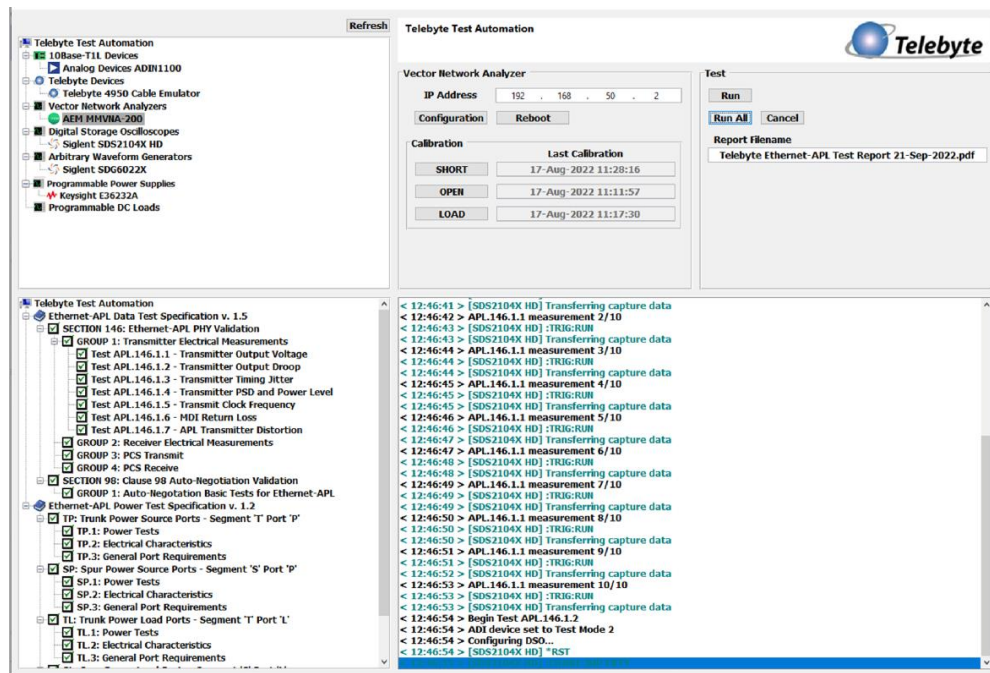




**"SPE Testing Made Easy"**

## Telebyte SPE Test Automation Software Automation of SPE Standards-Based Testing



### Enabling a Fully Integrated Approach to SPE Testing

The Telebyte SPE Test Automation Software provides easy control and configuration of the devices in the test bed as well as data storage and reporting. This automates, unifies, standardizes and simplifies the testing process, thereby enabling repeatability across implementations, saving time and lowering costs.

Standardization in testing methods is of great importance for any technology to succeed. This develops the trust and reliability needed to accelerate SPE technology. Our convenient and efficient software is designed for automated testing following the standards below:

#### Ethernet-APL

- Ethernet-APL Port Profile Specification (FCG TS10186) Rev 1.2
- Ethernet-APL Data Test Specification (FCG TT10188) Rev 1.5.4
- Ethernet-APL Power Test Specification (FCG TT10189) Rev 1.3

**IEEE 802.3 – 2022 / IEEE 802.3dd** (Coming soon)

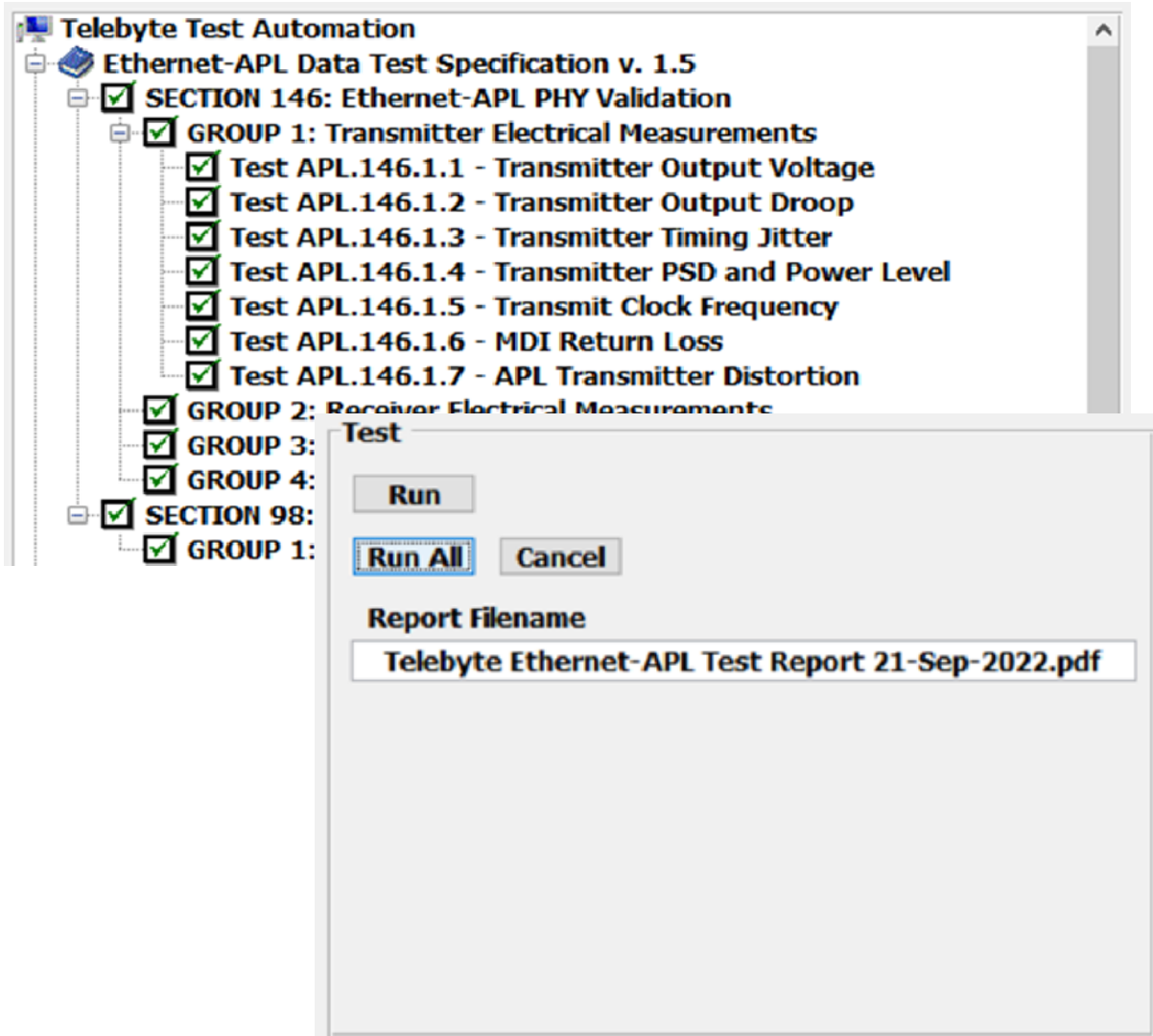
*"SPE Testing Made Easy"*

## Highlights

- **Types of Tests**
  - Conformance
    - -Transmitter and Receiver Validation Stressed BER in the presence of noise
    - -Tx Test Mode 1, Validation Jitter, Tx Voltage Level
    - -Tx Test Mode 2, Validation Tx Voltage Droop, Tx Distortion
    - -Tx Test Mode 3, Validation PSD Mask and Tx Power Level
    - -Tx Disable MDI Return Loss, Validation Differential Characteristic Impedance
  - Physical Coding Sublayer (PCS) Transmit and Receive Signaling
  - Advertisement & Auto-Negotiation Verification
  - Power Class (Validation)
  - Power Events Minimum and Maximum Current and Voltages, Short Circuit, Differential Ripple Noise In & Out of Band
  - Interoperability Testing in deployment type environments over various cable types, impulsive noise and alien crosstalk with traffic
- **Easy Selection of Built-In Standards Tests**
- **Realtime Test Status Feedback**
- **Convenient Configuration and Setup of Power Source or Load Devices**
- **Controls 10BASE-T1L Devices Under Test**
  - Configuration of Operating Mode
  - Reads 10BASE-T1L DUT Register Information
  - MSE, SNR, Rx, Errors
  - Power Classification
- **Traffic Generation and Analysis**
  - ICMP Ping
  - 10Mbps Rate Full Duplex for BER
  - PCS and Protocol Analysis
- **Controls Cable Emulator**
  - Cable Type, Length, Cable Faults, DC Resistance
  - Reads Current, Voltage at Side A and Side B
- **Controls Noise Generator**
  - Alien Crosstalk "6 around 1" 10BASE-T1L
  - Time Domain Impulsive Noise, Duration and Amplitude
- **Controls Oscilloscope**
  - Waveform capture and analysis
  - FFT for PSD and Transmit Power Level
- **Controls Power Supply and/or Programmable Load**
  - Slew rates
  - Voltage level
  - Current draw
- **Controls VNA and DMM**
- **Store Data in SQL Database/Display**
- **Live Graphs and Table Information**
  - Time correlated data telemetry
  - Waveforms / Tables
  - Method of Procedure Log Files
  - Pass / Fail Test Reports

*"SPE Testing Made Easy"*

## Select Tests from Standard and Run



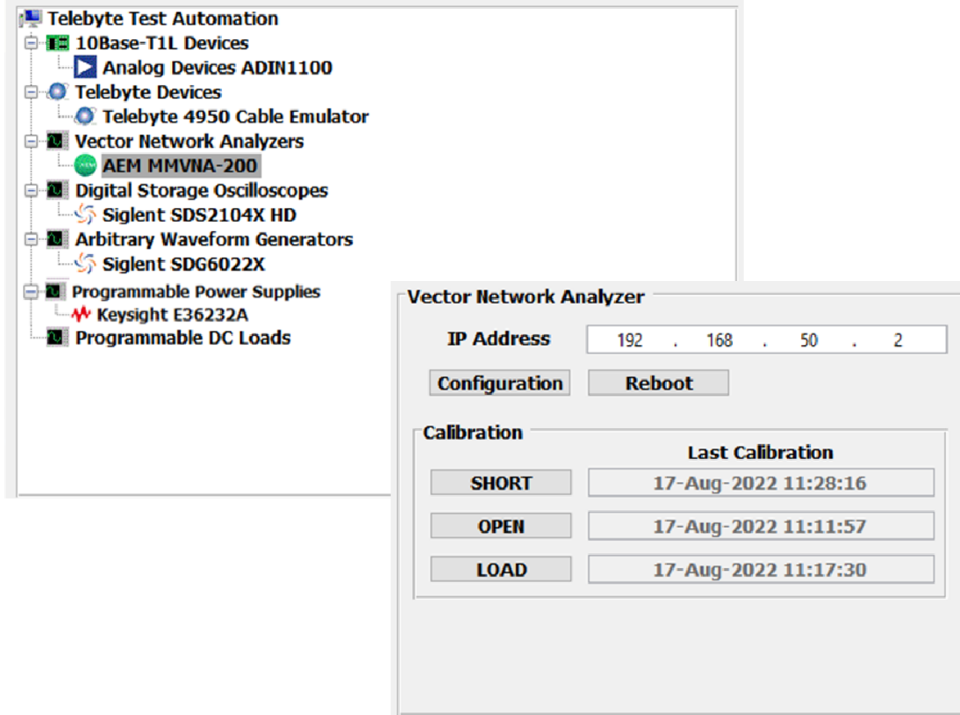
The screenshot displays the 'Telebyte Test Automation' interface. On the left, a tree view shows the 'Ethernet-APL Data Test Specification v. 1.5' with several sections and groups checked. A dialog box titled 'Test' is overlaid on the right, featuring a 'Run' button, a 'Run All' button (highlighted with a blue border), and a 'Cancel' button. Below the buttons, there is a 'Report Filename' field containing the text 'Telebyte Ethernet-APL Test Report 21-Sep-2022.pdf'.

**Telebyte Test Automation**

- ✓ **Ethernet-APL Data Test Specification v. 1.5**
  - ✓ **SECTION 146: Ethernet-APL PHY Validation**
    - ✓ **GROUP 1: Transmitter Electrical Measurements**
      - ✓ Test APL.146.1.1 - Transmitter Output Voltage
      - ✓ Test APL.146.1.2 - Transmitter Output Droop
      - ✓ Test APL.146.1.3 - Transmitter Timing Jitter
      - ✓ Test APL.146.1.4 - Transmitter PSD and Power Level
      - ✓ Test APL.146.1.5 - Transmit Clock Frequency
      - ✓ Test APL.146.1.6 - MDI Return Loss
      - ✓ Test APL.146.1.7 - APL Transmitter Distortion
    - ✓ **GROUP 2: Receiver Electrical Measurements**
    - ✓ **GROUP 3: Test**
    - ✓ **GROUP 4:**
  - ✓ **SECTION 98:**
    - ✓ **GROUP 1:**

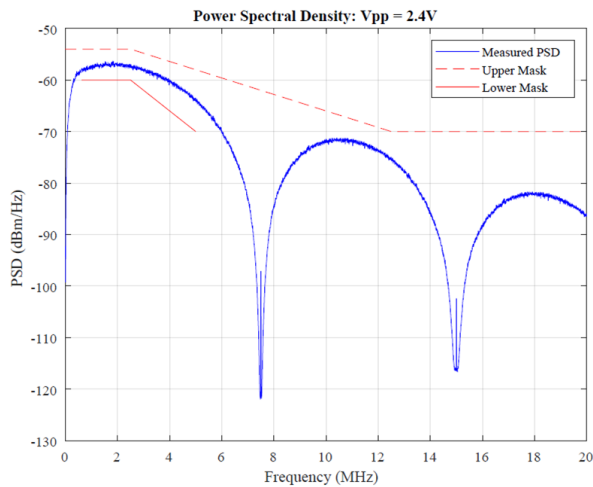
"SPE Testing Made Easy"

## Configure Devices



Calibration	
	Last Calibration
SHORT	17-Aug-2022 11:28:16
OPEN	17-Aug-2022 11:11:57
LOAD	17-Aug-2022 11:17:30

## Product Test Reports & Graphs



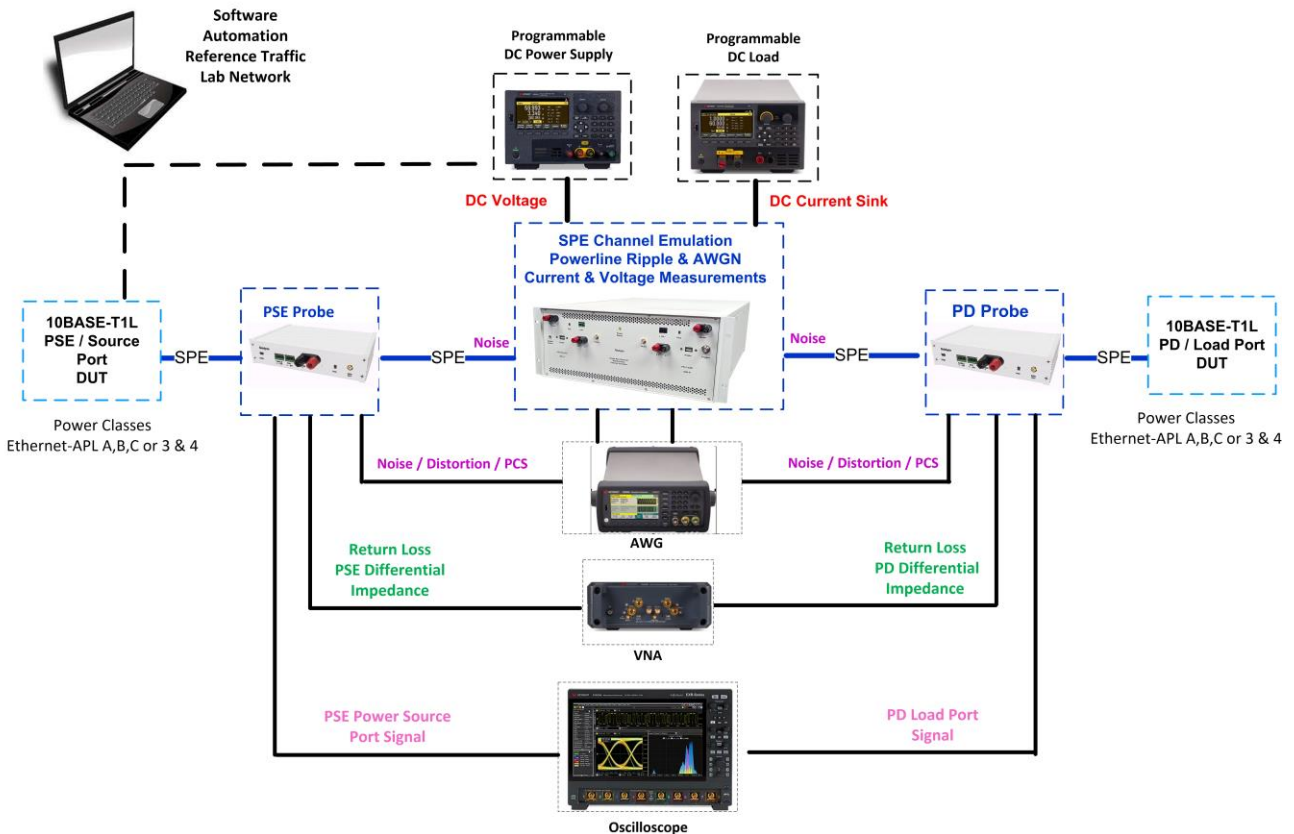
Operating Mode	Minimum Power	Maximum Power	Measured Power	Result
1.0 Vpp	-0.2 dBm	2.2 dBm	1.0 dBm	Pass
2.4 Vpp	7.4 dBm	9.8 dBm	8.7 dBm	Pass

Operating Mode	Lower PSD Mask	Upper PSD Mask
1.0 Vpp	Pass	Pass
2.4 Vpp	Pass	Pass

"SPE Testing Made Easy"

## Example

### Automated Conformance Testing of Power and Data Source Ports (PSE) or Load Ports (PD) (Best in class version)



The Telebyte Automation Software is installed on the customer PC. It is used to configure and control the device under test and the test instrumentation required to execute and complete the data, power and interoperability tests. It also stores and analyzes measured results to provide pass / fail criteria based on the specific standard selected.

The Automation Software runs on Windows 10 / 11 and communicates via TCP/IP, USB, VISA, Serial Console and a RESTful API. It sequences through selectable tests and controls the DUT, Programmable Power Supply, Programmable Load, Digital Storage Oscilloscope, Signal Generator (AWG), Vector Network Analyzer (VNA), Telebyte Channel Emulator Model 4950, Telebyte Power Source Probe, Telebyte Powered Device (Load) Probe, and traffic implementing ICMP Ping. Signal Capture and Analysis is completed in the time domain, with the 10BASE-T1L signaling, differential noise over various channel and power conditions specific to the test plan. Current and voltage is measured to ensure correct Power Class compliance. Signal Analysis is implemented using MATLAB, which is integrated into the Telebyte Automation Software.



"SPE Testing Made Easy"

## Supported Equipment

### Channel Emulators

Manufacturer	Part Number	Description
Telebyte	4950-001	10BASE-T1L / Ethernet-APL Channel Emulator. Integrated Noise Injector, AWGN, ripple noise generator, power monitor, cable faults, SCCP Protocol Analyzer, maximum cable 1100m
Telebyte	4950-002	10BASE-T1L / Ethernet-APL Channel Emulator. Integrated Noise Injector, AWGN, ripple noise generator, power monitor, cable faults, SCCP Protocol Analyzer, maximum cable 1700m

### Probes

Manufacturer	Part Number	Description
Telebyte	4950-P01	Single-Pair Multifunction Probe

### Arbitrary Waveform Generators

Manufacturer	Part Number	Description
Siglent	SDG6022X	200 MHz Arbitrary, Sweep Function Generator 2 Channel Sine, Square, Ramp, Pulse Display Type Touchscreen
Keysight	33612A (Coming soon)	Waveform generator, 2-Channels MEM Option 64MSa Memory 80 MHz
Keysight	33622A (Coming soon)	Waveform Generator, 2 Channels MEM Option 64MSa Memory 120 MHz

### Vector network analyzers

Manufacturer	Part Number	Description
AEM	MMVNA-200	8-Channel Vektored Network Analyzer, 100 kHz to 3 GHz
Keysight	P5000B-200 (Coming soon)	Vector Network Analyzer, 9kHz to 4.5 GHz, 2-port, with Thunderbolt 3 Interface

### Oscilloscopes

Manufacturer	Part Number	Description
Siglent	SDS2104X HD	12-Bit Digital Storage Oscilloscope, 100MHz, 4 Channels
Keysight	EXR054A (Coming soon)	Infiniium EXR-Series Oscilloscope: 500 MHz, 4 Channels
Keysight	EXR204A (Coming soon)	Infiniium EXR-Series Real-Time Oscilloscope, 2 GHz, 16 GSa/s, 100Mpts, 4 Ch



*"SPE Testing Made Easy"*

## Supported Equipment (Continued)

### DC Electronic Load

Manufacturer	Part Number	Description
Keysight	EL33133A DC	Electronic Load, Single-Input: 150V, 40A, 250W, Resolution: 0.05% + 820 $\mu$ A

### Programmable Power Supplies

Manufacturer	Part Number	Description
Keysight	E36232A	200W Auto-ranging Power Supply, 60V, 10A, 1 Channel
Keysight	E36234A (Coming soon)	400W Auto-ranging Dual Output Power Supply, 60V, 10A, 2 Channel

### Digital Multimeters

Manufacturer	Part Number	Description
Keysight	34465A (Coming soon)	Bench Digital Multimeter, 6.5 Digit, 50 kS/s
Keysight	34470A (Coming soon)	Digital multimeter, 7 1/2 digit, 50kS/s

## Software Ordering Options

Item Number	Description
TBAS-001	SPE Test Automation Software License
TBAS-M01	Annual Software & Support Maintenance Contract for TBAS-001
TBAS-M02	2-Year Software & Support Maintenance Contract for TBAS-001
TBAS-M03	3-Year Software & Support Maintenance Contract for TBAS-001

Please note the supported equipment is available for purchase from Telebyte.