VIAVI Solutions

Quick Card

T-BERD®/MTS-5800 Network Tester

IEEE 1588v2 Precise Timing Protocol (PTP) Verification Measurements in a G.8265.1 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.8265.1 Telecom Profile for Frequency Synchronization.***

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 in any situation where access to GPS (the sky) is limited and/or measurement accuracy of +/-20ns is necessary.

Figure 1: Equipment Requirements

Figure 2: T-BERD/MTS-5882

Figure 3: T-BERD 5800-100G

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.).

*Figure 4: T-BERD 5800v2 shown with the **TEM***

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. For 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.

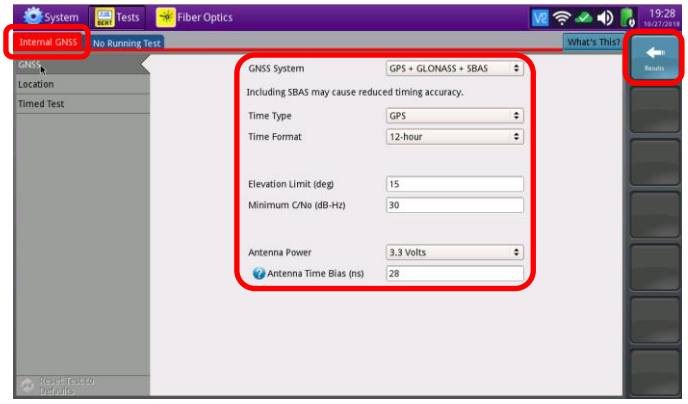


Figure 5: GNSS Setup

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 (C5TEM-R), tap the **Rubidium Osc.** button 

to turn on and tune the oscillator.

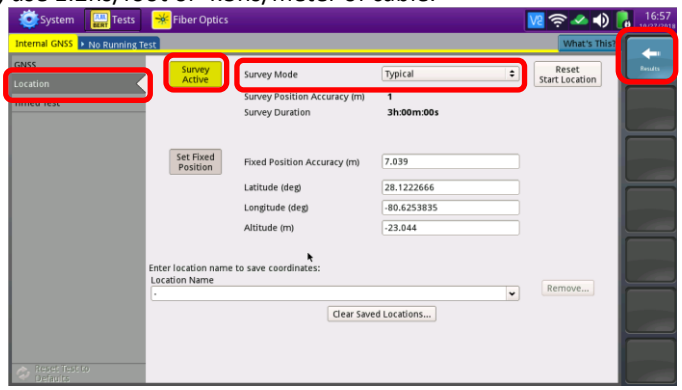


Figure 6: Location Setup

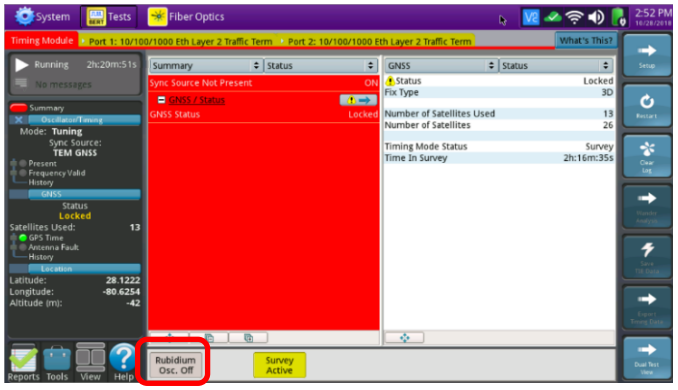


Figure 7: Test Results Screen, T-BERD 5800v2

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 (C5TEM-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 in **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

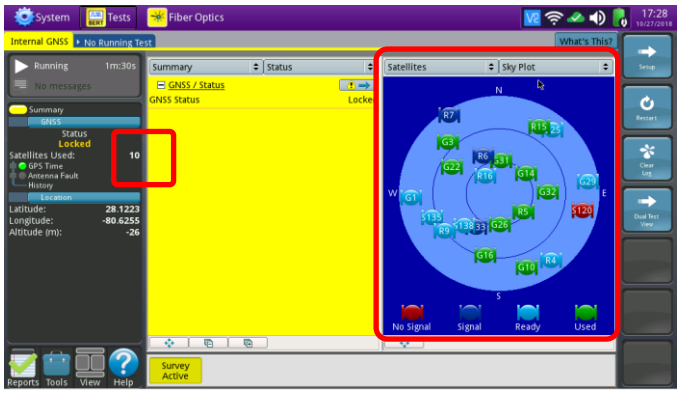


Figure 8: Satellites/Sky Plot results

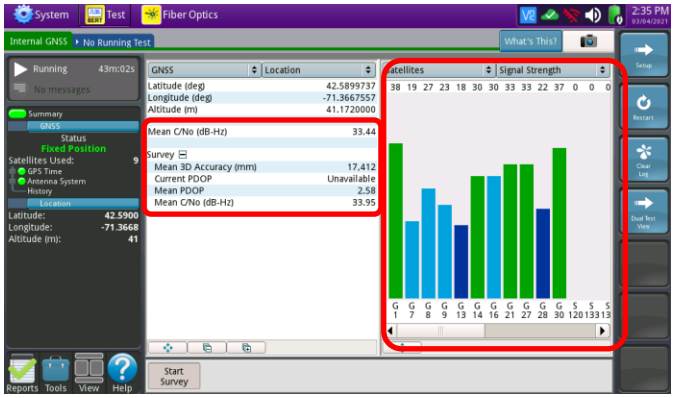


Figure 9: Satellites/Signal Strength results

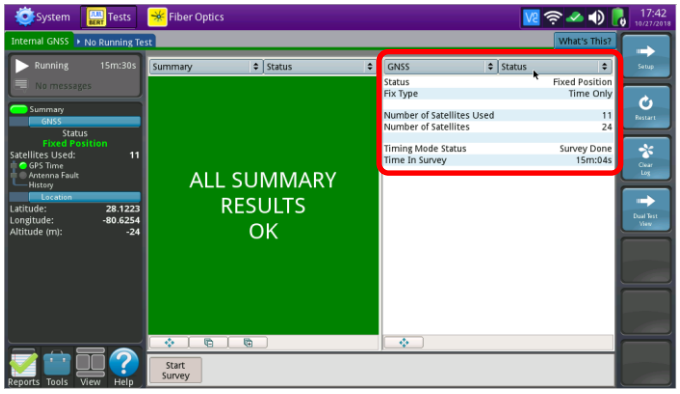


Figure 10: GNSS/Status after survey (Internal GNSS)

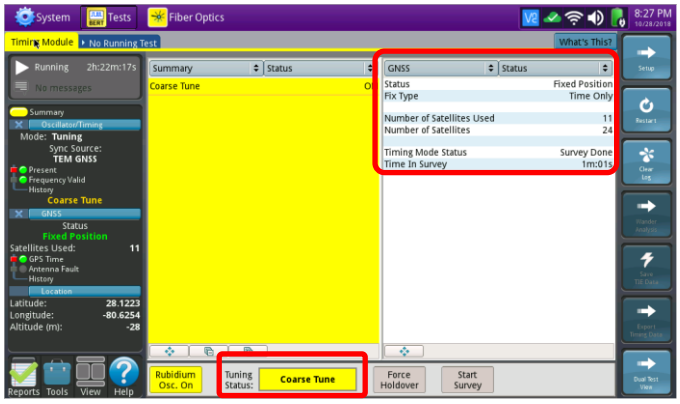


Figure 11: GNSS/Status after survey & course tune (TEM)

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 4 PTP/1588** test at the desired rate:
   - Ethernet> 1GigE Optical> Layer 4 PTP/1588> IPv4> P1 Terminate
   - Ethernet> 10GigE LAN> Layer 4 PTP/1588> IPv4> P1 Terminate
   - Ethernet> 25GigE LAN> Layer 4 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 **All Streams** folder. Configure **Source IP Type**, **Source IP** and **Default Gateway**.

5. Select the **PTP** folder. Make all PTP settings as necessary as a PTP Slave on the network under test.
   - **Mode**: Slave
   - **Domain**: 4 (commonly), 4 – 23 possible
   - **Address Mode**: Multicast or Unicast
   - **Master IP Address**: example shown
   - **Encapsulation:** None or VLAN and enter VLAN ID & VLAN Priority

6. Press **Results:**  to return.
7. In the **Actions** tab, press **Start Slave PTP Session**  .

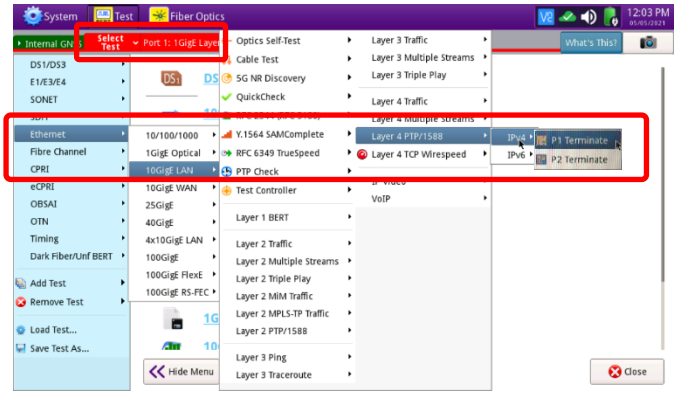


Figure 12: Test Selection

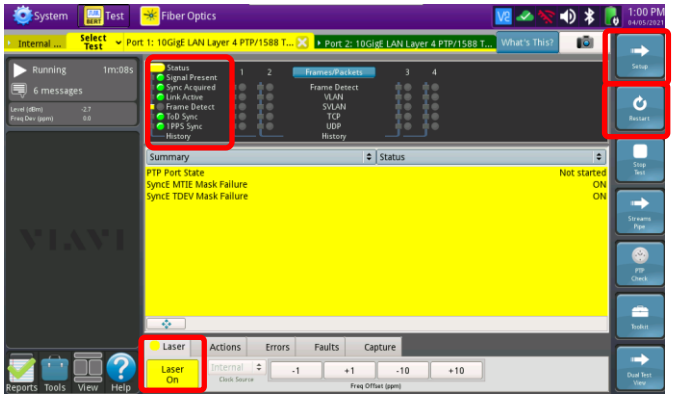


Figure 13: Physical Layer Establishment

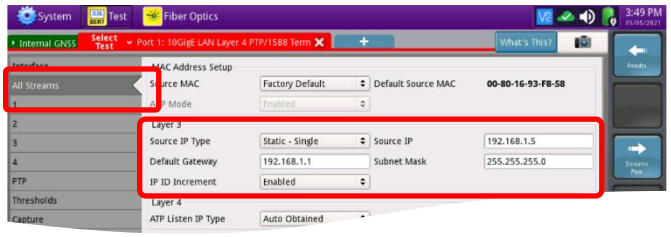


Figure 14: All Streams setup

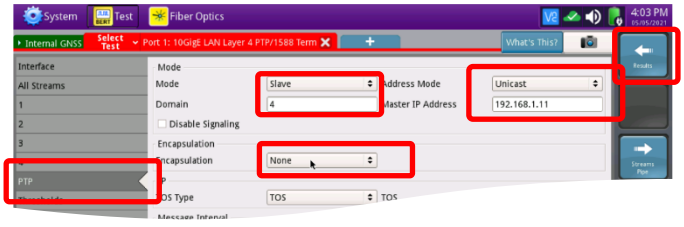


Figure 15: PTP Setup

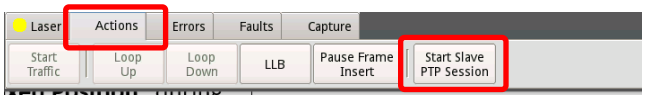


Figure 16: Actions Tab to Start PTP Session

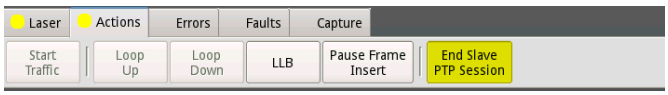


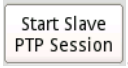
Figure 17: Session Started

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 (4) 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.
   - For 8265.1 implementations, **Floor Packet Measurement** is a recommended area of focus. Use the default values configured in the example shown.

4. Press **Results:**  to return.
5. In the **Actions** tab, press **Start Slave PTP Session**  .

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

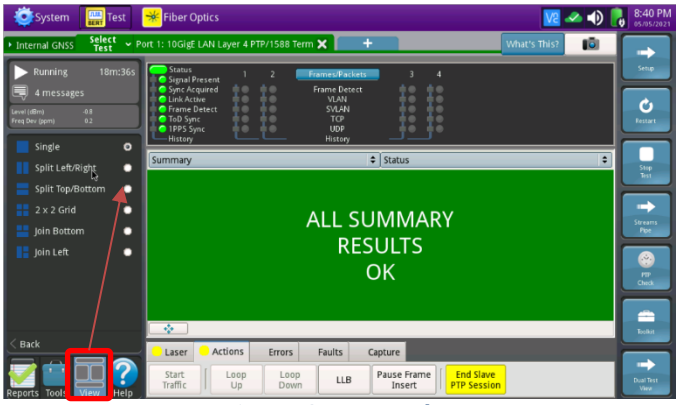


Figure 18: Test Results

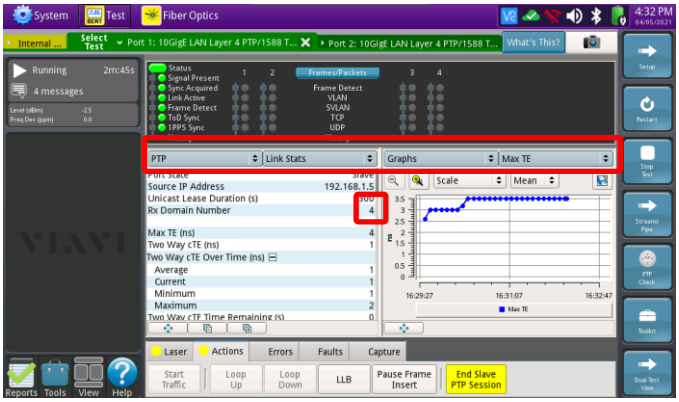


Figure 19: PTP Test Results

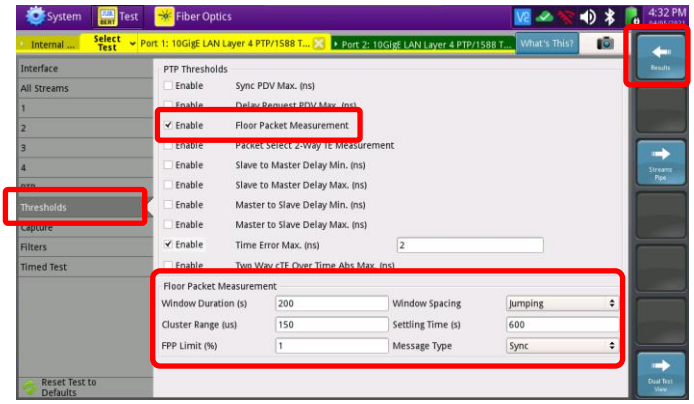


Figure 20: PTP Thresholds

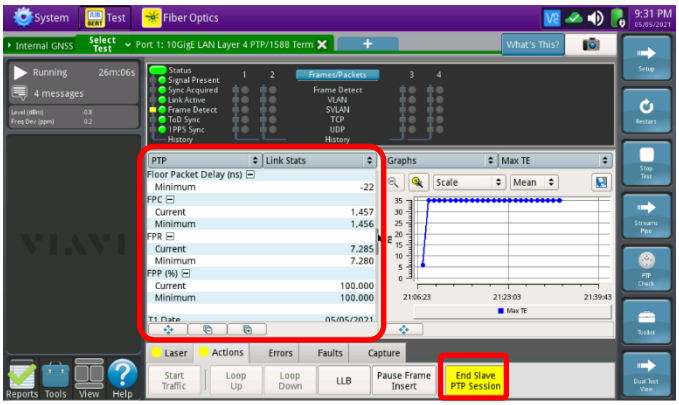


Figure 21: Floor Packet Delay