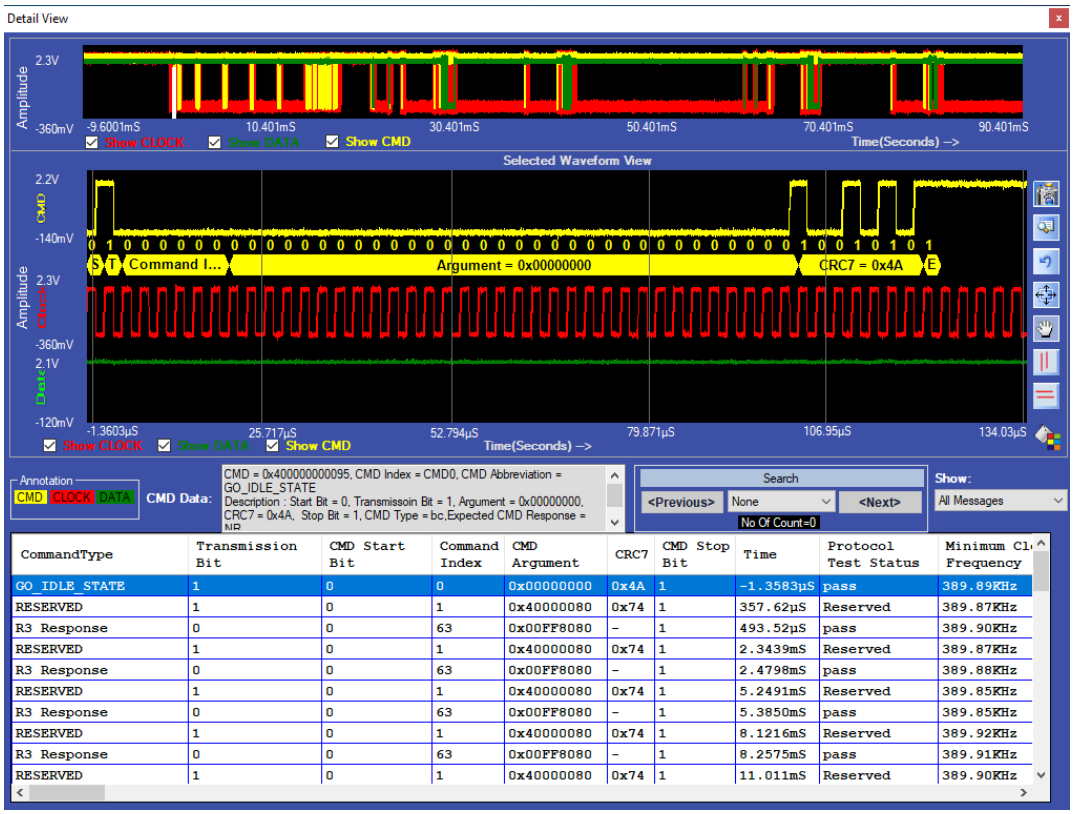
PGY-MMC SD/SDIO/eMMC Electrical Validation & Protocol Decode Software



CommandType	Transmission Bit	CMD Start Bit	Command Index	CMD Argument	CRC7	CMD Stop Bit	Time	Protocol Test Status	Minimum Cl Frequency
GO_IDLE_STATE	1	0	0	0x00000000	0x4A	1	-1.3583µS	pass	389.89KHz
RESERVED	1	0	1	0x40000080	0x74	1	357.62µS	Reserved	389.87KHz
R3 Response	0	0	63	0x00FF8080	-	1	493.52µS	pass	389.90KHz
RESERVED	1	0	1	0x40000080	0x74	1	2.3439mS	Reserved	389.87KHz
R3 Response	0	0	63	0x00FF8080	-	1	2.4798mS	pass	389.88KHz
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R3 Response	0	0	63	0x00FF8080	-	1	5.3850mS	pass	389.85KHz
RESERVED	1	0	1	0x40000080	0x74	1	8.1216mS	Reserved	389.92KHz
R3 Response	0	0	63	0x00FF8080	-	1	8.2575mS	pass	389.91KHz
RESERVED	1	0	1	0x40000080	0x74	1	11.011mS	Reserved	389.90KHz

MMC SD/SDIO/eMMC Electrical Validation & Protocol Decode Software

Features:

- eMMC and SD (UHS-I) electrical measurements and Protocol testing software conforms to eMMC version 4.51 and 5.0 and SD version 3.01 specification.
- eMMC/SD/SDIO Protocol Aware Trigger features
- Industry first Protocol decoding CMD and Data (1 bit/4 bit and 8-bit mode) using MSO capabilities of Oscilloscope
- Supports SDR and DDR and Boot mode for electrical measurement and protocol Decode
- Fast frame capability allows protocol analysis of CMD in 100s of second time
- Software automatically identifies the read and write operations using CMD and apply the electrical parameter limits accordingly.
- Detail View provides efficient debugging capability by correlating the analog waveform, protocol messages and electrical measurements for each protocol packet in single view
- Protocol View lists the protocol activities in sequential form to assist designers to know the host and card transactions
- Time stamp at the end of command token and time stamp at beginning of the response token in Protocol View enables designer to comply with specification and locate any anomaly in timing between host and card.
- Software displays the details of command and response in Protocol View and list the errors messages in card status for quick analysis
- Ability to store the eMMC and SD protocol data in CSV and txt format
- Utility features like zoom, undo, and fit to screen for easy manoeuvring the waveforms while debugging the cause to problem in Detail View makes it easy to use tool

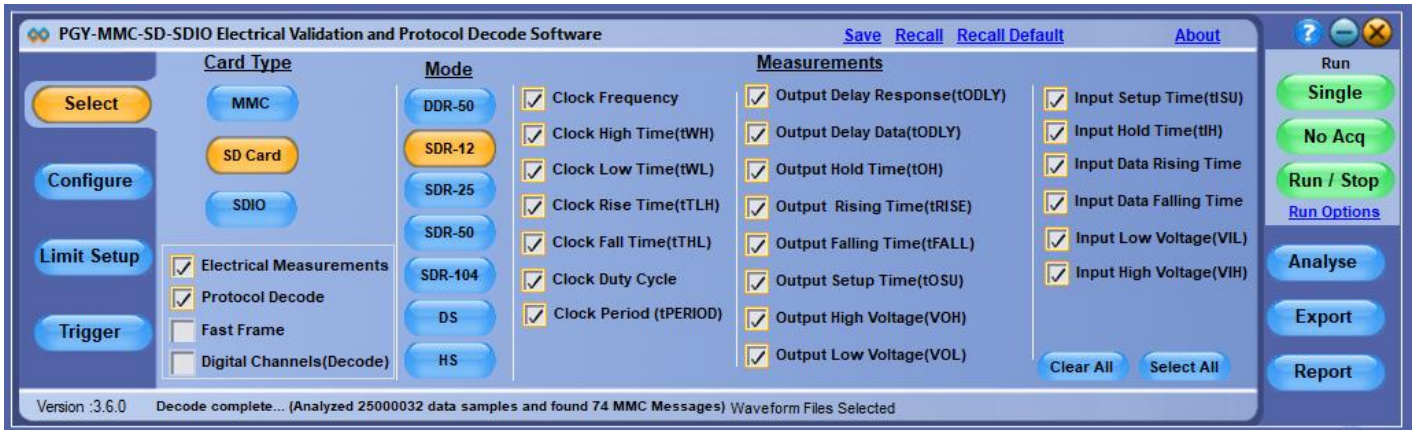
- Software seamlessly integrates with Tektronix windows-based oscilloscope and supports live signal analysis using live channels of Oscilloscope
- Supports data analysis for long record length and more acquisition memory of oscilloscope enables analysis of protocol events for longer duration
- Report generation in pdf format.
- Supports wfm and isf file formats of
- Tektronix oscilloscope for offline analysis

Applications

- ✓ Protocol Analysis
- ✓ eMMC and SD (UHS-I) Electrical Compliance Test (Supports eMMC4.42, 4.51 and 5.0 & SD3.01)
- ✓ Correlation of Analog waveform, Protocol activities and Electrical Measurements

Seamless Integration with Oscilloscope

PGY- MMC and SD Electrical Validation and Protocol Decode Software runs inside the Tektronix high performance windows oscilloscopes. Automatically imports the data from oscilloscopes live channels. Also supports Tektronix. wfm and .isf file formats. This enable live and offline testing of eMMC and SD Signals.

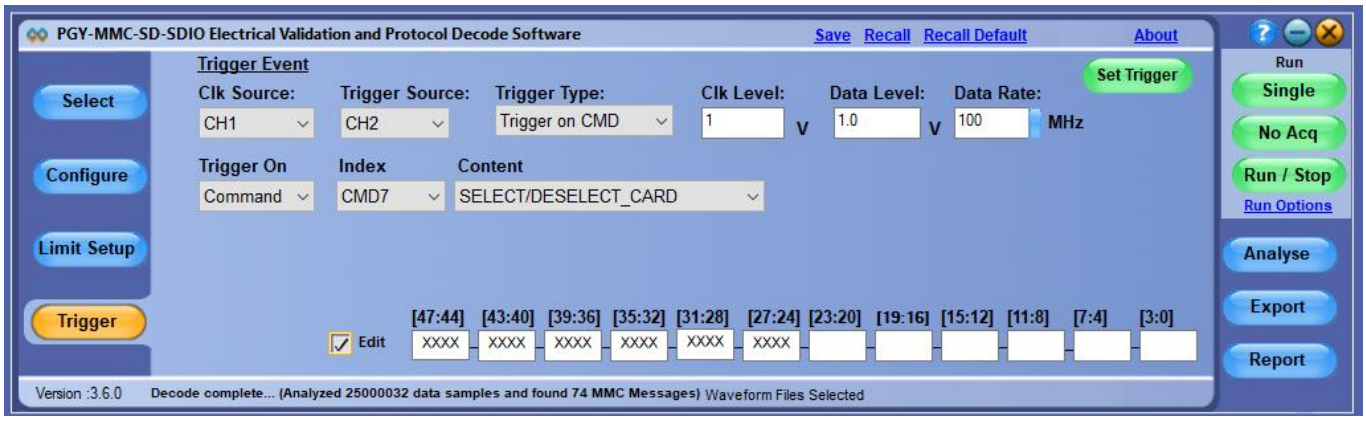


Measurements Selection

- Provides the flexibility to select type of Card interface to be tested and related Bus speed modes
- Flexibility select necessary or all electrical measurements
- Save and recall of application setup for repetitive testing at different times
- Supports single and continuous test mode using oscilloscope live data
- Online help

eMMC/SD/SDIO Protocol Aware Triggering

For efficient test and debugging eMMC/SD/SDIO, it is important to capture signals at right condition. PGY-MMCSD software provides protocol aware triggering along serial pattern trigger option of the oscilloscope to capture signals at specific event in CMD line.

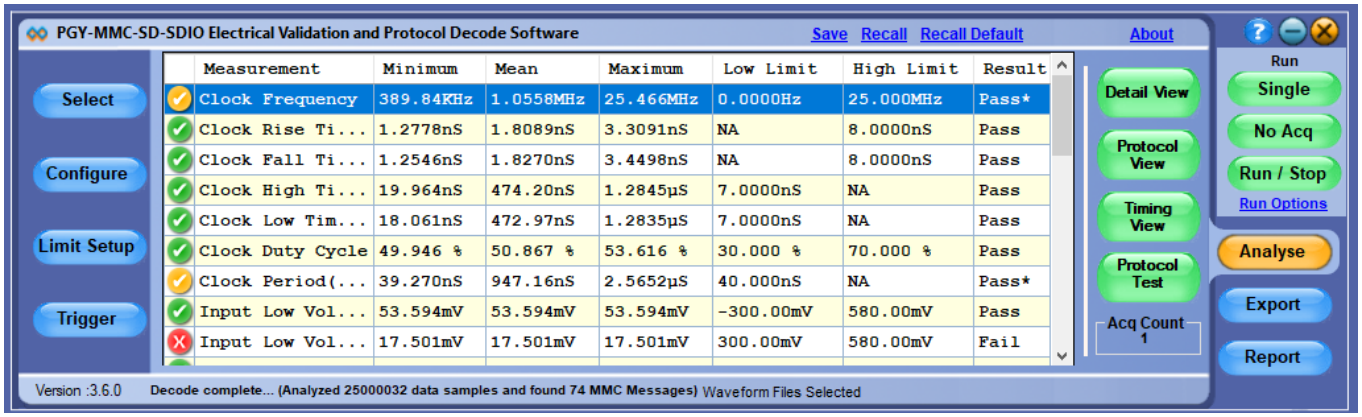


Trigger Setup menu

- Flexibility to trigger on command or response
- Offers all the standard triggers patterns with command and Response
- Flexibility to edit trigger pattern

Automated Electrical Validation & Protocol Software

As per the specification of eMMC and SD, the measurement limits are different for read and write operation. The PGY-MMC-SD measurement algorithms automatically find the read and write operations and validates with the respective limits. This enables you to save time in identifying the read and write operation and isolating any compliance issues.



Analyse lists all electrical measurements with pass/fail report

- Lists electrical measurements with mean, minimum and maximum values measured for the entire acquired waveform
- Indicates if measurement exceeds the min or max limits by orange color
- Lower and Upper limits of the electrical measurements are compared against measured values
- Supports Electrical Measurements as per eMMC 4.41 and 4.51 and UHS3.1 Specification.
- Automated identification read and write operation and apply electrical limits as per eMMC and UHS-I specification

Timing Parameters between CMD, Response and Data

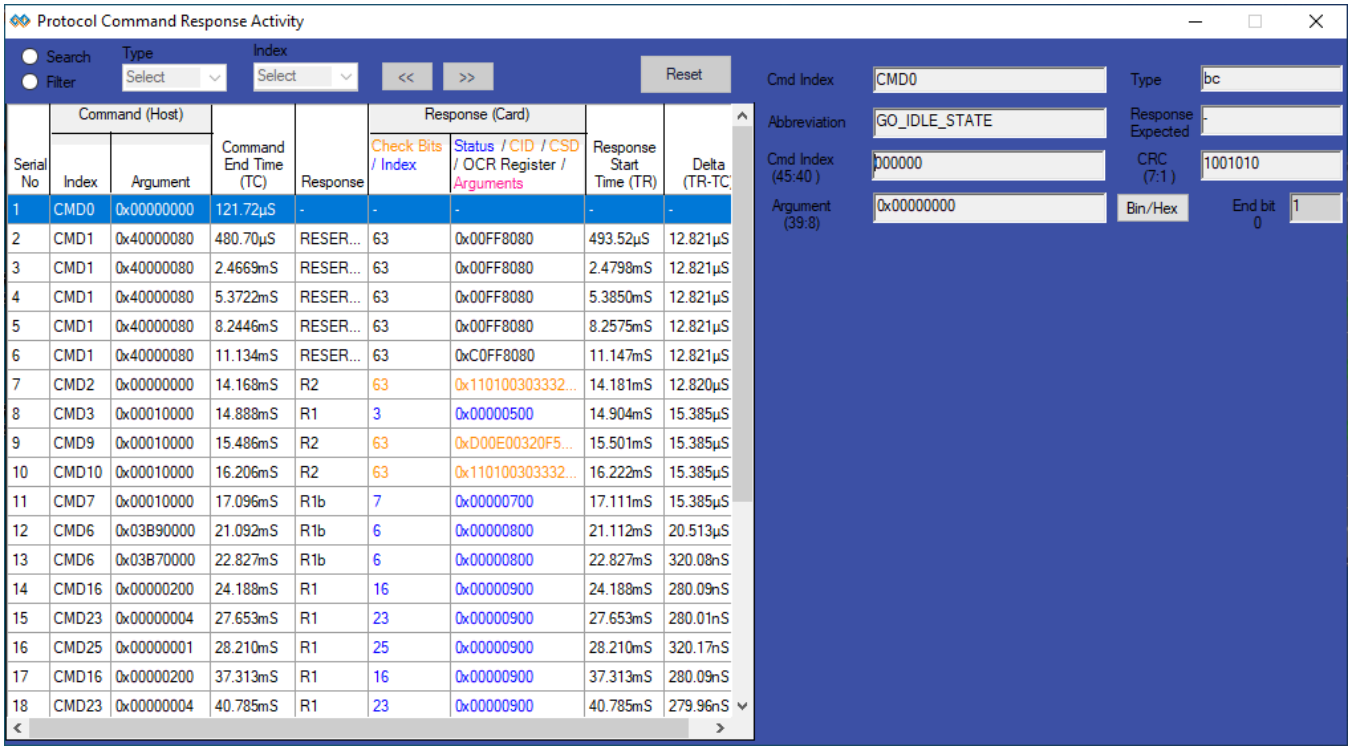
EMMC specifies the minimum and maximum cycles to present between the host and device to ensure interoperability. PGY-MMC-SD analyzes the data for these specifications and offers results**.**

Timing View

Description	Symbol	Primary Coverage	Minimum	Maximum	Unit	Minimum Measured	Maximum Measured	Results
Data Read Timing	NAC	System	2	10*(TAAC*FOP+10...	Clock Cycles	12	2260	Pass
Last Host Comman...	NCC	System	8	NA	Clock Cycles	NA	NA	NA
Boot Operation Co...	NCD	System	56	NA	Clock Cycles	92	92	Pass
Boot Operation Co...	NCP	System	74	NA	Clock Cycles	2959	2959	Pass
Assign a Device Re...	NCR	System	2	64	Clock Cycles	5	9	Pass
Device Identificatio...	NID	System	5	5	Clock Cycles	5	5	Pass
Last Device Respo...	NRC	System	8	NA	Clock Cycles	91	14003	Pass
R1b Response Timi...	NST	System	2	2	Clock Cycles	2	2	Pass
Data Write Timing	NWR	System	2	NA	Clock Cycles	2863	18251	Pass
Boot Operaion tBA ...	tBA	System	NA	50	mS	20.974	20.974	Pass
Boot Operaion tBD ...	tBD	System	NA	1	S	0.0210	0.0210	Pass

Protocol View

PGY-MMC-SD software lists all the protocol activity between the host and card. Engineers can now quickly view the command and its corresponding response from card. Selected protocol activity details are listed on right side of the list table. Now Engineers can know the errors reported by card or any other message to host without struggling to know the content of each message.

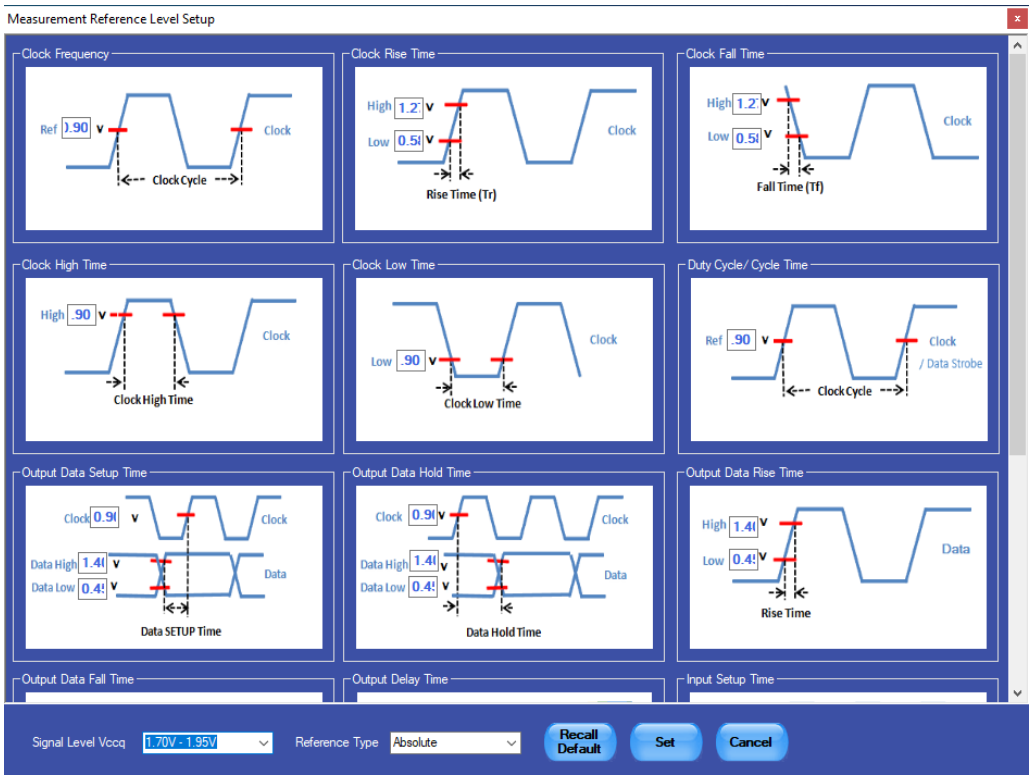


Serial No	Command (Host) Index	Command (Host) Argument	Command End Time (TC)	Response	Response (Card) Check Bits / Index	Response (Card) Status / CID / CSD / OCR Register / Arguments	Response Start Time (TR)	Delta (TR-TC)
1	CMD0	0x00000000	121.72µS	-	-	-	-	-
2	CMD1	0x40000080	480.70µS	RESER...	63	0x00FF8080	493.52µS	12.821µS
3	CMD1	0x40000080	2.4669mS	RESER...	63	0x00FF8080	2.4798mS	12.821µS
4	CMD1	0x40000080	5.3722mS	RESER...	63	0x00FF8080	5.3850mS	12.821µS
5	CMD1	0x40000080	8.2446mS	RESER...	63	0x00FF8080	8.2575mS	12.821µS
6	CMD1	0x40000080	11.134mS	RESER...	63	0xC0FF8080	11.147mS	12.821µS
7	CMD2	0x00000000	14.168mS	R2	63	0x110100303332...	14.181mS	12.820µS
8	CMD3	0x00010000	14.888mS	R1	3	0x00000500	14.904mS	15.385µS
9	CMD9	0x00010000	15.486mS	R2	63	0xD00E00320F5...	15.501mS	15.385µS
10	CMD10	0x00010000	16.206mS	R2	63	0x110100303332...	16.222mS	15.385µS
11	CMD7	0x00010000	17.096mS	R1b	7	0x00000700	17.111mS	15.385µS
12	CMD6	0x03B90000	21.092mS	R1b	6	0x00000800	21.112mS	20.513µS
13	CMD6	0x03B70000	22.827mS	R1b	6	0x00000800	22.827mS	320.08nS
14	CMD16	0x00000200	24.188mS	R1	16	0x00000900	24.188mS	280.09nS
15	CMD23	0x00000004	27.653mS	R1	23	0x00000900	27.653mS	280.01nS
16	CMD25	0x00000001	28.210mS	R1	25	0x00000900	28.210mS	320.17nS
17	CMD16	0x00000200	37.313mS	R1	16	0x00000900	37.313mS	280.09nS
18	CMD23	0x00000004	40.785mS	R1	23	0x00000900	40.785mS	279.96nS

Protocol View

Characterization of PHY layer by custom limit setup

PGY-MMC-SD is not just for standard electrical compliance testing, you can also vary the limits and test your device with custom limits. The intuitive limits and reference level setup allow you to configure the limits and reference levels for your custom testing needs. This enables you to test your device beyond the specification and characterize it.



Config panel to custom set the reference setting for electrical measurement

Powerful Debug environment: Detail view

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In Detail View, engineers can view the analog waveform, details of protocol and electrical measurements in single view. If there is any failure in electrical measurement or error in protocol messages, designers can

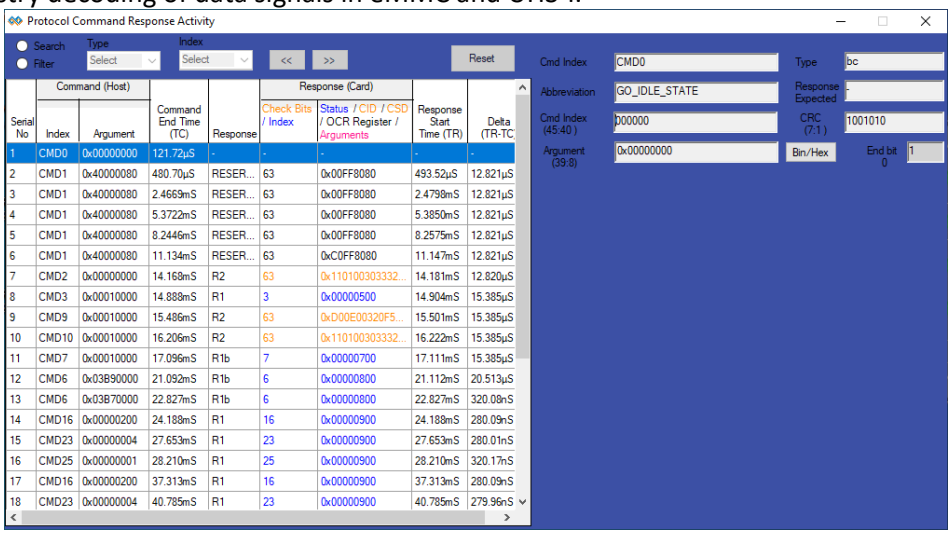
quickly correlate the protocol data with analog waveforms. These protocol errors can be caused due to the failure in electrical measurements. User can select any row in the detail view; corresponding analog waveform will be zoomed and displayed. In the same row, engineers can view all the electrical measurements corresponding to the selected row. Utility features such as zoom, cursors, and markers make custom measurement while debugging.

Detail view provides following capabilities:

- Plots the acquired waveform in waveform view window
- Lists all decoded command and response tokens in each row in decode table
- Indentifies of type of command and response for easy protocol interpretation
- Lists respective electrical measurements for command and response for each row
- Selected Protocol command or response's related analog waveform is plotted in a window.
- Bus Diagram view overlays protocol data for the selected row along with waveform
- Snap button enables storing selected waveform window for report generation purpose
- Zoom, fit to screen, pan, undo, vertical and horizontal cursors enables quick analysis and measurement of electrical signals

Industry First Decoding of CMD and data Signals:

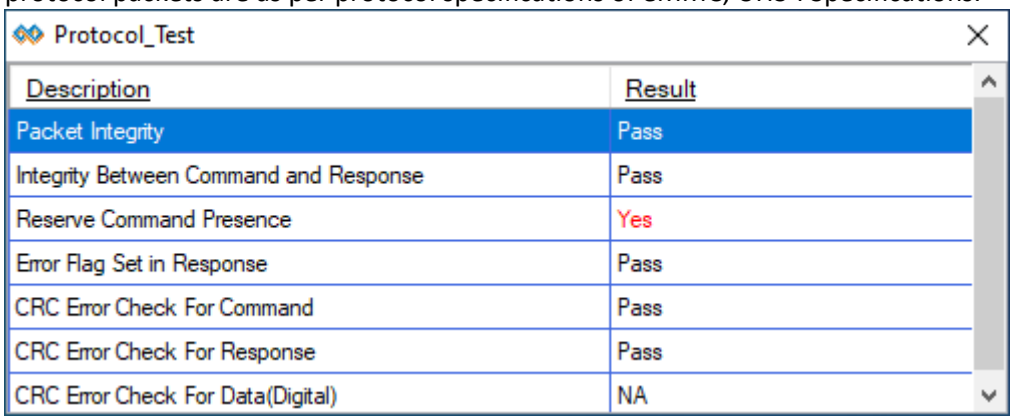
PGY-MMC-SD leverages powerful capabilities of Digital Channels of MSO70000/5000 series oscilloscope to provide industry decoding of data signals in eMMC and UHS-I.



Digital Decode View

Protocol test:

PGY-MMC-SD software automatically checks for Protocol Integrity. This allows very easy method ensuring protocol packets are as per protocol specifications of eMMC, UHS-I Specifications.



Tektronix Oscilloscopes Supported

- DPO/MSO5000 series
- DPO7000 series
- DPO/MSO/DSA 70000 series
- MSO5/6 series

with bandwidth 500MHz and above and standard RL.

Probes: Standard probes

Ordering Information:

PGY-MMC-SD (shipment includes CD with PGY-MMC-SD Electrical Validation and Protocol Decode Software)

Contact Information

Address: **Website:**	Prodigy Technovations Pvt Ltd 294, 7th Cross, 7th main, BTM 2nd Stage, Bengaluru – 560076. Karnataka India. **www.prodigytechno.com**
Technical Support:	contact@prodigytechno.com
Phone:	+91-80-42126100

About Prodigy Technovations Pvt Ltd

Technovations Pvt Ltd (www.prodigytechno.com) is a leading global technology provider of Protocol Decode, and Physical layer testing solutions on test and measurement equipment. The company's ongoing efforts include successful implementation of innovative and comprehensive protocol decode and physical Layer testing solutions that span the serial data, telecommunications, automotive, and defense electronics sectors worldwide.