The Tektronix automotive Ethernet test solution provides automated compliance support for BroadR-Reach V3.2 specifications and IEEE P802.3bw™ (100BASE-T1) requirements. The automated compliance solution includes test software that runs on a Tektronix Oscilloscope while performing all physical layer (PHY) transmitter compliance tests.

The compliance software allows for complete or selective testing of any of the transmitter electrical specifications including complete Oscilloscope control of the required setups. Software setup flexibility allows for design validation, margin analysis and repeatable compliance testing while reducing instrument setup difficulties. Additionally, the software can generate a comprehensive date-stamped test report with pass/fail results including Oscilloscope display waveforms and data plots.

Full compliance testing requires configuring the PHY device into special test modes along with selection of the corresponding compliance test(s). The Tektronix compliance software allows selection of all or any of the specific tests through a simple setup menu. Software navigation is arranged around a logical workflow for quick setups, changes and review of test results.

Equipment Requirements

Tektronix offers a full range of instruments and accessories with technical performance ideally suited for complete transmitter PHY transceiver testing including:

- MSO/DPO5000B, DPO7000C, or MSO/DPO 70000C/DX Oscilloscope (1 GHz or greater bandwidth required) with Option BRR compliance software
- TDP1500 differential probe
- AWG5000C or AFG3000C signal generator for Distortion and Return Loss tests
- TF-GBE-BTP and TF-BRR-CFD test fixtures
Unique to Tektronix is the ability to perform the required Return Loss measurement with an Oscilloscope using a patented technique without needing a more specialize RF instrument. For optimized use, a PC monitor can be connected or even used with Remote Desktop Connection.

**Jitter and Transmit Clock Frequency Tests**

The PHY has a symbol clock frequency of 66.667 MHz and is outputted using Test Mode 2. Separate tests are run to measure the Master (Slave) RMS jitter and the TX clock frequency.

**Droop Test**

The PHY is configured using Test Mode 1. The droop measurements are performed by determining the positive and negative waveform peaks voltages and measuring the voltage 500ns after the peak value where the magnitude of droop should be less than 45%.

**Power Spectral Density (PSD) Test**

The Spectral of an input signal (set to Test Mode 5) is computed using built-in scope MATH functions. Post processing is done on the signal to arrive at the PSD. The computed PSD is then compared with the specification - lower and upper masks to arrive at the final result.
Distortion Test

Configured for Test Mode 4 the distortion test measures the maximum allowable transmitter distortion. This test requires the use of a disturbing sine wave signal that is added to the PHY output signal. The peak transmitter distortion is calculated where measure values are compared against the compliance test specification.

Return Loss Test

The MDI return loss test determines if there is an impedance mismatch from the differential impedance specification of 100 Ω that will affect interoperability. This test can be performed using a VNA, but the Tektronix solution is capable of performing this test with an Oscilloscope using a patented measurement approach eliminating the need for additional test instruments.

Pass/Fail report

Compliance documentation is quick and easy with a summary report in MHTML or PDF format. The report provides Pass/Fail status and is automatically generated after tests are completed. The report includes test configuration details, waveform plots, Oscilloscope displays, and margin analysis to provide more insights into your design.

Test fixtures

Accurate and repeatable compliance testing requires access to the PHY transmitter output, reference clock and must support calibration and use of disturbing signals. One recommended approach is to use Tektronix TF-GBE-BTP Ethernet fixture and TF-BRR-CFD clock divider fixture that can support all test setups while providing convenient test points for probing.
Debug Analysis and Compliance

Development of automotive electronics capable of supporting higher data rates like automotive Ethernet along with other communication buses like CAN, FlexRay and LIN requires an Oscilloscope that offers a full suite of debug and analysis capabilities. The Tektronix Windows Oscilloscopes offer a range of performance models tailored for mixed signal electronics along with a comprehensive set of features that include:

- Bandwidth ≥ 1 GHz above that meet all technical requirements for automotive Ethernet
- >250,000 wfm/s for maximum waveform capture using FastAcq® acquisition
- Up to 250 Megapoint record length with MultiView zoom™
- >11 bits vertical resolution using HiRes sampling
- Trigger and decode options for mid-speed (CAN, FlexRay, and LIN) buses
- Optional analysis for memory, advanced jitter, serial data, power and Wideband RF
- Compliance test options for USB2.0, Ethernet, USB power, MOST, BroadR-Reach/100BASE-T1

For even greater insight into your automotive Ethernet design, advanced analysis tools like DPOJET can quickly allow extended jitter and timing analysis. In the screen display below DPOJET was able to characterize the 66.667 MHz PHY symbol clock including Rj histogram analysis.
Ordering Information

**Software for BroadR-Reach/100BASE-T1 (P802.3bw)**

Requires Oscilloscope with 1 GHz minimum bandwidth

- **Option BRR**
  Order with MSO/DPO70000C, DPO7000C, or MSO/DPO5000B Oscilloscopes

- **DPOFL-BRR (Floating license)**
  Upgrade an existing MSO/DPO70000C, DPO7000C, or MSO/DPO5000B Oscilloscopes

- **DPO-UP BRR (Upgrade)**
  Upgrade an existing MSO/DPO70000C, DPO7000C, or MSO/DPO5000B Oscilloscopes

**BroadR-Reach/100BASE-T1 solution**

- **Oscilloscope**
  MSO/DPO5000B, DPO7000C, and MSO/DPO70000C Windows 7 Oscilloscopes (1 GHz or greater bandwidth)

- **Oscilloscope options**

- **Probing**
  **Recommended (2 required)**: TDP1500 (70000 series Oscilloscope require TCA-VPI50 adapter)
  **Supported**: P6247 or P6248 (70000 series Oscilloscope requires TCA-BNC adapters, 7000 and 5000 series Oscilloscope require TPA-BNC adapters)

- **Signal source**
  **Recommended**: AFG3252C
  **Supported**: AWG5000C, AWG7000C

- **Fixtures**
  TF-GBE-BTP Ethernet adapter and TF-BRR-CFD Clock frequency divider

- **Recommended extras**
  External PC monitor and USB keyboard
  2 pair SMA cables or coaxial cables for use with AFG or AWG
  2 coaxial cables for use with clock divider outputs and 1 SMA cable for clock divider input
  1 coaxial cable for AFG or AWG for marker output

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Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.
