VIAVI Solutions

Brochure

VIAVI
Verifying Telecom Synchronization Systems

Synchronization test options for T-BERD/MTS-5800, T-BERD/MTS-5800–100G, and MAP-2100, Timing Expansion Module TEM

Synchronization test applications let users analyze synchronization parameters at telecom interfaces ranging from 1PPS to 25 Gbps. These tests are performed at clock, PDH or Ethernet interfaces with PTP/1588v2 or Synchronous Ethernet protocols. A highly stable reference module is provided to deliver the necessary accuracy for respective ITU-T measurement metrics and thresholds. The reference module can also be used to validate the performance of GNSS systems and deliver stable 1PPS/10MHz for measurement devices.

Value Proposition

Verify synchronization networks by performing time error, frequency error, packet delay variation, or floor packet percentile FPP measurements. Time error measurements are performed while emulating a PTP Telecom Time Slave Clock (T-TSC) thus enabling a true characterization of time error present at any part of the synchronization chain from the Telecom Grand Master (T-GM) to the T-TSC at the end application. Time error results present both constant time error (cTE) and dynamic time error (dTE) characterized by Time Interval Error (TIE), maximum Time Interval Error (MTIE) and Time Deviation (TDEV) metrics. Required ITU-T masks are provided so users can immediately obtain a pass/fail verdict of the performed MTIE/TDEV measurements. 1PPS and 10MHz wander tests (MTIE/TDEV) can be performed at any device delivering those interfaces.

Benefits

- Validate proper delivery of synchronization services in telecom and 4G/5G wireless networks throughout the synchronization chain from the Telecom Grandmaster (T-GM) to the Telecom Time Slave Clock (T-TSC)
- Easily perform synchronization measurements with workflows and automatic pass/fail verdicts enabled with a comprehensive library of ITU-T masks
- Enable accurate measurements meeting ITU-T standards with a highly stable reference clock
- Verify adequate installation and function of GNSS systems from the antenna to the GNSS receiver location
- Troubleshoot PTP synchronization problems with packet capture and decode

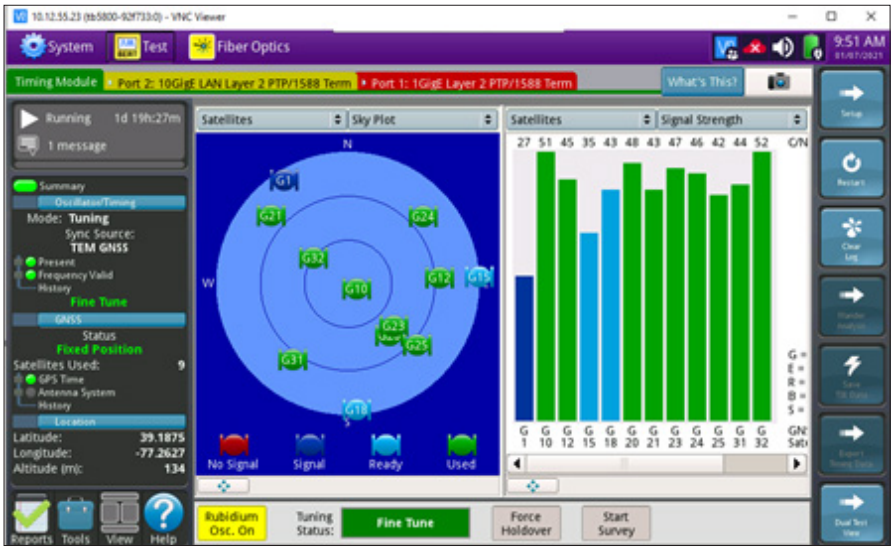
Intended audience

- Central office, metro/access and wireless technicians who install, turn up, or troubleshoot telecom equipment
- Engineers who design, maintain, or troubleshoot synchronization equipment in the lab or field

Timing Expansion Module (TEM)

The Timing Expansion Module provides a GNSS receiver chip set that can receive and decode GNSS systems such as GPS, Galileo, GLONASS and BeiDou. Delivering a highly stable reference signal necessitates a highly stable oscillator such as Rubidium available in the TEM.

Beyond providing the reference signals for synchronization measurements, the TEM can be used to verify the proper location and installation of GNSS antenna and cabling systems. Its sky plot and signal strength diagrams provide an accurate image of visible satellites and their respective signal strengths. TEM delivers Time of Day (ToD) and 1PPS and 10MHz reference signals to attached mainframes described in the next section. The 1PPS and 10MHz signals are also available on an SMB port for external test equipment.



Measurement Mainframes

VIAVI Solutions provide several mainframe variants with varying degree of synchronization capability to match the value and performance requirements of different user groups. They are distinguished by the range of the supported test signal rates and their capability to deliver stable reference signals. The measurement capabilities are described in the next sections.

Mainframe	Max test signal rate of 10 Gbps	Max test signal rate of 100 Gbps	Integrated GNSS	Support for TEM
T-BERD/MTS-5811 and 5822	Y	N	N	Y
T-BERD/MTS-5882	Y	N	Y	Y
T-BERD/MTS-5800-100G	Y	Y	Y	Y
MAP-2100	Y	Y	Y	N

IEEE 1588v2 PTP Test

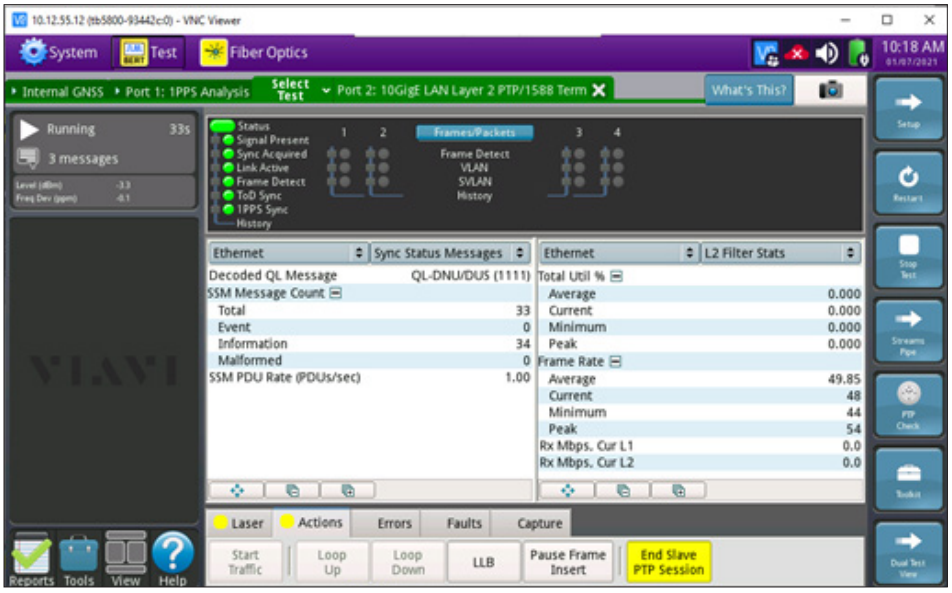
What the test is: The IEEE 1588v2 test is used to ensure proper connectivity to the PTP master clock by emulating a PTP slave device. In addition, the test measures KPIs for the PTP traffic such as PDV and time error. The PDV and time error tests can be run both with the PTP packets encapsulated in Ethernet frames (Layer 2 mode) or with the PTP packets encapsulated in UDP segments (Layer 4 mode). Supported ITU-T standards include G.8275.1, G.8275.2 and G.8265.1.

What it measures:

- Connectivity to the PTP master — ensures proper connectivity to the PTP master.
- Time error — measures the time difference between two clocks: one signal under test against a reference clock. The time error results include constant time error (cTE), maximum absolute time error, and dynamic time error. The dynamic time error component is characterized through MTIE and TDEV metrics.
- Packet delay variation (PDV) and Floor Packet Percentage FPP— the variation in packet delay for the PTP sync and PTP delay request packets, which are transmitted between the PTP master and the slave (test instrument) are measured and displayed as PDV. These measurements are valuable for non-PTP aware networks such as those designed according to ITU-T G.8752.2 profile. FPP determines the percentage of the packets received within the selected measurement floor as defined in ITU-T G.8261.1.
- Packet Capture and Decode: if there are problems in establishing a PTP connection to the master, the tester provides the capability to capture PTP packets and decode them on an on-board Wireshark application.

Synchronous Ethernet Test

What the test is: The synchronous Ethernet (SyncE) configuration test ensures that the Ethernet connection provided is a valid SyncE signal. This is defined by the signal being on frequency and containing synch status messages (SSM) at the expected rate and with the expected quality level.

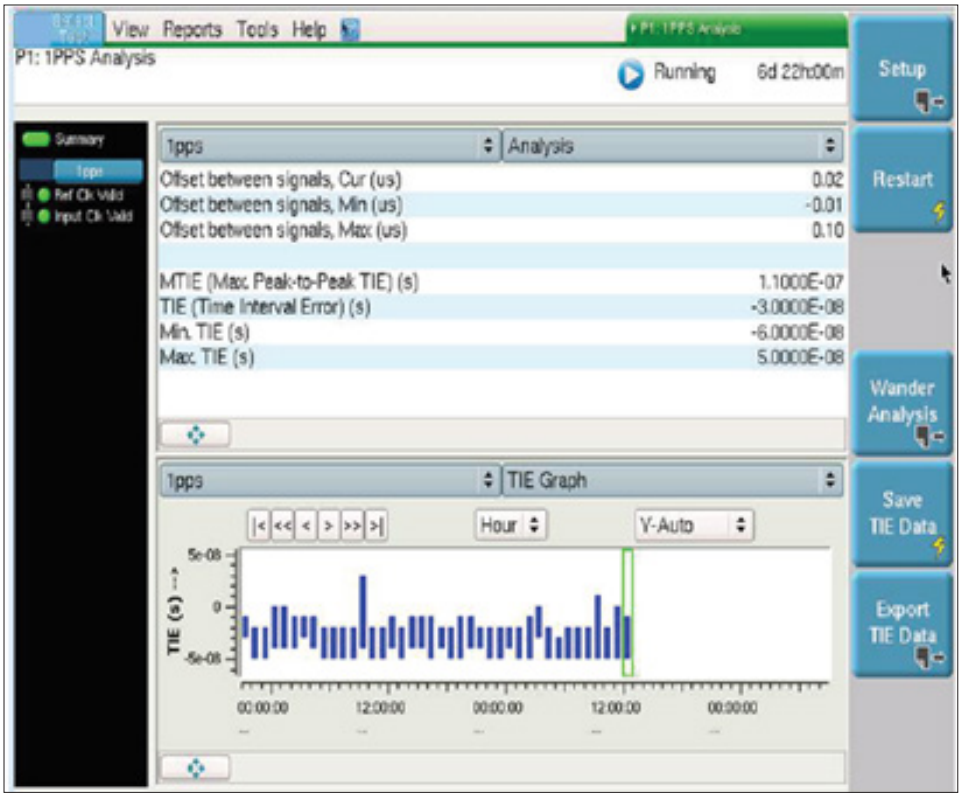


What it measures:

- Receive frequency and receive frequency deviation — the receive frequency relative to the highly accurate internal clock source in the test instrument. Valid SyncE signals should have a maximum frequency deviation of not more than 4.6 ppm. Current and maximum frequency deviations are measured.
- Synchronization status messages (SSM) — valid SyncE signals include periodic SSMs to indicate that the signal is a valid SyncE signal and to indicate the quality level of the clock source used to derive the frequency of the signal. Either missing SSMs or a mismatch between the expected quality level and the quality level in the SSM indicate a network misconfiguration that will negatively impact the cell-site timing reference.
- SyncE Wander: measures the receive frequency, frequency deviation, TIE, MTIE, and TDEV. It automatically compares the MTIE/TDEV against relevant ITU-T masks and creates a pass/fail verdict.

1 PPS Analysis

What the test is: The 1 PPS analysis test measures the accuracy of a 1 PPS signal (often derived from an IEEE 1588v2 PTP source) relative to a 1 PPS reference signal, which is often sourced from a portable GPS receiver. This test provides an indication on whether the 1 PPS used as a timing source for the eNodeB is of a high-enough quality to support the wireless protocol.

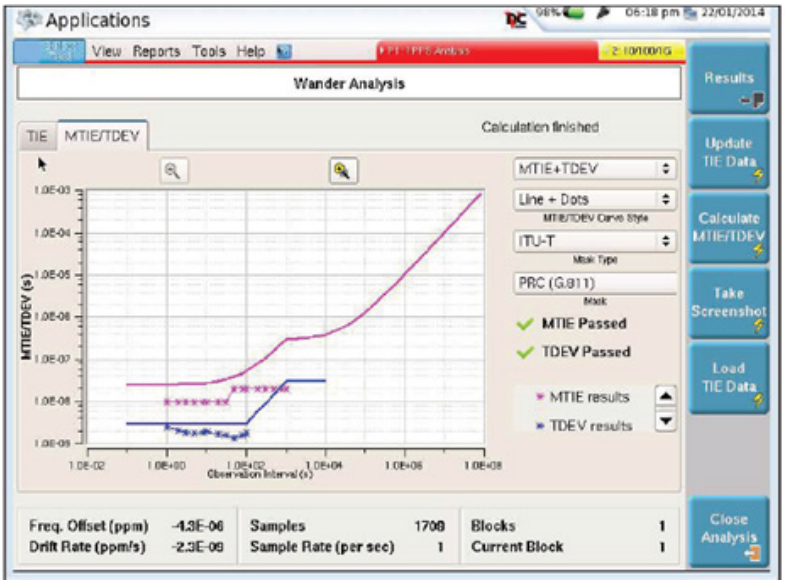


What it measures:

- Offset between signals — the time offset between the 1 PPS signal under test and the reference signal measured in microseconds. This measurement indicates how much timing error is present on the signal under test. Current, minimum, and maximum values are measured.
- TIE, MTIE and TDEV.

T1, E1, 2 MHz, 10 MHz Wander Analysis

What the test is: The wander analysis test for T1, E1, 2 MHz, and 10 MHz signals measures the accuracy of one of those signals (often derived from an IEEE 1588v2 PTP source) relative to a 2 MHz or 10 MHz reference signal, which is often sourced from a portable GPS receiver.



What it measures:

- TIE, MTIE and TDEV

Ordering Information

Description	Part Number
T-BERD/MTS-5811 & T-BERD MTS-5822	Various packages are available. Please contact your sales representative for a free initial consultation
T-BERD/MTS-5882	
T-BERD/MTS-5800-100G	
MAP-2100	
Timing expansion module (TEM)	C5TEM-R
10/100/1000 Mbps and 1 GE optical IEEE 1588v2 (PTP)	C5LS1588
10GE optical IEEE 1588v2 PTP	C510G1588
25GE optical IEEE 1588v2 PTP	C525G1588
1 PPS and 10 MHz timing and clock analysis	C5TIMING
1 GE optical SyncE	C5LSSYNCE
10 GE optical SyncE	C510GESYNCE
1 GE optical Ethernet wander	C5LSETHWANDER
10 GE optical Ethernet wander	C510GETHWANDER
PDH (DS1, DS3, etc.) Rx and Tx electrical wander	C5PDHWND
GNSS Option (T-BERD/MTS-5882/5800-100G, MAP-2100)	C5GNSS

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