M42h for HDMI 2.2 – Product Overview

April – 2025

TELEDYNE LECROY
Everywhereyoulook™

Teledyne HDMI Mission Statement

Help silicon and product developers bring their next-generation video solutions to market—faster, without interoperability problems and at reduced cost

Our solutions quicken Time-to-Insight

HDMI 2.2 – Spec Changes

- New link rates of 16G, 20G and 24G added to support the higher aggregate link rates up to 96G.
- Support for Higher bandwidths without compression.
  - 4K@240 and 8K@60Hz with HDR10 4:4:4 at 10/12-bit deep color.
  - 8K @120Hz YCbCr 4:2:0 sampling at 10/12-bit deep color.
  - 10K @60Hz 4:2:0 sampling at 10/12-bit deep color.
  - 12K @60Hz 4:2:0 sampling at 10/12-bit deep color.
- Latency Indication Protocol for end-to-end AV sync is approved.
- New cable plug will be required. This will be mechanically backward compatible.
- New receptacle will be required as well. Cables and plugs updated to Category 4.
- Changes to TxFFE for FRL link training.
- AC coupling on HDMI Tx ports.

M42h – Connectors – Front

- Front Chassis Connections and Controls
  - USB Type A (2) – Used for administration and management of the ATP embedded GUI with a mouse and keyboard.
  - LCD display – Provide status information and network configuration information.
  - HDMI 48G Tx Port – HDMI Type A Cat 3.
  - HDMI 48G Rx Port – HDMI Type A Cat 3.
  - HDMI 96G Tx Port – HDMI Type A Cat 4.
  - HDMI 96G Rx Port – HDMI Type A Cat 4.

- HDMI Tx/Rx Port LEDs.
  - **Speed**: Red=TMDS, Green=FRL
  - **Status**: Red=no HP/5V, Green=HP/5V
- LCD Display - Provides status information and network configuration.
  - **Page 1** - IP Address and Release:
    M42h IP address
    e.g.: 10.211.177.50
    e.g.: 7.46.02
  - **Page 2** - Date:
    e.g.: Wednesday April 01, 2025
  - **Page 3** - Format on active Tx port:
    e.g.: 48G Tx: 3840x2160p60 RGB
  - **Page 4** - eARC status on 96G Tx port:
    e.g.: disabled
  - **Page 5** - Rx Port configuration:
    e.g.: 48G Rx: TMDS
  - **Page 6** - eARC Tx on Rx Port:
    e.g.: enabled
    L-PCM 48kHz, 24-bit, 2ch, 6.144MHz clock

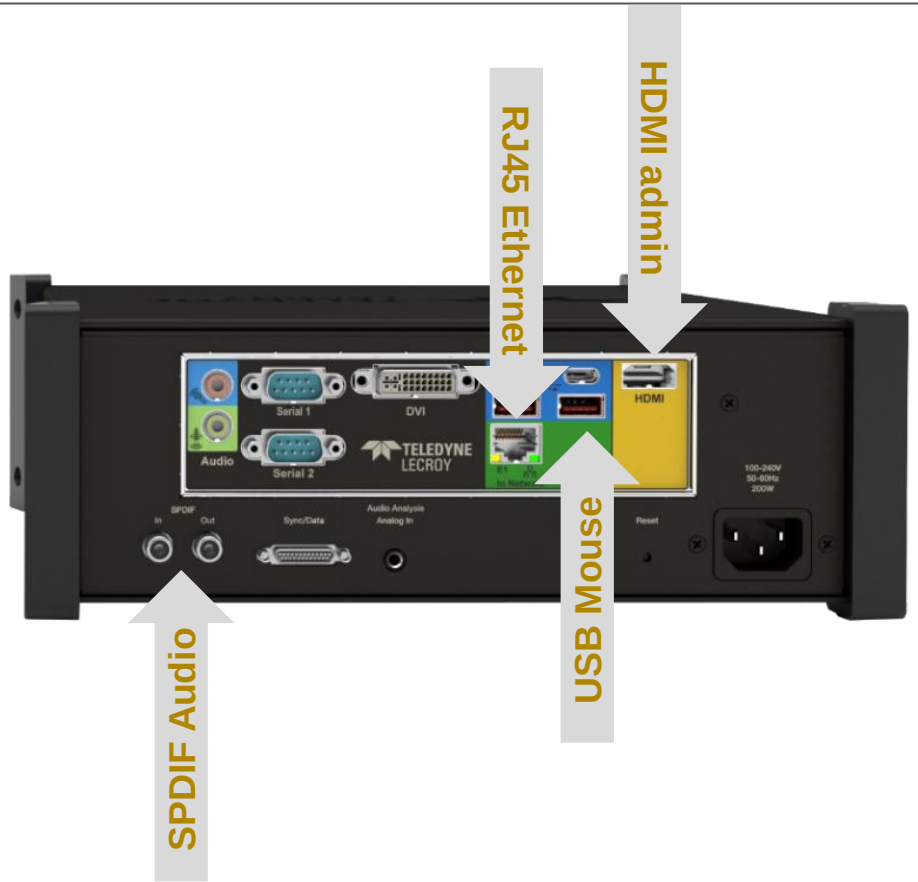
M42h – HDMI Tx & Rx Connectors – Front

- HDMI 48G Tx Port – HDMI Type A Cat 3. Supports TMDS and “legacy” FRL speeds. This port is hardware-capable of FFE features in the spec. Can be AC-coupled or DC-coupled.
- HDMI 48G Rx Port – HDMI Type A Cat 3. Supports TMDS and “legacy” FRL speeds. This port is hardware-capable of adaptive EQ.

- HDMI 96G Tx Port – HDMI Type A Cat 4. Supports TMDS, “legacy” FRL (up to 48G) and the new FRL speeds up to 96G. This port is not hardware capable of supporting FFE. HDMI Cat 4 connector type. Permanently AC-coupled. This port can support passive monitoring of the DDC and CEC lines.
- HDMI 96G Rx Port – HDMI Type A Cat 4. Supports TMDS, “legacy” FRL (up to 48G) and the new FRL speeds up to 96G. This port is not hardware capable of supporting adaptive EQ. HDMI Cat 4 connector type. This port can support passive monitoring of the DDC and CEC lines.

M42h – Connectors - Back

- Back Chassis Connections
  - HDMI Admin Port – Used for administration to show the embedded ATP GUI controlled with a mouse.
  - USB Type A – Use for connecting a mouse and keyboard for managing through the embedded ATP GUI.
  - RJ45 connector for Ethernet/IP session for managing through the external ATP GUI.
  - SPDIF In/Out for injecting and extracting SPDIF audio.
  - TRS 3.5mm Stereo Audio Jack – For Audio Analysis Analog in for measuring audio latencies using microphone input.



M42h – Comprehensive, Multi-Dimensional HDMI Test Solutions

Type of testing

Functional, Interop, COMPLIANCE

Protocols tested

TMDS, EDID, Video, HDR, Audio, FRL, Link Train, FEC, DSC, GameVRR, eARC, HDCP, CEC

Device types tested

Source, Sink, Repeater

Functional Testing – Emulation, status presentation, configurable

Interoperability Testing – Irregular tests, deep analysis

Compliance Testing – Testing to a compliance test spec for logo certification

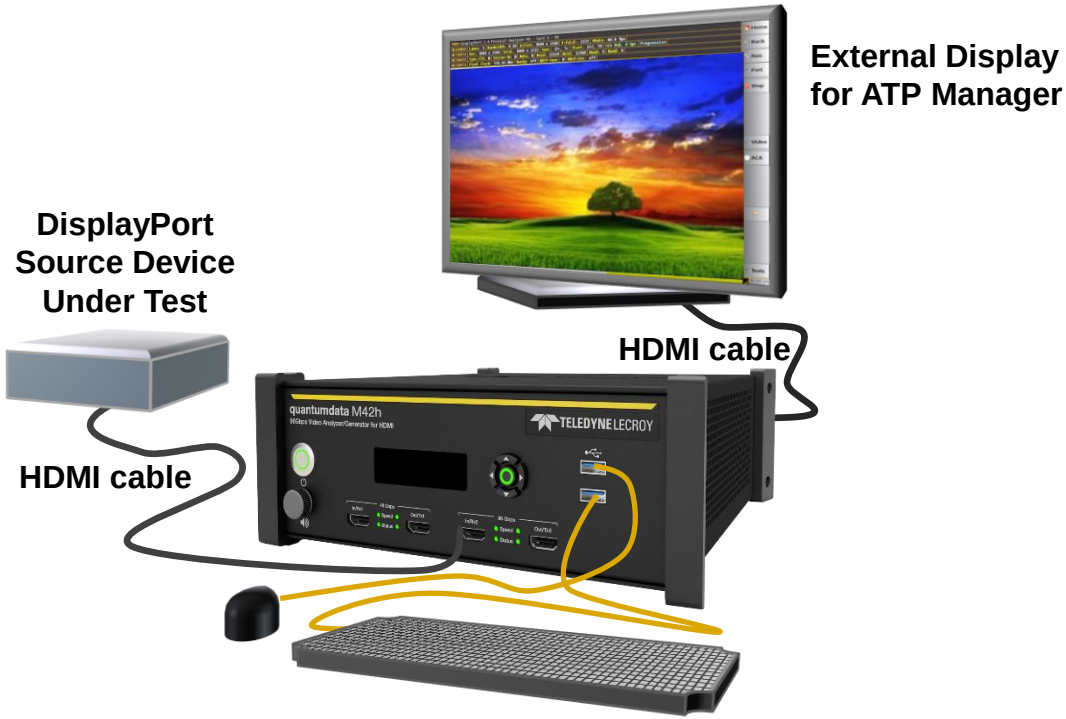
Fourth Dimension: Supports HDMI 1.4, HDMI 2.1, HDMI 2.2 spec tenures.

M42h – Roadmap and Rollout

- Phase I – Release 7.48 - May 2025
  - Video Generation (Sink Testing)
    - Link training at all new FRL2 rates.
    - Transmission of existing video formats and test patterns.
    - ACA monitoring as an emulated source.
    - Reading EDID/Parsing.
    - Transmission of LPCM audio.
  - Video/Protocol Analysis (Source Testing)
    - Link training at all new higher FRL lane rates.
    - Capture analysis for new higher FRL rates.
    - ACA monitoring as an emulated sink.
    - Emulating an EDID and SCDC of a sink with the new higher FRL rates.

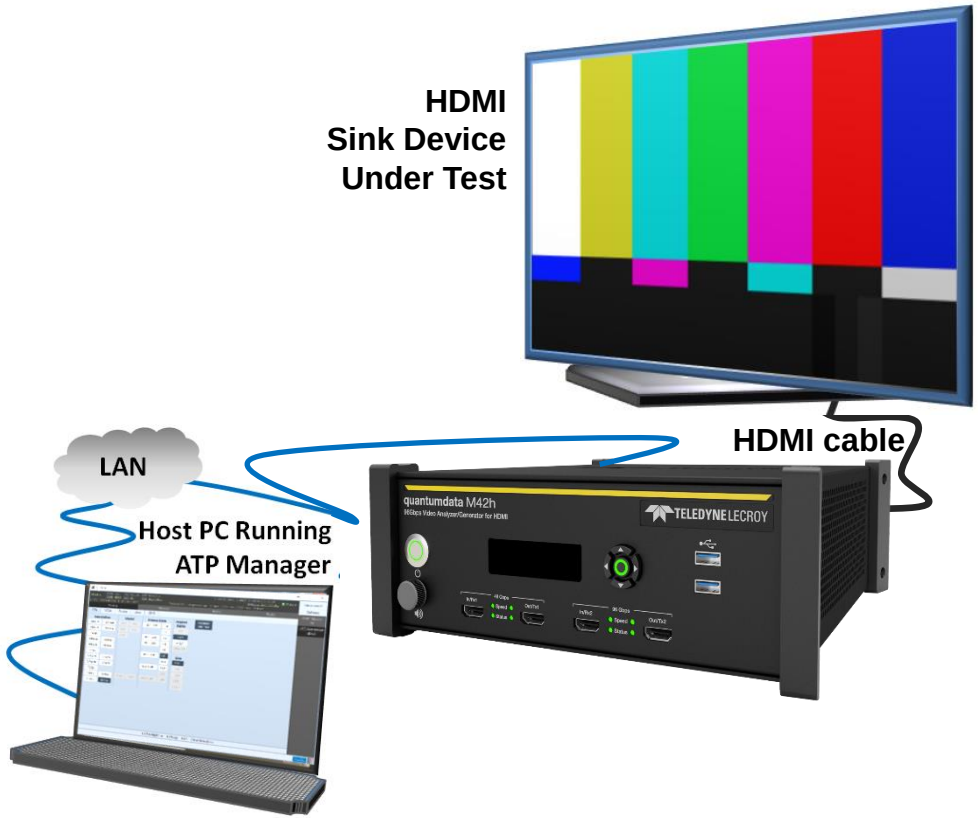
M42h Administration – Embedded ATP Manager GUI (Source Test)

- Administration
  - Use Keyboard and mouse to control ATP Manager GUI running on the connected display.

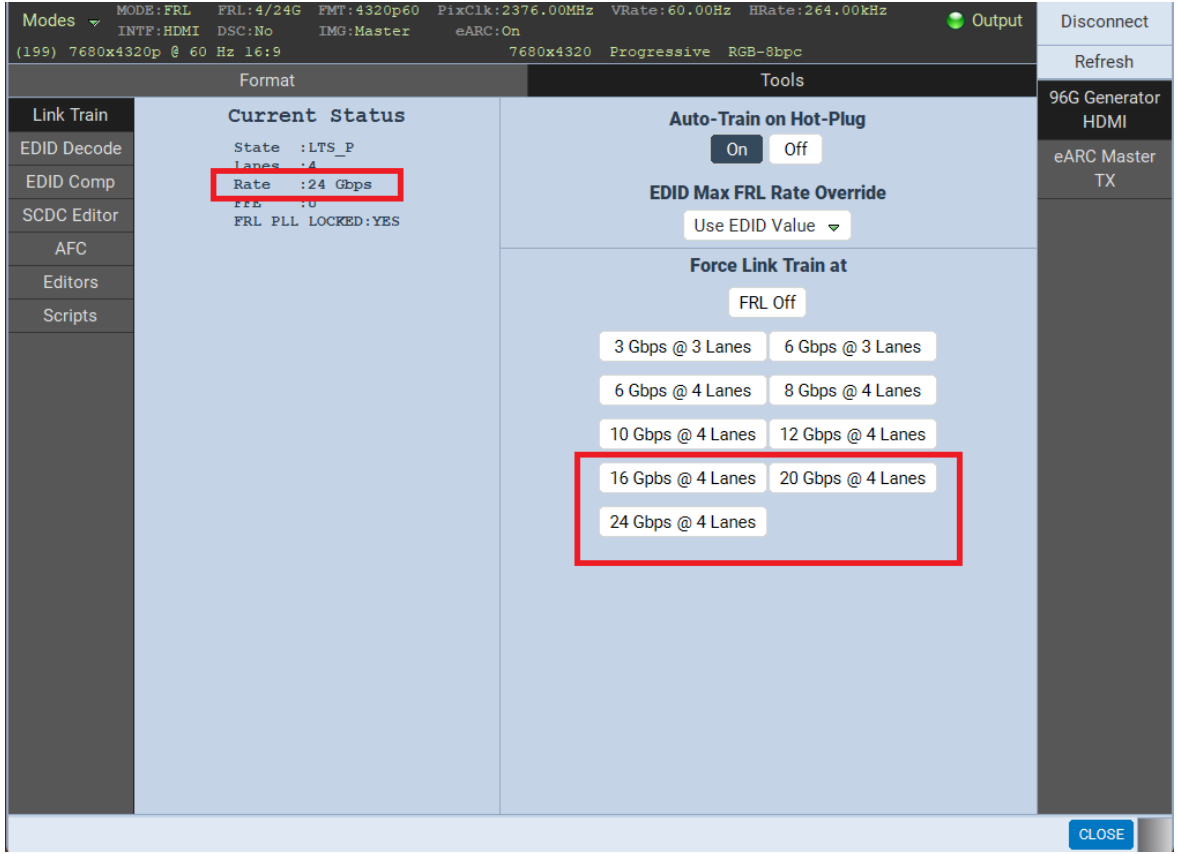


M42h Administration – External ATP Manager GUI (Source Test)

- Administration
  - Use Windows PC as a host for the external ATP Manager GUI.

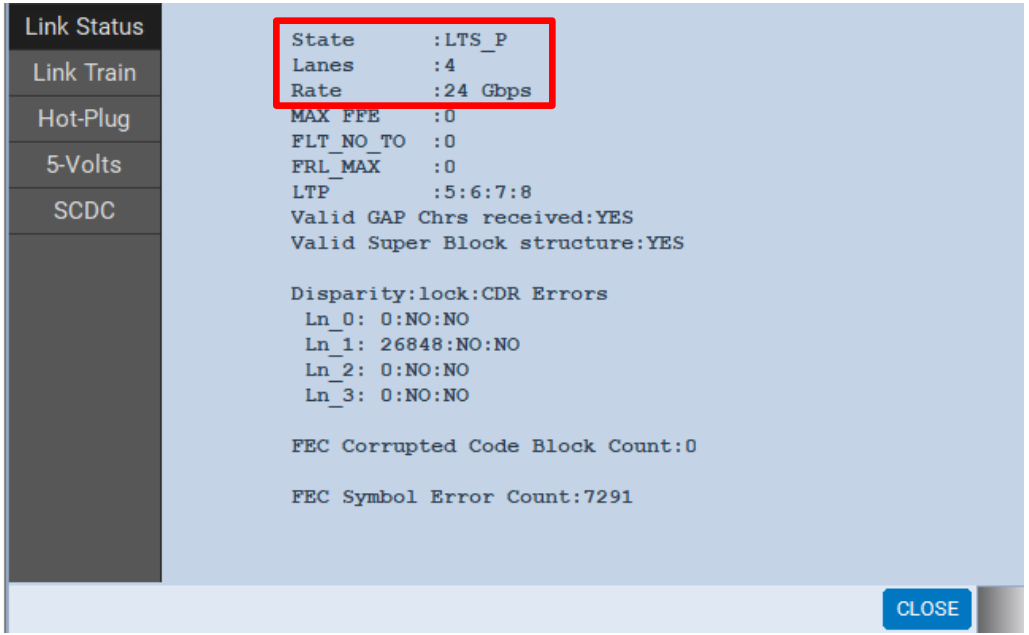


HDMI 2.2 – M42h - Video Generator Link Training



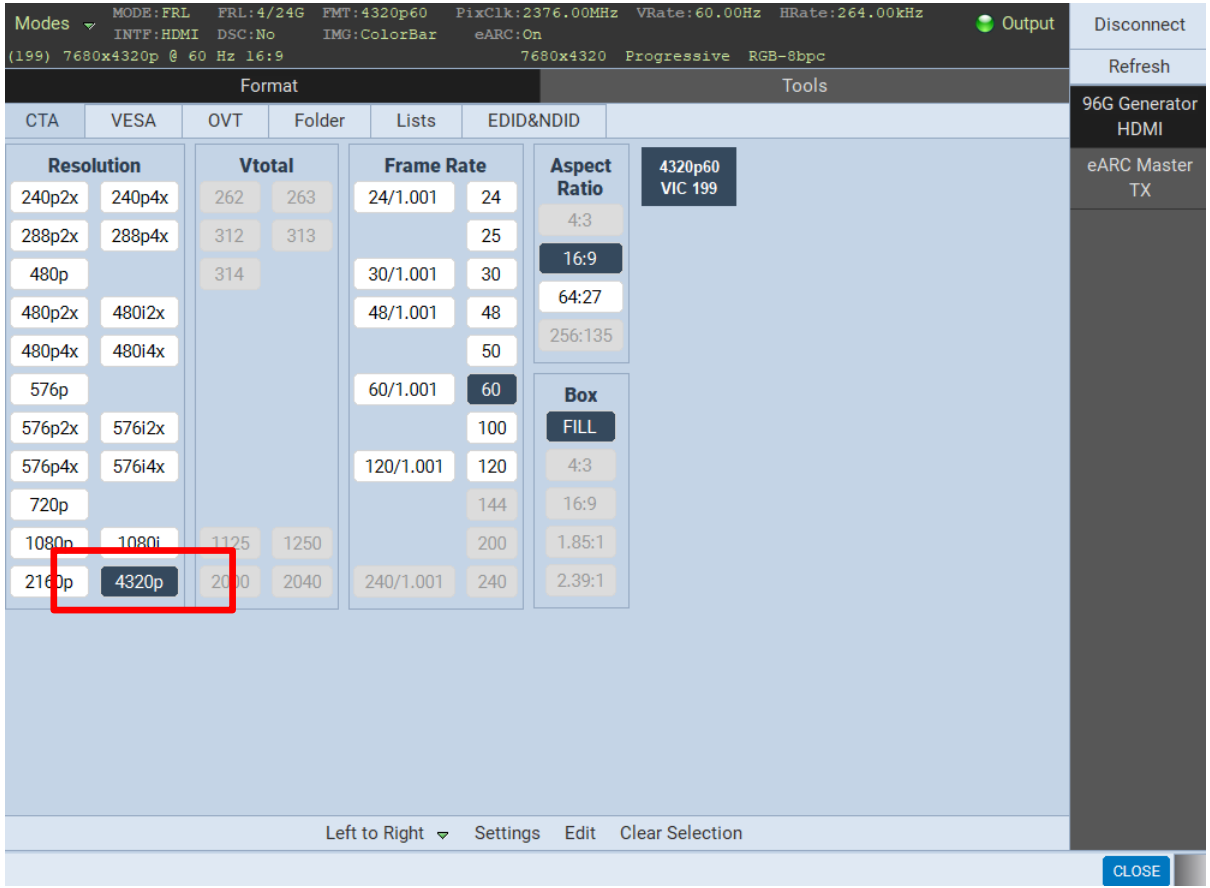
- Video Generator Link Training configuration screen showing 24G and other new FRL2 rates.

HDMI 2.2 – M42h – Analyzer Sink Status Screen



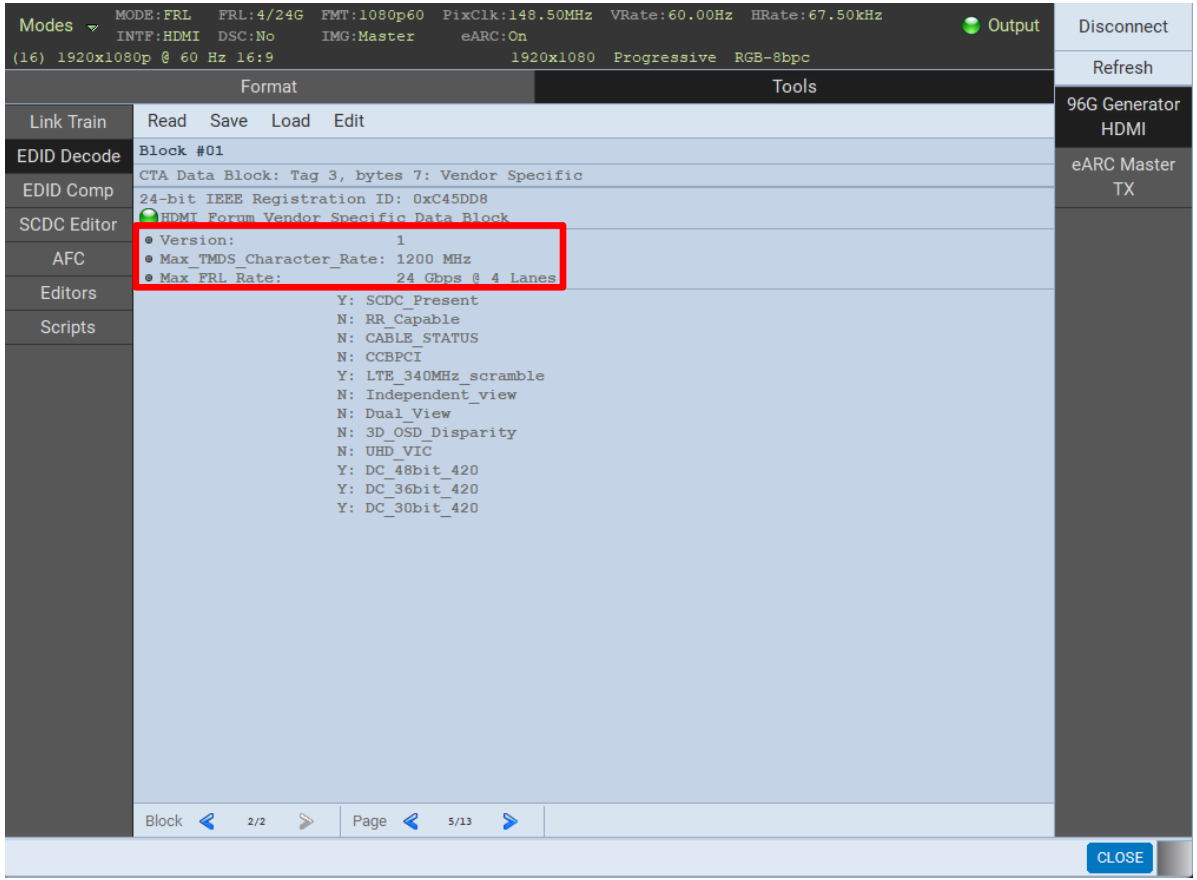
- Analyzer Link Status screen showing 24G link training status.

HDMI 2.2 – M42h – Video Generator Format Selection Screen



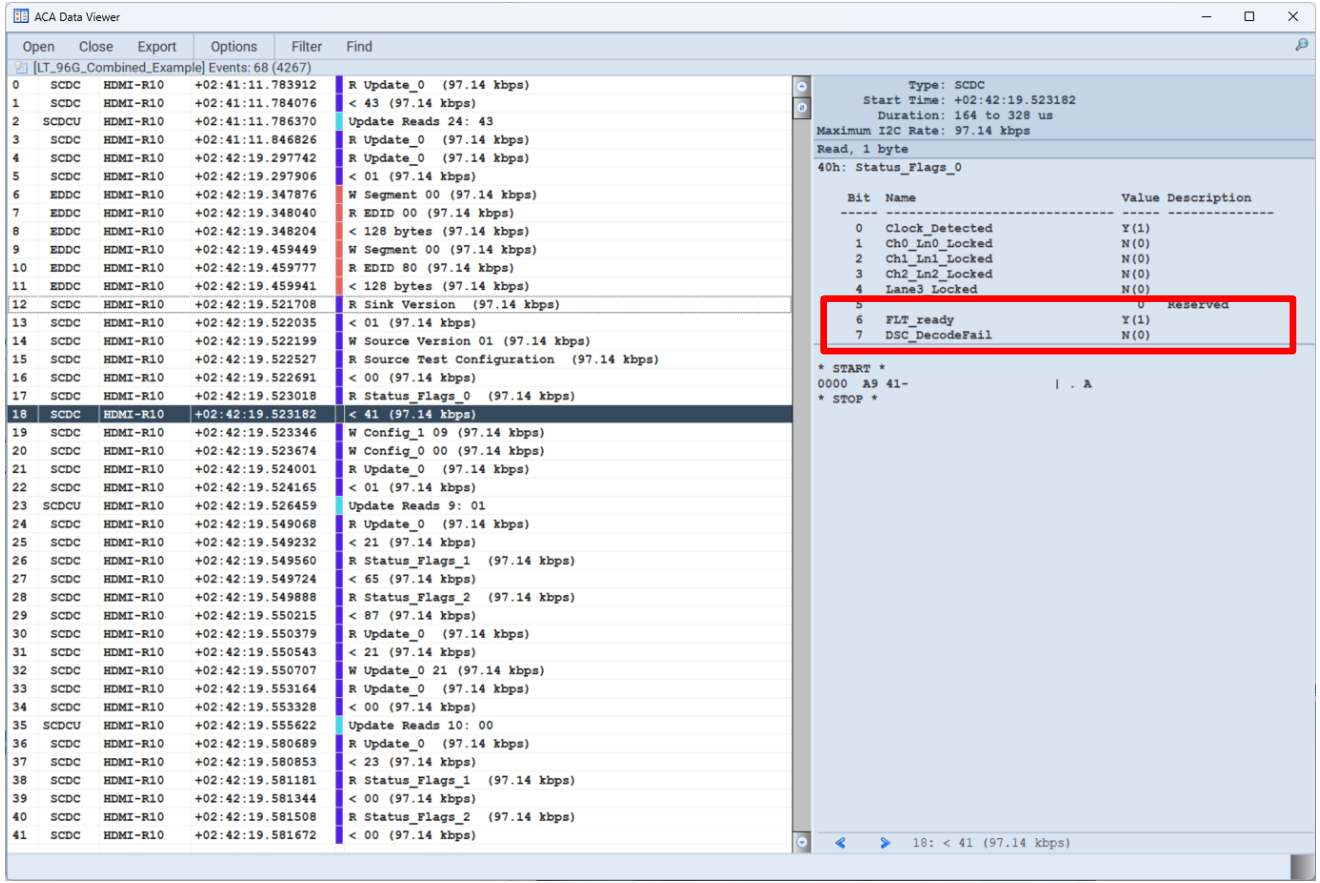
- Video Generator Format Selection screen showing 8K format being selected.
- 10K and 12K formats will also be available.

HDMI 2.2 – M42h - EDID



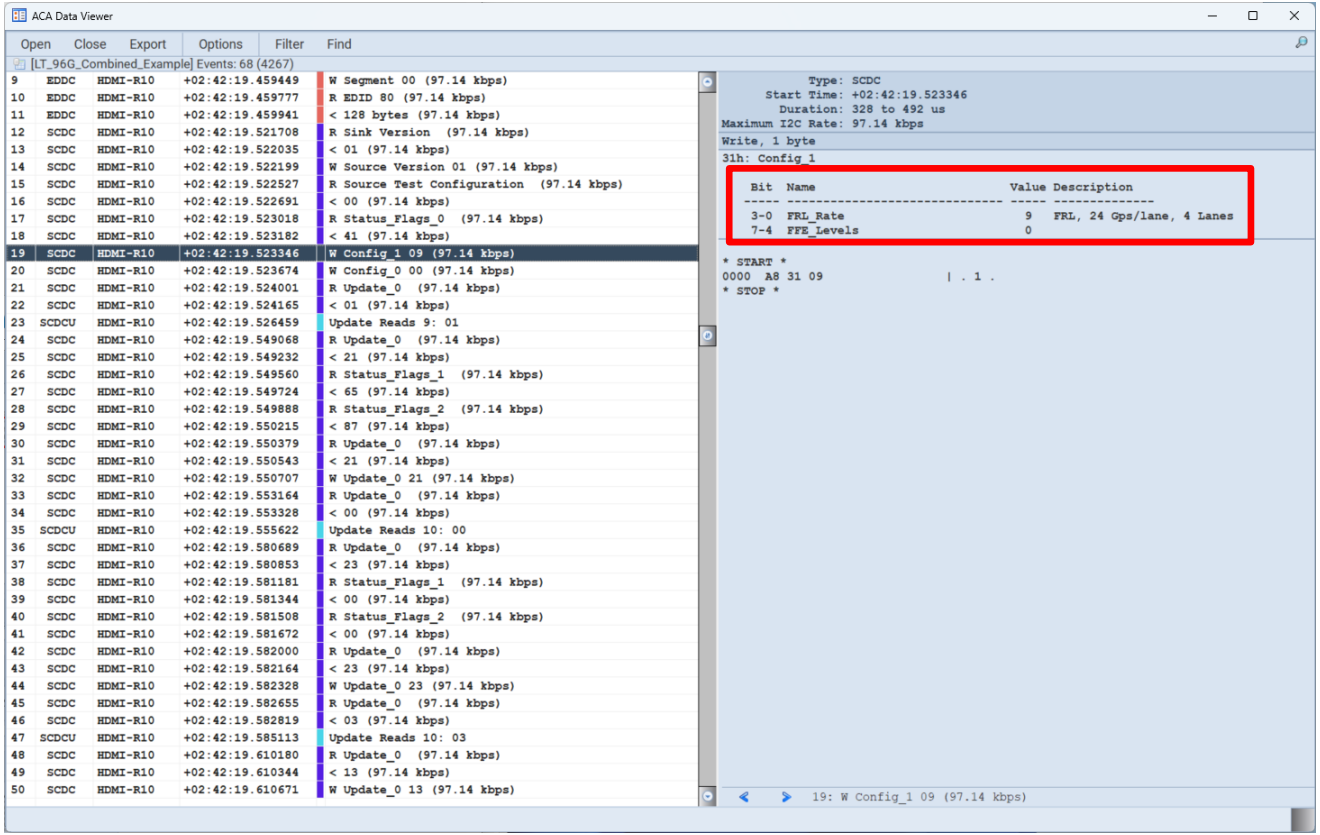
- EDID Decode Screen showing 24G capability on the connected sink.

HDMI 2.2 – M42h – Aux Channel Analyzer Capture



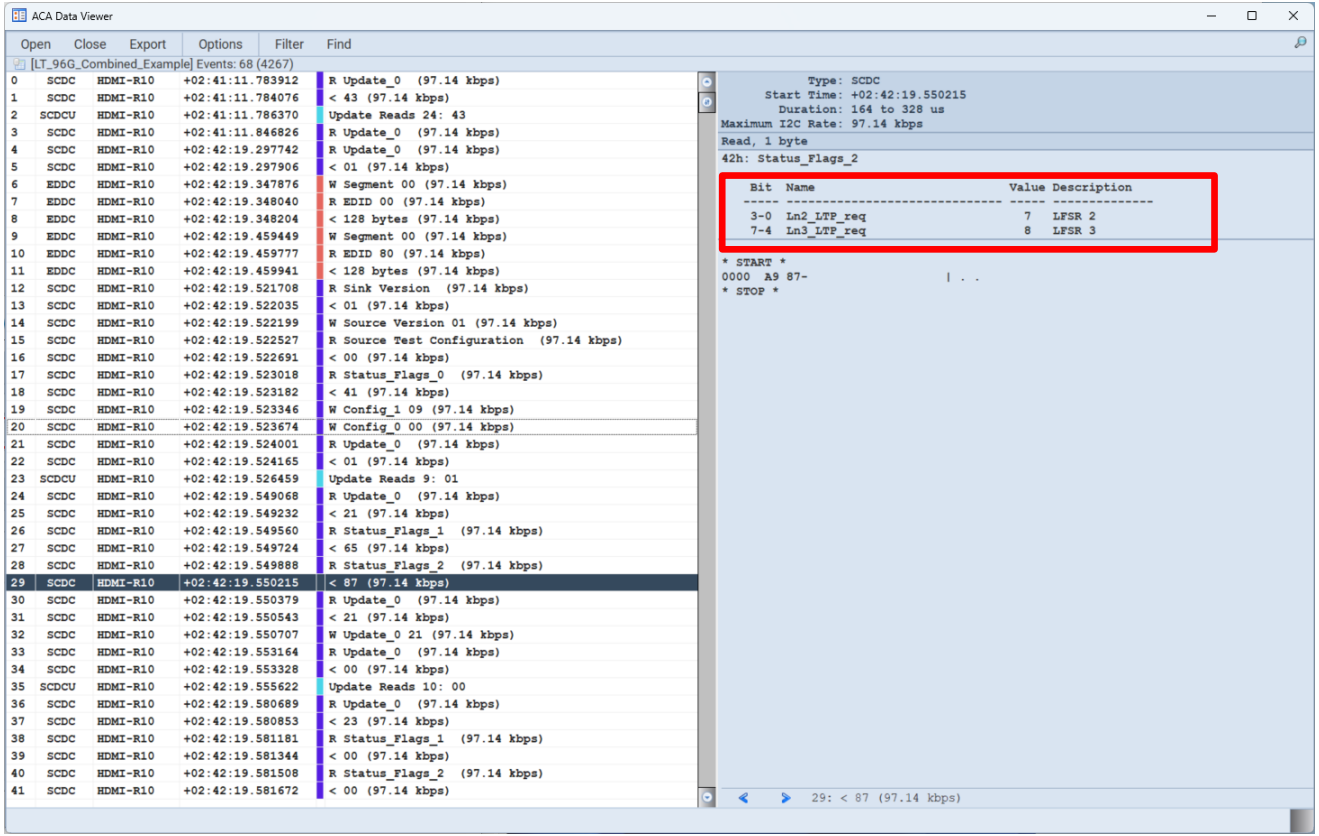
- Screen example showing FRL Link Training transactions captured at 24G per lane, 96G aggregate.
- Showing FRL Ready flag set.

HDMI 2.2 – M42h – Aux Channel Analyzer Capture



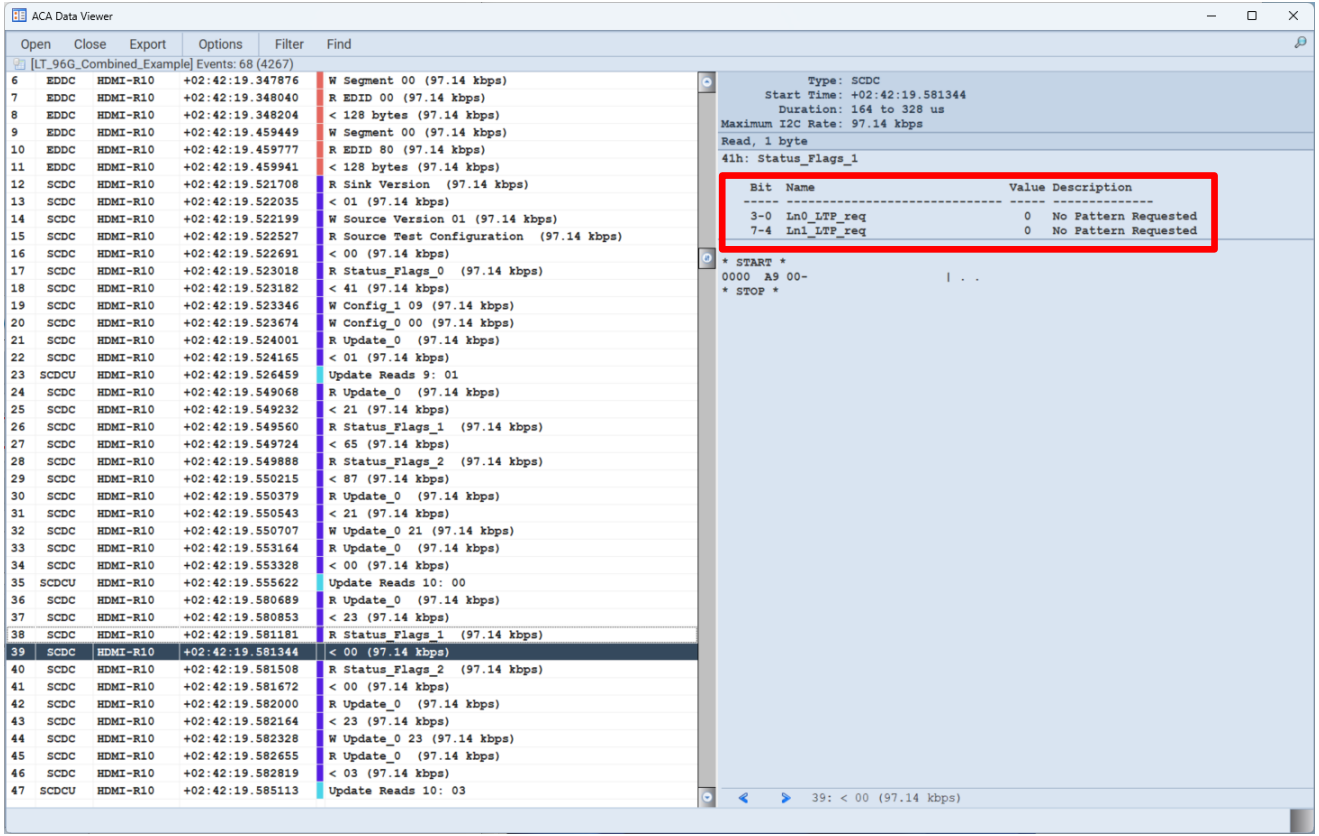
- Screen example showing FRL Link Training transactions capture at 24G per lane, 96G aggregate.
- Showing FRL rate being configured.

HDMI 2.2 – M42h – Aux Channel Analyzer Capture



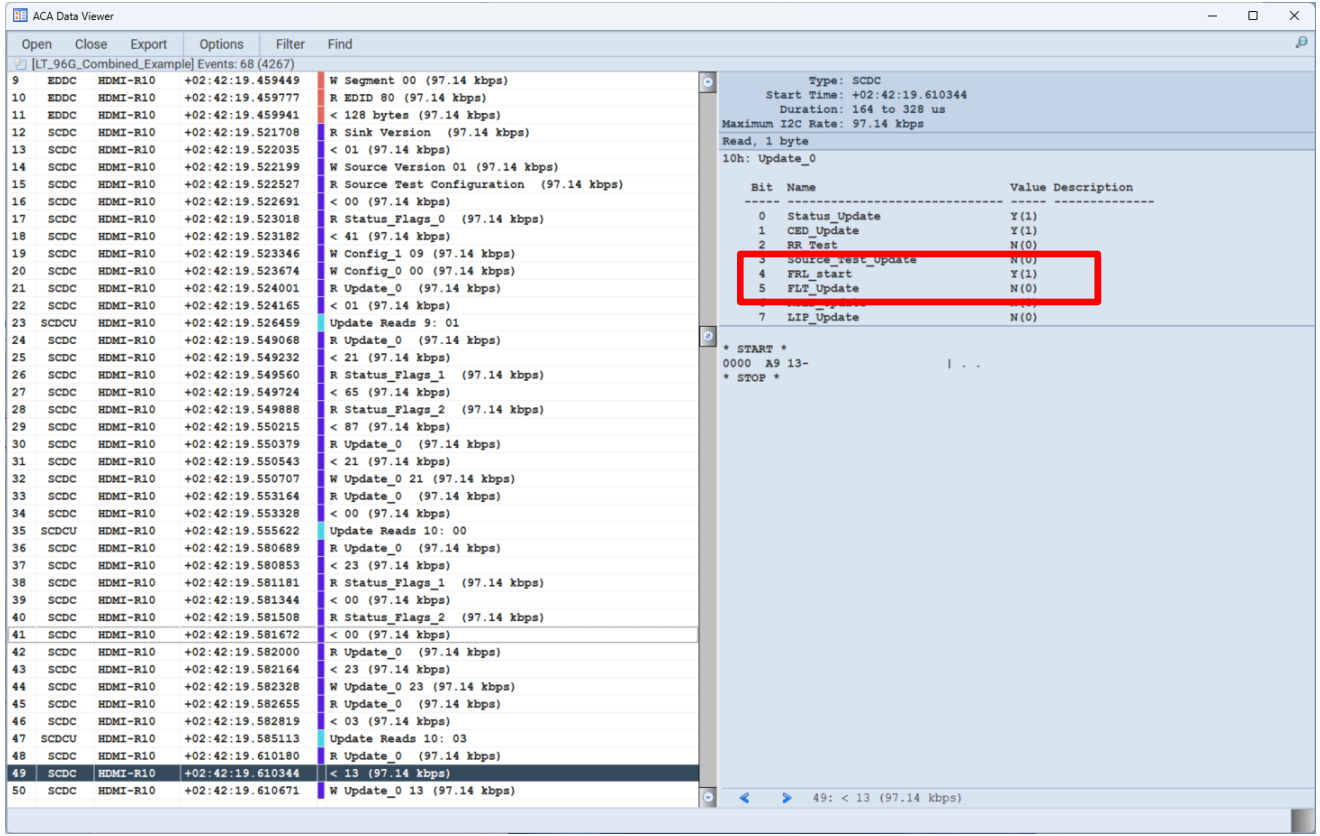
- Screen example showing FRL Link Training transactions capture at 24G per lane, 96G aggregate.
- Showing Link Training pattern being configured.

HDMI 2.2 – M42h – Aux Channel Analyzer Capture



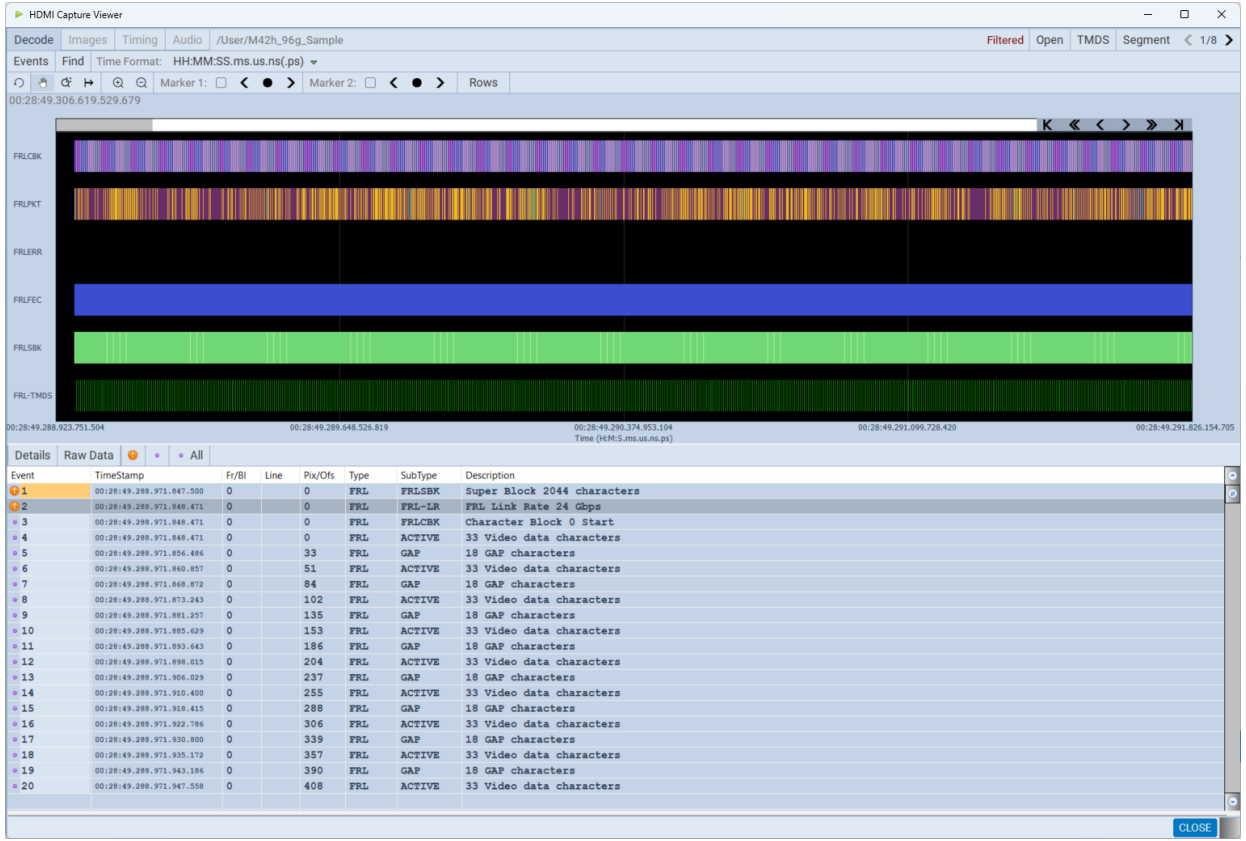
- Screen example showing FRL Link Training transactions capture at 24G per lane, 96G aggregate.
- Indicating “No Pattern Requested” meaning link training has been completed.

HDMI 2.2 – M42h – Aux Channel Analyzer Capture



- Screen example showing FRL Link Training transactions capture at 24G per lane, 96G aggregate.
- Showing FRL Start flag set indicating source ready to transmit FRL data.

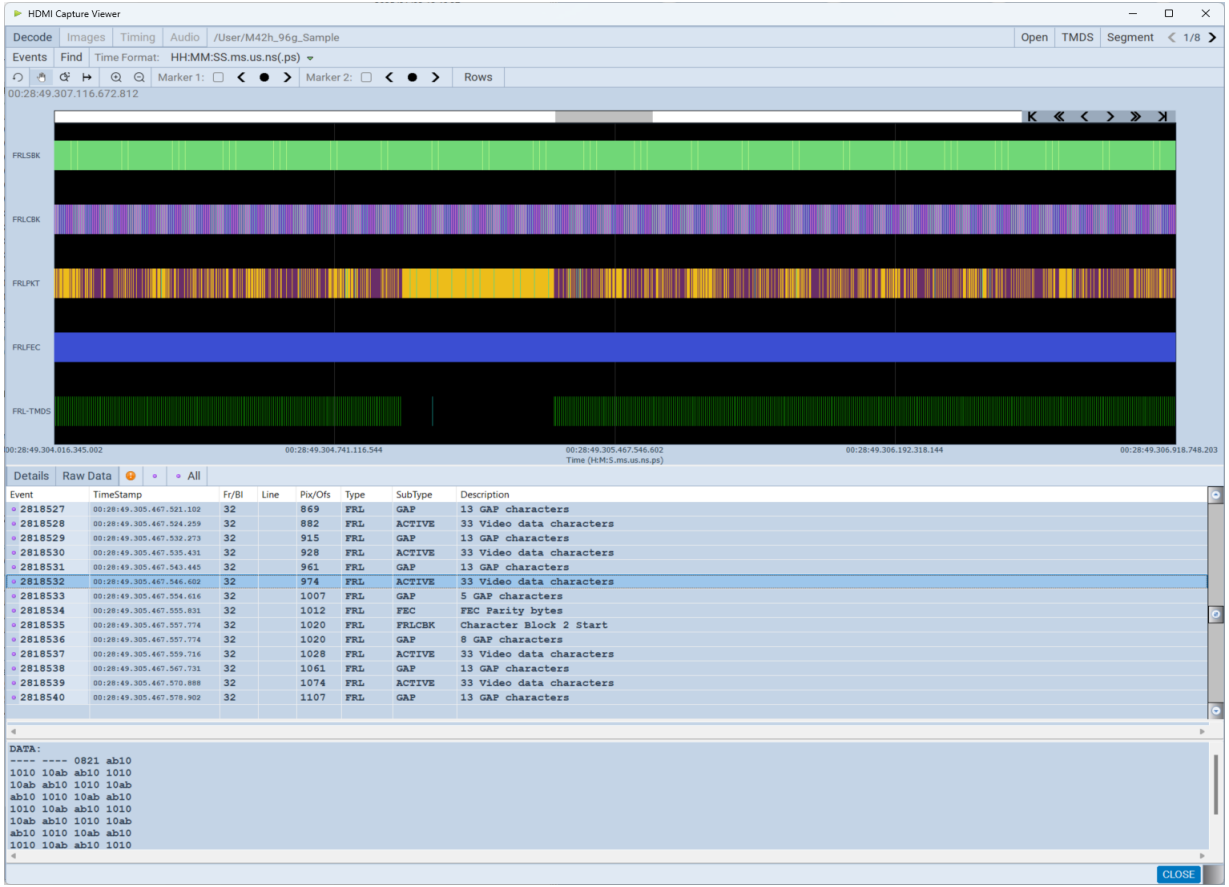
HDMI 2.2 – M42h – Main Link Capture - FRL



Event	TimeStamp	Fr/Bl	Line	Pix/Ofs	Type	SubType	Description
1	00:28:49.288.971.847.500	0		0	FRL	FRLSBK	Super Block 2044 characters
2	00:28:49.288.971.848.471	0		0	FRL	FRL-LR	FRL Link Rate 24 Gbps
3	00:28:49.288.971.848.471	0		0	FRL	FRLCBK	Character Block 0 Start
4	00:28:49.288.971.848.471	0		0	FRL	ACTIVE	33 Video data characters
5	00:28:49.288.971.856.486	0		33	FRL	GAP	18 GAP characters
6	00:28:49.288.971.860.857	0		51	FRL	ACTIVE	33 Video data characters
7	00:28:49.288.971.868.872	0		84	FRL	GAP	18 GAP characters
8	00:28:49.288.971.873.243	0		102	FRL	ACTIVE	33 Video data characters
9	00:28:49.288.971.881.257	0		135	FRL	GAP	18 GAP characters
10	00:28:49.288.971.885.629	0		153	FRL	ACTIVE	33 Video data characters
11	00:28:49.288.971.893.643	0		186	FRL	GAP	18 GAP characters
12	00:28:49.288.971.898.015	0		204	FRL	ACTIVE	33 Video data characters
13	00:28:49.288.971.906.029	0		237	FRL	GAP	18 GAP characters
14	00:28:49.288.971.910.400	0		255	FRL	ACTIVE	33 Video data characters
15	00:28:49.288.971.918.415	0		288	FRL	GAP	18 GAP characters
16	00:28:49.288.971.922.786	0		306	FRL	ACTIVE	33 Video data characters
17	00:28:49.288.971.930.800	0		339	FRL	GAP	18 GAP characters
18	00:28:49.288.971.935.172	0		357	FRL	ACTIVE	33 Video data characters
19	00:28:49.288.971.943.186	0		390	FRL	GAP	18 GAP characters
20	00:28:49.288.971.947.558	0		408	FRL	ACTIVE	33 Video data characters

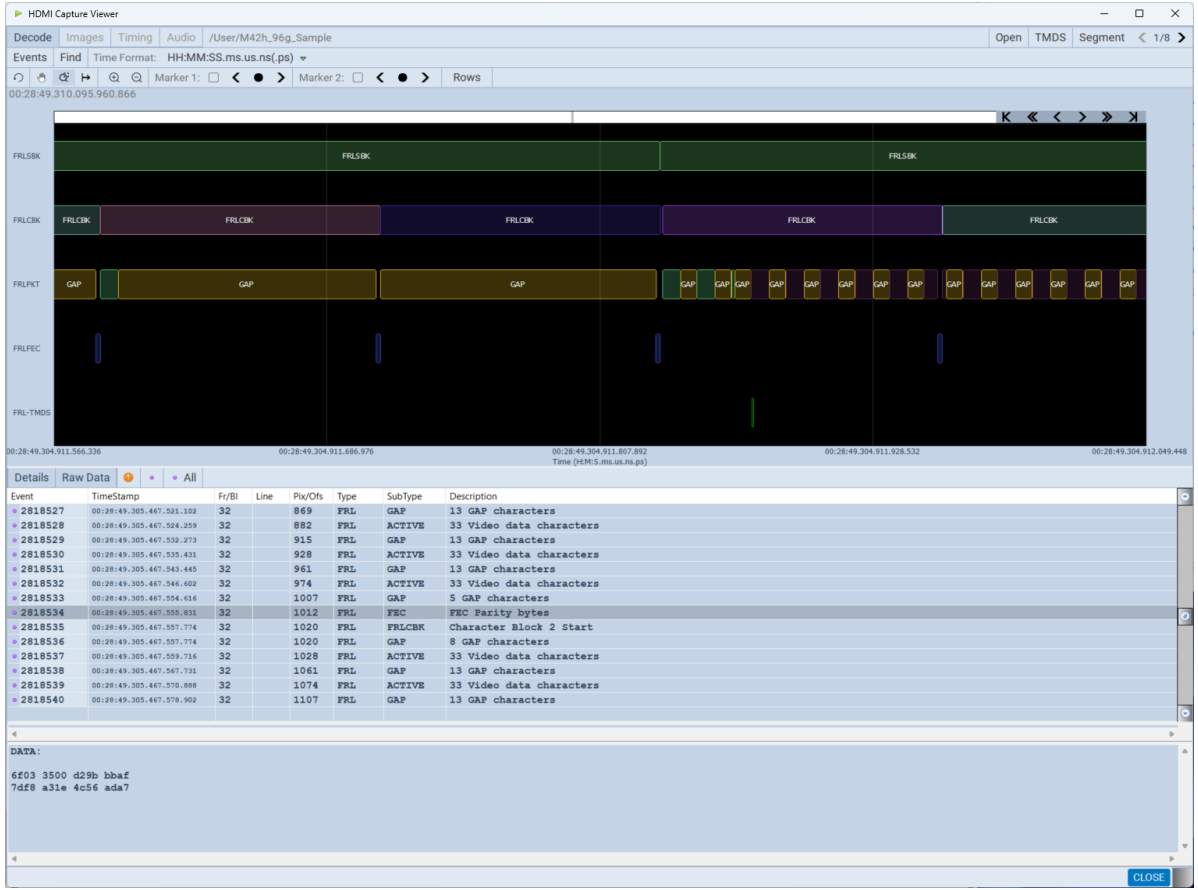
- Screen example showing FRL Main Link capture at 24G per lane, 96G aggregate.
- Showing Aggregate Link Rate of 96G.

HDMI 2.2 – M42h – Main Link Capture - FRL



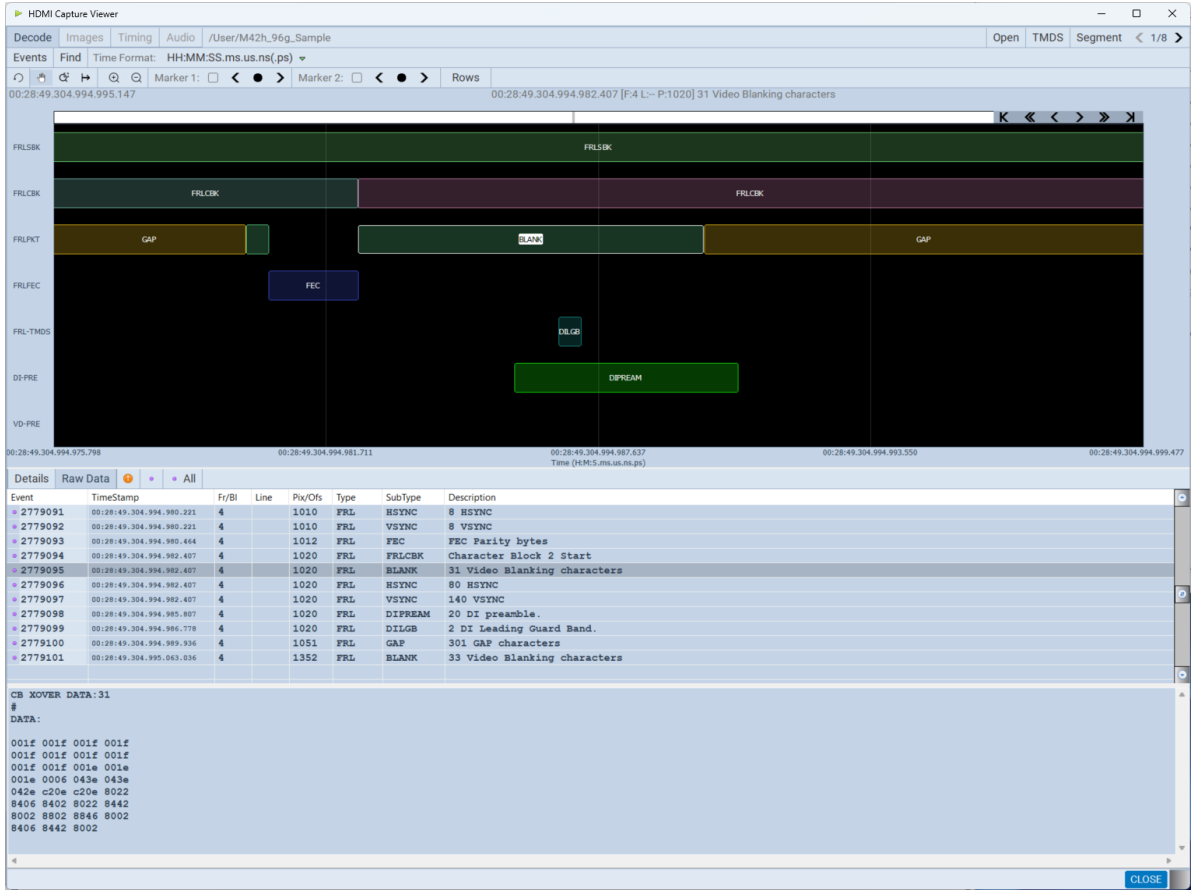
- Screen example showing FRL Main Link capture at 24G per lane, 96G aggregate.
- Showing zoomed out view of capture.

HDMI 2.2 – M42h – Main Link Capture - FRL



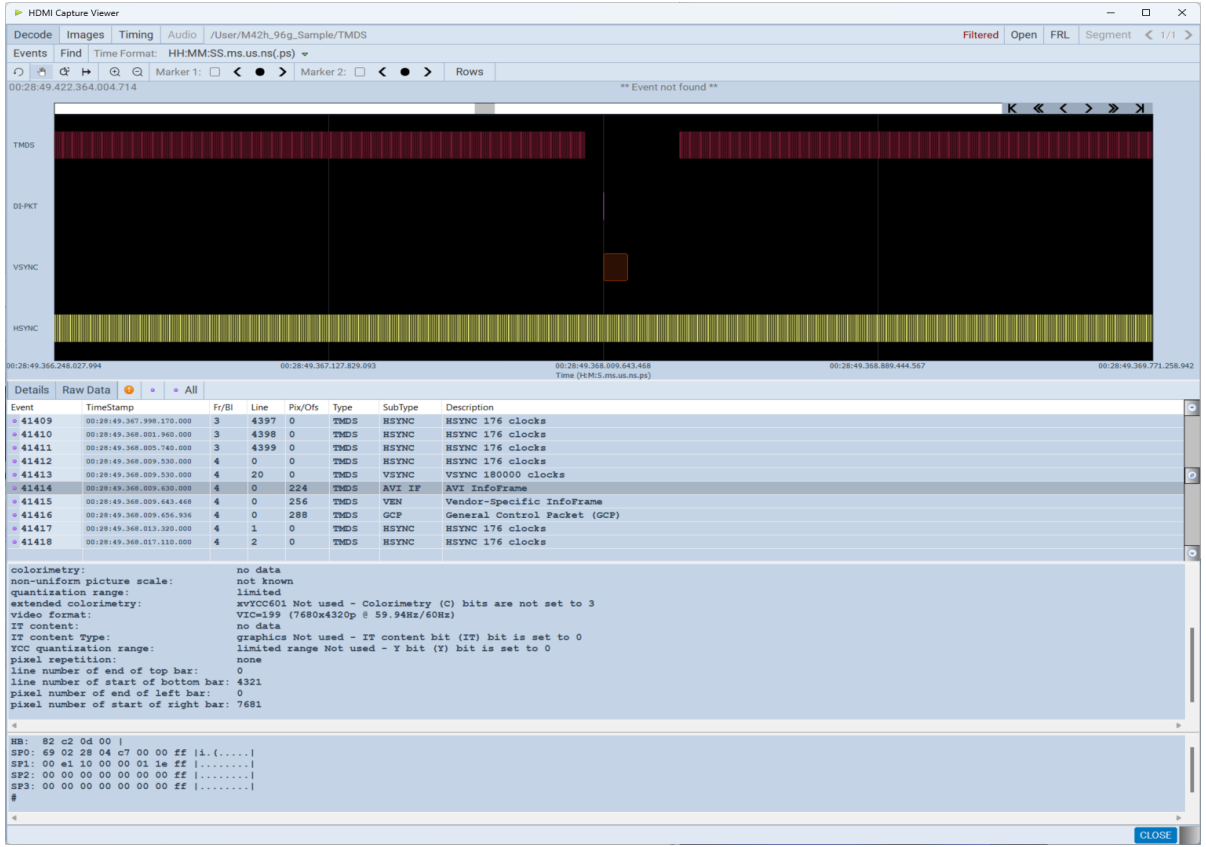
- Screen example showing FRL Main Link capture at 24G per lane, 96G aggregate.
- Showing zoomed in view of FRL structure.

HDMI 2.2 – M42h – Main Link Capture - FRL



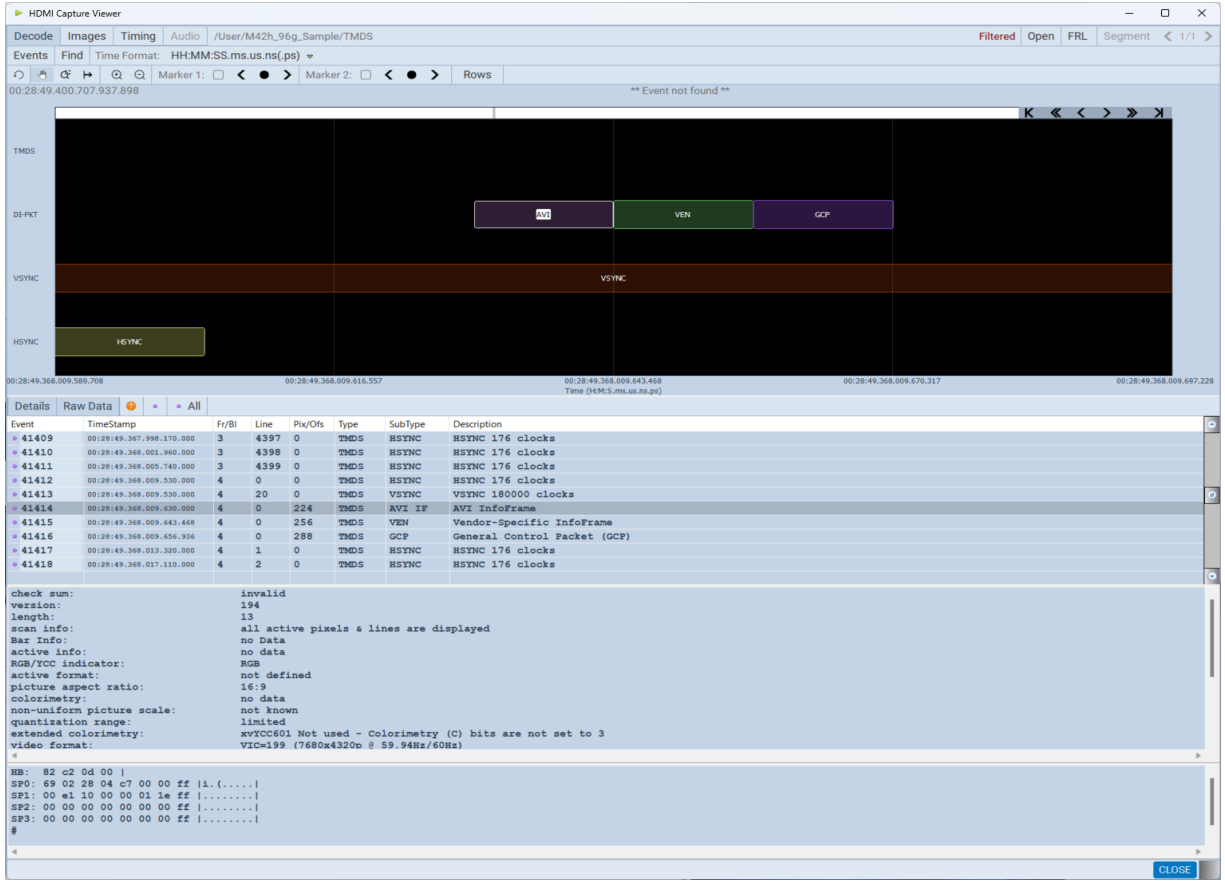
- Screen example showing FRL Main Link capture at 24G per lane, 96G aggregate.
- Showing zoomed in view of blanking area.

HDMI 2.2 – M42h – Main Link Capture - TMDS



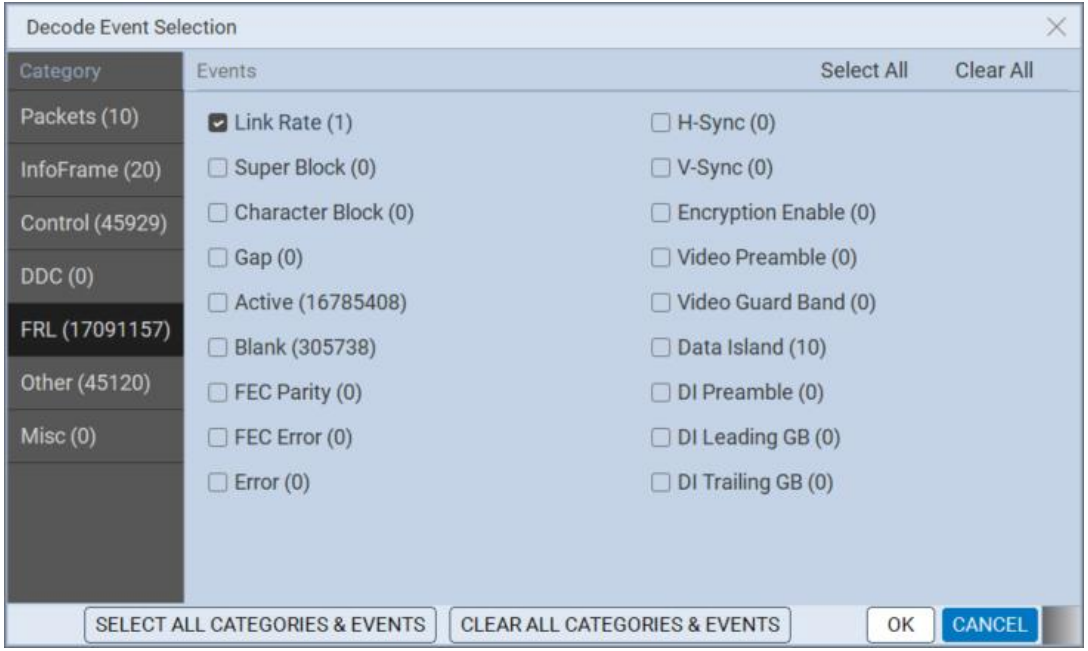
- Screen example showing TMDS view of capture.
- Showing AVI infoframe contents.

HDMI 2.2 – M42h – Main Link Capture - TMDS



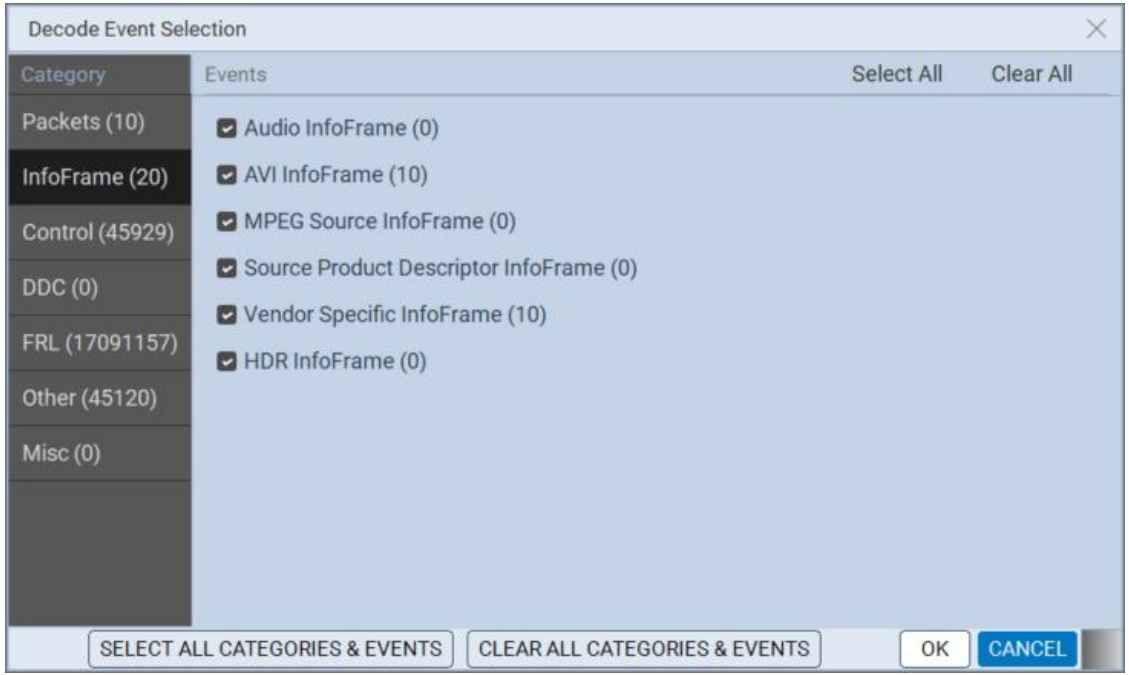
- Screen example showing TMDS view of capture.
- Showing zoomed in area of AVI infoframe.

HDMI 2.2 – M42h – Main Link Capture – FRL Event Types



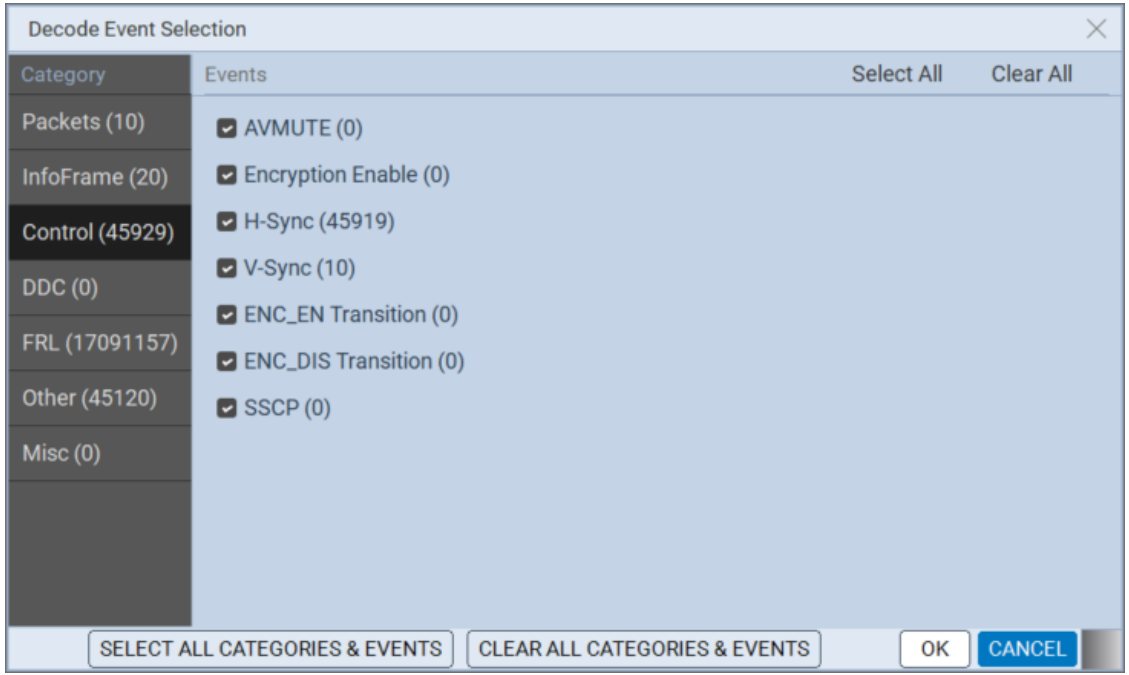
- Screen example all the FRL Event types.

HDMI 2.2 – M42h – Main Link Capture – TMDS Events



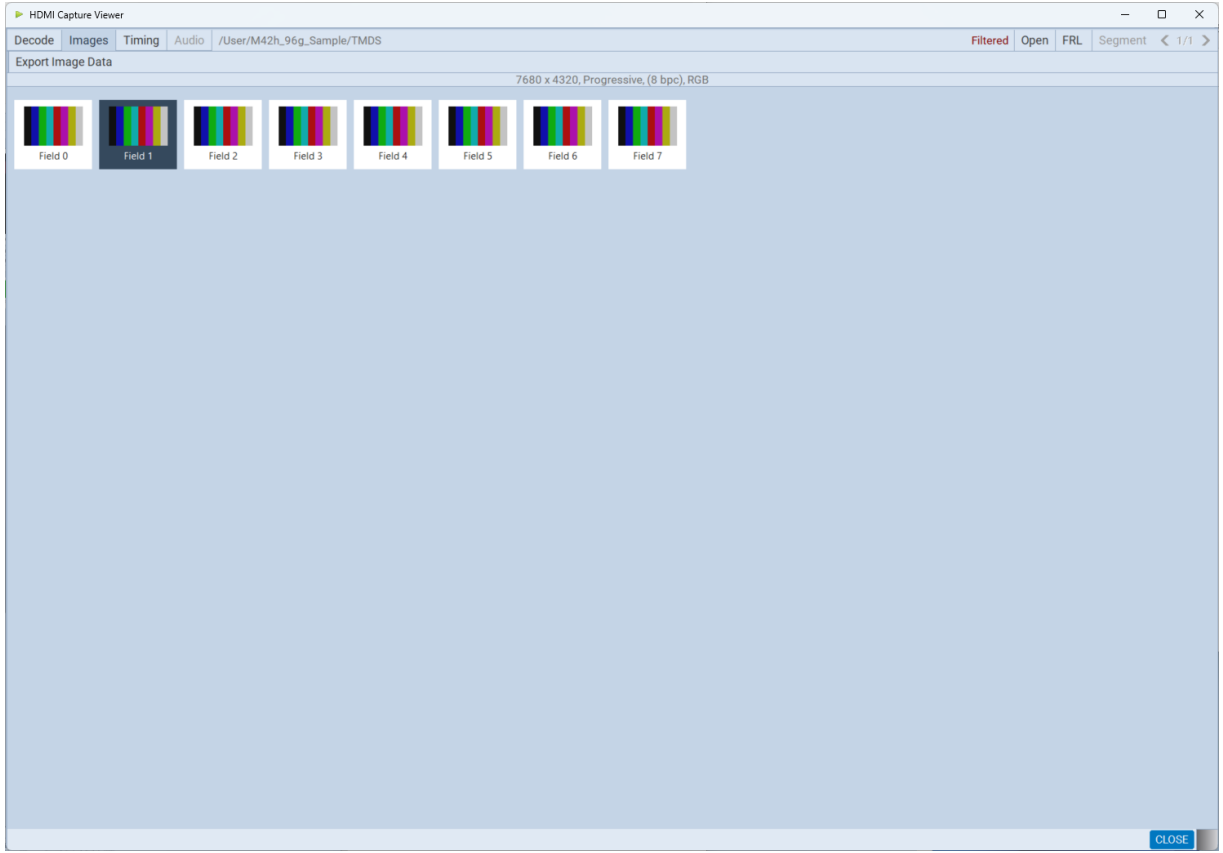
- Screen example all the TMDS InfoFrame Event types.

HDMI 2.2 – M42h – Main Link Capture – TMDS Events



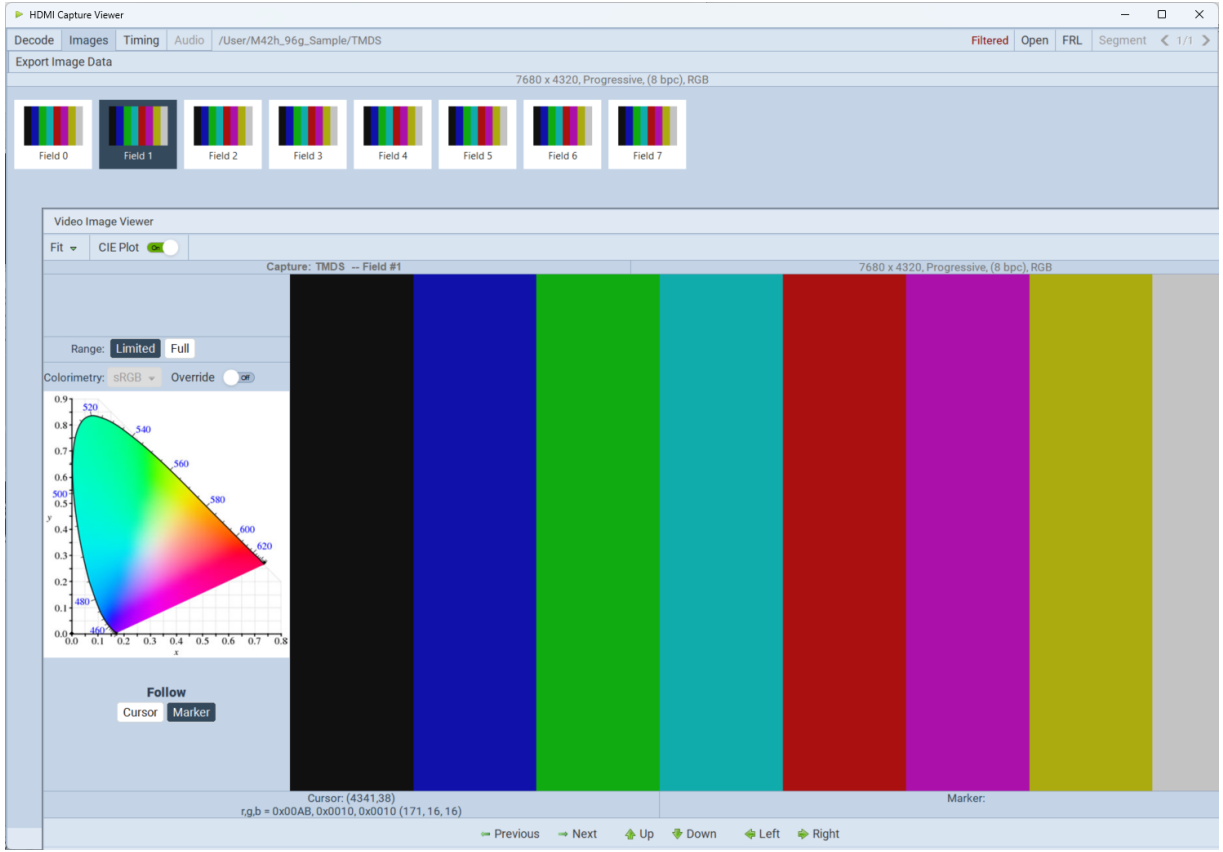
- Screen example all the TMDS Control Event types.

HDMI 2.2 – M42h – Main Link Capture – Video Frames



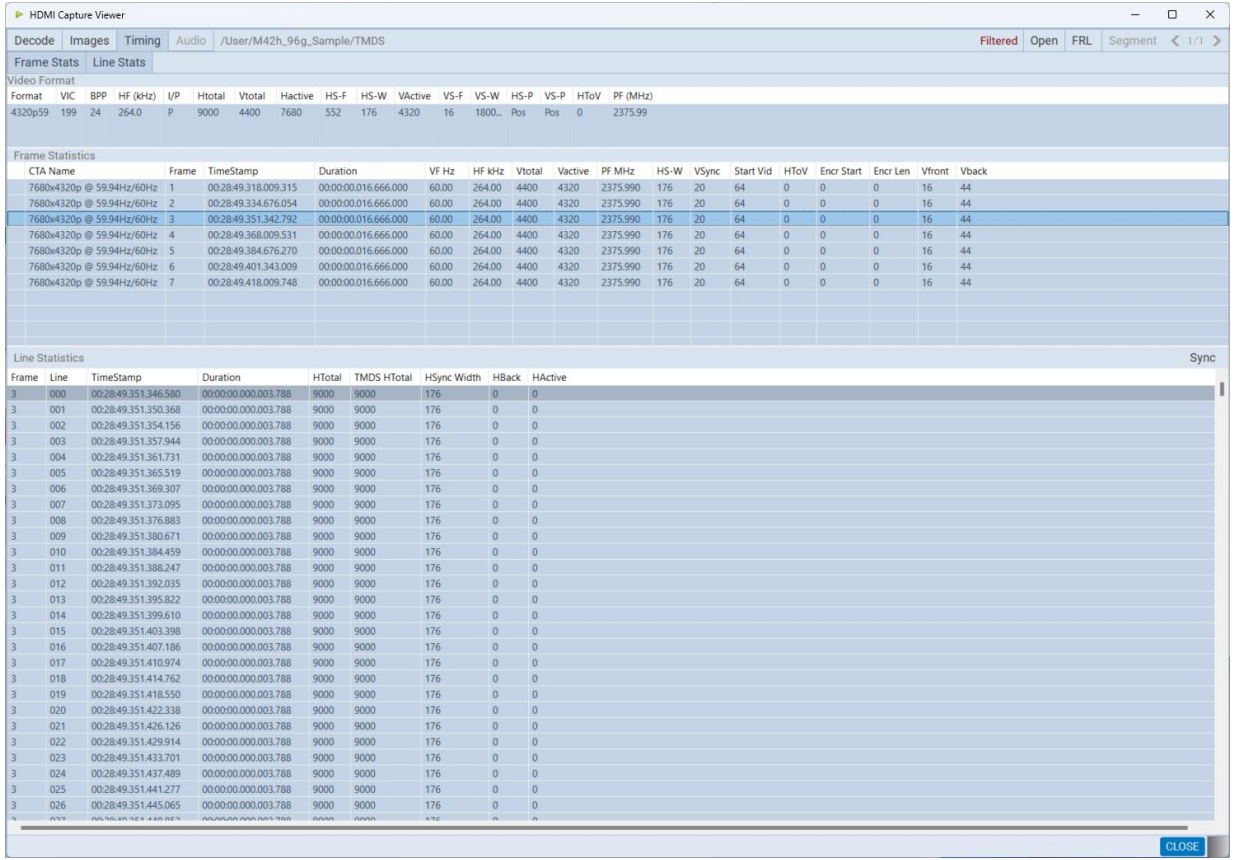
- Screen example showing FRL Main Link capture.
- Viewing Video Frames captured.

HDMI 2.2 – M42h – Main Link Capture – Video Frames



- Screen example showing FRL Main Link capture.
- Viewing a Video Frame captured.

HDMI 2.2 – M42h – Main Link Capture – Timing Analysis



- Screen example showing FRL Main Link capture video frame and line timing.