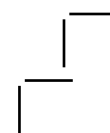
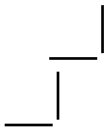


Closed Caption Monitoring & Analysis

Quick Start Guide

Tektronix[®]





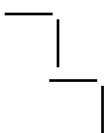
Quick Start Guide

Quick Start Guide

Let Tektronix guide you through the ABC's of closed caption monitoring and analysis. We'll provide a background on the FCC rules and the requirements for establishing best practices. In addition, we will provide some troubleshooting tips and real world examples to help you stay in compliance and keep your customers happy.

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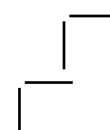
Background

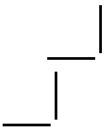
FCC Title 47 went into effect on March 16, 2015, ensuring that viewers who are deaf and hard of hearing have full access to pre-recorded, live and near-live programming. The FCC rules established a requirement for recordkeeping and a procedure for handling formal complaints, but there were no specific metrics or standards listed for measuring compliance. The rules only describe best practices and the requirements for that including caption accuracy, synchronicity with the audio, completeness and placement of captions.

- **Accurate:** Captions must match the spoken words in the dialogue and convey background noises and other sounds to the fullest extent possible.
- **Synchronous:** Captions must coincide with their corresponding spoken words and sounds to the greatest extent possible and must be displayed on the screen at a speed that can be read by viewers.
- **Complete:** Captions must run from the beginning to the end of the program to the fullest extent possible.
- **Properly placed:** Captions should not block other important visual content on the screen, overlap one another, or run off the edge of the video screen.



For Broadcasters, FCC enforcement of the new rules will happen at the transmission point, or Over-the-Air signal. Broadcasters now have a tighter mandate for ensuring locally produced content is captioned correctly in addition to syndicated and network content. This will require having a monitoring system that can establish a tighter alarm threshold for local news than network sourced content. Having closed caption alerts tied to time periods will allow the broadcaster to set up multiple times during a weekly schedule when captions have a tighter monitoring spec to meet the new FCC closed captioning monitoring requirements.





Closed Caption Workflow

The diagram below shows the steps in the closed caption workflow.

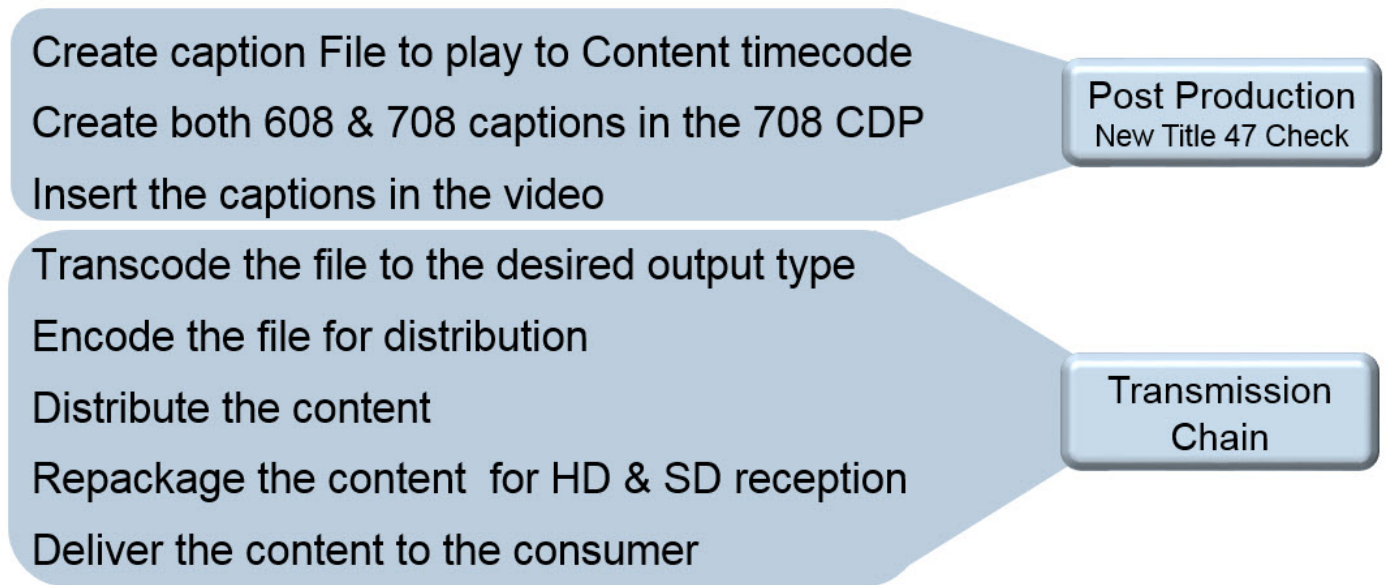
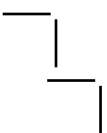
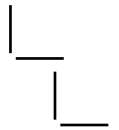


Figure 1. Closed Caption Workflow.





Troubleshooting

There are a number of things that can go wrong throughout the closed caption workflow resulting in no captions present, captions appearing at the wrong time and captions not ordered correctly, for example. The below outline shows examples of how errors get introduced from caption creation to network playout, when the content is delivered to the customer.

I. Caption Creation

- a. Setting timecode incorrectly
 - i. Impact: Captions will be out of time or they never get inserted
- b. Caption inserter configured with wrong settings (ex: 1080p for a 1080i file)
 - i. Impact: Most caption decoders will show scrambled captions

II. Network Acquisition

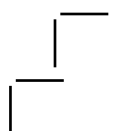
- a. Incorrect formatting of 1080 to 720 Conversion. (Note: If the program is 1080i but the transmission format is 720p, you have to repackage the captions with new headers in order to maintain the correct baud rate.)
 - i. Impact: Most caption decoders will show scrambled captions
- b. Caption Packet errors due to data hits
 - i. Impact: Most caption decoders will show scrambled captions
- c. Incorrect setting of network components drop or mangle the caption data

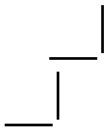
III. File Ingest to play-out server

- a. Caption dropped due to incorrect setting not capturing the caption data
 - i. Impact: No captions at all
- b. Caption Packet errors due to data hits
 - i. Impact: Most caption decoders will show scrambled captions

IV. Network playout

- a. Incorrect setting of network components drop or mangle the caption data
 - i. Impact: Most caption decoders will show scrambled captions





What do you do when you get a complaint?

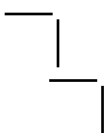
First you should check to see if you can reproduce the error from either the customer's point of view (set-top box or TV) or from a test point at the output of the system. If you can duplicate the error, go to a midway point in your system to see if the caption error continues. As you troubleshoot the caption error you may need to look at several types of media within your system including QAM, IP, files and SDI. It's important to have the proper monitoring and analysis tools to look at these different types of media at various points on your network.

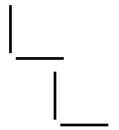
Tools to help prevent complaints

Fortunately, there are a number of closed captioning monitoring and analysis tools available for broadcasters and other video service providers. Here are some guidelines for choosing a solution that addresses the accuracy, synchronicity, completeness and placement requirements defined in the FCC rules.

Real-time Monitoring

- The ability to monitor, alert and report on the availability and quality of closed captions across all channels in real-time. You need to check that the captions are present and not in error. If they are in error, you need to know the percent of time they were in error and the reason for the error.
- The ability to perform closed captioning tests related to syntax, parity and sequencing.
 - 608 control words sent twice
 - 708 abnormal service block structure, length and size
 - 608 writing past the end of the text box (command sequence errors)
 - 608 writing past the bottom of a text box (missing command errors)
 - 608 roll-up errors/command errors
 - 708 illegal character values
 - 708 abnormal delays
 - 608 short/long duration (Presentation Time Error)
 - 608 Pop-On Presentation / Command Errors
 - 708 Writing past the boundaries of the window
 - Abnormal window size, characters, position data
- Depending on the size of the network, it may be helpful to understand if errors are occurring on a local, regional or national level. This will help to highlight where the errors are being generated.





Closed Caption Monitoring & Analysis

File-based Monitoring

Here are the types of errors a file-based monitoring system should catch:

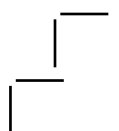
- Missing captions
- Not the same number of services in 608 and 708
- 708 Caption row exceeds length
- Illegal Character in 608 Closed Caption Data
- Illegal Window Command Code in Closed Captions
- Closed Caption data exceeds maximum bandwidth
- Illegal Character in 708 Closed Caption Data
- Caption windows overlap (Warning)
- DTV cc_data structure reserved bits set incorrectly
- Truncated caption data packet found
- Incorrect caption data ordering
- Incorrect packet sequence number
- Service descriptor null in the CDP

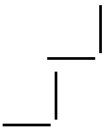


Waveform Monitoring

A waveform monitor can help with the following:

- Being able to view Both 608 & 708 at the same time
- Being able to ID strange text blank lines
- View that the Text is in sync with the Video
- Service counts same in 608 & 708
- Caption Data Packet (CDP) lengths





Quick Start Guide

Off-line Deep-Dive Analysis

Figures 2 and 3 below provide examples of the information a deep dive analysis tool should show you.

Content	Network	TV Station HD Feed	Cable SD Feed
Rate	1080i	720P	525i
608	Roll Up	Roll Up	Roll Up
708	Visible	Visible	NA
Errors			
608	Columns Exceed Maximum - Characters will be Overwritten	Columns Exceed Maximum - Characters will be Overwritten	Columns Exceed Maximum - Characters will be Overwritten
708	Caption Buffer Cleared without Presentation	Caption Buffer Cleared without Presentation	NA
608	Pop On	Pop On	Pop On
708	Not Visible	Not Visible	NA
Errors			
608	None	Field 1 Data is Missing	None

Figure 2. MPEG Analysis Diagram.

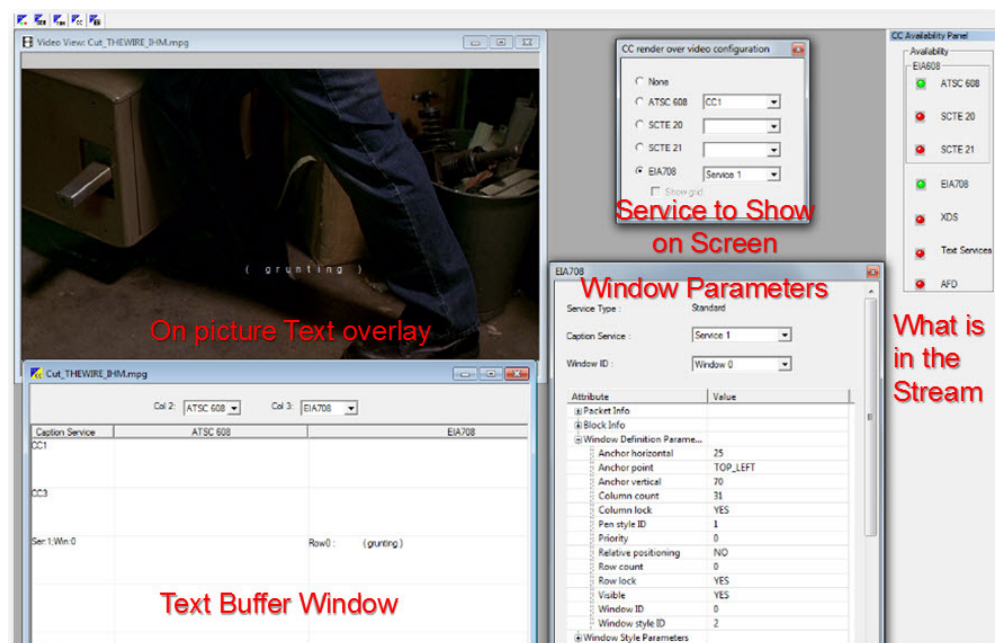
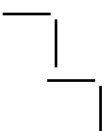
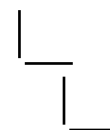


Figure 3. MPEG Caption Decode and Analysis.





Real World Examples

Here are some real world examples of the different types of caption issues you might experience.

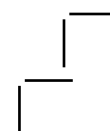


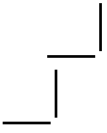
Figure 4. No captions at all.



Figure 5. Captions on top of Captions, Garbled Captions.

If the 708 captions are Not cleared or toggled to remove them off the screen the next set of captions will be placed on top of them.

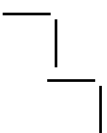


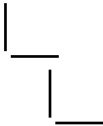


Quick Start Guide



Figure 6. Caption Issues Viewed on a TV / Monitor



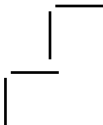


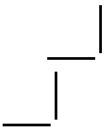
Blank line
As Viewed
on waveform
Monitor **RED**
text indicates
Issue with
Captions

Active Log Filter: All 01/20/2015 Page 1 of 1

	Source	Error Status	Timecode	Time
⚠	SDI 1A	CEA708 Caption Error (CC text obscured)	00:05:33:06	14:57:00
⚠	SDI 1A	CEA708 Caption Error (CC text obscured)	00:05:33:07	14:57:00

Figure 7. Caption Issues





Best Practice for Caption Compliance

SDI Domain: It is important to verify that the SD (608) and HD (708) captions are present and correct in the video. You should also check for the new rules: accuracy, synchronicity (timing), program completeness, and placement of the captions.

File Domain: It is important to check that the 608 and 708 captions are still intact. There are over 30 types of syntax and structure checks that can be performed to make sure the data has not been mangled in the transcode.

File Based Testing: Within a file based system, the files are copied or transferred to a Watch Folder. The data goes from the Watch Folder to the QC System where it is checked and verified. If everything looks OK, it will move on to a "Passed" location. If not, the data is sent to a "Quarantine" location and an email is sent with the details regarding the error. See Figure 8 below.

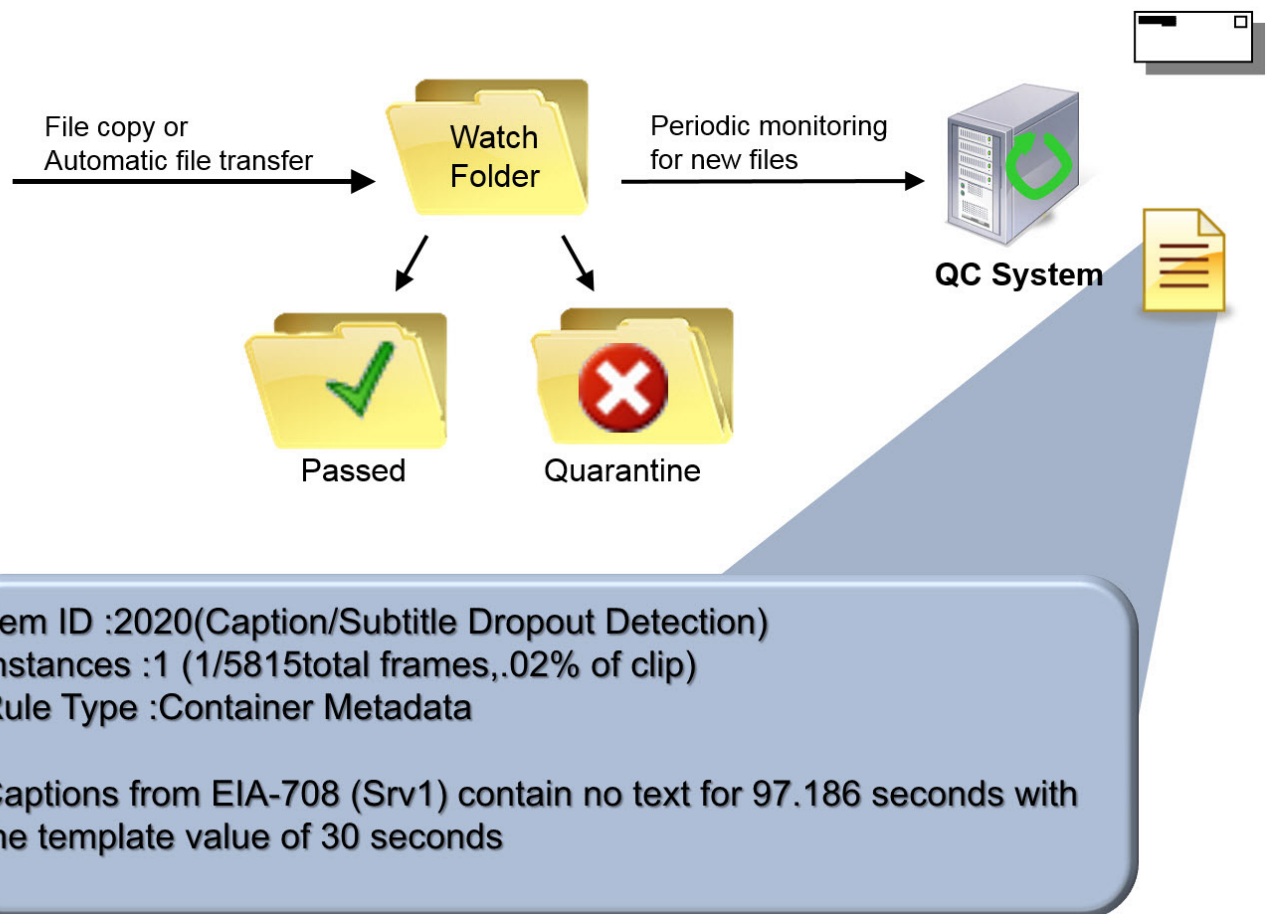
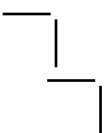


Figure 8. File Based Testing.



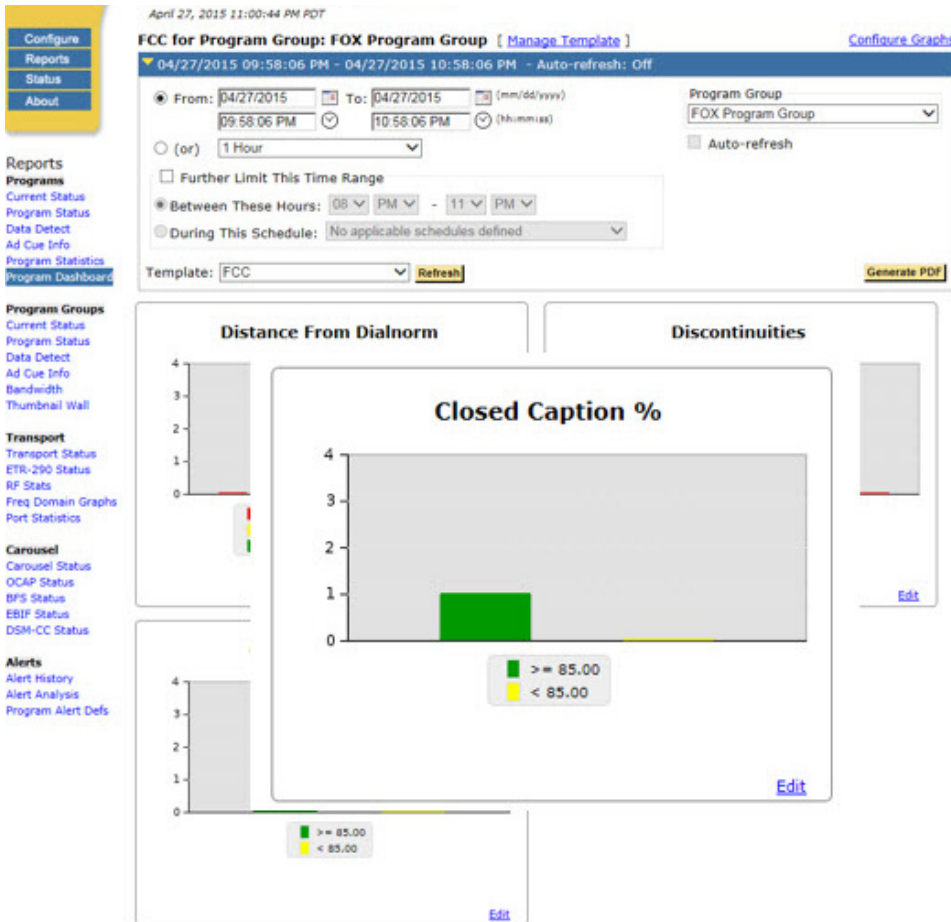


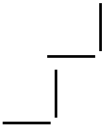
Figure 9. Example of a closed caption report.

Transmission Domain: Just like in the file domain, you want to make sure the 608 and 708 captions are still intact. There are over a dozen types of syntax and structure checks that can be performed to make sure there were no errors introduced in the transmission chain and that the captions are viewable on the end users screen.

Generating reports: There are a number of reports that can be run and customized to help you ensure compliance with the best practices. In Figure 9, a report was run to show whether captions were generated greater than 85% of the time.

Conclusion

The final resolution of the new closed caption rules will be determined by the viewer and to what level they could be annoyed enough to file a complaint. Unfortunately the entire reason the FCC never identified a compliance rule is that a caption decoders' capabilities vary greatly between consumer devices. Some devices just do what the standard says, while others will try to show some bad captions on the screen. Since not all devices will show captions the same way, it is imperative that broadcasters have all the essential tools in place to make sure the captions are compliant with the FCC's new best practice rules.



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Contact List Updated June 2013

For Further Information

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com



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