha \quad (0 \leq \alpha \leq 7)$
$f_{WK} = \pi_4 w_8 \cdot \pi_3 w_6, w_7 \cdot \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1$
$F_{WK} = f_{WK} \cdot f_{WK} \cdot \cdots \cdot f_{WK}$
Function fwk is repeated m times.
When $\alpha = 0$,
$C = F_{WK}(P)$
When $\alpha = 1$,
$C = \pi_1 \cdot F_{WK}(P)$
When $\alpha = 2$,
$C = \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 3$,
$C = \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 4$,
$C = \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 5$,
$C = \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 6$,
$C = \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 7$,
$C = \pi_3 w_6, w_7 \cdot \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$

Notes
1. π_1 to π_4 are elementary functions and are described in Section 2.3.1.4.
2. N represents the cipher stage.
3. || indicates a block union.
4. $a_x[\text{left}]$ represents the leftmost 32 bits of block a_x.
5. $a_x[\text{right}]$ represents the rightmost 32 bits of block a_x.

(Notification Annexed Table 1 Appendix 1)

2.3.1.4 Elementary Encryption Function

π_1

32-bit → 32-bit

$\pi_1(T)=T[left] \parallel (T[left] \oplus T[right])$

π_3

332-bit → 32-bit

x

k_2 → $x+k_2$
32-bit
y

$Rot_2(y)+y+1$
z

$Rot_8(z) \oplus z$
a

k_3 → $a+k_3$
32-bit
b

$Rot_1(b)-b$
c

$Rot_{16}(c) \oplus (c \vee x)$

x=T[left]
y=x+k_2
z=$Rot_2(y)+y+1$
a=$Rot_8(z) \oplus z$
b=a+k_3
c=$Rot_1(b)-b$
$\pi_3 k_2,k_3(T)=T[left] \parallel (T[right] \oplus (Rot_{16}(c) \oplus (c \vee x)))$

π_2

32-bit   32-bit

x

k_1 → $x+k_1$
32-bit
y

$Rot_1(y)+y-1$
z

$Rot_4(z) \oplus z$

x=T[right]
y=x+k_1
z=$Rot_1(y)+y-1$
$\pi_2 k_1(T)=(T[left] \oplus (Rot_4(z) \oplus z)) \parallel T[right]$

1. T represents elementary function input.
2. T[left] represents the leftmost 32 bits of block T.
3. T[right] represents the rightmost 32 bits of block T.
4. (+) indicates an exclusive OR operation.
5. + indicates an addition operation using a modulus of 2^{32}.
6. – indicates a subtraction operation using a modulus of 2^{32}.
7. Rot_s indicates a recursive bit shift s bits to the left.
8. V indicates a bitwise OR operation.
9. ‖ indicates a block union.

π_4

32-bit   32-bit

x

k_4 → $x+k_4$
32-bit
y

$Rot_2(y)+y+1$

x=T[right]
y=x+k_4
$\pi_4 k_4(T)=(T[left] \oplus (Rot_2(y)+y+1)) \parallel T[right]$

(Notification Annexed Table 1 Appendix 2)

2.3.1.5 Level at Which Scrambling is Performed

　MPEG-2 TS

2.3.1.6 Scrambling Scope

　The scope of the scrambling operation extends to the TS packet payload (excluding packets used to send transmission control signals and associated information), as with the conditional access system defined in Part 1, so that normal reception and playback are enabled on the conventional receivers.

2.3.1.7 Scrambling Unit

　Scrambling is performed by TS packet basis, as with the conditional access system defined in Part 1, so that normal reception and playback are enabled on the conventional receivers.

2.3.1.8 Time During Which the Same Lifetime of Key is Used

　Minimum of 1 second per ECM

2.3.2 Associated Information Subsystem for Stream-type Conditional Access System

2.3.2.1 Types of Associated Information

　Figure 2-1 provides the system architecture for stream-type conditional access system.
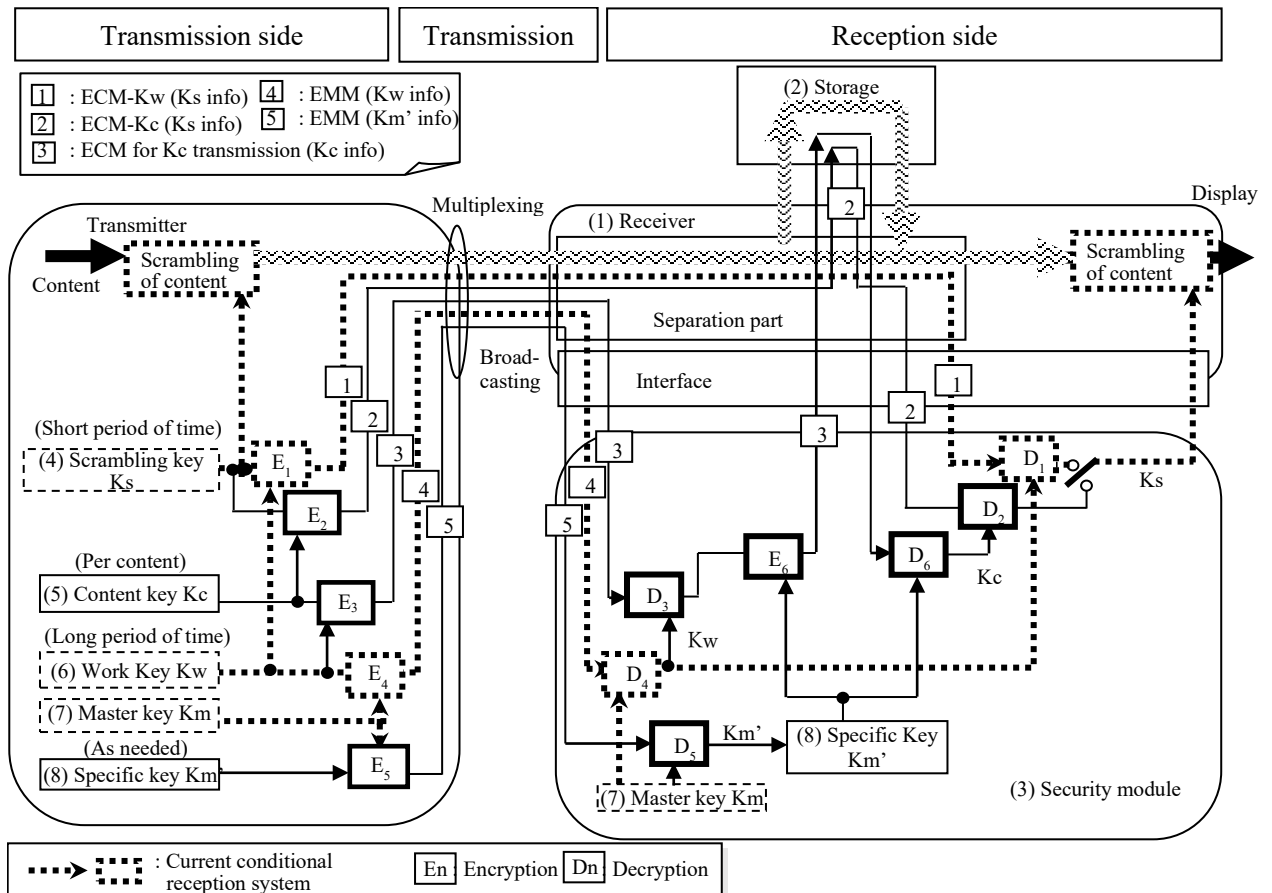
Figure 2-1 System architecture for stream-type conditional access system

The types of devices and keys shown in Figure 2-1 are as follows:

1) Receiver

Consists of a tuner, key information separation part, content descrambling part, and interface.

2) Storage

Stores content and key information to descramble them

3) Security module

Decrypts/re-encrypts various key information

4) Scrambling key Ks

A key to scramble content.

5) Content key Kc

A key to encrypt the scrambling key, which is changed per content.

6) Work key Kw

A key to encrypt the scrambling key or content key, and is shared per contract, per group, etc. A work key may be a common work key with the conditional access system, or a separate work key from the conditional reception access for the conditional playback system.

7) Master key Km

A key to encrypt the work key, and is a specific key for the security module. A master key may be a common master key with the conditional access system, or a separate master key from the conditional access system for the conditional playback system.

8) Specific key Km'

A key to re-encrypt when storing the content key. Km' is a key that can be set per security module. As Km' can be shared between more than one security module for control by broadcasters, stored content can be played on all receivers with a security module for which the same Km' has been set.

Common information of the stream-type conditional access system consists of the following three types of information:

1) ECM-Kw

Common information to transmit the scrambling key encrypted by the work key (① in Figure 2-1).

Basically, it is not stored on the reception side.

2) ECM-Kc

Common information to transmit the scrambling key encrypted by the content key (② in Figure 2-1).

When content are stored on the reception side, it is stored along with the content in the storage.

3) ECM for Kc transmission

Common information to transmit the content key (③ in Figure 2-1) encrypted by the work key. When content is stored on the reception side, the content key used for re-encryption is stored along with the content in the storage.

Individual information of the stream-type conditional access system consists of the following three types of information:

1) EMM for Kw transmission

Individual information to transmit the work key per viewer (④ in Figure 2-1).

2) EMM for Kc transmission

Individual information to transmit the content key per viewer. EMM for Kc transmission is used when transmitting Kc to viewers who were unable to receive ECM for Kc transmission.

3) EMM for Km' transmission

Individual information to transmit the specific key per viewer (⑤ in Figure 2-1).

4) Other EMMs

Individual information, which does not correspond to the above 1), 2), and 3), to transmit information related to the contract, etc.

See 2.5 for simplified operation using the same ECM between the conditional access and conditional playback.

2.3.2.2 Format of Associated Information

Broadcasters can select an integrated or independent format for individual information.

2.3.2.3 ECM

2.3.2.3.1 Basic ECM Structure

Common information used for stream-type access control is transmitted in the section format.

The value of table identifiers (table_id) within the ECM section header part shall be 0x82, which indicates ECM. With regard to their three types of ECMs (ECM-Kc, ECM for Kc transmission, and ECM-Kw), when transmitting different types of ECMs with the TS packet of the same PID, they can be identified with the value of "table identifier extension (table_id_extension) within the section header.

(1) In the case of ECM-Kc and ECM-Kw transmissions, each TS (Transport Stream) packet contains an ECM section.

Figure 2-2 illustrates the basic structure of the TS packets used to transmit ECM-Kc and ECM-Kw.

TS Packet (188Bytes)		
TS Header*	ECM Area	
	ECM Section	Stuffing
5		
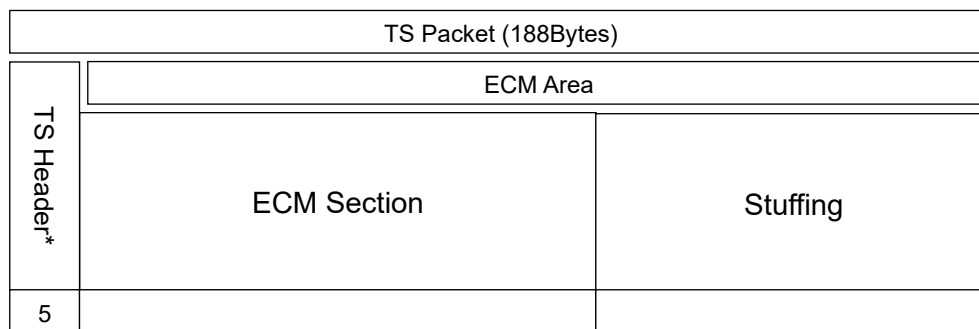
*Includes pointer field.

Figure 2-2 TS Packet Structure to transmit ECM-Kc and ECM-Kw

(2) The following describes the ECM section and the basic structure of the ECM payload:
- The entire ECM section is subject to a section CRC.
- The ECM payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.
- Only necessary ECM function information is inserted into the variable part of the ECM.

Figure 2-3 illustrates the ECM-Kw section structure, Figure 2-4 the ECM-Kc section structure, and Figure 2-5 the ECM for Kc transmission section structure.

ECM Section					
ECM Section Header	ECM				Section CRC
	Unencrypted Part	Encrypted Part			
	ECM Fixed Part	ECM Variable Part		Tamper Detection	
8 Bytes	26 Bytes			4 Bytes	4 Bytes
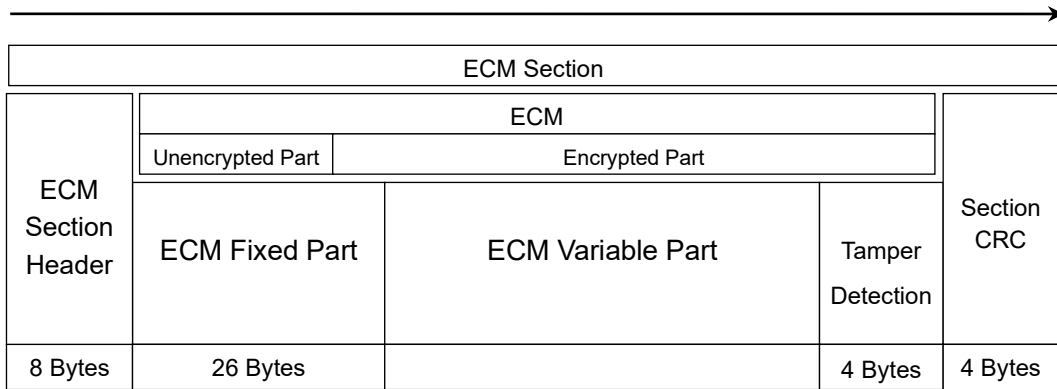
Figure 2-3 ECM-Kw Section Structure

ECM Section					
ECM Section Header	ECM				Section CRC
	Unencrypted	Encrypted Part	Unencrypted		
	ECM Fixed Part	ECM Variable Part		Tamper Detection	
8 Bytes	30 Bytes			32 Bytes	4 Bytes
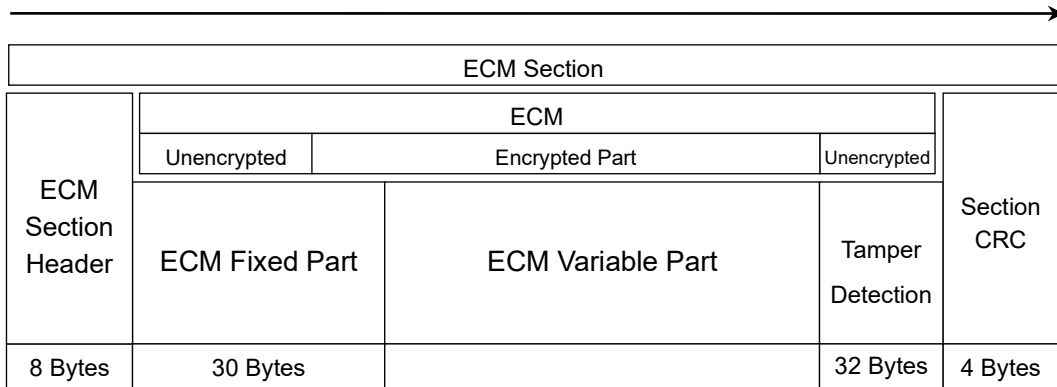
Figure 2-4 ECM-Kc Section Structure

ECM Section					
ECM Section Header	ECM				Section CRC
	Unencrypted	Encrypted Part	Unencrypted		
	ECM Fixed Part	ECM Variable Part		Tamper Detection	
8 Bytes	13 Bytes			32 Bytes	4 Bytes
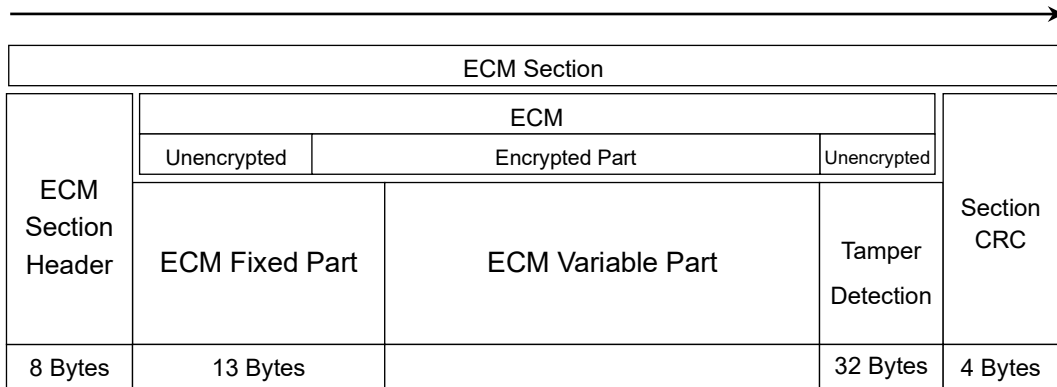
Figure 2-5 Section Structure of ECM for Kc Transmission

2.3.2.3.2 ECM Details (1) ECM-Kw

(1) ECM-Kw section structure

Table 2-1 details the ECM-Kw section structure.

Table 2-1 ECM-Kw Section Structure

Structure				Notes
ECM section	ECM section header (Table identifier 0x82) (Table identifier extension 0x0000)			8 Bytes
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster identifier	1 Byte
			Work key identifier	1 Byte
			Scrambling key Ks (odd)	8 Bytes
			Scrambling key Ks (even)	8 Bytes
			Judgment type	1 Byte
			Date/time (Date MJD + Time BCD)	5 Bytes
			Recording control	1 Byte
		Variable part		Capable of accommodating various functional information such as charging information
		Tamper detection		4 Bytes
	Section CRC			4 Bytes

(2) ECM-Kw fixed part

1) Protocol number

Protocol number used to make the following information known to the reception side: information contained in ECM-Kw, lengths of each information, and overall structure of ECM-Kw

2) Broadcaster identifier

Code used to identify service broadcaster groups in conditional access system operation; combined with the work key identifier, specifies individual information to be referenced.

3) Work key identifier

Identifier information related to the work key used to encrypt ECM-Kw

4) Scrambling key Ks (odd/even)

Scrambling key Ks encrypted by the work key Kw. Sends pair of two including the current and next keys Ks.

5) Judgment type

Indicates the viewing judgment type such as free, PPV, etc.

6) Date/time

Date/time of ECM-Kw transmission. Indicates the current date/time to be used in viewing judgments. Date MJD + time BCD. Use MJD format as described in ARIB STD-B10 Part 2 Appendix C.

7) Recording control

Indicates the recording conditions for the program in question (recordable, not recordable, recordable by subscribers only, etc.).

8) Tamper detection

Code used to detect tampering with the ECM payload.

(3) An example of ECM-Kw variable part

The variable part of the ECM-Kw payload accommodates only necessary function information depending on the transmission objective of the associated common information. Function information uses a descriptor format. Below is an example of function information:

1) Function information related to PPV judgment

Indicates program attributes required to make a viewing judgment, the program number, the PPV viewing fee, and other information for programs judged to be PPV.

2) Function information related to erasure

Erases specific individual information from the specified IC card. Equivalent to the "control information" described in Telecommunications Technology Council Inquiry Report No. 17.

2.3.2.3.3 ECM details (2)   ECM-Kc

(1) ECM-Kc section structure

Table 2-2 details the ECM-Kc section structure.

Table 2-2 ECM-Kc Section Structure

Structure				Notes
ECM section	ECM section header (Table identifier 0x82) (Table identifier extension 0x0001)			8 Bytes
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster identifier	2 Bytes
			Content key identifier	4 Bytes
			Scrambling key Ks (odd)	8 Bytes
			Scrambling key Ks (even)	8 Bytes
			Judgment type	1 Byte
			Date/time (Date MJD + Time BCD)	5 Bytes
			Recording control	1 Byte
		Variable part		Capable of accommodating various functional information such as charging information
		Tamper detection		32 Bytes
	Section CRC			4 Bytes

(2) ECM-Kc fixed part

1) Protocol number

   Protocol number used to make the following information known to the reception side: information contained in ECM-Kc, lengths of each information, and overall structure of ECM-Kc

2) Broadcaster identifier

   Code used to identify service broadcaster groups in conditional access system operation; combined with the content key identifier, specifies individual information to be referenced.

3) Content key identifier

   Identifier information related to the content key used to encrypt ECM-Kc

4) Scrambling key Ks (odd/even)

   Scrambling key Ks encrypted by the content key Kc. Sends pair of two including the current and next keys Ks.

5) Judgment type

   Indicates the viewing judgment type such as free, PPV, etc.

6) Date/time

   Date/time of ECM-Kc transmission. Used in a supplementary manner in viewing

judgments. Date MJD + time BCD. Use MJD format as described in ARIB STD-B10 Part 2 Appendix C.

7) Recording control

Indicates the recording conditions for the program in question (recordable, not recordable, recordable by subscribers only, etc.).

8) Tamper detection

Code used to detect tampering with the ECM payload.

(3) An example of ECM-Kc variable part

The variable part of the ECM-Kc payload accommodates only necessary function information depending on the form of the service. Function information uses a descriptor format. Below is an example of function information:

1) Information related to contract judgment.

2.3.2.3.4 ECM for Kc transmission Details

(1) Structure of ECM section for Kc transmission

Table 2-3 details the structure of the ECM section for Kc transmission.

Table 2-3 Structure of ECM section for Kc transmission

Structure				Notes
ECM section	ECM section header (Table identifier 0x82) (Table identifier extension 0x0002)			8 Bytes
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster identifier	2 Bytes
			Work key identifier	10 Bytes
		Variable part		Capable of accommodating various functional information
		Tamper detection		32 Bytes
	Section CRC			4 Bytes

(2) Fixed part of ECM for Kc transmission

1) Protocol number

Protocol number used to make the following information known to the reception side: information contained in ECM for Kc transmission, lengths of each information, and overall structure of ECM for Kc transmission.

2) Broadcaster identifier

Code used to identify service broadcaster groups in conditional access system operation; combined with the work key identifier, specifies individual information to be referenced.

3) Work key identifier

Identifier information related to the work key used to encrypt ECM for Kc transmission.

4) Tamper detection

Code used to detect tampering with the ECM payload.

(3) An example of the variable part of ECM for Kc transmission

The variable part accommodates only necessary function information depending on the form of the service. Function information uses a descriptor format. Below is an example of function information:

1) Content key Kc

Content key Kc encrypted with the work key Km

2) Content key identifier

Identifier name when using the content key Kc transmitted by the ECM for Kc transmission.

3) Charging information, contract judgment information

4) Expiration date

Expiration date of the content key Kc

5) Function information related to the specification of the storage place for the content key

6) Function information related to identification of re-encryption key

7) Usage conditions

Used when sending conditions of content usage such as the time frame for viewing, information on viewing limitation on each block per scene, information related to copying limitation, etc.

2.3.2.4 EMM

2.3.2.4.1 EMM Overview

Individual information used for stream-type access control is transmitted respectively in section formats. The value of "table identifier (table_id)" within the EMM section header shall be 0x84 indicating EMM, and the types of EMM can be identified with the value of "table identifier extension (table_id_extension)" within the section header.

(1) The following describes the basic EMM structure:

- The EMM section is capable of transmitting multiple EMM payloads using multiplexing in the section.

- The entire EMM section is subject to a CRC.

(2) The following describes the basic structure of the EMM payload:

- The EMM payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.

- Only necessary EMM function information is inserted into the variable part of the EMM.

- The card ID number (6 bytes) and the associated information byte length (2 byte) are placed at the beginning of the EMM fixed part (unencrypted part). The receiver filters

this area to identify EMM payloads addressed to itself.

(3) Figure 2-6 provides an example of the EMM section structure. (The figure shows a single EMM section with 3 EMM payloads.)
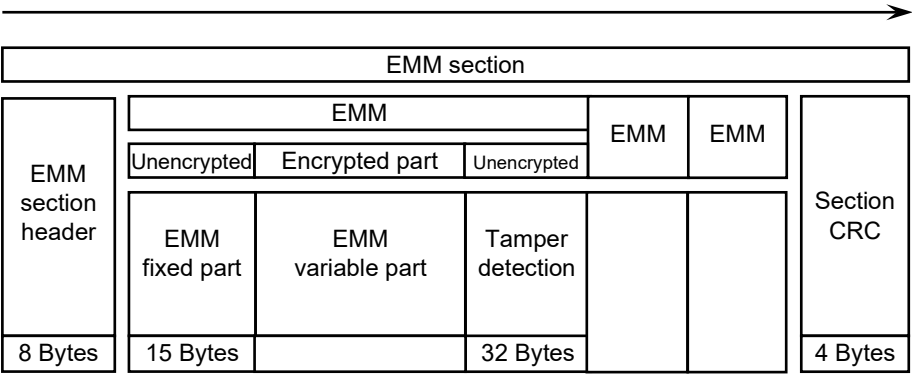
Figure 2-6 EMM Section Structure

2.3.2.4.2 EMM details

（1）EMM section structure

Table 2-4 details the EMM section structure.

Table 2-4 EMM Section Structure

Structure				Notes
EMM section	EMM section header (Table identifier 0x84) (Table identifier (*1) 0x0000)			8 Bytes
	EMM payload 1	Fixed part	Decoder identifier number (Card ID)	6 Bytes
			Associated information byte length	2 Bytes
			Protocol number	1 Byte
			Broadcaster identifier	2 Bytes
			Update number	2 Bytes
			Expiration date	2 Bytes
		Variable part		Capable of accommodating various functional information
		Tamper detection		32 Bytes
	Payload 2	(Same as above)		
	Payload 3	(Same as above)		
	⋮	⋮		
	Payload n	(Same as above)		
	Section CRC			4 Bytes

(*1) When identifying various EMMs using the table identifier extension (reserved), the following values are used:

> 0x0001 EMM for Kc transmission
> 0x0002 EMM for Km' transmission
> 0x0003 Other EMMs

(2) EMM fixed part
  1) Decoder identifier number (card ID)
    ・Information on for which viewers the information is intended (number identifying the target IC card)
  2) Associated information byte length
    ・Describes the byte length from the protocol number to the tamper detection field and serves as an offset that points to the next EMM payload's card ID when sending multiple EMM payloads in a single section.
  3) Protocol number
    ・Information contained in individual information, lengths of each information, and the structure of the overall individual information to be made known to the reception side. Code that serves to identify processing functions on the IC card, encryption algorithms, etc.
  4) Broadcaster identifier
    ・Code used to identify service broadcaster groups in access control system operation
  5) Update number
    ・Number that is increased when individual information is updated
  6) Expiration date
    ・Indicates when individual information expires
  7) Tamper detection
    ・Code used to detect tampering with the EMM payload

(3) Example of EMM variable part
    The variable part of the EMM payload accommodates only necessary function information depending on the transmission objective of the associated EMM. Function information uses a descriptor format. Below is an example of function information:
  (a) EMM
    1) Function information related to the work key
    Sends the work key identifier and the work key.
    2) Function information related to deferred-payment PPV settings
    Sets PPV contract information. Also used to specify the next regular call-in date/time and other data.
    3) Function information related to power-on control
    Sets when to perform power-on control etc. used to lower power consumption.
    4) Function information related to overall control.
    Performs control operations (password deletion, etc.) shared among all broadcaster groups as seen from the decoder.
    5) Function information related to forced call-ins
    Instructs the decoder to perform a forced call-in.
  (b) EMM for Kc transmission

1) Content key Kc

Content key Kc encrypted with the master key Km. Used when sent per card.

2) Content key identifier

Code used to identify the content key Kc.

3) Charging information

4) Expiration date

Expiration date of the content key Kc.

5) Function information related to the specification of the storage place for the content key

6) Function information related to identification of re-encryption key

7) Usage conditions

Used when sending conditions of content usage such as the time frame for viewing, information on viewing limitation on each block per scene, information related to copying limitation, etc.

(c) EMM for Km' transmission

1) Km'

Km' encrypted with the master key Km. Additionally sets Km' for grouping more than one card.

2) Km' identifier

Code used to identify Km'.

3) Expiration date

Expiration date of Km'

2.3.2.5 Message Information (EMM)

2.3.2.5.1 EMM common messages

(1) Basic structure of EMM common messages

EMM common messages are transmitted using the MPEG-2 system section format (EMM message section). The following describes the basic structure of the EMM message section:

- The entire EMM message section is subject to a CRC.
- Each section is used to send a single message.
- The EMM message section header's table_id_extension signifies the Fixed Message Sentence Number for the message, and ranges from 0x0001 to 0xFFFF.
- EMM message sections are not encrypted.
- EMM common messages are sent by broadcaster groups.

Figure 2-7 illustrates the EMM common message section structure.
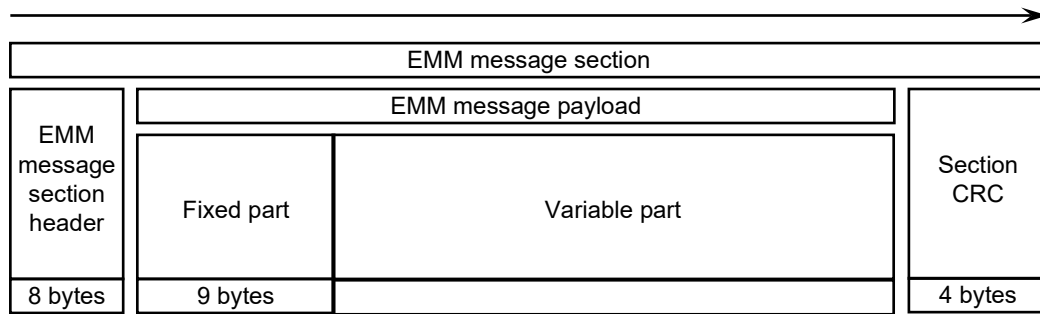
Figure 2-7 EMM Common Message Section Structure

(2) EMM common message section structure

Table 2-5 details the section structure of EMM common messages.

Table 2-5 Section Structure of EMM Common Messages

Structure				Notes
EMM message section		EMM message section header		8 Bytes
	EMM message payload	Fixed part	Broadcaster identifier	1 Byte
			Kind of Automatic display deletion	1 Byte
			Automatic display duration time 1	1 Byte
			Automatic display duration time 2	1 Byte
			Automatic display duration time 3	1 Byte
			Number of times for Automatic display	1 Byte
			Format number	1 Byte
			Message length	2 Bytes
		Variable part	Message code payload	N Bytes
	CRC error detection			4 Bytes

(3) EMM common message section details

Table 2-6 EMM Common Message Section Details

Syntax	Description	No. of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	Fixed Message Sentence Number (0x0001 to 0xFFFF)	16
reserved		2
version_number		5
current_next_indicator		1
section_number		8
last_section_number		8
ca_broadcaster_group_ID	Broadcaster identifier	8
deletion_status	Kind of Automatic message deletion	8
displaying_duration1	Automatic display duration time 1	8
displaying_duration2	Automatic display duration time 2	8
displaying_duration3	Automatic display duration time 3	8
displaying_cycle	Number of times for Automatic display	8
format_version	Format number	8
message_length	Message length	16
message_area	Message code payload	N
EMM_message_section_CRC	CRC error detection	32

(4) Details of EMM common message fields

The following provides more detailed information for principal EMM common message fields:

1) Fixed Message Sentence Number (table_id_extension)

Indicates the Fixed Message Sentence Number (0x0001 to 0xFFFF) being sent by the EMM common message in question.

2) Broadcaster identifier

Code used to identify broadcaster groups in conditional access system operation.

3) Kind of Automatic display deletion

- Indicates the following type for the display of messages stored on the IC card (automatic display messages):

    a. 0x00: Erasable; message can be erased by viewer.

    b. 0x01: Not erasable; message cannot be erased by viewer.

    c. 0x02: Display/erase; indicates one of the following display control operations:

（see note 1）

    i.   When the automatic display/erasure type for the EMM common message being automatically displayed is 0x02, the receiver shall not display the automatic display message is not display.

    ii.   When the automatic display erasure type for the EMM common message currently being used for an automatic display in progress is updated to the value 0x02 （see note 2）, the receiver shall erase that automatic display message.

Note 1: The automatic display duration （1, 2, and 3）, format number, message length, automatic display count, and message code payload are ignored.

Note 2: While an automatic display message is being displayed, the receiver monitors the version_number field for the EMM common message being displayed to detect updates. The version_number field is also monitored when the automatic display erasure type is set to "display/erase 0x02."

4) Automatic Display Duration Time 1, 2, and 3

- After service selection for the display of messages stored on the IC card （automatic display messages）, specifies the duration of the automatic display in 0.1-minute increments （for a total of 0 to 25.4 minutes）. The setting 0xFF is a special value used to indicate indefinite display of the message.

5) Number of times for Automatic display

- Indicates how many times to repeat the duration from T1 to T3.
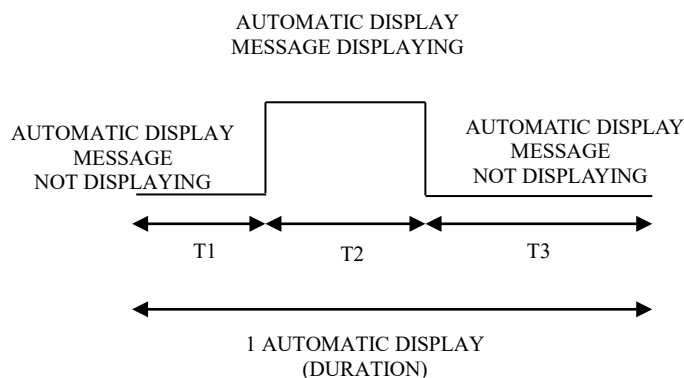
Figure 2-8 Automatic Display Duration Time and the direction of displaying the message

6) Format number

Indicates the format of the message code payload.

7) Message length

Indicates the number of bytes in the Message code payload.

8) Message code payload

Stores the specific contents of the message (fixed sentence).

2.3.2.5.2 EMM Individual Messages

EMM Individual Messages are defined by Part 1 Conditional Access System.

2.3.2.6 Association with SI

2.3.2.6.1 Specific-channel EMM Transmission

A descriptor is defined in the NIT for specifying the channel when transmitting EMMs on a specific channel (see Chapter 3 Section 3.2.6.2, "EMM (Individual Information)" and Reference 3, "8. EMM Transmission") of Part 1.

a. Descriptor name

CA_EMM_TS descriptor (CA_emm_ts_descriptor)

b. Location

First NIT descriptor region

c. Data structure

Table 2-7 CA_EMM_TS Descriptor Data Structure

Data structure	No. of bits	Mnemonic
CA_emm_ts_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_id	16	uimsbf
transport_stream_id *1)	16	uimsbf
original_network_id *2)	16	uimsbf
power_supply_period (Note)	8	uimsbf
}		

*1) Indicates the transport stream being used to transmit the EMM.
*2) Indicates the original distribution system network.
Note: Indicates the period when power supply is tuned on. Unit: Minute

2.3.2.6.2 PPV

A descriptor is located in either the SDT or EIT for checking whether a program scheduled for broadcast is a flat/tier type service or event, or a PPV event, and for checking whether it is possible to reserve the program for viewing (recording) in advance.

a. Descriptor name

CA contract information descriptor (CA_contract_info_descriptor)

b. Descriptor location

A descriptor is located in either the SDT or EIT. In the event that both table contains descriptors for a single event, the descriptor in EIT takes precedence. One descriptor must be allocated and sent for each distinct charging unit (ECM).

c. Data structure

Table 2-8 CA Contract Information Descriptor Data Structure

Data structure	No. of bits	Mnemonic
CA_contract_info_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_id	16	uimsbf
CA_unit_id	4	uimsbf
num_of_component	4	uimsbf
for(i = 0;i<num_of_component;i++) {		
component_tag	8	uimsbf
}		
contract_verification_info_length	8	uimsbf
for(i=0;i<contract_verification_info_length ;i++) {		
contract_verification_info	8	uimsbf
}		
fee_name_length	8	uimsbf
for (i = 0;i< fee_name_length ;i++) {		
fee_name	8	uimsbf
}		
}		

1) CA_unit_id:

- This 4-bit field is used to distinguish between the charging unit/non-charging unit to which the component belongs. The value 0x0 is not used with this descriptor.

  0x0: Non-charging unit group

  0x1: Charging unit group including default event ES group

  0x2 to 0xF: Charging unit group other than above.

2) contract_verification_info (contract verification information):

- When located in the SDT, this field is used to confirm whether the service (or ES group comprising a service) in question can be reserved for viewing (recording). In order to perform this advance confirmation, the receiver provides contract verification information and the planned viewing date to the IC card, which responds with the result of a judgment of whether the program can be viewed on the specified date.

- When located in the EIT, this field is used to determine whether the event in question is a flat/tier type event (or ES group comprising an event) or a PPV type event (or ES group comprising an event). If the event in question is a PPV type event (or ES group comprising an event), the descriptor is used to determine the viewing fee and recording request information as well as to confirm whether the event in question (or ES group comprising an event) can be reserved for viewing (recording). In order to perform this

advance confirmation, the receiver provides contract verification information and the planned viewing date to the IC card, which responds the preceding information with the result of a judgment of whether the program can be viewed (recorded) based on the preceding information and specified date.

3) fee_name (fee name):

- This field provides information about the fee for the ES group being described. For a pay data broadcast associated with a cooking program, for example, it might describe a "Cooking Data Service."

2.3.2.6.3 EMM Message Reception

A descriptor is located in the CAT to facilitate the display of automatic display messages by indicating the broadcaster group providing the service, the direction of displaying the automatic display message, and the delay time for the display of the automatic display message.

a. Descriptor name

CA service descriptor (CA_service_descriptor)

b. Data structure

Table 2-9 CA Service Descriptor Data Structure

Data structure	No. of bits	Mnemonic
CA_service_descriptor () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_system_id	16	uimsbf
ca_broadcaster_group_id *1)	8	uimsbf
message_control *2)	8	uimsbf
for(i=0;i<N;i++) {		
service_id	16	uimsbf
}		
}		

*1) ca_broadcaster_group_id: code used to identify broadcaster groups
*2) message_control: Delay time

Indicates the delay time in days before the automatic display message previously embedded in the IC card is displayed. A value of 0xFF indicates that the delay time is disabled (that the start of the delay time has been put on hold).

- 0x00 to 0xFE: Delay time (in days) until the display of the automatic display message
- 0xFF: Start of delay time has been put on hold.

When playing a previously received and stored program on a receiver with stored reception functionality, a least significant bit of 1 for the delay time indicates that the automatic display message will not be displayed.

2.3.2.6.4 Association of stream-type content and associated information

In order to enable referencing associated information with a stored content (ECM, EMM) when playing the said content, a conditional playback system descriptor is defined to be transmitted as a transmission control signal.

By transmitting this conditional playback system descriptor with PMT and CAT, the reception side can identify where the ECM-Kc, ECM for Kc transmission, and EMM is sent, which are related to stream-type access control for the said content. Since ECM-Kw is common with conditional access system, the receiver can reach the ECM-Kw by referring to conditional_access_system_descriptor or access control descriptor with PMT.

        a. Name of descriptor

           Conditional playback system descriptor

        b. Data structure

Table 2-10 Conditional playback system descriptor data structure

Data Structure		No. of bits	Mnemonic
Conditional_playback_descriptor( ){			
descriptor_tag		8	uimsbf
descriptor_length		8	uimsbf
CA_system_id	*1)	16	uimsbf
private_data		3	
CA_PID	*2)	13	
for(i= 0; I < N; I++){			
private_data_byte	*3)	8	uimsbf
}			
}			

*1) CA_system_id (conditional playback system identifier): Indicates the number to identify the conditional playback system.

*2) CA_PID (packet identifier containing associated information): An area to write the PID of the TS packet including associated information. The following is specified by means of the transmission position.

    ・ When sending the conditional playback system descriptor with the PMT:
        Specifies the PID of the TS packet that transmits ECM

    ・ When sending the conditional playback system descriptor with the CAT:
        Specifies the PID of the TS packet that transmits EMM

*3) private_data_byte (broadcaster groups data): When sending the conditional playback system descriptor with the PMT, the leading one byte is the reserved area while the second and third bytes from the beginning are the area to write PID of ECM for Kc transmission.

2.3.2.6.5 Demonstration of control information regarding storage other than digital copy control descriptor

The conditional playback system requires a descriptor in order to specify information such as availability of storage of stream when storing content in the receivers. For this purpose, the content usage descriptor defined by the ARIB STD-B10 is used.

At this time, the extended information requires defining. For this descriptor, see also Chapter 17 "Right Protection Functions" of the ARIB STD-B21.

Defining extended information enables setting storage control information per demodulation stage of content by the receivers, such as TS stream before descrambling, TS stream after descrambling, after TS demultiplexing, etc. The specific usage is defined in the operation specification.

2.4 Stream-type access control simplified method

As one service model of the stream-type access control method, a service model whereby the current realtime broadcasts (PPV broadcasts) are temporarily stored and viewed later by purchasing in a "time-shift" way. The content administration after purchase is based on the current recording control. Such a service model can be realized by diverting the current system by means of the following simplified operation in the conditional playback system of stream-type content shown in 2.3.

1) The work key (Kw) used for the conditional access system defined in Part 1 serves also as the content key (Kc) to encrypt the scrambling key (Ks) at the time of conditional playback. The same ECM is used for conditional reception and conditional playback without introducing a new ECM for the current conditional access system.

2) In relation to storage for conditional playback, scrambled stream and ECM for the conditional access system defined in Part 1 are temporarily stored in the hard disk.

3) The same receiver is used for temporary storage and playback. The specific key (Km') is not used.

4) As a result, a structure based on the conditional access system of the conventional digital broadcasting whereby the PPV is purchased at the time of viewing after storing is achieved.

5) For availability of temporary storage before charging and content protection, the right protection system defined in Chapter 17 of the ARIB STD-B21 is used.

The following points should be noted in carrying out this simplified operation:

1) ECM-Kw shall not be stored in the case of conditional playback using ECM-Kc or ECM for Kc transmission (in the case of stream-type access control system described in 2.3).

2) ECM-Kc or ECM for Kc transmission shall not be transmitted in the case of conditional playback using ECM-Kw (in the case of stream-type access control simplified system described in 2.4).

Chapter 3 Access Control System for File-type Content

3.1 General Matters

The standard stipulated in this chapter applies to conditional playback of file-type content.

3.2 Functional Specifications

3.2.1 Specifications of Encryption and Associated Information

3.2.1.1 General Functions

This conditional playback system shall contain the following functions:

（1） Functions whereby the contract information can be operated independently of the content and the charging control information, and playback only by the contractant is feasible

（2） Functions to control the licensed use / charging per content (minimum: scene unit or file unit) at the time of playback

（3） Functions to set up more than one charging unit within the content which are stored

（4） Functions whereby one charging unit can consist of more than one file, and playback per file is feasible

（5） Functions to select the encryption system depending on the characteristics of service formats per content such as video, audio, text, etc.

（6） Functions to control the terminals where playback on other than the receiving terminal is feasible

3.2.1.2 Ensuring and Supporting Security

The system shall offer advanced security functionality and address piracy in parallel with pay broadcasting operation.

As a unit for controlling security, control per stored and played program (content) shall be enabled in addition to control per file.

3.2.2 Service Scenarios of Broadcast Service

3.2.2.1 Broadcast Service

This standard shall be applied to the following service formats:

（1） Playback and viewing service of file-type data (stored content) that is transmitted in the transmission frequency band (service channel) after the time of storage:

　1) Data broadcasts

Data broadcasts use a dual billing structure consisting of stream (channel) and file (content) billing. This chapter is subjected to file-type services exclusively for viewing after storing.

（2） Services to play and view after storing signals of file-type data (stored content) services of integrated digital broadcasts that combine a variety of information including video, audio,

and data in a flexible format (ISDB; Integrated Services Digital Broadcasting)

(3) Viewing formats

    1) Conditional playback

     Stored without decrypting, and viewed after decrypting at the time of playback.

3.2.2.2 Fee Structure

  The system shall support the following fee structures.

(1) Flat/tier

    1) The system shall support the following fee structures:

      i. Flat viewing by service channel

      ii. Service channel-defined tiers

      iii. Broadcaster-defined tiers

      iv. Broadcaster group-defined tiers

    2) Fees shall be able to be set by day, month, 6-month period, year, etc.

    3) Series purchases

     Multiple programs shall be able to be grouped as a series for viewing under tier contracts.

(2) Pay per Use (PPU)

    Charging per content unit depending on the usage formats

a. Purchase of PPU

  The following operations shall be feasible with regard to purchase of the PPU.

     i.   Promotion: Having selected PPU content with unpurchased promotion, automatic playback of the promotion should also be enabled (data broadcasts only)

     ii.   Purchase: Purchases require viewers to confirm their intention to purchase before the transaction is processed

b. Setting fees

  Setting of more than one fee corresponding to the following should be enabled:

     i.   Setting of fees depending on the period of usage of content should be feasible.

     ii.   Setting of fees depending on the usages of content listed below should be feasible.

        1) Viewing only

        2) Output to external media only

        3) Combination of 1) and 2)

c. Viewing data call-in function

     i.   Periodic call-in: System shall call in during a specified period of time, generally once per month.

     ii.   Call-in when viewing data full: System shall automatically call in once a certain amount of viewing data has been stored.

     iii.   Forced call-in control: Forced call-ins shall be initiated and stopped by ID.

     iv.   User call-in: Viewers shall be allowed to initiate call-ins by operating their receivers.

v.   Ad hoc call-in: Call-in shall be initiated at the time of purchase of content by users.
(3) Free

The system shall provide a means of judging viewability that includes operability and is separate from viewing fee transactions.

3.2.2.3 Fee Payment Systems

The system supports the following fee payment systems:

(1) Payment at time of contract

For flat and tier billing formats, payment is at the time of contract.

(2) Viewing-based payment (pay later): Supports IPPU.

(3) Lump-sum payment (pay first): Supports IPPU with prepaid card or similar.

3.2.2.4 Contract scheme

The system shall support implementation of the following contract formats.

(1) Contracting Entity

Contracts are made by broadcaster groups as well as per content.

(2) Contracts can be made based on the selection of the desired individual fee structure or of a combination thereof.

1) Flat/tier billing contract by broadcaster group

2) PPU billing contract by broadcaster group

3) Integrated flat/tier and PPU billing contract by broadcaster group.

For flat/tier billing, the system also shall support package contracts.

3.2.2.5 Collection of Viewing Information

The system also shall be able to provide the following functionality and operations by means of terminal power-on call-in control and a separately defined viewing information collection network protocol.

1) Collect viewing information by means of terminal call-in using a public communication network.

2) Compatibility with two-way functionality

3.2.2.6 Transmission of EMM

The system shall be able to send EMMs to individual broadcasters and broadcaster groups effectively.

3.2.2.7 Transmission of ACI

Frequency of transmission of ACIs depends on the service schemes.

3.2.2.8 Security Functionality

(1) Associated Information Encryption

1) Encryption System

The encryption system uses three layer structure with common and private keys which are DES-equivalent or over.

2) Administration functionality

In parallel with the operation, the system provides support for dealing with piracy, for example by changing the encryption protocol.

3.3 Encryption System

3.3.1 Encryption Subject

- "blockDataByte" of DDB messages of the data carousel defined in Volume 3, ARIB STD-B24

3.3.2 Encryption Unit

- Per unit of resource (file) of data carousel defined in Volume 3, ARIB STD-B24

3.3.3 Encryption Algorism

- Identified by encrypt_id of content information header defined in 3.4.4.4 and encryption of LLI defined in 3.4.4.6.

3.3.4 Encryption Identification

- Identified as an encryption file by means of the Encryption Descriptor defined in 3.4.4.7 and LLI defined in 3.4.4.6.

3.4 Associated Information Subsystem

3.4.1 Associated Information Types

- ACI (Common Information), EMM (Individual Information)

3.4.2 ACI

3.4.2.1 ACI Overview

- ACI is transmitted by the media type defined in 3.4.4.10 as one resource (file) of the data carousel defined in Volume 3, ARIB STD-B24. ACI corresponding to an encryption file is positioned within the same carousel.
- Includes information in which usage conditions to judge usage by users defined per content, content key to de-encrypt depending on the usage conditions, etc.
- ACI can be encrypted except for the protocol number and broadcaster identifier.
- The encryption file and ACI are associated with one of the following:
  - Specified with the content information header defined in 3.4.4.4 and ACG descriptor defined in 3.4.4.5.
  - Specified with LLI defined in 3.4.4.6.

3.4.2.2 ACI Structure

Table 3-1 provides the ACI structure.

Table 3-1 ACI structure

Structure	Notes
Protocol number	1 Byte
Broadcaster identifier	2 Bytes
Work key identifier	10 Bytes
Broadcaster area	Positions various information

1) Protocol number

Code to identify information contained in the ACI, length of each piece of information, and the overall structure of ACI

2) Broadcaster identifier

Code to identify the service provider for the operation.

3) Work key identifier

Code to identify encryption key for ACI.

4) Broadcaster area

An area in which different types of information can be positioned depending on the service schemes. The following is an example of information to be positioned.

- Information related to contract judgment.
- Information related to usage conditions (expiration date, etc.).
- Information related to content key.
- Information related to tamper detection.

3.4.3 EMM

3.4.3.1 EMM Overview

・ EMM is transmitted with the EMM section as defined in the Ministry of Internal Affairs and Communications Notification No.233, 2014.

・ EMM is the information related to the contracts between service providers and users, which differ for each user. Asynchronously distributed to individual users with distribution of content.

・ EMM can be partially encrypted.

3.4.3.2 EMM structure

Table 3-2 provides the EMM structure transmitted with the EMM section.

Table 3-2 EMM structure

Structure	Notes
Decoder identifier number	6 Bytes
Associated information byte length	2 Bytes
Protocol number	1 Byte
Broadcaster area	Positions various information

1) Decoder identifier number

Code identifying the target user.

2) Associated information byte length

Describes the byte length which is a total of the protocol number and broadcaster area and serves as an offset that points to the leading position of the next piece of individual information when sending multiple individual pieces of information in a single section.

3) Protocol number

Code to identify information contained in EMM, lengths of each piece of information, and overall structure of EMM.

4) Broadcaster area

An area in which different pieces of information can be positioned depending on the contract formats between service providers and users. The following is an example of information to be positioned. The following is an example of information:

- Information related to broadcaster identifier.
- Information related to the update number.
- Information related to the expiration date.
- Information related to the work key.
- Information related to the contract.
- Information related to tamper detection.

3.4.4 ACI Position Specification

The ACI position corresponding to content is specified with the following:

1) Content information header
2) ACG (Access Control Group) descriptor
3) License link information (LLI)

3.4.4.1 ACI Position Specification with Content Information Header

- The ACI position is specified with ACI_URI_path of the content information header defined in 3.4.4.4.

3.4.4.2 ACI Position Specification with ACG Descriptor

・ The ACI position is specified with ACI_URI_path of the ACG descriptor defined in 3.4.4.5.

・ The ACG descriptor is positioned and transmitted at the Private Data Byte of DII, Module Info Byte, or DDB's storage type ACG list defined in Volume 3, ARIB STD-B24.

3.4.4.3 ACI Position Specification with License Link Information

・ The ACI position is specified with aci_uri of the license link information (LLI) defined in 3.4.4.6.

3.4.4.4 Content Information Header

　(1) Content Information Header Overview

・ Identifies encrypted files in which the encryption descriptor defined in 3.4.4.7 is positioned.

・ The content information header is positioned at the beginning of the encryption file and includes information such as the specification of the encryption algorism, specification of the ACI position, etc.

　(2) Content information header

　　　When transmitted having encrypted a file (resource) such as mono-media data, etc. defined in Volume 2, ARIB STD-B24, it is transmitted having added the content information header defined below to the beginning of the file (resource). Table 3-3 provides the data structure of the content information header.

Table 3-3 Data Structure of the Content Information Header

Data Structure	No. of bits	Mnemonic
ContentInfoHeader( ){		
contentInfo_length	16	uimsbf
encrypt_id	8	uimsbf
CA_content_id	32	uimsbf
ACI_reference_loop_length	16	uimsbf
for(j= 0; j < ACI_reference_loop_length; j++){		
CA_system_id	16	uimsbf
ACI_URI_length	8	uimsbf
for(i = 0; i < ACI_URI_length; i++){		
ACI_URI_path	8	uimsbf
}		
}		
PrivateDatalength	8	uimsbf
for(k = 0; k <privateDatalength; k++){		
PrivateDataByte	8	uimsbf
}		
}		

Meaning of the ContentInfoHeader( ):

1) contentInfo_length (content information byte length): This 16-bit field indicates the byte length of an area from the encryption identifier to private data area.

2) encrypt_id (encrypt identifier): This 8-bit field is used to identify the encryption algorism applied to the data after the content information header.

3) CA_content_id (access control group identifier): This 32-bit field is used to identify the access control group.

4) ACI_reference_loop_length (ACI reference loop area length): This 16-bit field indicates the byte length of the ACI reference loop area consisting of the succeeding conditional playback system identifier, length of ACI_URI, and ACI_URI area.

5) CA_system_id (conditional playback system identifier): This 16-bit field is used to identify the conditional playback system.

6) ACI_URI_length (ACI_URI length): This 8-bit field indicates the byte length of the succeeding URI letter string.

7) ACI_URI_path (ACI_URI area): This is an 8-bit field and a series of areas indicate the URI letter strings indicating the whereabouts of ACI corresponding to the charging unit content specified by the charging unit content identifier.

8) PrivateDatalength (private data area length): This 8-bit field indicates the byte length of the succeeding private data area.

9) privateDataByte (private data area): This is an 8-bit field. Stored in a series of areas and are the data structure defined by the data coding system in the descriptor format and data structure defined per broadcaster.

3.4.4.5 ACG Descriptor

The ACG (Access Control Group) Descriptor describes information for control related to charging at the time of conditional playback. Table 3-4 provides the data structure.

Table 3-4 ACG Descriptor

Data Structure	No. of bits	Mnemonic
ACG_descriptor( ){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
CA_content_id	32	uimsbf
CA_system_id	16	uimsbf
ACI_URI_length	8	uimsbf
for(i = 0; i < ACI_URI_length; i++){		
ACI_URI_path	8	uimsbf
}		
fee_name_length	8	uimsbf
for(j = 0; j < fee_name_length; j++){		
fee_name	8	uimsbf
}		
content_URI_length	8	uimsbf
for(k = 0; k < content_URI_length; k++){		
content_URI_path	8	uimsbf
}		
PrivateDatalength	8	uimsbf
for(l = 0; l < privateDatalength; l++){		
PrivateDataByte	8	uimsbf
}		
}		

Meaning of ACG Descriptor:

1) CA_Content_id (access control group identifier): This 32-bit field is used to identify the access control group.

2) CA_system_id (conditional playback system identifier): This 16-bit field is used to identify the conditional playback system.

3) ACI_URI_length (ACI_URI length): This 8-bit field indicates the byte length of the succeeding URI letter string.

4) ACI_URI_path (ACI_URI area): This is an 8-bit field. A series of areas indicate the URI letter strings indicating the whereabouts of the ACI corresponding to the charging unit content specified by the charging unit content identifier.

5) fee_name_length (fee name byte length): This 8-bit field indicates the byte length of the succeeding fee name.

6) fee_name (fee name): This is an 8-bit field. A series of areas indicate the name of the charging unit content and fees to be presented to viewers using the data coding system or letter coding defined by the operation.

7) content_URI_length (content URI length): This 8-bit field indicates the byte length of the

succeeding URI letter string.

8) content_URI_path (content URI area): This is an 8-bit field. A series of areas indicate the URI letter string indicating the whereabouts of the content to be presented at the beginning of the charging unit content.

9) privateDatalength (private data area length): This 8-bit field indicates the byte length of the succeeding private data area.

10) PrivateDataByte (private data area): This is an 8-bit field. Stored in a series of areas are the data structure defined by the data coding system in the descriptor format and data structure defined per broadcaster.

3.4.4.6 License Link Information

When specifying the position of the ACI corresponding to the content, the License Link Information (LLI) has a structure containing the following information items. XML is used for LLI coding.

Table 3-5 License Link Information (LLI)

Structure				Explanation	Notes
content_crid				Content identifier	
CA_system				Identifier information of the CA system	
	aci_uri			ACI's URI	
		key_id		Content key ID	
		Encryption		Resource encryption system	
			resource_url	Resource's URI	

Meaning of License Link Information:

(1) content_crid

Information to identify content.

(2) CA_system

Information to identify the CA system.

(3) aci_uri

Information to indicate ACI's URI.

(4) key_id

Information to identify the content key.

(5) encryption

Information to identify the encryption system of resources.

(6) resource_url

Resource's URI

3.4.4.7 Encryption Descriptor

Encryption Descriptor indicates the encryption identifier of the resources defined in Volume 2,

ARIB STD-B24. Table 3-6 provides the data structure.

Table 3-6 Encryption Descriptor

Data Structure	No. of bits	Mnemonic
Encrypt_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
encrypt_id	8	uimsbf
}		

Meaning of the Encryption Descriptor:

encrypt_id (encryption identifier): This 8-bit field is used to identify the encryption algorism of resources.

3.4.4.8 Transmission of ACG Descriptor and Encryption Descriptor

The ACG descriptor and Encryption descriptor necessary for transmitting the encryption files are defined in conformity with two methods mapped to the module defined in Volume 3, ARIB STD-B24.

(1) When mapping a single resource directly to a single module

Table 3-7 provides descriptors stored in the module information area and private area of the DII message.

Table 3-7 Functions and Tag Values of Descriptors Used for Module Information Area / Private Area

Tag Value	Descriptor	Functions	Module Information Area	Private Area
0xCB	Encryption Descriptor	Information necessary for identifying / interpreting the encryption of directories / files	○	○
0xCC	ACG Descriptor	Describes information related to charging subject groups in conditional playback processing	○	○

(2) When storing the resource in the module in the entity format of HTTP/1.1 defined in IETF RFC2068

In the case of a storage type resource list in the module of the multi-part format assuming the storing services, the storage type resource list defined in Volume 2, ARIB STD-B24 is used for services utilizing file-type access control, etc., for the purpose of simplifying the process of resource and ACI acquisition encrypted by the storage media where the module is stored in the storage media of the receptor. Table 3-8 provides descriptors storable in "additionalDirectoryInfo" and "additionalFileInfo" of the storage type resource list in the case that the encrypted resource and ACI are transmitted in the multi-part format.

**Table 3-8 Functions and Tag Values of Descriptors Used for
"additionalDirectoryInfo" and "additionalFileInfo"**

Tag Value	Descriptor	Function	Additional DirectoryInfo	Additional FileInfo
0xCB	Encryption Descriptor	Information necessary for identifying / interpreting the encryption of directories / files	○	○
0xCC	ACG Descriptor	Describes information related to charging subject groups in conditional playback processing	○	○

3.4.4.9 Storage Type ACG List when Multiple ACG Descriptors are Included in the Module

The name of the charging subject resource included in the module at the time of its purchase solicitation, information on the place of ACI storage, storage place of presented content after purchase, and information related to conditional playback are defined for services utilizing file-type access control, etc., for the purpose of simplifying the process of ACG descriptors information acquisition from the storage media where the module is stored in the storage media of the receptor. The media type (Content-Type) of the storage type ACG list itself should be "application/X-arib-storedAcgList." Table 3-9 provides the coding for the storage type ACG list.

Table 3-9 Coding of Storage Type ACG List (X-arib-storedAcgList)

Data Structure	No. of bits	Mnemonic
X-arib-storedAcgList {		
StoredAcgListLength	16	Uimsbf
for (i=0; i<storedAcgLisLength; i++) {		
AcgInfo()	8	Uimsbf
}		
}		

Meaning of X-arib-storedAcgList ()

  1) storedAcgListLength (ACG list length): This 16-bit field indicates the byte number from immediately after the ACG list length filed to the end of the said ACG list.

  2) AcgInfo (information related to ACG): This is an 8-bit field. Storable in a series of areas is only the ACG descriptor among all the data structure in a descriptor format defined in Volume 3, ARIB STD-B24.

3.4.4.10 Media Type

Table 3-10 provides the necessary media types for transmitting the ACI and storage type ACG list in the data carousel transmission system defined in Volume 3, ARIB STD-B24.

Table 3-10 Compatibility of Media Type (Content-Type) and File Type / Format Type

Media Type	File Type	Format Type
application/X-arib-storedAcgList	0x5	0x480
application/X-arib-ACI	0x5	0x481

3.4.4.11 Storage Place for Media Type

The media type newly defined in 3.4.4.8 is stored in the Type descriptor defined in Volume 3, ARIB STD-B24, and resourceTypeValue() defined in Volume 2, ARIB STD-B24.

3.4.5 EMM Transmission Position Specification

The transmission position of EMM associated with the file-type content is specified by the conditional playback system descriptor defined in 2.3.2.6.4.

Part 2

Appendix

Appendix 1 Explanation of the Conditional Playback System

1. Summary
1.1 System Overview

The access control system is a system to control the usability of content for each viewer. The control of usability of such content is realized by broadcast providers transmitting encrypted content and giving out the encryption key to decrypt them to viewers individually.

The conditional access system described in Part 1 does not consider the storage functions of the receivers, and therefore, it is a system whereby content is decrypted as soon as the said content is received. Therefore, viewing of content cannot be controlled after storage, when the content is stored after being decrypted.

In consideration of the large storage capability of receivers, the access control system in the broadcasting system based on home servers requires a system whereby content is stored without decrypting, and whereby the control of decryption each time the content is viewed is enabled.

The broadcasting systems based on home servers have the following two types of content: 1) content transmitted by the "stream-type transmission system" where the time required for transmitting the content and the time required for viewing the said content is always the same (stream-type content), and 2) content transmitted by the "file-type transmission system" where the time required for transmitting the content and the time required for viewing the said content is not always the same (file-type content).

The access control system for stream-type content should be a compatible one with the conditional access system described in Part 1 so that normal reception and playback are feasible even with conventional receivers, and when the content is stored, it should be able to store them without decrypting. The access control system of this format is referred to as the "stream-type access control system."

On the other hand, the file-type content is temporarily stored in the receiver as soon as they are received and they can be viewed only when played. Therefore, the conditional access system with which the viewing of content after storage cannot be controlled is not suitable as an access control system for such content. Based on the transmission system for file-type content (see Section 2.2, Chapter 2 of ARIB STD-B38) and storage control system for file-type content (see Section 2.3, Chapter 2 of ARIB STD-B38), it is necessary that the access control system for file-type content can always store them without decrypting. The access control system of this method is referred to as the "file-type access control system."

1.2 Classification of Services Based on Home Servers from the Viewpoint of Access Control

Services provided by broadcasts based on home servers can be classified into the following in terms of access control of their viewing and copying, etc. for each viewer:

1) Basically, viewing is allowed at the time of reception of broadcasts and storage in the receiver is not included in the services (conditional access system).

  Access control is necessary only at the time of reception.

2) Viewing at the time of reception of broadcasts is enabled and storage in the receiver is also permitted (stream-type access control system).

  Access control is necessary at the time of reception and access to the content after storage.

3) Viewing at the time of reception of broadcasts is not permitted and storage on the receiver side is necessary (file-type access control system).

  Access control is necessary only when accessing the content after being stored. Access control is sometimes carried out also at the time of reception.

Since the conditional access system for pay broadcasting (see Part 1) is sufficient for 1) services, the access control system necessary for realization of 2) and 3) services is reviewed here.

1.3 Examples of Services

1.3.1 Services with Access Control at the time of Reception

1) Current pay broadcasting services

Services that allow viewers to receive programs based on the contract concluded before the reception of broadcasts (basic package contract, individual channel contract, pay per view, etc.)

1.3.2 Services with Access Control after Storage

1) Content usage licensing type services

Services that allow storing and viewing of content according to the licensed usage information set up by broadcast providers

[Service examples]

- Services that allow viewing of news programs by replacing them with the latest information for each item according to the licensed usage information such as the expiry date, etc.

- Services to allow storing and viewing of already broadcasted content for program advertising with an expiry date.

- Services to allow viewing programs for which the free viewing period has expired,

upon renewal of the licensed usage by contacting broadcast providers.

- Services to store more than one content in the receiver in advance based on the viewers' tastes and specifications where the viewers can view stored content by paying for desired viewing periods (e.g., 24 hours or one week)

1.3.3 Services with Access Control after Storage on Content that can be Viewed at the time of Reception of Broadcasting

1) Time-shift viewing services

Pay broadcasting can be stored by contractants, or non-contractants and charges are incurred only when the viewer plays the content.

[Service examples]

- Services to store pay per view content without concluding a contract, and charges are incurred only when actually viewed.

2) Expansionary type content charging services

Services in which the conditions for charging are varied between when viewing at the same time as broadcasting and when viewing stored content after broadcasting.

[Service examples]

- Services with varying charges between when viewing at the same time as broadcasting and when viewing after the event is over, such as live sports events, etc.
- In using content of broadcasts based on home servers and unique services transmitted by broadcasting after the completion of storage, services of transmitting the content key to decrypt content or information to control usage of content on an ad hoc basis via communication, controlling the expiry date and charging, such as rental videos.

3) Content sharing control type services

Services whereby pay broadcasting can be played only on one or more than one receiver specified at the time of the contract conclusion.

[Service examples]

- Content broadcasted and stored on pay broadcasting can be played only on more than one receiver located within the household of the contractor.

1.3.4 Services with Access Control after Storage of Content that cannot be Viewed at the time of Reception of Broadcasts

1) Random access type services

Services whereby more than one content is distributed collectively as one charging unit and arbitrary content can be viewed individually irrespective of the order of transmission

of the content.

[Service examples]

- A large volume of music content is collectively stored and free short-period listening is allowed. The listener then can purchase only the ones of his/her choice.
- A set of electronic books consisting of more than one dictionary, etc. are collectively stored, and only those of the viewer's choice can be purchased.

2) Content storage guarantee type services

Services whereby only content for which all information is stored without an error are subjected to charging.

[Service examples]

- Services whereby the digital signals themselves recorded in the package media, DVD-VIDEO, are transmitted by the radio signal and written in the DVD type removable media in the DVD-VIDEO compatible mode before being used.

3) Time axis stretching type services

Services of transmission of content that are independent from the time necessary for viewing of the content.

[Service examples]

- A large volume of music content is transmitted in a short space of time, broadcasted in the block of new hit songs, genres, artists, etc., and various purchase schemes are provided by selecting from a list of stored music content in the unit of music or albums.
- Services to transmit a large volume of image content using the intervals of transmitting other broadcast content.

1.4 Functional Requirements for Access Control System

Functions required for the access control system are as follows:

(1) Functions whereby the contract information can be operated independently of the content or charging control information, and playback only by the contractant is enabled

(2) Functions to set up control information independently and control, in the case that the licensed use / charging differs between the time of reception and playback

(3) Functions to control the licensed use / charging per content, per scene, per file, etc. at the time of playback

(4) Functions to set up more than one charging unit within content stored together

(5) Functions to consist of one charging unit with more than one file, and to playback per file

⑹ Functions to select encryption systems depending on the characteristics of services per content such as image, voice, text, etc.

⑺ Functions to control the terminals where playback on other than the receiving terminal is feasible

⑻ Functions to receive and control more than one receiving terminal, such as per household as one group

⑼ Functions of realtime viewing enabled by compatibility with the current conditional access system

Table 1.1 provides the relationship between each function and stream-type content services/file-type content services described in 1.1. In this table, "○" indicates required functions and "—" unnecessary functions.

Table A1-1 Relationship Between Functions Required and Services

Functions	Stream-type Content Services	File-type Content Services
(1)	○	○
(2)	○	—
(3)	○	○
(4)	—	○
(5)	—	○
(6)	—	○
(7)	○	○
(8)	○	—
(9)	○	—

2. Technical Conditions

2.1 System Overview

2.1.1 Subject of Control for Stream-type Content and File-type Content

The access control system enables playback of content to only given viewers by decrypting the encrypted content at the time of reception or playback of the content using some kind of control information. Since this decryption is better carried out immediately before access control is enabled, the stage in which encryption should be carried out differs depending on the types of services provided by broadcasting based on home servers.

In the case of stream-type services described in 1.1, control needs to be exerted at the time of reception of content. Therefore, encryption per TS packet unit is essential in order to realize this access control, as in the case of the conditional access system specified for the current standard system. Such content is referred to as "stream-type content," and this format of access control system is referred to as the "stream-type access control system." In addition, the conditional access system specified for the current standard system is also a type of stream-type access control system.

On the other hand, the file-type services described in 1.1 are exclusively for viewing after storage, and therefore, using the DSM-CC data carousel is appropriate for transmitting their content. As for the access control system accommodating viewing and playback after storage, encryption per "file" unit transmitted by the DSM-CC data carousel is the most appropriate. Such content is referred to as "file-type content," and this format of access control system is referred to as the "file-type access control system."

Even in the case of the file-type services, the "stream-type access control system" is also used when control at the time of reception of content is necessary.

In this Standard, the processes of encryption on content are differentiated in accordance with the access control system; encrypting content for the stream-type access control is referred to as "scrambling" while encrypting content for the file-type access control is referred to as "encrypting."

2.1.1.1 Control Information for Access Control

The access control system specified for the standard system, conditional access system refers to necessary information for control as "associated information". This Standard uses "associated information" as the generic term for control information for access control.

The associated information needs to be transmitted in the section format for stream-type access control, as with the "transmission control information" used to separate multiplexed information. This does not necessarily apply to the file-type access control.

In addition, associated information includes common information for all viewers and customized information for each viewer.

Among those, two types of common associated information for all viewers are specified: common information for stream-type access control (ECM: Entitlement Control Message) and common information for file-type access control (ACI: Account Control Information.

In addition, individual information (EMM: Entitlement Management Message) is specified as the associated information differing for each viewer.

Figure A1-1 provides the relationship between the content and control information in the transmission protocol.

Subject of control for file-type access control ◄---	Content (file-type services) Control information (file-type)	Transmission control information Control information for access control (stream-type)	Content (stream-type services)
Subject of control for stream-type access control ◄---	DSM-CC data carousel		
	Section		PES
	TS packet		
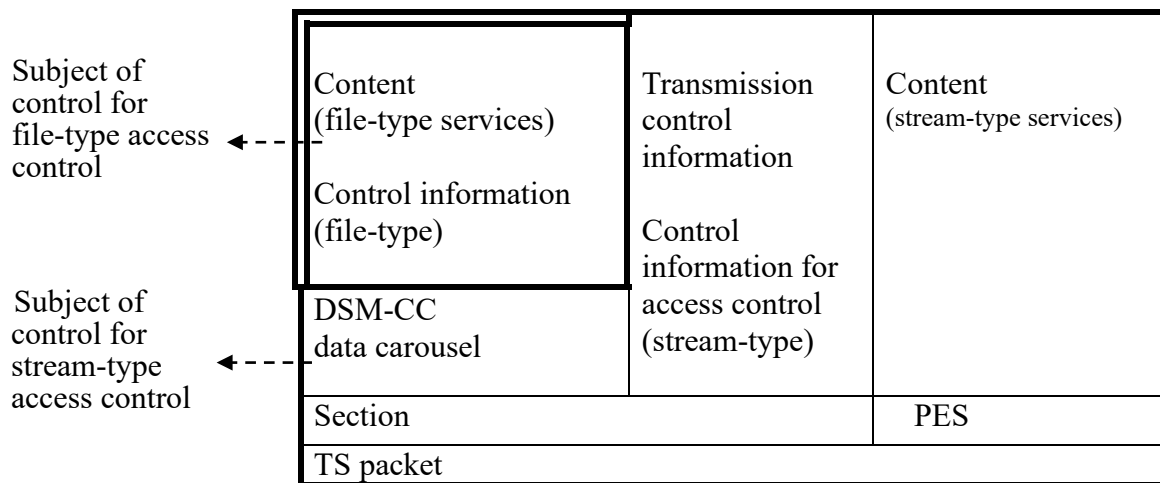
Figure A1-1 Protocol Stack Related to Access Control

2.1.2 System Architecture

Figures A1-2 and A1-3 provide the system architecture on the transmission side and reception side corresponding to both stream-type access control and file-type access control.

2.1.2.1 Transmission Side
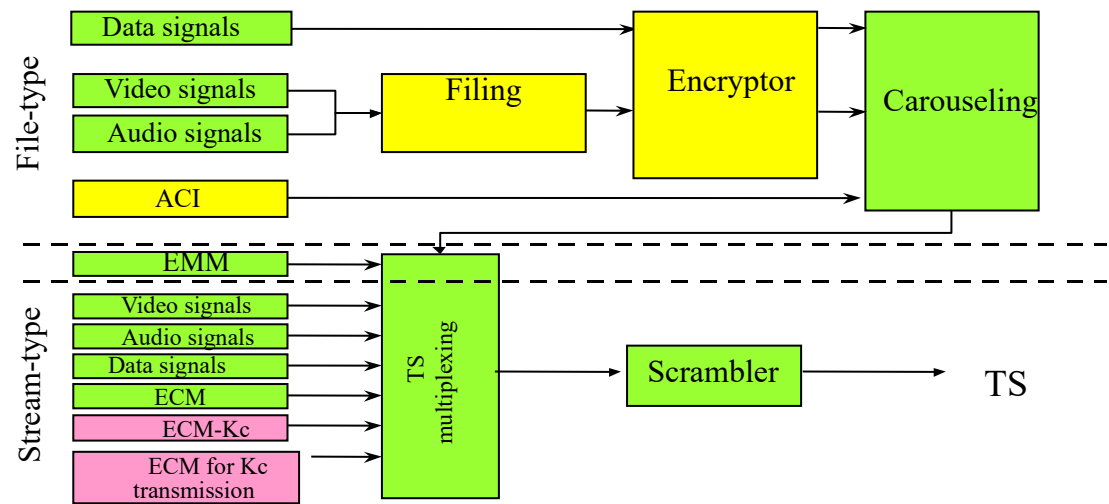
Figure A1-2 System Architecture on the Transmission Side

2.1.2.2 Reception Side

TS
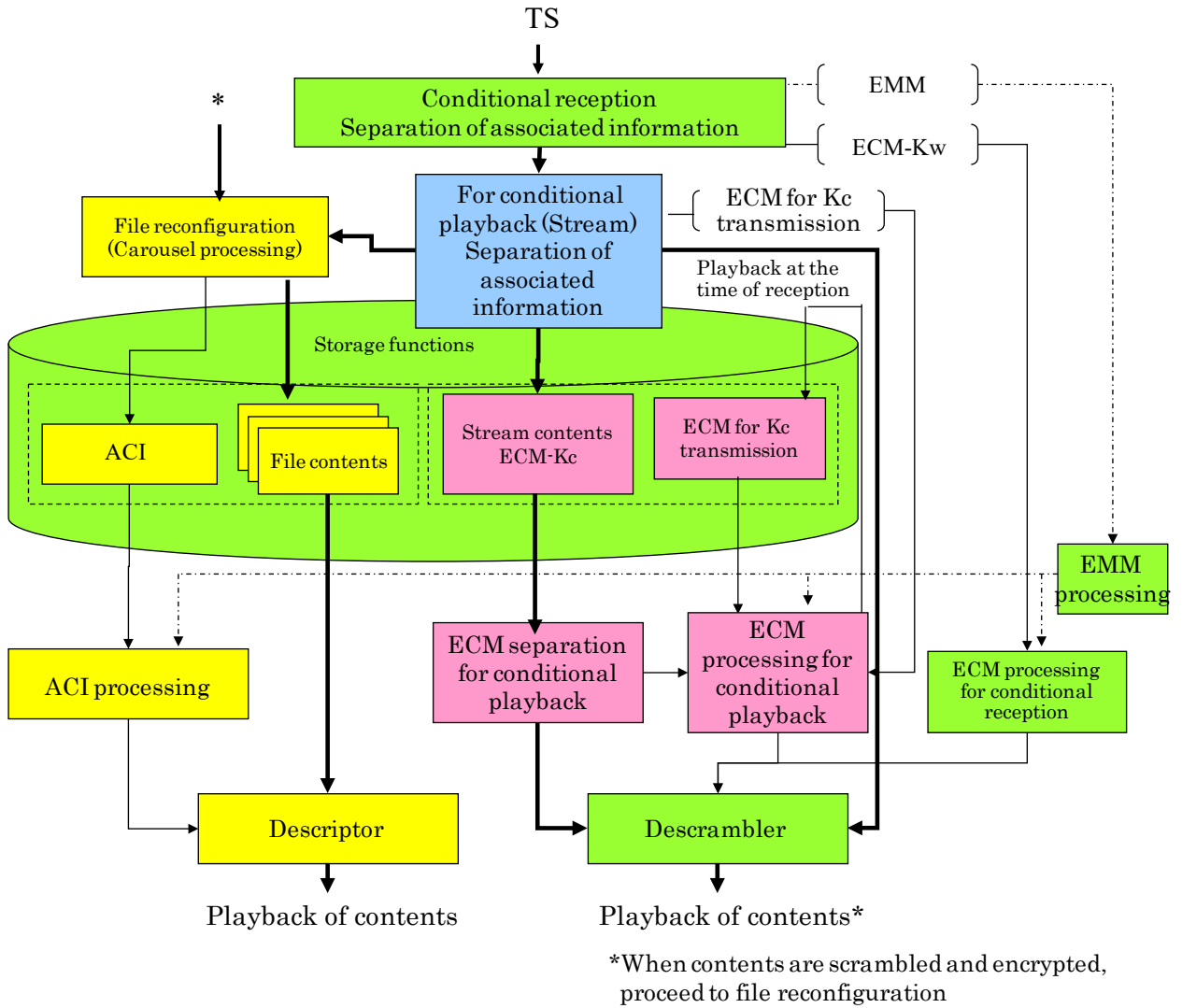
Figure A1-3 System Architecture on the Reception Side

2.1.2.3 Example of Transmission Formats

Figure A1-4 provides an example of transmission format of stream-type content and file-type content.
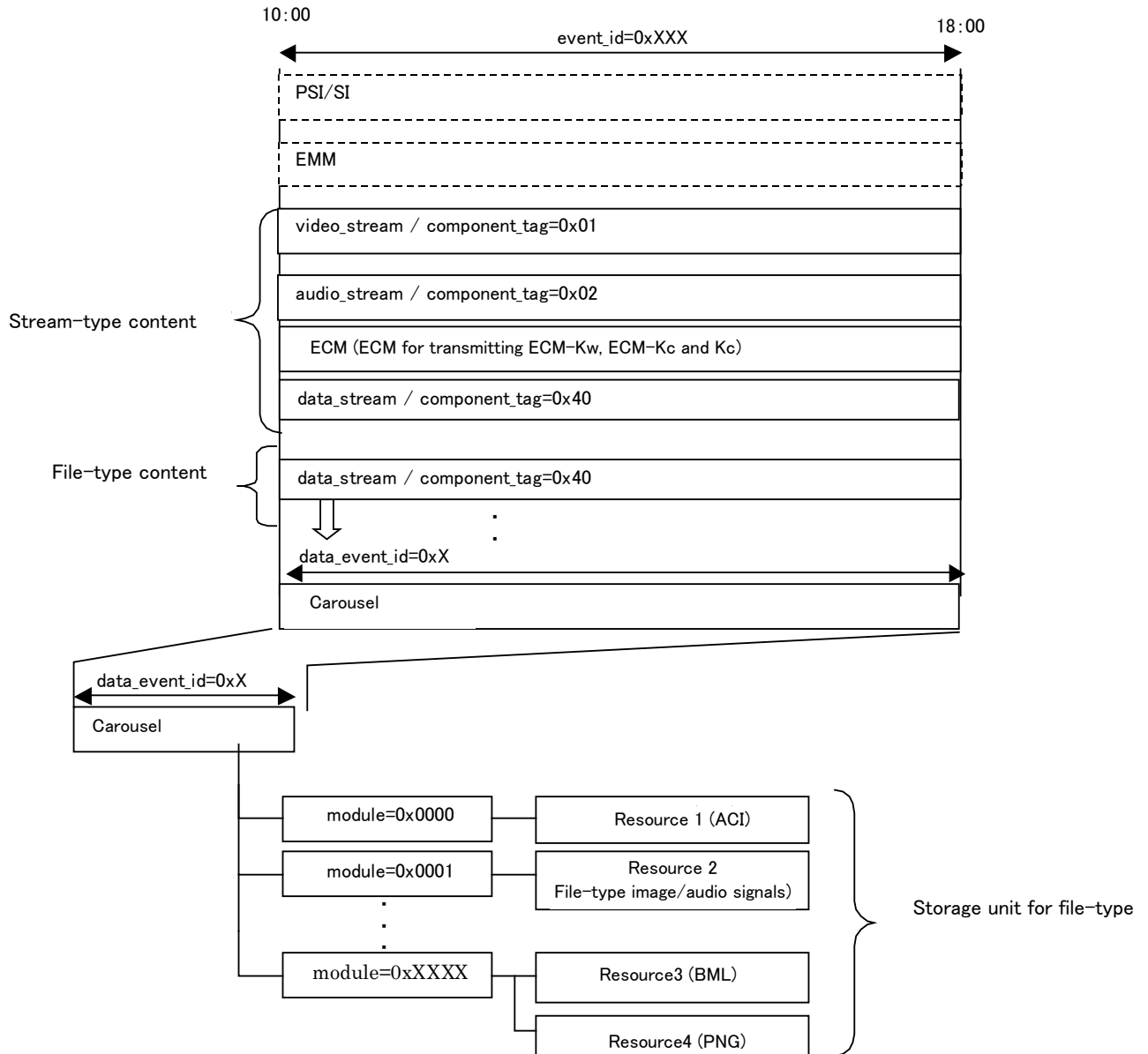
Figure A1-4 Example of Transmission Formats of Stream-Type Content and File-Type Content

2.2 Stream-type Access Control System

2.2.1 System Architecture

Figure A1-5 provides the system architecture of the stream-type access control system.
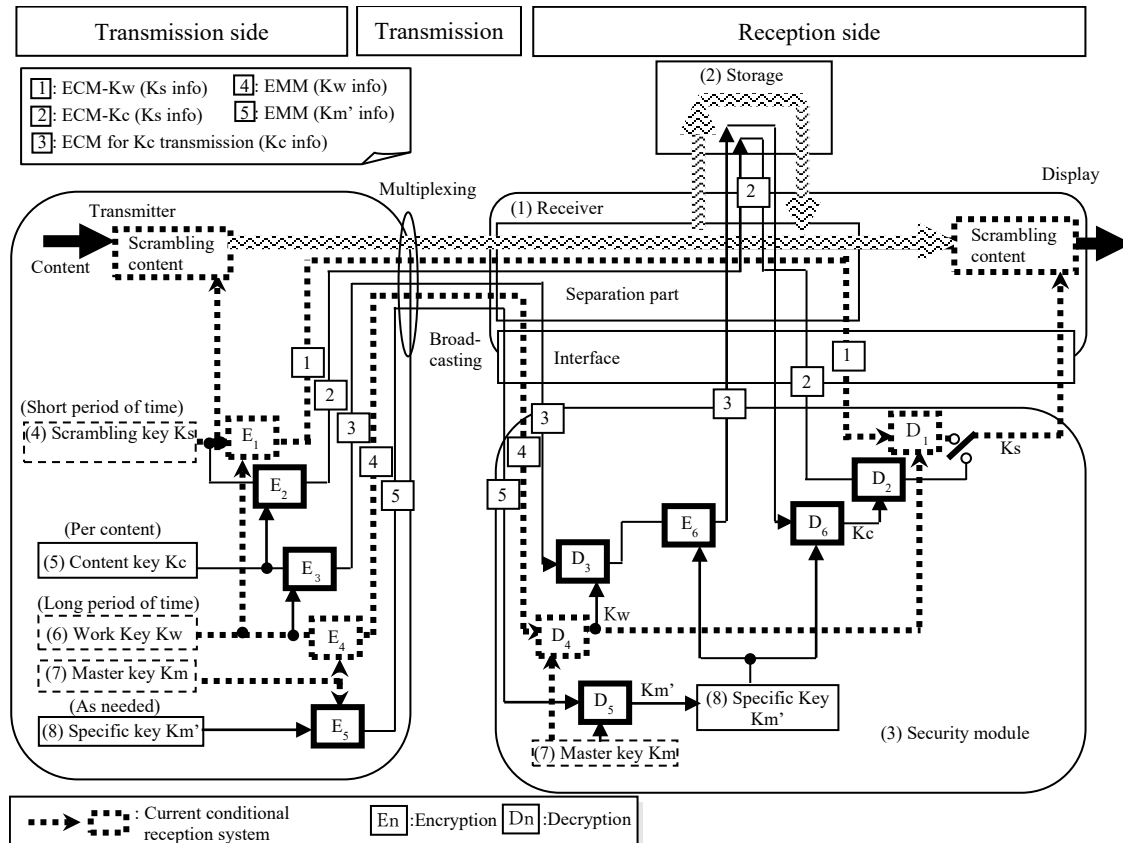
Figure A1-5 System Architecture for Stream-Type Conditional Access System

Each function is described in Section 2.3.2, Chapter 2, Part 2 of this Standard. Content key Kc (5), Specific key Km' (8), and functions of encryption/decryption using these are added to the conditional access system described in Part 1. For the work key Kw and master key Km, sometimes the common key with the conditional access system is used respectively, and sometimes different ones from those for the conditional access system are used.

Kc is the key to encrypt ECM including the scrambling key Ks with a key per content unit so that control per content unit is enabled when playing and viewing stored programs. This Kc needs to be stored along with the scrambled content in the storage media, and the key to encrypt when storing is Km'. Km' is a key that can be set for each security module. Furthermore, Km' can be shared by more than one security module by means of a control by

the providers, and therefore, the stored content can be played on all receivers with the security module on which the same Km' is set.

2.2.2 Associated Information of the Stream-Type Access Control System

2.2.2.1 Types of Associated Information and Contents of Information

As described in Section 2.3.2.1, Chapter 2, Part 2, two types of common information (ECM-Kc, ECM for Kc transmission) and three types of individual information (EMM for Kc transmission, EMM for Km' transmission, and other EMMs) have been added to the conditional access system described in Part 1 as the associated information used for the stream-type access control system.

The Information and Communications Council reports that the contents of common information is specified to include the following, respectively:

1) ECM-Kw: Protocol number, broadcaster identifier, work key identifier, scrambling key Ks (encrypted with the work key Kw), date, charging information.

2) ECM-Kc: Protocol number, broadcaster identifier, content key identifier, scrambling key Ks (encrypted with the content key Kc), date, charging information.

3) ECM for Kc transmission: Protocol number, broadcaster identifier, work key identifier, content key Kc (encrypted with the work key Kw), content key identifier, charging information, expiry date.

However, which information should be described in which structure in the common information differs significantly depending on the types of services actually provided. Therefore, information containing the following should be transmitted for each common information of the stream-type access control system, and the "protocol number" is used to make its details identified by the receiver.

Furthermore, secrecy is required for the contents of the common information, and as such, the information other than the "protocol number" and "broadcaster identifier" can be encrypted, and "work key/content key identifier" is used as necessary information to decrypt them.

The individual information of the stream-type access control system is transmitted asynchronously to each viewer from the distribution of content. The contents of this individual information vary significantly depending on the types of services actually provided and the contents of contract each viewer concludes. Therefore, information containing the decoder identifier number and protocol number should be transmitted for individual information, and as in the case of common information, the "protocol number" is used to make the receiver identify which information is described in which structure in the individual information. Furthermore, secrecy is required for the contents of the individual information, and therefore it

can be encrypted, while various methods are available for transmitting the information necessary to decrypt it such as a method to transmit it with common information or a method to transmit without encrypting individual information, etc. Therefore, the methods for transmitting the information necessary for decryption are arbitrary according to a report by the Information and Communications Council from the viewpoint of ensuring the diversification of broadcast services and the extensibility of broadcasting methods.

2.2.2.2 Transmission Method for Common Information

Each common information used for the stream-type control system is transmitted by the extended section format specified in the Ministry of Internal Affairs and Communications Notification 2014, No. 233, Annexed table 5. The value of "table identifier (table_id)" within the ECM section header part should be 0x82 indicating ECM; ECM-Kc, ECM for Kc transmission, and ECM-Kw are identified by the value of "table identifier extension (table_id_extension)."

2.2.2.3 Transmission Method of Individual Information

When transmitting each individual information with the broadcast waves, it is transmitted by the extended section format specified in the Ministry of Internal Affairs and Communications Notification 2014, No. 233, Annexed table 5. The value of "table identifier (table_id)" within the EMM section header part should be 0x84 indicating EMM, and when identification of types of EMM is necessary by the receiver, it can be done by allocating the value of "table identifier extension (table_id_extension)" within the section header.

2.2.3 Association of Content and Associated Information

When the receiver plays the stored content, it is necessary to transmit information to make it feasible for the identification of associated information related to the said content.

The current digital broadcasting system transmits information related to stream-type content in the region in which the descriptor of the transmission control signals is written in accordance with the MPEG-2 Systems. Therefore, it is appropriate to also transmit information to make it feasible for the identification of associated information related to the stream-type content. Information to make it feasible for the identification of associated information related to the stream-type content is transmitted in the region in which the descriptor for transmission of the control signals is written, after being coded as a conditional playback system descriptor (see 2.3.2.6.4, Part 2).

2.3 File-type Access Control System when Content Information Header and ACG Descriptor are used for ACI Reference

2.3.1 File-type Content Architecture

Figure A1-6 provides an example of architecture of file-type content and associated information necessary for their access control.

: Encryption / encrypted area
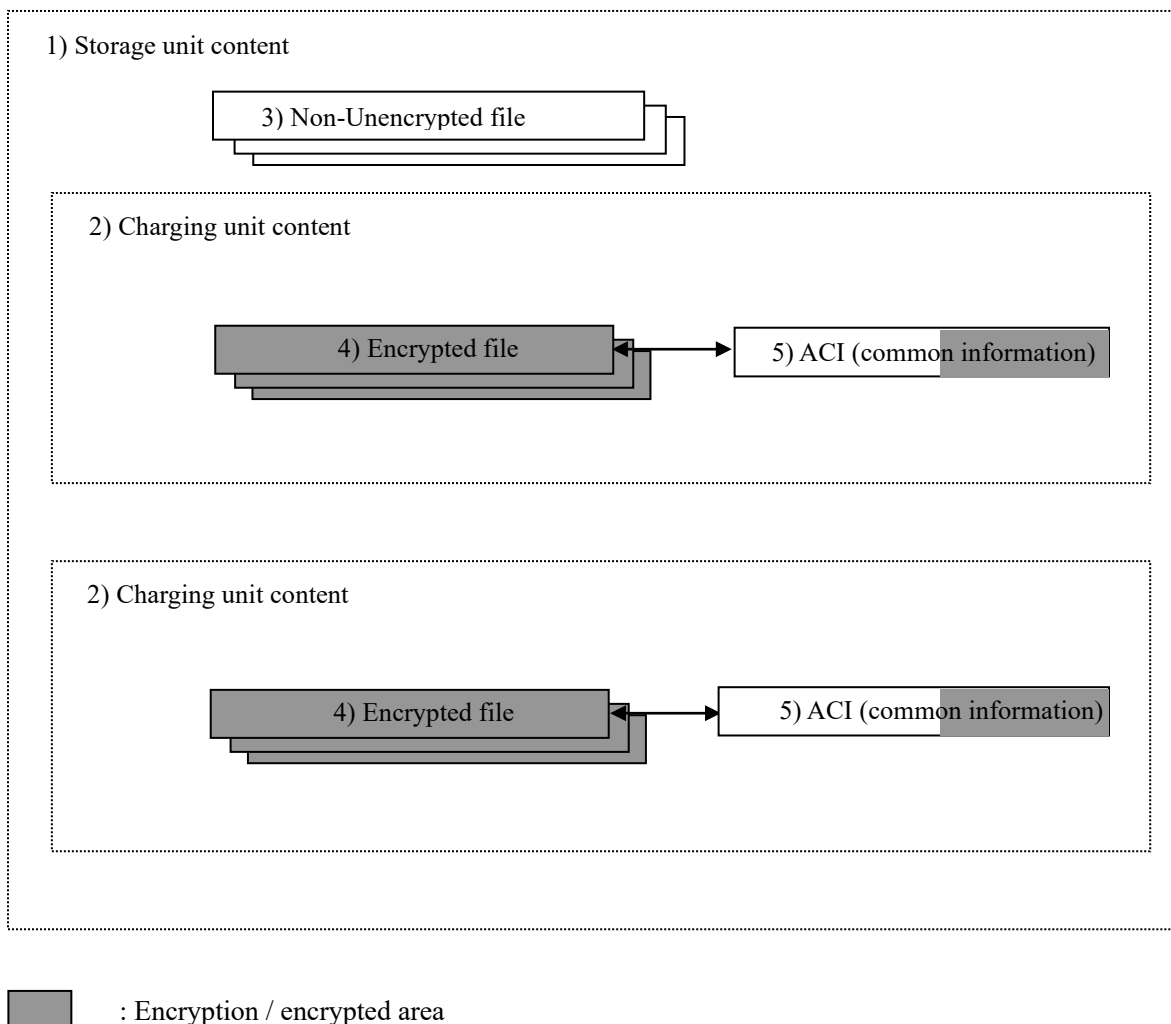
Figure A1-6 An Example of Architecture of File-type Content

1) Storage unit content

Storage unit content indicate the unit to store content by means of EPG services, etc. This unit corresponds to programs (events) in the current system.

The storage unit content consists of non-chargeable files, encrypted files comprising more than one charging unit, and common information (ACI) defined per charging unit.

2) Charging unit content

Charging unit content consist of an aggregate of encrypted files comprising one charging unit and corresponding ACI.

The service provider charges (performs access control) per charging unit within the set

storage unit content.

3) Unencrypted file

Indicates non-chargeable unencrypted files.

4) Encrypted file

Indicates chargeable encrypted files.

5) ACI

Indicates partially encrypted information, in which usage conditions to carry out usage judgment for each user defined for charging unit content, and content key to decrypt depending on the usage conditions, etc. are stored.

2.3.2 Specification of Encryption System

2.3.2.1 Media Type of Encrypted Files

The media type of unencrypted files and encrypted files is identical in the conditional playback system, and encrypted files are distinguished from unencrypted files by newly defining the encryption descriptor for encrypted files.

As a data structure when the resource unit is encrypted, content information header is added before the encrypted files. See Figure A1-7.
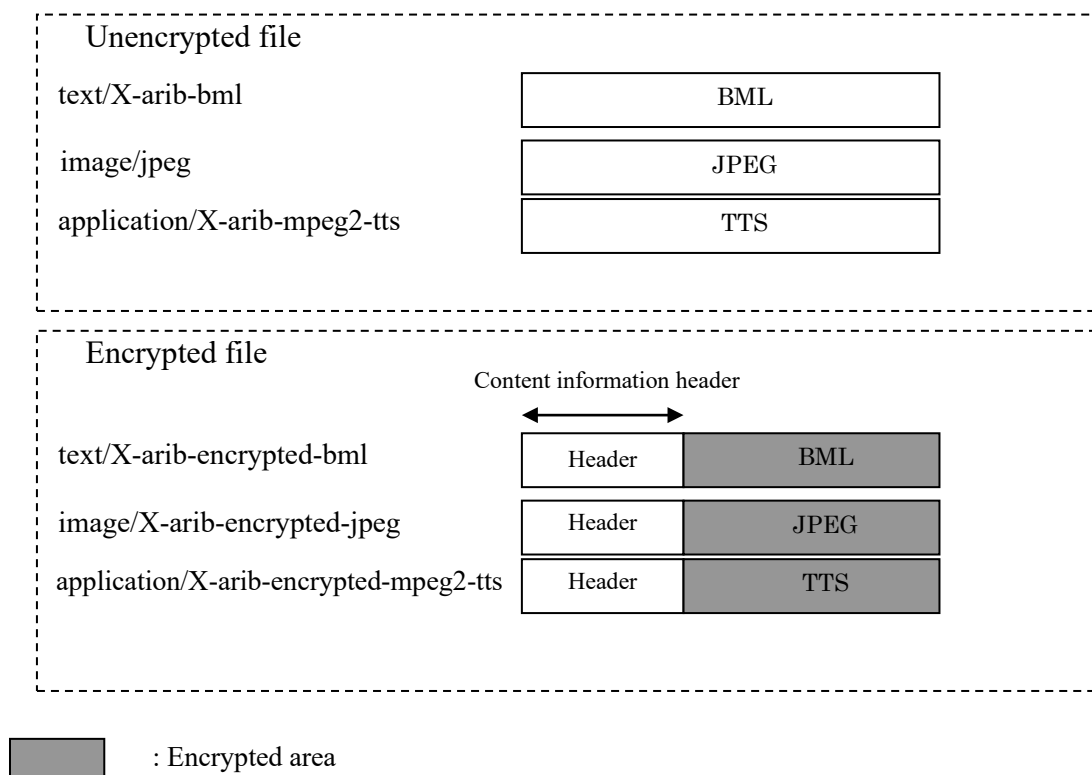
Figure A1-7 Encrypted File Structure

2.3.2.2 Identification of Encryption Method

In the conditional playback system, the encryption algorism can be set per file unit. Therefore, the identifier to identify the encryption algorism (encrypt_id) is newly defined and allocated within the aforementioned content information header.

The receiving terminal identifies the encryption algorism on the file using newly defined encrypt_id.
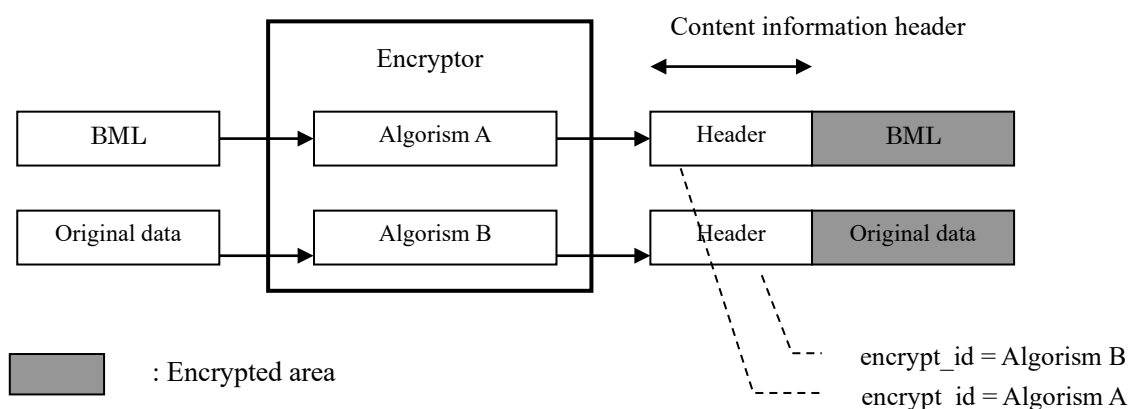
Figure A1-8 Identification of Encryption Method

2.3.3 ACI Reference Method

2.3.3.1 Storage Administration Mode

The ACI reference method is closely associated with the charging unit content and storage conditions of ACI. Here are examples of the administration model at the time of storage of each data.

(1) Storage unit content
   ・ One storage unit content is transmitted as one carousel, and can be identified by the root directory specified with the Store Root descriptor.
(2) Charging unit content
   ・ The encrypted file comprised in one charging unit content, ACI, can be identified with the sub-directory information specified by the Sub Directory descriptor.
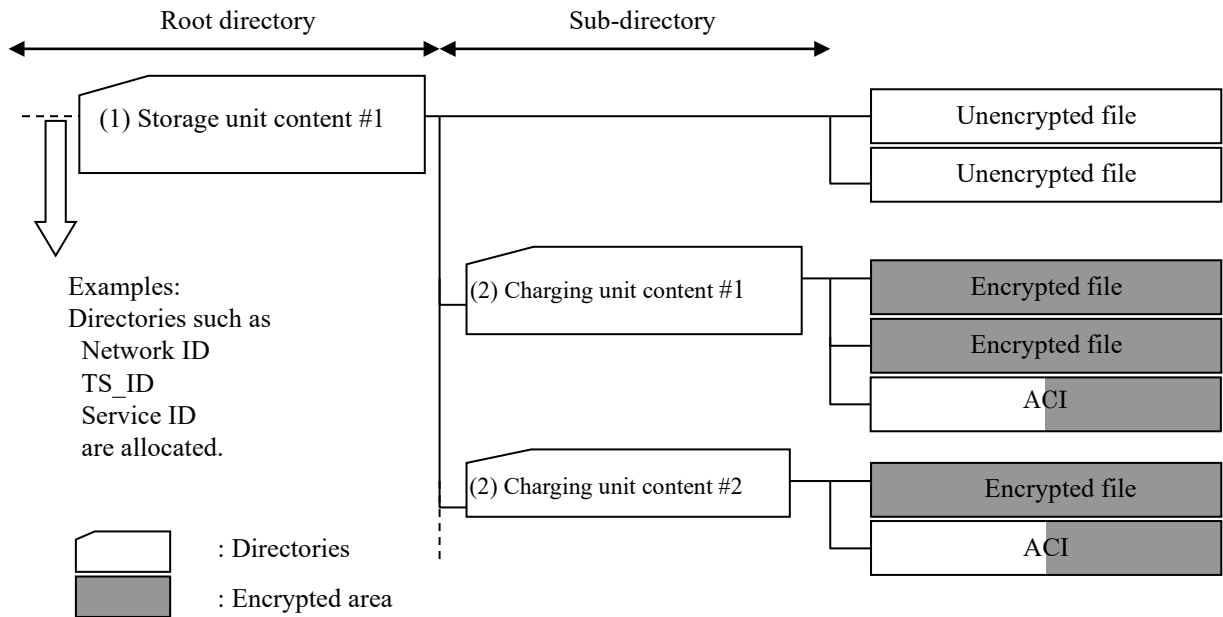
Figure A1-9 Example of Storage Administration Model

2.3.3.2 Reference Method

The ACI reference methods are different for when usage judgment of content is made from a screen showing a list of stored content before playback of chargeable files and when the judgment is made at the time of playback of chargeable files. See below for the methods in each case.

(1) Before file playback

Transmitted as the Private Data Byte within DII as information related to the ACI position and as a new descriptor, or as Module Info Byte / a list of DDB, and stored as internal information of the receiver to carry out ACI reference (Figure A1-10-(1)).

New descriptor: ACG (AccessControlGroup) descriptor
New media type: application/X-arib-stored_ACIList
New list: Storage type ACG list

(2) At the time of file playback

Information regarding the ACI position is allocated in the aforementioned content information header, and ACI reference is carried out at the time of playback of scrambled files (Figure A1-10-(2)).
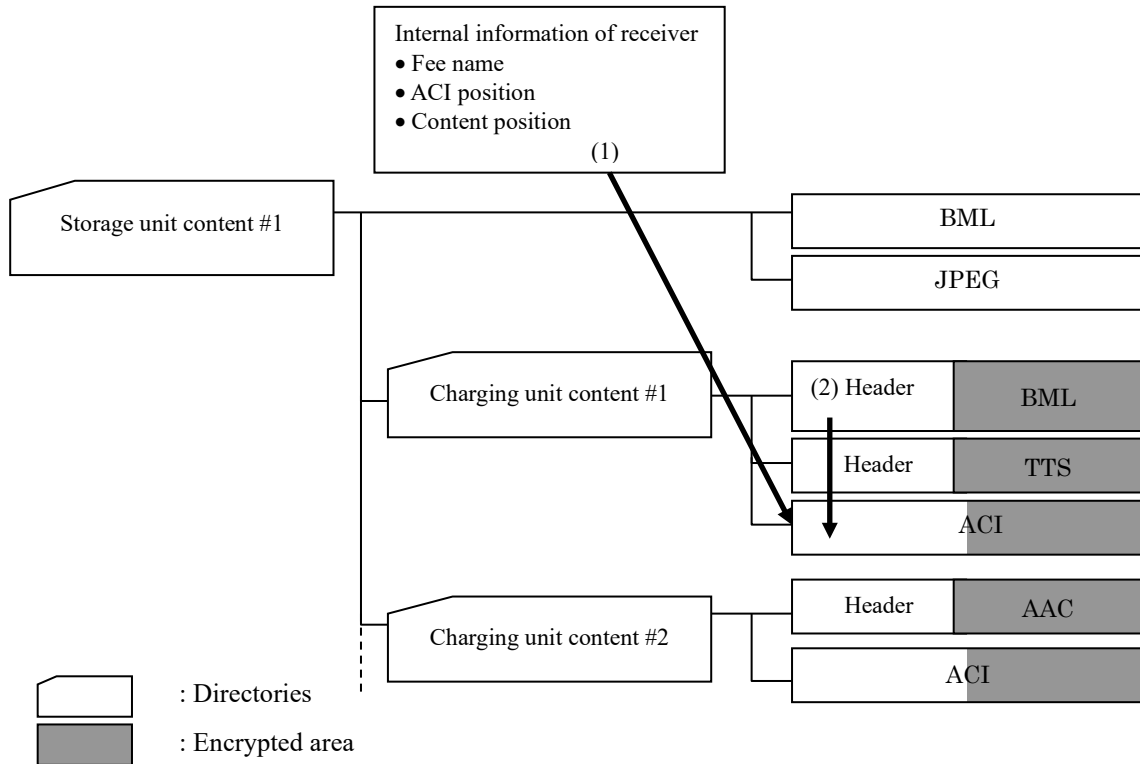
Figure A1-10 ACI Reference Method

2.4 File-type Access Control Method when License Link Information is used for ACI Reference

2.4.1 File-type Content Architecture and ACI Reference Method

Figure A1-11 provides the file-type content and an example of architecture of associated information necessary for their access control. ACI, in which the usage conditions of content and content key are described, is referred to from information described in LLI.
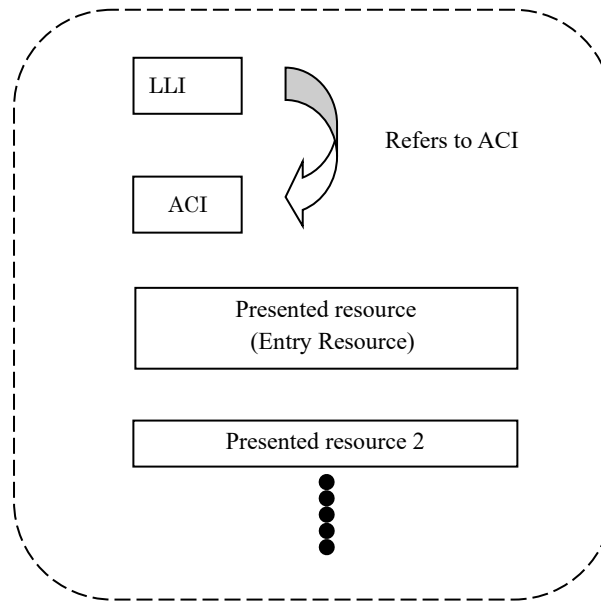
Figure A1-11 An Example of File-type Content Architecture

2.4.2 Specifying Encryption Method

Specified with the encryption of license link information (LLI)
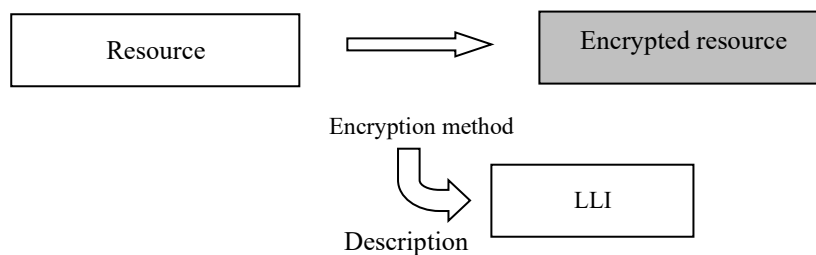
Figure A1-12 Specifying Encryption Method

Appendix 2 Operation

1. Relationship between Encryption and Scrambling in File-Type Content Services

Since the encryption of file-type content targets files for encryption, the encrypted layer is different from that of the current scrambling targeted at the transport stream. Technically speaking, therefore, scrambling the transport layer after encrypting the file-type content in the file layer is feasible.

When control in the transport layer is necessary with encrypted file-type content for the purpose of control in the file layer, an operation of scrambling also the transport layer can be considered.

2. Addressing Reproduction

For the access control of the stream-type and file-type described in this document, content is stored at the time of broadcasting without de-scrambling / decrypting and de-scrambled / decrypted at the time of playback to carry out access control. Therefore, it is assumed that control of reproduction of the stored content is basically feasible in the following two conditions:

1) Reproduction in the condition that content is scrambled / encrypted (reproduction in the encrypted condition before access control)

2) Reproduction after access control at the time of playback in the condition that the content is de-scrambled / decrypted (reproduction in the decrypted condition after access control)

The concepts of reproduction in each of these conditions are provided below.

2.1 Reproduction in the condition that the content is scrambled / encrypted

It is desirable that control on reproduction is realized when the providers intend to do so at the time of the content distribution even in the condition that the content is scrambled / encrypted.

2.2 Reproduction after access control at the time of playback in the condition that content is de-scrambled / decrypted

Basically, in the condition that the content is de-scrambled / decrypted, control on reproduction is necessary by means of enforcement on the receiver operation as in the case of existing reproduction control.

3. Consideration for Encryption Identifier

Furthermore, the encryption algorithm for file-type content employs a system with a degree of freedom allowing a selection of various algorisms depending on the services.

In the actual operation, however, it is desirable that mutually available encryption algorisms are determined to implement on the receiver as a standard, and that encryption algorisms necessary for other individual services can be implemented as necessary, from the viewpoint of cost / standardization of the receiver and prevention of introducing unnecessary encryption algorisms.

The encryption identifier is an identifier mutually used for broadcasting. Therefore, it is more appropriate for an organization of a public nature to manage it in a unified way, and it is assumed that this organization manages number assignment in response to the request from providers.

4. Common Information

Common information contains information with a high degree of secrecy such as information related to the scrambling key / content key, information to make judgment regarding contracts, etc. It exists in combination with the content dependent on services. With some examples of services in mind, necessary information for all services and information that some services do not require have been sorted out to designate information necessary for all services as common essential information.

Information required for concrete service sequences is explained below with examples of services.

4.1 Rental Video Services

More than one AV content is stored in the received based on the viewers' tastes and specifications, and the viewers can view stored content by paying for desired viewing periods (e.g., 24 hours in the case of one night/two days services of rental videos)

<Necessary Associated Information>

1) Provider identifier
   ・ Identifies the provider of rental video services.
2) Work key identifier
   ・ Identifier information related to the work key used to encrypt associated information.
3) Information related to contract judgment
4) Information related to the scrambling key / content key
5) Viewing fees
6) Viewing periods

Part 3

Reception Control System
（Content Protection System）

Part 3 Contents

Chapter 1 General Matters

1.1   Purpose

Part 3 of this standard addresses an access control system for use in digital broadcasting, a reception control system, notably a content protection system for free program reception ("this content protection system") and defines scrambling, associated information specifications as well as related reception specifications.

1.2   Scope

Part 3 of this standard applies to digital and high-definition standard television broadcasts by terrestrial basic broadcasting stations (Hereinafter referred to as "terrestrial digital television broadcasts") that comply with "Standard transmission system for digital broadcasting among standard television broadcasting and the like" (Ministry of Internal Affairs and Communications Ordinance No. 87, 2011).

1.3   References

1.3.1 Normative References

The following documents are documents in which some of the items specified in the documents are referenced or cited as part of the standard in this standard.

   (1) Ordinance of the Ministry of Internal Affairs and Communications: "Standard transmission system for digital broadcasting among standard television broadcasting and the like" (No.87, 2011. Hereinafter referred to as "Ordinance")

   (2) Notification of the Ministry of Internal Affairs and Communications: "On defining the information especially notified by the Minister for Internal Affairs and Communications among associated information" (No.298, 2011)

   (3) Notification of the Ministry of Internal Affairs and Communications: "On defining the configuration of the associated information and the procedure of transmission, the procedure of transmitting PES packet, section format, TS packet, IP packet, ULE packet, MMTP packet, compressed IP packet and TLV packet, the configuration of transmission control signal and identifier and the configuration of emergency information descriptor and emergency warning broadcasting message" (No.233, 2014)

   (4) Notification of the Ministry of Internal Affairs and Communications: "On defining the system for scrambling" (No.235, 2014. Hereinafter referred to as "Notification")

1.3.2 Informative References

The documents associated with this standard are as follows.

(1) Telecommunications Technology Council Inquiry Report No. 17

(2) Telecommunications Technology Council Inquiry Report No. 74

(3) Information and Communications Council Inquiry Report No. 2003

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

(5) ARIB STD-B21 "Receiver for Digital Broadcasting"

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

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

1.4　Terminology and abbreviations

Terminology and Abbreviations	Details
CAS	Conditional Access System
CAT	Conditional Access Table. Table to display the packet ID of the TS packet that carries EMMs.
ECM	Entitlement Control Message. Data that carries information shared by all receiver units mainly scrambling keys and program information for scrambled programs.
EIT	Event Information Table. Table of information related to programs such as program names, attributes, broadcasting dates and times and contents.
EMM	Entitlement Management Message. Data that carries information for individual device IDs, which includes device IDs used to identify EMMs and mainly carries work keys to decrypt ECMs.
EMM message	General term for individual and common messages transmitted in EMM.
Kd	Device key. An individual key defined for each customer is used as a Master key (Km) in the common conditional access system, but in part 3 of this standard, since individual keys are assigned for each receiver unit manufacturer and receiver unit model, a device key is defined as an individual key equivalent to a master key.
Ks	Scrambling key.
Kw	Work key.
NIT	Network Information Table. Table displaying transmission path information such as frequencies and the modulation system.
PAT	Program Association Table. Table displaying the packet ID of the TS packet that carries the PMT that shows the stream information of programs.
PID	Packet Identifier.
PMT	Program Map Table. Table displaying the packet ID of the TS packet that carries the ECM and stream (component) information of programs.
PSI	Program Specific Information.
SDT	Service Description Table. Table of information related to service channels such as service channel names and broadcaster names.

SI	Service Information. Various types of information, which is multiplexed in broadcast signals and is necessary for the operation of broadcasting services. Defines various types of table data such as SDT and EIT.
TS	Transport Stream.
RMP broadcaster group	Collection of broadcasters that operate the content protection system together.
Device ID	64-bit identification number that is managed for each receiver unit model or by each receiver unit manufacturer in order to identify receiver unit models or manufacturers.
RMP Model ID	Device ID managed for each receiver unit model in order to identify the receiver unit model.
RMP manufacturer ID	Device ID managed for each receiver unit manufacturer in order to the identify receiver unit manufacturer.
Individual ID	Device ID for automatic display messages randomly generated by a receiver.
Specified ID	Device ID for automatic display messages set by EMM.
ID for automatic display message	General term for individual ID and specified ID
Revocation of specific keys	Revoking a specific key from the system within the operation system.
Device ID generation	Displays the update status when a device ID and device key are updated within a receiver unit and is identified with a generation number.
Content protection information	Collective term for digital copy control descriptor and content availability descriptor.
Automatic display message	A message stored in a receiver by EMM messages (including the case of playing back signals received by a receiver with storage functionality), which is simultaneously displayed during program reception.
Storage functionality	Recording and playback function that can only be played back on the device on which it was recorded.

Chapter 2 Functional Specifications

2.1 Scrambling and associated information specifications

2.1.1 Basic concept

This content protection system must be realized as inexpensively as possible under a certain level of security as a technical system to protect various types of rights included in content against unauthorized copying, etc. in digital broadcasting. Additionally, it must be designed so that various manufacturers can manufacture related devices such as receivers and transmitters inexpensively and so that broadcasters across the country can improve their facilities at low cost.

2.1.2 Requirements for content protection systems

(1)   Enforcement
- The operator of this content protection system must be able to provide enforcement in order to protect content.

(2)   Transmission of associated information
- Associated information must be transmitted in compliance with the Ministry of Internal Affairs and Communications Notification No. 233, 2014.

(3)   Services and receivers
- Digital terrestrial television service for 13-segment receivers.
- The system must be applicable to receivers that can be adapted to a variety of reception formats, such as receivers built into personal computers, cable STBs, etc.

(4)   Operation of multiple content protection systems
- Multiple content protection systems can be operated in parallel.
- The system shall be capable of operating in parallel with the conditional access system specified in Part 1.
- Multiple conditional access systems shall be capable of operating in parallel.
- The system shall be capable of operating in parallel with new access control systems in the future.

(5)   Inexpensive operating cost
  The system must be operated inexpensively.

(6)   Security level
- A level of security that only engineers with specialized knowledge could bypass or tamper with when given time and energy must be ensured.

(7)   Transmission of scrambling key s (Ks)
- Kss must be transmitted securely.
- A pair of Kss (an even key and odd key) must be transmitted in an ECM following

encryption.

- The shortest change cycle of a pair of Kss (an even key and odd key) must be 2 seconds.

(8) Support for dual tuner receivers

- Descrambling of more than two TS at the same time must be possible in order to support dual-tuner receivers.

(9) Revocation of specific keys

- It must be possible to invalidate a key with revoke function when the key that encrypts Ks is changed and so on.
- The granularity (resolution) for invalidating the revocation key should be set by the operator according to receiver manufacturers, receiver model number, and lot number.

(10) Short delay times

- Delay times, for example, until content is displayed after a channel is switched, must be kept short.

(11) Method for implementing the system on a receiver unit

- A method for implementing the system into receiver units must be provided so that the requirements for content protection are correctly implemented into receiver units and at the same time, receiver units that can effectively prevent possible breaking of the functional requirements and rerouting can be designed and manufactured.

(12) Others

- The system must be user-friendly.
- Implementation in receivers must be simple and inexpensive.

2.1.3 Overall functionality

This content protection system must have the following functions.

(1) Management scale

The system must be extendable in stages and must be managed with a resolution capability for models and lot numbers for a maximum of all receiver manufacturers.

(2) System life

The system can be managed by supporting applicable broadcast media.

(3) Ensuring and dealing with security

- The system must provide support for dealing with piracy in parallel with providing broadcasting services.
  - ➢ To deal with leaks of work keys (Kws) and acts of piracy, it must be possible to identify receivers that are possible leak sources using a resolution capability for the lot number as a minimum granularity.
  - ➢ To deal with leaks of device keys (Kds) and acts of piracy against device keys, it

must be possible to update device keys (Kds).

2.1.4 Broadcast service formats

2.1.4.1 Supported digital broadcast service formats

The standard can be applied to the following service formats.

(1) Broadcast service consisting of video and audio program in the transmission frequency band (service channels); for example:

1) Standard-definition television broadcasts (MP@ML, etc.)

2) High-definition television broadcasts (MP@HL, etc.)

3) Sound broadcasts

4) Data broadcasts

(2) Integrated digital broadcasts that combine a variety of information including video, audio, and data in a flexible format (ISDB; Integrated Services Digital Broadcasting)

(3) Reception formats

1)Realtime reception

2)Stored reception (non-realtime reception)

The content protection system described in part 3 of this standard addresses the storage of data following descrambling.

3) Recorded reception (including reserved reception)

The standard for digital interface functions used for receivers such as IEEE1394 must be followed in order to protect copyrights included in content against unauthorized copying.

2.1.4.2 Compatibility with multiple broadcast media types

The system shows consideration of the need to be expandable for integrated operation with a variety of broadcast media.

2.1.5 EMM transmission

The system can send EMMs from individual broadcasters and RMP broadcaster groups and supports the following operations:

1) A single broadcaster forms a single RMP broadcaster group and transmits its EMMs within its transport streams.

2) Multiple broadcasters form a single RMP broadcaster group together and transmit common EMMs within transport streams of each broadcaster.

3) RMP broadcaster groups of the above types 1) and 2) co-exist and provide services.

4) When multiple content protection systems are operated, the corresponding EMM is transmitted for each content protection system.

2.1.6 ECM transmission

Although ECMs can be delivered at a minimum interval of 100 msec, this value only defines the minimum time between ECM transmissions. The standard must be able to balance the interval and transmission capacity to be balanced in light of service content.

When multiple content protection systems are operated, the corresponding ECM is transmitted for each content protection system.

2.1.7 Security functionality

2.1.7.1 Associated information encryption

(1) Encryption system

The encryption system uses three layer architecture with common private keys which are equivalent to a 128-bit key length. From the perspective of implementation on a receiver unit, the encryption system should feature a compact program size and be conducive to high-speed processing on a 16 to 32-bit microcomputer.

(2) Administration functionality

The system provides support for dealing with piracy in parallel with providing services.

2.2 Receiver specifications

2.2.1 IDs

● To identify the receiver in automatic display message, the receiver shall have individual ID and specified ID.

● The value of individual ID is randomly generated in the receiver during the initial setup of the receiver. The value of specified ID is set for each receiver by a broadcaster using the EMM.

● RMP model ID, RMP manufacturer ID, and ID for automatic display messages shall be displayed by user operation. Only either individual ID or specified ID shall be displayed as the ID for automatic display messages. If the specified ID is not set in the receiver, only the individual ID shall be displayed. If a specified ID is set in the receiver, only the specified ID shall be displayed.

2.2.2 Basic user input and display

● The receiver unit should have capabilities of basic key input via a remote controller, etc. so as to allow the user to select programs, make a variety of settings, and display error messages. Full-screen display of text and other representation, as well as superimposed

messages, should be available.

● In order to display error messages, automatic display messages and device IDs, the receiver provides functionality that is equivalent to applications providing subtitle service processing.

2.2.3 Program selection and viewing

● The receiver can display unscrambled free program and scrambled free program by selecting the program from PSI/SI, selecting the corresponding transport stream, and referencing the scrambling control and ECM.

● Unscrambled program can be selected and viewed regardless of the work key.

● Copy control shall be performed based on PSI/SI information. (However, detail for copy control is not specified in this standard.)

2.2.4 Descrambler

● The descrambler descrambles transport stream packets using the MULTI2 system.

2.2.5 ECM reception

● When an ECM is found to exist while referencing PMT information, the receiver receives and processes the ECM, and performs descrambling control.

● When multiple content protection systems are in operation, PIDs for transmitting ECM are specified by multiple conditional access system descriptors or access control system descriptors, and therefore, conditional access system identification (CA_system_id) of conditional access system descriptor or access control descriptor is used for appropriate processing.

2.2.6 EMM reception

● EMM reception is performed by filtering with multiple IDs such as RMP model ID and RMP manufacturer ID.

● A single section contains multiple EMMs, which the receiver filters using multiple IDs and table_ID data.

● When multiple content protection systems are in operation, PIDs for transmitting ECM are specified by multiple conditional access system descriptors or access control system descriptors, and therefore, EMM reception is performed appropriately by conditional access system identification (CA_system_id) of conditional access system descriptor or access control descriptor.

2.2.7 Tamper resistance

- A receiver unit must have sufficient tamper resistance so that the requirements for content protection are correctly implemented into the receiver unit and at the same time, it can effectively prevent possible breaking of the functional requirements and rerouting.

2.2.8 Function to protect content protection information from tamper.

- Content protection information (digital copy control descriptor, content availability descriptor) specified during broadcasting may be falsified or deleted so that the receiver unit operates as if the content that should be protected were not protected. The receiver unit must have a function to prevent such acts.

2.2.9 EMM message reception

- The ID for the automatic display message must be loaded and filtering of the EMM message must be performed.

- There is one EMM common message per section and multiple EMM individual messages per section, which shall be filtered by PID and table_ID, respectively. In addition, EMM common messages and EMM individual messages shall be determined by referring to table_ID_extension.

- When an EMM common message is received by a receiver with storage functionality, the EMM common message and the CAT contained in the TS being received shall be included in the signal to be stored in the receiver. When EMM individual messages are included in the signal played by a receiver with storage functionality, these messages shall be ignored.

- When multiple content protection systems are in operation, multiple conditional access system descriptors or access control system descriptors specify PIDs for transmitting EMM messages, so that EMM reception is performed appropriately by conditional access system identifications (CA_system_id) of conditional access system descriptors or access control descriptors.

2.2.10 EMM message control

- During program viewing (including the case of playing back signals received by a receiver with storage functionality), automatic display message shall be automatically displayed on the screen.

Chapter 3 Technical Specifications for Scrambling and Associated information

3.1 Scrambling subsystems

3.1.1 Scrambling Method

The scrambling algorithm is the MULTI2 method as with the conditional access system stipulated in Part 1.

Specifically, the scrambling procedure is as shown in Section 3.1.2 and consists of a combination of the following 2 electrical processes: 1) For 64-bit encoded sequences, the original encoding is replaced with another binary code string using 64 and 256-bit variables. 2) For code strings of less than 64 bits, the method described in 1) is used to generate a series of pseudo-random encoded sequences, which are combined to create the scrambled signal.

3.1.2 Scrambling procedure

Note 1 The MULTI2 cipher is described in sections 3.1.3 and 3.1.4.
    2 reg indicates a register.
    3 ⊕ indicates an exclusive OR operation.

(Notification Annexed Table 1)

3.1.3 MULTI2 cipher

Key Schedule

Data key （D$_K$） (64bits)

System key (S$_K$)
(256 bits)

π 1

Extended key (W$_K$)

(256 bits)

S1 → π 2

a$_1$

S2 →
S3 → π 3

a$_2$

S4 → π 4

a$_3$

π 1

a$_4$

S5 → π 2

a$_5$

S6 →
S7 → π 3

a$_6$

S8 → π 4

a7

π 1

a$_8$

$S_K = s_1 /\!/ s_2 /\!/ \cdots /\!/ s_8$
$a_1 = \pi_2 s_1 \cdot \pi_1(D_K)$
$w_1 = a_1[\text{left}]$
$a_2 = \pi_3 s_2, s_3(a_1)$
$w_2 = a_2[\text{right}]$
$a_3 = \pi_4 s_4(a_2)$
$w_3 = a_3[\text{left}]$
$a_4 = \pi_1(a_3)$
$w_4 = a_4[\text{right}]$
$a_5 = \pi_2 s_5(a_4)$
$w_5 = a_5[\text{left}]$
$a_6 = \pi_3 s_6, s_7(a_5)$
$w_6 = a_6[\text{right}]$
$a_7 = \pi_4 s_8(a_6)$
$w_7 = a_7[\text{left}]$
$a_8 = \pi_1(a_7)$
$w_8 = a_8[\text{right}]$
$W_K = w_1 /\!/ w_2 /\!/ \cdots /\!/ w_8$

Note
1. π_1 to π_4 are elementary functions and are described in Section 3.1.4.
2. N represents the cipher stage.
3. // indicates a block union.
4. a$_x$[left] represents the leftmost 32 bits of block a$_x$.
5 a$_x$[right] represents the rightmost 32 bits of block a$_x$.

Encryption

Plaintext (P) (64 bits)

π 1   N=1

w$_1$ → π 2   N=2

w$_2$

w$_3$ → π 3   N=3

w$_4$ → π 4   N=4

π 1   N=5

w$_5$

π 2   N=6

w$_6$

w$_7$ → π 3   N=7

w$_8$ → π 4   N=8

π 4

Ciphertext (C) (64 bits)

$W_K = w_1 /\!/ w_2 /\!/ \cdots /\!/ w_8$
$N = 8m + \alpha \quad (0 \leq \alpha \leq 7)$
$f_{WK} = \pi_4 w_8 \cdot \pi_3 w_6, w_7 \cdot \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1$
$F_{WK} = f_{WK} \cdot f_{WK} \cdot \cdots \cdot f_{WK}$
Please note that f_{WK} is repeated m times.
When $\alpha = 0$,
$C = F_{WK}(P)$
When $\alpha = 1$,
$C = \pi_1 \cdot F_{WK}(P)$
When $\alpha = 2$,
$C = \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 3$,
$C = \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 4$,
$C = \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 5$,
$C = \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 6$,
$C = \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 7$,
$C = \pi_3 w_6, w_7 \cdot \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$

(Notification Annexed Table 1, Appendix 1)

3.1.4 Elementary encryption function

π_1

32bits   32bits

$\pi_1(T)=T[left] \mathbin{/\!/} (T[left] \oplus T[right])$

π_2

32bits   32bits

x

k_1 → $x+k_1$

32bits   y

$Rot_1(y)+y-1$

z

$Rot_4(z) \oplus z$

x=T[right]
y=x+k_1
z=Rot_1(y)+y-1
$\pi_2 k_1(T)=(T[left] \oplus(Rot_4(z) \oplus z)) \mathbin{/\!/} T[right]$

π_3

32bits   32bits

x

k_2 → $x+k_2$
32bits   y

$Rot_2(y)+y+1$

z

$Rot_8(z) \oplus z$

a

k_3 → $a+k_3$
32bits   b

$Rot_1(b)-b$

c

$Rot_{16}(c)\oplus(c \vee x)$

x=T[left]
y=x+k_2
z=Rot_2(y)+y+1
a=Rot_8(z) \oplus z
b=a+k_3
c=Rot_1(b)-b
$\pi_3 k_2,k_3(T)=T[left] \mathbin{/\!/} (T[right] \oplus(Rot_{16}(c)\oplus(c \vee x)))$

π_4

32bits   32bits

x

k_4 → $x+k_4$
32bits   y

$Rot_2(y)+y+1$

x=T[right]
y=x+k_4
$\pi_4 k_4(T)=(T[left] \oplus (Rot_2(y)+y+1)) \mathbin{/\!/} T[right]$

Note 1. T represents elementary function input.
2. T[left] represents the leftmost 32 bits of block T.
3. T[right] represents the rightmost 32 bits of block T.
4. (+) indicates an exclusive OR operation.
5. + indicates an addition operation using a modulus of 2^{32}.
6. – indicates a subtraction operation using a modulus of 2^{32}.
7. Rot_s indicates a recursive bit shift to the left.
8. V indicates a bitwise OR operation.
9. $\mathbin{/\!/}$ indicates a block union.

(Notification Annexed Table 1, Appendix 2)

3.1.5 Scrambled layer

Transport stream

3.1.6 Scrambled area

The scrambled area is the payload part of the TS packet (excluding packets used to transmit data link control signals and associated information). (Ordinance)

3.1.7 Scramble units

Scrambling is performed in units of TS packets.

3.1.8 Period when the same key is used

Minimum of 1 second per ECM.

3.1.9 System keys

Part 3 of this standard does not address specific values for system keys.

3.1.10 CBC initial values

Part 3 of this standard does not address specific register default values in the CBC mode.

3.2 Associated information subsystem

3.2.1 The basic principle of the system

Figure 3-1 Basic Principle of the System.

This system is based on the common three-layer-key method for CAS（Conditional Access System）. The program content is scrambled by a key used at the broadcasting station as a scrambling key (Ks), descrambled in the receiver unit and presented to the viewers. Additionally, from the broadcasting station to the receiver unit, an ECM as associated information shared by all receiver units and an EMM as associated information for individual receiver unit IDs (device ID) are transmitted. The EMM is transmitted following encryption using an individual device key (Kd) that is pre-set in the receiver unit as a key and sets the work key (Kw) in the receiver unit. The ECM is encrypted using the work key (Kw) and it carries a scrambling key (Ks) used to descramble the data. The receiver descrambles the data using the received scrambling key (Ks).

In this system, the basic principle shown in Figure 3-1 is extended as described in the subsequent sections for optimization of the content protection mechanism.

Additionally, in this system, IDs that are unique to each receiver unit are not used, instead device IDs namely an ID to identify the receiver unit model and an ID to identify the receiver unit manufacturer are used.
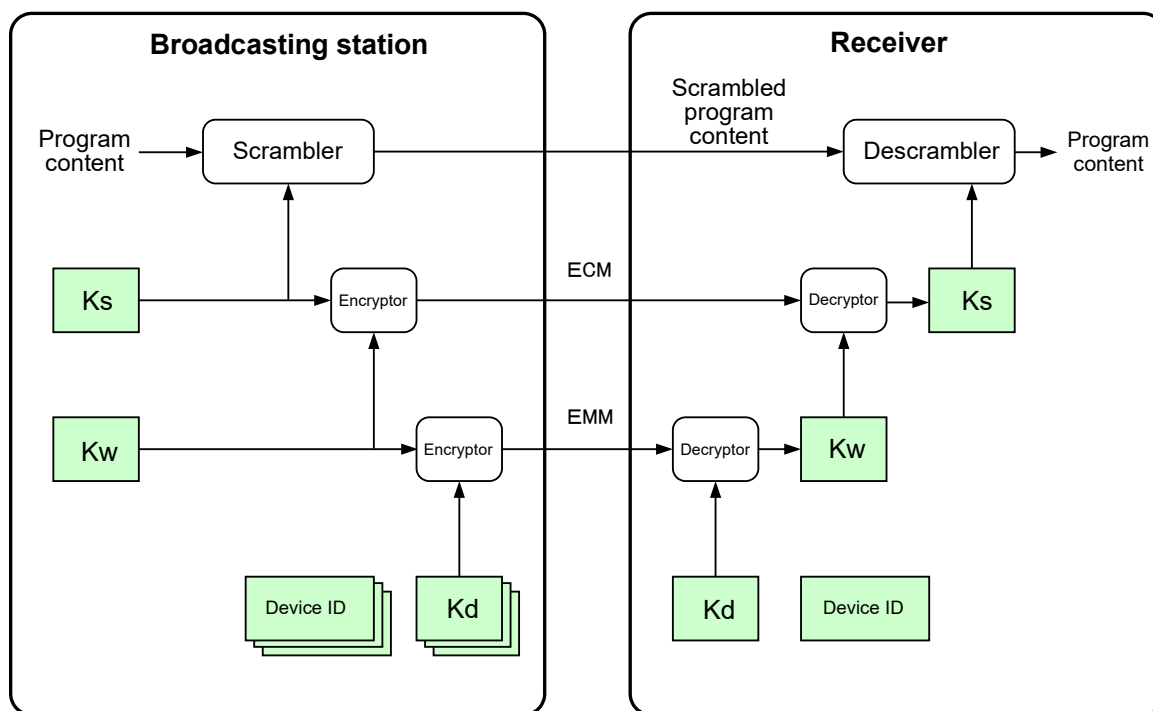
Figure 3-1 Basic Principle of the System

3.2.2 Structure of this content protection system

This content protection system assumes that all the requirements for basic operation are disclosed to authorized receiver unit manufacturers. Accordingly, methods for dealing with leaks of Kws and Kds that should be confidential information that exists in the receiving end are defined. Regarding Kws, a receiver unit that is a possible leak source is identified at an ID level to provide a means to seek causes for information leaks. For Kds, in order for there to be a unique value specified for individual receiver unit IDs, there should be a leak source specification function. However, in order to deal with leaks, a new Kd generation/update capabilities has been prepared.

3.2.3 Associated information types

There are two types of associated information, namely ECM (program information) and EMM (individual information). There are two types of ECMs in different forms (ECM-F0 and ECM-F1). The main purpose of both types of ECMs is to carry scrambling keys but the role of the ECM-F0 is to carry information used to detect tamper of content protection information and the role of the ECM-F1 is to detect a leak source when a work key is leaked from a receiver unit. There is only one type of EMM, which carries information required for decrypting ECM-F0 and ECM-F1 at the same time.

The key structure of ECM-F0 is the same as that of the CAS defined in Part 1 of this document, and the structure of the basic principle of Figure 3-1 is applied as is. In other words, in each RMP broadcaster group, a single work key common to all receiver units is generated and data is encrypted by this common work key. On the other hand, the basic principle of the system shown in Figure 3-1 is extended as Figure 3-2 so that ECM-F1 can detect sources of work key leaks.

In the structure extended as in Figure 3-2, the system operates as below.

  a) Multiple work keys are generated and transmitted in one RMP broadcaster group.
  b) Among the generated multiple Kws, only one is distributed to each receiver unit Identifier.
  c) The transmission system encrypts a single Ks that is used for scrambling using all the Kws and the encrypted Kss are superimposed in an ECM.
  d) The receiver unit selects the Ks part only that was encrypted using the Kw that was distributed to itself and decrypts it.
  e) Content is decrypted using the decrypted Ks acquired.

Limiting receiver units to which each work key is distributed in this structure makes it possible to narrow down leak sources when a work key distributed in an EMM is leaked. A

single leak source can be identified depending on how multiple Kws are assigned.

Regarding ECM, there are cases where only one of the two types of ECM is used depending on the operation of broadcasters.
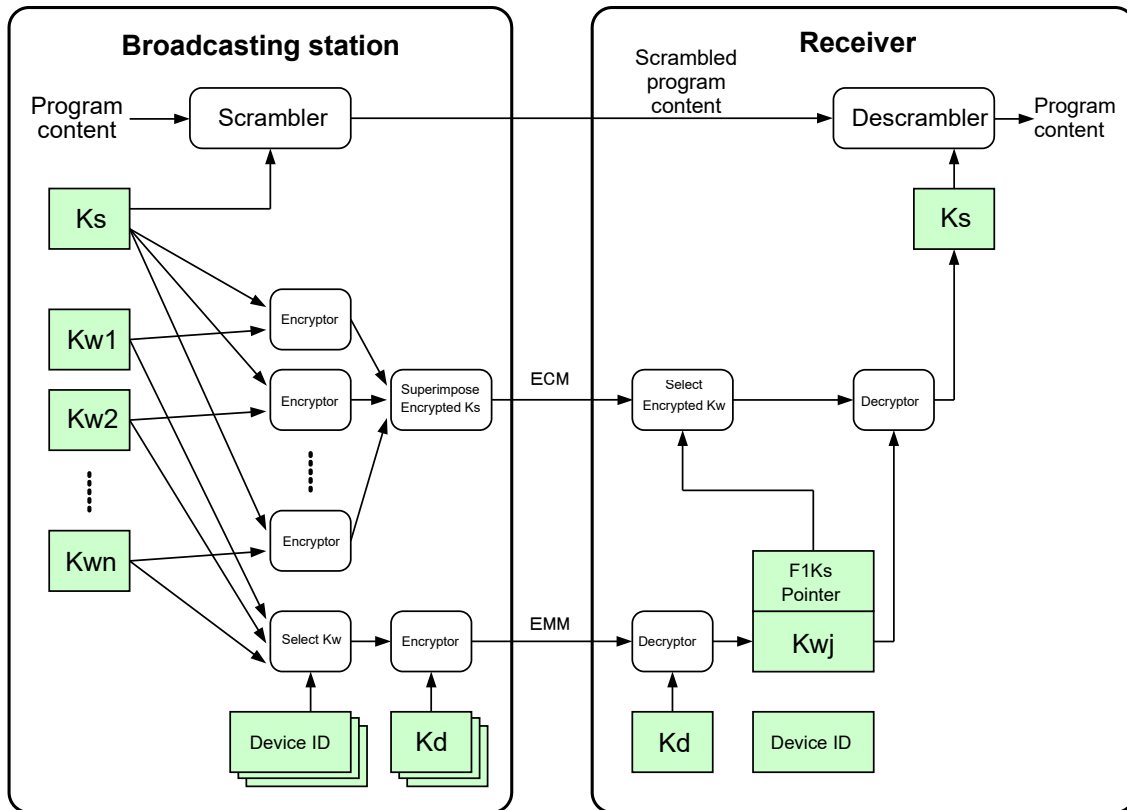
Figure 3-2 System Structure Extended for Kw Leak Source Detection

3.2.4 Format of associated information

Broadcasters can select an integrated or independent format for individual information.

3.2.5 Encryption method of associated information

The encryption algorithm uses common private keys which are equivalent to a 128-bit key length and includes a CBC mode that has a CBC initial value as a parameter. Additionally, this encryption method is commonly used in this content protection system but part 3 does not address the details.

3.2.6.ECM

3.2.6.1 Basic ECM structure

(1) ECMs are transmitted using the MPEG-2 system section format. An ECM may be carried in a single TS packet or in multiple TS packets. In either case, multiple sections never co-exist in a single TS packet (single section). Please note that the transmitting end must transmit "0" as the "reserved" bit in the ECM payload and the receiving end must ignore it.

Figure 3-3 illustrates the basic structure of ECM TS packet.

(When an ECM is carried in a single TS packet)
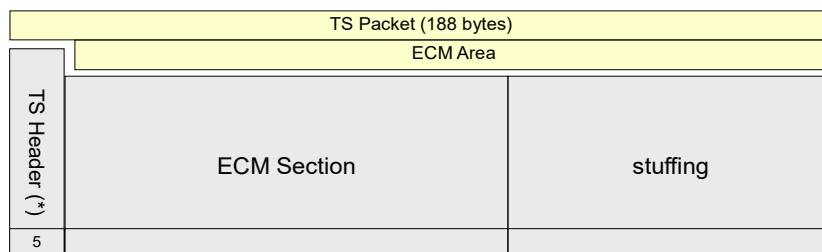
(*)Includes pointer field.

(When an ECM is carried in multiple TS packets)
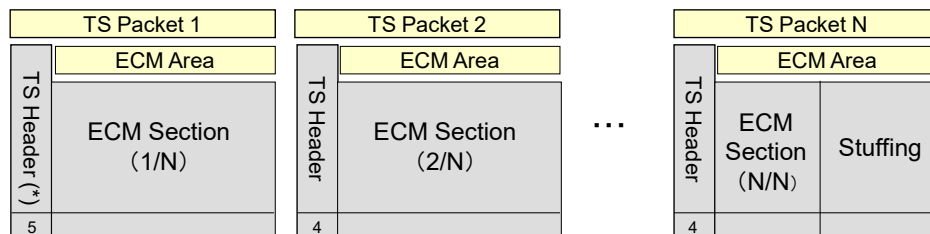
(*) Includes pointer field

Figure 3-3 TS Packet Structures that Carry ECMs

(2) There are two types of ECMs, namely ECM-F0 and ECM-F1 and they have different architectures. ECM-F0 is the structure illustrated in Figure 3-4 and ECM-F1 in Figure 3-5. ECM-F0s and ECM-F1s are identified using ECM protocol numbers.

- Structure of ECM-F0
  - ➢ The ECM payload consists of a fixed part that is always transmitted and a variable part whose content varies according to the transmission objective.
  - ➢ The entire ECM section is subject to a section CRC.
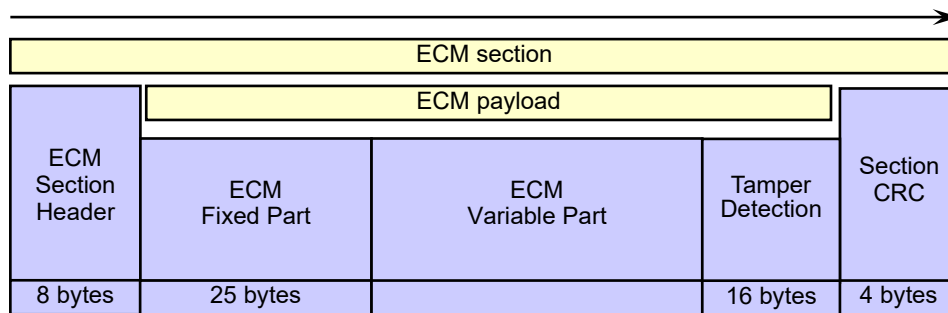
Figure 3-4 ECM-F0 Section Structure

● Structure of ECM-F1
  ➢ The ECM payload consists of a fixed part that is always transmitted and a variable part whose length varies depending on the operation.
  ➢ Tamper detection does not exist.
  ➢ The entire ECM section is subject to a section CRC.
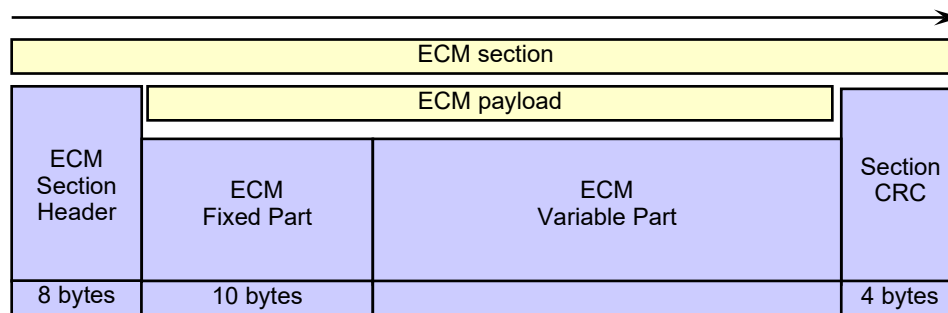
Figure 3-5 ECM-F1 Section Structure

(3) Depending on the operation of broadcasters, either ECM-F0 or ECM-F1 may be used as for ECM transmission. The specific operation of transmitting ECM is defined separately in the operational guideline for broadcasters.

3.2.6.2 Data structure of ECM-F0

Table 3-1 details the ECM-F0 section structure.

Table 3-1 ECM-F0 Section Structure

Structure						Notes
ECM Section	ECM-F0 payload			ECM section header (Table identifier 0x82)		8 Bytes
		Encrypted part	Tamper detection calculation range	Fixed part	Protocol number	1 Byte
					RMP broadcaster identifier	2 Bytes
					F0 work key identifier	1 Byte
					Scrambling key (odd)	8 Bytes
					Scrambling key (even)	8 Bytes
					Date/time	5 Bytes
				Variable part		Capable of accommodating various function information
			Tamper detection			16 Bytes
	Section CRC					4 Bytes

(1)   ECM-F0 fixed part

　　(i) Protocol number（common to ECM-F0 and ECM-F1）

● Identification of ECM forms and encryption/decryption algorithm parameters.

● The upper 2 bits specify the CBC mode default value for associated information encryption. Please note that part 3 of this standard does not address specific CBC mode default values.

The least significant bit (bit 0) distinguishes ECM-F0 from ECM-F1.

0: Form 0 (ECM-F0)

1: Form 1 (ECM-F1)

5 bits (bits1 to 5) are reserved.

Table 3-2 Protocol Numbers

Values (binary numbers)	Details
00XXXXX0B 00XXXXX1B	Specifies the CBC initial value 0 for associated information encryption ECM-F0 "　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　ECM-F1
01XXXXX0B 01XXXXX1B	Specifies the CBC initial value 1 for associated information encryption ECM-F0 "　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　ECM-F1
10XXXXX0B 10XXXXX1B	Specifies the CBC initial value 2 for associated information encryption ECM-F0 "　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　ECM-F1
11XXXXX0B 11XXXXX1B	Specifies the CBC initial value 3 for associated information encryption ECM-F0 "　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　ECM-F1

(ii) RMP broadcaster identifier (common to ECM-F0 and ECM-F1)

- Code used to identify RMP broadcaster groups that operate this content protection system and values between 0x0000 and 0xFFFF are used.
- Only one (common) RMP broadcaster identifier within a single transport stream.

(iii) F0 work key identifier

- An F0 work key identifier has 1 byte and shows the identifier of the F0 work key used to decrypt this ECM-F0. Among the F0 work keys (Odd/Even) for broadcaster individual data stored in the receiver, the one corresponding to this item and identifier is the F0 work key.

  (Note) If there is no F0 work key with the same identifier in the broadcaster individual data that means that EMMs that carry work keys are not received and there is no F0 work key, therefore ECM-F0 cannot be decrypted.

(iv) Scrambling keys (odd/even)

- Sends a pair of scrambling keys (Ks) including the current and next keys.

(v) Date/time

- This is not being used (reserved).

(2) ECM-F0 variable part

The variable part is composed of a descriptor area (arbitrary length).

(i) Descriptor area

The following descriptor is placed in the descriptor area. The descriptor may not be placed. Additionally, values defined only within the range of this standard can be used for the tag value of the descriptor.

Table 3-3 Type of ECM Descriptor

Type of descriptor	Tag value
copy control information protection descriptor	0xE0

(3) Tamper detection

Code data used to detect tampering of ECM-F0. Part 3 of this standard does not address a calculation method for detecting tamper, etc.

3.2.6.3 Data structure of ECM-F1

Table 3-4 details the ECM-F1 section structure.

Table 3-4 ECM-F1 Section Structure

Structure					Notes
ECM Section	ECM-F1 payload		ECM section header (Table identifier 0x82)		8 Bytes
		Encrypted part	Fixed part	Protocol number	1 Byte
				RMP broadcaster identifier	2 Bytes
				Date and time	5 Bytes
				F1 work key identifier	1 Byte
				Number of scrambling key pairs	1 Byte
			Variable part	Scrambling key 0 (odd)	8 Bytes
				Scrambling key 0 (even)	8 Bytes
				Scrambling key 1 (odd)	8 Bytes
				Scrambling key 1 (even)	8 Bytes
				· ·	· ·
				Scrambling key n-1 (odd)	8 Bytes
				Scrambling key n-1 (even)	8 Bytes
	Section CRC				4 Bytes

ECM-F1 payload is composed of the 10-byte fixed part and the variable part whose length varies depending on the number of scrambling key pairs (n). Tamper detection is not arranged.

(1) Fixed part in ECM-F1

　(i) Protocol number（common to ECM-F0 and ECM-F1）

　　● Identification of ECM forms and encryption/decryption algorithm parameters.

　　● The upper 2 bits specify the CBC mode default value for associated information encryption. Please note that part 3 of this standard does not address specific CBC mode default values.

　　The least significant bit (bit 0) distinguishes ECM-F0 from ECM-F1.

　　　　0: Form 0 (ECM-F0)

　　　　1: Form 1 (ECM-F1)

　　5 bits (bits 1 to 5) are reserved.

　　(Note) In ECM-F1, because an encryption block has 16 bytes, CBC calculation is normally not required, but it is kept in order to have the same processing procedure as the ECM-F0.

Table 3-5 Protocol Numbers

Values (binary numbers)	Details	
00XXXXX0B	Specifies the CBC initial value 0 for associated information encryption	ECM-F0
00XXXXX1B	"	ECM-F1
01XXXXX0B	Specifies the CBC initial value 1 for associated information encryption	ECM-F0
01XXXXX1B	"	ECM-F1
10XXXXX0B	Specifies the CBC initial value 2 for associated information encryption	ECM-F0
10XXXXX1B	"	ECM-F1
11XXXXX0B	Specifies the CBC initial value 3 for associated information encryption	ECM-F0
11XXXXX1B	"	ECM-F1

(ii) RMP broadcaster identifier (common to ECM-F0 and ECM-F1)

- Code used to identify RMP broadcaster groups that operate this content protection system and values between 0x0000 and 0xFFFF are used.
- Only one (common) RMP broadcaster identifier within a single transport stream.

(iii) Date/time

- This is not being used (reserved).

(iv) F1 work key identifier

- Two types of F1 work keys (odd/even) are setup in an EMM. The F1 work key identifiers of these F1 work keys (1 byte) are compared with this item (1 byte), and the F1 work key with the same identifier as this one is regarded as the work key to decrypt this ECM-F1. If there is no work key with the same identifier, it means that there is no work key needed for decryption and this ECM-F1 cannot be decrypted.

(v) Number of scrambling key pairs

- Shows the number of scrambling key (Ks) pairs that are carried in the variable part. The value (n) changes depending on the operation. $1 \leqq n \leqq 254$.

(2) ECM-F1 variable part

n pairs of scrambling keys (fixed length – 16 bytes) are placed in the variable part of

-332-

ECM-F1. No descriptors are placed.

(i) Scrambling keys 0 to n-1 (odd/even)

- A pair of scrambling keys(Ks), namely the current and next scrambling keys, is transmitted.

- The same pair of Ks (odd/even) is encrypted using n different types of F1 work keys and transmitted in scrambling keys 0 to n-1.

- Only scrambling keys 0 to n-1 are encrypted in the ECM-F1.

- When ECM-F1 is encrypted, n different types of F1 work keys are used, but each receiver unit has only type of F1 work key. With which scrambling key each receiver unit decrypts depends on the F1Ks pointer value that is set in the EMM. For example, when the F1Ks pointer is 0x00, the scrambling key 0 is decrypted and when the F1Ks pointer is 0x14, the scrambling key 20 is decrypted.

3.2.6.4 Descriptors in the ECM

ECM descriptors are placed only in ECM-F0 when needed. No descriptors are placed in ECM-F1.

(1) Copy control information protection descriptor

Table 3-6 Copy Control Information Protection Descriptor Structure

Syntax	Number of Bytes	Notes
Descriptor tag	1	0xE0
Descriptor length	1	
Service ID	2	
Detection threshold	1	
Number of detection loops	1	=N
Detection descriptor tag	1	N times loop
Detection level	1	
Detection code	4	
Total	6+6N	

(Role)

- Descriptor to detect tampering of content protection information (digital copy control descriptor, content availability descriptor). When this descriptor is placed, the receiver unit follows the specified operation and performs the tamper detection process for the specified content protection information.

(Operational Rules)

● Only content protection information in PMTs is examined and content protection information that is carried in SDTs and EITs is not examined.

● A digital copy control descriptor can be placed in both first and second loops, but tampering can be detected using this descriptor only when the digital copy control descriptor is placed only in the first loop and not in the second loop. In operations other than the above, this descriptor is not transmitted in ECM-F0 and the tamper detection process is not performed.

● Only one copy control information protection descriptor can be placed in a single ECM-F0.

● There are times when a single ECM-F0 is used in multiple services. However, the receiver unit performs the tamper detection process for each service being descrambled. When tampering is detected, only the falsified service is dealt with accordingly.

● There are times when a single ECM-F0 is used in multiple services A, B, C and at the same time, the receiver unit descrambles services A, B and C at the same time. In such case, the receiver unit examines the PMT for service A with the first ECM-F0, the PMT for service B with the next ECM-F0, and the PMT for service C with the next ECM-F0. In other words, different ECM-F0s are used to examine each PMT. When service A is examined, the tamper status in services B and C just before the examination of service A remains and when an operation predefined by the operational guideline for broadcasters separately is being performed, that operation also continues.

In addition, when an ECM-F1 is received, an ECM-F1 is not included in this descriptor but the tamper status of each service remains as is for the previous value.

Additionally, regarding the service ID of services being used, when it is never written in those descriptors in successive ECM-F0s for services for several minutes being transmitted in the relevant TS, the tamper detection process for the relevant services is not performed, the tamper detect counter must be reset, and the operation to be performed when tampering is detected that is defined by the operational guideline for broadcasters separately must be canceled.

● While the tamper detection process is being performed, this descriptor must be placed in any of the ECM-F0s transmitted during the process. On the other hand, while the tamper detection process is not being performed, ECM-F0s without this descriptor must be transmitted to expressly show that the tamper detection

（Explanation of the items）

process will not be performed. When the receiver unit receives an ECM-F0 that does not have this descriptor, the tamper detection counters for all the services that use this ECM-F0 must be reset and the operation to be performed when tampering is detected that is defined by the operation guideline for broadcasters must be cancelled.

(Explanation of the items)

(i) Service ID

● Identifies services for which tampering of content protection information is checked.

Displays a service to be examined for when a single ECM can be commonly used for multiple services (three SD services and one HD service, etc.). However, among such services, services being descrambled are eventually examined and services not being descrambled are not examined.

(ii) Detection threshold

● Counter threshold for deciding whether there was a tamper detection error. As there may be a time difference between when the PMT is updated and when the ECM is updated, it is not considered a tamper detection error when an inconsistency is detected only once, however when an inconsistency is detected for more than certain numbers of times in succession, it is considered as a tamper detection error. The detection threshold shows the threshold value for the number of times an inconsistency was detected in succession.

● The receiver unit must have one counter for tamper detection (tamper detection counter) for each service to be examined (= service being descrambled).

● When an ECM-F0 with this descriptor is received, content protection information in the latest PMT that has been received is examined for the service specified by the ECM-F0. When there is an inconsistency between the examination result and the detection code, the tamper detection counter for the corresponding service is incremented (one for each ECM). In other words, when there is a possibility that multiple inconsistencies are detected when N times loop is examined within this descriptor, these inconsistencies are counted as one.

● When an ECM-F0 without any inconsistencies is received, the tamper detection counter for the corresponding service is initialized.

● When an ECM-F0 that does not have this descriptor is received, the tamper detection counters for all the services for which the ECM-F0 are used are initialized.

● Values other than "0" are set in the detection threshold (1≦detection threshold ≦255). When "0" is described in the detection threshold, the receiver unit performs the same processing as when this descriptor is not placed.

(iii) Number of detection loops
● Shows the number of sets of detection descriptor tag, detection level and detection code listed below.

(iv) Detection descriptor tag
● Shows the tag value of a descriptor for content protection information of which tampering is examined. Descriptors to be examined for tamper detection are shown below.

Table 3-7 Detection Descriptor Tags

Value	Descriptors to be examined
0xC1	Digital copy control descriptor
0xDE	Content availability descriptor
Others	Not used (the receiver unit ignores this item and does not invalidate the entire descriptor)

● When a digital copy control descriptor is examined, it must be confirmed that this descriptor exists in the first loop of the PMT and not in the second loop. When it does not exist in the first loop, it is judged that the descriptor has been deleted by tampering. When it exists in the second loop, it is judged that the descriptor has been inserted by tampering. In either case, it is regarded there has been an inconsistency, which increments the counter by one.
● When a content availability descriptor is examined, it must be confirmed that this descriptor exists in the PMT. If not, it is judged that the descriptor has been deleted by tampering and it is regarded there has been an inconsistency, which increments the counter by one.

(v) Detection level
● Defines an examination method for or details of tamper detection examination of content protection information descriptors.

Table 3-8 Detection Level

Value	Operation
0x00	Examines all data of the descriptor shown with an detection descriptor tag.
0x01	● When the detection descriptor tag is a digital copy control descriptor, for the digital copy control descriptor in the first loop of the PMT, "digital_recording_control_data" (2 bits), "copy_control_type" (2 bits) and "APS_control_data" (2 bits)" only is examined. ● When the detection descriptor tag is a content availability descriptor, only "retention_mode" (1 bit), "retention_state" (3 bits) and "encryption_mode" (1 bit) are examined.
Others	Not used (the receiver unit ignores this item and does not invalidate the entire descriptor)

(vi) Detection code

● Reference code for the tamper detection examination results of content protection information descriptors

➢ When the detection level is "0x00" (all data examined), a CRC calculation is performed for all data of the descriptor to be examined (entire descriptor including the descriptor length and tag) using the CRC encoding method described in "Appendix B 'CRC Decoder', Part 2 of the ARIB STD-B10)", and Reference code shall be 4 bytes in the result on the calculations.

A CRC calculation is performed for the corresponding descriptor in the PMT and the result is compared with this item.

➢ When the detection descriptor tag is a digital copy control descriptor and the detection level is "0x01", a total of 6 bits from "digital_recording_control_data" (2bits), "copy_control_type" (2bits) and "APS_control_data" (2bits) within the digital copy control descriptor to be transmitted is described in order starting from the MSB.

Only bits 7 to 2 in the first 1 byte among 4bytes are used.

    digital_recording_control_data   : bits 7 to 6

    copy_control_type   : bits 5 to 4

    APS_control_data   : bits 3 to 2

The result is compared with the corresponding item in the digital control copy descriptor in the first loop of the PMT.

➢ When the detection descriptor tag shows a content availability descriptor and the detection level is "0x01", a total of 5 bits from "retention_mode" (1bit), "retention_state" (3bits) and "encryption_mode" (1bit) within the

content availability descriptor to be transmitted are described starting from the MSB (bit 7).

Only the bits 7 to 3 in the first 1 byte among 4bytes are used.

retention_mode ：bit 7

retention_state ：bits 6 to 4

encryption_mode：bits 3

The examination is compared to the corresponding item of the content use descriptor in the PMT.

● The receiver unit, according to the detection level, refers to the descriptor shown with the detection descriptor tag or performs a calculation and checks whether the result is consistent with the detection code. When an inconsistency is found in succession for more than the number of times on the detection threshold, it is judged that the descriptor has been falsified in the corresponding PMT.

3.2.7 EMM

3.2.7.1 Basic EMM Structure

EMMs are transmitted using the MPEG2 section format. The basic structure of an EMM section is described below. For operation of the reserve bit in the payload of EMM, the transmitting side must transmit "0" and the receiving side must ignore it.

● The EMM section can carry multiple EMM payloads.

● Within a single section, the first EMM and the second EMM accommodate the device ID with the smallest value and the device ID with the largest value within the section respectively. The remaining EMMs are sorted in ascending order of device ID values.

● ID identifiers within a single section have the same value.

● The entire EMM section is subject to a CRC.

The following describes the basic structure of the EMM payload:

● The EMM payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.

● Only necessary EMM functional information is inserted into the variable part of the EMM.

● The device ID (8 bytes) and the associated information byte length (1 byte) are sent at the beginning of the EMM fixed part (unencrypted part). The receiver filters this area to identify EMM payloads addressed to itself.
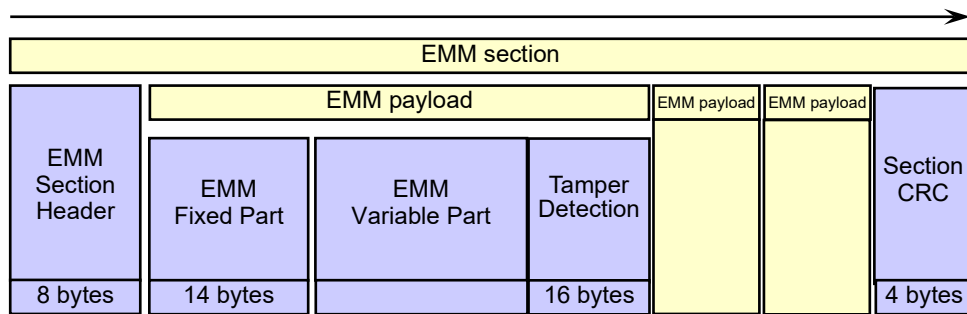
Figure 3-6 EMM Section Structure

3.2.7.2 EMM data structure

The EMM section structure is shown below.

Table 3-9 EMM Section Structure

Structure					Notes
EMM section	EMM section header (Table identifier 0x84)				8 Bytes
	EMM payload 1	Tamper detection calculation range	Fixed part	Device ID	8 Bytes
				Associated information byte length	1 Byte
				Protocol number	1 Byte
				RMP broadcaster identifier	2 Bytes
				Update number	2 Bytes
		Encrypted Part	Variable part		Capable of accommodating various function information
		Tamper detection			16 Bytes
	Payload 2	(Same as above)			
	Payload 3	(Same as above)			
	⋮	⋮			
	Payload n	(Same as above)			
	Section CRC				4 Bytes

(1) EMM fixed part

    (i) Device ID

- Identification number given to each receiver unit to identify manufacturers or models.

  - ・bit 63 to bit 61 (3bits)：ID identifier to identify RMP model IDs and RMP manufacturer IDs.
  - ・bit 60 to bit 8 (53bits)：Device ID payload to show the identifier of the model and manufacturer.
  - ・bit 7 to bit 0 (8bits): Generation number (Extended part of the ID payload)

- There are two types of device IDs of the RMP model ID and RMP manufacturer ID, and they are identified with an ID identifier value (3bits).

- The receiver unit compares consistency between the Device ID payload of the device ID that corresponds to the ID identifier (3bits) with the generation number (bit 60 to bit 0).

- Multiple EMMs transmitted within a single section must have the same ID identifier.

- RMP model IDs may not be operated. Specific operation of device IDs shall be defined separately in the operational guideline for broadcasters.

Table 3-10 ID identifiers

ID identifier	ID referenced by the receiver unit
000	Transmission with an individual ID (Note)
001	Transmission for an RMP model ID
010	Transmission for with RMP manufacturer ID
Others	Unused

(Note) Reserved. Individual IDs are not used in this content protection system.

    (ii) Associated information byte length

- Describes the byte length from the protocol number to tamper detection and serves as an offset to point to the device card ID of the EMM payload when sending multiple EMM payloads in a single section.

    (iii) Protocol number

- Encryption/decryption algorithm parameter.
- The upper 2 bits specify the CBC mode default value for associated information encryption. The lower 6 bits are reserved.
- Part 3 of this standard does not address specific CBC mode default values.

Table 3-11 Protocol Numbers

Values (binary numbers)	Details
00XXXXXXB	Specifies the CBC initial value 0 for associated information encryption
01XXXXXXB	Specifies the CBC initial value 1 for associated information encryption
10XXXXXXB	Specifies the CBC initial value 2 for associated information encryption
11XXXXXXB	Specifies the CBC initial value 3 for associated information encryption

(iv) RMP broadcaster identifier

- Code used to identify RMP broadcaster groups. Values between 0x0000 and 0xFFFF are used.

- Only one (common) RMP broadcaster identifier within a single transport stream.

(v) Update number

- Number that is increased when the EMM (individual information) is updated. The default value stored in the receiver unit is "0x0000" and the EMM update number transmitted for the first time is "0x0001" as a rule.

- The update number is managed for each RMP manufacture ID or RMP model ID by each RMP broadcaster group. Additionally, the same update number is shared by an RMP manufacture ID and an RMP model ID, and therefore shared by a minimum of two types of device IDs, and when the generation of a device ID is updated, it is shared by a maximum of four types of device IDs.

- Even when the device ID is updated and the generation number changes, the update number will not be reset.

- As a rule, for the same EMM, the update number is not updated.

- In the receiver unit side, the largest update number that has been received in the past is stored and managed, and when the update number of a transmitted EMM is larger than the one that is stored, it processes the reception. When the update number of a transmitted EMM is equal to or smaller than the stored update number, it discards the received EMM.

- When the update number of the EMM is equal to "0x0000", the receiver unit does not compare this with the stored update number and does not store it, and processing of the EMM is conducted unconditionally. The number and interval of

EMM transmissions must be decided in consideration of the load on the receiver.

● When the update number of the EMM is equal to "0xFFFF", the update number stored in the receiver is reset to "0x0000" and at the same time, the receiver unit processes the EMM unconditionally. "Update number = 0xFFFF" is used for testing receivers. In this case, as the receiver unit processes the EMM unconditionally, the number and interval of EMM transmissions must be decided in consideration of the load on the receiver.

(2) EMM variable part

The following descriptors are placed in the variable part. Values defined only within the range of this standard can be used for the descriptor tag values.

Table 3-12 Types of EMM Descriptors

Types of descriptors	Tag value
Work key setup descriptor	0xF0
Device key update descriptor	0xF1
Dummy descriptor	0xF2
F0 work key setup descriptor	0xF3
F1 work key setup descriptor	0xF4
Work key invalid notification descriptor	0xF5

(3) Tamper detection

Code data used to detect tampering of EMMs. Part 3 of this standard does not address the calculation method for detecting tamper, etc.

3.2.7.3 Descriptors in an EMM

(1) Work key setup descriptor

Table 3-13 Work Key Setup Descriptor Structure

Syntax	Number of bytes	Notes
Descriptor tag	1	0xF0
Descriptor length	1	0x47
Work key invalid flag	1	
F0 work key identifier (odd)	1	
F0 work key (odd)	16	
F0 work key identifier (even)	1	
F0 work key (even)	16	
F1 work key identifier (odd)	1	
F1Ks pointer (odd)	1	
F1 work key (odd)	16	
F1 work key identifier (even)	1	
F1Ks pointer (even)	1	
F1 work key (even)	16	
Total	73	

(Role)

    Sends information necessary for decrypting ECM-F0 (F0 work key identifier and F0 work key) and information necessary for decrypting ECM-F1 (F1 work key identifier, F1Ks pointer and F1 work key).

(Explanation of the items)

  (i) Work key invalid flag

- Information that shows whether the work key is valid/invalid and the following values are used.

    0x00 : Work key is valid

    0x01 : Work key is invalid

- When this item is "0x01", the relevant broadcasting station is notified that the receiver unit has been revoked. When the receiver unit receives "0x01", the work key invalid flag for the individual broadcasting station status is turned "ON". Since the receiver unit can know whether it has been revoked or not by managing the work key invalid flag, it can classify the types of error messages to display. When the receiver unit receives the value "0x00" when the work key invalid flag is "ON", the flag is returned to "OFF".

- When this item is "0x01", the following items (ii) to (vi) are all ignored.

(ii) F0 work key identifier (odd/even)

- Information use to identify F0 work keys and values between "0x00" and "0xFF" are used.

(iii) F0 work key (odd/even)

- Work key used to decrypt ECM-F0. The receiver stores two types of F0 work keys (odd/even) in the relevant storage area for broadcaster individual data. The F0 work key is shared by all the receiver units in the relevant RMP broadcaster group.

(iv) F1 work key identifier (odd/even)

- Information used to identify F1 work keys and F1Ks pointers, and values between "0x00" and "0xFF" are used.

(v) F1Ks pointer (odd/even)

- Shows the number of the scrambling key (0 to n-1) in the ECM-F1 that should be decrypted with the transmitted F1 work key.

(vi) F1 work key (odd/even)

- Work key to decrypt ECM-F1. The receiver stores two types of F1 work keys (odd/even) in the relevant storage area for broadcaster individual data. An RMP broadcaster group uses n types of F1 work keys at the same time but each receiver has only one type among these F1 work keys.

(2) Device key update descriptor

Table 3-14 Device Key Update Descriptor Structure

Item	Number of byes	Notes
Descriptor tag	1	0xF1
Descriptor length	1	0x06
ID identifier	1	
Generation number	1	
Device key update parameter	4	
Total	8	

(Role)

Sends update information of the device ID and device key (Kd) to the receiver unit.

(Explanation of the items)

(i) ID identifier

- Shows the identifier number of the ID to be updated. "0x01" is for an RMP model ID and "0x02" is for an RMP manufacturer ID.

(ii) Generation number

- Shows the generation number after the device ID/device key (Kd) has been updated. Values between "0x01" and "0xFF" are valid.

(iii) Device key update parameter

- Parameter used to generate a device key (Kd) in the receiver unit.

(Notes)

- EMMs with the device key update descriptor is transmitted only for the original device ID of each respective RMP model ID and RMP manufacturer ID.
- The default value of the generation number stored in the receiver unit (the value when the device ID/device key has not been updated) is "0x00".

(3) Dummy descriptor

Table 3-15 Dummy Descriptor Structure

Syntax	Number of bytes	Notes
Descriptor tag	1	0xF2
Descriptor length	1	
Dummy data	N	$0 \leqq N$
Total	N+2	

(Role)

Inserts dummy data in order to ensure enough length for an encrypted EMM data area (longer than 16 bytes).

(Explanation of the items)

(i) Dummy data

- Dummy data such as random numbers. The receiver unit must ignore the content of this data.

(4) F0 work key setup descriptor

Table 3-16 F0 Work Key Setup Descriptor Structure

Syntax	Number of bytes	Notes
Descriptor tag	1	0xF3
Descriptor length	1	0x22
F0 work key identifier (Odd)	1	
F0 work key (Odd)	16	
F0 work key identifier (Even)	1	
F0 work key (Even)	16	
Total	36	

(Role)

Transmits information (F0 work key identifier, F0 work key) necessary for ECM-F0 decryption.

(Explanation of the items)

(i) F0 work key identifier (Odd/Even)

- Information used to identify F0 work keys, with values from 0x00 to 0xFF.

(ii) F0 work key (Odd/Even)

- This is a work key for decoding ECM-F0. A receiver stores two types of work keys, Odd and Even, in the relevant storage area in station individual data. The F0 work key is a common work key for all receivers in the relevant RMP broadcaster.

(5) F1 work key setup descriptor

Table 3-17 F1 Work Key Setup Descriptor Structure

Syntax	Number of bytes	Notes
Descriptor tag	1	0xF4
Descriptor length	1	0x24
F1 work key identifier (Odd)	1	
F1Ks pointer (Odd)	1	
F1 work key (Odd)	16	
F1 work key identifier (Even)	1	
F1Ks pointer (Even)	1	
F1 work key (Even)	16	
Total	38	

(Role)

Transmits information (F1 work key identifier, F1Ks pointer, and F1 work key) necessary for ECM-F1 decryption.

(Explanation of the items)

(i) F1 work key identifier (Odd/Even)

- Information used to identify F1 work keys and F1Ks pointers, with values from 0x00 to 0xFF.

(ii) F1Ks pointer (Odd/Even)

- Indicates the number (0 to n-1) of ECM-F1 scrambling key that should be decoded with the transmitted F1 work key.

(iii) F1 work key (Odd/Even)

- This is a work key for decoding ECM-F1. A receiver stores two types of work keys, Odd/Even, in the relevant storage area of station individual data. N types of F1 work keys are operated simultaneously by a RMP broadcaster, but each receiver has only one of them.

(6) Work key invalid notification descriptor structure

Table 3-18 Work Key Invalid Notification Descriptor Structure

Syntax	Number of bytes	Notes
Descriptor tag	1	0xF5
Descriptor length	1	
Work key invalid flag	1	
Notification Description	N	$0 \leqq N \leqq 254$
Total	N＋3	

(Role)

It transmits validity/invalidity of the work key to the receiver concerned.

(Explanation of the items)

(i) Work key invalid flag

- This information indicates whether the work key is valid or invalid, and the following values are used.

    0x00 : The work key is valid.

    0x01 : The work key is invalid.

- When this item is 0x01, the receiver is notified that the work key for the relevant broadcast station has been disabled. When the receiver receives 0x01, it shall turn ON the work key invalidation flag of the station individual status.

By managing the work key invalidation flag, the receiver can know whether its own work key has been invalidated or not and can differentiate the type of error message to be displayed. If a value of 0x00 is received while the work key invalidation flag is ON, the flag is set back to OFF.

(ii) Notification description

● For the receiver concerned, the character information (e.g., contact information when disabled) regarding the validity/invalidity of the work key shall be described.

● Encoding of character information, limitation of character information length, and display method on receivers shall be separately stipulated in the operational guideline for broadcasters.

3.2.8 Message information (EMM/ECM)

3.2.8.1 EMM common messages

(1) Basic structure of EMM common messages

EMM common messages are transmitted in the section format (EMM message section) of MPEG2 system. The basic structure of the EMM message section is described below.

● The entire EMM message section is subject to CRC.

● "One message per one section"

● The table_id_extension in EMM message section headers means the Fixed Message Sentence Number, the possible value is a value between 0x0001 to 0xFFFF.

● EMM common messages are not encrypted.

● The source of the message shall be a RMP broadcaster.

The structure of the EMM common message section is shown below.

EMM message section			
	EMM message payload		
EMM message Section Header	EMM common message Fixed Part	EMM common message Variable Part	Section CRC
8 bytes	19 bytes		4 bytes
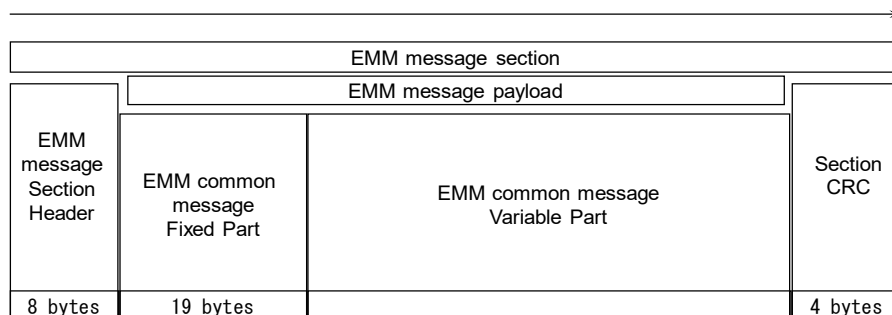
Figure 3-7 Structure of EMM common message section

(2) Structure of EMM common message section

The section structure of EMM common messages shall be as follows.

Table 3-19 Section Structure of EMM Common Message

Description				Notes
EMM message section	EMM message payload	EMM common message Fixed Part	RMP broadcaster identifier	2 Bytes
			Kind of Automatic message deletion	1 Byte
			Automatic display duration time 1	1 Byte
			Automatic display duration time 2	1 Byte
			Automatic display duration time 3	1 Byte
			Number of times for Automatic display	1 Byte
			Format number	1 Byte
			Model control information	2 Bytes
			Partial identification	1 Byte
			Mask data	1 Byte
			Mask exclusion period	1 Byte
			Individual ID validity date	2 Bytes
			Display delay interval	1 Byte
			Message length	2 Bytes
			Recommended display position	1 Byte
		EMM common message Variable Part	Message code payload	N Bytes
	CRC Error detection			4 Bytes

Note: "EMM message section header — 8 Bytes" appears as the first row under "EMM message section".

(3) EMM message section details

Table 3-20 EMM Common Message Section Details

Syntax	Description	Number of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	Fixed Message Sentence Number (0x0001~0xFFFF)	16
reserved		2
version_number		5
current_next_indicator		1
section_number		8
last_section_number		8
rmp_broadcaster_group_ID	RMP broadcaster identifier	16
deletion_status	Kind of Automatic message deletion	8
displaying_duration1	Automatic display duration time 1	8
displaying_duration2	Automatic display duration time 2	8
displaying_duration3	Automatic display duration time 3	8
displaying_cycle	Automatic display count	8
format_version	Format number	8
receiver_type	Model control	16
partial_identification	Partial identification	8
mask_data	Mask data	8
exception_period	Mask exclusion period	8
validity_period	Individual ID validity date	16
delayed displaying period	Display delay interval	8
message_length	Message length	16
displaying_position	Recommended display position	8
message_area	Message code payload	N
EMM_message_section_CRC	CRC Error detection	32

(4) Details of EMM common message items

Details of major items are shown below.

1) Fixed Message Sentence Number（table_id_extension）

It indicates the number (0x0001 to 0xFFFF) of fixed sentence being sent in this EMM common message.

2) RMP broadcaster identifier

It identifies codes of RMP broadcaster groups and is used in the range of 0x0000 to

0xFFFF.

3) Kind of Automatic message deletion

It indicates the following types with respect to erasure and display of automatic display messages.

(1) 0x00 : Erasable; user-operated erase is possible

(2) 0x01 : Not erasable; user-operated erase is not possible

(3) 0x02 : Display erase; the following display control is performed. (Note 1)

> a) If the automatic display deletion type of the EMM common message to be displayed automatically is "0x02", its automatic display message is not displayed.

> b) If the automatic display deletion type of EMM common messages in use during automatic display is updated to "0x02" (Note 2), the display of the automatic display message is aborted.

> (Note 1) Automatic display duration 1, 2, 3, format number, message length, auto display count, and message code payload are ignored.

> (Note 2) During display of automatic display messages, a receiver monitors version_number of EMM common messages being used for display and detects updates. In this case, version_number shall be monitored even when "Display Erasure 0x02" is selected for automatic display deletion type.

4)   Automatic display duration time 1, 2, 3

In display of automatic display messages, the time parameter for a single display is specified in "0.1 minute" units (0 to 25.4 minutes) after service selection. However, 0xFF shall be indefinite.

5) Automatic display count

In display of automatic display messages, the number of display defined by automatic display duration 1, 2, and 3 is specified as automatic display count.
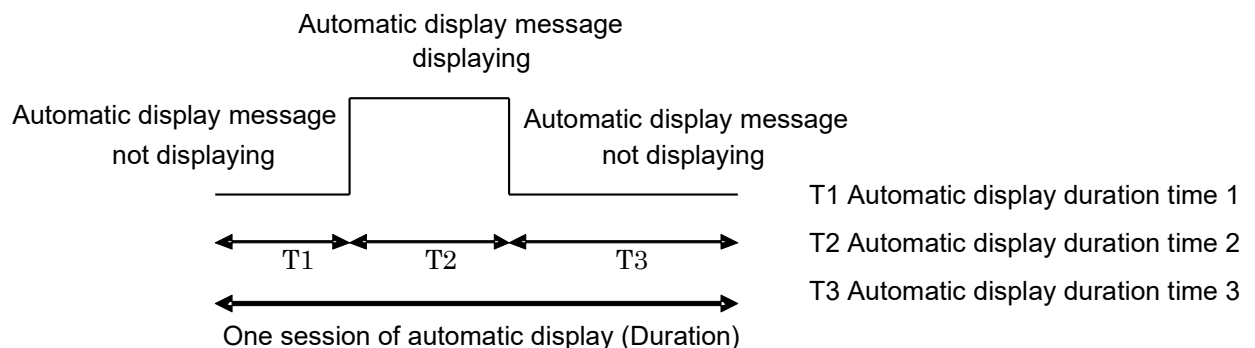
Figure 3-8 Automatic display duration and status of automatic display messages on receivers

6) Format number

It indicates description format (format) of message code payload.

7) Model control

It indicates the model of receivers for which the relevant EMM common message is valid. Specific receiver models shall be defined separately in the operational guideline for broadcasters. This item also controls the display of automatic display messages when playing programs received and stored by a receiver with storage functionality. Specific details are defined in the operational guideline for broadcasters.

8) Partial identification and mask data

Partial identifications specify the least significant 1 byte of individual ID or designated ID of a receiver for which the relevant EMM common message is to be valid. Only when the value of the logical product of the least significant 1 byte of the receiver's individual ID or designated ID and the mask data matches the value of the partial identification, the receiver makes the relevant EMM common message valid. However, if the mask data is 0x00, the message shall be valid for all receivers regardless of the value of the partial identification.

9) Mask exclusion period

It indicates the period during which designation process on a receiver by partial identification indicated in 8) is not performed (i.e., the EMM common message is always valid without performing the partial identification judgment process). The mask exclusion period is specified by the number of days (0 to 255 days) elapsed from the date of generation of the individual ID. 0 days (0x00) indicates that processing for partial identification is performed immediately.

10) Individual ID validity date

The effective date of individual ID is specified in the MJD. If the generation date of individual ID held in a receiver is past individual ID validity date, the receiver ignores the relevant EMM common message.

11) Display delay interval

It indicates the delay interval in days (0x00 to 0xFE) before automatic display messages are displayed (equivalent to the delay interval of CA service descriptor). However, when the value is 0xFF, messages are displayed immediately without delay interval. Like the delay interval for CA service descriptor, it does not control the playback of programs that have been received and stored by a receiver with storage functionality.

12) Message length

It indicates the number of bytes in the message code payload.

13) Recommended display position

The upper 4 bits shall be the recommended display position in the horizontal direction (0100: left, 0010: middle, 0001: right) and the lower 4 bits shall be the recommended display

position in the vertical direction (0100: top, 0010: middle, 0001: bottom). The specific position of the recommended display position shall be determined by product planning of receivers, and shall not be strictly defined at the display pixel level. However, in the case of 0xFF, it shall be displayed in the position separately specified in the operational guideline for broadcasters.

14) Message code payload

The specific sentence of the message (fixed sentence) is loaded. Character codes, etc. shall be defined separately in the operational guideline for broadcasters.

3.2.8.2 EMM individual messages

(1) Basic structure of EMM individual messages

EMM individual messages are transmitted in the MPEG2 system section format (EMM message section). The basic structure of an EMM message section is described below.

- "multi messages per one section"
- The entire EMM message section is subject to CRC.
- The table_id_extension in EMM message section header is 0x0000, meaning it is EMM individual message.
- The EMM message payload consists of EMM individual message fixed part that is always transmitted in a fixed length and EMM individual message variable part that is transmitted in variable length.
- The head of EMM individual message fixed part has automatic display message ID, EMM message identification and message byte length, and this part is filtered to identify EMM message payload addressed to itself.
- There are two types of EMM individual messages: individual messages for new use and individual messages for change, and they are distinguished by EMM message identification.
- EMM individual messages need not be encrypted.
- The source of the message shall be RMP broadcaster group.

The structure of EMM individual message section is shown below.

	EMM message section				
EMM message Section Header	EMM message payload 1			EMM message Payload 2	Section CRC
	Non-encrypted	Encrypted part(Encryption not required)			
	EMM individual message Fixed part	EMM individual message Variable part		**. . .**	
8 bytes	14 bytes				4 bytes
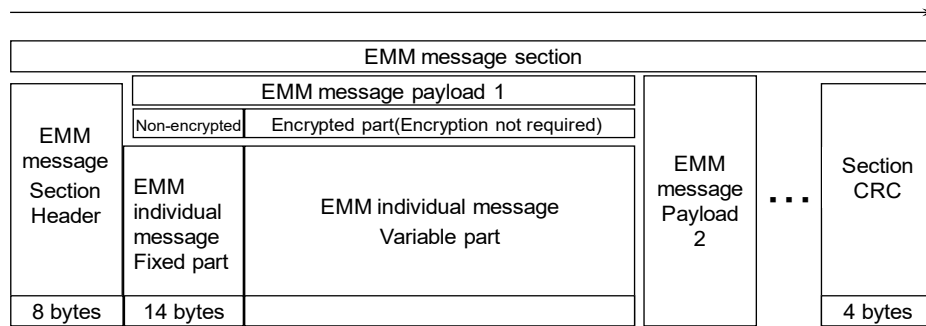
Figure 3-9 EMM Individual Message Section Structure

(2) Section structure of EMM individual messages

The section structure of EMM individual message shall be as follows.

Table 3-21 EMM Individual Message Section Structure

Structure				Notes
EMM message section	EMM message section header			8 Bytes
	EMM message payload1 1	EMM individual message Fixed part (Unencrypted)	Automatic display message ID	8 Bytes
			EMM message identifier	2 bits
			Message byte length	14 bits
			Protocol number	1 Byte
			RMP broadcaster identifier	2 Bytes
			Message ID	1 Byte
		EMM individual message Variable part		Various functional information can be placed
	Payload2	(Same as above)		
		⋮		
	Payload N	(Same as above)		
	CRC Error detection			4 Bytes

（3）Section details for EMM individual message

Table 3-22 Section details for EMM individual message

Syntax	Description	Number of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	0x0000	16
reserved		2
version_number		5
current_next_indicator		1
section_number		8
last_section_number		8
for (i=1 ; i<N ; i++) {		
receiver_ID	Automatic display message ID	64
EMMmessage_ID	EMM message identifier	2
message_length	Message byte length	14
protocol_number	Protocol number	8
rmp_broadcaster_group_ID	RMP broadcaster identifier	16
message_ID	Message ID	8
variable_area	(Variable part)	N
}		
EMM_message_section_CRC	CRC Error detection	32

（3）Details for EMM individual message items

Details of the major items are given below.

1) table_id_extension

In the EMM message (table_id=0x85), the section with table_id_extension=0x0000 is the EMM individual message.

2) Automatic display message ID

A number that identifies the target receiver. In the case of an individual message for a new use, this ID is called individual ID and is randomly generated by the receiver. In the case of an individual message for change, this ID is called designated ID and is set by EMM individual message containing designated ID setup descriptor.

3)　EMM message identification

EMM message identifier shall be as follows.

Table 3-23 EMM message identifier

EMM Message Identifier (binary)	Message
00B	Reserved
01B	Individual message for new use
10B	Individual message for change
11B	Reserved

4) Message byte length

The byte length from the message protocol number to the end of the message code area. When multiple EMM message payloads are transmitted in one section, it indicates the number of offsets indicating the location of the ID for automatic display message of the next EMM message payload.

5) Protocol number

It indicates the type of encryption algorithm. 0xFF indicates that the algorithm is unencryption. When encryption is used, the upper two bits specify the initial CBC value as shown in Table 3-11 (specific values of the initial CBC value are not specified in ARIB STD-B24 Part 3). The encryption key is assumed to be the device key for the RMP model ID or the device key for the RMP manufacturer ID, etc., but these are not specified in Part 3 of this standard. Therefore, the lower 6 bits shall be reserved.

6) RMP broadcaster identifier

This code identifies the RMP broadcaster group and is used in the range of 0x0000 to 0xFFFF.

7) Message ID

The RMP broadcaster identifier and message ID are used to create a unique identifier, which a receiver uses to perform a retransmission check of the same message (received only once on retransmission).

8) Variable part

The following descriptors are placed in a variable part. The tag values of the descriptors are defined only within the scope of this standard.

Table 3-24 EMM individual message descriptor type

Descriptor type	Tag value
Designated ID setup descriptor	0xFA
Individual message display descriptor	0xFB
Delete message descriptor	0xFC

3.2.8.3 EMM individual message descriptor

(1) Designated ID setup descriptor

Table 3-25 EMM individual message descriptor configuration

Syntax	Number of bytes	Notes
Descriptor tag	1	0xFA
Descriptor length	1	0x08
Designated ID	8	
Total	10	

(Role)

This descriptor specifies the ID (designated ID) to be set in a receiver for EMM messages. This descriptor is mainly transmitted in individual messages for new use.

(Explanation of the items)

(i) Designated ID

● The ID to be set on a receiver for EMM messages is placed.

(2) Individual message display descriptor

Table 3-26 Configuration of Individual Message Display Descriptors

Syntax	Number of bytes	Notes
Descriptor tag	1	0xFB
Descriptor length	1	
Tampering check	4	
Expiration date	2	
Fixed message sentence number	2	
Differential format number	1	
Differential information length	2	
Differential information	N	
Simultaneous display RMP broadcaster identifier	2	n RMP broadcaster groups can be placed
Broadcaster group check parameter	2	
Total	13+N＋4n	

(Role)

This descriptor specifies the information to be displayed on a receiver as EMM individual message.

(Explanation of the items)

(i) Tampering check

- It specifies a byte sequence for tampering check. The method for tampering check and other details are not specified in Part 3 of this standard.
- If it is determined that there is tampering, the received EMM individual message is discarded.

(ii) Expiration date

- It specify the expiration date of the message in MJD.
- However, 0x0000 shall be reserved. When an EMM individual message with this expiration date of 0x0000 is received, the received EMM individual message shall be discarded.

(iii) Fixed message fixed sentence number

- It specifies the code of the fixed sentence to be displayed in the range from 0x0001 to 0xFFFF.
- If 0x0000 is received, the receiver shall ignore it (it means that there is no fixed sentence).

(iv) Differential format number

- It specifies the number of the description format of the differential information.
- The operation of this format number is separately stipulated in the operational guideline for broadcasters.

(v) Differential information length

- It indicates the byte length (maximum 20 bytes) of the differential information shown in (vi).
- If the differential information length is 0x0000, it indicates that there is no differential information in (vi).

(vi) Differential information

- The differential information inserted into a fixed sentence specified by a fixed message sentence number is stored.
- Identifiers, character codes, etc. for insertion are defined separately in the operational guideline for broadcasters.
- The maximum size shall be 20 bytes.

(vii) Simultaneous display RMP broadcaster identifier

- This descriptor applies to RMP broadcaster identifiers placed in the fixed part of EMM individual messages, but also specifies other RMP broadcaster identifiers to be applied simultaneously.
- When there is no RMP broadcaster group to be applied simultaneously, this item is not placed together with broadcaster group check parameters shown in ⑧.

- Multiple simultaneous display RMP broadcaster identifiers may be specified. In that case, they should be placed repeatedly together with broadcaster group check parameters shown in ⑧.

(viii) Broadcaster group check parameter

- It specifies information (magic number) to prevent accidental designation of other simultaneous display RMP broadcaster identifier.

- The specific operation for broadcaster group check parameters is not specified in this standard.

(3) Delete message descriptor

Table 3-27 Configuration of delete message descriptor

Syntax	Number of bytes	Notes
Descriptor tag	1	0xFC
Descriptor length	1	
Tampering check	4	
Simultaneous delete RMP broadcaster group length	1	
Simultaneous delete RMP broadcaster identifier	2	n RMP broadcaster groups can be placed
Broadcaster group check parameter	2	
Total	7＋4n	

(Role)

It instructs the deletion of the automatic display message as the EMM individual message.

(Explanation of the items)

(i) Tampering check

- It specifies a byte sequence for tampering check. The tampering check method and other details are not specified in Part 3 of this standard.

- If it is determined that there is tampering, the received EMM individual message is discarded.

(ii) Simultaneous delete RMP broadcaster group length

- It indicates the byte length ((iii) + (iv)) of the items shown in (iii) and (iv).

- If it is 0x00, the automatic display message is deleted only for a RMP broadcaster identifier placed in the fixed part of an EMM individual message.

(iii) Simultaneous delete RMP broadcaster identifier

- Other RMP broadcaster identifiers to be deleted simultaneously are specified.

- Multiple simultaneous delete RMP broadcaster identifiers may be specified. In that case, they should be placed repeatedly together with broadcaster group check parameters shown in④.

(iv) Broadcaster group check parameter

- It specifies information (magic number) to prevent accidental designation of other simultaneous delete RMP broadcaster group.

- The specific operation of broadcaster group check parameters is not specified in this standard.

(4) Dummy descriptor

When encrypting an EMM individual message, the dummy descriptor (tag value 0xF2) shown in 3.2.7.3 (3) may be placed to ensure a sufficient length (16 bytes or more) for the encrypted area of an EMM message payload.

3.2.8.4 ECM messages (program messages)

Part 3 of this standard does not address ECM messages.

3.2.9 Associated information transmission methods

3.2.9.1 ECM (Program information)

ECMs (Entitlement Control Message) are transmitted using the MPEG-2 system section format at a minimum interval of once every 100 ms in order to improve the receiver's tuning response speed.

Depending on the operation of broadcasters, either ECM-F0 or ECM-F1 may be transmitted. The specific transmission operation is defined separately in the operational guideline for broadcasters.

3.2.9.2 EMM (Individual information)

EMMs (Entitlement Management Message) are transmitted using the MPEG-2 system section format.

Multiplexing method:

A single section can contain multiple EMMs.

Chapter 4 Receiver Technical Specifications

This chapter describes technical specifications for receivers that are capable of providing built-in processing functionality of this content protection system. It describes operations of the receiver unit which is referenced as a model and which is intended to help understand the functional specifications and is not binding on actual design and manufacturing of receiver units.

The operations of the modelized unit are described focusing on basic receiver operations, rather than detailed or transitional operations in the flow charts. Please bear this in mind when actually designing and/or manufacturing receiver units.

4.1 Receiver Overview

1) Digital broadcast receivers should be capable of providing built-in processing functionality of this content protection system.

2) Receivers should provide support for this content protection system that is shared among broadcasters. Specifications should not obstruct expandability for accommodating new (content protection system) broadcasters.

4.2 User Interface

4.2.1 Program viewing screen/ Viewing not available notification screen

As a rule, programs are selected using an EPG or similar guide based on the SI. The method for selecting programs using the EPG is defined by the receiver standard. This standard describes the processes used to perform the following tasks: select the corresponding transport stream after a program has been selected, reference the scrambling control, receive and decode ECMs, and perform processing based on the results of those actions. Please note that processing functions regarding this content protection system such as reception and decoding of ECMs are described later.

Program viewing processing for program attributes by referencing the scrambling control and receiving and decoding ECMs can be categorized into unscrambled free programs and scrambled free programs. This content protection system processes scrambled free programs.

When a copy control information protection descriptor is placed in the ECM, the tamper detection process is performed for content protection information in the PMT and when tampering is detected, the operation defined by the operational guideline for broadcasters separately will be performed. Please note that this content protection system processes scrambled free programs and an error message will not be displayed for unscrambled free programs.
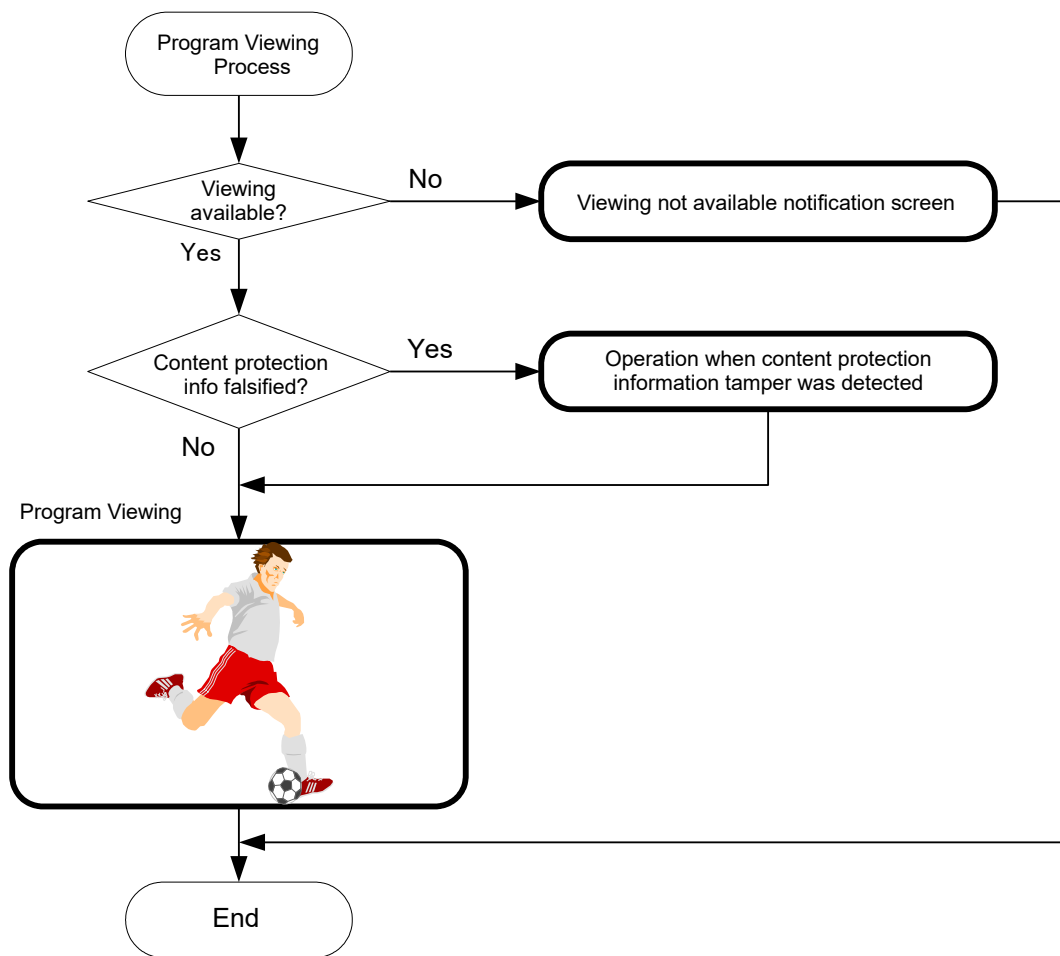
Figure 4-1 Program Viewing Process Flow

4.2.1.1 Program viewing screen

〔Function〕

If the results of the ECM reception and decoding indicate that program viewing is available, the receiver plays the program.

〔Display item〕

No display items.

4.2.1.2 Viewing not available notification screen

〔Function〕

If the results of the ECM reception and decoding indicate that program viewing is not available, the receiver notifies of the unavailability.

The receiver displays a message under the following conditions.

> ➤ When there are no Kws at all (When EMMs are not received because the receiver has just been shipped from the factory).

> ➢ When the Kw is old (When EMMs which carry new Kws can not be received).

> ➢ When the Kw is not valid (when it has been notified that the receiver has been revoked).

［Display items］

The receiver displays messages that show the reasons why viewing is not available.

> ➢ No Kw ：Before EMMs are received (Work Key not setup yet).

> ➢ Invalid Kw ：It has been notified that the receiver has been revoked.

4.2.2 Automatic display message

If an automatic display message is transmitted from each broadcaster group, the message is superimposed on the viewing screen when the program of that broadcaster group is selected for viewing.

Automatic display messages are obtained from EMM individual messages, which indicate the pointer of the message transmitted to each receiver, and EMM common messages, which indicate the message payload common to all receivers. EMM individual messages are received in advance and stored in the receiver. EMM common messages are basically received during display execution. Whether or not the message display can be erased depends on the control information in the message.

[Input/Display items]

● When an automatic display message is transmitted, the message is superimposed and displayed on the viewing screen when viewing the program of the broadcaster group that is the transmission source of the message.

● If the message display is erasable, a confirmation input is required as well as an indication of the confirmation input.

4.2.3 Mail display

Since the mail function is not specified in Part 3 of this standard, there is no provision for mail display.

4.3 Scrambling detection

The receiver references the scrambling control and adaptation field control in the TS packet header for each stream to determine whether the stream is scrambled. Table 4-1 details this process:

<p style="text-align:center">Table 4-1 Scrambling Detection Details</p>

Transport scrambling control	Adaptation field control	Description
00	01 or 11	Not Scrambled
01		Reserved
10		Scrambled (even key)
11		Scrambled (odd key)
XX	00 or 10	Reserved

4.4 Number of scrambling keys that can be processed simultaneously

In the case of the receiver with a single tuner, number of scrambling keys to be processed simultaneously shall be one pair (the odd and even scrambling key).

(Note) The number of tuners implemented in a receiver is a matter of product plan. This standard does not restrict the number of tuners.

4.5 Number of PIDs that can be processed simultaneously

This content protection system must be capable of simultaneously processing 12 PIDs or more.

4.6 Implementation of this content protection system

- All the processing functions and storage data related to this content protection method must be within the receiver unit, and implemented within the category of receiver unit design.
- All the processing functions for this content protection system include processing functions regarding user interfaces described in section 4.2 as well as the following processing functions described in section 4.8.
  - ➢ ECM processing
  - ➢ Descrambling processing
  - ➢ EMM processing
- It is assumed that the above processing functions will be implemented using receiver software and nonvolatile memory. This standard does not restrict specific implementation methods (for example, making function modules).

4.7 Stored data

Data stored in the receiver in relation to this content protection system is specified below. Please note that the intention of this specification is to define functions for the purpose of

explanation and not to physically restrict the actual design of receivers.

4.7.1 Classification of stored data

● There are two types of data stored in the nonvolatile memory in this content protection system, namely "common data", which is common to and managed by all broadcasting stations (there is only one type of common data) and "broadcaster individual data", which is stored and managed independently by individual broadcasting stations.

● There is also "content protection information-related data" which is stored in the temporary memory that is cleared when the receiver is turned on. This detects and manages tampering of content protection information.

4.7.2 Common data

● An example for common data to all the broadcasting stations is shown in Table 4-2. For cases such as not operating RMP model IDs, common data should be specified in the operational guideline for broadcasters.

● All the common data shown in Table 4-2 is stored in the nonvolatile memory.

● Specified data is stored when the receiver is designed or manufactured.

Table 4-2 An example for Common Data

Item	Length	Data type	Notes
System key for the MULTI2 cipher (scrambled subsystems)	32 Bytes	Common to the whole system	
CBC initial value for the MULTI2 cipher (scrambled subsystems)	8 Bytes	Common to the whole system	
CBC initial value 0 for the associated information encryption	16 Bytes	Common to the whole system	Corresponds to the upper 2 bits = 00B of the protocol number
CBC initial value 1 for the associated information encryption	16 Bytes	Common to the whole system	Corresponds to the upper 2 bits = 01B of the protocol number
CBC initial value 2 for the associated information encryption	16 Bytes	Common to the whole system	Corresponds to the upper 2 bits = 10B of the protocol number
CBC initial value 3 for the associated information encryption	16 Bytes	Common to the whole system	Corresponds to the upper 2 bits = 11B of the protocol number
Original RMP model ID	6 Bytes	Unique for each receiver unit model	Upper 3 bits = 001B Lower 1B = 0x00
Original device key for RMP model ID	16 Bytes	Unique for each receiver unit model	
EMM tamper detection key for RMP model ID	16 Bytes	Unique for each receiver unit model	
Original RMP manufacturer ID	6 Bytes	Unique for each receiver unit manufacturer	Upper 3 bits = 010B Lower 1B = 0x00
Original device key for RMP manufacturer ID	16 Bytes	Unique for each receiver unit manufacturer	
EMM tamper detection key for RMP manufacturer ID	16 Bytes	Unique for each receiver unit manufacturer	
Total	180 Bytes		

4.7.3 Broadcaster individual data

● Data for individual broadcasting stations. The data shown in Table 4-2 is stored and managed for each broadcasting station (transport stream).

(Note 1) The data is stored and managed for each broadcasting station (transport stream), not for each RMP broadcaster identifier. Therefore, pieces of data for a single RMP broadcaster identifier within different transport streams need to be stored and managed separately.

(Note 2) It is also possible that more than one broadcasting station is in a single transport stream. In such case, these broadcasting stations are handled as

a single RMP broadcaster identifier, and they are stored and managed as one.

● Number of sets of broadcaster individual data and the storage setup method are not defined.

(Note) Specific storage setup methods are not defined because they depend on product planning and basic operation of each receiver, for example, how to make settings for reception of broadcasting signals when the receiver is purchased. However, please note that EMMs must be received and broadcaster individual data for the corresponding broadcasting station must be setup in order to view programs from the station.

● Table 4-3 details broadcaster individual data for a single broadcasting station as an example. All the broadcaster individual data shown in Table 4-3 is stored in the nonvolatile memory.

● For cases such as not operating ECM-F0, the broadcaster individual data shall be specified in the operational guideline for broadcasters.

● All the broadcaster individual data is initialized to "0" when the receiver is shipped or initialized.

Broadcasting station 1	General data other than content protection-related	Content protection-related broadcaster individual data
Broadcasting station 2	General data other than content protection-related	Content protection-related broadcaster individual data
Broadcasting station 3	General data other than content protection-related	Content protection-related broadcaster individual data
	. . .	. . .
Broadcasting station N	General data other than content protection-related	Content protection-related broadcaster individual data

Figure 4-2 Image of Broadcaster Individual Data Storage

Table 4-3 An example for Broadcaster Individual Data

Item	Length	Data Type	Notes
RMP broadcaster identifier	2 Bytes	Set when all EMMs are received	
Generation number of the RMP model ID	1 Byte	Set when EMMs with a device key update descriptor is received	(Note 1), (Note 2)
Device key update parameter of the RMP model ID	4 Bytes	Set when EMMs with a device key update descriptor is received	(Note 1)
Generation number of the RMP manufacturer ID	1 Byte	Set when EMMs with a device key update descriptor is received	(Note 1), (Note 2)
Device key update parameter of the RMP manufacturer ID	4 Bytes	Set when EMMs with a device key update descriptor is received	(Note 1)
Update number	2 Bytes	Set when all EMMs are received	
Work key invalid flag	1 Byte	Set when EMMs with a work key setup descriptor is received	
F0 work key identifier (odd)	1 Byte	Set when EMMs with a work key setup descriptor is received	
F0 work key (odd)	16 Bytes	Set when EMMs with a work key setup descriptor is received	
F0 work key identifier (even)	1 Byte	Set when EMMs with a work key setup descriptor is received	
F0 work key (even)	16 Bytes	Set when EMMs with a work key setup descriptor is received	
F1 work key identifier (odd)	1 Byte	Set when EMMs with a work key setup descriptor is received	
F1Ks pointer (odd)	1 Byte	Set when EMMs with a work key setup descriptor is received	
F1 work key (odd)	16 Bytes	Set when EMMs with a work key setup descriptor is received	
F1 work key identifier (even)	1 Byte	Set when EMMs with a work key setup descriptor is received	
F1Ks pointer (even)	1 Byte	Set when EMMs with a work key setup descriptor is received	
F1 work key (even)	16 Bytes	Set when EMMs with a work key setup descriptor is received	
Total	85 Bytes		

(Note 1)

　　This means that the generation number and device key update parameter of the device ID are stored. In such case, each time an EMM is received or a broadcasting station is selected, the original device ID within the common data and the device ID of the generation specified using the device key and device key needs to be calculated. If the calculation time, etc. is a problem, the calculated results may be stored.

(Note 2)

　　When the generation number of the device ID is "0", this means that the update

parameter of the device ID has not been received for the EMM and that the device ID for individual broadcasting station has not been set.

(Note 3)

The items in Table 4-3 are the data required for having the receiver unit supported this content protection system. For example, in order to decrease the time in which reception is not possible when the key is updated, the PID of the EMM is temporarily stored, and it is not for restricting receiver unit for product planning.

4.7.4 Content protection information-related data

- Table 4-4 shows as content protection information-related data. Note that when ECM-F0 is not operated (when the content protection information tamper detection descriptor is not used), management of this data is not required.

- Content protection information-related data is stored and managed for each service being used.

- All the content protection information-related data is initialized to "0" when the receiver is turned on or a service channel is selected.

- The number of sets of services and storage setup methods are not defined. The number of sets of services and storage setup methods depends on product planning and basic operations of the receiver.

Table 4-4 Content Protection Information-Related Data

Item	Length	Description
Tamper detection counter	1 Byte	Each time a copy control information protection describer which includes the service ID of the relevant service is received, the content protection information tamper detection process is performed, and if falsified, the counter is incremented (incrementation stops with 0xFF), if not, the counter is reset (0x00).
Tamper detection threshold	1 Byte	Tamper detection threshold described in the copy control information protection describer of the previous relevant service.
Tamper detection status (Note)	1 Byte	When it was judged that the copy control information protection describer of the relevant service had been falsified, "0x01", and when not falsified, "0x00".
Total	3 Bytes	

(Note)

When data from the tamper detection counter and the tamper detection threshold is used, this field may be ignored.

4.7.5 Message information related data

- Message information related data is shown in "Table 4-5 Message information related data".

- The individual ID shall be generated at the time of initial setting of a receiver, etc., and the generation data shall be retained in the individual ID generation date. The designated ID shall be set to the value of the designated ID transmitted by the designated ID setting descriptor.

- After a designated ID is set, the individual ID is cleared or otherwise disabled unless otherwise specified.

- In the transfer of a receiver, it is necessary to delete the individual ID, designated ID, etc. set in the receiver, but the specific deletion method related to operation in the receiver is not specified in Part 3 of this standard.

- The format of the model information and its specific values shall be defined separately in the operational guideline for broadcasters. The model information is set by receiver manufacturers as non-rewritable according to receiver models.

- Broadcaster group check parameters are set by receiver manufacturers as a non-rewritable value specified in advance by broadcasters, etc.

- The start date of the delay interval shall be set in MJD to the date when a CA service descriptor is received for the first time in the relevant RMP broadcaster group. The delay interval start date, once set in the RMP broadcaster, shall not be renewed. However, this does not apply if the receiver is deleted (initialized) due to transfer of the receiver, etc.

- As for the fixed message sentence number, a value specified by broadcasters and so on may be written in a receiver at the time of manufacture and shipped. In such cases, when the designated ID set in the receiver is deleted, the fixed message sentence number set at the time of shipment must be re-set (re-written). (Note that the expiration date, etc. must also be re-set at the same time.)

- Deletion of automatic display messages indicated by deletion message descriptors means deletion of each item of the individual message display in Table 4-5. Deletion of the expiration date, fixed message sentence number, and differential format number means setting 0x0000 (or 0x00).

- The state in which differential information does not exist or has been deleted means that a specific character (e.g., NULL character: specified separately in the operational guideline for broadcasters) is set at least at the beginning of the differential information.

- In addition, the deletion of each item of the individual message display may be managed by separately setting up a flag or the like.

- The initialization state of each item shall be as follows.
  - ➢ Since the individual ID can take any value of 8 bytes in length, if the individual ID generation date is 0x0000, the individual ID is considered to be unset.
  - ➢ If the designated ID is 0x0000000000000000, it shall be unset.
  - ➢ If the message ID is 0x00 and the delay interval start date is 0x0000, it is considered that they are not received.
  - ➢ Each item in the individual message display shall be deleted. However, if a value specified by broadcasters, etc. is written in when receivers are manufactured and shipped, that value shall be set.
- In addition to the message information related data specified in Table 4-5, the encryption / decryption key for EMM individual messages and the tamper detection key (or information related to tamper detection) for individual message display descriptors, etc. may be required as common data, details of which are separately specified in the operational guideline for broadcasters.

Table 4-5 Message information related data

Item		Length	Description	Storage data category※
Individual ID		8 Bytes	ID randomly generated by a receiver during initial setup of the receiver, etc.	Common data
Designated ID		8 Bytes	ID to be set by the specified ID setting descriptor.	Common data
Individual ID generation date		2 Bytes	The date (MJD) when the individual ID was generated or set.	Common data
Model information		2 Bytes	Information indicating the type of receivers. (non-volatile data)	Common data
Message ID		1 Byte	Number to check for retransmission of EMM individual messages	Individual data
Broadcaster group check parameter		2 Bytes	Information that prevents accidental deletion by a deletion message descriptor (non-volatile data)	Individual data
Delay interval start date		2 Bytes	The date (MJD) when a CA service descriptor was first received.	Individual data
Individual message display	Expiration date	2 Bytes	The expiration date of message codes is represented in MJD.	Individual data
	Fixed message sentence number	2 Bytes	Fixed sentence number to be displayed in a message	Individual data
	Differential format number	1 Bytes	Description format number of differential information	Individual data
	Differential information	20 Bytes	Differential information for each receiver	Individual data

※Common data is data that is common to all receivers regardless of RMP broadcaster

identifier. Individual data is data managed for each RMP broadcaster identifier. Note that the management unit is different from the station individual data shown in Table 4-3.

4.8 Receiver unit processing regarding this content protection system

4.8.1 ECM processing

- A TS packet PID carried by an ECM section is specified and the ECM is received.

- The version number within the ECM section header is referenced and ECMs with the same version number are processed just once.

- The received ECM must be processed differently for the two ECM formats of ECM-F0 and ECM-F1 according to the protocol number.

- When the received ECM is ECM-F0, an appropriate work key is selected from the F0 work keys that are stored in the broadcaster individual data (odd/even) and decrypted.

- When the received ECM is ECM-F01, the scrambling key (odd/even) to be decrypted is selected from the scrambling keys 0 to n-1 (odd/even) based on the F1Ks pointer value stored in the broadcaster individual data. For example, when the F1Ks pointer value is "0x01" and "0x14", the scrambling key 1 (odd/even) and scrambling key 20 (odd/even) are decrypted respectively.

- When the received ECM is ECM-F0, the tamper detection process must be performed for the ECM after decryption.

- When instructed to detect tampering of content protection information within the ECM, the tamper detection process is performed for the relevant content protection information, and when it has been judged that the content protection information was falsified, the operations defined by the operational guideline for broadcasters separately must be performed.

- What should be done when the received ECM has an error is described below.

  ➢ When there is an inconsistency in the format (when the entire length of the variable part calculated back from the syntax of the ECM payload is not equal to the total length of descriptors), the entire ECM must be discarded as an invalid ECM.

  ➢ When the ECM includes non-standard data in the fixed part, the entire ECM must be discarded as an invalid ECM. Please note that for parts that are defined as "reserved", only the relevant part is ignored (they may be used in future and are not non-standard data).

  ➢ When an unknown descriptor is included, the descriptor must be ignored.

  ➢ When a known descriptor includes non-standard data, the entire descriptor must be ignored as an invalid descriptor. Please note that for parts that are

defined as "reserved", only the relevant part is ignored (they may be used in future and are not non-standard data).

4.8.1.1 ECM processing flow

```
                    ┌─────────────────────┐
                    │   ECM processing    │
                    └─────────────────────┘
                               │
                               ▼
              ┌────────────────────────────────────┐
              │ Comparison of RMP broadcaster identifiers │
              └────────────────────────────────────┘
                               │
                               ▼                              No
              ◇─────────────────────────────◇──────────────────────────┐
               \  RMP broadcaster identifiers /                          │
                \        are the same?       /                           ▼
                 ◇─────────────────────────◇          ┌──────────────────────────────────┐
                               │                        │ Display of the "Work key not set error" │
                             Yes                        │              (Note)               │
                               ▼                        └──────────────────────────────────┘
              ┌────────────────────────────┐                            │
              │  Protocol number processing │                           ▼
              └────────────────────────────┘                  ┌─────────────────┐
                               │                               │       End       │
                               ▼                    1          └─────────────────┘
              ◇─────────────────────────────◇──────────────────────┐
               \  The least significant bit is /                     │
                \        '1' or '0'?          /                      │
                 ◇─────────────────────────◇                        │
                               │                                     │
                             0 │                                     │
                               ▼                                     ▼
              ┌────────────────────────────┐       ┌────────────────────────────┐
              │    ECM form F0 processing   │       │    ECM form F1 processing   │
              └────────────────────────────┘       └────────────────────────────┘
                               │                                     │
                               ▼                                     ▼
                     ┌─────────────────┐                   ┌─────────────────┐
                     │       End       │                   │       End       │
                     └─────────────────┘                   └─────────────────┘
```
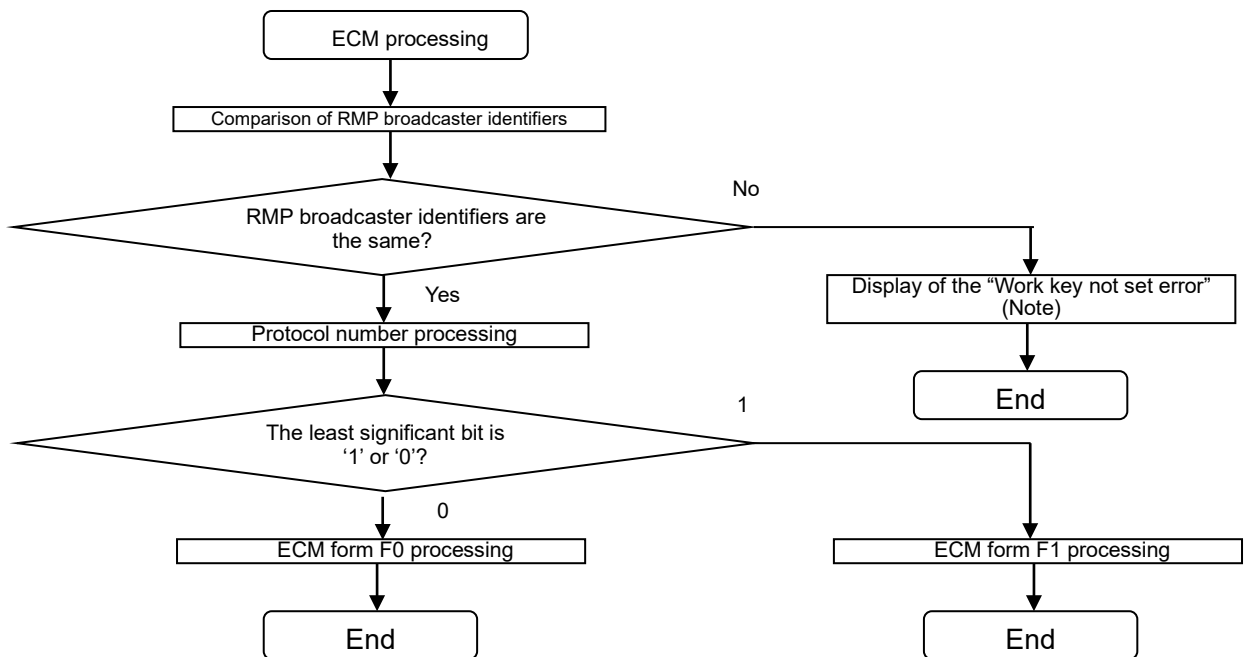
Note- Do not display an error when not scrambled.

Figure 4-3 ECM Processing Flow 1

```
                    ┌──────────────────────────┐
                    │   ECM Form F0 Processing  │
                    └──────────────────────────┘
                                 │
                    ┌──────────────────────────┐
                    │ Work key invalid flag detection │
                    └──────────────────────────┘
                                 │
                    ◇ Work key invalid flag: 0x01? ◇──── Yes ──┐
                                 │                              │
                                 No              ┌──────────────────────────────────┐
                                 │               │ Display of the "Work key invalid error" (Note) │
                    ┌──────────────────────────┐ └──────────────────────────────────┘
                    │ Work key identifier detection │              │
                    └──────────────────────────┘         ┌──────────────┐
                                 │                        │     End      │
                    ◇ Work key identifiers               └──────────────┘
                      are the same ? ◇──── No ──┐
                                 │               │
                                Yes   ┌────────────────────────────────────┐
                                 │    │ Display of the "Work key not set error" (Note) │
                    ┌──────────────────────────┐ └────────────────────────────────────┘
                    │        Decryption         │            │
                    └──────────────────────────┘     ┌──────────────┐
                                 │                    │     End      │
                    ┌──────────────────────────┐     └──────────────┘
                    │ Calculation of tamper detection key │
                    └──────────────────────────┘
                                 │
                    ┌──────────────────────────┐
                    │  Tamper detection process │
                    └──────────────────────────┘
                                 │
                    ◇ Tampering error? ◇──── Yes ──┐
                                 │                  │
                                 No     ┌────────────────────────────────────┐
                                 │      │ Display of the "ECM data error" (Note) │
                    ┌──────────────────────────┐ └────────────────────────────────────┘
                    │ ECM form F0 processing continues │       │
                    └──────────────────────────┘      ┌──────────────┐
                                                      │     End      │
                                                      └──────────────┘
```

Note- Do not display an error when not scrambled.

Figure 4-4 ECM Processing Flow 2 (1/2)
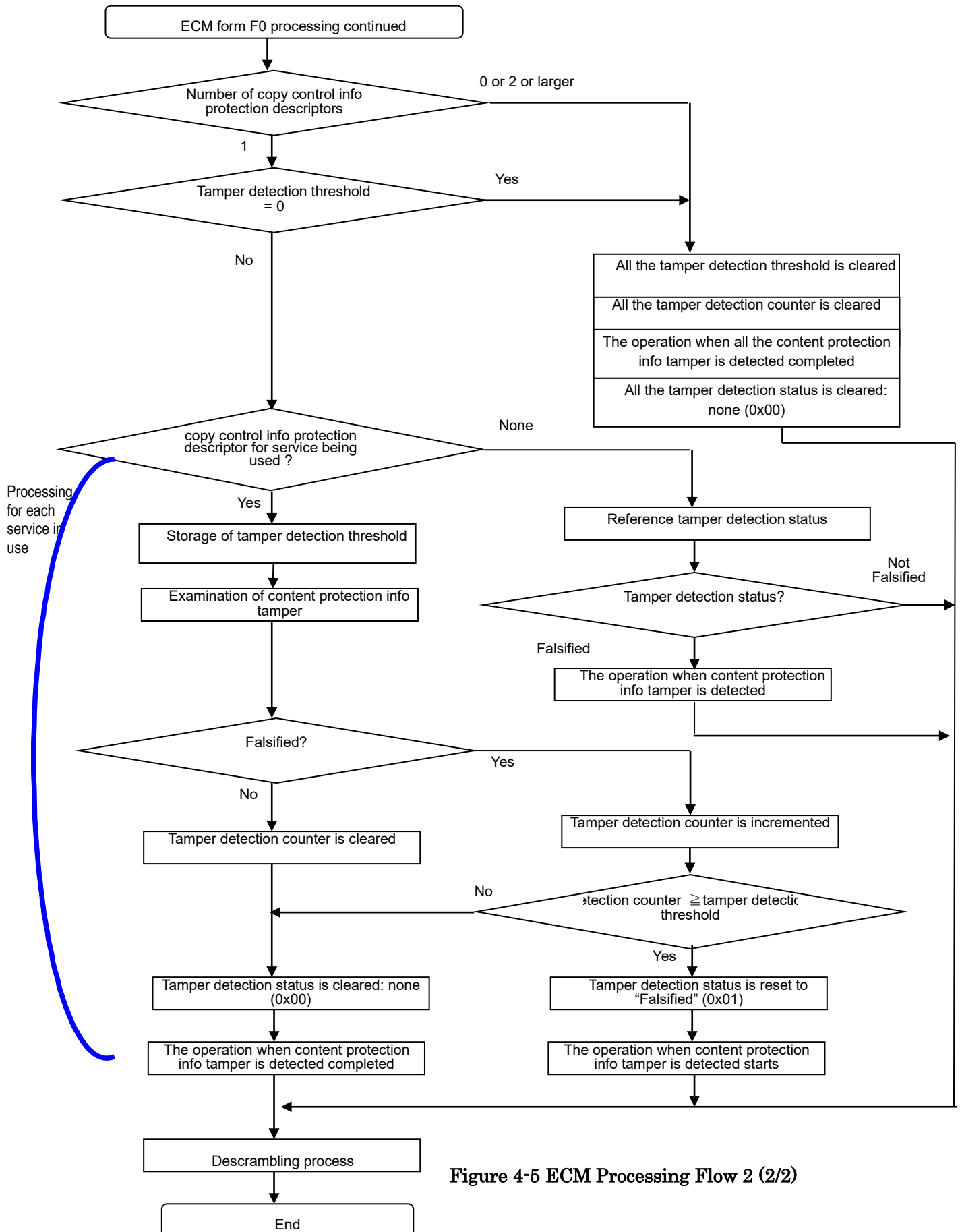
Figure 4-5 ECM Processing Flow 2 (2/2)
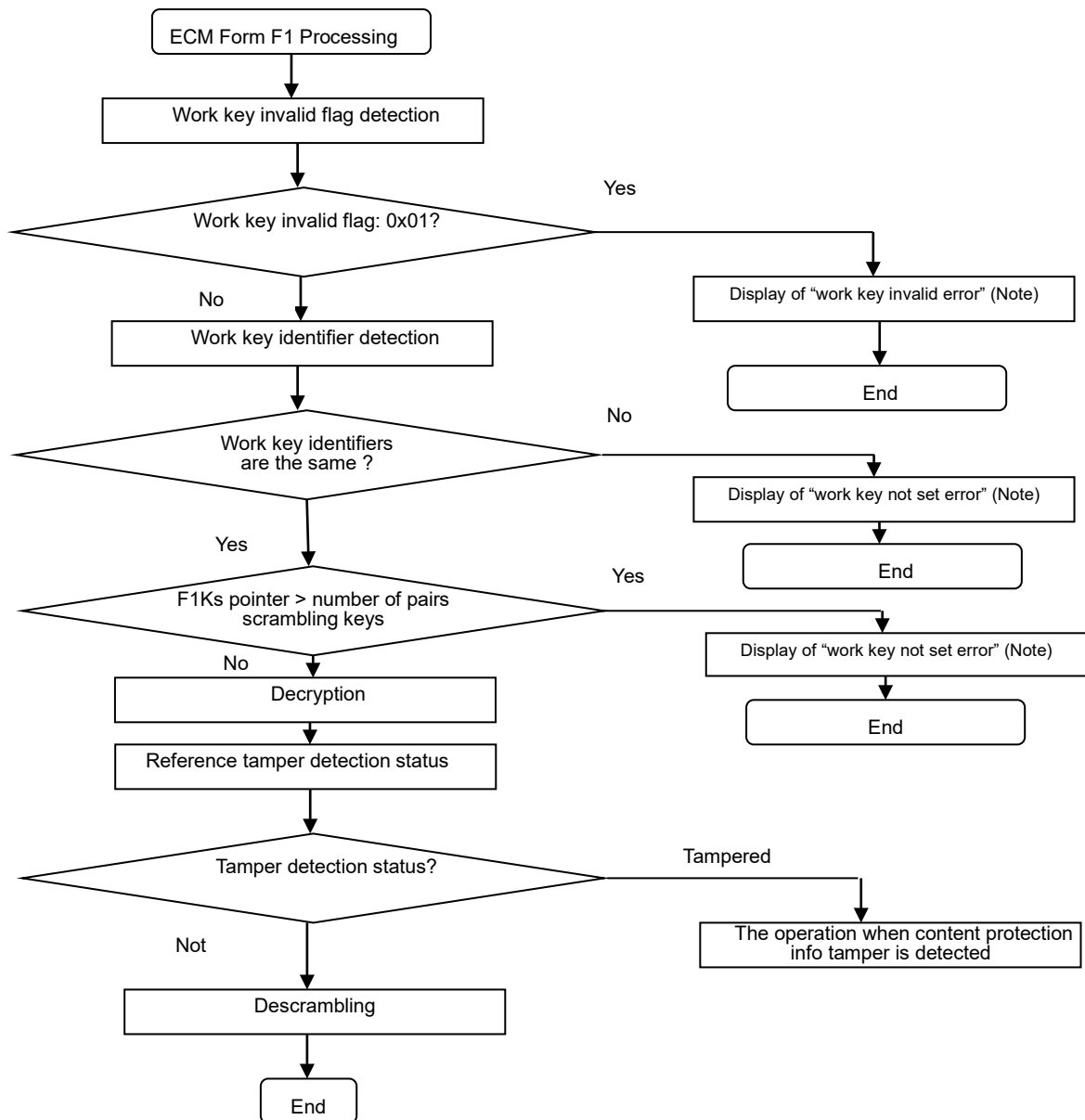
Note- Do not display an error when not scrambled.

Figure 4-6 ECM Processing Flow 3

4.8.1.2 Comparison processing of RMP broadcaster identifier values

- The RMP broadcaster identifier values within the ECM and within the broadcaster individual data are compared and when they are not the same, a "Work key not setup error" is displayed.

4.8.1.3 Protocol number processing

- The CBC initial value specified using the upper 2 bits of the protocol number within the ECM is used as the CBC initial value for decrypting associated information.
- The least significant bit of the protocol number within the ECM is the identifier of the ECM form, and when this bit is '0' F0 is displayed and for '1' F1 is displayed.
- The remaining 5 bits are ignored.

4.8.1.4 Work key invalid flag detection

- The work key invalid flag stored in the broadcaster individual data is referenced and when it is "0x01 (ON)", it is judged that the work key of the receiver has been disabled at the relevant broadcasting station and a "work key invalid error" is displayed.

4.8.1.5 Work key identifier detection

[1] When the ECM form is F0

- The F0 work key identifier within the ECM and the F0 work key identifiers (odd/even) stored in the broadcaster individual data are compared, and if both values in the broadcaster individual data are not the same as the value in the ECM, a "work key not setup error" is displayed.

[2] When the ECM form is F1

- The F1 work key identifier within the ECM and the two F1 work key identifiers (odd/even) stored in the broadcaster individual data are compared, and if both values in the broadcaster individual data (odd/even) are not the same as the value in the ECM, a "work key not setup error" is displayed. Even when they are the same, when the value of the F1Ks pointer (odd/even) stored in the broadcaster individual data is the same as the number of pairs of the scrambling keys within the ECM (n) or larger, it shall be "Work key not setup" error.

4.8.1.6 Wok key selection

[1] When the ECM form is F0.

- Among the F0 work keys (odd/even) stored in the broadcaster individual data, the one with the same F0 work key identifier as the F0 work key identifier within the ECM is selected as the work key.

[2] When the ECM form is F1.

- Among the F1 work keys (odd/even) stored in the broadcaster individual data, the one with the same F1 work key identifier as the F1 work key identifier within the ECM is selected as the work key.

4.8.1.7 ECM decryption

[1] When the ECM form is F0.

- Encryption is performed using the F0 work key stored in the broadcaster individual data as the key. Part 3 of this standard does not address the decryption algorithm.

[2] When the ECM form is F1.

- Encryption is performed using the F1 work key stored in the broadcaster individual data as the key. Part 3 of this standard does not address the decryption algorithm.

4.8.1.8 Tamper detection key calculation

- Tamper detection key calculation is performed only when the ECM form is F0.
- Part 3 of this standard does not address the tamper detection key calculation process.

4.8.1.9 Tamper detection

- ECM tamper detection calculation is performed only when the ECM form is F0.
- Part 3 of this standard does not address the ECM tamper detection calculation process.
- When the calculation result and the value of the tamper detection data at the end of the ECM are compared and when they are the same, it is judged as "not falsified" and when they are not the same, it is judged as "falsified" and an "ECM data error" is displayed.

4.8.1.10 Content protection information tampering examination

[1] When the ECM form is F0.

- The content protection information tampering examination process is performed for each service being used.
  At the moment the use of each service is started, the data listed in Table 4-4 for the service is cleared to make the status "not falsified" before starting the examination process.

- When multiple services reference a single ECM (see the example in Figure 4-7), because a copy control information protection descriptor for only one service is placed in a single ECM service, this descriptor is placed in each ECM. Please see Figure 4-8 for an example.

- When a single copy control information protection descriptor exists in an ECM, the tampering examination process is performed for the digital copy control descriptor or content availability descriptor according to the description in the copy control information protection descriptor.

- When a copy control information protection descriptor does not exist or more than one copy control information protection descriptor exists within the ECM, the data listed in Table 4-4 for the service which references the relevant ECM is cleared. Additionally, when multiple services reference a single ECM, the data listed in Table 4-4 for all the services that reference the relevant ECM is cleared.

- When the content protection information tampering examination process is performed and tampering is not detected, the content protection information tamper detection counter is cleared and it is judged as "not falsified". When tampering of the content protection information is detected, the tamper detection counter is incremented and the value on this tamper detection counter is compared with the tamper detection threshold value described in the copy control information protection descriptor. If the value on the tamper detection counter is equal to or larger than the tamper detection threshold value, it is judged that the content protection information has been falsified and if it is smaller than the tamper detection threshold value, it is judged as "not falsified".

- When it is judged that the content protection information has been falsified, the operation defined by the operational guideline for broadcasters separately is performed.

- When it is judged that the content protection information has not been falsified, the tamper detection status is changed to "not falsified".

- Regarding the service ID of a service that is being used, when this descriptor has not been placed even once in successive ECM-F0s for the number of services being transmitted in the relevant TS, the tampering examination process for the relevant services is not performed, the data listed in Table 4-4 for the relevant services is cleared, and the operation to be performed when tampering is detected that is defined by the operational guideline for broadcasters separately is canceled.

[2] Common processing when the ECM form is F0 and F1

● When the tamper detection status is "falsified", the process defined by the operational guideline for broadcasters separately is performed. This process is performed for each service being used.

● When the power switch is ON and a service channel is selected, the content protection information tamper detection counter and the tamper detection status are reset.

PMT1	Service ID1	Digital copy control descriptor 1	ECM11

PMT2	Service ID2	Digital copy control descriptor 2	ECM1
		Content availability descriptor 2	

PMT3	Service ID3	Digital copy control descriptor 3	ECM1

Figure 4-7 Example of PMTs when 3 services reference a single ECM

● Figure 4-8 shows an example of the content protection information tampering examination process performed when the receiver uses multiple services. This example is based on the following assumptions.

   ✧ Three services reference a single ECM.

   ✧ A set of three ECM-F0s and a set of three ECM-F1s are transmitted alternately and a single copy control information protection descriptor is placed in each ECM-F0.

   ✧ The receiver is using Service ID 2 and 3.

   ✧ The detect count for the copy control information protection descriptor for Service ID 2 is "1".

   ✧ The detect count for the copy control information protection descriptor for Service ID 3 is "2".

   ✧ The numbers on the tamper detection threshold for Service ID 2 and 3 were all "0" before receiving the first ECM in the Figure.

● Under the above assumptions, each time an ECM-F0 in which a copy control information protection descriptor is placed as displayed in Figure 4-8 is received, the content protection information tampering examination process is performed to see if the information has been falsified.

✧ Service ID 2 is judged as "falsified" at the moment when the number on the tamper detection threshold becomes "1" while the content protection information tampering examination is being performed.

✧ Service ID 3 is judged as "falsified" at the moment when the number on the tamper detection threshold becomes "2" while the content protection information tampering examination is being performed.

A copy control information protection descriptor for Service ID 1 is placed.
A copy control information protection descriptor for Service ID 2 is placed.
A copy control information protection descriptor for Service ID 3 is placed.
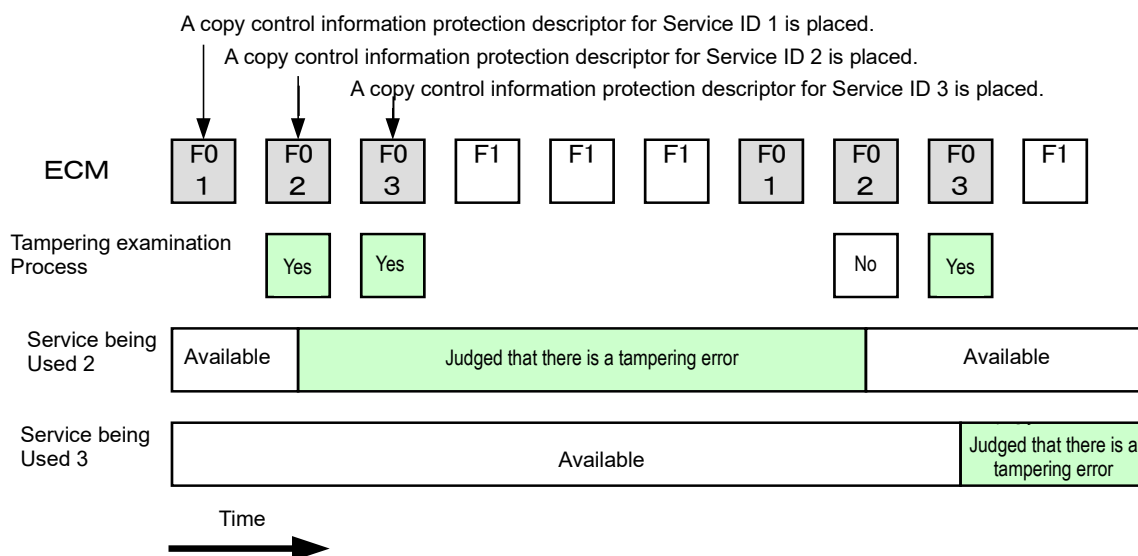
Figure 4-8 Example of Content protection Information Tampering Examination Process Performed When Multiple Services Are Being Used

4.8.2 Descrambling

● When the ECM form is F0, the codes in the ECM is decrypted and after it is judged that the ECM has not been falsified, the scrambling key (Ks) within the ECM is setup for the descrambler and the program is descrambled.

● When the ECM form is F1, the codes in the ECM are decrypted and the scrambling key (Ks) within the ECM is setup for the descrambler and the program is descrambled.

4.8.3 EMM processing

● The EMM section carried by the PID of the TS packet is specified and the EMM section is received.

● The received EMM section is filtered using 2 to 4 types of device IDs and decrypted using the corresponding device keys.

● After decryption, the tamper detection process is performed for the EMM.

- The update number is managed and the update and control process of the update number is performed.

- When instructed to update device IDs and device keys, the corresponding device IDs and device keys are updated.

- What should be done when the received EMM has an error is described below.

  ➢ When there is an inconsistency in the format (when the entire length of the variable part calculated back from the syntax of the EMM payload is not equal to the total length of the descriptor), the entire EMM must be discarded as an invalid EMM.

  ➢ When the EMM includes non-standard data in the fixed part, the entire EMM must be discarded as an invalid EMM. Please note that for parts that are defined as "reserved", only the relevant part is ignored (they may be used in future and are not non-standard data).

  ➢ When an unknown descriptor is included, the descriptor must be ignored.

  ➢ When a known descriptor includes non-standard data, the entire descriptor must be ignored as an invalid descriptor. Please note that for parts that are defined as "reserved", only the relevant part is ignored (they may be used in future and are not non-standard data).

<< Important >>

- Although there are contents that depend on the receiver unit implementation in this method, attention must be paid to the following points.

- As described in "3.14.7.3 Broadcaster individual data", broadcaster individual data transmitted in EMMs is stored and managed for each broadcasting station (transport stream). Therefore, when a service channel is selected, measures should be taken so that an EMM received for the previous service channel (= broadcasting station (transport stream)) is not wrongly recognized as an EMM received for the service channel that has been selected (= broadcasting station (transport stream)). For example, this issue can be dealt with by stopping EMM processing before a station is selected and re-starting it after selection.

- There is a possibility that the storage processes defined by "3.14.7.3 Broadcaster individual data" compete with each other (EMM processing (writing) and ECM processing (reading)).

- This content protection system is for scrambled free programs and it is necessary to decrease the length of time as much as possible when reception is not possible for each key update. For EMM processing, this can be achieved, for example, by implementing a receiver that stores PIDs in EMMs temporarily to process EMMs quickly.

4.8.3.1 EMM processing flow

```
                    ┌─────────────────────┐
                    │   EMM processing    │
                    └─────────────────────┘
                              │
   No        ╱─────────────────────────────╲         ⎫
  ┌──────── ╱      Has a generation          ╲       │
  │         ╲      number been set?          ╱        │  These processes can be performed
  │          ╲─────────────────────────────╱         │  separately depending on how the
  │                    │ Yes                          │  receiver processes data
  │         ┌─────────────────────┐                  │
  │         │  Calculation of IDs │                  │
  │         └─────────────────────┘                  │
  │                    │                             │
  │         ┌─────────────────────┐                  │
  │         │ Calculation of device Keys │           ⎭
  │         └─────────────────────┘
  └──────────────────►│
            ┌─────────────────────┐
            │ Filtering of device IDs │
            └─────────────────────┘
                       │
            ╱──────────────────────╲              No
           ╱     Are the device IDs  ╲───────────────────────────┐
           ╲        same?            ╱                            │
            ╲──────────────────────╱                             │
                       │ Yes                                      │
            ┌─────────────────────────────┐                      │
            │ RMP broadcaster identifier detection │             │
            └─────────────────────────────┘                      │
                       │                                          │
   No       ╱──────────────────────╲                             │
  ┌─────── ╱    Are the RMP broadcaster ╲                        │
  │        ╲    identifiers same?      ╱                         │
  │         ╲──────────────────────╱                             │
  │                    │ Yes                                      │
  │        ╱──────────────────────╲      Yes                     │
  │ Yes   ╱      Update number = 0? ╲◄──────┐                    │
  │◄──────╲                         ╱       │                    │
  │        ╲──────────────────────╱         │                    │
  │                    │ No                  │                    │
  │        ┌─────────────────────────┐       │                   │
  │        │ Update number processing │       │                  │
  │        └─────────────────────────┘       │                   │
  │                    │                      │                   │
  │        ╱──────────────────────╲    No     │                  │
  │       ╱    Update number OK?    ╲──────────────────────────► │
  │       ╲                        ╱          │                   │
  │        ╲──────────────────────╱           │                   │
  │                    │ Yes                   │                   │
  └───────────────────►│                      │                   │
            ┌─────────────────────────┐                           │
            │ Protocol number processing │                        │
            └─────────────────────────┘                           │
                       │                                           │
            ┌─────────────────────┐                               │
            │     Decryption      │                               │
            └─────────────────────┘                               │
                       │                                           │
            ┌─────────────────────────────┐                       │
            │ Tamper detection key calculation │                  │
            └─────────────────────────────┘                       │
                       │                                           │
            ┌─────────────────────┐                               │
            │  Tamper detection   │                               │
            └─────────────────────┘                               │
                       │                                           │
            ╱──────────────────────╲        Yes                   │
           ╱       Tamper error ?    ╲──────────────────────────► │
           ╲                         ╱                             │
            ╲──────────────────────╱                              │
                       │ No                                        │
   Yes      ╱──────────────────────╲                              │
  ┌─────── ╱    Are the RMP broadcaster ╲                         │
  │        ╲    identifiers same ?     ╱                          │
  │         ╲──────────────────────╱                              │
  │                    │ No                                       │
  │        ┌──────────────────────────────────┐                  │
  │        │ Initialization of broadcaster individual data │     │
  │        └──────────────────────────────────┘                  │
  │                    │                                          │
  └───────────────────►│                                         │
            ┌─────────────────────────┐                           │
            │  EMM processing continues │                         │
            └─────────────────────────┘                           │
                                                                  │
```

Figure 4-9 EMM Processing Flow

4.8.3.2 Calculation of device IDs and device keys

- In the original setup when the receiver is shipped, there are two types of device IDs of the RMP model ID and RMP manufacturer ID, and two types of original device keys for each respective device ID. (when using both RMP model ID and RMP manufacturer ID)

- When a device key update EMM is transmitted from a broadcasting station and a generation number and device key update parameter have been setup, the corresponding device ID and device key are updated and a new device ID and device key are generated within the receiver.

- A new device ID is generated by replacing the lower 1 byte of the original device ID with a new generation number.

- A new device key is generated using a device key update parameter, etc. Each receiver manufacturer uses their own non-disclosed device key update algorithm and can decide the use of other parameters at their discretion.

  The basic requirements for a device key update algorithm are listed below.

  (Requirement 1) A new device key can be uniquely updated for each device ID (RMP manufacturer ID and RMP model ID).

  ➢ Can be updated uniquely using a device key update EMM.

  (Requirement 2) It must be difficult to guess a new device key.

  ➢ It must be difficult to guess the device key among generations.

        ➢   It must be difficult to guess the device key among models.

（Note）A receiver manufacturer's own device key update algorithm must be safely implemented. For improved safety, using device key update parameters is recommended. Additionally, for further improved safety, it is recommended that different receiver designs for example (different receiver models) have different device key update algorithms.

● Device IDs and device keys must be generated for each broadcasting station and each type of device ID (two types).

    (Note) Device IDs/device keys are updated according to operations which are common to all the broadcasting stations as a rule, but as there is some difference in the operation time, they are generated independently for each broadcasting station.

● The timing for calculating device ID/device key generation can be decided at the discretion of each receiver manufacturer.

    (Note) This document explains that a device ID and device key are generated at the moment an EMM is received taking into account a method in which a generation number and device key update parameter are stored in individual data for each broadcasting station as an example for purposes of explanation. However, the generation timing that is the best for each receiver can be decided at the discretion of each manufacturer.
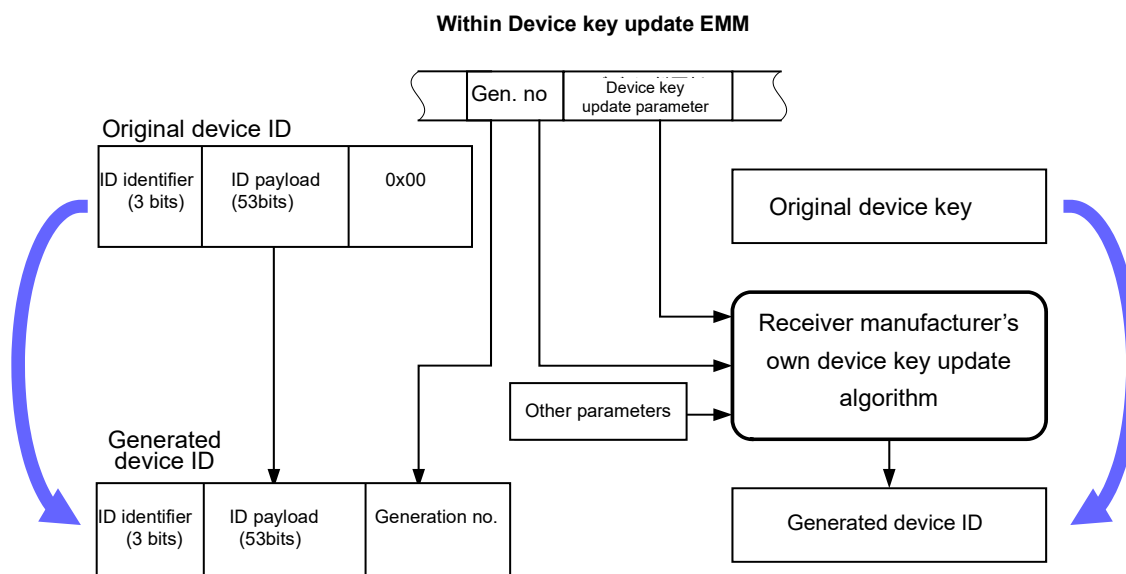
Figure 4-10 Device ID and Device Key Generation

4.8.3.3 Device ID filtering

- Two types of device IDs at a minimum and four types of device IDs at a maximum when the device key update EMM is transmitted and device IDs and device keys are updated, are filtered.

  (1) Original RMP model ID stored in the common data.

  (2) Original RMP manufacturer ID stored in the common data

  (3) RMP model ID of the latest generation generated for each broadcasting station (when a generation number and device key update parameter are setup with the device key update EMM)

  (4) RMP model ID of the latest generation generated for each broadcasting station (when a generation number and device key update parameter are setup with the device key update EMM)

- The value of the device ID within the EMM (64 bits) and the values of the device IDs (2 to 4 types of IDs) are compared and if all the values are the same, the EMM is processed and if they are not, the received EMM is discarded.
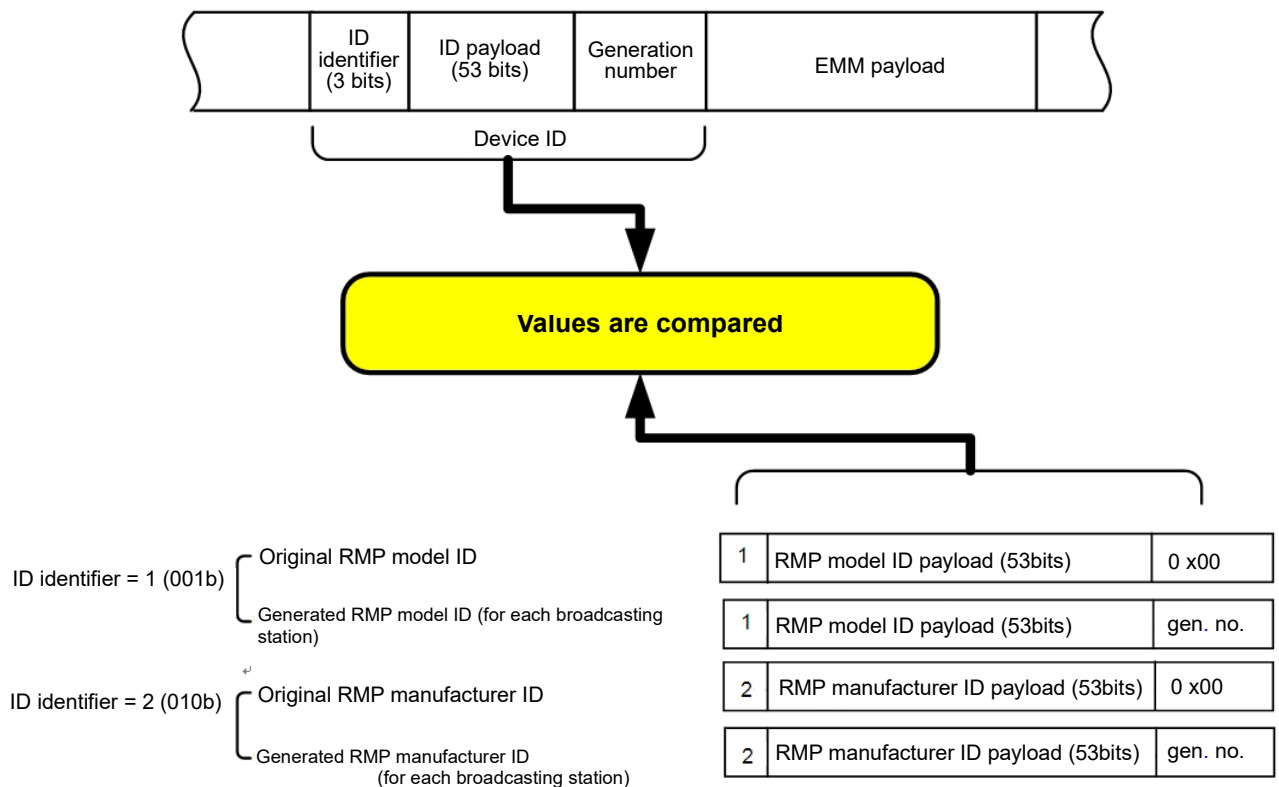
Figure 4-11 Device ID Filtering

4.8.3.4 RMP broadcaster identifier detection

● When the RMP broadcaster identifier within the EMM and the RMP broadcaster identifier stored within the corresponding broadcaster individual data are not the same, the corresponding broadcaster individual data is initialized to "0" when it is judged as "not falsified" after the EMM tamper detection process described in Section 4.8.3.9 is performed. After the data is initialized, a new RMP broadcaster identifier that was carried in the EMM is written.

4.8.3.5 Update number processing

● The update number within the EMM (unencrypted part) and the update number to be stored in the broadcaster individual data are compared. When the update number in the EMM is larger than the update number to be stored, the EMM is decrypted. When it is equal to or smaller than the update number to be stored, the received EMM is discarded.

● When the update number within the EMM is "0x0000", the EMM is decrypted unconditionally.

4.8.3.6 Protocol number processing

● The CBC initial value specified using the upper 2 bits of the protocol number within the EMM is used as the CBC initial value for decrypting associated information.

● The lower 6 bits of the protocol number within the EMM is ignored.

4.8.3.7 EMM decryption

● Decryption is performed using the device key that corresponds to the device ID within the transmitted EMM as the key. Part 3 of this standard does not address the decryption algorithm.

4.8.3.8 Tamper detection key calculation

● Two types of tamper detection keys are used depending on the ID identifier within the EMM.

● When the ID identifier within the EMM is an RMP model ID, the EMM tamper detection key for the RMP model ID in the common data is used as the key to detect tampering.

● When the ID identifier within the EMM is an RMP manufacturer ID, the EMM tamper detection key for the RMP manufacturer ID in the common data is used as the key to detect tampering.

● The same tamper detection key is used whether or not the device ID/device key are updated.

4.8.3.9 Tamper detection

● Tamper detection calculation is performed for EMMs. However, part 3 of this standard does not address the EMM tamper detection calculation process.

● When the calculation result and the value of the tamper detection data at the end of the EMM is compared and when they are the same, it is judged as "not falsified" and when they are not the same, it is judged as "falsified" and the received EMM is discarded.

4.8.3.10 Update number storage

● The update number storage process stores the update number within the EMM in the update number for the broadcaster individual data corresponding to the broadcasting station of the transmitted EMM. However, when the update number is "0x0000", it is not stored in the update number in the broadcaster individual data.

● When the update number within the EMM is "0xFFFF", the update number to be stored in the corresponding broadcaster individual data is cleared to "0x0000".

4.8.3.11 EMM payload processing

There are two types of EMMs to be transmitted of the work key setup EMM and device key update EMM.

[1] Work key setup EMM

● The work key invalid flag, F0 work key identifiers (odd/even), F0 work keys (odd/even), F1 work key identifiers (odd/even), F1Ks pointer (odd/even) and F1 work keys (odd/even) carried by the work key setup descriptor are each respectively stored as they are in the corresponding item within the broadcaster individual data of the station to which EMM is transmitted.

● The F0 work key identifier (Odd/Even) and F0 work key (Odd/Even) transmitted by the F0 work key setting descriptor are stored as they are in the corresponding items in the station individual data of the station that transmitted the EMM, respectively.

● The F1 work key identifier (Odd/Even), F1Ks pointer (Odd/Even) and F1 work key (Odd/Even) transmitted by the F1 work key setting descriptor are stored as

they are in the corresponding items in the station individual data of the station that transmitted the EMM, respectively.

● The work key invalidation flag transmitted by the work key invalidation notification descriptor is stored as it is in the corresponding item in the station individual data of the station that transmitted the EMM. Also, if the notification description is set, it will be presented according to the operational guideline for broadcasters.

[2] Device key update EMM

● The broadcasting station to which EMM is transmitted, the generation number within the broadcaster individual data that corresponds to the ID identifier and data transmitted to the device key update parameter are stored.

(Note) The device key update EMM is transmitted to the device ID whose generation number is set to "0". Additionally, this document assumes that a device ID/device key generation calculation is performed before receiving and filtering an EMM taking into account a method in which the generation number and device key update parameter are stored within the individual data for each broadcasting station as an example for purposes of explanation.

4.9 Receiver processing regarding EMM messages

4.9.1 EMM message function

(1) Automatic display message display

● A receiver determines whether automatic display message display is performed for the relevant service according to the CA service descriptor transmitted by CAT. If automatic display message display is performed, the receiver receives EMM individual messages and retains the display information of automatic display messages, such as the fixed sentence number, for each broadcaster group according to the descriptor. Based on the automatic display message display information retained in the receiver, the fixed sentence transmitted in the EMM common messages are acquired and automatic display messages are created and displayed.

● Regarding the display time and frequency of automatic display messages, the "display off / display on / display off" cycle specified by automatic display durations 1, 2, and 3 is repeated for the number of times specified by the automatic display frequency.

● The display position shall follow the recommended display position specified in the EMM common message. Figure 4-12 shows a display image when the value of the recommended display position is other than 0xFF. It is desirable to optimize the

layout of the picture frame according to the number of characters and lines as shown in Figure 4-12.

● There are three types of erasure for automatic display message: "erasable," "non-erasable," and "display-erasable". In the case of "erasable," the message on the screen can be erased by viewer operation (the specific operation procedure shall depend on product planning), while in the case of "non-erasable," the message cannot be erased by viewer operation. As for "display-erasable," if the automatic display erasure type of an EMM common message that is about to be displayed automatically is "display-erasable," that automatic display message shall not be displayed. If the automatic display erasure type of the EMM common message in use is updated to "display-erasable" during automatic display, the automatic display message display shall be discontinued. During displaying the automatic display message, the receiver monitors the version_number of the EMM common message in use for display and detects the update. The receiver also monitors the version_number when the automatic display erasure type is "display-erasable" and automatically displays the corresponding message if it is updated to "erasable" or "non-erasable".

● When an EMM individual message containing a delete message descriptor is received during displaying the automatic display message, the display information of the automatic display message (each item of the individual message display in Table 4-5), such as the fixed sentence number, is deleted and the display of the automatic display message is discontinued (deleted).

● When playing back a program received and stored by a receiver with a storage reception functionality, and when the CA service descriptor specifies that automatic display messages are to be displayed when the program is played back for viewing, only EMM common messages are acquired from the playback signal, and the same display as above is performed (EMM and EMM individual messages are not acquired). Details of the operation for automatic display messages of receivers with a storage reception functionality are defined separately in the operational guideline for broadcasters.

(2) Mail display

● Since the mail functionality is not specified in Part 3 of this standard, receiver processing for mail display is not required.
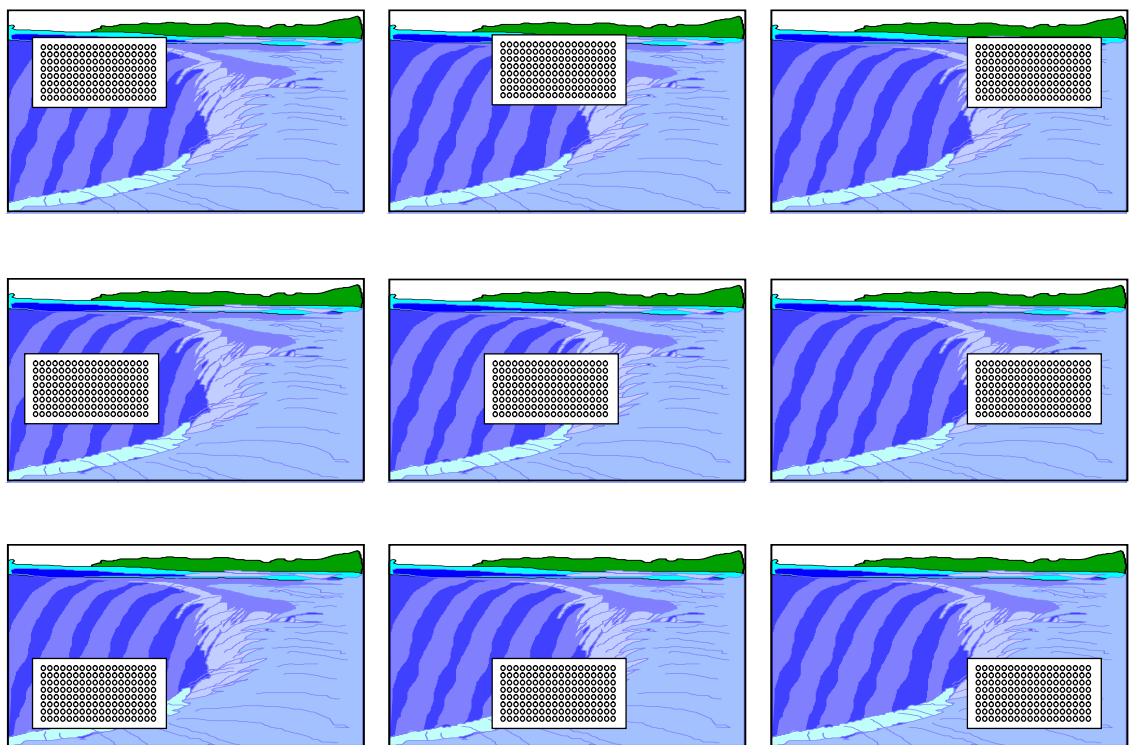
[Example of optimized picture frame]
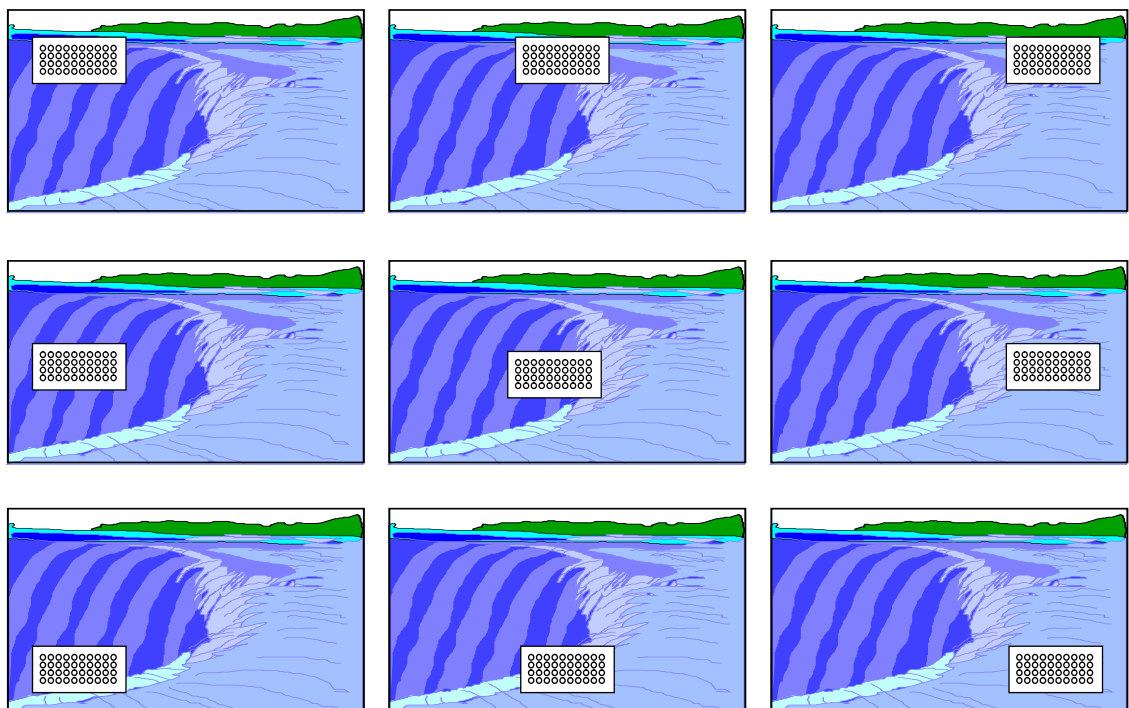
Display image of automatic display message

4.9.2 SI

● The CA service descriptors defined in Part 1 of this standard are described in the CAT to describe the service channels of the broadcaster group operating automatic display messages and the display control information for relevant messages.

● A receiver determines whether or not an automatic display message service is provided for each broadcaster group by means of the CA service descriptor.

● The delay interval (message_control) of the CA service descriptor shall be disabled in this ARIB STD-B24 Part 3. Therefore, the receiver shall ignore this value. The display delay is controlled by the display delay interval of EMM common messages.

● The display of automatic display messages when playing back programs received and stored by a receiver with storage functionality is performed by EMM common message model control.

● The broadcaster identifier (ca_broadcaster_group_id) of the CA service descriptor is 1 byte long, which is different in length from the RMP broadcaster identifier (rmp_broadcaster_group_ID: 2 bytes long) specified in Part 3. Therefore, for transmission operation, the conversion rules, such as, for example, the lower 1 byte of the RMP broadcaster identifier should be mapped to the broadcaster identifier of the CA service descriptor, should be defined in the operational guideline for broadcasters. A receiver checks the broadcaster identifier of the CA service descriptor according to the conversion rules defined in the operational guideline for broadcasters.

4.9.3 Generation of individual ID

● Individual IDs are randomly generated in a receiver at the time of initial receiver setup, such as regional setting and channel setting, and are retained as common data. Part 3 of this standard does not specify the specific method of generating individual IDs.

● The individual ID consists of a randomly generated 8-byte long random number. There is a related description in Part 3, Reference 3.

● The date when the individual ID is generated is retained as common data.

4.9.4 Receiver processing regarding EMM individual messages

● If a designated ID is not set for a receiver, the individual ID is used to acquire the EMM individual message addressed to the receiver.

● If a designated ID is set for a receiver, the designated ID is used to acquire the EMM individual message addressed to the receiver.

- At least a designated ID setup descriptor is placed in the individual message for new use. When the designated ID setup descriptor is received, the designated ID of the descriptor is retained in the receiver as data common to all broadcasting stations.

- Designated ID setup descriptors may be placed in individual messages for change.

- When a designated ID is set on a receiver, the individual ID is disabled unless otherwise specified.

- When an individual message display descriptor is placed, the expiration date, fixed message sentence number, differential format number, and differential information are retained for each RMP broadcaster group. If the simultaneous display RMP broadcaster identifier is set, the broadcaster group check parameter in the receiver and the broadcaster group check parameter in the descriptor are compared for each RMP broadcaster group, and only if they match, the same expiration date, the same fixed message sentence number, the same differential format number, and the same differential information are retained for the simultaneous display RMP broadcaster identifier.

- If the delete message descriptor is placed, the automatic display message is deleted. At this time, if the simultaneous delete RMP broadcaster identifier is set, the broadcaster group check parameter in the receiver and the broadcaster group check parameter in the descriptor are compared for each RMP broadcaster group, and only if they match, the message is also deleted for the simultaneous delete RMP broadcaster identifier.

4.9.4.1 Processing flow of EMM individual messages
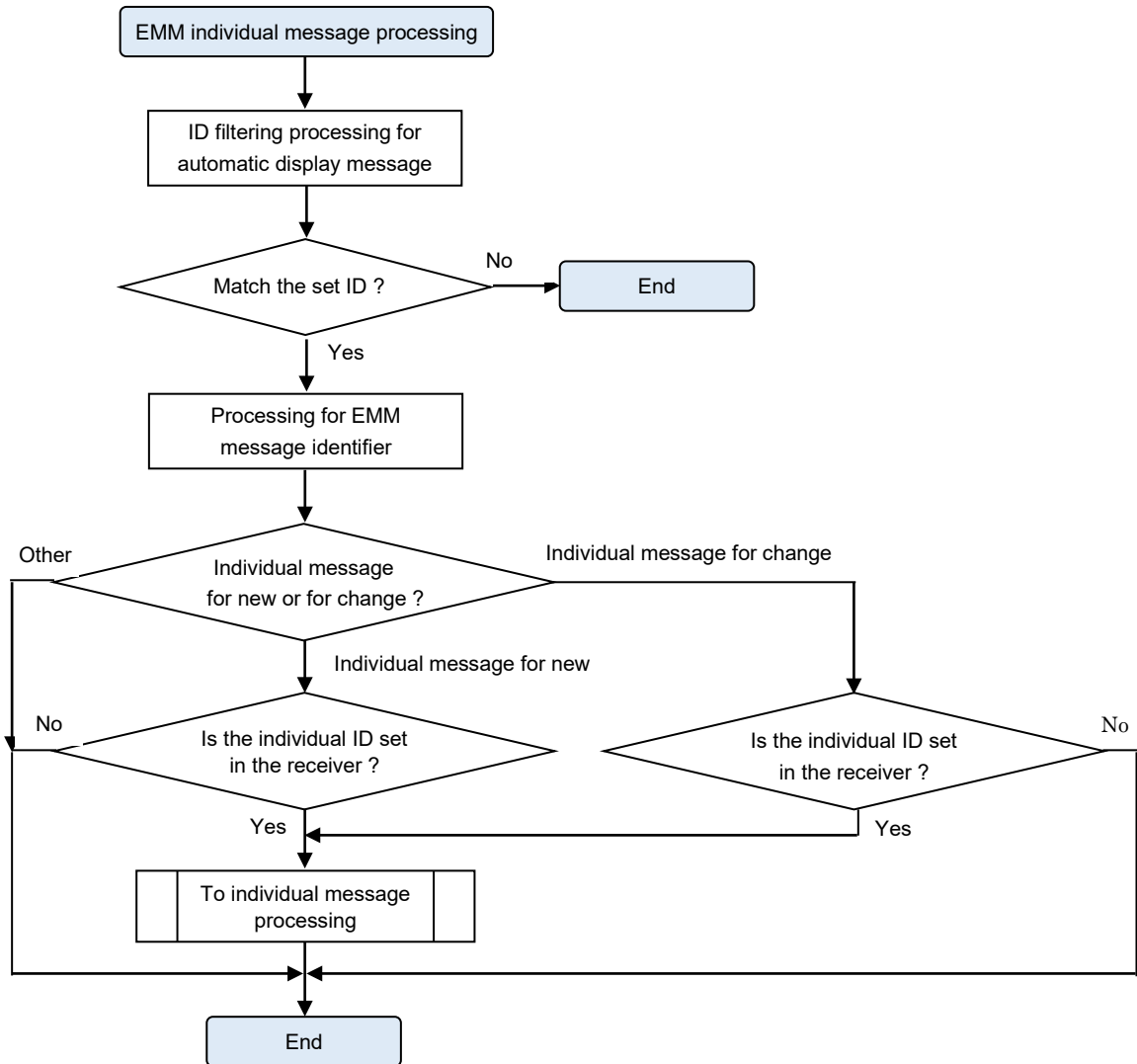
Figure 4-13 Processing flow 1 for EMM individual message
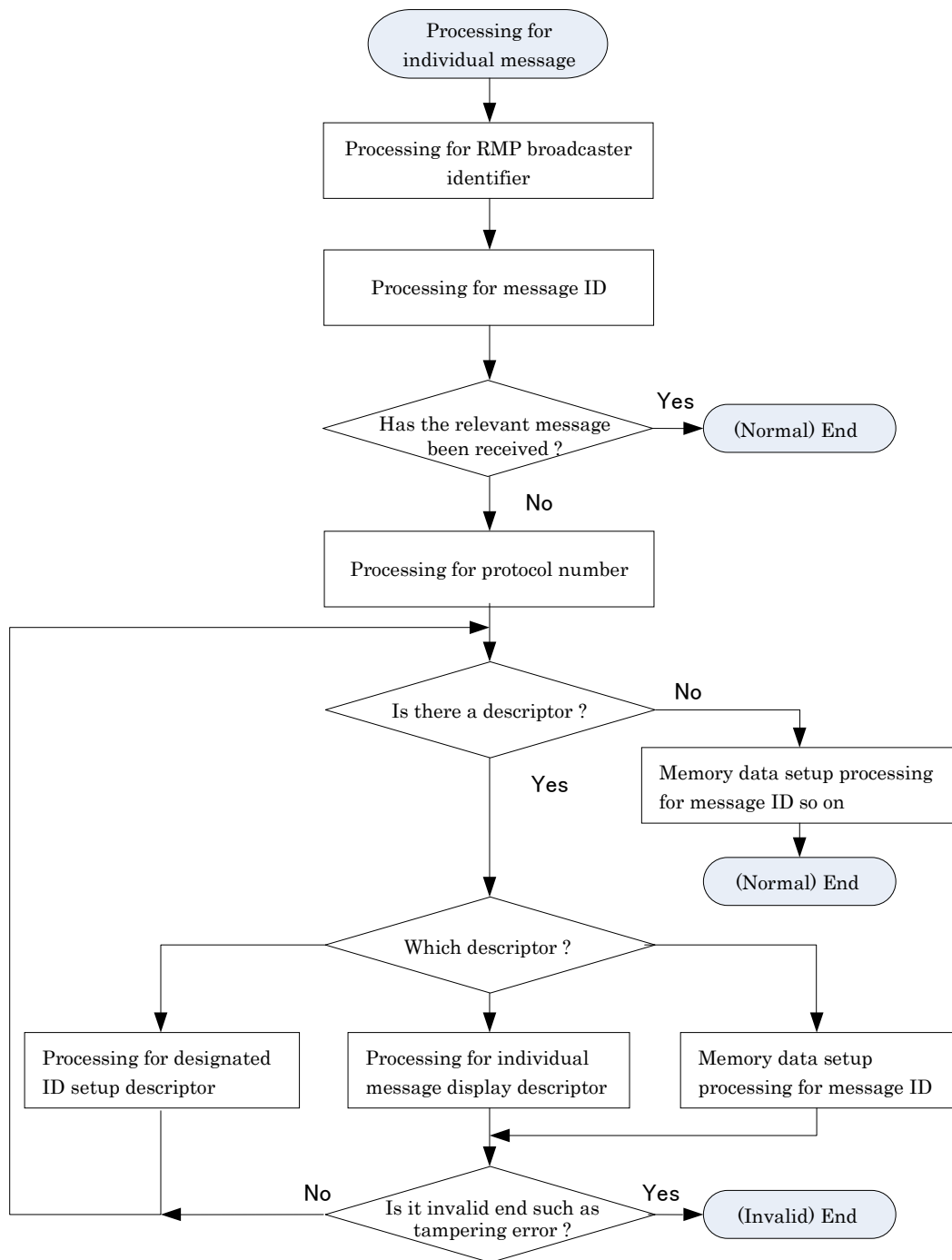
Figure 4-14 Processing flow 2 for EMM individual message

4.9.4.2 Filtering of IDs for automatic display message

- When an individual ID is set in a receiver, processing for the EMM individual message is performed if the EMM message identifier in the EMM individual message is an individual message for new use, and if the ID for the automatic

display message matches the individual ID in the common data. Otherwise, the received EMM individual message is discarded.

● When a designated ID is set in a receiver, processing for the EMM individual message is performed if the EMM message identifier in the EMM individual message is an individual message for change, and if the ID for the automatic display message matches the designated ID in the common data. Otherwise, the received EMM individual message is discarded.

● Since the ID (individual ID/designated ID) of the relevant receiver is changed by the designated ID setting descriptor, the filtering function for EMM individual messages in the receiver shall be able to change the ID to be filtered at any timing. The acceptable time required for change, frequency of change, etc. shall be specified separately in the operational guideline for broadcasters, taking into account the receiver load and operational conditions.

4.9.4.3 Processing for RMP broadcaster identifier

● In the content protection systems specified in Part 3 of this standard, it is assumed that station individual data is stored and managed for each station (transport stream), as specified in 4.7.3, but for the automatic display messages specified here, they shall be stored and managed for each RMP broadcaster group.

● Therefore, each data specified in Table 4-5 is not initialized as specified in 4.8.3.4. The initialization of each data is described in 4.7.5.

● The total number of RMP broadcaster groups managed within a receiver shall be determined separately in the operational guideline for broadcasters.

4.9.4.4 Message ID processing

● By comparing the message ID in the EMM individual message with the message ID stored as individual data, the receiver performs a retransmission check of the same message (received only once upon retransmission).

● When the message ID of an EMM individual message is updated, the ID is written as individual data.

4.9.4.5 Protocol number processing

● The protocol number in the EMM individual message indicates the type of encryption algorithm. However, 0xFF indicates no encryption.

● If the protocol number is other than 0xFF, it indicates that it is encrypted, and the CBC initial value specified by the upper two bits should be the CBC initial value for decryption.

- The lower 6 bits (excluding 0x3F) specify the key, decoding algorithm, etc. for decoding, but their specific identification is not specified in Part 3 of this standard.

4.9.5 Reception and processing of EMM common messages

- EMM common messages are transmitted repeatedly and are basically received and processed at the time of display execution.

- If an EMM common message with the same value as the fixed message sentence number stored in the receiver exists, the receiver performs the reception and processing of the relevant EMM common message. However, if the fixed message sentence number stored in the receiver has expired, the relevant EMM common message is not received.

- The differential information in the EMM individual message information is added to the received EMM common message information, and the cycle of "non-display, display, non-display" specified by automatic display duration 1, 2, 3, is repeated the number of times specified by the automatic display count, and is displayed on the screen in superimpose. However, under the following conditions, the automatic display message shall not be displayed.

  ➢ When the model information of the receiver differs from the model information specified in the EMM common message

  ➢ When the individual ID generation date of the receiver is past the individual ID validity date specified in the EMM common message

  ➢ When the display delay interval specified in the EMM common message is between 0x00 and 0xFE and the present date is not later than the date of the delay interval start date of the receiver plus the display delay interval

  ➢ When the value obtained by the logical OR of the least significant 1 byte of the individual ID or designated ID of the receiver and the mask data does not match the value of the partial identification specified in the EMM common message (however, this restriction is excluded for the mask exclusion period specified in the EMM common message and an automatic display message is displayed)

- If the user can erase the screen display of automatic display messages according to the automatic display delete type in the EMM common message information, the screen display of the automatic display message is erased by user operation. The specific user operation method depends on the product planning.

- When the automatic display delete type is "not erasable," the screen display of automatic display messages cannot be deleted by user operation.

● When "delete display" is indicated by the automatic display delete type in the EMM common message information, the screen display of the relevant message is deleted while the relevant message is being displayed automatically. If the automatic display delete type is changed from "delete display" to "erasable" or "not erasable" during "delete display," the corresponding message is automatically displayed.

4.9.5.1 Processing flow of EMM common messages

● The processing of EMM common messages shown in Figure 4-15 is a processing flow that is intended to be processed in parallel with the processing of EMM individual messages (Figure 4-13).
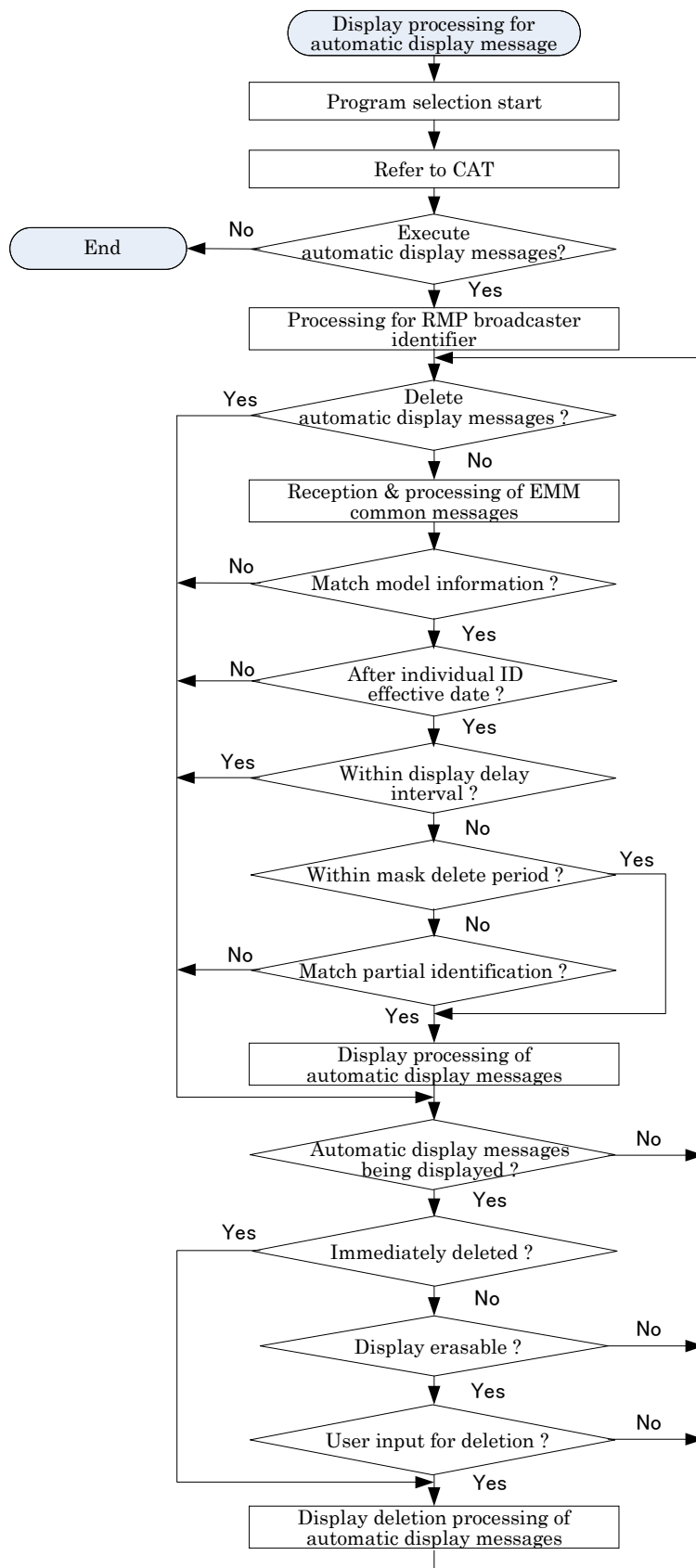
Figure 4-15 Processing flow of EMM common messages

4.9.5.2 Processing of RMP broadcaster identifier

- Since EMM common messages are basically received and processed at the time of display execution, initialization by EMM common messages is not performed for each data shown in Table 4-5.

<Blank Page>

Part 3

Appendix

Appendix 1

1. Operational Overview of This Content Protection System

1.1 Basic operation

1.1.1 Operational management

- An organization to manage various technical information of this content protection system (hereinafter referred to as RMP Management Center) is assumed. The RMP Management Center generates and issues the original device IDs and device keys of receivers and manages devices IDs and device keys that are used.

- Work keys are basically generated by an RMP broadcaster group, but there are cases where the RMP Management Center generates all work keys.

1.1.2 ECM/EMM transmission

- EMMs which carry work key setup data and ECMs which carry scrambling keys are constantly transmitted from broadcasting stations that operate this content protection system.

- An ECM and EMM are encrypted using a work key that is deferent for each RMP broadcaster group and a device key that is deferent for each device ID respectively and transmitted.

- This system can co-exist with the current system (system defined by Part 1 of this standard) and these two systems transmit original ECMs of each system with the same program scrambling (using common scrambling keys).

- ECM and EMM transmission conditions are listed in (Attached table 1), (Attached table 2) and (Attached table 3) in 1.1.4.

1.1.3 Receivers

- The RMP Management Center issues the original RMP model ID and RMP manufacturer ID and device keys for a receiver, etc. to the receiver manufacturer. The receiver manufacturer sets up the issued data in the receiver before shipment.

- The receiver receives constantly-transmitted EMMs and sets up data related to this content protection system for programs that are broadcast in that region (work keys, etc.). When a program is viewed, the receiver descrambles the data by receiving and processing an EMM to provide the program to the viewers.
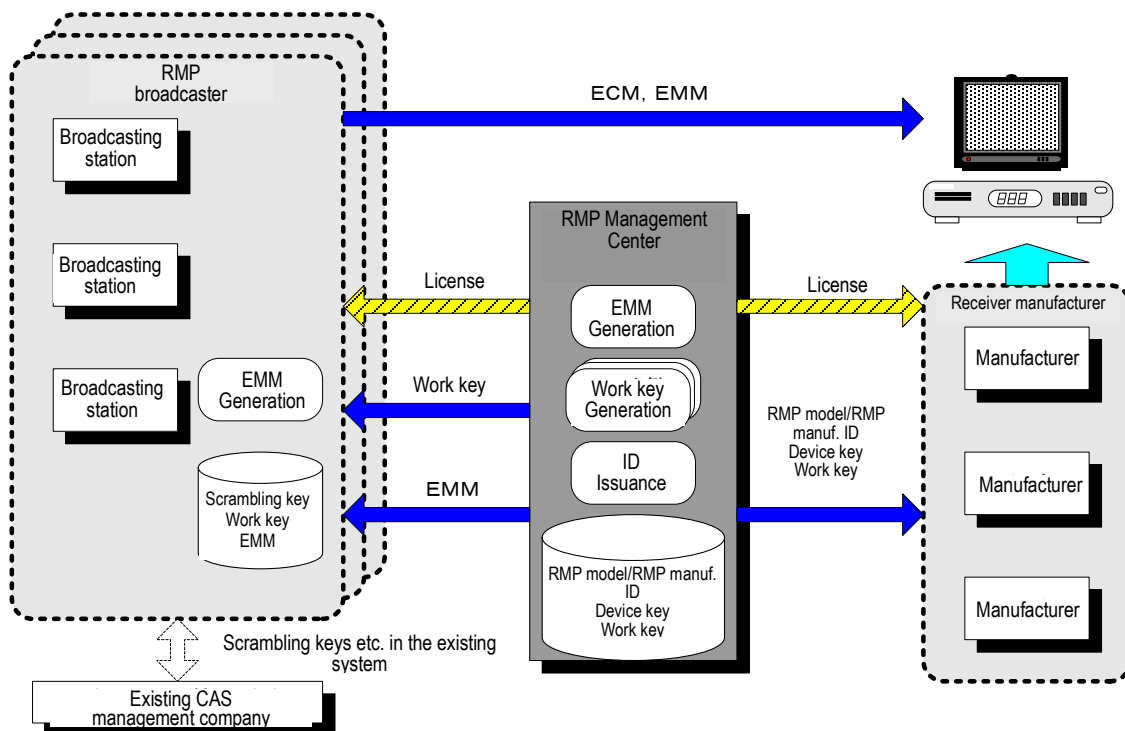
Figure   A1-1 System Configuration

1.1.4 Attached tables

(Attached table 1) ECM transmission conditions.

Item	Standard
Section length	4096 Bytes or shorter
Minimum length of time of ECM update (per ECM)	1 s
Minimum length of time of ECM re-transmission	100 ms

(Attached table 2) EMM transmission conditions.

Item	Standard
Section length	4096 Bytes or shorter
Minimum and maximum numbers of EMMs within a section	1 to 256
Number of EMMs with the same ID within the same section	1
Minimum length of time for an interval of EMM transmission to the same receiver	1 s

(Attached table 3) EMM section transmission frequency.

Item	Standard
Transmission frequency of EMM sections (TS packets) and EMM individual message sections	1] Type A More than one EMM payload is included in an EMM section. An EMM section is a single section. 1) In case of a TS for a program When EMM sections are carried, a TS packet with the same PID is transmitted within the range of 1.28kB±100% per 32ms. A TS packet with the same PID that carries EMM sections must be transmitted at 320 kbits or less per 1 second period (It is considered that the amount of data in a single EMM section is 4kB when transmitted at 320 kbits as described above). 2) In case of a dedicated TS (specific channel) Part 3 of this standard does not address transmission of dedicated TSs 2] Type B Part 3 of this standard does not address transmission of Type B

* Methods to identify EMM transmission (Type A or Type B) are defined by the operational guideline for

broadcasters.

1.2 Revocation of specific keys at receivers

1.2.1 Purpose of revocation

- In environments that receive broadcasting services using this content protection system, when a receiver unit manufactured without an original license from the RMP Management Center receiver units (hereinafter illegal receiver unit) appears by imitating receiver units (hereinafter licensed receiver unit) which are manufactured based on licensing from the RMP Management Center (extraction of key information etc.), or when a receiver unit with a defect that does not satisfy the implementation criteria of receiver units demanded by this system etc. appears within a licensed receiver unit and when such a receiver unit has a serious effect on the operation of this system, revocation is assumed as technical measure to maintain the system.

1.2.2 Device ID/device key update

- The irregular receiver revocation process is firstly, the device IDs and device keys of a licensed receiver based on which the irregular receiver was made are updated. Device IDs and device keys are updated with a receiver manufacturer's own algorithm at their own discretion.
- The updated device IDs and device keys and parameters used to update the device keys are notified from the receiver manufacturer to RMP Management Center, which updates the ID management regarding the receiver within the relevant service.
- An EMM is sent to renew the device ID/device key to the receiver unit to be updated from the broadcasting station and the receiver updates the device IDs and device keys based on the EMM.
- After the device IDs/device keys are updated, EMMs used to update the device IDs and device keys and EMMs that carry the latest work key will be constantly transmitted.

1.2.3 Basic revocation execution

- Revocation is executed by transmitting EMMs to update the work key to receivers other than the receiver to be revoked and not by transmitting the updated work key to the receiver to be revoked.
- It is possible to notify (with a work key invalid error) the revoked receiver that it has been revoked (by transmitting an EMM that carries a work key invalid flag that is set to "0x01" in a work key setup descriptor to the revoked receiver).
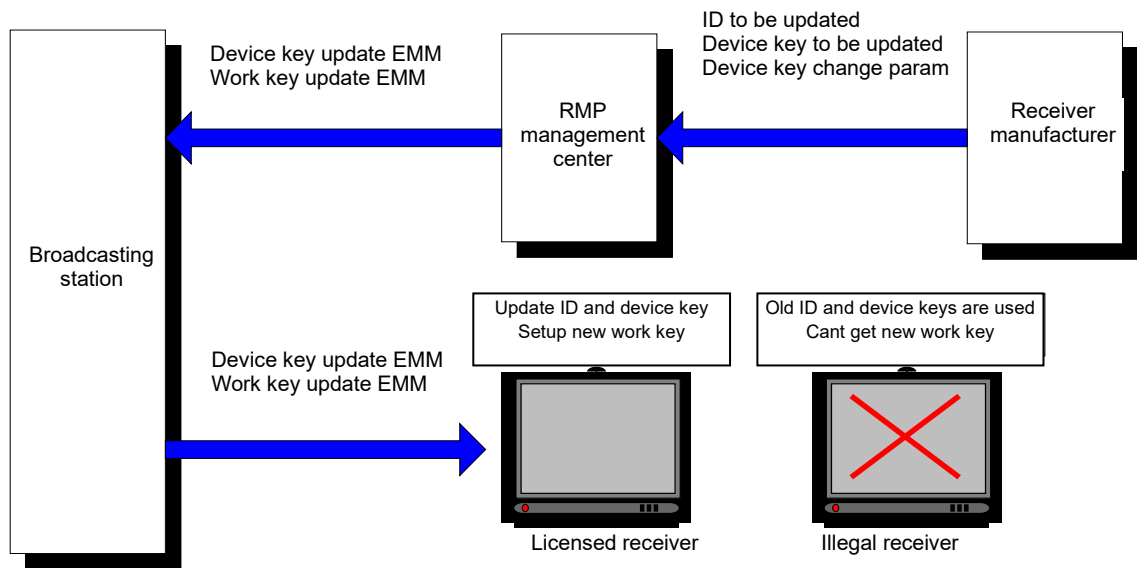
Figure A1-2 System Configuration of Device ID/Device Key Update and Revocation

1.3 Example of information provided to receiver manufacturers

An example of data and technical information provided to receiver manufacturers from the RMP Management Center are shown below.

Table A1-1 Example of Information Provided to Receiver Manufacturers

Item	Details
Original device ID	There are two types of device IDs – RMP model ID and RMP manufacturer ID. Identifier data managed in each receiver model and manufacture.
Original device key	Key data unique to each ID
Associated information tamper detection key	Keys used to detect tampering in EMMs include key data unique to each device ID.
Associated information tamper detection algorithm	Technical information regarding ECM-F0 and EMM tamper detection codes.
CBC mode default values for associated information encryption	Default values used when ECM/EMM is decrypted (16 bytes). 4 types of CBC initial value data in total.
Encryption/decryption algorithm	Encryption/decryption algorithm of associated information, technical information for block encryption/decryption procedure.
System keys and CBC initial values for MULTI2	Data on system keys and CBC initial values used by scrambling subsystems (MULTI2).

1.4 Example of information provided by receiver manufacturers

An example of data that must be provided to the RMP Management Center from the receiver manufacturer when the relevant receiver or a manufacturer is revoked and when at the same time, the device IDs/device keys of a licensed receiver are updated is shown below.

Table A1-2 Example of Information Provided by Receiver Manufacturer

Item	Details
Updated device ID	RMP model ID to be updated or value for the RMP manufacturer ID after update.
Updated device key	Value of the device key to be updated that corresponds to the ID to be updated.
Generation number	Generation number used to update a device ID/device key.
Device key update parameter	Parameter used to update a device key.

Appendix 2

1. Device ID and Device Key Generation Update

A receiver has device IDs and device keys (Kd) and it is quite possible that these pieces of data may be leaked. In such case, it is easy to identify the leak source because each device ID and device key is unique. However, even if the leak source can be identified, it needs to be updated to improve the situation and eliminate the problem.

When a device key or device ID is leaked, the following mechanism is used to restore broadcasting systems that use this content protection system.

(1) The receiver must have the original device IDs and original device keys.

(2) Furthermore, the receiver must have a receiver manufacturer's own undisclosed algorithm and generate new device keys and device IDs that are different from the original ones based on instructions from EMMs.

(3) The licensed receiver manufacturer registers the new device key with the RMP Management Center.

(4) Based on this new device key, subsequent EMMs are encrypted.

The above concept is illustrated in Figure A2-1. Use of a mechanism like this can restore the system up to a certain level after a device key is leaked.
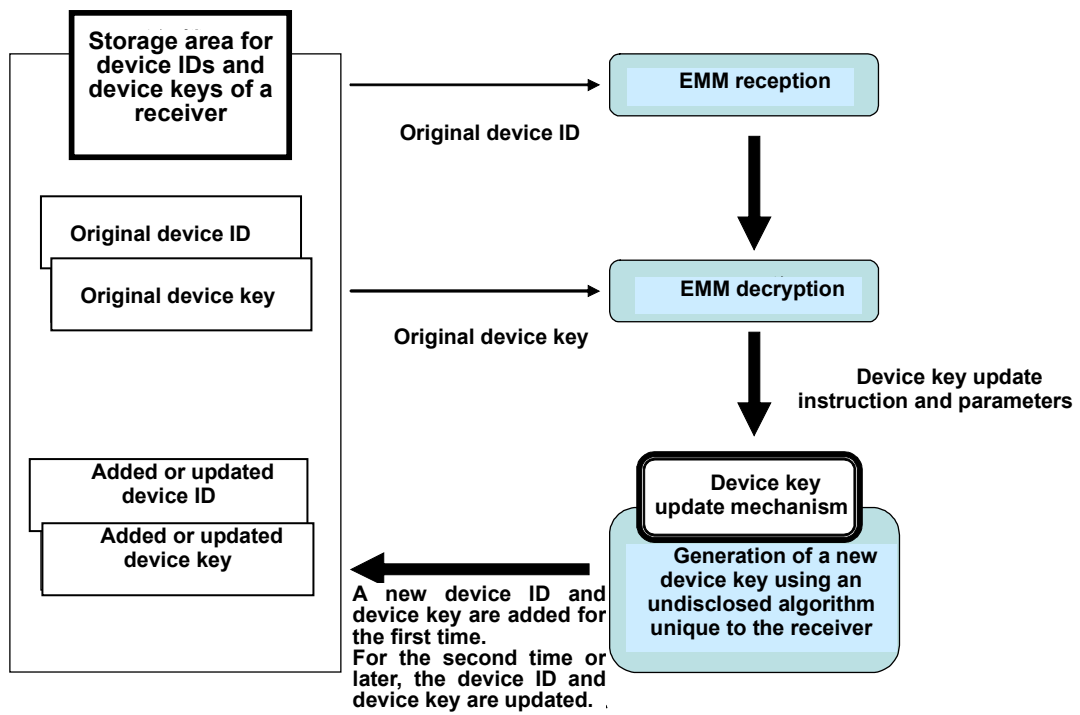
Figure A2-1 Device ID and Device Key Generation Update

Appendix 3

1. Description of EMM message

1.1 Basic concepts of EMM message

1.1.1 Overview

There are two following transmission patterns for EMM message.

    1. EMM common message:　It transmits messages common to all receivers

    2. EMM individual message: It transmits designated information for individual receiver

Note that there are two types of EMM individual messages, one for new use and one for change.

- The "EMMs individual message" transmits designated information for individual viewers, and the "EMMs common message" transmits messages common to all receiver units (fixed sentence).
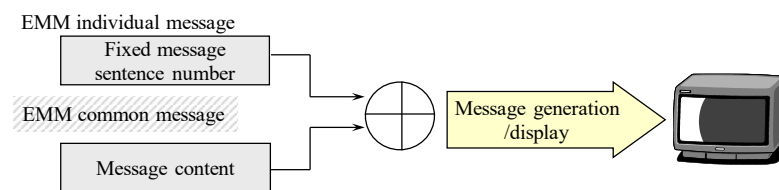
Figure A3-1 Overview of EMM message

- By sending the difference from the message content (fixed sentence) of EMMs common message by means of EMMs individual message, a message consisting of the fixed sentence and the difference can be displayed.
- Any combination of fixed sentence and differences would be possible. If you transmit with EMM individual message only, without using any fixed sentence, a 100% individual message would be displayed.
- The EMM message transmission conditions and transmission frequency are described in the attached table in 1.1.6.

1.1.2 EMM common message

- This message is receivable at all receivers and is not encrypted.
- This message transmits such message information as fixed sentence, type of display/erase, time of display duration, and type of display.

1.1.3 EMM individual message

- This message is transmitted to individual viewers, and is receivable at a specific receiver.

- The individual message for new use is transmitted to each receiver individually by specifying the receiver with an individual ID generated by the receiver.

- The individual message for change is transmitted to each receiver by specifying the receiver with the designated ID given by the broadcaster.

- The designated ID is set by the designated ID setup descriptor. In a receiver where a designated ID is written, the individual ID is disabled and only the designated ID is valid.

- Individual messages for new use and change are used to transmit information such as fixed message sentence numbers, differential information of messages, and message control information.

- Encryption is not essential.

1.1.4 Automatic display message

- Automatic display messages are messages that are automatically superimposed on the screen during program viewing.

- A pointer indicating the fixed sentence and the differential data are transmitted in the EMM individual message, and the fixed sentence is transmitted in the EMM common message, and the two are basically combined and displayed.

- The EMM individual message can be uniquely identified by "RMP broadcaster identifier + message ID", and if the same message is being retransmitted, it should be received only once.

- EMM common messages and EMM individual messages may be transmitted unencrypted.

- The type of EMM individual message in the automatic display message shall be one type per RMP broadcaster group, and the information content shall be stored in the receiver.

- EMM common messages are transmitted repeatedly and are basically acquired at the time of display execution.
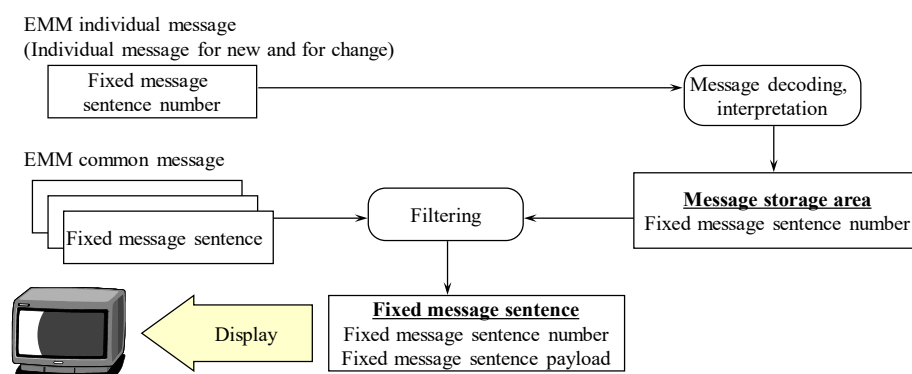
Figure A3-2 Automatic display message

1.1.5 Individual ID and designated ID

- The content protection system specified in Part 3 of this standard does not use a device ID to identify each individual receiver. Even for EMM messages, it is not practical to assign IDs individually at the time of receiver manufacture from the standpoint of operational consistency.

- Therefore, for the initial ID in the EMM message, it is assumed that a random number is generated in the receiver and used as the individual ID.

- It is undesirable for individual IDs to collide with the individual IDs of other receivers. In order to minimize the possibility of collision, it is necessary to generate a random number with a length of 64 bits or more. (For 64-bit length, approximately 4.3 billion (32nd power of 2) receivers collide with each other with a probability of 1/2.)

- When operating automatic display messages, by replacing individual IDs with designated IDs assigned by broadcasters through EMM individual messages, the system of IDs can be arranged and ID collisions can be avoided for receivers that have designated automatic display messages.

1.1.6 Annexed table

(Annexed table 1) Transmission conditions of EMM messages

Syntax		Specification
Section length		4096 bytes or less
Minimum and maximum number of EMMs in a section	EMM individual message	1～256
	EMM common message	1
Number of EMMs with the same ID in the same section in an individual EMM message		1
Minimum interval of EMM transmission to the same receiver in EMM individual messages		1 sec
Maximum length of automatic display message payload (total of individual and common parts)		400 bytes or less
Maximum length of differential information in automatic display messages		20 bytes or less

(Annexed table 2) Transmission frequency of EMM message sections

This follows to 1.1.4 (Annexed table 3) of Reference 1 of Part 3 of this standard.

<Blank Page>

Part 4

Access control system for terrestrial multimedia broadcasting based on connected segment transmission

Part 4 Contents

Chapter 1 General Matters

1.1 Purpose

Part 4 of this standard aims the definition of the specifications for scrambling, encrypting and associated information, and the receiver specifications related thereto regarding the systems of controlling during reception (hereinafter referred to as the conditional access system) and playback (hereinafter referred to as the conditional playback system) in terrestrial mobile multimedia broadcasting based on connected segment transmission among terrestrial multimedia broadcasting for mobile and portable terminals.

1.2 Scope

This standard applies to the cases of conducting the conditional access for content that is transmitted through a "real-time type broadcasting transmission system" in which the time required for transmission of content and the time required for viewing the content are always constant (hereinafter referred to as "real-time type broadcasting content") and the conditional playback for content that is transmitted through a "download-type broadcasting transmission system" in which the times are not necessarily the same (hereinafter referred to as "download-type broadcasting content") in the terrestrial multimedia broadcasting based on the connected segment transmission system which is conducted by broadcasting stations using radio waves with a frequency above 207.5 MHz and below 222 MHz (VHF-high band) (hereinafter referred to as "V-High terrestrial multimedia broadcasting based on ISDB-Tmm system") and by those using radio waves with a frequency above 99 MHz and below 108 MHz (VHF-low band) (hereinafter referred to as "V-Low terrestrial multimedia broadcasting based on ISDB-T$_{SB}$ system").

Regarding the conditional access system for the real-time type broadcasting content and the conditional playback system for the download-type broadcasting content, see Chapter 2 and Chapter 3, respectively.

Receivers in this standard indicate a device that is capable of receiving terrestrial multimedia broadcasting for mobile and portable terminals. Refer to ARIB STD-B53 on receivers.

Figure 1-1 shows a conceptual diagram of access control system for terrestrial multimedia broadcasting services in ISDB-Tmm system for reference.

As for an overview of access control system and its requirements for download-type broadcasting services, refer to Part 2 and Part 3 in ARIB STD-B45.

indicates outside the scope of this standard.
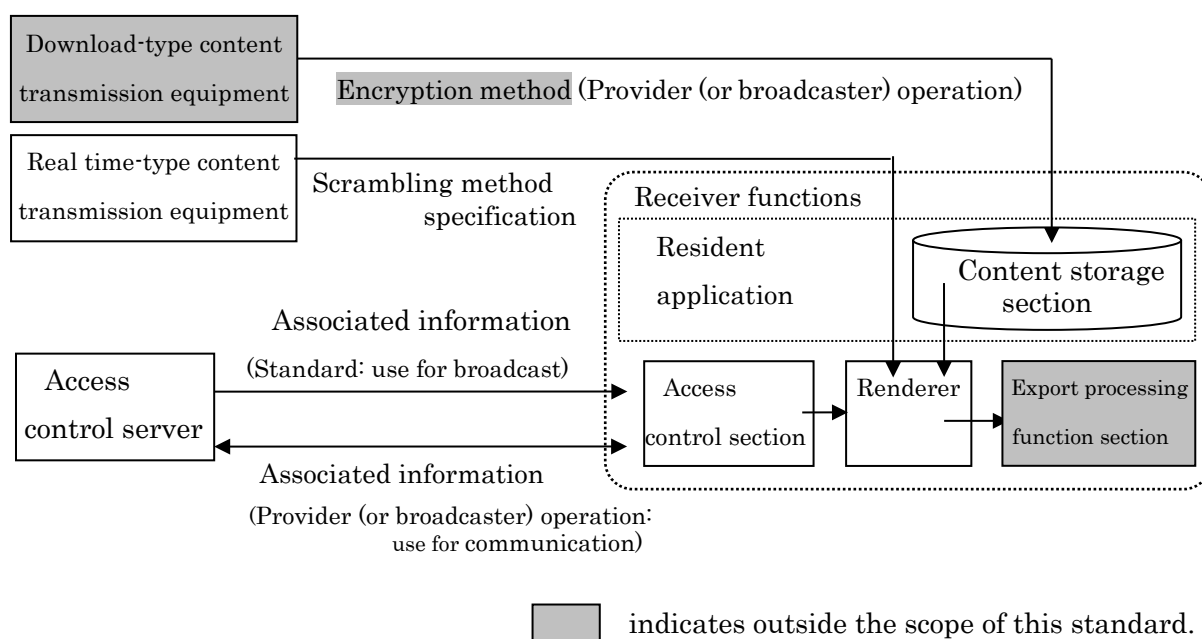
Figure 1-1 Conceptual Diagram of Access Control System for Terrestrial Multimedia Broadcasting in ISDB-Tmm System

1.3 References

1.3.1 Normative references

The following documents are documents in which some of the items specified in the document are referred to or cited as part of the standard in this standard.

(1)　Ordinance of the Ministry of Internal Affairs and Communications: "Standard transmission system for digital broadcasting among standard television broadcasting and the like" (No.87, 2011. (Revision: No.111, 2013 and No.81, 2014) Hereinafter referred to as "Ordinance")

(2) Notification of the Ministry of Internal Affairs and Communications: "On defining the information especially notified by the Minister for Internal Affairs and Communications among associated information" (No.298, 2011)

(3)　Notification of the Ministry of Internal Affairs and Communications: "On defining the configuration of the associated information and the procedure of transmission, the procedure of transmitting PES packet, section format, TS packet, IP packet, ULE packet, MMTP packet, compressed IP packet and TLV packet, the configuration of transmission control signal and identifier and the configuration of emergency information descriptor and emergency warning broadcasting message" (No.233, 2014)

(4)　Notification of the Ministry of Internal Affairs and Communications: "On defining the system for scrambling" (No.235, 2014. Hereinafter referred to as "Notification")

In this standard, for the purpose of convenience of reference, the items which are specified in

the compliant document are indicated with a frame.

In addition, the descriptions in the frame may not correspond exactly to the relevant parts of the compliant document due to supplementary explanations of technical contents, etc.

1.3.2 Informative references

   (1) Telecommunications Technology Council Inquiry Report No. 17

   (2) Telecommunications Technology Council Inquiry Report No. 74

   (3) Information and Communications Council Inquiry Report 2003

   (4) ARIB STD-B1 "Digital Receiver for Digital Satellite Broadcasting" Standard

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

   (6) ARIB STD-B45 "Download Method for Digital Broadcasting" Standard

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

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

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

 (10) ARIB STD-B38 "Coding, Transmission and Storage Specification for Broadcasting System Based on Home Servers" Standard

 (11) ARIB STD-B53 "Receiver for Terrestrial Mobile Multimedia Broadcasting Based on Connected Segment Transmission" Standard

1.4 Terminology and abbreviations

CAS	Conditional Access System
ECM	Entitlement Control Message
EMM	Entitlement Management Message
IPPU	Impulse Pay Per Use
IPPV	Impulse Pay Per View
PPU	Pay Per Use
PPV	Pay Per View
PSI	Program Specific Information
SI	Service Information
TS	Transport Stream

Encryption   Encryption is performed on a file-by-file basis in the download-type broadcasting service, which is different from scrambling in which encryption is performed on the payload section of TS packets.

License   Associated information necessary to use encrypted content for viewing or
             otherwise in the download-type broadcasting service.

Chapter 2 Access Control System for Real-Time Type Broadcasting Service

2.1 General matters

The standard in this chapter applies to the conditional reception for real-time type broadcasting content.

2.2 Functional specification

2.2.1 Specification of scrambling and associated information

2.2.1.1 Overall functionality

(1) Size of contract

The system shall be able to expand in stages, and be capable of managing customers with contracts covering up to a large majority of the domestic population.

(2) System life span

The system shall be able to be managed, corresponding to applicable media.

(3) Ensuring security and response

The system shall have advanced security functions and be able to respond to piracy in case (Pirates) in parallel with pay broadcasting operations.

(4) The access control system in this chapter shall have the following overall functionality.

1) The function which is possible to set and control information independently in the case where the usage license and charge are different between reception and playback

2) The function that enables output control when outputting to terminals which are capable of playback other than the receiving terminal during playback

2.2.1.2 Form of real-time type broadcasting service

2.2.1.2.1 Service forms by the corresponding digital broadcasting

It shall be applicable to the following service forms.

(1) Broadcasting services such as video and audio programs transmitted in the transmission frequency band (programming service ID): For examples,

1) Standard television broadcasting (MP@ML, etc.)

2) High-definition television broadcasting (MP@HL, etc.)

3) Data broadcasting

In data broadcasting, two types of charge are distinguished: billing for streams (service IDs) and billing for files (content). This chapter focuses on real-time type services. For download-type services, refer to Chapter 3.

(2) Integrated Services Digital Broadcasting (ISDB), which integrates and flexibly programs a variety of information including video, audio, data, etc.

(3) Form of reception

1) Real-time reception (conditional reception)

2) Recording reception (including reserved reception)

For the management of copyright issues, it conforms to the standards for digital interface functions used in receivers such as IEEE1394.

2.2.1.2.2 Consistency across media

It shall consider extensibility for integrated operations among the various media.

2.2.1.3 Pricing system

It shall be applicable to the following pricing schemes.

2.2.1.3.1 With scrambling

(1) Flat/Tier

1) The following pricing shall be possible.

(i) Flat viewing per same programming service ID unit

(ii) Tier within a connected segment

(iii) Tier within the same provider (or broadcaster)

(iv) Tier within the same business entity

(The operational form must allow Call Ahead PPV, PP Series, PP Season, etc.)

2) The pricing period can be set on a daily basis, and can be set on a monthly basis for six months, one year, etc.

3) Series purchase

Multiple PPV programs as a series are available for subscription viewing with a tier contract.

(2) Pay-per-view (Impulse PPV [abbreviation; IPPV])

1) Organization service ID, pay-per-use viewing per program for events

(i) Preview; When a PPV program that can be previewed is selected, the preview mode is automatically activated.

(ii) Preview time; Including preview prohibition, a preview time can be set within the same service ID, at the beginning of a program, or within a certain period of time from the beginning of a program.

(iii) Formation of contract; Contract is formed when the user answers the confirmation of viewing intention.

2) Viewing-information call function (support for IPPV for post-paid storage of results)

The viewing-information call function is not defined in Part 4 of this standard.

3) Setting of recording fees

The setting of recording fees is not defined in Part 4 of this standard.

(3) Free

Judgment of "Viewing Availability" is enabled including operation, independently of the transfer of viewing fees.

2.2.1.3.2 Without scrambling

(1) Free

Free unscrambled services are not defined in Part 4 of this standard.

2.2.1.3.3 Data broadcasting billing system

(1) Billing subject

In real-time type broadcasting, the case where data broadcasting is considered as a billing unit at the TS level in the same way as video, audio, etc. (real-time type data service)

(2) Billing format

Same as video, audio, etc.

2.2.1.4 Fee collection system

Any of the following fee collection systems shall be applied.

(1) Contracted storage:

For flat/tier, collect at the time of contracting.

(2) Lump-sum payment (prepayment)

Support for billing in advance using telecommunication, IPPV by prepaid card, etc.

(Note) Part 4 of this standard does not define prepaid card interfaces.

(3) Actual payment storage (post-payment); support IPPV

2.2.1.5 Contract form

Any of the following contract types shall be feasible.

2.2.1.5.1 Contract unit

It shall be provider (or broadcaster) or business entity unit.

2.2.1.5.2 Combination of contract forms

It is desirable to be able to contract with any single pricing system or a combination of systems.

(1) Flat/tier billing contract per business entity

(2) PPV billing contract per business entity

(3) Integrated flat/tier and PPV contract per unit of business entity

In the case where multiple providers (or broadcasters) are integrated into a single EMM as a single business entity in a joint operation, it shall be possible for viewers and providers (or

broadcasters) to contract even in a joint operation at the operational level, for example by classifying providers (or broadcasters) based on the method of assigning tier flags within the EMM.

In case of flat/tier, package contract shall be also possible.

2.2.1.6 Collection of viewing information

The collection of viewing information is not defined in Part 4 of this standard.

2.2.1.7 EMM Transmission

The system shall be able to transmit by each provider (or broadcaster) or business entity and shall be capable of the following operations.

(1) Proprietary provider (or broadcaster) transmission; In the case of individual operation (one provider (or broadcaster) in one business entity), only the company's own service ID is used.

(2) Joint transmission by providers (or broadcasters): In the case of joint operation (multiple providers (or broadcasters) in one business entity), the same EMM is transmitted with all service IDs of the providers (or broadcasters) participating in that entity.

(3) Mixed operation; Individual transmission and integrated transmission are mixed.

(4) EMM transmission by specific channel or service ID;

In order to improve the efficiency of EMM transmission, associated digital broadcasting EMMs are collected to a specific channel or service ID and are transmitted. In this case, EMMs such as contract renewals that are transmitted in batches are transmitted using a specific channel or service ID, but EMMs that are transmitted online by operators such as customer centers are transmitted using each provider's (or broadcaster's) channel or service ID.

(5) Transmission of EMM using communication; This can be transmitted in any of the above cases (1) to (3).

2.2.1.8 ECM transmission

The frequency of ECM transmission can be as short as 100ms, but since the bandwidth of multimedia broadcasting services is narrower than that of other media, there shall be room for balancing the interval with the transmission capacity depending on the service content.

2.2.1.9 Program operation management system

Execution of scrambling and transmission of ECM shall be possible according to the program schedule. Program operation management is performed within each provider (or broadcaster) or business entity (program transmission system).

2.2.1.10 Security functionality

2.2.1.10.1 Encryption of associated information

(1) System

In order to receive programs in real time, the encryption system shall correspond to the so-called triple key structure (by scrambling key (Ks), work key (Kw), and master key (Km)) in the conditional access system in Part 1. In addition, the encryption system is selected by business entity, but it is desirable to use a system with encryption strength equal to or higher than the encryption used for the scrambling system specified in Notification No. 235.

ECM (encrypted with Kw) and EMM (encrypted with Km) are used as associated information.

(2) Management function

In parallel with the operation, it shall be able to deal with piracy by changing the encryption protocol, etc.

2.2.1.11 Preview

(1) It shall be possible to set a time period during which previews can be performed for a certain period immediately after the start. Make it possible to operate preview prohibition.

(2) Define the cumulative preview time limit, and allow viewing until the cumulative preview time limit is reached within the above preview period. The accumulated preview time does not include the time of switching to another service ID or the time of turning off the power of the receiver.

In addition, it is necessary to maintain settings, prohibitions, time limits, etc. for previewing in order that they cannot be easily tampered within the receiver.

2.2.1.12 Rebroadcast billing control

Rebroadcast billing control is not defined in Part 4 of this standard.

2.3 Specifications related to the receiver

2.3.1 Access control unit

(1) Access control unit ID

An original ID number (called the access control unit ID) is set in the access control unit. For security reasons, it is desirable that the ID number is not reused.

(2) Authentication system

In using this access control system as a rights protection technology for multimedia broadcasting, it is desirable to provide a function to check the access control section and the receiver itself by authentication or other means, when using an access control module in order to prevent the occurrence of receivers that do not respond to the rights protection

information.

2.3.2 Receiver main unit

2.3.2.1 Power conservation

●Consideration shall be given to power saving for the access control section and related functions of the receiver function.

2.3.2.2 Time

●The system shall acquire the time information specified by provider (or broadcaster) or business entity, and operate according to that date and time.

2.3.2.3 Basic user input and display

●The display shall have basic key input functions for program selection, various settings, etc., and it shall display characters, etc., on the screen or by superimposing them on the screen.

2.3.2.4 Descrambler

●The transport stream packets shall be descrambled according to the scrambler specified in Notification No. 235 of the Ministry of Internal Affairs and Communications, using one of the following methods: AES, Camellia, or MULTI2. In addition, from the viewpoint of the configuration of receiver functions, it is desirable for provider (or broadcaster) or business entity to select one of these methods in common for their operation.

2.3.2.5 Communication control within the receiver function of the access control section

●The communication control function of the access control section in the receiver is not defined in Part 4 of this standard.

2.3.2.6 Communication function

●It is desirable to have a communication function in order to obtain EMM. In addition, it is recommended that communication protocols, etc. are defined as operational by the provider (or broadcaster) or business entity from the viewpoint of the configuration of receiver function.

2.3.2.7 Transmission of viewing history information

●The transmission of viewing history information is not defined in Part 4 of this standard.

2.3.2.8 Energization call control

●The energization call control is not defined in Part 4 of this standard.

2.3.2.9 Receiving ECM
●If an ECM exists in the PMT reference, the ECM shall be received, the received ECM shall be sent to the access control section, and the processing by the response and the descrambling control shall be performed.

2.3.2.10 Receiving EMM messages
●The receiving EMM messages is not defined in Part 4 of this standard.

2.3.2.11 Energization control
●The energization control is not defined in Part 4 of this standard.

2.3.2.12 Selective viewing of programs
●The program is selected from PSI/SI and the corresponding transport stream is selected, and then the program shall be viewed as a free program without scrambling, free program with scrambling, flat/tier contract pay program, PPV contract pay program, flat/tier contract or PPV contract pay program by referring to the scrambling control or ECM by the access control section.
●The program without scrambling shall be selected for viewing regardless of the access control section.
●Preview viewing and purchase solicitation can be performed according to the response from the access control section.

2.3.2.13 Program reservation
●Program viewing reservations shall be made from metadata, and reserved program viewing shall be performed.
●The contract status shall be determined based on the contract confirmation information in the metadata, and it shall be determined whether or not the reserved program can be viewed.

2.3.2.14 Receiver control by EMM
●The password erase control function in EMM is not defined in Part 4 of this standard.

2.3.2.15 Parental control
●Viewing can be restricted by entering a password by comparing the parental level of the program with the set parental level.

2.3.2.16 Display of information in access control section
●The display of information in access control section is not defined in Part 4 of this standard.

2.3.2.17 System setting

- ●The parental level shall be set for parental control.

- ●Set, change, and erase of passwords for parental control and PPV program purchase restrictions shall be performed.

- ●The parameters shall be set.

- ●The PPV monthly purchase limit setting function is not defined in Part 4 of this standard.

- ●The PPV single-program purchase limit setting function is not defined in Part 4 of this standard.

- ●PPV purchase records and their displays are not defined in Part 4 of this standard.

- ●The inspection of communication line connection is not defined in Part 4 of this standard.

- ●The display of trouble history is not defined in Part 4 of this standard.

2.3.2.18 Screen display

- ●The functionality shall be equivalent to that which can be provided by subtitling service processing.

2.3.2.19 Copy control

- ●Copy control shall be available.

2.3.2.20 Indication of receiver functions in operation

- ●When the viewer selects a service including a service that requires an access control section, the receiver displays that fact.

2.3.2.21 Notification display of communication function usage status

- ●It is desirable to have a function for recognizing the failure of communication involving the access control section.

2.3.2.22 User call request

- ●User call request is not defined in Part 4 of this standard.

2.4 Technical specifications for scrambling and associated information

2.4.1 Scrambling subsystem

2.4.2.1 Scrambling system

When performing pay broadcasting or when trying to protect rights related to broadcast programs, scrambling shall be performed by the following method.

That is, the scrambling procedure shall be as shown in Sec. 2.4.1.2, and the method shall be

electrically scrambled in combination with the following two methods.

(1) A method in which a 64-bit or 128-bit code string is replaced with another binary code string using variables, respectively.

(2) For code strings of less than 64 or 128 bit, a method of superimposing a pseudo-random number code string generated using the method specified in (1).

Figure 2-1 shows a conceptual diagram of the conditional access system based on Notification No. 235 of the Ministry of Internal Affairs and Communications.
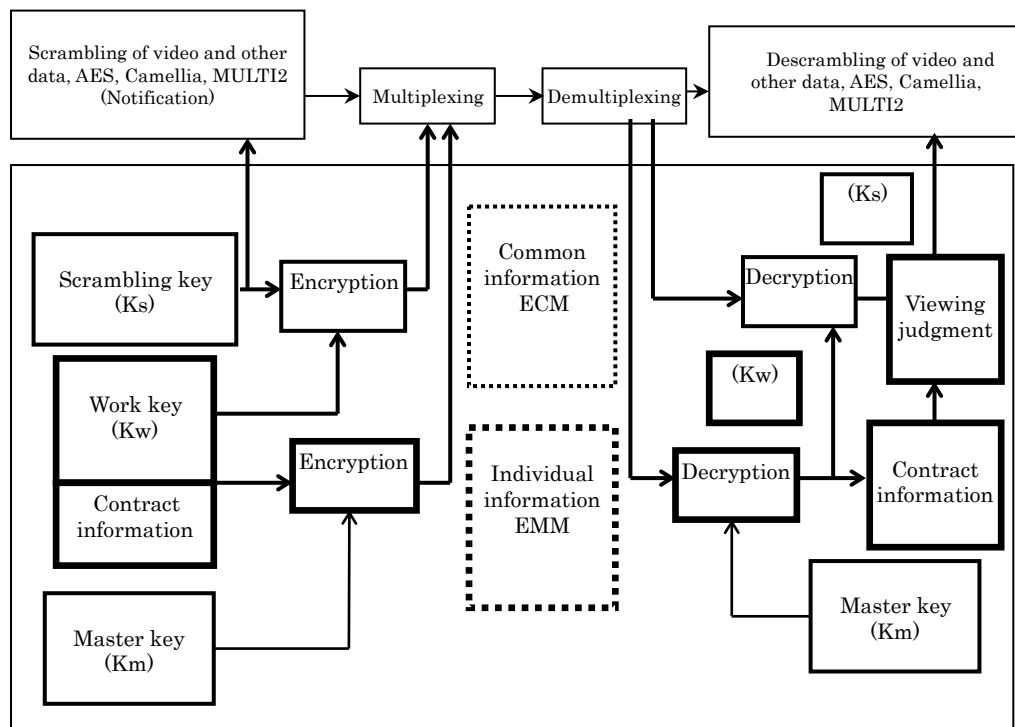
Figure 2-1 Conditional Access System

2.4.1.2 Scrambling procedure and elementary functions of encryption

The scrambling operation shall be in accordance with Notification 235 of the Ministry of Internal Affairs and Communications. Since descrambling is a symmetric-key block cipher, it operates in the same way as scrambling.

The scrambling procedure and encryption method specified in the Notification are shown below.

(1) Scrambling procedure using MULTI2 cipher

64-bit key

Block length
=8 Bytes

Unencrypted
TS data

MULTI2
Cipher

reg

CBC mode

Encrypted
TS data

Block length
≠8 Bytes

MULTI2
Cipher

reg

OFB mode

Notes 1 MULTI2 cipher is shown in 2.4.1.2 (1) 1).

2 reg indicates a register.

3 ⊕ indicates exclusive OR.

(Notification Annexed Table 1)

1) MULTI2 cipher

Key Schedule

Encryption

Data Key (D$_K$) (64 bits)

System Key (S$_K$)
(256 bit)

π_1

Expanded key (W$_K$)
(256 bit)

Plaintext (P) (64 bits)

π_1 N=1

S1 → π_2

a$_1$ w$_1$ π_2 N=2

S2 → π_3
S3 →   w$_2$

a$_2$ w$_3$ π_3 N=3

S4 → π_4

a$_3$ w$_4$ π_4 N=4

π_1

a$_4$ π_1 N=5

S5 → π_2

a$_5$ w$_5$ π_2 N=6

S6 → π_3
S7 →   w$_6$

a$_6$ w$_7$ π_3 N=7

S8 → π_4

a$_7$ w$_8$ π_4 N=8

π_1

a$_8$

π_4

Ciphertext (C) (64 bits)

$S_K = s_1 \mathbin{/\!/} s_2 \mathbin{/\!/} \cdots \mathbin{/\!/} s_8$
$a_1 = \pi_2 s_1 \cdot \pi_1(D_K)$
$w_1 = a_1[\text{left}]$
$a_2 = \pi_3 s_2, s_3(a_1)$
$w_2 = a_2[\text{right}]$
$a_3 = \pi_4 s_4(a_2)$
$w_3 = a_3[\text{left}]$
$a_4 = \pi_1(a_3)$
$w_4 = a_4[\text{right}]$
$a_5 = \pi_2 s_5(a_4)$
$w_5 = a_5[\text{left}]$
$a_6 = \pi_3 s_6, s_7(a_5)$
$w_6 = a_6[\text{right}]$
$a_7 = \pi_4 s_8(a_6)$
$w_7 = a_7[\text{left}]$
$a_8 = \pi_1(a_7)$
$w_8 = a_8[\text{right}]$
$W_K = w_1 \mathbin{/\!/} w_2 \mathbin{/\!/} \cdots \mathbin{/\!/} w_8$

Notes
1 π_1 to π_4 indicate the elementary functions and are described in Section 2.4.1.2(1)2).
2 N represents the number of encryption stages.
3 $/\!/$ indicates a block union.
4 a$_x$[left] represents the leftmost 32 bits of block a$_x$.
5 a$_x$[right] represents the rightmost 32 bits of block a$_x$.

$W_K = w_1 \mathbin{/\!/} w_2 \mathbin{/\!/} \cdots \mathbin{/\!/} w_8$
$N = 8m + \alpha \quad (0 \leqq \alpha \leqq 7)$
$f_{WK} = \pi_4 w_8 \cdot \pi_3 w_6, w_7 \cdot \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1$
$F_{WK} = f_{WK} \cdot f_{WK} \cdot \cdots \cdot f_{WK}$
Function fwk is repeated m times.
When $\alpha = 0$,
$C = F_{WK}(P)$
When $\alpha = 1$,
$C = \pi_1 \cdot F_{WK}(P)$
When $\alpha = 2$,
$C = \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 3$,
$C = \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 4$,
$C = \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 5$,
$C = \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 6$,
$C = \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$
When $\alpha = 7$,
$C = \pi_3 w_6, w_7 \cdot \pi_2 w_5 \cdot \pi_1 \cdot \pi_4 w_4 \cdot \pi_3 w_2, w_3 \cdot \pi_2 w_1 \cdot \pi_1 \cdot F_{WK}(P)$

(Notification Annexed Table 1 Appendix 1)

2) Elementary functions

$\pi_1(T)=T[left] \mathbin{/\!/} (T[left] \oplus T[right])$

π_2

x=T[right]
y=x+k$_1$
z=Rot$_1$(y)+y$-$1
π_2k$_1$(T)=(T[left] $\oplus$(Rot$_4$(z) $\oplus$ z)) $\mathbin{/\!/}$ T[right]

x=T[left]
y=x+k$_2$
z=Rot$_2$(y)+y+1
a=Rot$_8$(z) $\oplus$z
b=a+k$_3$
c=Rot$_1$(b)$-$b
π_3k$_2$,k$_3$(T)=T[left] $\mathbin{/\!/}$ (T[right] $\oplus$(Rot$_{16}$(c)$\oplus$(c$\vee$x)))

x=T[right]
y=x+k$_4$
π_4k$_4$(T)=(T[left] $\oplus$ (Rot$_2$(y)+y+1)) $\mathbin{/\!/}$ T[right]

Notes
 1 T indicates the input to the elementary function.
 2 T[left] represents the leftmost 32 bits of block T.
 3 T[right] represents the rightmost 32 bits of block T.
 4 $\oplus$ indicates a bitwise exclusive OR.
 5 + indicates addition modulo 2^{32}.
 6 - indicates subtraction modulo 2^{32}.
 7 Rot$_n$ represents a left-cyclic s-bit shift.
 8 $\vee$ represents a bitwise logical OR.
 9 $\mathbin{/\!/}$ indicates a block union.

(Notification Annexed Table 1 Appendix 2)

(2) Scrambling procedure using AES cipher

128-bit key

Block length =16
 Bytes

Unencrypted
TS data

CBC mode

Block length ≠
 16 Bytes

AES
Cipher

reg

AES
Cipher

reg

OFB mode

Encrypted
TS data

Note
1　AES cipher is shown in 2.4.1.2 (2) 1).

(Notification Annexed Table 2)

1) AES cipher

Key Schedule

Secret Key K (128 bits)

Expanded key
(every 128-bit)

Encryption

Plaintext(P) (128 bits)

K$_0$ → ADD

Rcon[1] → KR

Sub

Shift

Mix

K$_1$ → ADD

N = 1

Rcon[2] → KR

Sub

Shift

Mix

K$_2$ → ADD

N = 2

Rcon[9] → KR

K$_9$ → ADD

N = 9

Rcon[10] → KR

Sub

Shift

K$_{10}$ → ADD

Ciphertext (C) (128 bits)

K$_0$ = K

Repeat the following for N = 1, 2, ..., 10,

$\quad$ K$_N$ = KR(K$_{N-1}$, Rcon[N])

S = ADD(P, K$_0$)
$\quad$ Repeat the following for N = 1, 2, ..., 9,
$\qquad$ S = Sub(S)
$\qquad$ S = Shift(S)
$\qquad$ S = Mix(S)
$\qquad$ S = ADD(S, K$_N$)
S = Sub(S)
S = Shift(S)
C = ADD(S, K$_{10}$)

Notes
1$\quad$ ADD, Sub, Shift, Mix, KR indicate the elementary functions and are shown in 2.4.1.2 (2) 2).
2$\quad$ N represents the number of encryption stages.
3$\quad$ Rcon[j] represents the algorithm constant and is shown in 2.4.1.2 (2) 3).

(Notification Annexed Table 2 Appendix 1)

2) Elementary functions

KR

128 bits
T

$T = t_0 \| t_1 \| t_2 \| t_3$
$a = Rot_8(t_3)$
$w_0 = SW(a) \oplus t_0 \oplus Rcon$
$w_1 = w_0 \oplus t_1$
$w_2 = w_1 \oplus t_2$
$w_3 = w_2 \oplus t_3$
$KR(T, Rcon) = w_0 \| w_1 \| w_2 \| w_3$

Sub

128 bits
T

128 bits

$T = t_0 \| t_1 \| t_2 \| t_3$
$Sub(T) = SW(t_0) \| SW(t_1) \| SW(t_2) \| SW(t_3)$

Shift

128 bits
S

$S = s_0 \| s_1 \| s_2 \| s_3 \| s_4 \| \cdot\cdot\cdot \| s_{15}$
$P(S) = a_0 \| a_1 \| a_2 \| a_3$
Here, $a_0 = (s_0 \| s_4 \| s_8 \| s_{12})$
$a_1 = (s_1 \| s_5 \| s_9 \| s_{13})$
$a_2 = (s_2 \| s_6 \| s_{10} \| s_{14})$
$a_3 = (s_3 \| s_7 \| s_{11} \| s_{15})$
$B = a_0 \| Rot_8(a_1) \| Rot_{16}(a_2) \| Rot_{24}(a_3)$
$Shift(S) = P^{-1}(B)$
$= s_0 \| s_5 \| s_{10} \| s_{15} \| s_4 \| s_9 \| s_{14} \| s_3 \| s_8 \| s_{13} \| s_2 \| s_7 \| s_{12} \| s_1 \| s_6 \| s_{11}$

ADD

128 bits
T

K
128 bits

128 bits

$T = t_0 \| t_1 \| t_2 \| t_3$
$K = k_0 \| k_1 \| k_2 \| k_3$
$ADD(T, K) = (t_0 \oplus k_0) \| (t_1 \oplus k_1) \| (t_2 \oplus k_2) \| (t_3 \oplus k_3)$

(Notification Annexed Table 2 Appendix) 2)

Notes

1   T indicates the input to the elementary function.

2   $\oplus$ indicates a bitwise exclusive OR.

3   $\parallel$ indicates a block union.

4   SW indicates the auxiliary function and is shown in 2.4.1.2 (2) 3).

5   Rot_n represents a left-cyclic n-bit shift.

6   · indicates multiplication on $GF(2^8)$. The irreducible polynomial shall be $x^8 + x^4 + x^3 + x + 1$.

Mix

128 bits

T

t_0 t_1 t_2 t_3

$a(x) \otimes t_0$ $a(x) \otimes t_1$ $a(x) \otimes t_2$ $a(x) \otimes t_3$

w_0 w_1 w_2 w_3

128 bits

$T = t_0 \parallel t_1 \parallel t_2 \parallel t_3$

$w_i = a(x) \otimes t_i = z_0 \parallel z_1 \parallel z_2 \parallel z_3$

Here, $t_i = (y_0 \parallel y_1 \parallel y_2 \parallel y_3)$

$z_0 = (\{02\} \cdot y_0) \oplus (\{03\} \cdot y_1) \oplus y_2 \oplus y_3$

$z_1 = y_0 \oplus (\{02\} \cdot y_1) \oplus (\{03\} \cdot y_2) \oplus y_3$

$z_2 = y_0 \oplus y_1 \oplus (\{02\} \cdot y_2) \oplus (\{03\} \cdot y_3)$

$z_3 = (\{03\} \cdot y_0) \oplus y_1 \oplus y_2 \oplus (\{02\} \cdot y_3)$

$Mix(T) = w_0 \parallel w_1 \parallel w_2 \parallel w_3$
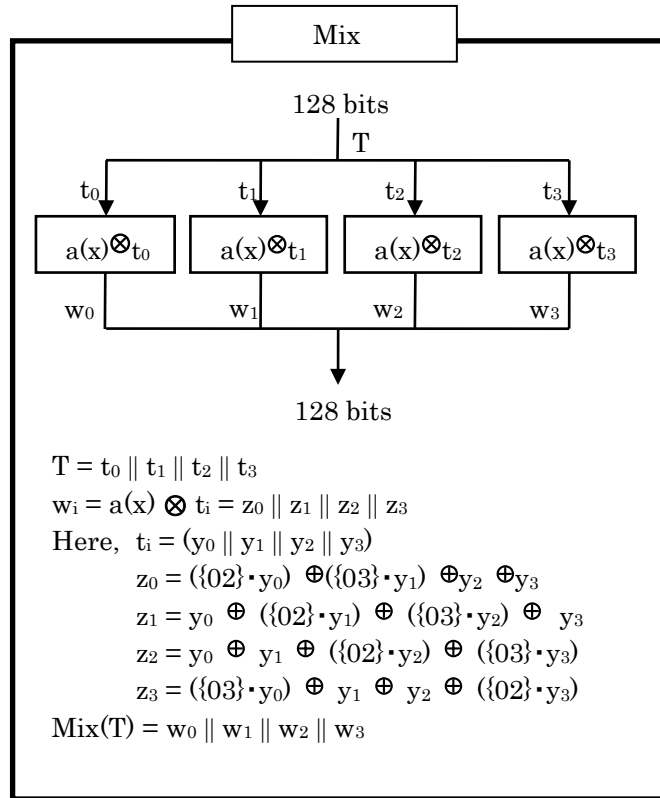
(Notification Annexed Table 2 Appendix 2)

3) Algorithm constants and auxiliary function

Algorithm constants

Rcon[1]	= 01000000
Rcon[2]	= 02000000
Rcon[3]	= 04000000
Rcon[4]	= 08000000
Rcon[5]	= 10000000
Rcon[6]	= 20000000
Rcon[7]	= 40000000
Rcon[8]	= 80000000
Rcon[9]	= 1b000000
Rcon[10]	= 36000000

Note: Numerical values are in hexadecimal notation.

Auxiliary function

SW

32 bits

u

S(u)

32 bits

$u = x_0 \parallel x_1 \parallel x_2 \parallel x_3$

$SW(u) = s(x_0) \parallel s(x_1) \parallel s(x_2) \parallel s(x_3)$
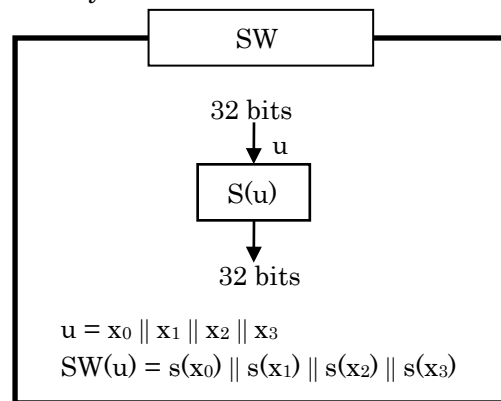
Notes

1   u indicates an input to the auxiliary function.

2   $\parallel$ indicates a block union.

3   s represents an 8-bit translation table, and the details shall follow the ISO/IEC18033-3.

(Notification Annexed Table 3 Appendix 4)

(3) Scrambling procedure using Camellia cipher

128-bit key

Block length
=16 Bytes

Unencrypted
TS data

Camellia
Cipher

reg

CBC mode

Encrypted
TS data

Block length
≠16 Bytes

Camellia
Cipher

reg

OFB mode

Note

1　Camellia cipher is shown in 2.4.1.2 (3) 1).

(Notification Annexed Table 3)

1) Camellia cipher

Key Schedule

Secret Key (K_L) (128 bits)

Constant Σ
(64-bit each)

Σ_1 F

Σ_2 F

Σ_3 F

Σ_4 F

Subkey(K_A) (128 bits)

Choice_and_Rotation

Expanded key
(every 64-bit)

Encryption

Plaintext(P) (64 bits)

Kw₁ → K_{w1}

Kw₂ → K_{w2}

L_0 R_0

K_1 F N = 1

K_2 F N = 2

K_3 F N = 3

K_4 F N = 4

K_5 F N = 5

K_6 F N = 6

Kl_1 FL

Kl_2 FL⁻¹

K_7 F N = 7

K_{12} F N = 12

Kl_3 FL

Kl_4 FL⁻¹

K_{13} F N = 13

K_{18} F N = 18

L_{18} R_{18}

Kw₃ → K_{w3}

Kw₄ → K_{w4}

Ciphertext (C) (128 bits)

$A_1 = F((K_L[\text{left}] \| K_L[\text{right}]), \Sigma_1)$
$A_2 = F((A_1[\text{left}] \| A_1[\text{right}]), \Sigma_2) \oplus K_L$
$A_3 = F((A_2[\text{left}] \| A_2[\text{right}]), \Sigma_3)$
$K_A = F((A_3[\text{left}] \| A_3[\text{right}]), \Sigma_4)$
$(Kw_1, \cdots, Kw_4, K_1, \cdots, K_{18}, Kl_1, \cdots, Kl_4) = \text{Choice\_and\_Rotation}(K_L, K_A)$

Notes

1 Σ_i indicates the algorithm constant and is shown in 2.4.1.2 (3) 3).

2 F indicates the elementary function and is shown in 2.4.1.2 (3) 2).

3 Choice_and_Rotation represents the process that retrieves 64-bit data from a specific position in K_L or K_A, and is shown in 2.4.1.2 (3) 4).

4 N indicates the number of encryption stages.

5 FL and FL⁻¹ indicate the auxiliary functions and are shown in 2.4.1.2 (3) 3).

6 $\|$ indicates a block union.

7 a[left] represents the leftmost 64 bit of block a.

$L_0 \| R_0 = (P[\text{left}] \| P[\text{right}]) \oplus (Kw_1 \| Kw_2)$

Repeat the following for N=1,2,...,18.

When N≠6, 12,
$L_N \| R_N = F((L_{N-1} \| R_{N-1}), K_N)$

When N = 6, 12,
$L_N \| R_N = F((L_{N-1} \| R_{N-1}), K_N)$
$L_N = FL(L_N, Kl_{(N/3)-1})$
$R_N = FL^{-1}(R_N, Kl_{N/3})$

$C = (R_{18} \| L_{18}) \oplus (Kw_3 \| Kw_4)$

(Notification Annexed Table 3 Appendix 1)

2) Elementary function

$X = T[\text{left}] \oplus K = (x_8 \| x_7 \| x_6 \| x_5 \| x_4 \| x_3 \| x_2 \| x_1)$

$Y = S(X) = (s_1(x_8) \| s_4(x_7) \| s_3(x_6) \| s_2(x_5) \| s_4(x_4) \| s_3(x_3) \| s_2(x_2) \| s_1(x_1))$

$\quad\quad = (y_8 \| y_7 \| y_6 \| y_5 \| y_4 \| y_3 \| y_2 \| y_1)$

$Z = P(Y) = (z_8 \| z_7 \| z_6 \| z_5 \| z_4 \| z_3 \| z_2 \| z_1)$

Here, $\quad z_1 = y_1 \oplus y_3 \oplus y_4 \oplus y_6 \oplus y_7 \oplus y_8$

$\quad\quad\quad z_2 = y_1 \oplus y_2 \oplus y_4 \oplus y_5 \oplus y_7 \oplus y_8$

$\quad\quad\quad z_3 = y_1 \oplus y_2 \oplus y_3 \oplus y_5 \oplus y_6 \oplus y_8$

$\quad\quad\quad z_4 = y_2 \oplus y_3 \oplus y_4 \oplus y_5 \oplus y_6 \oplus y_7$

$\quad\quad\quad z_5 = y_1 \oplus y_2 \oplus y_6 \oplus y_7 \oplus y_8$

$\quad\quad\quad z_6 = y_2 \oplus y_3 \oplus y_5 \oplus y_7 \oplus y_8$

$\quad\quad\quad z_7 = y_3 \oplus y_4 \oplus y_5 \oplus y_6 \oplus y_8$

$\quad\quad\quad z_8 = y_1 \oplus y_4 \oplus y_5 \oplus y_6 \oplus y_7$

$F(T, K) = (T[\text{right}] \oplus Z) \| T[\text{left}]$

Notes　1 T indicates an input to the auxiliary function.

2 T[left] represents the leftmost 64 bits of block T.

3 T[right] represents the rightmost 64 bits of block T.

4 ‖ indicates a block union.

5 s_i represents an 8-bit translation table, and the details shall follow the ISO/IEC18033-3:2005(E) Section 5.2.3.4.

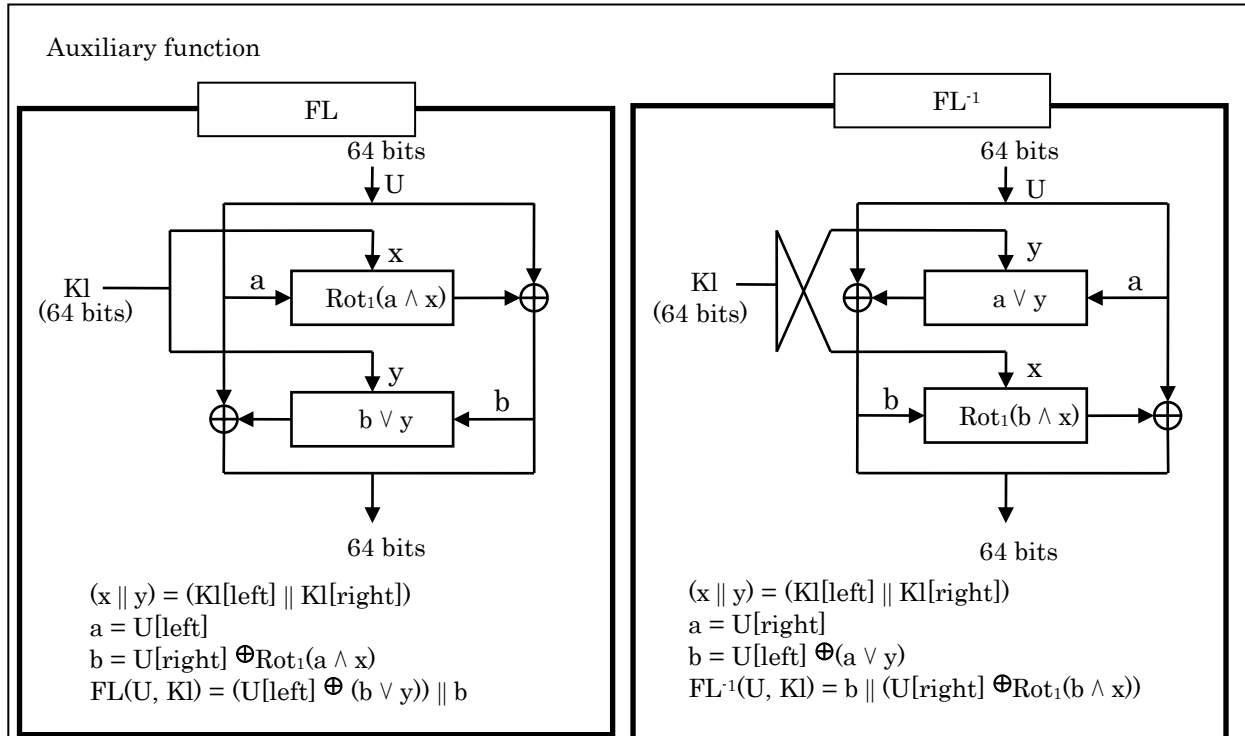(Notification Annexed Table 3 Appendix 2)

3) Auxiliary functions and algorithm constants

Auxiliary function

$(x \parallel y) = (Kl[left] \parallel Kl[right])$
$a = U[left]$
$b = U[right] \oplus Rot_1(a \wedge x)$
$FL(U, Kl) = (U[left] \oplus (b \vee y)) \parallel b$

$(x \parallel y) = (Kl[left] \parallel Kl[right])$
$a = U[right]$
$b = U[left] \oplus (a \vee y)$
$FL^{-1}(U, Kl) = b \parallel (U[right] \oplus Rot_1(b \wedge x))$

Notes 1 U indicates an input to the auxiliary function.
2 $\parallel$ indicates a block union.
3 Rot_1 represents a left-cyclic 1-bit shift.
4 $\wedge$ represents a bitwise logical product.
5 $\vee$ represents a bitwise logical OR.
6 U[left] represents the leftmost 32 bits of block U.
7 U[right] represents the rightmost 32 bits of block U.

Algorithm constants $\Sigma_1 = a09e667f3bcc908b$

$\Sigma_2 = b67ae8584caa73b2$
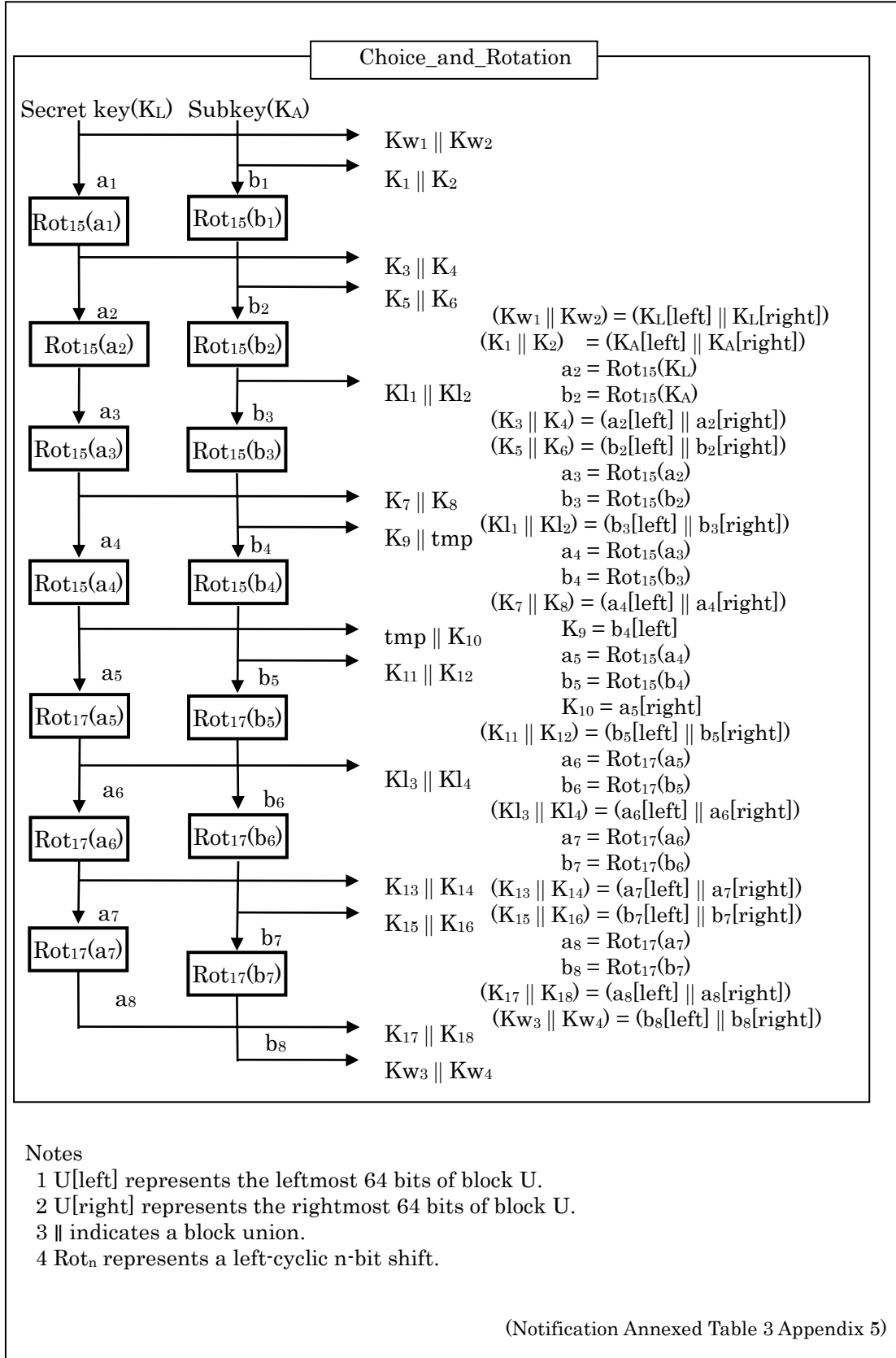
$\Sigma_3 = c6ef372fe94f82be$

$\Sigma_4 = 54ff53a5f1d36f1c$

Note: Numerical values are in hexadecimal notation.

(Notification Annexed Table 3 Appendix 3 and 4)

4) Choice_and_Rotation

Choice_and_Rotation

Secret key(K_L) Subkey(K_A)

$Kw_1 \| Kw_2$

$K_1 \| K_2$

$Rot_{15}(a_1)$ $Rot_{15}(b_1)$ a_1 b_1

$K_3 \| K_4$

$K_5 \| K_6$

$Rot_{15}(a_2)$ $Rot_{15}(b_2)$ a_2 b_2

$Kl_1 \| Kl_2$

$Rot_{15}(a_3)$ $Rot_{15}(b_3)$ a_3 b_3

$K_7 \| K_8$

$K_9 \| tmp$

$Rot_{15}(a_4)$ $Rot_{15}(b_4)$ a_4 b_4

$tmp \| K_{10}$

$K_{11} \| K_{12}$

$Rot_{17}(a_5)$ $Rot_{17}(b_5)$ a_5 b_5

$Kl_3 \| Kl_4$

$Rot_{17}(a_6)$ $Rot_{17}(b_6)$ a_6 b_6

$K_{13} \| K_{14}$

$K_{15} \| K_{16}$

$Rot_{17}(a_7)$ $Rot_{17}(b_7)$ a_7 b_7

a_8

b_8

$K_{17} \| K_{18}$

$Kw_3 \| Kw_4$

$(Kw_1 \| Kw_2) = (K_L[left] \| K_L[right])$
$(K_1 \| K_2) = (K_A[left] \| K_A[right])$
$a_2 = Rot_{15}(K_L)$
$b_2 = Rot_{15}(K_A)$
$(K_3 \| K_4) = (a_2[left] \| a_2[right])$
$(K_5 \| K_6) = (b_2[left] \| b_2[right])$
$a_3 = Rot_{15}(a_2)$
$b_3 = Rot_{15}(b_2)$
$(Kl_1 \| Kl_2) = (b_3[left] \| b_3[right])$
$a_4 = Rot_{15}(a_3)$
$b_4 = Rot_{15}(b_3)$
$(K_7 \| K_8) = (a_4[left] \| a_4[right])$
$K_9 = b_4[left]$
$a_5 = Rot_{15}(a_4)$
$b_5 = Rot_{15}(b_4)$
$K_{10} = a_5[right]$
$(K_{11} \| K_{12}) = (b_5[left] \| b_5[right])$
$a_6 = Rot_{17}(a_5)$
$b_6 = Rot_{17}(b_5)$
$(Kl_3 \| Kl_4) = (a_6[left] \| a_6[right])$
$a_7 = Rot_{17}(a_6)$
$b_7 = Rot_{17}(b_6)$
$(K_{13} \| K_{14}) = (a_7[left] \| a_7[right])$
$(K_{15} \| K_{16}) = (b_7[left] \| b_7[right])$
$a_8 = Rot_{17}(a_7)$
$b_8 = Rot_{17}(b_7)$
$(K_{17} \| K_{18}) = (a_8[left] \| a_8[right])$
$(Kw_3 \| Kw_4) = (b_8[left] \| b_8[right])$

Notes
 1 U[left] represents the leftmost 64 bits of block U.
 2 U[right] represents the rightmost 64 bits of block U.
 3 ‖ indicates a block union.
 4 Rot_n represents a left-cyclic n-bit shift.

(Notification Annexed Table 3 Appendix 5)

2.4.1.3 Scrambling layer

It shall be a transport stream.

2.4.1.4 Scrambling range

The scrambling range shall be the payload portion of TS packets (excluding those for transmission control signals and associated information).

2.4.1.5 Unit of scrambling

Scrambling shall be performed in units of TS packets.

2.4.1.6 Usage time of the same key

The minimum time for 1ECM shall be about 1 second, but this shall be determined by provider (or broadcaster) based on the computing power of the receiver function and the implementation method between the associated information subsystem in the receiver function and the scrambling subsystem.

2.4.2 Associated information subsystem

2.4.2.1 Type of associated information

There are ECM (program information/control information) and EMM (individual information), etc.

Figure 2-2 shows an example of EMM/ECM and conditional access flow.
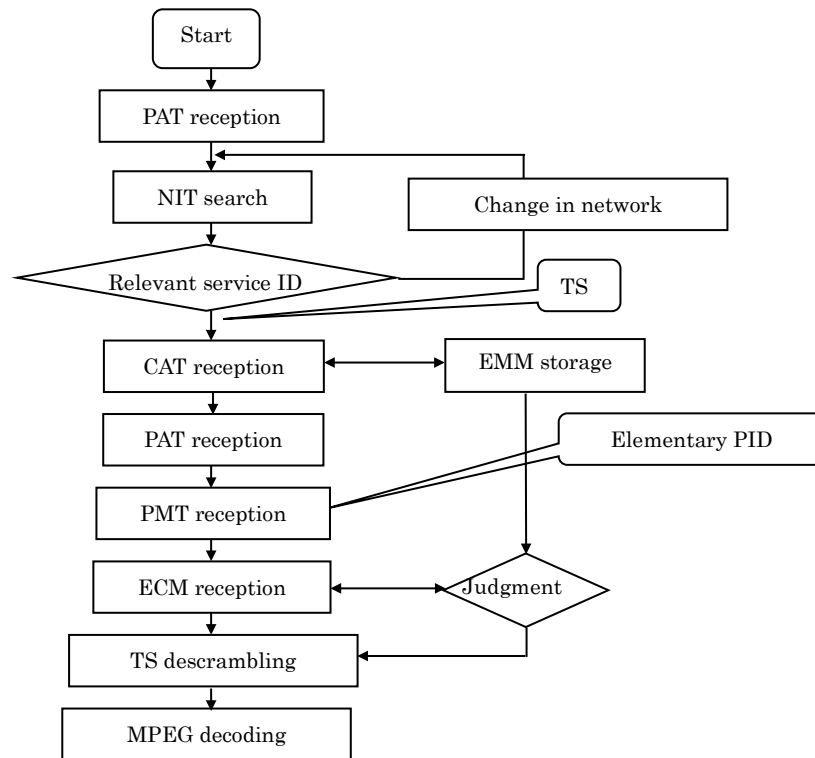
Figure 2-2 An Example of EMM/ECM and Conditional Access Flow

2.4.2.2 Format of associated information

A format in which individual information is integrated among providers (or broadcasters) and a format that is independent for each provider (or broadcaster) can be selected.

2.4.2.3 ECM

2.4.2.3.1 Basic configuration of ECM

(1) One TS (Transport Stream) packet contains one ECM section.

Figure 2-3 shows the basic configuration of a TS packet that transmits ECM.
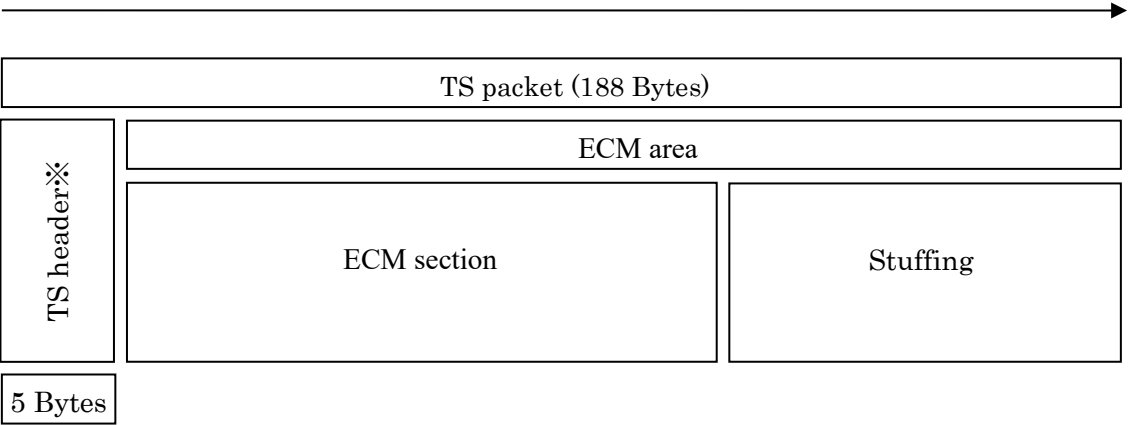
(※) contains a pointer field.

Figure 2-3 The Configuration of TS Packet

(2) The basic configuration of the ECM section and ECM payload is described below.

●The entire ECM section is subject to Section CRC.

●The main payload of ECM consists of a fixed part that is always fixedly transmitted, and a business-entity individual setting section that can be made variable depending on the purpose.

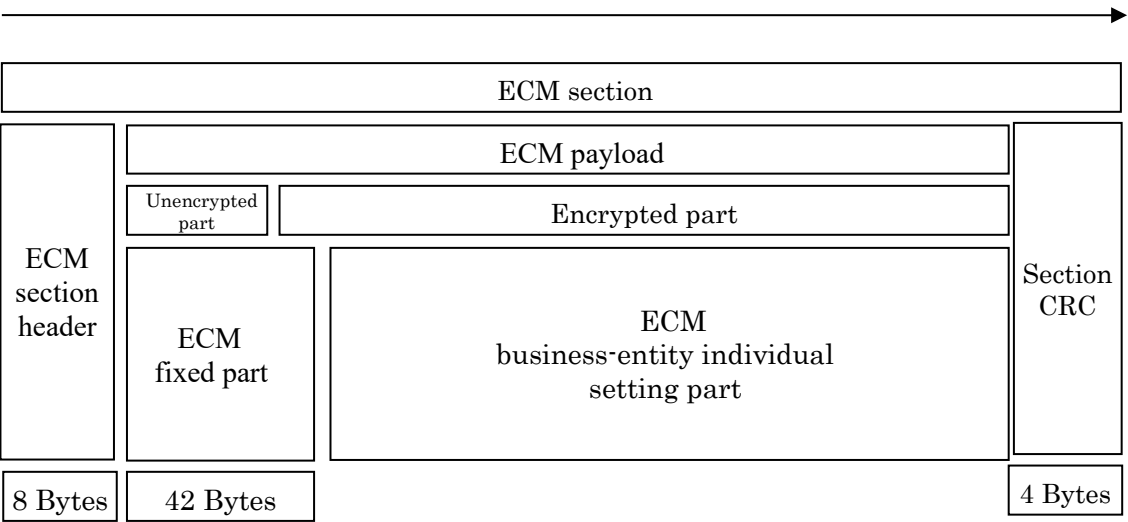The configuration of the ECM section is shown in Figure 2-4.

Figure 2-4 The Configuration of ECM Section

2.4.2.3.2 ECM details

(1) ECM section structure

The ECM section has the structure shown in Table 2-1. The scrambling key length shall be the encryption key length to be used.

Table 2-1 ECM Section Structure

Structure				Data length
ECM section	ECM payload	ECM section header (Table identifier 0x82)		8 Bytes
		ECM fixed part	Protocol number	1 Byte
			Business entity identifier	1 Byte
			Work key identifier	1 Byte
			Scrambling key (Odd)	16 Bytes*
			Scrambling key (Even)	16 Bytes*
			Judgment type	1 Byte
			Date and time (Date MJD + Hour, Minute, Second BCD)	5 Bytes
			Recording control	1 Byte
		ECM business-entity individual setting part	Various functional information can be placed.	Determined by business entity
	Section CRC			4 Bytes

*: For 128-bit encryption key length

(2) Fixed part in ECM

1) Protocol number

Protocol number for processing common information

2) Business entity identification

It is a code that identifies the business entity for the conditional access system operation and it specifies individual information to be referred to together with the work key identification.

3) Work key identification

It specifies the work key used to decrypt the common information.

4) Scrambling key (Odd/Even)

It sends the current and next two scrambling key pairs.

5) Decision Type

It indicates the type of viewing decision, such as free, tier, PPV, etc.

6) Date and Time

They indicate the current day, month, hour, and minute used for the viewing decision, using the MJD in ARIB STD-B10, Part 2, Appendix C.

7) Recording control

It indicates the recording conditions for this program (recordable, not recordable, or recordable only by the purchaser).

2.4.2.4 EMM
2.4.2.4.1 EMM overview

(1) The basic configuration of EMM is described below.

●The EMM section is capable of intra-section multiplex transmission that transmits multiple EMM payloads.

●The entire EMM section is subject to CRC.

(2) The basic configuration of the EMM main payload is as follows.

●The EMM main payload consists of a fixed part that is always fixedly transmitted and an EMM business-entity individual setting part that differs in content depending on the purpose.

●Required EMM functional information can be placed in the EMM business-entity individual setting part.

(3) A configuration example of the EMM section is shown in Figure 2-5. (This shows the case where there are three EMM payloads in one EMM section.)
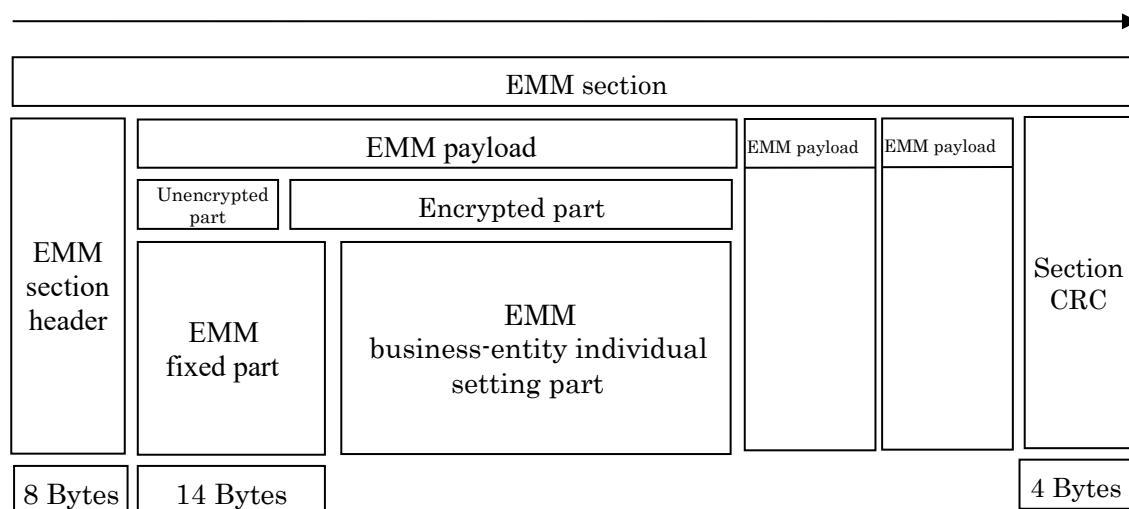

Figure 2-5 An Example of EMM Section Configuration

2.4.2.4.2 EMM details

(1) EMM section structure

The EMM section has the structure shown in Table 2-2.

Table 2-2 EMM Section Structure

Structure				Data length
EMM section	EMM payload 1	EMM section header (Table identifier 0x84)		8 Bytes
		EMM fixed part	Access control section ID	6 Bytes
			Associated information byte length	2 Bytes
			Protocol number	1 Byte
			Business entity identifier	1 Byte
			Update number	2 Bytes
			Expiration date	2 Bytes
		EMM business-entity individual setting part	Various functional information can be placed.	Determined by business entity
	EMM Payload 2	(Same as above)		
	EMM Payload 3	(Same as above)		
	⋮	⋮		
	EMM Payload n	(Same as above)		
	Section CRC			4 Bytes

(2) Fixed part in EMM

1) Access control section ID

A number that identifies the target access control section

2) Associated information byte length

The total byte length from the protocol number of the EMM fixed part to the expiration date and the EMM business-entity individual setting section. When transmitting multiple EMM payloads in one section, an offset value pointing to the access control section ID of the next EMM payload.

3) Protocol number

A code that indicates the identification of the internal processing function of the access control section, the encryption algorithm, etc.

4) Business entity identification

A code that identifies the business entity operating the conditional access system

5) Update number

A number that increases when individual information is updated.

6) Expiration date

Expiration date of individual information

(3) Example of EMM business-entity individual setting section

In the EMM business-entity individual setting section, only necessary function information is placed according to the purpose of transmission of the EMM.

Functional information is expressed in descriptor format. An example of functional information is shown below.

1) Functional information related to work key

Transmit work key identification and work key.

2) Functional information related to tier

Set the contract registration code information.

2.4.2.5 Message information (EMM/ECM)

Message information is not defined in Part 4 of this standard.

2.4.3 Transmission method of associated information

2.4.3.1 ECM (program information, control information)

Using MPEG-2 system section format, it shall be transmitted by ECM (Entitlement Control Message).

It is sent every 100 ms at the shortest to improve the response speed of channel selection in the receiver. Since the bandwidth of multimedia broadcasting services is narrower than that of other media, the ECM transmission interval is determined separately by provider (or broadcaster). However, it is desirable to operate the ECM transmission interval at roughly equal intervals.

2.4.3.2 EMM (individual information)

It is transmitted by EMM (Entitlement Management Message), using the section format of the MPEG-2 system.

Multiple methods;

The format shall have multiple EMMs in one section.

It is possible to set up a transmission method that concentrates a service ID transmitting EMM on a specific service ID from the viewpoint of transmission efficiency.

Chapter 3 Access Control System for Download-Type Broadcasting Content

3.1 General matters

The standard in this chapter applies to conditional playback of download-type broadcasting content.

3.2 Functional specification

3.2.1 Specifications of encryption and associated information

3.2.1.1 Overall functions

This conditional playback system shall have the following overall functions. In addition, for the scale of the contract, system lifetime, and measures to ensure security, refer to Sec. 2.2.1.1.

(1) Ensuring and handling security

For ensuring and handling security, the following overall functions shall be provided in addition to Sec. 2.2.1.1. As a security-related control unit, it shall be possible to control by the unit of program (content) that are downloaded, stored, and then played back or used (hereafter referred to as use).

(2) The access control system in this chapter shall have the following overall functions.

1) The contract information shall be able to be operated independently from the information to control content and billing, and shall be possible to be controlled in order that only the subscriber can use the service.

2) A billing unit shall be able to consist of multiple files, and each file shall be used individually.

3) For the time of use, it shall be able to control the output to the functional part that can be used other than the receiving function or the terminal.

3.2.1.2 Form of download-type broadcasting services

3.2.1.2.1 Supported digital broadcasting services

It shall be applicable to the following service forms.

(1) Broadcasting services such as video and audio programs transmitted in the transmission frequency band (programming service ID): For example,

1) Standard television broadcasting (MP@ML, etc.)

2) High-definition television broadcasting (MP@HL, etc.)

3) Data broadcasting

(2) A service in which download-type broadcasting data (download-type content) signals transmitted in the transmission frequency band (programming service ID) are downloaded and then played back for viewing: For example,

1) Data broadcasting

In data broadcasting, two types of billing are distinguished: billing for streams (service IDs) and billing for files (content). This chapter focuses on download-type broadcasting services that are viewed after downloading.

(3) Service to use (view) after downloading signals of download-type broadcasting data (download-type content) services in Integrated Services Digital Broadcasting (ISDB) in which integrates and flexibly programs diverse information such as video, audio, and data, etc.

(4) Viewing format

    1) Conditional playback and use

       After downloading, the data is stored without being decrypted, and decrypting is performed at the time of use.

3.2.1.2.2 Diversification of receiving devices

The applicability to embedding receiver functions to many mobile devices and mobile terminals, including receivers with mobile phone functions shall be considered.

3.2.1.3 Fee setting systems

The following fee setting systems shall be applicable.

3.2.1.3.1 With encryption

The following fee systems shall be applicable.

(1) Pay-Per-Use (PPU)

    Content-based pay-per-use according to the form of use.

    1) Purchase of pay-per-use

      The following operations shall be available for the purchase of pay-per-use.

      (i) Formation of contract; to be concluded at the time of replying to confirmation of purchase intent

    2) Setting of fees

      Multiple fees shall be set according to the following;

      (i) Fees can be set according to the duration of content usage.

      (ii) Fees can be set according to the form of content usage.

        1) Use only

        2) Output to external media only

        3) A combination of both 1) and 2)

(2) Free of charge

    Independently of the transfer of viewing fees, it shall be possible to determine "viewing availability", including operation.

3.2.1.3.2 Without encryption

  (1) Free of charge

    Unencrypted free services are not defined in Part 4 of this standard.

3.2.1.3.3 Billing system for data broadcasting

  (1) Billing target

    The billing system for data broadcasting is not defined in Part 4 of this standard. (Download- type data service)

  (2) Billing format

    The same as for video, audio, etc.

3.2.1.4 Fee collection systems

  Either of the following fee collection systems shall be applicable.

  (1) Collection at the time of contract

  (2) Actual payment collection (postpaid); compatible with IPPU

  (3) Lump-sum payment collection (advance payment); supports IPPU using prepaid cards, etc.

    (Note) Part 4 of this standard does not define the prepaid card interface.

3.2.1.5 Contract form

  The following contract form shall be feasible.

3.2.1.5.1 Unit of contract

  It shall be a provider (or broadcaster) or business entity unit. Contracts for each content unit are allowed.

3.2.1.5.2 Combination of fee setting systems

  It is possible to select a single rate setting system or contract with a combination of multiple systems. Examples of fee setting systems and their combinations are shown below, but the names are not defined.

    (1) Monthly billing contract within business entity

    (2) PPU billing contract within business entity

    (3) Integrated contract of monthly billing and PPU within business entity

      When multiple providers (or broadcasters) jointly operate as one business entity in joint operation, it is possible to make a contract between viewers and providers (or broadcasters) at the operational level.

        In case of monthly contract, package contract is also possible.

3.2.1.6 Collection of viewing information

The collection of viewing information is not defined in Part 4 of this standard.

3.2.1.7 Program operation management system

Encryption shall be able to be executed according to the program schedule. Program operation management is performed within each business entity (program transmission system).

3.2.1.8 Security functions

（1）Encryption of associated information

1）System

The encryption system shall be selected by business entity, but it is desirable to use an encryption system with an encryption strength equivalent or greater than that used for the scrambling system defined in Notification No. 235.

2）Management function

The encryption system shall be able to cope with piracy by changing the encryption protocol, etc.

3.3 Encryption system

3.3.1 Target of encryption

・It shall be the entire file.

3.3.2 Unit of encryption

・It shall be the file unit.

3.3.3 Encryption Algorithm

The encryption system shall be selected by business entity. It is desirable to use an encryption system with an encryption strength equal to or greater than that of the scrambling method defined in Notification No. 235. From the viewpoint of the configuration of receiver functions, it is desirable that provider (or broadcaster) or business entity should use either encryption system for operation, and that it should be selected in common with the scrambling system for real-time type broadcasting.

3.3.4 Encryption identification

Since the encryption identification is to be specified for each business entity, it is not defined in Part 4 of this standard.

3.4 Associated information subsystem

3.4.1 Type of associated information

・The associated information which is used for download-type broadcasting services is the license.

3.4.2 License

3.4.2.1 Overview of license

・The license shall be transmitted by communication separately from the download-type broadcasting content.

・The license shall include usage conditions defined for each content for judging usage by viewers, and information describing content keys for canceling encryption according to the usage conditions and others.

・The mapping of encoded download-type broadcasting content files to licenses shall be performed using CRIDs defined in the ARIB STD-B38.

3.4.2.2 License structure

The elements which are required for the structure of the license are shown below.

Table 3-1 License Structure

Element	Remarks
License identification information	Information identifying the license
Version information	Indicates license version
Content key	Content key for target CRID
Terms of use	Terms of use of content

In operation, other necessary information can be added.

Chapter 4 Technical Specifications Related to the Receiver

4.1 Overview of the receiver

(1) It shall be possible to incorporate access control functions into digital broadcasting receivers. The physical shape of the access control unit does not matter.

(2) The access control system shall enable a common method among providers (or broadcasters). On the other hand, specifications shall not hinder expandability for new providers (or broadcasters) (with access control system).

(3) The receiver shall have functions for effective use of radio waves.

4.2 User interface

4.2.1 Activation of receiver function

The activation of the receiver function is defined separately in the operational guideline for providers (or broadcasters).

4.2.2 Program viewing

The program viewing is defined separately in the operational guideline for providers (or broadcasters).

4.2.2.1 Free viewing process

The free viewing process is defined separately in the operational guideline for providers (or broadcasters).

4.2.2.2 Contract viewing process

The contracted viewing process is defined separately in the operational guideline for providers (or broadcasters).

4.2.2.3 PPV Viewing Process

The concrete contracted viewing process is defined separately in the operational guideline for providers (or broadcasters).

4.2.3 Program reservation

The program reservation is defined separately in the operational guideline for providers (or broadcasters).

4.2.3.1 Free viewing reservation processing

The free viewing reservation processing is defined separately in the operational guideline for

providers (or broadcasters).

4.2.3.2 Contract viewing reservation processing

The contract viewing reservation processing is defined separately in the operational guideline for providers (or broadcasters).

4.2.4 Error notification screen

4.2.4.1 Password mismatch notification screen

The password mismatch notification screen is not defined in Part 4 of this standard.

4.2.4.2 Contract viewing unavailable notification screen

The contract viewing unavailable notification screen is not defined in Part 4 of this standard.

4.2.4.3 PPV viewing unavailable notification screen

The PPV viewing unavailable notification screen is not defined in Part 4 of this standard.

4.2.4.4 Purchase unavailable notification screen outside the purchase period

The purchase unavailable notification screen outside the purchase period is not defined in Part 4 of this standard.

4.2.4.5 Purchase unavailable notification screen for full storage area in access control unit

The purchase unavailable notification screen for full storage area in access control unit is not defined in Part 4 of this standard.

4.2.4.6 Communication failure notification (retry over notification) screen

The communication failure notification (retry over notification) screen is not defined in Part 4 of this standard.

4.2.5 Automatic display message

The automatic display message is not specified in Part 4 of this standard.

4.2.6 Main menu for functions related to access control unit

The main menu for functions related to access control unit is not specified in Part 4 of this standard.

4.2.7 PPV purchase record display

The PPV purchase record display is not specified in Part 4 of this standard.

4.2.8 Access control unit information display

The Access control unit information display is not specified in Part 4 of this standard.

4.3 EMM receiving function (improving efficiency of reception)

As well as efficiently accessing the number of customers expected for digital pay broadcasting and making effective use of radio waves, the receiver functions are defined together with the EMM multiplexing system in consideration of environmental issues. Concrete operation is defined separately in the operational guideline for providers (or broadcasters).

4.3.1 EMM filtering

The EMM filters multiple EMM data which are multiplexed within one section.

The EMM data has one access control unit ID, and the receiver filters only the EMM data addressed to itself. When the access control unit has an individual ID and a group ID, the EMM data is filtered for all of them.

4.4 Communication function

The system shall have the functions necessary for license issuance. Considering the security of communication, it is desirable to use an encrypted communication channel such as TSL.

Specific protocols are not defined in Part 4 of this standard.

4.5 Judgement of scrambled or not scrambled

The receiver judges whether the stream is scrambled or not, referring to the scrambling control header and the adaptation field control in the TS packet for each stream. Details are shown in Table 4-1.

Table 4-1 Details of Scrambled/Unscrambled Judgment

Transport Scrambling Control	Adaptation field control	Description
00	01 or 11	Unscrambled
01		Reserved
10		Scrambled (even key)
11		Scrambled (odd key)
XX	00 or 10	Reserved

CONDITIONAL ACCESS SYSTEM SPECIFICATIONS
FOR DIGITAL BROADCASTING

ARIB STANDARD

ARIB TR-B25   VERSION 6.7-E1
(January 21st, 2019)

This Document is based on the ARIB standard of "Conditional
Access System Specifications for Digital Broadcasting" in
Japanese edition and translated into English in April 2024.

Published by

Association of Radio Industries and Businesses

Nittochi Bldg. 11F
1-4-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-0013, Japan

TEL 81-3-5510-8590
FAX 81-3-3592-1103