

# SMPTE RECOMMENDED PRACTICE

## Conversion from CEA-708 Caption Data to SMPTE-TT



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## Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Operations Manual.

SMPTE RP 2052-11 was prepared by Technology Committee 24TB.

## Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

## Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

In North America, CEA-708 is in broad use as a distribution format for closed captioning and related data. In the United States (US), for digital transmission via Cable and Terrestrial Transmission, where captions are present, it is required by regulation.

Although not directly used as an authoring format, the syntax of CEA-708 is in widespread use. Most or all 708 captions are converted from 608 by machine. Arguably, SMPTE RP 2052-10 is sufficient to cover today's practices, since converting both would theoretically result in substantively the same SMPTE-TT. However, it appears that US regulatory activity could alter this state of authoring and having a well-defined conversion between 708 and SMPTE-TT would facilitate US Broadcast Television and Internet content interoperability early in adoption.

There are different levels of CEA-708 implementation and regulation that are useful background for the SMPTE RP 2052-11 audience.

1. CEA-708 has a full toolkit useful for comprehensive authoring and transmission of caption (and subtitle) data. Multiple languages, on-screen windows, etc are supported. This is referred to as "full-708", profile. It is proposed that SMPTE RP 2052-11 provide the necessary conversion tools to populate the SMPTE ST 2052-1 syntax and losslessly tunnel the 708 stream (including support for its CEA-608 compatibility bytes).
2. CEA-708 decoders, when compliant with FCC rules, support a limited toolkit and have constraints expected on the incoming data stream. These restrictions should have no impact to SMPTE RP 2052-11 other than informative notes for clarity. Incoming streams that are constrained should be maintained as such through the SMPTE RP 2052-11 conversion.

The primary use case is a tunnel to a target device that has MPEG-2 TS output capability and the 708 information needs to be reconstructed.

Requirements consist of the following:

1. Support the conversion of 'full-708' into SMPTE ST 2052-1
2. Provide for a lossless tunnel (using the SMPTE ST 2052-1 tunnel mechanism) of 708 cc\_data() data structure including 608 compatibility bytes and other signaling.
3. Support both file-based and real-time streaming scenarios.

## 1 Scope

This document defines the preferred method of converting from CEA-708 data as defined in CEA-708 into SMPTE-TT (as defined in SMPTE ST 2052-1). This document details how such a conversion can be made, and defines some constraints on the process so that the resulting SMPTE-TT file is interoperable between SMPTE-TT implementations.

## 2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

## 3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this recommended practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this recommended practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

CEA-708-D, Digital Television (DTV) Closed Captioning

SMPTE ST 2052-1:2013, Timed Text Format (SMPTE-TT)

Unicode Consortium, Unicode 6.0.0, <http://unicode.org/versions/Unicode6.0.0/>

## 4 Definitions and Acronyms

### 4.1 Definitions

**CEA-608:** The term is used in this document to refer to the CEA-608 standard or to a data stream complying to that standard, depending on context. CEA 608 closed captions are composed of a byte sequence which is carried embedded in a video signal, and which when played on a suitably equipped video device creates text captions on the display.

**CEA-708:** The term is used in this document to refer to the CEA-708 standard or to a data stream complying to that standard, depending on context. CEA 607 closed captions are composed of a byte sequence which is carried embedded in a compressed video stream, and which when played on a suitably equipped video device creates text captions on the display.

**Chunk:** A segment of a media timeline that forms part of a larger contiguous sequence of timeline segments where each segment has a 1 to 1 mapping with a SMPTE-TT document.

**Namespace:** Mechanism for scoping the definitions of names in an XML document.

**Presentation Processor:** Hardware or software that creates a visible rendition of a document as defined in W3C TTML.

### 4.2 Acronyms

**CEA:** Consumer Electronics Association

**FCC:** (US) Federal Communication Commission

**SMPTE-TT:** SMPTE Timed Text

**TTML:** (W3C) Timed Text Markup Language

**W3C:** World Wide Web Consortium

**XML:** eXtensible Markup Language

## 5 CEA-708 Data Mapping to SMPTE-TT

### 5.1 Introduction

This document defines a conversion from CEA-708 data into a SMPTE-TT document (or series of document chunks) that will, when presented using a conforming SMPTE-TT Presentation Engine, give a functionally equivalent display. In most cases there will be no single correct conversion, but multiple possible interpretations that will generate a similar outcome when rendered. The constraints given in this document are intended to promote consistency amongst implementations of SMPTE-TT processors and to improve interoperability of SMPTE-TT files when displayed on those different implementations.

CEA-708 data can be obtained primarily from digital video streams (MPEG-2 or H.264). It can also come from other methods such as directly from caption authoring file formats, although most CEA-708 data at this writing is converted from CEA-608. Many input formats may be acceptable so long as they enable the same `cc_data()` structure recreated by a presentation processor from tunneled data to conform to the CEA-708 standard.

There is no detailed buffering model for CEA-708 except to note that off-screen compositioning and rendering is required for all windows, in addition to the display memory. The text which is mapped to SMPTE-TT corresponds to the final text placed in the current display memory.

5.2 Conversion Constraints

SMPTE-TT documents converted from CEA-708 data shall have the constraints defined in Section 5 of this specification. The process of conversion from a specific CEA-708 data stream may lead to a number of possible SMPTE-TT documents; no unique conversion is defined by this document.

Although the US FCC regulations define minimum decoder functionality (in affect a strict profile of CEA-708), the conversion defined in this specification is a full conversion of CEA-708 except as noted. If the input is known to conform to the FCC minimum decoder functionality, the converter can set the metadata fccMinimum attribute.

5.3 SMPTE Namespaces for CEA-708

TTML allows for metadata to be added in private namespaces. The namespace for the extensions, including metadata, defined in this document shall be as defined in Table 1. An informative XML schema is defined in SMPTE RP 2052-11b.

When a prefix is used, SMPTE-TT documents should use the namespace prefix in Table 1. Although this prefix is used in examples throughout this specification the m708 namespace can also be the default. Also, it is assumed that if a full namespace declaration is not given in an example XML fragment in this document then the namespace in Table 1 is set in an outer context in the surrounding XML.

Table 1 – Namespace and Prefix

| Prefix | Namespace                                                                                                                             |
|--------|---------------------------------------------------------------------------------------------------------------------------------------|
| m708:  | <a href="http://www.smpte-ra.org/schemas/2052-1/2013/smpte-tt#cea708">http://www.smpte-ra.org/schemas/2052-1/2013/smpte-tt#cea708</a> |

5.4 Converting Metadata Information

The URI used for the origin attribute shall be:

http://www.smpte-ra.org/schemas/2052-1/2013/smpte- tt#cea708.

The attributes defined in this section should be added to the <smpte:information> element to encode the CEA-708 metadata for the caption service that was converted.

Additionally, when tunnel data is present, the metadata for all caption services should be encoded in the <m708:service> elements within the <smpte:information> element.

5.4.1 <m708:service> Element

This element should be used to convey the 708 metadata as defined in CEA-708, Section 4. One element shall be used for each caption service. It is a simple type with various attributes defined in this section. It is a child only of <smpte:information> (contained in <metadata>).

### 5.4.2 m708:number Attribute

This is the service number.

|              |                                 |
|--------------|---------------------------------|
| Type         | unsigned integer                |
| Values:      | 1-31 inclusive                  |
| Initial:     | none                            |
| Applies to:  | m708:service, smpte:information |
| Inherited:   | no                              |
| Percentages: | N/A                             |
| Animatable:  | none                            |

### 5.4.3 xml:lang Attribute

This is the service language as defined by XML.

### 5.4.4 m708:aspectRatio Attribute

This is the aspect ratio.

|              |                                 |
|--------------|---------------------------------|
| Type         | enumeration                     |
| Values:      | 4:3 or 16:9                     |
| Initial:     | none                            |
| Applies to:  | m708:service, smpte:information |
| Inherited:   | no                              |
| Percentages: | N/A                             |
| Animatable:  | none                            |

### 5.4.5 m708:easyReader Attribute

This is “easy reader”.

|              |                                 |
|--------------|---------------------------------|
| Type         | Boolean                         |
| Values:      | true or false                   |
| Initial:     | none                            |
| Applies to:  | m708:service, smpte:information |
| Inherited:   | no                              |
| Percentages: | N/A                             |
| Animatable:  | none                            |

### 5.4.6 m708:fccMinimum Attribute

If the converter has knowledge that the service that has been converted conforms to the FCC minimum decoder functionality as defined in US 47CFR79.102, then this flag should be set.

|              |                                 |
|--------------|---------------------------------|
| Type         | boolean                         |
| Values:      | true or false                   |
| Initial:     | false                           |
| Applies to:  | m708:service, smpte:information |
| Inherited:   | no                              |
| Percentages: | N/A                             |
| Animatable:  | none                            |