ENGLISH TRANSLATION

STRUCTURE AND OPERATION OF CLOSED CAPTION DATA CONVEYED BY ANCILLARY DATA PACKETS

ARIB STANDARD

ARIB STD-B37 Version 2.2

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Preface

ARIB (Association of Radio Industries and Businesses) has established the ”ARIB standards” for the basic technical conditions of standard specifications related to variety of radio communication equipments, broadcasting transmission equipments, and its reception equipments using radio wave with the participation of radio communication equipment manufactures, broadcasting equipment manufacturers, electric communication companies, service providers and the other users.

“ARIB standards” are nongovernmental standards established by combining governmental technical standards established for purpose of effective use of frequency and to avoid interference of other users, and nongovernmental optional standards established for convenience for radio communication equipment manufacturers, broadcasting equipment manufacturers, electric communication companies, service providers and users, in order to secure appropriate quality and compatibility of radio communication equipment and broadcasting equipment, etc.

This specific standard is applicable to the structure and operation of closed caption conveyed in the form of ancillary data packets. It was established by the approval of the standardization committee, participated widely and indiscriminately by radio equipment manufactures, broadcasting equipment manufacturers, telecommunication enterprises, broadcasters and users, to secure impartiality and clearness.

We hope that this standard will be put to practical use actively by radio communication equipment manufactures, broadcasting equipment manufactures

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Annexed table

Patent applicant	Name of invention	Patent number	Remarks
Motorola, Inc	A comprehensive confirmation form has been submitted with regard to ARIB STD-B37 ver.2.1.		Note1

(Note1) Applied to the revised portion of ARIB STD-B37 ver.2.1

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Chapter 1 General Items

1.1 Purpose

This standard defines structure of closed caption data for characters displayed on-screen in synchrony with video which is conveyed in ancillary data packet format using the vertical ancillary data area within the component bit-serial interfaces for 525/60-televisions and bit-serial interfaces for 1125/60 HDTV systems used in studios.

1.2 Scope

This standard is applicable to devices which convey closed caption data using ancillary data packets defined in ARIB Standard STD-B6 "*Ancillary Data Packet and Space Formatting of Bit-Serial Digital Interface for 525/60 Television System*" and ARIB Standard BTA S-005B "*Ancillary Data Packet and Space Formatting of Bit-Serial Digital Interface for 1125/60 HDTV Systems*".

1.3 References

1.3.1 Referenced Documents

The following standards relating to the construction of digital terrestrial broadcasting systems have been referenced in this standard.

- ARIB STD-B3: *ARIB Standard for Operation of the FM Multiplex Broadcasting System*
- ARIB STD-B5: *Data Multiplex Broadcasting System for the Conventional Television Using the Vertical Blanking Interval*
- ARIB STD-B6: *Ancillary Data Packet and Space Formatting of Bit-serial Digital Interface for 525/60 Television System*
- ARIB TR-B14: *Operational Guidelines for Digital Terrestrial Television Broadcasting*
- ARIB TR-B15: *Operational Guidelines for Digital Satellite Broadcasting*
- ARIB STD-B20: *Transmission System for Digital Satellite Broadcasting*
- ARIB TR-B23: *Operational Guidelines for Ancillary Data Used to Convey Inter-Stationary Data*
- ARIB STD-B24: *Data Coding and Transmission Specification for Digital Broadcasting*
- ARIB STD-B27: *Closed Caption Data Conveyed by Ancillary Data Packets for Component Bit-serial Digital Interface of 525/60 and 1125/60Television System*
- ARIB STD-B36: *Exchange Format of the Digital Closed Caption File for Digital Television Broadcasting System*
- BTA S-005B: *Ancillary Data Packet and Space Formatting of Bit-serial Digital Interface for 1125/60 HDTV Systems*

- NAB Technical Standard T021-1996: *Program Conversion Using 8-inch Floppy Disks for Data Transmission*
- NAB Technical Standard T027-1996: *Program Conversion Using 3.5-inch Floppy Disks for Data Transmission*
- Kenrokukan Publishing: *The Technical Handbook on the BTA teletext systems (revised edition)*

1.4 Definition of Terminology

1.4.1 Terminology

The terms used in this standard are defined as follows:

Table 1-1: Definition of Terminology

Adaptation field	An area for stuffing data and for additional ancillary data related to an individual stream.
Analog closed caption	A closed caption format for character multiplex broadcasting as used for analog television broadcasting.
Analog closed caption data	37-word section of closed caption data used in analog closed caption broadcasting.
ANC data	Ancillary data which is embedded onto video signals for transmission.
BTA	Broadcasting Technology Association. BTA standards are referenced herein; however, BTA was relocated to ARIB following disbandment of the association in 1997.
Buffer send mode	A mode wherein closed caption data packets are buffered by page data units before sending.
CCIS	The conversion information for closed caption data and other auxiliary data located within PES_private_data. (For more details, refer to Supplement 3.3 “Operation using CCIS”.)
Closed caption	Transcripts of dialogue and the like which are displayed on-screen in synchrony with video.
Closed caption data	A name given to character data and control data for dialogue and the like as displayed on-screen in synchrony with video.
Closed caption data identifier	An identifier which indicates the type of closed caption page data which is being transmitted.
Closed caption data packet	A closed caption data packet transmitted in ANC packet format.
Closed caption dummy data	Data used during closed-captioned programs when no closed caption data exists.
Closed caption header	Header data comprised of the first 4 words of the UDW of a closed caption data packet (i.e., the closed caption format identifier, the send mode identifier, the start/end packet flag, the language identifier, the closed caption data identifier, etc.).
Closed caption page	A transmission unit for closed caption data as transmitted in one or more closed caption data packets. (Corresponds to one page.)
Data type identifier	An identifier which indicates a type for the display timing value (i.e., PTS value, time, time code, etc.).
DC	Data count word which indicates the length of the UDW.
DID	Data identification word for ancillary data.
Digital closed caption	The closed caption format used for data transmission in digital television broadcasting.
Display timing data word	Time code parameters which determine the display timing control for closed caption data.
End packet flag	A flag indicating the final ancillary packet of the closed caption data group.
Exchange format data	File exchange format data for digital closed caption as defined in ARIB STD-B36
Format identifier	An identifier which indicates the format for closed caption data.
Group-A CRC	CRC added when Group A is used for closed-caption text page management data.

Group-B CRC	CRC added when Group B is used for closed caption text page management data.
HD Closed Caption	The closed caption format used in high definition digital television broadcasting.
Language identifier	An identifier which indicates the type of language used when multi-language closed captions are broadcasted.
LEN	A length indicator used in case of short form data to indicate the length of the data which follows it.
LI	A length indicator located at the start of the logic block to indicate the length of the data which follows it.
Mobile Closed Caption	The caption format used in digital television broadcasting for portable (mobile) receivers.
NAB	The National Association of Commercial Broadcasters in Japan. NAB standards are referenced herein. Do not confuse with the American NAB (National Association of Broadcasters).
Page	The unit for a single closed caption screen.
Page information	The combination of page management information and page data.
Page management information	Management information for individual pages (i.e., page number, display start time, etc.).
Page data	Data for characters displayed on-screen for a single page.
PES packet	Comprised of a PES header and a PES packet payload, a PES packet is used for the transmission of elementary streams (i.e., closed caption data).
PES header	Header of a PES packet (i.e., PES_packet_length, PTS, etc.).
Portable receiver (Mobile receiver)	A reception format in which only one segment of the portable reception hierarchy can be received. (In preparation for Mobile receivers, etc.)
Program control information	Management information relevant to closed-captioned programs (i.e., program name, broadcast date, etc.).
PTS	Time management information used for the display of closed caption data.
SD Closed Caption	The closed caption format used in standard definition digital television broadcasting.
SDID	Secondary data identification word for ancillary data.
Send mode identifier	An identifier which indicates the transmission timing for closed caption data.
Sequential send mode	A mode wherein closed caption data packets are sent in real time.
Short form	A transmission format wherein only the display timing, closed caption control data and closed caption text data are transmitted.
Start packet flag	A flag indicating the leading ancillary packet of the closed caption data group.
TSP header	Header of TSP (i.e., sync_byte, PID, scrambling_control, adaptation_field_control, continuity_counter, etc.).
TS packet	A fixed-length packet of 188 bytes as defined in ISO/IEC 13818-1.
UDW	Corresponds to the closed caption data packet in this standard.
User data	Data in a customized format as specified by the user.

1.4.2 Abbreviations

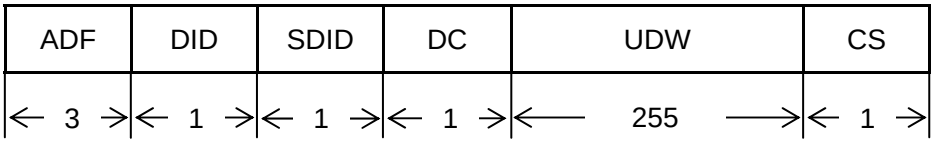
The following abbreviations are used within this standard.

ADF	Ancillary Data Flag
ANC	Ancillary
CCIS	Conversion Control Information Support
CRC	Cyclic Redundancy Check
CS	Checksum
DC	Data Count
DID	Data ID (identification) word
ES	Elementary Stream
LEN	Length
LI	Length Indicator
PES	Packetized Elementary Stream
PID	Packet Identifier
PTS	Presentation Time Stamp
SDID	Secondary Data ID (identification) word
TSP	Transport Stream Packet
UDW	User Data Words

Chapter 2 Closed Caption Ancillary Data Packets

2.1 Packet Structure

Closed caption data is conveyed using closed caption ancillary data packets. The structure of these ancillary data packets conforms with Type 2 ancillary data format which is defined in ARIB Standard STD-B6 for bit-serial interfaces for 525/60 television systems and in ARIB Standard BTA S-005B for bit-serial interfaces for 1125/60 HDTV systems. In this structure, furthermore, 1 word comprises 10 bits. The structure of closed caption ancillary data packets is illustrated in Figure 2-1.



ADF: Ancillary data flag
DID: Data identification word
SDID: Secondary data identification word
DC: Data count word
UDW: User data words
CS: Checksum word

Figure 2-1: Structure of Closed Caption Ancillary Data Packets

(Figures indicate word numbers. Same applies below.)

The DID/SDID combinations used with digital closed caption are illustrated in Table 2-1; furthermore, DID values and SDID values are indicated using the 8-bit word comprising b0 through b7. Only one packet per field shall have a specific DID/SDID combination.
Values in parentheses correspond to the 10-bit word which also includes both b8 (i.e., the even parity for b0 through b7) and b9 (i.e., the inverse of b8). (Note that the same notation will be used elsewhere in this standard.)

Table 2-1: DID/SDID for Digital Closed Caption

Digital closed caption type	DID value	SDID value
HD closed caption	5Fh (25Fh)	DFh (1DFh)
SD closed caption		DEh (2DEh)
Analog closed caption		DDh (2DDh)
Mobile closed caption		DCh (1DCh)
Undefined		DBh (2DBh)
Undefined		DAh (1DAh)
Undefined		D9h (1D9h)
Undefined		D8h (2D8h)
Undefined		D7h (2D7h)
Undefined		D6h (1D6h)
Undefined		D5h (1D5h)
Undefined		D4h (2D4h)
Undefined		D3h (1D3h)
Undefined		D2h (2D2h)
Undefined		D1h (2D1h)
Undefined		D0h (1D0h)

2.2 Packet Arrangement and Internal Makeup

Figure 2-2 illustrates the arrangement and internal makeup of closed caption ancillary data packets which are embedded in one line of video.

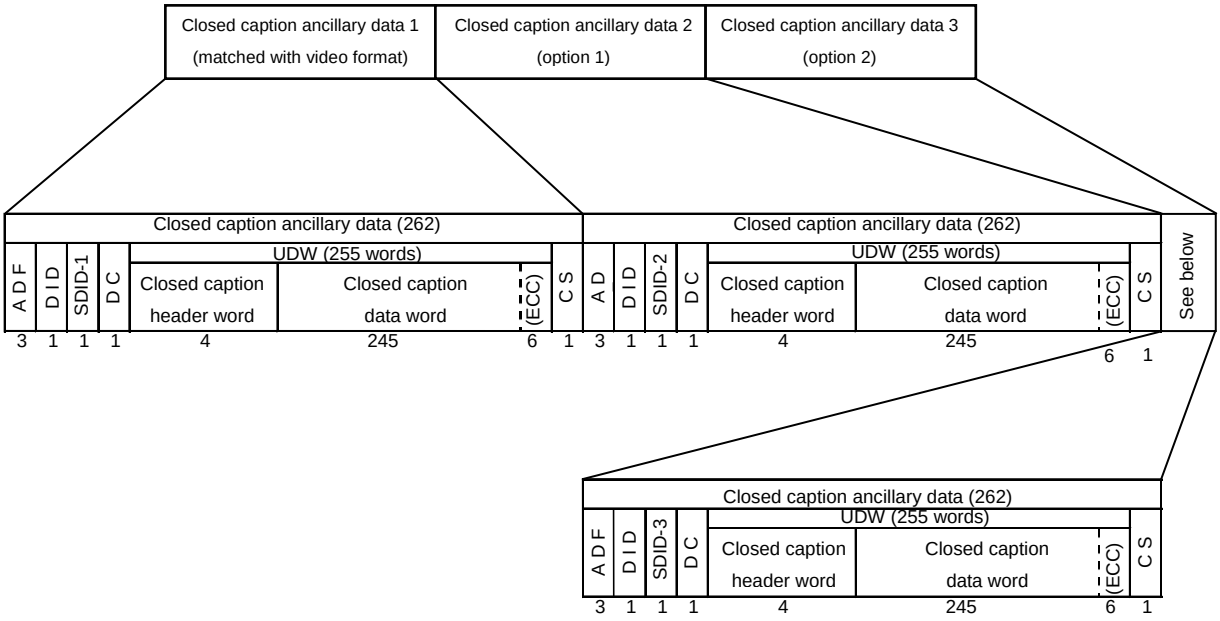


Figure 2-2: Arrangement and Internal Makeup of Closed Caption Ancillary Data Packets

- The data length for individual closed caption ancillary data packets is fixed at 262 words. (The number of user data words is fixed at 255 words.)
- The names Closed caption ancillary data 1, Closed caption ancillary data 2, and Closed caption ancillary data 3 are applied in sequence from the leading ancillary data packet.
- It is preferable that closed caption ancillary data 1 be closed caption data conforming to the video data format. For example, when closed caption data is embedded in HD video signals, it is preferable that closed caption ancillary data be in HD closed caption format.
- Closed caption ancillary data 2 (option 1) can be used for closed caption data that has a different SDID from the closed caption data embedded in closed caption ancillary data 1.
- Closed caption ancillary data 3 (option 2) can be used for closed caption data that has a different SDID from the closed caption data embedded in closed caption ancillary data 1 and closed caption ancillary data 2.

2.2.1 Closed Caption Header Words

A closed caption header consisting of 4 words shall be appended to the start of the UDW.

2.2.1.1 First Word

The bit allocation for the first closed caption header word is illustrated in Table 2-2.

Table 2-2: Bit Allocation for First Closed Caption Header Word

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Error correction identifier
b6	Undefined (See note.)
b5	Undefined (See note.)
b4	Undefined (See note.)
b3	CI
b2	
b1	
b0(LSB)	

Note: Undefined bits shall be set to 0 (zero) until defined. (Same applies below.)

(1) Continuity Index

The continuity index (CI) indicates the state of data packet continuity. The CI increases by 1 for each packet, cycling between values from 0 to 15.

(2) Error Correction Identifier

The error correction identifier indicates whether or not error correction parity words are present. If set to [No error correction], the last 6 words from the UDW are not used and are all set to 00h (200h). If set to [Error correction], the last 6 words from the UDW constitute parity words. Code allocation for the error correction identifier is illustrated in Table 2-3.

Table 2-3: Code Allocation for Error Correction Identifier

b7	Description
0	No error correction
1	Error correction

2.2.1.2 Second Word

The bit allocation for the second closed caption header word is illustrated in Table 2-4.

Table 2-4: Bit Allocation for Second Closed Caption Header Word

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Undefined
b6	
b5	
b4	
b3	
b2	
b1	
b0(LSB)	

The second word is reserved for future extension purposes. The content of this word shall be set at 00h (200h) until defined.

2.2.1.3 Third Word

The bit allocation for the third closed caption header word is illustrated in Table 2-5.

Table 2-5: Bit Allocation for Third Closed Caption Header Word

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Undefined
b6	Start packet flag
b5	End packet flag
b4	Send mode identifier
b3	Format identifier
b2	
b1	
b0(LSB)	

(1) Format identifier

Indicating formats for the closed caption data, this identifier specifies the video signal format supported by the closed caption data in question. Code allocation for the format identifier is illustrated in Table 2-6.

The closed caption format specified using the format identifier shall be the same type as the digital closed caption format specified by the DID or SDID. (If the type is not consistent, the corresponding closed caption ancillary data words will be processed as invalid.) Note, however, that when the format identifier indicates “No closed caption”, any of the defined combination of DID and SDID can be used for digital closed caption.

Table 2-6: Code Allocation for Format Identifier

b3	b2	b1	b0	Description
0	0	0	0	Analog Closed Caption Format
0	0	0	1	HD Closed Caption Format
0	0	1	0	SD Closed Caption Format
0	0	1	1	Mobile Closed Caption Format
0	1	0	0	Undefined (See Note1)
~				
1	1	1	0	
1	1	1	1	No Closed Caption (See Note2)

Note 1: These closed caption formats are reserved for future extension purposes.

Note 2: No closed caption is embedded over this entire ancillary packet range.

(2) Send mode identifier

Indicating the transmission timing for closed caption data, this identifier specifies the synchronous timing for video and closed caption data. Code allocation for the send mode identifier is illustrated in Table 2-7.

Table 2-7: Code Allocation for Send Mode Identifier

b4	Description
0	Sequential send mode
1	Buffer send mode

In the sequential send mode, closed caption data are embedded immediately as closed caption data packets. In the buffer send mode, closed caption data are buffered in each page data unit and embedded as page unit data packet. The relationship between video and the various formats for sending digital closed caption are illustrated in Figure 2-3.

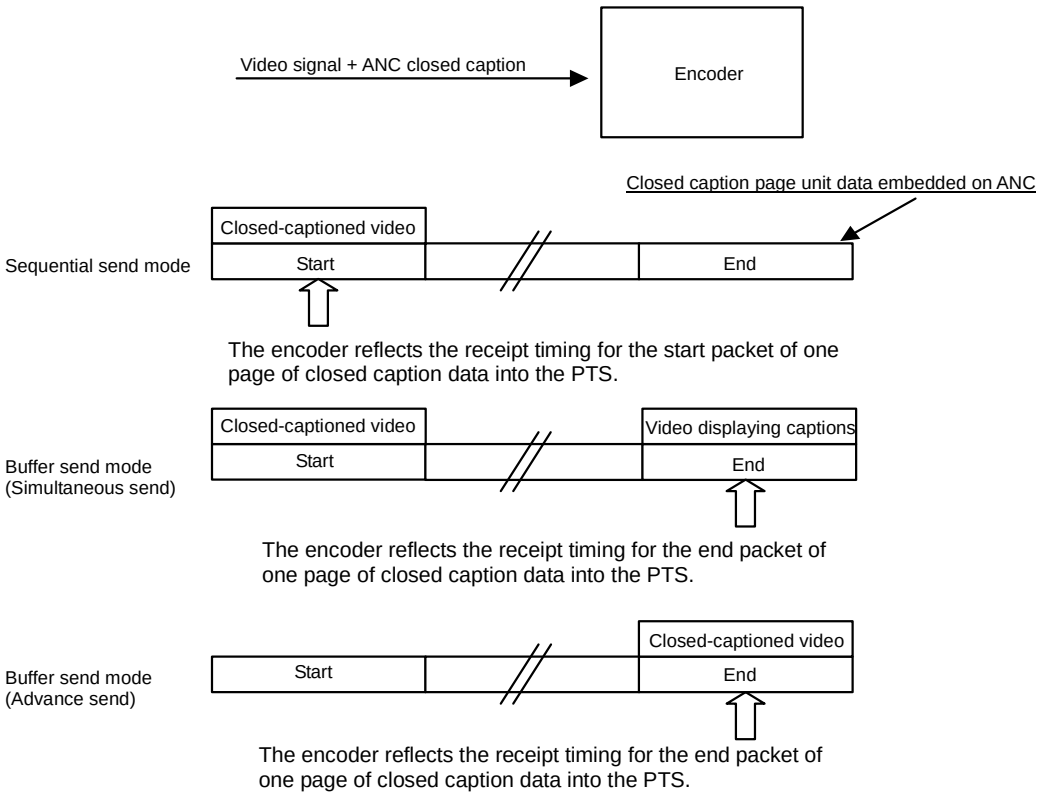


Figure 2-3: Relationship between Output Mode and Output Timing

(3) End packet flag

The end packet flag indicates whether the closed caption data section of short form data will contain the end TS packet when closed caption PES packet data is divided into individual TS packets. Code allocation for the end packet flag is illustrated in Table 2-8.

Table 2-8: Code Allocation for End Packet Flag

b5	Description
0	Not end packet
1	End packet

(4) Start packet flag

The start packet flag indicates whether the closed caption data section of short form data will contain the start TS packet when closed caption PES packet data is divided into individual TS packets. Code allocation for the start packet flag is illustrated in Table 2-9 and combinations of start packet flag and end packet flag are shown in Table 2-10.

Table 2-9: Code Allocation for Start Packet Flag

b6	Description
0	Not leading packet
1	Leading packet

Table 2-10: Combinations of Start and End Packet Flags

b6	b5	Description
0	0	Intermediate or dummy packet
0	1	End packet
1	0	Leading packet
1	1	Structure features one packet per data group

2.2.1.4 Fourth Word

The bit allocation for the fourth closed caption header word is illustrated in Table 2-11.

Table 2-11: Bit Allocation for Fourth Closed Caption Header Word

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Undefined
b6	
b5	Closed caption data identifier
b4	
b3	
b2	Language identifier
b1	
b0(LSB)	

(1) Language identifier

In situations where closed captions for multiple languages are sent using digital closed caption format (i.e., Japanese, English, etc.), the language identifier allows determination of the actual language contained in the closed caption packet. The "1st language" is specified when analog closed caption format is being used or when only one language is used with the digital closed caption format. Code allocation for the language identifier is illustrated in Table 2-12.

Table 2-12: Code Allocation for Language Identifier

b2	b1	b0	Description
0	0	0	1st language
0	0	1	2nd language
0	1	0	3rd language
0	1	1	4th language
1	0	0	5th language
1	0	1	6th language
1	1	0	7th language
1	1	1	8th language

(2) Closed caption data identifier

The closed caption data identifier indicates the type of closed caption data word to be sent. Two transmission formats are supported—namely, exchange format and short form. Exchange format refers to the transmission format for closed caption exchange data as defined in ARIB STD-B36 "*Exchange Format of The Digital Closed Caption File for Digital Television Broadcasting System*". Short form refers to the transmission format in which closed caption data (in either TS packets or analog closed caption packets) are sent in synchrony with video. Code allocation for the closed caption data identifier is illustrated in Table 2-13.

When the short form data (closed caption management data) "100" is set as the closed caption data identifier, the language identifier setting is to be ignored.

Table 2-13: Code Allocation for Closed Caption Data Identifier

b5	b4	b3	Description
0	0	0	Exchange format data (closed caption data label)
0	0	1	Exchange format data (program management information)
0	1	0	Exchange format data (page information 1)
0	1	1	Exchange format data (page information 2)
1	0	0	Short form data (closed caption management data)
1	0	1	Short form data (closed caption text data)
1	1	0	Undefined
1	1	1	Dummy data

2.2.2 Exchange Format Data

2.2.2.1 Word Structure

Exchange format data contains (a) a closed caption data label, (b) program management information, (c) page information 1, and (d) page information 2. In accordance with its length, the data is sent as a single 245-word-unit closed caption data word or separated into multiple units before transmission. Unused closed caption data word spaces are padded with FFh (2FFh).

Exchange format data send timing is not synchronized with the video material; rather, it is to be operated with each package.

Bit allocation for the exchange format data is illustrated in Table 2-14.

Table 2-14: Bit Allocation for Exchange format Data Word

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Exchange format data
b6	
b5	
b4	
b3	
b2	
b1	
b0(LSB)	

2.2.2.2 Closed Caption Data Word

The following types of closed caption page data will be embedded in accordance with the closed caption data identifier.

(1) Closed caption data label

The closed caption data label corresponds to the closed caption data label information defined by logical block 1 of the digital closed caption exchange format as defined in ARIB STD-B36. The structure of the closed caption data label is illustrated in Figure 2-4.

Figure 2-4: Closed Caption Data Label

(2) Program management information

Program management information represents operational information which is appended to the relevant program data. It conforms to ARIB STD-B36 (with the exception of the unused logical block area). The structure of the program management information is illustrated in Figure 2-5.

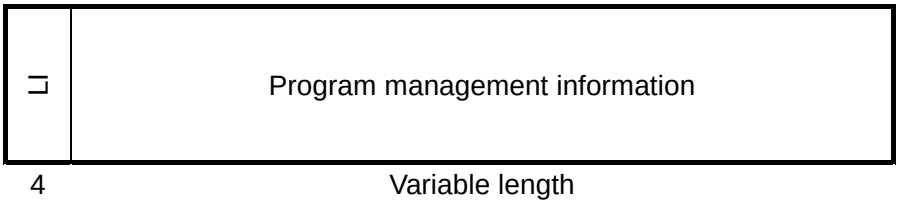


Figure 2-5: Program Management Information

(3) Page information 1

Page information 1 is comprised of page management information and page management data for closed caption text. It conforms to ARIB STD-B36 (with the exception of the unused logical block area). The structure of page information 1 is illustrated in Figure 2-6.

Figure 2-6: Page Information 1

(4) Page information 2

Page information 2 is comprised of page management information, page management data for closed caption text, and closed caption text. It conforms to ARIB STD-B36 (with the exception of the unused logical block area). The structure of page information 2 is illustrated in Figure 2-7.

LI	Label (2A)	Data Length	Page management information PageCode=0	Label (3A)	Data Length	Page management data for closed caption text	Label (2A)	Data Length	Closed caption text
4	1	2	Variable length	1	2	18	1	3	Variable length

Figure 2-7: Page Information 2

Page information 1 represents the top page management information, which does not contain closed caption text data; page information 2 represents closed caption data for page 1 and all pages thereafter and includes closed caption text data.

2.2.3 Short Form Data

Enabling closed caption transmission which is in synchrony with video, short form data represents a format for TS-packet or analog closed caption packet transmission. The structure of the closed caption data words for short form data is illustrated in Figure 2-8.

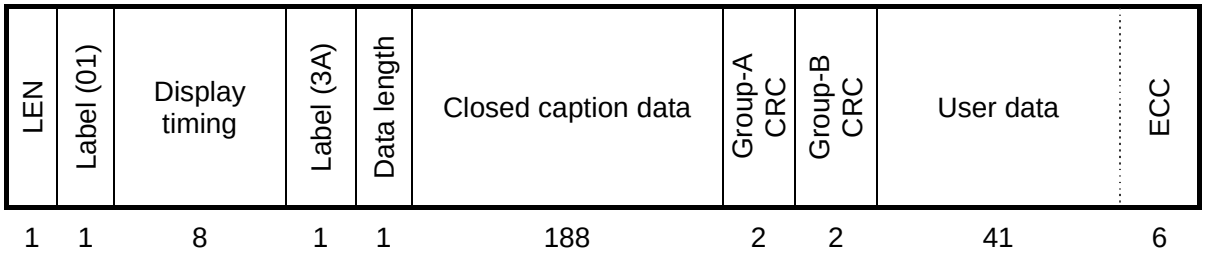


Figure 2-8: Structure of Closed Caption Data Words for Short Form Data

The length of closed caption data words is fixed at 254 words.

2.2.3.1 LEN (Length)

LEN contains data regarding the length of the valid closed caption data words which immediately follow it. When no user words are being used, the LEN value will be 203 words; and when user data words are being used, the LEN value will be between 204 and 244 words. Unused user data area is filled in with 00h (200h).

2.2.3.2 Label (01)

Label (01) represents a header identifier for display timing and is fixed at 01h (101h).

2.2.3.3 Display Timing

Display timing represents time code parameters that indicate timing controls for the display of closed caption data; furthermore, only the display timing value of the top ancillary data packet for each closed caption data group is used. FFh (2FFh) is filled into all other ancillary data packets and closed caption data which do not contain timing values. The structure of display timing is illustrated in Figure 2-9.

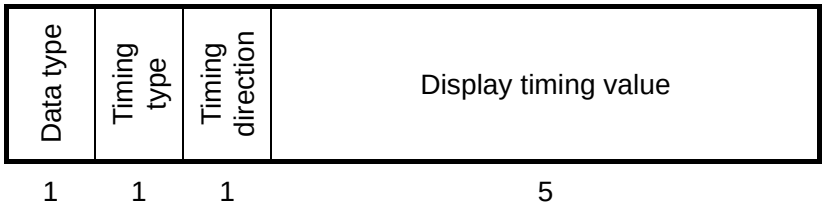


Figure 2-9: Data Word Structure of Display Timing

(1) Data type

Data type indicates the type of data used as the display timing value. Bit allocation for the display timing's data type is illustrated in Table 2-15; the corresponding data-type identifiers are illustrated in Table 2-16.

Table 2-15: Bit Allocation for Data Type from Display Timing

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Undefined
b6	
b5	
b4	
b3	
b2	
b1	Data-type identifier
b0(LSB)	

Table 2-16: Data Type Identifiers

b1	b0	Description
0	0	PTS value
0	1	Time
1	0	Undefined
1	1	Undefined

(2) Timing type

Timing type indicates the type of display timing used. Bit allocation for timing type is illustrated in Table 2-17; the corresponding timing-type identifiers are shown in Table 2-18. In addition, Figure 2-10 provides a conceptual diagram of display timing (in the case of “time”).

Table 2-17: Bit Allocation for Timing Type

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Undefined
b6	
b5	
b4	
b3	
b2	
b1	Timing-type identifier
b0(LSB)	

Table 2-18: Timing Type Identifiers

b1	b0	Timing	Description
0	0	Invalid	
0	1	Undefined	
1	0	Relative time (relative PTS)	Specifies relative display timing (i.e., PTS adjustable value) for video frame embedded with ancillary data.
1	1	Undefined	

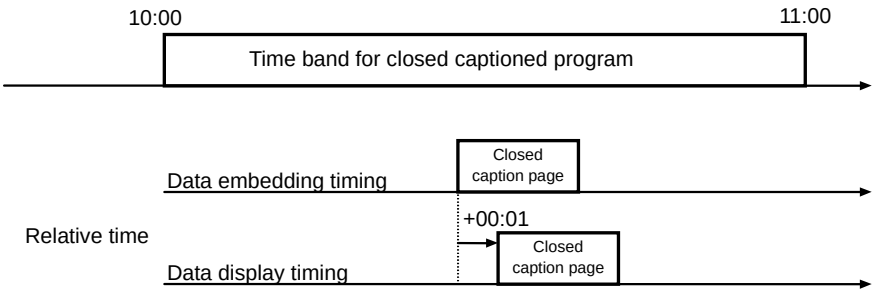


Figure 2-10: Display Timing Conceptual Diagram (for time specification)

(3) Timing direction

Timing direction indicates the direction of time correction used when relative time is set as the timing type. Bit allocation for timing direction is illustrated in Table 2-19; the corresponding timing-direction identifiers are shown in Table 2-20.

Table 2-19: Bit Allocation for Timing Direction

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Undefined
b6	
b5	
b4	
b3	
b2	
b1	Timing-direction identifier
b0(LSB)	

Table 2-20: Timing Direction Identifiers

b1	b0	Description
0	0	Undefined
0	1	Plus direction (i.e., addition to current timing) The display timing is shifted to after the time setting. (See Note 1)
1	0	Minus direction (i.e., subtraction from current timing) The display timing is shifted to before the time setting. (See Note 2)
1	1	Undefined

Note 1: For example, if a 5-second time shift in the plus direction were implemented for a closed caption page with a display timing of 10 seconds, the actual display timing would become 15 seconds.

Note 2: For example, if a 5-second time shift in the minus direction were implemented for a closed caption page with a display timing of 10 seconds, the actual display timing would become 5 seconds.

(4) Display timing value

Display timing values when the data type is “time” are illustrated in Table 2-21. Display timing values when the data type is “PTS value” are shown in Table 2-22.

Timing correction values are indicated when the timing type is “relative time”. When the data is closed caption management data, 00h (200h) is used to fill the display timing value, and immediate transmission is implemented.

Table 2-21: Display Timing Values for “Time”

	Display time code				
	Hour	Minute	Second	Frame	
	W0	W1	W2	W3	W4
b9(MSB)	Inverse of b8	←	←	←	1
b8	Even parity	←	←	←	0
b7 b6 b5 b4	Order of 10 (BCD)	←	←	←	0xF
b3 b2 b1 b0(LSB)	Order of 1 (BCD)	←	←	←	0xF

Table 2-22: Display Timing Values for “PTS Value”

	Display time code				
	W0	W1	W2	W3	W4
b9(MSB)	Inverse of b8	←	←	←	←
b8	Even parity	←	←	←	←
b7	0	PTS29	PTS21	PTS14	PTS6
b6	0	PTS28	PTS20	PTS13	PTS5
b5	1	PTS27	PTS19	PTS12	PTS4
b4	0	PTS26	PTS18	PTS11	PTS3
b3	PTS32	PTS25	PTS17	PTS10	PTS2
b2	PTS31	PTS24	PTS16	PTS9	PTS1
b1	PTS30	PTS23	PTS15	PTS8	PTS0
b0(LSB)	1	PTS22	1	PTS7	1

(5) Transmission timing for closed caption management data

The transmission timing for closed caption management is between 0.1 seconds and 0.6 seconds ahead of the output timing for each item of closed caption text data. In cases where transmission timings for closed caption management data and closed caption text data overlap, priority will be given to the latter.

2.2.3.4 Label (3A)

Label (3A) represents a header identifier for closed caption data and is fixed at 3Ah (23Ah).

2.2.3.5 Data Length

Data length indicates the total length of valid data, beginning from closed caption data and including Group-A CRC and Group-B CRC. When a CRC is present, data length is set to 192 words; the length is set to 188 words when a CRC is not present.

2.2.3.6 Closed Caption Data

Closed caption data contain a 188-word closed caption TS-packet data. The TS packet data represents closed caption data which has been formatized into independent PES format — i.e., a transmission format for closed caption transmission — and has been packetized into TS packet format. (For more details, refer to ARIB STD-B24.)

Note that in cases where closed caption PES data are divided into packets during TS packetization, the CRC which is appended to the final 2 bytes of the closed caption data group should not be divided into 2 different packets. (For more details, refer to Supplement B2 “Package Separation of Closed Caption Data”.)

The structure of closed caption data is illustrated in Figure 2-11.

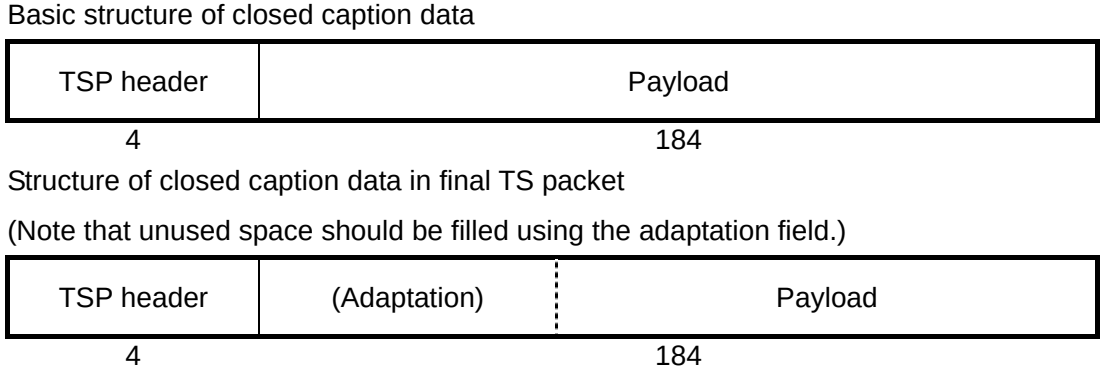


Figure 2-11: Structure of Closed Caption Data

(1) TSP header

The data structure for the TSP header is illustrated in Table 2-23.

Table 2-23: Structure of TSP Header Data

	Code for TSP header				
	W0		W1	W2	W3
b9(MSB)	Inverse of b8		←	←	←
b8	Even parity		←	←	←
b7	Sync byte (47h)	0	Error indicator	PID7	Scramble control
b6		1	Start indicator	PID6	
b5		0	Priority	PID5	Adaptation field control
b4		0	PID12	PID4	
b3		0	PID11	PID3	Continuity counter
b2		1	PID10	PID2	
b1		1	PID9	PID1	
b0(LSB)		1	PID8	PID0	

The following items are to be satisfied for the TSP header.

- PID values are to be arbitrary values.
- When the payload start point of the TS packet corresponds to the PES packet start point or is a pointer, the payload-unit start indicator of the TSP header shall be “1”.
- Within a specific data group, the continuity index shall increase in increments of 1. “1111” shall be followed by “0000”.

(2) Adaptation field

The adaptation field conforms to ITU-T Recommendation H.222.0. Furthermore, it can only be used in the final TS packet of a PES (i.e., equivalent to a single closed caption page). Packets other than the final packet do not include an adaptation field.

In the case of a closed caption page with a 3 packet structure, for example, the first and second packets do not include an adaptation field. Regarding the third packet, if the payload is less than 184 bytes, the adaptation field is used to align the closed caption data size to 184 bytes.

(3) Payload

The payload represents the area where the actual closed caption data is stored. The header block for the closed caption PES (i.e., PES header + header extension + PES packet header) is illustrated in Table 2-24; the bit allocation for block data from the closed caption PES header is shown in Table 2-25.

The closed caption PES header is fixed at 35 words. Although it is preferable that fixed values be implemented for the data content — with the exception of the PES packet length and the PTS value — modification may be freely carried out within a range which does not affect the data length.

Refer to Supplement 3.3 “Operation with CCIS”, for more details regarding CCIS as indicated in the table.

Table 2-24: Header Block for Closed Caption PES

	W0	W1	W2	W3	W4 to W33	W34
b9(MSB)	Inverse of b8	←	←	←	←	←
b8	Even parity	←	←	←	←	←
b7	0	0	0	1		1
b6	0	0	0	0		1
b5	0	0	0	1		1
b4	0	0	0	1		1
b3	0	0	0	1		0
b2	0	0	0	1		0
b1	0	0	0	0		0
b0(LSB)	0	0	1	1		0

Table 2-25: Bit Allocation for Header Block Data for Closed Caption PES

Block name	Description		Size (bits)
Packet_start_code_prefix	Code indicating the start of a PES packet. Fixed at 000001h		24
Stream_id	Stream identifier, private stream 1 (BDh)		8
PES_packet_length	Contains the number of bytes that follows this block in the PES packet.		16
Reserved	“10”		2
PES_scrambling_control	“00”: No scramble		2
PES_priority	“0”: Priority level		1
Data_alignment_indicator	“0”: Alignment (i.e., synchrony) not defined		1
Copyright	“0”: Copyright setting		1
Original_or_copy	“0”: Original		1
PTS_DTS_flags	“10”: PTS field is present		2
ESCR_flag	“0”: Not set		1
ES_rate_flag	“0”: Not set		1
DSM_trick_mode_flag	“0”: Not set		1
Additional_copy_info_flag	“0”: No copyright data		1
PES_CRC_flag	“0”: No CRC calculation for previous PES		1
PES_extension_flag	“1”: Set		1
PES_header_data_length	PES header data length		8
Reserved	“0010”		4
PTS[32..30]			3
Marker_bit	“1”		1
PTS[29..15]			15
Marker_bit	“1”		1
PTS[14..0]			15
Marker_bit	“1”		1
PES_private_data_flag	“1”: Set		1
Pack_header_field_flag	“0”: Not set		1
Program_packet_sequence_counter_flag	“0”: Not set		1
P-STD_buffer_flag	“0”: Not set		1
Reserved	“111”		3
PES_extension_flag_2	“0”: Not set		1
PES_private_data	CCIS	CCIS_code Indicates the presence of an ancillary flag for conversion control information “CCIS”: (4-byte character code)	32
		Caption_conversion_type Indicates the display-style conversion method 01h: HD side panel 02h: SD (4:3) 03h: SD wide side panel 04h: Mobile closed caption	8
		DRCS_conversion_type “00”: DRCS conversion mode A “01”: DRCS conversion mode B “10”: Moblie DRCS “11”: DRCS conversion not possible	2
		“111111”: Undefined	6
	User area	All unused bits shall be “1”.	80
Stuffing_byte	FFh		8
Data_identifier	80h		8
Private_stream_id	FFh		8
Reserved	‘1111’		4
PES_data_packet_header_length	‘0000’		4
PES_data_private_data_byte	Unused		0

Note: This table only contains actual data sections (i.e., b0 through b7) from each word.

2.2.3.7 Analog Closed Caption Data

The structure for cases where analog closed caption data is stored in the closed caption data is illustrated in Figure 2-12. The packet for analog closed caption data has a 37-word structure starting at the header and including error correction (i.e., BEST coding).

TSP header	User area	Analog closed caption data
4	147	37

Figure 2-12: Structure of Analog Closed Caption Data

(1) TSP header

The TSP header is defined to match the structure for digital closed caption data, and the content of this header conforms to Table 2-23 “Structure of TSP Header Data”. PID values are arbitrary.

(2) User area

This data area may be used freely by users, and if unused, it is filled using FFh.

(3) Analog closed caption data

The analog closed caption data are embedded in the analog closed caption data packets, and the structure of this packet is illustrated in Figure 2-13.

Synchronous section (3 words)		Data packet (34 words)		
Bit synchrony code	Byte synchrony code	Information bits		Check code
		PFX	Data block	
2 words	1 words	14 bits	176 bits	82 bits

Figure 2-13: Structure of Analog Closed Caption Packet

- Bit synchronous code: Fixed at 55h 55h (255h 255h)
- Byte synchronous code: Fixed at A7h (1A7h)
- PFX (PreFix) data: Comprises service identifier (SI) codes required for the broadcasting service system and for transmission of the send mode, and also the various packet control (PC) codes which indicate factors such as the continuity of data packets from a specific program which are separated for sending.
- Data block: Contains the send data.
- Check code: Appended to enable error correction in each packet. The code structure is known as (272, 190) compressed differential cyclic coding, which can correct all errors of 8 bits or less.

(4) Others

The bit allocation for analog closed caption data is illustrated in Table 2-26.

- Teletext data other than closed caption are optional.
- The send identification number (SID) in the program index data is set to “00000” by default and the operational method is optional.
- The embedding interval of teletext program index data is typically 20 seconds and shall be within 30 seconds.
- The service identifier for closed caption data shall be set to No.1 send mode, 92h (192h), or No. 2 send mode, 2Ah (12Ah).

Table 2-26: Bit Allocation for Analog Closed Caption Data

	B1	B2	B3	B4	B5	B6	B7 to B26	B27	B28	B29 to B36	B37
b9(MSB)	Inverse of b8	←	←	←	←	←	←	←	←	←	←
b8	Even parity	←	←	←	←	←	←	←	←	←	←
b7	0	0	1	Service identifier code (SI)	Dat01	Dat09	~	Ck01	Ck09	~	Ck81
b6	1	1	0		Dat00	Dat08		Ck00	Ck08		Ck80
b5	0	0	1		Packet control code (PO)	Dat07		Dat175	Ck07		Ck79
b4	1	1	0			Dat06		Dat174	Ck06		Ck78
b3	0	0	0			Dat05		Dat173	Ck05		Ck77
b2	1	1	1			Dat04		Dat172	Ck04		Ck76
b1	0	0	1	(SI)		Dat03		Dat171	Ck03		Ck75
b0(LSB)	1	1	1			Dat02		Dat170	Ck02		Ck74

DAT00 through DAT175 represent 176 data bits on the data block; Ck00 through Ck81 represent 82 bits of check code data. For more details, refer to “*The Technical Handbook on the BTA Teletext Systems (revised edition)”*.

2.2.3.8 Group-A CRC & Group-B CRC

CRCs are stored within the final ancillary data packet of each closed caption data group; specifically, either the CRC for Group A or Group B information, or both CRCs can be stored. In cases where ancillary data packets do not contain a CRC, this area contains FFh FFh (2FFh 2FFh).

2.2.3.9 User Data

Operation of the user data area is arbitrary.

2.2.3.10 ECC / Error Correction Parity Word (optional)

In consideration of the error characteristics of the transmission system, the Reed-Solomon encoding RS (254, 248) method is adopted for the error correction parity word. However, the length of the protected data word from the beginning of the UDW to the error correction parity word – not including the 1st word of the UDW closed caption header – is 248. Reed-Solomon encoding is defined as shown below.

The following HF(x) formula is used in the primitive polynomial which uses GF(2^8) elements and defines GF(2^8).

$$HF(x) = x^8 + x^4 + x^3 + x^2 + 1$$

With root α (=02h) of HF(x) as the primitive element, the code generation polynomial G(x) for Reed-Solomon encoding is defined as:

$$G(x) = (x + 1)(x + \alpha)(x + \alpha^2)(x + \alpha^3)(x + \alpha^4)(x + \alpha^5)$$

If the data word sequence D(x) for the lower order 8 bits of protected UDW is expressed as:

$$D(x) = D_{247}x^{247} + D_{246}x^{246} + \ldots + D_2x^2 + D_1x + D_0$$

the polynomial for error-correction parity words P5, P4, P3, P2, P1, and P0 can be expressed as the remainder P(x), when $x^6D(x)$ is divided by G(x).

$$P(x) = P_5x^5 + P_4x^4 + P_3x^3 + P_2x^2 + P_1x + P_0$$

The polynomial representation C(x) of the lower order 8 bits of the entire conveyed code is:

$$C(x) = x^6D(x) + P(x)$$

Note that even in the case of P(x) words from the conveyed packet, b8 (even parity for b0 through b7) and b9 (inverse of b8) will — in the same way as for D(x) — be added at the MSB side to enable conveyance of a single 10-bit word. Bit allocation for the error correction parity word is illustrated in Table 2-27; the structure of UDW featuring ECC is illustrated in Figure 2-14.

Table 2-27: Bit Allocation for Parity Word

Bit number	Description
b9(MSB)	Inverse of b8
b8	Even parity for b0 through b7
b7	Parity word
b6	
b5	
b4	
b3	
b2	
b1	
b0(LSB)	

Figure 2-11: Structure of UDW featuring ECC

UDW (255 words)							
Closed caption header word	Closed caption data word	Error correction packet					
		P5	P4	P3	P2	P1	P0
4	245	6					

2.2.4 Closed Caption Dummy Data

Closed caption dummy data, which is used in the absence of closed caption data during a closed-captioned program, is defined as shown in Table 2-28.

Table 2-28: Closed Caption Dummy Data

Closed caption data		Description
Closed caption header: Word 1	Continuity index	Increases periodically.
	Error correction identifier	Set via ECC usage.
Closed caption header: Word 2		For expansion
Closed caption header: Word 3	Text-style identifier	Sets the same text style as that for the closed caption data in this area.
	Send mode	Sets the same send mode as that for the closed caption data in this area.
	End packet flag	“0”
	Start packet flag	“0”
Closed caption header: Word 4	Language identifier	“111”, fixed
	Closed caption data identifier	“111”, fixed
Closed caption data word		Not regulated (recommendation = 2FFh)

Informative Explanation

A1 Types of Closed Caption

Table A1-1 shows the classification table for closed caption data. Closed caption data are classified in terms of data type and recording/send formats. The shaded areas of the table indicate areas defined by this standard.

Table A1-1 Closed Caption Data Types

<table>
<tr><th></th><th>Closed caption data format</th><th>Data type</th><th>Exchange format closed-caption data</th><th>Video record closed-caption data</th><th>In-station closed caption data</th><th colspan="2">Broadcast signal closed-caption data</th></tr>
<tr><td rowspan="2">Digital closed caption (ARIB STD-B24)</td><td rowspan="2">HD/SD/Mobile closed caption</td><td rowspan="2">Closed caption management data / No. 1 language closed-caption text / No. 2 language closed-caption text</td><td rowspan="2">ARIB-specified digital closed-caption data (ARIB STD-B36)</td><td rowspan="2">Digital ANC closed-caption data (ARIB STD-B37)</td><td>Digital ANC closed-caption data (ARIB STD-B37)</td><td rowspan="2">TS packet data (ITU-T H.222)</td><td>Digital satellite broadcasting (ARIB TR-B15)</td></tr>
<tr><td>PES closed-caption data (ARIB STD-B24)</td><td>Digital terrestrial broadcasting (ARIB TR-B14)</td></tr>
<tr><td rowspan="2">Teletext broadcasting closed captions (analog) (Ordinance No.77)</td><td rowspan="2">Analog closed captions (4:3 screen)</td><td rowspan="2">Program management data / page data / program index data</td><td rowspan="2">NAB-specified analog closed caption data (NAB standard T027-1996) (NAB standard T021-1996)</td><td>Teletext broadcasting closed captions (Ordinance No.77)</td><td>Teletext broadcasting closed captions (Ordinance No.77)</td><td colspan="2" rowspan="2">Teletext broadcasting closed captions (Ordinance No.77)</td></tr>
<tr><td>Analog ANC closed-caption data (ARIB STD-B27)</td><td>Analog ANC closed-caption data (ARIB STD-B27)</td></tr>
</table>

Closed caption name	Description
ARIB-specified digital closed caption	Exchange format data from digital closed caption data (ARIB STD-B36)
NAB-specified digital closed caption	Exchange format data from digital closed caption data (NAB Standard T027-1996) (NAB Standard T021-1996)
Digital ANC closed caption	Digital closed caption data embedded in the ancillary data area of video SDI and stores digital closed-caption exchange format data (i.e. ARIB-specified digital closed captions) or short form data. (ARIB STD-B37)
Analog ANC closed caption	Digital closed caption data embedded in the ancillary data area of video SDI and stores digital closed-caption exchange format data (i.e. NAB-specified digital closed captions) or short form data. (ARIB STD-B27)
Teletext transmission closed caption	Analog closed-caption packet data which is embedded in 21H in the vertical blanking interval (i.e., the VBI range) for video (NTSC signals) in accordance with analog teletext broadcasting standards. (Ordinance No. 77)
PES closed caption	Digital closed caption data which is transmitted in PES data format. (ARIB STD-B24)
TS packet data	Digital closed caption packet data which is transmitted in TS packet format. (ITU-T H.222)

Closed caption content types

Exchange format closed caption data	Closed caption elements created using closed caption exchange format data (i.e., ARIB-specified digital closed caption data, NAB-specified analog closed caption data).
Real-time closed caption data	Closed caption elements which are created immediately for live broadcasts and the like.

A2 Embedding of Closed Caption Data in Ancillary Data

The following section presents supplementary items relating to the embedding of closed caption data in the closed caption ancillary data area.

When closed caption data are embedded in the closed-caption ancillary data area, it is necessary to define the closed caption data format in the “Format Identifier” of the closed caption header word, from the start of video field to the end of video field. Furthermore, closed caption data formats are set independently for closed caption ancillary data 1, closed caption ancillary data 2, and closed caption ancillary data 3. Consistent formats are to be set, within the same video material, for closed caption ancillary data 1 through 3. (With the exception of cases in which the analog closed caption data format and mobile closed caption format are embedded in the same area as shown in Figure A2-1.) For example, HD closed caption data are embedded in closed caption ancillary data 1 area from the start to the end field of the same video material.

When closed caption data are embedded in the ancillary data areas, closed caption ancillary data packets are to be sequentially filled in order from closed caption ancillary data 1 through closed caption ancillary data 3, and no gaps are permitted between closed caption ancillary data areas. Furthermore, in cases where closed caption ancillary data 1 and data2 are used and there is no closed caption data to be displayed for closed caption ancillary data 1, “No closed caption” is set for closed caption ancillary data 1. Typical embedding combinations for the various closed caption ancillary data items are illustrated in Table A2-1.

Table A2-1: Embedding Combinations for Closed Caption Ancillary Data

Case	Closed caption ancillary data 1	Closed caption ancillary data 2	Closed caption ancillary data 3
1	-	-	-
2	Closed caption	-	-
3	Closed caption	Closed caption	-
4	Closed caption	Closed caption	Closed caption
5	Closed caption	No closed caption	Closed caption
6	No closed caption	Closed caption	-

Note: The entry “Closed caption” includes occurrences of dummy packets. “No closed caption” indicates packets for which “No closed caption” is set in the “Format Identifier”. The “—“ mark indicates the absence of packets.

For example, it is conceivable that closed caption ancillary data 1 contains HD closed caption data, that closed caption ancillary data 2 contains SD closed caption data, and that closed caption ancillary data 3 contains analog closed caption data.

When the “Format Identifier” is declared as an analog closed caption, HD closed caption, or SD closed caption, and when there are partial absences of closed caption data over a certain continuous period (normally one TV program), the “Closed Caption Data Identifier” is to be set as “Dummy data”.

A3 Closed Caption Transmission Timing, Advantages & Disadvantages

The timing at which closed caption data is embedded in the ancillary data area is linked to the transmission timing for closed caption. In other words, the transmission timing for closed captions will vary depending on whether embedding is carried out before or after the video which closed caption display is to be synchronized with.

A3.1 Transmission Timing

The transmission timing for closed caption data is illustrated in Table A3-1 and Figure A3-1.

Table A3-1: Closed Caption Send Modes and Timing

Send mode	Transmission timing
Sequential send mode	Closed caption data start to be sent with closed-captioned video.
Buffer send mode (simultaneous send)	Closed caption data start to be sent with closed-captioned video.
Buffer send mode (advance send)	The transmission of closed caption data is completed when transmission of closed-captioned video begins.

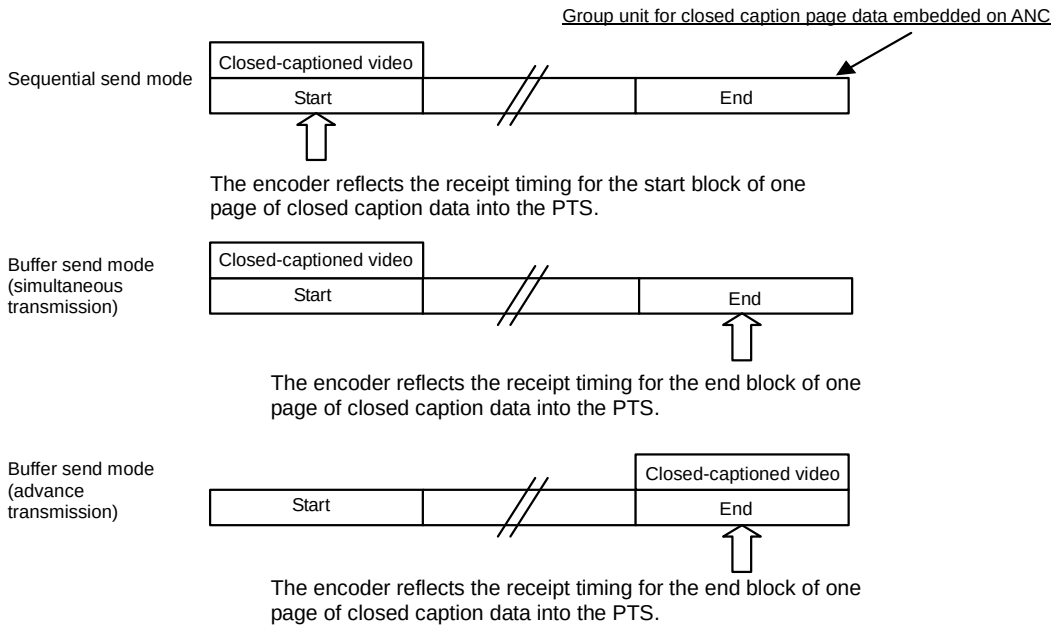


Figure A3-1: Relationship between Send Mode and Timing

The advantages and disadvantages of the various send modes are presented below.

Table A3-2: Advantages & Disadvantages of Send Modes

	Advantages	Disadvantages
Sequential send mode	• Since the closed caption is embedded after the video frame to be displayed, loss of the leading closed caption will not happen during VTR editing and the like. • Transmissin control is uncomplicated.	• In cases where the data size for a single page is large, the display of closed captions may be delayed from the receiver's display timing target (i.e., 0.5 s). • There is a possibility that closed caption data may overlap with the subsequent program. • In receivers which do not reference PTS, display timing will vary depending on the data size.
Buffer send mode (simultaneous transmission)	• Since the closed caption data are embedded after the video frame to be displayed, loss of the leading closed caption will not happen during VTR editing and the like. • Transmission control is uncomplicated.	• When closed caption data are larger than 1 packet, closed caption display will be delayed, and this delay will vary depending on the data size. • There is a possibility that closed caption data may overlap with the subsequent program. • In receivers which do not reference PTS, display timing will vary depending on the data size.
Buffer send mode (advance transmission)	• Strict adherence to the closed caption display timing is possible. • There is no timing delay dependant on closed caption data sizes. In receivers which do not reference PTS, closed caption is displayed with a fixed delay.	• Since the closed caption data are embedded before the video frame to be displayed, there is a possibility that loss of the leading closed caption data may happen during VTR editing and the like. • Transmission control is complicated.

A3.2 Mixed Send Modes

PTS append timings and closed caption transmission timings are different for each send mode. Note that although sequential send mode and buffer send mode (simultaneous transmission) are different, the timing for the embedding of closed caption is the same for both.

In cases where video with embedded closed caption data is exchanged between stations which use different send modes, it is preferable that the transmission process be changed according to the send mode of exchanged material. However, there is a possibility that the transmission process may not be changed by reason of system configuration and the like. In such cases, the situtations below will occur:

(1) Transmission of closed caption data processed in buffer send mode (advance transmission) using a system that supports sequential send mode:
The closed caption screen will be displayed in advance depending on the size of the closed caption page. (The larger the closed caption page, the earlier the closed caption screen will be displayed.)

(2) Transmission of closed caption data processed in sequential send mode using a system that supports buffer send mode (advance transmission):
In this case, the closed caption screen will be displayed in the same way as in the transmission timing for the buffer send mode (simultaneous transmission).

A4 Timing for Closed Caption Embedding & TS Transmission Start Timing

As examples of closed caption processed in the sequential send mode, Figure A4-1 and Figure A4-2 illustrate the relationship between the timing for the embedding of closed caption data onto ancillary data and the TS transmission start timing for specific transmission bit rates.

A4.1 Sample Data

This example of closed caption processing will be calculated assuming that the data amount of the sampled closed caption page is 5 packets in TS. This is rather large closed caption page data that contains 2 DRCS characters. The probability of the transmission of pages larger than this is estimated to be 2% or less.

A4.2 Data Embedding Timing

The term “data embedding timing” refers to the timing for embedding of closed-caption text data onto ancillary data with respect to the display timing for closed caption pages, which are synchronized to video and audio display (i.e., PTS point and in-time for closed caption production). And also, this value is set at +0.2 seconds (where positive values indicate time delay). The closed caption management data which make up this page is to be embedded 0.1 seconds in advance of this point.

By embedding closed caption data with a delay of +0.2 seconds, it is possible to ensure that closed caption data will be retained within VTR editing points.

A4.3 TS Transmission Start Timing for Specific Transmission Bit Rate

(1) Transmission bit rate

The transmission packet of digital closed caption data is a 204-byte unit which is appended with Reed-Solomon encoding (16 bytes) to TS (188 bytes).

If closed caption packets are transmitted with a ratio of 1 packet per 6 video fields, 10 packets will be transmitted in a 1-second period. Thus, a transmission bit ratio of approximately 16 kbps will be achieved as follows.

8 (bits/byte) x 204 (bytes/packet) x 10 (packets/second) = 16320 (bps)

(2) Required transmission time

If the transmission bit rate is as above, then the number of transmission intervals is (5 -1) times, since there are 5 closed caption TS packets.

$$[\text{Required send time}] = \frac{[5(\text{Number of packets of closed caption text data}) - 1] \times 204 \times 8}{[\ 10 \times 204 \times 8\ (\text{Send bit rate})]} = 0.4\ (\text{seconds})$$

(3) TS transmission start timing

As described in operational guideline ARIB TR-B15/B14, the transmission of PES packets are to be completed prior to Td (target = 0.5 s) in advance of PTS time.

When compression/de-compression time required of video data is assumed as 0.6 seconds each, the appropriate TS transmission start timing is as follows:

0.6 [Compression time] + 0.6 [De-compression time] - 0.5 [Td]

= 0.7 s [Transmission completion time]

0.7 [Transmission completion time] - 0.2 [Data embedding timing] - 0.4 [Required transmission time]

= + 0.1 s [TS transmission start timing with respect to the reception time for the leading packet of closed caption text data]

(4) Practical equations

If parameters which can be fixed for each broadcaster's system are set as constants, the above equation may be rewritten as:

$$[\text{TS transmission timing}] = 0.6 + 0.6 - 0.5 - 0.2 - [\text{Required transmission time}]$$

Accordingly,

$$[\text{TS send timing}] = 0.5 - \frac{[(\text{Number of packets of closed caption text data}) - 1] \times 204 \times 8}{[\text{Send bit rate}](\text{bps})}\ (\text{seconds})$$

And this can be presented for practical use as

$$= 0.5 - \frac{[(\text{Number of packets of closed caption text data}) - 1] \times 1.63}{[\text{Send bit rate}](\text{bps})}\ (\text{seconds})$$

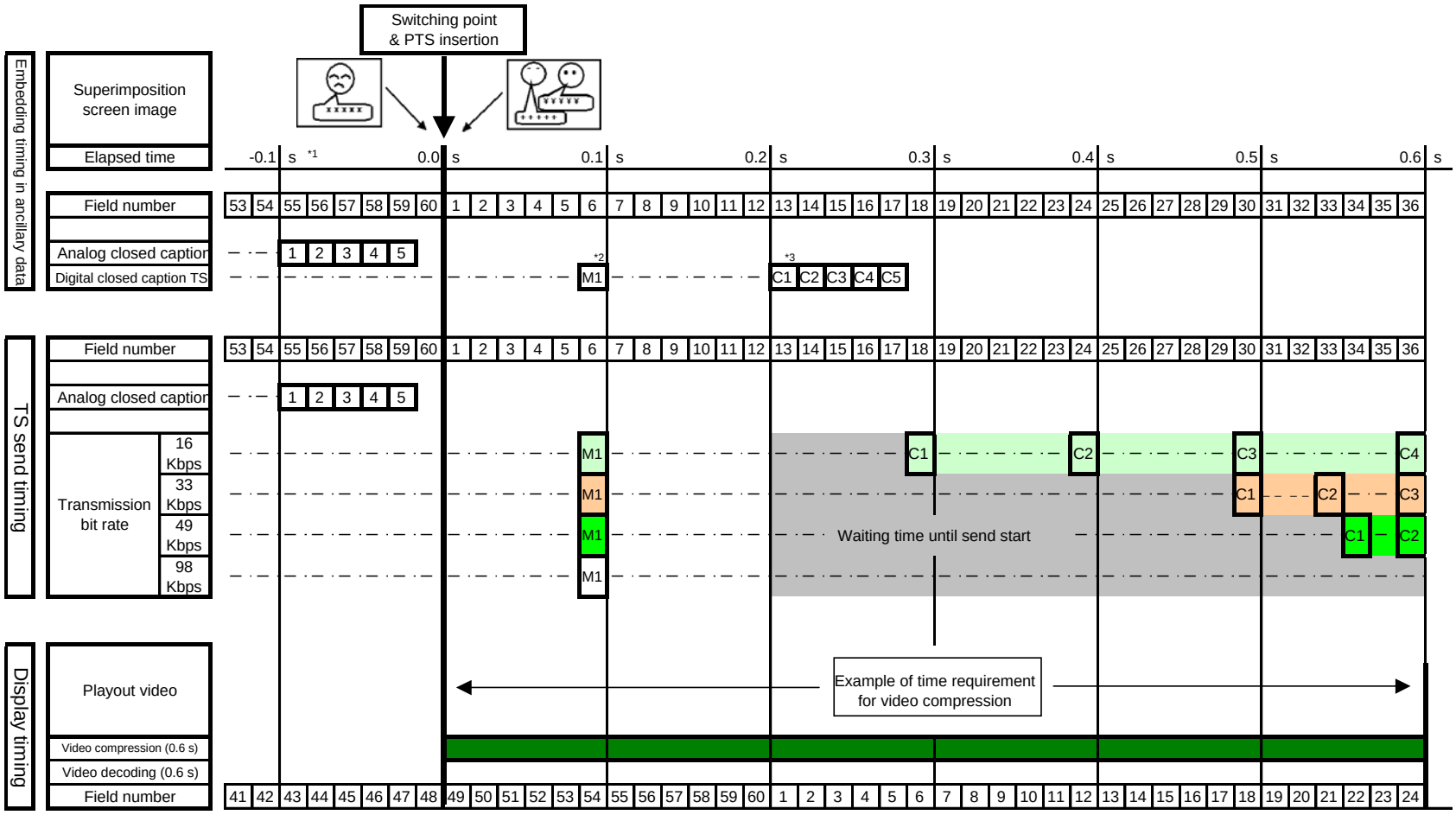
A4.4 Send Completion Timing and Display Timing

(1) Design of transmission timing

As defined in operational guideline ARIB TR-B15/B14, the sending of PES packets is to be completed prior to the point which is Td (target = 0.5 s) in advance of PTS time. And on the other hand, ARIB STD-B24 defines that when independent PES packets – the TMD parameter of this PES is defined as “Free” – are received, immediate display after reception is required for receivers which can not process PTS. Accordingly, in a transmission system where excessive Td is given or where packets are transmitted at an untimely time before Td, it may happen in some receivers that closed caption screens are always displayed in an untimely manner.

(2) Receiver processing of heavy closed caption packets

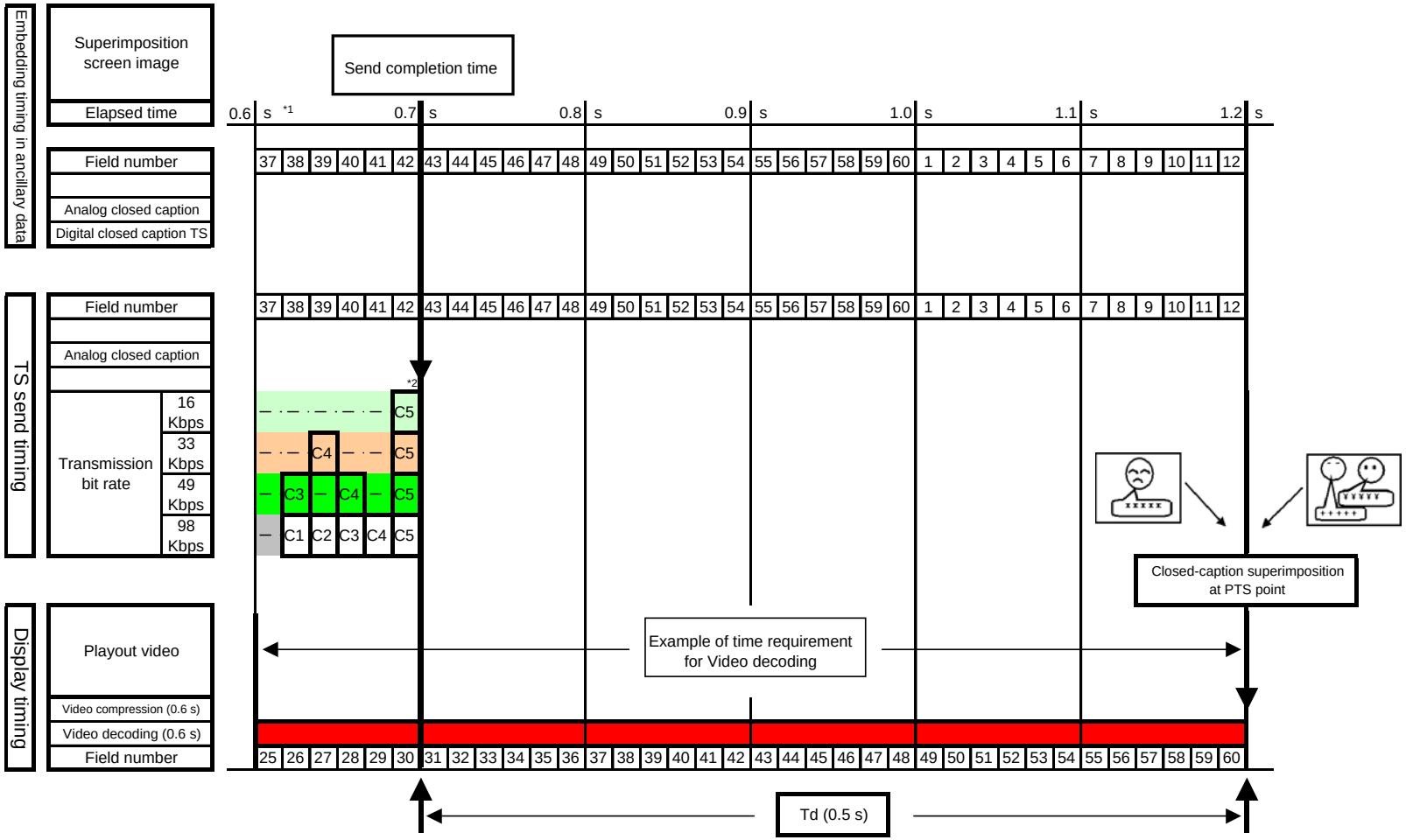
When the transmission bit rate for closed captions is set to 16 kbps in the systems shown in Figure A4-1 and A4-2, it can be seen that transmission of 7 or more packets cannot be completed before Td value. And also that the completion of the transmission of 12 or more packets will even over-run the PTS time. Immediate display after reception is preferable in cases of reception completion after PTS time.



*1 s:seconds
*2 M:Number of packets for closed-caption management data
*3 C:Number of packets for closed-caption text data

Figure A4-1: Timing for Closed-Caption Embedding and Transmission-Rate-Specific Send Timing (1/2)

(1) The above assumes a case where the data quantity for closed caption pages (5 packets) is relatively large at approximately DRCS x 2.
(2) The time chart shown assumes 0.6-s settings for both the video compression-processing time and the decoding display-processing time.
(3) OFDM and other send-channel delay times are omitted from this chart.



*1 s:seconds

*2 C:Number of packets for closed-caption text data

Figure A4-2: Timing for Closed Caption Embedding and Transmission-Rate-Specific Transmission Timing (2/2)

(1) The above assumes a case where the data quantity for closed caption pages (5 packets) is relatively large at approximately DRCS x 2.
(2) The time chart shown assumes 0.6-s settings for both the video compression-processing time and the decoding display-processing time
(3) OFDM and other send-channel delay times are omitted from this chart.

A5 Data Size for Various Pages of Basic Closed Caption Elements

The results of analysis of the actual page data size for closed caption elements used in actual broadcasting are illustrated in Table A5-1. These examples were obtained through the conversion of digital closed caption data after the conversion of analog-HD closed caption data as concluded by NAB.

Table A5-1: Data Size for Various Pages of Basic Closed Caption Elements

				Inter-page time (Upper value:seconds/ Lower value:fields)			Date size (Upper value:PES byte/ Lower value:packets)			Appropriate page ratio for packet size (Upper value:sum of pages/Lower value:ratio)							
No	Program type	Total pages	Program duration	Average	Minimum	Maximum	Average	Minimum	Maximum	1	2	3	4	5	6	7	Total
1	Science	394	1 hour	7.45	2	74	190.28	77	875	317	37	36	3	1	0	0	394
				447.02	120.00	4440	1.31	1	5	80.46 %	9.39 %	9.14 %	0.76 %	0.25 %	0.00 %	0.00 %	100.00 %
2	Science	384	1 hour	8.51	2.5	129	183.90	82	545	305	41	38	0	0	0	0	384
				510.70	150.00	7740	1.30	1	3	79.43 %	10.68 %	9.90 %	0.00 %	0.00 %	0.00 %	0.00 %	100.00 %
3	Science	326	1 hour	8.90	2	92	172.01	87	821	267	43	14	1	1	0	0	326
				534.28	120.00	5520	1.24	1	5	81.90 %	13.19 %	4.29 %	0.31 %	0.31 %	0.00 %	0.00 %	100.00 %
4	Variety show	270	30 minutes	5.32	1.66667	21.6667	264.31	29	815	166	9	87	5	3	0	0	270
				319.18	100.00	1300	1.78	1	5	61.48 %	3.33 %	32.22 %	1.85 %	1.11 %	0.00 %	0.00 %	100.00 %
5	Variety show	270	30 minutes	5.32	1.66667	26	174.61	87	771	231	10	28	0	1	0	0	270
				318.96	100.00	1560	1.26	1	5	85.56 %	3.70 %	10.37 %	0.00 %	0.37 %	0.00 %	0.00 %	100.00 %
6	Variety show	294	30 minutes	4.87	1.66667	26	206.94	91	826	218	22	50	3	1	0	0	294
				292.01	100.00	1560	1.46	1	5	74.15 %	7.48 %	17.01 %	1.02 %	0.34 %	0.00 %	0.00 %	100.00 %
7	Historical drama	512	1 hour	6.76	2	163.5	262.55	82	1157	323	12	156	1	19	0	1	512
				405.44	120.00	9810	1.80	1	7	63.09 %	2.34 %	30.47 %	0.20 %	3.71 %	0.00 %	0.20 %	100.00 %
8	Historical drama	461	1 hour	7.51	2	147	234.94	82	876	325	13	111	1	11	0	0	461
				450.78	120.00	8820	1.61	1	5	70.50 %	2.82 %	24.08 %	0.22 %	2.39 %	0.00 %	0.00 %	100.00 %
9	Historical drama	426	1 hour	8.12	2	150	218.43	82	875	312	18	95	0	1	0	0	426
				486.92	120.00	9000	1.50	1	5	73.24 %	4.23 %	22.30 %	0.00 %	0.23 %	0.00 %	0.00 %	100.00 %
	Total sum of pages	3337					214.80		Pages	2464	205	615	14	38	0	1	3337
									Ratio	73.84 %	6.14 %	18.43 %	0.42 %	1.14 %	0.00 %	0.03 %	100
									Data Size	188	376	564	752	940	1128	1316	

A6 DID and SDID

The data identification word (DID) and the secondary data identification word (SDID) for ancillary data packets indicate the type of user data (UDW) which is sent in the ancillary data packet. As for ancillary data packets of type 1, the user data type is identified using a 1-word DID; and as for type 2, the type is identified using a 2-word combination of the DID and SDID.

This standard makes use of 5Fh as DID from the range of type 2 DID 50h through 5Fh used in domestic applications. Furthermore, SDID is also used to identify 16 types of closed captions, and D0h through DFh SDID are assigned. Note that there should be only one packet per field having the same DID/SDID combination.

The DID/SDID combinations used in the digital closed captions are illustrated in Table A6-1 and DID and SDID values are indicated using the 8-bit word comprising b0 through b7.

Values in parentheses correspond to the 10-bit word which includes both b8 (i.e., the even parity for b0 through b7) and b9 (i.e., the inverse of b8).

Table A6-1: DID/SDID for Digital Closed Caption

Digital closed caption type	DID value	SDID value
HD closed caption	5Fh (25Fh)	DFh (1DFh)
SD closed caption		DEh (2DEh)
Analog closed caption		DDh (2DDh)
Mobile closed caption		DCh (1DCh)
Undefined		DBh (2DBh)
Undefined		DAh (1DAh)
Undefined		D9h (1D9h)
Undefined		D8h (2D8h)
Undefined		D7h (2D7h)
Undefined		D6h (1D6h)
Undefined		D5h (1D5h)
Undefined		D4h (2D4h)
Undefined		D3h (1D3h)
Undefined		D2h (2D2h)
Undefined		D1h (2D1h)
Undefined		D0h (1D0h)

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Supplement:

Operational Guidelines for Closed Captions

Supplement: Operational Guidelines for Closed Captions

Table of Contents

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Chapter 1 General Items

1.1 Purpose

The purpose of this supplement is to establish operational guidelines regarding the implementation of embedding methods for use in the conveyance of digital closed caption data, conversion of analog/digital closed caption data, conversion of HD/SD closed caption data, and other similar items as defined in the main part of ARIB Standard STD-B37 "*Structure and Operation of Closed Caption Data Conveyed by Ancillary Data Packets"* (hereinafter referred to as "Main Part").

1.2 Scope

This supplement is applicable to broadcasting devices which convey digital closed caption data and to devices which carry out the conversion of analog/digital and SD/HD digital closed caption data using ancillary data packets from bit-serial interfaces as defined in ARIB Standard STD-B6 "*Ancillary Data Packet and Space Formatting of Bit-serial Digital Interface for 525/60 Television System*" and ARIB Standard BTA S-005B "*Ancillary Data Packet and Space Formatting of Bit-serial Digital Interface for 1125/60 HDTV Systems*".

1.3 Terminology

1.3.1 Definition of Terminology

The terms used in this guideline are defined as follows:

Table 1-1: Definition of Terminology

Relative PTS	A value for correction of closed caption display timing with respect to frames of video containing embedded ancillary data
CLUT	A table for the conversion of color information from index values to physical values.
DJCS	External character processing for the coding of JIS X 0208 Level 2 *kanji* characters.
DRCS	A method for the feeding of external characters in the form of patterns and which is used in standards for the encoding of characters for teletext and data broadcasting.
EUC	Extended UNIX Code. A multiple-byte coded character set established by AT&T in 1985 based on proposal by the Japanese UNIX System Consultative Committee.
JIS (code)	One of the JIS regulated Japanese coded character sets. Also known as ISO-2022-JP.
VICS	A system which displays traffic information received from FM multiplex signals, beacons, and the like using images and characters.

1.3.2 Abbreviations

The following abbreviations are used within this supplement.

CLUT	Color Look Up Table
DJCS	Downloaded Japanese Character Sets
DRCS	Dynamically Redefinable Character Set
VICS	Vehicle Information and Communication System

Chapter 2 Operational Guidelines for Digital Closed Caption

2.1 Packet Embedding Locations

Closed caption ancillary data packets are embedded in the area corresponding to closed-caption ancillary data 1, closed-caption ancillary data 2 (optional), and closed-caption ancillary data 3 (optional) as defined in ARIB TR-B23 "*Operational Guidelines for Ancillary Data Used to Convey Inter-Stationary Data*". In the ancillary data area, closed caption ancillary data packets can be embedded with no dependence on the video formats corresponding to the closed caption ancillary data. The format of the video corresponding to the closed caption ancillary data is to be identified by the DID/SDID.

2.2 Operation of Format Identifier "No Closed Caption"

Although it is defined that the Format Identifier "No Closed Caption" is to be utilized in the case of a closed caption data area without closed caption data but followed thereafter by other closed caption ancillary data, it is also possible to use "Invalid Packet" as defined in ARIB TR-B23.

2.3 Sending Mode and Timing

2.3.1 Embedding of Closed Caption Data Using Short Form Data Format

When embedding into ancillary data using the short form data format of digital closed captions, The send mode is to be sequential send mode. .Such closed caption data are sent 0.2 seconds* behind the video frame to be synchronized with. Furthermore, closed caption management data for the relevant page are sent 0.1 seconds in advance of the closed caption data.

The timing correction value in "display timing" indicates the gaps between the frame corresponding to the PTS value (in other words, the in-time as determined at the time of production of closed captions) and the actual frame that the data is to be embedded in.

When converting HD and SD digital closed caption packets from analog closed caption packets and sending simultaneously converted closed caption packets using ancillary data, the substituted PTS frame is to be the frame that immediately follows that to which the end block of analog data packets making up the page is embedded. It is preferable that the timing correction value reflects actual processing time if it exceeds 0.2 seconds.

*Note: The reasons for an embedding delay of 0.2 seconds are as follows:

(1) Even in the cases of closed caption pages not using DRCS, a processing time of approximately 0.2 seconds will be required for simultaneous conversion from analog closed caption to digital closed caption.

(2) Materials packages that include digital closed caption ancillary data delayed by 0.2 seconds

from the in-time of the closed caption page, will not be easily damaged by re-editing and shortening for rebroadcast. Furthermore, the fact that no additional processing is required for use is of considerable benefit in practical terms.

(3) The 0.2-second delay time has no effect on keeping closed captions synchronized with video images. This is because a 0.2-second delay time is adequately smaller than the amount of time necessary in digital broadcasts for processing {(time to compress + time to decompress) – Td} and is within a scope that can be compensated by the selection of an appropriate data transfer rate. (Refer to A4 “Timing for Closed Caption Embedding & TS Transmission Timing” for details about Td.)

(4) When time lags caused by switching during inter-stationary transmissions are taken into consideration, it can be seen that actual processing takes place with closed caption management data being sent 2 to 3 frames after the switching point and closed caption text data being sent 0.1 seconds after this.

2.3.2 Embedding of Analog Closed Caption Data in the Ancillary Data Area

When analog closed caption data is being embedded in the digital closed caption ancillary data area, it is to be done within a scope that will only bring about negligible processing delays within the system.

In order to facilitate trouble-free reproduction of analog closed caption, it is required that auxiliary signals such as program index data be sent in accordance with specifications in addition to closed caption page data, and that when no data is contained in data packets within the closed-captioned program, bit synchronous codes or byte synchronous codes be sent, or alternatively, operational signals (i.e., dummy packets for analog teletext broadcasting) be sent continuously.

2.3.3 Embedding of Mobile Closed-Caption Data in the Ancillary Data Area

Mobile closed caption data shall be embedded in the digital closed caption ancillary data area in accordance with 2.3.1.

As with other closed caption data formats, mobile closed caption data are to be embedded, as a general rule, into a separate ancillary data area. However, as the data size per page is small, the same ancillary data area may be shared with analog closed caption data by using time division embedding.

As analog and mobile closed caption data can be easily identified by their SDID, there are no restrictions on the timing of the embedding (Fig. 2-1). Meanwhile, the, “continuity index” (CI) in the first word of the header words is to be counted independently for analog and mobile closed caption data according to SDID value.

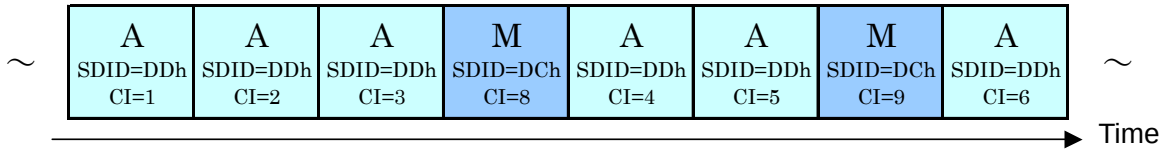


Figure 2-1 Timing Example of Analog and Mobile Closed Caption Data Embedded in the Same Ancillary Data Area (A=Analog M=Mobile)

When an ancillary data area is shared by analog and mobile closed caption data, there is a need to take the immediacy and continuity of discriminating between analog and mobile into consideration. Hence, analog closed caption ancillary data (closed caption text or dummy data) and mobile closed caption ancillary data (closed caption management, closed caption text, or dummy data) must be embedded approximately once every 0.5 seconds.

2.3.4 Transmission of Digital Closed Caption Packets

(1) Transmission end timing

In accordance with the regulations defined in ARIB TR-B14 "*Operational Guidelines for Digital Terrestrial Television Broadcasting*", the transmission of closed caption PES packets (or in practical terms, TS transmission from multiplexer, as adopted hereafter) must be completed before the Td value (i.e., the time from completion of receipt to completion of closed caption display — target = 0.5 seconds). If the Td value were too large, the receipt completion timing would be advanced, and in receivers which do not reference the PTS, this would result in a situation where closed caption display is too early for the corresponding video. Therefore, care must be taken accordingly to avoid excessively large Td values.

(2) Transmission start timing

The initial TS transmission start timing for a closed caption PES packet must be determined by back-calculating the time required for transmission — which varies depending on the closed caption TS packet's transmission bit rate — from the transmission end timing. Parameters related to this transmission start correspond to specific factors of each station's equipment which are relevant to the time required for compression of video encoders, closed caption transmission bit rates, and the like. Furthermore, these parameters are to be calculated in accordance with the Informative Explanation of the Main Part, A4 "Timing for Closed Caption Embedding & TS Transmission Timing" from STD-B37.

(3) Mobile Closed Caption Transmission Timing

When embedding digital closed captions into ancillary data using the short form data format, the data is to be transmitted in the sequential send mode, and the mobile closed caption data is to be embedded at a timing that is delayed from the relevant video frame which corresponds to the PTS value, and with which the data is to be synchronized.

When mobile closed caption data shares the closed caption ancillary data area with analog closed caption data, the operational limitations as described in Informative Explanation of the Main Part, A3 “Closed Caption Transmission Timing, Advantages & Disadvantages” apply.

In this case, the time difference between the timing of the relevant video frame as indicated by the PTS value (i.e. the visual in-time of the captions as set at the time of production) and the timing of the actual embedded frame is entered as the timing correction value in the display timing.

When the mobile closed caption packets are converted from analog closed caption packets and transmitted in the same ancillary data area, the frame following the frame in which the last block of the analog data packet constituting the page is embedded, should be replaced as the PTS frame.

2.4 Language Types

In terms of language types, the “File Extension” section of ARIB STD-B36 “*Closed Caption File Conversion Format for Digital Television Broadcasting*” defines the types as Language No. 1 through Language No. 8. In ARIB TR-B14 “*Operational Guidelines for Digital Terrestrial Television Broadcasting*”, however, the “ES Quantity” section specifies that “the number of ES which can be transmitted simultaneously for closed captions and for subtitles is 1 each”, and the “Transmitting Multiple Languages” section specifies that “a maximum of 2 languages can be simultaneously transmitter per single ES.” Accordingly, implementation is only possible with 1 or 2 language types.

Mobile closed captions are to be handled in an equivalent manner.

2.4.1 Mobile Closed Caption Language Management

Data group ID is used in order to specify the number of languages for closed captions.

When there is only one language, group A is to be used, and when there are two languages, group B is to be used. As group A CRC and group B CRC that follow the closed caption data in the short form data are not used, FFh FFh (2FFh 2FFh) is to be stored therein.

2.5 Short Form Data

Operational guidelines regarding a portion of the content of Section 2.2.3 “Short Form Data“ contaned in the Main Part are prescribed below.

2.5.1 Implementation of User Data Area

The user data area in the short form data (refer to Section 2.2.3.1 “LEN (Length)” in the Main Part) is not to be used and should be filled with 00h (200h).

2.5.2 Implementation of Display Timing

(1) Data types

The “Time” item from Table 2-16 (Data Type Identifiers) in the Main Part is not to be used.

(2) Timing types

“Relative time (relative PTS)” is to be used as the timing type identifier.

(3) Display timing value

The timing correction value of “Relative time (relative PTS)” is to be used. Regarding this value, no value that would cause the reversal of sequences between closed caption pages is to be used. In consideration of gaps between closed captions and video, it is preferable that the upper limit be set within 2 seconds.

Note: PTS values are indicated in units of 1/90k seconds. For example, 1 second is represented by 90,000 (decimal) and 1 frame is represented by 3,003 (decimal); however, these values are converted to 33-bit binary values containing marker bits for implementation.

2.5.3 Implementation of Closed Caption Data

Payload: The length of the closed caption PES header block is fixed at 35 words, and the data content is implemented on the basis of fixed values with the exception of PES packet length, PTS value, and PES private data.

2.5.4 Implementation of Analog Closed Caption Data

User area: Unused and filled with FFh.

2.5.5 Implementation of Mobile Closed Caption Data

User area: Unused and filled with FFh.

2.5.6 Source Identification

The Source Identification number (SID) in the program index data is to be fixed at '00000'.

2.6 Implementation of ECC

Although it is stated in Section 2.2.3.10 “ECC / Error Correction Parity Word“ of the Main Part that the ECC is treated as an optional item, it is preferable that ECC is constantly added at the transmission side in order to maintain the reliability of transmission data. Accordingly, the error correction identifier in the closed caption header word is to be constantly set to “1” (i.e., Error Correction). It is preferable that error correction be carried out at the receivers; however, implementation is possible for devices which only have functionality for error detection or devices which cannot use the ECC.

Chapter 3 Closed Caption Conversion

The conversion of analog closed caption data to digital closed caption data, of HD closed caption data to SD closed caption data, and other similar types of closed caption conversion are important issues in the implementation of closed caption. This chapter will detail the guidelines which enable the conversion of closed caption.

The inter-relations which are relevant to the conversion of closed caption are illustrated in Figure 3-1. In this figure, the terms “HD closed caption (limited)” and “SD closed caption (limited)” refer to digital closed caption data created with operating conditions which permit conversion to analog closed caption or conversion between SD and HD closed caption. Furthermore, the terms “HD closed caption (full spec.)” and “SD closed caption (full spec.)” refer to closed caption data which satisfies all specifications for digital closed caption. (Note that this operational guideline does not apply to the conversion of closed caption in this case.)

To convert closed caption data to mobile closed captions, conversion from HD/SD services (Closed caption DM conversion) and conversion from analog services (Closed caption AM conversion) should be considered. Only one-way conversion needs to be considered, as the reverse conversions are not operated due to the nature of mobile closed captions.

This chapter will principally consider the conditions for implementation illustrated within the broken-line box in the following figure; furthermore, language types will be selectable for closed caption AD conversion and closed caption DA conversion.

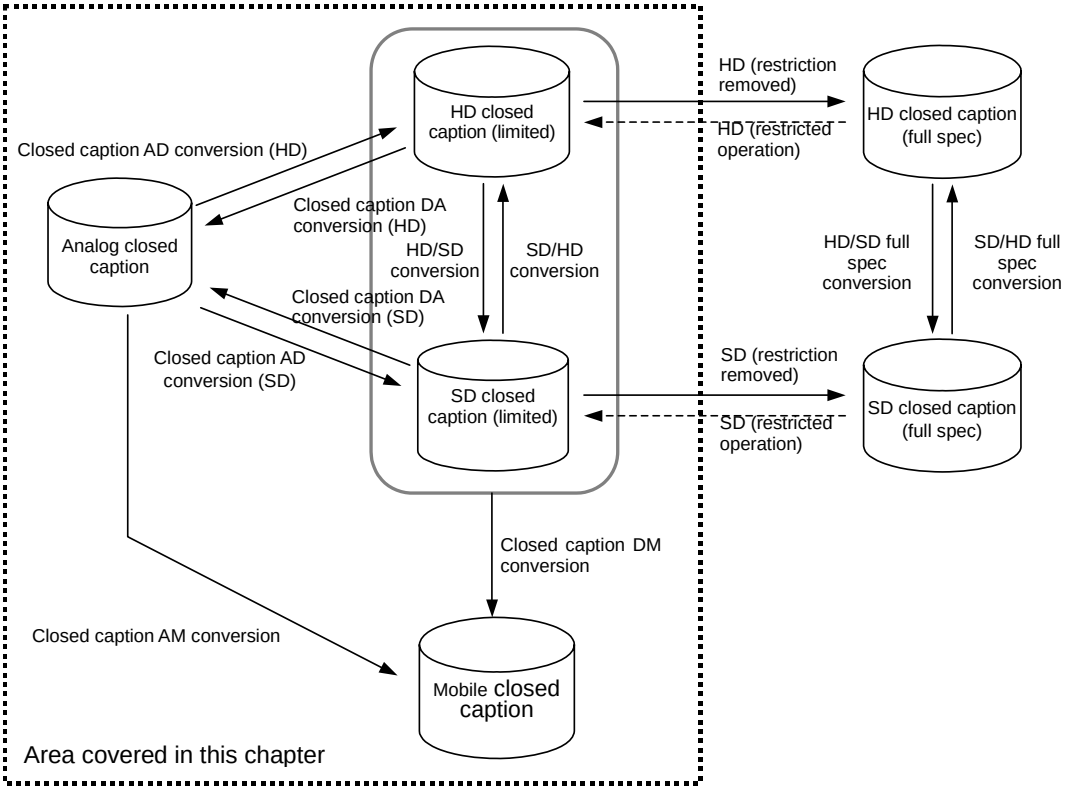


Figure 3-1: Inter-Relationships for Conversion of Closed Caption Data

3.1 Analog/Digital Closed Caption Conversion

This chapter represents conversion methods for analog closed caption and digital closed caption. This chapter does not define conversion methods. Rather, they are guidelines for smooth display of closed captions when decoded by receivers. Guidelines for conversion of closed caption to broadcast and guidelines for the production of closed caption are defined in this chapter.

Specifically speaking, these sections will define conversion methods for analog-to-digital closed caption conversion (i.e., closed caption AD conversion) and for digital-to-analog closed caption conversion (i.e., closed caption DA conversion), during the transitional period from analog broadcasting to digital broadcasting (i.e., simultaneous broadcasting).

The conversion method for mobile closed captions is also defined. Due to the nature of mobile closed captions, however, only conversion to mobile closed captions is covered, rather than bi-directional conversion. Specifically, the method for converting analog closed caption to mobile closed caption (Closed Caption AM conversion), and digital closed caption (HD, SD) to mobile closed caption (Closed Caption DM conversion) are covered.

3.1.1 Closed Caption AD Conversion

This section defines guidelines for the conversion of analog closed caption to digital closed caption. The conversion of analog materials to digital materials will be necessary when simultaneous broadcasting which makes use of analog materials, and this type of conversion is referred to as “closed caption AD conversion.” (The term “analog materials” as used here refers to NAB[*2]-defined analog closed caption data, VBI-embedded closed caption data, and analog closed caption data which has been embedded in ancillary data. Meanwhile, the term “digital materials” refers to the exchange format data defined in ARIB STD-B36 “*Exchange Format of The Digital Closed Caption File for Digital Television Broadcasting System*” and digital closed caption data which has been embedded in ancillary data area.)

It is necessary to convert with care in analog-to-digital closed caption conversion because of different specifications between digital and analog closed captions. At a number of points, the specifications for digital closed caption have been expanded with respect to those for analog closed caption. Regarding closed caption AD conversion, therefore, screen pages of analog closed caption are reproduced by using specific functions of digital closed caption.

The character sizes and styles used with analog closed caption are basically used Furthermore, parameters for digital specifications are adjusted in order to reproduce the screen pages of analog closed caption. Although styles for analog closed caption (i.e., lines per page, characters per line, line spacing, font spacing, and character size) are determined based on character types, digital

closed caption has high flexibility with respect to the setting of such styles. For this reason, it is preferable that digital closed caption styles basically conform with analog closed caption styles, and screen pages of digital closed caption are as equivalent as possible with those of analog closed caption.

*2 : “NAB” means “The National Association of Commercial Broadcasters in Japan”.

3.1.1.1 Style Conversion

Regarding examples of closed caption AD conversion, the style conversion table for HD mode is presented in Table 3.1; and for SD mode, in Table 3.2.

Note:

- Both tables are represented as premises for aspect ratios of 16:9 for conversion. It is necessary to convert with care as closed caption display may overrun the video display area in cases of SD display with 4:3 side panel.
- When very-small characters are replaced with small characters during AD conversion, assignment of ACPS (Active Coordinate Position Set) will not be needed for character positioning, and reverse conversion (i.e., DA) may be easily carried out
- If presentation update control in the page data header (PACI) is not assigned as screen initialization prohibition when converting from analog to digital, clear screen (CS) control data will be appended to the front of the closed caption text data after conversion, and with the exception of cases where display is realized using the initial values defined in the operational guidelines (i.e., line spacing, font spacing, font size, etc.), SVS (Set Vertical Space), SHS (Set Horizontal Space), SWF (Set Writing Format) will also be appended after the clear screen (CS) control data.

Table 3-1: From-Analog Style Conversion Table (HD)

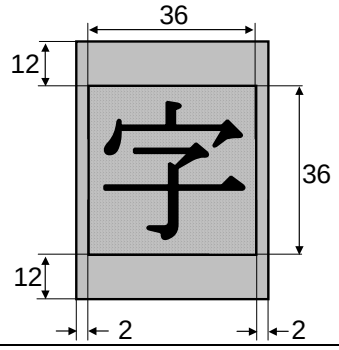
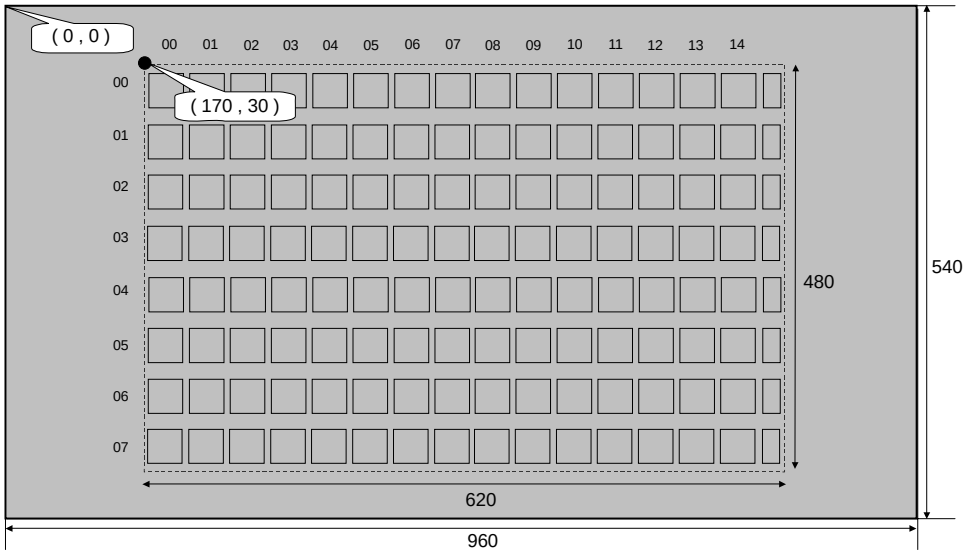
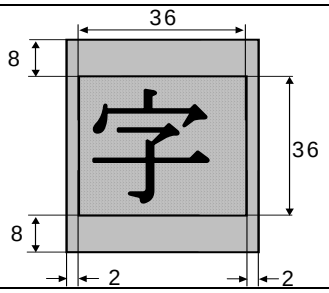
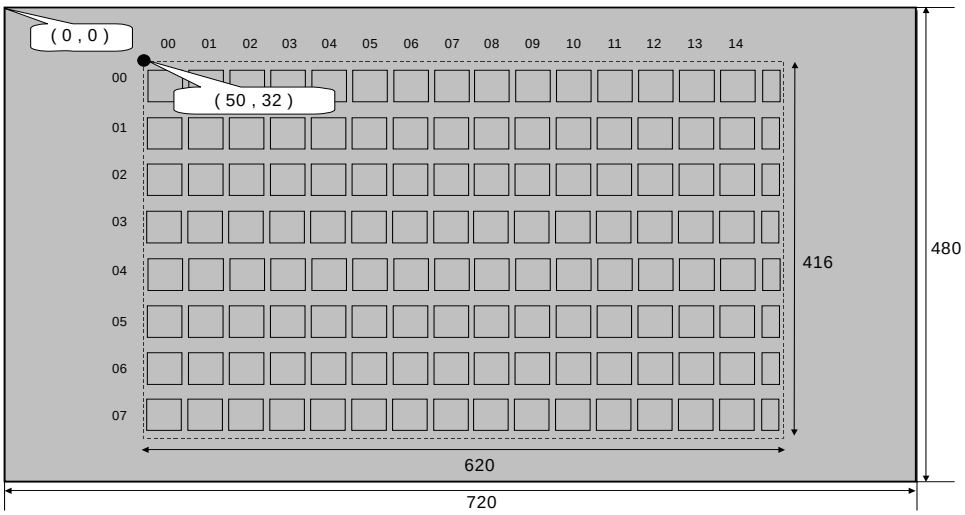
Font size/Spacing (initial values)	Font size: 36 , Font spacing: 4 , Line spacing: 24
Character size (normal size)	
Closed caption display area	SDF (620, 480)
Initial position of closed caption (center)	SDP (170, 30)
Display style	
Coordinate conversion method	Normal size Width: 40 x 'NOC[*1]' + 170 , Height: 60 x 'NOL[*2]' + 30 Medium size Width: 20 x 'NOC' + 170 ,Height: 60 x 'NOL' + 30 Small size Width: 20 x 'NOC' + 170 , Height: 30 x 'NOL' + 30 Very-small size Width: 10 x 'NOC' + 170 ,Height: 10 x 'NOL' + 30 Double-height size Width: 40 x 'NOC' + 170 , Height: 120 x 'NOL'+ 30 Double-width size Width: 80 x 'NOC' + 170 , Height: 60 x 'NOL' + 30 Full-double size Width: 80 x 'NOC' + 170 , Height: 120 x 'NOL' + 30 Special 1 size Width: 40 x 'NOC' + 170 , Height: 50 x 'NOL' + 30 ('NOC' and 'NOL' are values starting from 0. However, care must be taken in cases where the standard character point is positioned at the bottom left.) *1 : NOC = Number of characters *2 : NOL = Number of Lines
Ruled-line, Hemming, and underlined characters	Supported (i.e., correctly displayed)
DRCS conversion	Factor of enlargement from analog closed caption: double-width, double-height Normal size Width: 40 , Height: 60 Medium size Width: 20 , Height: 60 Small size Width: 20 , Height: 30 Special 1 size Width: 40 , Height: 50

Table 3-2: From-Analog Style Conversion Table (SD)

Font size/Spacing (initial values)	Font size: 36 , Font spacing: 4 , Line spacing: 16
Character size (normal size)	
Closed caption display area	SDF (620, 416)
Initial position of closed caption (center)	SDP (50, 32)
Display style	
Coordinate conversion method	Normal size Width: 40 x 'NOC[*1]' + 50 , Height: 52 x 'NOL[*2]' + 32 Medium size Width: 20 x 'NOC' + 50 , Height: 52 x 'NOL' + 32 Small size Width: 20 x 'NOC' + 50 , Height: 26 x 'NOL' + 32 Very-small size Width: 10 x 'NOC' + 50 , Height: 52 / 6 x 'NOL' + 32 (rounded off) Double-height size Width: 40 x 'NOC' + 50 , Height: 104 x 'NOL' + 32 Double-width size Width: 80 x 'NOC' + 50 , Height: 52 x 'NOL' + 32 Full-double size Width: 80 x 'NOC' + 50 , Height: 104 x 'NOL' + 32 Special 1 size Width: 40 x 'NOC' + 50 , Height: (36 + 16 / 3) x 'NOL' + 32 (rounded off) ('NOC' and 'NOL' are values starting from 0. However, care must be taken in cases where the standard character point is positioned at the bottom left.) *1 : NOC = Number of characters *2 : NOL = Number of Lines
Ruled-line, Hemming, and underlined characters	Supported (i.e., correctly displayed)
DRCS conversion	Factor of enlargement from analog closed caption: double-width, double-height Normal size Width: 40 , Height: 52 Medium size Width: 20 , Height: 52 Small size Width: 20 , Height: 26 Special 1 size Width: 40 , Height: 36 + 16 / 3

3.1.1.2 Character Code Conversion

(1) Control codes

Refer to Informative Explanation Section B6 “Control Code Conversion Tables”.

(2) DRCS

Refer to Informative Explanation Section B7 “Examples of DRCS Conversion“.

(3) DJCS

DJCS is not required by digital closed caption receivers and is not transmitted.

(4) Character colors and background colors

The color assignments of analog closed caption correspond to a part of the color map for digital closed caption, and for this reason, character colors and background colors do not convert. Care is, however, required with respect to the “Translucent black” specification for closed caption background color.

Refer to Informative Explanation Section B3.3(4) “Character colors and background colors“.

3.1.2 Closed Caption DA Conversion

Only the Level A function of analog closed caption is used when converting from digital closed caption to analog closed caption.

3.1.2.1 Style Conversion

With analog closed caption, display is possible for 15.5 characters x 8 lines (when using the normal size); accordingly, it is preferable with digital closed caption also that there be an identical number of characters and lines, and in addition, that the style corresponds with the contents of Table B3-2 through Table B3-5. Conversions from any other number of characters or lines are product-dependent.

Note: When clear screen (CS) control data is appended at the start of the digital closed caption text, initialization prohibition is not to be assigned for the page data header’s (PACI) presentation update control upon data conversion. Furthermore, clear screen (CS) control data is to be removed from closed caption data.

(1) Display style

Only horizontal text is supported with the display style for analog closed caption, and for this reason, it is preferable that digital closed caption also be rendered horizontally. Conversion from vertical text is product-dependent.

Furthermore, the size of the character display area will affect the number of characters and

lines in addition to font size, font spacing, and line spacing. For more details, refer to (3) “Font spacing and line spacing” below.

(2) Font size

The font size will affect the number of characters and lines in addition to the display area size, font spacing, and line spacing. Furthermore, the font size will also affect the DRCS pattern conversion. For more details regarding character and line numbers, refer to (3) “Font spacing and line spacing” below, and regarding DRCS pattern conversion, refer to 3.1.2.2 (2) “DRCS”.

(3) Font spacing and line spacing

The font spacing and line spacing will affect the number of characters and lines in addition to the display area size and the font size. The numbers of characters and lines are calculated as follows:

Number of characters = Width of closed caption display area ÷ (font size + font spacing)
Number of lines = Height of closed caption display area ÷ (font size + line spacing)

3.1.2.2 Character Code Conversion

When converting character codes from digital closed caption to analog closed caption, it is preferable that character codes correspond with the content of Table B3-2 through Table B3-5 in Informative Explanation Section B3 “Approach to Closed Caption AD Conversion“. Conversions from any other character codes are product-dependent.

(1) Control codes

Refer to Informative Explanation Section B6 “Control Code Conversion Tables“.

(2) DRCS

It is not possible to use 2-byte DRCS codes with analog closed caption, and therefore, it is preferable that 2-byte DRCS codes are also not used with digital closed caption. Conversion of 2-byte DRCS codes is product-dependent.

Regarding 1-byte DRCS codes, it will not be necessary to convert character codes or to add control codes. For more details regarding DRCS pattern conversion, refer to Informative Explanation Section B7 “Examples of DRCS Conversion“.

Note that when DRCS are used as double-height, double-width, or full-double sizes, it will be necessary that DRCS font patterns which are designed as normal size, are removed two lines each at the top and bottom in order that they will fit inside the frame for Special size 1. For

more details regarding Special size 1, refer to Figure B3-2 “Character Sizes for Analog Closed caption”.

(3) DJCS

When converting JIS X 0208 Level 2 *kanji* characters to analog closed caption, DJCS pattern data are transmitted in advance. Conversion of the character code and addition of control codes is not necessary.

DJCS font patterns must be defined in such a way that they fit inside the frame for Special size 1, DJCS processing can be assigned only as normal, double-width, double-height, and full-double sizes.

Note that when assigning sizes for double-width, double-height, and full-double characters, expansion of the font pattern will also be carried out automatically in the same way as for DRCS.

(4) Character colors and background colors

- Number of colors

Although 16 colors (including transparent) can be used with analog closed caption, digital closed caption can make use of 128 CLUT common-fixed colors (including transparent. The first 16 colors in the table are same as for analog closed caption.) Consequently, it is preferable with digital closed caption also that the first 16 clors of CLUT common-fixed colors be only used. Conversions using any other palette colors are product-dependent.

- Character colors

Assignments of foreground colors and background colors are possible with analog closed caption, and furthermore, it is also possible to assign foreground intermediate colors and background intermediate colors with digital closed caption. Methods for converting these intermediate colors are product-dependent.

- Exception

In situations where translucent is assigned as the background color for digital closed caption, it will be necessary to convert this color to half-brightness white in order to conform with exceptional regulations for analog closed caption. For more details regarding the color index for translucent colors, refer to ARIB TR-B14 “*Operational Guidelines for Digital Terrestrial Television Broadcasting*”.

(5) Additional characters

No DJCS characters exist for analog closed caption in terms of a part of general additional characters and VICS additional characters; accordingly, it is preferable that these also not be used for digital closed caption. Conversions of these general additional characters and VICS additional characters are product-dependent.

(6) Horizontal scrolling

In order to make use of the horizontal scrolling function with analog specifications, it will be necessary to specify the program as being of batch format (i.e., all display content is sent in a single batch); however, since closed caption is not applicable to batch format, horizontal scrolling cannot be used. For this reason, it is preferable with digital closed caption also that horizontal scrolling be not used. Conversion when this type of scrolling is used is product-dependent.

(7) Roll up

Usage of the roll-up function (i.e., vertical scrolling) is not possible with analog specifications. However, in the same way as for digital receivers which do not support roll-up mode as defined in ARIB TR-B14 "*Operational Guidelines for Digital Terrestrial Television Broadcasting*", data units for closed caption text must be displayed as normal closed caption. Furthermore, the CS which is positioned at the start of the digital closed caption text data is to be removed upon conversion.

3.2 Conversion for Digital Closed Caption

Three different types of closed caption data are contained in digital specifications for use with digital terrestrial broadcasting — namely HD materials, SD materials, and mobile closed captions. This section will define the regulations for the conversion methods used, when the content of HD materials is to be broadcasted as SD materials, when the content of SD materials is to be broadcasted as HD materials, or when HD/SD closed captions are to be broadcasted as mobile closed captions. The following types of conversion are used.

1) Conversion of HD materials to SD materials
2) Conversion of SD materials to HD materials
3) Conversion of HD/SD closed captions to mobile closed captions.

These methods are referred to as HD/SD conversion, SD/HD conversion, and Closed Caption DM conversion, respectively, and the regulations defined below apply to these methods.
With digital closed caption, the closed caption formats for HD and SD are controlled separately, and

closed caption material data in accordance with the video format must be transmitted. Accordingly, it is assumed that HD/SD conversion and SD/HD conversion of closed caption materials are carried out in the cases of material conversion using digital material data and real-time conversion using data embedded on ancillary data area.

HD/SD conversion and SD/HD conversion are format conversions within digital closed caption specification, and no restrictions exist for conversions of control codes and 8-bit coded characters. Consequently, this section will define conversions in terms of display position, font size, font spacing, lines spacing, and DRCS.

Due to the nature of closed caption DM conversion, reciprocal conversion is not included; only conversion to mobile closed captions is covered.

This chapter does not regulate conversion methods. Rather, they are guidelines for smooth display of closed captions when decoded by receivers. Therefore, this chapter defines guidelines for the transmission of closed captions (i.e., reciprocal conversion method for transmission of closed captions) and production of closed captions (i.e., production methods for closed captions).

3.2.1 HD/SD Conversion

This section defines guidelines for conversion from HD size to SD size for digital closed caption.

3.2.1.1 Style Conversion

This section covers display position conversion and font size conversion as part of HD/SD conversion.

(1) Display position conversion

The display areas for HD closed caption and SD closed caption are as follows.

Table 3-3: Display areas for HD closed caption and SD closed caption

Mode	Width	Height
HD	960	540
SD	720	480

(Units: Pixels)

It is expected that conversion from HD closed caption to SD closed caption will be of one of the following two types.

- HD closed caption, 16:9 → SD closed caption (16:9)
- HD closed caption, 4:3 area within 16:9 → SD closed caption (4:3)

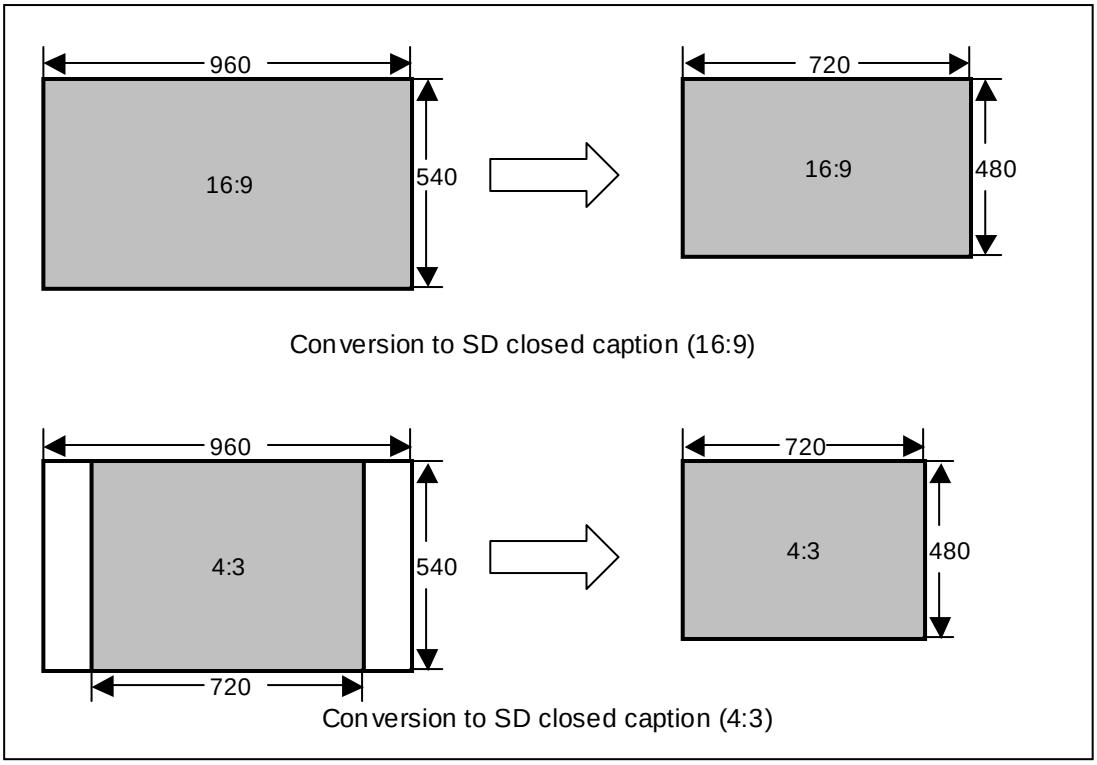


Figure 3-2: HD/SD Conversion Methods

The relationships between the coordinate values of the display area for HD closed caption and SD closed caption are as follows:

Horizontal pixels	HD:SD (16:9)	=	960:720	=	4:3
	HD:SD (4:3)	=	720:720	=	1:1
Vertical pixels	HD:SD	=	540:480	=	9:8

Consequently, the following definitions apply to the conversion of display positions from HD closed caption to those for SD closed caption.

Conversion to SD closed caption (16:9)

X axis: SD coordinate = $(\frac{3}{4})$ HD coordinate

Y axis: SD coordinate = $(\frac{8}{9})$ HD coordinate

Conversion to SD closed caption (4:3)

X axis: SD coordinate = HD coordinate – 120

Y axis: SD coordinate = $(\frac{8}{9})$ HD coordinate

Note that it will be necessary to round up or to round off any figures below the decimal point upon conversion, and that consideration must be given to overlapping in terms of font spacing, line spacing, and display area coordinates, and also to safety zones. The corresponding adjustment methods are product-dependent.

(2) Font size, font spacing, and line spacing conversion

As an example of HD/SD conversion, Table 3-4 presents font sizes, font spacing, and line spacing for HD mode, and the corresponding values after conversion to SD. Ruled-line characters, hemming characters and underlined characters can be displayed correctly by using pre-conversion and post-conversion values in the table. Note that conversion is not required for SD(4:3) as both HD and SD(4:3) have the same numbers of Horizontal pixels for this mode.

Table 3-4: HD/SD Conversion of Font Sizes, Font Spacing, and Line Spacing

Conversion to SD (16:9)	HD		SD（16：9）		Remarks
	Font size	Font spacing Line spacing	Font size	Font spacing Line spacing	
Horizontal text	36	4	36	4	15.5 characters (width) x 8 characters (height) AD conversion format (Refer to 3.1.1: “Closed Caption AD Conversion”)
		24		16	
	36	4	30	0	24 characters (width) x 11 characters (height)
		12		13	
	30	2	24	0	30 characters (width) x 13 characters (height)
		10		11	
	24	3	20	0	35 characters (width) x 16 characters (height)
		8		9	
	20	2	16	0	43 characters (width) x 20 characters (height)
		7		7	
Vertical text	36	6	30	7	16 characters (width) x 12 characters (height)
		24		10	
	30	5	24	5	19 characters (width) x 15 characters (height)
		20		8	
	24	4	20	4	24 characters (width) x 19 characters (height)
		16		7	
	20	3	16	4	35 characters (width) x 23 characters (height)
		7		5	

Conversion to SD (4:3)	HD		SD(4：3)		Remarks
	Font size	Vertical spacing	Font size	Vertical spacing	
Horizontal text	36	24	36	16	9 characters (height)
	30	20	30	13	10 characters (height)
	24	16	24	11	13 characters (height)
	20	7	20	4	20 characters (height)
		13		9	16 characters (height)
	16	11	16	7	20 characters (height)
Vertical text	36	6	36	0	12 characters (height)
	30	5	30	0	15 characters (height)
	24	4	24	0	19 characters (height)
		8		3	16 characters (height)
	20	7	20	4	20 characters (height)
	16	3	16	0	28 characters (height)
		5		2	25 characters (height)

Note: No conversion is required for horizontal font spacing (horizontal text) or line spacing (vertical text) because the numbers of pixels are the same.

3.2.1.2 DRCS Conversion

Regarding DRCS size for digital specifications, the assignment of font size in the character codes is also applied. Accordingly, DRCS conversion in the HD/SD conversion is carried out similarly to the conversion of font size in the character codes.

Although scaling-down conversion may be required by any HD/SD conversion methods, algorithms to be used are product-dependent.

Note also that when a large character is compounded by some external characters, it may not be possible to guarantee correct conversion when using any font sizes, line spacing, and font spacing in the HD/SD conversion process.

Table 3-5: DRCS Sizes for HD/SD Conversion

HD closed caption font size	Font size from SD conversion	DRCS size
36	36	No size conversion
	30	Compression by a factor of 5/6
30	30	No size conversion
	24	Compression by a factor of 4/5
24	24	No size conversion
	20	Compression by a factor of 5/6
20	20	No size conversion
	16	Compression by a factor of 4/5
16	16	No size conversion

3.2.2 SD/HD Conversion

This section defines guidelines for conversion from SD size to HD size for digital closed caption.

3.2.2.1 Style Conversion

This section covers display position conversion and font size conversion as part of SD/HD conversion.

(1) Display position conversion

Display areas for HD closed caption and SD closed caption are as follows.

Table 3-6: Display Areas for HD Closed Caption and SD Closed Caption

Mode	Width	Height
HD	960	540
SD	720	480

(Units: Pixels)

It is expected that conversion from SD closed caption to HD closed caption will be of one of the following two types.

- SD closed caption, 16:9 → HD closed caption, 16:9
- SD closed caption, 4:3 → HD closed caption, 4:3 area

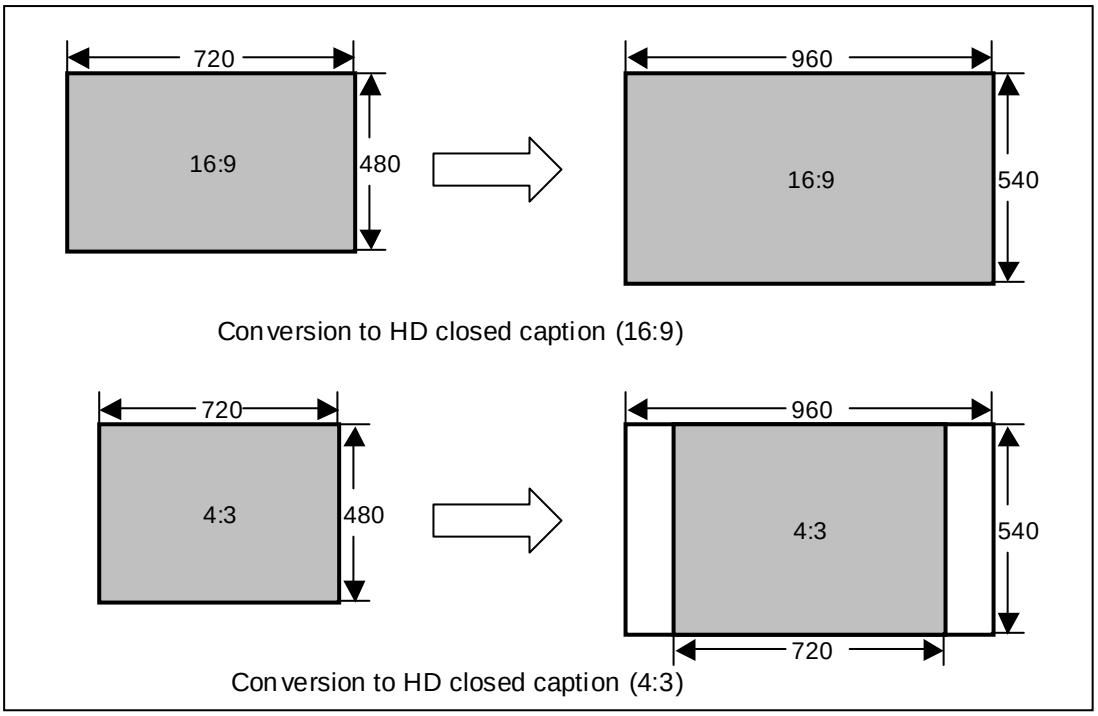


Figure 3-3: SD/HD Conversion Methods

The relationships between display area coordinate values for HD closed caption and SD closed caption are as follows:

Horizontal pixels	SD:HD (16:9)	=	720:960 =	3:4
	SD:HD (4:3)	=	720:720 =	1:1
Vertical pixels	SD:HD	=	480:540 =	8:9

Consequently, the following definitions apply to the conversion of display positions from SD closed caption to those for HD closed caption.

Conversion to HD closed caption (16:9)

X axis:	HD coordinate	=	$(\frac{4}{3})$ SD coordinate
Y axis:	HD coordinate	=	$(\frac{9}{8})$ SD coordinate

Conversion to HD closed caption (4:3)

X axis:	HD coordinate	=	SD coordinate + 120
Y axis:	HD coordinate	=	$(\frac{9}{8})$ SD coordinate

Note that it will be necessary to round up or to round off any figures below the decimal point upon conversion, and that consideration must be given to overlapping in terms of font spacing, line spacing, and display area coordinates. The corresponding adjustment methods are product-dependent.

(2) Font size, font spacing, and line spacing conversion

As an example of SD/HD conversion, Table 3-7 presents font sizes, font spacing, and line spacing for SD mode, and the corresponding values after conversion to HD. Ruled-line characters, hemming characters and underlined characters can be displayed correctly by using pre-conversion and post-conversion values in the table. Note that conversion is not required for HD(4:3) as both SD and HD (4:3) have the same numbers of Horizontal pixels for this mode.

Table 3-7: SD/HD Conversion of Font Sizes, Font Spacing, and Line Spacing

Conversion to HD (16:9)	SD		HD(16 : 9)		Remarks
	Font size	Font spacing Line spacing	Font size	Font spacing Line spacing	
Horizontal text	36	4 24	36	4 16	15.5 characters (width) x 8 characters (height) AD conversion format (Refer to 3.1.1: “Closed Caption AD Conversion”)
	30	0 13	36	4 12	24 characters (width) x 11 characters (height)
	24	0 11	30	2 10	30 characters (width) x 13 characters (height)
	20	0 9	24	3 8	35 characters (width) x 16 characters (height)
	16	0 7	20	2 7	43 characters (width) x 20 characters (height)
Vertical text	30	7 10	36	6 24	16 characters (width) x 12 characters (height)
	24	5 8	30	5 20	19 characters (width) x 15 characters (height)
	20	4 7	24	4 16	24 characters (width) x 19 characters (height)
	16	4 5	20	3 7	35 characters (width) x 23 characters (height)

Conversion to HD (4:3)	SD		HD(4 : 3)		Remarks
	Font size	Vertical spacing	Font size	Vertical spacing	
Horizontal text	36	16	36	24	9 characters (height)
	30	13	30	20	10 characters (height)
	24	11	24	16	13 characters (height)
	20	4	20	7	20 characters (height)
		9		13	16 characters (height)
	16	7	16	11	20 characters (height)
Vertical text	36	0	36	6	12 characters (height)
	30	0	30	5	15 characters (height)
	24	0	24	4	19 characters (height)
		3		8	16 characters (height)
	20	4	20	7	20 characters (height)
	16	0	16	3	28 characters (height)
		2		5	25 characters (height)

Note: No conversion is required for horizontal font spacing (horizontal text) or line spacing (vertical text) because the numbers of pixels are the same.

3.2.2.2 DRCS Conversion

Regarding DRCS size for digital specifications, assignment of font size in the character codes is also applied. Accordingly, DRCS conversion in the SD/HD conversion is carried out similarly to the conversion of font size in the character codes.

Although expanding conversion may be required by any SD/HD conversion methods, algorithms to be used are product-dependent.

Note also that when a large character is compounded by some external characters, it may not be possible to guarantee correct conversion when using any font sizes, line spacing, and font spacing used in SD/HD conversion process.

Table 3-8: DRCS Sizes for SD/HD Conversion

SD closed caption font size	Font size from HD conversion	DRCS size
36	36	No size conversion
30	36	Expansion by a factor of 6/5
	30	No size conversion
24	30	Expansion by a factor of 5/4
	24	No size conversion
20	24	Expansion by a factor of 6/5
	20	No size conversion
16	20	Expansion by a factor of 5/4
	16	No size conversion

3.2.3 Closed Caption DM Conversion, AM Conversion

This section defines the guidelines for conversion from digital closed captions or analog closed captions to mobile closed captions.

Digital closed captions include both HD closed captions and SD closed captions. The difference between the two closed caption data types is only the display format. The same control codes and the ISO 8-bit coded characters are used in both closed captions. The same process can therefore be used in closed caption DM conversion.

3.2.3.1 Format Conversion

As the display functions are restricted in the mobile receiver, the specific parameters for digital closed captions (font size, character spacing, etc) should be deleted for the mobile closed captions. AM conversion and DM conversion use the same method basically.

(1) Font size, character spacing, line spacing

The font size, character spacing, and line spacing settings are to be deleted. (Only for closed caption DM conversion.)

(2) Character size

Normal size and medium size are to be used as is. Special size 1 is to be converted to the normal size. The conversion of small, double-height, double-width, and double-size characters are product-dependent.

(3) Closed caption display area, initial display point.

The closed caption display area (SDF), and initial display point (SDP) settings are to be deleted. (Only for closed caption DM conversion.)

(4) Display format

Only horizontal display is to be used. As positioning operations other than line return are not performed, the text layout should be controlled by the mobile receivers. The text layout are product-dependent.

3.2.3.2 Code Conversion

As for the character coding method for mobile closed caption, mobile closed caption 8-bit coded character set, which is the subset of the standard 8-bit coded character set, is used. In the mobile closed caption 8-bit coded character set, the GL code area is fixed as in the DRCS character set (1-byte code), and the GR code area is fixed as in the Kanji character set (2-byte code, *ku* 1-94), both defined in ARIB STD-B24. Character code table swapping is not performed. Areas described in (2) that are not used for character codes are used for control codes.

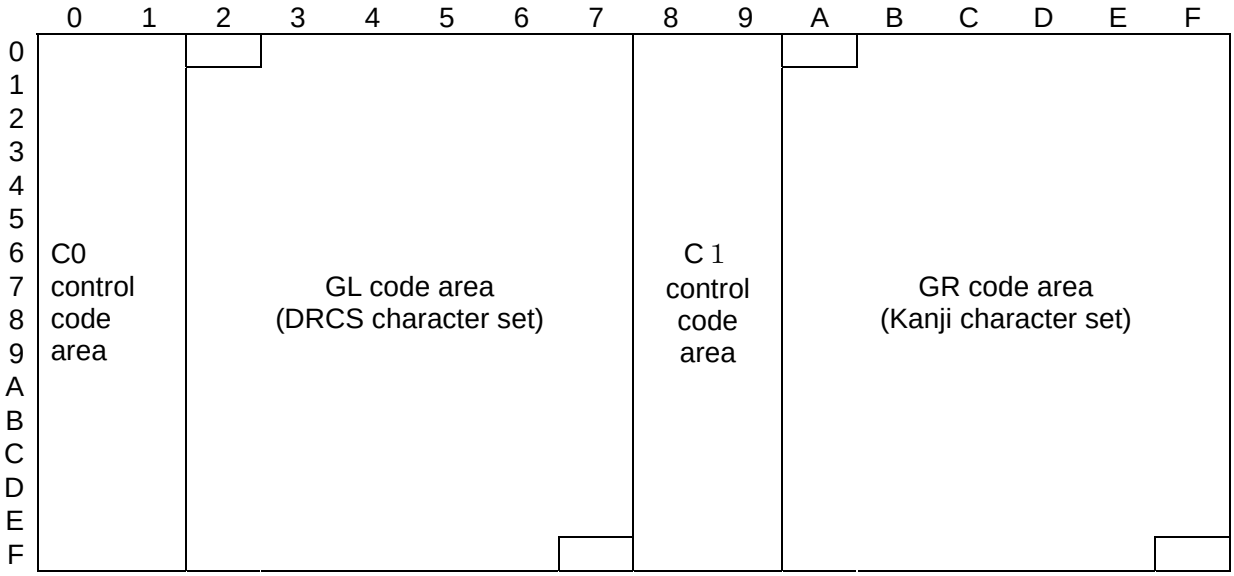


Figure 3-4 Code Ranges for Mobile Closed Caption 8-bit Coded Character

(1) *Kanji* Character Set Range

First byte: A1-FEh

Second byte: A1-FEh

(2) Control codes

Refer to Informative Explanation B6 “Control Code Conversion Tables”.

The control codes below can be used, because they are not used as character codes.

00-1Fh, 20h, 7Fh, 80-9Fh

(3) DRCS

The DRCS font patterns used for mobile closed captions are the same dot-patterns as used for analog closed captions (16 width x 18 height). For further details on closed caption DM conversion, refer to Informative Explanation B7.2 “DRCS Conversion Example (DA Conversion)”. For further details on closed caption AM conversion, refer to Informative Explanation B7.4 (DRCS Conversion Example (AM conversion)).

The DRCS character codes used in this standard are a fixed 41h for the first byte (External character code set), and the range of 21h-7Eh for the second byte.

(4) DJCS

As DJCS is not required by the digital closed caption receiver, it is to be deleted.

(5) Character colors and background colors

Character colors are only used in the mobile closed captions, therefore, background, character intermediate colors and background intermediate colors cannot be used, and their color control codes must be deleted.

3.3 Operation using CCIS

It may seem that a large variety of alternatives are available in digital closed caption since it is possible to individually specify items such as font size, spacing, display area. However, when reproducing expressions of analog closed-captioned screen and/or character positioning, there are limited parameters (descriptions) to closed caption format.

Auxiliary conversion information “CCIS“ as style parameter values are defined, and application methods of this identifier are indicated in this section in order to achieve easy operation of conversion,.

CCIS is used to convey auxiliary information, such as closed caption conversion information, when transmitting closed caption data. Also, it consists of header identifiers of Caption_conversion_type and DRCS_conversion_type. Although CCIS provides a lot of useful advantages when being used in DA reverse conversion and HD/SD reciprocal conversion, CCIS is an identifier in the user area and it is not mandatory to use CCIR for operations. Nevertheless, ARIB approval will be required in order to ensure compatibility in closed caption operations if CCIS is expanded and/or modified

3.3.1 Using Caption_conversion_type Identifier

When display area of digital closed caption is fitted to video areas for HD side-panel screen display or SD (4:3) screen display, no major problems will occur if the default values of ARIB TR-B14 “*Operational Guidelines for Digital Terrestrial Television Broadcasting*” is adopted for character size, character spacing, and line spacing. In the case of SD wide screen and side-panel, however, default values will result in the closed caption over-running the horizontal side of the video area by a considerable degree, and the screen position for the base video as set during closed caption production will be significantly corrupted. In such a case, by setting character spacing to 0 and using defaults for all other values, it will be possible to obtain a display which is relatively close to that intended. Caption_conversion_type identifier is used for this type of operation.

Also, as the operation does not set font size (dots), character spacing, and line spacing in the case of mobile closed caption data, they are indicated using this identifier.

Definitions for the Caption_conversion_type identifier are as follows:

- HD side panel 01h
- SD (4:3) 02h
- SD wide side panel 03h
- Mobile closed caption 04h

3.3.2 DRCS_conversion_type identifier

Two conversion methods for the achievement of easy reversible reciprocal conversion for DRCS are defined in AD and DA conversion of closed caption data, and the DRCS_conversion_type identifier is set up in order to identify these two conversion types.

As indicated in section B7.1.1 “Mode-A DRCS Conversion”, Mode-A DRCS Conversion shall be conversion in which 4 deficient dots for 36 dots are split two by two, and each 2 dots are assigned on both sides using background color.

And also, as indicated in Section B.7.1.2 “Mode-B DRCS Conversion“, Mode-B DRCS Conversion shall be conversion in which 4 deficient dots are added onto right side.

For both of these modes, DA conversion is assured using a reverse AD conversion method, which does not cause character deformation. In case of Mode-A DRCS Conversion, a DRCS is positioned in the center of the character display area; however, the corresponding display is characterized by partial blank (spaces) on both sides. 4-bit processing for conversion is required.

In the case of Mode-B DRCS Conversion, as the left edge of DRCS is the reference position, a small blank arises on the right side. This is suitable for real-time conversion as conversion can be processed in 1-byte units.

As shown in B7.1.1, the mobile closed caption DRCS pattern data is a 16-width by 18-height clipping of the analog closed caption and keeps the basic form of the analog closed caption.

Definitions for DRCS_conversion_type identifier are as follows:

- Mode-A DRCS Conversion ‘00’ (binary value)
- Mode-B DRCS Conversion ‘01’ (binary value)
- Mobile DRCS ‘10’ (binary value)
- DRCS conversion not possible ‘11’ (binary value)

3.3.3 Short Form Data CCIS for Ancillary Data Packets

The CCIS block is setup within the PES_private_data (128 bits) user's area of the closed caption PES header block, and this is defined as shown in Table 3-9.

Table 3-9: Bit Allocation for PES_private_data from Closed Caption PES Header Block

PES_private_data	CCIS	CCIS_code Indicates the presence of an ancillary flag for conversion control information "CCIS" (4-byte character code)	32
		Caption_conversion_type Indicates the display style conversion method. 01h: HD side panel 02h: SD (4:3) 03h: SD wide side panel 04h: Mobile closed caption	8
		DRCS_conversion_type Indicates the DRCS conversion method. '00': DRCS conversion. Mode A '01': DRCS conversion. Mode B '10': Mobile DRCS '11': DRCS conversion not possible	2
		'111111' Undefined	6
	User area	All unused bits shall be '1'.	80

3.3.4 CCIS in File Exchange Format

In order to identify the DRCS conversion mode of the file exchange format of ARIB STD-B36, CCIS identifier data as shown in Table 3-10 and 3-11 are contained in the user's areas for program management information and page management information respectively.

Table 3-10 User's Area Entry for Program Management Information

No	Item name	Bytes	Definition, usable characters, etc.
30	User's area identification	1	• Space: User's area not used • *: CCIS present
31	User's area	N	• When CCIS is to be used, the 2 bytes after the entry for "CCIS" using a character code (4-bytes) at the start of the user's area are to contain CCIS data. • CCIS data content (1) Display style conversion mode (1 byte) 01h: HD side panel 02h: SD (4:3) 03h: SD wide side panel 04h: Mobile closed caption (2) DRCS conversion mode (1 byte) 2 most significant bits '00': Mode-A DRCS Conversion '10': Mobile DRCS '01': Mode-B DRCS Conversion '11': DRCS conversion not possible following 6 bits '111111': undefined

Table 3-11 User's Area Entry for Page Management Information

No	Item name	Bytes	Definition, usable characters, etc.
20	User's area identification	1	• Space: User's area not used • *: CCIS present
21	User's area	N	• When CCIS is to be used, the 2 bytes after the entry for "CCIS" using a character code (4-bytes) at the start of the user's area are to contain CCIS data. • CCIS data content (1) Display style conversion mode (1 byte) 01h: HD side panel 02h: SD (4:3) 03h: SD wide side panel 04h: Mobile closed caption (2) DRCS conversion mode (1 byte) 2 most significant bits '00': Mode-A DRCS Conversion '10': Mobile DRCS '01': Mode-B DRCS Conversion '11': DRCS conversion not possible following 6 bits '111111': undefined

3.3.5 Operation Model using CCIS for Closed Caption Conversion

Figure 3-5 presents an operation model for reversible reciprocal conversion originating with analog closed caption and using CCIS.

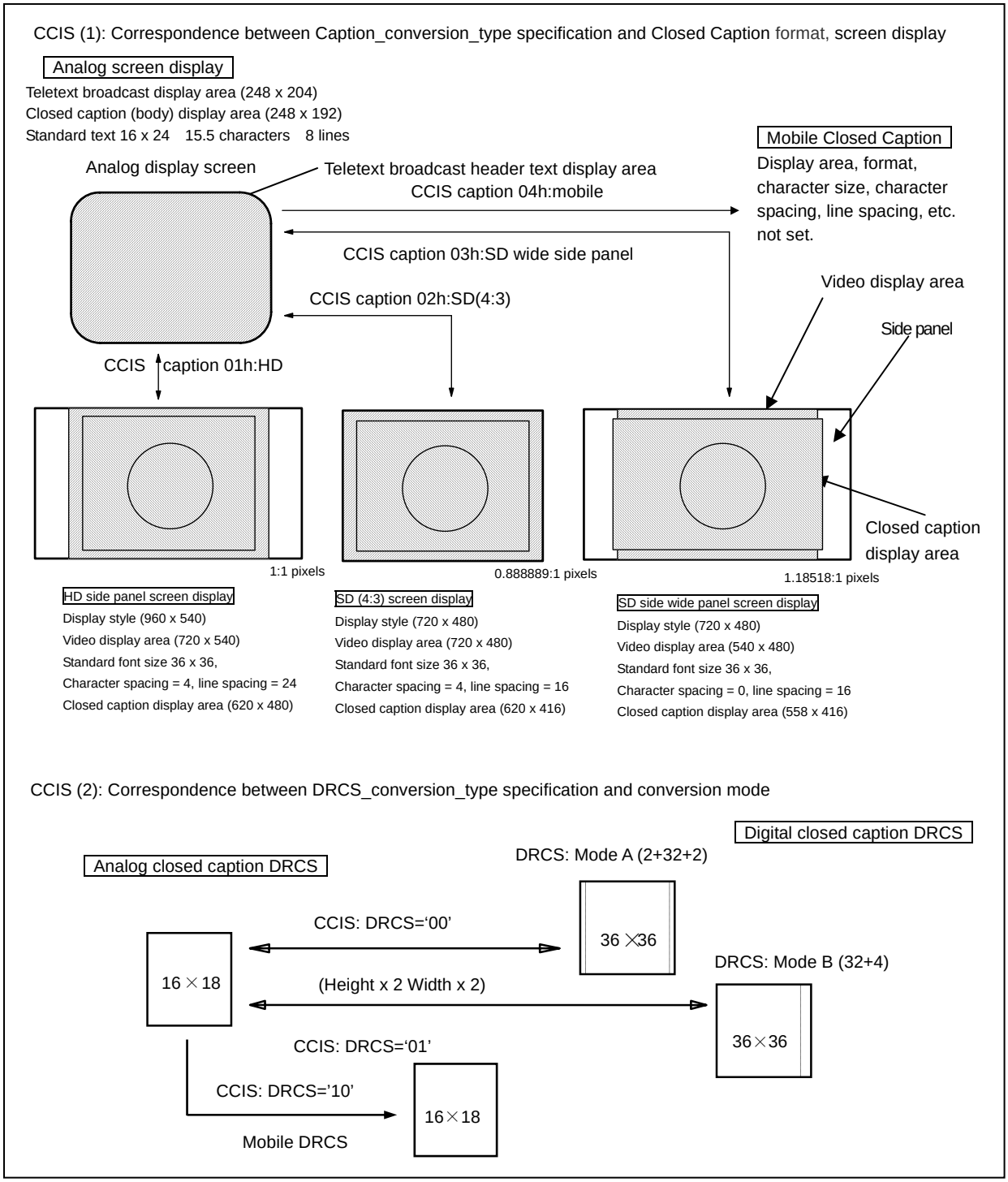


Figure 3-6: Reversible Reciprocal Conversion Model Using CCIS

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Informative Explanation

B1 Invalid Conditions for Closed Caption Packets

Closed caption packets which conform to any of the following are invalid.

(1) Invalid as ancillary data packets

- ADF error
- DID, SDID error
- CS error

Even in cases of CS error, however, the corresponding packet shall be processed as being valid if correction is possible using the error correction parity word and if this ensures the validity of CS .

(2) When correction is not possible using the ECC/Error correction parity word

Since, ECC usage is optional when decoding, and error detection will not be possible on devices which do not use this code, there is more possibility of data loss or character errors.

Note: Determination of continuity using the continuity index (CI);

For closed caption usage, discontinuity of CI between ancillary data packets as a result of skipping, repeating, or freezing in devices which use frame memory like FS, is not to be permitted within a closed caption PES packet.

B2 Separation of Closed Caption Data Packets

When closed caption PES data is being separated into different packets, care must be taken to ensure that the CRC appended to the final 2 bytes in the closed caption data group is not to be allocated to the different packets. (Refer to 2.2.3.6 “Closed Caption Data“ in the Main Part.)

Especially, when the length of the closed caption data which contains the closed caption PES header satisfies Formula 1, the length of this data is to be modified.

$$L = (184 \times n) + 1 \qquad \text{Formula 1}$$

where L is the length of the closed caption data group (including the PES header) and n is a natural number (i.e., 1, 2, 3, etc.). The modification method of the data length is product-dependent.

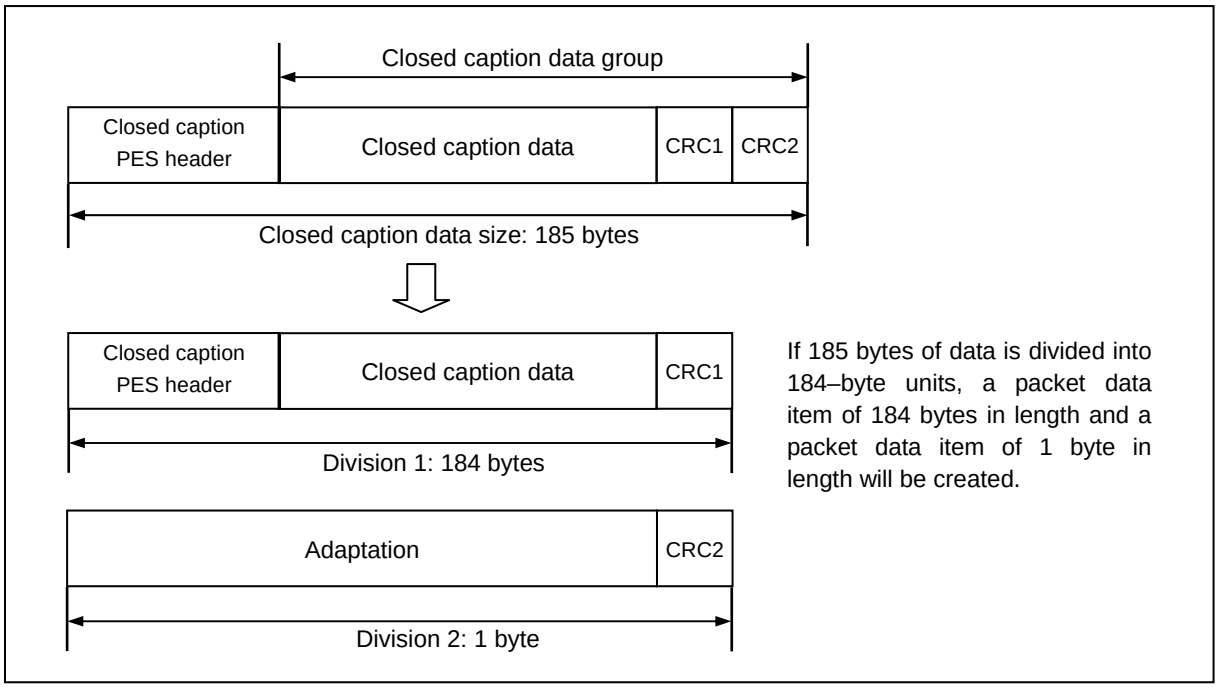

Figure B2-1: Example of CRC Splitting as a Result of Closed Caption Packet Division

The following presents a typical method for the modification of closed caption data length.
In the case of closed caption text data, an NUL control code (empty) may be appended at the end of the text data. In the case of closed caption management data, text data which comprises extended control codes (SWF, SDF, SDP, SSM, SHS, and SVS) may be appended; however, additions of NUL or extended control codes must be carried out in a range which does not affect the closed caption display.

B3 Approach to Closed Caption AD Conversion

B3.1 Style Overview for Analog Specifications

A total of 5 different types of analog style are available based on the type of character used — namely, standard horizontal text, standard vertical text, high-density horizontal text, high-density vertical text, and horizontal writing form. In terms of these style settings, the style of the whole of the closed caption is set by the initial presentation control (IPC) code in the page data header (PACI), and sectional styles are set by the style selection (SWF) code inserted along character codes.
Closed caption AD conversion is only applicable to “standard horizontal text” as the Level A function as it follows analog closed caption operations. The styles relevant to standard horizontal text are illustrated in Table B3-1 and Figure B3-1; furthermore, the character sizes for analog closed caption are illustrated in Figure B3-2.

Table B3-1: Style Specifications for Standard Horizontal Text

	Pixels	Characters (normal)	Characters (medium)	Characters (small)
Height (total area)	204	8.5	8.5	17
Height (display area)	192	8	8	16
Width	248	15.5	31	31

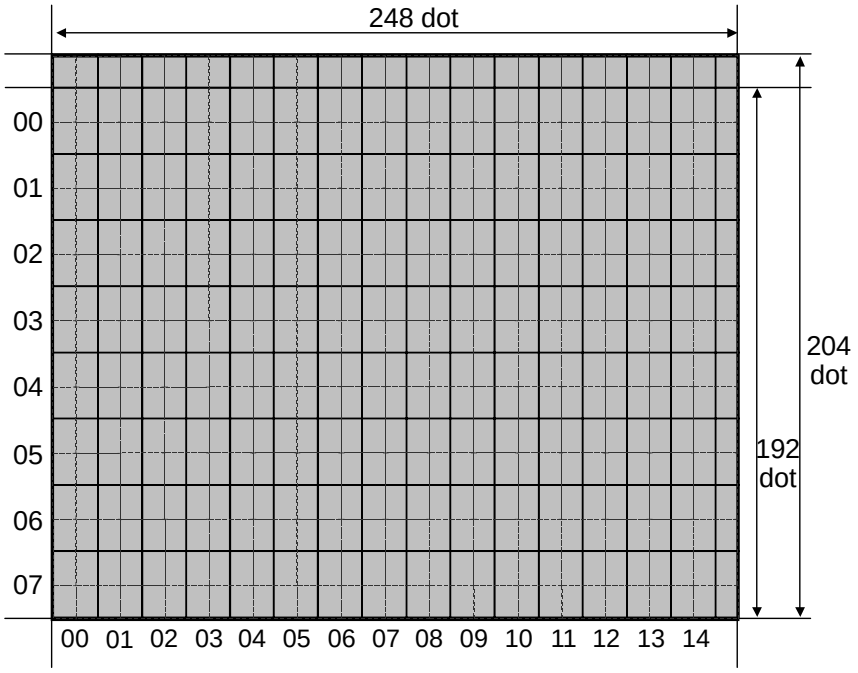

Figure B3-1: Analog Specification — Styles for Standard Horizontal Text

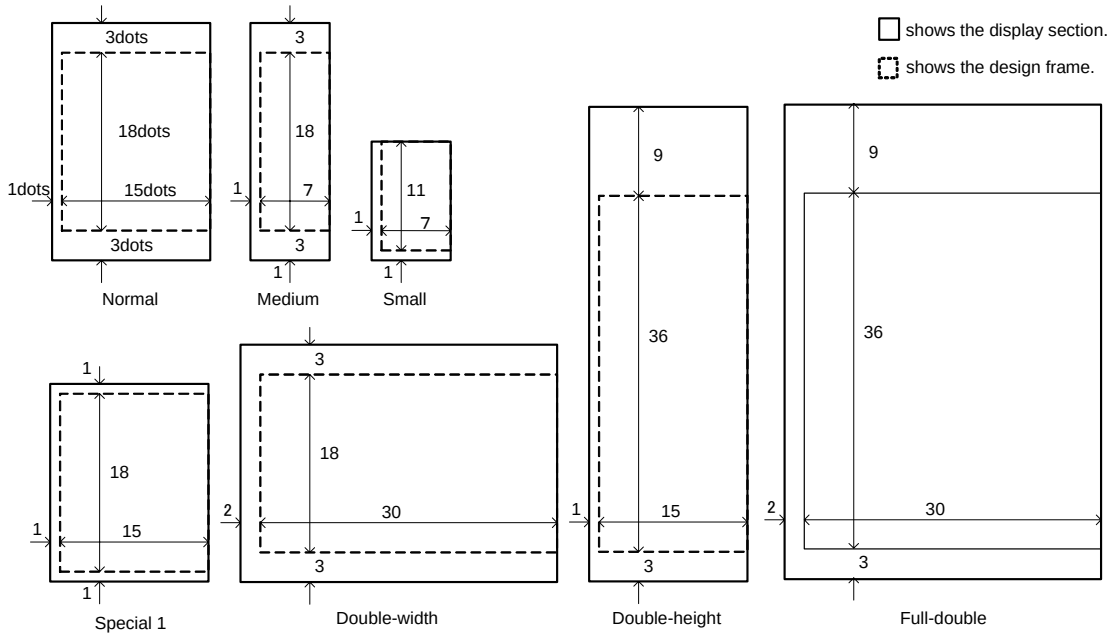

Figure B3-2: Character Sizes for Analog Closed caption

B3.2 Style Differences for Closed Caption AD Conversion

The following differences exist when converting analog closed caption styles to digital closed caption styles as part of closed caption AD conversion.

(1) Display style

Whereas analog closed caption can only use an area of 248 (width) x 204 (height), the closed caption plane for digital closed caption can use either HD mode horizontal text (i.e., 960 (width) x 540 (height)) or SD mode horizontal text (i.e., 720 (width) x 480 (height)) (with the exception of vertical text). It is required to convert each of these styles using the corresponding method.

(2) Character size

Although the design frame for analog closed caption is defined as a unit of font sizes, font spacing, and line spacing, the design frame for digital closed caption is defined in terms of combinations of font sizes, font spacing, and line spacing.

Normal, medium, small, and very-small sizes are defined for analog closed caption; however, only normal, medium, and small are defined for digital closed caption, and there is no very-small size. Accordingly, it is important that closed caption display position settings which use the very-small size are not supported for digital closed caption. Furthermore, the normal size has various types in the case of digital closed caption, and different types can be selected as the font size.

In addition, analog closed caption can make use of the special 1 size which is implemented during the setting of certain patterns. Regarding these character sizes, refer to Figure B3-2 “Character Sizes for Analog Closed Caption”.

(3) Font spacing and line spacing

In analog closed caption, font spacing and line spacing are set in combination with the character as its outside frame; however, these parameters can be set regardless of font size in digital closed caption.

B3.3 Character-Code Differences for Closed Caption AD Conversion

(1) Control code

Certain control codes which are used in the analog closed captions are deleted in the digital closed captions. In cases where it is considered that removing these control codes during closed caption AD conversion may have an effect on the closed caption screen, it is preferable that the intention of the closed caption producer be respected.

Refer to Section B6 “Control Code Conversion Tables“ in this Informative Explanation.

(2) DRCS

DRCS is used as standard external characters, and it can be used with both analog and digital specifications. However, as a result of the difference in width-to-height ratios, DRCS data from analog specifications cannot be used as is with digital specifications. For this reason, font pattern conversions are required, and the conversion algorithm is to be as simple as possible.

Note that when a large character is compounded by some external characters in analog specifications, there is a possibility that the loss of horizontal or vertical lines may occur during the conversion of font patterns to digital; accordingly, it may not be possible to guarantee the outcome of the conversion process.

Refer to Section B7 “Examples of DRCS Conversion” in this Informative Explanation.

(3) DJCS

When DJCS for analog specifications was standardized, it was practical to support only JIS X 0208 Level 1 kanji characters as a result of the price and capacity of the *kanji* font ROM mounted in the receiver. When JIS X 0208 Level 2 *kanji* characters were displayed, it was necessary that Level 2 *kanji* codes were set within the closed caption text data, and that the corresponding character font patterns were transmitted in advance. DJCS is the font pattern data that was transmitted in advance. With digital specifications, it is a precondition that font

patterns for JIS X 0208 Level 2 *kanji* characters be mounted in the receiver, and so there is no need to transmit DJCS data.

(4) Character colors and background colors

For the reason that color assignments for analog closed caption essentially correspond to a portion of the color maps for digital closed caption, color conversions are not required. However, since the “Transparent” assignment as a background color is not supported, the following conversion is required.

- Analog specification: COL 05/15 → Displayed as translucent black.

If this is used as is, the following incorrect color would be rendered.

- Digital specification: COL 05/15 → Displayed as non-transparent gray
  (Color index = 15; R170, G170, B170, α255)

Accordingly, a typical conversion to digital is carried out as follows:

- Digital specification: COL 02/0 04/4 → Palette set to 4 (upper order of color index = 4)
  COL 05/1 → Specification of CMLA = 1
  (lower order of color index = 1)

For more details regarding color indices, refer to ARIB TR-B14 “*Operational Guidelines for Digital terrestrial Television Broadcasting*”.

B3.4 Closed Caption Display Area for Digital Closed caption

Safety zones for digital closed caption are defined below in terms of SD mode and HD mode. (For more details, refer to Informative Explanation A2 from ARIB STD-B36 “*Closed Caption File Conversion Format for Digital Television Broadcasting*“.) Although it is the basics of closed caption AD conversion that conversions into this safety zone are carried out, since displays with large display areas, e.g. PDP (plasma display panels) or LCD, are now available, it is permissible for the closed caption display area to extend beyond the safety zone.

(1) HD mode: SDP (width = 58, height = 29), SDF (width = 844, height = 482)

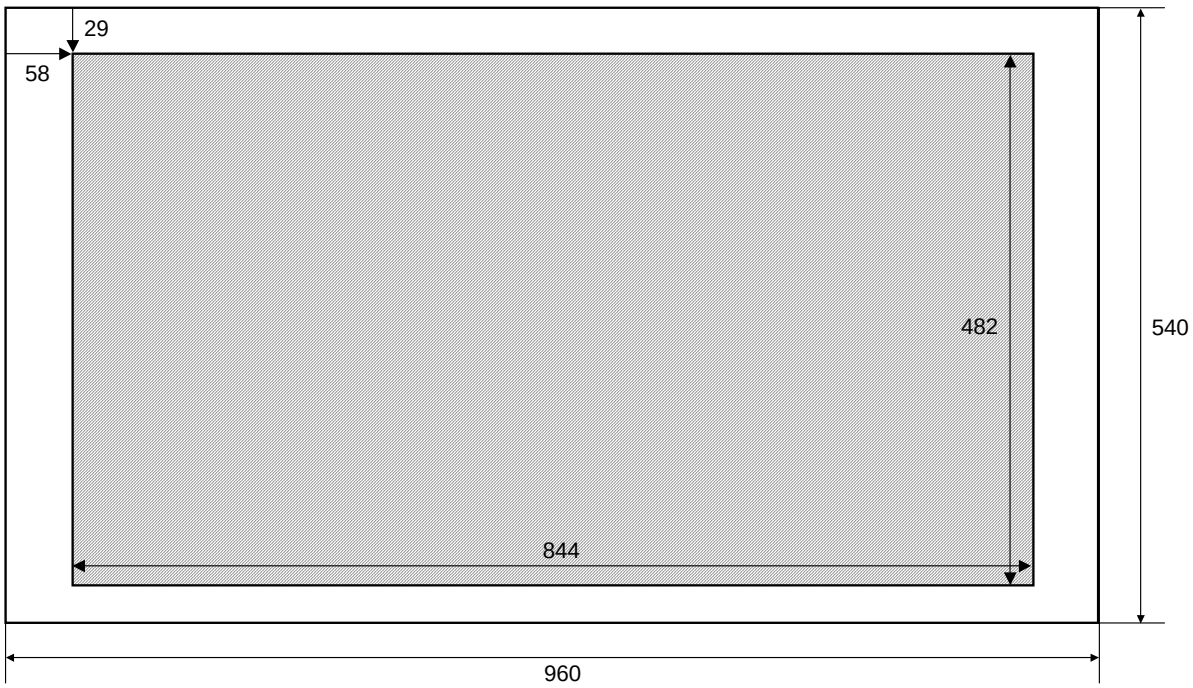

Figure B3-3: Safety Zone for HD Mode

(2) SD mode: SDP (width = 44, height = 26), SDF (width = 632, height = 428)

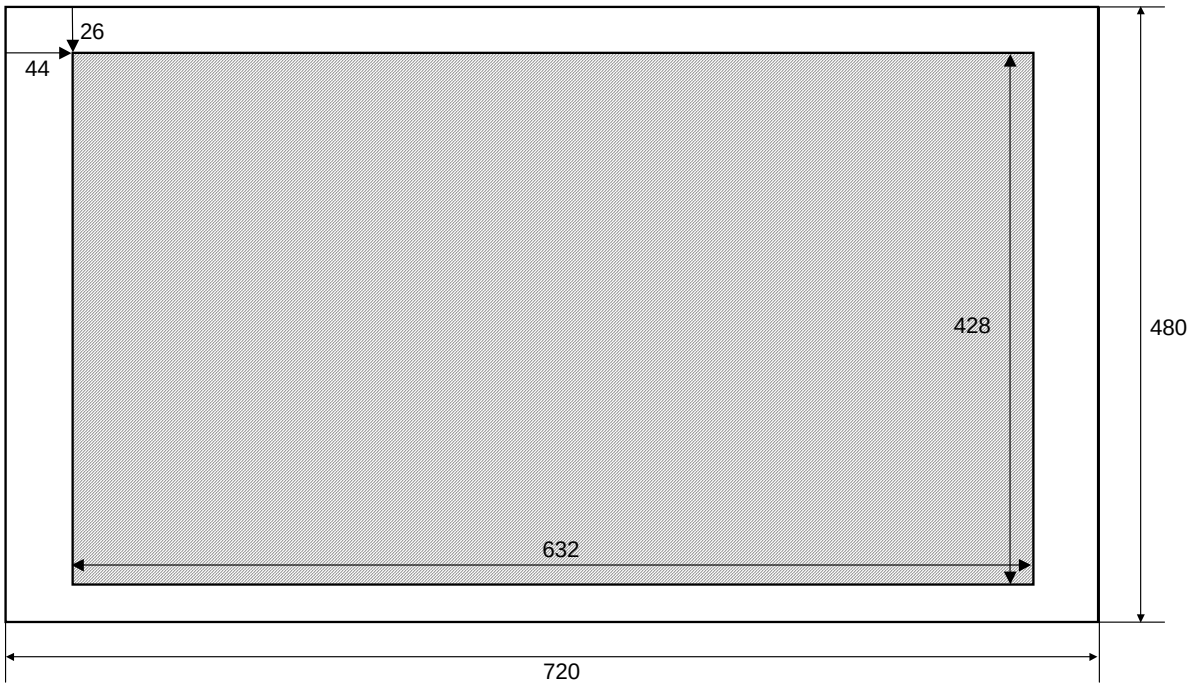

Figure B3-4: Safety Zone for SD Mode

B3.5 Display Positions for Closed Caption AD Conversion

The closed caption display area is defined within the safety zone for closed caption AD conversion, and since the closed caption display area is usually smaller than the safety zone, extra blank areas consequently remain at all four sides. In order to adjust extra blank areas, SDP for closed caption display start position setting and SDF for closed caption display area setting (width, height) can be used for style setting.

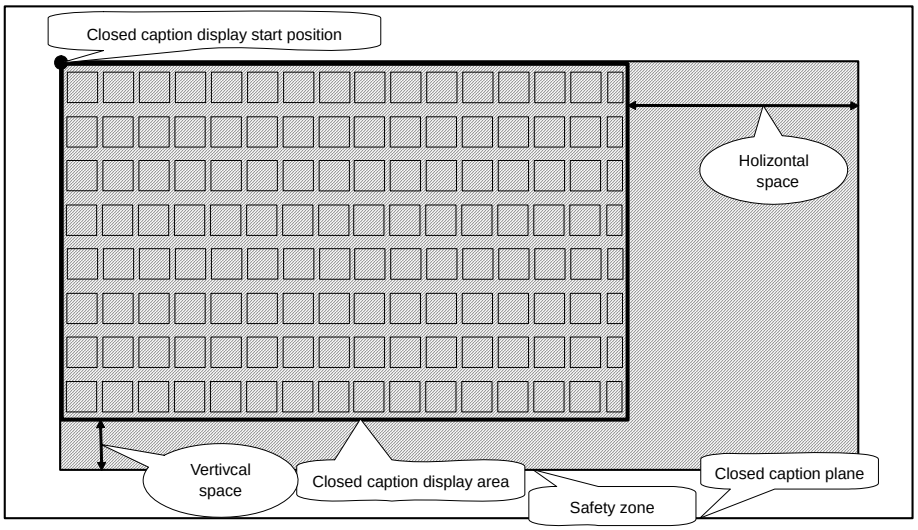

Figure B3-5: Closed Caption Display Area Positioned Top-Left in Safety Zone

The following parameters are set as default values in order to display in the center of the screen; furthermore, positioning in the four directions is possible if the area is within the safety zone.

- Top space = Vertical space / 2
- Bottom space = Vertical space / 2
- Right space = Horizontal space / 2
- Left space = Horizontal space / 2

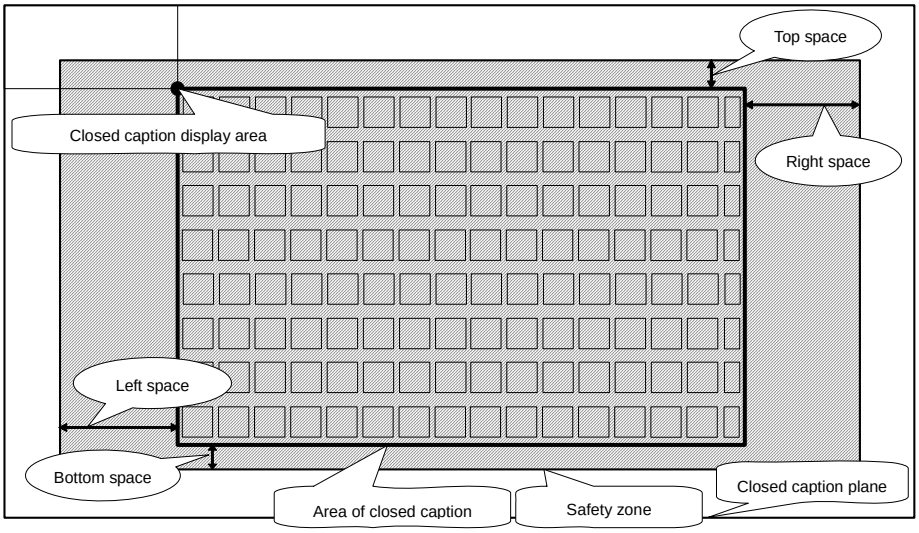

Figure 3-6: Closed Caption Display Area Centered in the Safety Zone

B3.6 Style Conversion for Standard Horizontal Text

As indicated in Section B3.1 “Style Overview for Analog Specifications”, analog specifications (excluding the header text display area) correspond to a style of 15.5 characters (width) x 8 lines (height), and consequently, conversion to digital is carried out in such a way that an equivalent style is established. Validity of parameters relating to font size, font spacing, and line spacing are summarized below. Furthermore, validty (○) or invalidity (×) of the conversions below are also indicated.

A: Position specification for very-small characters

B: DRCS conversion

C: Ruled-line characters, hemming characters, and underlined characters (Referred from ARIB TR-B14 “Operational Guidelines for Digital terrestrial Television Broadcasting”)

(1) Style conversion to HD mode

In Table B3-2 and Table B3-3, it can be seen that the above conditions A through C are satisfied for font spacing of 4 and line spacing of 24, and that the actual display ratio would be at the maximum value; accordingly, this is adopted as a conversion example.

Table B3-2: Horizontal Study

Screen size	Effective size	Font size	Font spacing	Display size	Actual display ratio	A	B	C
960	844	36	0	558	66%	○	○	○
			2	589	70%	×	○	○
			4	620	73%	○	○	○
			6	651	77%	×	○	×

Table B3-3: Vertical Study

Screen size	Effective size	Font size	Font spacing	Display size	Actual display ratio	A	B	C
540	482	36	0	288	60%	○	○	○
			4	320	66%	×	○	×
			8	352	73%	×	○	×
			12	384	80%	○	○	○
			16	416	86%	×	○	×
			20	448	93%	×	○	×
			24	480	99%	○	○	○

(2) Style conversion to SD mode

Table B3-4 indicates the horizontal study; Table B3-5, the vertical study. From these tables, it can be seen that when using the parameters font size 36, font spacing 4, and line spacing 16, the actual display ratio would be at the maximum value; accordingly, this is adopted as a conversion example.

Table B3-4: Horizontal Study

Screen size	Effective size	Font size	Font spacing	Display size	Actual display ratio	A	B	C
720	632	30	0	465	74%	×	×	○
			2	496	78%	○	×	○
			3	512	81%	×	×	○
			4	527	83%	×	×	×
			6	558	88%	○	×	×
		36	0	558	88%	○	○	○
			2	589	93%	×	○	○
			4	620	98%	○	○	○
			6	651	103%	×	○	×

Table B3-5: Vertical Study

Screen size	Effective size	Font size	Font spacing	Display size	Actual display ratio	A	B	C
480	426	30	0	240	56%	○	×	○
			4	272	64%	×	×	×
			7	296	69%	×	×	○
			13	344	81%	×	×	○
			16	368	86%	×	×	×
			20	400	94%	×	×	×
		36	0	288	68%	○	○	○
			4	320	75%	×	○	×
			8	352	83%	×	○	○
			12	384	90%	○	○	×
			16	416	98%	×	○	○
			20	448	105%	×	○	×

B4 Approach to Closed Caption DA Conversion

B4.1 Style Differences for Closed Caption DA Conversion

The following differences exist between styles for digital closed caption and analog closed caption.

(1) Display style

The following closed caption planes are available for digital closed caption.

- 960 (width) x 540 (height) dot horizontal text (HD)
- 720 (width) x 480 (height) dot horizontal text (SD)
- 960 (width) x 540 (height) dot vertical text (HD)
- 720 (width) x 480 (height) dot vertical text (SD)

Although it is possible to set the closed caption display start position and the closed caption display area within these closed caption planes, standard horizontal text in a 248 (width) x 192 (height) dot area (excluding the header text area) is only used for analog closed caption.

(2) Font size

The font size for digital closed caption can be set at 16, 20, 24, 30, or 36 dots (although the same size applies to width and height); however, the character size for analog closed caption is fixed (within the display section) at 16 (width) x 24 (height) dots, and this cannot be modified. Note that these font sizes represent the normal sizes for both digital and analog closed caption, and that characters of medium size, small size, in addition to characters of double-height, double-width, and full-double size can also be used.

(3) Font spacing and line spacing

With digital closed caption, the font spacing and line spacing can be set independently of the font size, and the number of characters and lines which can be displayed are determined together with font size; however, this functionality is not supported by analog closed caption. The area outside the design frame shown in Figure B3-2 “Character Sizes for Analog Closed Caption“ is used as font spacing and line spacing, and as a result of this, the number of characters and lines are fixed and unchangeable at 15.5 characters x 8 lines (for normal size, not including the header text area).

B4.2 Character-Code Differences for Closed Caption DA Conversion

The differences between character codes for digital closed caption and analog closed caption are detailed below.

(1) Control code

With regard to differences in control codes, certain codes and their corresponding functions have been added to digital closed caption from analog specifications, and similarly, certain codes and the corresponding functions have been removed. (Refer to Section B6 “Control Code Conversion Tables” in this Informative Explanation.)

(2) DRCS

Whereas digital closed caption can make use of both 1-byte and 2-byte DRCS, analog closed caption is only capable of using the former. Furthermore, differences in the handling of font sizes, font spacing, and line spacing for digital and analog closed caption result in differences in the dot sizes which comprise pattern data.

(3) DJCS

Regarding JIS X 0208 Level 2 *kanji* characters (*kuten* 4801 to 8406) of the *kanji* character set (2-byte), pattern data are sent in advance in order to enable their display on analog specification receivers which do not retain the corresponding font patterns. Characters from *kuten* 4801 to 8404 do exist in JIS C 6226-1983, where they are defined as DJCS for analog specifications; however, those from *kuten* 8405 to 8406 are not included here (although they are added in JIS X 0208-1990). Accordingly, there is a possibility that these characters may not be correctly displayed on old analog specification receivers.

The following presents a typical DJCS pattern (*kuten* 4817, JIS code 5031h) and the DJCS pattern data.

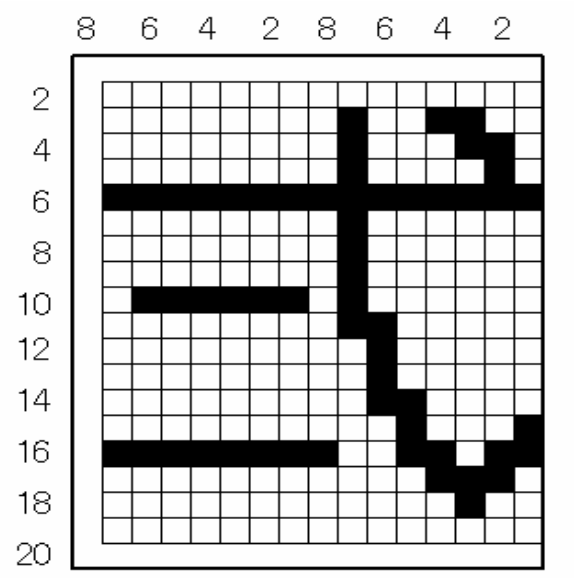

Figure B4-1: Typical DJCS Pattern

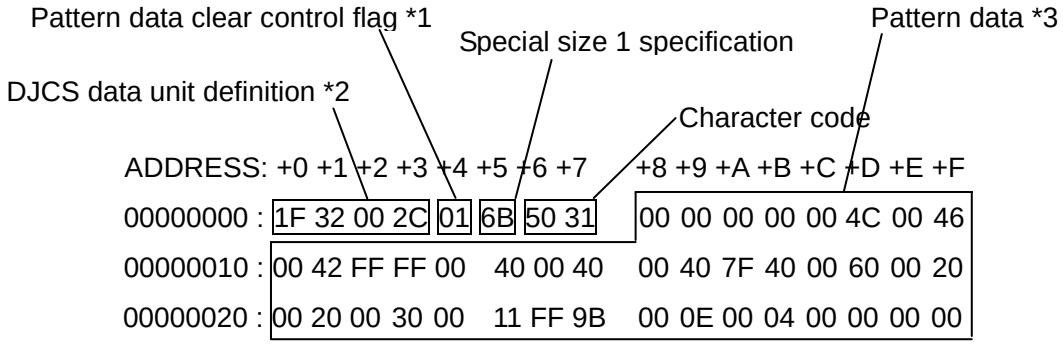

Figure B4-2: Example of DJCS Pattern Data

*1: When b1 (the least significant bit) is “1”, the DJCS and DRCS font patterns are cleared.

*2: For more details, refer to the "*The Technical Handbook on the BTA teletext systems (revised edition)*".

*3: Pattern data for DJCS bit patterns is rendered using principal scanning from left to right, and secondary scanning from top to bottom. Note that the top left corresponds to b8 (the most significant bit).

(4) Additional characters

The following characters from the *kanji* character set do not exist in analog specifications, and if the corresponding data patterns for DRCS are not transmitted, they can not be displayed on analog specification receivers.

- Additional VICS characters

  Kuten 9001 to 9006, 9008 to 9011, 9016, 9017, 9020 to 9040, 9064, and 9065

  Kuten 9101 to 9149

- A part of general additional characters (all but the following are common for analog specifications)

  Kuten 9215 to 9215, 9226 to 9231, 9242 to 9247, and 9255 to 9291

  Kuten 9309 to 9312, 9339 to 9345, 9346, 9347, 9354 to 9363, and 9380 to 9387

  Kuten 9413 to 9416, 9429 to 9432, 9459 to 9464, 9477 to 9480, and 9493

B5 AD/DA Conversion and Inheritance Upon Initialization

In analog closed caption, the screen-initialization-prohibit flag in the page header data (PACI) determines whether to enable or disable the initializing screen at time of updating.

Meanwhile, in the case of digital closed caption, there is no specific control unit to indicate the initialization procedure that is sent ahead of closed caption text data.

Accordingly, it is necessary to indicate initialization at the start of closed caption text data for each page. Without this indication, a previous closed caption page would not be erased and only certain portions of the text would be overwritten.

To resolve this problem, it is required that screen initialization control during conversion is inherited, and that the initialization is applied to AD conversion, and removed for DA conversion.

B5.1 Creation of Screen Initialization Data Units

The display control function of the screen-initialization-prohibit flag in analog closed caption could be inherited to execute a “clear-screen (CS)” control [*1] instruction in advance of closed caption display in digital closed caption. Specifically, this clear-screen (CS) control data must be constructed in such a way that stable operation can be ensured on all types of receiving equipment, and its deletion must be easy during reverse conversion. Accordingly, it is preferable that this data to be a simple as possible and also be an independent data unit.

As a screen initialization data unit, this data is arranged in a way that it will be sent in advance of the closed caption text data unit groups. It is recommended that the screen initialization data unit is comprised of 1Fh 20h 00h 00h 01h 0Ch and the like.

Meanwhile, a NUL data unit is used instead of the screen initialization data unit in situations where screen initialization is to be prohibited. Accordingly, the first unit from the group of text data units can be used to identify the presence of a control unit for screen initialization prohibition, and thus, consistency will be assured for overall structure of data, and structure will be simplified. It is recommended that the NUL data unit is comprised of 1Fh 20h 00h 00h 01h 00h and the like.

Note that format parameters such as code loading, operating positions, and styles are also initialized through screen initialization when using this clear-screen (CS) control. With the exception of cases where initial values such as line spacing, font spacing, and font sizes as defined in ARIB TR-B14 “*Operational Guidelines for Digital terrestrial Television Broadcasting*“ are used for display, it will be necessary to set SVS (Set Vertical Space), SHS (Set Horizontal Space), and SWF (Set Writing Format) at the start of the text data unit after the clear-screen (CS) control has been executed.

*1: Refer to Chapter 8: Initialization from Volume 3 of ARIB STD-B24 “*Data Coding And Transmission Specification For Digital Broadcasting*“, first edition

B5.2 Generation of Screen Initialization Prohibit Flags

It is recommended that the clear-screen (CS) control data, which is positioned at the start of closed caption text data for digital closed caption, be converted into a screen initialization prohibit flag within the page data header (PACI) during conversion to analog closed caption. Furthermore, it is preferable that any unused clear-screen (CS) control data other than page data for screen clearing (i.e., erase packets) be not allowed to remain at the start of the analog closed caption data.

B6 Control Code Conversion Tables

B6.1 Control Code Conversion Tables for Analog/Digital Conversion

Table B6-1 through Table B6-3 illustrate the correspondence of control codes during conversion of analog teletext closed caption data to digital closed caption data.

Table B6-1: C0 Control Code Correspondence

C0 control code	Control function	Analog closed caption usage	Digital closed caption usage	Analog/digital conversion	Conversion process
NUL	Empty	○	○	Possible	No conversion
BEL	Bell	○*	×	Not possible	Discarded
APB	Move operation position backwards	○	○	Possible	No conversion
APF	Move operation position forwards	○	○	Possible	No conversion
APD	Move operation position down	○	○	Possible	No conversion
APU	Move operation position up	○	○	Possible	No conversion
APR	Line return at operation position	○	○	Possible	No conversion
PAPF	Move forwards at specified operation position	○	○	Possible	No conversion
APS	Specify operation position	○	○	Possible	No conversion
CS	Clear screen	○	○	Possible	No conversion
CAN	Cancel	○*	×	Not possible	Discarded
ESC	Escape	○	○	Possible	No conversion
LS1	Locking shift 1	○	○	Possible	No conversion
LS0	Locking shift 0	○	○	Possible	No conversion
SS2	Single shift 2	○	○	Possible	No conversion
SS3	Single shift 3	○	○	Possible	No conversion
RS	Data header identification code	○	×	Not possible	Discarded
US	Data unit identification code	○	○	Possible	No conversion

○: Usage possible ×: Usage not possible ○* = Analog closed caption transmission level B (additional function)

Digital closed caption data is based on ARIB TR-B14 "*Operational Guidelines for Digital terrestrial Television Broadcasting*".

Table B6-2: C1 Control Code Correspondence

C1 control code	Control function	Analog closed caption usage	Digital closed caption usage	Analog/digital conversion	Conversion process
BKF	Specification of black foreground color and lower-order color-map address	○	○	Possible	No conversion
RDF	Specification of red foreground color and lower-order color-map address	○	○	Possible	No conversion
GRF	Specification of green foreground color and lower-order color-map address	○	○	Possible	No conversion
YLF	Specification of yellow foreground color and lower-order color-map address	○	○	Possible	No conversion
BLF	Specification of blue foreground color and lower-order color-map address	○	○	Possible	No conversion
MGF	Specification of magenta foreground color and lower-order color-map address	○	○	Possible	No conversion
CNF	Specification of cyan foreground color and lower-order color-map address	○	○	Possible	No conversion
WHF	Specification of white foreground color and lower-order color-map address	○	○	Possible	No conversion
COL	Color specification	○	△	Possible	COL 04/8 to 04/15 COL 05/0 to 05/14 No conversion COL 05/15: Setting of a semi-bright white background is carried out using the index value for translucent on the broadcasting station's equipment. Usage of front and rear intermediate colors during conversion is to be regulated at the product–planning stage.
POL	Pattern polarity	○	△	Possible	Only POL04 /0(normal polarity) and POL04/1 (reverse polarity 1) are used.
SSZ	Small size	○	○	Possible	No conversion
MSZ	Medium size	○	○	Possible	No conversion

NSZ	Normal size	○	○	Possible	No conversion
SZX	Specified size	○	△	Possible	Only double-height, double-width, and full-double expansion are used. • If N1 is very small (0X60) → Coordinate conversion is carried out. (Note 1) • If N1 is special 1 (0X6B) → The control code and index are substituted for NSZ(0X8A)
FLC	Flashing control	○	△	Possible	No conversion (although inverted is converted to standard)
CDC	Concealed control	○	×	Not possible	Discarded
MCS	Start of reduced coloring	○	None	Not possible	Discarded
MCT	End of reduced coloring	○	None	Not possible	Discarded
WMM	Modification of write mode	○	×	Not possible	Discarded
TIME	Time control	○	△	Possible	Standby only
MACRO	Macro specification	○*	×	Not possible	Only the default macro is used.
RPC	Character repeat	○	△	Possible	No implementation within scroll strings if parameter P1 is “0”.
STL	Start of underline and mosaic separation	○	△	Possible	Only underlines are used.
SPL	End of underline and mosaic separation	○	○	Possible	Only underlines are used.
HLC	Enclosure control	○	△	Possible	Refer to ARIB TR-B14.
CSI	Control sequence introducer	○	○	Possible	
CSI SWF	Control sequence style selection	○	△	Possible	Dependent of closed caption plane
CSI CCC	Control sequence composition control	○*	×	Not possible	Discarded

○: Usage possible ×: Usage not possible Empty: No regulation △: Limited use possible

* = Analog closed caption transmission level B (additional function)

Digital closed caption data is based on ARIB TR-B14 “*Operational Guidelines for Digital terrestrial Television Broadcasting*”.

Note 1: Coordinate conversion is carried out for the digital closed caption coordinate system when specifying very-small size closed caption. Refer to Section 3.1.1.1 “Style Conversion” for details regarding coordinate conversion.

Table B6-3 presents the extended control codes (CSI) which are added for digital closed caption. In this table, a “○” mark is placed in the digital closed caption column for extended control codes which must be generated upon analog/digital conversion; a “△” mark is placed in the digital closed caption column for codes created as a result of product-planning requirements; and a “×” mark is placed in this column for codes which are not used.

Table B6-3: Table of Extended Control Codes (CSI) for Digital Closed caption

Extended control code	Control function	Analog closed caption usage	Digital closed caption usage	Analog/digital conversion
RCS	Raster color control	None	△	
ACPS	Specification of operation position coordinates	None	△	
SDF	Specification of display composition dots	None	○	
SDP	Specification of display position	None	○	
SSM	Specification of character composition dots	None	△	
PLD	Partial line down	None	×	
PLU	Partial line up	None	×	
SHS	Specification of character spacing	None	○	
SVS	Specification of line spacing	None	○	
GSM	Character deformation	None	×	
GAA	Coloring section	None	×	
SRC	Raster specification	None	×	
TCC	Switching control	None	×	
CFS	Character font setting	None	×	
ORN	Specification of character decoration	None	△	Only bordering can be used.
MDF	Lettering specification	None	×	
XCS	Definition of non-standard replacement code string	None	×	
PRA	Play internal sound	None	△	
SCR	Scroll specification	None	△	Only usable for horizontal text.

B6.2 Closed Caption AM Conversion Control Code Conversion Table

Table B6-4 through Table B6-5 illustrate the correspondence of control codes during conversion of analog teletext closed caption data to mobile closed caption data.

Table B6-4: C0 Control Code Conversion Correspondence

C0 control code	Control function	Analog closed caption usage	Mobile closed caption usage	Closed caption AM conversion	Conversion process
NUL	Empty	○	○	Possible	No conversion
BEL	Bell	○*	×	Not possible	Discarded
APB	Move operation position backwards	○	×	Not possible	Discarded
APF	Move operation position forwards	○	×	Not possible	Discarded
APD	Move operation position down	○	×	Not possible	Discarded
APU	Move operation position up	○	×	Not possible	Discarded
APR	Line return at operation position	○	○	Possible	No conversion
PAPF	Move forwards at specified operation position	○	×	Not possible	Discarded
APS	Specify operation position	○	×	Not possible	Discarded
CS	Clear screen	○	○	Possible	No conversion
CAN	Cancel	○*	×	Not possible	Discarded
ESC	Escape	○	×	Not possible	Discarded (but necessary during code conversion)
LS1	Locking shift 1	○	×	Not possible	Discarded (but necessary during code conversion)
LS0	Locking shift 0	○	×	Not possible	Discarded (but necessary during code conversion)
SS2	Single shift 2	○	×	Not possible	Discarded (but necessary during code conversion)
SS3	Single shift 3	○	×	Not possible	Discarded (but necessary during code conversion)
RS	Data header identification code	○	×	Not possible	Discarded
US	Data unit identification code	○	○	Possible	No conversion

○: Usage possible ×: Usage not possible ○*: Analog closed caption transmission level B (additional function)

Other mobile closed caption data are based on the content of the Informative Explanation B8 of this standard.

Table B6-5: C1 Control Code Conversion Correspondence

C1 control code	Control function	Analog closed caption usage	Mobile closed caption usage	Closed caption AM conversion	Conversion process
BKF	Specification of black foreground color and lower-order color-map address	○	○	Possible	No conversion
RDF	Specification of red foreground color and lower-order color-map address	○	○	Possible	No conversion
GRF	Specification of green foreground color and lower-order color-map address	○	○	Possible	No conversion
YLF	Specification of yellow foreground color and lower-order color-map address	○	○	Possible	No conversion
BLF	Specification of blue foreground color and lower-order color-map address	○	○	Possible	No conversion
MGF	Specification of magenta foreground color and lower-order color-map address	○	○	Possible	No conversion
CNF	Specification of cyan foreground color and lower-order color-map address	○	○	Possible	No conversion
WHF	Specification of white foreground color and lower-order color-map address	○	○	Possible	No conversion
COL	Color specification	○	△	Possible	COL 04/8-04/15→No conversion COL 05/0-05/14→Discarded
POL	Pattern polarity	○	△	Possible	Only POL04 /0(normal polarity) and POL04/1 (reverse polarity 1) are used.
SSZ	Small size	○	×	Not possible	Discarded
MSZ	Medium size	○	○	Possible	No conversion
NSZ	Normal size	○	○	Possible	No conversion
SZX	Specified size	○	×	Not possible	Discarded
FLC	Flashing control	○	△	Possible	No conversion (although inverted is converted to normal)
CDC	Concealed control	○	×	Not possible	Discarded
MCS	Start of reduced coloring	○	×	Not possible	Discarded
MCT	End of reduced coloring	○	×	Not possible	Discarded
WMM	Modification of write mode	○	×	Not possible	Discarded
TIME	Time control	○	△	Possible	Standby only
MACRO	Macro specification	○*	×	Not possible	Default macro is used during code conversion.
RPC	Character repeat	○	×	Not possible	Discarded
STL	Start of underline and mosaic separation	○	△	Possible	Only underlines are used.
SPL	End of underline and mosaic separation	○	○	Possible	Only underlines are used.
HLC	Enclosure control	○	△	Possible	Refer to ARIB TR-B14.
CSI	Control sequence introducer	○	×	Not possible	Discarded
CSI SWF	Control sequence style selection	○	×	Not possible	Discarded
CSI CCC	Control sequence composition control	○*	×	Not possible	Discarded

○: Usage possible ×: Usage not possible △: Limited use possible

* = Analog closed caption transmission level B (additional function)

Other mobile closed caption data are based on the content of the Informative Explanation B8 of this standard.

B6.3 Control Code Conversion Table in the Closed Caption DM Conversion

Table B6-6 through Table B6-8 illustrate the correspondence of control codes during conversion of digital closed caption data to mobile closed caption data.

Table B6-6: C0 Control Code Conversion Correspondence

C0 control code	Control function	Digital closed caption usage	Mobile closed caption usage	Closed caption DM conversion	Conversion process
NUL	Empty	○	○	Possible	No conversion
BEL	Bell	×	×	Not possible	
APB	Move operation position backwards	○	×	Not possible	Discarded (but used during text layout conversion)
APF	Move operation position forwards	○	×	Not possible	Discarded (but used during text layout conversion)
APD	Move operation position down	○	×	Not possible	Discarded (but used during text layout conversion)
APU	Move operation position up	○	×	Not possible	Discarded (but used during text layout conversion)
APR	Line return at operation position	○	○	Possible	No conversion
PAPF	Move forwards at specified operation position	○	×	Not possible	Discarded (but used during text layout conversion)
APS	Specify operation position	○	×	Not possible	Discarded (but used during text layout conversion)
CS	Clear screen	○	○	Possible	No conversion
CAN	Cancel	×	×	Not possible	
ESC	Escape	○	×	Not possible	Discarded (but necessary during code conversion)
LS1	Locking shift 1	○	×	Not possible	Discarded (but necessary during code conversion)
LS0	Locking shift 0	○	×	Not possible	Discarded (but necessary during code conversion)
SS2	Single shift 2	○	×	Not possible	Discarded (but necessary during code conversion)
SS3	Single shift 3	○	×	Not possible	Discarded (but necessary during code conversion)
RS	Data header identification code	×	×	Not possible	
US	Data unit identification code	○	○	Possible	No conversion

○: Usage possible ×: Usage not possible

Other mobile closed caption data are based on the content of the Informative Explanation B8 of this standard.

Table B6-7: C1 Control Code Conversion Correspondence

C1 control code	Control function	Digital closed caption usage	Mobile closed caption usage	Closed caption DM conversion	Conversion process
BKF	Specification of black foreground color and lower-order color-map address	○	○	Possible	No conversion
RDF	Specification of red foreground color and lower-order color-map address	○	○	Possible	No conversion
GRF	Specification of green foreground color and lower-order color-map address	○	○	Possible	No conversion
YLF	Specification of yellow foreground color and lower-order color-map address	○	○	Possible	No conversion
BLF	Specification of blue foreground color and lower-order color-map address	○	○	Possible	No conversion
MGF	Specification of magenta foreground color and lower-order color-map address	○	○	Possible	No conversion
CNF	Specification of cyan foreground color and lower-order color-map address	○	○	Possible	No conversion
WHF	Specification of white foreground color and lower-order color-map address	○	○	Possible	No conversion
COL	Color specification	△	△	Possible	COL 04/8-04/15→No conversion Other→Discarded
POL	Pattern polarity	△	△	Possible	Only POL04 /0(normal polarity) and POL04/1 (reverse polarity 1) are used. No conversion
SSZ	Small size	○	×	Not possible	Discarded Conversion to other sizes is product dependent.
MSZ	Medium size	○	○	Possible	No conversion
NSZ	Normal size	○	○	Possible	No conversion
SZX	Specified size	△	×	Not possible	Discarded Conversion to other sizes is product dependent.
FLC	Flashing control	△	△	Possible	No conversion
CDC	Concealed control	×	×	Not possible	
MCS	Start of reduced coloring	None	×	Not possible	
MCT	End of reduced coloring	None	×	Not possible	
WMM	Modification of write mode	×	×	Not possible	
TIME	Time control	△	△	Possible	Standby only
MACRO	Macro specification	×	×	Not possible	Default macro is used during code conversion.
RPC	Character repeat	△	×	Not possible	Discarded
STL	Start of underline and mosaic separation	△	△	Possible	Only underlines are used.

SPL	End of underline and mosaic separation	○	○	Possible	Only underlines are used.
HLC	Enclosure control	△	△	Possible	Refer to ARIB TR-B14.
CSI	Control sequence introducer	○	×	Not possible	Discarded
CSI SWF	Control sequence style selection	△	×	Not possible	Discarded
CSI CCC	Control sequence composition control	×	×	Not possible	Discarded

○: Usage possible ×: Usage not possible △: Limited use possible

Other mobile closed caption data are based on the content of the Informative Explanation B8 of this standard.

Table B6-8 presents the extended control codes (CSI) which are added for mobile closed captions. In this table, a "○" mark is placed in the column for extended control codes which must be generated upon digital/mobile conversion; a "△" mark is placed in the column for codes created as a result of product-planning requirements; and an "×" mark is placed in the column for codes which are not used.

Table B6-8: Table of Extended Control Codes (CSI) for Mobile Closed Captions

Extended control code	Control function	Digital closed caption	Mobile closed caption	Conversion process
RCS	Raster color control	△	×	Discarded
ACPS	Specification of operation position coordinates	△	×	Discarded (but used during text layout conversion)
SDF	Specification of display composition dots	○	×	Discarded
SDP	Specification of display position	○	×	Discarded
SSM	Specification of character composition dots	△	×	Discarded
PLD	Partial line down	×	×	
PLU	Partial line up	×	×	
SHS	Specification of character spacing	○	×	Discarded
SVS	Specification of line spacing	○	×	Discarded
GSM	Character deformation	×	×	
GAA	Coloring section	×	×	
SRC	Raster specification	×	×	
TCC	Switching control	×	×	
CFS	Character font setting	×	×	
ORN	Specification of character decoration	△	×	Discarded
MDF	Lettering specification	×	×	
XCS	Definition of non-standard replacement code string	×	×	
PRA	Play internal sound	△	×	Discarded
SCR	Scroll specification	△	×	Discarded

B7 Examples of DRCS Conversion

B7.1 Typical DRCS Conversion (AD)

This section will discuss a sample of conversion where DRCS (Dynamically Redefinable Character Set) patterns for analog closed caption are converted to DRCS pattern data for digital closed caption. Mode A, Mode B, and others are available for conversion, and the DRCS conversion type from the CCIS is used to identify the actual mode.

B7.1.1 Mode-A DRCS Conversion

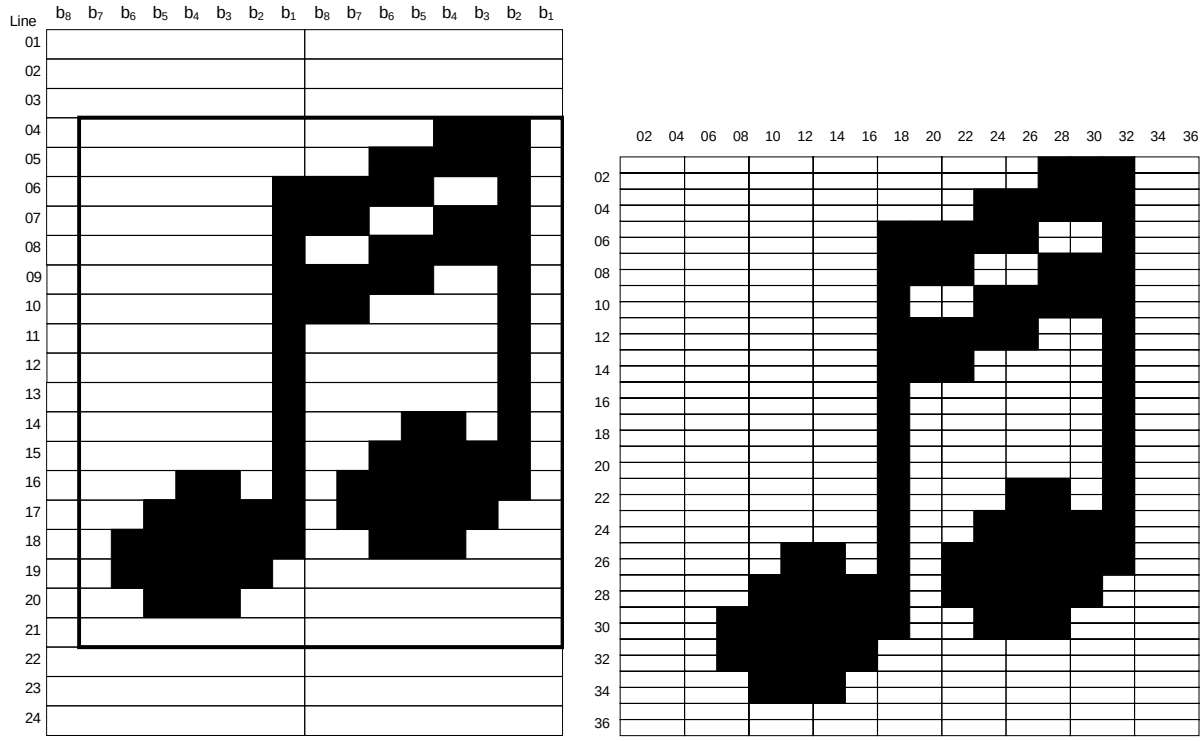

Figure B7-1: Typical Analog ⇔ Digital Conversion of DRCS Pattern Data (Mode A)

An example of the conversion of analog DRCS pattern data to digital DRCS pattern data is illustrated in Figure B7-1.

In Mode A, the design frame (i.e., 15 (width) x 18 (height) dots inside the heavy lines of Figure B7-1, left) from the pattern data in 16 (width) x 24 (height) dots of analog DRCS in the standard horizontal format (Figure B7-1, left) is clipped out as a 16 (width) x 18 (height) area by extending one dot to the left , and then the clipped data is doubled both vertically and horizontally and is converted to a 36 x 36-dot font (Figure B7-1, right). Regarding the 4-dot insufficiency in the horizontal direction, 2 dots each is equally allocated to the left and right.

Furthermore, since individual dots from pattern data for digital DRCS are represented in 4 grayscale levels (i.e., 2 bits), bit 0 from the analog DRCS pattern data (i.e., background color) is converted to “00”, and bit 1 (i.e., foreground color) is converted to “11” (i.e., maximum foreground value). The following presents values for both types of pattern data.

Table B7-1: Pattern Data (Hexadecimal) for Analog DRCS from Figure B7-1

00	00	00	00	00	00	00	0E	00	3E	01	F2	01	CE	01	3E
01	F2	01	C2	01	02	01	02	01	02	01	1A	01	3E	0D	7E
1F	7C	3F	38	3E	00	1C	00	00	00	00	00	00	00	00	00

Table B7-2: Pattern Data (Hexadecimal) for Digital DRCS from Figure B7-2

00	00	00	00	00	00	0F	FF	00	00	00	00	00	00	00	0F
FF	00	00	00	00	00	00	0F	FF	FF	00	00	00	00	00	00
0F	FF	FF	00	00	00	00	00	FF	FF	F0	0F	00	00	00	00
00	FF	FF	F0	0F	00	00	00	00	00	FF	F0	0F	FF	00	00
00	00	00	FF	F0	0F	FF	00	00	00	00	00	F0	0F	FF	FF
00	00	00	00	00	F0	0F	FF	FF	00	00	00	00	00	FF	FF
F0	0F	00	00	00	00	00	FF	FF	F0	0F	00	00	00	00	00
FF	F0	00	0F	00	00	00	00	00	FF	F0	00	0F	00	00	00
00	00	F0	00	00	0F	00	00	00	00	00	F0	00	00	0F	00
00	00	00	00	F0	00	00	0F	00	00	00	00	00	F0	00	00
0F	00	00	00	00	00	F0	00	00	0F	00	00	00	00	00	F0
00	00	0F	00	00	00	00	00	F0	00	FF	0F	00	00	00	00
00	F0	00	FF	0F	00	00	00	00	00	F0	0F	FF	FF	00	00
00	00	00	F0	0F	FF	FF	00	00	00	0F	F0	F0	FF	FF	FF
F0	00	00	0F	F0	F0	FF	FF	FF	F0	00	00	FF	FF	F0	FF
FF	F0	00	00	00	FF	FF	F0	FF	FF	F0	00	00	0F	FF	FF
F0	0F	FF	00	00	00	0F	FF	FF	F0	0F	FF	00	00	00	0F
FF	FF	00	00	00	00	00	00	0F	FF	FF	00	00	00	00	00
00	00	FF	F0	00	00	00	00	00	00	00	FF	F0	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00												

Digital DRCS pattern data which has been converted from analog DRCS pattern data in this way will be reverse-converted without trouble by removing 2 dots from both the left and right, converting 4 bits of “1” (F) to 1 bit of “1”, 4 bits of “0” to 1 bit of “0”, and appending 6 bytes of “0” to the top and bottom.

B7.1.2 Mode-B DRCS Conversion

An example of the conversion of analog DRCS pattern data to digital DRCS pattern data using Mode B is illustrated in Figure B7-2.

In Mode B (in the same way as in Mode A), the design frame (i.e., 15 (width) x 18 (height) dots inside the heavy lines of Figure B7-2, left) from the pattern data in 16 (width) x 24 (height) dots of analog DRCS in the standard horizontal format) (Figure B7-2, left) is clipped out as a 16 (width) x 18 (height) area by extending one dot to the left, and then the clipped data is doubled both vertically and horizontally and is converted to a 36 x 36-dot font (Figure B7-2, right). In this mode, however, the 4-dot insufficiency in the horizontal direction is allocated to the right side.

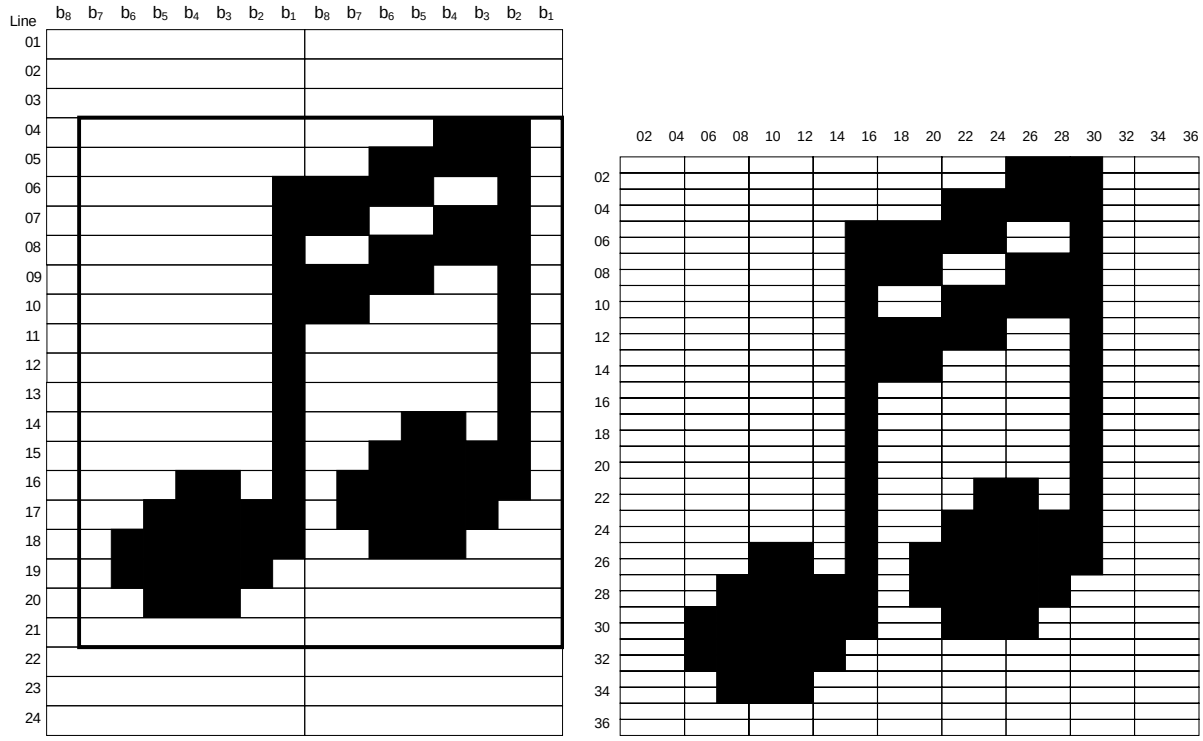

Figure B7-2: Typical Analog ⇔ Digital Conversion of DRCS Pattern Data (Mode B)

The following present values for digital DRCS pattern data converted using Mode B.

Table B7-3: Pattern Data (Hexadecimal) for Digital DRCS from Figure B7-2

00	00	00	00	00	00	FF	F0	00	00	00	00	00	00	00	FF
F0	00	00	00	00	00	00	FF	FF	F0	00	00	00	00	00	00
FF	FF	F0	00	00	00	00	0F	FF	FF	00	F0	00	00	00	00
0F	FF	FF	00	F0	00	00	00	00	0F	FF	00	FF	F0	00	00
00	00	0F	FF	00	FF	F0	00	00	00	00	0F	00	FF	FF	F0
00	00	00	00	0F	00	FF	FF	F0	00	00	00	00	0F	FF	FF
00	F0	00	00	00	00	0F	FF	FF	00	F0	00	00	00	00	0F
FF	00	00	F0	00	00	00	00	0F	FF	00	00	F0	00	00	00
00	0F	00	00	00	F0	00	00	00	00	0F	00	00	00	F0	00
00	00	00	0F	00	00	00	F0	00	00	00	00	0F	00	00	00
F0	00	00	00	00	0F	00	00	00	F0	00	00	00	00	0F	00
00	00	F0	00	00	00	00	0F	00	0F	F0	F0	00	00	00	00
0F	00	0F	F0	F0	00	00	00	00	0F	00	FF	FF	F0	00	00
00	00	0F	00	FF	FF	F0	00	00	00	FF	0F	0F	FF	FF	F0
00	00	00	FF	0F	0F	FF	FF	F0	00	00	0F	FF	FF	0F	FF
FF	00	00	00	0F	FF	FF	0F	FF	FF	00	00	00	FF	FF	FF
00	FF	F0	00	00	00	FF	FF	FF	00	FF	F0	00	00	00	FF
FF	F0	00	00	00	00	00	00	FF	FF	F0	00	00	00	00	00
00	0F	FF	00	00	00	00	00	00	00	0F	FF	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00												

B7.1.3 Other Conversion Methods

In situations where the original pattern for the analog DRCS extends beyond the design frame in the vertical direction, the above-mentioned method will result in the loss of dot information at the top and bottom. Accordingly, it is preferable that the analog DRCS patterns being used during periods of simultaneous broadcasting be restricted to within the design frame. The conversion methods for this type of analog DRCS pattern data to digital DRCS pattern data are product-dependent.

Furthermore, methods which differ from that described above, such as one in which the analog DRCS pattern data within the design frame only is converted into digital DRCS pattern data are also conceivable. An example is to expand the horizontal 15 dots in the design frame of the analog DRCS pattern data by 12/5 times to 36 dots (Figure B7-3). Nevertheless, when adopting such methods, factors relevant to methods — including methods for reverse conversion — are product-dependent.

In cases where this type of conversion method is used, the DRCS conversion type in the CCIS flag is to be specified as being “DRCS conversion not possible”.

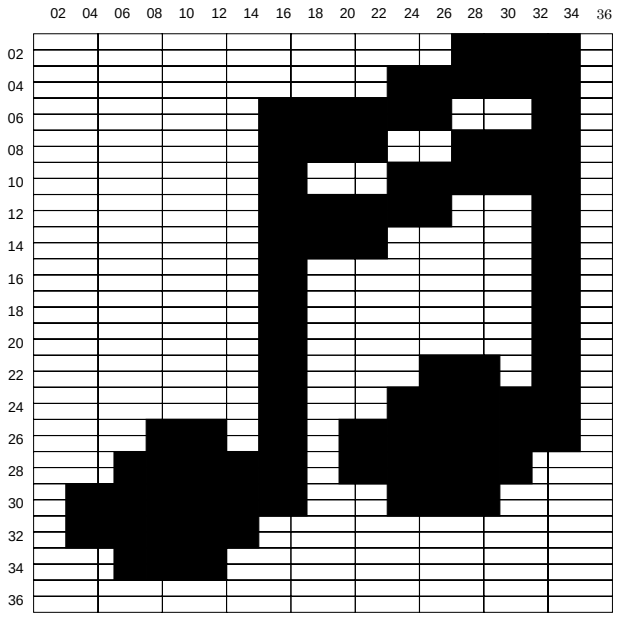

Figure B7-3: Example of Analog → Digital Conversion of DRCS Pattern Data (DRCS conversion not possible)

B7.2 DRCS Conversion Example (DA Conversion)

In cases where the digital DRCS pattern data is as described in the AD conversion examples from B7.1.1 and B7.1.2 above (i.e., Mode A or Mode B), trouble-free conversion to analog DRCS pattern data will be possible. It is preferable, therefore, that these types of digital DRCS pattern data be created during periods of simultaneous broadcasting.

Any other conversion method from digital DRCS pattern data to analog DRCS pattern data, such as that shown in Figure B7-4, are product-dependent.

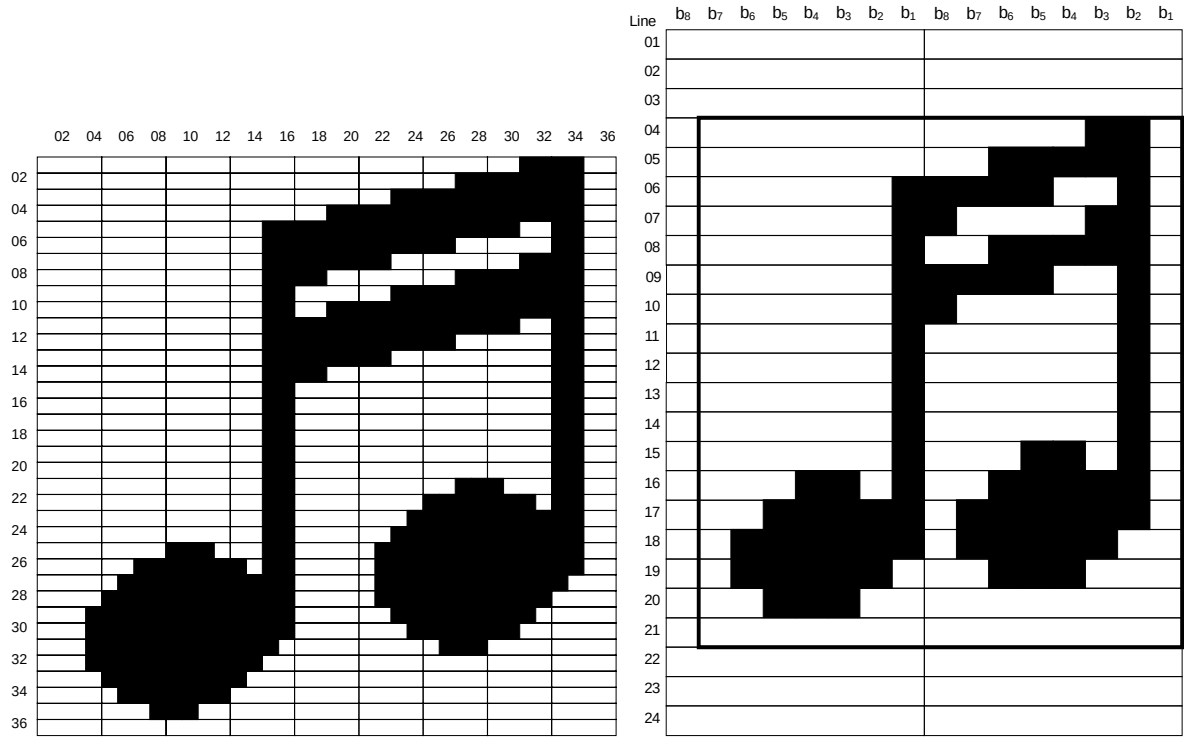

Figure B7-4: Example of Digital → Analog Conversion of DRCS Pattern Data

B7.3 Conversion Example of Analog Closed Caption to Digital Closed Caption

The following section presents a conversion example of analog closed caption data to the corresponding digital closed caption data (HD mode).

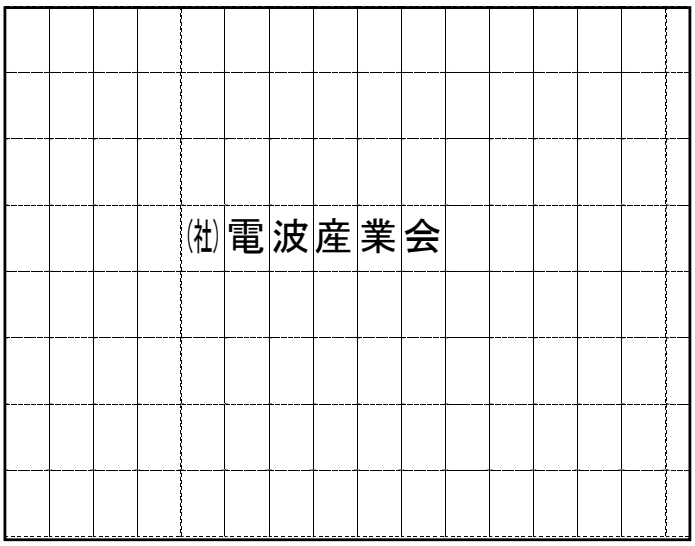

Figure B7-5: Display Example of Analog Closed caption

Analog closed caption as shown in Figure B7-5 are comprised of DRCS pattern data and text data as described below.

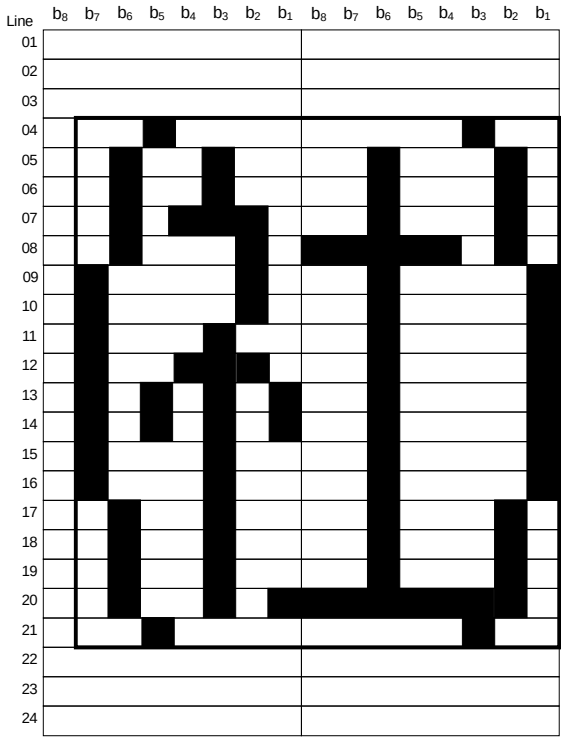

Figure B7-6 Example of Analog DRCS Pattern Data

Table B7-4 Encoding Example of DRCS Pattern Data for Analog Closed caption

1F	30	00	34	01	73	41	21	00	00	00	00	00	00	10	04
DI	DRCS	DL=52		Mode	Standard horizontal format	The 1st extra character code		DRCS pattern data: 48 bytes							
24	22	24	22	2E	22	22	FA	42	21	42	21	44	21	4E	21
DRCS pattern data (continued)															
55	21	55	21	44	21	44	21	24	22	24	22	24	22	25	FE
DRCS pattern data (continued)															
10	04	00	00	00	00	00	00								
DRCS pattern data (continued)															

Table B7-5 Encoding Example of Text Data for Analog Closed caption

1F	20	00	14	1C	43	44	8A	80	1B	2A	20	41	A1	45	45
DI	Body	DL=20		APS	3 line feeds	Forward 4 characters	NSZ	BKF	1-byte DRCS read					Character 1 of 5	
47	48	3B	3A	36	48	32	71								
Character 2 of 5		Character 3 of 5		Character 4 of 5		Character 5 of 5									

Note: For more details regarding DI, DL, APS, and the like from Table B7-4 through Table B7-7, refer to "*The Technical Handbook on the BTA Teletext Systems (revised edition)*".

The following illustrates the conversion example of DRCS pattern data and text data, as described above, to digital closed caption data.

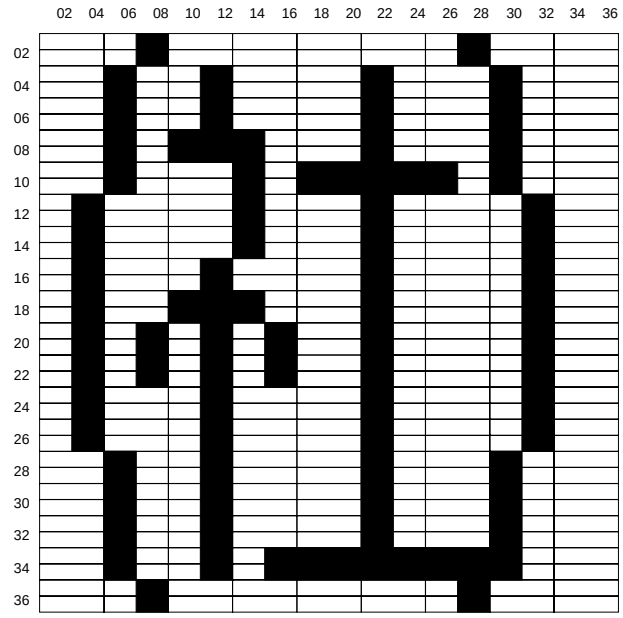

Figure B7-7: Example of Digital DRCS Pattern Data Converted from Analog (Mode B)

Table B7-6: Encoding Example of Digital DRCS Pattern Data Converted from Analog

data_unit()

1F	30	00 01 4C
unit_separator	Data_unit_parameter(1-byte DRCS)	data_unit_size= number of characters x 324+8=332

data_unit_data_byte()=Drcs_data_structure()

01	41	21	01	01	02	24	24
NumberOfCode=1	CharacterCode		NumberOfFont=1	fontId/mode=0/1	depth=2	width=36	height=36

patternData: 324 bytes of digital DRCS pattern data

00	0F	00	00	00	00	0F	00	00	00	0F	00	00	00	00	0F
00	00	00	F0	0F	00	00	F0	00	F0	00	00	F0	0F	00	00
F0	00	F0	00	00	F0	0F	00	00	F0	00	F0	00	00	F0	0F
00	00	F0	00	F0	00	00	F0	FF	F0	00	F0	00	F0	00	00
F0	FF	F0	00	F0	00	F0	00	00	F0	00	F0	FF	FF	F0	F0
00	00	F0	00	F0	FF	FF	F0	F0	00	0F	00	00	F0	00	F0
00	0F	00	0F	00	00	F0	00	F0	00	0F	00	0F	00	00	F0
00	F0	00	0F	00	0F	00	00	F0	00	F0	00	0F	00	0F	00
0F	00	00	F0	00	0F	00	0F	00	0F	00	00	F0	00	0F	00
0F	00	FF	F0	00	F0	00	0F	00	0F	00	FF	F0	00	F0	00
0F	00	0F	0F	0F	0F	00	F0	00	0F	00	0F	0F	0F	0F	00
F0	00	0F	00	0F	0F	0F	0F	00	F0	00	0F	00	0F	0F	0F
0F	00	F0	00	0F	00	0F	00	0F	00	00	F0	00	0F	00	0F
00	0F	00	00	F0	00	0F	00	0F	00	0F	00	00	F0	00	0F
00	0F	00	0F	00	00	F0	00	0F	00	00	F0	0F	00	00	F0
00	F0	00	00	F0	0F	00	00	F0	00	F0	00	00	F0	0F	00
00	F0	00	F0	00	00	F0	0F	00	00	F0	00	F0	00	00	F0
0F	00	00	F0	00	F0	00	00	F0	0F	00	00	F0	00	F0	00
00	F0	0F	0F	FF	FF	FF	F0	00	00	F0	0F	0F	FF	FF	FF
F0	00	00	0F	00	00	00	00	0F	00	00	00	0F	00	00	00
00	0F	00	00												

Table B7-7: Encoding Example of Digital Closed Caption Text Data Converted from Analog

data_unit()

1F	20	00 00 38
unit_separator	data_unit_parameter (body)	data_unit_size=56

data_unit_data_byte()

9B	36 32 30			3B	34 38 30			20	56	9B	31 37 30			3B	33 30			20	5F	9B	34	20	58	9B	32 34			20	59
CSI	Closed caption display area, width: 620 dots			I1	Closed caption display area, height: 480 lines			I2	SDF	CSI	Initial horizontal position: 170th dot			I1	Initial vertical position30th line			I2	SDP	CSI	Character spacing: 4	I1	SHS	CSI	Line spacing: 24			I1	SVS

9B	33 36			3B	33 36			20	57	1C	43	44			8A	80													
CSI	Font width: 36 dots			I1	Font height: 36 dots			I2	SSM	APS	3 line feeds	Forward 4 characters			NSZ	BKF													

1B 2A 20 41 A1	45 45	47 48	3B 3A	36 48	32 71
1-byte DRCS read	Character 1 of 5	Character 2 of 5	Character 3 of 5	Character 4 of 5	Character 5 of 5

Figure B7-8 shows converted digital closed caption data.

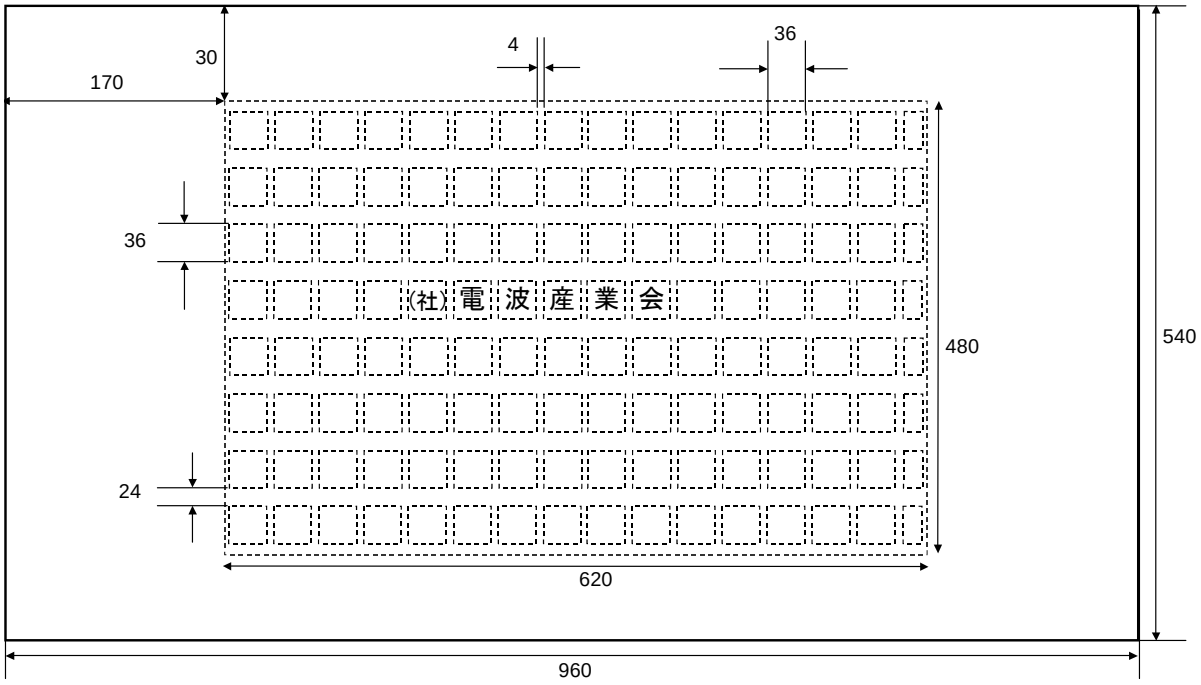

Figure B7-8: Display Example of Digital Closed Caption Data Converted from Analog

B7.4 DRCS Conversion Example (AM Conversion)

This section describes an example of the conversion of analog closed caption DRCS pattern data to mobile closed caption DRCS pattern data. When converting to mobile closed caption DRCS pattern data, the design frame of the analog closed caption DRCS pattern data (standard horizontal format, 15 width x 18 height) is extended by one pixel to the left and becomes the logical pixel structure of the mobile closed caption DRCS pattern data (16-width x 18-height). The transmission mode is “2 grayscale levels, without compression”.

As mobile closed caption DRCS pattern data is the clipping of the analog closed caption DRCS pattern data, pattern data conversion is not necessary. However, header data must be added in order to encode the data into a data unit. Figure B7-9 shows the conversion of the analog pattern data found in Figure B7-6 into mobile closed caption DRCS pattern.

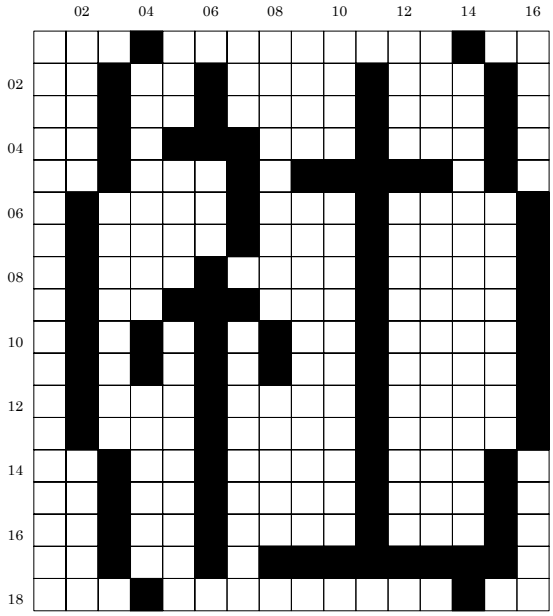

Figure B7-9 Analog → Mobile DRCS Pattern Data Conversion Example

Table B7-8 is an example of mobile closed caption DRCS pattern data codes that is converted from the analog closed caption DRCS pattern data codes of Table B7-4.

Table B7-8: Encoding Example of Mobile Closed Caption DRCS Pattern Data

data_unit()

1F	30	00	00	2C
unit_separator	Data_unit_parameter(1 byte DRCS)	data_unit_size=characters 36+8=44		×

data_unit_data_byte()=Drcs_data_structure()

01	41	21	01	00	00	10	12
NumberOfCode=1	CharacterCode		NumberOfFont=1	fontId/mode=0/0	depth=0	width=16	height=18

patternData mobile DRCS pattern data 36 bytes

10	04	24	22	24	22	2E	22	22	FA	42	21	42	21	44	21
4E	21	55	21	55	21	44	21	44	21	24	22	24	22	24	22
25	FE	10	04												

B7.5 DRCS Conversion Example (DM Conversion)

This section describes a conversion example from the digital closed caption DRCS pattern data to mobile closed caption DRCS pattern data. As explained in B7.4, mobile closed caption DRCS pattern data is data that has been clipped from analog closed caption DRCS pattern data, and the pattern data conversion method is the same method as shown in the example for DA conversion. Therefore, it is preferable that the source digital closed caption DRCS is one that can be easily converted to analog. As the numbers of pixels and grayscales used in digital closed caption DRCS pattern data differ from those of mobile closed caption DRCS pattern data, data other than pattern data must also be converted when encoding the data into a data unit. Table B7-8 also shows the digital closed caption DRCS pattern data of Table B7-6 converted to a mobile closed caption DRCS pattern.

B8 About Mobile Closed Captions

B8.1 Mobile Closed Caption Display Area

The display area of mobile closed captions is basically product-dependent.

B8.2 Mobile Closed Caption Transfer Rate Calculation Example

The data rates for the mobile broadcasting are low compared with HD/SD broadcasting, hence, the data rates for the mobile closed caption data are required to be lower than HD/SD closed caption data.

The transferred data for one DRCS character are 36 bytes in the standard horizontal format (16 width x 18height). The transferred data are 36x1+13(*1)=49 bytes when a DRCS character is transferred in a unit.

So, when transferring a DRCS character, it can be contained within a TS packet (184 bytes).

If the transmission interval are approx. two seconds, the transferred data are 49+184=233 bytes (2 TS packets) per two seconds based on the above calculation, hence the below closed caption transfer rate is attained.

2x204x8/2=1632bps

Generally, when approx. 4 DRCS characters are transferred, the transfer rate will be higher than the above value.

(*1) The information added to the head of the DRCS data unit.

STRUCTURE AND OPERATION OF CLOSED CAPTION DATA
CONVEYED BY ANCILLARY DATA PACKETS

ARIB STANDARD

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