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PTP Testing with Ether.Genius: Slave Clock Test (Frequency)

Ether10.Genius and Ether.Genius may optionally supply IEEE 1588 version 2, also known as *Packet Time Protocol (PTP)*, emulation and analysis features. This document focuses in the tests to be done in the application end, where the PTP slave is installed. It is assumed that the unicast PTP profile is used. The clock reference used is derived from GNSS.
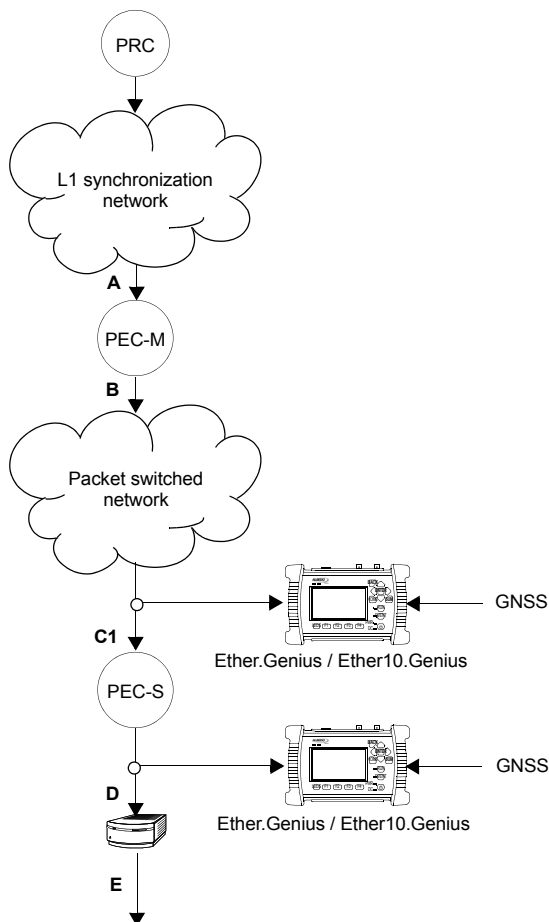

Figure 1 *This test verifies the PTP performance level in a remote site using the ITU-T G.82651.1 frequency distribution profile.*

1. SETTING UP THE REFERENCE

Ether.Genius and Ether10.Genius units may be equipped with a built in GPS / Glonass receiver. These units have a SMA female connector suitable for connecting an antenna. Units with the built in GPS / Glonass receiver are also supplied with a compact antenna with 5 m of coaxial cable plus a 10 m extension cable. Using a different antenna is possible as long as the specifications of the GPS / Glonass module are taken into account. To use the built in GPS / Glonass module follow these steps:
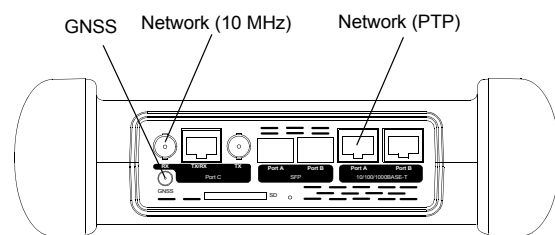

Figure 2 *Albedo Ether10.Genius / Ether.Genius test and clock reference interfaces used in this testing scenario.*

1. Attach the GPS antenna to the unit. Make sure that the antenna sees as much of the sky as possible. The unit may fail to achieve synchronization if there are not enough satellites in sight. Some tests may loss accuracy if the number of satellites in sight is reduced.

2. From the *Home* panel, go to *Setup*,
   The port setup panel is displayed.

3. Go to *Reference clock*.

4. Configure *Input clock* to *GPS / Glonass*.

5. Press *LEDS* to display the test status.

6. Wait for the REF and LOCK LEDs to become green.

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A L B E D O - APPLICATION NOTE

Note: The locking process for the OCXO version of Ether10.Genius and Ether.Genius may take around 10 minutes. The locking process in Rubidium units requires around 20 minutes.

Note: Both Rubidium and OCXO versions of Ether.Genius / Ether10.Genius are ready for testing once the LOCK LED is green but Rubidium units are not yet prepared to supply their maximum accuracy. These units go to a *Fine locking* status before being fully *Locked* to the reference. The *Fine locking* status may last for around four hours in Rubidium units. OXCO units do not have fine locking status and they go directly to the *Locked* when they finish the coarse locking procedure. The user could check the current locking status (*Locking*, *Fine locking*, *Locked*, *Holdover*, etc.) from the *Oscillator lock status* field in the *Reference clock* menu.

Configuring the GNSS Properties

The user could optionally configure the GNSS interface in the test unit. Despite being not mandatory, the increase in accuracy it could be obtained in this way is quite important. This is the required procedure:

1. From the *Home* panel, go to *System*,
   The system configuration panel is displayed.

2. Go to *General settings*.

3. Go to *GNSS*.

4. Optionally, enable or disable any of the *GPS*, *GLONASS* or *Beidou* constellations through the Active GNSS setting.

5. Go to *Fixed-position mode*.

6. Optionally, adjust the *Position averaging time* and enable position averaging by configuring *Fixed-position mode* to *Auto-average*.
   The *Fixed-position status* field now displays *Averaging*
   Note: At least one hour of position averaging is required for a reasonable accuracy.
   Note: The position averaging procedure should be run only once as long as the test unit geographical location is not changed. The unit checks any change in position (longitude, latitude, altitude) every time it is connected to a GPS antenna. If a change in the coordinates is

detected, then an error message is displayed in the status field and the mode is disabled.

7. Wait to the *Fixed position status* to become *Active*. The unit is now ready for testing.
   Note: Theoretically, testing could start before the end of the position averaging process. The improved time estimation due to this function would be automatically applied starting from the end of the auto-averaging process.

2. PTP Test

Ether10.Genius and Ether.Genius can be configured to behave as PTP slave clocks. There is no difference between any standard PTP clock and these equipments but the testers supply measurement results that are useful to qualify the stability of a PTP timing source.

In the pseudo-slave emulation mode the equipment behaves as a PTP slave but keeping an independent synchronization source that enables the unit to compute MTIE, TDEV, FPP and other performance metrics based on the comparison of the test signal phase and frequency with the clock reference input. The following description assumes that the equipment is configured with the factory defaults.

Connecting the Unit

Connect the Port A RJ-45 port to the network in the same interface where PEC-S is connected and follow these steps to enable the IP protocol in the port:

1. From the *Home* panel, go to *Setup*,
   The port configuration panel is displayed.

2. Select *Mode* to enter in the mode selection menu.

3. Choose *IP endpoint* and confirm by pressing ENTER.

Configuring the Port

When the equipment is configured in *IP Endpoint* mode it behaves like any other IP host in the network. That means that the test unit should be able to receive traffic directed to it or transmit test and signaling traffic to other devices. To do that, users should assign an IP profile to each test port: IP address, network mask, gateway address and DNS address.

The following procedure assumes that most simple test port configuration is used (1000BASE-T interface, no VLANs). Additional settings are required for more complicated connections.

1. From the *Home* panel, go to *Setup*,
   The port setup panel is displayed.

2. Select *Port A*.

3. Enter in *Local profile*.

4. Decide whether you want to configure the local IP profile with the help of the DHCP protocol or you want to statically set these profiles by means the *Use DHCP* control.

5. If you have enabled DHCP wait for the tester to get an IP profile from a DHCP server. If DHCP is not enabled, enter a valid *Static IPv4 address*, *Static IPv4 network mask*, *Static IPv4 gateway* and *Static IPv4 DNS address*.

Configuring PTP

Follow this procedure to enable the IEEE 1588-2008 protocol in test port A.

1. From the *Home* panel, go to *Test*,
   The test configuration panel is displayed.

2. Go to *PTP (IEEE 1588)*.

3. Configure the equipment to become an IEEE 1588 pseudo-slave by configuring *PTP mode* to *Test*.
   A label with the text PTP is displayed in the top notification area.

4. Set the transport protocol to *UDP*.

5. Configure the *Addressing mode* to *Unicast*.

6. Configure the timing of the different messages associated to PTP from the *Message timing*

menu.

7. Configure the *Domain* to the right value for your network.

8. Configure the IP addresses corresponding to one or more PTP grandmasters you want to communicate with from the *Unicast master table* menu.

If the previous settings are correct, the PTP indication in the top of the screen will change from yellow to green and the "S" indication will be displayed close th the "PTP" label.

Configuring the Test

Once the PTP is active the user still has to configure the tests to be run. In this setup these are the FPP and MTIE / TDEV tests. To enable the FPP test follow these steps:

1. From the *Home* panel, go to *Test*,
   The test configuration panel is displayed.

2. Go to *Floor delay population test (FPP)*.

3. Configure *Enable* to *On* to activate the test

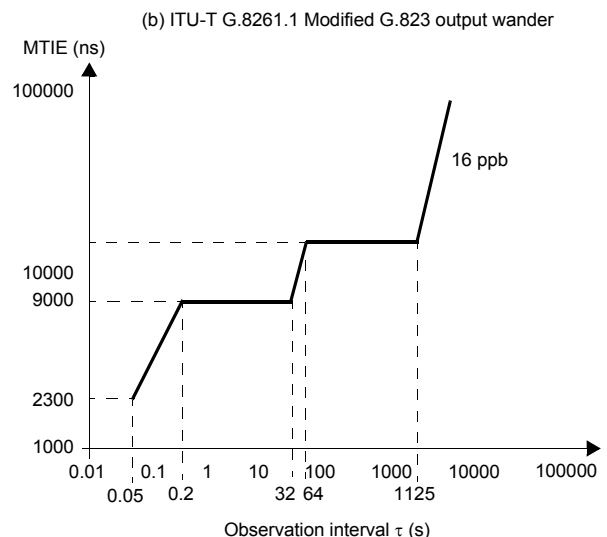To enable the MTIE / TDEV test, the correct procedure is as follows:

Figure 3 *ITU-T G.8261.1 modified ITU-T G.823 mask that applies to PEC-S.*

1. From the *Home* panel, go to *Test*,
   The test configuration panel is displayed.

2. Go to *PTP wander test.*

3. Enable the MTIE / TDEV test by setting the *Enable* control to *On*.

4. Configure *Standard* to *PEC G.8261.1*.

Running the Test

Te test is now ready to start. Press *RUN* in the test unit to do that. Now the FPP and MTIE / TDEV are computed in real time. To check the FPP results follow these steps:

1. From the *Home* panel, go to *Results*,
   The test port results panel is displayed.

2. Select *Port A* to enter in the port specific results.

3. Enter in *PTP* to display results about the PTP protocol.

4. Go to *Floor delay population test (FPP)*.

5. Check the values of *FPC (pkts)*, *FPR (pkts/s)* and *FPP (%)* and make sure that the minimum *FPP (%)* is at least 1%.
   Note: On the top right corner a *Settling* indication is displayed at the beginning of the test. Once the settling period expires the indication changes to *Testing* but no result is displayed before the measurement window is filled with data. The whole process takes 400 s with the default settings.

6. Verify that the *Estimation excess*, the *Floor delay estimation* and *Sync packet rate* are acceptable.

The MTIE / TDEV test is executed at the same time that the FPP test. Real time results can be checked in the following way:

1. From the *Home* panel, go to *Results*,
   The test port results panel is displayed.

1. Select *Port A* to enter in the port specific results.

2. Enter in *PTP* to display results about the PTP protocol.

3. Go to *PTP wander test*.

4. Choose between MTIE or TDEV

5. Check the *Time*, *TIE*, *MTIE* and *Mask* results (*MTIE* results panel) or *Time*, *TDEV* and *Mask* results (*TDEV* results panel) and make sure that the MTIE is below the mask for all observation intervals.
   Note: The TIE, MTIE and TDEV values must be understood as pktfilteredTIE, pktfilteredMTIE, and pktfilteredTDEV respectively.
   Note: It may be necessary to wait for 30 s 60 s to get the first MTIE and TDEV test results.

To stop the FPP and MTIE / TDEV tests press *RUN* a second time at any moment.

3. 10 MHz MTIE / TDEV Test

MTIE and TDEV test is available either from the Ethernet / IP output (PTP test) or in a frequency / time output from the PTP slave. Strictly, ITU-T G.8261.1 requires only the measurement over the clock interface.

In Ether.Genius / Ether10.Genius, monitored signals include frequency (2048 kb/s, 2048 kHz, 1544 kb/s, 1544 kHz, 10 MHz) and time (1 PPS). The performance metrics in these interfaces are similar to that in Ethernet / IP ports. Traditional MTIE and TDEV are used rather than their versions for packet interfaces. This example assumes that the clock signal is 10 MHz over single-ended (BNC) interface.

Connecting the Unit

Connect the Port C BNC port to a PEC-S clock output and follow these steps to enable the 10 MHz clock analysis in the port.

1. From the *Home* panel, go to *Setup*,
   The port configuration panel is displayed.

2. Select *Mode* to enter in the mode selection menu

3. Choose *Clock monitor*.

Configuring the Port

1. From the *Home* panel, go to *Setup*,
   The *Setup* configuration panel is displayed.

2. Select *Port C* to enter in the port specific configuration menu.

3. Configure *Clock frequency* to *10 MHz (Port C)*.

4. Configure *Connector* to *Unbalanced*.

Configuring the Test

Once the 10 MHz clock interface is configured, the user still has to configure the tests to be run. In this setup this is the MTIE / TDEV test. To enable this test, the correct procedure is as follows:

1. From the *Home* panel, go to *Test*,
The test configuration panel is displayed.

2. Go to *Wander test.*

3. Enable the MTIE / TDEV test by setting the *Enable* control to *On*.

4. Configure *Standard mask* to *PEC G.8261.1*.

Running the Test

Te test is now ready to start. Press *RUN* in the test unit to do that. The MTIE / TDEV results are computed by the test unit in real time and they can be checked at any moment in the following way:

1. From the *Home* panel, go to *Results*,
The test port results panel is displayed.

1. Select *Port C* to enter in the port specific results.

2. Go to *Wander test*.

3. Choose between MTIE or TDEV

4. Check the *Time*, *TIE*, *MTIE* and *Mask* results (*MTIE* results panel) or *Time*, *TDEV* and *Mask* results (*TDEV* results panel).

To stop the MTIE / TDEV tests press RUN a second time at any moment.