T-BERD®/MTS-5800 Network Tester
IEEE 1588v2 Precise Timing Protocol (PTP) Verification Measurements in a G.8275.1 Architecture

This document outlines how to set up a T-BERD/MTS-5800 test instrument for timing and sync measurements related to the IEEE 1588v2 (aka Precise Timing Protocol (PTP)) according to **G.8275.1 Telecom Profile for Phase/Time Synchronization with Full Timing Support from the Network.**

**Equipment Requirements:**
- One of the following T-BERD/MTS-5800 models:
  - T-BERD 5800-100G or T-BERD 5882 equipped with GNSS Timing and Location option (Part# C5GNSS)
  - Any T-BERD/MTS-5800 equipped with Timing Expansion Module (C5TEM-R)
- Ethernet and IEEE1588v2/PTP Test options:
  - For 1G: C510M1GE and C5LS1588
  - For 10G: C510GELAN and C510G1588
  - For 25G: C525GE and C525G1588 (TBERD 5800-100G only)
- BERT software release V29.0.1 or greater
- GNSS Antenna (Taoglas AA.171, VIAVI Part# C5TEM-ANTENNA)
- The Timing Expansion Module (C5TEM-R) is recommended when access to GPS (the sky) is limited and/or measurement accuracy of +/-20ns is necessary.

**Connect the GNSS Antenna:**
1. Connect the antenna cable to the SMA connector on the T-BERD/MTS-5800/TEM (labeled Antenna).
2. Tighten the connector until the antenna is securely attached.
3. Place the antenna in a location with minimum interference or blocking (buildings, terrain, etc.).
Enable GNSS Receiver and Complete Survey:

1. Press the Power button to turn on the test set.
2. Tap the Test icon.
3. Tap the Internal GNSS tab or the Timing Source tab.
4. Tap the Setup soft key.
5. Configure GNSS Settings as follows:
   - **GNSS System(s):** Select GPS for use in North America. Other constellations or combination of constellations can also be used.
   - **Time Type:** GPS
   - **Time Format:** 12-hour
   - **Elevation Limit:** 5 deg recommended and will work in “urban canyon” environments with many obstructions. Using satellites near the horizon may degrade performance so using an Elevation Limit greater than 5 but less than 15 degrees is acceptable.
   - **Minimum C/No:** 9 dB-Hz recommended and will work in “urban canyon” environments with many obstructions. Using satellites with a weak carrier to noise ratio may degrade performance so values as high as 30 dB-Hz are acceptable for “clear-key” environments.
   - **Antenna Power:** 3.3 volts for VIAVI supplied Taoglas AA.171 antenna. If you are using a different antenna, enter the voltage required by that antenna. Enter “0” if the antenna has a power source.
   - **Antenna Time Bias:** 28 ms for VIAVI supplied Taoglas AA.171 antenna. If you are using a different antenna, enter the cumulative delay introduced by the antenna, the cables, and any in-line splitters, surge arresters or amplifiers. In absence of more specific information, use 1.2ns/foot or 4.5ns/meter of cable.
6. Tap the Location settings tab.
7. Configure Location Settings as follows:
   - **Survey mode:** Typical (3 hours) the minimum recommended survey length for best accuracy. Fast or Quick may be used, but timing accuracy is reduced.
8. Tap the Start Survey button to start a survey.
9. Tap the Results soft key to view the Test Result screen.
10. If you are using a T-BERD 5800v2 and Timing Module (CSTEM-R), tap the Rubidium Osc. button to turn on and tune the oscillator.
11. Using the results group and category drop-down menus, change the left or right displays to the following:

- **Satellites/Sky Plot**: Displays the satellites detected by the GNSS receiver. Ensure at least 4 satellites are “**Used**”. Otherwise, relocate antenna to a less obstructed location.
- **GNSS/Location**: Provides the mean (avg) C/No, the 3D Location Accuracy, and the Current (during survey) and Mean Position Dilution of Precision (PDOP). A PDOP of 1 is perfect. A value below 4.0 is desired.
- **Satellites/Signal Strength**: Uses a bar graph to display the signal strength for each identified satellite. Green indicates the signal is above the **Minimum C/No** setting.
- **GNSS/Status**: Displays general information concerning the GNSS Satellites. Ensure that **Status** progresses from “**No Lock**” to “**Locked**” to “**Fixed Position**” during the survey. Ensure that **Timing Mode Status** progresses from “**Survey**” to “**Survey Done**”.

Note: If you are using a T-BERD 5800v2 and Timing Module (CSTEM-R), the **Summary** LED and **Summary/Status** results display will remain red until the rubidium oscillator is tuned.

12. Once the survey is done (oscillator is **Fine Tune** state if using TEM), you are ready to perform timing tests using the attached antenna, including:

- One-way delay measurements
- IEEE 1588 Precision Time Protocol (PTP) Time Error, and Packet Delay Variation (PDV) measurements
- Wander analysis
- Timing and 1PPS Analysis
Enable PTP Slave Session:

1. Tap the second folder under the Test Icon at the top of the screen.
2. Tap the Select Test drop-down and select the Layer 2 PTP/1588 at the desired rate:
   - Ethernet> 1GigE Optical> Layer 2 PTP/1588> P1 Terminate
   - Ethernet> 10GigE LAN> Layer 2 PTP/1588> P1 Terminate
   - Ethernet> 25GigE LAN> Layer 2 PTP/1588> P1 Terminate
3. Connect T-BERD SFP+ Port 1 to the network port to be tested using an LC patch cable.
   - Enable the Laser:
   - Press Restart:
   - Look for 5 or 6 green LEDs: This will indicate that the link is up, and GPS sourced timing is available.
   - Press Setup:
4. Select the PTP Folder. Make all PTP settings as necessary as a PTP Slave on the network under test.
   - **Mode:** Slave
   - **Address Mode:** Multicast
   - **Domain:** default value should be set to 24, otherwise use the value recommended by your network timing administrators
   - **Encapsulation:** None or VLAN and enter VLAN ID & VLAN Priority
   - **Cable Delay (ns):** This is the delay caused by the cable that connects the TBERD (PTP Slave) to the network (Ethernet switch/router). Assume 1.2ns/foot of fiber.
5. Press Results: to return.
6. In the Actions Tab: Press Start Slave PTP Session
Review PTP Slave Session Results:

1. The default view is single screen with Summary & Status. The view can be changed to dual results (Split Left/Right) through the View button on the lower left.

2. Select PTP / Link Stats and Graphs / Max TE for the two results windows.
   - Detecting the Rx Domain Number (24), Message interval (Supported) and seeing a Max TE value indicates that the PTP Slave Session is active. The T-BERD is receiving timing from the PTP master.
   - Note: There are many more categories and sub-categories of results both tabular and graphed.

3. It is also possible to set thresholds for certain measurements:
   - Press Setup: .
   - Select the Thresholds tab.
   - Enable and set desired thresholds.
   - Press Results: to return.
   - In the Actions tab, press Start Slave PTP Session .
   - Press Restart: .

4. If any of the thresholds are triggered the Test Folder, the Status LED and the value for that result will all turn red.