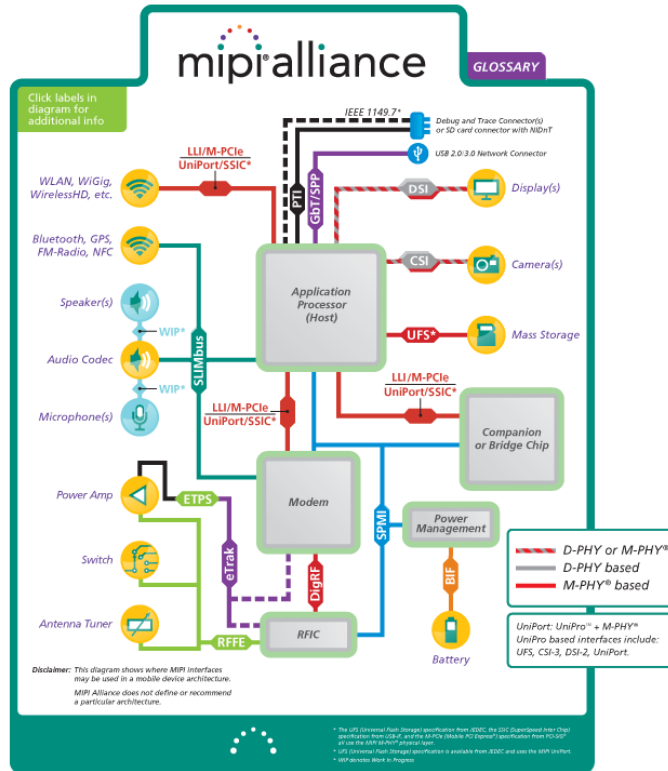


MIPI Mobile Segment Protocol Decode Solutions Datasheet



Source -MIPI®Alliance

Device driver ICs for peripherals like camera, display, memory, RF, and USB interface with application processors in mobile handsets - each of these interfaces has their own protocol to communicate to the application processor. System validation teams face constant challenges in terms of integration and validating communication between the devices. Tektronix provides a complete suite of these protocol decoders for M-PHY, D-PHY and various other interfaces in the mobile handset. The decoding solution helps designers efficiently and cost-effectively perform protocol validation in conjunction with electrical validation for MIPI specifications using a single oscilloscope.

The decoding solution offered has the ability to trigger on the signal of interest using hardware-based triggering and software-based triggering. The ability to use oscilloscope hardware triggers on live waveforms improves the accuracy of locking onto packet types of interest, search on different packet types and correlate with M-PHY electrical signals. Oscilloscope-based hardware triggering provides much higher accuracy than software triggers for capturing decoded signals. Hardware-based triggering is a unique capability offered by Tektronix for oscilloscope-based decoders. Various decoders are available and are listed below in detail.

M-PHY UniPro and LLI decode

- Leverages the oscilloscope serial trigger (ST6G)
 - Triggers on the UniPro and LLI specific events for all Gears
- 4-lane automated decoding
 - Automatically identifies all Gears and signaling schemes, and decodes
 - Automatically verifies CRC errors in the Protocol Packets
 - Acquires up to 4 lanes of data traffic simultaneously, and correlates the lane-to-lane events
- Protocol to physical-layer data correlation
 - Automatically links protocol decode data to the waveforms on the oscilloscope
 - Enables faster system-level protocol debugging

M-PHY 8b-10b decode

- All M-PHY Gears
 - Decodes M-PHY data traffic up to 6.25 Gb/s data rate, from symbols or 10-bit into 8-bit data
- Trigger and search
 - Supports trigger and search on any control character, character/ symbol, error (character error and disparity error), or pattern
- Custom decode
 - Additionally, Option SR-CUST Custom Serial Analysis Kit can be used for any custom protocols decoding up to 6.25 Gb/s data rate

M-PHY DigRFv4 decode

- Automated decoding
 - Automatically recognizes data speeds, disassembles, and displays the decoded data in different readable-data formats
- 4-Lane decoding
 - Acquires up to 4 lanes of data traffic at a time
- Online, offline, and remote analysis
 - Supports LAN interface, and leverages TekVISA to connect to Tektronix oscilloscopes
- Filter, search, and option tabs
 - Searches and filters the decoded messages based on user criteria

SSIC Protocol Decoder

- Leverages the oscilloscope serial trigger (ST6G)
- Software trigger support on the SSIC specific events

- Supports all M-PHY HS Gears & PWM Gears
- Supports 1, 2 and 4 lanes of SSIC decoding
- Single/Consolidated hierarchical view to display protocol decode at raw data, 8b10b, Physical Layer, Link Layer and Protocol Level
- Generates customized reports in .mht format and PDF

RFFE Protocol Decoder

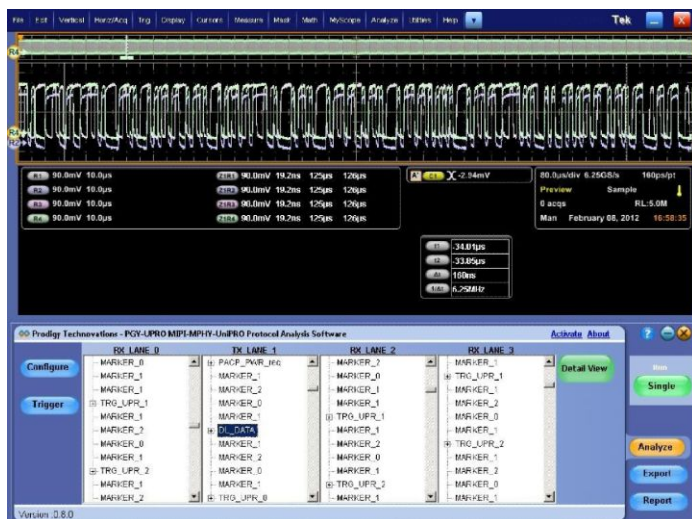
- RFFE protocol Analysis using oscilloscope live channel data or stored RFFE signals
- Powerful RFFE real-time protocol aware hardware based trigger capabilities
- Displays the decoded data in RFFE frame format
- Error checks, Search & Filter capabilities
- Report Generation

HSI Electrical Validation & Protocol Decode

- Automated HSI electrical measurements and protocol testing
- Supports analysis of Synchronized data flow, Pipelined data flow and Receiver real time data flow
- Supports Stream Transmission and Frame Transmission Modes
- Supports wfm file formats for offline analysis

Oscilloscope-based decode for M-PHY UniPro and LLI

M-PHY design and test engineers need to monitor and debug UniPro/LLI protocol interfaces to ensure reliable operation of the system. Manually interpreting the protocol layer information using oscilloscope data is time consuming and prone to human error in a versatile UniPro and LLI protocol standard.



PGY-UPRO and PGY-LLI Decode

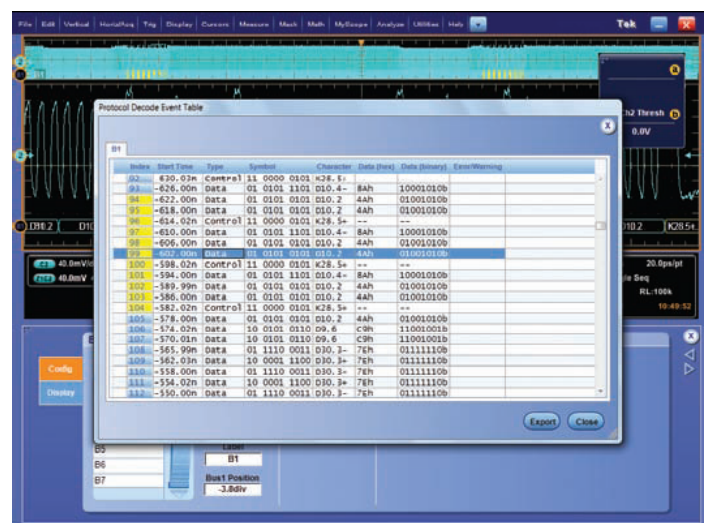
The Prodigy PGY-UPRO/PGY-LLI Protocol Decode software offers extensive protocol decoding for M-PHY UniPro/LLI protocol specifications respectively. With this software, the M-PHY design and test engineers can now automatically make accurate and reliable decodes of multi-lane data, acquired by a Tektronix DPO/DSA/MSO70000 oscilloscope, and significantly reduce the development and test cycle.

The PGY-UPRO/PGY-LLI software automatically identifies all gears and signaling schemes such as NRZ and PWM, and decodes the protocol frames of multi-lane traffic. Built up on oscilloscope serial trigger features, the software computes CRC and verifies for CRC errors in a UniPro/LLI protocol packet. The software also links the decoded data to the electrical signal in the oscilloscope display, enabling better correlation from protocol-to physical-layer data. Furthermore, the software generates comprehensive and customizable reports, along with protocol data exportable in TXT and CSV formats. The software conforms to the M-PHY specification v1.0, the UniPro specification v1.4, and the LLI specification v0.8.

Oscilloscope-based decode for M-PHY 8b-10b

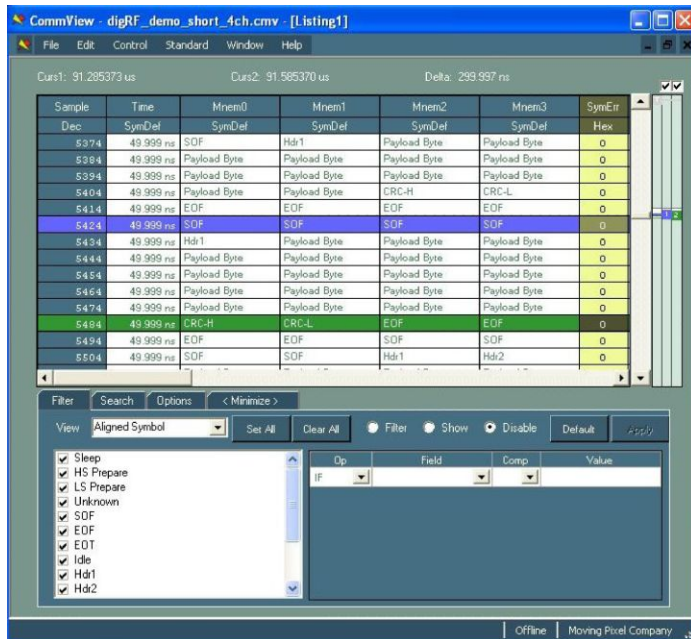
The SR-810B Serial Analysis application option enables Decode, Search, and Trigger on 8b/10b bus events for fast verification. All Tektronix MSO/ DPO/DSA70000 Series oscilloscopes are equipped with a dedicated trigger chip for triggering on 8b/10b data patterns in high-speed serial signals up to 6.25 Gb/s. Installed as part of TekScope firmware, this software ensures finding even rare events. Furthermore, the DPO/DSA/MSO70000 Series oscilloscopes with PTD software support several 8b10b data values for triggering.

A very unique feature of the SR-810B option and perhaps the most powerful debugging tool is the capability to trigger on 8b/10b code errors. No serial trigger would be able to trigger on all possible character errors, disparity errors, or losses of byte synchronization, but the Tektronix 8b/10b serial trigger allows triggering on common errors such as disparity or character errors.



Oscilloscope-based decode for M-PHY 8b-10b

Oscilloscope-based decode for M-PHY DigRFv4



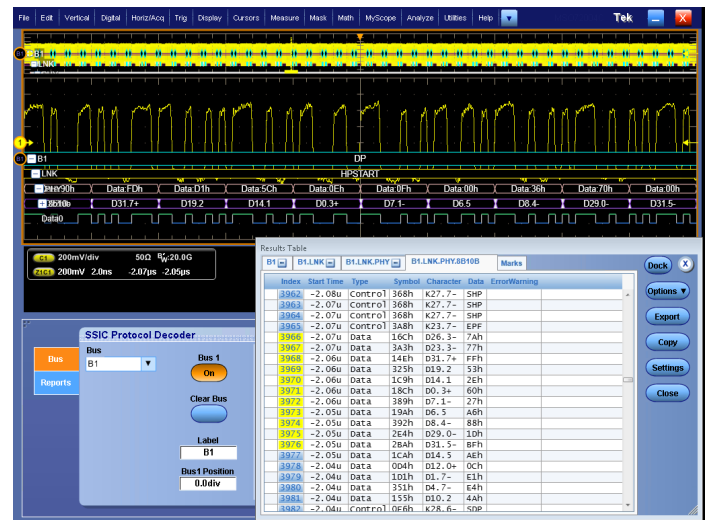
Oscilloscope-based decode for M-PHY DigRFv4

The Moving Pixel MPHYVIEW Protocol Decode software automatically recognizes M-PHY data speeds, disassembles, decodes the DigRFv4 data streams, and displays the decoded data in different readable-data formats. The software can be configured to acquire up to 4 lanes of data traffic at a time.

The MPHYVIEW software can be connected to a remote oscilloscope, and executed remotely from any Windows system, using TekVISA. The Filter and Search tabs enable searching and possibly highlighting records that satisfy given criteria. The MPHYVIEW also supports bit-sync, align, 10b-8b decode form packets, and disassemble.

SSIC Protocol Decoder

SSIC implementation provides low-power, efficient connectivity on a PCB between a smartphone/tablet application processor to a modem or WiFi SoC. It uses existing USB 3.0 software stack help preserve software compatibility. The electrical PHY layer MIPI M-PHY with SSIC controllers can result in up to an 80 percent power savings over USB 3.0 PHYs.



- Support SSIC specification v1.0
- Leverages the oscilloscope serial trigger (ST6G). This hardware-based triggering provides accuracy of locking on a packet type with much higher accuracy than a software trigger.
- Software trigger support on the SSIC specific events for all M-PHY HS Gears & PWM Gears
- Supports 1, 2 and 4 lanes of SSIC decoding
- Single/Consolidated hierarchical view to display protocol decode at raw data, 8b10b, Physical Layer, Link Layer and Protocol Level
- Clicking on the packets in the results tabs will center align the corresponding packet in the scope graticule providing user with ease of navigation of the decoded data
- Search capability of different packet types, ordered set and errors
- Protocol to physical-layer data correlation in the results tab as well as Scope graticule
- Highlights packet errors in the results tab for easy navigation and quick analysis of errors
- Generates customized reports in .mht format and PDF
- Color coding of header, payload and CRC on scope graticule
- Supports decoding for both M-PHY TX & M-PHY RX

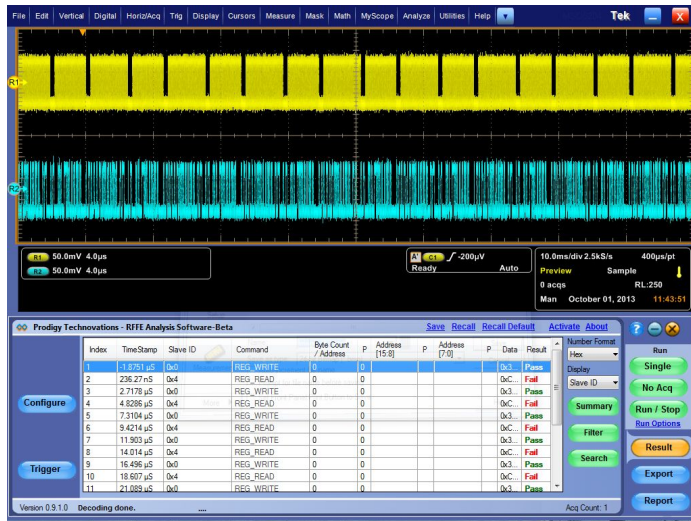
Supported Oscilloscopes & Probes

- Same as the recommended oscilloscopes and probes recommendation for M-PHY

Oscilloscope Options requirements

- ST6G
- SR-CUST

PGY-RFFE Protocol Trigger and Decode Analysis Software



RFFE Protocol Analysis view in oscilloscope waveform display

Features:

- RFFE protocol Analysis using oscilloscope live channel data or stored RFFE signals
- Powerful RFFE real-time protocol aware hardware based trigger capabilities
- Displays the decoded data in RFFE frame format
- Error checks for parity bits of command and data
- Error checks for Byte count with actual data count and missing SSC
- Flexibility to view Slave ID in Symbol or Hex value
- Flexibility to view decoded data in hex, binary, Decimal or octal format
- Long duration data decode support to capture more number of RFFE protocol transactions
- Search capabilities to locate protocol event
- Filter capabilities to view information of Interest
- Documentation by exporting data in CSV and TXT file format
- Report Generation

RF Front End control interface (RFFE) developed for controlling front interfaces including Power Amplifiers, Low-noise amplifiers, filters, switches, and power management modules in new generation mobile devices. Engineers designing RFFE interfaces need to test and debug the RFFE interface for its protocol specification. System designers need to debug the communication taking place in the RF interface. This process is time consuming and error prone, due to manually decoding the clk and data signals of RFFE for testing and debugging the hundreds of RFFE messages.

PGY-RFFE Software runs inside Tektronix oscilloscopes such as DPO/MSO5000, DPO7000 and DPO/DSA/MSO70000 oscilloscope series. PGY-RFFE utilizes the hardware based real-time RFFE protocol aware trigger, protocol analysis of long acquisition record length up to 125 MB to provide superior RFFE Protocol Analysis results at the press of a button.

Easy RFFE Protocol Test Setup and Debug

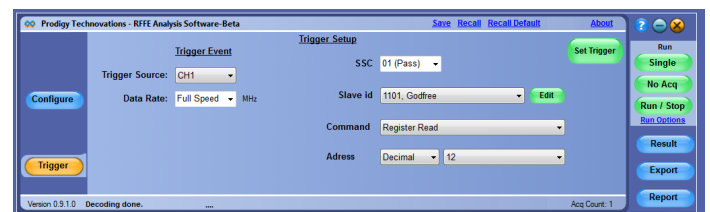
PGY-RFFE Software installed in Tektronix oscilloscopes can be launched by clicking on the PGY-RFFE icon in the oscilloscope desktop folder. Now the user has simultaneous view and control of the oscilloscope as well as PGY-RFFE Software. PGY-RFFE Software is set to make RFFE Protocol analysis. The user can analyze RFFE in single acquisition mode, Repetitive mode and No Acq mode. In No Acq mode, RFFE software can analyze a previously-captured RFFE signal that is present in the acquisition memory of the oscilloscope.



PGY-RFFE Software runs inside MSO5204 Oscilloscope

Powerful RFFE Protocol Aware Hardware Based Real-Time Trigger

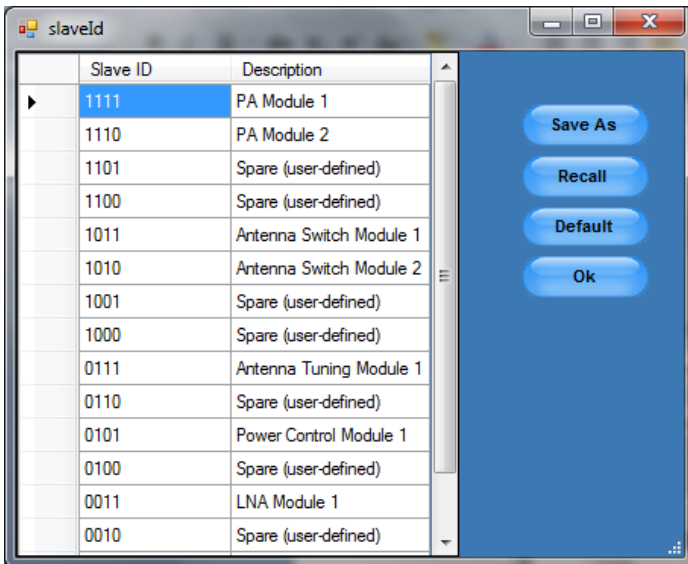
Simple, easy-to-use RFFE protocol-aware trigger features allow engineers to capture RFFE signals at a specific event in the RFFE interface.



Select any live channels (CH1 to CH4) as the trigger source and set the trigger pattern. Trigger can be set to full speed, half speed or any custom data rate. RFFE provides the flexibility to select a combination of any one of the sixteen slave IDs, any command and command-dependent parameter, such as Byte count or Address or Data.

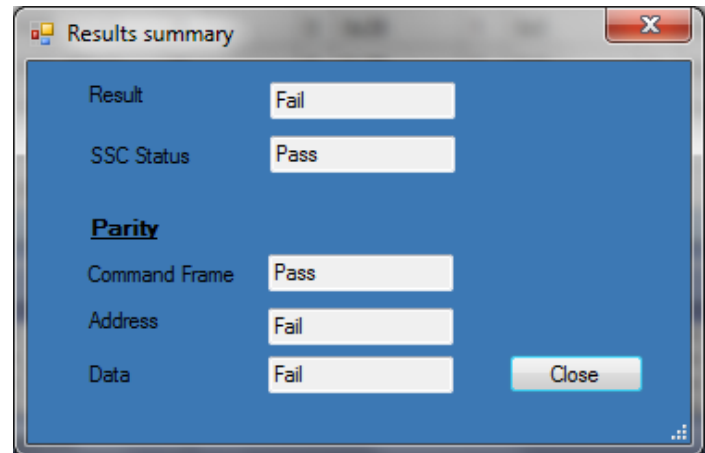
Symbol table for Slave ID

PGY-RFFE Software provides the flexibility to view the decoded data in symbol table. RFFE specification documents provide guidelines to describe the Slave IDs. PGY-RFFE software has the default slave ID table. However user can edit the default table and apply the custom described slave ID for easy analysis of protocol activities. This symbol table is used for easy trigger setup, protocol analysis, filter and search features.



Slave ID	Description
1111	PA Module 1
1110	PA Module 2
1101	Spare (user-defined)
1100	Spare (user-defined)
1011	Antenna Switch Module 1
1010	Antenna Switch Module 2
1001	Spare (user-defined)
1000	Spare (user-defined)
0111	Antenna Tuning Module 1
0110	Spare (user-defined)
0101	Power Control Module 1
0100	Spare (user-defined)
0011	LNA Module 1
0010	Spare (user-defined)

Buttons: Save As, Recall, Default, Ok



Results summary

Result: Fail

SSC Status: Pass

Parity

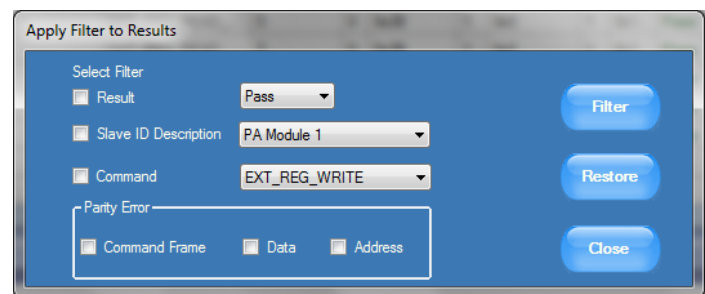
Command Frame: Pass

Address: Fail

Data: Fail

Buttons: Close

PGY-RFFE filter feature



Apply Filter to Results

Select Filter

☒ Result: Pass

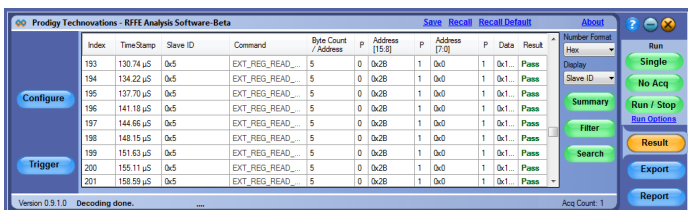
☒ Slave ID Description: PA Module 1

☒ Command: EXT_REG_WRITE

Parity Error: ☐ Command Frame ☐ Data ☐ Address

Buttons: Filter, Restore, Close

Protocol Analysis of RFFE Signals



Index	Time Stamp	Slave ID	Command	Byte Count / Address	P	Address [15:8]	P	Address [7:0]	P	Data	Result
193	130.74 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
194	134.22 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
195	137.70 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
196	141.18 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
197	144.66 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
198	148.15 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
199	151.63 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
200	155.11 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass
201	158.59 µs	0x5	EXT_REG_READ...	5	0	0x2B	1	0x0	1	0x1...	Pass

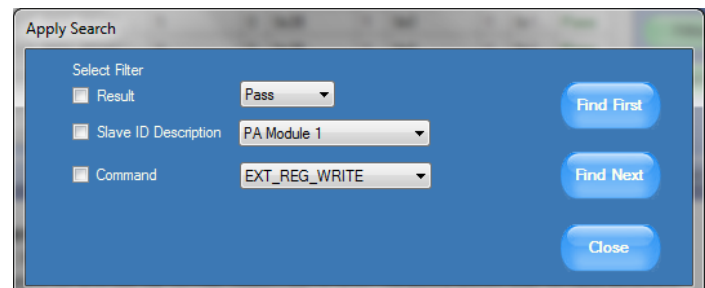
Buttons: Configure, Trigger, Run / Stop, Result, Export, Report

RFFE Protocol decoded data is displayed as above. PGY-RFFE software can process record lengths up to 125 MB and display all of the RFFE protocol packets. The software analyzes each RFFE packet for missing SSC, parity bit error in address, command and Data bytes. PGY-RFFE software identifies any RFFE packet with missing SSC. This ensures that each RFFE packet meets the protocol specifications of RFFE. PGY-RFFE software displays the result (pass or fail) for each RFFE protocol packet.

Protocol Summary provides a quick-result view of protocol analysis of RFFE signals. This view lists SSC status, parity bit status in Command, address and data in the acquired data. This helps locate the cause of the RFFE Protocol packet failure.

It is extremely challenging to view information of interest while there are hundreds of protocol transactions taking place between different front devices. These problems compound during the protocol analysis of long record length. PGY-RFFE software simplifies this problem by Filter feature. By filtering information for Slave ID or specific command, or parity error type, the user can view only the specific data of interest. The Filter feature provides flexibility of filtering information using individual packet content or a combination of packet content.

During the protocol analysis, large amounts of data are captured in order to avoid any non repeatable event, making it extremely difficult to locate the RFFE packet of interest. The search feature in the RFFE Software allows the user to quickly locate the required Slave ID or command or combination of both.



Apply Search

Select Filter

☒ Result: Pass

☒ Slave ID Description: PA Module 1

☒ Command: EXT_REG_WRITE

Buttons: Find First, Find Next, Close

Documentation of Protocol Analysis

PGY-RFFE RFFE Protocol Trigger and Decode Analysis software provides the flexibility of exporting the decode data in either .txt or .csv file format. The Report Generation capability allows the user to have different waveform images, including the oscilloscope screen shot in pdf format. Report header, comments, and test attributes can be added to the report.

Tektronix oscilloscopes supported

- DPO/MSO5000 series
- DPO7000 series
- DPO/MSO/DSA 70000 series

PGY-HSI Datasheet MIPI-HSI Electrical Validation and Protocol Decode Software



Detail View correlates Waveform, Protocol and electrical measurements

The PGY-HSI HSI Electrical Validation and Protocol Decode Software offers electrical measurements compliance testing and protocol decoding as specified in version 1.01.00 dated September 2008. Now design and test engineers can automatically make accurate and reliable HSI electrical measurements and decode protocols in PGY-HSI software using data acquired by Tektronix DPO5000, DPO7000, DPO/MSO/MSO70000 oscilloscope series to reduce the development and test cycle.

Features:

- Automated HSI electrical measurements and protocol testing as per HSI documentation 1.01.00 dated 30 September 2008
- Supports analysis of Synchronized data flow, Pipelined data flow and Receiver real time data flow
- Supports Stream Transmission and Frame Transmission Modes
- User can set the channel descriptor bits
- Links the protocol content to the electrical signal in the oscilloscope for easy understanding of the electrical characteristics of the protocol
- Overlays the protocol data on analog waveform in a bus diagram window
- Zooms the selected HSI packet content in the decode table in the bus diagram display for easy analysis of electrical characteristics of the HSI frame
- Ability to view protocol decode data in hexadecimal, decimal, binary, octal, and ASCII formats
- Ability to store the HSI protocol data in CSV and txt format
- Utility features like zoom, undo, and fit screen for easy debugging while correlating the protocol data to the waveform
- Report generation in pdf format
- Supports wfm file formats for offline analysis

Tektronix oscilloscopes supported

- DPO/MSO5000 series
- DPO7000 series
- DPO/MSO/DSA 70000 series

Required equipment for MIPI® (M-PHY and D-PHY) transmitter and receiver testing

For a complete list of required equipment please visit <http://www.tek.com/MIPI>.

Ordering information

Recommended Oscilloscopes for M-PHY based Decoders

Model	Description
DPO/DSA/MSO70000C/D	<p>DPO (Digital Phosphor Oscilloscope), DSA (Digital Serial Analyzer), or MSO (Mixed Signal Oscilloscope) Oscilloscopes with Option DJA</p> <p>The following bandwidths are needed:</p> <ul style="list-style-type: none"> ■ 6 GHz and above is recommended for HS-Gear1 ■ 12.5 GHz and above is recommended for up to HS-Gear2 ■ 23 GHz and above is recommended for up to HS-Gear3

MIPI Decoders

Nomenclature	MIPI Decoders
PGY-UPRO ¹	M-PHY UniPro Protocol Decode (3rd-party software)
PGY-LLI	M-PHY LLI Protocol Decode (3rd-party software)
MPHYVIEW	M-PHY DigRFv4 CommView Protocol Decode (3rd-party software)
SR-810B	M-PHY 8b/10b Serial Analysis
SSIC ^{1 2}	SSIC Protocol Decode (M-PHY)
PGY-RFFE ¹	RFFE Protocol Decode (3rd-party software)
PGY-HSI	HSI Electrical & Protocol Decode (3rd-party software)

Recommended probes for M-PHY Decoders

Gear type	Data rate	Rise time (20-80)	Required probe rise time (20-80)	Fixture / RF connection	Package / circuit board probing
HS-Gear1 ³	1.46 Gb/s	68.6 ps	45.7 ps	P7313SMA	P7380A, P7313, P7508, or P7513A
HS-Gear2	2.92 Gb/s	34.3 ps	22.9 ps	P7313SMA or P7625	P7313, P7516, or P7520A
HS-Gear3	5.83 Gb/s	17.15 ps	11.4 ps	P7625	P7520A
PWM Gears ⁴	192 Mb/s	521 ps	347 ps	P7313SMA	P7380A or P7313

PGY-UPRO and PGY-LLI require differential probing. For the DPO70000 Series, P7500 and P7300 Series probes are well suited.

Recommended probes for RFFE & HSI

Oscilloscope	Passive probes	Active probes
DPO/MSO5000 series	TPP1000	TAP1500, TAP2500
DPO7000 series	P6139B	TAP1500, TAP2500
DPO/MSO/DSA 70000 series	TCA-1MEG	P6250 with TCA-BNC, P6251 with TCA-BNC

¹ Requires Option ST6G Serial Protocol Triggering.

² Option SR-CUST required.

³ RT (Resistively Terminated).

⁴ NT (Not Terminated).

ASEAN / Australasia (65) 6356 3900	Austria 00800 2255 4835*	Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
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Central East Europe and the Baltics +41 52 675 3777	Central Europe & Greece +41 52 675 3777	Denmark +45 80 88 1401
Finland +41 52 675 3777	France 00800 2255 4835*	Germany 00800 2255 4835*
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Middle East, Asia, and North Africa +41 52 675 3777	The Netherlands 00800 2255 4835*	Norway 800 16098
People's Republic of China 400 820 5835	Poland +41 52 675 3777	Portugal 80 08 12370
Republic of Korea 001 800 8255 2835	Russia & CIS +7 (495) 6647564	South Africa +41 52 675 3777
Spain 00800 2255 4835*	Sweden 00800 2255 4835*	Switzerland 00800 2255 4835*
Taiwan 886 (2) 2722 9622	United Kingdom & Ireland 00800 2255 4835*	USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

Updated 10 April 2013

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