

quantumdata™ 980

48G Protocol Analyzer / Generator Module for HDMI Testing

Deep Analysis & **NEW!** Generation of HDMI Fixed Rate Link (FRL) w/ Forward Error Correction (FEC)

Now Supports eARC Testing!



Key Features

- Verify the 16b/18b encoding for Fixed Rate Link (FRL) Packets in both 3 and 4 lane configurations
- Generator and Analyzer functions support three (3) Lane configuration supports 3Gbps & 6Gbps data rates; four (4) Lane configurations support 6Gbps, 8Gbps, 10Gbps and 12Gbps (48Gbps aggregate)
- Analyzer function enables viewing of captured data elements graphically in Event Plot and in Data Decode Table; searching and filtering data are supported
- Analyzer function provides visibility into the FRL packet mapping into Character Blocks and Character Block (including FEC characters) mapping into Super Blocks
- Analyzer function supports viewing of underlying TMDS video and protocol elements, data island blocks, preamble data and sync control elements
- Generator and Analyzer functions support link training through EDID and SCDC register read and emulation in accordance with source and sink link training states defined in the HDMI 2.1 specification.
- Generator and Analyzer functions enable monitoring of Link Training transactions in the Auxiliary Channel Analyzer (ACA) utility to show SCDC reads and writes over the DDC channel
- Analyzer Reports the Lane Error Counts and Reed Solomon Corrections Count in the SCDC CED registers
- **NEW!** Verify the eARC common mode channel on either an eARC Tx or Rx device
- **NEW!** Run eARC compliance tests on an eARC Tx or Rx device

The Teledyne LeCroy quantumdata 980 48G Protocol Analyzer / Generator module for HDMI Testing is equipped with HDMI Tx and Rx ports supporting HDMI 2.1 Fixed Rate Link and FEC capture analysis and decode up to 48Gbps (12Gbps/Lane). The HDMI Rx analyzer port provides visibility into the Fixed Rate Link packetization—super blocks, character blocks and FRL packets and underlying TMDS video, protocol, control and metadata elements. The HDMI Tx video generator port **NEW!** transmits Fixed Rate Link video streams with embedded TMDS video, protocol, control and metadata elements. The module also supports the link training functions of the source and sink functions in the FRL mode in both 3 and 4 lane configurations. **NEW!** Enhanced Audio Return Channel testing is also supported.

FRL Analysis and Generation

The 980 48G Protocol Analyzer / Generator module provides video generation and deep analysis test features necessary to test the development of your HDMI 2.1 FRL-capable source and sink devices. These features enable developers to identify and resolve interoperability problems early in the product life cycle. The module's analyzer depicts the incoming FRL packet structure and associated control elements. This includes depicting the Character Block structure and Super Block structure. All FRL packet data elements are assigned precise timestamps. The FRL generator **NEW!** enables selection of pre-capture FRL video streams for playback through the HDMI Tx port.

eARC Testing

NEW! The 980 48G Protocol Analyzer / Generator module supports functional testing and compliance testing of enhanced Audio Return Channel sources Tx devices (e.g. UHD TV) and eARC Rx devices (e.g. sound bar).

Operation

The 980 48G Protocol Analyzer / Generator module supports video generation and analysis of the FRL/FEC HDMI data streams through the user friendly 980 Manager which presents the data in an easy to understand way.

The 980 48G Protocol Analyzer / Generator module can be equipped in either the 980B or 980R Advanced Test Platform.

FIXED RATE LINK (FRL) CAPTURE/DECODE ANALYSIS

Capture and Decode (FRL & FEC)

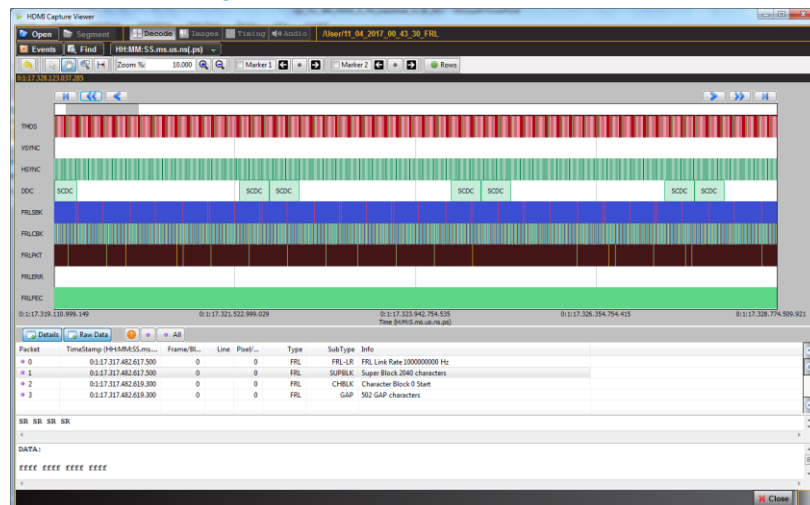
The 980 48G Protocol Analyzer / Generator module captures and decodes incoming HDMI 2.1 streams that have been packetized with Fixed Rate Link packet structures. These FRL-related data elements are depicted graphically in the Event Plot. The decoded data and the raw data is shown in table form in the Data Decode window.

The Forward Error Correction (FEC) characters are also shown as appended on the Character Blocks. The module reports the Lane Error Counts and the FEC Reed Solomon Corrections Count in the SCDC CED registers.

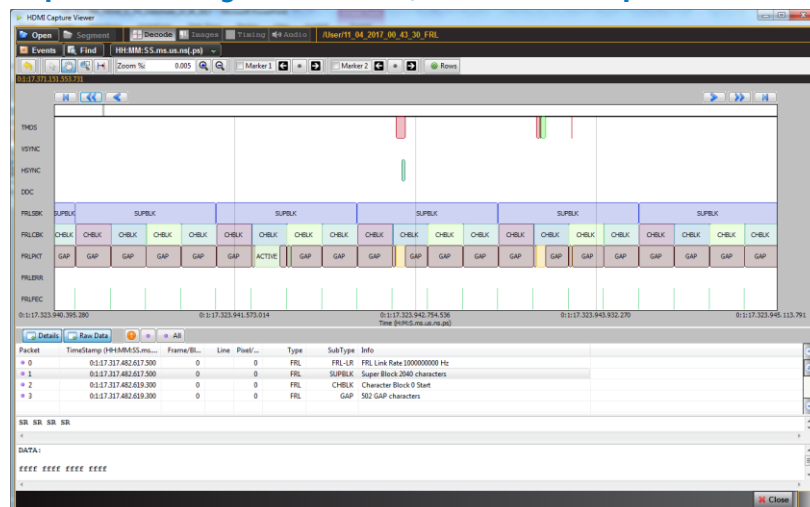
The underlying TMDS video and protocol elements such as the active video, data island and preamble blocks, are also depicted and decoded.

Each element is assigned a precise time stamp. Users can search and filter the FRL captured data by type.

Capture Showing SCDC, FRL & TMDS Elements



Capture Showing FRL Packets, Character & Super Blocks



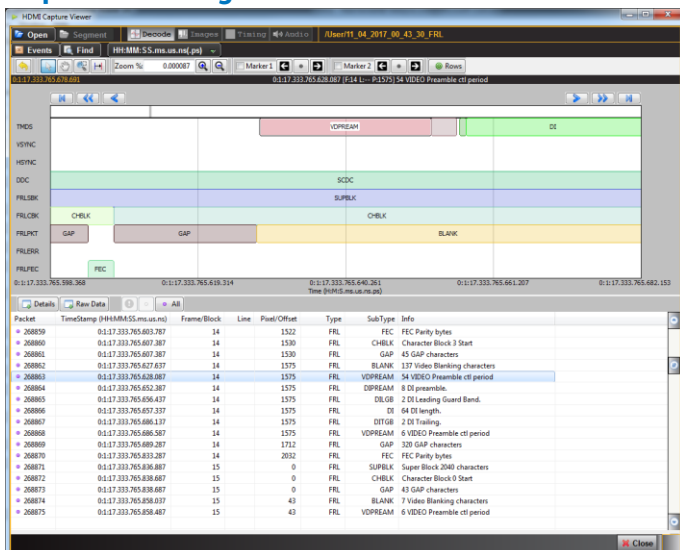
980 with 48G Protocol Analyzer / Generator module for HDMI Testing

HDMI 2.1 Source

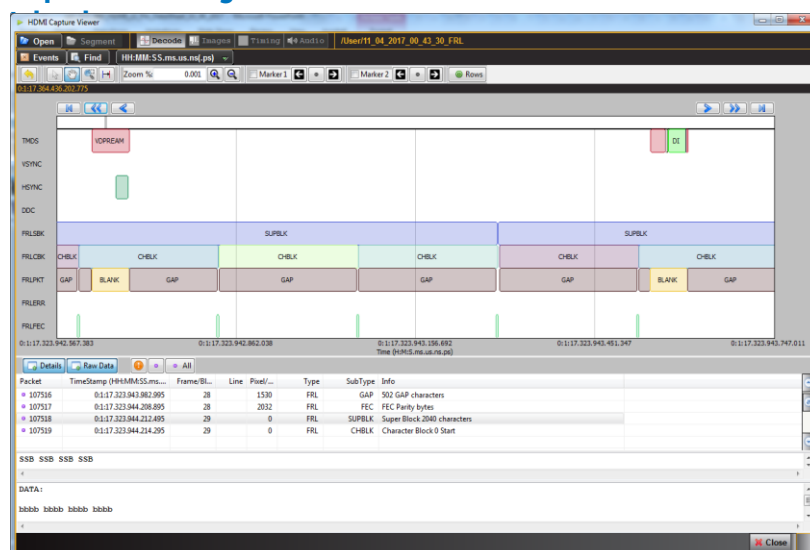


Test Setup for Source Test

Capture Showing Active Video Elements and FEC



Capture Showing FRL Elements & TMDS Video & Data



FIXED RATE LINK (FRL) LINK TRAINING ANALYSIS

Link Training

The 980 48G Protocol Analyzer / Generator module supports Link Training configuration. The module emulates an HDMI 2.1 sink indicating the max FRL rate in the HF-VSDB of the EDID and various other essential link training parameters in the SCDC control registers.

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HDMI 2.1 Source

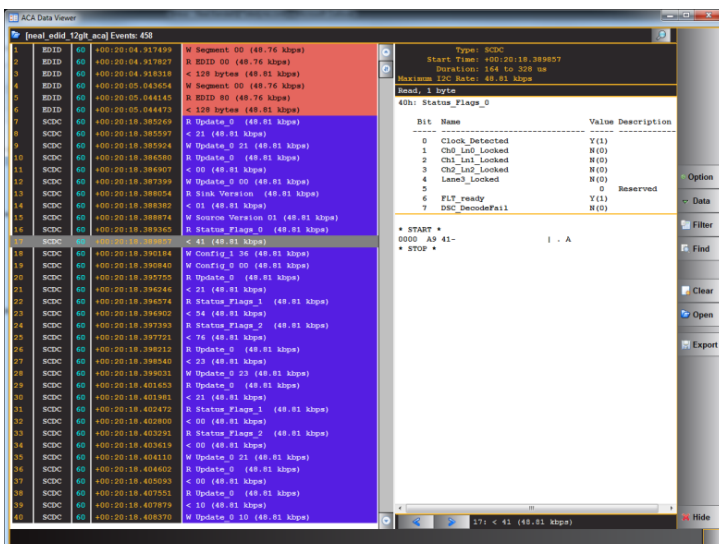


Test Setup for Source Test

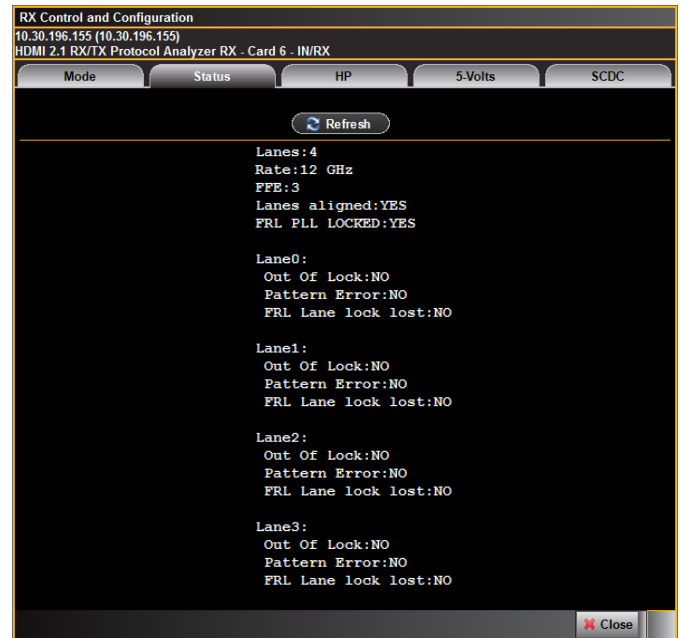
Auxiliary Channel Analyzer

You can use the 980 48G Protocol Analyzer / Generator module to monitor the Link Training transactions—EDID exchange and reads and writes to the SCDC registers over the DDC channel—with the Aux Channel Analyzer (ACA) utility. This enables you to verify link training functions to identify potential interoperability problems.

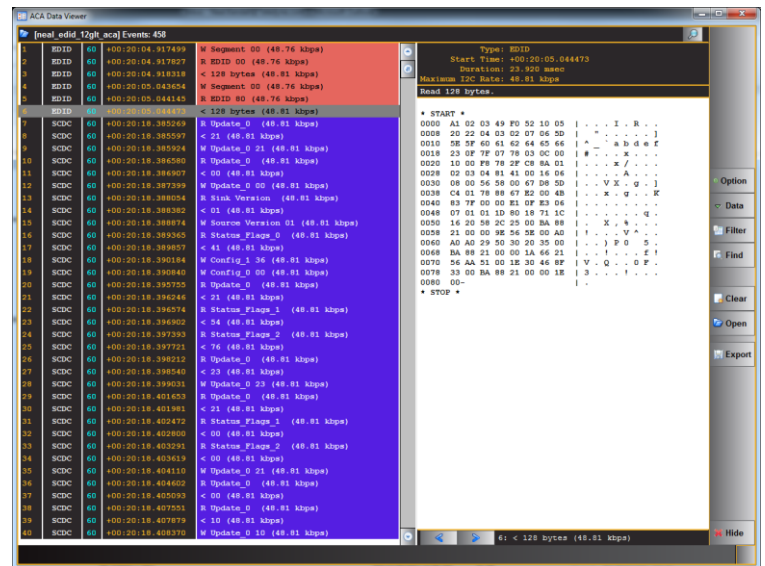
Auxiliary Channel Analyzer (Link Training over DDC)



Link Training Status Screen



Auxiliary Channel Analyzer (Link Training over DDC)



FIXED RATE LINK (FRL) VIDEO GENERATION

FRL Video Generation

The 980 48G module for HDMI Testing enables developers of HDMI FRL-capable sink devices and silicon makers to run functional tests on their FRL-capable display devices by rendering uncompressed, unencrypted FRL streams at up to 8K video resolutions at lane rates up to 12Gb/s and at an aggregate link rate of 48Gb/s. The initial phase of the video generator function is implemented through a playback function using pre-captured FRL streams with various resolutions, frame rates and bit depths. Future releases will include a full video generator function with specific selections of video formats, colorimetry, bit depth, chroma subsampling and test patterns.

HDMI 2.1 FRL-Capable UHD TV

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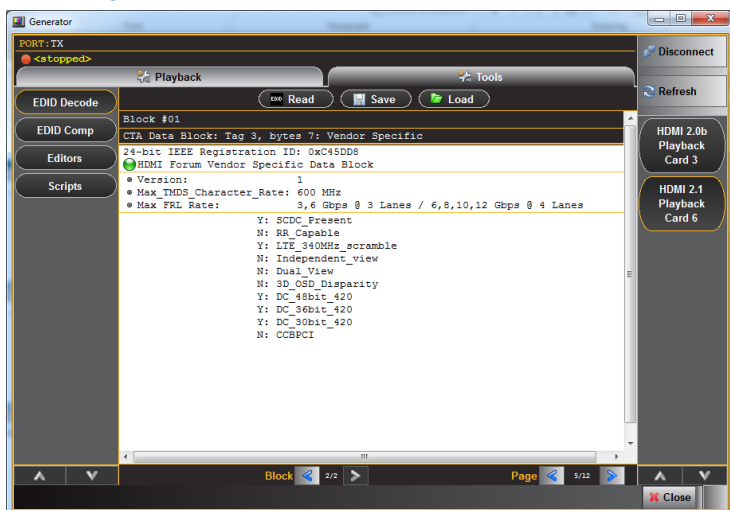


HDMI cable

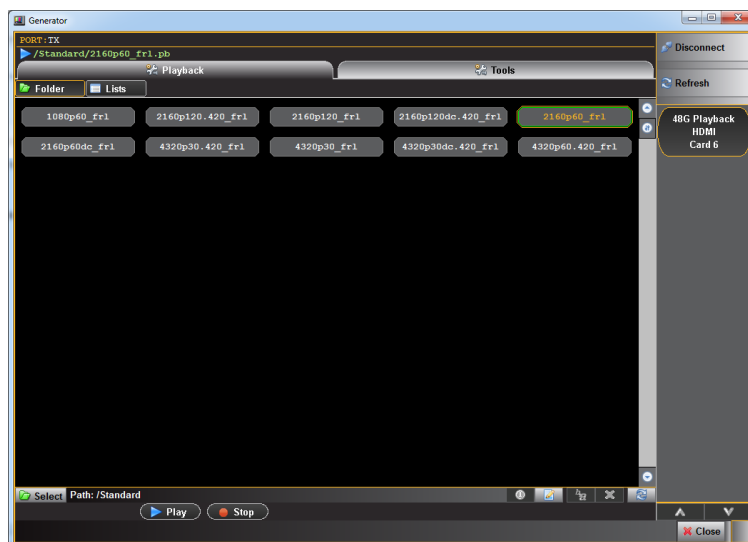
EDID Read

The 980 48G Protocol Analyzer / Generator module enables you to view the EDID of the connected display (below).

Reading the EDID



Selection of FRL Playback Capture Files



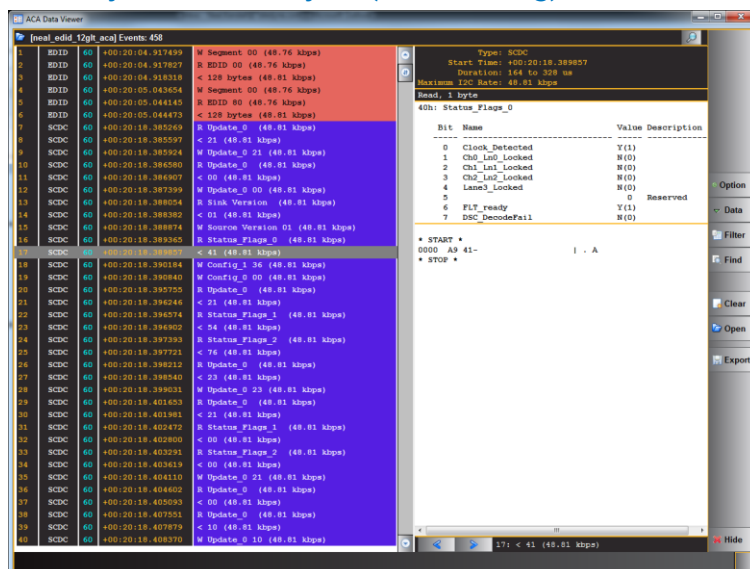
Link Training

The 980 48G Protocol Analyzer / Generator module's video generation function reads the EDID values for max FRL rate as well as various other essential lane capability parameters in the SCDC control registers. The FRL generator will then initiate link training as a compliant FRL source. The link training status can quickly be viewed from the Auxiliary Channel Analyzer (ACA) utility.

Auxiliary Channel Analyzer

You can use the 980 48G Protocol Analyzer / Generator module to monitor the Link Training transactions—EDID exchange and reads and writes to the SCDC registers over the DDC channel—with the Aux Channel Analyzer (ACA) utility. The FRL link training transactions enable developers to verify that their displays are properly conducting their role in the link training process.

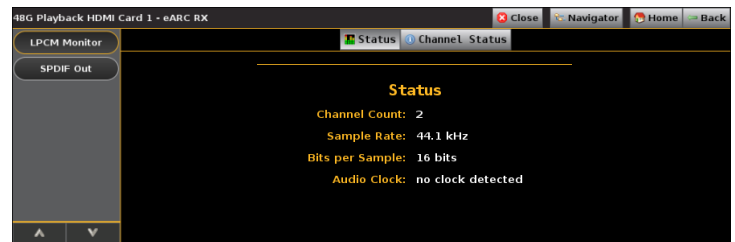
Auxiliary Channel Analyzer (Link Training)



eARC FUNCTIONAL AND COMPLIANCE TESTING

eARC Functional Testing

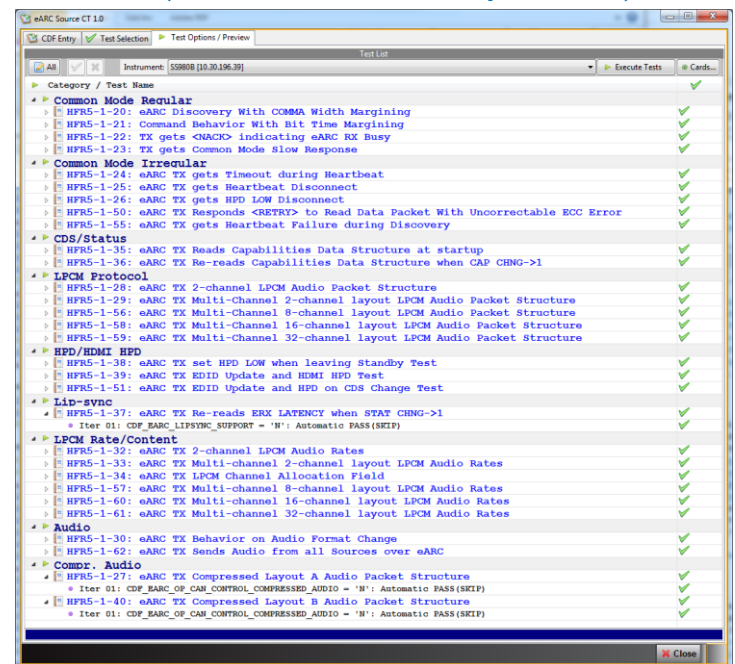
The 980 48G module is also supports enhanced Audio Return Channel (eARC) Tx/Rx functional testing. The solution provides emulation of an eARC Tx and Rx functions over the eARC Common Mode and Differential mode data channels. Solution supports discovery and disconnect, heartbeat, status and capabilities data structure and transmission over the differential channel. (Sample screen showing monitoring incoming audio stream, right.)



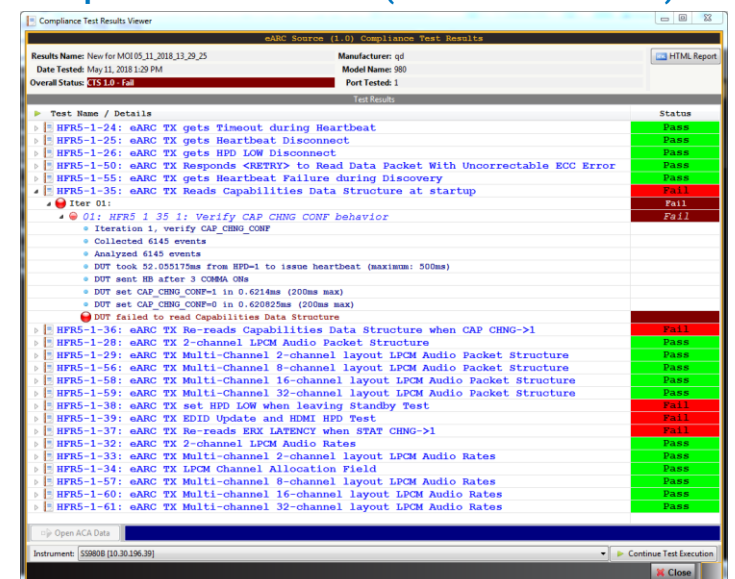
eARC Compliance Testing

The 980 48G module for HDMI Testing enables developers of HDMI eARC Tx and Rx devices to run compliance tests on their eARC-capable. The compliance tests, once initiated, run with little or no human interaction. Detailed results are provided for each test to help identify the root cause of failures. The reports can be exported and disseminated to colleagues and other subject matter experts.

Test Suite (Source Test Suite Example Shown)



Sample eARC Test Results (Source Tests Shown)



HDMI 2.1-eARC Rx (A/V Receiver)



HDMI cable

eARC Rx Test Setup

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HDMI 2.1 eARC Tx (UHD TV)



HDMI cable

eARC Tx Test Setup

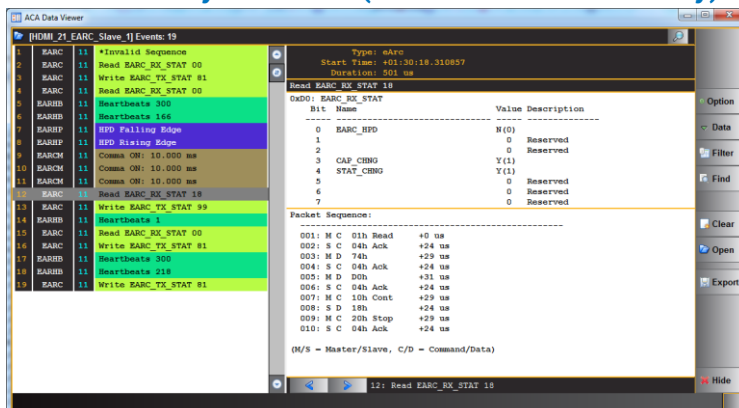
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Auxiliary Channel Analyzer

The 980 48G module can monitor the Link Training transactions—EDID exchange and reads and writes to the SCDC registers over the DDC channel -with the Aux Channel Analyzer (ACA) utility. Viewing the FRL link training transactions enables developers to verify their displays are properly conducting the link training process properly.

Aux Chan Analyzer Traces (Common Mode Discovery)



SPECIFICATIONS

HDMI Ports

Version	HDMI 2.1
Standard Formats	CEA
Connector	Rx HDMI Type A; Category 2 Tx HDMI Type A: Category 2 Note: Connectors are not approved Category 3 connectors
Protocols	FRL with FEC Note: TMDS support is future
FRL bit rates	3Gbps; 6Gbps; 8Gbps; 10Gbps; 12Gbps (48Gbps aggregate)
Line Code	16b/18b
HDCP	Future
Capture memory	8 GBytes

HDMI 2.1 Protocol Analyzer Features

Fixed Rate Link (FRL)	Captures and Decodes Fixed Rate Link (FRL) and FEC data streams
Forward Error Correction	Displays FEC packets in FRL Character Blocks
FRL Lanes	3 & 4 lane configurations are supported
FRL Link Training Patterns	Supports LPT5 through LPT8
FRL Link Training	Supports link training with an FRL source in accordance with states defined in the HDMI 2.1 specification (fallback to TMDS is not supported)

HDMI 2.1 Video Generator Features

Fixed Rate Link (FRL)	Transmits Fixed Rate Link (FRL) and FEC data streams
FRL Lanes	3 & 4 lane configurations are supported
FRL Link Training Patterns	Supports LPT5 through LPT8
FRL Link Training	Supports link training with an FRL sink in accordance with states defined in the HDMI 2.1 specification (fallback to TMDS is not supported)

HDMI 2.1 Module Options

NEW! Video Generator license option	Transmits Fixed Rate Link (FRL) and FEC data streams
Protocol Analysis license option	Analyzes Fixed Rate Link (FRL) and FEC data streams
NEW! Functional test of eARC Tx	Emulate eARC Rx to run functional test on an eARC Tx common & differential mode
NEW! Functional test of eARC Rx	Emulate eARC Tx to run functional test on an eARC Rx common & differential mode
NEW! Compliance test of eARC Tx	Run compliance test on an eARC Tx
NEW! Compliance test of eARC Rx	Run compliance test on an eARC Rx

980 Test Platforms

Embedded Display	980B: 15" diagonal; Resolution: 1024(H); x 768 (V) resolution; 24 bit RGB color. 980R: 7" diagonal; Resolution: 800 (H) x 480 (V); 24 bit RGB color.
Power	90-264 VAC, 47-63Hz
Weight	23.76 LBS; 10.78 Kg
Size	980B: Height: 15.25 in. (38.7 cm) Width: 14.57 in. (36.5 cm) Depth: 6.29 in. (15.9 cm) 980R: Height: 6.29 in. (15.9 cm); Width: 15.25 in. (38.7 cm); Depth: 14.57 in. (36.5 cm)
Command Line Control	Ethernet (RJ-45) for external GUI and telnet
Environmental	Operating Temp: 32 to 104 (F); 0 to 40 (C)



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