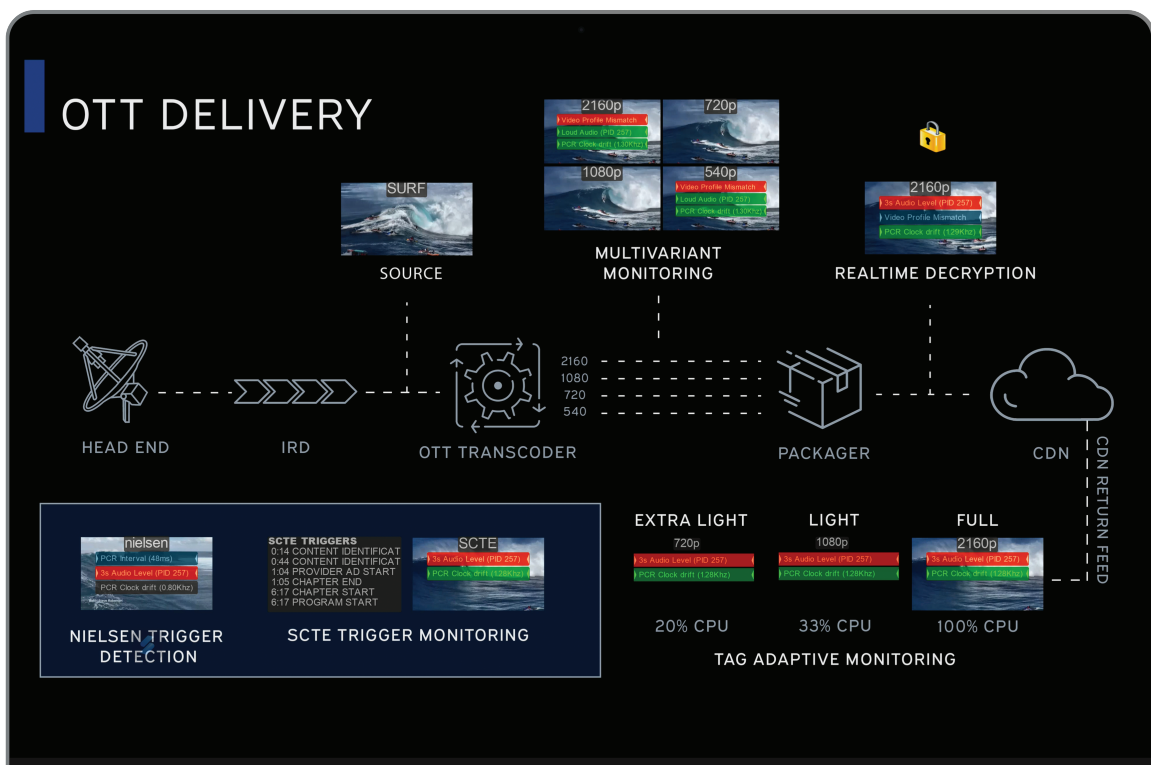
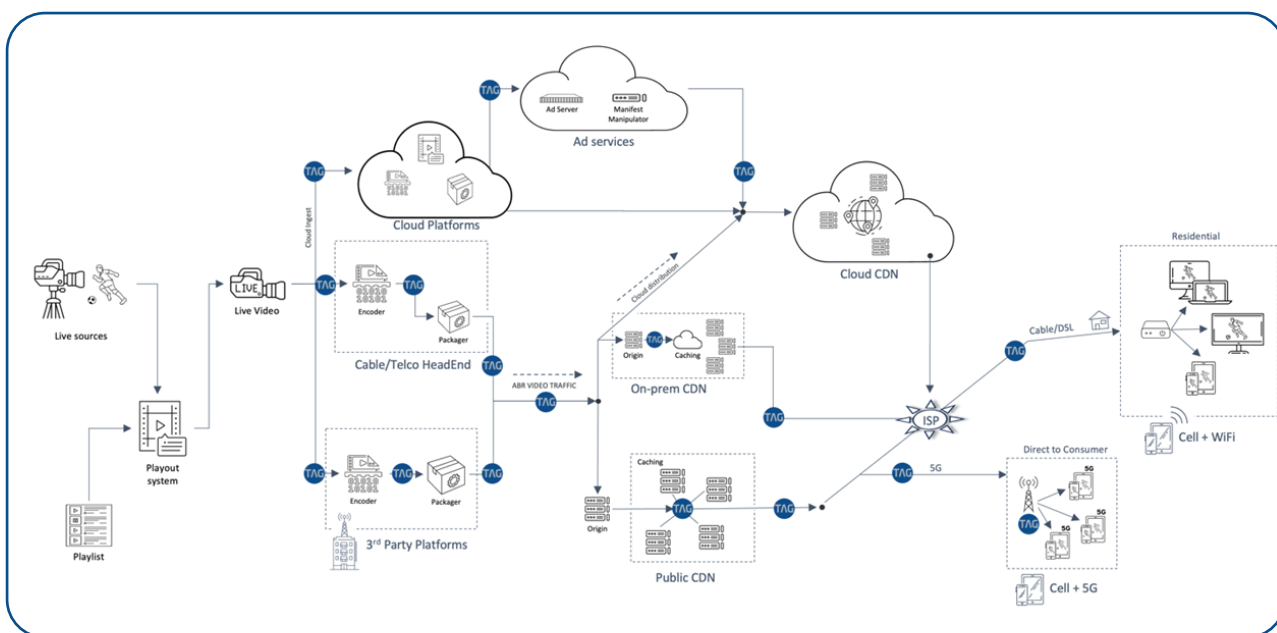


OTT WORKFLOW MONITORING: BEST PRACTICES



OTT WORKFLOW MONITORING: BEST PRACTICES

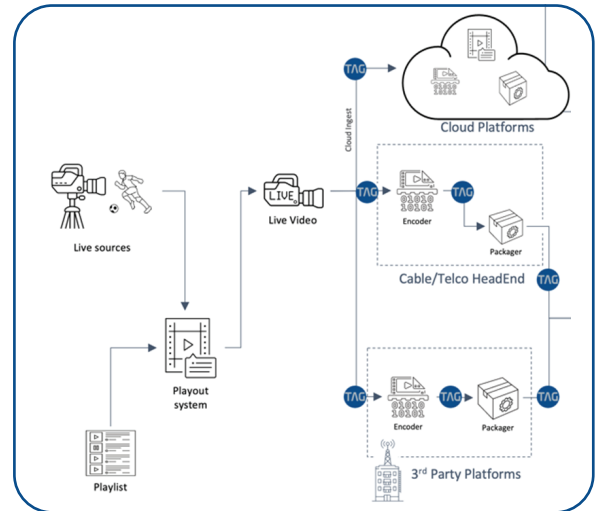
Effective monitoring across the OTT workflow is essential for maintaining high-quality content delivery. This involves establishing strategic monitoring setups at various stages of the delivery chain, from content acquisition to DRM/metadata to include the whole end-to-end infrastructure. This guide provides best practices for setting up a monitoring system at each critical point in the workflow, ensuring issues are promptly identified and resolved to maintain content integrity and service quality.



Content Acquisition and Playout System:

- What to Monitor: Source content acquisition, live feeds, and playout system
- Why Are We Monitoring: Ensures the integrity of the original content and checks for issues in live feeds
- Probing Point Actions: Real-time monitoring for signal integrity, frame rate, and resolution

Configure monitoring at the Content Acquisition and Playout System to ensure the quality of source feeds. Implement real-time monitoring to assess signal integrity, frame rate, and resolution. This stage is crucial for maintaining the quality of the content at the start of the workflow.



Thresholds/Alarms

- We recommend monitoring **video, audio, subtitles**, and possibly **SCTE markers** to make sure originally received stream is good quality and complies with all internal relevant requirements. For example, ensuring the stream includes audio tracks for all of the different available languages for the specific programming and associated subtitles.
- The major thresholds are relevant to video: **black video, video freeze, blocking, bars and no video.**

| # ↑ | Label | Group | Standard | Threshold | Severity | Record | Default |
|-----|---|-------|----------|-----------|----------|--------|---------|
| 38 | Black frame detection | Video | All | 12500 ms | Major | OFF | ON |
| 43 | Detect decoding errors | Video | All | | Major | OFF | ON |
| 49 | Black frame with logo detection | Video | All | 12500 ms | Major | OFF | ON |
| 59 | Freeze frame | Video | All | 12500 ms | Major | OFF | ON |
| 60 | No Video | Video | All | 1500 ms | Critical | OFF | ON |
| 84 | Video bitrate, max threshold | Video | All | 25 % | Notice | OFF | ON |
| 85 | Video bitrate, min threshold | Video | All | 15 % | Notice | OFF | ON |
| 116 | Detect color-space mismatch (ex. YU...) | Video | All | | Critical | OFF | ON |

| | | | | | | | |
|-----|----------------------------------|-------|-----|-------------|----------|-----|----|
| 134 | Missing SPS | Video | All | 4000 ms | Critical | OFF | ON |
| 172 | Video blocking detection - scene | Video | All | 50 relative | Minor | OFF | ON |
| 173 | Video blocking detection - peak | Video | All | 50 relative | Minor | OFF | ON |
| 229 | HDR SEI data | Video | All | | Disabled | OFF | ON |
| 230 | HDR SEI data missing | Video | All | 10 sec | Disabled | OFF | ON |
| 234 | Video PTS variance detection | Video | All | | Disabled | OFF | ON |
| 320 | Missing AFD | Video | All | | Disabled | OFF | ON |
| 321 | AFD Value Changed | Video | All | | Disabled | OFF | ON |
| 374 | Detect Video Bars | Video | All | 2000 ms | Major | OFF | ON |

- For audio we will most importantly monitor **silence/no audio** and then additional thresholds based on type (i.e **dolby**) and if it was **uncompressed also audio phasing**.

| # ↑1 | Label | Group | Standard | Threshold | Severity | Record | Default |
|------|---|-------|----------|-----------|----------|--------|---------|
| 61 | No Audio | Audio | All | 2000 ms | Critical | OFF | ON |
| 62 | Audio Silence | Audio | All | 5000 ms | Critical | OFF | ON |
| 63 | Audio Phase | Audio | All | 60000 ms | Major | OFF | ON |
| 73 | True-peak audio level above X dBTP | Audio | All | -1 dBTP | Major | OFF | ON |
| 74 | Short term (3sec) audio level above ... | Audio | All | -6 LUFS | Major | OFF | ON |
| 86 | Audio bitrate, max threshold | Audio | All | 24 % | Notice | OFF | ON |
| 87 | Audio bitrate, min threshold | Audio | All | 14 % | Notice | OFF | ON |
| 107 | Detect Mono audio (on streams with ... | Audio | All | 120000 ms | Notice | OFF | ON |

- This monitoring allows us even to troubleshoot the workflow because, obviously, if the source is bad, it will be bad throughout.

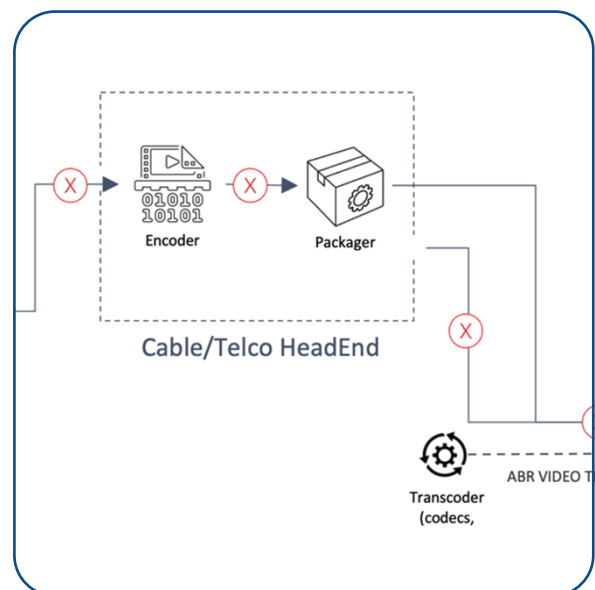
Encoders:

- What to Monitor: Encoding process for format conversion and compression
- Why Are We Monitoring: Verifies proper encoding to avoid quality degradation and format incompatibility
- Probing Point Actions: Check for compression artifacts and conformity to specified codecs and resolutions

Set up the monitoring system to scrutinize the encoding process, focusing on compression and format conversion. Include checks for compression artifacts and verify codec compliance and resolution accuracy. Proper monitoring at this stage prevents quality degradation and format incompatibility.

There are two common formats of Packager created wrapping of compressed sources: DVB (Digital Video Broadcasting – European Consortium) and ATSC (Advanced Television Systems Committee – American set).

DVB is often used for satellite and fiber feeds of signals, there are recommended set of thresholds for SDT, BAT, EIT, NIT, AIT, TDT tables used in this standard.



Threshold Configuration

Label
Default

| # ↑1 | Label | Group | Standard | Threshold | Severity | Record |
|------|---|----------|----------|------------|----------|--------|
| 146 | STT Table error | STT, RRT | ATSC | | Critical | OFF |
| 147 | STT accuracy error | STT, RRT | ATSC | 5 sec | Critical | OFF |
| 148 | STT Table missing | STT, RRT | ATSC | 10000 ms | Major | OFF |
| 149 | STT Table repetition rate too slow | STT, RRT | ATSC | 1000 ms | Major | OFF |
| 154 | RRT Table missing | STT, RRT | ATSC | 120000 ... | Major | OFF |
| 155 | RRT Table repetition rate too slow | STT, RRT | ATSC | 60000 ms | Major | OFF |
| 159 | RRT is illegal | STT, RRT | ATSC | | Major | OFF |
| 160 | STT is illegal | STT, RRT | ATSC | | Major | OFF |
| 170 | RRT CRC change (Monitor changes to RRT crc) | STT, RRT | ATSC | | Critical | OFF |
| 171 | RRT Version Change | STT, RRT | ATSC | | Major | OFF |

- Starting off the recommended SDT (Service Description Table), and BAT (Bouquet Association Table) Thresholds, all alarms on these sub-tables of DVB are either Critical or Major
- The DVB's EIT (Event Information Table) is an optional table, but if it is enabled 'after scan' we recommend these alarms.

Threshold Configuration

Label
Default

| # ↑1 | Label | Group | Standard | Threshold | Severity ↑2 | Record |
|------|--|-------|----------|-----------|-------------|--------|
| 41 | EIT actual not found | EIT | DVB | 5000 ms | Major | OFF |
| 42 | EIT actual repetition rate too slow | EIT | DVB | 2250 ms | Major | OFF |
| 44 | EIT other not found | EIT | DVB | 20000 ms | Notice | OFF |
| 45 | EIT other repetition rate too slow | EIT | DVB | 11000 ms | Minor | OFF |
| 46 | EIT Actual Version Change | EIT | DVB | | Major | OFF |
| 47 | EIT Schedule Actual not found | EIT | DVB | 20000 ms | Disabled | OFF |
| 48 | EIT Schedule Actual repetition rate too slow | EIT | DVB | 11000 ms | Disabled | OFF |

| | | | | | | |
|-----|---|-----|-----|----------|----------|-----|
| 51 | EIT Schedule Other repetition rate too slow | EIT | DVB | 30000 ms | Disabled | OFF |
| 53 | Table ID error on PID 0x12 (EIT) | EIT | DVB | | Critical | OFF |
| 79 | EIT is illegal | EIT | DVB | | Critical | OFF |
| 100 | CC errors on EIT | EIT | DVB | 1 CC/sec | Critical | OFF |
| 139 | Service EIT not found | EIT | All | 5000 ms | Notice | OFF |

- DVB's NIT (Network Information Table) gives information on organization of multiplexes carried via network.

Threshold Configuration

Label: Default

| # ↑1 | Label | Group | Standard | Threshold | Severity ↑2 | Record |
|------|---------------------------------------|-------|----------|-----------|-------------|--------|
| 27 | NIT Actual not found | NIT | DVB | 20000 ms | Minor | OFF |
| 28 | NIT Actual repetition rate too slow | NIT | DVB | 10000 ms | Minor | OFF |
| 30 | NIT Other repetition rate too slow | NIT | DVB | 10000 ms | Minor | OFF |
| 31 | Table ID error on PID 0x10 (NIT) | NIT | DVB | | Major | OFF |
| 78 | NIT is illegal | NIT | DVB | | Critical | OFF |
| 103 | CC errors on NIT | NIT | DVB | 1 CC/sec | Critical | OFF |
| 174 | Carrier ID field missing | NIT | DVB | 30000 ms | Disabled | OFF |
| 175 | Carrier ID Repetition rate | NIT | DVB | 2000 ms | Minor | OFF |
| 176 | Carrier ID illegal | NIT | DVB | | Major | OFF |
| 177 | Carrier ID mismatch (not as expected) | NIT | DVB | | Major | OFF |

- DVB's AIT (Application Information Table) gives full information on the data broadcast and the required state of applications used.

Threshold Configuration

Label: Default

| # ↑1 | Label | Group | Standard | Threshold | Severity ↑2 | Record |
|------|---------------------------|-------|----------|-----------|-------------|--------|
| 532 | AIT is illegal | AIT | All | | Critical | OFF |
| 533 | AIT repetition too slow | AIT | All | 3000 ms | Major | OFF |
| 534 | Table ID error on AIT PID | AIT | All | | Critical | OFF |
| 535 | AIT is Scrambled | AIT | All | | Critical | OFF |
| 536 | AIT Missing | AIT | All | 5000 ms | Disabled | OFF |

- Finally, the last DVB Table we have alarms on is the TDT (Time and Date Table) time signals are required for smooth playback of DVB streams

Threshold Configuration

Label: Default

| # ↑1 | Label | Group | Standard | Threshold | Severity ↑2 | Record |
|------|------------------------------------|-------|----------|-----------|-------------|--------|
| 54 | Table ID error on PID 0x13 (RST) | TDT | DVB | | Critical | OFF |
| 55 | TDT Not Found | TDT | DVB | 60000 ms | Major | OFF |
| 56 | TDT repetition rate too slow | TDT | DVB | 30000 ms | Major | OFF |
| 58 | Table ID error on PID 0x14 (TDT) | TDT | DVB | | Critical | OFF |
| 80 | TDT is illegal | TDT | DVB | | Critical | OFF |
| 81 | RST is illegal | TDT | DVB | | Critical | OFF |
| 102 | CC errors on TDT/TOT | TDT | DVB | 1 CC/sec | Critical | OFF |
| 180 | TDT Accuracy error | TDT | DVB | 5 sec | Critical | OFF |
| 207 | RST Not Found | TDT | DVB | 60000 ms | Disabled | OFF |
| 208 | RST repetition rate too slow | TDT | DVB | 30000 ms | Major | OFF |
| 209 | RST running status not as expected | TDT | DVB | | Major | OFF |

In North America, a simpler wrapping is used by packagers, especially if OTT streams originated in over-the-air broadcasts; that wrapping standard is ATSC (Advanced Television Systems Committee – American set). Here are thresholds for MGT, VCT, STT, and RTT tables used in this standard.

- ATSC's MGT (Master Guide Table) is the primary description of the stream, and we recommend these thresholds.

Threshold Configuration

Label: Default

| # ↑1 | Label | Group ↑ | Standard | Threshold | Severity | Record |
|------|---|---------|----------|-----------|----------|--------|
| 150 | MGT Table missing | MGT | ATSC | 2000 ms | Major | OFF |
| 151 | MGT Table repetition rate too slow | MGT | ATSC | 150 ms | Major | OFF |
| 156 | MGT Version Change | MGT | ATSC | | Major | OFF |
| 157 | MGT is illegal | MGT | ATSC | | Critical | OFF |
| 163 | MGT CRC change (Monitor changes to MGT crc) | MGT | ATSC | | Critical | OFF |

- ATSC's VCT (Virtual Channel Table) contains a list of attributes for the channels within the stream, most probed element of this table are critical.

Threshold Configuration

Label: Default

| # ↑1 | Label | Group | Standard | Threshold | Severity | Record |
|------|--|-------|----------|-----------|----------|--------|
| 152 | VCT Table missing | VCT | ATSC | 4000 ms | Major | OFF |
| 153 | VCT Table repetition rate too slow | VCT | ATSC | 400 ms | Major | OFF |
| 158 | VCT is illegal | VCT | ATSC | | Critical | OFF |
| 161 | VCT Version Change | VCT | ATSC | | Major | OFF |
| 162 | VCT CRC change (Monitor changes to VCT crc) | VCT | ATSC | | Critical | OFF |
| 164 | VCT Table type mismatch | VCT | ATSC | | Critical | OFF |
| 165 | VCT channel number mismatch (major or minor) | VCT | ATSC | | Critical | OFF |
| 166 | VCT service type mismatch | VCT | ATSC | | Critical | OFF |
| 167 | VCT source id mismatch | VCT | ATSC | | Critical | OFF |
| 168 | Channel missing in VCT | VCT | ATSC | | Critical | OFF |
| 169 | Check for VCT channel short name matching | VCT | ATSC | | Major | OFF |

- ATSC's SST (System Time Table) and RRT (Rating Region Table) are either for packet timing or ratings for multiple geographical regions.

Threshold Configuration

Label: Default

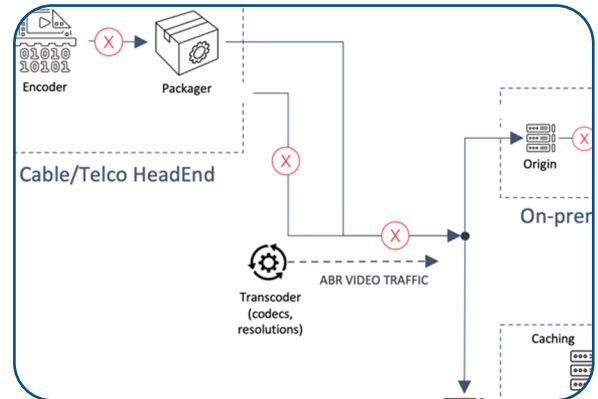
| # ↑1 | Label | Group | Standard | Threshold | Severity | Record |
|------|---|----------|----------|------------|----------|--------|
| 146 | SST Table error | STT, RRT | ATSC | | Critical | OFF |
| 147 | SST accuracy error | STT, RRT | ATSC | 5 sec | Critical | OFF |
| 148 | SST Table missing | STT, RRT | ATSC | 10000 ms | Major | OFF |
| 149 | SST Table repetition rate too slow | STT, RRT | ATSC | 1000 ms | Major | OFF |
| 154 | RRT Table missing | STT, RRT | ATSC | 120000 ... | Major | OFF |
| 155 | RRT Table repetition rate too slow | STT, RRT | ATSC | 60000 ms | Major | OFF |
| 159 | RRT is illegal | STT, RRT | ATSC | | Major | OFF |
| 160 | SST is illegal | STT, RRT | ATSC | | Major | OFF |
| 170 | RRT CRC change (Monitor changes to RRT crc) | STT, RRT | ATSC | | Critical | OFF |
| 171 | RRT Version Change | STT, RRT | ATSC | | Major | OFF |

Transcoders (if applicable):

- What to Monitor: Transcoding operations for multiple formats and bitrates
- Why Are We Monitoring: Ensures availability of content in formats suitable for various devices
- Probing Point Actions: Monitor for successful creation of all required profiles and bitrates

For transcoding operations, extend monitoring to oversee the creation of multiple-format profiles and bitrates. Ensure all required profiles are generated accurately and bitrates align with specified standards. This monitoring ensures content compatibility across various devices and network conditions.

Transcoded OTT signals into HLS and other formats can have numerous errors; the number of these OTT thresholds and alerts is such a large group that three screens are needed to show all the settings, with TAG's recommendation on Critical and Major levels highlighted.



| # | Label | Group | Standard | Threshold | Severity | Record |
|-----|---|-------|----------|-----------|----------|--------|
| 213 | HLS block doesn't start with PAT | OTT | All | | Critical | OFF |
| 214 | HLS block doesn't start with PMT | OTT | All | | Critical | OFF |
| 215 | HLS Block sequence error | OTT | All | | Critical | OFF |
| 216 | HLS Block sequence stopped changing | OTT | All | | Critical | OFF |
| 217 | HLS Profile not found on the master M3U8 file | OTT | All | | Critical | OFF |
| 218 | HLS M3U8 / Mpeg-Dash MPD / MSS ISM parsing er... | OTT | All | | Critical | OFF |
| 219 | HLS/Mpeg-Dash/MSS Block download fail | OTT | All | | Critical | OFF |
| 220 | HLS/Mpeg-Dash/MSS Block download time too long | OTT | All | 10000 ms | Critical | OFF |
| 221 | HLS Profile version not equal to playlist version | OTT | All | | Critical | OFF |
| 222 | HLS Version not as expected | OTT | All | | Critical | OFF |
| 223 | HLS/Mpeg-Dash/MSS download retry (but success... | OTT | All | | Minor | OFF |
| 224 | HLS content not scrambled | OTT | All | | Major | OFF |
| 225 | OTT content scrambled (and not decrypted) | OTT | All | | Major | OFF |
| 226 | RTMP/CTP Connection failure | OTT | All | | Critical | OFF |
| 227 | RTMP/CTP Underrun | OTT | All | | Critical | OFF |

Threshold Configuration

Label: Default

| # | Label | Group | Standard | Threshold | Severity | Record |
|-----|---|-------|----------|-----------|----------|--------|
| 228 | HLS/Mpeg-Dash/MSS Block download started too l... | OTT | All | | Critical | OFF |
| 235 | HLS/Mpeg-Dash/MSS Block shorter from expected... | OTT | All | 1% | Minor | OFF |
| 236 | HLS/Mpeg-Dash/MSS Block longer from expected... | OTT | All | 1% | Minor | OFF |

| | | | | | | |
|-----|--|-----|-----|---------|----------|-----|
| 240 | HLS Block audio vs video PTS mismatch (Neg - au... | OTT | All | 500 ms | Minor | OFF |
| 241 | Compare Video PTS increment with EBP | OTT | All | 5 ms | Critical | OFF |
| 242 | Compare Video PTS/EBP drift | OTT | All | 5 ppm | Critical | OFF |
| 243 | EBP information is missing | OTT | All | | Disabled | OFF |
| 244 | EBP presented after initial video PTS | OTT | All | | Critical | OFF |
| 245 | No PTS/EBP reference info found | OTT | All | | Critical | OFF |
| 246 | Profiles PTS out of sync | OTT | All | 2500 us | Critical | OFF |
| 247 | Profiles EBP out of sync | OTT | All | 2500 us | Critical | OFF |
| 248 | Missing program data/time on HLS m3u8 | OTT | All | | Disabled | OFF |

Threshold Configuration

Label: Default

| # | Label | Group | Standard | Threshold | Severity | Record |
|-----|--|-------|----------|-----------|----------|--------|
| 249 | HLS/Mpeg-Dash/MSS Block download fail due to ti... | OTT | All | | Disabled | OFF |
| 250 | HLS/Mpeg-Dash/MSS Block download fail except fo... | OTT | All | | Disabled | OFF |
| 343 | Missing OTT audio component | OTT | All | | Critical | OFF |
| 344 | Missing OTT subtitle component | OTT | All | | Critical | OFF |
| 345 | Anvato content type change | OTT | All | | Disabled | OFF |
| 346 | Anvato content type is not program | OTT | All | | Disabled | OFF |
| 347 | Anvato no content type change | OTT | All | 15 min | Disabled | OFF |
| 348 | OTT discontinuity marker received | OTT | All | | Disabled | OFF |
| 349 | OTT sequence discontinuity | OTT | All | | Disabled | OFF |
| 378 | OTT chunk burst (m3u8/ism/mpd updated with mu... | OTT | All | 3 chunks | Major | OFF |
| 379 | OTT playback jump (m3u8/ism/mpd updated refer... | OTT | All | 5 sec | Critical | OFF |
| 540 | Detect certificate error (any) | OTT | All | | Critical | OFF |
| 541 | Detect expired certificate | OTT | All | | Critical | OFF |
| 542 | Detect certificate verification error | OTT | All | | Critical | OFF |
| 543 | Detect missing certificate for host url | OTT | All | | Critical | OFF |

ISPs or Final Delivery to Customers

Subtitles, Teletext or Closed Captions not only assist hearing-impaired persons, but also OTT streams being monitored with audio turned down in waiting rooms and the like.

Threshold Configuration

Label: Default

| # ↑1 | Label | Group | Standard | Threshold | Severity | Record |
|------|---|----------|----------|------------|------------|--------|
| 122 | Subtitle CC Error | Subtitle | All | 2 CC/sec ▼ | Critical ▼ | OFF |
| 131 | Zero bitrate on subtitle PID | Subtitle | All | 5000 ms ▼ | Major ▼ | OFF |
| 132 | Subtitle PES Drop - Subtitle PTS and PCR mismatch | Subtitle | All | | Critical ▼ | OFF |
| 133 | Subtitle content error | Subtitle | All | | Critical ▼ | OFF |
| 145 | Teletext Subtitle content error | Subtitle | All | | Critical ▼ | OFF |
| 197 | Subtitle data_identifier is not 0x20 | Subtitle | All | | Minor ▼ | OFF |
| 210 | No Subtitles content | Subtitle | All | 2 min ▼ | Major ▼ | OFF |
| 488 | No OP-47/OP-42/Teletext carrier | Subtitle | All | 30 sec ▼ | Disabled ▼ | OFF |
| 489 | No OP-47/OP-42/Teletext subtitles content | Subtitle | All | 30 sec ▼ | Disabled ▼ | OFF |

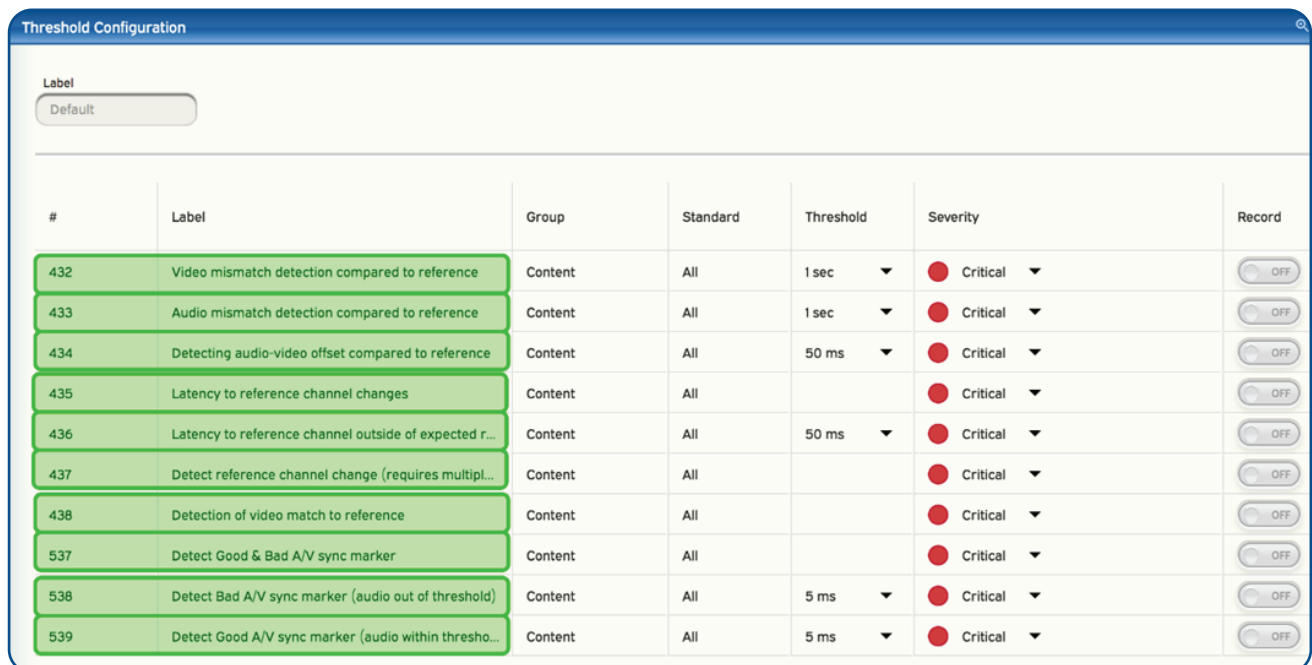
Threshold Configuration

Label: Default

| # | Label | Group | Standard | Threshold | Severity | Record |
|-----|--|-----------------|----------|-----------|------------|--------|
| 185 | Closed Captions, All channels missing (EIA-608) | Closed Captions | All | 30 sec ▼ | Disabled ▼ | OFF |
| 186 | Closed Captions, All channels not updated (EIA-60... | Closed Captions | All | 30 sec ▼ | Disabled ▼ | OFF |
| 187 | Closed Captions, Parse parity error (EIA-608/708) | Closed Captions | All | | Major ▼ | OFF |
| 188 | Closed Captions (EIA-608), Channel 1 missing | Closed Captions | All | 30 sec ▼ | Disabled ▼ | OFF |

| | | | | | | |
|-----|--|-----------------|-----|----------|------------|-----|
| 195 | Closed Captions (EIA-608), Channel 4 not updated | Closed Captions | All | 30 sec ▼ | Disabled ▼ | OFF |
| 341 | OTT Closed Captions missing | Closed Captions | All | 30 sec ▼ | Major ▼ | OFF |
| 342 | OTT Closed Captions not updated | Closed Captions | All | 30 sec ▼ | Critical ▼ | OFF |
| 490 | Closed Captions (EIA-708), Channel 1 missing | Closed Captions | All | 30 sec ▼ | Disabled ▼ | OFF |
| 491 | Closed Captions (EIA-708), Channel 2 missing | Closed Captions | All | 30 sec ▼ | Disabled ▼ | OFF |

Then, we probe the primary content of the OTT streams and recommend these threshold settings, including mismatches of signals to the reference in the stream.



The screenshot shows a 'Threshold Configuration' window with a search bar and a table of monitoring thresholds. The table has columns for ID, Label, Group, Standard, Threshold, Severity, and Record. All entries are set to 'All' standard and 'Critical' severity. The 'Record' column contains toggle switches, all of which are currently turned off.

| # | Label | Group | Standard | Threshold | Severity | Record |
|-----|---|---------|----------|-----------|----------|--------|
| 432 | Video mismatch detection compared to reference | Content | All | 1 sec | Critical | OFF |
| 433 | Audio mismatch detection compared to reference | Content | All | 1 sec | Critical | OFF |
| 434 | Detecting audio-video offset compared to reference | Content | All | 50 ms | Critical | OFF |
| 435 | Latency to reference channel changes | Content | All | | Critical | OFF |
| 436 | Latency to reference channel outside of expected r... | Content | All | 50 ms | Critical | OFF |
| 437 | Detect reference channel change (requires multipl... | Content | All | | Critical | OFF |
| 438 | Detection of video match to reference | Content | All | | Critical | OFF |
| 537 | Detect Good & Bad A/V sync marker | Content | All | | Critical | OFF |
| 538 | Detect Bad A/V sync marker (audio out of threshold) | Content | All | 5 ms | Critical | OFF |
| 539 | Detect Good A/V sync marker (audio within thresho... | Content | All | 5 ms | Critical | OFF |

Packagers:

- What to Monitor: Segmenting and packaging content for adaptive streaming (eg, HLS, DASH)
- Why Are We Monitoring: Critical for smooth adaptive bitrate streaming, crucial for different network conditions
- Probing Point Actions: Validate segment availability, integrity, and compliance with streaming protocols

TAG MCM has many thresholds for things like expired DASH certificates that we have developed over the years with input from our clients to catch common errors with packagers.

Content Delivery Networks (CDNs):

- What to Monitor: CDN performance, including edge servers
- Why Are We Monitoring: Affects content delivery speed and buffering; key for global distribution
- Probing Point Actions: Monitor latency, packet loss, and throughput at various geographic locations

If a CDN server gets overwhelmed with clients but has not yet failed, it will often increase the inter-packet timing, and the MCM has an alarm threshold to report that change.

Origin Servers:

These servers are usually the last point before CDN servers, where video is stored or composed.

- What to Monitor: Server performance and content availability
- Why Are We Monitoring: Ensures content is readily available for distribution to CDNs
- Probing Point Actions: Check server health, load, and response times

Many clients use TAG MCMs to confirm high-quality audio, video, and metadata in all streams from Origin Servers. An example would be our video blocking level alerts, where the compression blocks are evident to the viewer.

Cloud Computing Resources (if used):

- What to Monitor: Cloud infrastructure and services
- Why Are We Monitoring: Cloud failures can impact content availability and delivery
- Probing Point Actions: Monitor cloud resource utilization, scalability, and redundancy

Most cloud providers provide monitoring services, but the TAG MCS software just shows the health of the cloud instances where MCM is running.

Edge Devices (Set-top boxes, Sticks like Chromecast, Roku, and Amazon Fire Stick):

- What to Monitor: Final content delivery and playback on consumer devices
- Why Are We Monitoring: Directly impacts viewer experience, crucial for QoE
- Probing Point Actions: Collect data on playback issues, buffering, app crashes, and device compatibility

Some non-TAG software products monitor devices; we can only monitor one of these devices if its output is converted to an IP stream by a third-party converter and sent back to an MCM.

Metadata and DRM Systems:

- What to Monitor: Metadata accuracy and DRM (Digital Rights Management) functionality
- Why Are We Monitoring: Ensures content discoverability and compliance with licensing agreements
- Probing Point Actions: Validate metadata integrity and DRM effectiveness

TAG MCMs have several thresholds for OTT certificate errors, and DVB Conditional access specific data to help monitor DRM before being sent to the end customer. It is also common for the DRM vendors to also have monitoring tools in this area.

