

ANSI/CEA Standard

Line 21 Data Services

ANSI/CEA-608-E

April 2008



CEA
Consumer Electronics Association

www.CE.org

NOTICE

Consumer Electronics Association (CEA®) Standards, Bulletins and other technical publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards, Bulletins and other technical publications shall not in any respect preclude any member or nonmember of CEA from manufacturing or selling products not conforming to such Standards, Bulletins or other technical publications, nor shall the existence of such Standards, Bulletins and other technical publications preclude their voluntary use by those other than CEA members, whether the standard is to be used either domestically or internationally.

Standards, Bulletins and other technical publications are adopted by CEA in accordance with the American National Standards Institute (ANSI) patent policy. By such action, CEA does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Standard, Bulletin or other technical publication.

Note: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

This CEA Standard is considered to have International Standardization implication, but the International Electrotechnical Commission activity has not progressed to the point where a valid comparison between the CEA Standard and the IEC document can be made.

This Standard does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

This document is copyrighted by the Consumer Electronics Association (CEA®) and may not be reproduced, in whole or part, without written permission. Federal copyright law prohibits unauthorized reproduction of this document by any means. Organizations may obtain permission to reproduce a limited number of copies by entering into a license agreement. Requests to reproduce text, data, charts, figures or other material should be made to CEA.

(Formulated under the cognizance of the CEA **R4.3 TV Data Systems Subcommittee.**)

Published by

©CONSUMER ELECTRONICS ASSOCIATION 2011

Technology & Standards Department

www.CE.org

All rights reserved

This is a preview of "CEA 608-E-2008 (ANSI...)". [Click here to purchase the full version from the ANSI store.](#)

FOREWORD

This standard was developed under the auspices of the Consumer Electronics Association (CEA) Technology & Standards R4.3 Television Data Systems Subcommittee.

eXtended Data Services (XDS) are additional services provided in Line 21 Field 2 data. New services may have been standardized by CEA since the publication of this standard. No attempt is made to list XDS Private Data Services, although it is requested that users of such services notify CEA of Private Data packet assignments. XDS services, whether Private Data or not, may not be meant for transmission to the television receiver.

CEA-608-E supersedes CEA-608-D.

(This page intentionally left blank.)

CONTENTS

1 Purpose and Scope	1
1.1 Purpose	1
1.2 Scope	1
1.3 Other Vertical Interval Lines.....	1
1.4 Antecedent Documents	1
2 References	2
2.1 Normative References.....	2
2.2 Informative References.....	2
2.3 Regulatory References	3
2.4 Antecedent References.....	3
2.5 Reference Acquisition.....	3
3 Definitions	5
3.1 Definitions	5
3.2 Terms Employed.....	5
3.2.1 Acronyms	5
3.2.2 Glossary (Informative).....	6
3.3 Compliance Notation.....	9
4 Background (Informative)	10
4.1 Data Types in the Line 21 Signal.....	10
4.2 Program Distribution Paths.....	10
5 Signal Characteristics	12
5.1 Introduction.....	12
5.2 Line 21 Waveform	12
5.3 Data Formats.....	15
6 Closed Captioning	15
6.1 Introduction.....	15
6.2 Background and Foreground Attributes	15
6.3 Closed-Group Extensions (Informative).....	17
6.4 Character Sets (Normative)	18
6.4.1 Standard	18
6.4.2 Optional Extended Characters	18
7 Text Mode	26
7.1 Introduction.....	26
7.2 Text Mode Service Providers and Equipment Manufacturers	26
7.3 Field 2 Text Bandwidth Considerations	26
7.4 Real-Time Scrolling Display	26
7.5 Other Real-Time Display Methods	27
7.6 Delayed Display	27
7.7 Other Interruptions	27
7.8 Automatic Erasure of Text and Background	27
7.9 Data Channel Nomenclature for Text Services	28
7.10 Transmitting URLs in T-2.....	28
7.11 Character Set	28
7.12 Standard Syntax	28
7.13 Special Characters	31
7.14 Bandwidth Considerations	31

8	Field 2 Formats and Protocols	32
8.1	Introduction.....	32
8.2	Signal Characteristics.....	32
8.3	Data Formats.....	32
8.4	Closed Caption Mode.....	32
8.5	Text Mode.....	32
8.6	XDS Mode.....	33
8.6.1	XDS Characters.....	33
8.6.2	Control Codes.....	33
8.6.3	Checksum.....	34
8.6.4	Interleave Service Example.....	34
8.6.5	Multiple Interleave.....	35
8.6.6	Packet Length.....	35
8.6.7	Packet Suspension.....	35
8.6.8	Packet Termination.....	35
9	XDSPackets	36
9.1	Introduction.....	36
9.2	General Use.....	36
9.3	XDS Packet Control Codes.....	37
9.4	Class Definitions.....	37
9.5	Type Definitions.....	38
9.5.1	Current Class.....	38
9.5.1.1	Type=0x01 Program Identification Number.....	38
9.5.1.2	Type=0x02 Length/Time-in-Show.....	38
9.5.1.3	Type=0x03 Program Name (Title).....	38
9.5.1.4	Type=0x04 Program Type.....	39
9.5.1.5	Type=0x05 Content Advisory.....	40
9.5.1.5.1	U.S. TV Parental Guideline Rating System.....	41
9.5.1.5.2	Canadian English Language Rating System.....	42
9.5.1.5.3	Système de classification français du Canada.....	43
9.5.1.5.4	General Content Advisory Requirements.....	44
9.5.1.6	Type=0x06 Audio Services.....	44
9.5.1.7	Type=0x07 Caption Services.....	45
9.5.1.8	Type=0x08 Copy and Redistribution Control Packet.....	45
9.5.1.9	Type=0x09 Reserved.....	47
9.5.1.10	Type=0x0C Composite Packet-1.....	47
9.5.1.11	Type=0x0D Composite Packet-2.....	47
9.5.1.12	Type=0x10 to 0x17 Program Description Row 1 to Row 8.....	48
9.5.2	Future Programming.....	48
9.5.3	Channel Information Class.....	48
9.5.3.1	Type=0x01 Network Name (Affiliation).....	48
9.5.3.2	Type=0x02 Call Letters (Station ID) and Native Channel.....	48
9.5.3.3	Type=0x03 Tape Delay.....	49
9.5.3.4	Type=0x04 Transmission Signal Identifier (TSID).....	49
9.5.4	Miscellaneous.....	49
9.5.4.1	Type=0x01 Time of Day.....	49
9.5.4.2	Type=0x02 Impulse Capture ID.....	50
9.5.4.3	Type=0x03 Supplemental Data Location.....	50
9.5.4.4	Type=0x04 Local Time Zone & DST Use.....	50
9.5.4.5	Out-of-Band Channel Information.....	51
9.5.4.5.1	Type=0x40 Out-of-Band Channel Number.....	51
9.5.4.5.2	Type=0x41 Channel Map Pointer.....	51
9.5.4.5.3	Type=0x42 Channel Map Header Packet.....	52
9.5.4.6	Type=0x43 Channel Map Packet.....	52
9.5.5	Public Service Class.....	53

9.5.5.1 Type=0x01 National Weather Service Code (WRSAME)	53
9.5.5.2 Type=0x02 National Weather Service Message	55
9.6 Encoder Operation (Informative)	55
9.6.1 General Usage Types	55
9.6.2 XDS Packet Usage Recommendations	56
9.6.2.1 Initial Setup	56
9.6.2.2 Program Identification Number (Scheduled Start Time)	56
9.6.2.3 Length/Time-in-Show	56
9.6.2.4 Program Title	56
9.6.2.5 Content Advisory	56
9.6.2.6 Program Description Row 1 to Row 8	56
9.6.2.7 Network Name (Affiliation)	57
9.6.2.8 Call Letters (Station ID) and Native Channel	57
9.6.2.9 Tape Delay	57
9.6.2.10 Time of Day	57
9.6.2.11 Impulse Capture ID	57
9.6.2.12 Local Time Zone & DST Use	57
9.6.2.13 National Weather Service Code (WRSAME)	57
9.6.2.14 National Weather Service Message	58
9.6.2.15 Program Type	58
10 Component Television Systems –Analog (480I)	58
10.1 Color Difference	58
10.2 RGB	58
Annex A Character Set Differences (Informative)	59
Annex B Service Providers (Normative)	61
B.1 Introduction	61
B.2 New Mid-Screen PACs	61
B.2.1 TeleCaption I	61
B.2.2 TeleCaption II	61
B.3 Delete to End of Row	62
B.4 Tab Offsets	62
B.5 Base Row Implementation	63
B.6 New Displayable Characters	64
B.7 Protocols for Paint-On Style	64
B.8 Proper Order of Data	65
B.8.1 Roll-Up Style	65
B.8.2 Paint-On Style	65
B.8.3 Pop-On Style	65
B.9 Supporting the TeleCaption I Decoder	66
B.10 Supporting the TeleCaption II Decoder	67
B.11 Other Encoding and Transmission Information	68
B.11.1 Using Incompatible or Non-Standard Features	68
B.11.2 Timing of Control-Code Transmissions	68
B.11.3 Integrating Live Transmissions with Encoded Data	68
B.11.4 Miscellaneous Control Codes Can Stand Alone	68
B.11.5 Avoiding Invalid Control Codes	68
B.11.6 Field 2 Captioning Codes	69
B.11.7 Maintaining Captioning Sync	69
B.12 Backspacing	69
B.13 Data Channel Nomenclature for Caption Services	69
B.14 Double Control-Byte Pairs	70
B.15 Non-Functioning Control Byte Pairs	70

Annex C Decoder Manufacturers (Normative)	71
C.1 Introduction	71
C.2 Processing Color in a Monochrome-Display Decoder (Regulatory)	71
C.3 Smooth Scroll (Preferred)	71
C.4 Roll-Up Row/Base Row Conflicts (Preferred)	72
C.5 Allocation of Rows in Memory (Regulatory)	72
C.6 Receiving Too Many Rows of Caption Data (Preferred)	73
C.7 PACs and Tab Offsets (Regulatory/Preferred).....	73
C.8 Solid Spaces Added for Legibility (Regulatory/Preferred)	73
C.9 Automatic Caption Erasure (Preferred)	74
C.10 Style Switching (Regulatory)	74
C.11 Response to EOC During Roll-Up Captioning (Regulatory).....	74
C.12 Prompt Response to Caption Commands (Regulatory)	74
C.13 Right Margin Limitation (Regulatory/Normative).....	75
C.14 Special Cases Regarding Attributes (Normative).....	75
C.15 Remembering Cursor Location (Preferred).....	75
C.16 Proper Implementation of EDM and ENM Commands (Normative)	75
C.17 Using Unique Control Codes to Flag Field Reversal (Optional)	76
C.18 Data Channel Nomenclature for Captions and Text (Informative).....	76
C.19 Flashing Underline (Optional).....	76
C.20 Viewer Control by XDS Content Advisory (Regulatory).....	76
C.21 Display Enable/Disable Logic and Timing (Regulatory)	76
C.22 Safe Caption Area (Regulatory).....	77
Annex D Captioning and Text Encoder Manufacturers	78
D.1 Introduction (Informative)	78
D.2 Transmission of Control Code Pairs (Normative/Regulatory)	78
D.3 Text-Mode Multiplexing (Informative)	78
D.4 Automatic Caption Blanking (Informative).....	78
D.5 Vendor and Version Enquiry (Informative).....	79
D.6 Encode Disable Mode (Informative).....	79
D.7 Field 1 Waveform When Processing Field 2 (Regulatory/Informative).....	79
D.8 Re-Encoding Delays (Normative)	80
D.9 Field 2 Text Bandwidth Considerations (Normative)	80
Annex E XDS Encoder Manufacturers	81
E.1 Introduction (Informative)	81
E.2 Maintaining Captioning Sync (Informative).....	81
E.3 Data Channel Bandwidth (Normative).....	81
E.4 Packet Integration (Normative)	82
E.4.1 Two Way Integration (Normative)	84
E.4.2 Bridging (Informative).....	84
E.4.3 Store and Forward (Normative).....	84
E.4.4 Three-way Integration (Normative)	84
E.5 Field Reversal (Normative).....	85
E.6 Typical Packet Insertion Points (Normative).....	85
E.7 High Level Encoder Requirements (Normative)	85
E.7.1 Re-encoding Delays	85
E.7.2 Field 2 Text Service Requirements.....	86
E.7.3 XDS Packet Handling Requirements	86
E.8 Line 21 Data Flow (Normative).....	87
E.8.1 Sources of Captioning, Text and XDS Data.....	89
E.8.1.1 Caption File (Optional)	89
E.8.1.2 SMPTE Time Code Data (Optional).....	89
E.8.1.3 Time Code Driver (Optional).....	89
E.8.1.4 XDS/Text File (Optional).....	89

E.8.1.5 XDS/Text Driver (Optional)	89
E.8.1.6 Real Time Clock.....	89
E.8.1.7 Serial/Keyboard Port Data (Optional)	89
E.8.1.8 Bridged Video Data (Optional)	89
E.8.1.9 Upstream Video Data (Required)	89
E.8.2 Demultiplexer.....	90
E.8.3 Incoming Data Filter (Optional).....	90
E.8.4 Line 21 Data Buffers.....	90
E.8.4.1 Field 1 Caption and Text Buffers	90
E.8.4.2 Field 2 Caption Buffer	90
E.8.4.3 Field 2 Text Buffer	90
E.8.4.4 XDS Packet Demultiplexer.....	90
E.8.4.5 XDS Buffers.....	93
E.8.4.6 XDS Packet Multiplexer.....	93
E.8.5 Field Multiplexers	93
E.8.5.1 Field 1 Multiplexer	93
E.8.5.2 Field 2 Multiplexer	93
E.8.6 Encoding Process Flow for Video Signal	94
E.8.6.1 Upstream Video	94
E.8.6.2 Encoder	94
E.8.6.3 Encoded Video.....	94
E.9 Priorities for Field 1 Re-encoding (Integration)	94
E.10 Priorities for Field 2 Re-encoding (Integration)	94
E.10.1 Captioning vs Text vs XDS.....	94
E.10.2 XDS Vs XDS	95
Annex F FCC Regulations (Regulatory).....	96
F.1 FCC Rules Excerpts	96
F.1.1 Character Set Table.....	96
F.1.1.1 Special Characters	96
F.1.1.2 Standard Characters	96
F.1.1.3 Mid-Row Codes.....	99
F.1.1.4 Miscellaneous Control Codes	99
F.1.1.5 PACs	100
F.2 U.S. FCC Rules	102
Annex G Future Expansion Plans (Normative)	104
G.1 XDS.....	104
G.1.1 Lengthening Existing Packets.....	104
G.1.2 Adding Additional Packets	104
G.1.3 Defining Additional Class Types.....	104
G.1.4 Adding Other Line Formats	104
G.2 Text.....	104
G.2.1 Enhanced Text Introduction	104
G.2.2 Article Identifiers.....	104
G.2.3 Page And Row Identifiers.....	105
G.2.4 Downward Compatibility	105
G.2.5 Examples	105
Annex H Recommended Schedule for Support of TeleCaption I and TeleCaption II Decoders in Closed-Caption Transmissions	106
Annex I [Intentionally Omitted].....	107
Annex J Repetition Rates for Various Conditions (Informative).....	108
J.1 Linear Lookup	108

J.2 Alternating Lookup.....	110
J.3 Linear VS Alternating Algorithm - Conclusions	113
J.4 Linear VS Alternating Algorithm - Detailed Analysis.....	113
J.5 Spreadsheet Heading Description.....	113
Annex K Canadian CRTC Letter Decisions and Official Translations (Informative).....	119
K.1 Primary Language.....	121
Annex L Content Advisories (Informative).....	122
L.1 Scope.....	122
L.2 Receiver Indication.....	122
L.3 Blocking	122
L.4 Cessation	122
L.4.1 Analog Cessation	123
L.4.2 Digital Cessation.....	123
L.5 Selection Advisory	123
L.6 Rating Information.....	123
L.7 XDS Data	123
L.8 Auxiliary Input.....	124
L.9 Invalid Ratings	124
L.10 Multiple Rating Systems	124
L.11 Blocking Hierarchy (Television Parental Guidelines).....	124
L.12 Blocking Hierarchy (MPA Guidelines).....	126
L.13 Blocking Hierarchy (Canadian English and French Language rating systems).....	126
L.14 On Screen Display.....	126
L.15 Terms and Codes	126
Annex M Recommended Practice for Expansion of XDS to Include Cable Channel Mapping System Information (Informative).....	127
M.1 Encoder Recommendations	127
M.2 Decoder Recommendations	127

Tables

Table 1 Field 1 and Field 2 Packets.....	10
Table 2 Line 21 Waveform Timing	14
Table 3 Background and Foreground Attribute Codes.....	17
Table 4 Special Assignments	18
Table 5 Extended Character Set—Spanish	20
Table 6 Extended Character Set—Miscellaneous.....	21
Table 7 Extended Character Set—French	22
Table 8 Extended Character Set—Portugese.....	23
Table 9 Extended Character Set—German.....	24
Table 10 Extended Character Set--Danish.....	25
Table 11 URL Types	30
Table 12 Abbreviated Forms	30
Table 13 Example—Hexadecimal Character Sequence	35
Table 14 Control Code Assignments	37
Table 15 Time/Date Coding	38
Table 16 Show Length Coding.....	38
Table 17 Hex Code and Descriptive Key Word	39
Table 18 Content Advisory XDS Packet.....	40
Table 19 Content Advisory Systems a0-a3 Bit Usage.....	40
Table 20 MPA Rating System.....	41

Table 21 U.S. TV Parental Guideline Rating System	41
Table 22 Canadian English Language Rating System	42
Table 23 Canadian French Language Rating System	43
Table 24 Audio Services.....	44
Table 25 Language.....	45
Table 26 Audio Types	45
Table 27 Caption Services.....	45
Table 28 Caption Service Types	45
Table 29 Copy and Redistribution Control Packet.....	46
Table 30 CGMS-A Bit Meanings.....	46
Table 31 APS Bit Meanings	46
Table 32 Field Contents—Composite Packet-1.....	47
Table 33 Field Contents—Composite Packet-2.....	48
Table 34 Tape Delay Character Format.....	49
Table 35 TSID Bits.....	49
Table 36 Day and Year Character Format.....	50
Table 37 Supplemental Data Character Location	50
Table 38 Local Time Zone	50
Table 39 Out-of-Band Channel Number Format.....	51
Table 40 Channel Map Pointer	51
Table 41 Channel Map Header	52
Table 42 Channel Map Packet.....	52
Table 43 WRSAME Packet Code.....	54
Table 44 National Weather Service Code Data	55
Table 45 ISO 8859-1 and CEA-608-D Character Set Differences	59
Table 46 FCC Safe Caption Area Dimensions.....	77
Table 47 Initial Timer Values	93
Table 48 Top Level Data Integration Priority Table	95
Table 49 Special Characters	96
Table 50 Standard Characters	97
Table 51 Mid-Row Codes.....	99
Table 52 Miscellaneous Control Codes	99
Table 53 Preamble Address Codes (PACs).....	101
Table 54 Linear Algorithm Lookup Table	109
Table 55 Alternating Algorithm Lookup Table	111
Table 56 Alternating Algorithm Lookup Table (Continued).....	115
Table 57 Alternating Algorithm Lookup Table (Continued).....	116
Table 58 Alternating Algorithm Lookup Table (Continued).....	117
Table 59 Alternating Algorithm Lookup Table (Continued).....	118
Table 60 Blocking Example A	124
Table 61 Blocking Example B	125
Table 62 Blocking Example C	125
Table 63 Blocking Example D	125
Table 64 Blocking Example E	126

Figures

Figure 1 Program Distribution Path for Closed Captioned Programming	11
Figure 2 Line 21 Waveform Diagram	13
Figure 3 FCC Safe Caption Area	77
Figure 4 Line 21 Data Structures	83
Figure 5 Two-way Integration Process	84
Figure 6 Three Way Integration Process	85
Figure 7 Line 21 Data Flow Diagram	88
Figure 8 XDS Packet Handling	91

LINE 21 DATA SERVICES

1 Purpose and Scope

This section describes the purpose and scope of the entire standard.

1.1 Purpose

CEA-608-D is a technical standard and guide for using or providing Closed Captioning services or other data services embedded in line 21 of the vertical blanking interval of the NTSC video signal. This includes provision for encoding equipment and/or decoding equipment to produce such material as well as manufacturers of television receivers which are required to include such decoders in their equipment as a matter of regulation (see Annex F). It is also a usage guide for producing material using such equipment, and for distributing such material.

This standard describes the specifications for creation, transmission, reception, and display of caption data, plus the relationship of Caption Mode data to other line 21 data. A comparison of decoders meeting Federal Communications Commission (FCC) rules to all decoders designed prior to the drafting of those rules and a timetable for the implementation of features which are unique to the different generations of decoders are retained from the prior version.

ATSC DTV Closed Captioning, as well as a method of carrying the CEA-608-E data stream in ATSC DTV is documented in CEA-708-C.

Guidance on digital transmission of CEA-608-E signals is provided in SMPTE 334 and SMPTE EG-43.

1.2 Scope

Where recommendations or requirements are made for service providers, they apply to anyone who creates, transmits, or modifies data, i.e., someone other than an equipment manufacturer. For example, a "caption service provider" could be the agency which creates the captions for a program, the distribution system (e.g. network) which carries the captions on line 21, or the local affiliate which uses its own data encoder to insert Text Mode or XDS between the captions. In a few cases specific categories of service providers are called out.

It is recommended that regardless of the function to be performed, the reader should become familiar at least with all the introductions to sections of this standard to avoid unintentionally degrading other services, and then concentrate on the sections which are appropriate to the activity being undertaken.

While there is no legal requirement to abide by this standard or its recommended practices, except for those portions labeled regulatory, it is strongly recommended that this advice be followed by line 21 data service providers and manufacturers of equipment used to transmit and receive these data services. Failure to follow these practices is likely to result in a degraded and inferior service and a non-uniform, unpredictable display of captions, text or operation of XDS features on the consumer's receiver.

It is necessary to abide by this Standard to be CEA-608-E compliant, however while methods described in this standard for the inclusion of a service shall be followed, unless otherwise stated no service is mandatory.

1.3 Other Vertical Interval Lines

Nothing in this standard shall preclude the use of the methods described in this standard for transmission of data on other lines of the Vertical Interval or when allowed the video portion of the NTSC television signal.

1.4 Antecedent Documents

CEA-608-E not only is an updated version, but it also includes and supersedes those documents listed in Section 2.4.