



ENGLISH TRANSLATION

**CONDITIONAL ACCESS SYSTEM SPECIFICATIONS
FOR DIGITAL BROADCASTING**

ARIB STANDARD

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Association of Radio Industries and Businesses

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Foreword

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

“ARIB Standards” are private sector standards that combine governmental technical standards established for the purposes of effectively using frequencies and avoiding interference with other users, and voluntary private sector standards established for the purpose of ensuring the quality and interoperability of broadcast equipment and radio equipment to improve the convenience of broadcast equipment manufacturers, broadcasting companies, radio equipment manufacturers, telecommunications carriers, and users.

This Standard on “Conditional Access System Specifications for Digital Broadcasting,” was established with the approval of ARIB’s standardization committee that consisted of a wide range of randomly selected stakeholders, including Japanese and non-Japanese broadcast equipment manufacturers, broadcasting companies, radio equipment manufacturers, telecommunications carriers, and users, for ensuring impartiality and transparency during the Standard’s preparation stage.

We hope that this Standard would be actively used by broadcast equipment manufacturers, broadcasting companies, radio equipment manufacturers, telecommunications carriers, and users.

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Annexed table

(Selection of option 2)

Patent applicant	Title of the invention	Application/Patent No.	Remarks
Nippon Hosokai (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
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.	Enciphering Method (*2)	JP Application S63-103919	Japan
	Enciphering Method and Decoding Device (*2)	JP Application H9-329841	Japan
	Encoding and Decoding Device (*2)	JP Application H 9-329842	Japan
Toshiba Corp.	Satellite Broadcast Reception System (*3)	P 2941398	Japan
	Broadcast Receiver and Contract Management System (*5)	JP Kokai H11-243536	Japan, USA
Nippon Hosokai (NHK)	Contents Transmitting Device, Contents Receiving Device, Contents Transmitting program 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).		

(*1) Applicable from Version 1.0 (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 1.0 (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

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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 digital standard television broadcasts, high-definition television broadcasts, VHF broadcasts, and data broadcasts by broadcast satellites 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 broadcast satellites 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 television stations (“terrestrial digital television broadcasts”); digital VHF broadcasts by television stations (“digital terrestrial audio broadcasts”); and VHF broadcasts by broadcasting satellites and television stations using frequencies greater than 2,630 MHz but less than 2,655 MHz (“digital satellite audio broadcasts”).

Although this standard generally assumes the use of a receiver with a low-speed CA interface, the system defined in Part 1 Chapter 6 applies to digital satellite audio broadcasts.

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 and digital satellite 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 Cited Documents

1.3.1 Pursuant Documents

- (1) Ministry of Internal Affairs and Communications Directive No. 26, 2003
- (2) Ministry of Internal Affairs and Communications Notification No. 36, 2003
- (3) Ministry of Internal Affairs and Communications Notification No. 37, 2003
- (4) Ministry of Internal Affairs and Communications Notification No. 40, 2003

1.3.2 Related Documents

- (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) ARIB STD-B41 “Transmission System for Digital Satellite Sound Broadcasting” Standard
- (16) ARIB STD-B42 “Receiver for Digital Satellite Sound Broadcasting” Standard
- (17) ISO 7816-1: 1987
ISO 7816-2: 1988
ISO 7816-3: 1997
ISO 7816-4: 1995

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
ECM-S	Entitlement Control Message for S-band
EMM	Entitlement Management Message
EMM-S	Entitlement Management Message for S-band
IPPV	Impulse Pay Per View
PID	Packet Identifier
PPL	Pay Per Listening
PSI	Program Specific Information
SI	Service Information
TS	Transport Stream

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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.

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 programming broadcast in the transmission frequency band (channels); for example:

- a. Standard television broadcasts (MP@MP, 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 channel
- ii. 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 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.

2.1.8 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 leaves room for the interval and transmission capacity to be balanced in light of service content.

2.1.9 Programming schedule management System

Scrambling and ECM delivery can be performed according to the programming schedule. Programming schedule 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 tree layer encryption with DES-equivalent and private keys. From the perspective of implementation on an IC card, the encryption system should feature a compact program size and be conducive to high-speed processing on an 8-bit microcontroller.

(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 IC cards.
- 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.

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, 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) above, 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 shared message 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 shared 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 shared message (IC card storage message) is received by a receiver with stored reception functionality, that EMM shared message 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 circuits whose operation is required for EMM reception are 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 proceeds 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 programming, scrambled free programming, pay programming requiring a flat/tier contract, pay programming requiring a PPV contract, and pay programming requiring a flat/tier contract or PPV contract by selecting the program from PSI/SI, selecting the corresponding transport stream, and referencing the scramble flag and ECM using the IC card.
- Unscrambled programming 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 programming 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 programming 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 programming, etc.

2.2.2.25 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.

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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 broadcast programming, for example when broadcasting pay programming (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 broadcast programming).

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) above 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.

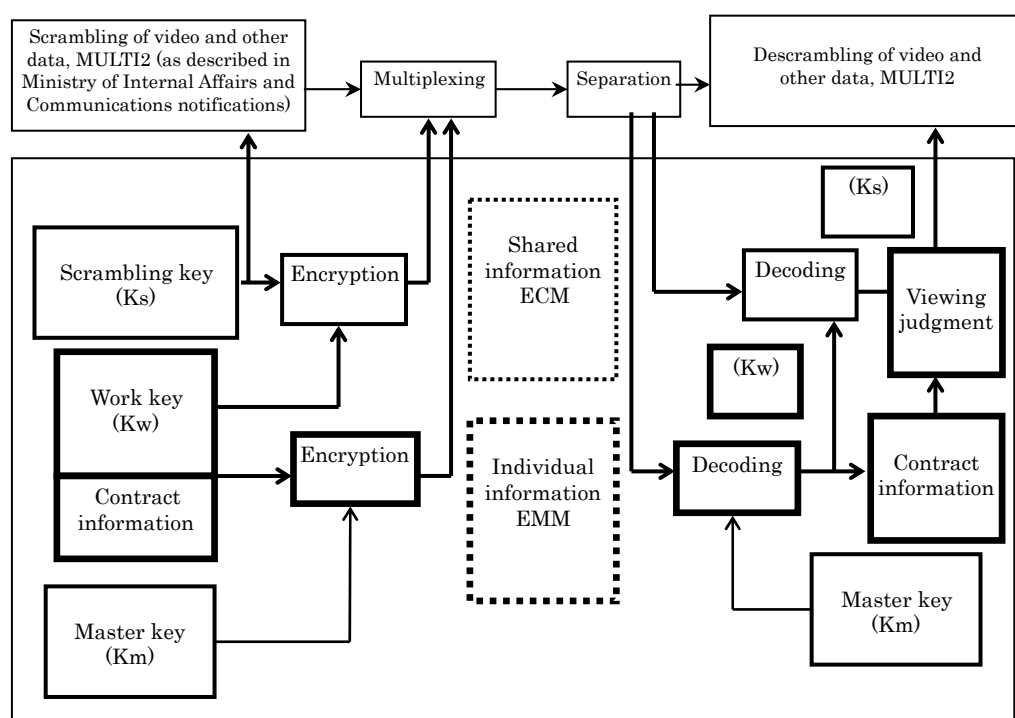
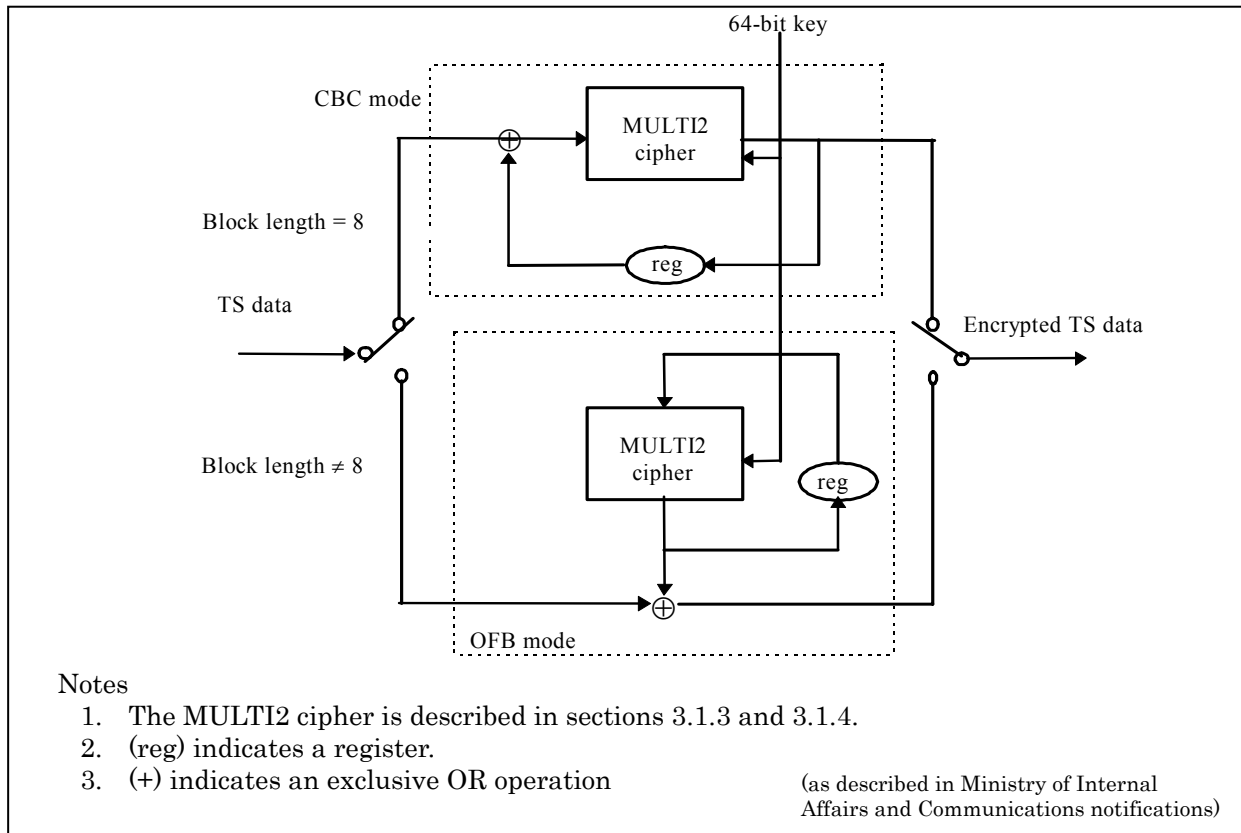
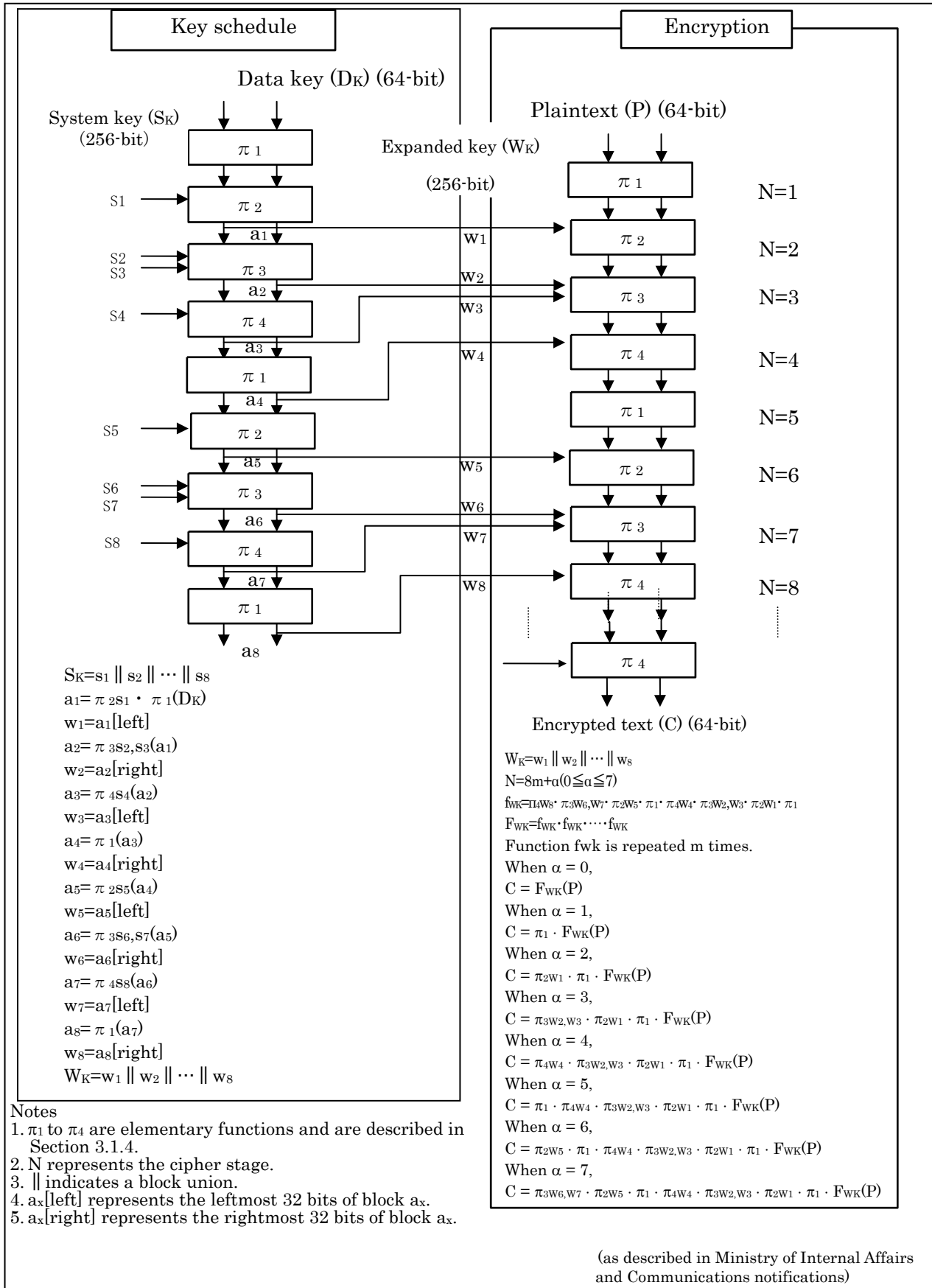


Figure 3-1 Conditional Access System

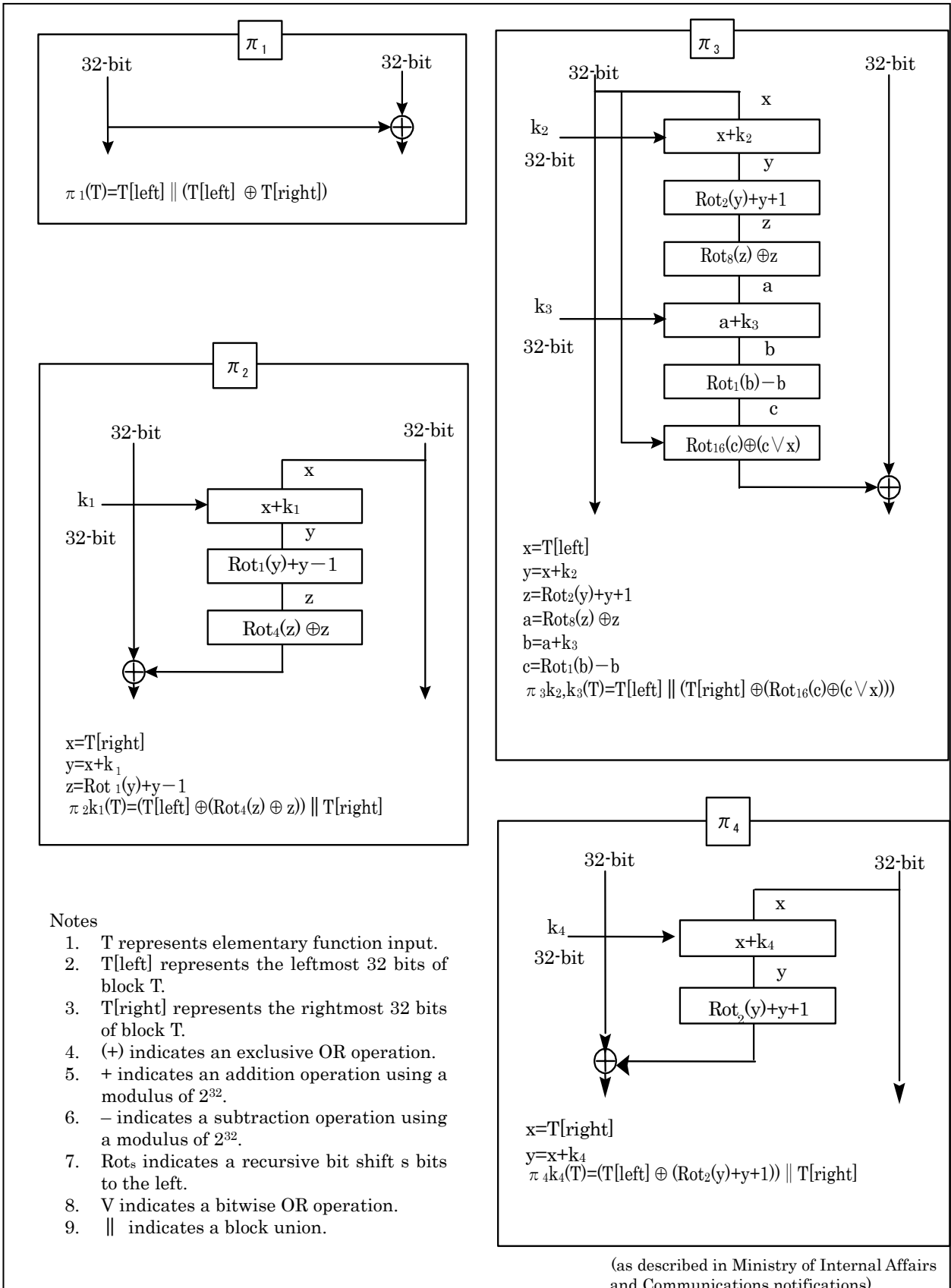
3.1.2 Scrambling Procedure



3.1.3 MULTI2 Cipher



3.1.4 Elementary Encryption Function



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, 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 shared messages, and EMM individual messages.

Figure 3-2 provides an example flowchart depicting EMM/ECM reception and conditional access.

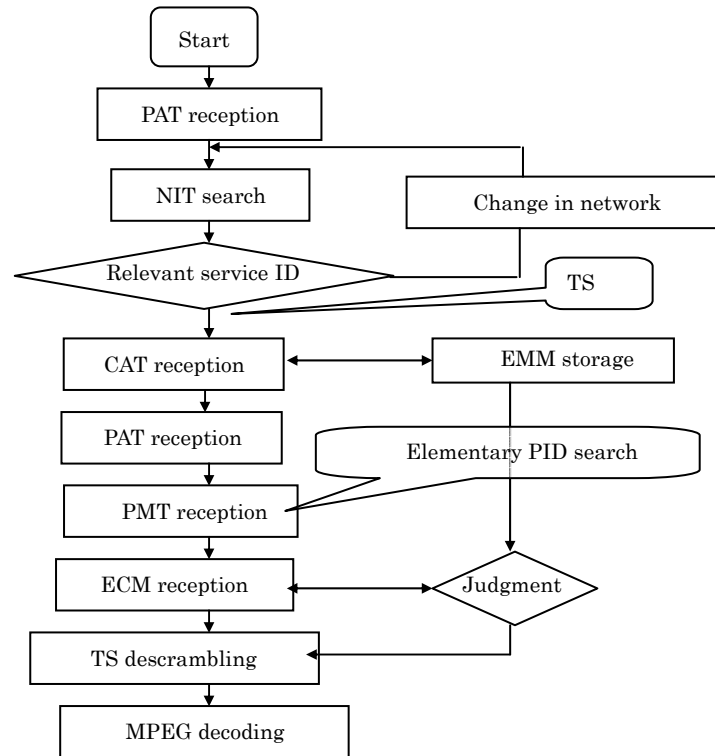


Figure 3-2 Example Flowchart Depicting EMM/ECM Reception and Conditional Access

3.2.2 Format of Associated Information

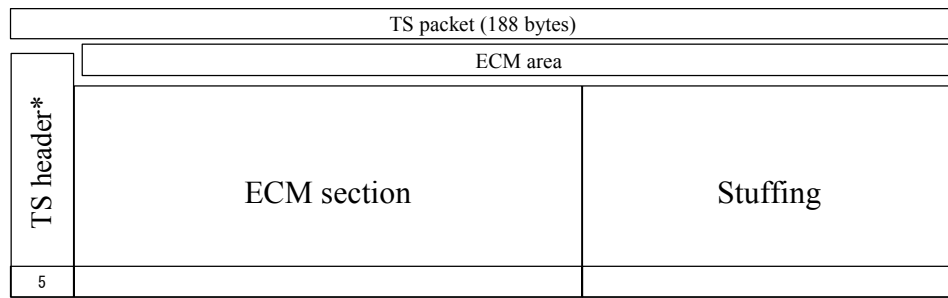
Broadcasters can select an integrated or independent format for individual information.

3.2.3 ECM

3.2.3.1 Basic ECM architecture

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

Figure 3-3 illustrates the basic architecture of the ECM TS packet.



*Includes pointer field.

Figure 3-3 TS Packet architecture

(2) The following describes the ECM section and the basic architecture 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 architecture.

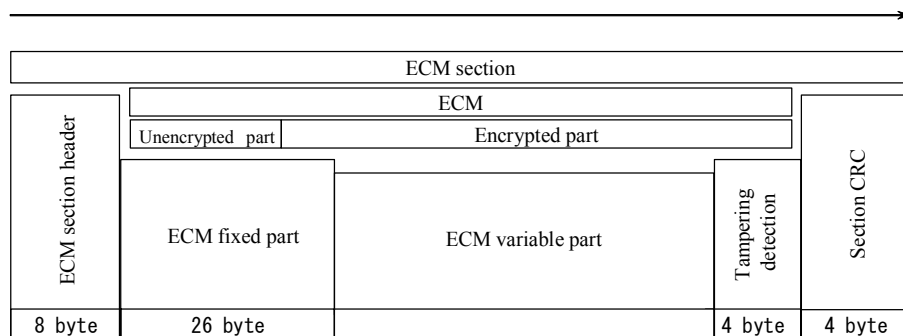


Figure 3-4 ECM Section Architecture

3.2.3.2 ECM Details

(1) ECM section structure

Table 3-1 details the ECM section structure.

Table 3-1 ECM Section Structure

Architecture				Notes
ECM section	ECM section header (Table identifier 0x82)			8 Byte
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster group identifier	1 Byte
			Work key identifier	1 Byte
			Scrambling key (odd)	8 Byte
			Scrambling key (even)	8 Byte
			program type	1 Byte
			Date/time (Date MJD + Time BCD)	5 Byte
			Recording control	1 Byte
		Variable part		Capable of accommodating various function information
	MAC			4 Byte
	Section CRC			4 Byte

(2) ECM fixed part

1) Protocol number

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

2) Broadcaster group identifier

Code used to identify broadcaster groups in conditional access system operation.
Combined with the work key identifier, specifies the work.

3) Work key identifier

Specifies the work key used to encrypt ECM, is combined with the broadcaster group identifier.

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) MAC(message authentication code)

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 shared 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 a 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 architecture:

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

- (2) The following describes the basic architecture 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 architecture. (The figure shows a single EMM section with 3 EMM payloads.)

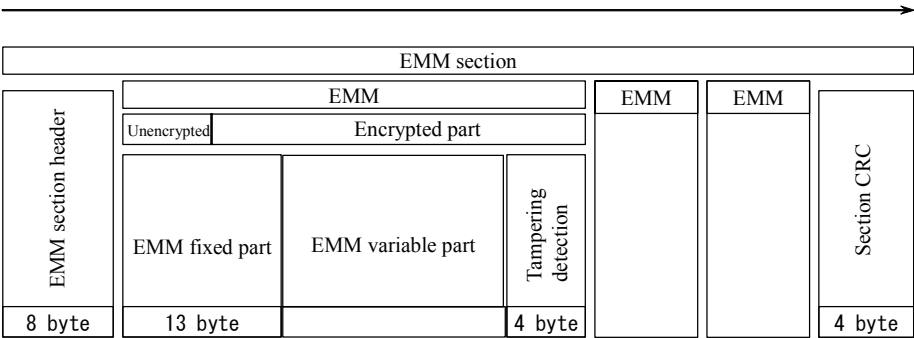


Figure 3-5 EMM Section Architecture

3.2.4.2 EMM Details

(1) EMM section structure

Table 3-2 details the EMM section structure.

Table 3-2 EMM Section Structure

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

(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 MAC 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 group 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

Indicates when individual information expires.

7) MAC

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 Shared Messages

(1) Basic architecture of EMM shared messages

EMM shared messages are transmitted using the MPEG-2 system section format (EMM

message section). The following describes the basic architecture 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 id of a preset message and ranges from 0x0001 to 0xFFFF.
- EMM shared message sections are not encrypted.
- EMM shared messages are sent by broadcaster groups.

Figure 3-6 illustrates the EMM shared message section architecture.

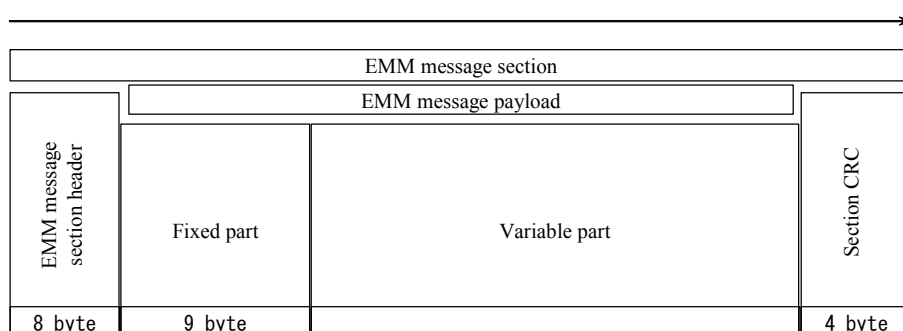


Figure 3-6 EMM Shared Message Section Architecture

(2) EMM shared message section structure

Table 3-3 details the section structure of EMM shared messages

Description			Notes	
EMM message section	EMM message section header		8 Byte	
	EMM message payload	Fixed part	ca_broadcaster_group_ID	1 Byte
			deletion_status	1 Byte
			displaying_duration1	1 Byte
			displaying_duration2	1 Byte
			displaying_duration3	1 Byte
			displaying_cycle	1 Byte
			format_version	1 Byte
			Message length	2 Byte
	Variable part	Message code payload	N Byte	
CRC error detection		4 Byte		

(3) EMM shared message section details

Table 3-4 EMM Shared Message Section Details

Field	Description	No. of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	Message preset text 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 group identifier	8
deletion_status	Automatic message erasure type	8
displaying_duration1	Automatic display duration 1	8
displaying_duration2	Automatic display duration 2	8
displaying_duration3	Automatic display duration 3	8
displaying_cycle	Automatic display count	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 shared message field details

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

- 1) ID of a preset message (table_id_extension)
Indicates the the id of a preset message (0x0001 to 0xFFFF) being sent by the EMM shared message in question.
- 2) ca_broadcaster_group_ID
Code used to identify broadcaster groups in conditional access system operation
- 3) deletion_status

- 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 shared message being automatically displayed is 0x02, the automatic display message is not displayed.
 - ii. When the deletion_status for the EMM shared message 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_duration1 (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 shared message 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) Displaying_duration1 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) Displaying_cycle

- 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.

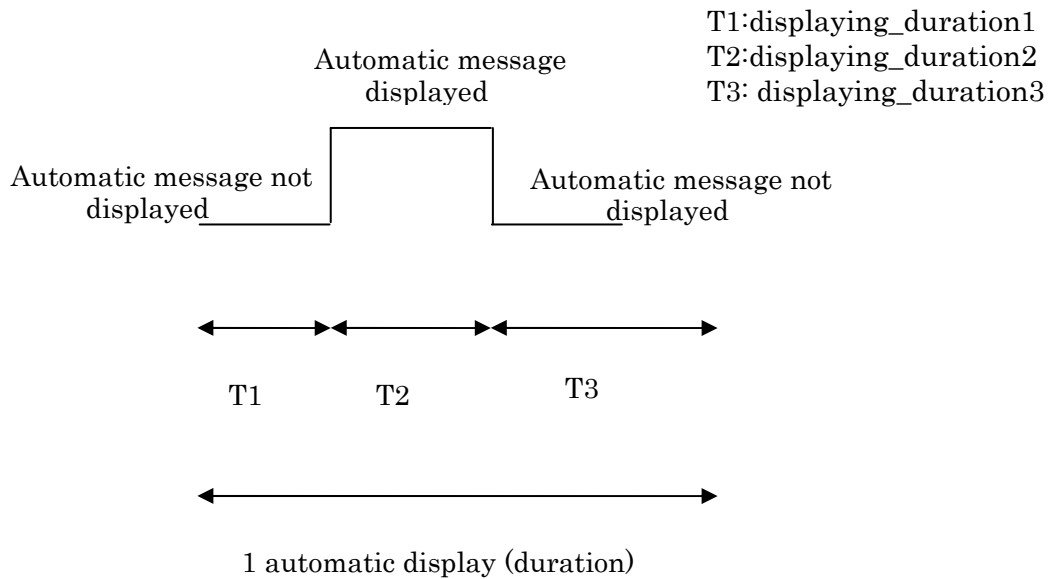


Figure 3-7 Automatic Display Duration and Receiver Automatic Message Display

6) Format version

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 (preset message).

3.2.5.2 EMM Individual Messages

(1) Basic Architecture of EMM Individual Messages

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

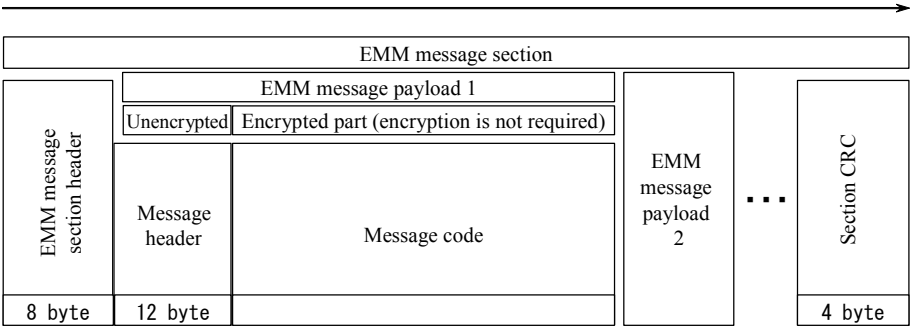


Figure 3-8 EMM Individual Message Section Architecture

(2) EMM individual message section structure

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

Table 3-5 EMM Individual Message Section Structure

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

(3) EMM individual message section details

Table 3-6 EMM Individual Message Section Details

Field	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 group 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 individual message 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 shared 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 group identifier

Code used to identify broadcaster groups in conditional access system operation

6) Message ID

Together the broadcaster group 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

Message code region field	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) ID of a preset message	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) ID of a preset message (0x0000 to 0xFFFF)
Specifies the code of the preset text to display. Meaningful messages stored on IC cards should specify a preset text 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 message preset text 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) ID of a preset message (0x0000 to 0xFFFF)

Specifies the code of the preset message display. A value of 0x0000 signifies “no preset message.”

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 Messages) 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 Messages) are transmitted using the MPEG-2 system section format.

Multiplexing method:

A single section can contain multiple EMMs.

The CAS includes a system for concentrating EMMs 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

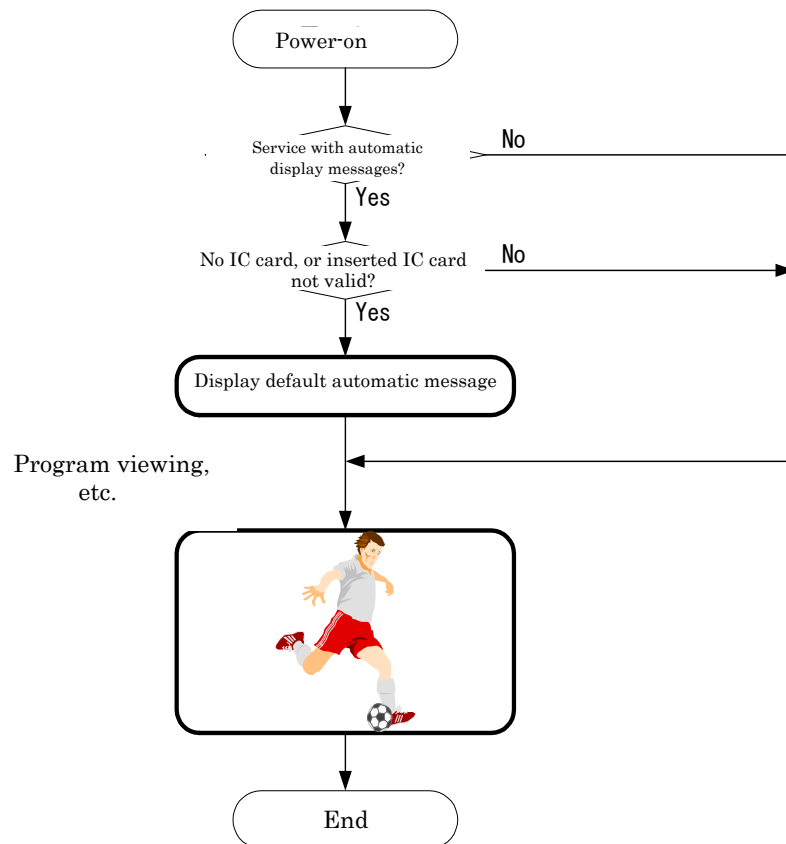


Figure 4-1 Power-on Processing

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 scramble flag, 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 scramble flag 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.

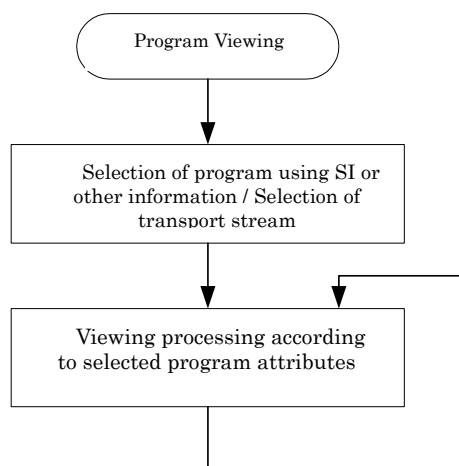


Figure 4-2 Program Viewing Flow

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]

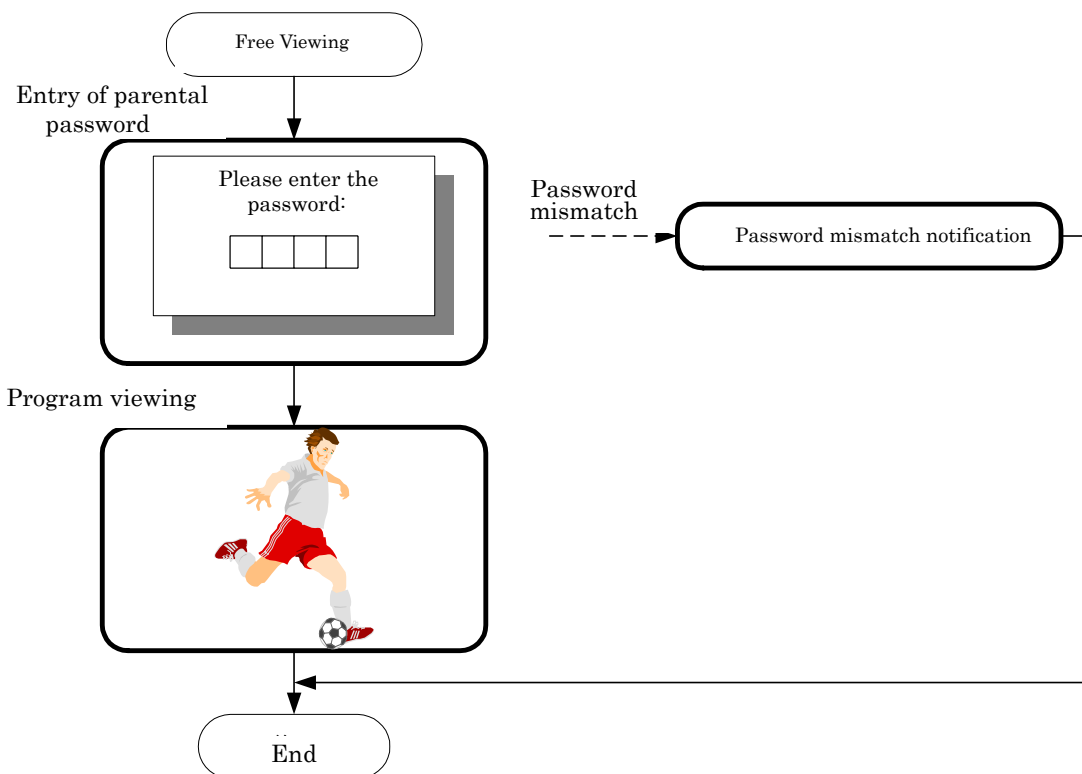


Figure 4-3 Free Viewing Processing Flow

(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]

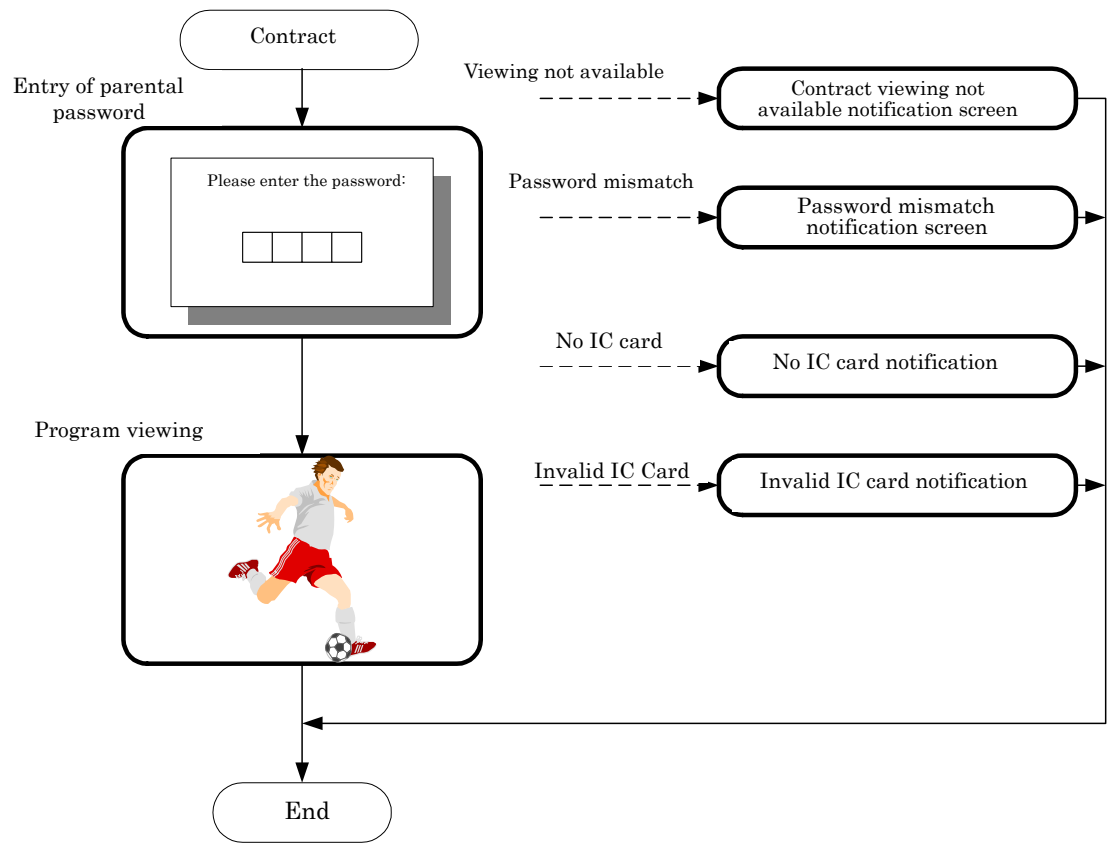


Figure 4-4 Contract Viewing Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1) above.

(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

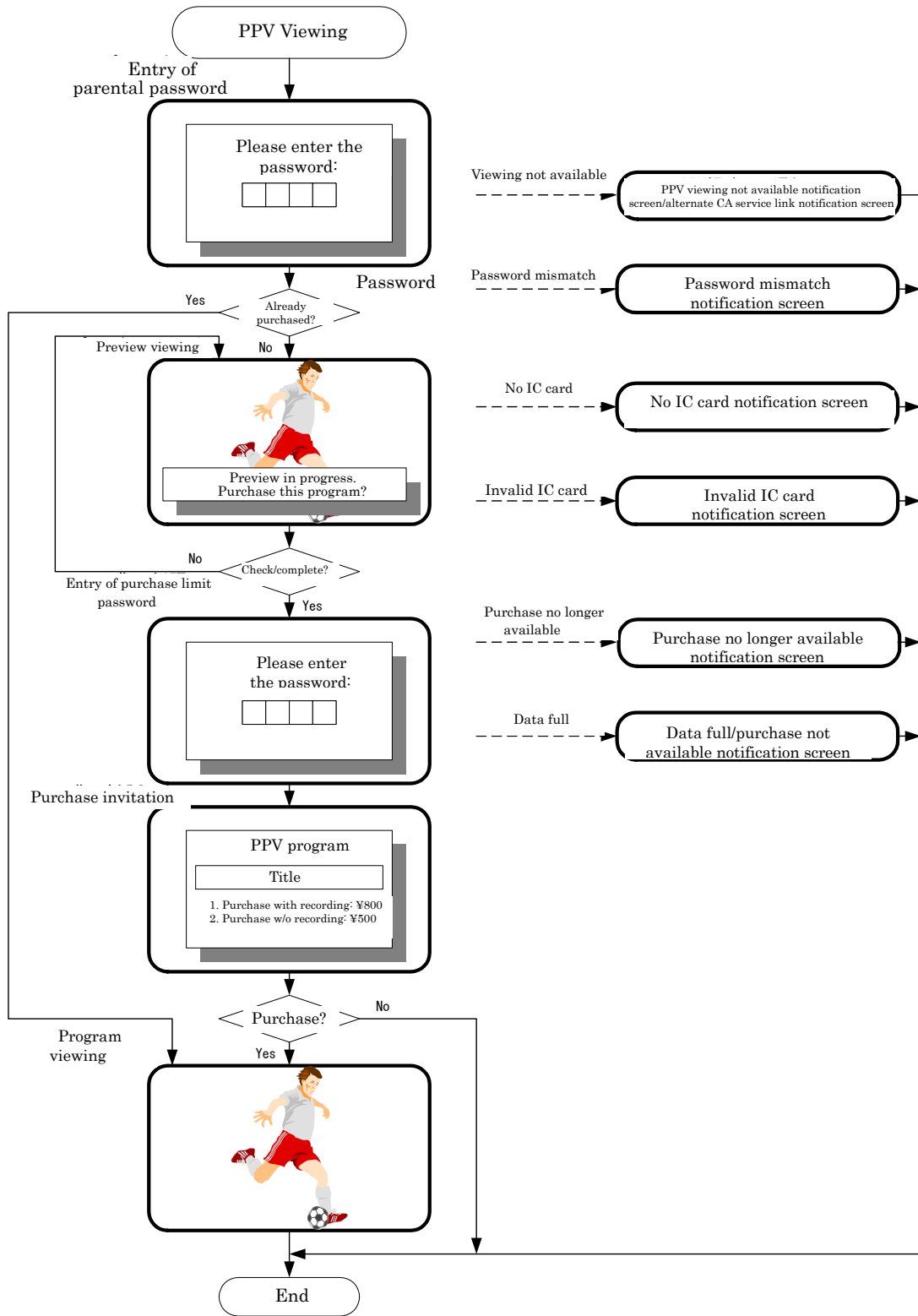


Figure 4-5 PPV Viewing Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1) above.

(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) above.

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

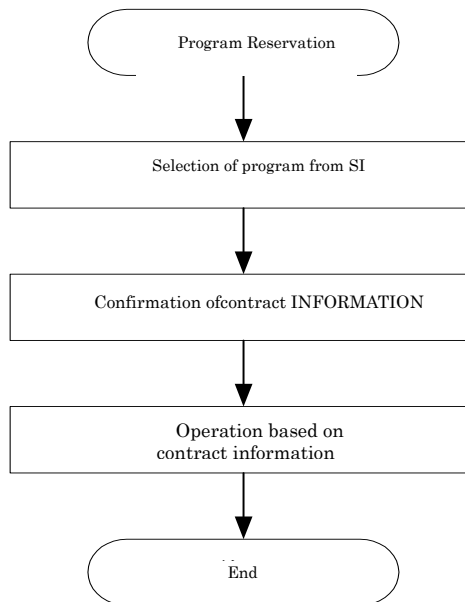


Figure 4-6 Program Reservation Flow

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]

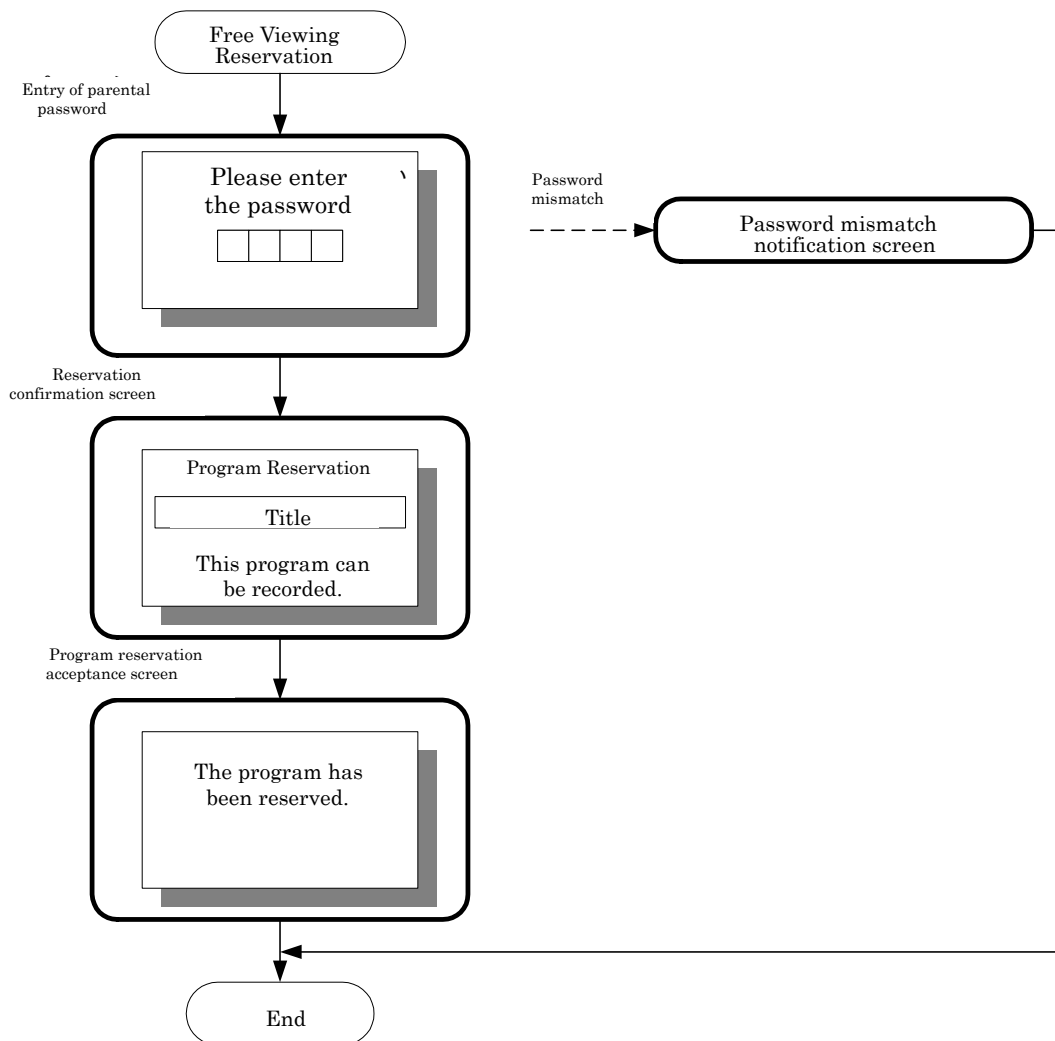


Figure 4-7 Free Viewing Reservation Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1) above.

(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]

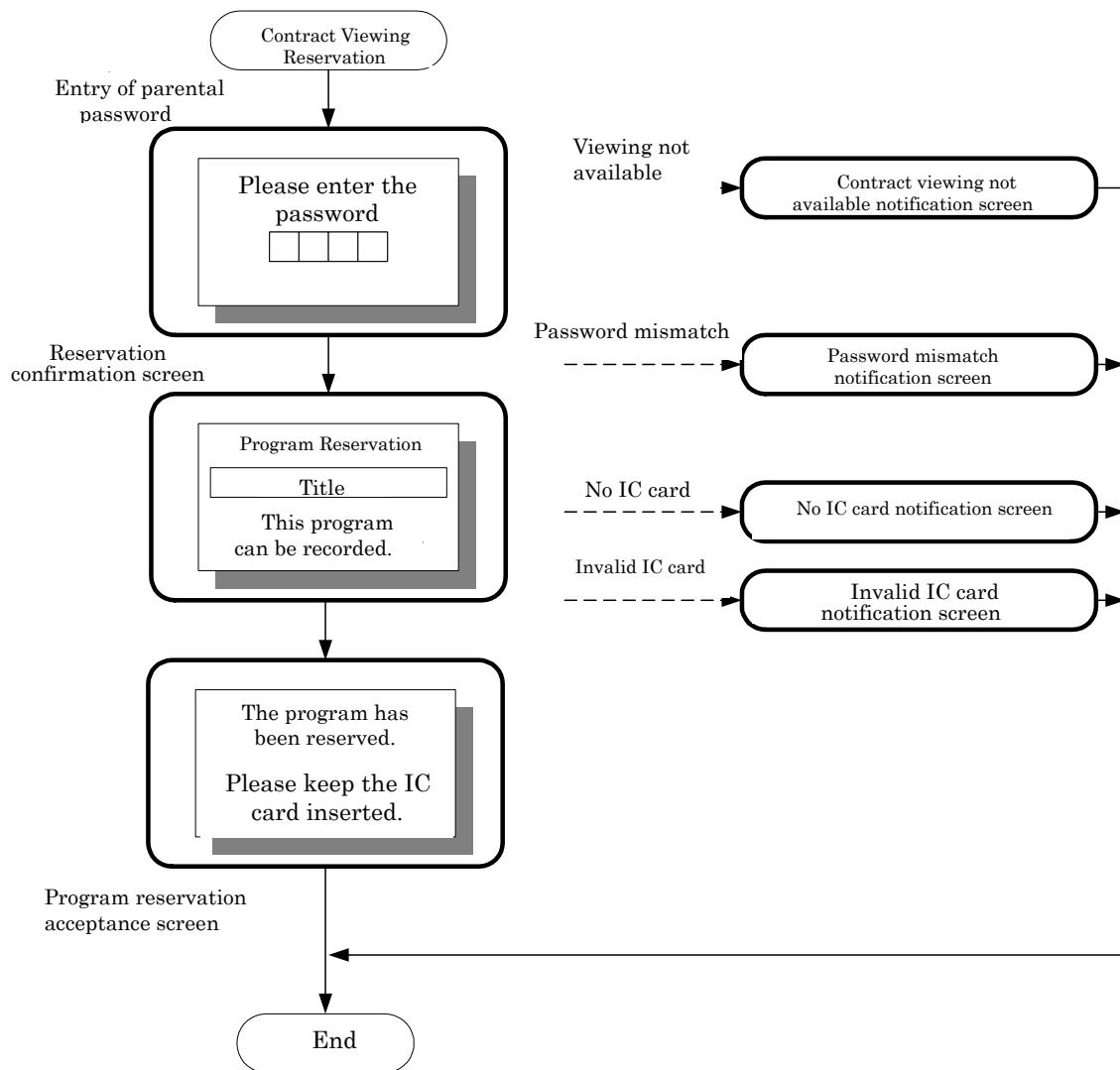


Figure 4-8 Contract Viewing Reservation Processing Flow

- (1) Parental password input screen
 - Same as Section 4.2.3.1 (1) above.
- (2) Program confirmation screen
 - Same as Section 4.2.4.1 (2) above.

(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]

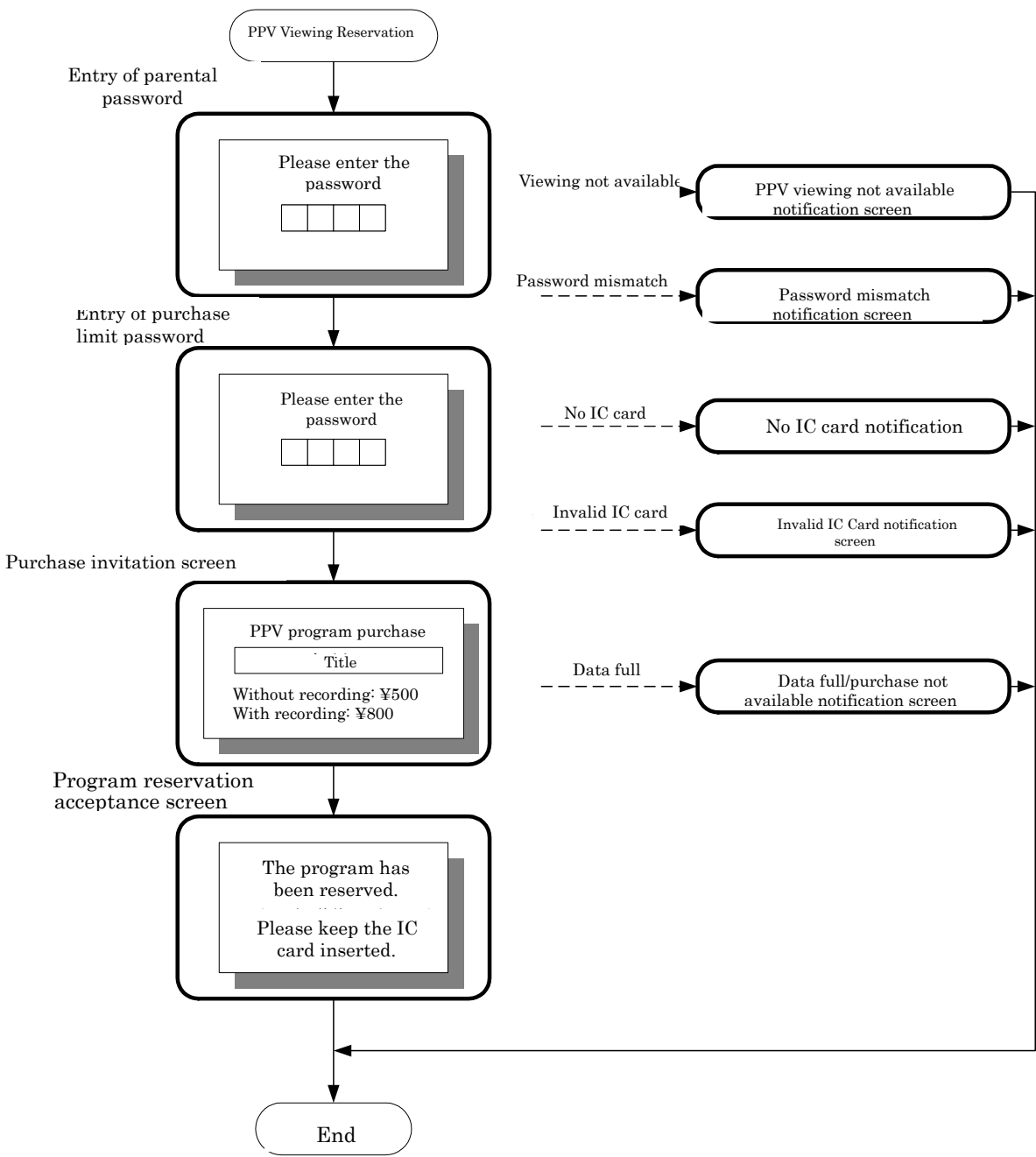


Figure 4-9 PPV Viewing Reservation Processing Flow

(1) Parental password input screen

- Same as Section 4.2.3.1 (1) above.

(2) Purchase limit password input screen

- Same as Section 4.2.3.3 (3) above.

(3) Purchase invitation screen

- Same as Section 4.2.3.3 (4) above.

(4) Program reservation acceptance screen

- Same as Section 4.2.4.2 (3) above.

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:
 - When there is no contract (no Kw)
 - When the expiration date has been passed
 - 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
 - If the response from the IC card is “No Kw”: No contract
 - If the response from the IC card is “Contract expired”: Contract expired
 - 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:
 - When the expiration date has been passed
 - 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 shared 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 shared 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 settings
 - Parental level setting
 - PPV unit fee allowance program setting
 - PPV monthly fee allowance setting
 - Line selection
 - Telephone line settings
 - 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

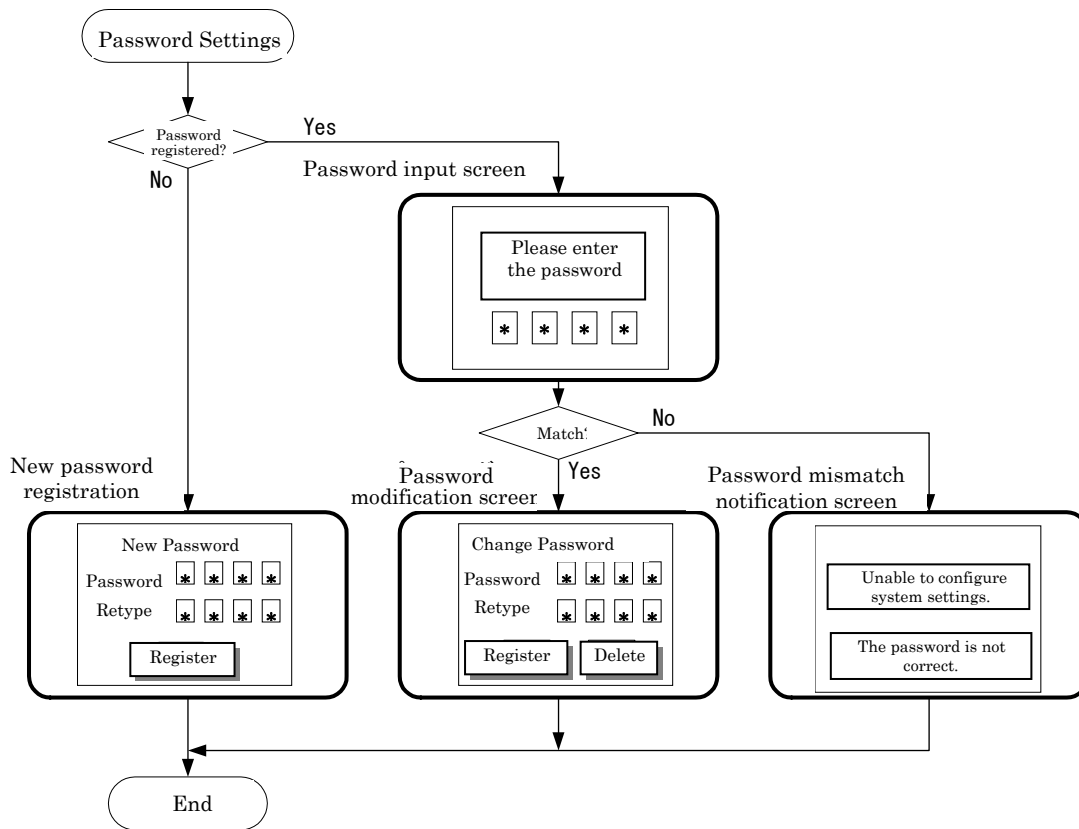


Figure 4-10 Password Setting Flow

(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

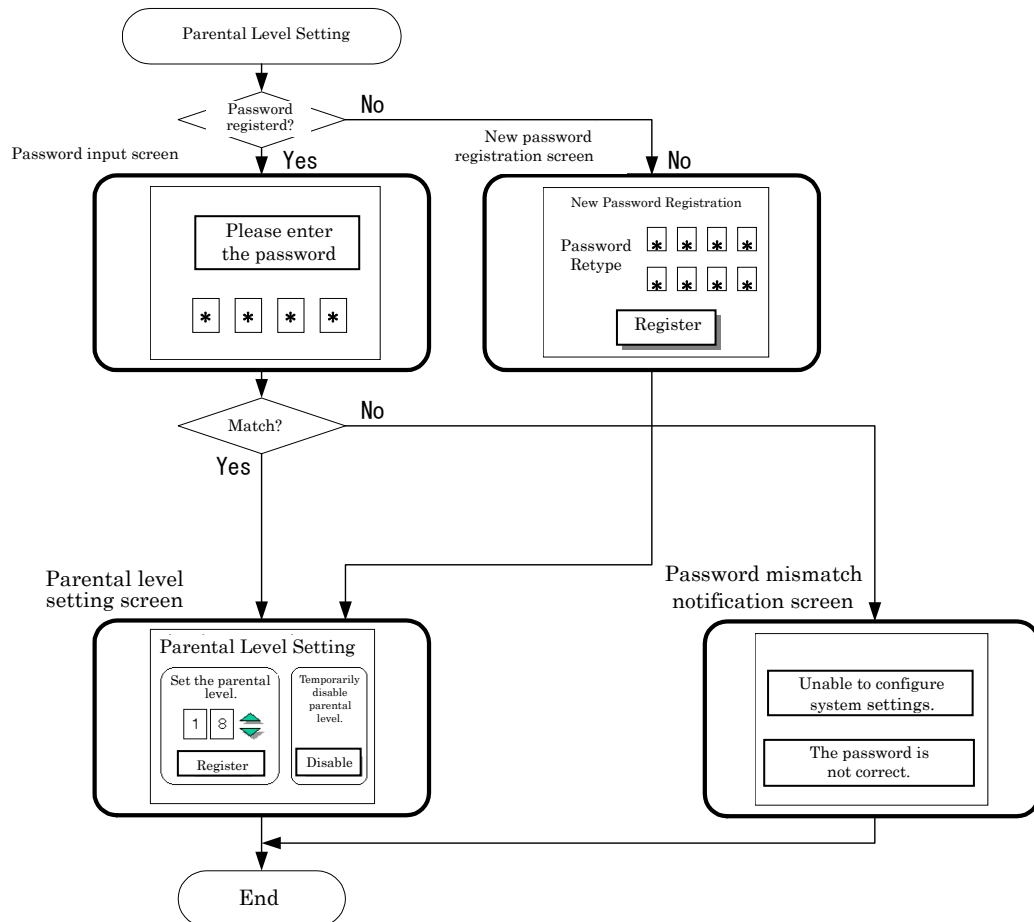


Figure 4-11 Parental Level Setting Flow

(1) Password Input Screen

- Same as Section 4.2.11.1 (2) above.

(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) above.

(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) above.

4.2.11.3 PPV Unit Fee Allowance Setting (Optional)

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

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

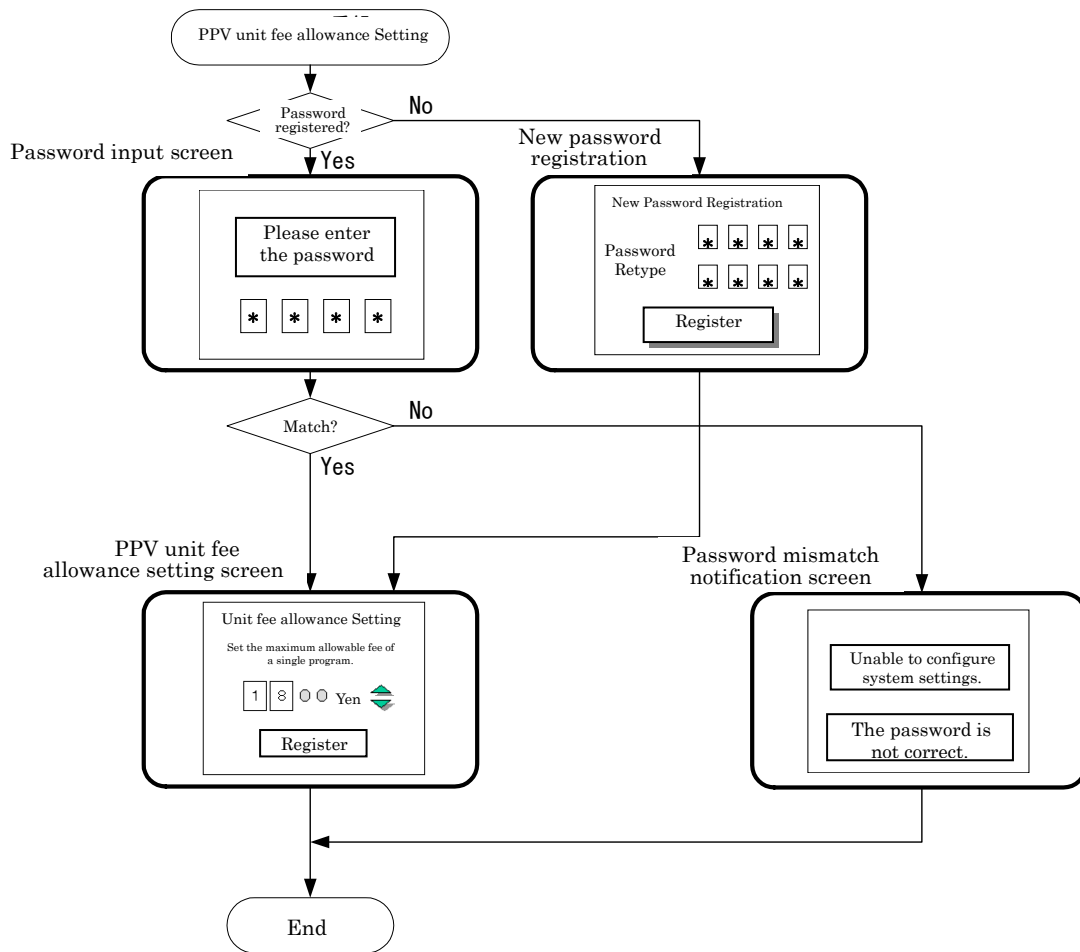


Figure 4-12 PPV Unit Fee Allowance Setting Flow

(1) Password Input Screen

- Same as Section 4.2.11.1 (2) above.

(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) above.

(3) PPV Unit Fee Allowance Setting Screen

Functionality

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

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) above.

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

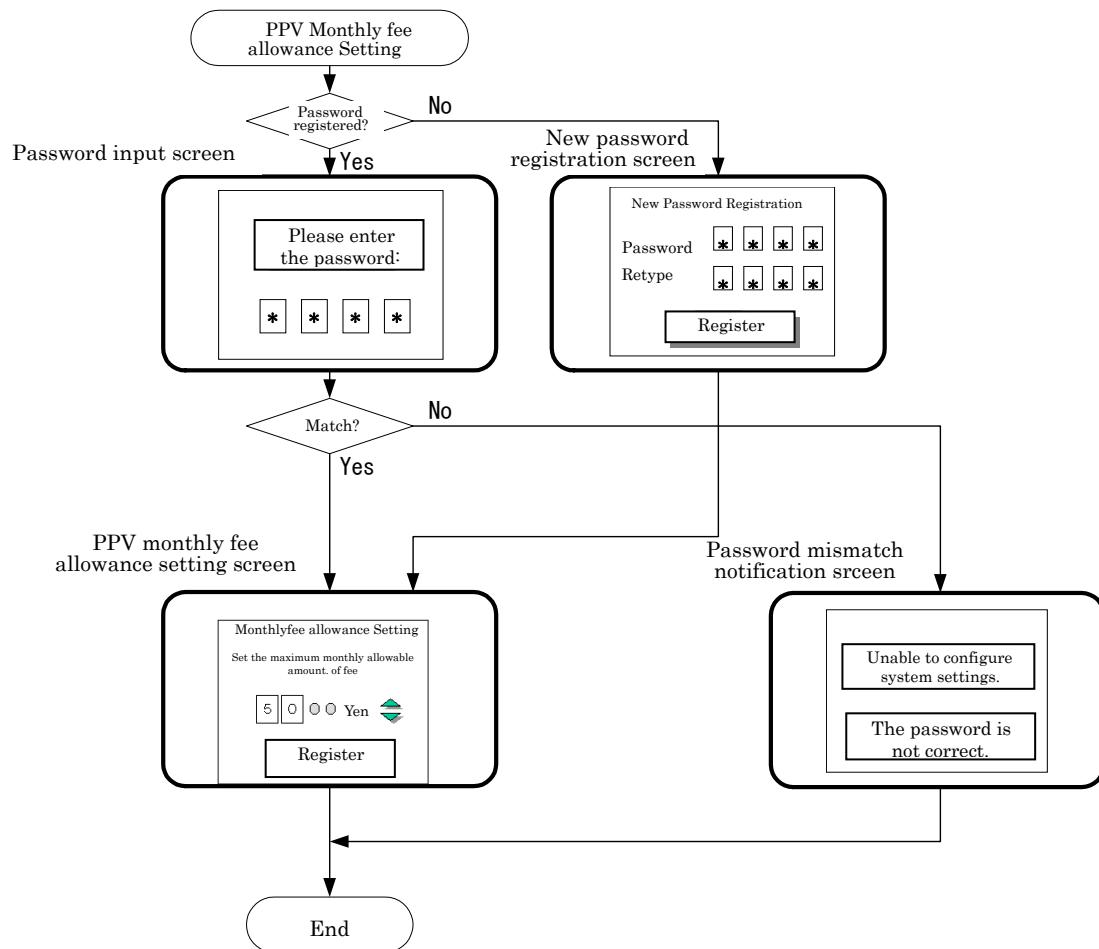


Figure 4-13 PPV Monthly Fee Allowance Setting Flow

(1) Password Input Screen

- Same as Section 4.2.11.1 (2) above.

(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) above.

(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) above.

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:
 - 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
 - Dial settings
Configures dial settings. User can select one of “Touch-tone,” “10 pps (pulse),” or “20 pps (pulse).”
 - 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.
 - On-hook detection
Configures on-hook detection. Select either “Enable” or “Disable.”
 - 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

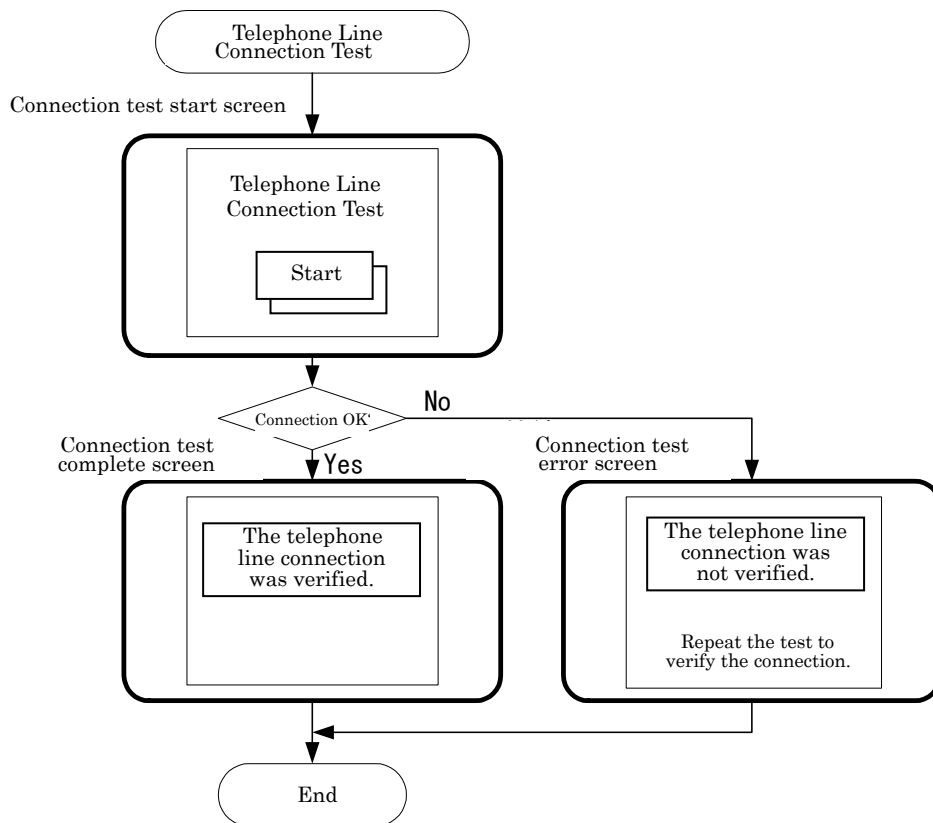


Figure 4-14 Line Connection Test Flow (Telephone Line)

(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 K_s is encrypted based on the confidential information shared between the receiver and the IC card during the authentication process performed in step (3) above.

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 .

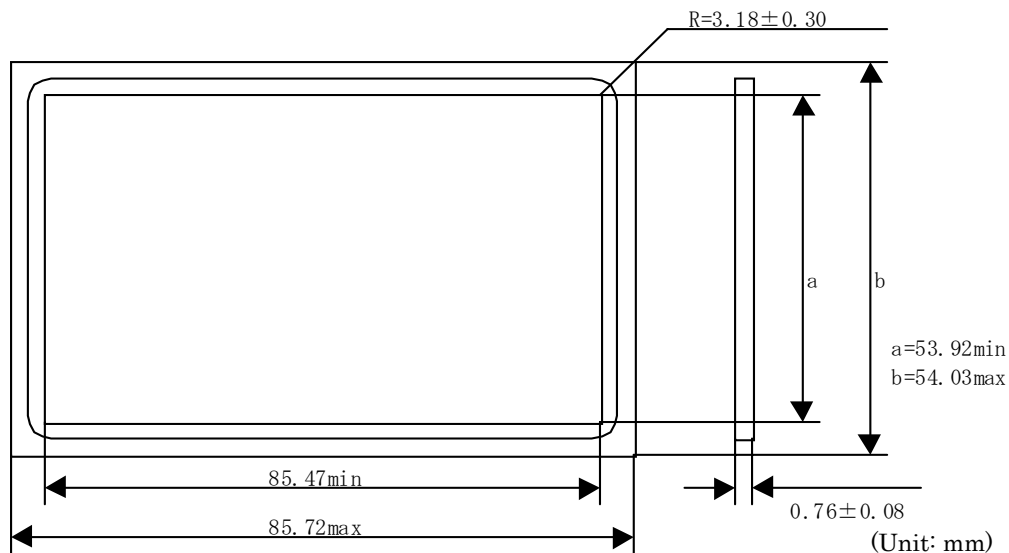


Figure 4-15 IC Card Dimensions

4.3.2.2 Pin Assignments and Dimensions

IC card pin specifications should comply with ISO 7816-2:1988.

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

12.25.

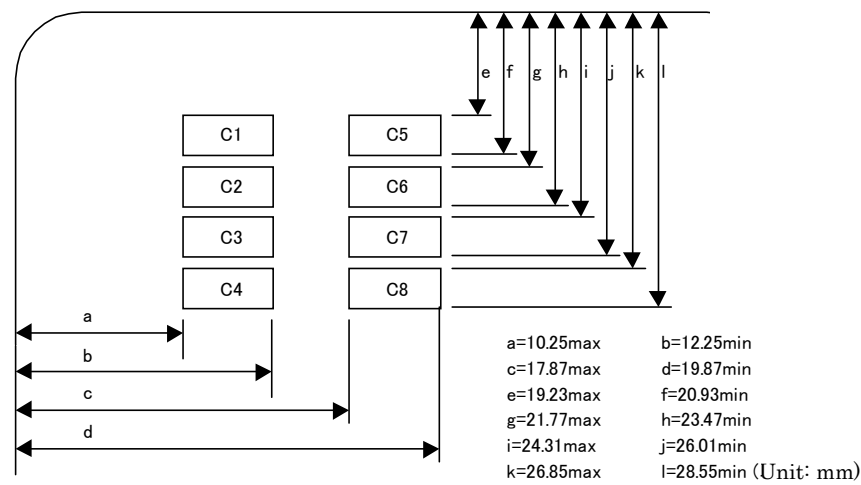


Figure 4-16 Pin Assignments and Numbers

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.

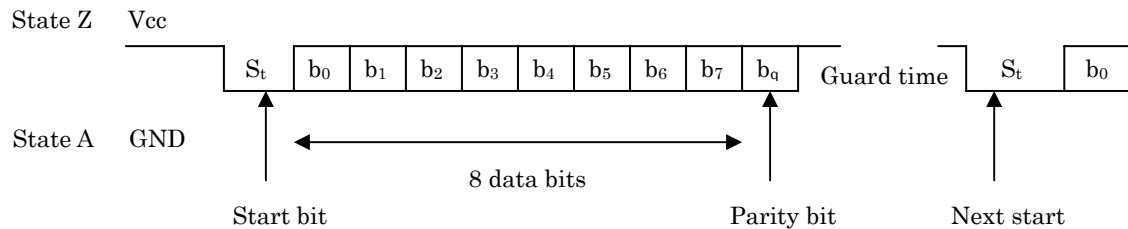


Figure 4-17 Character Format

(4-2) External clock transmission speed during ATR

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

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

Note: The etu refers to the transmission time for 1 bit. T_n 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 T_0 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:
 $12 \leq \text{leading interval} \leq 9,600$ [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 TD_i .

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’ ‘03’	[b ₇ b ₆] Set to disallow use of clock stops (XI = 0). [b ₅ :b ₀] Set the power supply specification to Class A only (U = 1) or Class AB (U = 3).
	Check character	TCK	‘xx’ Exclusive OR of T ₀ 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 $etu^{-1} = f \cdot D / F$ [bps]. (D and F are determined by the FI/DI values of the ATR response TA₁.) The baud rate margin while sending and receiving is $(n - 0.2) \leq T_n \leq (n + 0.2)$ [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	$0 \leq n \leq \text{IFSC or IFSD byte}$	1 byte

The block structure consists of the following fields:

a. 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.

b. 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.

c. 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.

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

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.

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

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.

$BGT = 22 \text{ [etu]}$

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

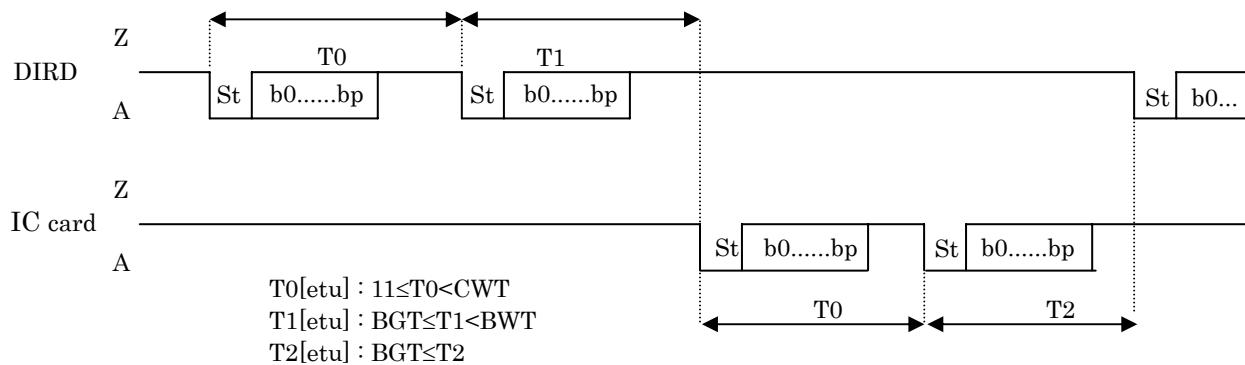


Figure 4-18 Character Interval

(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
b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	
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
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.

Table 4-4 S Block PCB Coding

PCB coding								Meaning
b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀	
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 $N(S) = X(X = Y_{XOR1})$ 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	Note
Category	Code	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 byte	
	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	Note
Category	Code	Name		
Body	DATA	Data	N byte	Optional
Trailer	SW1	Status Byte 1	1 byte	Required
	SW2	Status Byte 2	1 byte	Required

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.

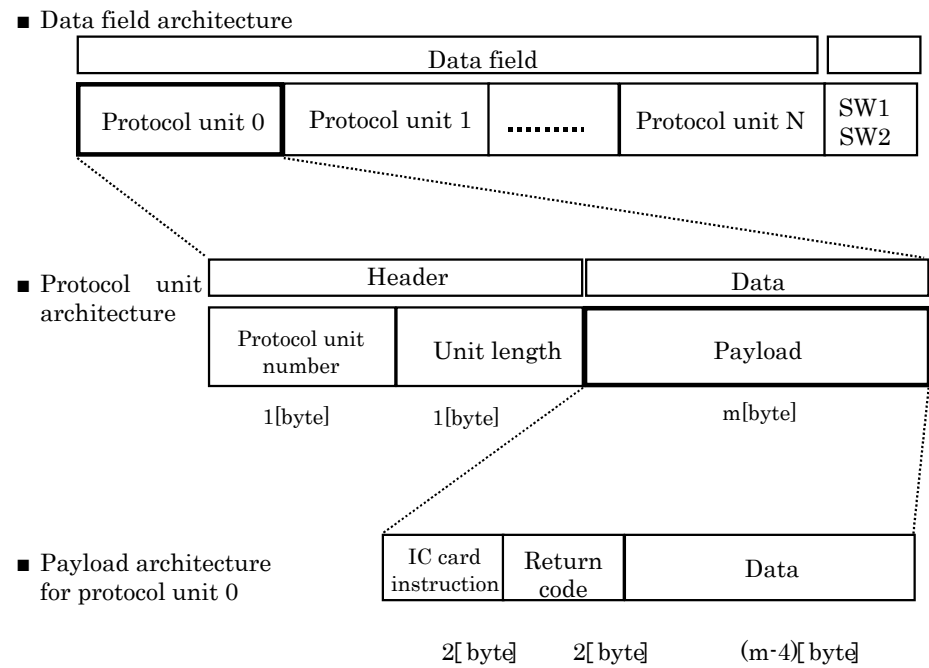


Figure 4-24 Detailed Data Field Architecture

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 partition 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 Receive 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 Receive 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 Receive 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 Receive 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 programming 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 group 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 Receive 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 group 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 Receive 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	
n+9	SW1		*1)	
n+10	SW2		1	
			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 message preset text number is 0 and when the differential information length is 0.

(6) 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 Display Information Acquire 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 group 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 Display 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		Expiration date *1)	2	
11		Message preset text no. *2)	2	
13		Differential format number *3)	1	
14		Differential info. length *4)	2	
16		Differential 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 programming.
- 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

Table 4-21 PPV Status 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	n
8	D ata	ECM	n	
n+8	Le	RESPONSE DATA LENGTH	1	00

c) Response

Table 4-22 PPV Status 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		Broadcaster group identifier	1	
10		PPV program number	2	
12		Recording control	1	
13		PPV viewing fee 1	2	
15		PPV viewing fee 2	2	
17		Min. prepaid balance	2	
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 programming.
- 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

Figure 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 group identifier	1	
9		PPV program number	2	
11		Recording request	1	*1)
12	Le	ECM	n	
n+12		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

(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	
6	P2	Parameter 2	1	
7	Lc	Command data length	1	02
8	Data	PDU number	1	00
9		Connection status	1	*1)
10	Le	Response data length	1	

*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
11		Upload data	n	*2)
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 ($n \geq 1$), issue this command n times to acquire the upload data.

b) Command

Table 4-29 Data 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	PDU number	1	*1)
9	Le	Response data length	1	00

c) Response

Table 4-30 Data 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		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	SW1	Telephone number	7	*2)
24			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 GROUP 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 group 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 *1)
4		Unit length	1	
5		IC card instruction	2	
7		Return code	2	
9		PDU number	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 group identifier	1	*1)
9		Center ID	1	*1)
10		PDU number	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	
10		DIRD response data	n	*1)
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 group 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	
6	P2	Parameter 2	1	
7	Lc	Command data length	1	
8	Data	Power-on control info. no.	1	
9	Le	Response data length	1	

*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	
10		FINAL POWER-ON CONTROL INFO. NO.	1	
11		BROADCASTER GROUP IDENTIFIER	1	
12		POWER-ON START REFERENCE DATE	2	*1)
14		POWER-ON START DATE OFFSET	1	
15		POWER-ON PERIOD	1	*2)
16		POWER SUPPLY HOLD TIME	1	*3)
17		RECEIVE NETWORK	2	*4)
19		RECEIVE TS	2	*5)
21	SW1		1	*6)
22	SW2		1	*7)

*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	
n+9	SW1	Prepaid balance	2	*1)
n+11			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	
10		Display card ID (1) *1)	10	
...		...		
10M		Display card ID (M) *1)	10	M
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; $M \geq 2$: 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 Conditions	INT	30	
Basic processing	Receive ECM	ECM	34	
	Receive EMM	EMM	36	
Contract confirmation	Confirm Contract	CHK	3C	
EMM messages	Receive EMM individual message	EMG	38	
	Acquire Automatic Display Message Display Information	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	Request Power-on Control Information	WUI	80	
Display of card ID	Acquire Card ID Information	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.

Table 4-54 SW1/SW2

Type	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 \neq 0)
	0x6A86	Incorrect P1/P2 value
	0x6D00	Undefined INS
	0x6E00	Undefined CLA (CLA upper nibble \neq 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 code	SW1 /SW2	Detailed status	
Name	Code			Category	Subcategory

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

			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 code	SW1 /SW2	Detailed status	
Name	Code			Category	Subcategory

■ Initial settings conditions

Initial Settings Conditions	INT	2100	9000	Normal termination	
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■ ECM reception

Receive ECM	ECM	A102	9000	Non-operational card	Non-operational protocol number
		A103		No contract	No Kw
		8901 8501 8301		No contract: Outside contract	Tier Prepaid PPV Payment-deferred PPV
		8902 8502 8302		No contract: Expired	Tier Prepaid PPV Payment-deferred PPV
		8903 8503 8303		No contract: Viewing restriction	Tier Prepaid PPV Payment-deferred PPV
		0800 0400 0200		Purchased: Viewing	Tier Prepaid PPV Payment-deferred PPV
		4480 4280		Available for purchase: Previewing	Prepaid PPV Payment-deferred PPV
		8500 8300		Available for purchase: Outside preview	Prepaid PPV Payment-deferred PPV
		8108 8109 850F		Purchase refused	Purchase prohibited period Viewing history memory full 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 code	SW1 /SW2	Detailed status	
Name	Code			Category	Subcategory

■ Contract confirmation

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

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 code	SW1 /SW2	Detailed status	
Name	Code			Category	Subcategory

■ PPV purchase

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:	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
		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						
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		Sequence error	Command error	
		9106			PDU number error	
Center Response	CRD	2100		Normal termination		
		1102		DIRD data transmission possible		
		9105		Sequence error	Command error	
		9106			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		Sequence error	Command error	
		9106			PDU number error	
Decode DIRD Response Data	UNC	2100		Normal termination		
		9104		Center communications error		
		9105		Sequence error	Command error	
9106		PDU number error				
	End DIRD Data Communications	IRR		2100	Normal termination	
				9105	Sequence error	Command error
9106		PDU number error				

■ Power saving

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

■ Display of card ID

Acquire Card ID Information	IDI	2100	9000	Normal termination	
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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 broadcasts 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.

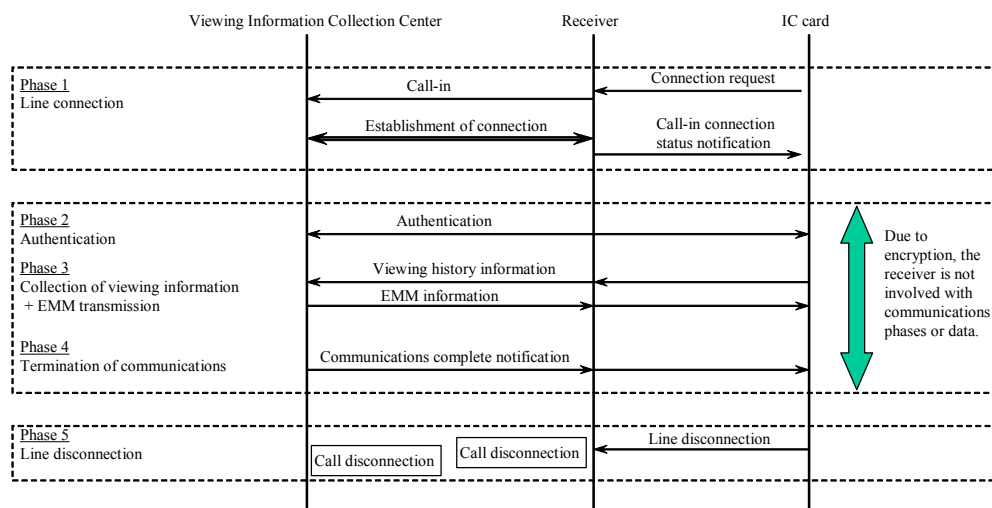


Figure 4-25 Processing Flow During Viewing Information Collection

(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

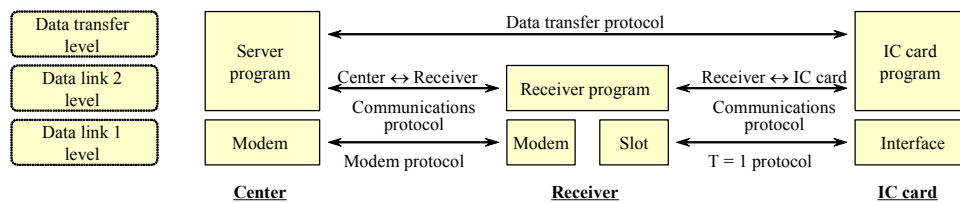


Figure 4-26 Protocol Stack

(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:

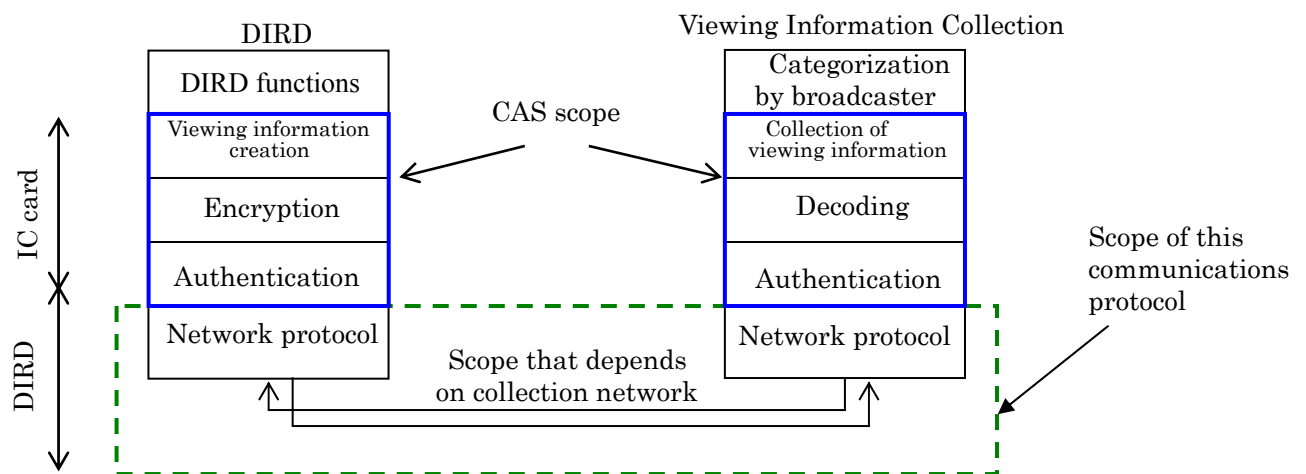
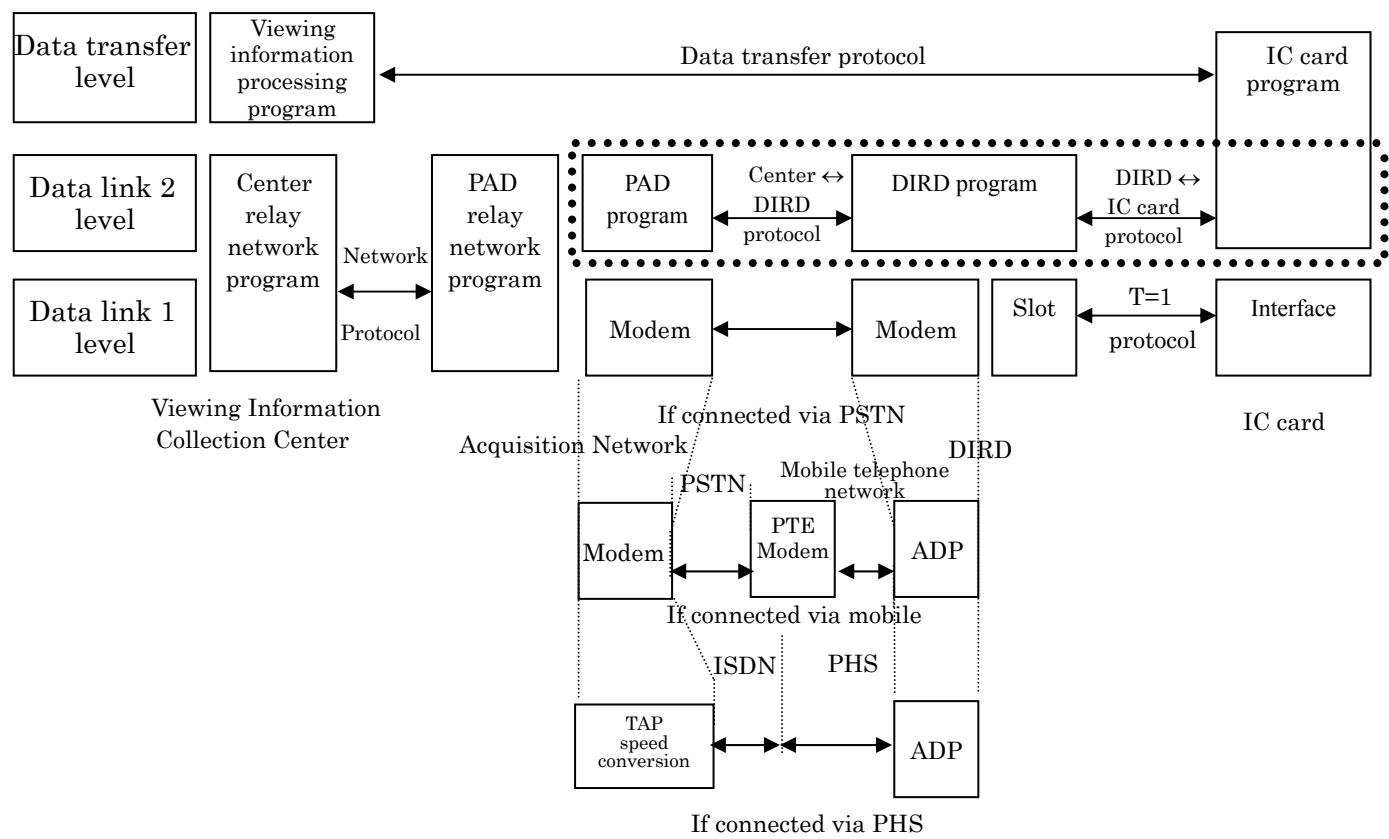


Figure 4-27 Overview of the Communications Protocol Defined by This Standard



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).

Table 4-62 Protocol Stack for Communications
Between the DIRD and the Viewing Information Collection Center

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.

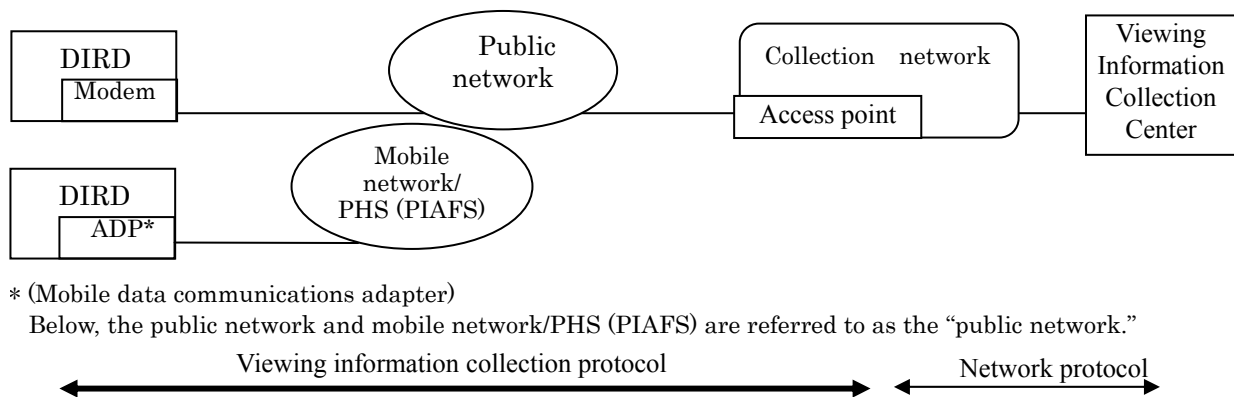


Figure 4-29 Viewing Information Collection System

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 → Collection Network: CR only Collection network → 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

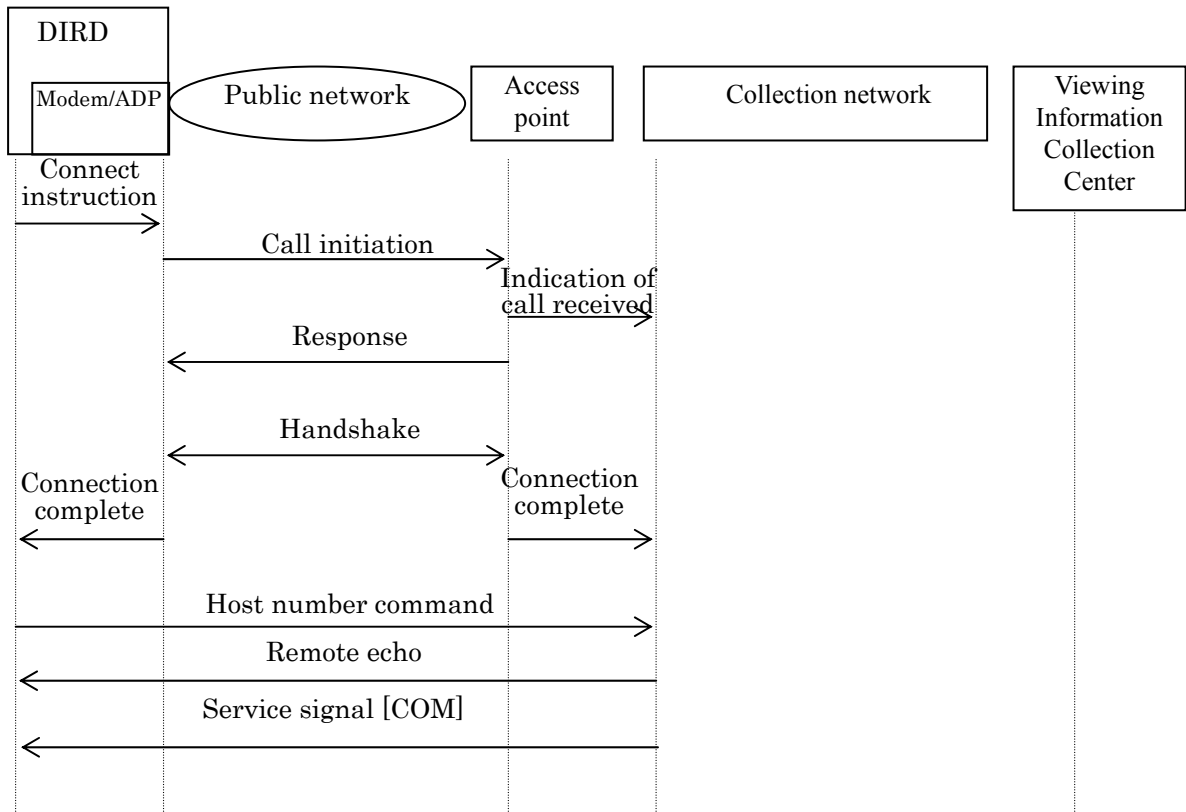


Figure 4-30 Normal Sequence

2) Error sequence (host number command error)

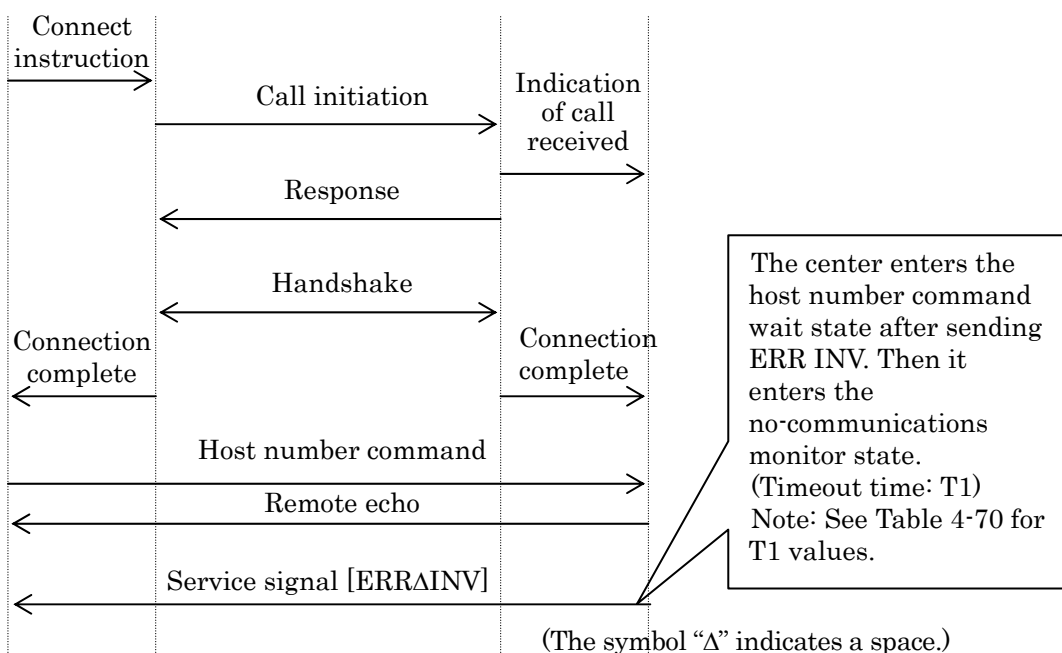


Figure 4-31 Error Sequence (Host Number Command Error)

3) Error sequence (host timeout while waiting for host number command)

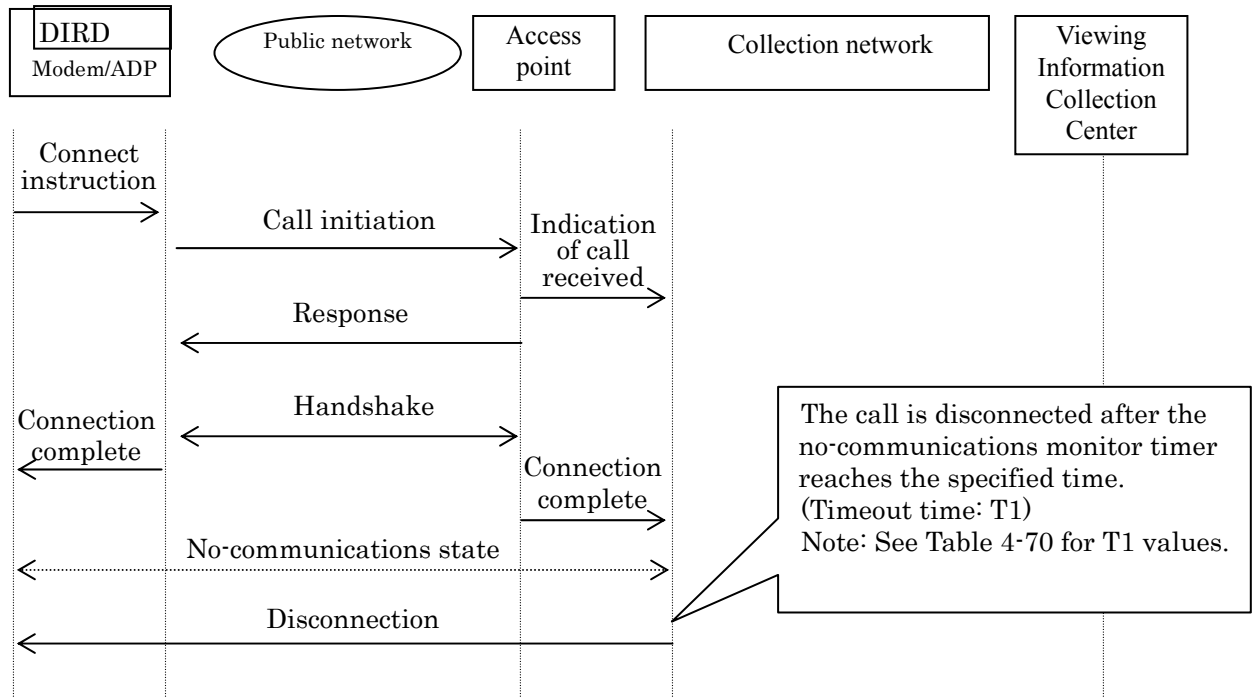


Figure 4-32 Error Sequence (Host Timeout While Waiting for Host Number Command)

4) Error sequence (call rejected by host)

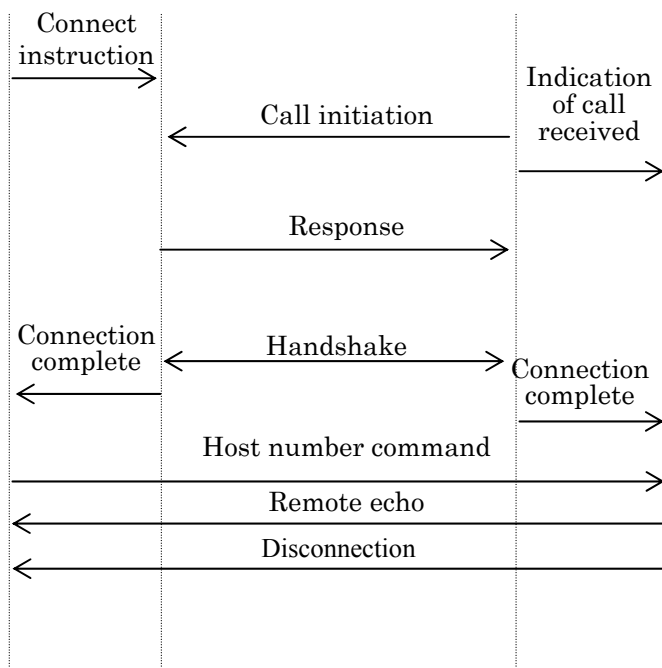


Figure 4-33 Error Sequence (Call Rejected by Host)

5) Error sequence (remote echo error)

See Table 4-66, “Receiver Operation While Waiting for Remote Echo.”

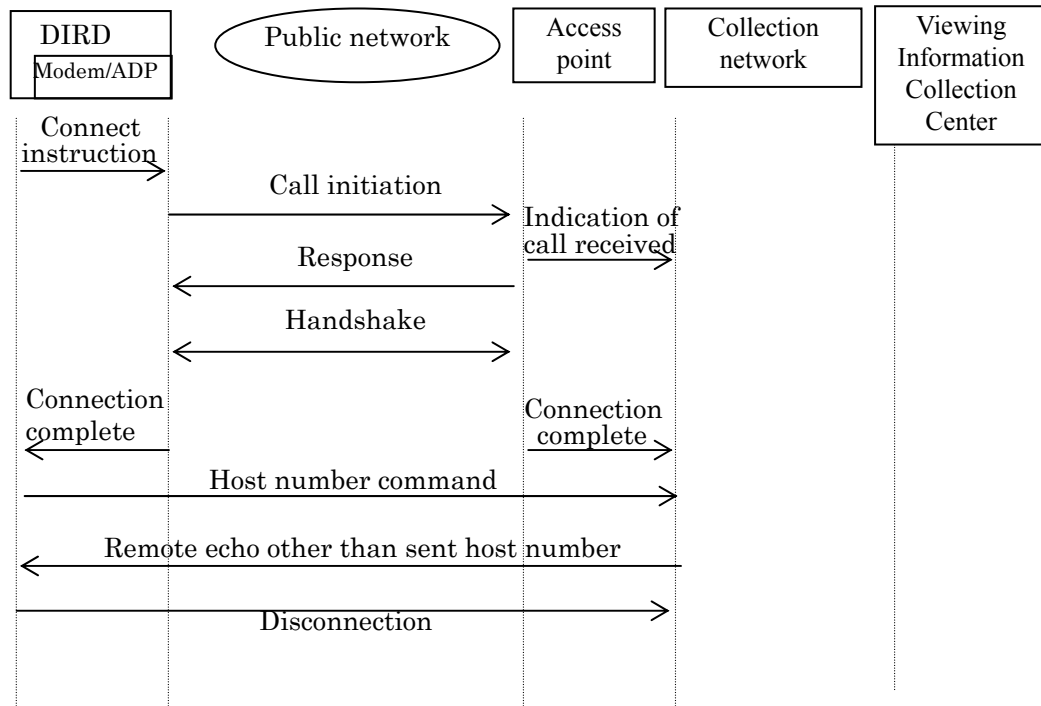


Figure 4-34 Error Sequence (Remote Echo Error)

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

See Table 4-66, “Receiver Operation While Waiting for Remote Echo.”

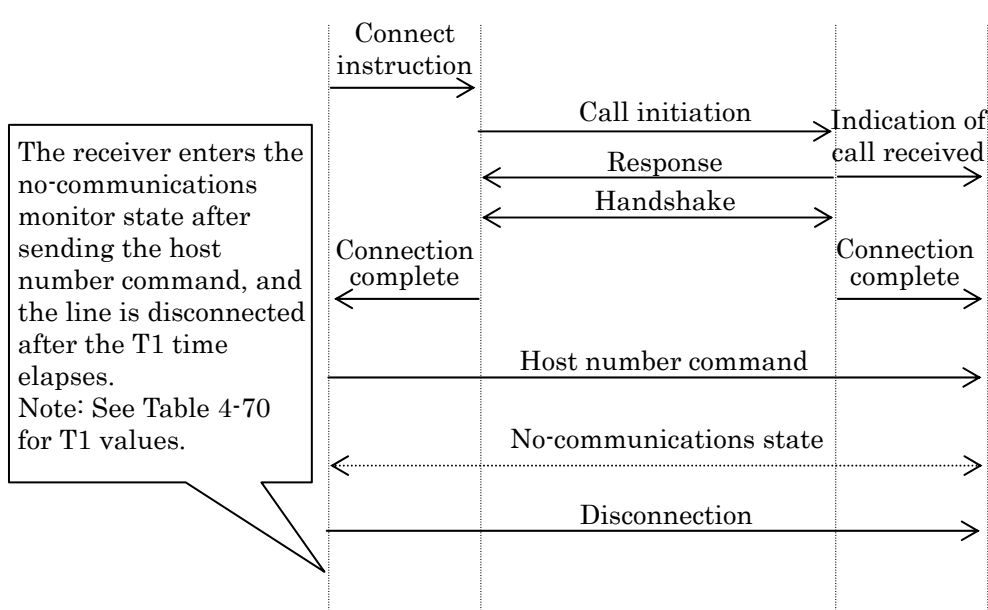


Figure 4-35 Error Sequence (DIRD Timeout While Waiting for Remote Echo)

7) Error sequence (service signal error)

See Table 4-67, “Receiver Operation in the Service Signal Wait State.”

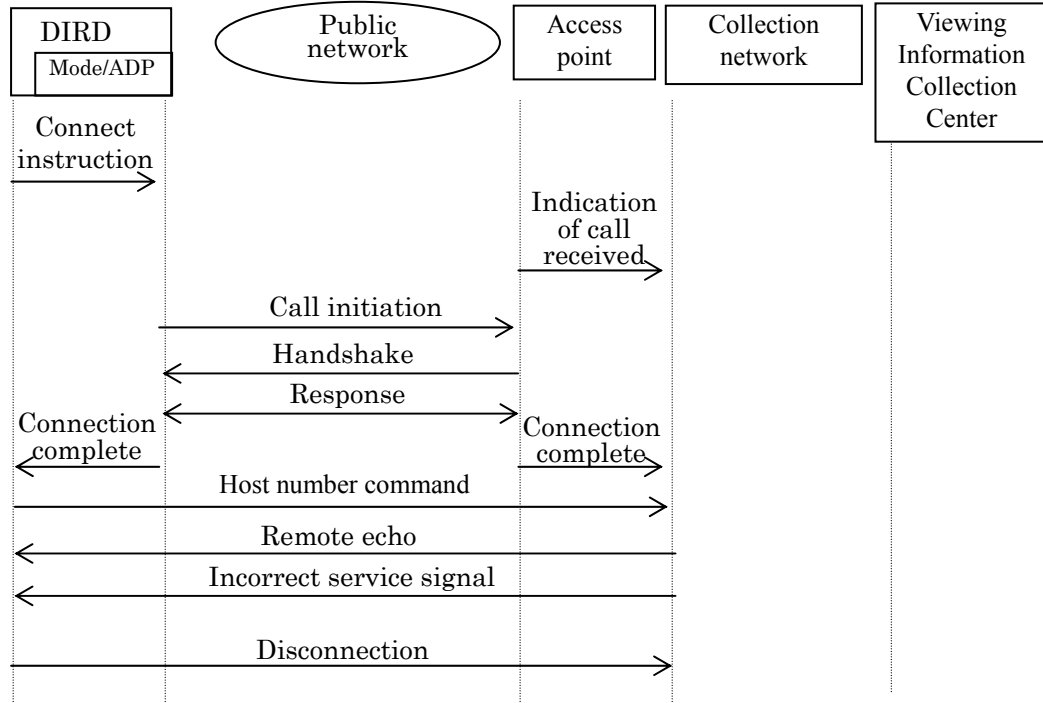


Figure 4-36 Error Sequence (Service Signal Error)

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

See Table 4-67, “Receiver Operation in the Service Signal Wait State.”

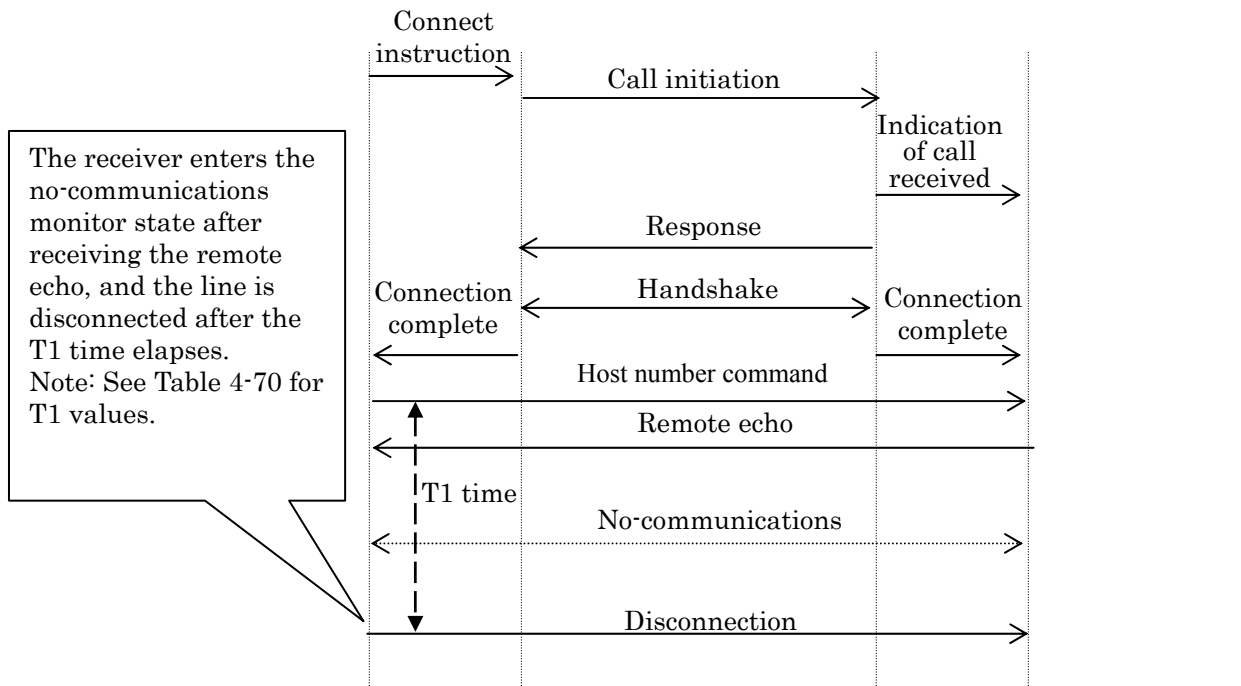
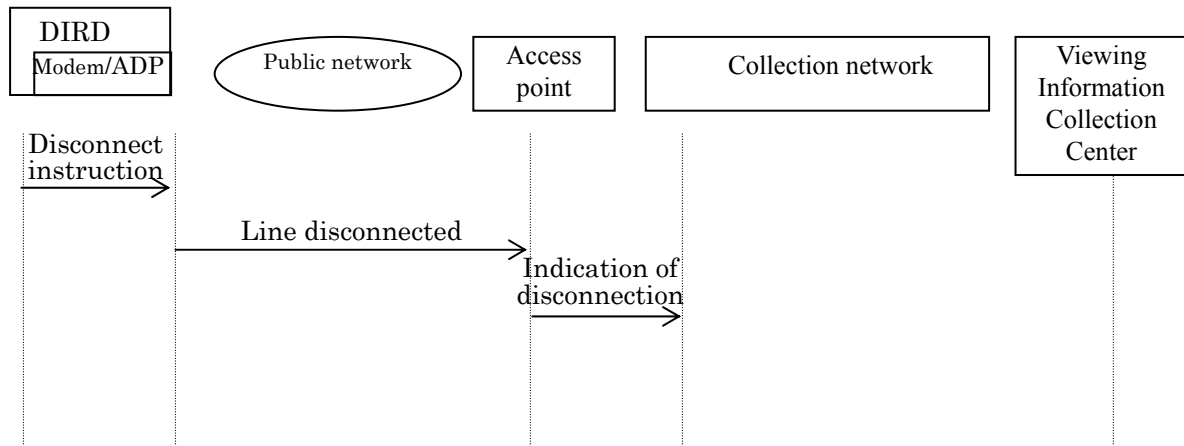


Figure 4-37 Error Sequence (DIRD Timeout While Waiting for the Service Signal)

b) Disconnect sequences

1) Disconnect by DIRD



2) Disconnect by Viewing Information Collection Center

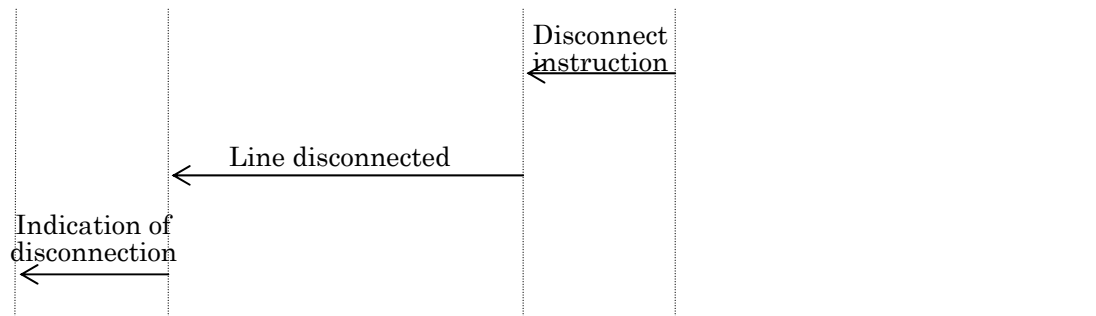


Figure 4-38 Disconnect by DIRD

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:

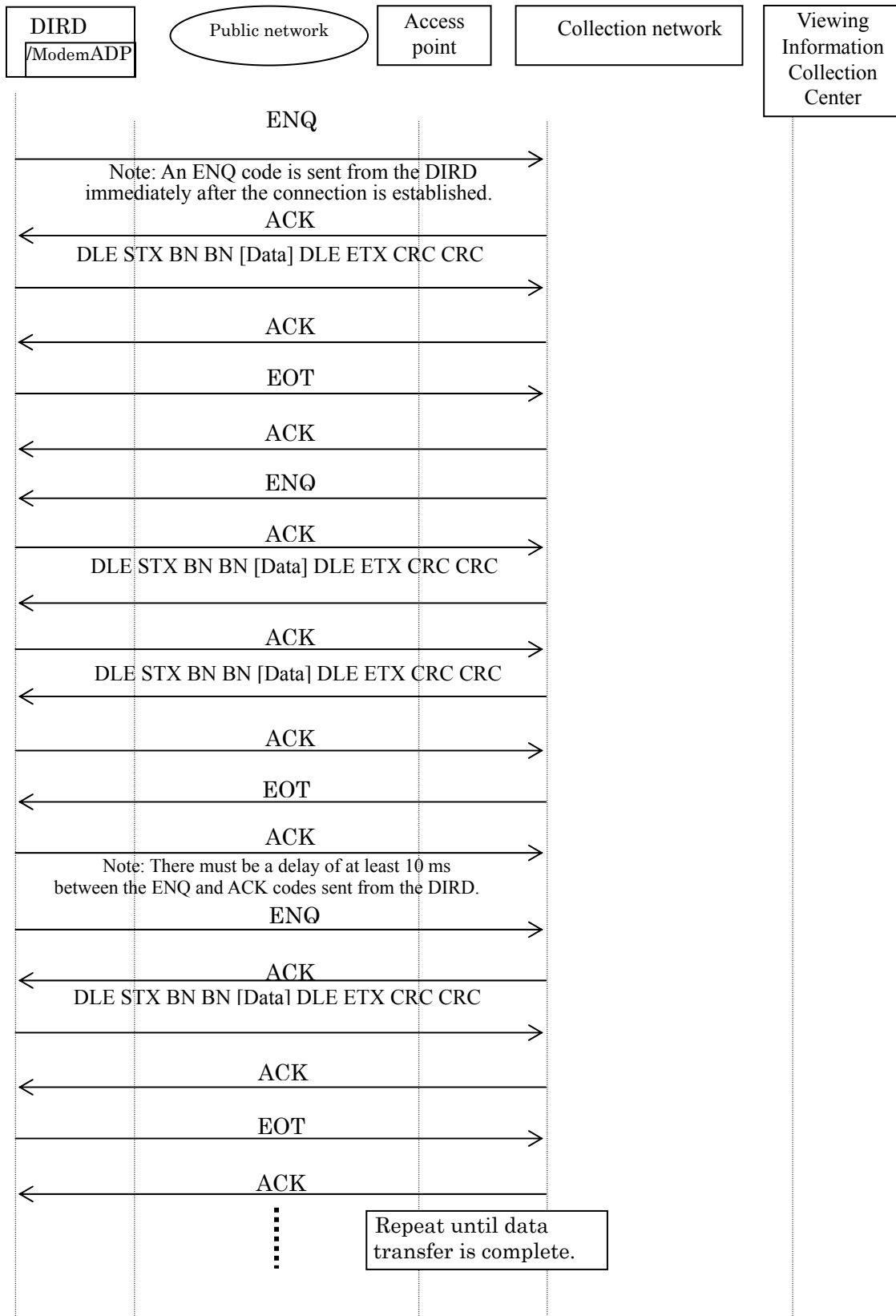


Figure 4-39 Example Data Transfer Sequence Between the DIRD and Collection Network

b. Text format

1) Text transmission format

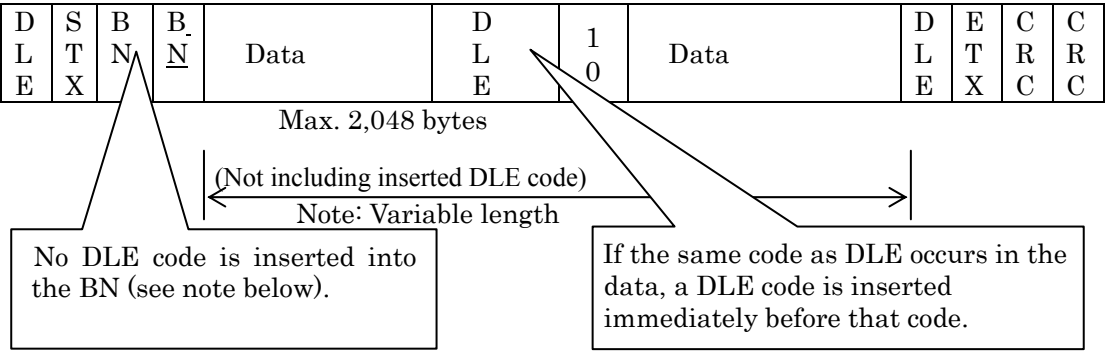


Figure 4-40 Text Transmission Format

Note: BN: Block number (0 to 255)

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

2) CRC calculation scope

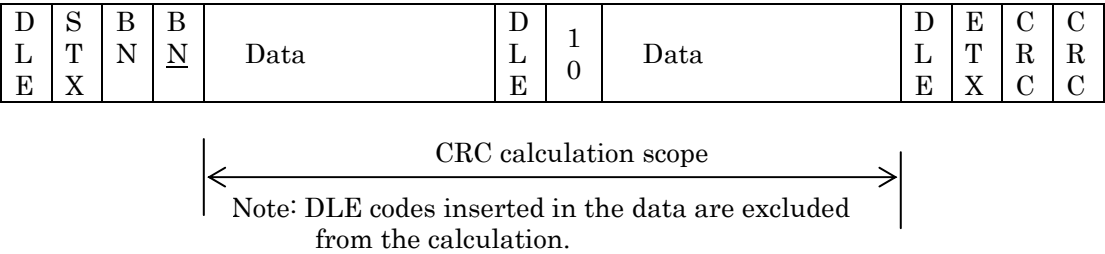


Figure 4-41 CRC Calculation Scope

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 (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 Block Number Flow

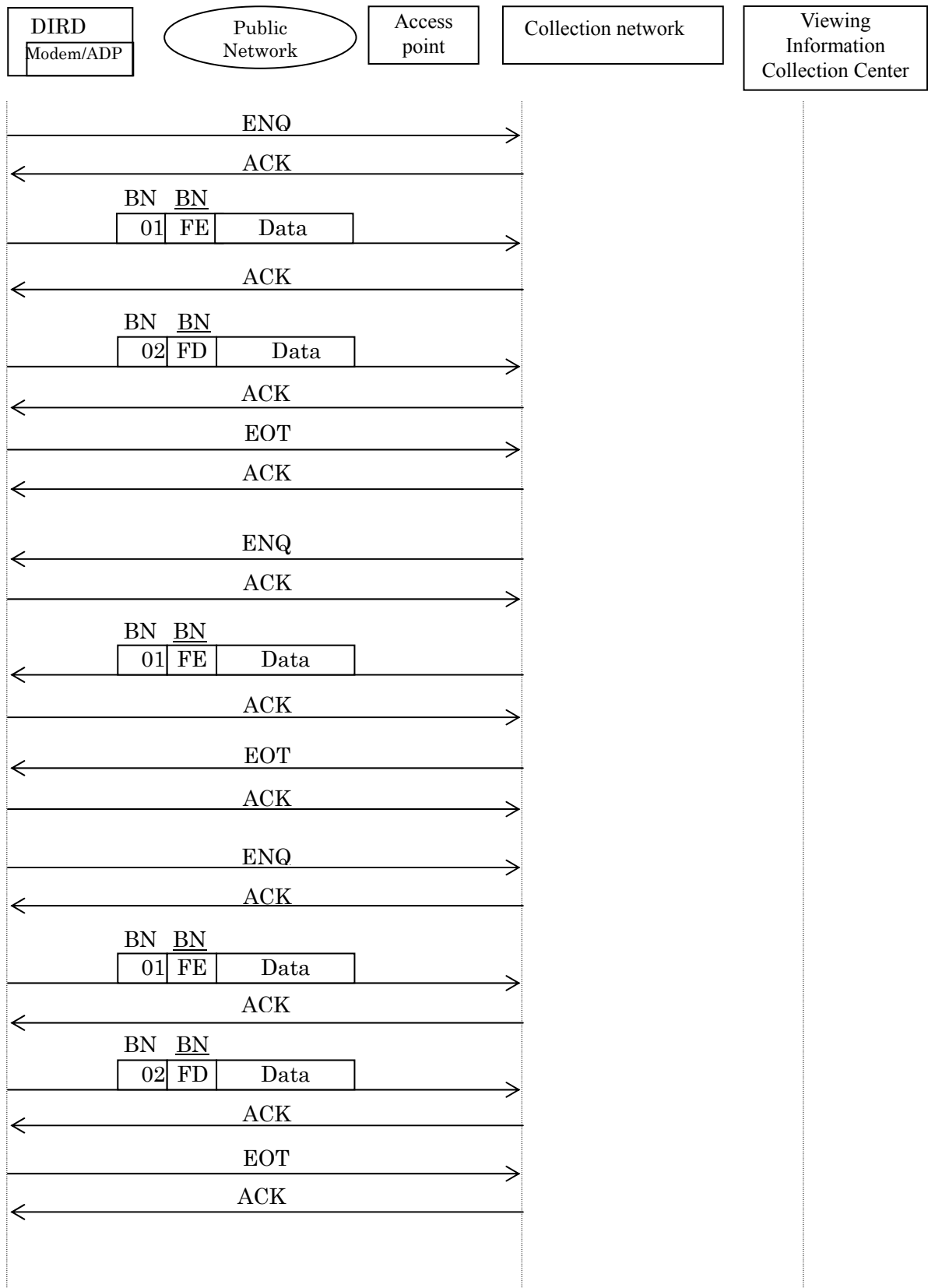


Figure 4-43

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

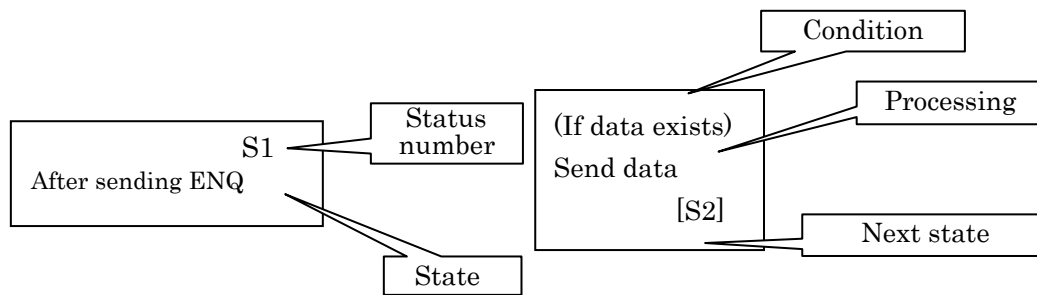
6) State transitions

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 BN (one's complement) are not properly related, send NAK.
- b) When BN and BN are properly related but differ from the expected value:
 - b-1) When the previous BN and BN, 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

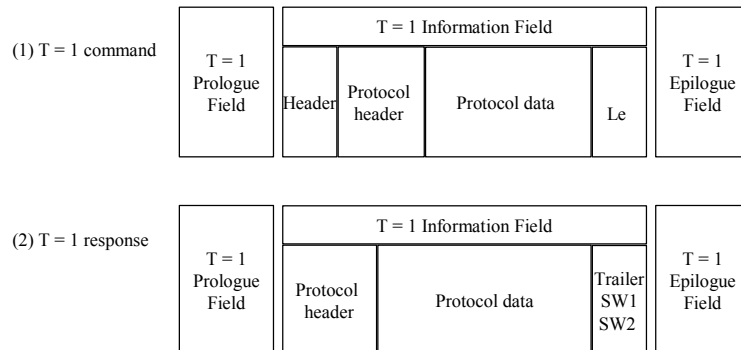


Figure 4-44 Command/Response

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.

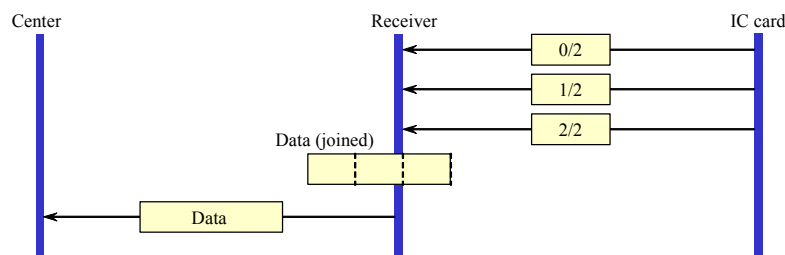


Figure 4-45 PDU Mechanism (Data from IC Card)

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.

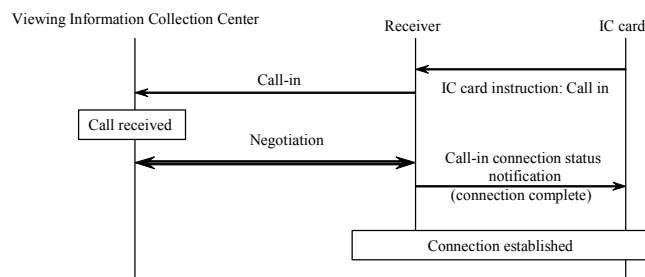


Figure 4-46 Normally Terminated Call-in Processing Flow

- 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.

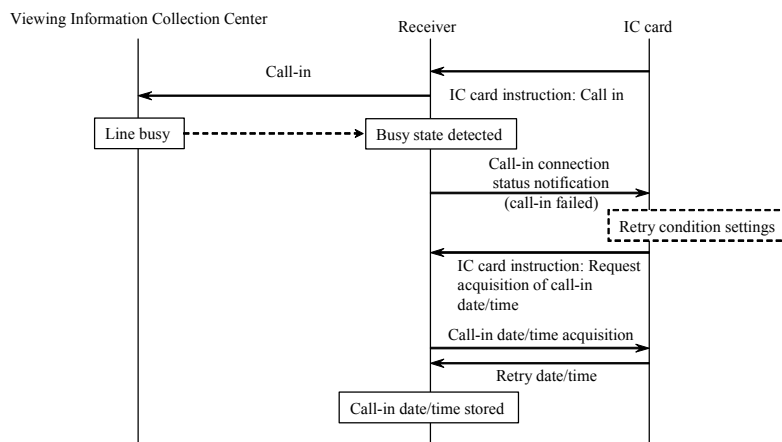


Figure 4-47 Failed Call-in Processing Flow

- 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.

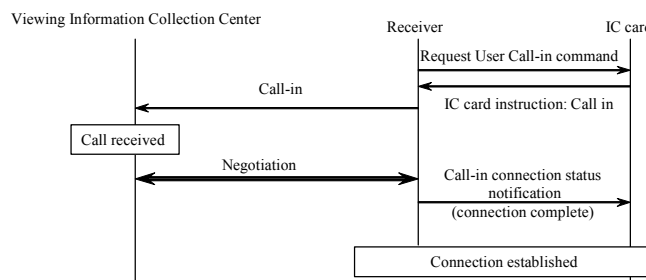


Figure 4-48 User Call-in Processing Flow

(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.

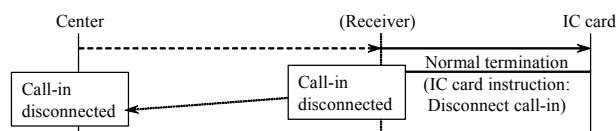


Figure 4-49 Call-in Disconnect processing Flow

- 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.

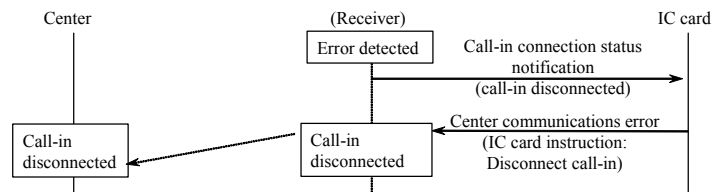


Figure 4-50 Processing Flow When the Receiver Has Detected an Error

4.5.1.7 Receiver State Transitions

The following table describes receiver state transitions.

Table 4-74 Receiver State Transitions

Receiver state		Idle	Call-in in progress	Communications in progress
Receiver event				
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 $\neq 0$)			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.

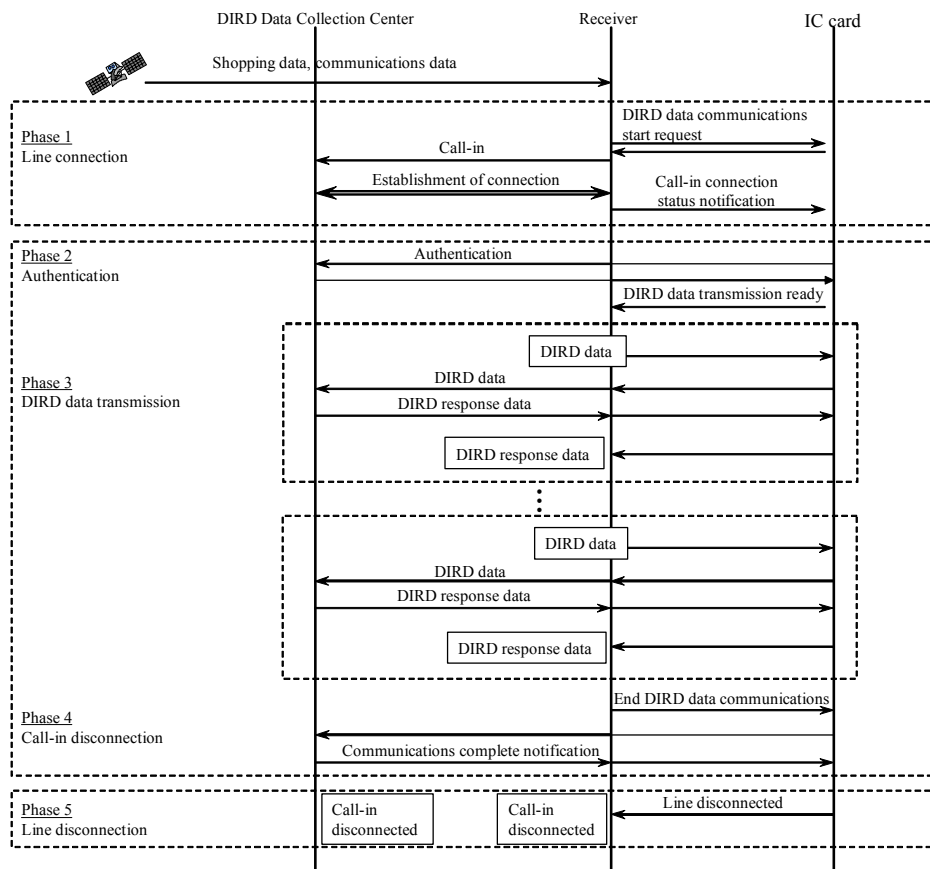


Figure 4-51 Processing Flow During DIRD Data Communications

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 group 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.

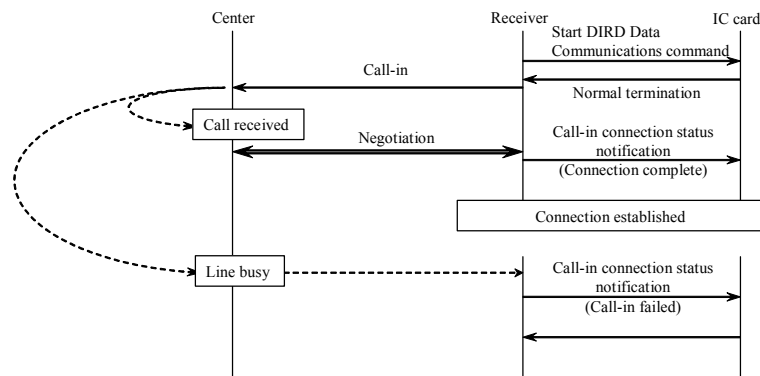


Figure 4-52 Connection Flow During DIRD Data Transmission

(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.

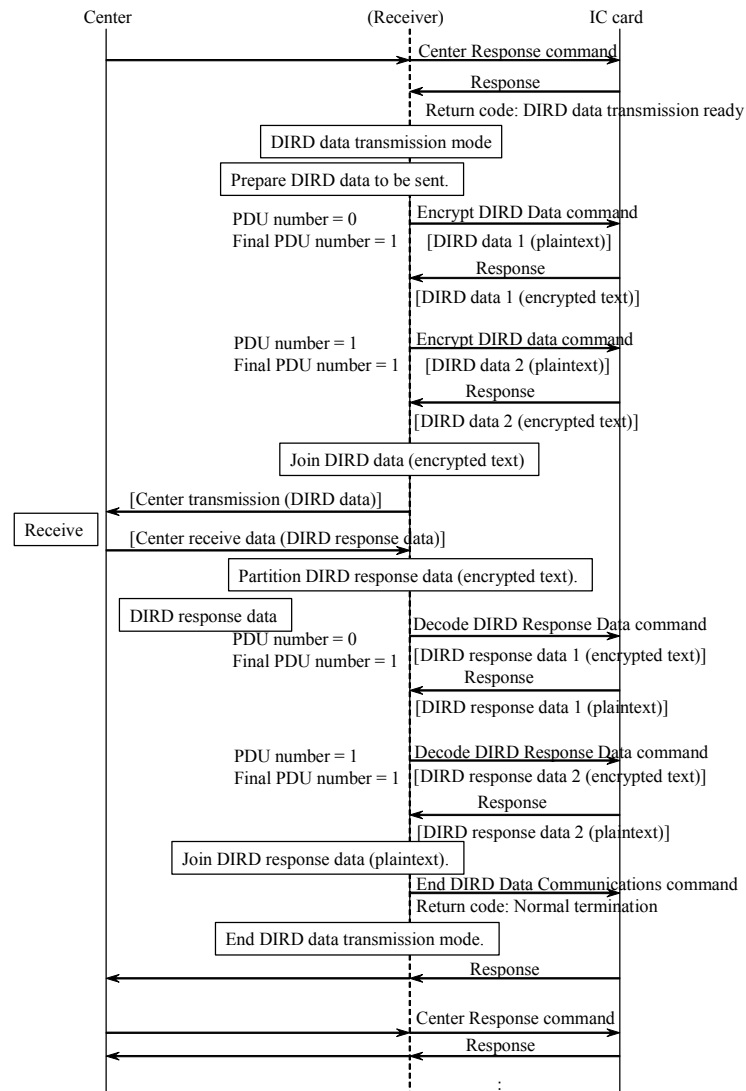


Figure 4-53 Data Transfer

(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 \neq 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 \neq 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 preset text number transmitted by the “EMM shared message” 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 preset text number for the specified EMM shared message 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 shared 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 shared messages” for which the automatic display erasure type is display-erasable are not displayed. When the automatic display message consisting of “EMM shared message” 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 shared message”. 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 “message preset text 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 shared 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	Bit string
CA_emm_ts_descriptor 0 {		
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	Bit string
CA_contract_info_descriptor(){ descriptor_tag descriptor_length CA_system_id CA_unit_id num_of_component for(i = 0;i<num_of_component;i++) { component_tag } contract_verification_info_length for(i=0;i<contract_verification_info_length ;i++) { contract_verification_info } fee_name_length for (i = 0;i< fee_name_length ;i++) { fee_name } }	8 8 16 4 4 8 8 8 8 8	uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf 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”.

- Descriptor name
CA service descriptor (CA_service_descriptor)
- Data structure

Table 4-78 CA Service Descriptor Data Structure

Data structure	No. of bits	Bit string
CA_service_descriptor () { descriptor_tag descriptor_length CA_system_id ca_broadcaster_group_id *1) message_control *2) for(i=0;i<N;i++) { service_id } }	8 8 16 8 8 16	uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf

*1) ca_broadcaster_group_id: Broadcaster group 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 scramble control flag and adaptation field control for the TS packet header in each stream to determine whether the stream is scrambled. The following table details this process:

Table 4-79 Scrambling Detection Details

Scramble flag value	Adaptation field control	Description
00	01 or 11	No scrambling
01		Not defined
10		Scrambled (even key)
11		Scrambled (odd key)
XX	00 or 10	Not defined

4.9 Number of Scramble Keys That Can Be processed Simultaneously

The system must be capable of simultaneously processing a minimum of 8 pairs of scramble keys.

4.10 Number of PIDs That Can Be Processed Simultaneously

The conditional access system must be capable of simultaneously processing a minimum of 12 PIDs.

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 programming.

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 programming 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 an 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 and physical specifications should comply with ISO 7816-1:1987. IC card pin layout and dimensions should comply with ISO 7816-2:1987.

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.

5.3 Application of This CAS-R System to Digital Satellite Audio Broadcasts

The provisions of Chapter 6 of this standard apply for access control systems (“conditional access systems”) for digital satellite audio broadcasts.

Chapter 6 CAS-R System Using ECM-S and EMM-S Associated Information

6.1 Conditional Access Identification

The value of the conditional access identifier corresponding to the provisions of this chapter must differ from those corresponding to the provisions of Chapters 2 through 4 of this standard.

6.2 Functional Specifications

6.2.1 Specifications Related to Scrambling and Associated Information

6.2.1.1 Overall Functionality

(1) Contract scope

The system must provide subscriber management functionality capable of supporting phased expansion up to a maximum membership rate of 100% household participation.

(2) Security

The system offers advanced security functionality and can address piracy in parallel with pay broadcast operation.

6.2.1.2 Broadcast Service Formats

(1) Supported Digital Broadcast Service Formats

This standard can be applied to the following service formats:

- (1-1) Broadcast service consisting of audio programming broadcast in the transmission frequency band (channels); for example:

- a. VHF broadcasts
- b. Data broadcasts (specific approach is left as a topic for future consideration)

Conditional reception will operate in the same way as for audio.

Conditional playback support is left as a topic for future consideration.

- (1-2) Integrated digital broadcasts that combine a variety of information including video, audio, and data in a flexible format (ISDB: Integrated Services Digital Broadcasting)

(1-3) Reception formats

- a. Realtime reception
- b. Stored reception (non-realtime reception)

For the time being, this reception format describes the process of descrambling and storing programming. Functionality for storing programming in the scrambled state is left as a topic for future consideration.

- c. Recorded reception (including reserved reception)

The system must comply with standards for digital interface functionality used in IEEE 1394 and other receivers in order to manage copy protection issues.

(2) Compatibility with multiple media types

The system should show consideration of the need to be expandable for integrated operation with a variety of media types.

6.2.1.3 Fee Structure

This standard can be applied to the following fee structures:

(1) Scrambled

- 1) Fixed-fee listening
- 2) Pay-per-Listening support is left as a topic for future consideration.
- 3) Free

The system should provide a means of judging whether listening is available that includes operability and is separate from listening fee transactions.

(2) Unscrambled

Free

(3) Data broadcast billing system

Conditional access for data broadcast will operate in the same way as for audio. Conditional playback support is left as a topic for future consideration.

6.2.1.4 Fee Payment System

The system supports payment at the time of contract.

6.2.1.5 Collection of Listening Information

Support for collection of listening information is left as a topic for future consideration.

6.2.1.6 Security Functionality

(1) Information encryption

(1-1) Method

The encryption system uses a triple key architecture with common and private keys that meet or exceed the DES specification. From the perspective of implementation in a CA module, a low-cost system is desirable.

(1-2) Administration functionality

The encryption should provide support for dealing with piracy, for example by changing the encryption protocol, in parallel with operation.

6.2.2 Receiver Device Specifications

6.2.2.1 CA Module

(1) Module ID

Each CA module has a unique ID number (called the module ID). Although the decoder (digital broadcast reception device) may also be assigned a unique ID (the decoder ID), control under these CAS specifications is performed by transferring the module ID to the decoder. The decoder ID is not used.

When updating the module, the new module is enabled after the old module has been disabled. Although it is necessary that this switch be accomplished in as short a time period as possible, security considerations make it necessary to perform processing to permanently invalidate the old module. For this reason, modules IDs are changed without sharing old ID numbers.

(2) Descrambler

The descrambler descrambles transport stream packets using the MULTI2 system.

6.2.2.2 Reception Device

(1) “EMM message” reception (optional)

Reception device would receive “EMM messages”. Implementation Reception details are left to broadcasters.

(2) Program reservations (optional)

When reserving program using SI information and listening to reserved programs, the reception device provides contract verification information in the SI to the CA module to validate whether listening to the program.

(3) Control of the reception device using “EMM message” (optional)

The reception device should erase passwords when password erasure control is assigned in the EMM.

(4) Parental control

The reception device should restrict listening by comparing each program’s parental level as obtained from PSI/SI with the set parental level.

The parental level for reception devices that lack a password entry function is fixed at 3 (the minimum value). While reception devices that allow the parental level to be changed must provide a password entry function.

(5) Display of module ID

Based on user operation, the reception device can obtain and display the module ID from the CA module.

(6) Copy control

Reception devices equipped with digital output jacks must support copy control.

6.3 Technical Specifications for Scrambling and Associated Information

6.3.1 Scrambling Subsystem

6.3.1.1 Scrambling Method

The provisions of Chapter 3 of this standard apply.

6.3.1.2 Scrambling Procedure

The provisions of Chapter 3 of this standard apply.

6.3.1.3 MULTI2 Cipher

The provisions of Chapter 3 of this standard apply.

6.3.1.4 Elementary Encryption Function

The provisions of Chapter 3 of this standard apply.

6.3.1.5 Layer at Which Scrambling is Performed

The provisions of Chapter 3 of this standard apply.

6.3.1.6 Scrambling Scope

The provisions of Chapter 3 of this standard apply.

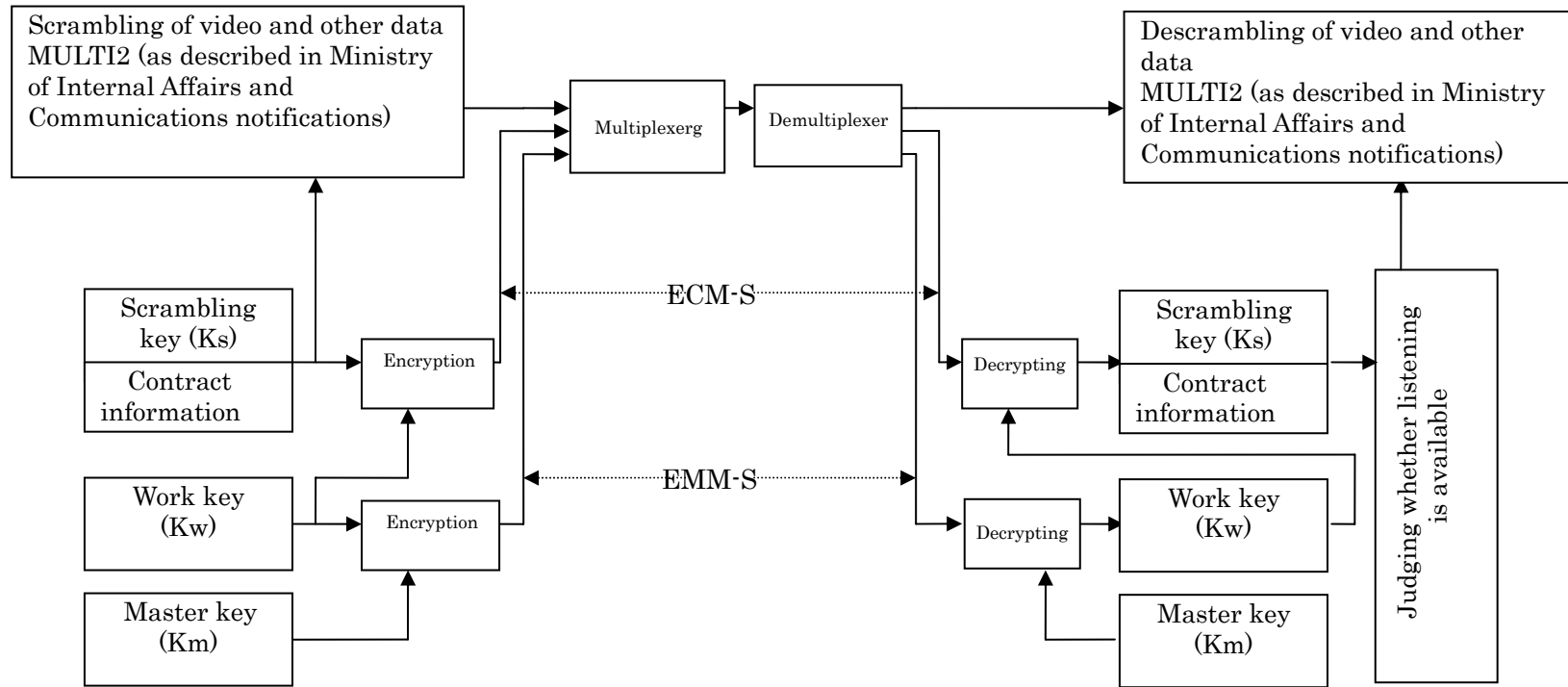


Figure 6-1 Conditional Access System

6.3.1.7 Scrambling Unit

The provisions of Chapter 3 of this standard apply.

6.3.1.8 Time During Which the Same Key is Used

The provisions of Chapter 3 of this standard apply.

6.3.2 Associated Information Subsystem

6.3.2.1 Types of Associated Information

ECM-S, EMM-S, “EMM individual messages”

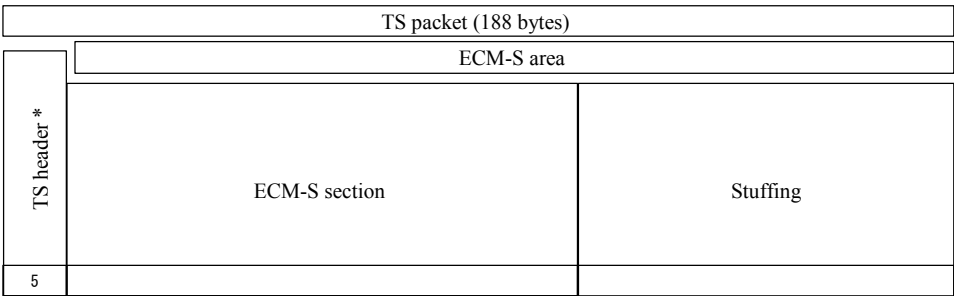
Support for ECM, EMM, and EMM shared messages is left as a topic for future consideration.

6.3.2.2 ECM-S

(1) Basic ECM-S structure

(1-1) The following describes the basic ECM-S structure:

One TS (transport stream) packet contains a single ECM-S section. Figure 6-2 show the basic structure of the TS packet used to transmit ECM-S messages.



*Includes pointer field.

Figure 6-2 ECM-S Message TS Packet Structure

(1-2) The following describes the basic structure of the ECM-S section and payload:

- The ECM-S section uses a standard section format.
- The value of the table identifier located in section header is 0x82.
- The ECM-S payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.
- The ECM-S variable part contains ECM-S function information including program information, scrambling key information, and individual contract information.

- Figure 6-3 show the ECM-S section structure.

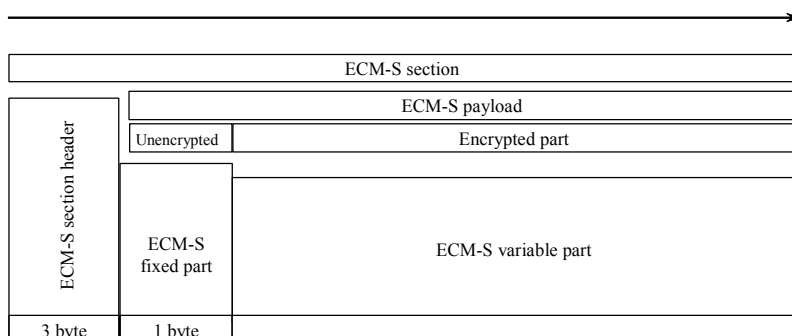


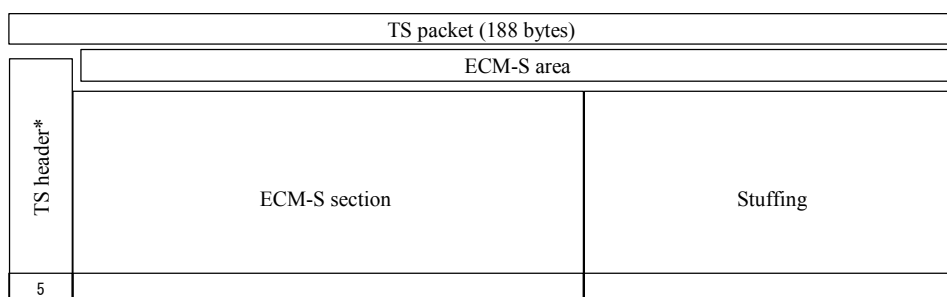
Figure 6-3 ECM-S Section Structure

6.3.2.3 EMM-S

(1) Basic EMM-S structure

(1-1) The following describes the basic ECM-S structure:

One TS (Transport Stream) packet contains a single EMM-S section. Figure 6-4 show the basic structure of the TS packets used to transmit ECM-S messages.



*Includes pointer field.

Figure 6-4 EMM-S Message TS Packet Structure

(1-2) The following describes the basic structure of the EMM-S section and payload:

- The EMM-S section uses a standard section format.
- The value of the table identifier located in section header is 0x84.
- The EMM-S payload consists of a fixed part that is always transmitted and a variable part whose content varies by transmission objective.
- The EMM-S variable part contains EMM-S function information consisting of ECM-S key information(Kw).
- Figure 6-5 show the EMM-S section structure.

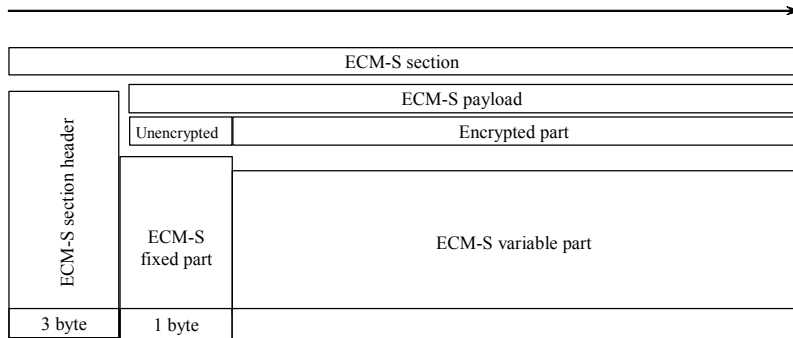


Figure 6-5 EMM-S Section Structure

6.3.2.4 Message Information

Messages are transmitted using the MPEG-2 system section format (EMM message section) as defined by Ministry of Internal Affairs and Communications Notification No. 37, 2003. The table_id for EMM message sections is 0x85. The following describes the basic structure of the EMM message section:

- The entire EMM message section is calculated to a section CRC.
- Each section contain single EMM message.
- EMM shared message section support is left as a topic for future consideration.

Figure 6-6 show the EMM individual message section.

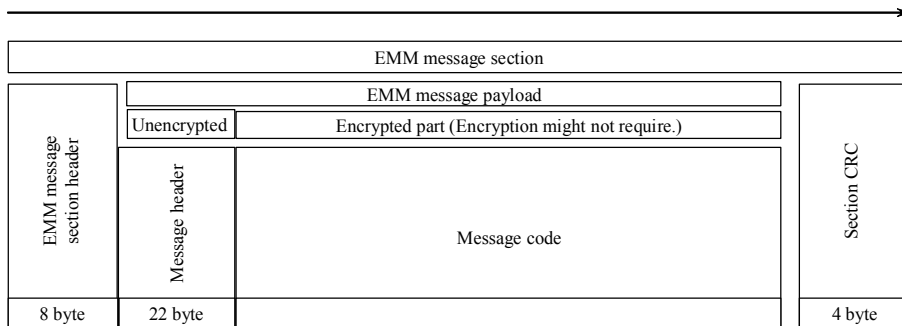


Figure 6-6 EMM Individual Message Section Structure

6.4 Receiver Technical Specifications

6.4.1 User Interface

6.4.1.1 Program Listening

- Usually, a program is selected using EPG on the SI, and the process for selecting programs using EPG is defined by the each reception devices. This standard describes the processing that must be performed after program selection.
- Because the CA modules based on this system incorporate built-in functionality for tasks ranging from associated information separation and processing to descrambling, the DIRD does not need to consider most program attributes. For this reason, the processing described above is limited to parental control, reserved program listening, and listening not available notification.

The following describes an example processing flow from program selection to program presentation:

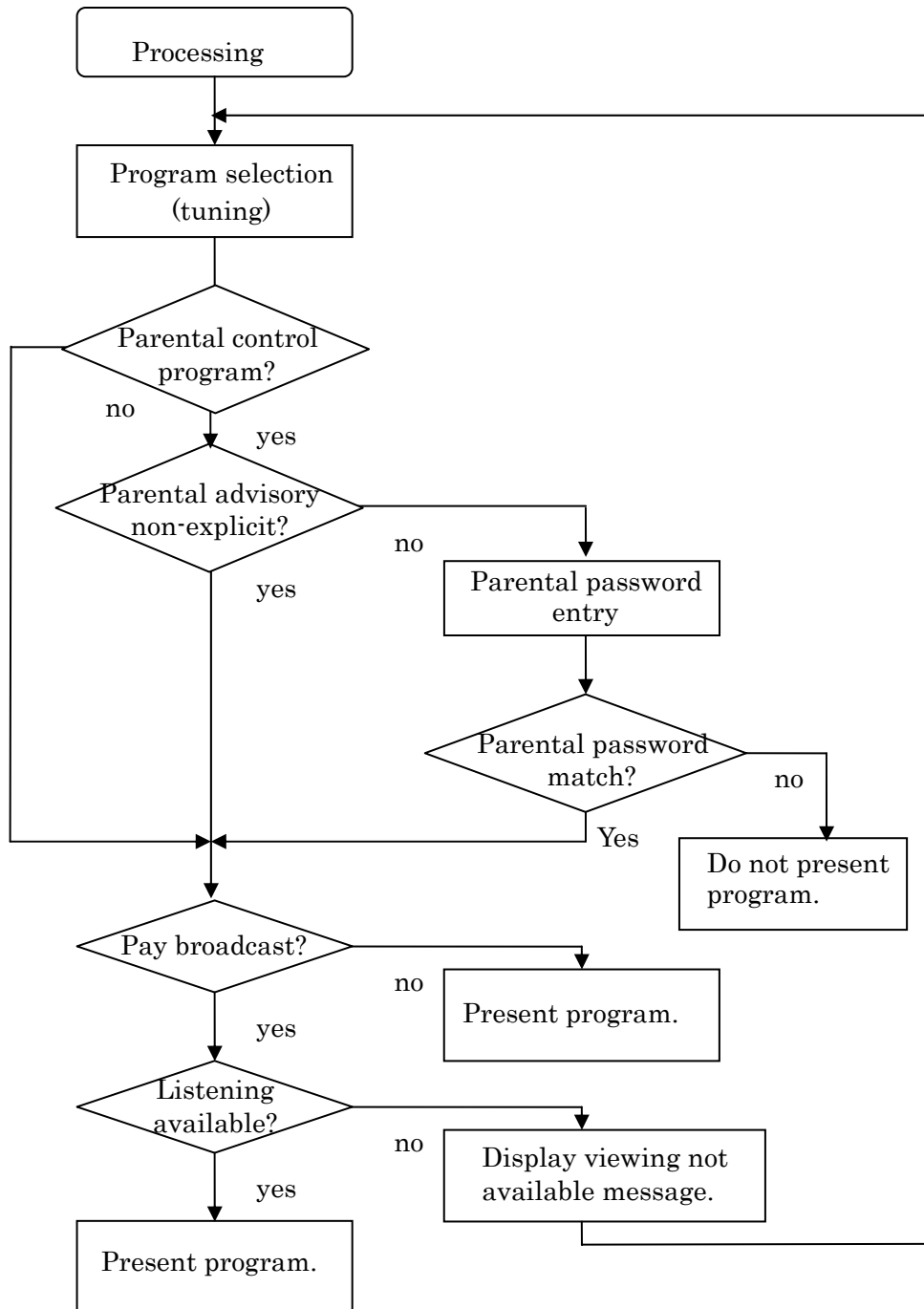


Figure 6-7 Example Flow from Program Selection to Presentation

Note: For more information about the parental level and parental password settings, see “6.4.1.6 System Settings.”

6.4.1.2 Program Reservations (Optional)

- The receiver reserves program using EPG or similar functionality based on SI information. As a rule, programming reservations using an EPG are defined by the SI standard. This standard describes the flow of reservation based on specific program attributes.
- The receiver references the SI for the program being reserved, verifies that the authentication information is in place with the CA module if the program is scrambled, and performs reservation processing depending on the response from the CA module.
- Because CA modules based on this system incorporate built-in functionality for tasks ranging from associated information separation and processing to descrambling, the DIRD does not need to consider most program attributes. For this reason, the processing described above is limited to parental control, reserved program listening, and listening not available notification.

The following describes an example processing flow from program selection to completion of the reservation:

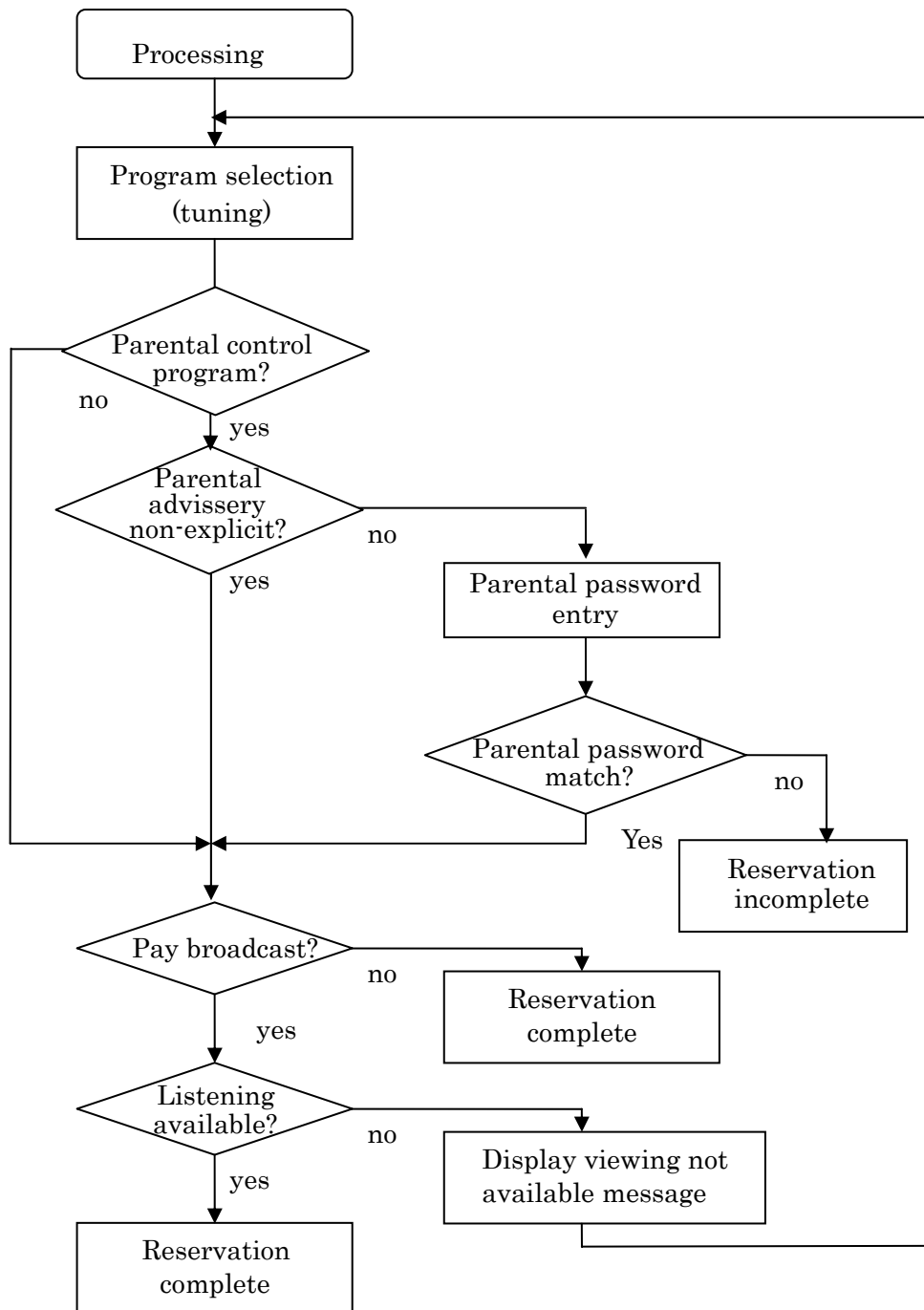


Figure 6-8 Example Program Reservation Flow

Note: For more information about the parental level and parental password settings, see “6.4.1.6 System Settings.”

6.4.1.3 Error Notification Display

(1) Password mismatch notification display

Functionality;

This display notifies the listener that the program is not available for listening due to a password mismatch.

Input/display fields;

Display indicating that the program is not available for listening due to a password mismatch

(2) Contract for the listening not available notification display

Functionality;

- a. This display notifies the listener when contract verification or other processing by the CA module indicates that the program is not available for listening.
- b. It is displayed under the following conditions:
 - When there is no contract (no Kw)
 - For flat rate pay program when there is no listening contract

Input/display fields;

- a. Display indicating that the program is contract required program
- b. Display of a message indicating the reason that the program is not available for listening depending on the response from the CA module
 - If the response from the CA module is “No Kw”: No contract
 - If the response from the CA module is “Flat contract expired”: Contract expired
- c. Display of a message encouraging the user to contact the Customer Center or other office for more information

(3) CA module error notification display

Functionality;

This display indicates that the CA module has failed and encourages the user to check the reception device due to the fact that some programs may not be available for listening depending on the terms of the user’s contract.

Input/display fields;

Display of a message encouraging the user to contact the Customer Center or other office and check the reception device.

6.4.1.4 CA Function Main Menu

- (1) Although functions are listed in a single menu, the composition of individual functions is not defined.
- (2) The menu provides the following functionality:
 - a. Display of the module ID
 - b. Display of mail messages
 - Display of mail message details (optional)
 - c. System settings
 - Password settings
 - Parental level setting

6.4.1.5 Module ID Display

Functionality;

This display indicates the CA module ID obtained from the CA module.

Input/display fields;

- a. Display of the module ID and a check code together as a 20-digit decimal numeric, separate into groups of 4 digits. This information is displayed as the module ID (17-digit decimal numeric) and a checkcode (3 digits), separated into groups of 4 digits.
- b. Display indicating that the module ID is being viewed

6.4.1.6 System Settings

- (1) Password setting

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

Input/display fields;

- a. When no password has been registered, first password registration
- b. When a password has already been registered, modification of the existing password after confirming the registered password
- c. When entering passwords do not match, display of a password mismatch notification

The following describes an example password settings processing flow:

Procedure

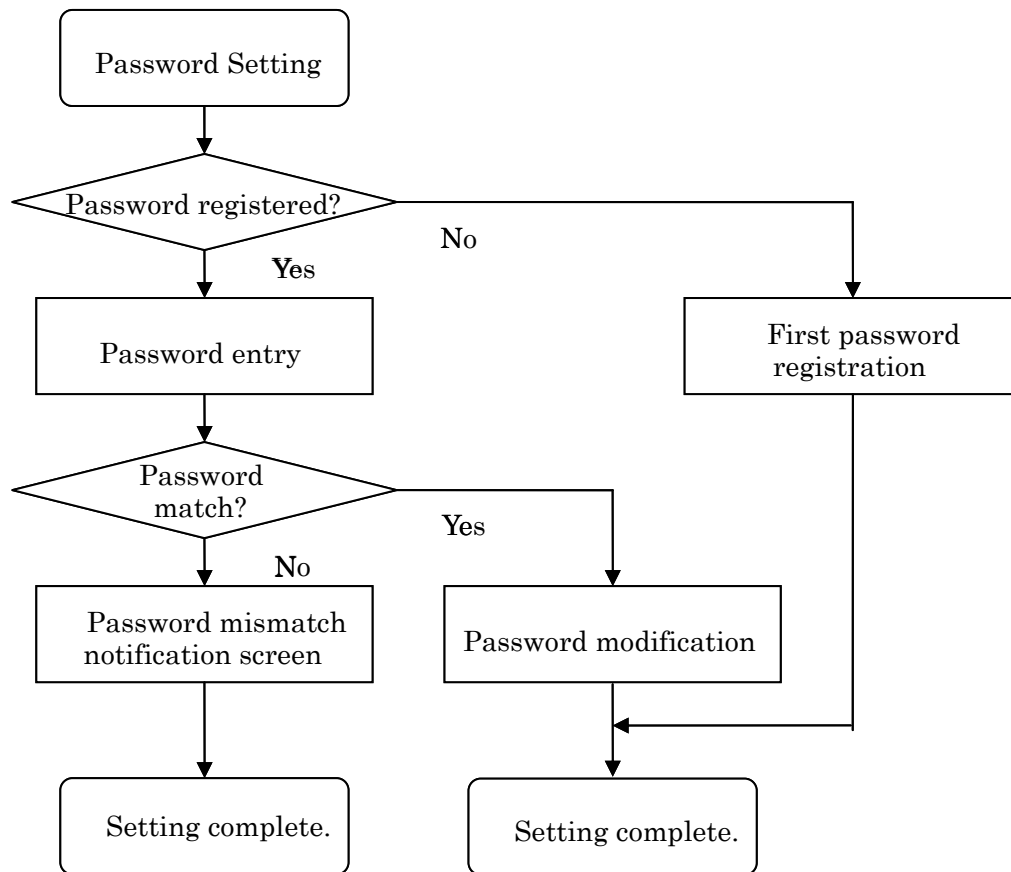


Figure 6-9 Example Password Setting Processing Flow

(1-1) First password registration function

Functionality;

This function registers first password when no password has been registered.

Input/display fields;

- Display indicating that first password is being registered
- Input of first password and display (blind display)
- Input to confirm the first password

- Input to accept and register the first password

(1-2) Password entry function

Functionality

This function accepts password input in order to configure system settings.

Input/display fields

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

(1-3) Password mismatch notification function

Functionality

- This function notifies the user that system settings cannot be configured because the entered password is incorrect.

Input/display fields

- Display indicating that system settings cannot be configured because the entered password is incorrect

(1-4) Password modification function

Functionality;

This function changes or deletes a previously registered 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 accept and register the new password
- Input to delete the password

(2) Parental level setting

- This function 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, first password registration
- Parental level settings when the passwords match or when first password registration
- When the passwords do not match, display of a password mismatch notification

The following describes an example parental level setting processing flow:

Procedure

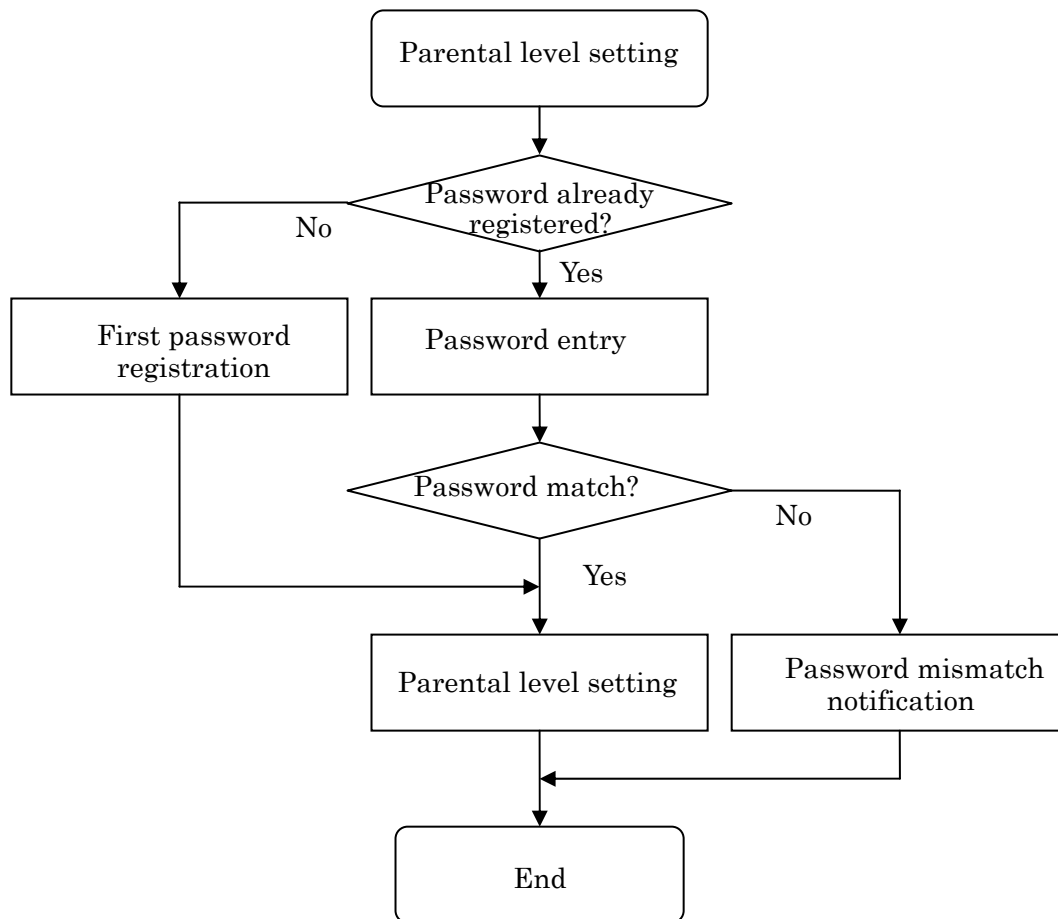


Figure 6-10 Parental Level Setting Processing

(2-1) Password entry function

Same as Section 6.4.1.6 (1) above.

(2-2) First password registration function

When no password has been registered, this function registers first password as described in Section 6.4.1.6 (1-1) above.

(2-3) Parental level setting function

Functionality;

This function sets the parental level stored by the reception device 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 operation to register the parental level

Optional field;

- Selection input to temporarily disable the parental control function

(2-4) Password mismatch notification function

- Same as Section 6.4.1.6 (1-3) above.

6.4.2 CA Interface

The CA interface must support the CA module defined in Section 6.4.3.

6.4.3 CA Module

This standard anticipates a variety of receiver types due to its assumption of a reception environments based primarily on mobile reception.

For this reason, it does not limit the CA module type.

Accordingly, the CA module specifications depend on required functionality, and the method

for defining the interface depends on the data whose input and output is required.

6.4.3.1 Functionality

The CA module includes the following functionality:

- Content separation and descrambling
- ECM-S extraction and processing including decrypting
- EMM-S extraction and processing including decrypting

Figure 6-11 provides an overview of the CA module.

6.4.3.2 I/O Signals

(1) Input packets

MPEG-2 TS packets including the following:

- Content subject to descrambling
- ECM-S, EMM-S

Note: It is not necessary to structure a complete MPEG-2 TS.

(2) Output packets: MPEG-2 TS packets including descrambled content

Note: It is not necessary to structure a complete MPEG-2 TS.

Control data: The module inputs and outputs the following:

(3) Control data input

- PID scope subject to descrambling
- PIDs for ECM-S and EMM-S messages
- CA module ID output instructions
- (Optional) SI contract verification information

(4) Control data output

CA module ID and information for verification the following listening:

- Available for listening: The program in question is a subscription program.
- No Kw: No contract
- Flat rate program no contract: Flat rate pay program for which there is no listening contract

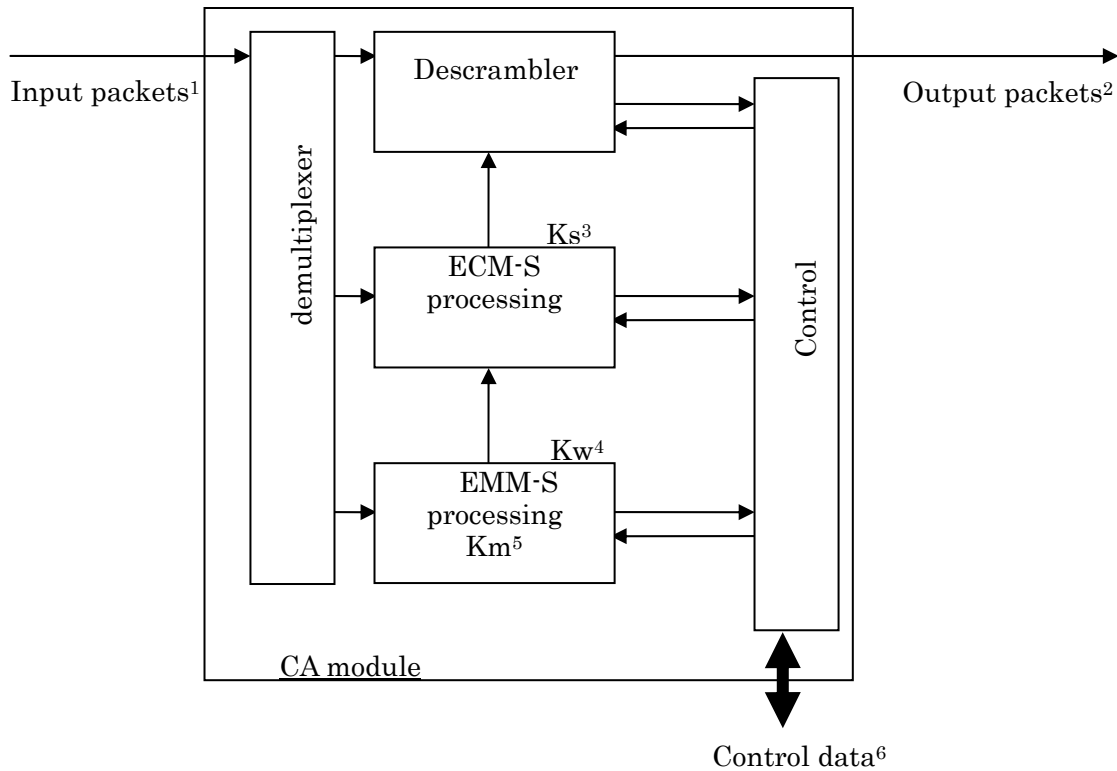


Figure 6-11 CA Module Overview

¹MPEG-2 TS packets including the following:

- Content subject to descrambling
- ECM-S, EMM-S messages

It is not necessary to structure a complete MPEG-2 TS.

²MPEG-2 TS packets including descrambled content

It is not necessary to form a complete MPEG-2 TS.

³Scramble key

⁴Work key

⁵Master key

⁶Includes the following I/O:

Input: PID scope subject to descrambling
 PIDs for ECM-S and EMM-S
 (Optional) SI contract verification information

Output: CA module ID

Information for verification the following listening :

- Available for listening: The program in question is a subscription program.
- No Kw: No contract
- Flat rate program no contract: Flat rate pay program for which there is no listening contract

6.4.4 Relationship to SI

Descriptors are included in either the SDT or EIT for checking whether a program scheduled for pay broadcast can be reserved for viewing (recording) in advance.

(1) Descriptor name

CA contract information descriptor (CA_contract_info_descriptor)

(2) Descriptor location

The provisions of Chapter 4 of this standard apply.

(3) Data structure

The provisions of Chapter 4 of this standard apply.

his standard apply.

Part 1

References

Reference 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 an broadcaster group consists of a single enterprise, individual operation applies;

If an broadcaster group consists of multiple broadcaster, 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 shared message, and

2) EMMs individual message.

- The “EMMs individual message” transmits designated information for individual viewers, and the “EMMs shared message” transmits messages common to all receiver units (preset texts).

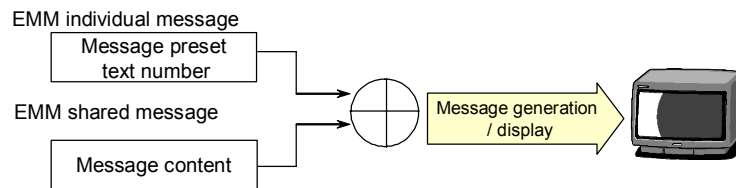


Figure A1-1. Overview of EMM Message

- By sending the difference from the message content (preset text) of EMMs shared message in EMMs individual message, a message consisting of the preset texts and the difference is displayed.
- Any combination of preset texts and differences would be possible. If you transmit with EMMs individual message only, without using any preset texts, a 100% individual message would be displayed.

2.1.2 EMM shared message

- Receivable at all receiver units.
- Transmits such message information as preset texts, 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 shared message (the message preset text 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 base 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.

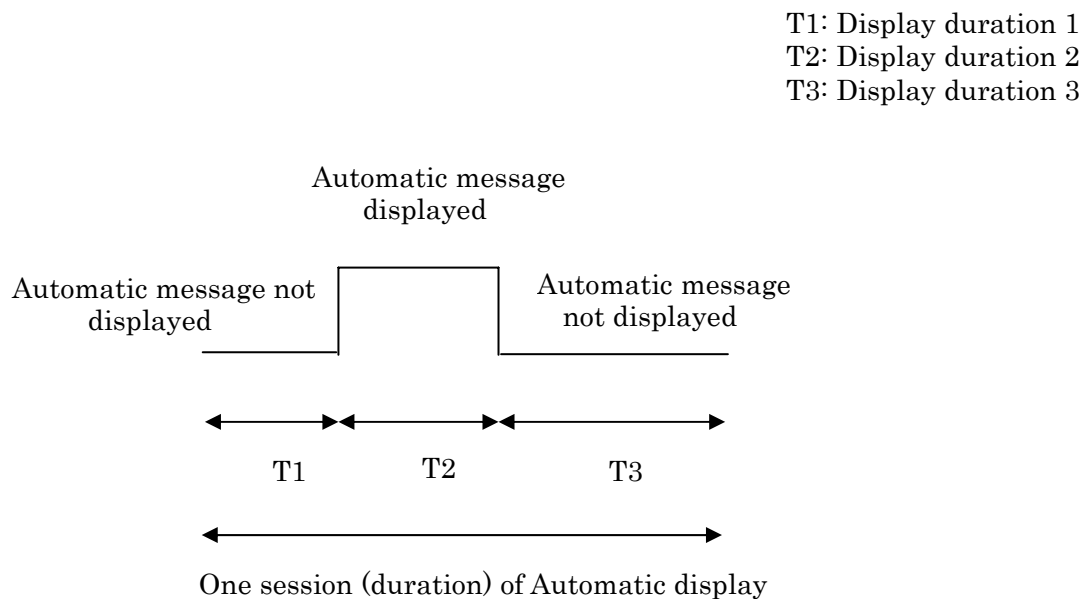


Figure A1-2. Display duration of Automatic display, and the message display status on receiver unit

- 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 shared 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 shared message will be excluded from the display list of automatic display. DIRD shall monitor

the version number of EMMs shared messages on automatic display, and detect any updates.

- If automatic display message with the message preset text 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. Application of the CAS-R system to data broadcasting

3.1 Applicable data broadcasting services

3.1.1 Video service

The same conditions as for HDTV/SDTV (hereafter “TV service”) shall apply to the billing, copy control, and other conditions for the data broadcasting for continuous video and sound transmission. Table A1-1 indicates the billing methods.

Table A1-1. Billing for stream-type data broadcasting

Data type	Billing	Scrambling (encryption) system and the processing unit	CAS processing	Charging timing (when the fee is settled)
Stream-type data service	Flat rate	MULTI2 (Notification) receiver unit	IC card	At application
	PPV	MULTI2 (Notification) receiver unit	IC card	At the collection of viewing information
File-type data service		File-type data services are excluded.		

3.1.2 Combined service

For data broadcasting transmitted in the same channel as TV service, the fee can be charged separately, regardless of the scrambling status of the TV service. In this case, ECMs should be transmitted as follows.

(1) How to transmit ECMs:

- Designate a Packet Identifier (PID), which transmits ECMs in the CAS descriptor, placing the ECM for video and sound service in the descriptor area 1 of the Program Map Table (PMT).
- Designate a PID, which transmits ECMs in the CAS descriptor, placing the Elementary Stream (ES) for the relevant data broadcasting service in the descriptor area 2 of the PMT.
- The ECMs of the data service and the relevant ES are associated by the descriptor placed in the area 2 of the PMT. If data service only is scrambled, a CAS descriptor is not required in the area 1 of the PMT. In this case, the reception rate of video and sound service only might be enhanced, depending on the transmission interval of ECMs.
- The ES to be scrambled in video and sound service is the remnant after subtracting the ES for data service (i.e. those with the CAS descriptor in the area 2 of the PMT) from the whole. For ES to be excluded from scrambling, input “00” for the two bits of

scrambling flag in the TS packet header.

→ The procedures vary between the video and sound service, and the data service.

(2) Descrambling

This system basically supports the distribution of ECMs on DIRD, etc.

- Select required service on DIRD.
- DIRD sends the ECMs (multiple PIDs) of the selected service to the card.
- The card returns Ks to DIRD, as usual.
- DIRD sets Ks as the descrambler, in proportion to the arrangement of descriptors in the areas 1 and 2 of the PMT.

(3) Processing burden

- You can respond to the problem of processing burden, by allocating respective descriptors to individual ESs comprising data service.

→ The larger the number of ESs grows, the more descriptors you will need. (This would not cause a major problem.)

- Because the two ECMs are sent with different PIDs, you will need multiple PIDs.
- The updating interval for ECMs sent with the same PID should be minimum one second per PID.

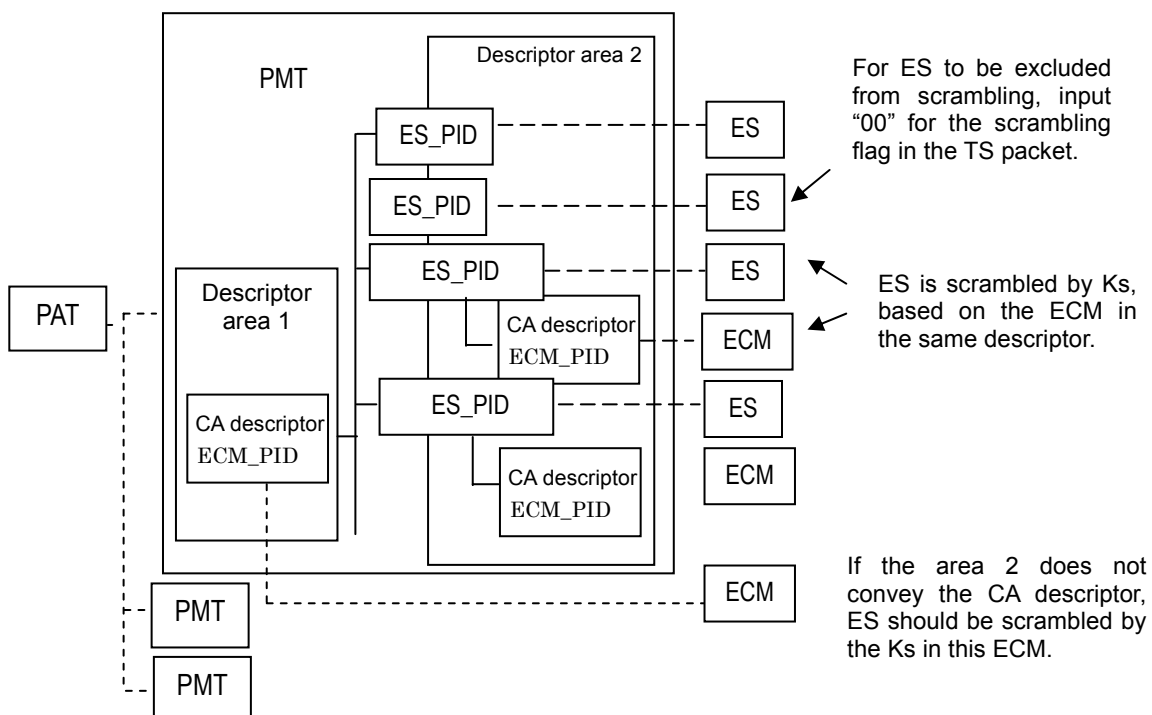


Figure A1-3. How to transmit ECM

3.1.3 Accumulation service

Billing is available for stream-type service based on accumulation. The same descrambling procedure and charging timing as for combined service apply. See Table A1-1.

4. 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.

4.1 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.

4.2 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 Reference 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 is shared by multiple broadcaster, 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.

4.3 Transmission by the specific stream

- (1) Benefits
 - i) Efficient transmission and reception of EMMs is 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

5. 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.

5.1 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 conditions 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]

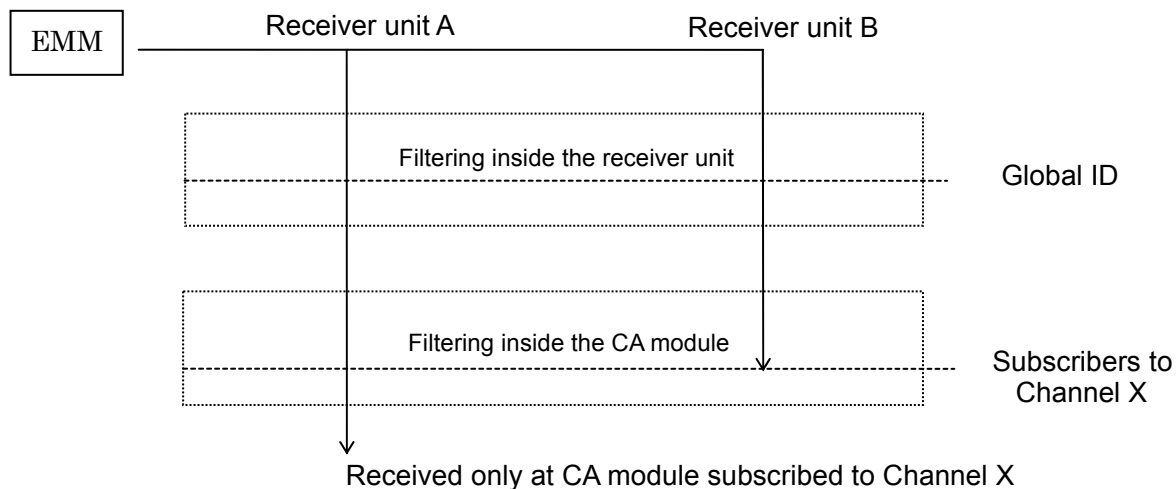


Figure A1-4. Example of applying global ID

5.2 Points of notice

5.2.1 Applicable service

EMMs equipped with global ID (hereafter “global EMMs”) are 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.

5.2.2 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.

5.2.3 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.

6. 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 CA 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.

7. 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.)

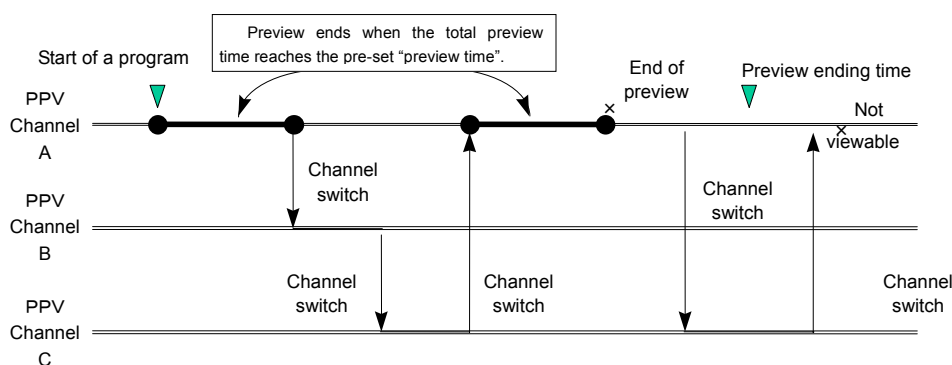


Figure A1-5. Example of preview patterns

(Example 4) Preview is unavailable

Preview is made unavailable, by the following setting:

Total preview time: 0 minute

8. 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

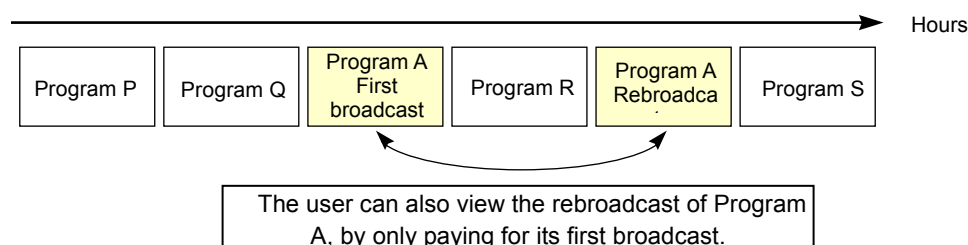


Figure A1-6. No charge for rebroadcasting of the same PPV program

Example 2: Paying in package for a series of PPV programs

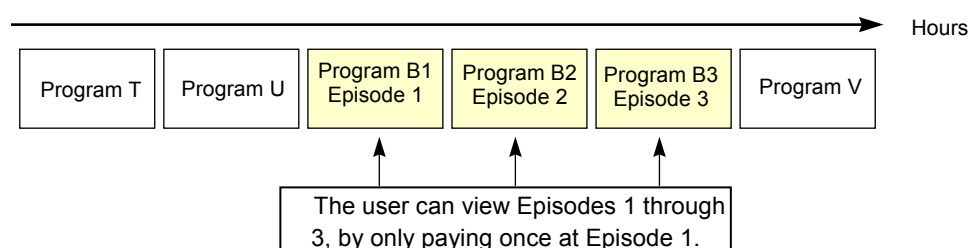


Figure A1-7. Paying in package for a series of PPV programs




9. 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.

9.1 Card insert / power on

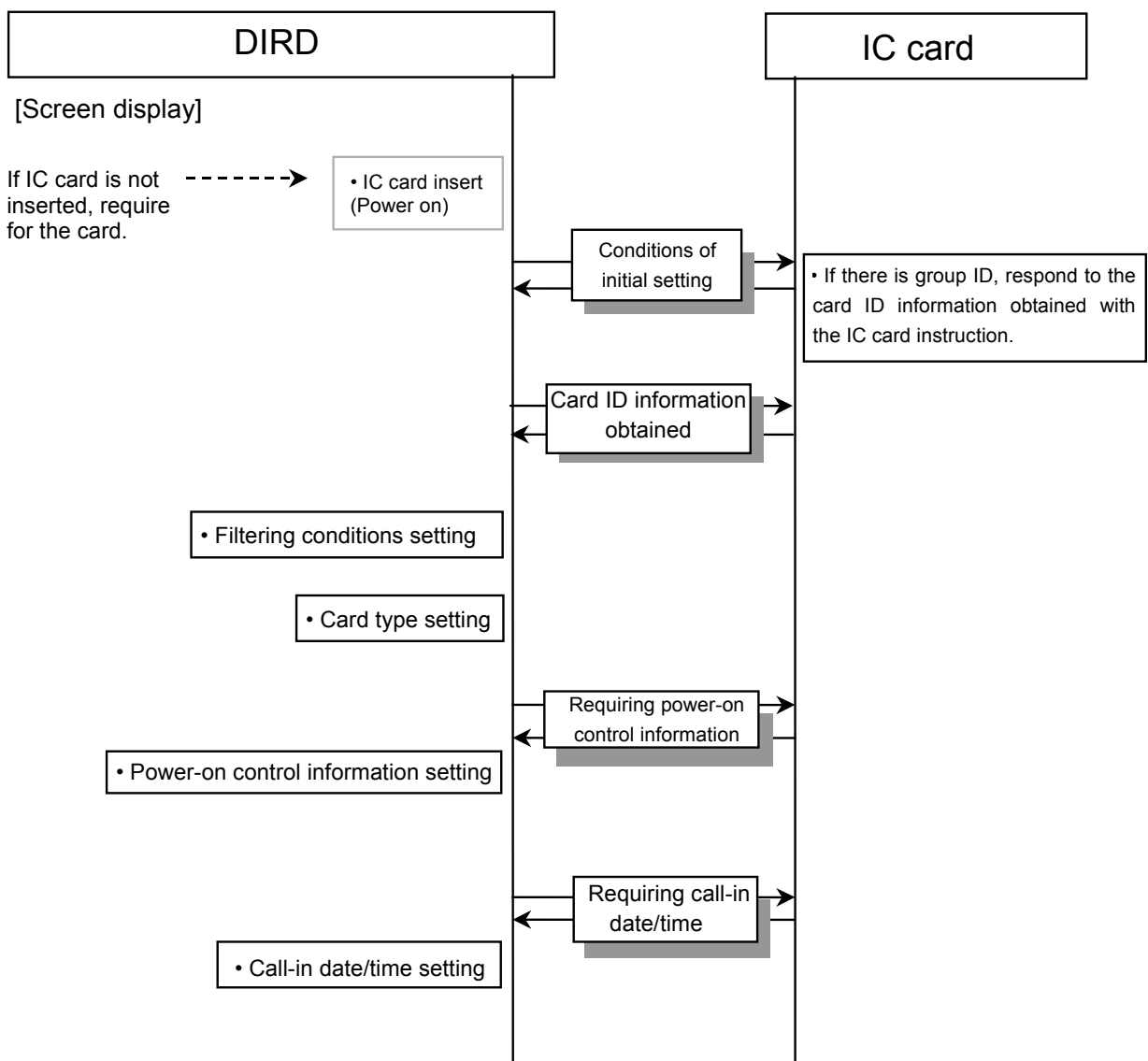


Figure A1-8. Card insert / power on

9.2 Updating group ID

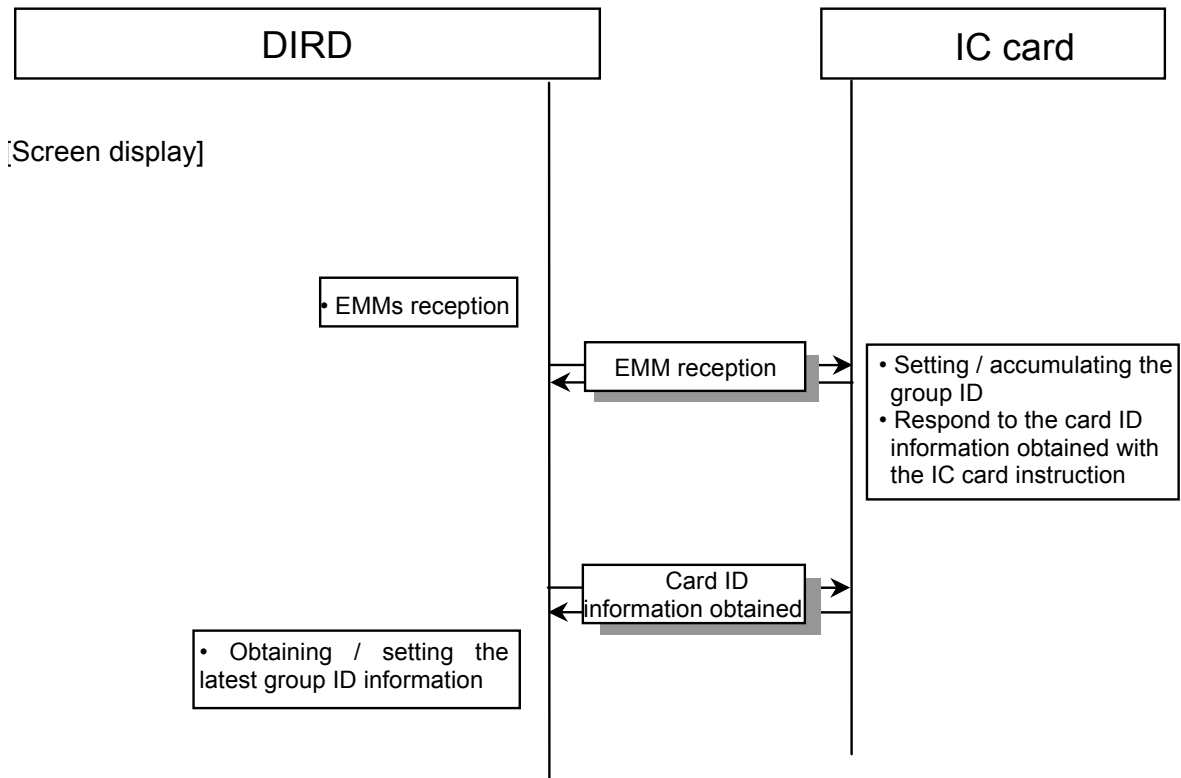


Figure A1-9. Updating group ID

9.3 ECMs reception (tier)

Note: For operations following the IC card instruction in ECM reception, see “9.5 EMM reception.”

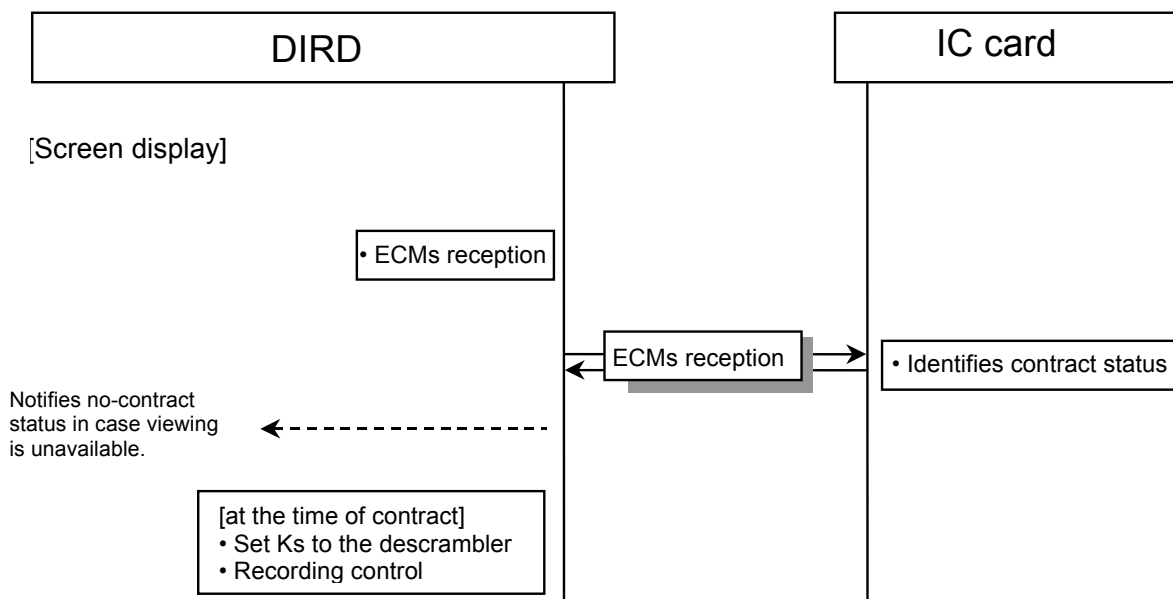


Figure A1-10. ECMs reception (tier)

9.4 Purchase of PPV program

Note: For operations following the IC card instruction in ECMs reception, see “9.5 EMMs reception.

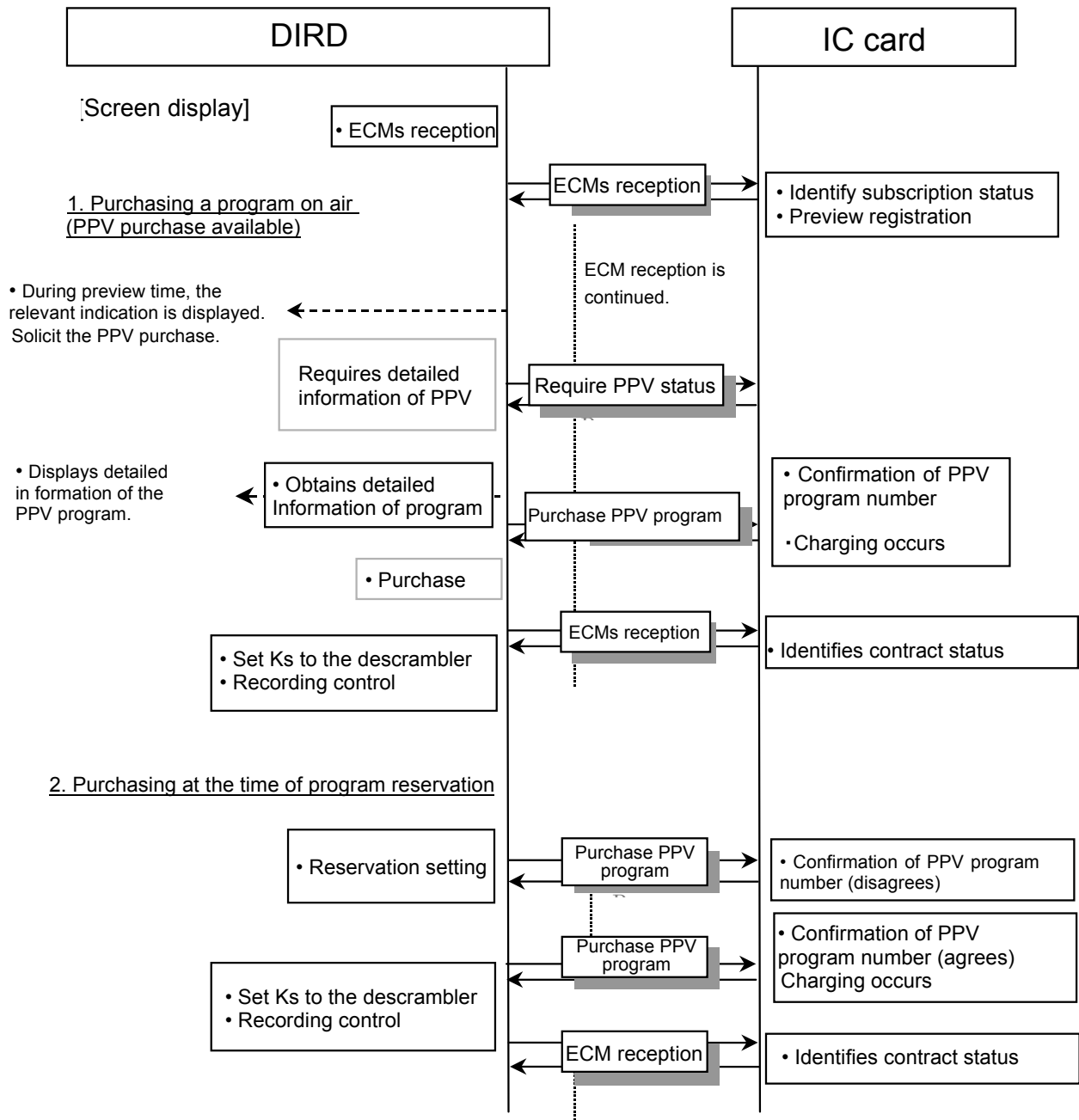


Figure A1-11. Purchase of PPV program

9.5 EMMs reception

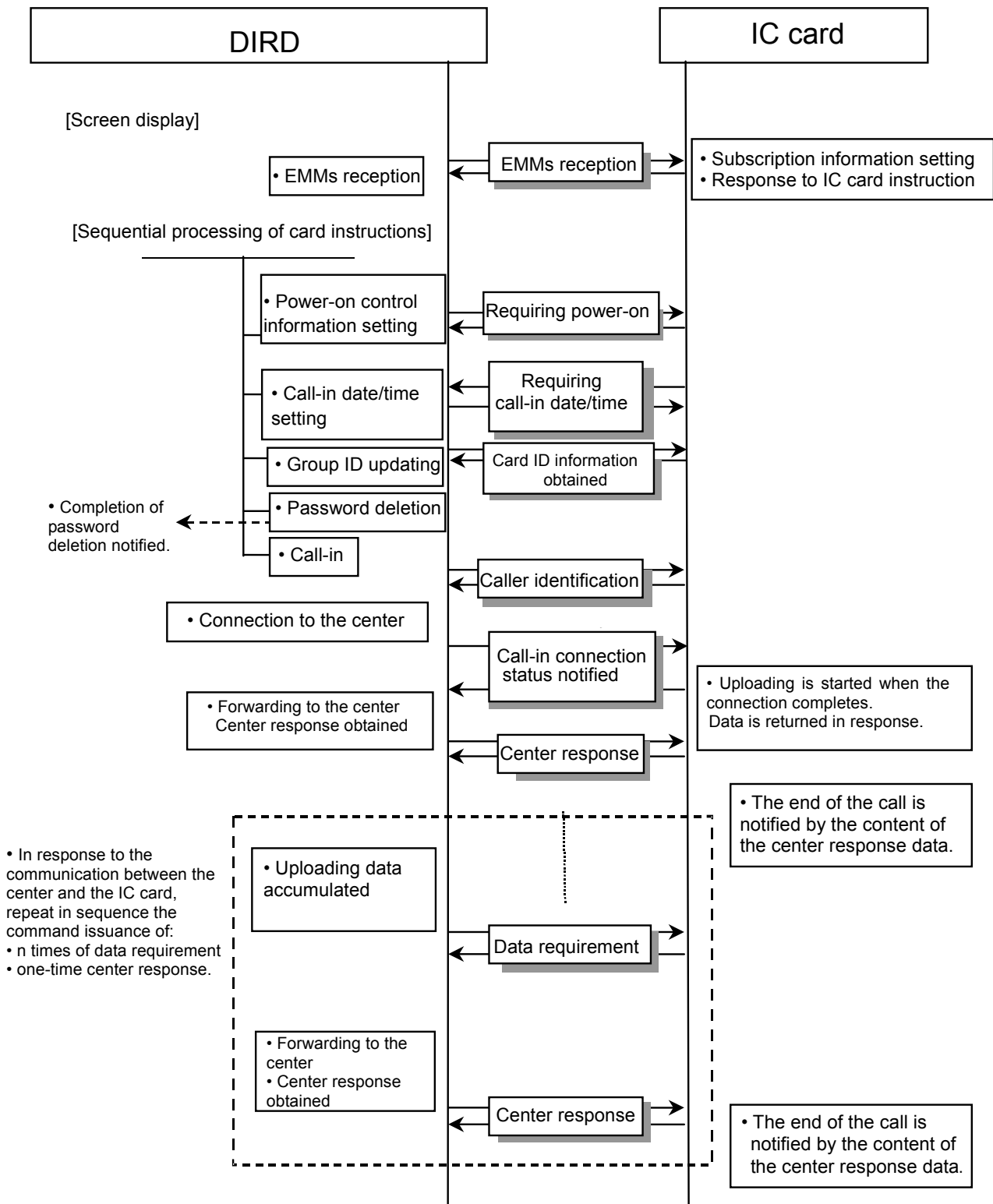


Figure A1-12. EMMs reception

9.6 Confirming subscription

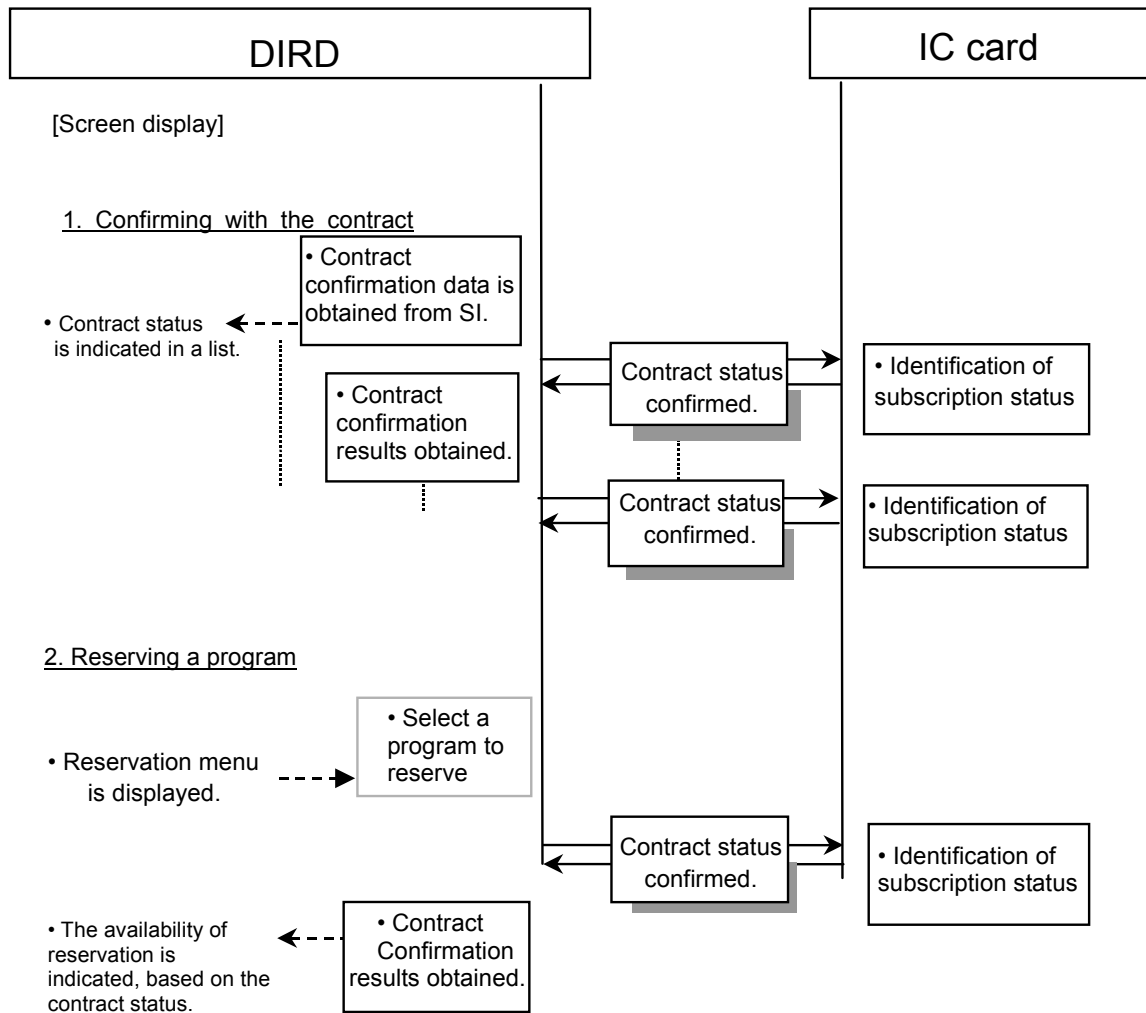
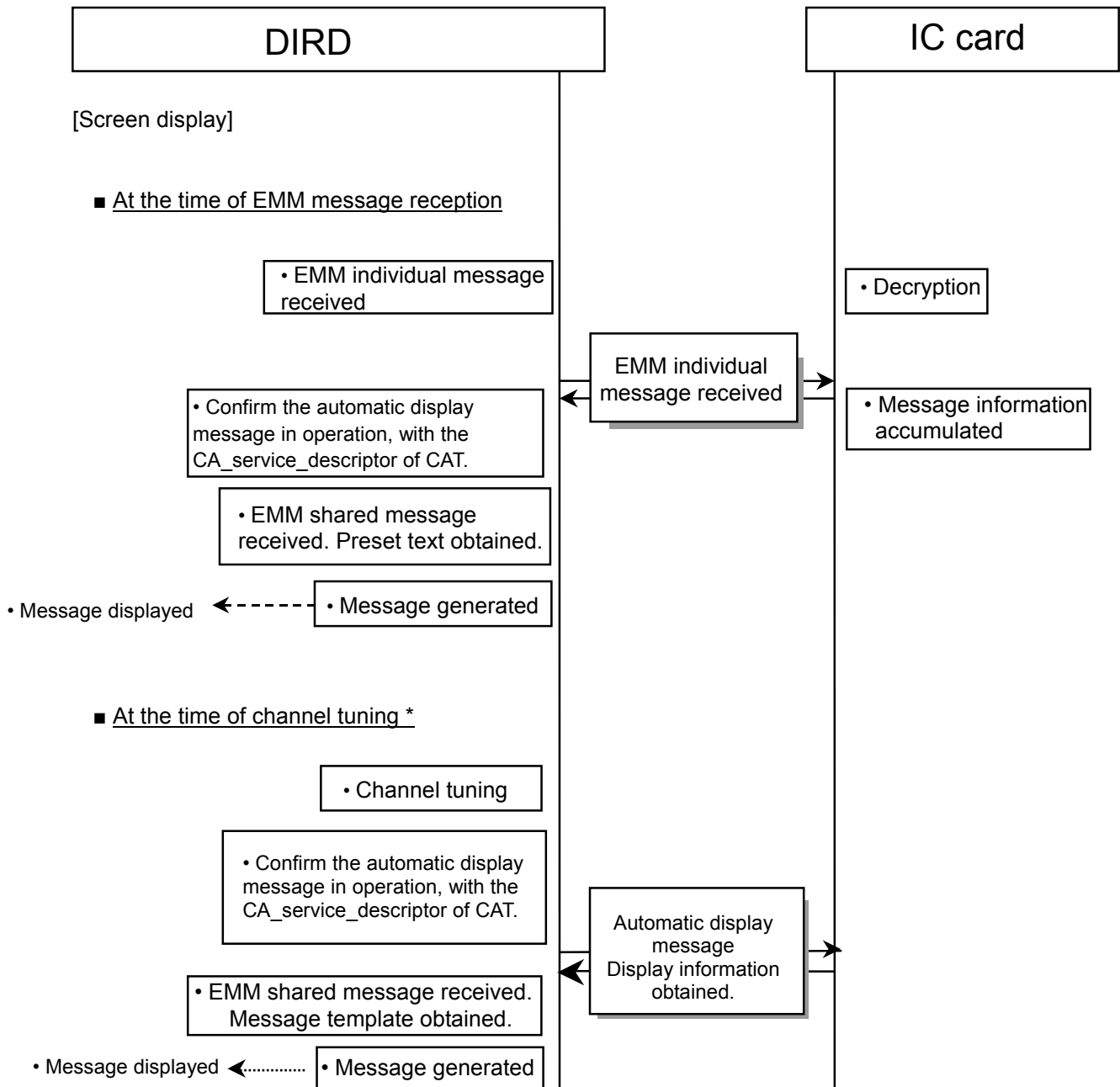


Figure A1-13. Contract Confirmation

9.7 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)

9.8 EMM message reception / display (Mail)

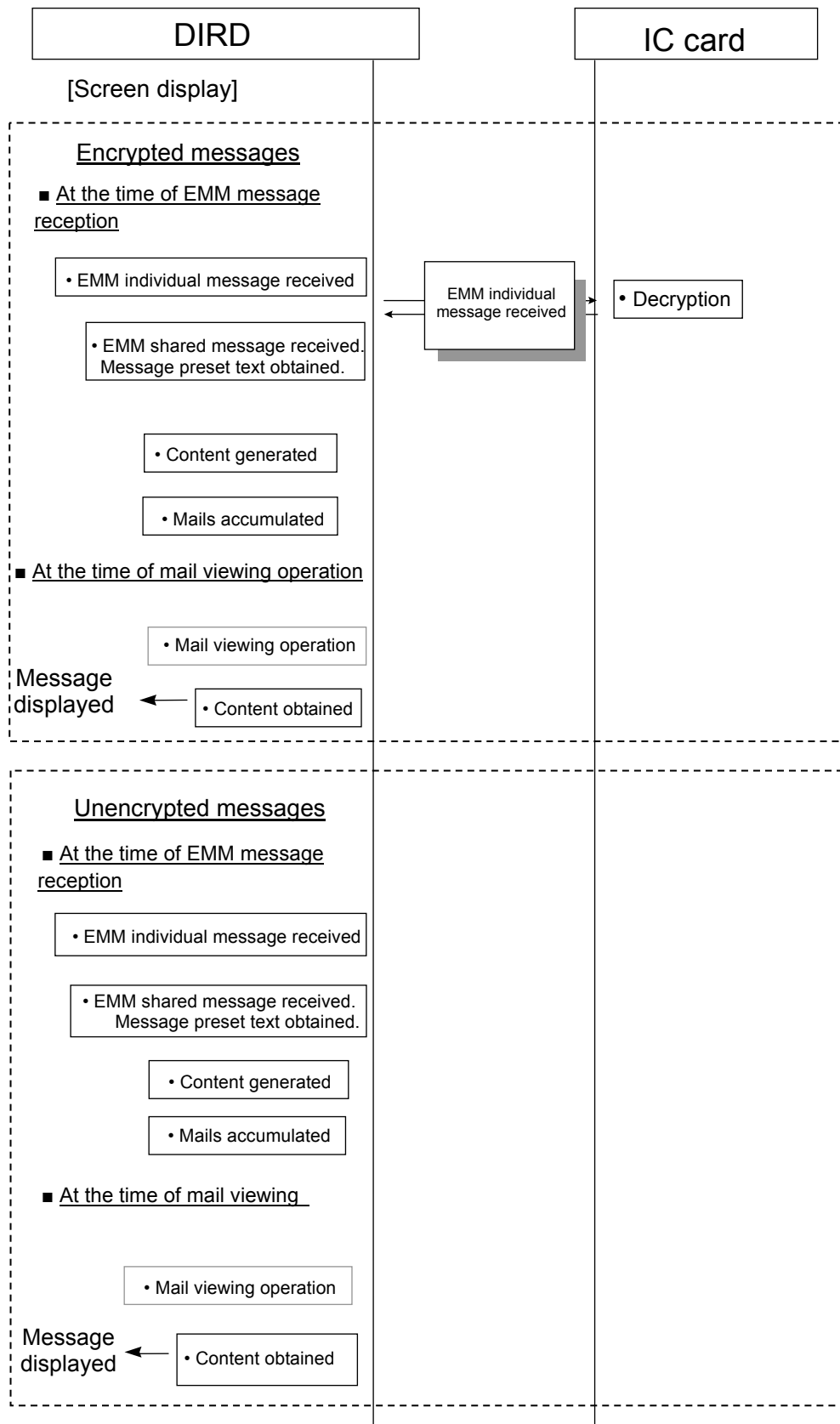


Figure A1-15. EMM message reception / display (Mail)

9.9 Communication call to the viewing information collection center (if there is uploading data)

If there is uploading data, the following operation scenario applies.

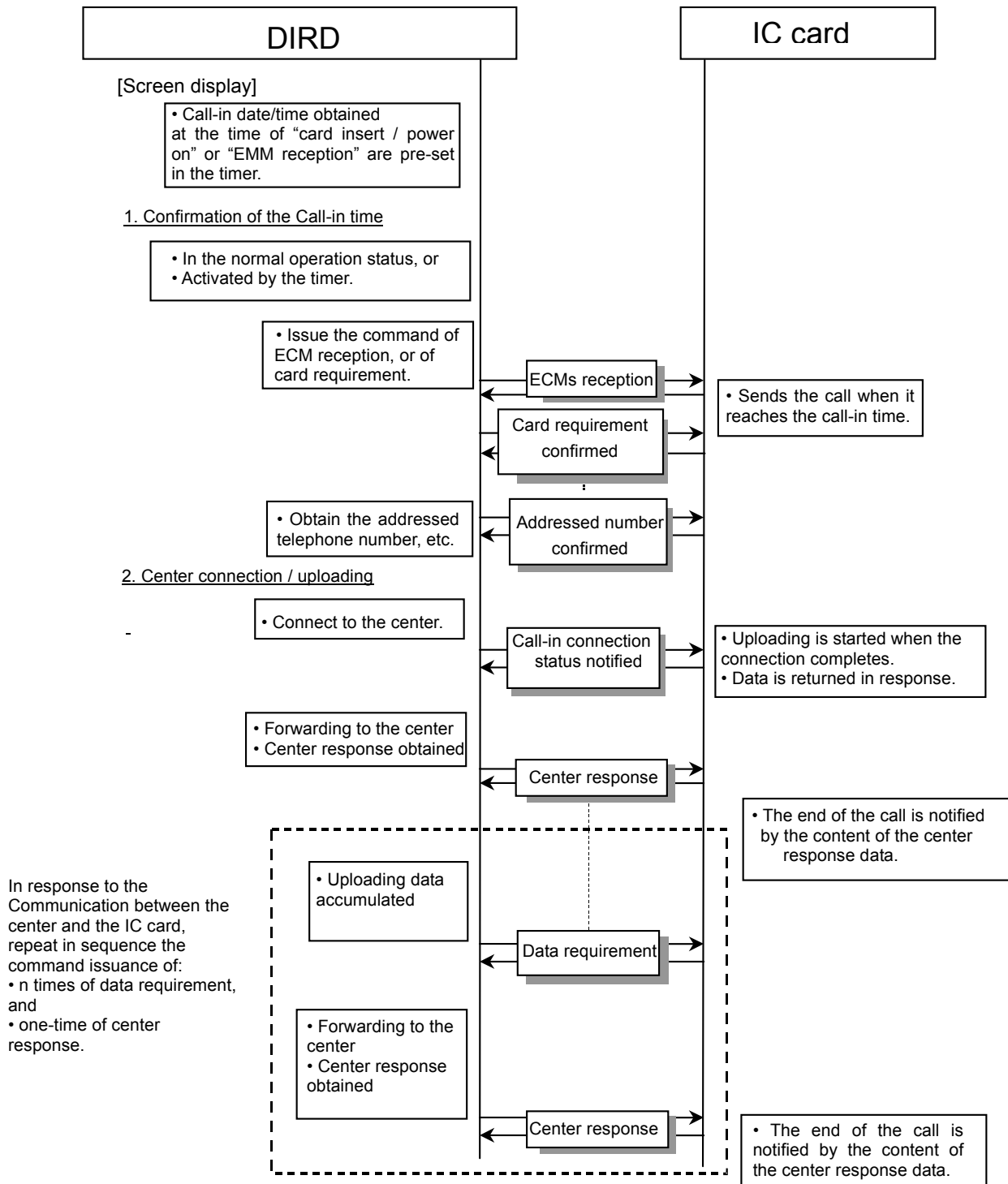


Figure A1-16. Communication call to the viewing information collection center (if there is uploading data)

9.10 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.

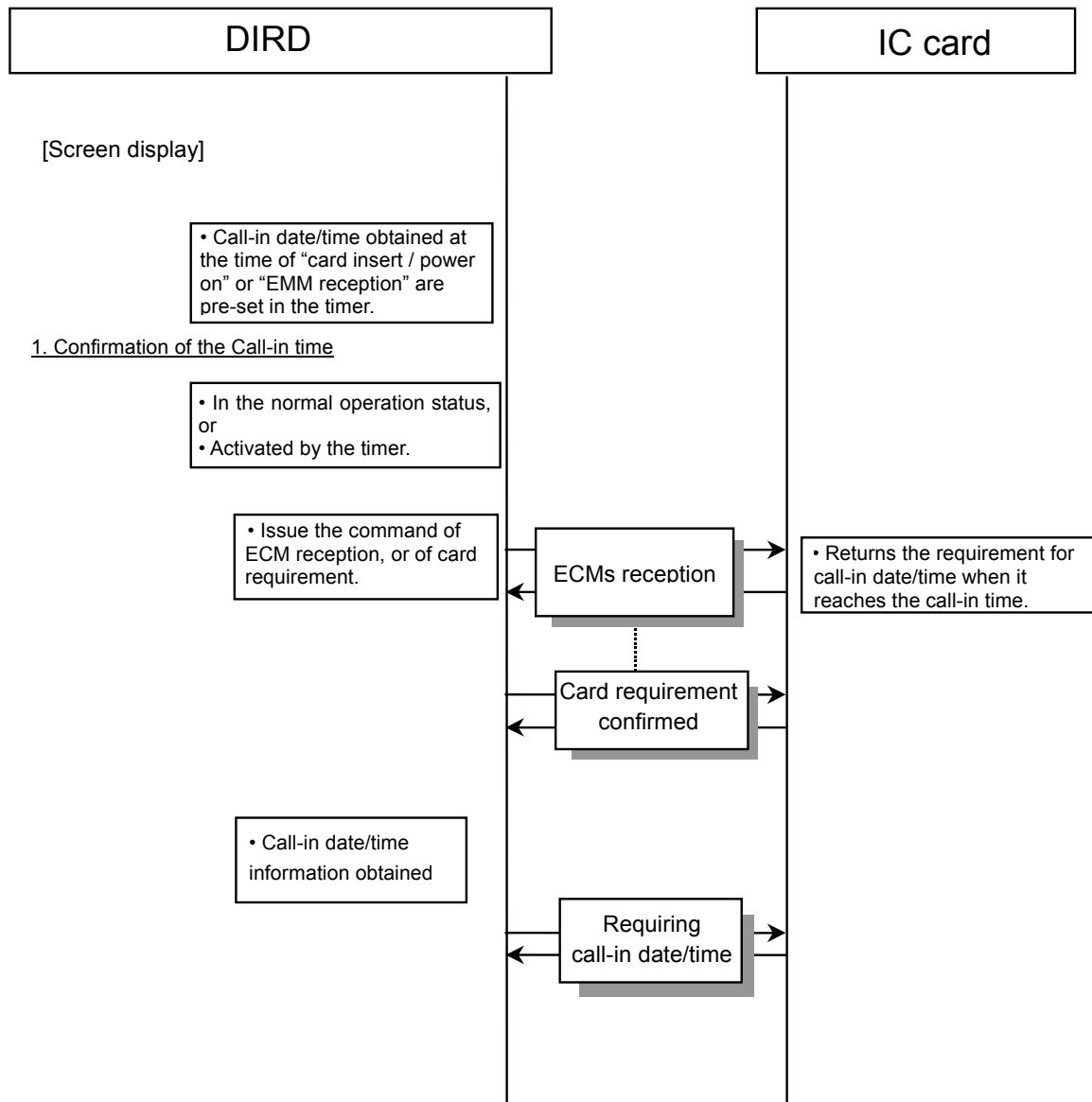


Figure A1-17. Communication call to the viewing information collection center
(if there is no uploading data)

9.11 DIRD data transmission

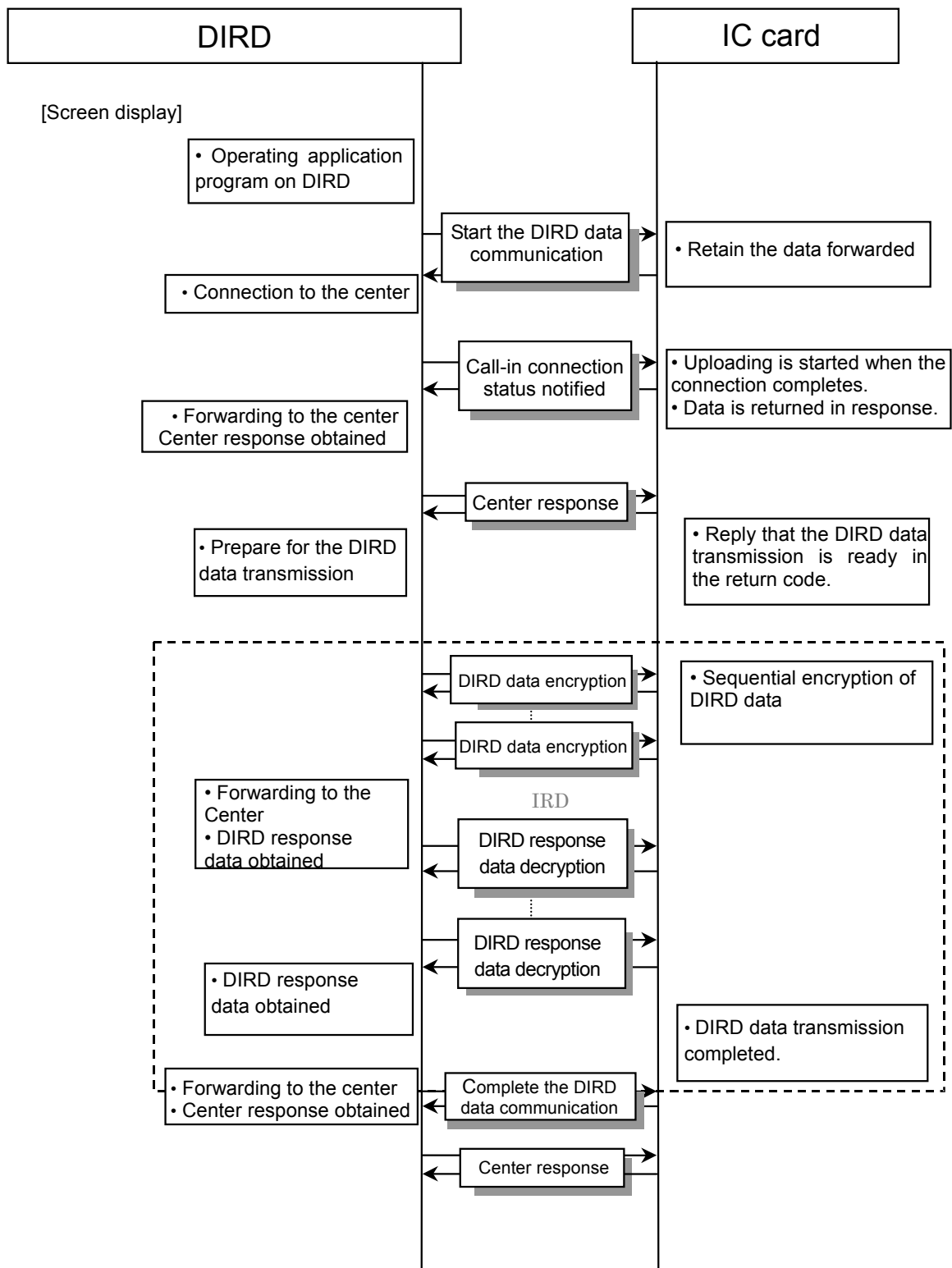


Figure A1-18. DIRD data transmission

9.12 Confirming the balance of advance payment

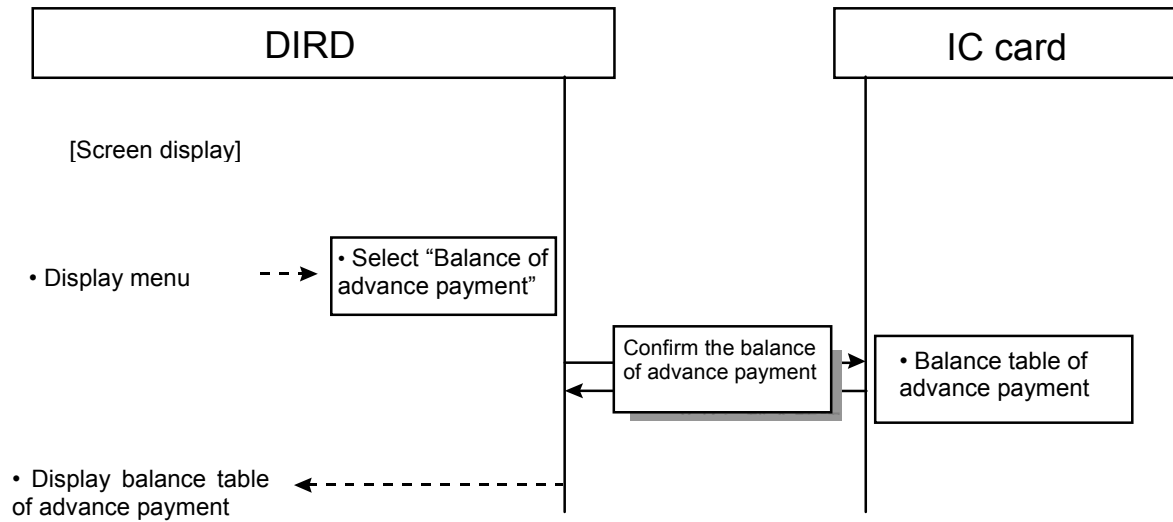


Figure A1-19. Confirming the balance of advance payment

9.13 Obtaining card ID information

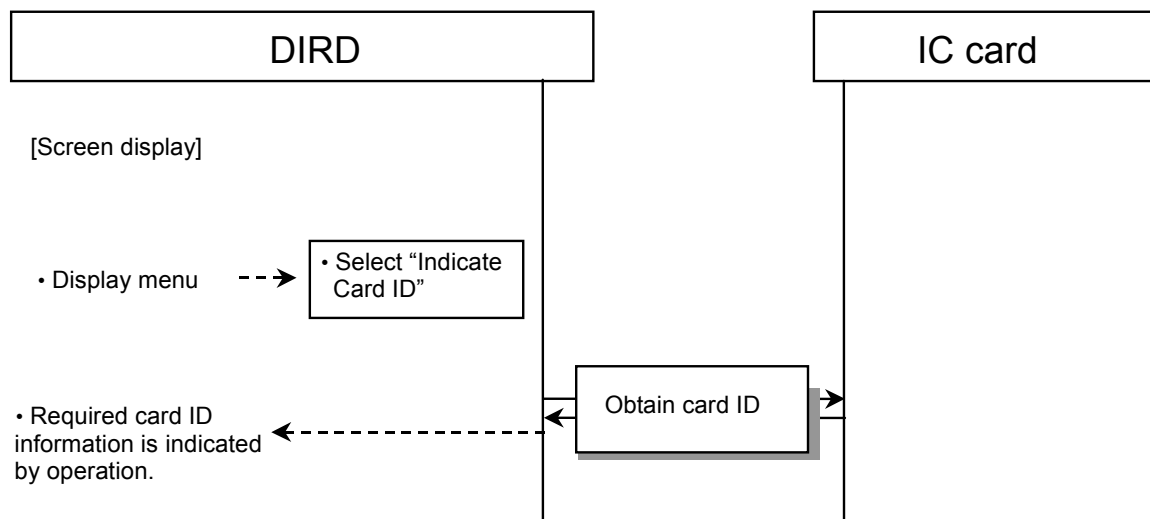


Figure A1-20. Obtaining card ID information

9.14 User call-in

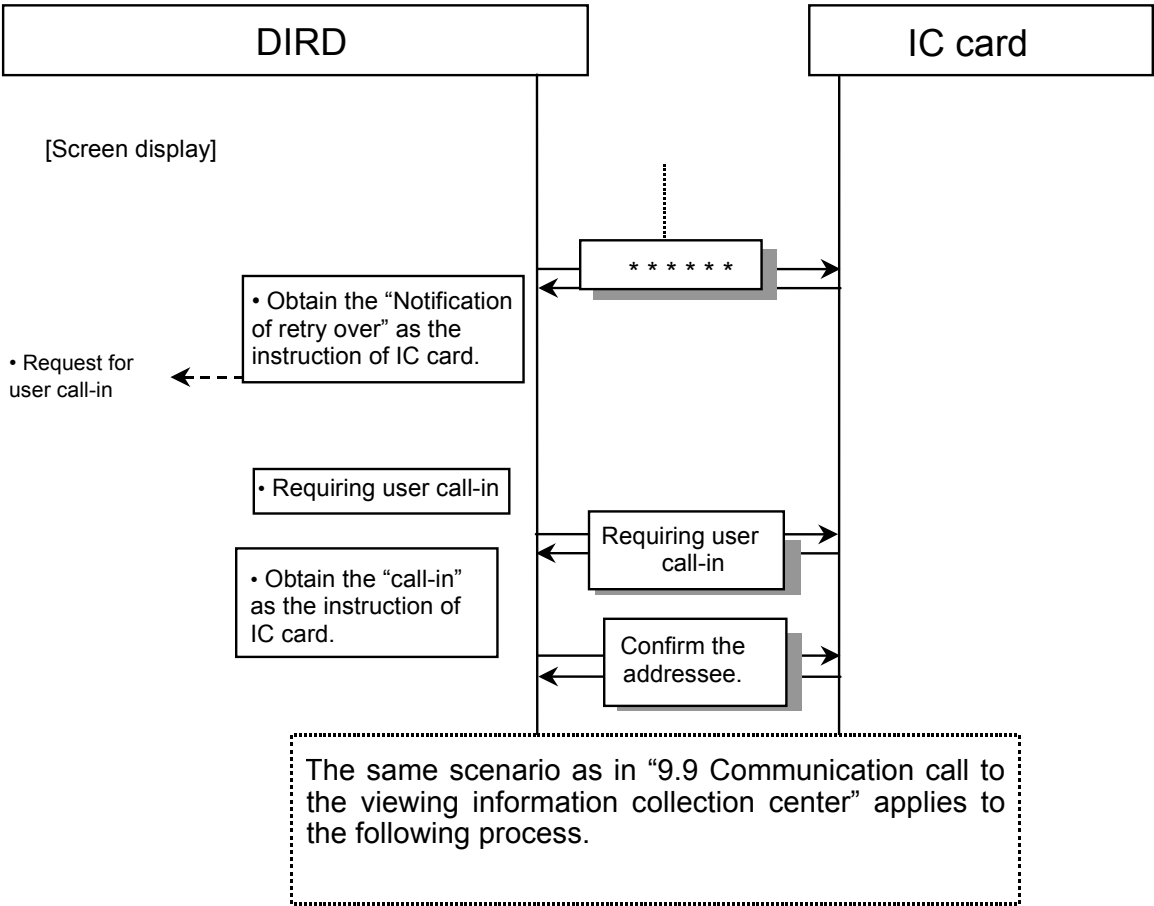


Figure A1-21. User call-in

10. 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 scramble 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).”

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Reference 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 modeled receiver unit for each item of the functional specifications. This part comprises three sections: Sections 1 and 2 define terminology and statuses for the modeled receiver unit, and Section 3 describes operations of the modeled receiver unit. The modeled 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 modeled unit are described 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 processings 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.

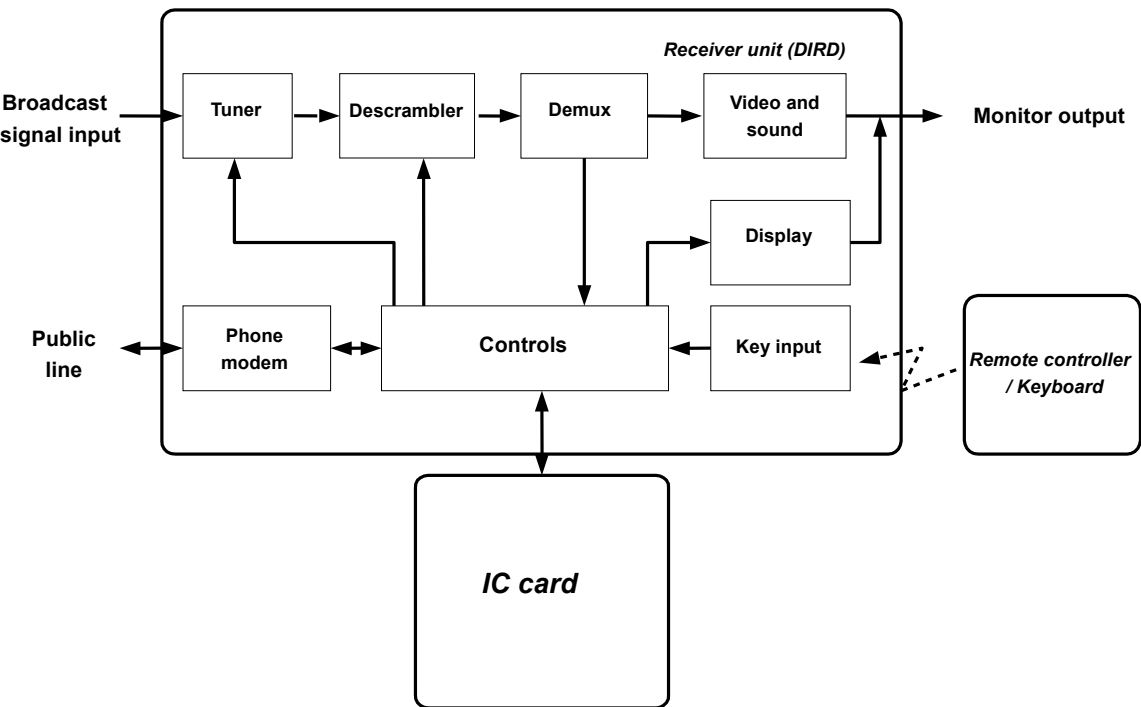


Figure A2-1. Basic configuration of the receiver unit

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.

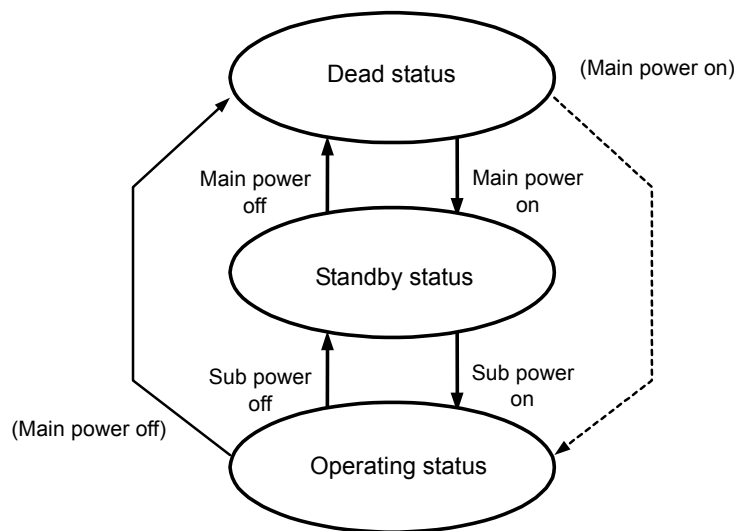


Figure A2-2. Statuses of the receiver unit

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.

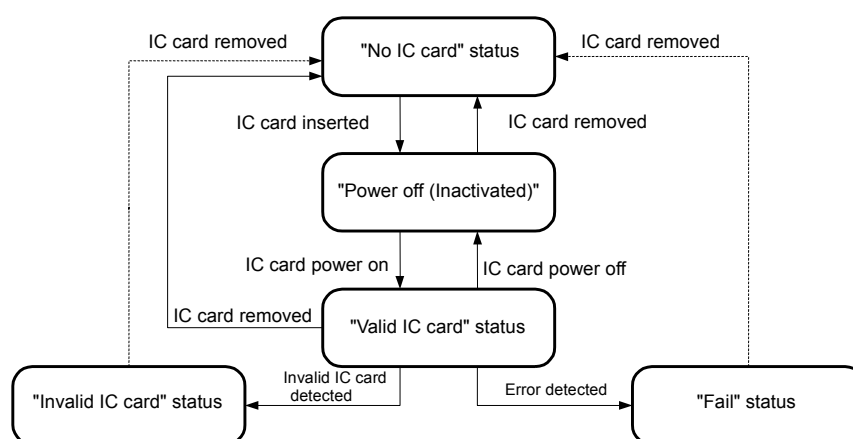


Figure A2-3. Statuses and status transitions of IC card

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 default 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 flag and values of the adaptation field control in the TS packet header to be input.

3.4.2 Processing scrambling flags on Descrambler

- If the scrambling flag indicates “Not scrambled,” the stream should be released regardless of the TS packet ID and the scrambling key provided.
- The state of the scrambling flag 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 default 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.

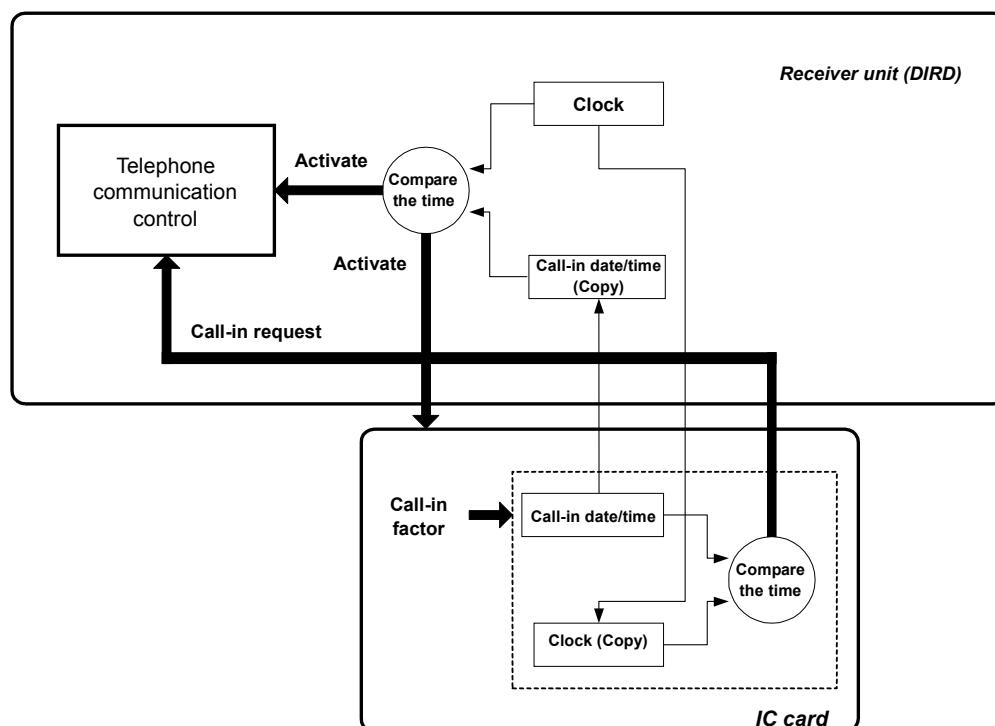


Figure A2-5. Power-on call-in current control

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.

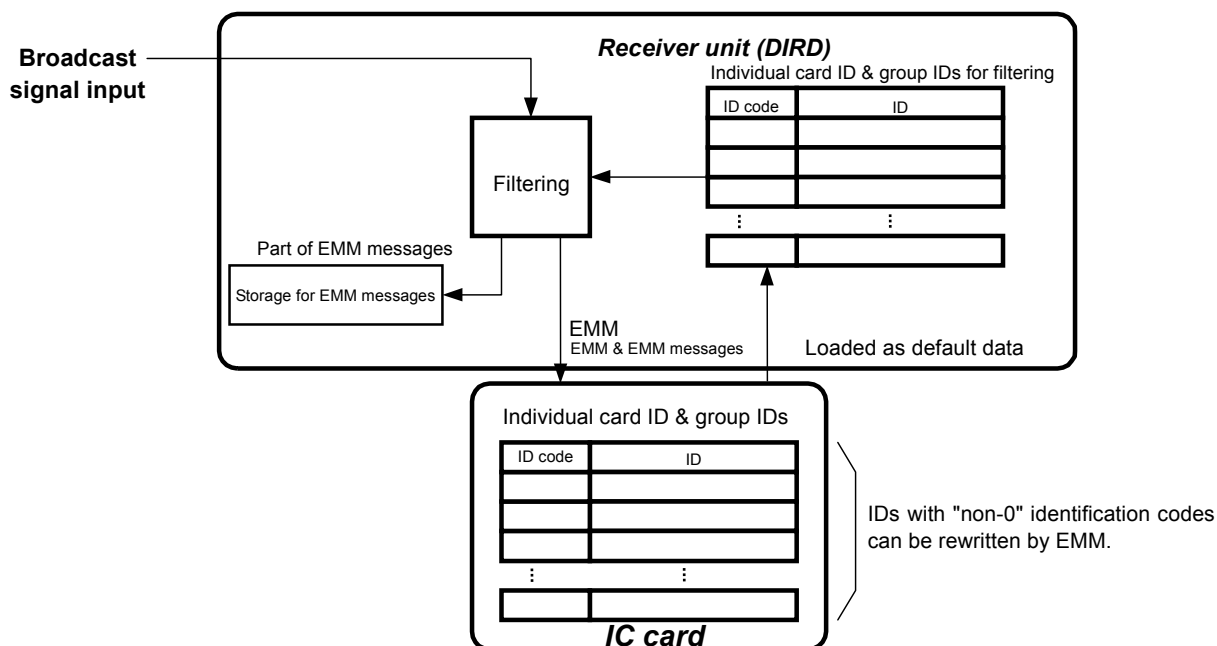


Figure A2-6. ID control

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 shared 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 shared message only from the replay signal, but does not obtain EMM individual messages. The EMM shared 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 shared message

- One EMM shared 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 shared message

- Reads in the value of table_ID_extension as a preset text 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 preset text is designated, the receiver unit receives the corresponding EMM shared 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 sequencetially 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.

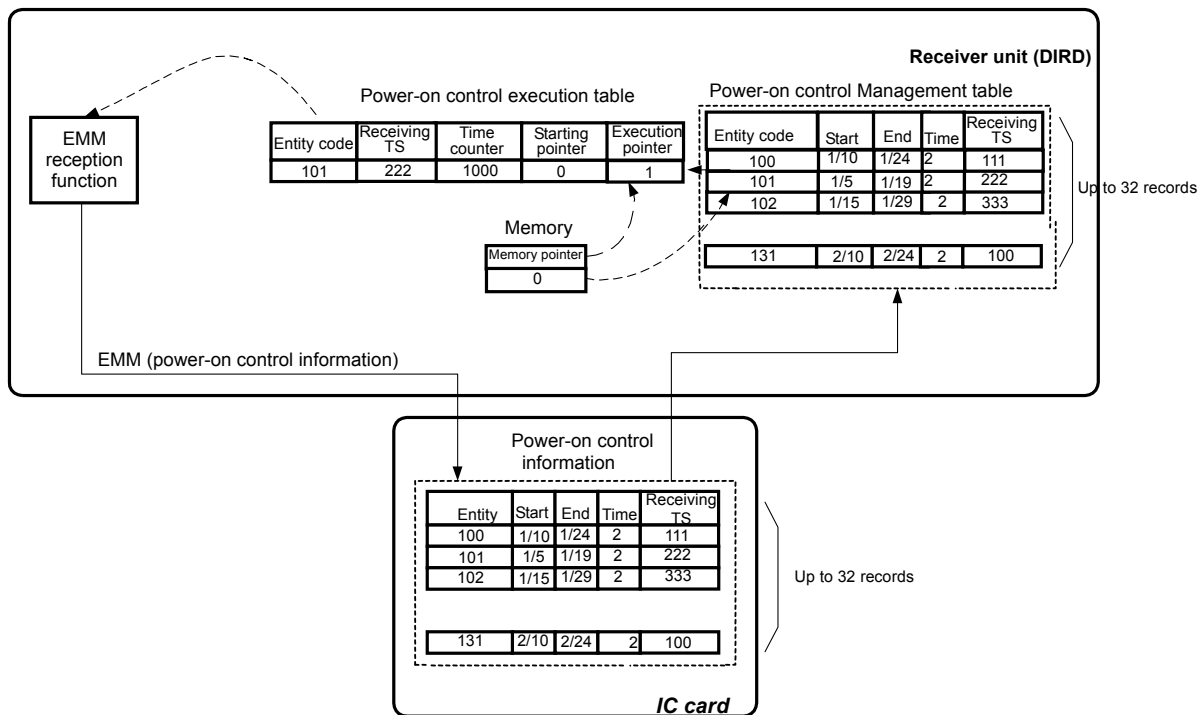


Figure A2-7. Example of the schedule management for power-on control

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 are 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 shared 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.

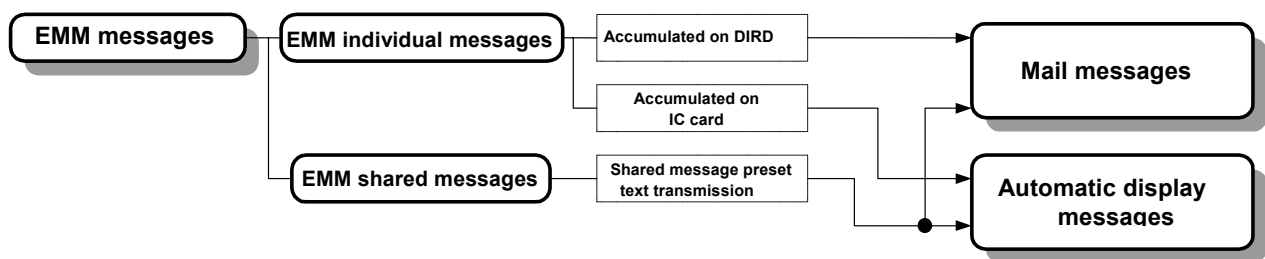


Figure A2-8. EMM message scheme

[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 preset text and difference data, and b) an EMM shared message, which conveys the preset text.
- The EMM individual message includes a unique identifier which comprises “Entity identifier + Message ID,” and enables message reception only once even if the same message has been sent for multiple times.
- The EMM shared 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 shared message is transmitted repeatedly, and is taken in at the execution of display process.

IC card

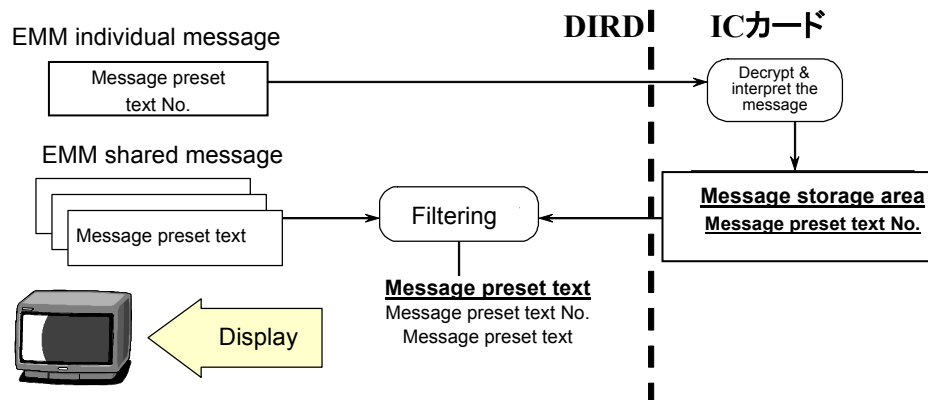


Figure A2-9. Automatic display message

[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 preset text number; and 2) Transmitting both a) the EMM individual message, which is accumulated on DIRD and conveys a pointer to a preset text and difference data, and b) the EMM shared message, which conveys the preset text.
- The EMM individual message includes a unique identifier which comprises “Entity 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 shared message is transmitted repeatedly, and is taken in at the execution of memory process.

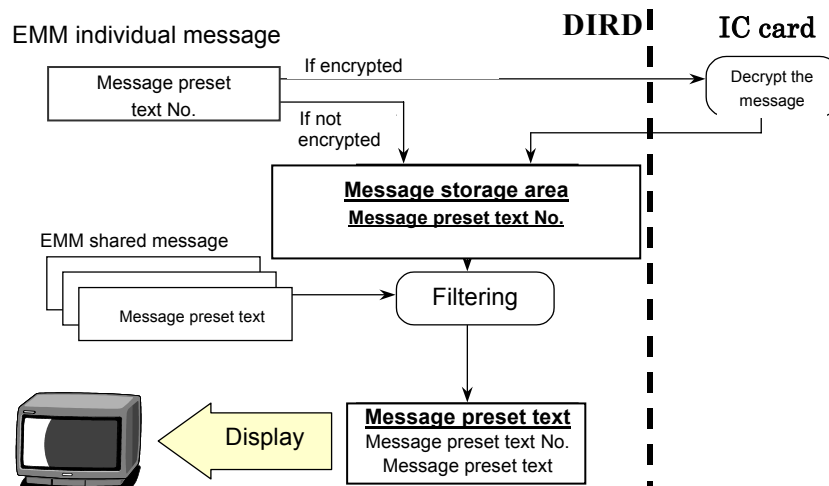


Figure A2-10. Mail message (With preset text and encrypted)

3.14.2 Display of automatic display message

[1] Availability of automatic display message service

- The availability of automatic display message service for each entity 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 an entity 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 preset text which is included in the EMM individual message obtained from the IC card, and receives the information of the EMM shared message (preset text) 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 text, 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 shared 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 shared 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

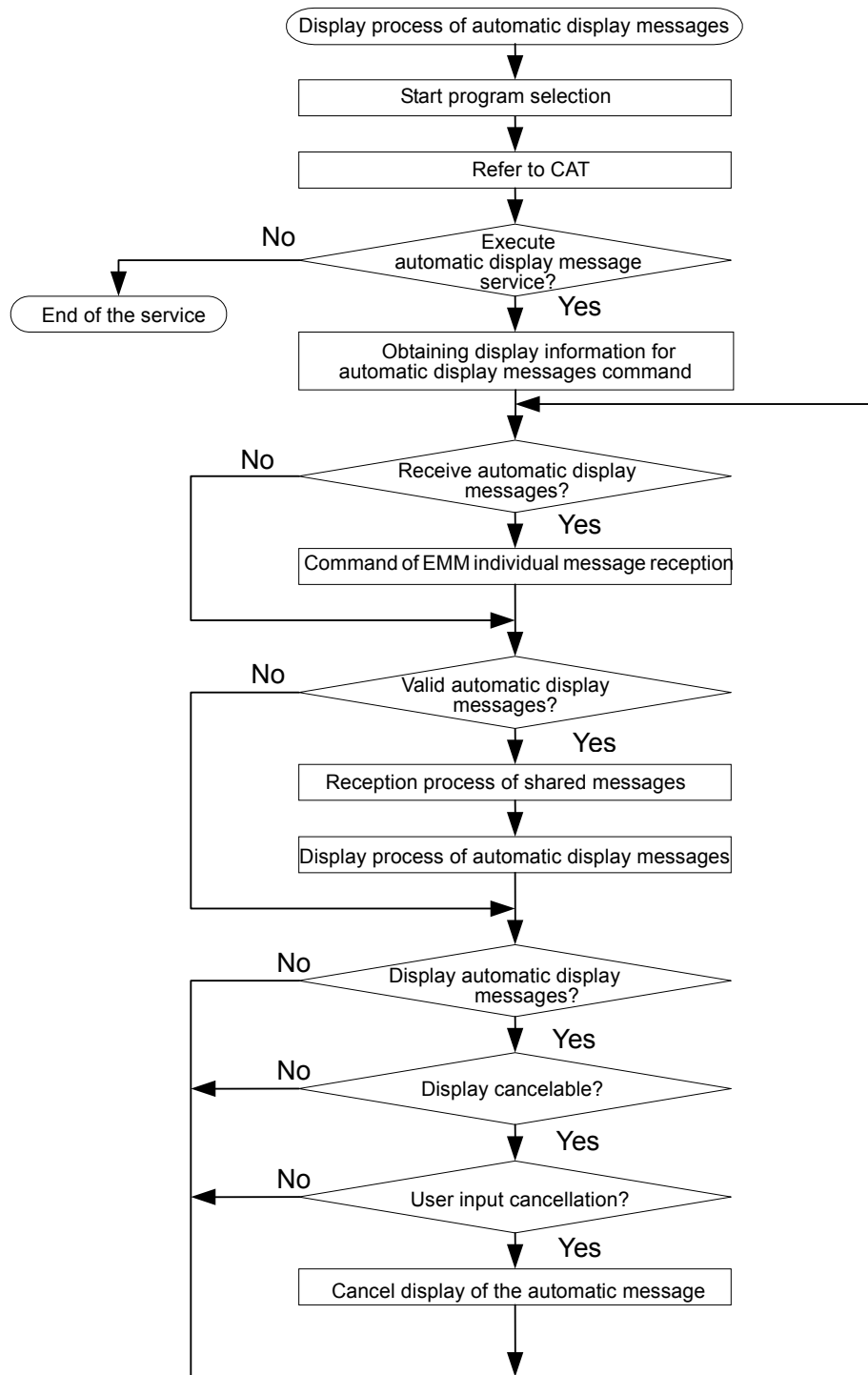


Figure A2-11. Display process of automatic display messages

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 preset text as a full message, while the EMM individual message with a designated preset text is stored as a mail message after combined with a separately received EMM shared 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 text 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 flags 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 flags 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 flags 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.

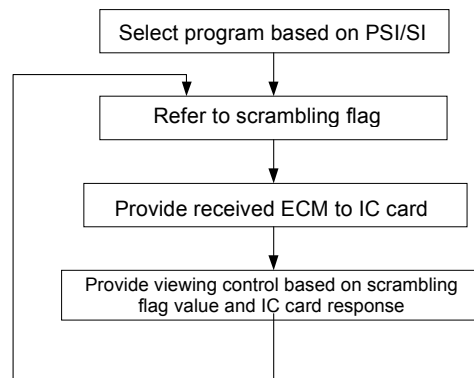


Figure A2-12. Basic operation of program selection and viewing

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 flag in TS header: Adaptation field control

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 flag should be ignored.

Table A2-3. Scrambling flag in TS header: Adaptation field control

Scrambling flag value	Adaptation field control	Description
00	01 or 11	Not scrambled
01		Undefined
10		Scrambled (even number keys)
11		Scrambled (odd number keys)
XX	00 or 10	Undefined

- 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 flags 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 PPVviewing 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 flags 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 flags, 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 flags” hereof refer to the flags included in transmitted TS packets, and serve as scrambling flags prior to the descrambling process, or provides equivalent determination.

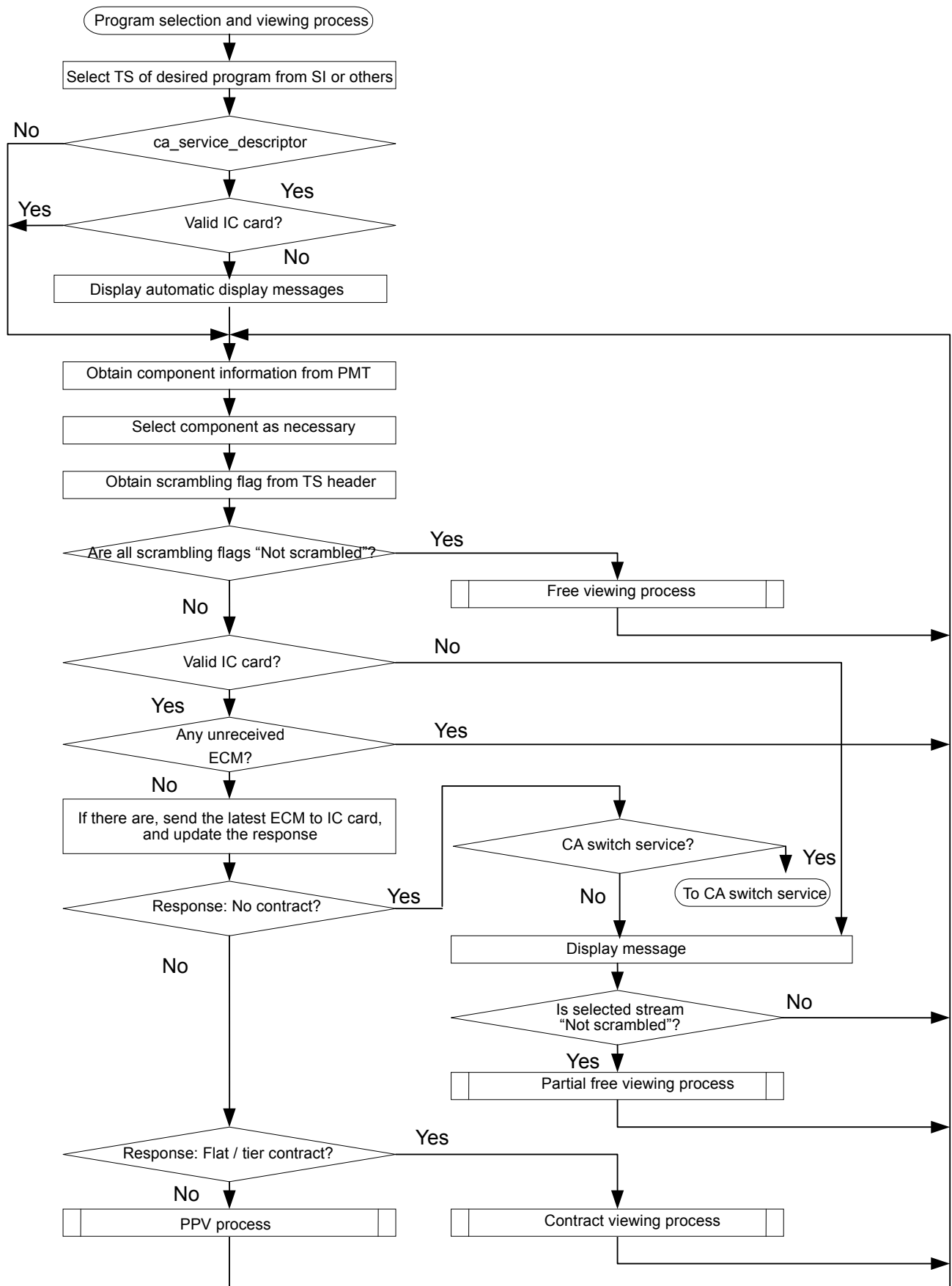


Figure A2-13. Program selection and viewing process

3.15.4 Free viewing process

Free viewing refers to a viewing process in the cases of all scrambling flags 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 flags 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.

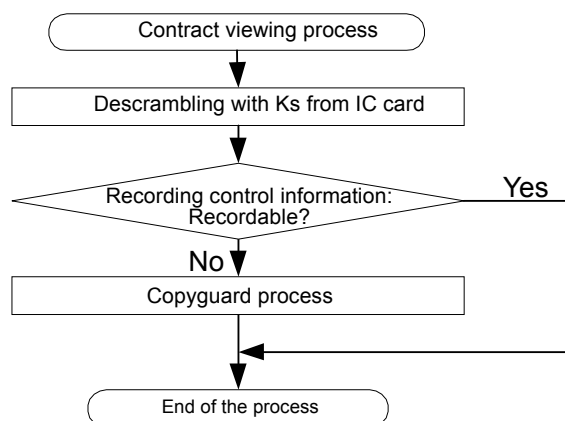


Figure A2-14. Contract viewing process

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.

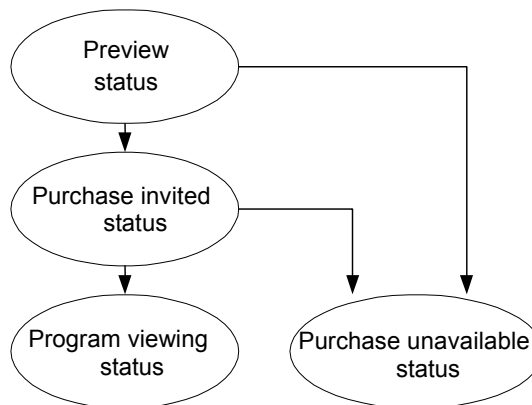


Figure A2-15. Basic operation of PPV

(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 transmits to the “Viewing” status.
- If the response from the IC card notifies that the program purchase period is expired, the program transmits 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 transitation, and provides viewing.
- If the program includes components with partial scrambling flags bieng “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.

*Note: This standard does not stipulate copy control specifications.

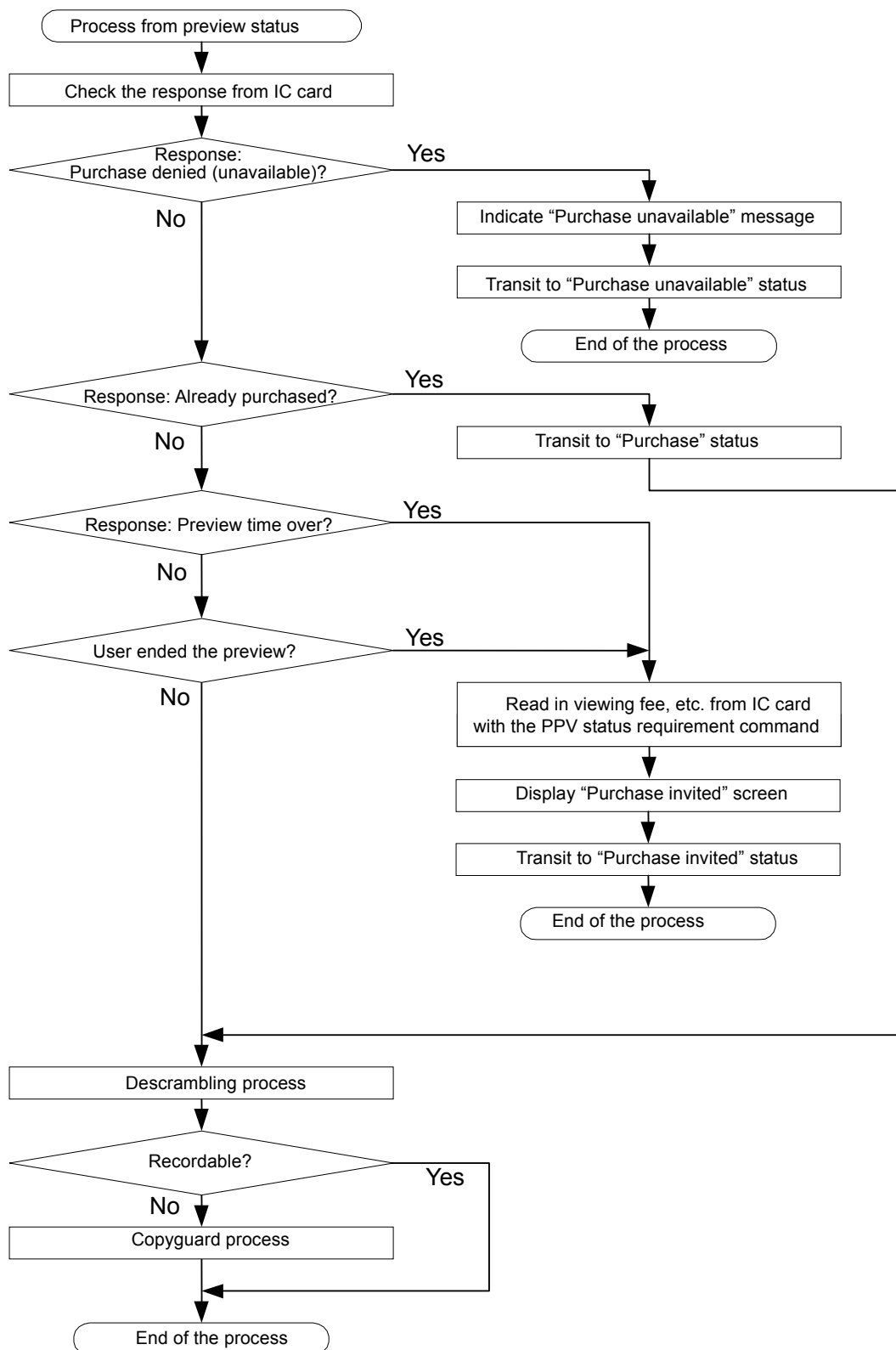


Figure A2-16. Process from preview status

(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 flags 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.

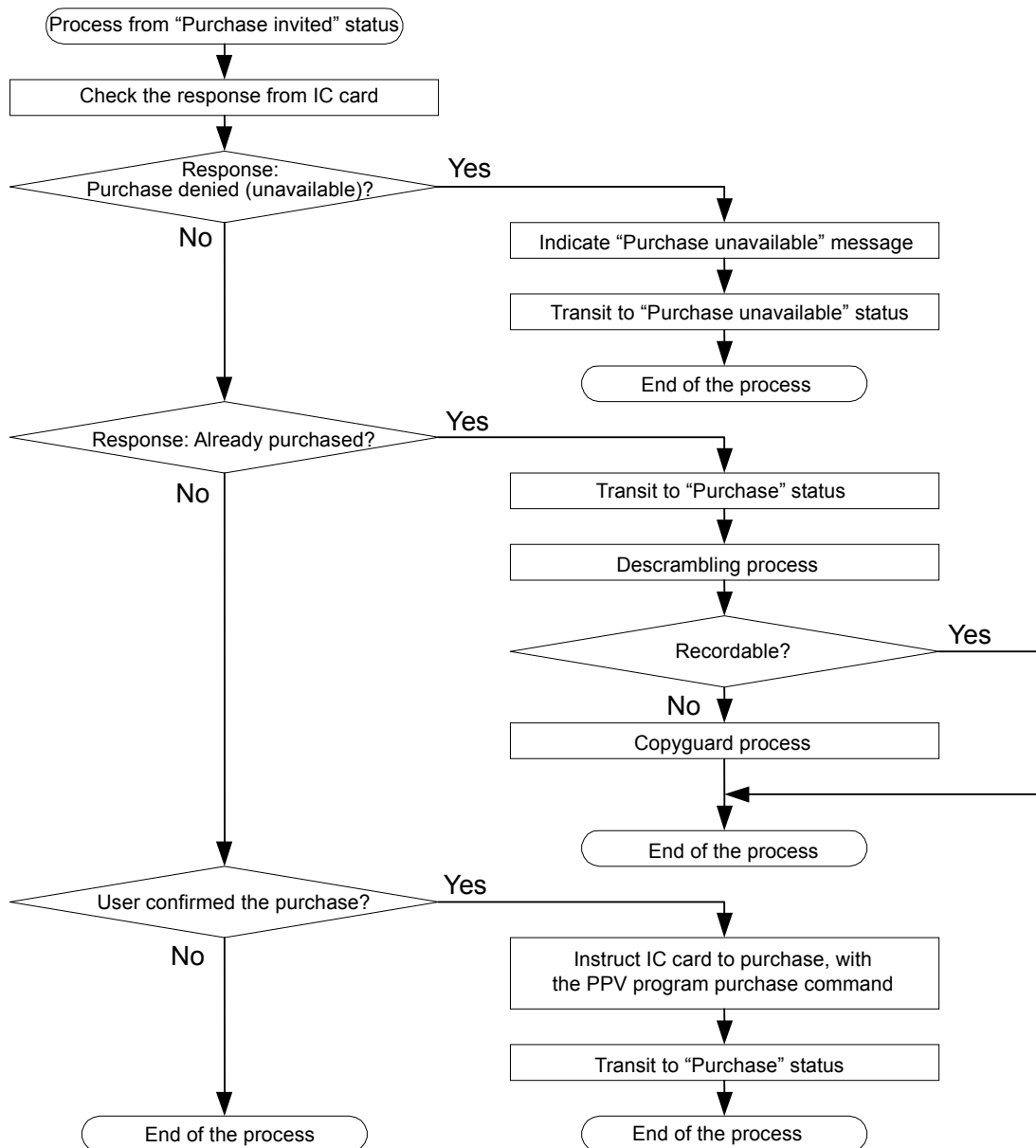


Figure A2-17. Process from “Purchase invited” status

(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 flags 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.

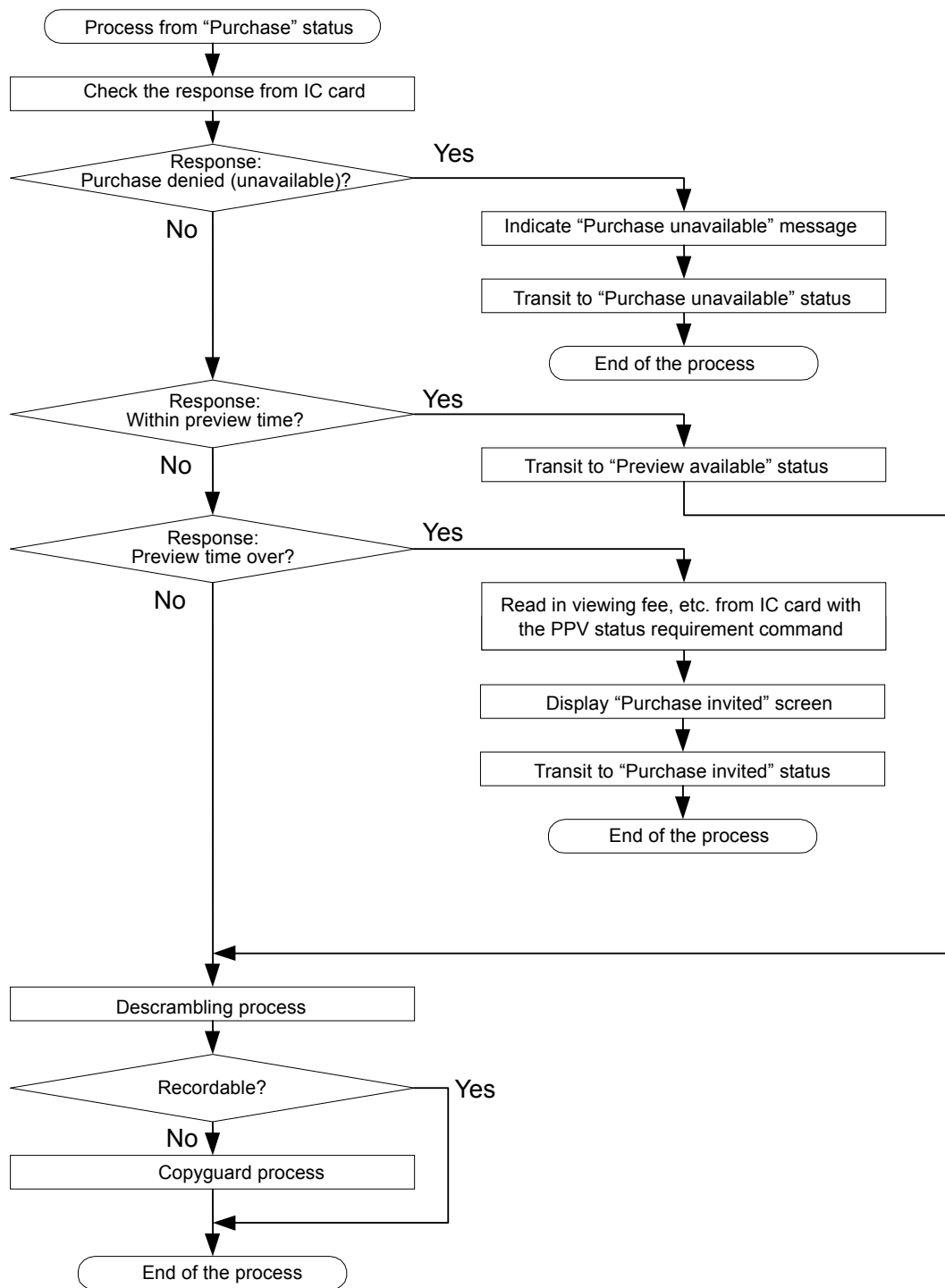


Figure A2-18. Process from “Purchase” status

(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 transitation.
- If the program includes components with partial scrambling flags “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.

Note: This standard does not stipulate copy control specifications.

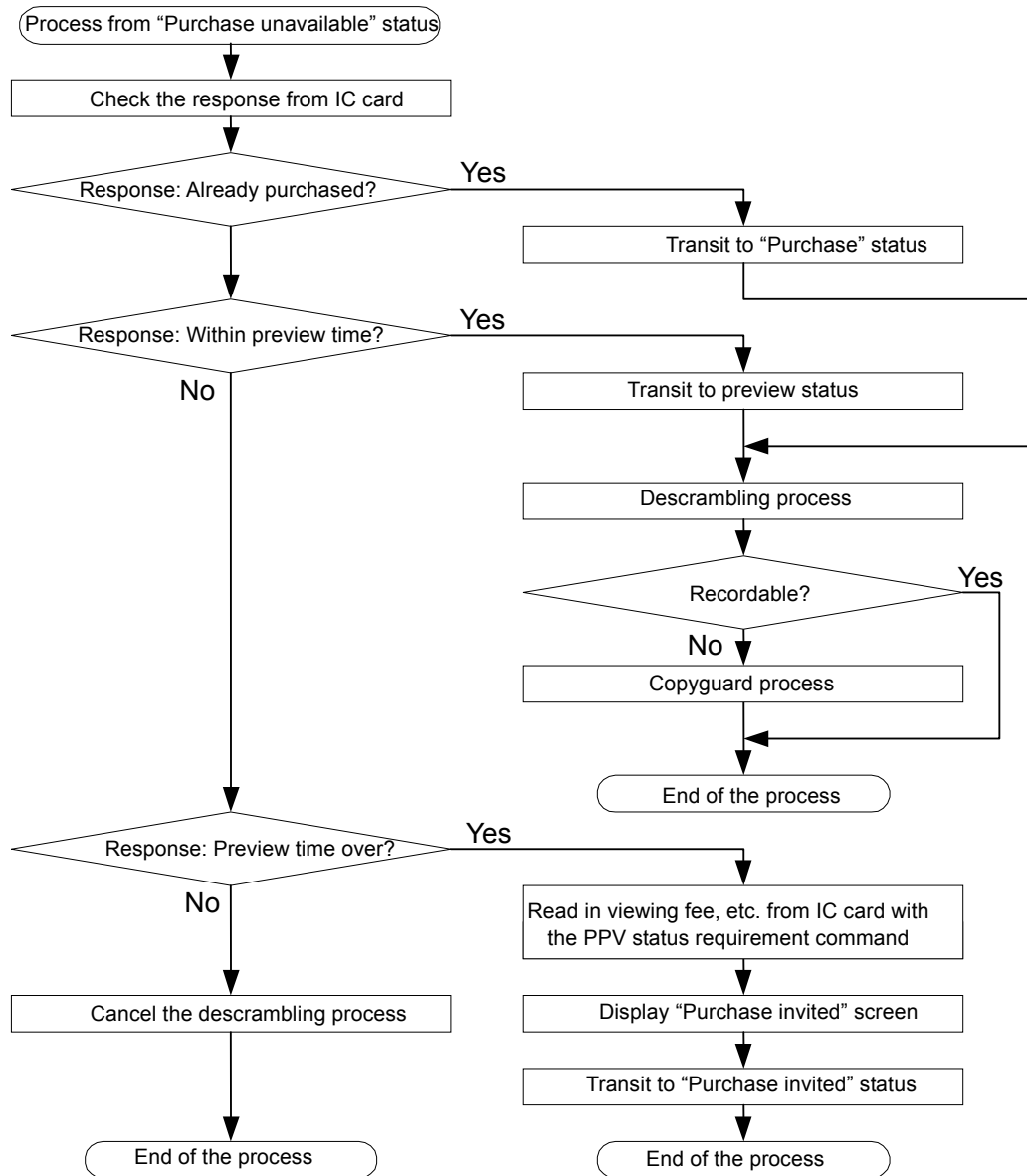


Figure A2-19. Process from “Purchase unavailable” status

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) PPVviewing

- 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.

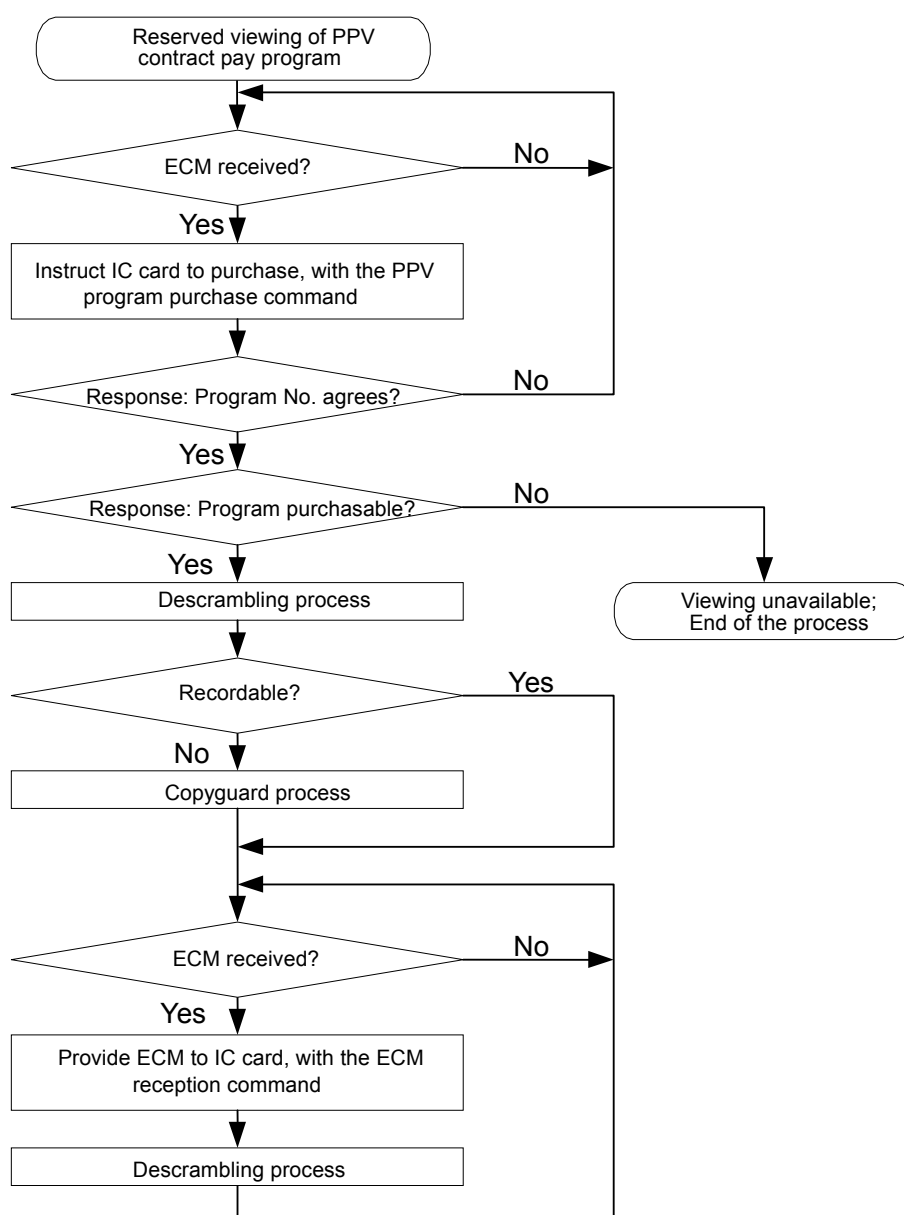


Figure A2-20. Operation for reserved viewing of PPV contract pay program

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 password 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 informations 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 shared 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	<p>[1] Type A</p> <p>One or more EMM bodies are included in the EMM section, which is a single section.</p> <p>1) Program TS</p> <p>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 $1.28 \text{ kB} \pm 100\%$, 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.)</p> <p>2) Dedicated TS (for specified channel)</p> <p>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 $5.2 \text{ kB} \pm 100\%$, 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.)</p> <p>[2] Type B</p> <p>A single EMM body is included in the EMM section, which comprises multiple sections.</p> <p>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 $8.0 \text{ kB} \pm 100\%$, 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.)</p>
Transmission frequency of EMM shared message section	<p>A specified preset No. (Table ID Extension) is assigned.</p> <p>The transmission frequency for the EMM shared message section should be up to one section per 200 msec.</p>

*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.

Reference 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

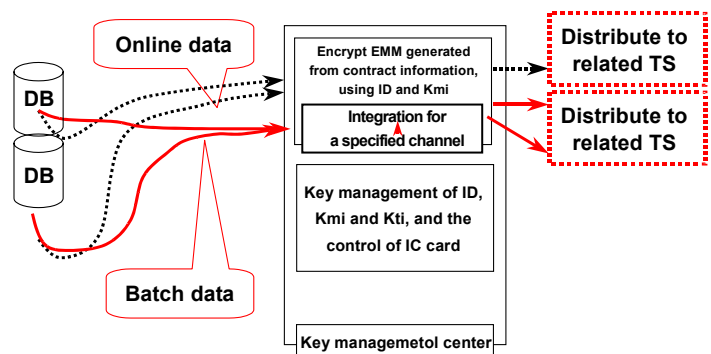


Figure A3-1. Key management center
(Common and secret keys)

2.2 Management of CA module

Production of the CA module,
distribution of the module to suppliers, etc.

2.3 Encryption

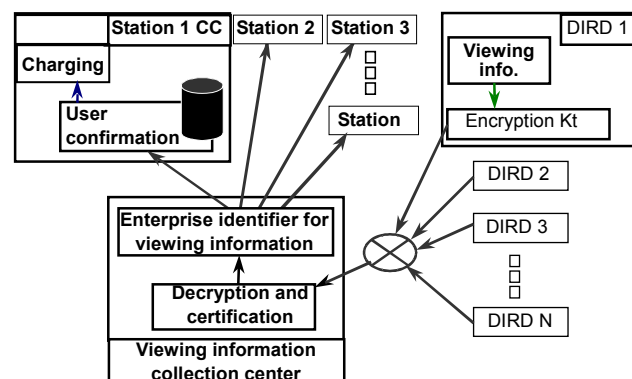
Establishment and operation of a system for the encryption of EMM and other data

2.4 Management of system parameters

Management of system parameters, required for the joint operation of CAS, such as broadcast entity identifier

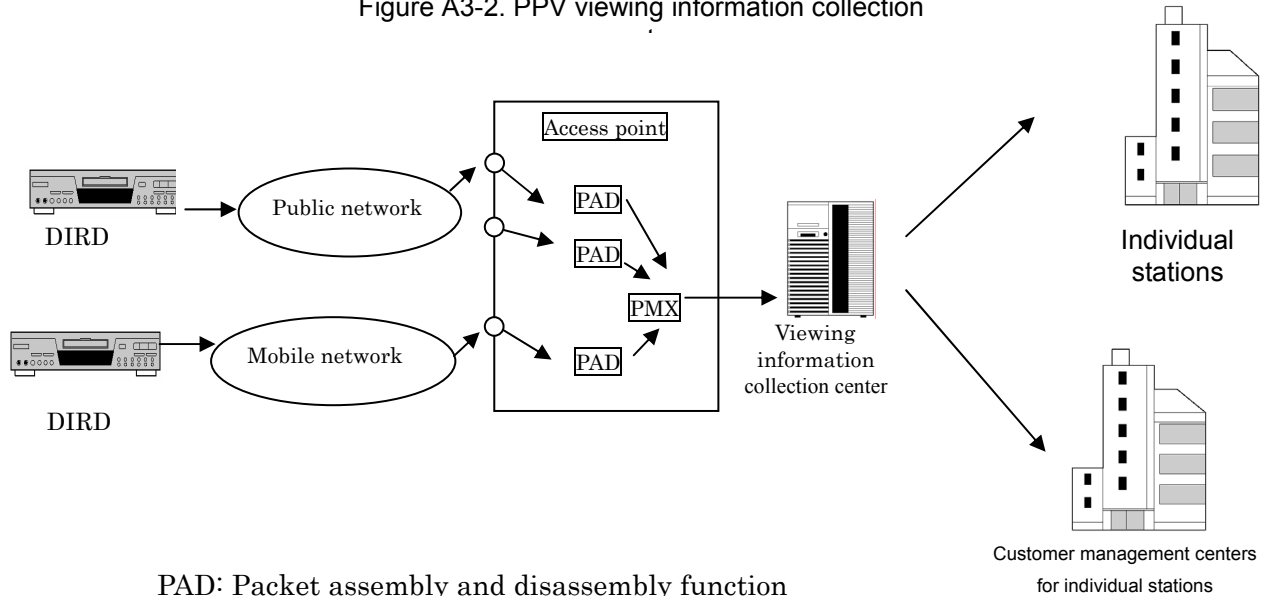
3. Collection of viewing information

- 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.



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.

Figure A3-2. PPV viewing information collection



PAD: Packet assembly and disassembly function

PMX: Packet multiplexer equipments

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)

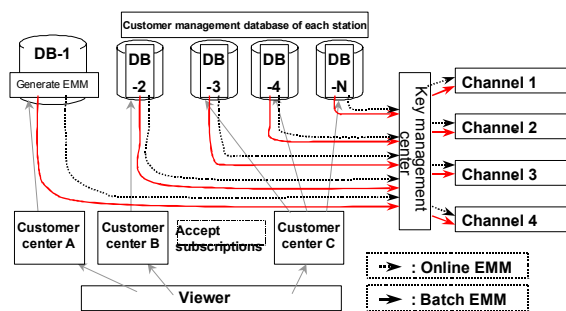


Figure A3-4. Individual transmission of EMM
(station-based EMM)

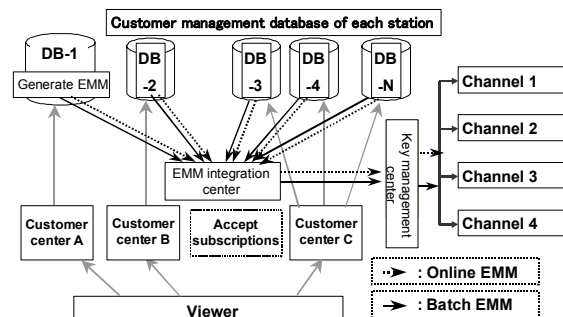


Figure A3-5. Integrated transmission of EMM
(all-station EMM)

- (3) Mixed operation: Example of mixed operation of individual and integrated transmissions (Figure A3-6)

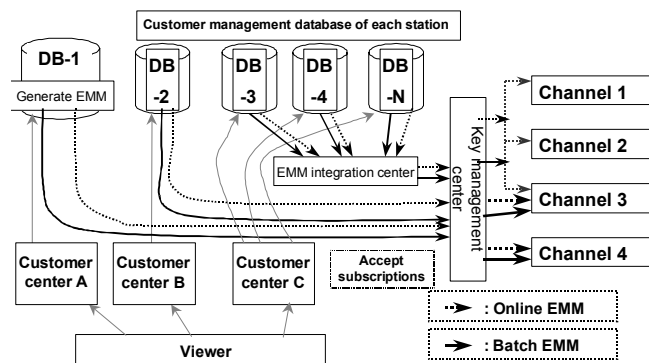


Figure A3-6. Example of mixed operation of individual and integrated transmissions of EMM

(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)

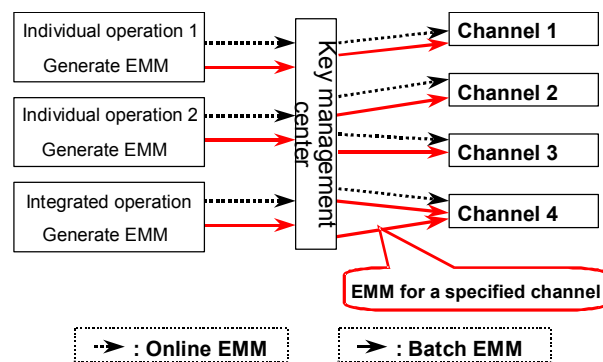


Figure A3-7. Example of EMM transmission by a dedicated channel

(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. Programming operation management system

The programming operation management system executes the scrambling and transmission of ECM, in accordance with the program schedule.

The ECM to send the scramble 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 progress control shall be undertaken by each enterprise as part of the program transmission system.

Reference 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: Satisfy the specifications for 5V single power supply (Class A) .

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

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. Note that the specifications for Classes AB are admitted on the card side, taking account of possible dramatic improvement in the performance of IC card chips in the next few years.

2. Vpp pin (4.3.2.3 (2), Chapter 4)

Specification: NC (Not connected)

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

Explanation: At present, IC card chips with Vpp pin as NC (generating Vpp power supply internally from Vcc) are the mainstream. Besides, the Vpp pin is changed to RFU in the Class B specifications. Therefore, NC is considered appropriate from the viewpoint of future applications.

3. CLK pin (4.3.2.3 (3), Chapter 4)

Specification: Capable of supplying both 4 MHz and 8 MHz.

In the initial reset following the insertion of IC card, 4 MHz is selected. If the maximum f_s value in response to ATR, FI (TA₁), is ‘3’, then the pin is reset again and switched to 8 MHz.

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.

Explanation: To avoid the destruction of an IC card in case of wrong insertion, 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: Comply with the ISO7816-3:1997.

Following the external reset, the unit automatically transits to ATR at the point of 400 to 40,000 [1/f], and sends response to the reset. Control information characters (historical bytes) are not transmitted.

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.

Explanation: The control information characters (historical bytes) are stipulated by the ISO 7816-4, but we don't consider 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: In the initial response information, the TS of opening characters are followed by other characters indicated below.

- The Y_{i+1} elements are expressed by the values set to individual bits, corresponding to the existence of TA_{i+1}, TB_{i+1}, TC_{i+1}, and TD_{i+1} (the characters following TD_i, and indicating connection information).

b_4 : existence of TA_{i+1} , b_5 : existence of TB_{i+1} , b_6 : existence of TC_{i+1} , b_7 :
existence of TD_{i+1}

(Exists: '1', Not exists: '0')

Opening characters	TS	'3B'	Set the sequential significance. Set 'logic 1' as 'status Z', and 'b0' as 'LSB'.
Structure indication characters	T0	'F0'	First 4 bits: Y_1 indicating the existence of connection characters that follow 'T0'. Set to 'F'. Last 4 bits: Set 'K' to '0' (the number of control information characters).
Connection information characters	TA_1	'1x' '3x'	First 4 bits: Set the integer 'FI' to '1' ($F=372$, $f_{max}=5MHz$), or '3' ($F=744$, $f_{max}=8MHz$). Last 4 bits: Set the integer 'DI' to '2' ($D=2$), '3' ($D=4$), or '4' ($D=8$).
	TB_1	'00'	Vpp pin should be "Not connected" (NC) .
	TC_1	'xx'	Set the integer (N) indicating the protection time for special characters.
	TD_1	'91'	If $N='FF'$, the guard time (Figure 4.3.3) signifies '1'. First 4 bits: Y_2 indicating the existence of subsequent connection characters. Set to '9'. Last 4 bits: Set the subsequent information exchange protocol to 'T=1'.
	TA_2	'81'	[b7] Set to '1', indicating that multiple reset is impossible. [b6b5] Fix to '00'. [b4] Designate '0', indicating that the designated values of interface characters equal the transmission parameters.(?) [b3-b0] Set the subsequent information exchange protocol T to 'T=1'.
	TD_2	'B1'	First 4 bits: Y_3 indicating the existence of subsequent connection characters. Set to 'B'. Last 4 bits: Set the subsequent information exchange protocol to 'T=1'.
	TA_3	'xx'	Set the information field size integer (IFSI). The initial value for the maximum size of information field receivable by the card (IFSC).
	TB_3	'xx'	First 4 bits: Block waiting time integer (BWI) Last 4 bits: Character waiting time integer (CWI)

Inspection characters	TD ₃	'1F'	First 4 bits: Y ₄ indicating the existence of subsequent connection characters. Set to '1'. Last 4 bits: Set to 'T=15', the connection information character indicating that the subsequent information is independent of protocol.
	TA ₄	'01'	[b ₇ b ₆] Set to 'Clock stop unused' (XI=0).
		'03'	[b ₅ -b ₀] Set the power supply specifications to 'Class A only' (U=1), or 'Classes AB(?)' (U=3).
	TCK	'xx'	Exclusive OR of 'T0' through 'TA ₄ '.

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 TD_i.
b₄: Presence of TA_{i+1}
b₅: Presence of TB_{i+1}
b₆: Presence of TC_{i+1}
b₇: 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' '03'	[b ₇ b ₆] Set to disallow use of clock stops (XI = 0). [b ₅ -b ₀] Set the power supply specification to Class A only (U = 1) or Class AB (U = 3).
Check character	TCK	'xx'	Exclusive OR of T ₀ 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: A field of 1 byte, identifying the source node address (SAD) and the destination node address (DAD) of the block, which is coded as follows:

Fix at ‘NAD=00h’ (SAD=DAD=0).

If there are multiple slots, and if simultaneous communication with multiple IC cards is required, each slot should be controlled independently with separate interfaces.

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								Significance
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 error, EDC error
		0		0	0	1	0	Other errors (e.g. sequence error, protocol violation)

* N (R): Receive sequence number .

Table 4-3 R Block PCB Coding

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: Not used.

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: Prior to the initial exchange of the I block, the DIRD must perform the modification of IFSD to the IC card, and enable it to receive the maximum 254 bytes of data (INF).

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: The DIRD must be capable of RESYNC control as necessary in the case of multiple transmission errors.

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: Not used.

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: If a transmission error (See 4.3.2.3 (7-6), Chapter 4) is detected, the following error recovery process shall be taken, dependent on the immediately preceding transmission block and the error detection node.

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) The immediately preceding transmission block is S(ctrl, REQ).

1) If the error detection node is DIRD:

- Request for re-transmission by the same block
- Request for re-synchronization by S(RESYNCH, REQ)
- Reset

2) If the error detection node is IC card:

- Request for re-transmission by the same block

(2) The immediately preceding transmission block is not S(ctrl, REQ).

1) If the error detection node is DIRD:

- Request for re-transmission by the R block
- Request for re-synchronization by S(RESYNCH, REQ)
- Reset

2) If the error detection node is IC card:

- Request for re-transmission by the R block

- c. 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
- d. 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
 - 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: Dedicated commands, separate from the common commands stipulated by the ISO 7816-4. The coding and significance of these commands shall be defined privately in these Standards. The logical channels and secure message function are not used.

The setting is ‘CLA=0x90’.

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

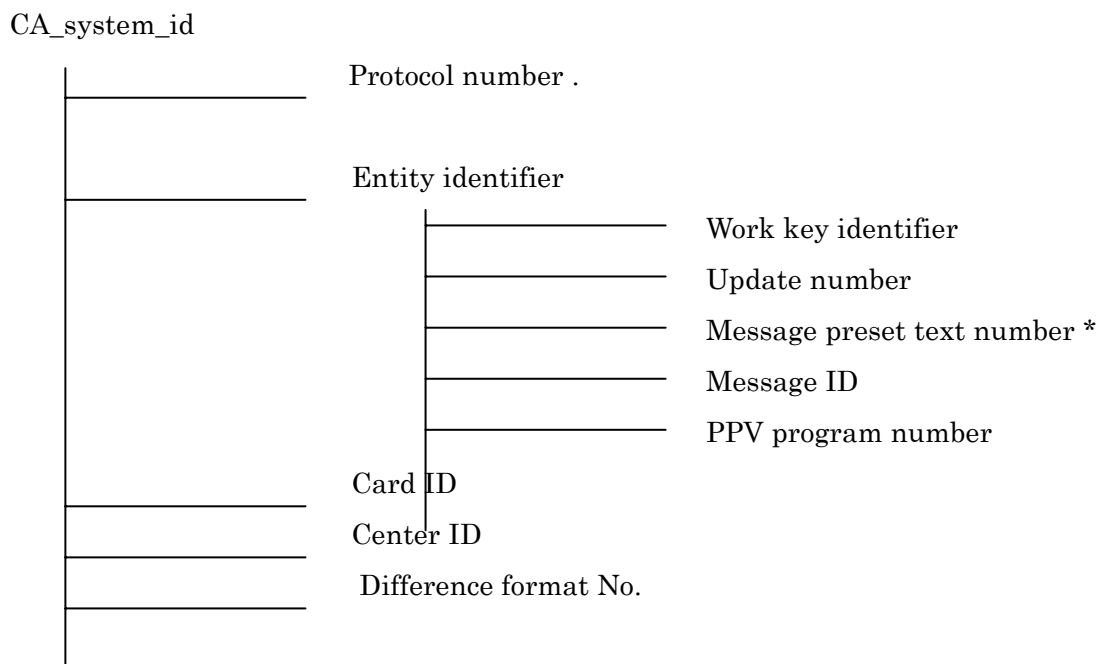
private use is restricted by the original standard, it is appropriate to use CLA in the earlier bits. Therefore, we set the first 4 bits to '9', based on the original standard.

Reference 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 .



* The message preset text (template) number can be defined independently of the entity identifier. In the above example, the first eight bits of the message template number (2B) are identical to those of the entity identifier, and its last eight bits are unique to the entity identifier, thereby avoiding the overlap of message text 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.

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 Entity identifier

It is expected that a new entity identifier will be issued:

- For each transmission unit of associated information,
- Due to restrictions of associated information, and for other reasons.

In the same entity identifier, you may allocate freely the sub-identifiers such as:

- Work key identifier,
- Update number,
- Message ID, and
- Message preset text (template) number (the last 8 bits)

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Part 2

Playback Control System (Conditional Playback System)

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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 contents transmitted by means of the “stream-type transmission system” where the interval between the time of the transmission of contents and the time of viewing/listening to the said contents are always constant (“stream-type contents”), and contents transmitted by means of the “file-type transmission system” where the interval between the time of the transmission of contents and the time of viewing/listening to the said contents are not always constant (“file-type contents”).

See Chapter 2 for the conditional playback system for stream-type contents or Chapter 3 for the conditional playback system for file-type contents.

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

- (1) Ministry of Internal Affairs and Communications Directive No. 26, 2003
- (2) Ministry of Internal Affairs and Communications Notification No. 36, 2003
- (3) Ministry of Internal Affairs and Communications Notification No. 37, 2003
- (4) Ministry of Internal Affairs and Communications Notification No. 39, 2003

(5) Ministry of Internal Affairs and Communications Notification No. 40, 2003

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 Services Using Communication Satellite” 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 Audio Broadcasting” Standard
- (11) ARIB STD-B30 “Receiver for Digital Terrestrial Audio 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) 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 Contents

2.1 General Matters

The standard stipulated in this Chapter applies to conditional playback of stream-type contents.

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 contents 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 programming broadcast that is transmitted in the transmission frequency band (channels) after the time of storage; for example:
 - d. Standard television broadcasts (MP@ML, etc.)
 - e. High-definition television broadcasts (MP@HL)
 - f. VHF broadcasts
 - g. 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 contents 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 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:

- (4) Viewing-based payment (pay later): Supports IPPV.
- (5) 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.

- (4) 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”).
- (5) 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
- (6) 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:

- (5) Individual broadcaster delivery: For individual operation (single broadcaster group consisting of a single broadcaster), EMMs are sent using only the broadcaster’s own channels

(6) 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

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

(8) 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 Programming Operation Management System

Scrambling and ECM delivery can be performed according to the programming schedule. Programming schedule 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 contents key (Kc) controlled per program (content), in addition to a so-called triple key architecture-equivalent (with scramble 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 K_w : ECM- K_w) and EMM (encrypted with K_m).

(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

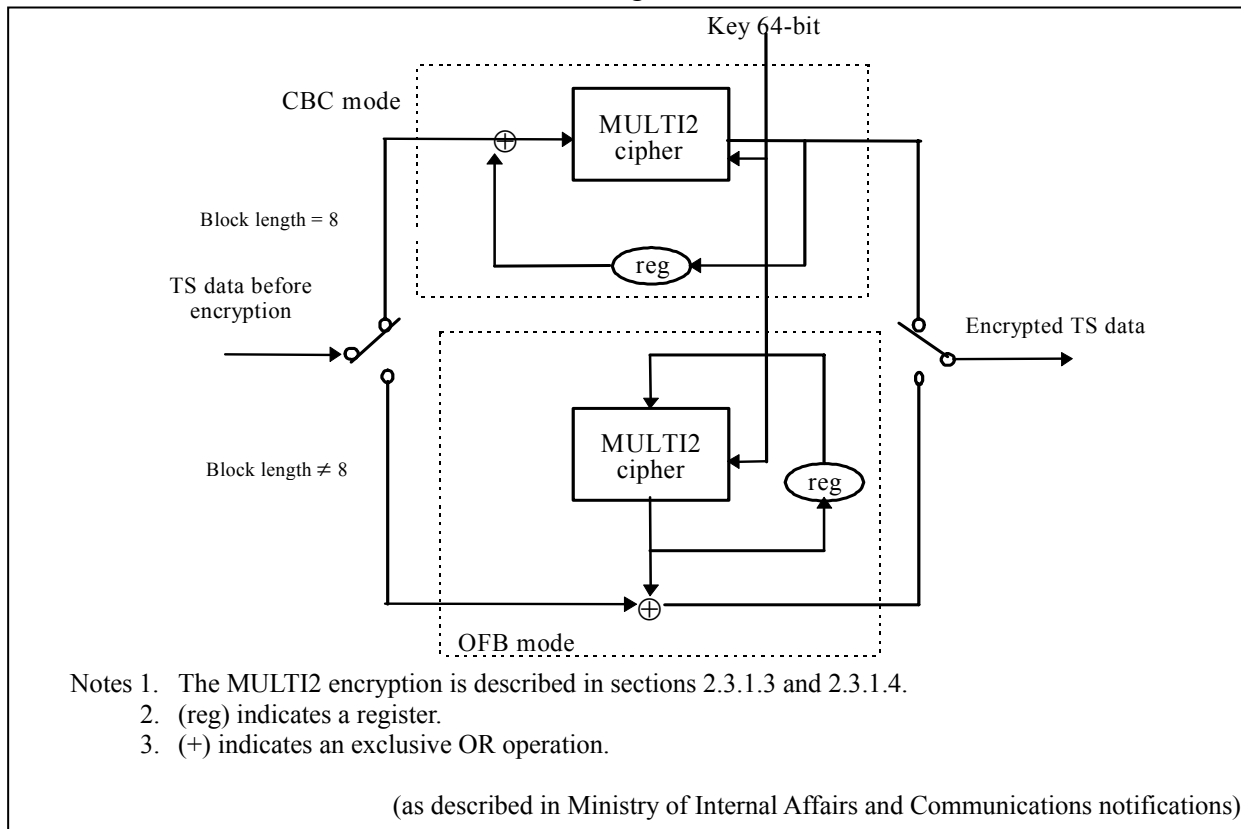
2.3.1.1 Algorithm for scrambling

The algorithm 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.

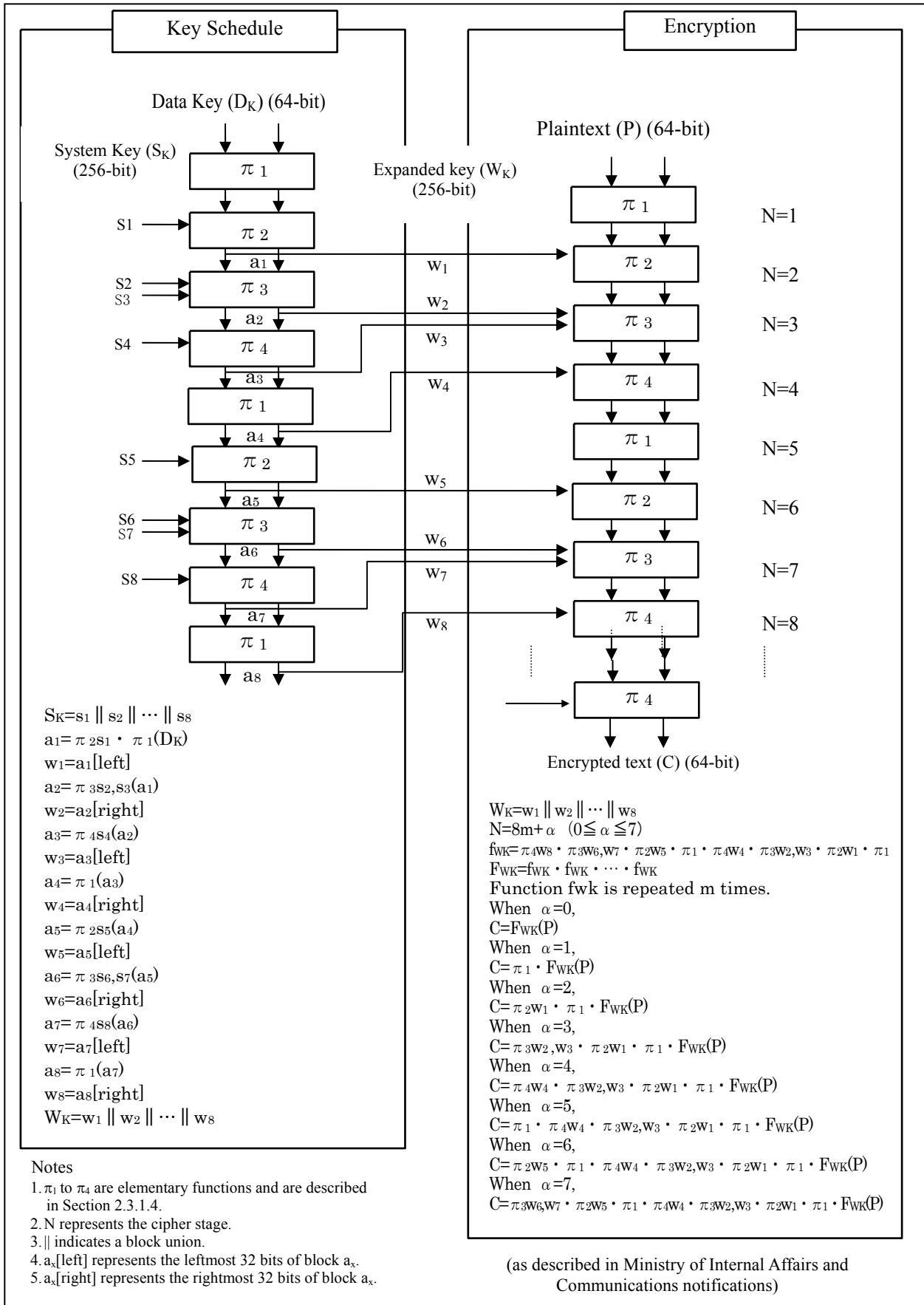
In other words, scrambling procedure is as shown in 2.3.1.2, and the following two systems are combined.

- (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) above is used to generate a series of pseudo-random encoded sequences, which are combined to create the scrambled signal.

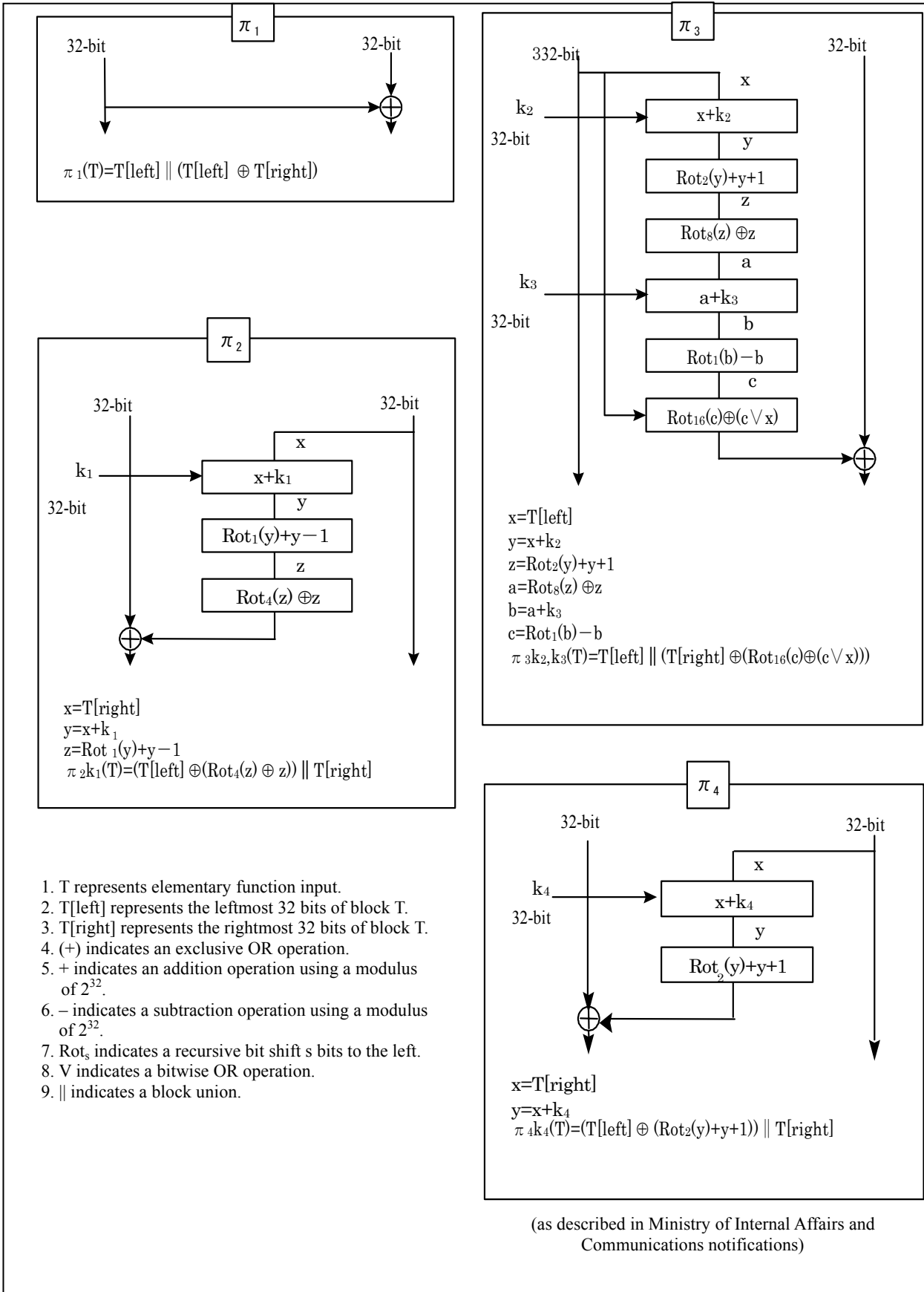
2.3.1.2 Scrambling Procedure



2.3.1.3 MULTI2 Cipher



2.3.1.4 Elementary Encryption Function



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.

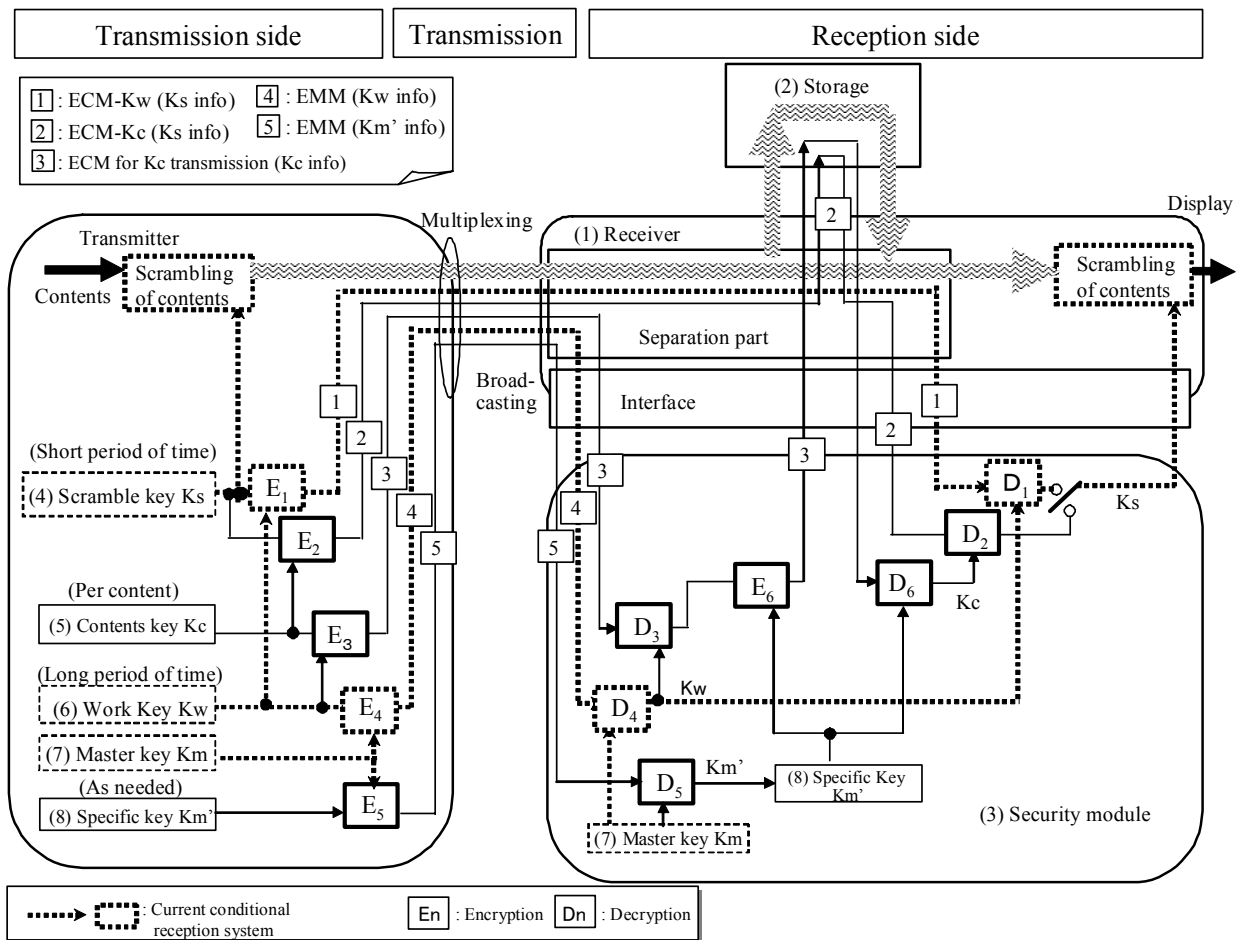


Figure 2-1 System architecture for stream-type conditional access system

The types of devices and keys shown in Figure 2-1 are as follows:

1) Receiver

Consists of a tuner, key information separation part, contents descrambling part, and interface.

2) Storage

Stores contents and key information to descramble them

3) Security module

Decrypts/re-encrypts various key information

4) Scramble key Ks

A key to scramble contents.

5) Contents key K_c

A key to encrypt the scramble key, which is changed per content.

6) Work key K_w

A key to encrypt the scramble key or contents 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 K_m

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 K_m'

A key to re-encrypt when storing the contents key. K_m' is a key that can be set per security module. As K_m' can be shared between more than one security module for control by broadcasters, stored contents can be played on all receivers with a security module for which the same K_m' has been set.

Common information of the stream-type conditional access system consists of the following three types of information:

1) ECM- K_w

Common information to transmit the scramble key encrypted by the work key (1 in Figure 2-1).

Basically, it is not stored on the reception side.

2) ECM- K_c

Common information to transmit the scramble key encrypted by the contents key (2 in Figure 2-1).

When contents are stored on the reception side, it is stored along with the contents in the storage.

3) ECM for K_c transmission

Common information to transmit the contents key (3 in Figure 2-1) encrypted by the work key.

When contents are stored on the reception side, the contents key used for re-encryption is stored along with the contents 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 contents 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

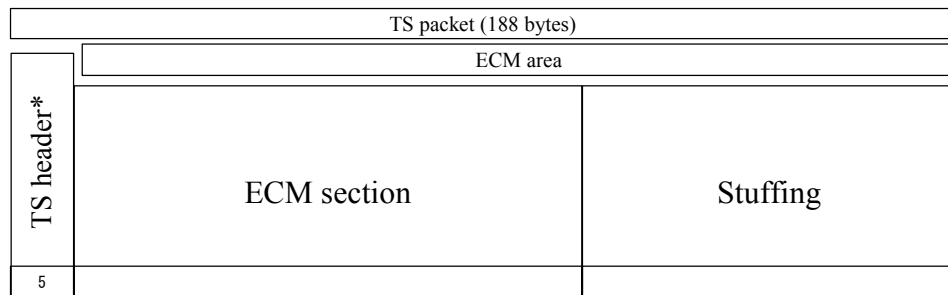
2.3.2.3.1 Basic ECM Architecture

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 architecture of the TS packets used to transmit ECM-Kc and ECM-Kw.



*Includes pointer field.

Figure 2-2 TS Packet Architecture to transmit ECM-Kc and ECM-Kw

(2) The following describes the ECM section and the basic architecture 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 architecture, Figure 2-4 the ECM-Kc section architecture, and Figure 2-5 the ECM for Kc transmission section architecture.

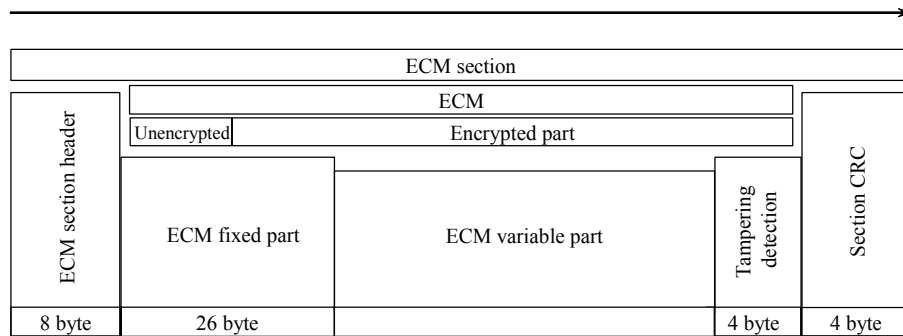


Figure 2-3 ECM-Kw Section Architecture

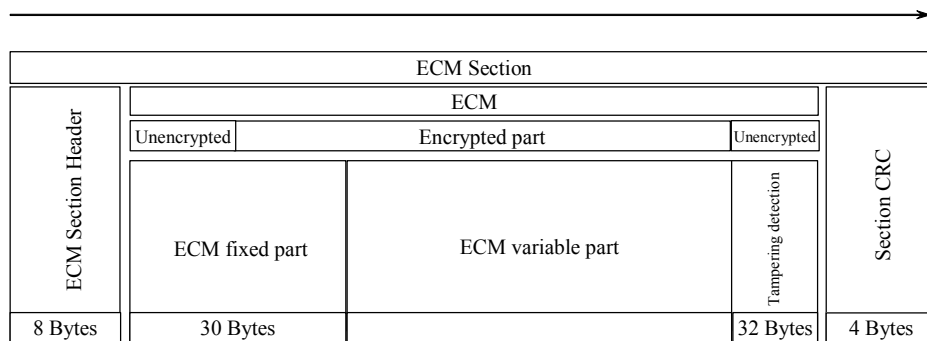


Figure 2-4 ECM-Kc Section Architecture

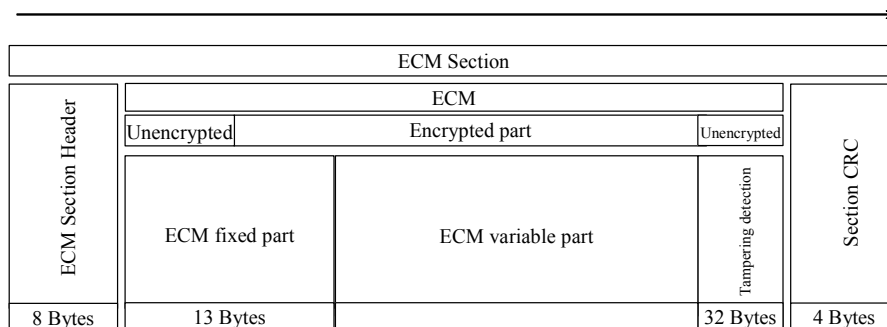


Figure 2-5 Section Architecture of ECM for Kc Transmission

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 Byte
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster group identifier	1 Byte
			Work key identifier	1 Byte
			Scrambling key Ks (odd)	8 Byte
			Scrambling key Ks (even)	8 Byte
			Judgment type	1 Byte
			Date/time (Date MJD + Time BCD)	5 Byte
			Recording control	1 Byte
		Variable part		Capable of accommodating various function information such as charging information
	Tampering detection			4 Byte
	Section CRC			4 Byte

(2) ECM-Kw fixed part

9) 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

10) Broadcaster group 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.

11) Work key identifier

Identifier information related to the work key used to encrypt ECM-Kw

12) 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.

13) Judgment type

Indicates the viewing judgment type such as free, PPV, etc.

14) 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.

15) Recording control

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

16) Tampering 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:

4) 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.

5) 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 Byte
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster group identifier	2 Byte
			Contents key identifier	4 Byte
			Scrambling key Ks (odd)	8 Byte
			Scrambling key Ks (even)	8 Byte
			Judgment type	1 Byte
			Date/time (Date MJD + Time BCD)	5 Byte
			Recording control	1 Byte
		Variable part		Capable of accommodating various function information such as charging information
	Tampering detection			32 Byte
	Section CRC			4 Byte

(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 group identifier

Code used to identify service broadcaster groups in conditional access system operation; combined with the contents key identifier, specifies individual information to be referenced.

3) Contents key identifier

Identifier information related to the contents key used to encrypt ECM-Kc

4) Scrambling key Ks (odd/even)

Scrambling key Ks encrypted by the contents 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) Tampering 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 Byte
	ECM payload	Fixed part	Protocol number	1 Byte
			Broadcaster group identifier	2 Byte
			Work key identifier	10 Byte
		Variable part		Capable of accommodating various function information
		Tampering detection		32 Byte
	Section CRC			4 Byte

(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 group 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) Tampering 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) Contents key Kc

Contents key Kc encrypted with the work key Km

2) Contents key identifier

Identifier name when using the contents key Kc transmitted by the ECM for Kc transmission

3) Charging information, contract judgment information

4) Expiration date

Expiration date of the contents key Kc

5) Function information related to the specification of the storage place for the contents key

6) Function information related to identification of re-encryption key

7) Usage conditions

Used when sending conditions of contents 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 architecture:

- 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 architecture 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 architecture. (The figure shows a single EMM section with 3 EMM payloads.)

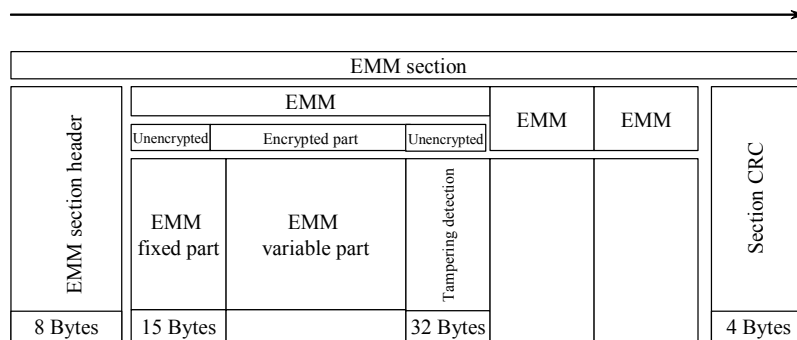


Figure 2-6 EMM Section Architecture

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 Byte
	EMM payload 1	Fixed part	Decoder identifier number (Card ID)	6 Byte
			Associated information byte length	2 Byte
			Protocol number	1 Byte
			Broadcaster group identifier	2 Byte
			Update number	2 Byte
			Expiration date	2 Byte
		Variable part		Capable of accommodating various function information
		Tampering detection		32 Byte
	Payload 2	(Same as above)		
	Payload 3	(Same as above)		
	⋮	⋮		
	Payload n	(Same as above)		
	Section CRC			4 Byte

(*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 tampering 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 group 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) Tampering 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

- 7) Function information related to the work key
Sends the work key identifier and the work key.
- 8) 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.
- 9) Function information related to power-on control
Sets when to perform power-on control etc. used to lower power

consumption.

10) Function information related to overall control

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

11) Function information related to forced call-ins

Instructs the decoder to perform a forced call-in.

(b) EMM for Kc transmission

1) Contents key Kc

Contents key Kc encrypted with the master key Km. Used when sent per card

2) Contents key identifier

Code used to identify the contents key Kc

3) Charging information

4) Expiration date

Expiration date of the contents key Kc

5) Function information related to the specification of the storage place for the contents key

6) Function information related to identification of re-encryption key

7) Usage conditions

Used when sending conditions of contents 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 architecture of EMM common messages

EMM common messages are transmitted using the MPEG-2 system section format (EMM message section). The following describes the basic architecture 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 message preset text 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 architecture.

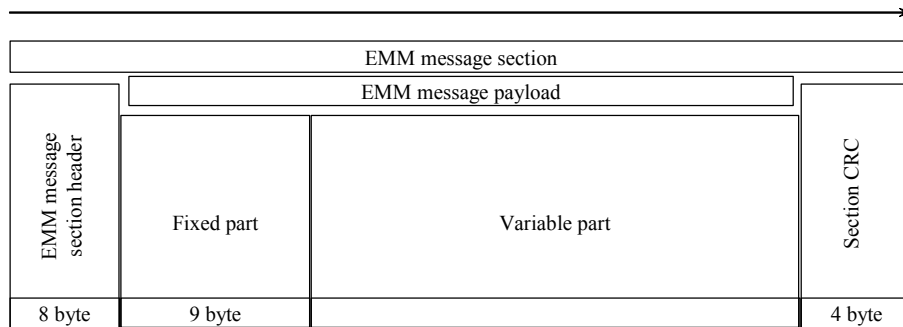


Figure 2-7 EMM Common Message Section Architecture

(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

Description				Notes
EMM message section	EMM message section header			8 Byte
	EMM message payload	Fixed part	Broadcaster group identifier	1 Byte
			Automatic display erasure type	1 Byte
			Automatic display duration 1	1 Byte
			Automatic display duration 2	1 Byte
			Automatic display duration 3	1 Byte
			Automatic display count	1 Byte
			Format number	1 Byte
			Message length	2 Byte
		Variable part	Message code payload	N Byte
	CRC error detection			4 Byte

(3) EMM common message section details

Table 2-6 EMM Common Message Section Details

Field	Description	No. of bits
table_id	0x85	8
section_syntax_indicator		1
private_indicator		1
reserved		2
section_length		12
table_id_extension	Message preset text 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 group identifier	8
deletion_status	Automatic message erasure type	8
displaying_duration1	Automatic display duration 1	8
displaying_duration2	Automatic display duration 2	8
displaying_duration3	Automatic display duration 3	8
displaying_cycle	Automatic display count	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:

9) Message preset text number (table_id_extension)

Indicates the preset text number (0x0001 to 0xFFFF) being sent by the EMM common message in question.

10) Broadcaster group identifier

Code used to identify broadcaster groups in conditional access system operation

11) Automatic display erasure type

- 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.”

12) Automatic display duration 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.

13) Automatic display count

- Indicates how many times to repeat the duration from T1 to T3.

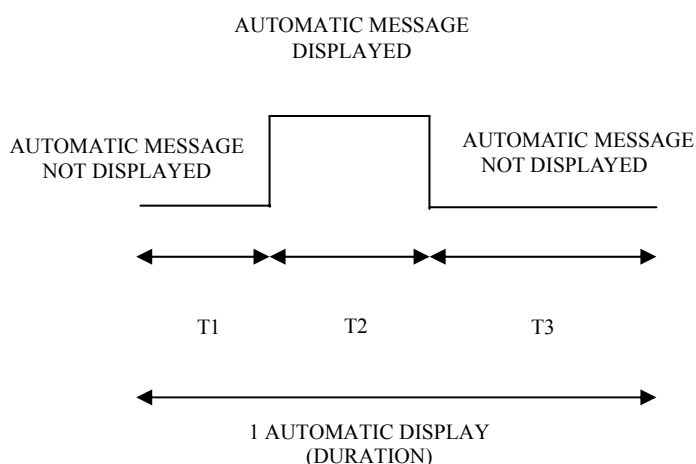


Figure 2-8 Automatic Display Duration and the direction of displaying the message

14) Format number

Indicates the format of the message code payload.

15) Message length

Indicates the number of bytes in the Message code payload.

16) Message code payload

Stores the specific contents of the message (preset text).

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.

- d. Descriptor name
CA_EMM_TS descriptor (CA_emm_ts_descriptor)
- e. Location
First NIT descriptor region
- f. Data structure

Table 2-7 CA_EMM_TS Descriptor Data Structure

Data structure	No. of bits	Bit string
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	Bit string
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.

c. Descriptor name

CA service descriptor (CA_service_descriptor)

b. Data structure

Table 2-9 CA Service Descriptor Data Structure

Data structure	No. of bits	Bit string
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 contents 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 are 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 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	Bit line description
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 contents 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 contents by the receivers, such as TS stream before descrambling, TS stream after descrambling, after TS multiplex separation, 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 contents 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 contents shown in 2.3.

- 1) The work key (K_w) used for the conditional access system defined in Part 1 serves also as the contents key (K_c) to encrypt the scramble key (K_s) 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 (K_m') 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 contents 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:

- i. 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).
- ii. 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 Contents

3.1 General Matters

The standard stipulated in this chapter applies to conditional playback of file-type contents.

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 contents 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 contents 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 broadcast 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 contents) that is transmitted in the transmission frequency band (channels) 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 contents) 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:

- iii. Flat viewing by channel
- iv. Channel-defined tiers
- v. Broadcaster-defined tiers
- vi. 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 contents 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 contents 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 contents should be feasible
- ii. Setting of fees depending on the usages of contents 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 contents 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:

(6) Payment at time of contract

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

(7) Viewing-based payment (pay later): Supports IPPU.

(8) 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 contents.

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

(4) Flat/tier billing contract by broadcaster group

(5) PPU billing contract by broadcaster group

(6) 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 a triple key architecture 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 Algorithm

- Identified by `encrypt_id` of contents 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, contents key to de-encrypt depending on the usage conditions, etc.
- ACI can be encrypted except for the protocol number and broadcaster group identifier.
- The encryption file and ACI are associated with one of the following:
 - Specified with the contents 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 Architecture

Table 3-1 provides the ACI structure.

Table 3-1 ACI structure

Structure	Notes
Protocol number	1 Byte
Broadcaster group identifier	2 Byte
Work key identifier	10 Byte
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 group 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 contents key
- Information related to tampering 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. 37, 2003.
- 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 contents.
- 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 Byte
Associated information byte length	2 Byte
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 architecture 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 group identification
- 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 tampering detection

3.4.4 ACI Position Specification

The ACI position corresponding to contents is specified with the following:

1) Contents information header

2) ACG (Access Control Group) descriptor

3) License link information (LLI)

3.4.4.1 ACI Position Specification with Contents Information Header

- The ACI position is specified with ACI_URI_path of the contents 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 Contents Information Header

(1) Contents Information Header Overview

- Identifies encrypted files in which the encryption descriptor defined in 3.4.4.7 is positioned.
- The contents information header is positioned at the beginning of the encryption file and includes information such as the specification of the encryption algorithm, specification of the ACI position, etc.

(2) Contents 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 contents information header defined below to the beginning of the file (resource). Table 3-3 provides the data structure of the contents information header.

Table 3-3 Data Structure of the Contents Information Header

Data Structure	No. of bits	Bit line description
ContentInfoHeader(){ contentInfo_length encrypt_id CA_content_id ACI_reference_loop_length for(j= 0; j < ACI_reference_loop_length; j++){ CA_system_id ACI_URI_length for(i = 0; i < ACI_URI_length; i++){ ACI_URI_path } } PrivateDatalength for(k = 0; k < privateDatalength; k++){ PrivateDataByte } }	16 8 32 16 16 8 8 8 8	uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf

Meaning of the ContentInfoHeader():

- 1) contentInfo_length (contents 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 algorithm applied to the data after the contents 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 contents specified by the charging unit contents 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 architecture defined per broadcaster.

3.4.4.5 ACG Descriptor

The ACG (AccessControlGroup) 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	Bit line description
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 contents specified by the charging unit contents 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 contents and fees to be presented to viewers using the data coding system or letter coding defined by the operation.
- 7) content_URI_length (contents URI length): This 8-bit field indicates the byte length of the succeeding URI letter string.
- 8) content_URI_path (contents URI area): This is an 8-bit field. A series of areas indicate the URI letter string indicating the whereabouts of the contents to be presented at the beginning of the charging unit contents.
- 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 architecture defined per broadcaster.

3.4.4.6 License Link Information

When specifying the position of the ACI corresponding to the contents, 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		Contents identifier	
CA_system		Identifier information of the CA system	
	aci_uri	ACI's URI	
	key_id	Contents key ID	
	Encryption	Resource encryption system	
	resource_url	Resource's URI	

Meaning of License Link Information:

(1) content_crid

Information to identify contents

(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 contents 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	Bit line description
Encrypt_descriptor(){		
descriptor_tag	8	uimbsf
descriptor_length	8	uimbsf
encrypt_id	8	uimbsf
}		

Meaning of the Encryption Descriptor:

encrypt_id (encryption identifier): This 8-bit field is used to identify the encryption algorithm 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	additionalDirectoryInfo	additionalFileInfo
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 contents 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	Bit line description
X-arib-storedAcgList { StoredAcgListLength for (i=0; i<storedAcgListLength; i++) { AcgInfo() } }	16 8	Uimsbf 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 field 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 architecture 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 contents is specified by the conditional playback system descriptor defined in 2.3.2.6.4.

Part 2

Appendix

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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 contents for each viewer. The control of usability of such contents is realized by broadcast providers transmitting encrypted contents 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 contents are decrypted as soon as the said contents are received. Therefore, viewing of contents cannot be controlled after storage, when the contents are 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 contents are stored without decrypting, and whereby the control of decryption each time the contents are viewed is enabled.

The broadcasting systems based on home servers have the following two types of contents: 1) contents transmitted by the “stream-type transmission system” where the time required for transmitting the contents and the time required for viewing the said contents are always the same (stream-type contents), and 2) contents transmitted by the “file-type transmission system” where the time required for transmitting the contents and the time required for viewing the said contents are not always the same (file-type contents).

The access control system for stream-type contents 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 contents are 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 contents are 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 contents after storage cannot be controlled is not suitable as an access control system for such contents. Based on the transmission system for file-type contents (see Section 2.2, Chapter 2 of ARIB STD-B38) and storage control system for file-type contents (see Section 2.3, Chapter 2 of ARIB STD-B38), it is necessary that the access control system for file-type contents 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 contents 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 contents after being stored. Access control is sometimes carried out also at the time of reception.

Since the conditional access system for pay broadcasts (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 broadcast 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) Contents usage licensing type services

Services that allow storing and viewing of contents 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 contents 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 contents in the receiver in advance based on the viewers' tastes and specifications where the viewers can view stored contents by paying for desired viewing periods (e.g., 24 hours or one week)

1.3.3 Services with Access Control after Storage on Contents that can be Viewed at the time of Reception of Broadcasting

1) Time-shift viewing services

Pay broadcasts can be stored by contractants, or non-contractants and charges are incurred only when the viewer plays the contents.

[Service examples]

- Services to store pay per view contents without concluding a contract, and charges are incurred only when actually viewed.

2) Expansionary type contents charging services

Services in which the conditions for charging are varied between when viewing at the same time as broadcasting and when viewing stored contents 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 contents of broadcasts based on home servers and unique services transmitted by broadcasting after the completion of storage, services of transmitting the contents key to decrypt contents or information to control usage of contents on an ad hoc basis via communication, controlling the expiry date and charging, such as rental videos

3) Contents sharing control type services

Services whereby pay broadcasts can be played only on one or more than one receiver specified at the time of the contract conclusion

[Service examples]

- Contents broadcasted and stored on pay broadcasts 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 Contents 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 contents can be viewed individually irrespective of the order of transmission of the contents

[Service examples]

- A large volume of music contents are 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) Contents storage guarantee type services

Services whereby only contents 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 contents that are independent from the time necessary for viewing of the contents.

[Service examples]

- A large volume of music contents are 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 contents in the unit of music or albums.
- Services to transmit a large volume of image contents using the intervals of transmitting other broadcast contents

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 contents 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 contents stored together

(5) Functions to consist one charging unit with more than one file, and to playback per file

(6) Functions to select encryption systems depending on the characteristics of services per content such as image, voice, text, etc.

(7) Functions to control the terminals where playback on other than the receiving terminal is feasible

(8) Functions to receive and control more than one receiving terminal, such as per household as one group

(9) 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 contents services/file-type contents 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 Contents Services	File-type Contents 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 Contents and File-type Contents

The access control system enables playback of contents to only given viewers by decrypting the encrypted contents at the time of reception or playback of the contents 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 contents. 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 contents are referred to as “stream-type contents,” 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 contents. 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 contents are referred to as “file-type contents,” 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 contents is necessary.

In this Standard, the processes of encryption on contents are differentiated in accordance with the access control system; encrypting contents for the stream-type access control is referred to as “scrambling” while encrypting contents 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 contents and control information in the transmission protocol.

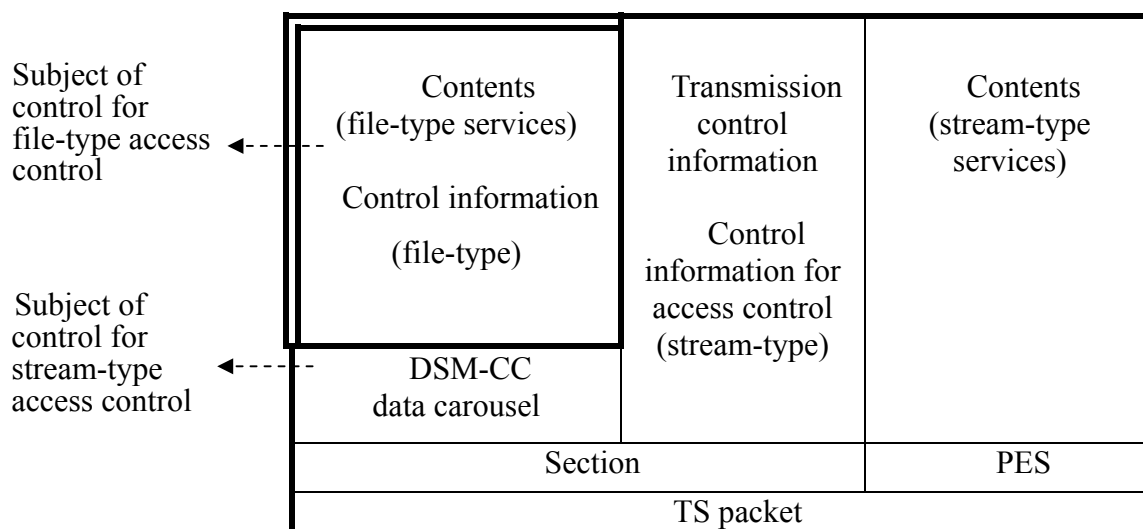


Figure A1-1 Protocol Stack Related to Access Control

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

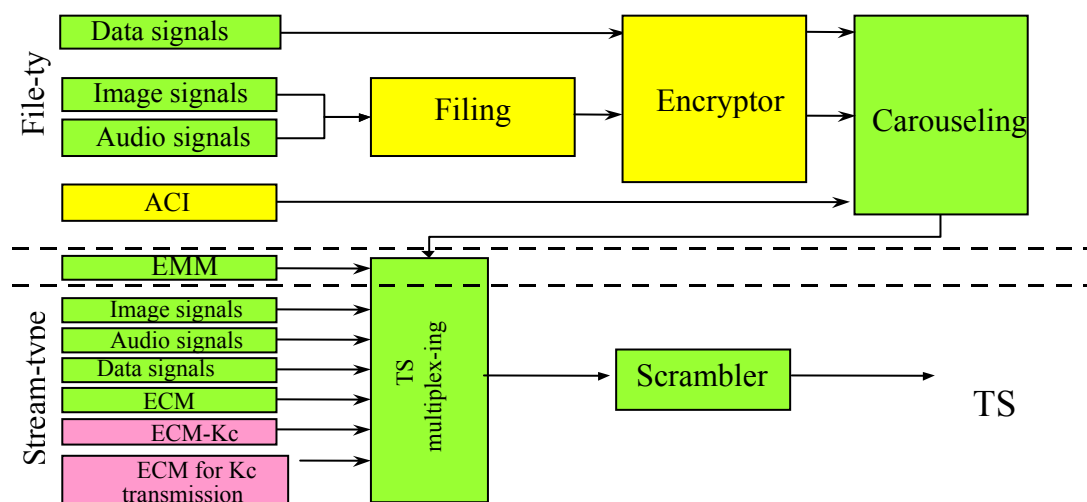


Figure A1-2 System Architecture on the Transmission Side

2.1.2.2 Reception Side

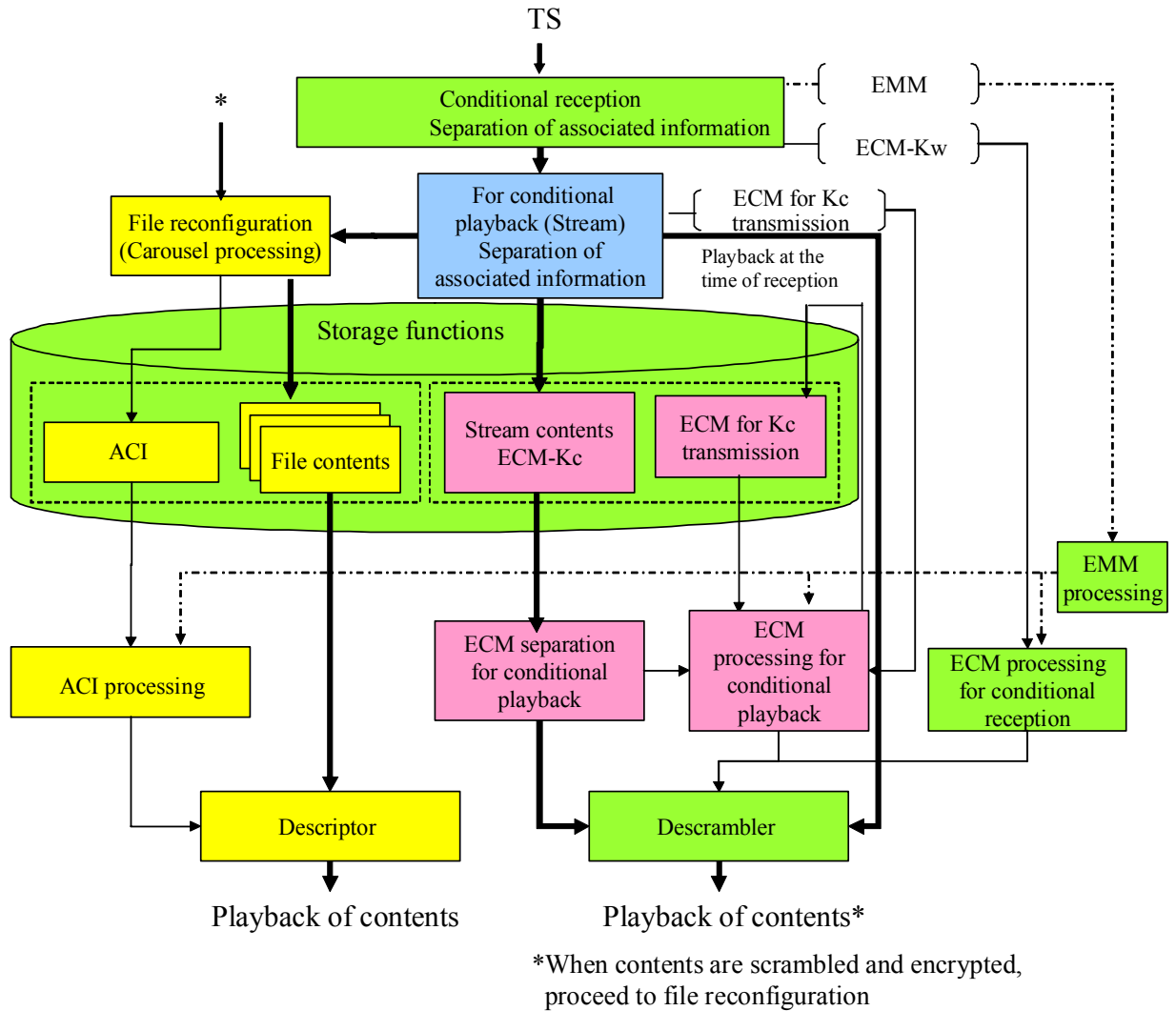


Figure A1-3 System Architecture on the Reception Side

2.1.2.3 Example of Transmission Formats

Figure A1-4 provides an example of transmission format of stream-type contents and file-type contents.

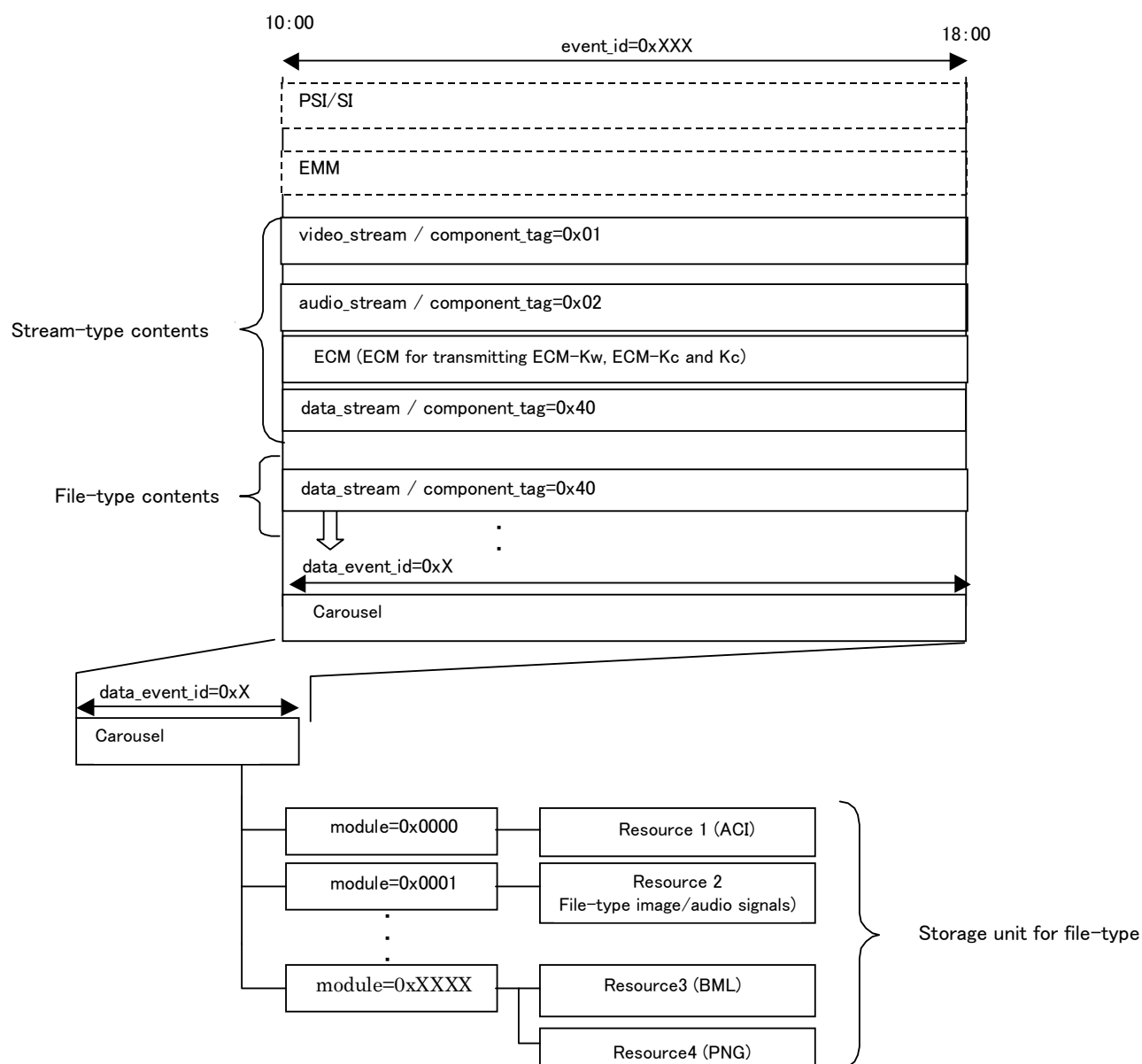


Figure A1-4 Example of Transmission Formats of Stream-Type Contents and File-Type Contents

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.

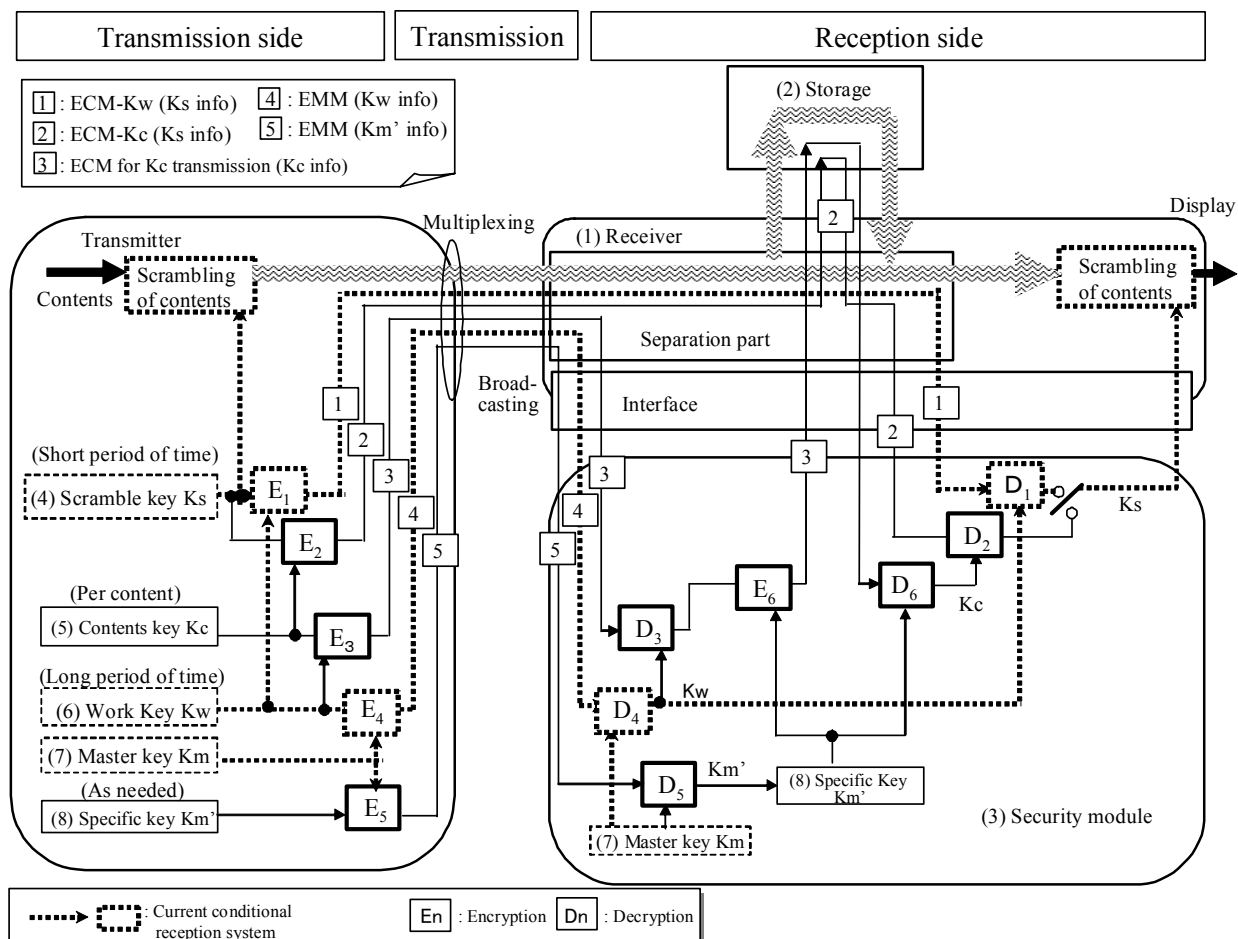


Figure A1-5 System Architecture for Stream-Type Conditional Access System

Each function is described in Section 2.3.2, Chapter 2, Part 2 of this Standard. Contents key K_c (5), Specific key $K_{m'}$ (8), and functions of encryption/decryption using these are added to the conditional access system described in Part 1. For the work key K_w and master key K_m , 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.

K_c is the key to encrypt ECM including the scramble key K_s with a key per contents unit so that

control per contents unit is enabled when playing and viewing stored programs. This Kc needs to be stored along with the scrambled contents 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 contents 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 group identifier, work key identifier, scramble key Ks (encrypted with the work key Kw), date, charging information
- 2) ECM-Kc: Protocol number, broadcaster group identifier, contents key identifier, scramble key Ks (encrypted with the contents key Kc), date, charging information
- 3) ECM for Kc transmission: Protocol number, broadcaster group identifier, work key identifier, contents key Kc (encrypted with the work key Kw), contents 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 group identifier” can be encrypted, and “work key/contents 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 contents. 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 2003, No. 37, Vol. 6. 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 2003, No. 37, Vol. 6. 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 Contents and Associated Information

When the receiver plays the stored contents, it is necessary to transmit information to make it feasible for the identification of associated information related to the said contents.

The current digital broadcasting system transmits information related to stream-type contents 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 contents. Information to make it feasible for the identification of associated information related to the stream-type contents 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 Contents Information Header and ACG Descriptor are used for ACI Reference

2.3.1 File-type Contents Architecture

Figure A1-6 provides an example of architecture of file-type contents and associated information necessary for their access control.

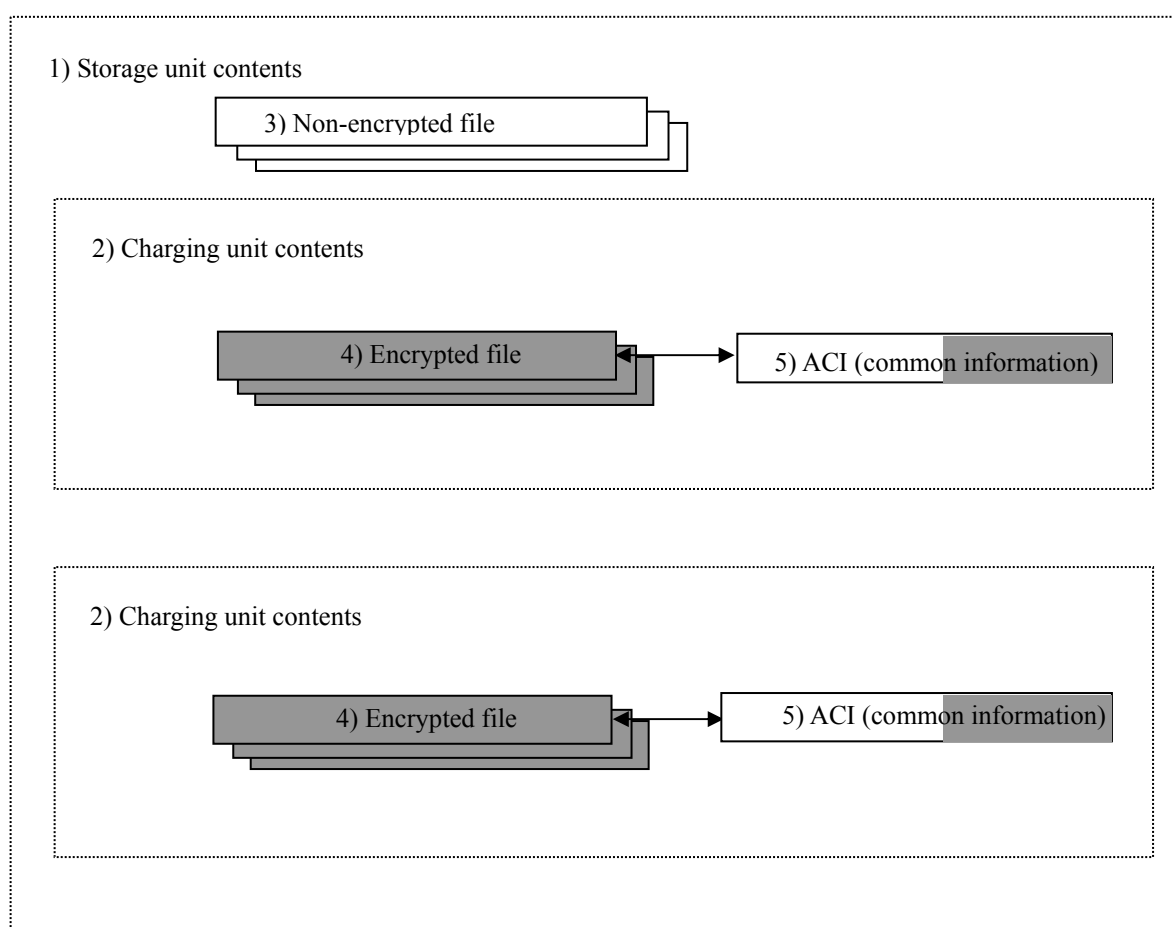


Figure A1-6 An Example of Architecture of File-type Contents

1) Storage unit contents

Storage unit contents indicate the unit to store contents by means of EPG services, etc. This unit corresponds to programs (events) in the current system.

The storage unit contents consist of non-chargeable files, encrypted files comprising more than one charging unit, and common information (ACI) defined per charging unit.

2) Charging unit contents

Charging unit contents 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 contents.

3) Non-encrypted file

Indicates non-chargeable non-encrypted files

4) Encrypted file

Indicates chargeable encrypted files

5) ACI

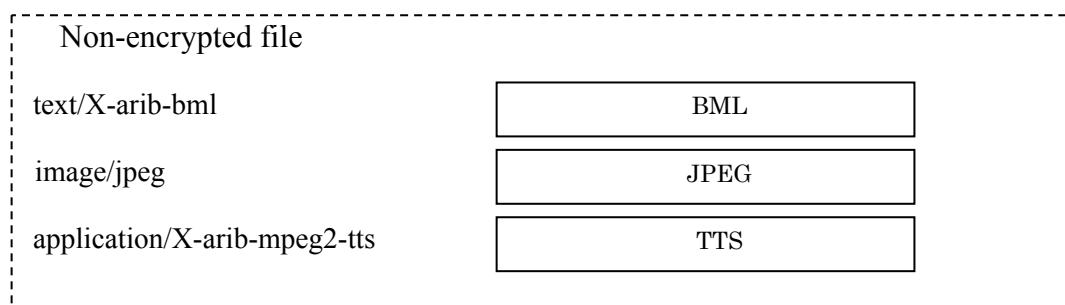
Indicates partially encrypted information, in which usage conditions to carry out usage judgment for each user defined for charging unit contents, and contents key to decrypt depending on the usage conditions, etc. are stored.

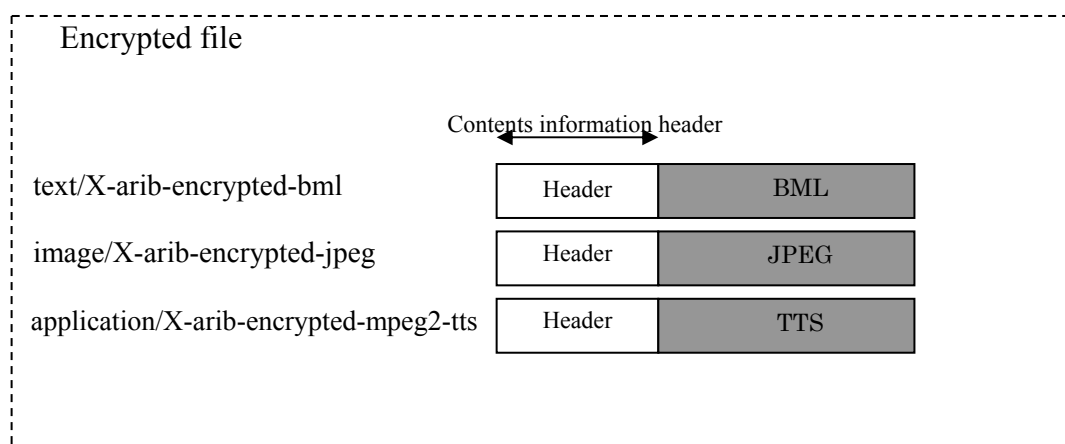
2.3.2 Specification of Encryption System

2.3.2.1 Media Type of Encrypted Files

The media type of non-encrypted files and encrypted files is identical in the conditional playback system, and encrypted files are distinguished from non-encrypted files by newly defining the encryption descriptor for encrypted files.

As a data structure when the resource unit is encrypted, contents information header is added before the encrypted files. See Figure A1-7.






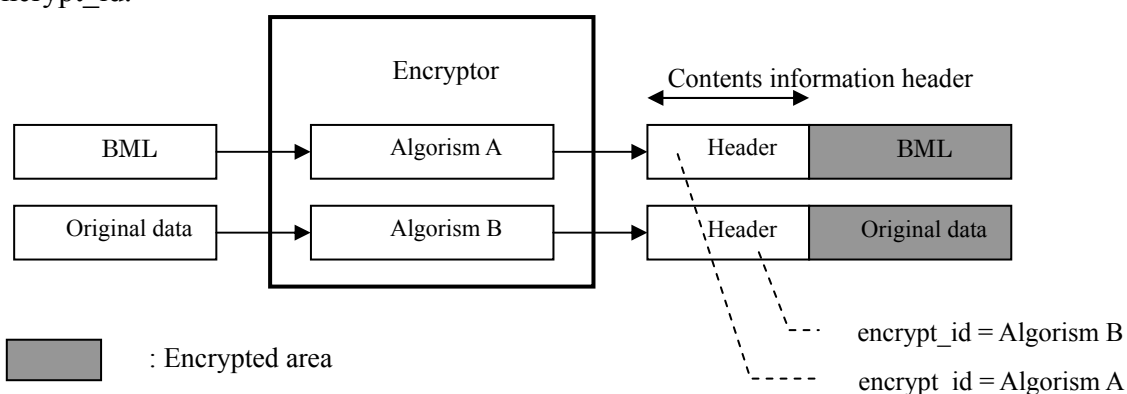
 : Encrypted area

Figure A1-7 Encrypted File Structure

2.3.2.2 Identification of Encryption Method

In the conditional playback system, the encryption algorithm can be set per file unit. Therefore, the identifier to identify the encryption algorithm (`encrypt_id`) is newly defined and allocated within the aforementioned contents information header.

The receiving terminal identifies the encryption algorithm on the file using newly defined `encrypt_id`.




 : Encrypted area

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 contents and storage conditions of ACI. Here are examples of the administration model at the time of storage of each data.

(1) Storage unit contents

- 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 contents

- The encrypted file comprised in one charging unit content, ACI, can be identified with the sub-directory information specified by the Sub Directory descriptor.

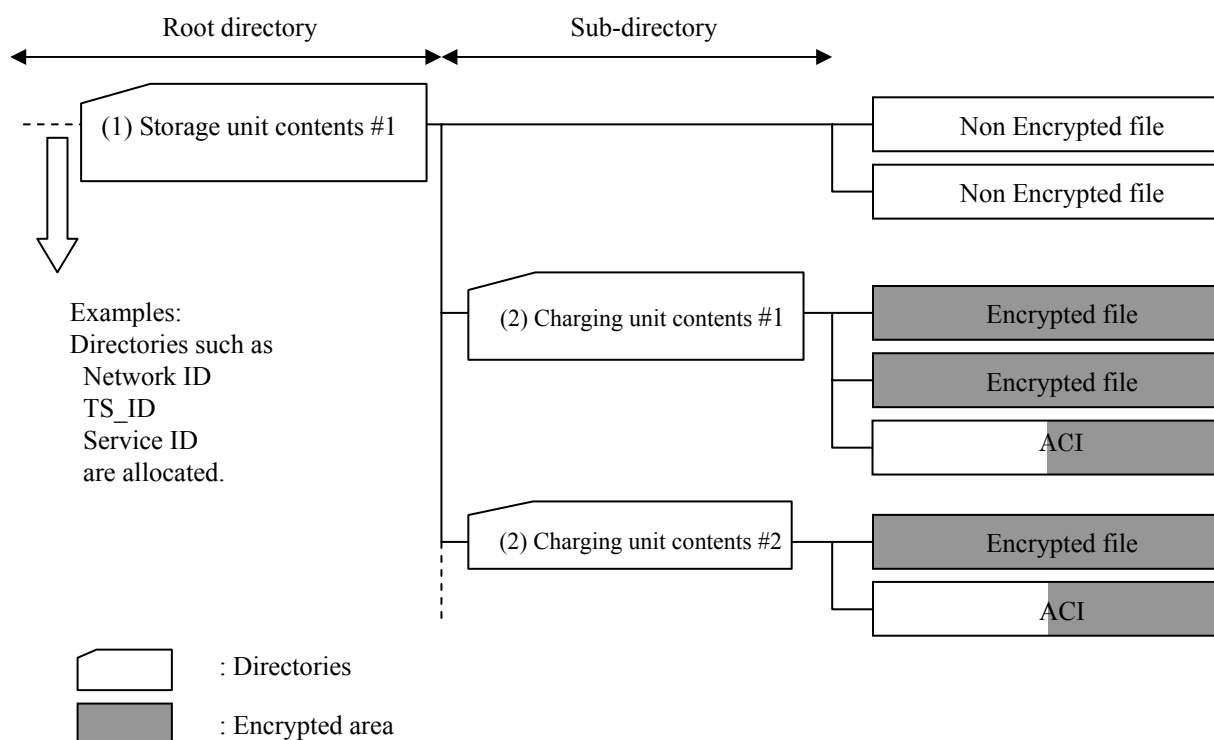


Figure A1-9 Example of Storage Administration Model

2.3.3.2 Reference Method

The ACI reference methods are different for when usage judgment of contents is made from a screen showing a list of stored contents 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 contents information header, and ACI reference is carried out at the time of playback of scrambled files (Figure A1-10-(2)).

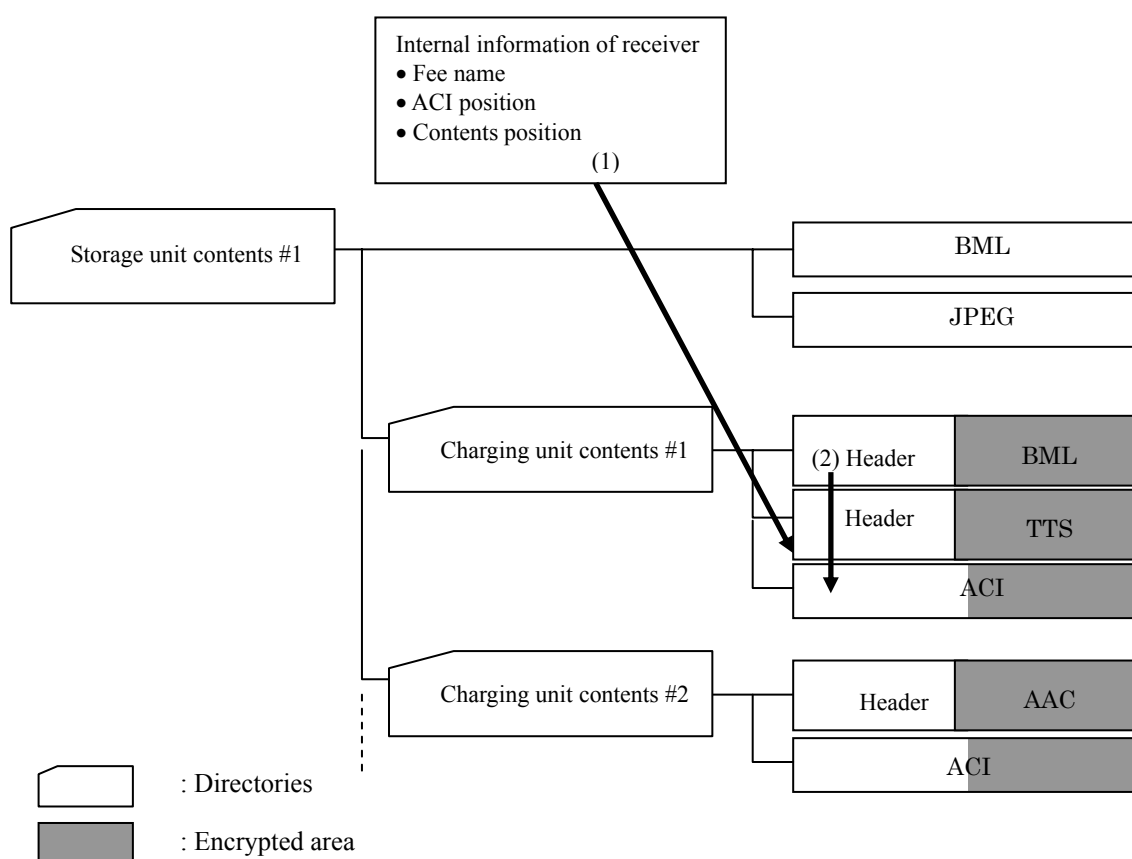


Figure A1-10 ACI Reference Method

2.4 File-type Access Control Method when License Link Information is used for ACI Reference

2.4.1 File-type Contents Architecture and ACI Reference Method

Figure A1-11 provides the file-type contents and an example of architecture of associated information necessary for their access control. ACI, in which the usage conditions of contents and contents key are described, is referred to from information described in LLI.

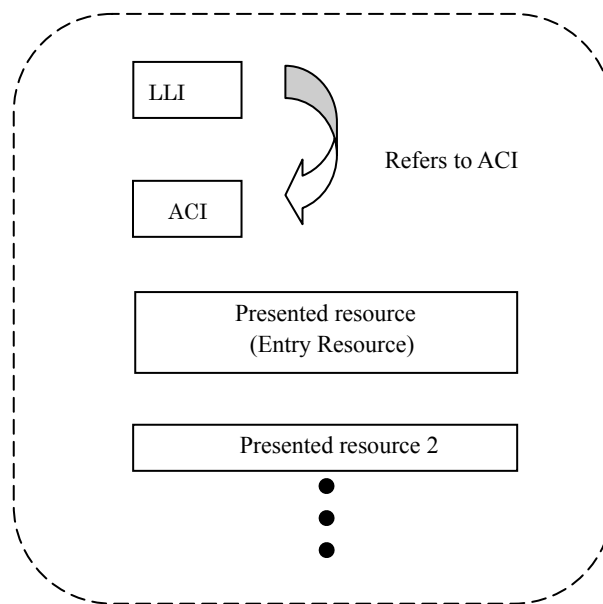


Figure A1-11 An Example of File-type Contents Architecture

2.4.2 Specifying Encryption Method

Specified with the encryption of license link information (LLI)

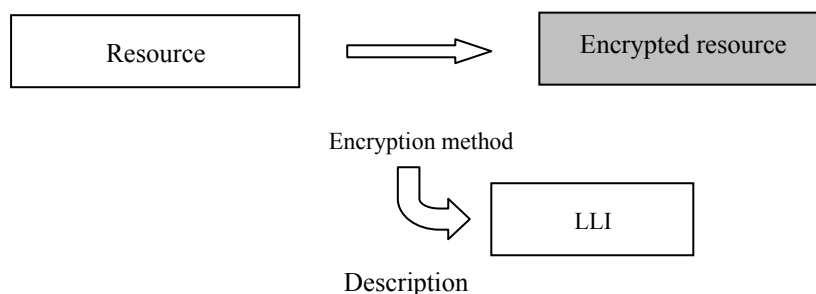


Figure A1-12 Specifying Encryption Method

Appendix 2 Operation

1. Relationship between Encryption and Scrambling in File-Type Contents Services

Since the encryption of file-type contents 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 contents in the file layer is feasible.

When control in the transport layer is necessary with encrypted file-type contents 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, contents are 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 contents is basically feasible in the following two conditions:

- 1) Reproduction in the condition that contents are 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 contents are 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 contents are scrambled / encrypted

It is desirable that control on reproduction is realized when the providers intend to do so at the time of the contents distribution even in the condition that the contents are scrambled / encrypted.

2.2 Reproduction after access control at the time of playback in the condition that contents are de-scrambled / decrypted

Basically, in the condition that the contents are 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 contents employs a system with a degree of

freedom allowing a selection of various algorithms depending on the services.

In the actual operation, however, it is desirable that mutually available encryption algorithms are determined to implement on the receiver as a standard, and that encryption algorithms 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 algorithms.

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 scramble key / contents key, information to make judgment regarding contracts, etc. It exists in combination with the contents 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 contents 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 scramble key / contents key

5) Viewing fees

6) Viewing periods

4.2 Music Distribution Services

50 latest hit songs are stored at once from which users can select only the desired ones in the unit of songs or albums, and the terrestrial channels are connected at the time of purchase contract being concluded, to obtain contract information and to process charging.

<Necessary Associated Information>

1) Provider identifier

- Identifies the provider of music distributions services

2) Work key identifier

- Identifier information related to the work key used to encrypt associated information

3) Specification of the URL to obtain contract information

4) Information related to connection

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CONDITIONAL ACCESS SYSTEM SPECIFICATIONS
FOR DIGITAL BROADCASTING

ARIB STANDARD

ARIB TR-B25 VERSION 4.2-E2
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