

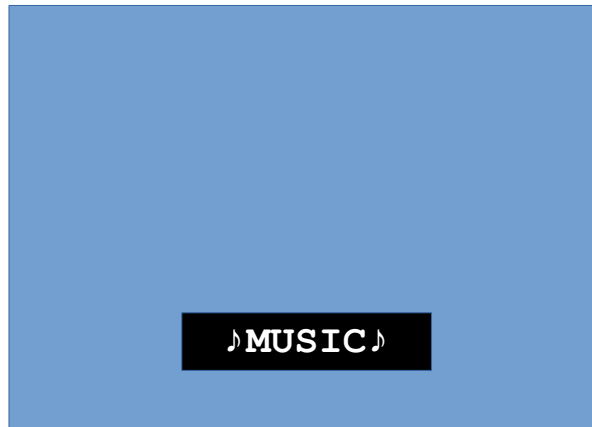
CEA-608 / CEA-708 Transmission

- Baseband / In-picture
 - VBI Line 21 (CEA-608 only)
 - VANC in SDI
- Video essence metadata
 - MPEG-2 user data (ATSC A/53)
 - H.264 / H.265 SEI (A/72)
- Track metadata
 - QuickTime CEA-608/708 CC tracks
 - MXF SMPTE 436m VBI/VANC track
- Sidecar files
 - SCC (CEA-608 only)
 - MCC (CEA-708 / 608)
 - Other proprietary formats (Cheetah CAP, etc.)

CEA-608 Capabilities

- 2 bytes per frame (480 bps @ 29.97 fps)
- On & Off-screen buffers
- 32x15 character grid (vs. 40x24 for Teletext)
- Fixed size monospace font
- Latin + Western European character set
- Max 4 simultaneous languages (but effectively only 2)
- Also carries content rating (V-chip) and program metadata (XDS)

CEA-608 Example



Frame	0	1	2	3	4	5	6	7	8	9
2 Data Bytes	9420	9476	97a1	9137	cdd5	d349	4380	9137	942c	942f
Meaning	Pop-on mode	Row 15	TAB Indent	♪	MU	SI	C	♪	Clear Screen	Display Caption

Contrast with timed text format e.g. TTML, which is a document containing markup and text, and is mostly human readable:

```
<p region='pop1' begin='00:00:00:09' end='00:00:02:01'>♪MUSIC♪</p>
```

Limitations of CEA-608 Technology

- 2 bytes per frame means data for one caption must be accumulated over many frames
 - Problems with first dialogue after a cut
 - Big challenge when editing clips containing CC
 - Very constrained when captioning in multiple languages
- Character set
 - Support for alternate sets is in use but not universally supported, e.g. South Korea

Limitations of CEA-608 cont'd

- SCC file format is not ideal for caption interchange
 - No header metadata
 - Not intended for frame rates other than 29.97 fps
 - Only one field of CEA-608 data (max 2 languages instead of 4)
 - No CEA-708 data
 - Source of many common timing issues (DF / NDF drift)
- “MCC” file format designed to overcome these limitations
 - Supported by Adobe Premiere, Blackmagic, Ateame, Telestream, Manzanita products, Imagine Nexio

CEA-708 Capabilities

- Higher bandwidth 9600bps (vs. 480 bps)
- Max 6 simultaneous services (languages)
- 42x15 character grid option (vs. 32x15)
- Can position over entire 16x9 screen
- More font options, including proportional
- Extension for 16-bit Unicode characters
- Includes CEA-608 for backwards compatibility

CEA-708 Limitations

- Most captions authored as 608 and converted to 708 at the broadcast encoder
- Most 708 features go unused because they are harder to author and QC
- Later revisions of spec recommend against using some features (e.g. limited to 32 columns in 42 column mode)
- Relative lack of native 708 authoring software (Telestream MacCaption)
- Relative lack of QC tools that support all 708 features (Telestream Switch)
- Lack of TVs / consumer decoders that support all features, especially Unicode characters