ZCU670 Unicast Boundary Clock Performance

Introduction

This report shows the results of Unicast Boundary Clock testing with the ZCU670 platform. Test results are compared to ITU-T G.8273.2 Full Time Support and ITU-T G.8273.4 Partial Time Support standards.

Contents

1. Introduction

This report shows the results of Unicast Boundary Clock testing with the ZCU670 platform. Test results are compared to ITU-T G.8273.2 Full Time Support and ITU-T G.8273.4 Partial Time Support standards. Noise generation tests measure the amount of noise produced at the output of the T-BC when there is an ideal input reference packet timing signal. Holdover performance tests check holdover performance by measuring the phase/time output in the event of the loss of the PTP input to the T-BC. The holdover performance is measured on PTP and 1PPS outputs of the DUT.

2. Results Summary

The table below shows the performance testing summary.

Standard	Configuration	Test Case	Results
G.8273.2	Standalone (ts2phc, ptp4l, synced)	Noise Generation	**Pass**
		Holdover	**Pass**
	External Servo (pcm4l, ptp4l, synced)	Noise Generation	**Pass**
		Holdover	**Pass**
G.8273.4 PTS	External Servo (pcm4l, ptp4l, synced)	Noise Tolerance – G.8271.2 PTS PDV Pattern	**Pass**

3. Test Configuration

Device Under Test	ZCU670
Oscillator	Rakon 38.4MHz Onboard MiniOcxo
1pps Source	Symmetricom TP5000
Software Version	4.3.1
PTP4L Version	4.0
Instrument	Paragon Neo
Instrument Serial Number	00036081
Ethernet Interface	10G Optical
CAT Version	28.10.22111.2025 [S] (C)

The ITU-T G.8273.2 and ITU-T G.8273.4 PTS performance testing was completed in the following configuration with Eth1 connected to Port 1 of the Calnex Paragon Neo, and Eth2 connected to Port 2. This configuration is used for both Boundary Clock and Slave Clock tests with two masters.

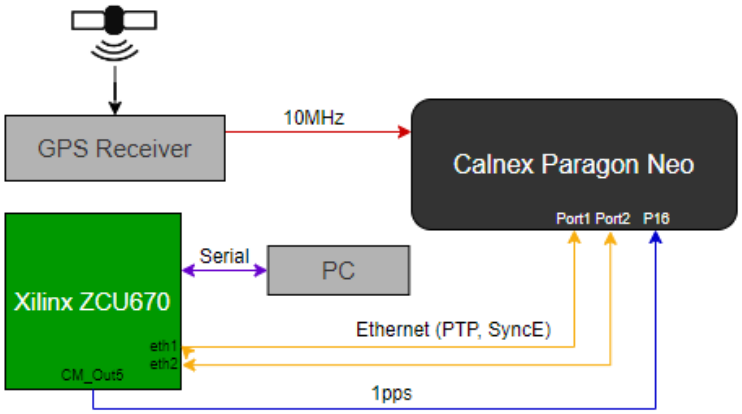


Figure 1. Test Configuration 1

4. G.8273.2: Noise Generation – Standalone

The noise generation of a T-BC represents the amount of noise produced at the output of the T-BC when there is an ideal input reference packet timing signal. The noise generation is measured on both the PTP and 1PPS outputs of the DUT.

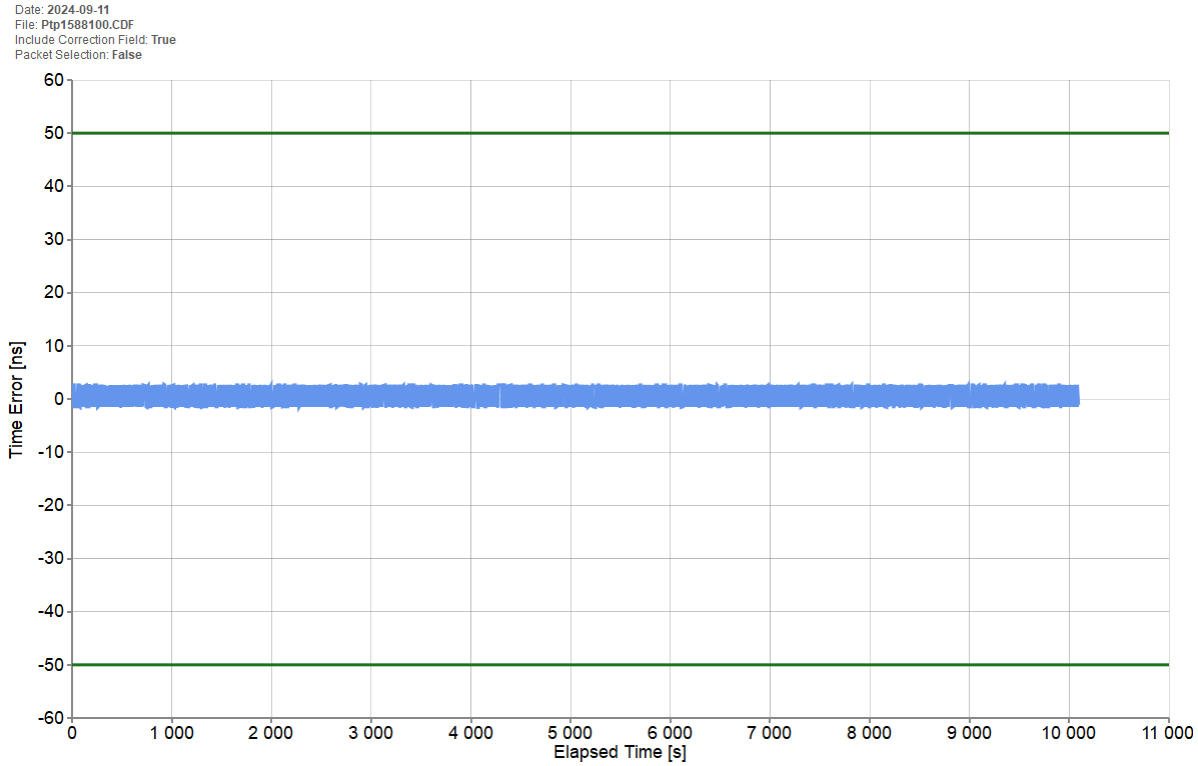
In this section, the standalone configuration (ts2phc, ptp4l, synced) is tested for conformance to ITU-T G.8273.2 Section 7.1 Class D. Physical layer assistance (SyncE) is used during this test.

4.1 PTP Measurements

Test Description	Noise Generation
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/11/2024 6:25:26 PM
Test Duration	02:48:13
Test Configuration	1

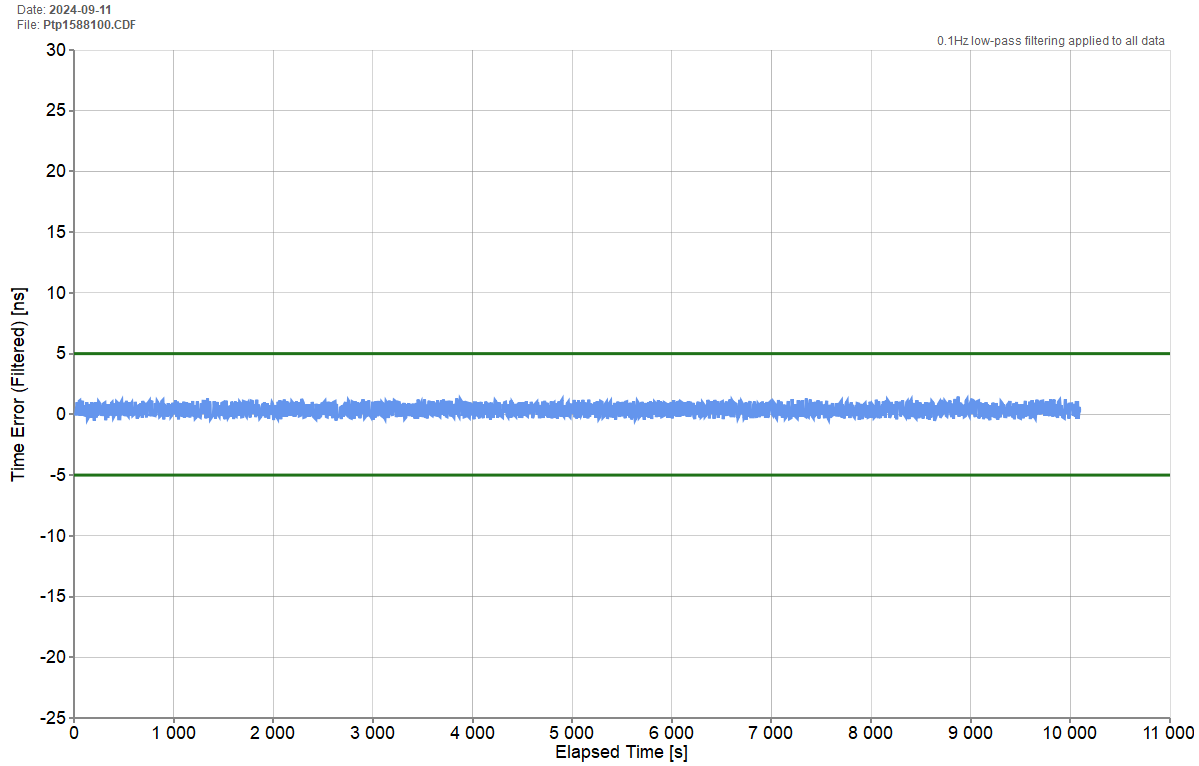
All Mask Results	**Pass**
Mask TIMEERROR	0.05µs
Mask TIMEERROR Result	**Pass**
Mask FILTEREDTIMEERROR	0.00 µs
Mask FILTEREDTIMEERROR Result	**Pass**
Mask CTE	0.01µs
Mask CTE Result	**Pass**
Mask DTE	0.01µs
Mask DTE Result	**Pass**
Mask DTEHF	0.07µs
Mask DTEHF Result	**Pass**
Mask DTEMTIE	G.8273.2 T-BC Class C Dynamic TE LF Const. Temp.
Mask DTEMTIE Result	**Pass**
Mask DTETDEV	G.8273.2 T-BC Class C Dynamic TE LF Const. Temp.
Mask DTETDEV Result	**Pass**

4.1.1 TIMEERROR Analysis



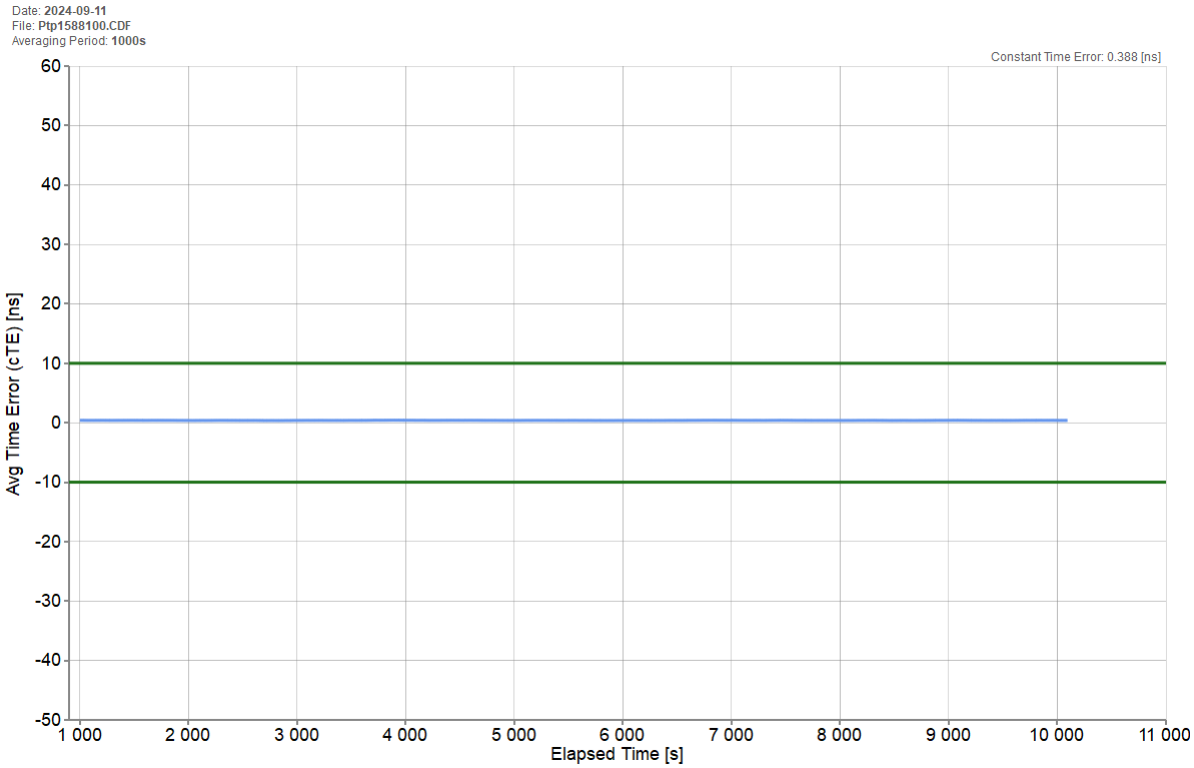
Pk-Pk [ns]	4.375
Mean [ns]	0.389
Min [ns]	-1.593
Max [ns]	2.782

4.1.2 FILTEREDTIMEERROR Analysis



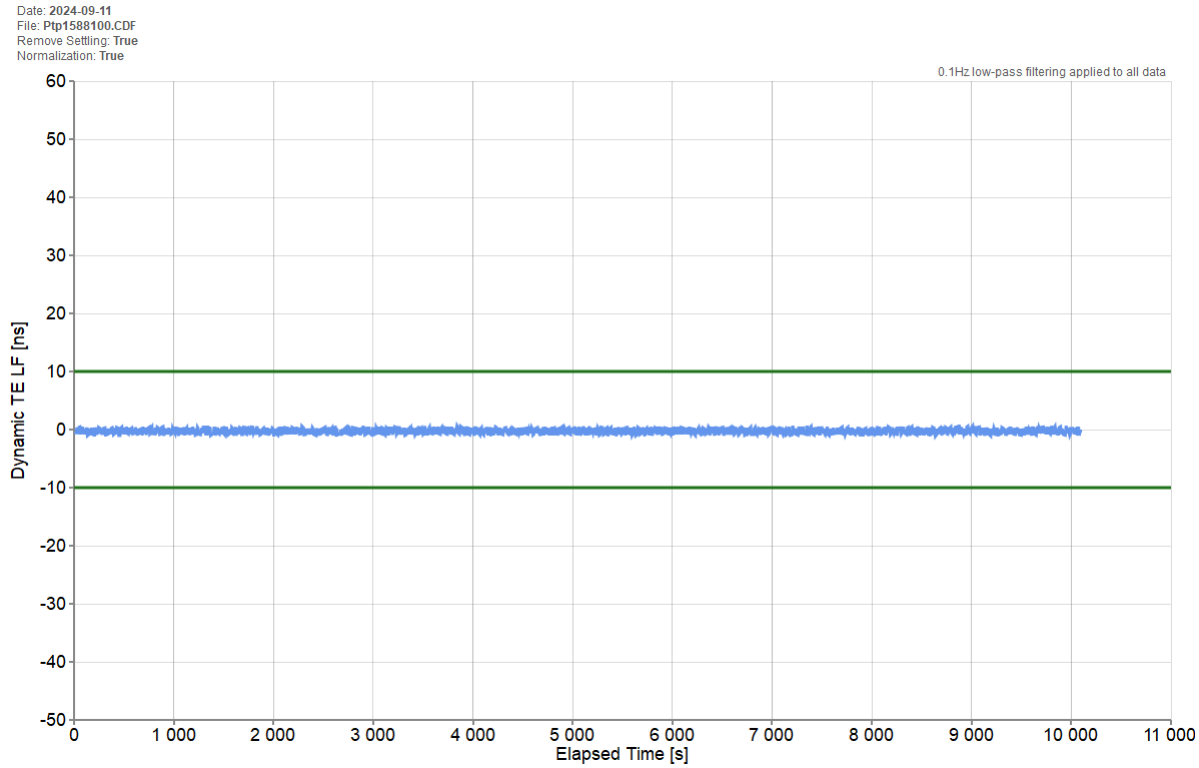
Mean [ns]	0.389
Min [ns]	-0.528
Max [ns]	1.461
Max-Min [ns]	1.989

4.1.3 CTE Analysis



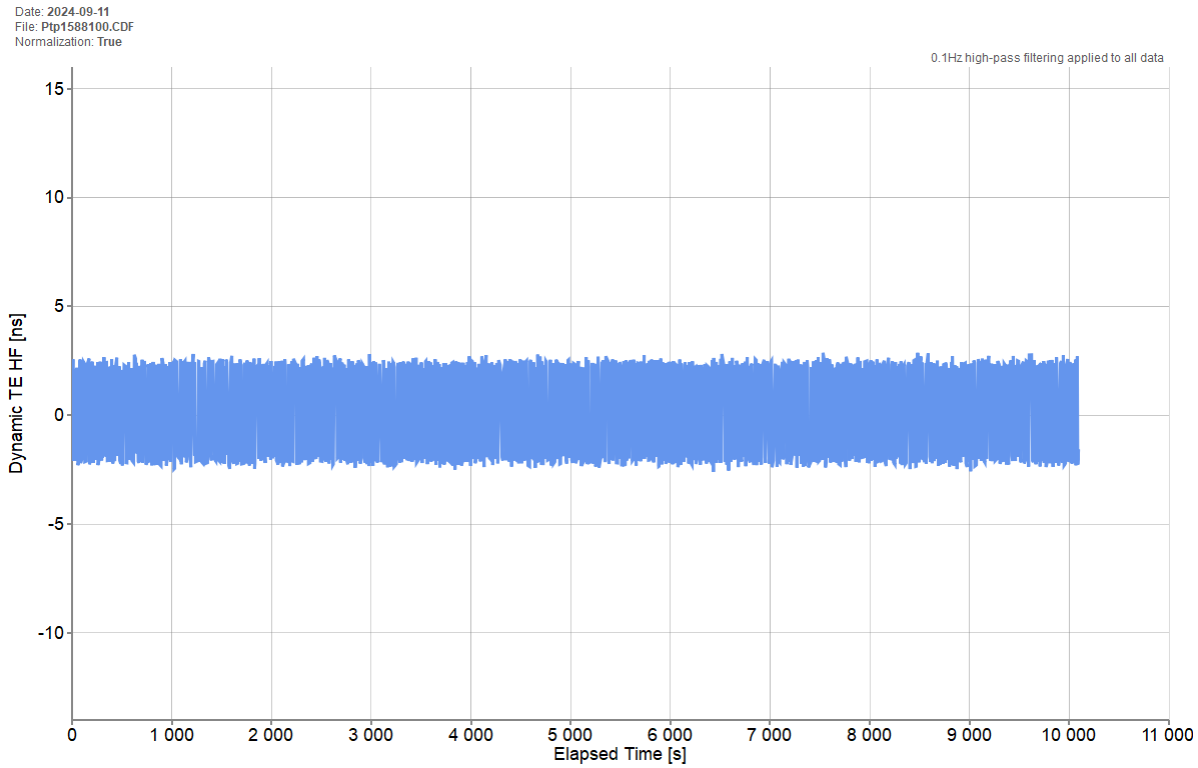
Averaging Time (s)	1000
Constant Time Error [ns]	0.388
Min [ns]	0.361
Max [ns]	0.423
Max-Min [ns]	0.062

4.1.4 DTE Analysis



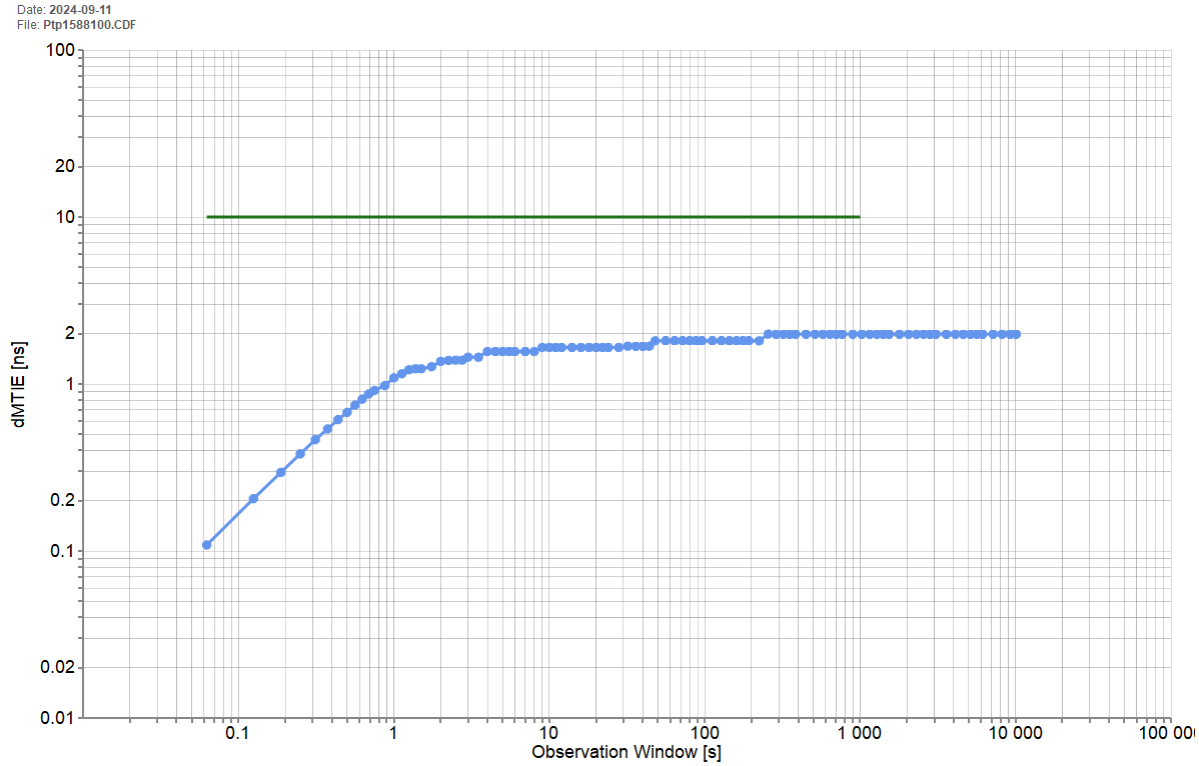
Mean [ns]	-0.268
Min [ns]	-1.186
Max [ns]	0.804
Max-Min [ns]	1.989

4.1.5 DTEHF Analysis



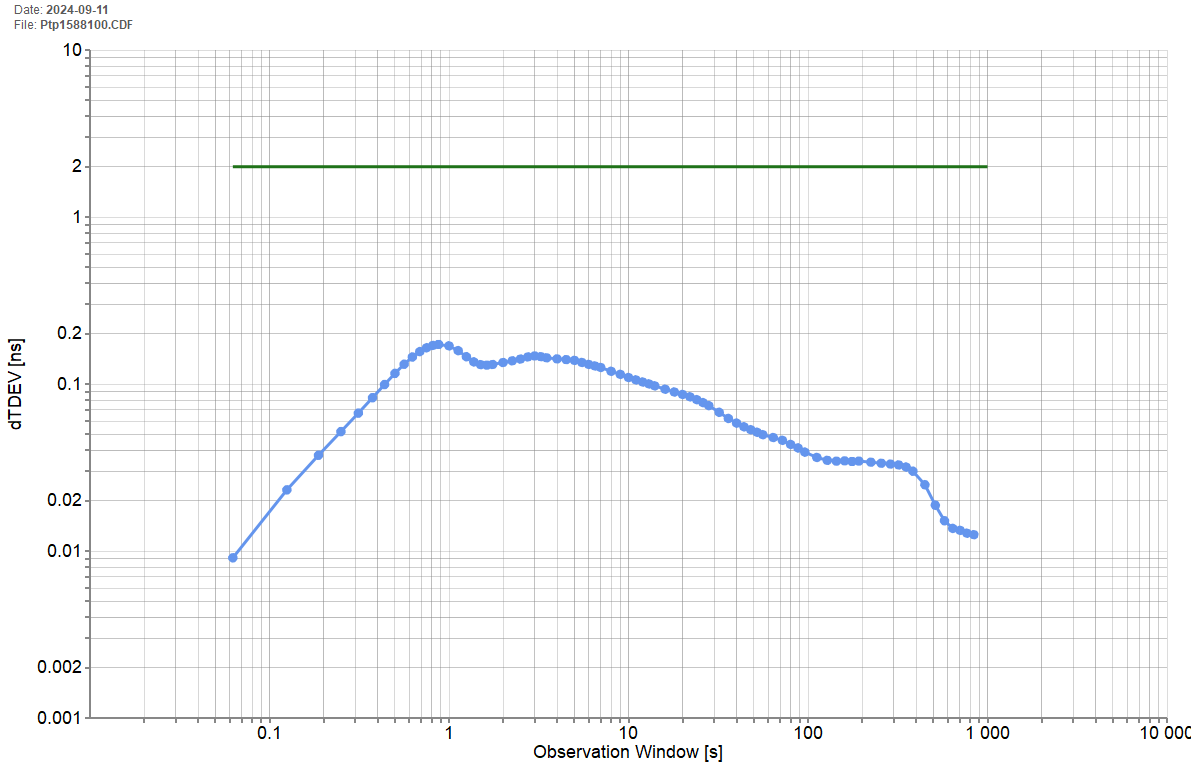
Pk-Pk [ns]	5.473
Mean [ns]	0
Min [ns]	-2.603
Max [ns]	2.87

4.1.6 DTEMTIE Analysis



Min [ns]	0.109
Max [ns]	1.989
Max-Min [ns]	1.881

4.1.7 DTETDEV Analysis



Min [ns]	0.009
Max [ns]	0.173
Max-Min [ns]	0.163

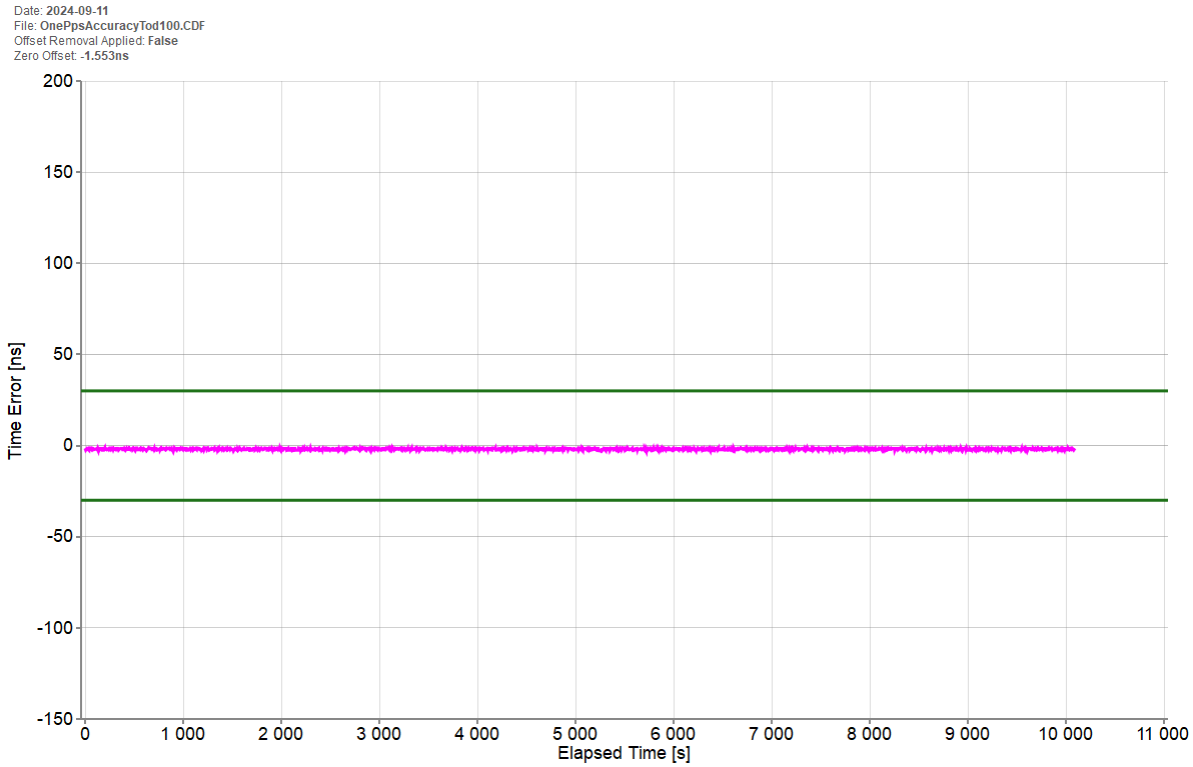
4.2 1PPS Measurements

Test Description	Noise Generation
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/11/2024 6:25:26 PM
Test Duration	02:48:12
Test Configuration	1

All Mask Results	**Pass**
Mask ONEPPS	0.03µs
Mask ONEPPS Result	**Pass**
Mask FILTEREDTIMEERROR	0.005µs
Mask FILTEREDTIMEERROR Result	**Pass**
Mask CTE	0.01µs
Mask CTE Result	**Pass**
Mask DTE	0.01µs
Mask DTE Result	**Pass**
Mask DTEHF	0.07µs
Mask DTEHF Result	**Pass**
Mask DTEMTIE	G.8273.2 T-BC Provisional Class D Dynamic TE LF Const. Temp.
Mask DTEMTIE Result	**Pass**
Mask DTETDEV	G.8273.2 T-BC Provisional Class D Dynamic TE LF Const. Temp.
Mask DTETDEV Result	**Pass**

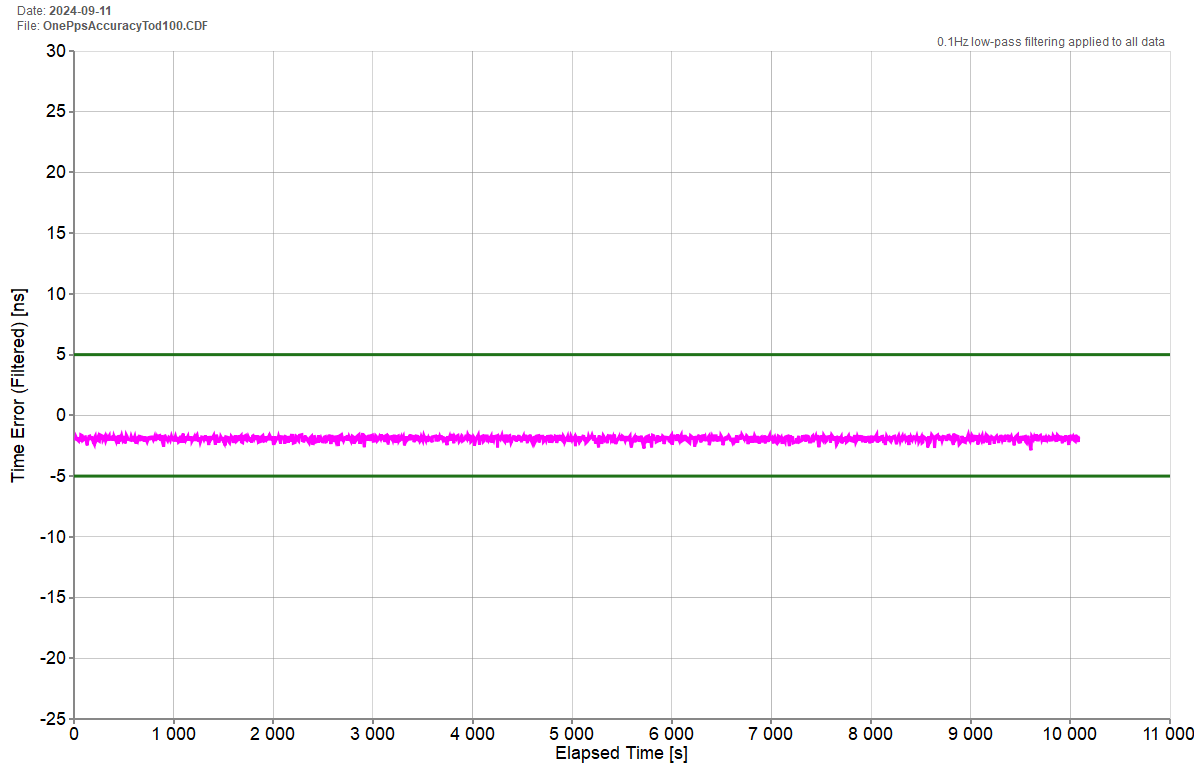
4.2.1 ONEPPS Analysis

Offset Removal Applied	Off
Zero Offset	-1.553ns



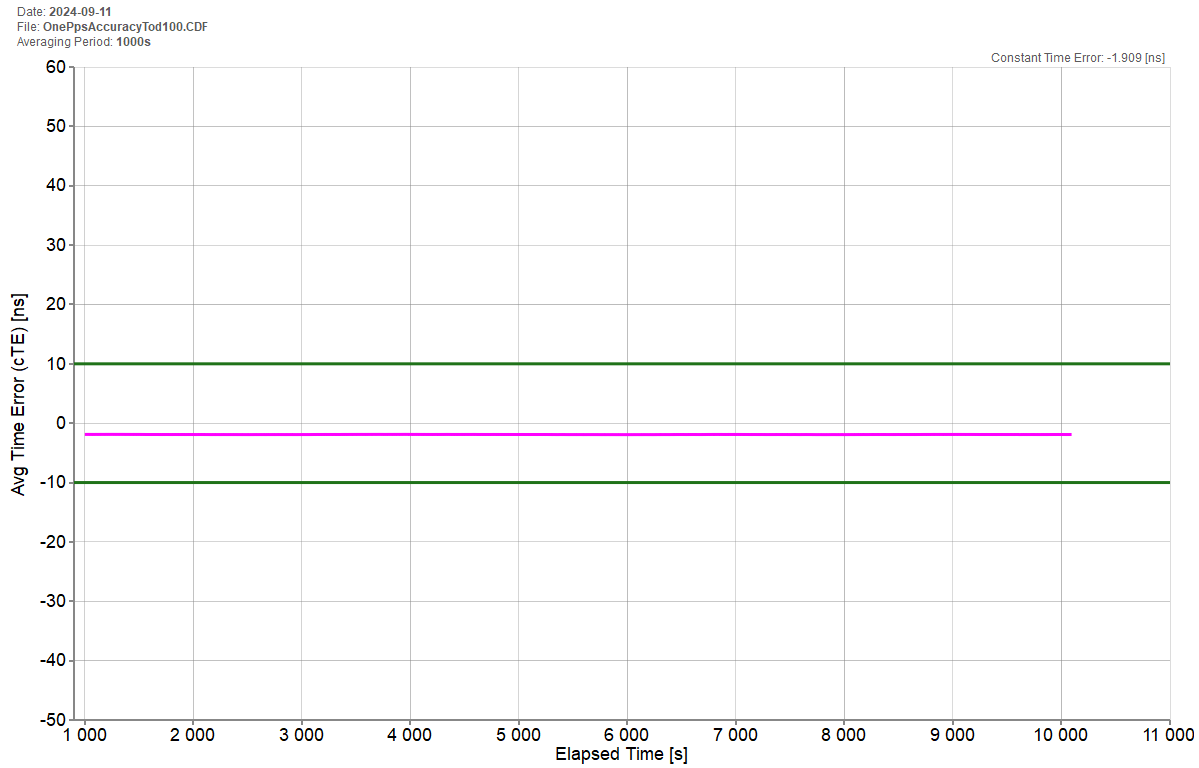
Mean [ns]	-1.908
Min [ns]	-3.303
Max [ns]	-1.053
Max-Min [ns]	2.25

4.2.2 FILTEREDTIMEERROR Analysis



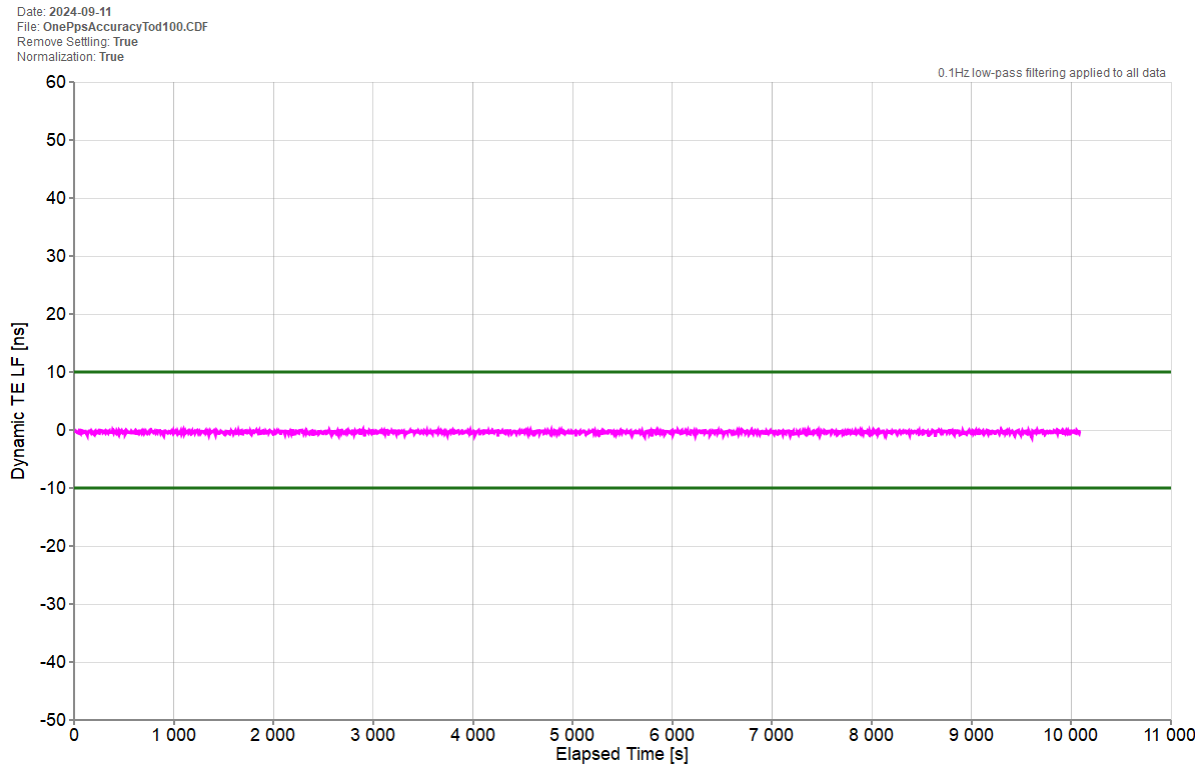
Mean [ns]	-1.908
Min [ns]	-2.871
Max [ns]	-1.465
Max-Min [ns]	1.406

4.2.3 CTE Analysis



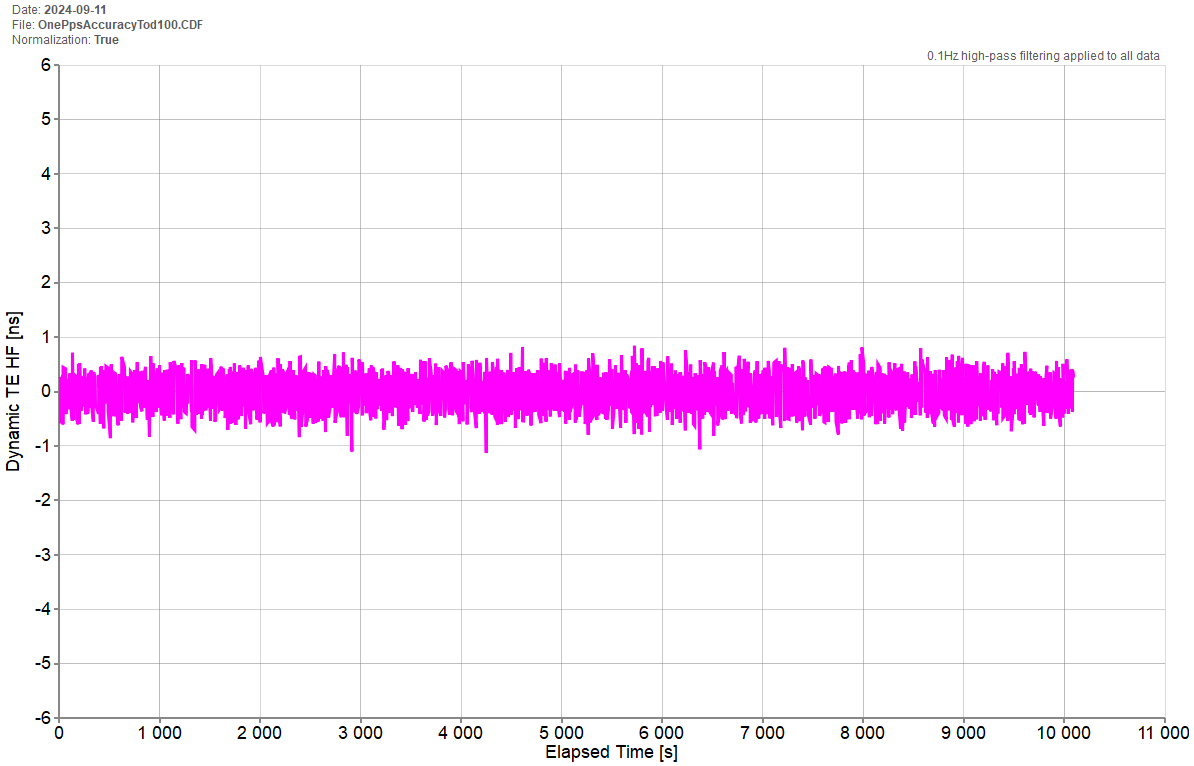
Averaging Time (s)	1000
Constant Time Error [ns]	-1.909
Min [ns]	-1.932
Max [ns]	-1.886
Max-Min [ns]	0.046

4.2.4 DTE Analysis



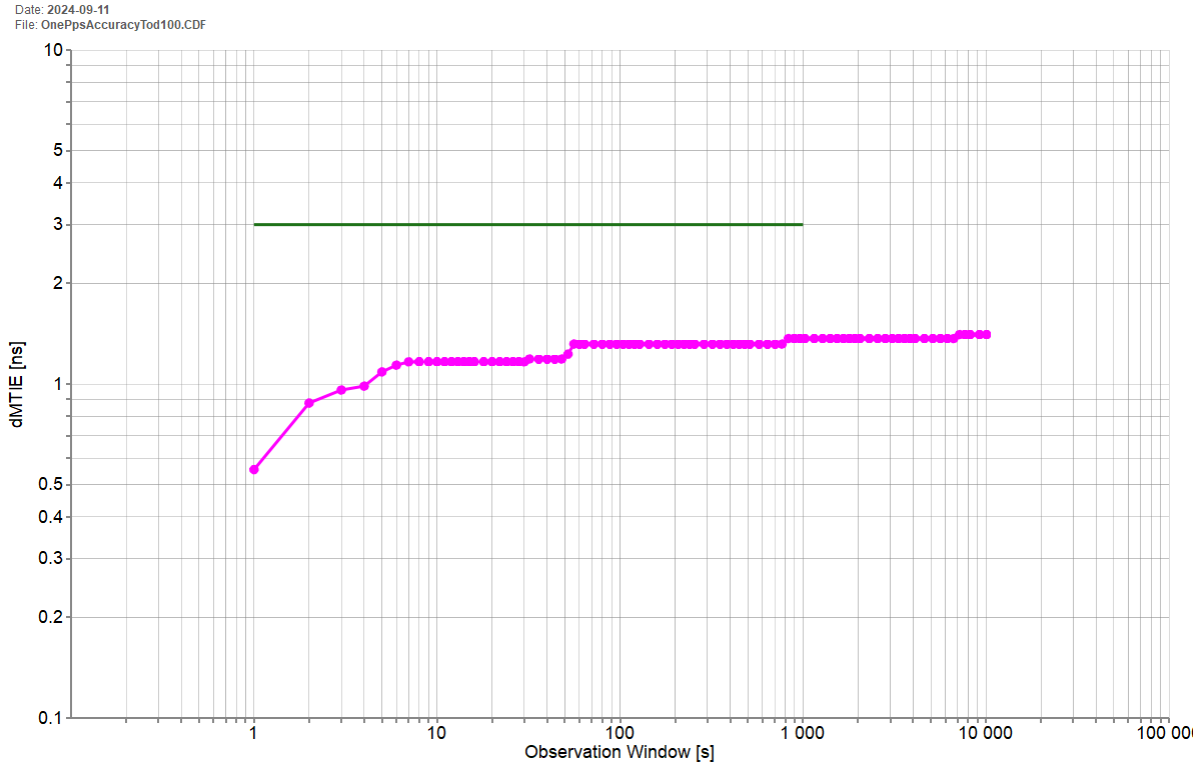
Mean [ns]	-0.355
Min [ns]	-1.318
Max [ns]	0.088
Max-Min [ns]	1.406

4.2.5 DTEHF Analysis



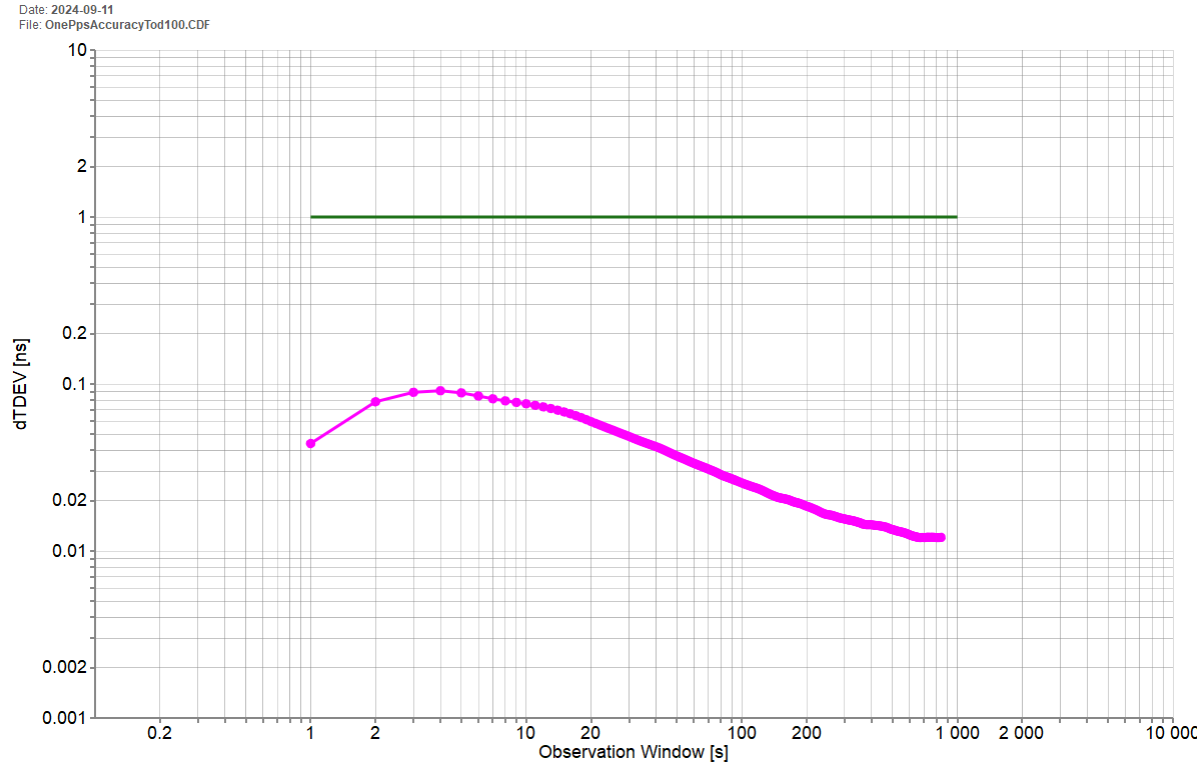
Mean [ns]	0
Min [ns]	-1.13
Max [ns]	0.84
Max-Min [ns]	1.97

4.2.6 DTEMTIE Analysis



Min [ns]	0.554
Max [ns]	1.406
Max-Min [ns]	0.852

4.2.7 DTETDEV Analysis



Min [ns]	0.012
Max [ns]	0.091
Max-Min [ns]	0.079

5. G.8273.2: Holdover – Standalone

Holdover performance is checked by measuring the phase/time output in the event of the loss of the PTP input to the T-BC. The holdover performance is measured on PTP and 1PPS outputs of the DUT.

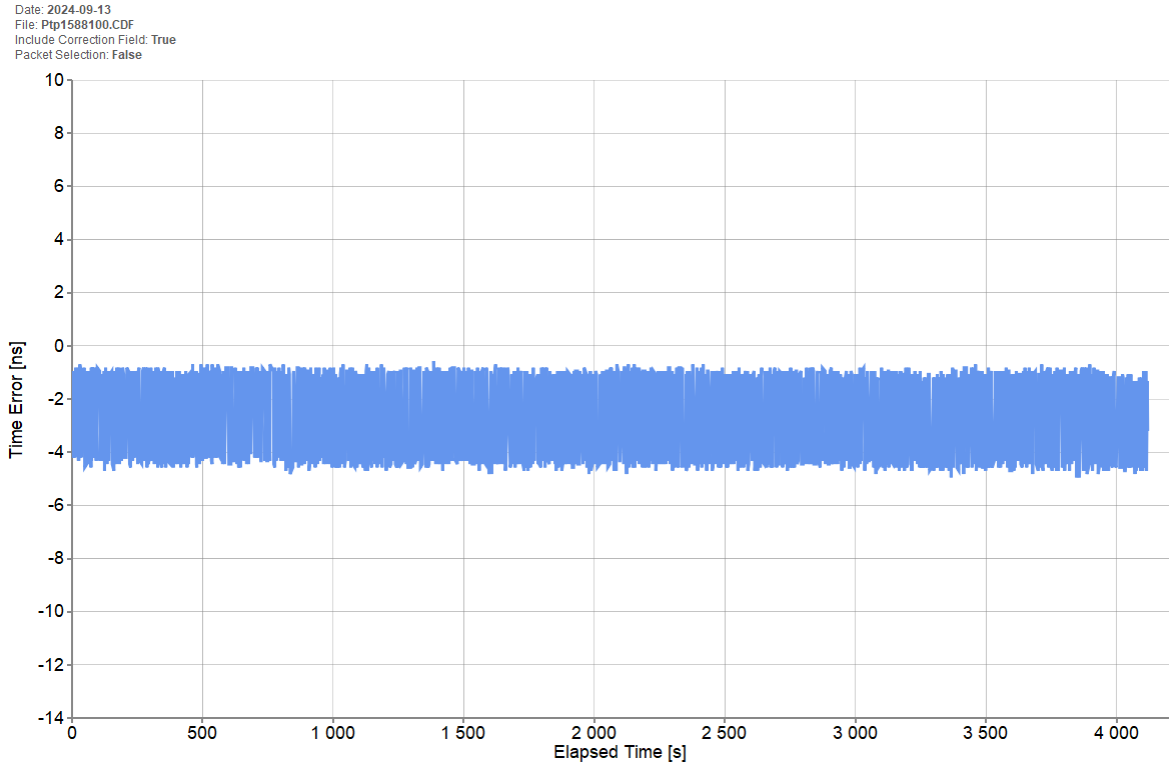
In this section, the standalone configuration (ts2phc, ptp4l, synced) is tested for conformance to ITU-T G.8273.2 Section 7.4.2.2 Class B. Physical layer assistance (SyncE) is used during this test.

5.1 PTP Measurements

Test Description	Holdover
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/13/2024 11:34:35 AM
Test Duration	01:08:38
Test Configuration	1

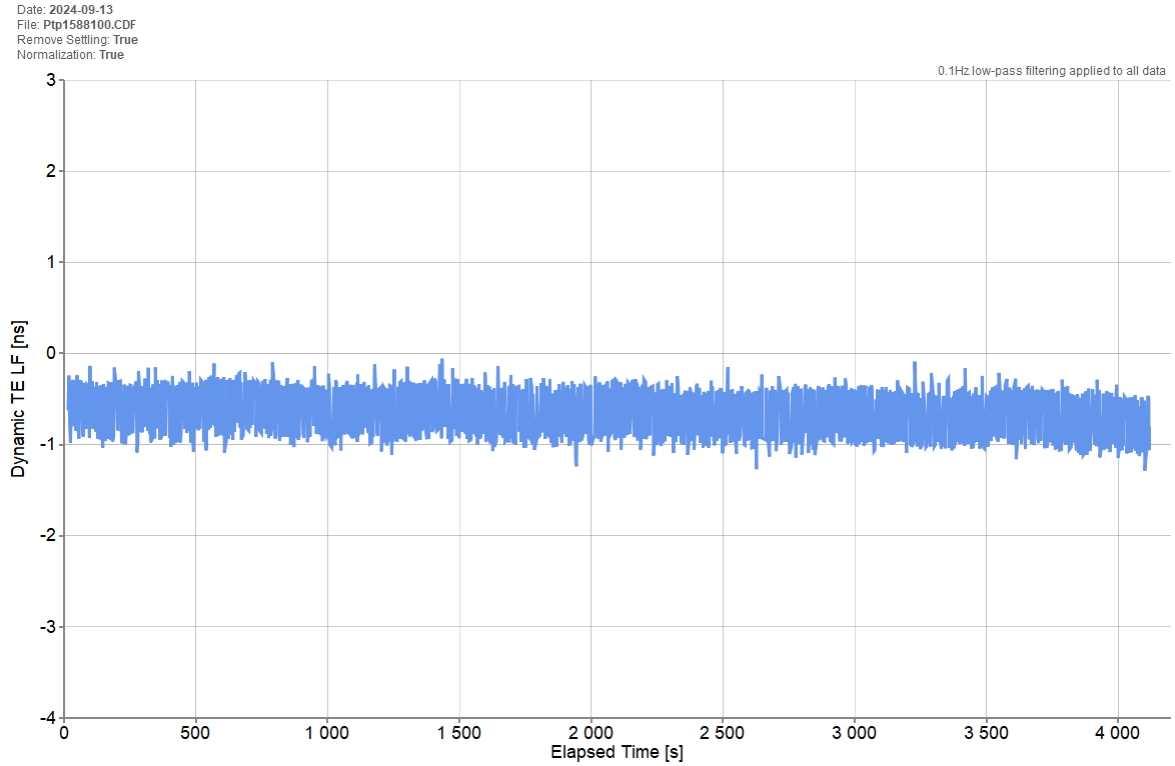
All Mask Results	**Pass**
Mask TIMEERROR	N/A
Mask TIMEERROR Result	NoMask
Mask DTE	N/A
Mask DTE Result	NoMask
Mask DTEMTIE	G.8273.2 T-BC Class B Time Holdover Const. Temp.
Mask DTEMTIE Result	**Pass**

5.1.1 TIMEERROR Analysis



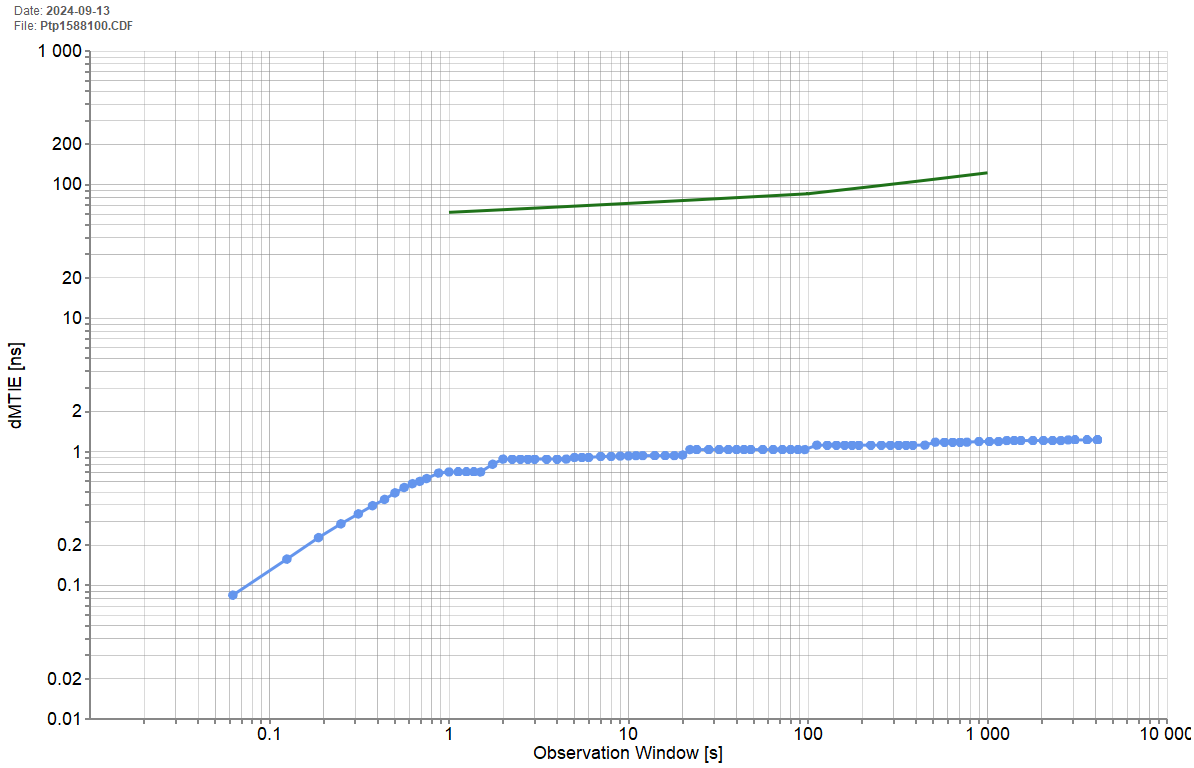
Pk-Pk [ns]	4.375
Mean [ns]	-2.725
Min [ns]	-4.948
Max [ns]	-0.573

5.1.2 DTE Analysis



Mean [ns]	-0.652
Min [ns]	-1.284
Max [ns]	-0.057
Max-Min [ns]	1.227

5.1.3 DTEMTIE Analysis



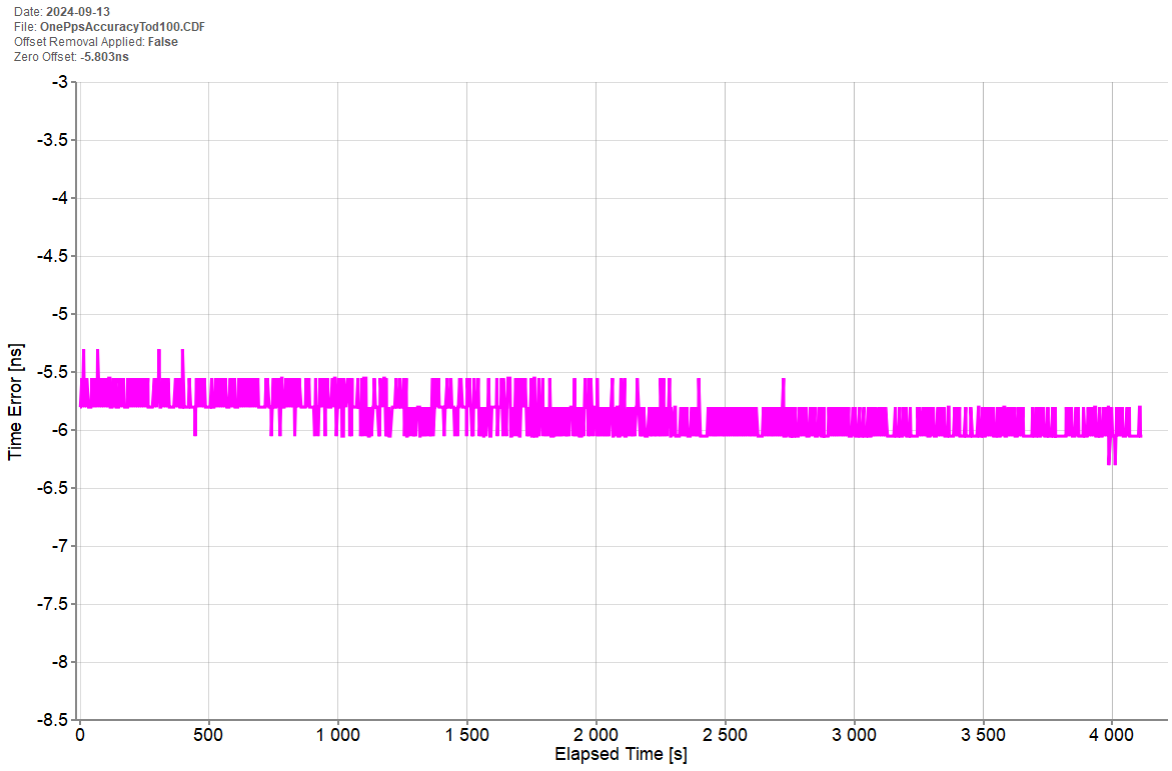
Min [ns]	0.084
Max [ns]	1.227
Max-Min [ns]	1.142

5.2 1PPS Measurements

Test Description	Holdover
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/13/2024 11:34:35 AM
Test Duration	01:08:36
Test Configuration	1

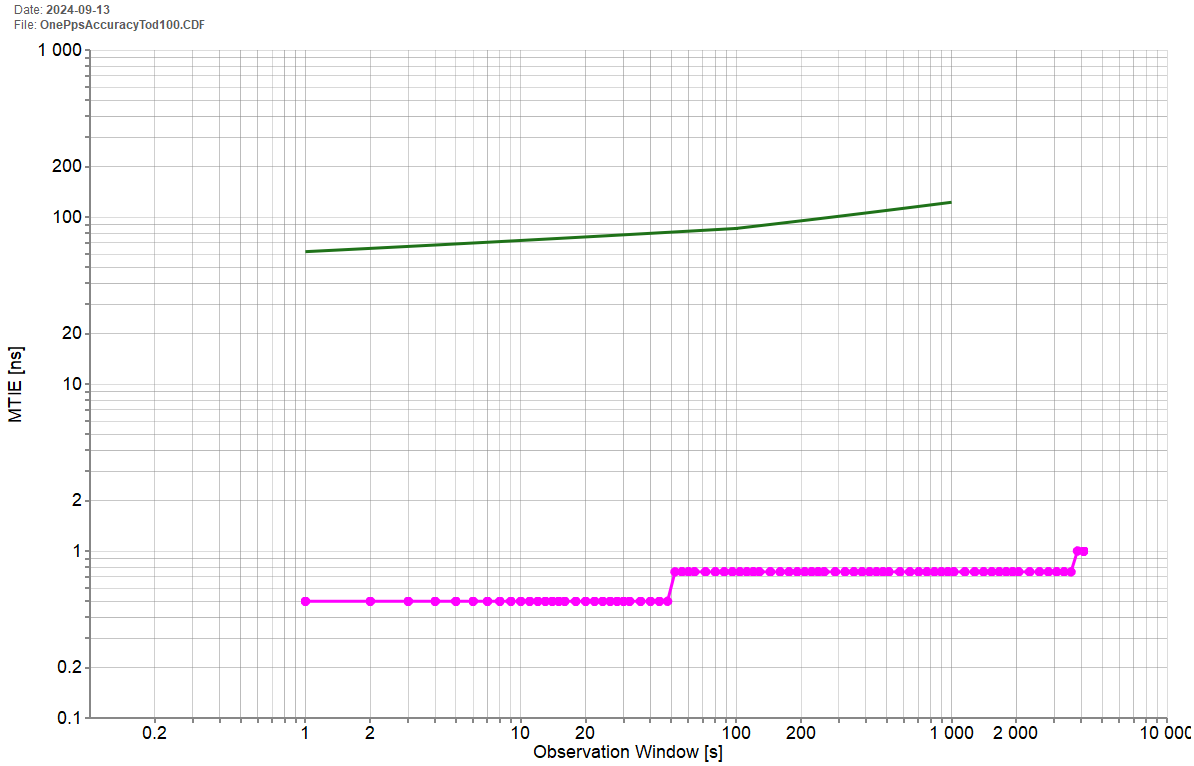
All Mask Results	**Pass**
Mask ONEPPS	N/A
Mask ONEPPS Result	NoMask
Mask MTIE	G.8273.2 T-BC Class B Time Holdover Const. Temp.
Mask MTIE Result	**Pass**

5.2.1 ONEPPS Analysis



Mean [ns]	-5.904
Min [ns]	-6.303
Max [ns]	-5.303
Max-Min [ns]	1

5.2.2 MTIE Analysis



Min [ns]	0.5
Max [ns]	1
Max-Min [ns]	0.5

6. G.8273.2: Noise Generation – External Servo

The noise generation of a T-SC represents the amount of noise produced at the output of the T-SC when there is an ideal input reference packet timing signal. The noise generation is measured on both 1PPS output of the DUT.

In this section, the external servo configuration (pcm4l, ptp4l, synced) is tested for conformance to ITU-T G.8273.2 Section 7.1 Class D. Physical layer assistance (SyncE) is used during this test.

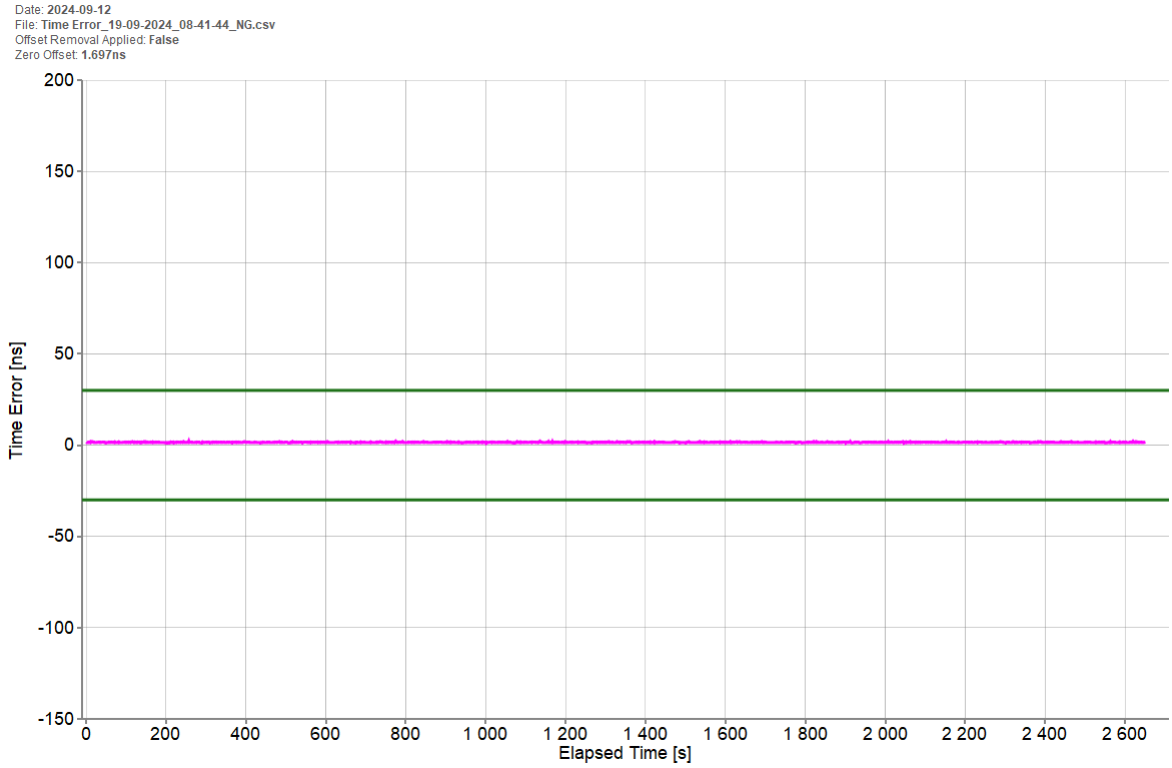
6.1 1PPS Measurements

Test Description	Noise Generation
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/12/2024 2:13:28 PM
Test Duration	00:44:10
Test Configuration	1
Time to Phase Lock (s)	19

All Mask Results	**Pass**
Mask ONEPPS	0.03µs
Mask ONEPPS Result	**Pass**
Mask FILTEREDTIMEERROR	0.005µs
Mask FILTEREDTIMEERROR Result	**Pass**
Mask CTE	0.01µs
Mask CTE Result	**Pass**
Mask DTE	0.01µs
Mask DTE Result	**Pass**
Mask DTEHF	0.07µs
Mask DTEHF Result	**Pass**
Mask DTEMTIE	G.8273.2 T-BC Provisional Class D Dynamic TE LF Const. Temp.
Mask DTEMTIE Result	**Pass**
Mask DTETDEV	G.8273.2 T-BC Provisional Class D Dynamic TE LF Const. Temp.
Mask DTETDEV Result	**Pass**

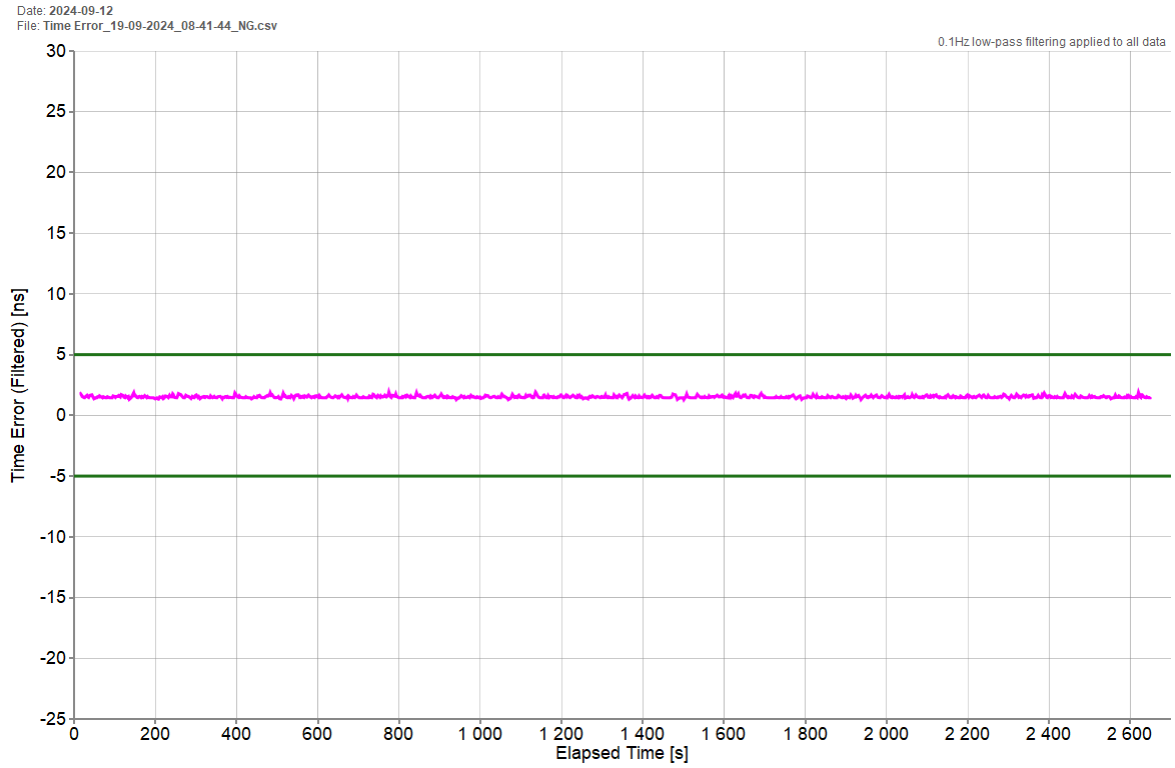
6.1.1 ONEPPS Analysis

Offset Removal Applied	Off
Zero Offset	1.697 ns



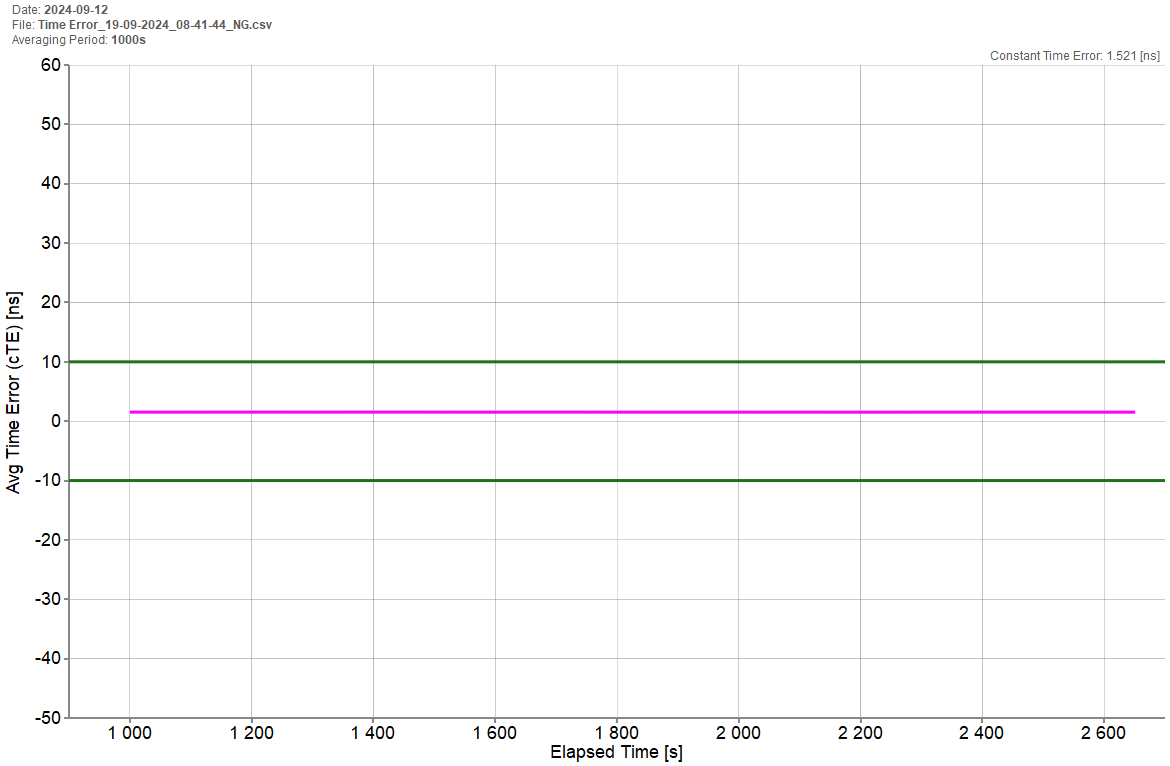
Mean [ns]	1.522
Min [ns]	1.197
Max [ns]	2.197
Max-Min [ns]	1

6.1.2 FILTEREDTIMEERROR Analysis



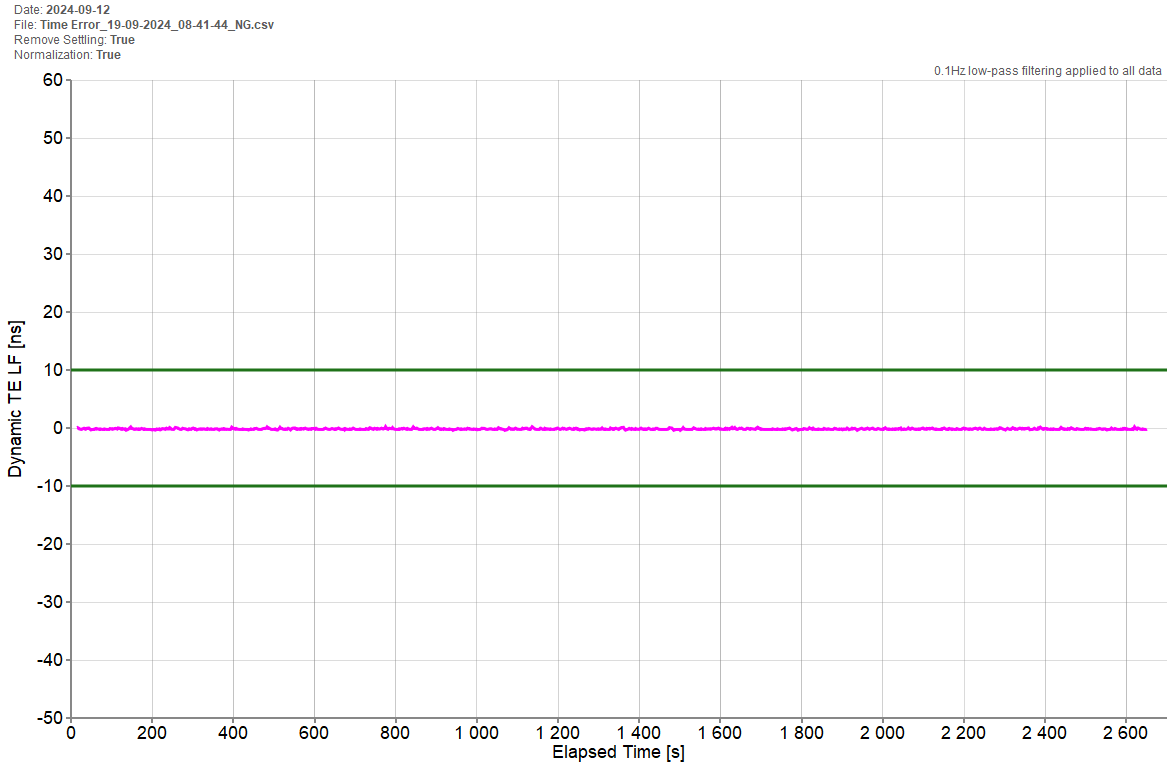
Mean [ns]	1.522
Min [ns]	1.293
Max [ns]	1.926
Max-Min [ns]	0.633

6.1.3 CTE Analysis



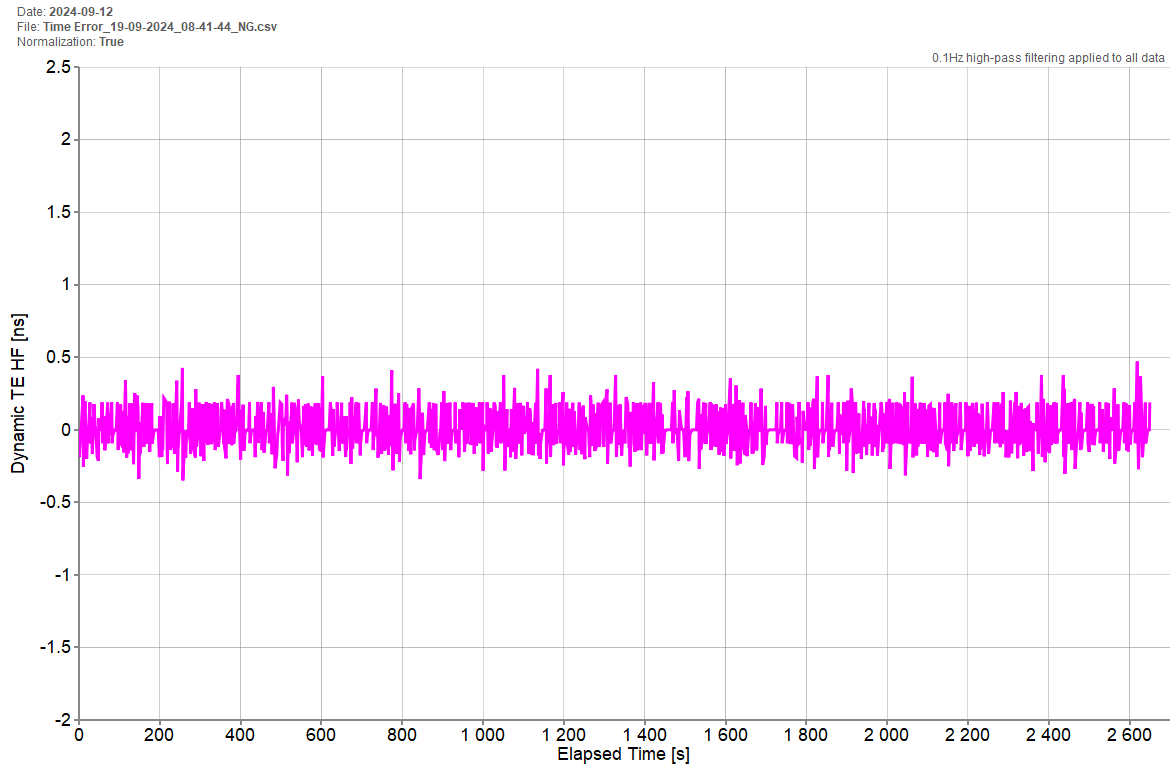
Averaging Time (s)	1000
Constant Time Error [ns]	1.521
Min [ns]	1.515
Max [ns]	1.527
Max-Min [ns]	0.012

6.1.4 DTE Analysis



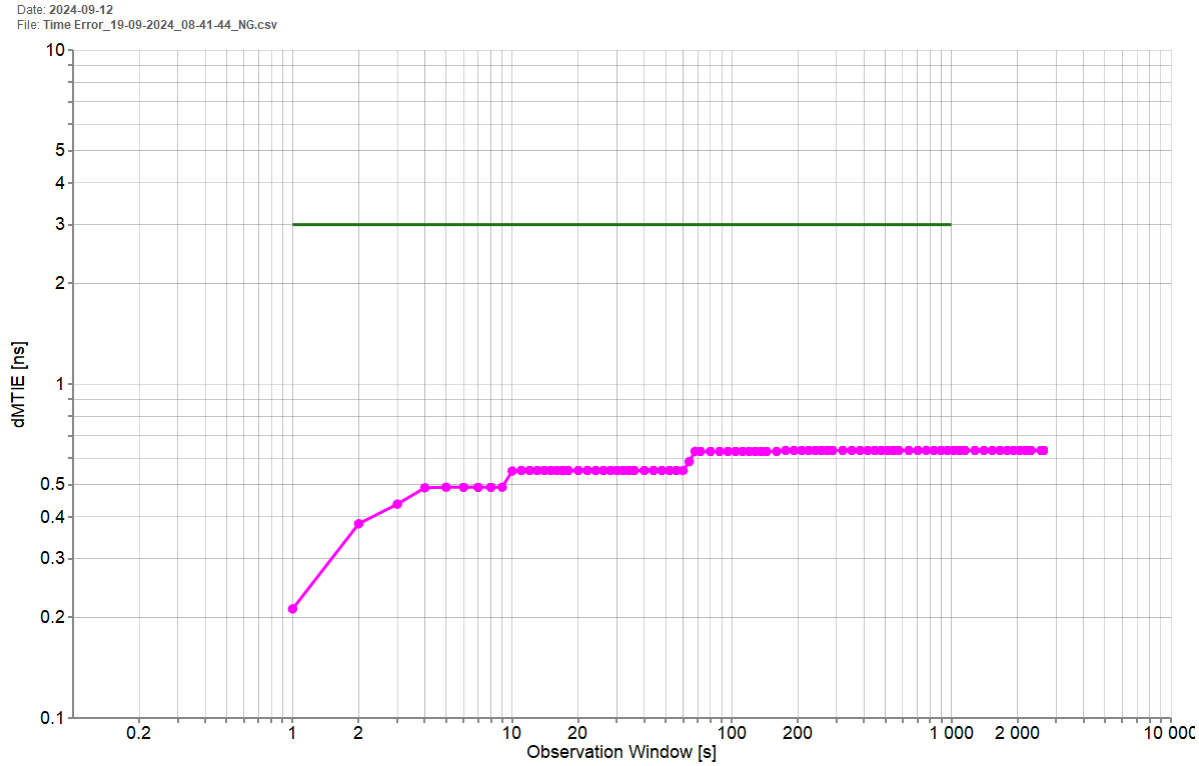
Mean [ns]	-0.175
Min [ns]	-0.404
Max [ns]	0.229
Max-Min [ns]	0.633

6.1.5 DTEHF Analysis



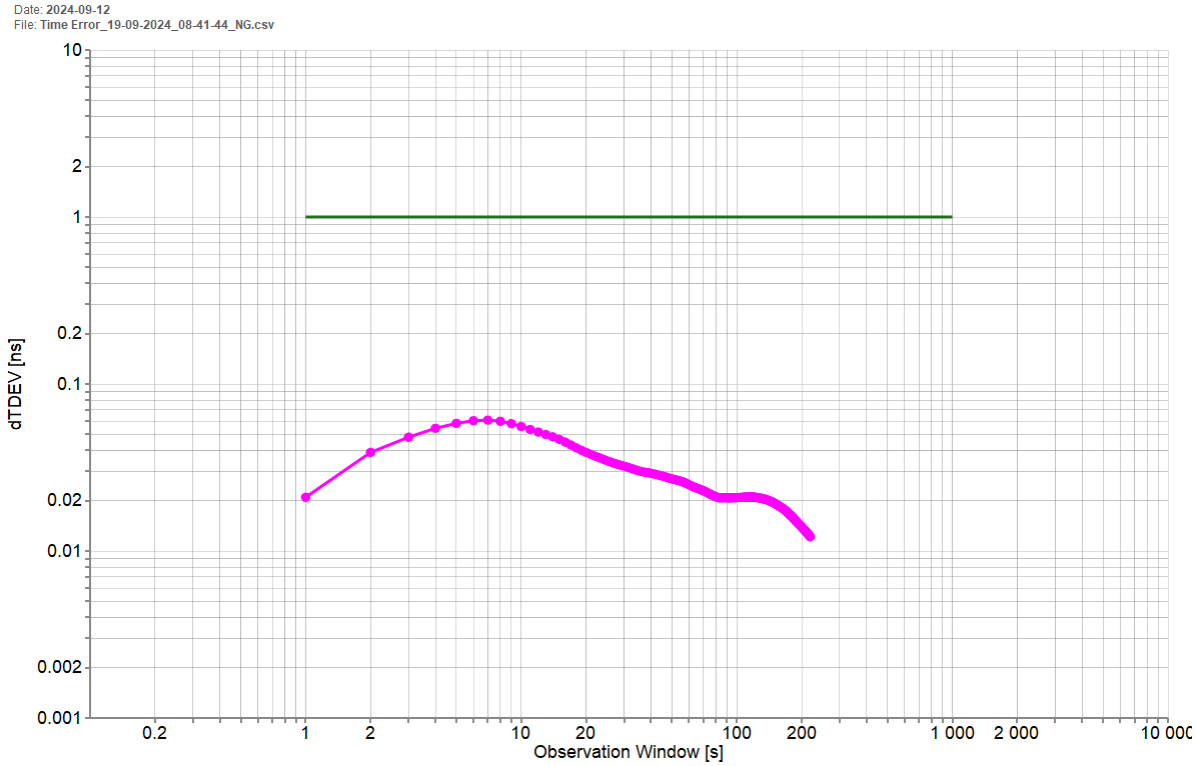
Mean [ns]	0
Min [ns]	-0.349
Max [ns]	0.47
Max-Min [ns]	0.819

6.1.6 DTEMTIE Analysis



Min [ns]	0.212
Max [ns]	0.633
Max-Min [ns]	0.421

6.1.7 DTETDEV Analysis



Min [ns]	0.012
Max [ns]	0.061
Max-Min [ns]	0.049

7. G.8273.2: Holdover – External Servo

Holdover performance is checked by measuring the phase/time output in the event of the loss of the PTP input to the T-SC. The holdover performance is measured on the 1PPS output of the DUT.

In this section, the external servo configuration (pcm4l, ptp4l, synced) is tested for conformance to ITU-T G.8273.2 Section 7.4.2.2 Class B. Physical layer assistance (SyncE) is used during this test.

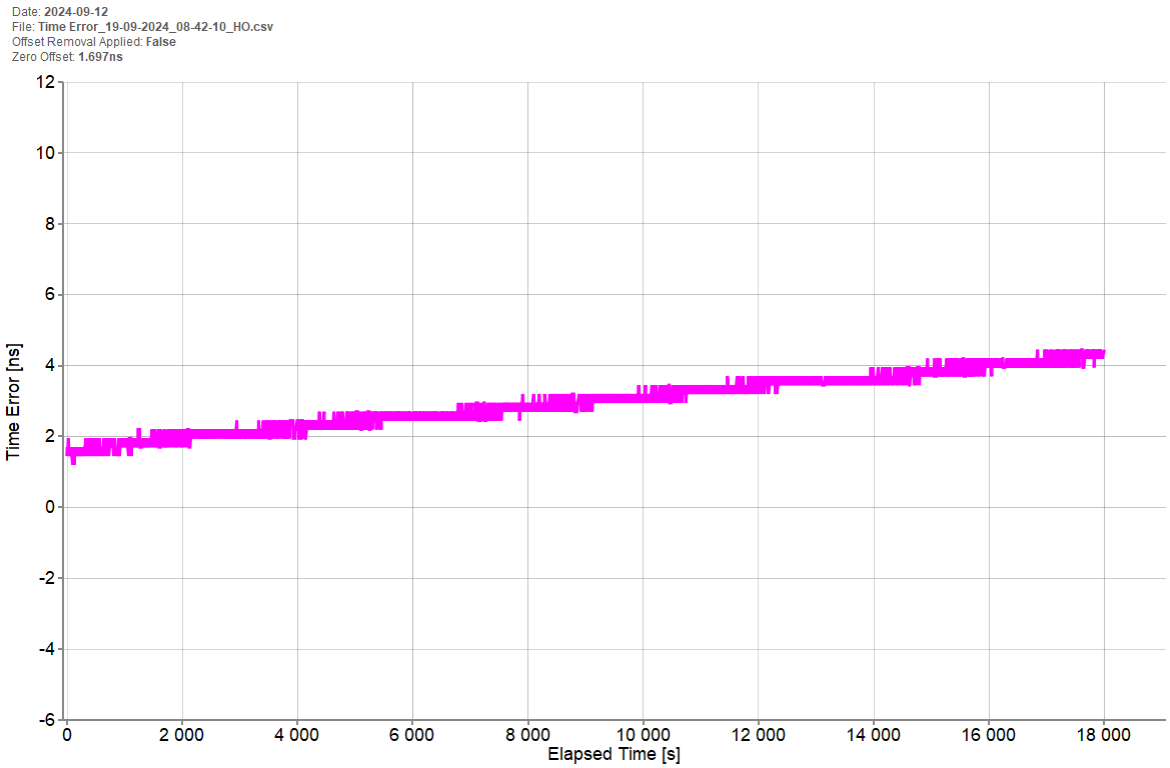
7.1 1PPS Measurements

Test Description	Holdover
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/12/2024 2:13:28 PM
Test Duration	05:00:00
Test Configuration	1
Time to Phase Lock (s)	19

All Mask Results	**Pass**
Mask ONEPPS	N/A
Mask ONEPPS Result	NoMask
Mask MTIE	G.8273.2 T-BC Class B Time Holdover Const. Temp.
Mask MTIE Result	**Pass**

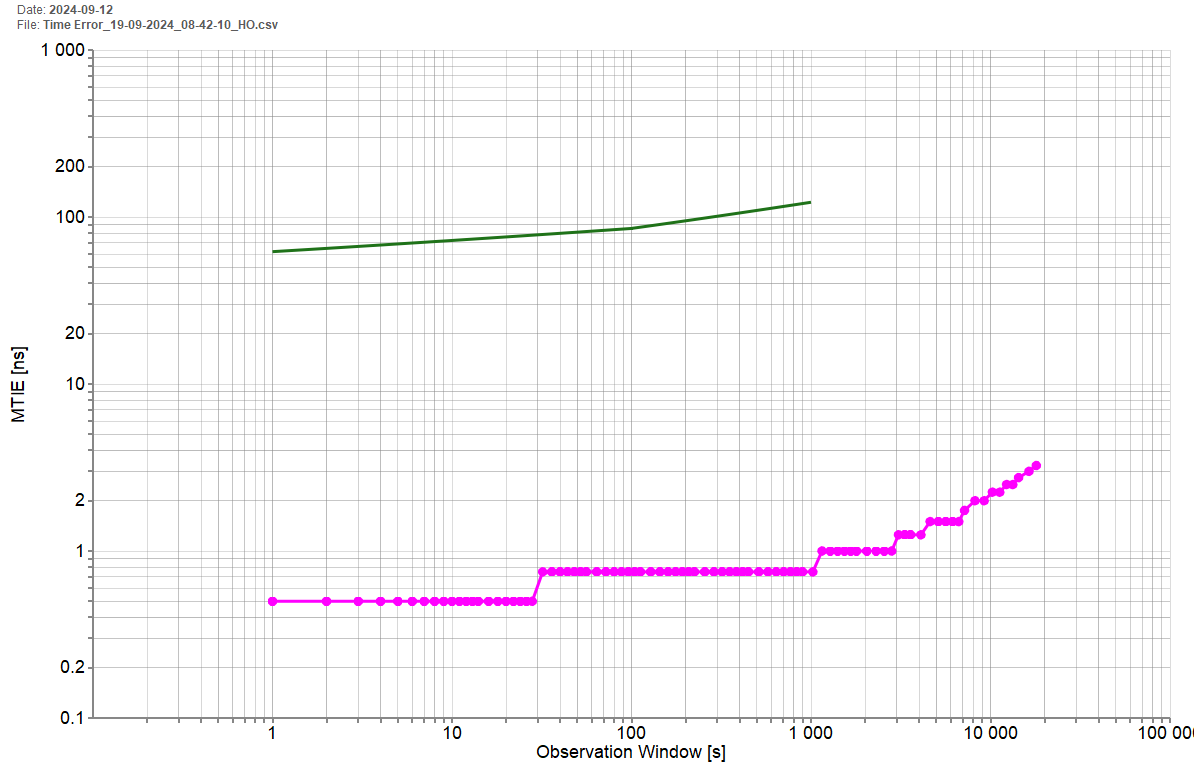
7.1.1 ONEPPS Analysis

Offset Removal Applied	Off
Zero Offset	1.697ns



Mean [ns]	2.918
Min [ns]	1.197
Max [ns]	4.447
Max-Min [ns]	3.25

7.1.2 MTIE Analysis



Min [ns]	0.5
Max [ns]	3.25
Max-Min [ns]	2.75

8. G.8273.4 PTS: Noise Tolerance G.8271.2 PDV Pattern

This test checks whether the equipment clock can maintain network limits at the output with maximum noise at the input. The noise tolerance of a clock indicates the minimum time error level at the input of the clock that should be accommodated while:

- not causing any alarms
- not causing the clock to switch reference
- not causing the clock to go into holdover

The level of noise that a PTS device must tolerate on its PTP input is max|pktSelected2wayTE| according to the network limit defined in ITU-T G.8271.2 clause 7.3.2.1 at the PTP input.

For this test, the G.8271.2 PDV pattern is applied to the PTP input and the output 1PPS performance is observed. Physical layer assistance (SyncE) is used during this test.

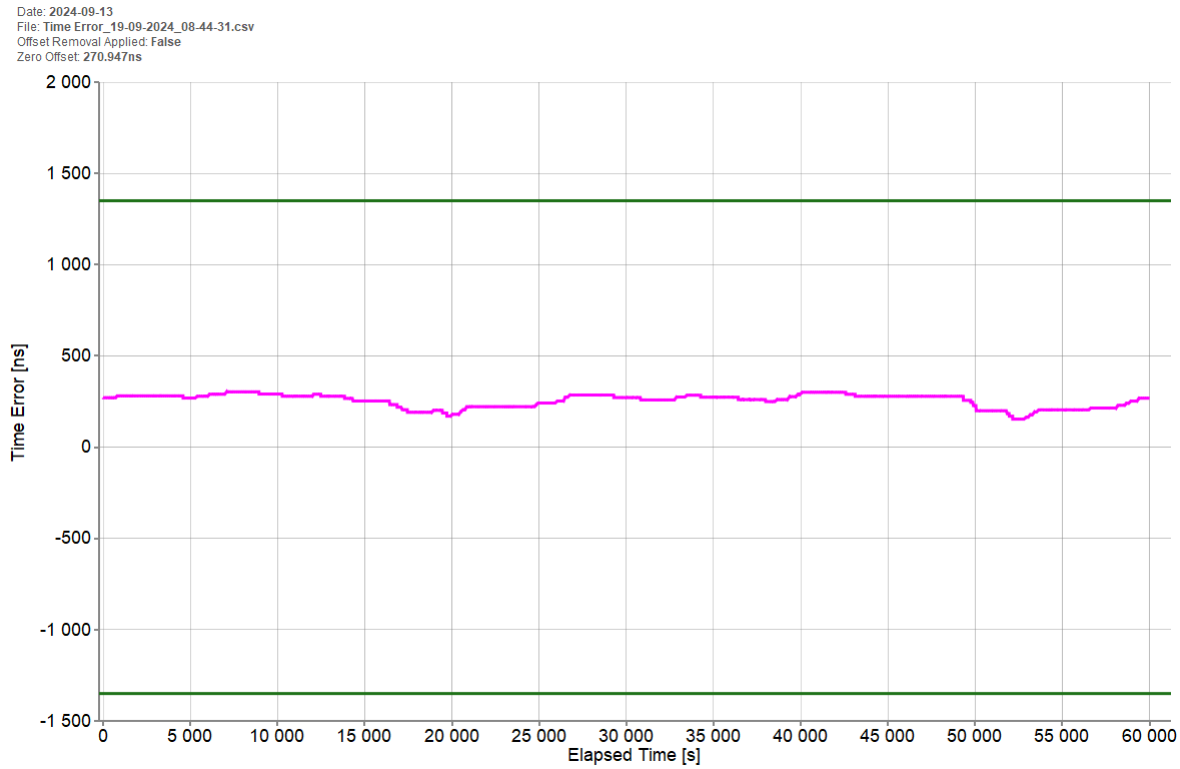
8.1 1PPS Measurements

Test Description	Noise Tolerance G.8271.2 PDV Pattern
Report Date	24-09-19_08-47-41
Packet Rate (pkt/s)	16
Beginning of Test	9/13/2024 1:23:17 PM
Test Duration	16:40:00
Test Configuration	1
Time to Phase Lock (s)	385

All Mask Results	**Pass**
Mask ONEPPS	1.35µs
Mask ONEPPS Result	**Pass**

8.1.1 ONEPPS Analysis

Offset Removal Applied	Off
Zero Offset	270.947 ns



Mean [ns]	255.301
Min [ns]	153.197
Max [ns]	303.197
Max-Min [ns]	150

9. Configuration Files

9.1 TCS File

The TCS file comes loaded with the ZCU670 image: ZCU670_8A34001_synced_2024aug16_10G.tcs.

9.2 Ts2phc cfg File

```
#
# ts2phc config file to get it to behave like syncd to align
# timestamper to PHC device's 1 PPS signal.
#
# Example:
# ./ts2phc -m -q -f ts2phc.cfg
#

[global]
clock_servo             nullf
first_step_threshold    0.000000001
step_threshold          0.000000001

# timestamper, slave device
[/dev/ptp1]
ts2phc.channel          0
#ts2phc.extts_correction        -12

# PHC device (ex. CM), master device
# Set ts2phc.channel to 2 for Sabre
# Set ts2phc.channel to 0 for FC3/W
[/dev/ptp0]
ts2phc.master           1
ts2phc.channel          0
```

9.3 Standalone ptp4l cfg Files

9.3.1 Unicast BC

```
[global]
domainNumber    44

sanity_freq_limit 0

slaveOnly       0
masterOnly      0

# Announce messages
announceReceiptTimeout  2
logAnnounceInterval     1

# Sync/Delay_Req/Delay_Resp messages
# ex. 0 = 1 PPS, -3 = 8 PPS, -4 = 16 PPS
logSyncInterval         -4
logMinDelayReqInterval  -4

#
# step_window is in units of sync packets
#
# 3 seconds:
#   @ 16 PPS, set to 48
#   @ 1  PPS, set to  3
step_window     48

clockClass      248
clockAccuracy   0xFE
timeSource      0xa0
maxStepsRemoved 255

offsetScaledLogVariance 0xffff

G.8275.defaultDS.localPriority  128
G.8275.portDS.localPriority     128

priority1       128
priority2       255

dataset_comparison      G.8275.x
transportSpecific       0

clock_type      BC
delay_mechanism E2E


first_step_threshold    0.000020000
step_threshold          0.000020000
tx_timestamp_timeout    1000
```

```
write_phase_mode        1
servo_offset_threshold  100
servo_num_offset_values 64
tsproc_mode             raw

network_transport       UDPv4

hybrid_e2e                      1
inhibit_multicast_service       1
unicast_listen                  1
unicast_req_duration            300

[unicast_master_table]
table_id                1
logQueryInterval        2
UDPv4                   10.64.10.1

[unicast_master_table]
table_id                2
logQueryInterval        2
UDPv4                   10.64.10.2 # Change to 10.64.10.16 for use with ADVA Master

[eth1]
unicast_master_table    1

[eth2]
unicast_master_table    2
```

9.3.2 Unicast SC (2 Masters)

```
[global]
domainNumber    44

sanity_freq_limit 0

slaveOnly       1
masterOnly      0

# Announce messages
announceReceiptTimeout  2
logAnnounceInterval     1

# Sync/Delay_Req/Delay_Resp messages
# ex. 0 = 1 PPS, -3 = 8 PPS, -4 = 16 PPS
logSyncInterval         -4
logMinDelayReqInterval  -4

#
# step_window is in units of sync packets
#
# 3 seconds:
#   @ 16 PPS, set to 48
#   @ 1  PPS, set to  3
step_window     48

clockClass      255
clockAccuracy   0xFE
timeSource      0xa0
maxStepsRemoved 255

offsetScaledLogVariance 0xffff

G.8275.defaultDS.localPriority  128
G.8275.portDS.localPriority     128

priority1       128
priority2       255

dataset_comparison      G.8275.x
transportSpecific       0

clock_type      OC
delay_mechanism E2E


first_step_threshold    0.000020000
step_threshold          0.000020000
tx_timestamp_timeout    1000

write_phase_mode        1
servo_offset_threshold  100
servo_num_offset_values 64
```

```
tsproc_mode             raw

network_transport       UDPv4

hybrid_e2e                      1
inhibit_multicast_service       1
unicast_listen                  1
unicast_req_duration            300

[unicast_master_table]
table_id                1
logQueryInterval        2
UDPv4                   10.64.10.1
UDPv4                   10.64.10.2

[eth1]
unicast_master_table    1

[eth2]
unicast_master_table    1
```

9.4 External Servo ptp4l cfg Files

9.4.1 Unicast BC

```
#
# PCM4L
#
# Telecom G.8275.2 T-TSC example configuration containing attributes
# which either differ from the defaults or are relevant to the profile.
#
[global]
domainNumber    44

# Announce messages
announceReceiptTimeout  2
logAnnounceInterval     1

# Sync/Delay_Req/Delay_Resp messages
# ex. 0 = 1 PPS, -3 = 8 PPS, -4 = 16 PPS
logSyncInterval         -4
logMinDelayReqInterval  -4

slaveOnly       0
masterOnly      0

clockClass      248
clockAccuracy   0xFE
timeSource      0xa0
maxStepsRemoved 255

offsetScaledLogVariance 0xffff

G.8275.defaultDS.localPriority  128
```

```
G.8275.portDS.localPriority     128

priority1       128
priority2       255

dataset_comparison      G.8275.x
transportSpecific       0

clock_type      BC
delay_mechanism E2E

#
# Send timestamps to pcm4l
#
free_running            1
slave_event_monitor     /var/run/pcm4l
tsproc_mode             raw
tx_timestamp_timeout    5
sanity_freq_limit       0


network_transport       UDPv4

hybrid_e2e                      1
inhibit_multicast_service       1
unicast_listen                  1
unicast_req_duration            300

[unicast_master_table]
table_id                1
logQueryInterval        2
UDPv4                   10.64.10.1

[unicast_master_table]
table_id                2
logQueryInterval        2
UDPv4                   10.64.10.2

[eth1]
unicast_master_table    1

[eth2]
unicast_master_table    2
```

9.4.2 Unicast SC (2 Ports)

```
#
# PCM4L
#
# Telecom G.8275.2 T-TSC example configuration containing attributes
# which either differ from the defaults or are relevant to the profile.
#
[global]
domainNumber    44

# Announce messages
announceReceiptTimeout  2
logAnnounceInterval     1

# Sync/Delay_Req/Delay_Resp messages
# ex. 0 = 1 PPS, -3 = 8 PPS, -4 = 16 PPS
logSyncInterval         -4
logMinDelayReqInterval  -4

slaveOnly       1
masterOnly      0

clockClass      255
clockAccuracy   0xFE
timeSource      0xa0
maxStepsRemoved 255

offsetScaledLogVariance 0xffff

G.8275.defaultDS.localPriority  128
G.8275.portDS.localPriority     128

priority1       128
priority2       255

dataset_comparison      G.8275.x
transportSpecific       0

clock_type      OC
delay_mechanism E2E

#
# Send timestamps to pcm4l
#
free_running            1
slave_event_monitor     /var/run/pcm4l
tsproc_mode             raw
tx_timestamp_timeout    5
sanity_freq_limit       0

network_transport       UDPv4

hybrid_e2e                      1
```

```
inhibit_multicast_service       1
unicast_listen                  1
unicast_req_duration            300

[unicast_master_table]
table_id                1
logQueryInterval        2
UDPv4                   10.64.10.1
UDPv4                   10.64.10.2

[eth1]
unicast_master_table    1

[eth2]
unicast_master_table    1
```

9.5 Pcm4l json File

9.5.1 Write Phase (FTS/G.8273.2)

```
{
  "versionId": "4.3",
  "testModeEnable": 0,
  "referenceTrackerType": "WritePhase",
  "remoteUdsAddress": "/var/run/ptp4l",
  "localUdsAddress": "/var/run/pcm4l",

  "stepWindowSeconds": 1,

  "phc4lConfig":
  {
      "dcoDevice": "/dev/ptp0",
      "tsDevice":
      [
          {
              "tsDeviceName": "/dev/ptp1",
              "tsDevicePinIndex": -1,
              "tsDeviceExttsChannel": 0,
              "tsDeviceExttsCorrectionNs": 0
          }
      ],
      "charDevice": "/dev/rsmu0",

      "phaseSnapDelaySeconds": 3,
      "tsCalibrationEnable": 0
  },

  "deviceConfig":
  {
      "oscillatorType": "Tcxo",
      "dpll1588Instance": 1,
      "tsDeviceAlignmentDisable": 0,
      "holdover":
      {
```

```
            "holdoverType": "HardwareEnhanced",
            "holdoverLossPhysicalOosEnable": 0,
            "holdoverTimeoutSeconds": 1000,
            "holdoverQualificationSeconds": 1000,
            "unqualifiedTimeoutSeconds": 10000,
            "outOfSpecUserDefinedFrequencyOffsetEnable": 0,
            "outOfSpecUserDefinedFrequencyOffsetPpb": 0
        }
    },

    "profileConfig":
    {
        "physicalPllClockCategory": 4,
        "physicalPllClockCategoryThreshold": 1,
        "physicalPllInstance": 0,
        "physicalPllWaitToRestoreTimeoutValue": 10
    },

    "loggerConfig":
    {
        "stdoutLog":
        {
            "enable": 1,
            "selectionMask": "0000000000111111",
            "_description_": "        | ||||||___ 0: Sync error                ",
            "_description_": "        | |||||____ 1: Sync warning              ",
            "_description_": "        | ||||_____ 2: Sync analysis             ",
            "_description_": "        | |||______ 3: Error                     ",
            "_description_": "        | ||_______ 4: Warning                   ",
            "_description_": "        | |________ 5: Debug                     ",
            "_description_": "        |__________ 7: Timestamp                 "
        },

        "externalFdLog":
        {
            "enable": 0,
            "selectionMask": "0000000000111111",
            "_description_": "        | ||||||___ 0: Sync error                ",
            "_description_": "        | |||||____ 1: Sync warning              ",
            "_description_": "        | ||||_____ 2: Sync analysis             ",
            "_description_": "        | |||______ 3: Error                     ",
            "_description_": "        | ||_______ 4: Warning                   ",
            "_description_": "        | |________ 5: Debug                     ",
            "_description_": "        |__________ 7: Timestamp                 "
        }
    },

    "instanceConfig":
    [
        {
            "correctionFieldEnable": 1,
            "lostMasterTimeoutMilliseconds": 2000,
            "manageClockClassExtendedEnable": 0,
```

```
          "numberOfTrackerInstances": 1,

          "trackerConfig":
          {
            "delayAsymmetryNanoseconds": 0,
            "phaseSnapThresholdSeconds": 0.00001,
            "floorDelayEstimateSeconds": -1.0,
            "timeLockThresholdNanoseconds": 250,
            "willCorrectFrequencyAtFirstSnap": 1,
            "frequencyLockThresholdPpb": 16.0,
            "lockFilterWindowLengthSeconds": 1.0
          }
      }
  ]
}
```

9.5.2 Adaptive Time (PTS/G.8273.4)

```
{
  "versionId": "4.3",
  "testModeEnable": 0,
  "referenceTrackerType": "AdaptiveTime",
  "remoteUdsAddress": "/var/run/ptp4l",
  "localUdsAddress": "/var/run/pcm4l",

  "stepWindowSeconds": 1,

  "phc4lConfig":
  {
      "dcoDevice": "/dev/ptp0",
      "tsDevice":
      [
          {
              "tsDeviceName": "/dev/ptp1",
              "tsDevicePinIndex": -1,
              "tsDeviceExttsChannel": 0,
              "tsDeviceExttsCorrectionNs": 0
          }
      ],
      "charDevice": "/dev/rsmu0",

      "phaseSnapDelaySeconds": 3,
      "tsCalibrationEnable": 0
  },

  "deviceConfig":
  {
      "oscillatorType": "Tcxo",
      "dpll1588Instance": 1,
      "tsDeviceAlignmentDisable": 0,
      "holdover":
      {
          "holdoverType": "Software",
          "holdoverLossPhysicalOosEnable": 0,
```

```
            "holdoverTimeoutSeconds": 1000,
            "holdoverQualificationSeconds": 1000,
            "unqualifiedTimeoutSeconds": 10000,
            "outOfSpecUserDefinedFrequencyOffsetEnable": 0,
            "outOfSpecUserDefinedFrequencyOffsetPpb": 0
        }
    },

    "profileConfig":
    {
        "physicalPllClockCategory": 4,
        "physicalPllClockCategoryThreshold": 1,
        "physicalPllInstance": 0,
        "physicalPllWaitToRestoreTimeoutValue": 10
    },

    "loggerConfig":
    {
        "stdoutLog":
        {
            "enable": 1,
            "selectionMask": "0000000000111111",
            "_description_": "        | ||||||___ 0: Sync error                ",
            "_description_": "        | |||||____ 1: Sync warning              ",
            "_description_": "        | ||||_____ 2: Sync analysis             ",
            "_description_": "        | |||______ 3: Error                      ",
            "_description_": "        | ||_______ 4: Warning                    ",
            "_description_": "        | |________ 5: Debug                      ",
            "_description_": "        |__________ 7: Timestamp                  "
        },

        "externalFdLog":
        {
            "enable": 0,
            "selectionMask": "0000000000111111",
            "_description_": "        | ||||||___ 0: Sync error                ",
            "_description_": "        | |||||____ 1: Sync warning              ",
            "_description_": "        | ||||_____ 2: Sync analysis             ",
            "_description_": "        | |||______ 3: Error                      ",
            "_description_": "        | ||_______ 4: Warning                    ",
            "_description_": "        | |________ 5: Debug                      ",
            "_description_": "        |__________ 7: Timestamp                  "
        }
    },

    "instanceConfig":
    [
        {
            "instanceEnable": 1,
            "correctionFieldEnable": 1,
            "lostMasterTimeoutMilliseconds": 2000,
            "manageClockClassEnable": 1,
            "manageClockClassExtendedEnable": 0,
```

```
            "ptpDomainNumber": -1,
            "numberOfTrackerInstances": 1,

            "trackerConfig":
            {
                "delayAsymmetryNanoseconds": 0,
                "floorDelayEstimateSeconds": -1.0,
                "willCorrectFrequencyAtFirstSnap": 0,
                "minExpProportionForMinTracking": 0.12,

                "stationarityBounds":
                {
                    "measure1Lower": 0.4,
                    "measure1Upper": 2.5
                },

                "maxNumberOfPhaseSnap": 1,
                "doubleDcoThresholdNanoseconds": 600,
                "phaseSnapThresholdSeconds": 0.00001,
                "rerouteFloorDelayThresholdSeconds": 0.000002,
                "rerouteAbnormalTodChangePpb": 20,
                "highPrecisionFrequencyCorrectionTimeMinutes": 6,

                "pdvThreshold":
                {
                    "downlink": -20,
                    "uplink": -20
                },

                "pdvThresholdExceededHysteresis":
                {
                    "downlink": 1,
                    "uplink": 1
                },

                "snapTransitionTimestamps": 4,

                "dcoLoopFilter":
                {
                    "minResponseTimeSeconds": 100,
                    "maxFfoCorrection": 5,
                    "integralBranchGain": 0.2,
                    "bandwidthScalar": 0.5
                },

                "desiredPrecisionSeconds": 0.0000001,
                "frequencyLockThresholdPpb": 15.0,
                "timeLockThresholdNanoseconds": 1350,
                "ffoSlopeLimitPpbPerSecond": -1
            }
        }
    ]
}
```

9.6 Synced cfg File

```
#
# Global parameters
#
[global]
net_opt 1
no_ql_en 0
synce_forced_ql_en 1
lo_ql SEC
lo_pri 255
max_msg_lvl 6
stdout_en 1
syslog_en 0
# Device configuration file path (applicable for generic device)
device_cfg_file ""
device_name /dev/rsmu0
synce_dpll_idx 0
holdover_ql SEC
holdover_tmr 10
hoff_tmr 300
wtr_tmr 10
advanced_holdover_en 0
pcm4l_if_en 1
pcm4l_if_ip_addr 127.0.0.1
pcm4l_if_port_num 2400
mng_if_en 1
mng_if_ip_addr 127.0.0.2
mng_if_port_num 2401

#
# Sync-E clock port
#
[eth1]
clk_idx 1
pri 1
tx_en 1
rx_en 1
tx_bundle_num -1
init_ql SEC

[eth2]
#clk_idx 1
pri 2
tx_en 1
rx_en 1
tx_bundle_num -1
init_ql SEC
```

10. Revision History

Revision	Date	Description
1.00	Dec 10, 2024	Initial release.

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

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