Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
	)	
Closed Captioning Requirements for	)	ET Docket No. 99-254
Digital Television Receivers	)	
	)	
	)	

NOTICE OF PROPOSED RULE MAKING

Adopted: July 14, 1999 **Released: July 15, 1999**

Comment Date: [75 days after publication in Federal Register]
Reply Comment Date: [105 days after publication in Federal Register]

By the Commission:

INTRODUCTION

1. By this action, we propose to amend Part 15 of our rules to adopt technical standards for the display of closed captions on digital television (DTV) receivers. We also propose to require the inclusion of closed captioning decoder circuitry in DTV receivers. The proposals contained herein will help ensure access to digital programming for people with disabilities. We take this action to fulfill the Commission's obligations contained in the Television Decoder Circuitry Act of 1990 (TDCA).[1]

BACKGROUND

2. Closed captioning is an assistive technology that allows persons with hearing disabilities to enjoy television programming. Through captioning, the audio portion of programming is displayed as text superimposed over the video. Closed captioning information is encoded and transmitted along with the video signal of television broadcasts. The text is not ordinarily visible. In order to display closed captioning, viewers must use either a set-top decoder or a television receiver with integrated decoder circuitry.

[1] Pub. L. No. 101-431, 104 Stat. 960 (1990) (codified at 47 U.S.C. §§ 303(u), 330(b)).

3. In 1990, Congress passed the TDCA. The Act was intended to reduce the cost to consumers of receiving closed captioning, to make closed captioning more widely available, and to create market incentives for broadcasters to invest in and provide more captioned programming. The Act requires that television receivers with picture screens 33 cm (13 inches) or larger contain built-in decoder circuitry designed to display closed captioned television transmissions. The Act also requires that the Commission take appropriate action to ensure that closed captioning services continue to be available to consumers as new video technology is developed.[2] In 1991, the Commission amended Title 47 of the Code of Federal Regulations by adding Section 15.119 to implement provisions of the TDCA.[3] Section 15.119 provides standards for the display of closed captioned text on television receivers. The rules were intended to apply to analog television receivers, the only receivers in use at that time. The introduction of digital broadcasting now requires the Commission to update its rules to fulfill its continuing obligations under the TDCA.

4. As part of the Telecommunications Act of 1996, Congress directed the Commission to adopt rules that generally require video programming to be closed captioned to ensure that it is accessible to persons with hearing disabilities.[4] In 1997, the Commission adopted rules to phase-in the closed captioning of video programming including separate transition schedules for "new programming" (i.e., programming first published or exhibited on or after January 1, 1998) and "pre-rule programming" (i.e., programming first published or exhibited before January 1, 1998).[5] The rules require an increasing amount of captioned new programming over an eight-year transition period with 100% of all new nonexempt programming required to be captioned effective January 1, 2006.[6] For pre-rule programming, we adopted a ten-year transition period and require that 75% of pre-rule nonexempt programming be captioned as of January 1, 2008.[7] In addition, we defined as "pre-rule programming" digital programming prepared or formatted

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[2] *See* 47 U.S.C. § 330(b).

[3] *See* 47 C.F.R. § 15.119, *Report and Order* in General Docket 91-1, 6 FCC Rcd. 2419 (1991), 56 FR 27200 (1991).

[4] 47 U.S.C. § 613.

[5] *See Closed Captioning and Video Description of Video Programming, Implementation of Section 305 of the Telecommunications Act of 1996, Video Programming Accessibility*, MM Docket No. 95-176, Report and Order, 13 FCC Rcd 3272 (1998) ("*Captioning Order*"); *Closed Captioning and Video Description of Video Programming, Implementation of Section 305 of the Telecommunications Act of 1996, Video Programming Accessibility*, MM Docket No. 95-176, Order on Reconsideration, 13 FCC Rcd 19973 (1998) ("*Captioning Reconsideration*"). *See also* 47 C.F.R. § 79.1(a)(5)-(6).

[6] 47 C.F.R. § 79.1(b)(1), (3). As authorized by Congress, the rules exempt certain programming for which a closed captioning requirement would impose an economic burden. *See* 47 C.F.R. § 79.1(d).

[7] 47 C.F.R. § 79.1(b)(2), (4).

for reception on digital television receivers prior to the date on which such television receivers must be equipped with decoder circuitry for the display of digital closed captioning transmissions.[8] This narrowly defined class of digital programming will be subject to the captioning requirements in accordance with the pre-rule transition schedule.[9] Once the standards adopted in the instant proceeding are effective, programming prepared or formatted for display on television receivers equipped for display of digital transmissions will fall under the established definition of "new programming" and be subject to the transition schedule for the captioning of new programming.

DISCUSSION

5. In 1996, the Commission incorporated an industry approved transmission standard for digital television broadcasts into its rules.[10] Although the standard included a data stream reserved for closed captioning information, specific instructions for implementing closed captioning services for digital television did not exist. Since then, the Electronics Industries Alliance (EIA) has adopted EIA-708-A, a standard which provides guidelines for caption providers as well as encoder and decoder manufacturers to implement closed captioning services with digital television technology.[11] Accordingly, digital television manufacturers now have an industry approved standard to use for guidance in designing captioning-capable receivers. This *Notice* proposes to incorporate the relevant sections of EIA-708-A into the Commission's rules.

6. EIA-708-A provides comprehensive instructions for the encoding, delivery, and display of closed caption information for digital television systems. The standard provides for a larger set of captioning characters than the existing caption standard. It also supports user options which enable caption display to be customized for a particular viewer. For example, closed caption decoders functioning pursuant to EIA-708-A may permit viewers to change various attributes of caption text such as its font, spacing, color, or screen position. This will

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[8] *Captioning Order*, 13 FCC Rcd 3300-3301 ¶ 60; *Captioning Reconsideration*, 13 FCC Rcd 19986-19987 ¶ 27. Specifically, pursuant to 47 C.F.R. § 79.1, the definition of "pre-rule programming" includes:

> [v]ideo programming published or exhibited for display on television receivers equipped for display of digital transmissions or formatted for such transmission and exhibition prior to the date on which such television receivers must, by Commission rule, be equipped with built-in decoder circuitry designed to display closed-captioned digital television transmissions.

[9] *Captioning Reconsideration*, 13 FCC Rcd 19986-19987 ¶ 27.

[10] *See Fourth Report and Order* in MM Docket 87-268, 11 FCC Rcd. 17771 (1996), 62 FR 14006 (1997).

[11] *See* EIA-708-A, Digital Television Closed Captioning, November 23, 1998. A complete copy of this standard has been included in the docket of this proceeding. Copies of EIA-708-A may be obtained from: Global Engineering Documents, 15 Inverness Way East, Englewood, Co 80112-5704, http://global.ihs.com/.

allow viewers to change the size and appearance of captions to suit their needs. Also, using EIA-708-A, caption providers may distribute the caption text for a particular program at different reading levels. Viewers would then have the option of displaying the standard near-verbatim captions or alternate "easy-reader" captions written for younger viewers or beginner readers. Captions for that same program may also be distributed in alternate languages, simultaneously. We believe that, because of these attributes, EIA-708-A provides substantial benefits for consumers, and substantial improvements over current captioning standards.

7. This *Notice* proposes to incorporate Section 9 of EIA-708-A into the Commission's rules.[12] Section 9 contains recommendations for the operation of DTV decoders with respect to closed captioning. These recommendations were intended to provide minimum performance standards for DTV caption decoders. Because Section 9 supplies manufacturers with a set of common basic functions for DTV caption decoders, we believe that it provides sufficient guidance for the successful implementation of closed caption services with digital television receivers.[13] Accordingly, we propose to transcribe the recommendations contained in Section 9 into requirements that will be contained in Part 15 of the Commission's rules. DTV receivers will be required to function pursuant to the recommendations contained therein. We seek comment on this proposal.

8. The recommendations contained in Section 9, however, do not exploit the full range of capabilities provided elsewhere in EIA-708-A. For example, Section 9.20 states that caption decoders may choose to support display of only 8 or 22 foreground and background colors, as opposed to the 64 colors possible with the full implementation of EIA-708-A. We wish to emphasize therefore that, although we only propose to adopt the recommendations contained in Section 9, nothing in this proposal would prohibit the full implementation of capabilities defined throughout the standard. Indeed, Section 9 of EIA-708-A notes that the minimum recommendations are not intended to, and should not, restrict caption providers from using the extensive capabilities available under the standard. Nonetheless, we seek comment on whether there are more caption features contained in EIA-708-A, in addition to those contained in Section 9, that should be required for DTV receivers. Finally, whether we adopt only Section 9 or additional requirements, we seek comment on whether it is necessary to incorporate into our rules by reference the entire EIA-708-A standard.

9. Receiver requirements. The TDCA requires closed caption decoder circuitry to be included in all television receivers with picture screens 13 inches or greater in size. For retail purposes, television screen size is currently measured in accordance with Federal Trade Commission (FTC) regulations.[14] We propose to apply the FTC labeling standard to DTV

[12] EIA-708-A, Section 9 is included as Appendix B.

[13] We note that broadcasters are not obligated to provide the extensive features of EIA-708-A. However, Section 9 summarizes what EIA believes to be the essential elements of EIA-708-A necessary for effective DTV caption display.

[14] *See* 16 C.F.R. § 410, which reads in pertinent part:

receivers. Accordingly, we propose to require all DTV receivers with picture screens 13 inches or larger, measured in accordance with the FTC regulations, to include closed caption decoder circuitry that functions pursuant to the recommendations contained in Section 9 of EIA-708-A. We invite comment on this proposal.

10. We note that, because digital television picture screens will be shaped differently than analog picture screens, based on the FTC labeling requirements, similarly labeled DTV receivers and analog receivers may actually have overall picture areas of different sizes. Specifically, whereas current analog receivers have a screen size ratio of 4:3, resulting in a relatively square picture screen, most digital receivers will have a ratio of 16:9, resulting in a more rectangular shape. Therefore, an analog receiver marketed with a picture screen measuring "13 inches diagonal" will have a picture area of 81.12 sq. inches. On the other hand, a DTV receiver labeled "13 inches diagonal" will have a picture area of 72.18 sq. inches. We invite comment as to whether the FTC screen size labeling standard is appropriate when applied to DTV receivers in light of this definition issue.

11. During the transition period from analog to digital broadcasting, programming will be transmitted in both analog and digital formats. Accordingly, the first few generations of DTV receivers are expected to be designed to operate in a dual mode. Dual mode receivers will allow consumers to enjoy the enhanced quality of digital broadcast stations while retaining the ability to watch programming on existing analog stations, all with the same receiver. For this type of receiver we believe that it is important to ensure that closed captioning display capability is available in both modes of operation. Accordingly, we propose to require that dual mode receivers operating in the analog mode provide closed captioning functionality pursuant to the Commission's existing rules.[15] In the digital mode, such receivers will be required to function in accordance with EIA-708-A, as specified above. We note that EIA-708-A supports transport of standard analog captioning information. However, we propose to require that the decoder circuitry in digital tuners respond primarily to any digitally formatted caption information. In

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Note 1: For the purposes of this part, measurement of the picture area on a single plane basis refers to a measurement of the distance between the outer extremities (sides) of the picture area which does not take into account the curvature of the tube. . . .

Examples of proper size descriptions when a television receiving set shows a 20-inch picture measured diagonally, a 19-inch picture measured horizontally, a 15-inch picture measured vertically, and a picture area of 262 square inches include:

"20 inch (50.80 cm) picture measured diagonally" or
"20 inch (50.80 cm) diagonal"
"19 inch x 15 inch (48.26 cm x 38.10 cm) picture" or
"19 inch (48.26 cm) picture" or
"19 inch (48.26 cm)" or
"262 square inch (1,690.32 cm. sq.) picture."

[15] *See* 47 C.F.R. § 15.119.

that way we can ensure that consumers who purchase DTV receivers will be able to take advantage of the new capabilities of captioning in the digital environment.[16] We seek comment on this proposal.

12. We are aware that DTV reception capability will be marketed in a number of ways. During the transition period we expect that many consumers will purchase set-top DTV converter boxes that allow digitally transmitted television signals to be displayed on analog receivers. We also are aware that some manufacturers may choose to sell DTV tuners and display units separately. Consumers will have the option of customizing their DTV system in much the same way that is now done for computer systems. We believe that most set-top converters and all separately sold DTV tuners will be used with picture screens that are 13 inches or larger. Therefore, we propose to require that all such devices be subject to the provisions of the TDCA and provide for the display of closed captioning. Specifically, we propose to require that DTV converter boxes used with analog receivers either decode any analog caption information that is transmitted with the DTV signal or pass this information directly to the receiver in a form recognizable by the receiver's built-in caption decoder. Separately sold DTV tuners will be required to have the capability to respond to digitally encoded caption information. Although these converter boxes and tuners may be marketed without display screens, we tentatively conclude that 47 U.S.C. § 330(b) provides the Commission with authority to require closed captioning capability in the devices. We seek comment.

13. Cost. We seek comment on the estimated cost to consumers associated with our proposal to require that dual mode receivers be capable of displaying both analog and digitally formatted captions. Similarly, we seek comment on the cost of including the proposed closed captioning functionality in set-top DTV converter boxes and separately sold DTV tuner. We do not believe that the requirements proposed herein will significantly impact costs for such equipment. However, we solicit comment on this matter.

14. Effective date. Finally, we propose that these rules become effective one year after adoption. We clarify that the effective date will indicate the time at which manufacturers must begin including this functionality in its products. We note that in previous filings with the Commission CEMA, a trade association representing manufacturers of consumer electronic devices, has indicated that the design cycle for television receivers generally lasts 18-24 months. According to CEMA, the cycle typically begins in January and leads to product introduction in the summer of the following year. Notwithstanding, we believe that a one year transition is reasonable given that the deadline is in reference to the date of manufacture, not the date of availability. Further, we believe that a one year transition period will provide sufficient time for programmers to incorporate closed captioning consistent with these standards into the digital programming they distribute. We seek comment on this issue.

[16] We note that the PIAC Report also recommends that broadcasters take full advantage of digital closed captioning technologies to provide viewers with maximum choice and caption quality.

15. We are aware that the proposals contained in this Notice may require hardware and software re-design shortly before or after January 1, 2000. Therefore, we also seek comment as to whether this implementation schedule will have an adverse impact on any year 2000 remediation efforts already undertaken by manufacturers.

PROCEDURAL MATTERS

A. Regulatory Flexibility Act

16. As required by Section 603 of the Regulatory Flexibility Act, 5 U.S.C. § 603, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the expected impact on small entities of the proposals suggested in this document. The IRFA is set forth in Appendix A. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments on the rest of the *Notice*, but they must have a separate and distinct heading designating them as responses to the IRFA. The Commission shall send a copy of this *Notice*, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with Section 603(a) of the Regulatory Flexibility Act, 5 U.S.C. § 603(a).

B. *Ex Parte* Rules -- Permit-But-Disclose Proceedings

17. This is a permit-but-disclose notice and comment rule making proceeding. *Ex parte* presentations are permitted, except during any Sunshine Agenda period, provided they are disclosed as provided in the Commission's rules. *See generally* 47 C.F.R. §§ 1.1200(a), 1.1203, and 1.1206.

C. Authority

18. This action is taken pursuant to Sections 303(u) and 330(b) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 303(u) and 330(b).

D. Comment Dates

19. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments on before **[75 days after publication in the Federal Register]**, and reply comments on or before **[105 days after publication in the Federal Register]**. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. See Electronic Filing of Documents in Rulemaking Proceedings, 63 Fed. Reg. 24,121 (1998).

20. Comments filed through the ECFS can be sent as an electronic file via the Internet at

<http://www.fcc.gov/e-file/ecfs.html>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

21. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appear in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. All filings must be sent to the Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room TW-A325, Washington, D.C. 20554.

22. Parties who choose to file by paper should also submit their comments on diskette. These diskettes should be submitted to: Neal L. McNeil, Office of Engineering and Technology, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room 7-A133, Washington, D.C. 20554. Such a submission should be on a 3.5 inch diskette formatted in an IBM compatible format using WordPerfect 5.1 for Windows or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labelled with the commenter's name, proceeding (including the lead docket number, in this case ET Docket No. 99-254, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy - Not an Original." Each diskette should contain only one party's pleadings, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, International Transcription Service, Inc., 1231 20th Street, N.W., Washington, D.C. 20037.

23. Comments and reply comments will be available for public inspection during regular business hours in the Reference Information Center (Room CY-A257) of the Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Washington, D.C. 20554. Copies of comments and reply comments are available through the Commission's duplicating contractor: International Transcription Service, Inc. (ITS, Inc.), 1231 20th Street, N.W., Washington, D.C. 20036, (202) 857-3800, TTY (202) 293-8810.

24. Alternative formats (computer diskette, large print, audio cassette and Braille) are available to persons with disabilities by contacting Martha Contee at (202) 418-0260, TTY (202) 418-2555, or at mcontee@fcc.gov. The *Notice* can also be downloaded at: http://www.fcc.gov/dtf/.

ORDERING CLAUSES

25. IT IS ORDERED that, pursuant to Sections 303(u) and 330(b) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 303(u) and 330(b), this Notice of Proposed Rule Making is hereby ADOPTED.

26. IT IS FURTHER ORDERED that the Commission's Office of Public Affairs Reference Operations Division, SHALL SEND a copy of this Notice of Proposed Rule Making, including the Initial Regulatory Flexibility Act, to the Chief, Counsel for Advocacy of the Small Business Administration.

27. For further information concerning this *Notice*, contact Neal McNeil, Office of Engineering & Technology, (202) 418-2408, TTY (202) 418-2989, email nmcneil@fcc.gov.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas
Secretary

APPENDIX A

INITIAL REGULATORY FLEXIBILITY ANALYSIS

As required by Section 603 of the Regulatory Flexibility Act,[17] the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the expected significant economic impact on small entities by the policies and rules proposed in this *Notice of Proposed Rule Making (Notice)*. Written public comments are requested on the IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the *Notice* provided above. The Commission shall send a copy of this *Notice*, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with paragraph 603(a) of the Regulatory Flexibility Act.

A. Need for and Objectives of the Proposed Rule.

In 1990, Congress passed the Television Decoder Circuitry Act (TDCA).[18] The TDCA requires that any apparatus designed to receive television broadcast signals, manufactured or imported for use in the United States, must have the capability of displaying closed captioned information if its television screen is 33 centimeters (13 inches) or larger. In 1991, the FCC incorporated the TDCA into its rules by requiring that each broadcast receiver shipped in interstate commerce, manufactured, assembled, or imported after July 1, 1993 be capable of displaying closed captioned information if its television screen is 33 centimeters or larger.[19]

This *Notice* proposes to amend Part 15 of our Rules to require that digital television receivers be capable of displaying closed captioning transmitted with television signals.

B. Legal Basis.

The proposed action is taken pursuant to Sections 303(u) and 330(b) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 303(u) and 330(b).

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules Will Apply.

The RFA generally defines the term "small entity" as having the same meaning as the terms "small business" "small organization," and "small governmental jurisdictions." In addition, the

[17] 5 U.S.C. § 603.

[18] Pub. L. No. 101-431, 104 Stat. 960 (1990) (codified at 47 U.S.C. §§ 303(u), 330(b)).

[19] *See* 47 C.F.R. § 15.119, *Report and Order* in General Docket 91-1, 6 FCC Rcd. 2419 (1991).

term "small business" has the same meaning as the term "small business concern" under the Small Business Act, 15 U.S.C. § 632, unless the Commission has developed one or more definitions that are appropriate to its activities.[20] Under the Small Business Act, a "small business concern" is one that: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) meets any additional criteria established by the Small Business Administration (SBA).[21]

According to the SBA's regulations, television equipment manufacturers must have 750 or fewer employees in order to qualify as a small business concern.[22] Census Bureau data indicates that there are 858 U.S. companies that manufacture radio and television broadcasting and communications equipment, and that 778 of these firms have fewer than 750 employees and would be classified as small entities.[23] The Census Bureau category is very broad, and specific figures are not available as to how many of these firms are manufacturers of television equipment. However, we believe that many of the companies that manufacture television equipment may qualify as small entities.

D. Description of Projected Reporting, Recordkeeping and Other Compliance Requirements.

The Commission's rules require television receivers to be verified for compliance with applicable FCC technical requirements. See 47 C.F.R. Sections 15.101, 15.117, and 2.951, *et seq*. Documentation concerning the verification must be kept by the manufacturer or importer. The rules adopted in this proceeding require that digital television receivers comply with industry-developed standards for closed captioning display. However, testing regarding closed captioning display is not necessary because compliance with the industry-developed standards, and the associated Commission rules, can be determined easily during the equipment design process. The Commission may, of course, ask manufacturers and importers to document upon occasion how a particular television receiver or computer system complies with the closed captioning display requirements.

E. Significant Alternatives to Proposed Rules Which Minimize Significant Economic Impact on Small Entities and Accomplish Stated Objectives.

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[20] See 5 U.S.C. § 601(3).

[21] 15 U.S.C. § 632.

[22] 13 C.F.R. § 121.201, (SIC) Code 3663.

[23] U.S. Department of Commerce, 1992 Census of Transportation, Communications, and Utilities, SIC Code 3663 (issued may 1995).

None.

F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rule.

None.

APPENDIX B

EIA-708-A, Section 9

9 DTVCC Decoder Manufacturer Recommendations

The following are the recommendations for DTV Closed Captioning decoder implementation including DTV, SDTV and HDTV. These recommendations are directed to the least common denominator of all of the DTVCC features described in the previous sections. Although voluntary, these recommendations should be considered as requirements for a realistic minimal implementation of the DTVCC capabilities. These minimal recommendations provide a bridge from NTSC (ANSI/EIA-608) captioning implementation to the eventual full-feature implementation of this DTVCC specification .

It should be emphasized that these minimum recommendations are not intended to, and should not, restrict caption providers from using the whole suite of DTVCC commands and their extensive capabilities. The following sections address the minimum recommendations that have been anticipated, but may not cover all conditions and manifestations. It is up to the manufacturer to consider all situations that are not explicitly presented herein.

NOTE--The section numbers in the following headings refer to the corresponding sections in the current DTVCC Specification, EIA-708-A, to which the minimum recommendations apply.

9.1 DTVCC Section 4.2 - Pre-Allocated Bandwidth

While the DTVCC Caption Channel provides a continuous 9600 bps bit stream within the DTVCC Transport Channel, the individual bandwidth allocated to any single service shall not exceed 25% of the total bandwidth averaged over any 1 second time interval. This limit permits a maximum, average captioning data rate of 300 Bpsper service.

That is, decoders need only implement enough buffering and processing power to handle a maximum of 2400 bps for each service. In effect, when this limit is exceeded for a service, the input storage buffer allocated for the service will overflow and data not already buffered will be lost.

NOTE-- In contrast, the per-service limitation addressed above still provides a five-fold enhancement over the maximum possible NTSC Closed-Caption service data rate of 60 Bps.

9.2 DTVCC Section 6.1 - Services

Decoders should be capable of decoding and processing data for at least one (1) service. Decoders shall be capable of decoding and processing the Caption Service Directory data.

9.3 DTVCC Section 6.2 - Caption Channel Service Blocks

Decoders should be capable of decoding all Caption Channel Block Headers consisting of Standard Service Headers, Extended Service Block Headers, and Null Block headers. However, decoding of the data is required only for Standard Service Blocks (Service IDs <= 6), and then only if the characters for the corresponding language are supported.

Decoders should be able to display the directory for services 1 through 6. Service decoding and directory display for services numbered 7 or greater are optional.

9.4 DTVCC Section 7.1 - Code Space Organization

Decoders must support Code Space C0, G0, C1, and G1 in their entirety.

The following characters within code space G2 must be supported:

- transparent space (TSP)
- non-breaking transparent space (NBTSP)
- solid block (█)
- trademark symbol (™)
- Latin-1 characters (Š, Œ, š, œ, Ÿ)

The substitutions in Table 17 are to be made if a decoder does not support the remaining G2 characters.

G2 Character	Substitute With
open single quote (‘), G2 char code 0x31	G0 single quote (‘), char code 0x27
close single quote(’), G2 char code 0x32	G0 single quote (‘), char code 0x27
open double quote (“), G2 char code 0x33	G0 double quote (“), char code 0x22
close double quote (”), G2 char code 0x34	G0 double quote (“), char code 0x22
bold bullet (•), G2 char code 0x35	G1 bullet (·), char code 0xB7
ellipsis(…), G2 char code 0x25	G0 underscore (_), char code 0x5F
one-eighth (1 /8), G2 char code 0x76	G0 percent sign (%), char code 0x25
three-eighths (3 /8), G2 char code 0x77	G0 percent sign (%), char code 0x25
five-eighths (5 /8), G2 char code 0x78	G0 percent sign (%), char code 0x25
seven-eighths (7 /8), G2 char code 0x79	G0 percent sign (%), char code 0x25
vertical border (│), G2 char code 0x7A	G0 stroke (|), char code 0x7C
upper-right border (┐), G2 char code 0x7B	G0 dash (-), char code 0x2D
lower-left border (└), G2 char code 0x7C	G0 dash (-), char code 0x2D
horizontal border (─),G2 char code 0x7D	G0 dash (-), char code 0x2D
lower-right border (┘), G2 char code 0x7E	G0 dash (-), char code 0x2D
upper-left border (┌), G2 char code 0x7F	G0 dash (-), char code 0x2D

Table 17 G2 Character Substitution Table

Support for code spaces C2, C3, and G3 is optional.

All unsupported graphic symbols in the G3 code space are to be substituted with the G0 underscore character (_), char code 0x5F.

9.5 DTVCC Section 8.2 - Screen Coordinates

Table 18 specifies the minimum screen coordinate recommendations for anchor point positioning in 4:3 and 16:9 display formats, and the number of characters per row.

Screen Aspect Ratio	Maximum Anchor	Minimum Anchor Position Resolution	Position Resolution
4:3	75v x 160h	15v x 32h	
16:9		75v x 210h	15v x 42h
other		75v x (5 x H)	15v x H*

Table 18 Minimum Screen Coordinates

*H = 32 x (the width of the screen in relation to a 4:3 display). For example, the 16:9 format is 4/3 wider than a 4:3 display; thus, H = 32 * 4/3 = 42.667, or 42.

This means that the minimum grid resolution for a 4:3 aspect ratio instrument is 15 vertical positions x 32 horizontal positions. This minimum grid resolution for 16:9 ratio instrument is 15 vertical positions x 42 horizontal positions. These minimum grid sizes are to cover the entire safe-title area of the corresponding screen.

The minimum coordinates equate to a 1/5 reduction in the maximum horizontal and vertical grid resolution coordinates. Caption providers are to use the maximum coordinate system values when specifying anchor point positions. Decoders using the minimum resolution are to divide the provided horizontal and vertical screen coordinates by 5 to derive the equivalent minimum coordinates.

Any caption targeted for both 4:3 and 16:9 instruments is limited to 32 contiguous characters per row. If a caption is received by a 4:3 instrument that is targeted for a 16:9 display only, or requires a window width greater than 32 characters, then the caption may be completely disregarded by the decoder. 16:9 instruments should be able to process and display captions intended for 4:3 displays, providing all other minimum recommendations are met.

If the resulting size of any window is larger than the safe title area for the corresponding display's aspect ratio, then this window will be completely disregarded.

9.6 DTVCC Section 8.4 - Caption Windows

Decoders need to display no more than 4 rows of captions on the screen at any given time, regardless of the number of windows displayed. This implies that no more than 4 windows can be displayed at any given time (with each having only one caption row).

However, decoders should maintain storage to support a maximum total of 8 rows of captions. This storage is needed for the worst-case support of a displayed window with 4 rows of captioning and a non-displayed window which is buffering the incoming rows for the next 4-row caption.

As implied above, the maximum number of windows that may be displayed at any one time by a minimum decoder implementation is 4. If more than 4 windows are defined in the caption stream, the decoder may disregard the youngest and lowest priority window definition(s). Caption providers must be aware of this limitation, and either restrict the total number of windows used or accept that some windows will not be displayed.

9.7 DTVCC Section 8.4.2 - Window Priority

Decoders do not need to support overlapped windows. If a window overlaps another window, the

overlapped window need not be displayed by the decoder. Decoders may support overlapped windows as an option.

9.8 DTVCC Section 8.4.6 - Window Size

At a minimum, decoders will assume that all windows have rows and columns “locked”. This implies that if a decoder implements the optional SMALL pen-size, then word-”un”wrapping, when shrinking captions, need not be implemented. Also, if a decoder implements the optional LARGE pen size, then word wrapping (when enlarging captions) need not be implemented.

9.9 DTVCC Section 8.4.8 - Word Wrapping

Decoders may support word wrapping as an option.

9.10 DTVCC Section 8.4.9 - Window Text Painting

9.10.1 Justification

For fixed-spaced (i.e., non-proportionally-spaced) fonts, all decoders should implement “left”, “right”, and “center”caption-text justification, with “full” justification implementation being optional. “Full” justification is to be converted to “left” justification when “full” justification is not implemented

For proportionally-spaced fonts, all decoders should implement left, right and center justification. For center and right justification, decoders need not display any portion of a received row of text until the entire row is received (i.e., until a CR or any non-text related command is received). This easement allows the decoder to calculate the “width” of a text row before displaying it, and thus, giving the decoder all of the parameters necessary to calculate a reasonable offset of the row within a window to effect center or right justification.

Receipt of a character for a displayed row which already contains text and which has already been “justified” will cause the row to be cleared prior to the display of the newly received character and any subsequent characters. Receipt of a justification command which changes the last received justification for a given window will cause the window to be cleared.

9.10.2 Print Direction

At a minimum, decoders must support LEFT_TO_RIGHT printing.

9.10.3 Scroll Direction

At a minimum, decoders must support BOTTOM_TO_TOP scrolling.

For windows sharing the same horizontal scan lines on the display, scrolling may be disabled.

9.10.4 Scroll Rate

At a minimum, decoders must support the same recommended practices for scroll rate as is provided for NTSC closed-captioning.

9.10.5 Smooth Scrolling

At a minimum, decoders must support the same recommended practices for smooth scrolling as is provided for NTSC closed-captioning.

9.10.6 Display Effects

At a minimum, decoders must implement the "snap" window display effect. If the window "fade" and "wipe" effects are not implemented, then the decoder will "snap" all windows when they are to be displayed, and the

9.11 DTVCC Section 8.4.11 - Window Colors and Borders

At a minimum, decoders need only to implement borderless windows with solid, black backgrounds (i.e., border type = NONE, fill color = (0,0,0), fill opacity = SOLID), and borderless transparent windows (i.e., border type = NONE, fill opacity = TRANSPARENT).

9.12 DTVCC Section 8.4.12 - Predefined Window and Pen Styles

Predefined Window Style and Pen Style ID's may be provided in the DefineWindow command. At a minimum, decoders should implement Predefined Window Attribute Style 1 and Predefined Pen Attribute Style 1, as shown in Table 19 and Table 20.

Style ID #	Justify	Print Direction	Scroll Direction	Word Wrap	Display Effect	Effect Direction	Effect Speed	Fill Color	Fill Opacity	Border Type	Border Color	Usage
1	LEFT	LEFT -TO- RIGHT	BOTTOM -TO- TOP	NO	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	NTSC Style PopUp Captions
2	LEFT	LEFT -TO- RIGHT	BOTTOM -TO- TOP	NO	SNAP	n/a	n/a	n/a	TRANS- PARENT	NONE	n/a	PopUp Captions w/o Black Background
3	CNTR	LEFT -TO- RIGHT	BOTTOM -TO- TOP	NO	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	NTSC Style Centered PopUp Captions
4	LEFT	LEFT -TO- RIGHT	BOTTOM -TO- TOP	YES	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	NTSC Stlye RollUp Captions
5	LEFT	LEFT -TO- RIGHT	BOTTOM -TO- TOP	YES	SNAP	n/a	n/a	n/a	TRANS- PARENT	NONE	n/a	RollUp Captions w/o Black Background
6	CNTR	LEFT -TO- RIGHT	BOTTOM -TO- TOP	YES	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	NTSC Stlye Centered RollUp Captions
7	LEFT	TOP -TO- BOTTOM	RIGHT -TO- LEFT	NO	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	Ticker Tape

Table 19 - Predefined Window Style ID's

Pre-defined Style ID #	Pen Size	Font Style	Offset	Italics	Underline	Edge Type	Foregrnd Color	Foregrnd Opacity	Backgrnd Color	Backgrnd Opacity	Edge Color	Usage
1	STNDR	0	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	Default NTSC Style*
2	STNDR	1	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	NTSC Style* Mono w/Serif
3	STNDR	2	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	NTSC Style* Prop w/Serif
4	STNDR	3	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	NTSC Stlye* Mono w/o Serif
5	STNDR	4	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	NTSC Style* Prop w/o Serif
6	STNDR	3	NORMAL	NO	NO	UNIFRM	(2,2,2) White	SOLID	n/a	TRANS-PARENT	(0,0,0) Black	Mono w/o Serif, Bordered Text, No BG
7	LEFT	4	NORMAL	NO	NO	UNIFRM	(2,2,2) White	SOLID	n/a	TRANS-PARENT	(0,0,0) Black	Prop. w/o Serif, Bordered Text, No BG

Table 20 - Predefined Pen Style ID's

* NTSC Stlye - White Text on Black Background

9.13 DTVCC Section 8.5.1 - Pen Size

At a minimum, decoders must support the STANDARD pen size, with the implementation of the LARGE and SMALL pen sizes being optional.

The STANDARD pen size should be implemented such that the height of the tallest character in any implemented font is no taller than 1/15 of the height of the safe-title area, and the width of the widest character is no wider than 1/32 of the width of the safe-title area for 4:3 displays and 1/42 of the safe-title area width for 16:9 displays.

The LARGE pen size should be implemented such that the width of the widest character in any implemented font is no wider than 1/32 of the safe-title area for 16:9 displays. This recommendation allows for captions to grow to a LARGE pen size without having to reformat the caption since no caption will have more than 32 characters per row (see Section 8.4.6).

9.14 DTVCC Section 8.5.3 - Font Styles

Although a caption service provider may specify any one of 8 font styles using the **SetPenAttributes** command, decoders need only to implement a single font for caption text display.

Decoders that implement more than one font but do not support a font style specified in the **SetPenAttributes** command should instead display the caption text in the most similar font available. In decoders with only one font (i.e., font style 0, the default), all caption text, regardless of the specified font style, will be displayed in the default font.

In decoders with more than one but less than eight fonts, unsupported font styles should be displayed using an alternate font, giving precedence to the spacing attribute of the indicated font style, if possible. For example, if the specified but unsupported font style is “monospaced with serifs”, the best substitute would be another monospaced font, and the second-best alternative would be a proportionally spaced font with serifs. If the Cursive font style is not supported, an acceptable substitution is an italicized version of an available font.

All supported font styles may be implemented in any typeface which the decoder manufacturer deems to be a readable rendition of the font style, and need not be in the exact typefaces given as examples in Section 8.5.3.

9.15 DTVCC Section 8.5.4 - Character Offsetting

Decoders need not to implement the character offsetting (i.e., subscript and superscript) pen attributes.

9.16 DTVCC Section 8.5.5 - Pen Styles

At a minimum, decoders must implement normal, italic, and underline pen styles.

9.17 DTVCC Section 8.5.6 - Foreground Color and Opacity

At a minimum, decoders must implement solid and flashing character foreground type attributes.

At a minimum, decoders must implement the following character foreground colors: white, black, red, green, blue, yellow, magenta and cyan.

9.18 DTVCC Section 8.5.7 - Background Color and Opacity

Decoders need only implement solid black character backgrounds. It is recommended that this background is extended beyond the character foreground to a degree that the foreground is separated from the underlying video by a sufficient number of background pixels to insure the foreground is separated from the background.

9.19 DTVCC Section 8.5.8 - Character Edges

Decoders need not to implement separate character edge color, opacity, and type attribute control. In this case, there is no separately controlled edge surrounding the body of characters.

9.20 DTVCC Section 8.8 - Color Representation

At a minimum, decoders must support the 8 colors described in Table 21.

Color	Red	Green	Blue
Black	0	0	0
White	2	2	2
Red	2	0	0
Green	0	2	0
Blue	0	0	2
Yellow	2	2	0
Magenta	2	0	2
Cyan	0	2	2

Table 21 Minimum Color List Table

When a decoder supporting this Minimum Color List receives an RGB value not in the list, it will map the received value to one of the values in the list via the following algorithm:

- All one (1) values are to be changed to 0
- All two (2) values are to remain unchanged
- All three (3) values are to be changed to 2

For example, the RGB value (1,2,3) will be mapped to (0,2,2), (3,3,3) will be mapped to (2,2,2) and (1,1,1) will be mapped to (0,0,0).

Table 22 is an alternative minimum color list table supporting 22 colors.

Color	Red	Green	Blue
Black	0	0	0
Gray	1	1	1
White	2	2	2
Bright White	3	3	3
Dark Red	1	0	0
Red	2	0	0
Bright Red	3	0	0
Dark Green	0	1	0
Green	0	2	0
Bright Green	0	3	0
Dark Blue	0	0	1
Blue	0	0	2
Bright Blue	0	0	3
Dark Yellow	1	1	0
Yellow	2	2	0
Bright Yellow	3	3	0
Dark Magenta	1	0	1
Magenta	2	0	2
Bright Magenta	3	0	3
Dark Cyan	0	1	1
Cyan	0	2	2
Bright Cyan	0	3	3

Table 22 Alternative Minimum Color List Table

When a decoder supporting the Alternative Minimum Color List in Table 22 receives an RGB value not in the list (i.e., an RGB value whose non-zero elements are not the same value), it will map the received value to one of the values in the list via the following algorithm:

- For RGB values with all elements non-zero and different - e.g., (1,2,3), (3,2,1), and (2,1,3), the 1 value will be changed to 0, the 2 value will remain unchanged, and the 3 value will be changed to 2.
- For RGB values with all elements non-zero and with two common elements - e.g. (3,1,3), (2,1,2), and (2,2,3), if the common elements are 3 and the uncommon one is 1, then the 1 elements is changed to 0; e.g. (3,1,3) -> (3,0,3). If the common elements are 1 and the uncommon element is 3, then the 1 elements are changed to 0, and the 3 element is changed to 2; e.g. (1,3,1) -> (0,2,0). In all other cases, the uncommon element is changed to the common value; e.g., (2,2,3) -> (2,2,2), (1,2,1) -> (1,1,1), and (3,2,3) -> (3,3,3).

All decoders not supporting either one of the two color lists described above, must support the full 64 possible RGB color value combinations.

9.21 Character Rendition Considerations

In NTSC Closed Captioning, decoders were required to insert leading and trailing spaces on each caption row. There were two reasons for this requirement:

1. to provide a buffer so that the first and last characters of a caption row do not fall outside the safe title area, and

2. to provide a black border on each side of a character so that the "white" leading pixels of the first character on a row and the trailing "white" pixels of the last character on a row do not bleed into the underlying video.

Since caption windows are required to reside in the safe title area of the DTV screen, reason number 1 (above) is not applicable to DTVCC captions. The attributes available in the **SetPenAttributes** command for character rendition (e.g.,character background and edge attributes) provide unlimited flexibilty to the caption provider when describing caption text in an ideal decoder implementation. However, manufacturers need only implement a minimum of pen attributes and font styles. Thus it is recommended that no matter what the level of implementation, decoder manufacturers should take into account the readablility of all caption text against a variety of all video backgrounds, and should implement some automatic character delineation when the individual control of character foreground, background and edge is not supported; and when only a minimum number of font styles are implemented.

9.22 DTVCC Section 8.9 - Service Synchronization

Service Input Buffers must be at least 128 bytes in size. Caption providers must keep this lower limit in mind when following Delay commands with other commands and window text. In other words, no more than 128 bytes of DTVCC commands and text should be transmitted (encoded) before a pending Delay command's delay interval expires.

9.23 DTV to NTSC Transcoders

It is anticipated that receiver (decoder) manufacturers will develop devices (e.g., settop boxes) which process an DTV stream and transcode it for display on NTSC monitors. The DTVCC command set is not necessarily transcodable to NTSC captions; i.e., there are DTVCC captions which have no NTSC equivalent.

Although receiver manufacturers are free to attempt an automatic transcode of the captions, there is no guarantee that the captions will appear as the caption provider intended. Caption providers apply many techniques to make the captions easy to read and as unobtrusive as possible over the underlying video. To maintain caption quality during an automated transcode process, a set of conversion rules would have to be defined which cover all possible window, pen and text attribute combinations.

Therefore, a separate NTSC caption channel was added to the Picture User Data (see Section 4.3). This channel allows caption providers to encode dual caption streams within the same programming. NTSC captions are under the complete control of the caption provider; and thus, no automated transcoding of captions is necessary.