

AMD ZCU102 with Renesas ClockMatrix, ITU-T G.8273.2

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1. Results Summary

| Standard | Test Case | Results |
|----------|------------------------------|---------|
| G.8273.2 | Noise Generation | Pass |
| G.8273.2 | Holdover | Pass |
| G.8273.2 | Noise Generation – No SyncE | N/A |
| G.8273.2 | Holdover – No SyncE | Pass |
| G.8273.2 | Noise Tolerance | Pass |
| G.8273.2 | SyncE Transient | Pass |
| G.8273.2 | SyncE to 1PPS Noise Transfer | Pass |
| G.8273.2 | PTP to 1PPS Noise Transfer | Pass |

1.1 Notes on Testing with a Physical Layer Clock

FTS uses a SyncE clock from the test equipment as an additional clock source. A DPLL (configured for ITU-T G.8262 EEC1) is locked to the SyncE source and is connected to the PTP DPLL via the combo bus. For FTS there is no filter on the combo bus connection.

Synced software is used to manage the SyncE clock based on the QL level from the test equipment for tests required a physical layer clock. A category 1 (QL-PRTC) SyncE source from the test equipment is connected to the SyncE input on Clock Matrix and is qualified before PTP (PCM4L/PTP4I) is started.

2. Test Configuration

Table 1. Test Configuration 1

| | |
|--------------------------|--------------------|
| Device Under Test | AMD + CM |
| Oscillator | Rakon E6241LF TCXO |
| 1pps Source | Symmetricom TP5000 |
| Instrument | Paragon Neo |
| Instrument Serial Number | 00036081 |
| Ethernet Interface | Optical |

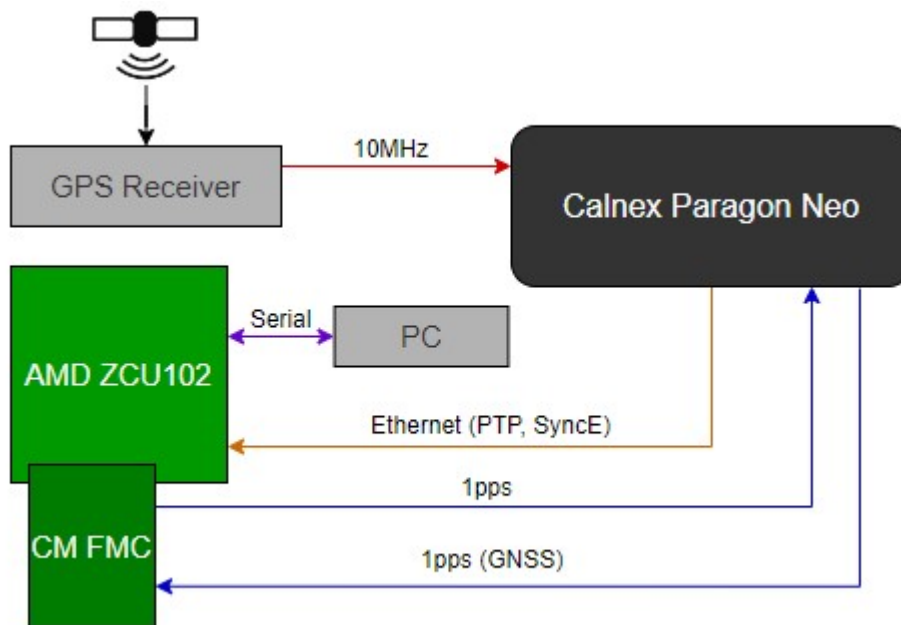


Figure 1. Equipment Configuration 1

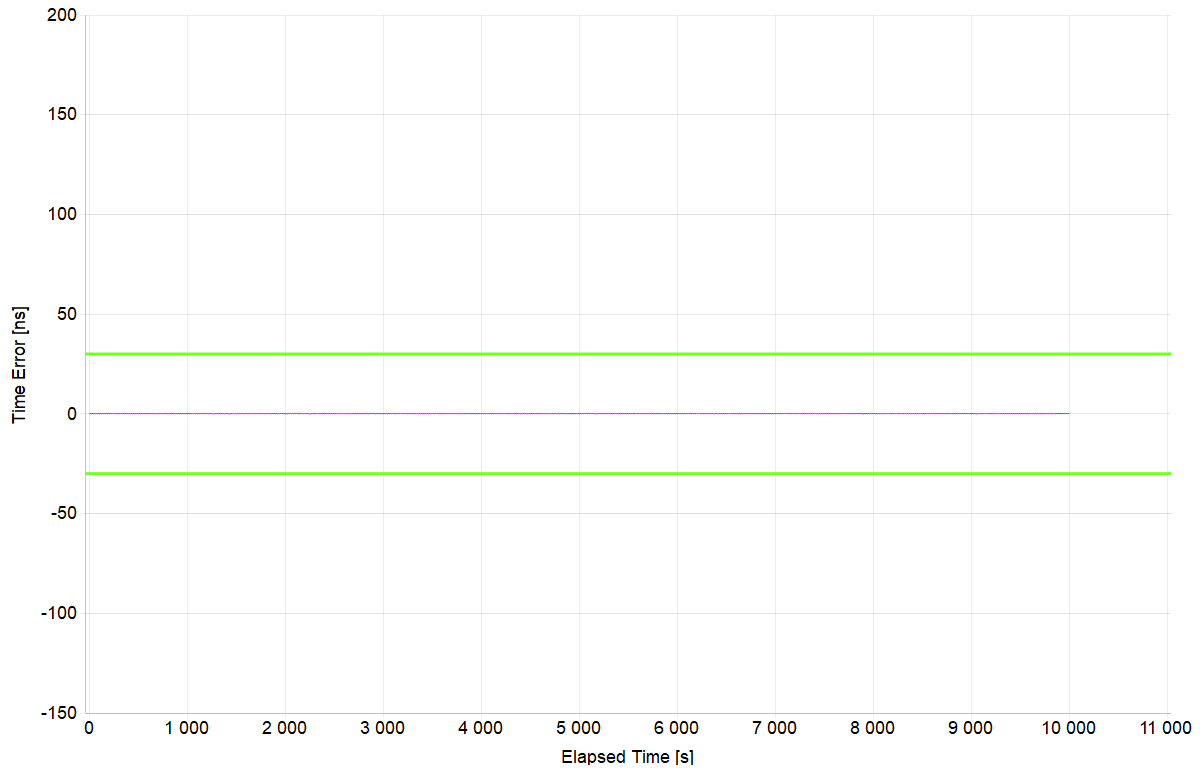
3. G.8273.2: Noise Generation

| | |
|-------------------------------|-------------------|
| Test Description | Noise Generation |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 02:46:40 |
| Time to Phase Lock (s) | 16 |

| | |
|--------------------------------------|---|
| 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 |

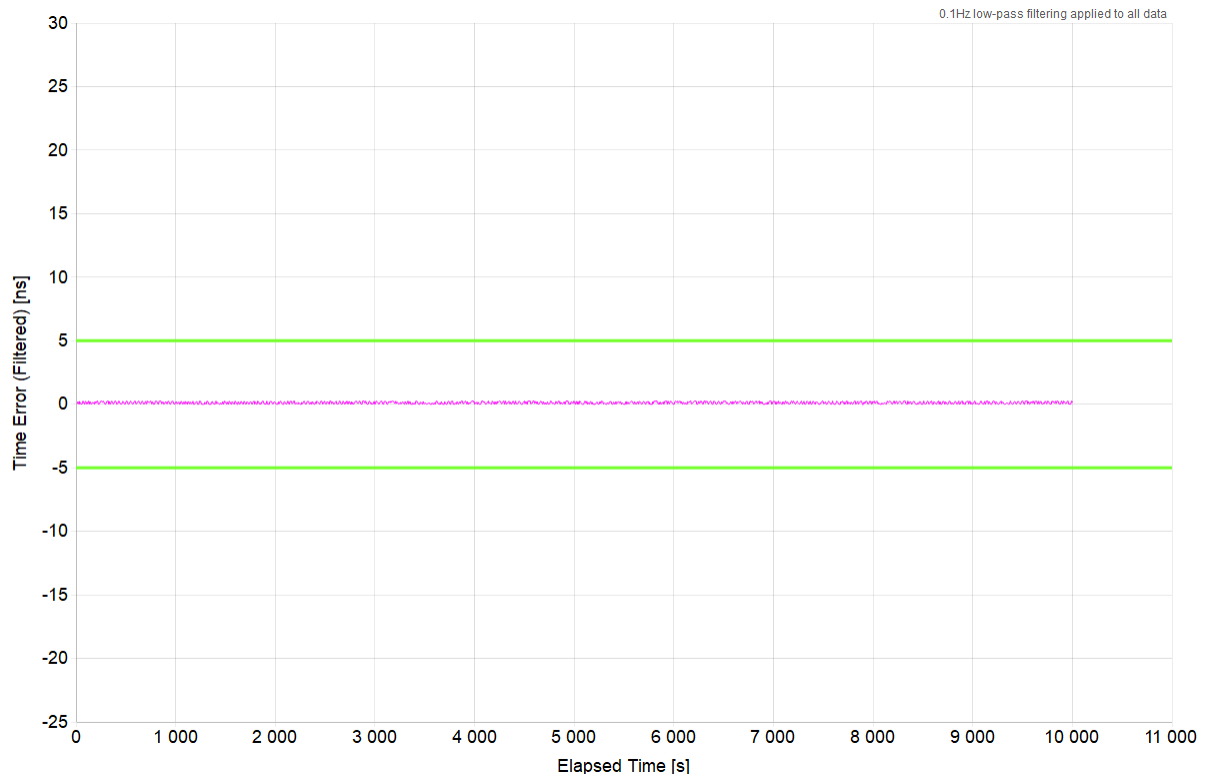
3.1 ONEPPS Analysis

| | |
|------------------------|-----|
| Offset Removal Applied | On |
| Zero Offset | 0ns |



| | |
|--------------|-------|
| Mean [ns] | 0.109 |
| Min [ns] | -0.25 |
| Max [ns] | 0.25 |
| Max-Min [ns] | 0.5 |

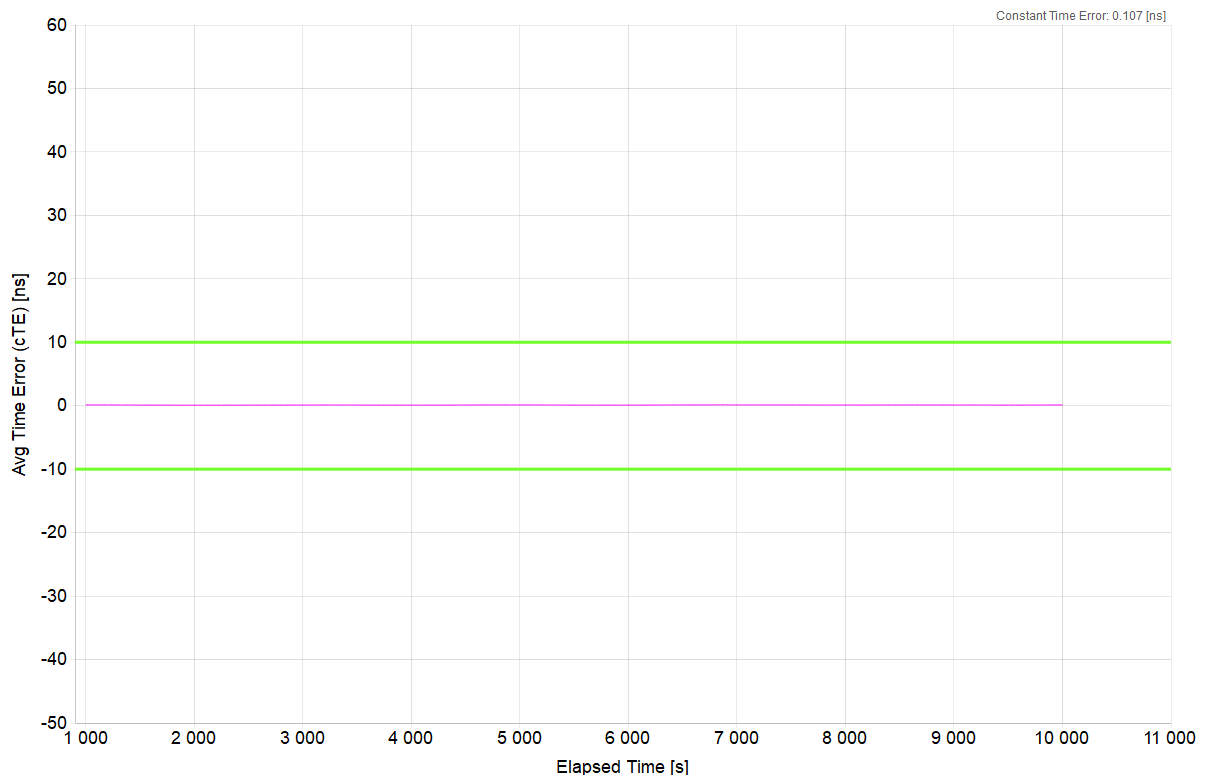
3.2 FILTEREDTIMEERROR Analysis



| | |
|---------------------|--------|
| Mean [ns] | 0.109 |
| Min [ns] | -0.045 |
| Max [ns] | 0.25 |
| Max-Min [ns] | 0.295 |

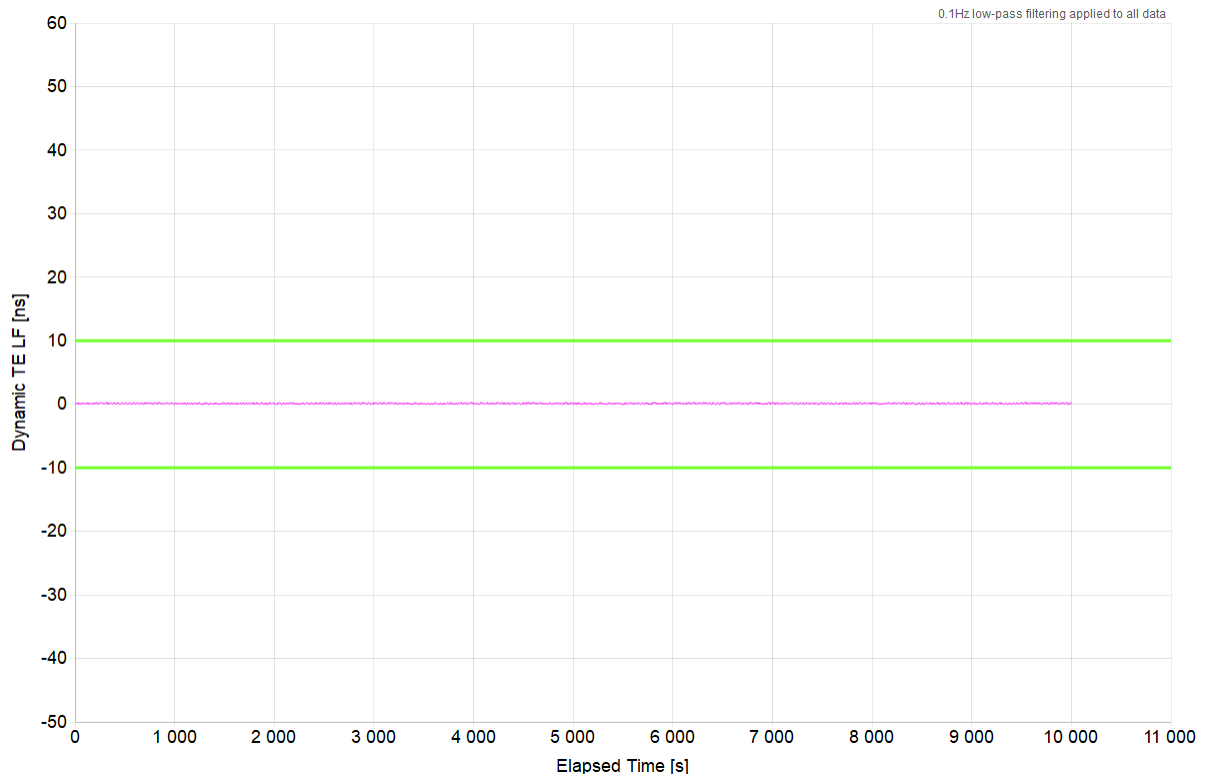
3.3 CTE Analysis

| | |
|---------------------------|------|
| Averaging Time (s) | 1000 |
|---------------------------|------|



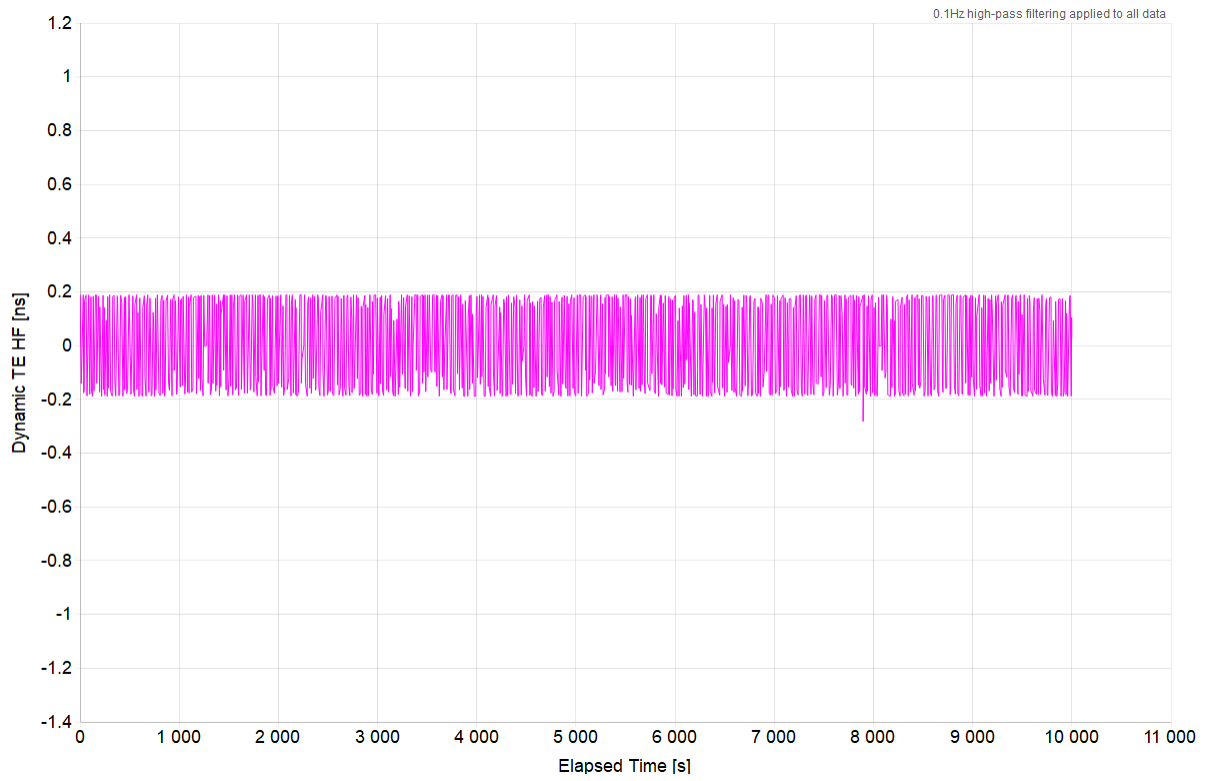
| | |
|---------------------------------|-------|
| Constant Time Error [ns] | 0.107 |
| Min [ns] | 0.08 |
| Max [ns] | 0.135 |
| Max-Min [ns] | 0.056 |

3.4 DTE Analysis



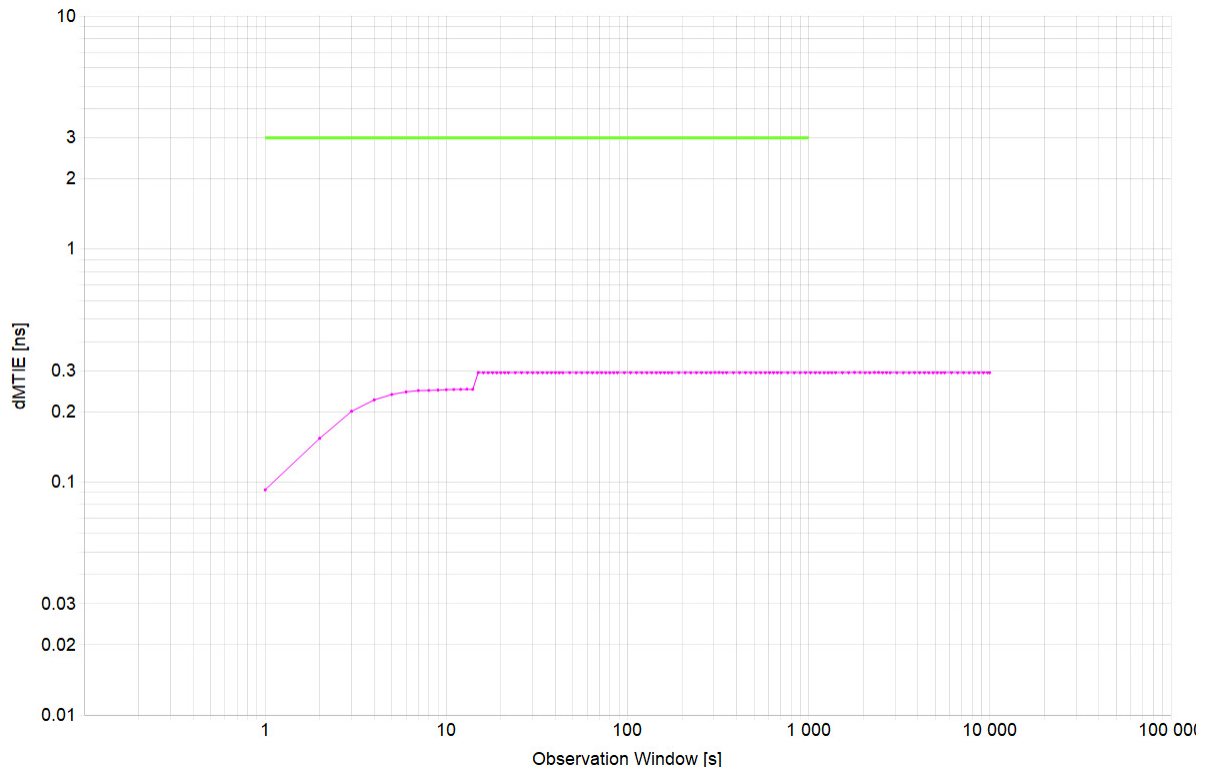
| | |
|---------------------|--------|
| Mean [ns] | 0.109 |
| Min [ns] | -0.045 |
| Max [ns] | 0.25 |
| Max-Min [ns] | 0.295 |

3.5 DTEHF Analysis



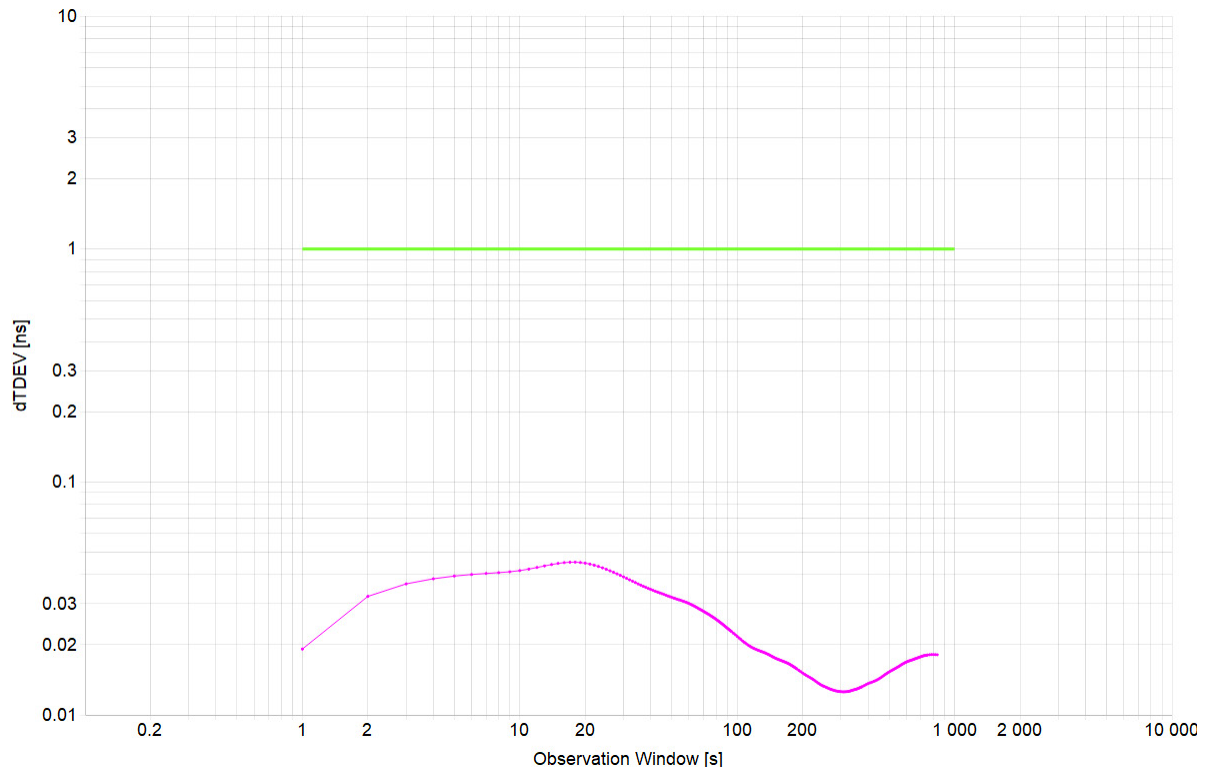
| | |
|---------------------|--------|
| Mean [ns] | 0 |
| Min [ns] | -0.282 |
| Max [ns] | 0.189 |
| Max-Min [ns] | 0.471 |

3.6 DTEMTIE Analysis



| | |
|---------------------|-------|
| Min [ns] | 0.093 |
| Max [ns] | 0.295 |
| Max-Min [ns] | 0.202 |

3.7 DTETDEV Analysis



| | |
|---------------------|-------|
| Min [ns] | 0.013 |
| Max [ns] | 0.045 |
| Max-Min [ns] | 0.033 |

4. G.8273.2: Holdover

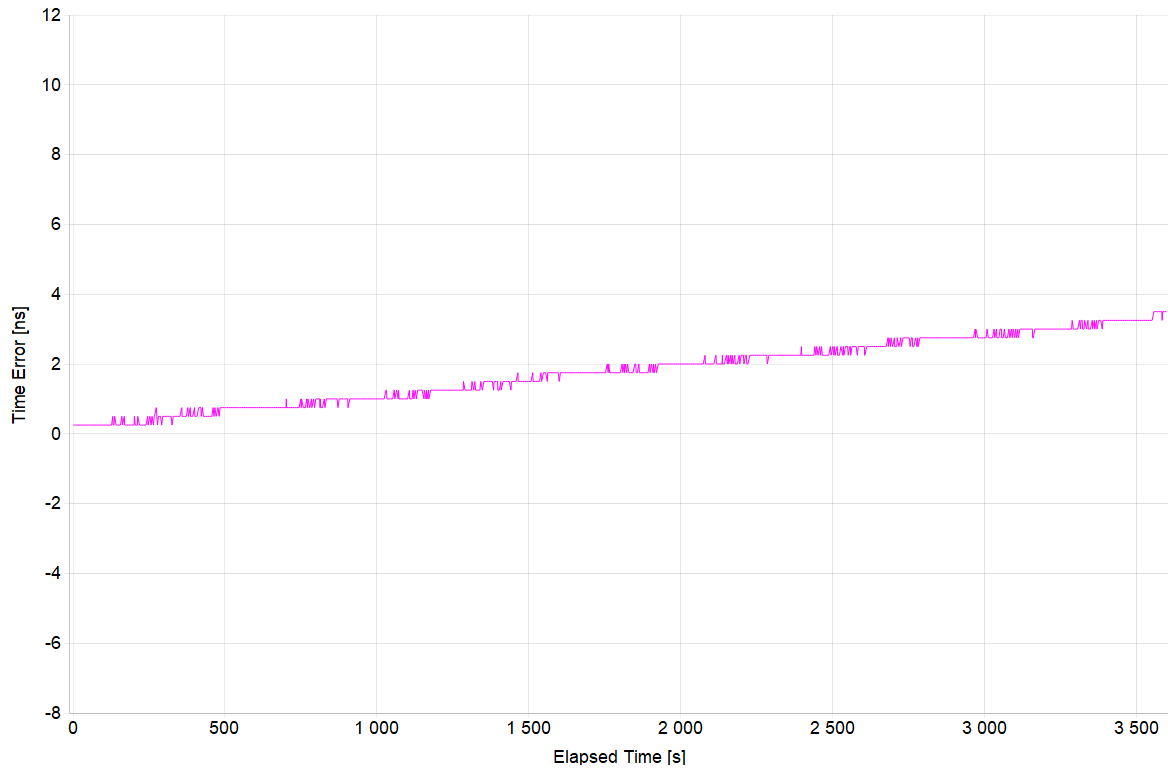
| | |
|-------------------------------|-------------------|
| Test Description | Holdover |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 00:59:57 |
| Time to Phase Lock (s) | N/A |

| | |
|---------------------------|---|
| All Mask Results | Pass |
| Mask ONEPPS | - |
| Mask ONEPPS Result | No Mask |
| Mask MTIE | G.8273.2 T-BC Class B Time Holdover Const. Temp. |
| Mask MTIE Result | Pass |

1. This test is a continuation of the previous Noise Generation test. This allows for an appropriate amount of settling time before collecting holdover data (10 000s). The results are split because holdover requires a different mask than noise generation.

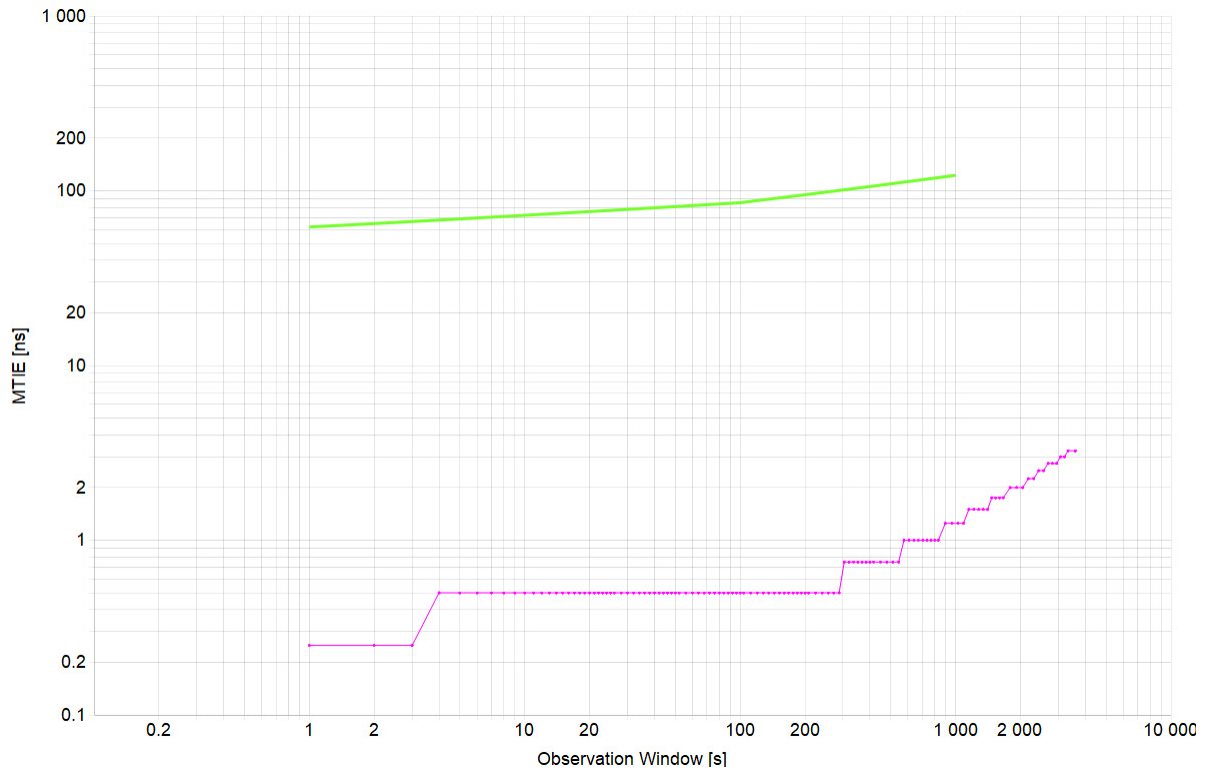
4.1 ONEPPS Analysis

| | |
|------------------------|--------|
| Offset Removal Applied | Off |
| Zero Offset | 0.25ns |



| | |
|--------------|-------|
| Mean [ns] | 1.777 |
| Min [ns] | 0.25 |
| Max [ns] | 3.5 |
| Max-Min [ns] | 3.25 |

4.2 MTIE Analysis



| | |
|---------------------|------|
| Min [ns] | 0.25 |
| Max [ns] | 3.25 |
| Max-Min [ns] | 3 |

5. G.8273.2: Noise Generation – No SyncE

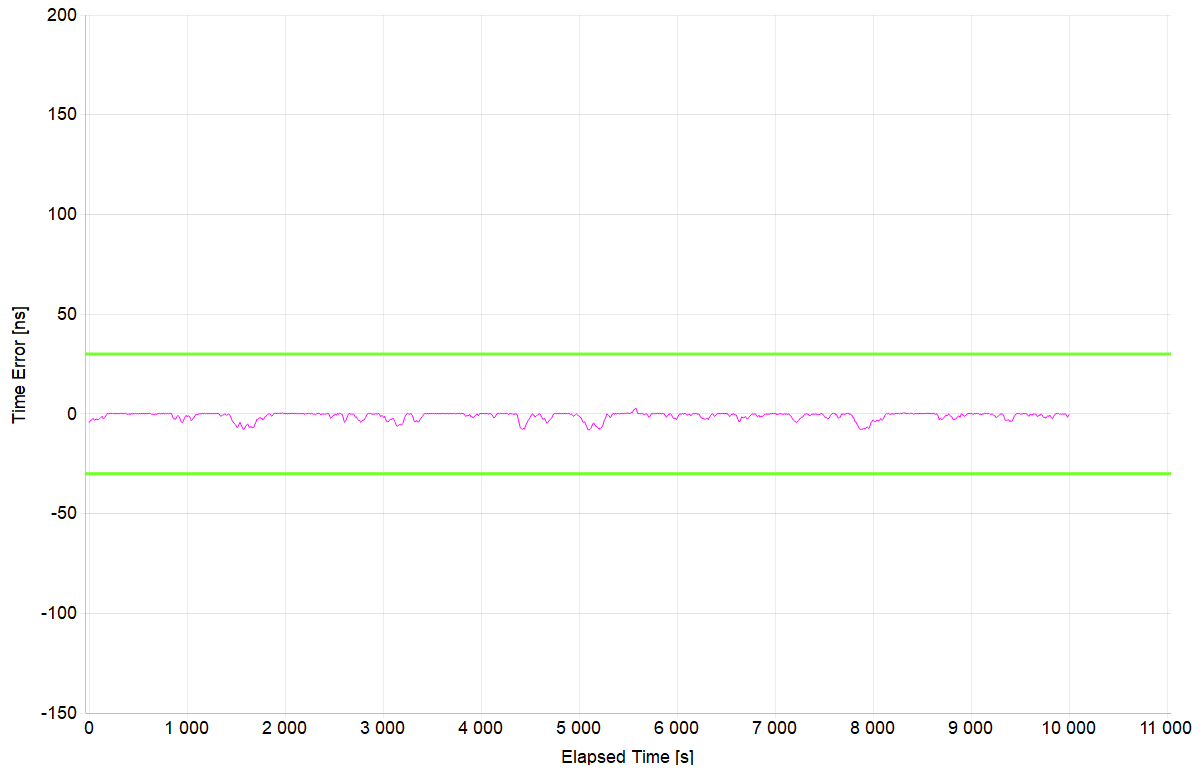
| | |
|-------------------------------|-----------------------------|
| Test Description | Noise Generation – No SyncE |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 02:46:40 |
| Time to Phase Lock (s) | 13 |

| | |
|--------------------------------------|--|
| All Mask Results | N/A |
| Mask ONEPPS | 0.03μs |
| Mask ONEPPS Result | Pass |
| Mask FILTEREDTIMEERROR | 0.005μs |
| Mask FILTEREDTIMEERROR Result | Fail |
| 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 | Fail |
| Mask DTETDEV | G.8273.2 T-BC Class C Dynamic TE LF Const. Temp. |
| Mask DTETDEV Result | Pass |

1. Class C Masks are provided as a reference. This test is not covered by ITU-T G.8273.2 as it does not use a physical layer reference. Results are dependent on the oscillator performance.

5.1 ONEPPS Analysis

| | |
|------------------------|------|
| Offset Removal Applied | Off |
| Zero Offset | -4ns |



| | |
|--------------|--------|
| Mean [ns] | -1.145 |
| Min [ns] | -8 |
| Max [ns] | 3 |
| Max-Min [ns] | 11 |

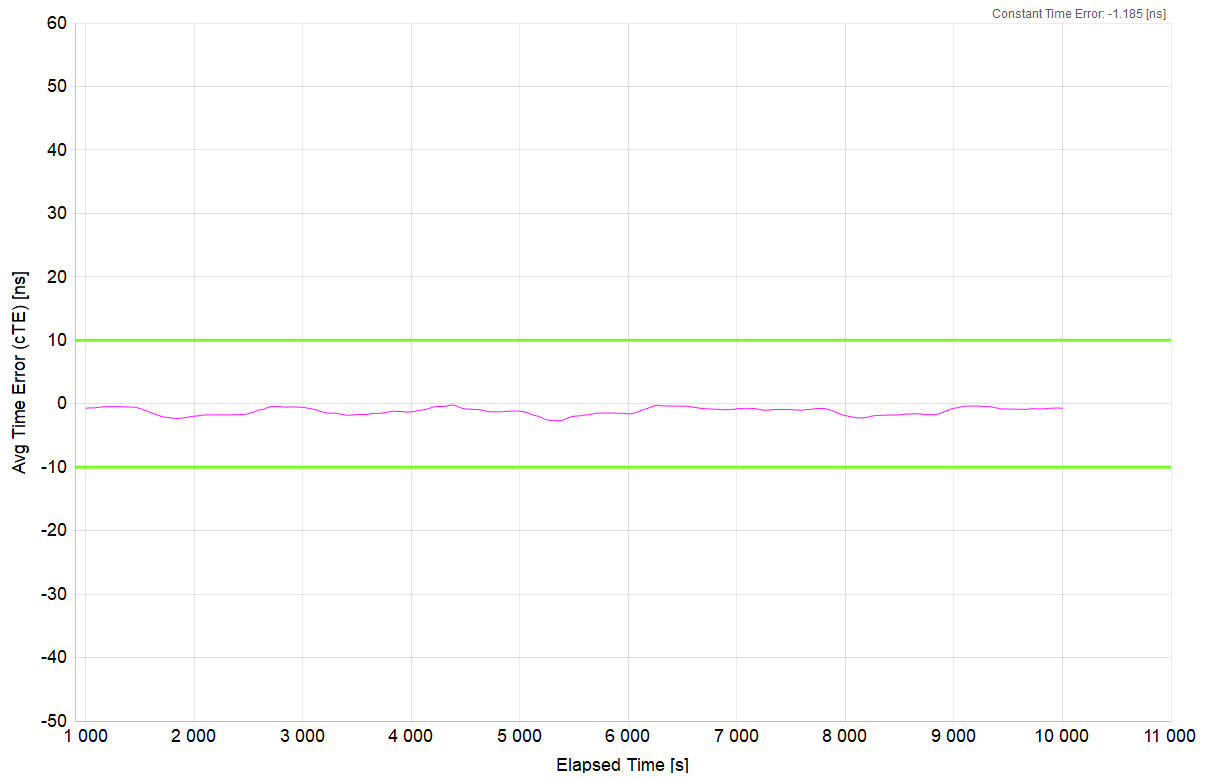
5.2 FILTEREDTIMEERROR Analysis



| | |
|---------------------|--------|
| Mean [ns] | -1.141 |
| Min [ns] | -7.939 |
| Max [ns] | 2.964 |
| Max-Min [ns] | 10.903 |

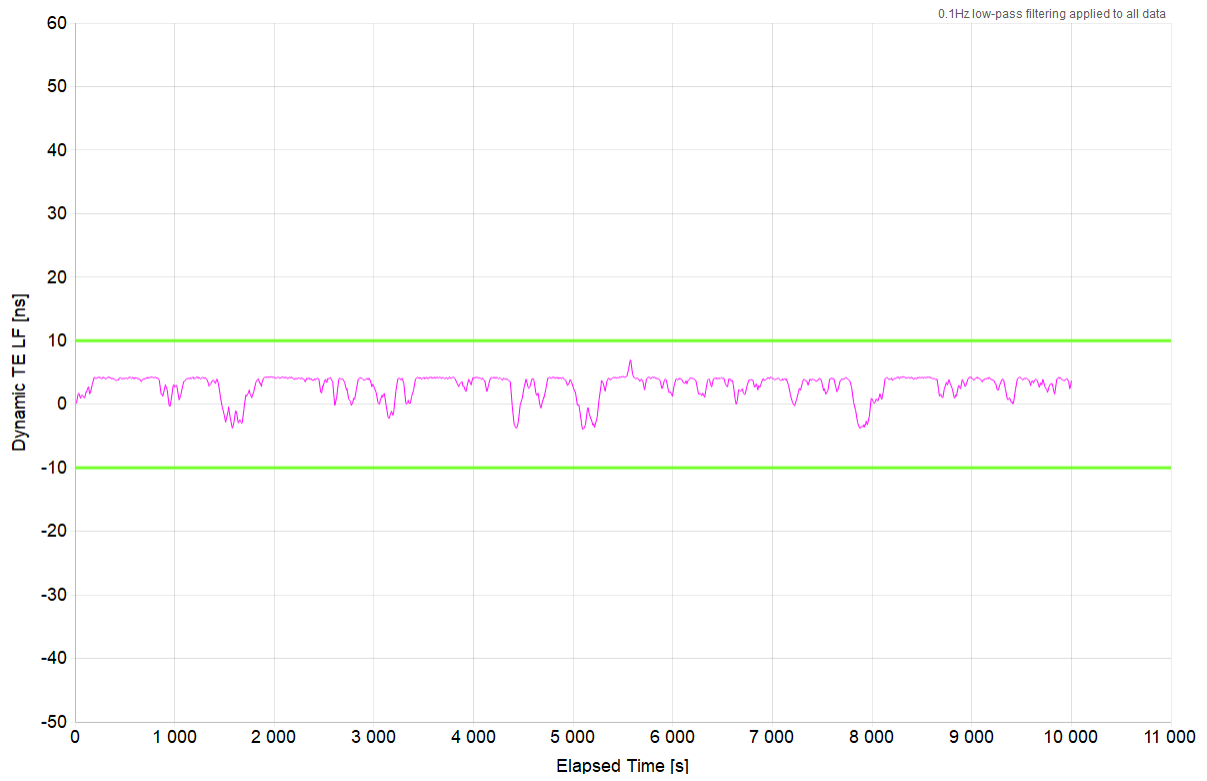
5.3 CTE Analysis

| | |
|---------------------------|------|
| Averaging Time (s) | 1000 |
|---------------------------|------|



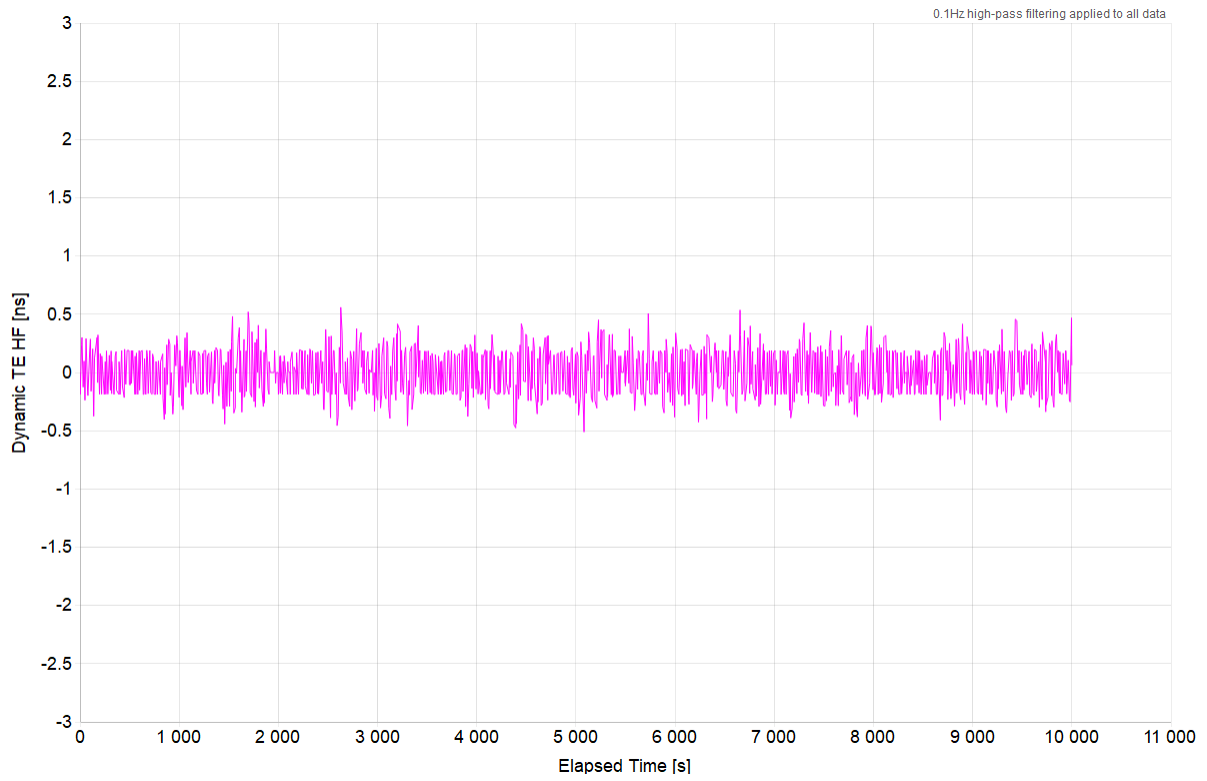
| | |
|---------------------------------|--------|
| Constant Time Error [ns] | -1.185 |
| Min [ns] | -2.681 |
| Max [ns] | -0.199 |
| Max-Min [ns] | 2.482 |

5.4 DTE Analysis



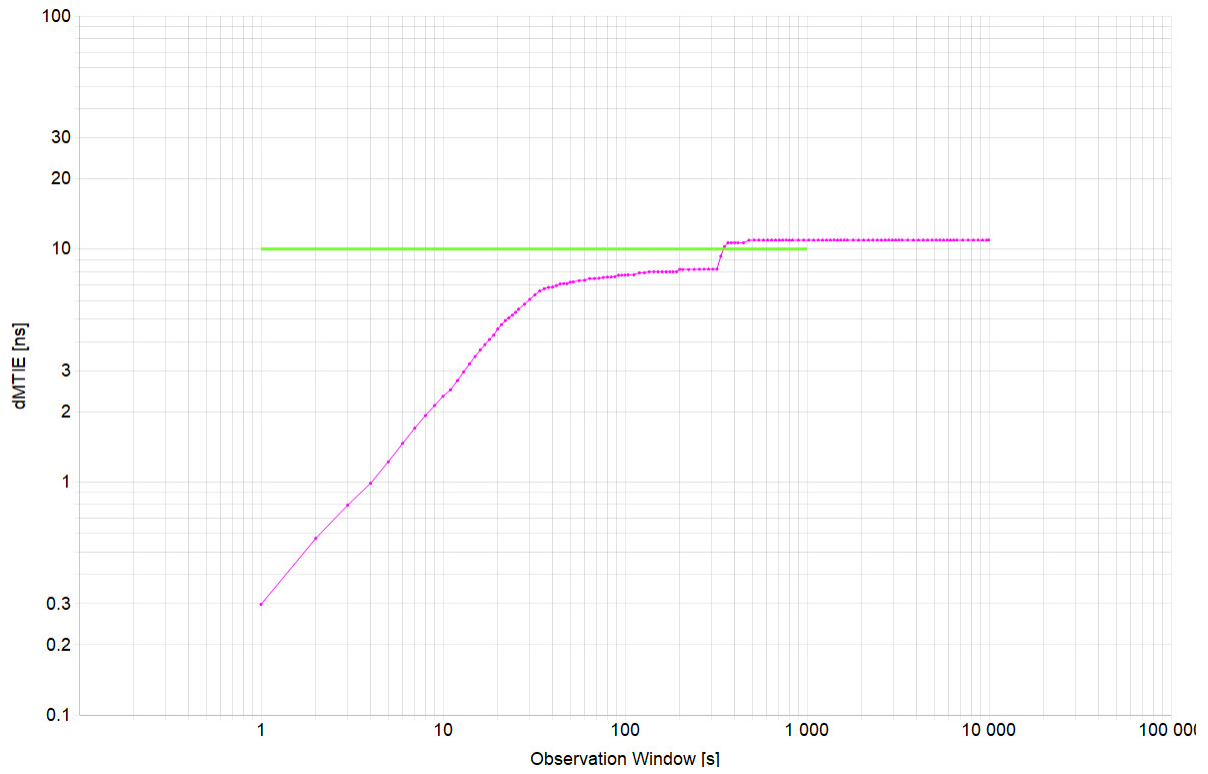
| | |
|---------------------|--------|
| Mean [ns] | 2.859 |
| Min [ns] | -3.939 |
| Max [ns] | 6.964 |
| Max-Min [ns] | 10.903 |

5.5 DTEHF Analysis



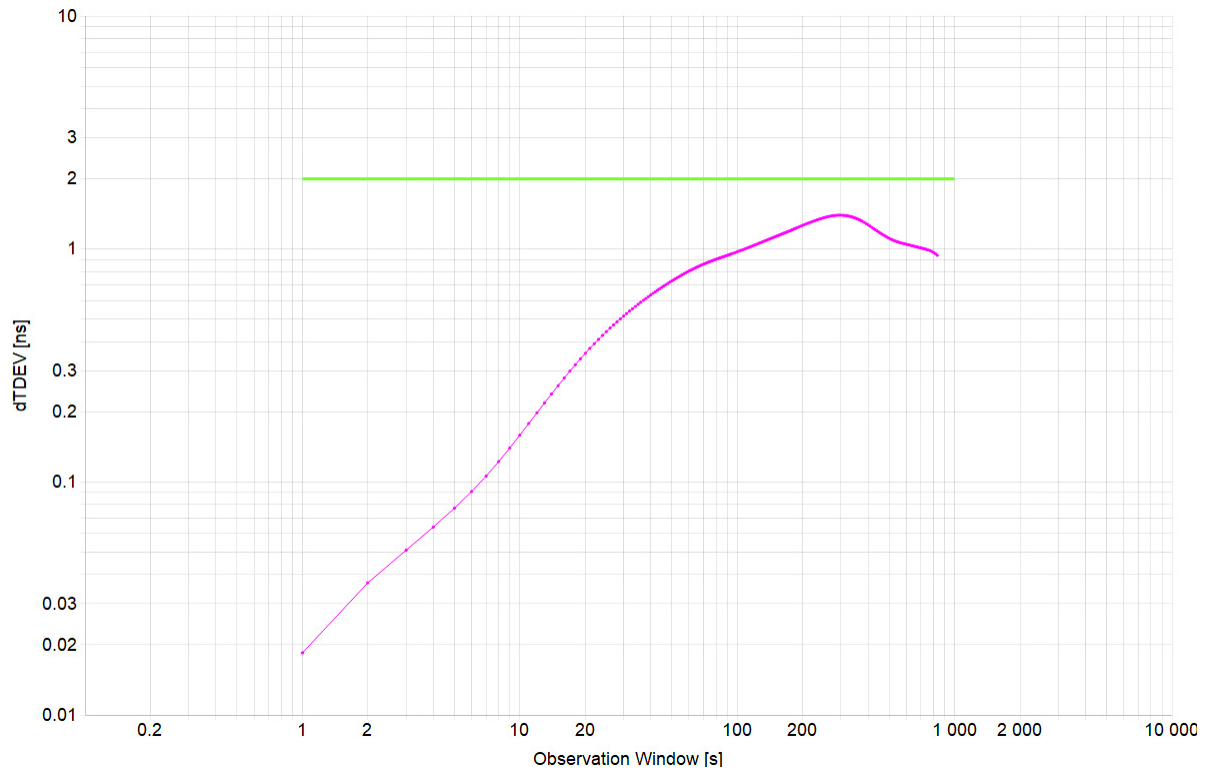
| | |
|---------------------|--------|
| Mean [ns] | 0.001 |
| Min [ns] | -0.511 |
| Max [ns] | 0.56 |
| Max-Min [ns] | 1.07 |

5.6 DTEMTIE Analysis



| | |
|---------------------|--------|
| Min [ns] | 0.298 |
| Max [ns] | 10.903 |
| Max-Min [ns] | 10.605 |

5.7 DTETDEV Analysis



| | |
|---------------------|-------|
| Min [ns] | 0.018 |
| Max [ns] | 1.396 |
| Max-Min [ns] | 1.378 |

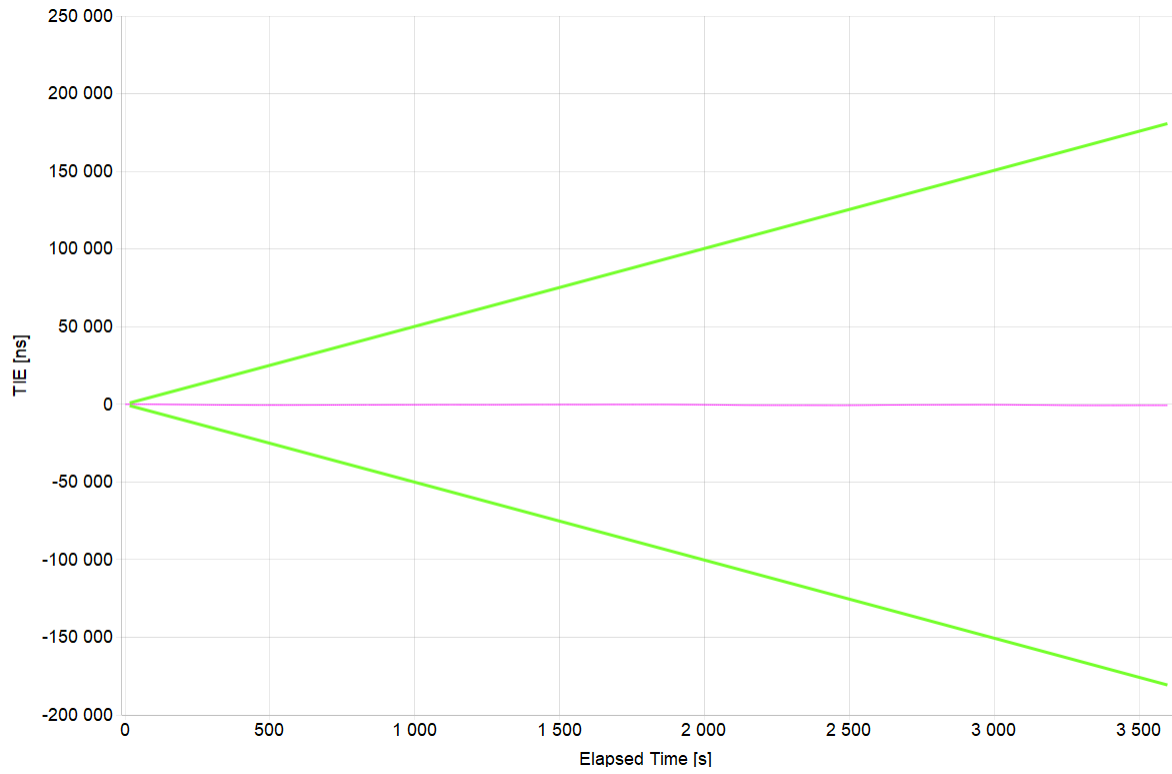
6. G.8273.2: Holdover – No SyncE

| | |
|-------------------------------|---------------------|
| Test Description | Holdover – No SyncE |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 00:59:57 |
| Time to Phase Lock (s) | N/A |

| | |
|-------------------------|--|
| All Mask Results | Pass |
| Mask TIE | G.8262 EEC Opt. 1 Long-Term Holdover Const. Temp. |
| Mask TIE Result | Pass |

1. This test is a continuation of the previous Noise Generation test. This allows for an appropriate amount of settling time before collecting holdover data (10 000s). The results are split because holdover requires a different mask than noise generation.

6.1 TIE Analysis



| | |
|---------------------|----------|
| Mean [ns] | -408.212 |
| Min [ns] | -744.25 |
| Max [ns] | 4.75 |
| Max-Min [ns] | 749 |

7. G.8273.2: Noise Tolerance

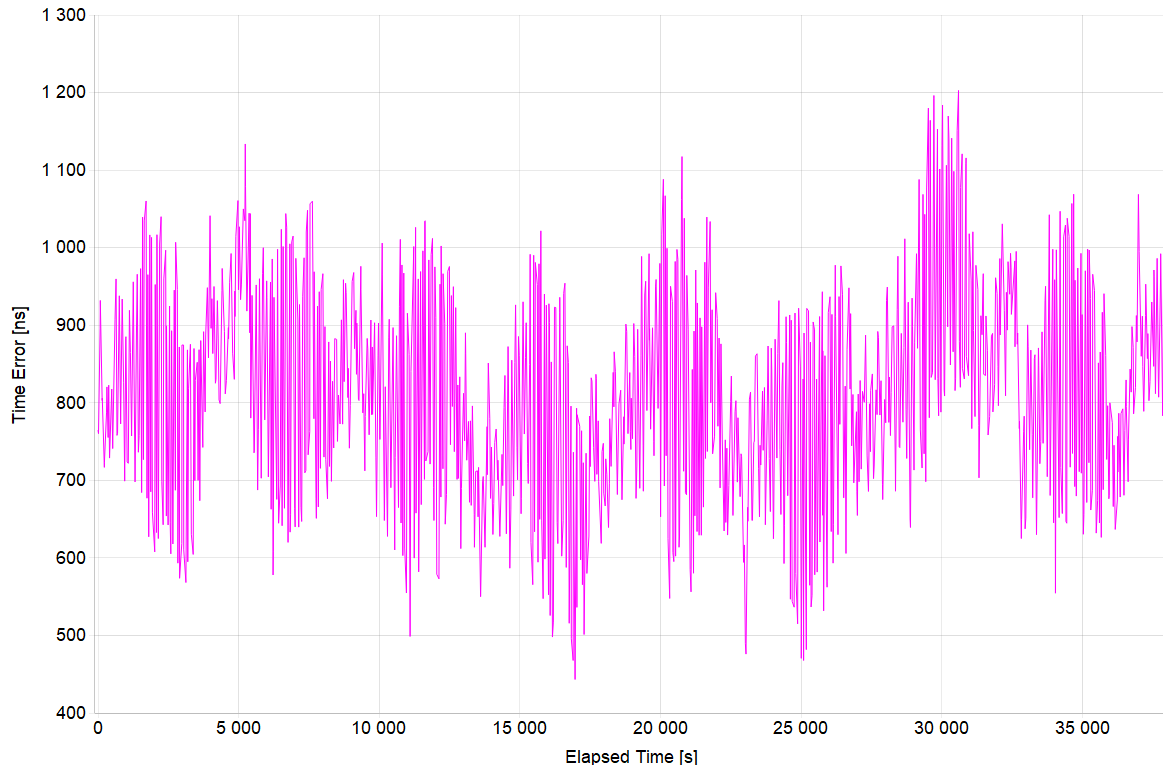
| | |
|-------------------------------|-------------------|
| Test Description | Noise Tolerance |
| Report Date | 23-03-07_08-22-53 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 10:33:17 |
| Time to Phase Lock (s) | 14 |

| | |
|---------------------------|-------------|
| All Mask Results | Pass |
| Mask ONEPPS | - |
| Mask ONEPPS Result | No Mask |

1. This test requires noise on both the PTP and SyncE sources. The PTP noise is the ITU-T G 8271.1 FTS pdv pattern provided by Calnex. The SyncE noise source is the noise tolerance wander table repeated throughout the length of the PTP pdv pattern. This is the same pattern used in Section 9 G.8273.2 SyncE to 1PPS Noise Transfer.

7.1 ONEPPS Analysis

| | |
|-------------------------------|-----------|
| Offset Removal Applied | Off |
| Zero Offset | 764.697ns |



| | |
|---------------------|----------|
| Mean [ns] | 811.069 |
| Min [ns] | 443.197 |
| Max [ns] | 1202.697 |
| Max-Min [ns] | 759.5 |

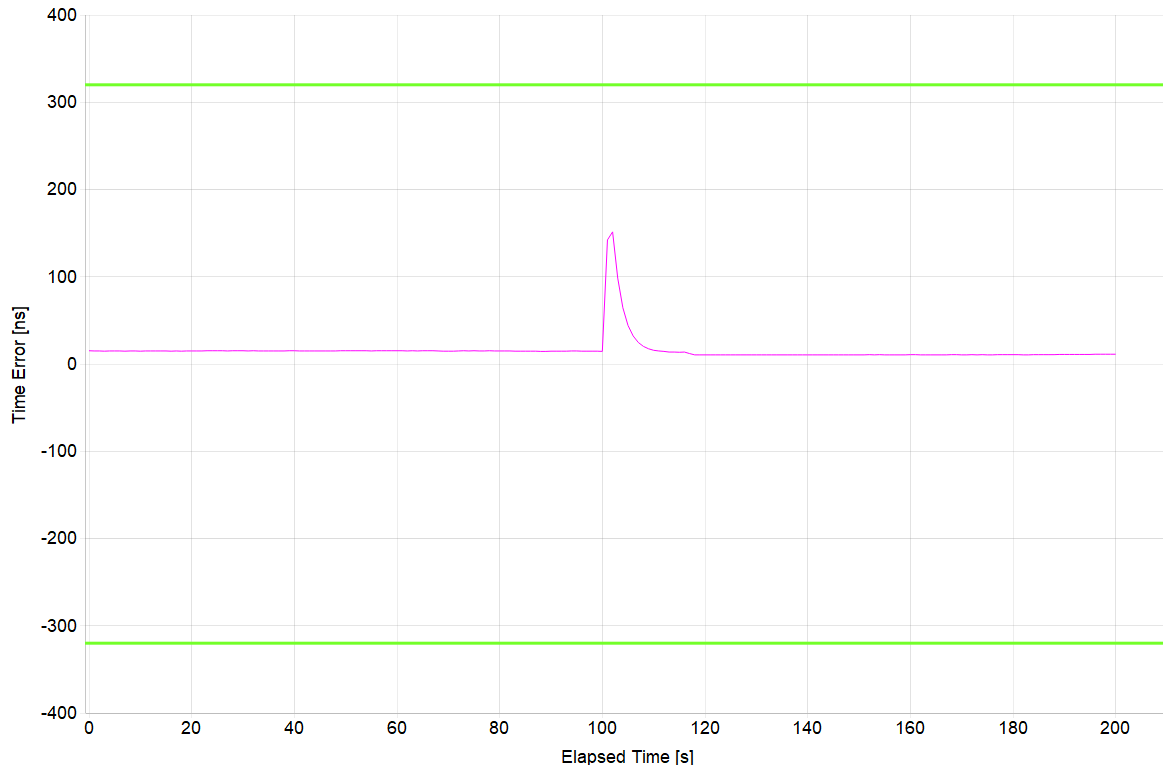
8. G.8273.2: SyncE Transient

| | |
|-------------------------------|-------------------|
| Test Description | SyncE Transient |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 00:03:20 |
| Time to Phase Lock (s) | 15 |

| | |
|--------------------------------------|----------------------|
| All Mask Results | Pass |
| Mask ONEPPS | 0.32μs |
| Mask ONEPPS Result | Pass |
| Mask TransientResponse | G.8273.2 Phase Error |
| Mask TransientResponse Result | Pass |

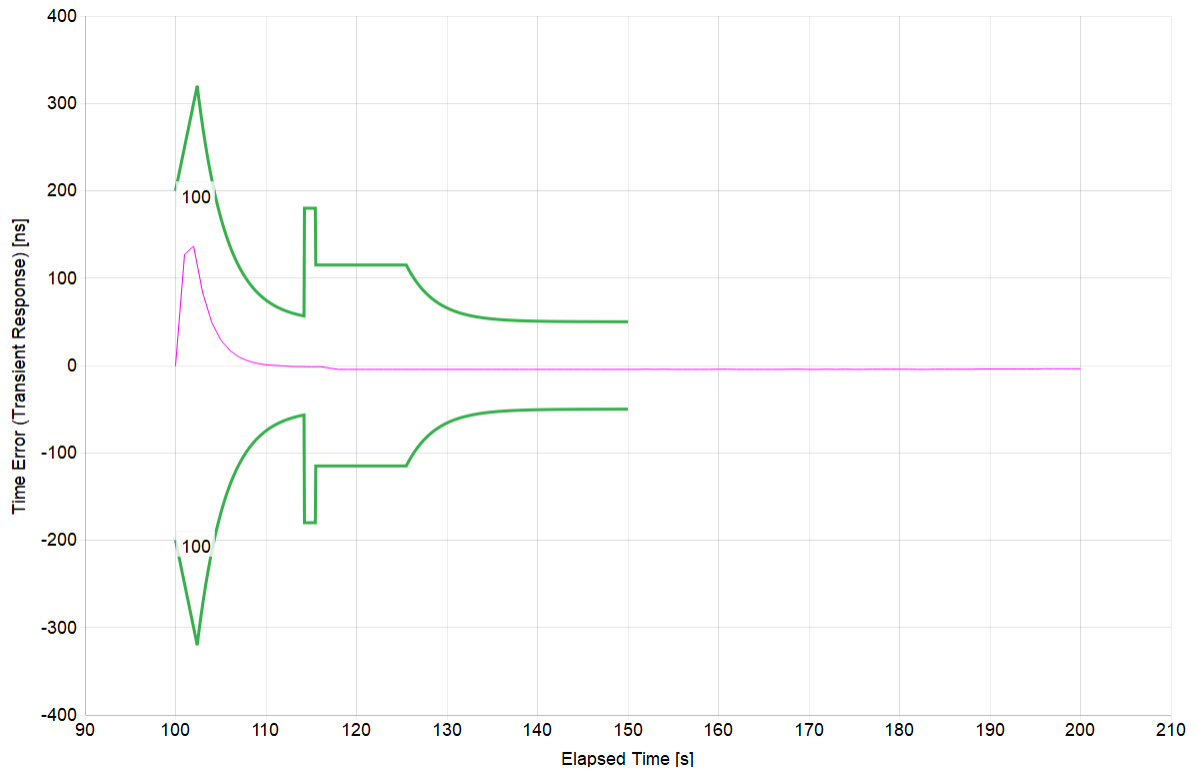
8.1 ONEPPS Analysis

| | |
|------------------------|----------|
| Offset Removal Applied | Off |
| Zero Offset | 15.197ns |



| | |
|--------------|---------|
| Mean [ns] | 15.403 |
| Min [ns] | 10.447 |
| Max [ns] | 151.447 |
| Max-Min [ns] | 141 |

8.2 TransientResponse Analysis



| | |
|---------------------|---------|
| Mean [ns] | 0.884 |
| Min [ns] | -4.512 |
| Max [ns] | 136.488 |
| Max-Min [ns] | 141 |

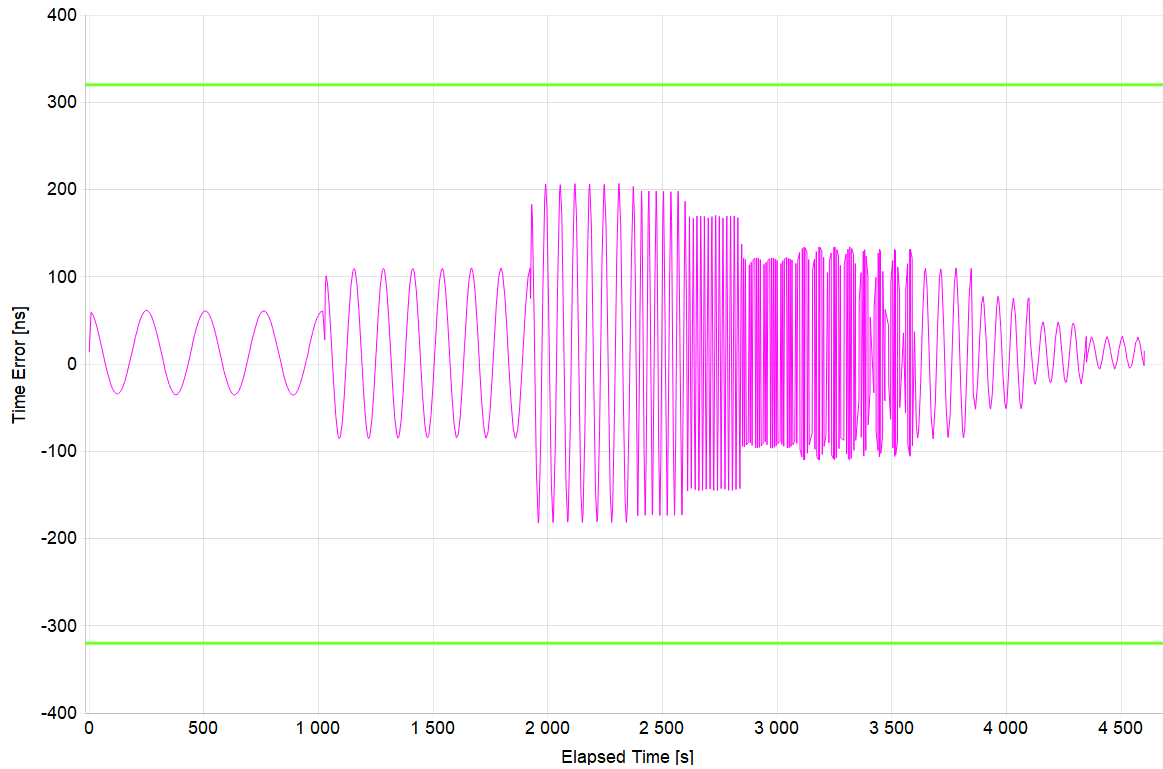
9. G.8273.2: SyncE to 1PPS Noise Transfer

| | |
|-------------------------------|------------------------------|
| Test Description | SyncE to 1PPS Noise Transfer |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 01:16:41 |
| Time to Phase Lock (s) | 15 |

| | |
|---------------------------------------|---|
| All Mask Results | Pass |
| Mask ONEPPS | 0.32μs |
| Mask ONEPPS Result | Pass |
| Mask SyncENoiseTransfer | G.8273.2 Class A,B T-BCs Noise Transfer |
| Mask SyncENoiseTransfer Result | Pass |

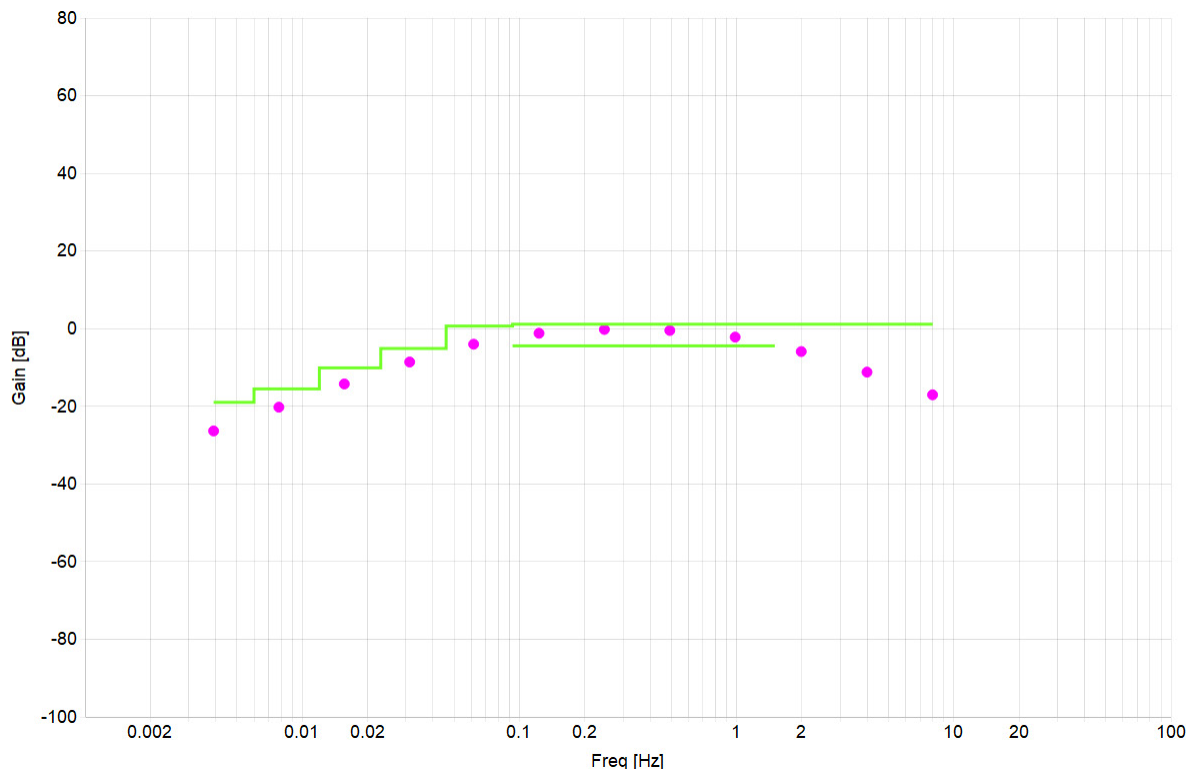
9.1 ONEPPS Analysis

| | |
|-------------------------------|----------|
| Offset Removal Applied | Off |
| Zero Offset | 13.947ns |



| | |
|---------------------|----------|
| Mean [ns] | 12.232 |
| Min [ns] | -182.303 |
| Max [ns] | 206.947 |
| Max-Min [ns] | 389.25 |

9.2 SyncNoiseTransfer Analysis



| Point # | Freq (Hz) | Ampl (ns) | Duration (s) | Pk-Pk Output (ns) | Gain (dB) | Upper Pk-Pk Limit (ns) | Lower Pk-Pk Limit (ns) |
|---------|-----------|-----------|--------------|-------------------|-----------|------------------------|------------------------|
| 1 | 0.00391 | 2000 | 1023.02 | 96.27 | -26.35 | 225 | - |
| 2 | 0.00781 | 2000 | 896.29 | 194.88 | -20.23 | 340 | - |
| 3 | 0.01563 | 2000 | 447.86 | 387.75 | -14.25 | 630 | - |
| 4 | 0.03125 | 1000 | 224.00 | 371.75 | -8.59 | 565 | - |
| 5 | 0.06156 | 500 | 243.66 | 315.10 | -4.01 | 545 | - |
| 6 | 0.12313 | 250 | 251.77 | 218.05 | -1.19 | 285 | 150 |
| 7 | 0.24625 | 250 | 251.78 | 243.98 | -0.21 | 285 | 150 |
| 8 | 0.4925 | 250 | 249.75 | 236.89 | -0.47 | 285 | 150 |
| 9 | 0.985 | 250 | 249.75 | 194.53 | -2.18 | 285 | 150 |
| 10 | 1.985 | 250 | 249.87 | 126.74 | -5.90 | 285 | - |
| 11 | 3.985 | 250 | 249.94 | 68.89 | -11.20 | 285 | - |
| 12 | 7.985 | 250 | 249.97 | 35.15 | -17.04 | 285 | - |

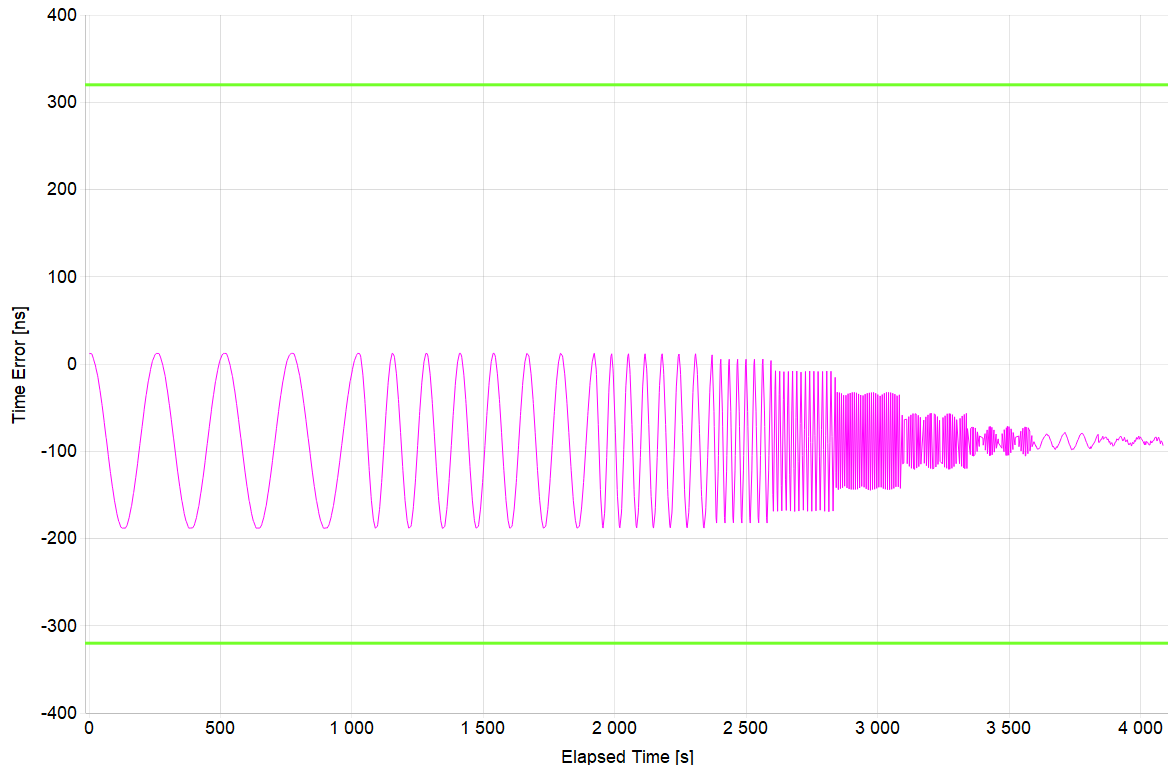
10. G.8273.2: PTP to 1PPS Noise Transfer

| | |
|-------------------------------|----------------------------|
| Test Description | PTP to 1PPS Noise Transfer |
| Report Date | 22-10-18_08-30-41 |
| Packet Rate (pkt/s) | 16 |
| Test Duration | 01:08:04 |
| Time to Phase Lock (s) | 16 |

| | |
|---------------------------|-------------|
| All Mask Results | Pass |
| Mask ONEPPS | 0.32μs |
| Mask ONEPPS Result | Pass |

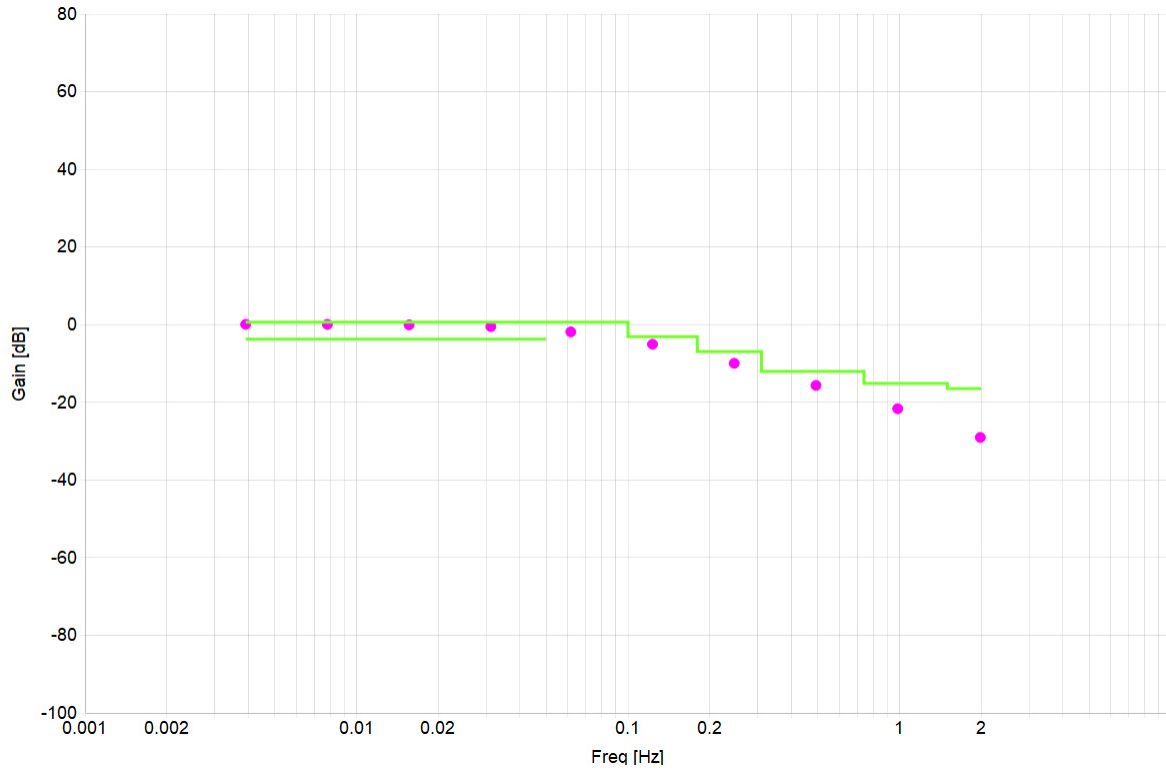
10.1 ONEPPS Analysis

| | |
|-------------------------------|----------|
| Offset Removal Applied | Off |
| Zero Offset | 11.947ns |



| | |
|---------------------|----------|
| Mean [ns] | -88.362 |
| Min [ns] | -188.303 |
| Max [ns] | 12.197 |
| Max-Min [ns] | 200.5 |

10.2 PTPNoiseTransfer Analysis



| Point # | Freq (Hz) | Ampl (ns) | Duration (s) | Pk-Pk Output (ns) | Gain (dB) | Upper Pk-Pk Limit (ns) | Lower Pk-Pk Limit (ns) |
|---------|------------|-----------|--------------|-------------------|-----------|------------------------|------------------------|
| 1 | 0.00390625 | 200 | 1024.00 | 201.97 | 0.09 | 215 | 130 |
| 2 | 0.0078125 | 200 | 896.00 | 201.41 | 0.06 | 215 | 130 |
| 3 | 0.015625 | 200 | 448.00 | 199.06 | -0.04 | 215 | 130 |
| 4 | 0.03125 | 200 | 224.00 | 188.40 | -0.52 | 215 | 130 |
| 5 | 0.0615625 | 200 | 243.65 | 161.23 | -1.87 | 215 | - |
| 6 | 0.123125 | 200 | 251.78 | 111.72 | -5.06 | 140 | - |
| 7 | 0.24625 | 200 | 251.78 | 63.61 | -9.95 | 90 | - |
| 8 | 0.4925 | 200 | 249.75 | 32.92 | -15.67 | 50 | - |
| 9 | 0.985 | 200 | 249.75 | 17.09 | -21.36 | 35 | - |
| 10 | 1.985 | 200 | 249.87 | 6.93 | -29.20 | 30 | - |

11. Revision History

| Revision | Date | Description |
|----------|--------------|--|
| 1.01 | Jul 16, 2024 | Replaced Xilinx with AMD thought the document. |
| 1.00 | May 5, 2023 | Initial release. |

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