

# Ethernet (2.5G, 5G and 10G) Electrical Testing Software for 6 Series MSO

Option 6-CMNBASET and 6-CMXGBT Application Datasheet

*Get more visibility into your Ethernet designs*



The Ethernet Transmitter Test application automates 10GBASE-T, NBASE-T (2.5GBASE-T and 5GBASE-T), and IEEE802.3bz (2.5G/5G) physical medium attachment (PMA) physical-layer (PHY) electrical testing to provide a fast and accurate way of testing your ethernet designs.

Based on the TekExpress test automation framework, the Ethernet Transmitter Test application performs all PMA electrical measurements as specified by the IEEE802.3an standard, the IEEE802.3bz standard, and the NBASE-T specification. This allows you to quickly and efficiently test ethernet devices running at 2.5G, 5G, and 10G data rates.

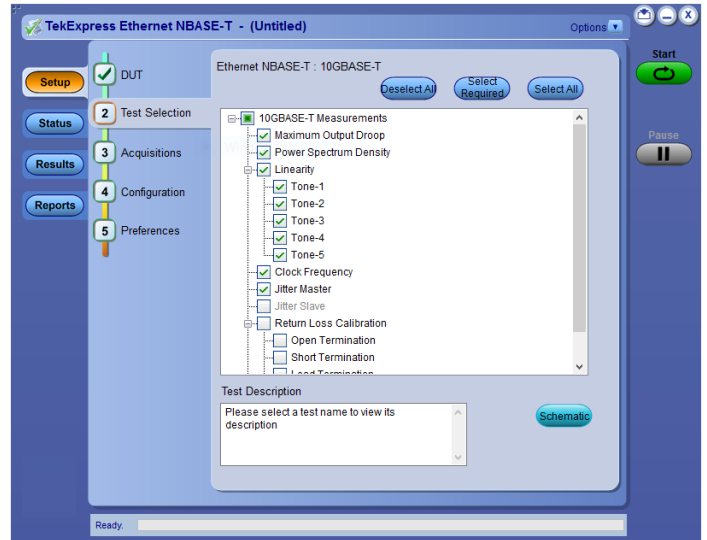
To accurately make these measurements, you need the Tektronix TF-XGBT test fixture. The TF-XGBT test fixture allows you to easily access the device under test (DUT) using either differential probes or matched SMA cables.

**Key features**

- Comprehensive automated solution for 2.5GBASE-T, 5GBASE-T and 10GBASE-T PHY testing
- Highly optimized and user friendly interface flow that sets up the test configuration for quick validation of electrical signals.
- Compliance and margin testing for accurate analysis and improved interoperability.
- Time-domain and frequency-domain measurements made with single analysis instrument.
- Test execution on an oscilloscope with remote control using programmatic interface from an external PC.
- Single instrument analysis of time and frequency domain measurements.
- Signal acquisition and analysis support for differential probes or direct SMA cabling.

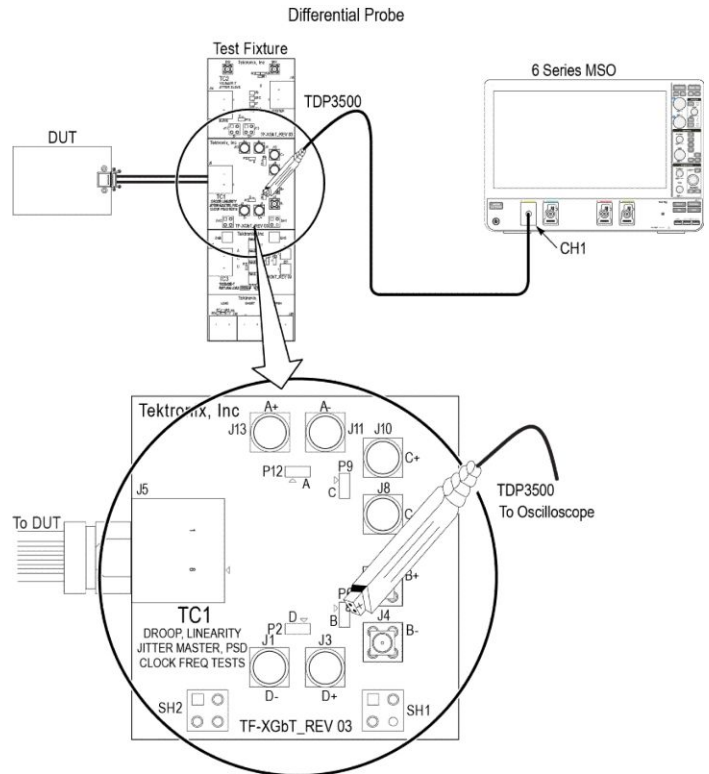
**Test selection and instrument setup**

Test selection is easy and straight forward through the intuitive TekExpress workflow. Select the measurements to execute and click on Start button.



For each measurement selected, the Ethernet Transmitter application automatically configures the oscilloscope, saving setup time and ensuring repeatable, reliable results.

As each test is performed, the application guides you through the connection diagrams.



Note: When using high input impedance differential probe, ensure that each of the single ended lanes is terminated with 50 Ω.

## Reports

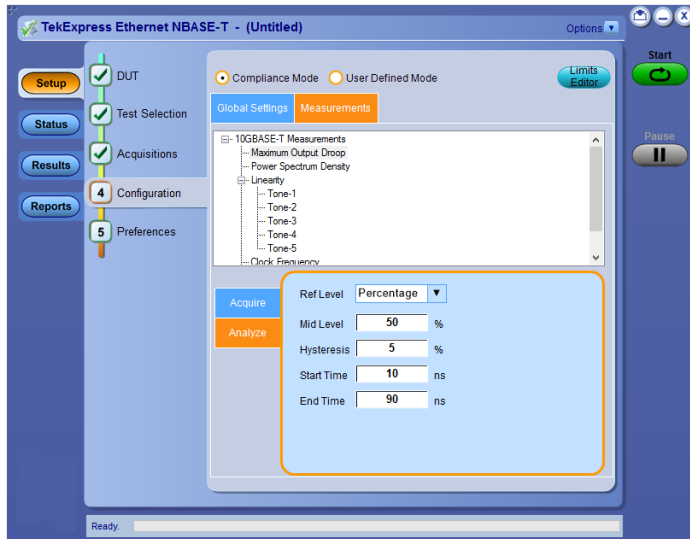
A summary report with Pass/Fail status for each test is created after the test execution is complete. This report includes test configuration details, waveform plots, and margin analysis to provide more insight into your design.

Tektronix TekExpress Ethernet NBASE-T 10GBASE-T Test Report									
<b>Setup Information</b>									
DUT ID	DUT001		Scope Information		MS064, PQ1 00009				
Date / Time	2018-12-16 22:11:28		SPC, FactoryCalibration		PASS				
Device Type	Ethernet NBASE-T		Scope F/W Version		1.13.61.5760				
TekExpress Ethernet NBASE-T Version	1.0.0.32								
TekExpress Framework Version	4.8.0.10								
Execution Mode	Pre-Recorded								
Probing Type	Differential								
Compliance Mode	True								
Overall Test Result	Pass								
Overall Execution Time	0:00:11								
DUT COMMENT:	General comment								
<b>Test Name Summary Table</b>									
Maximum Output Droop									
Pass									
<b>Maximum Output Droop</b>									
Measurement Details	Lane	Iteration	Measured Value	Test Result	Margin	Low Limit	High Limit	Units	Additional Info
Droop Positive	Lane C	1	3.4926097	Pass	H:6.5074	N.A.	10	%	Max: 4.0867 Min: 2.9976
Droop Negative	Lane C	1	3.4516256	Pass	H:6.5484	N.A.	10	%	Max: 4.0234 Min: 2.9912
COMMENTS		Population: 1000 Cycles							

Pass/Fail report

## Margin testing

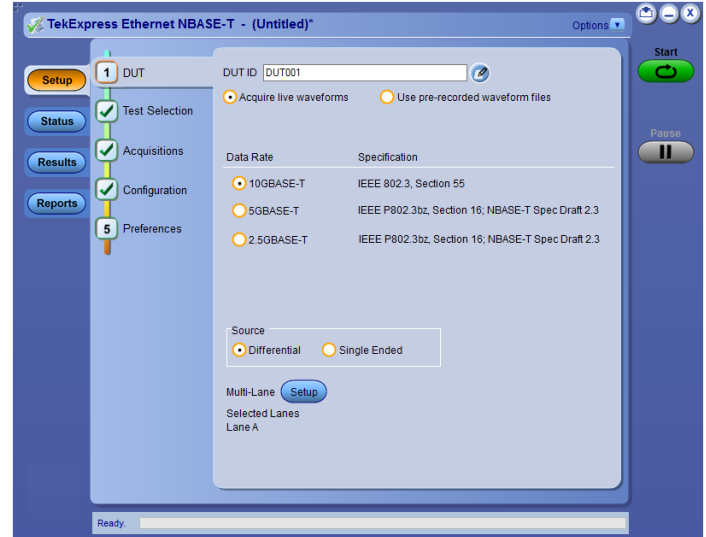
You can make changes to test specific parameters like test limits and other parameters to perform detailed margin analysis to validate your device performance.



Droop configuration parameters

## Probe support for signal acquisition

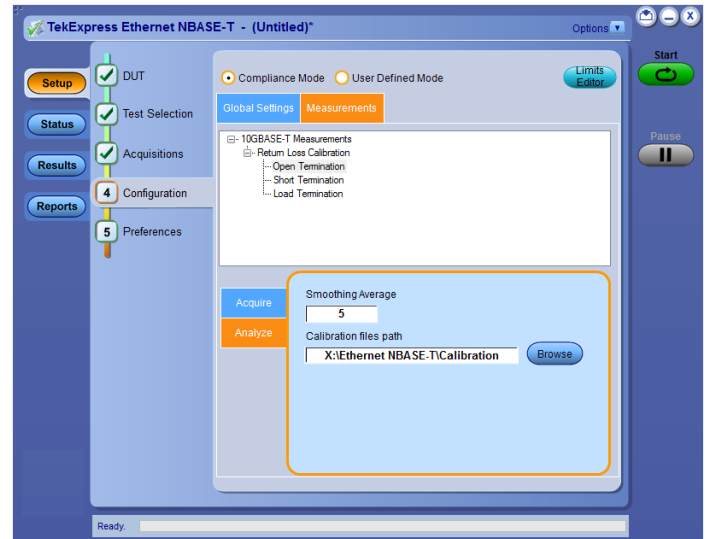
The application allows signal acquisition and analysis with either matched pair SMA cables or differential probes.



Differential and single-ended probe support

## Return loss

The automated test application simplifies Return Loss testing and eliminates the need for a Vector Network Analyzer by using a patented oscilloscope-based measurement along with a Tektronix AWG. Calibration data for Open, Load, and Short can be stored in a file and recalled in the test application.



Return loss

## Complete programming interface

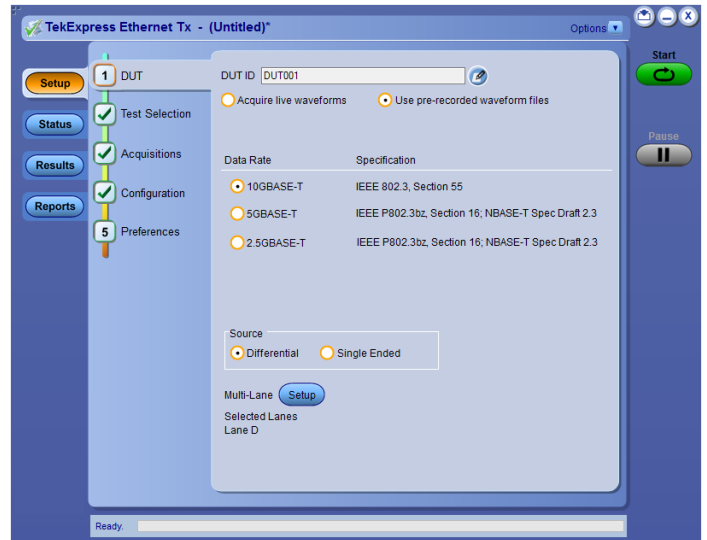
The TekExpress application provides a programmatic interface with support for a high-level automation layer such as Visual Basic, Microsoft.Net, C#, C++, Python, or any other web application. This lets you control the execution of the TekExpress Ethernet application running on an oscilloscope from a local machine or using a remote computer.

Programming examples are found in the application examples folder.

## Offline analysis

Offline analysis feature of the TekExpress Ethernet application allows the user to analyze the already acquired waveforms. Select **Use pre-recorded waveform files** in the application DUT panel to acquire the waveforms and save it as a waveform files.

This allows the waveforms to be captured from an oscilloscope and shared across multiple users, sites to perform analysis using other oscilloscopes.



Offline analysis using pre-recorded waveform files

## Specifications

### 10GBASE-T measurements

The following tests are performed as per the IEEE802.3-2012 standard. The device under test (DUT) must be able to provide the test mode signals as indicated in IEEE802.3-2012 Subclause 55.5.2.

Measurement	Standard reference and Test mode
Maximum Output Droop	IEEE802.3-2012 Subclause 55.5.3.1
Transmitter Timing Jitter - Master	IEEE802.3-2012 Subclause 55.5.3.3
Transmit Clock Frequency	IEEE802.3-2012 Subclause 55.5.3.5
Transmitter Timing Jitter - Slave	IEEE802.3-2012 Subclause 55.5.3.3
Transmitter Linearity	IEEE802.3-2012 Subclause 55.5.3.2
Transmitter Power Spectral Density (PSD) and Power	IEEE802.3-2012 Subclause 55.5.3.4
Return Loss	IEEE802.3-2012 Subclause 55.8.2.1

### 2.5GBASE-T and 5GBASE-T measurements

The following tests are performed as per the IEEE802.3bz/D3.3 draft standard. The device under test (DUT) must be able to provide the test mode signals as indicated in IEEE802.3bz/D3.3 Subclause 126.5.2.

Measurement	Test mode
Maximum Output Droop	IEEE802.3bz/D3.3 Subclause 126.5.3.1
Transmitter Timing Jitter - Master	IEEE802.3bz/D3.3 Subclause 126.5.3.3
Transmit Clock Frequency	IEEE802.3bz/D3.3 Subclause 126.5.3.5
Transmitter Timing Jitter - Slave	IEEE802.3bz/D3.3 Subclause 126.5.3.3
Transmitter Nonlinear Distortion	IEEE802.3bz/D3.3 Subclause 126.5.3.2
Transmitter Power Spectral Density (PSD) and Power	IEEE802.3bz/D3.3 Subclause 126.5.3.4
Return Loss	IEEE802.3bz/D3.3 Subclause 126.8.2.1

### NBASE-T measurements

The following tests are performed as per the NBASE-T Physical Layer Specification. The device under test (DUT) must be able to provide the test mode signals as indicated in NBASE-T Physical Layer Specification version 1.1 Subclause 2.9.

Measurement	Test mode
Maximum Output Droop	Subclause 55.5.3.1, Test Mode 6
Transmitter Timing Jitter - Master	Subclause 55.5.3.3, Test Mode 2
Transmit Clock Frequency	Subclause 55.5.3.5, Test Mode 2
Transmitter Timing Jitter - Slave	Subclause 55.5.3.3, Test Mode 1 and Mode 3
Transmitter Nonlinear Distortion	Subclause 55.5.3.2, Test Mode 4, Tones 1-5
Transmitter Power Spectral Density (PSD) and Power	Subclause 55.5.3.4, Test Mode 5
Return Loss	Subclause 55.8.2.1, Test Mode 5

## Ordering information

### Required hardware

Oscilloscope	6 Series MSO oscilloscope with minimum bandwidth of 4 GHz (option 6-BW-4000)
Supported instruments	MSO64
Required option	6-WIN (Removable SSD with Microsoft Windows 10 operating system)

### Software models

Application	Option	License type
Ethernet (2.5G and 5G BASE-T) Automated Compliance Solution	6-CMNBASET	New instrument license
	SUP6-CMNBASET	Upgrade license
	SUP6-CMNBASET-FL	Floating license
Ethernet (10G BASE-T) Automated Compliance Solution	6-CMXGBT	New instrument license
	SUP6-CMXGBT	Upgrade license
	SUP6-CMXGBT-FL	Floating license

### Recommended probes

Probes	Quantity
TDP3500	1 (minimum) <sup>1</sup>

### Recommended accessories

Accessories	Quantity
Power Splitter - PSPL5331	2
SMA to BNC adapter PN: 015057200	4

### AWG compatibility (For Return Loss Measurements)

AWG5202 with option 250,2HV and 2DC (recommended), AWG7122C

### IEEE 2.5GBASE-T Transmitter Non-linear Distortion Test (Section 126.5.3.2)

This test requires a 45 MHz sine wave to be injected, as per the specification. This is only required for 2.5GBASE-T. The supported signal sources are:

- AWG5202 , AFG3052C, AFG3102C, AFG3152C, AFG3252C (Recommended), AWG5002C, AWG5012C, AWG5014C, AWG7082C, AWG7122C

<sup>1</sup> \*Quantity 2x, if performing Return loss measurement and 4x for testing multi-lane.

**TF-XGBT 10GBASE-T, NBASE-T, and IEEE802.3bz**

The TF-XGBT test fixture is required to perform all measurements and is designed to meet the test fixture requirements in each of the applicable specifications/standards.

TF-XGBT contains	Quantity	Description
Test fixture main board	1	<p>Main test fixture consist of 3 sections:</p> <ul style="list-style-type: none"> <li>• Test Fixture TC1: For Droop, Transmitter Timing Jitter - Master, Transmit Clock Frequency, Transmitter Linearity, Transmitter Power Spectral Density (PSD), and Power Level Compliance test measurements <b>Note:</b> Includes SMA Male-to-Female Adapter × 8 and 50 Ω SMA Terminator × 8 mounted on the SMA connectors</li> <li>• Test Fixture TC2: Transmitter Timing Jitter – Slave compliance test measurement <b>Note:</b> Includes SMA Male-to-Female Adapter × 2 mounted on the SMA connectors</li> <li>• Test Fixture TC3: Return Loss compliance test measurement <b>Note:</b> Includes SMA Male-to-Female Adapter × 2 mounted on the SMA connectors</li> </ul>
Test fixture calibration board	1	Required for Return Loss calibration
RJ45 patch cord	2	0.08 meter, shielded RJ45 cable to connect the test fixture to the Return Loss calibration board and the device under test
China RoHS sheet	1	



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



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.



Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

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**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tek.com](http://www.tek.com).

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