

ZCU670 SyncE Switching Performance

Introduction

This report shows the results of SyncE switchover testing with the ZCU670 platform.

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1. Overview

This report shows the results of SyncE switchover testing with the ZCU670 platform. The SyncE switchover testing results in this report measured the response of the SyncE, PTP, and 1PPS to switching the SyncE source by changing the QL levels on the sources or the best PTP master by changing the PTP master clock class.

Three test cases are included in this report. The first case is one PTP master and two SyncE sources. This test shows the effect of switching SyncE sources while the PTP grandmaster remains constant. The second case is two PTP masters and two SyncE sources. This test shows the effect of switching SyncE and PTP sources at the same time. The third case is two PTP masters and one SyncE source. This test shows the effect of switching PTP masters while keeping the SyncE source constant.

2. Results Summary

The following table shows a summary of the SyncE Switchover testing results.

Test Case	Configuration	Results
One Master, Two SyncE Sources	Standalone Unicast BC	Pass
	External Servo Unicast BC – Adaptive Time	Pass
	External Servo Unicast BC – Write Phase	Pass
Two Masters, Two SyncE Sources	Standalone Multicast BC	Pass
	External Servo Multicast BC	Pass
	Standalone Unicast BC	Pass
	External Servo Unicast BC	Pass
Two Masters, One SyncE Source	Standalone Multicast BC	Pass
	External Servo Multicast BC	Pass
	Standalone Unicast BC	Pass
	External Servo Unicast BC	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)

A subset of the SyncE Switchover tests was 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.

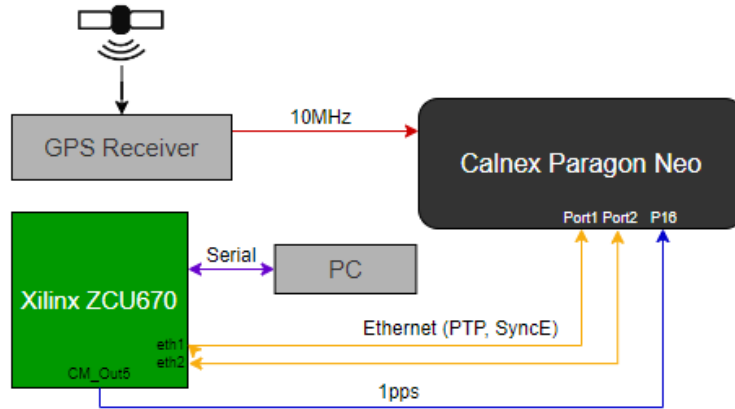


Figure 1. Test Configuration 1

A subset of SyncE Switchover testing was completed in BC configuration using an ADVA OSA 5412 as the GM and SyncE source connected to Eth2.

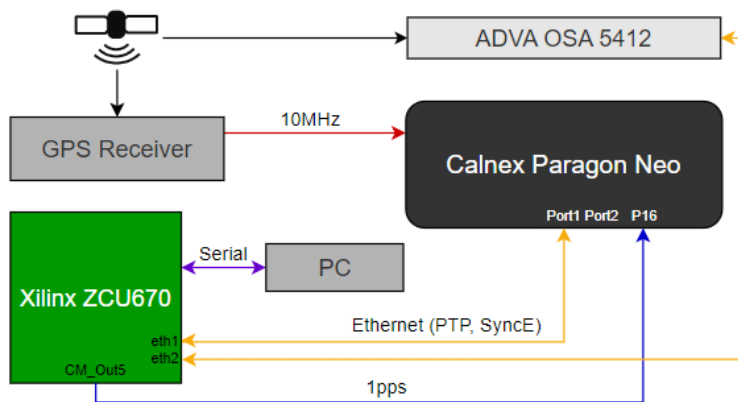


Figure 2. Test Configuration 2

4. SyncE Switchover Tests

SyncE switchover testing measured the SyncE, 1PPS and PTP response to switching either the syncE source by changing QL levels on the sources or the best PTP master by changing the PTP Master clock class.

4.1 One Master, Two SyncE Sources

This test shows the effect of switching SyncE sources while still locked to the same PTP GM. This testing was done in boundary clock configuration with Master 1 as the Calnex Paragon Neo, and Master 2 as the ADVA OSA 5412 (see [Test Configuration 2](#)).

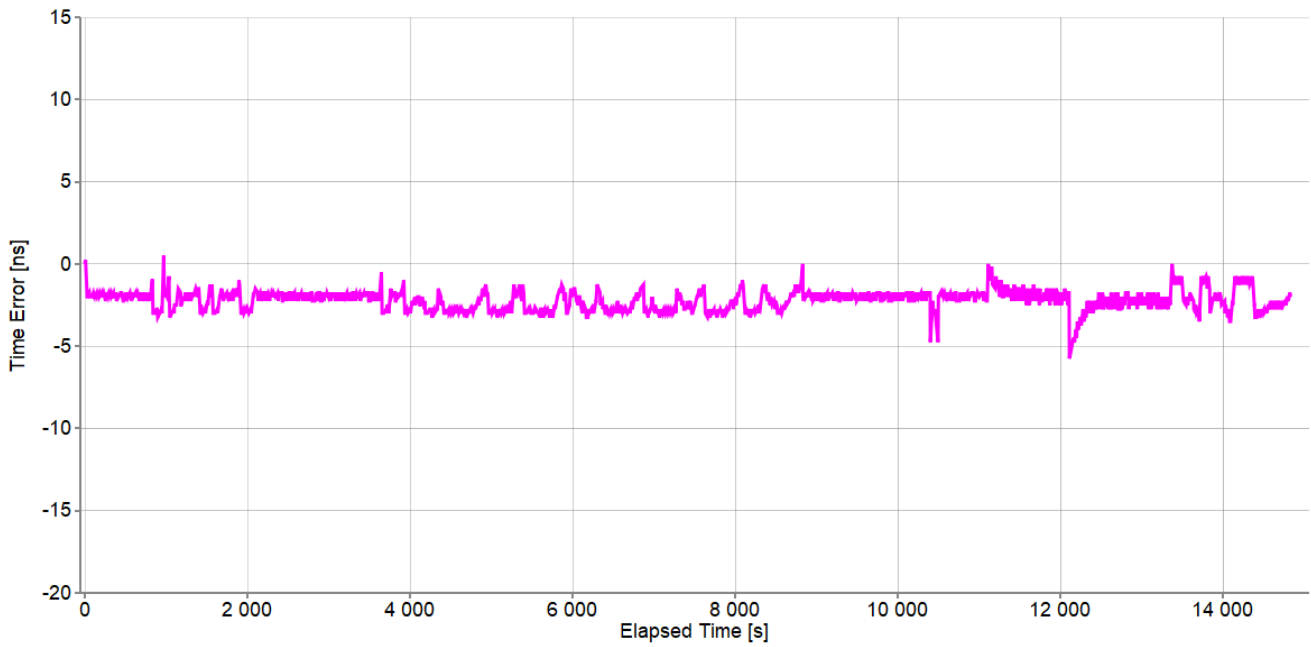
Note that the Calnex Paragon Neo SyncE reference frequency is sourced from a GPS disciplined rubidium oscillator which is much more stable than the ADVA OSA 5412 source that uses a quartz oscillator. The difference was intentional as it clearly demonstrates when one or the other SyncE source is being used by the DUT.

4.1.1 Standalone Unicast BC

Test Description	SyncE Switchover – One Master, Two SyncE
Report Date	2024-09-20 10:09:08
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-17 14:49:37
Test Duration	04:07:09
Test Configuration	2

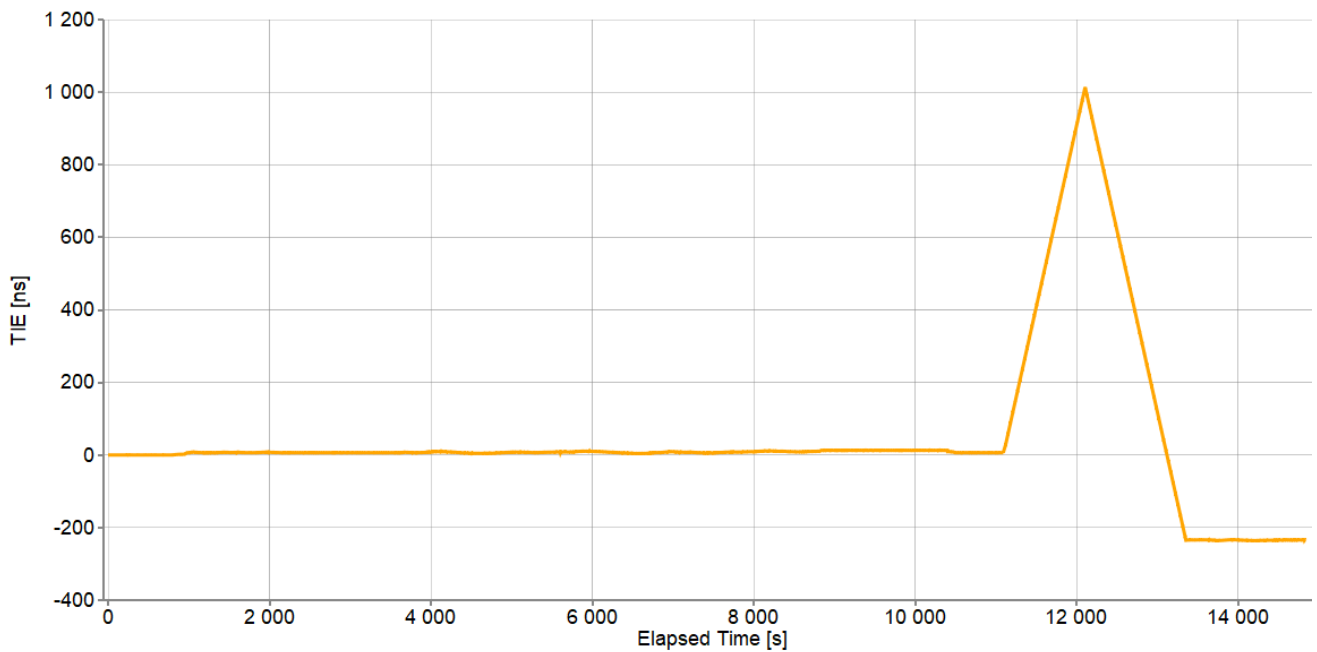
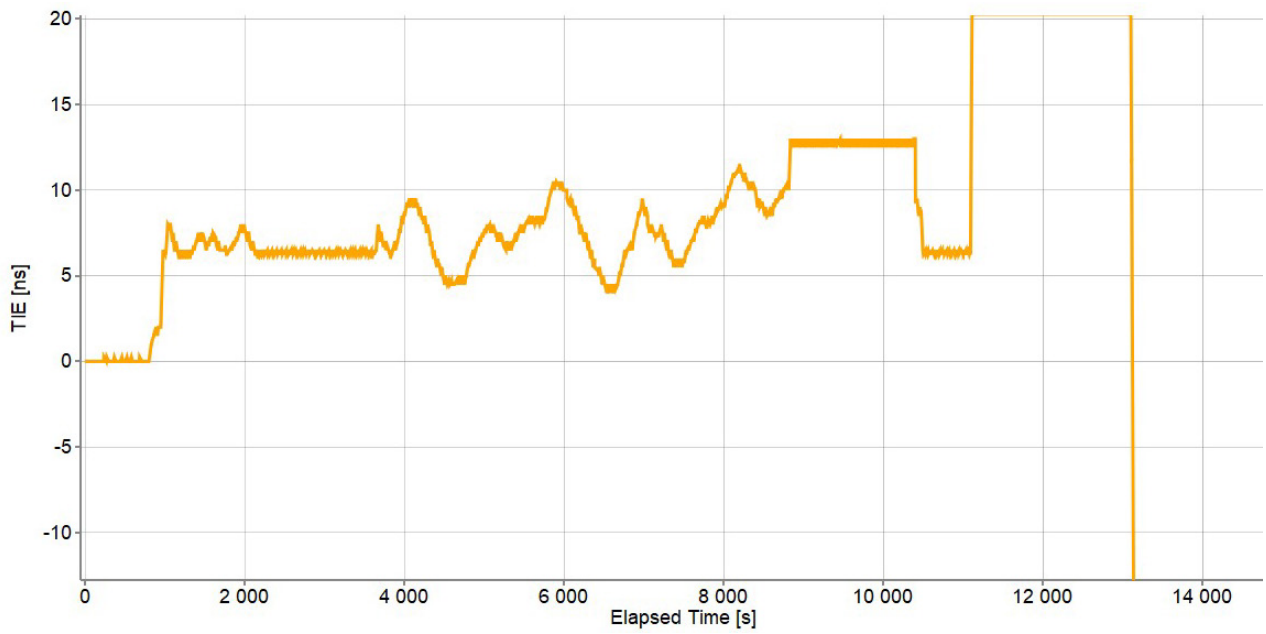
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo	Paragon Neo (PRTC)
830	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
970	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
1046	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
2144	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
3648	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
8830	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
10399	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
10494	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
11090	1ppb offset on Paragon Neo SyncE	Paragon Neo	Paragon Neo (PRTC)
11090	-1ppb offset on Paragon Neo SyncE	Paragon Neo	Paragon Neo (PRTC)
13370	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)

4.1.1.1 ONEPPS Analysis



Pk-Pk [ns]	-5.75
Mean [ns]	-2.261
Min [ns]	0.5
Max [ns]	6.25

4.1.1.2 TIE Analysis



Pk-Pk [ns]	1249.5
Mean [ns]	49.645
Min [ns]	-236
Max [ns]	1013.5

4.1.1.3 ESMC Analysis

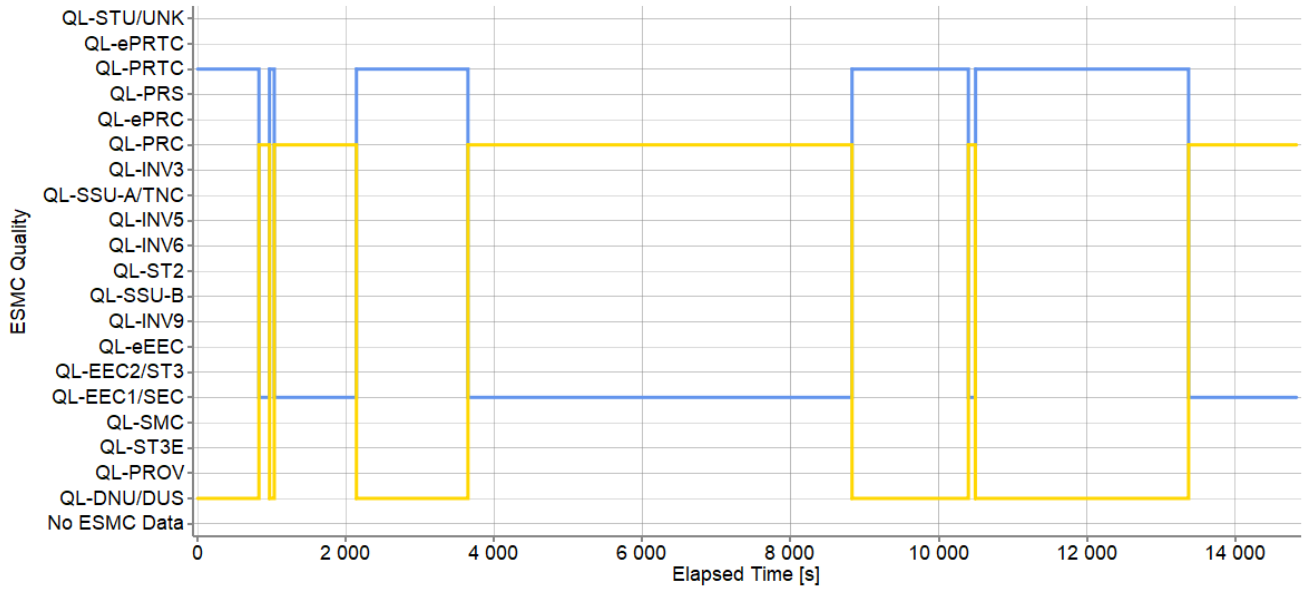


ESMC Quality: Tx (Port 1)

Date: 2024-09-17
File: EsmcStatus100.CDF

ESMC Quality: Rx (Port 1)

Date: 2024-09-17
File: EsmcStatus100.CDF

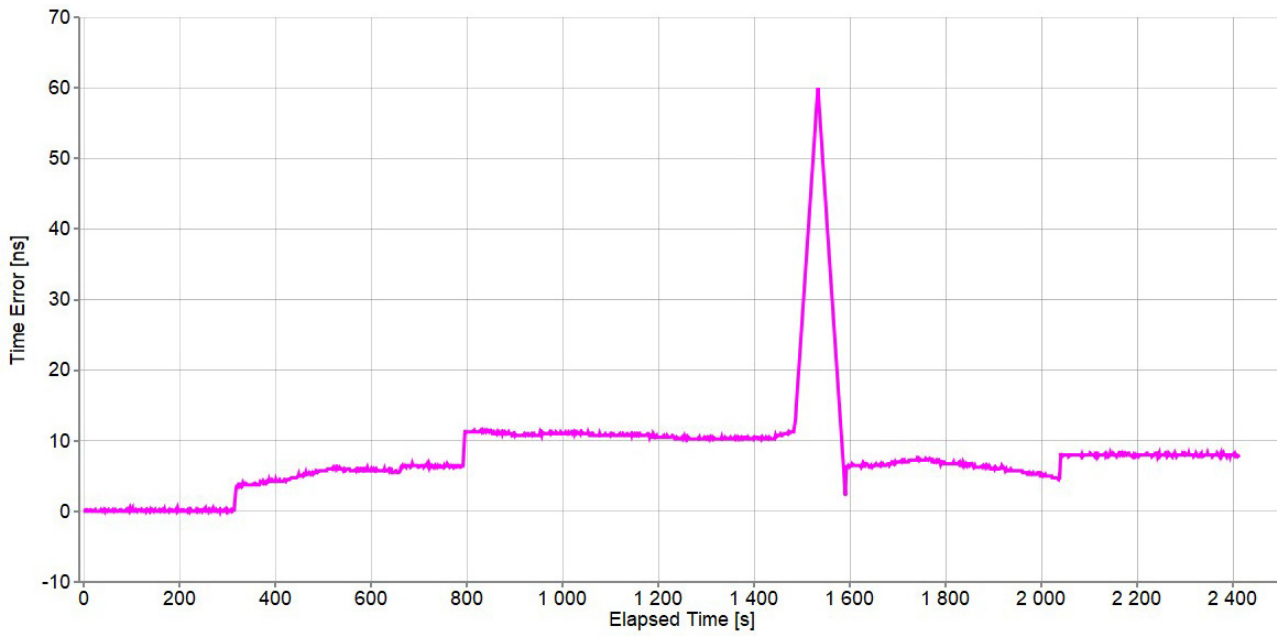


4.1.2 External Servo Unicast BC – Adaptive Time

Test Description	SyncE Switchover – 1Master, 2 SyncE
Report Date	2024-09-20 10:58:11
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-17 20:00:16
Test Duration	00:00:40:16
Test Configuration	2

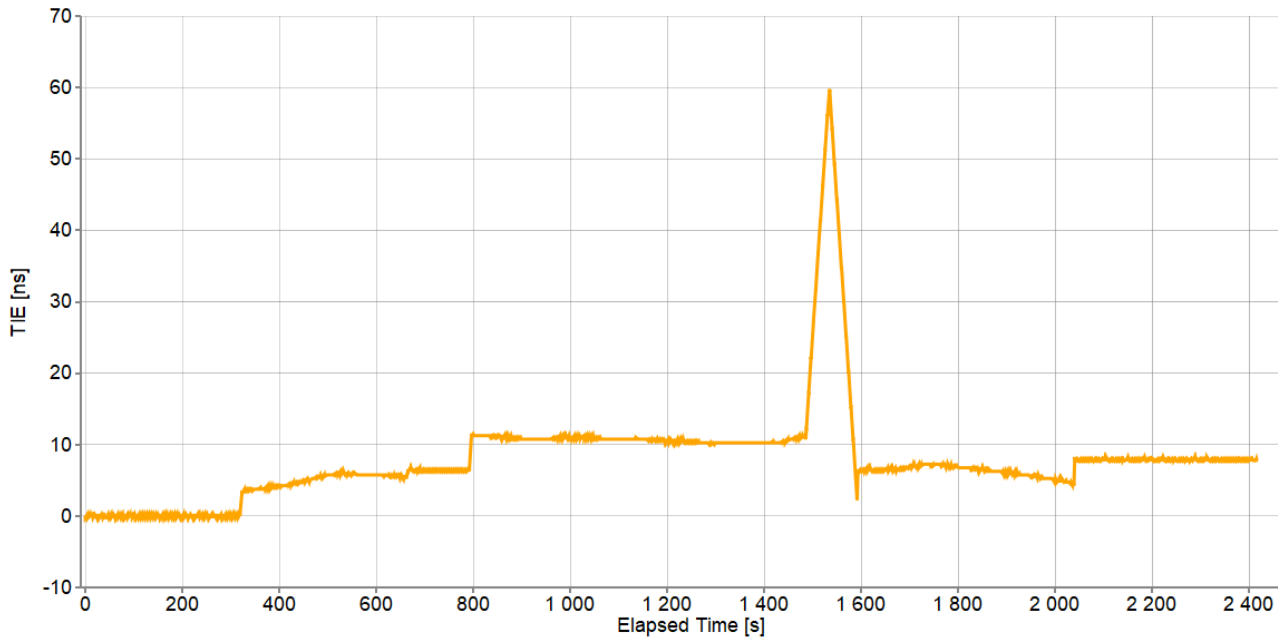
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo	Paragon Neo (PRTC)
319	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
663	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
795	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
1300	1ppb offset on Paragon Neo SyncE	Paragon Neo	ADVA (PRC)
1485	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
1534	-1ppb offset on Paragon Neo SyncE	Paragon Neo	Paragon Neo (PRTC)
1592	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
1650	0ppb offset on Paragon Neo SyncE	Paragon Neo	ADVA (PRC)
2039	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)

4.1.2.1 ONEPPS Analysis



Pk-Pk [ns]	60
Mean [ns]	8.037
Min [ns]	0
Max [ns]	60

4.1.2.2 TIE Analysis



Pk-Pk [ns]	60
Mean [ns]	7.949
Min [ns]	-0.25
Max [ns]	59.75

4.1.2.3 ESMC Analysis

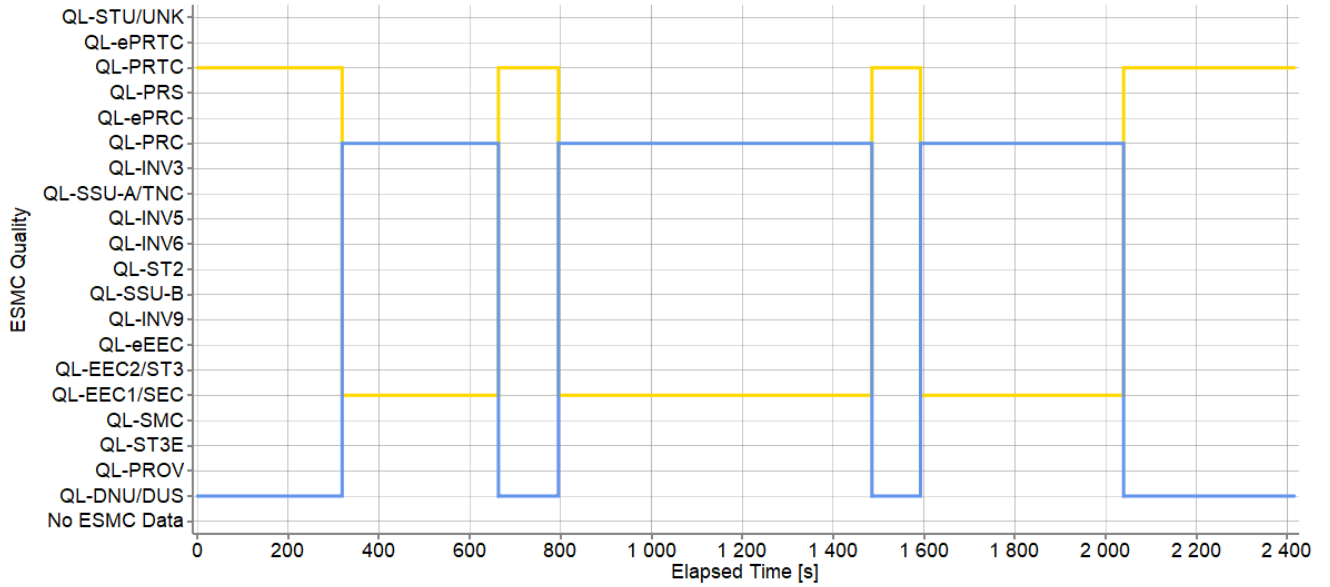


ESMC Quality: Tx (Port 1)

Date: 2024-09-17
File: EsmcStatus100.CDF

ESMC Quality: Rx (Port 1)

Date: 2024-09-17
File: EsmcStatus100.CDF

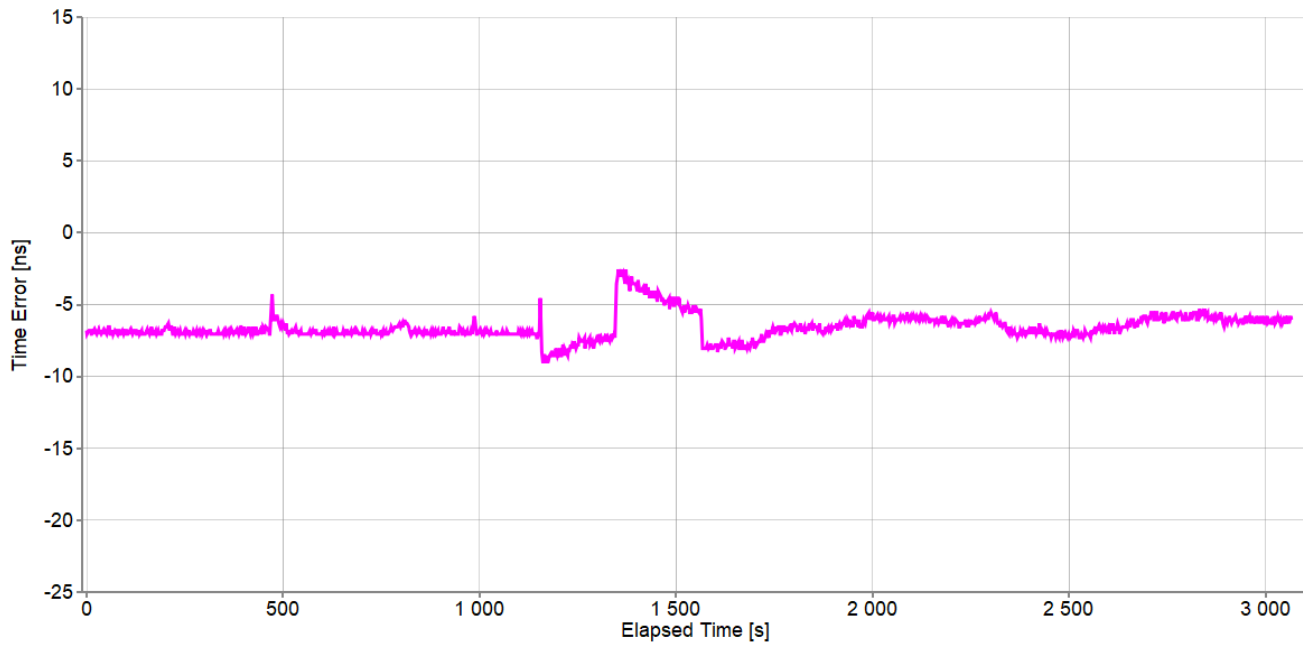


4.1.3 External Servo Unicast BC – Write Phase

Test Description	SyncE Switchover – One Master, Two SyncE
Report Date	2024-09-20 11:09:41
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-17 20:46:32
Test Duration	00:00:51:08
Test Configuration	2

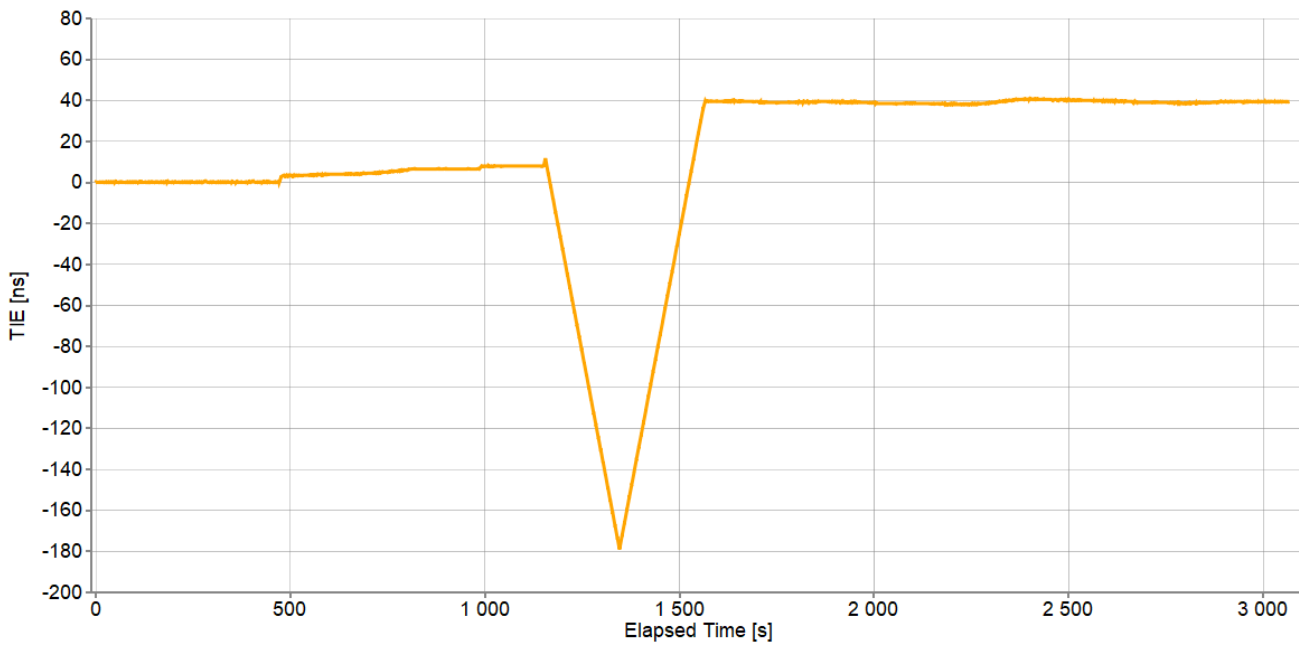
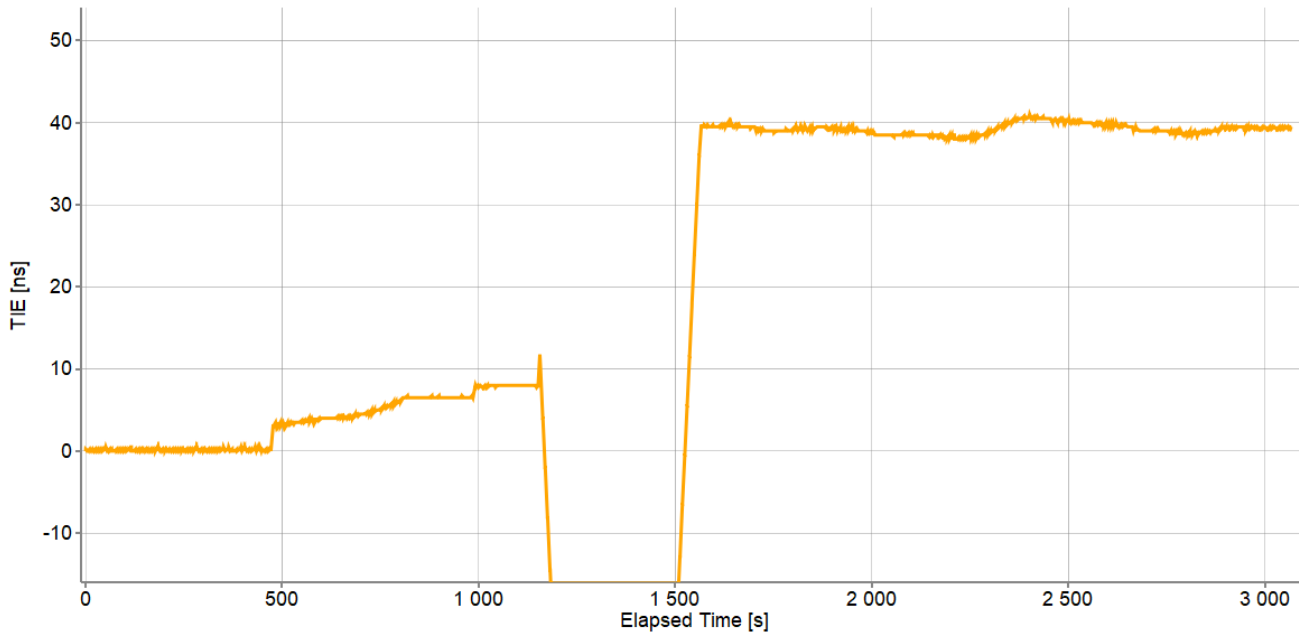
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo	Paragon Neo (PRTC)
472	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
808	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
986	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
1050	-1ppb offset on Paragon Neo SyncE	Paragon Neo	ADVA (PRC)
1155	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)
1345	1ppb offset on Paragon Neo SyncE	Paragon Neo	Paragon Neo (PRTC)
1564	Paragon Neo SyncE QL EEC1	Paragon Neo	ADVA (PRC)
2000	0ppb offset on Paragon Neo SyncE	Paragon Neo	ADVA (PRC)
2897	Paragon Neo SyncE QL PRTC	Paragon Neo	Paragon Neo (PRTC)

4.1.3.1 ONEPPS Analysis



Pk-Pk [ns]	6.5
Mean [ns]	-6.589
Min [ns]	-9.053
Max [ns]	-2.553

4.1.3.2 TIE Analysis



Pk-Pk [ns]	220
Mean [ns]	10.384
Min [ns]	-179
Max [ns]	41

4.1.3.3 ESMC Analysis

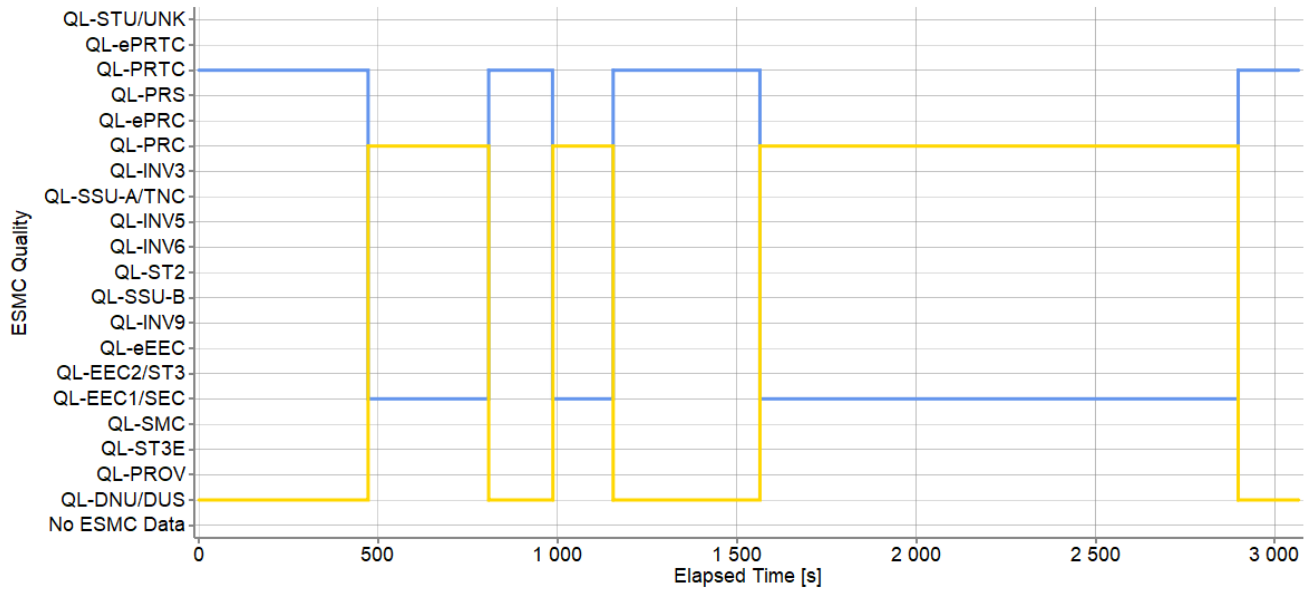


ESMC Quality: Tx (Port 1)

Date: 2024-09-17
File: EsmcStatus100.CDF

ESMC Quality: Rx (Port 1)

Date: 2024-09-17
File: EsmcStatus100.CDF



4.2 Two Masters, Two SyncE Sources

This test shows the effect of switching SyncE and PTP sources at the same time (emulates changing a cable). A script was used to change the SyncE QL level and PTP Master Clock Class at the same time.

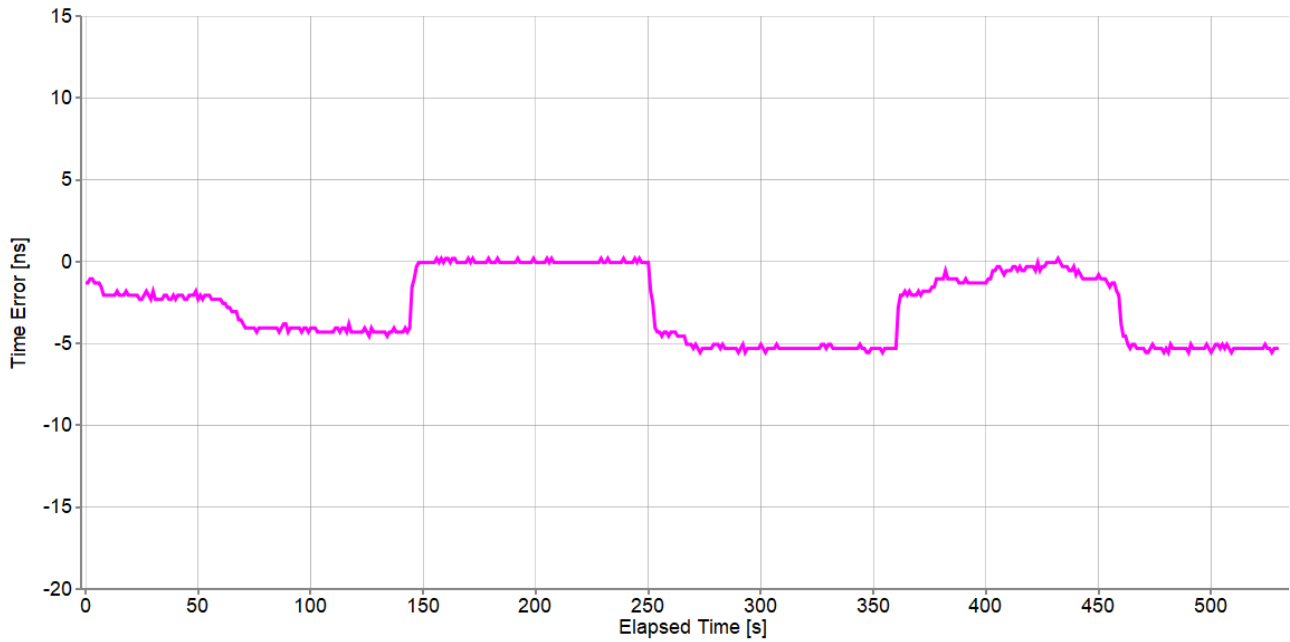
Both masters come from the Calnex Paragon Neo for these tests and the device is operated in Slave Clock mode (see [Test Configuration 1](#)).

4.2.1 Standalone Multicast BC

Test Description	SyncE Switchover – Two Masters, Two SyncE
Report Date	2024-09-20 11:34:55
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-18 20:36:35
Test Duration	00:00:08:54
Test Configuration	1

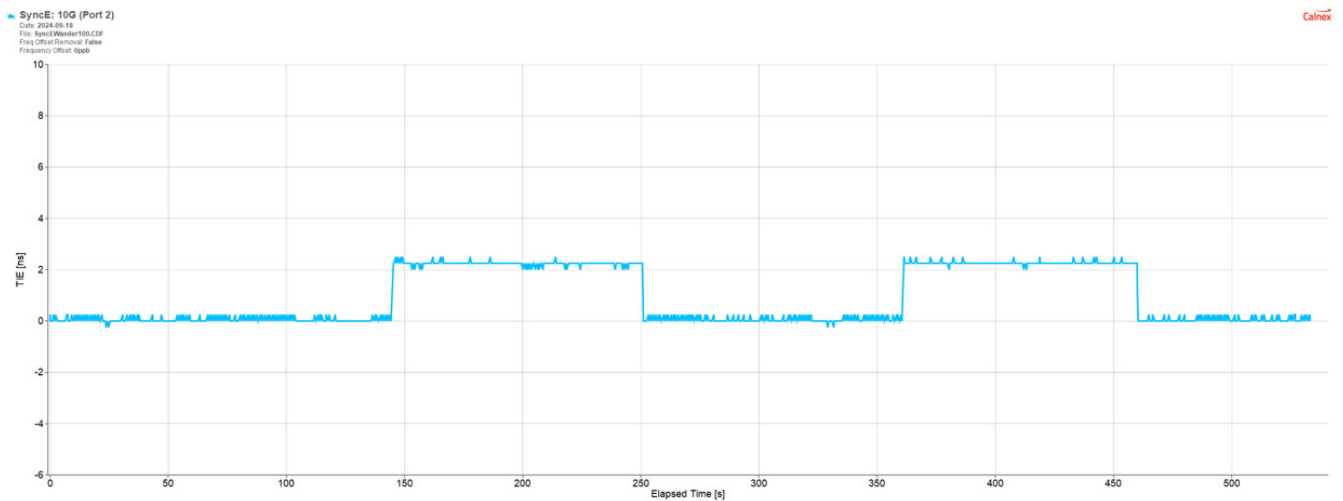
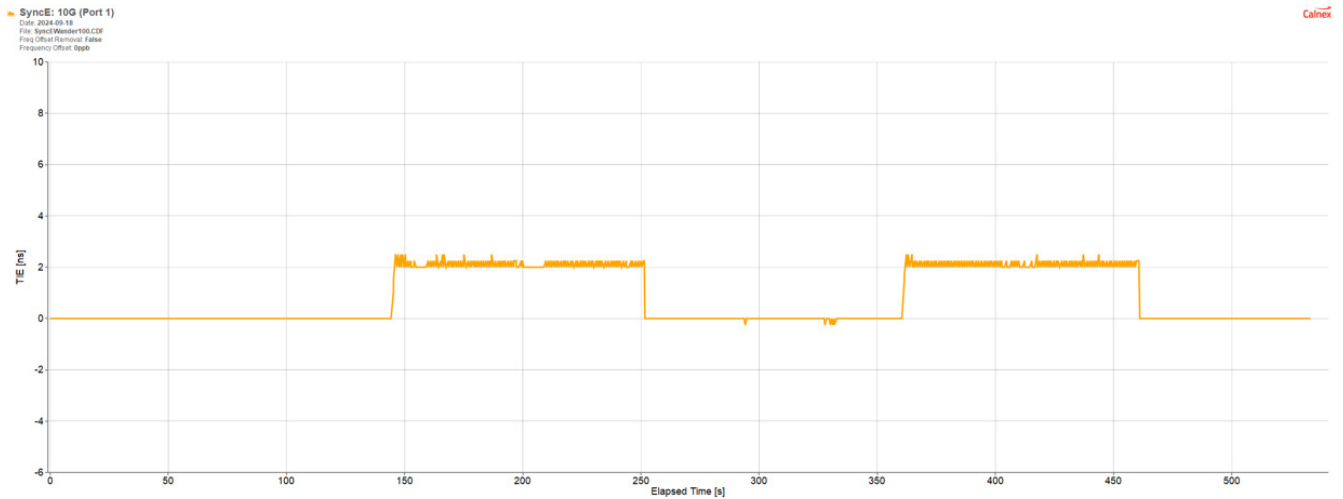
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
146	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
252	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
362	Port 1 Clock Class 7 and QL EEC Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
461	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.2.1.1 ONEPPS Analysis



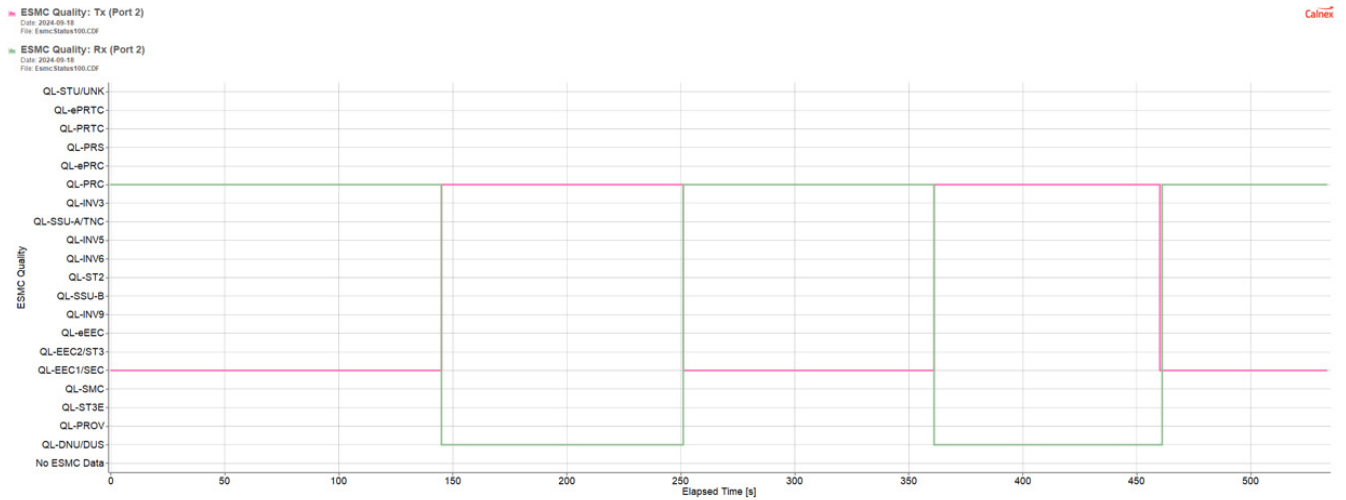
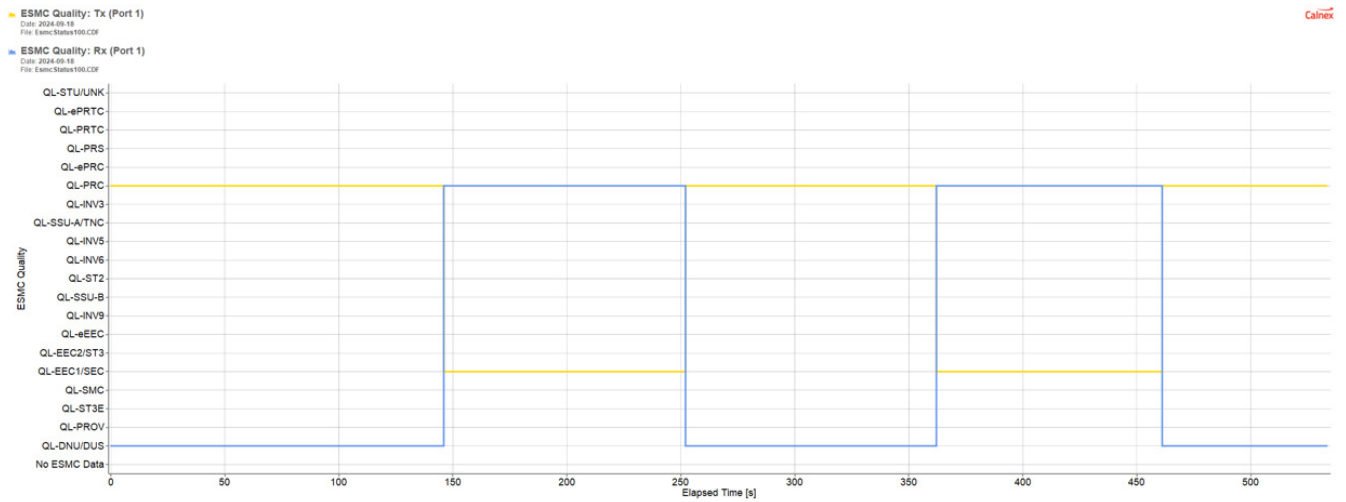
Pk-Pk [ns]	5.75
Mean [ns]	-2.82
Min [ns]	-5.553
Max [ns]	0.197

4.2.1.2 TIE Analysis



Port 1	
Pk-Pk [ns]	2.75
Mean [ns]	0.797
Min [ns]	-0.25
Max [ns]	2.5
Port 2	
Pk-Pk [ns]	2.75
Mean [ns]	0.881
Min [ns]	-0.25
Max [ns]	2.5

4.2.1.3 ESC Analysis

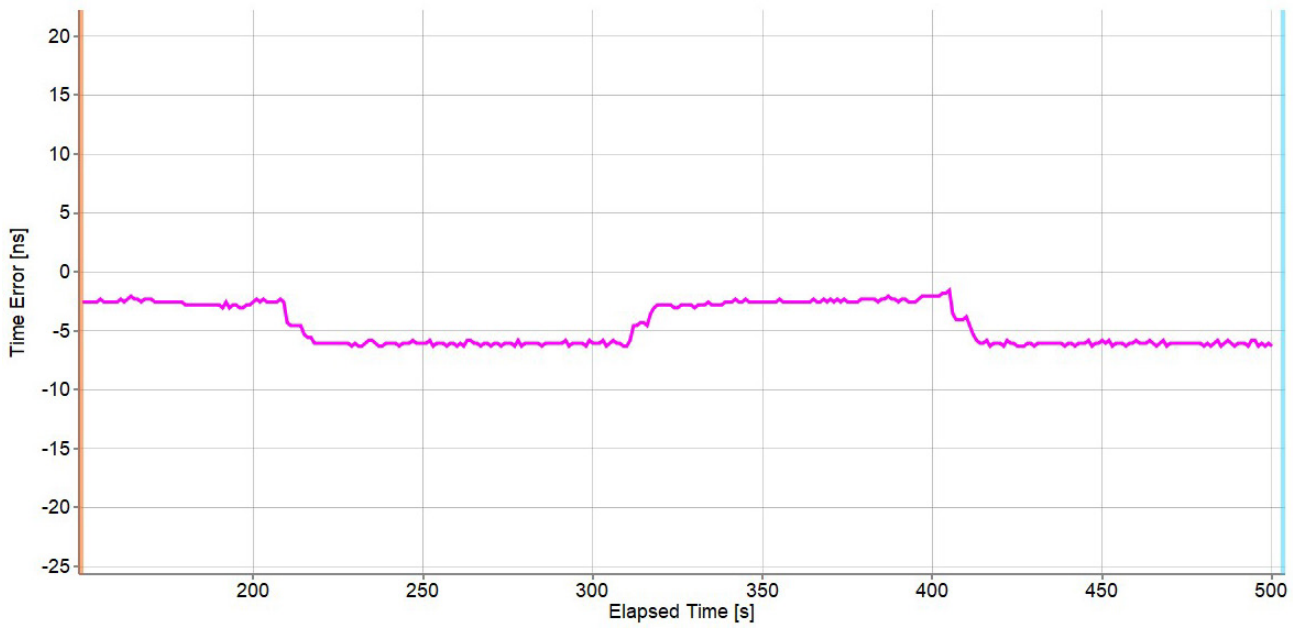


4.2.2 External Servo Multicast BC

Test Description	SyncE Switchover – Two Masters, Two SyncE
Report Date	2024-09-20 11:52:28
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-18 20:52:17
Test Duration	00:00:08:25
Test Configuration	1

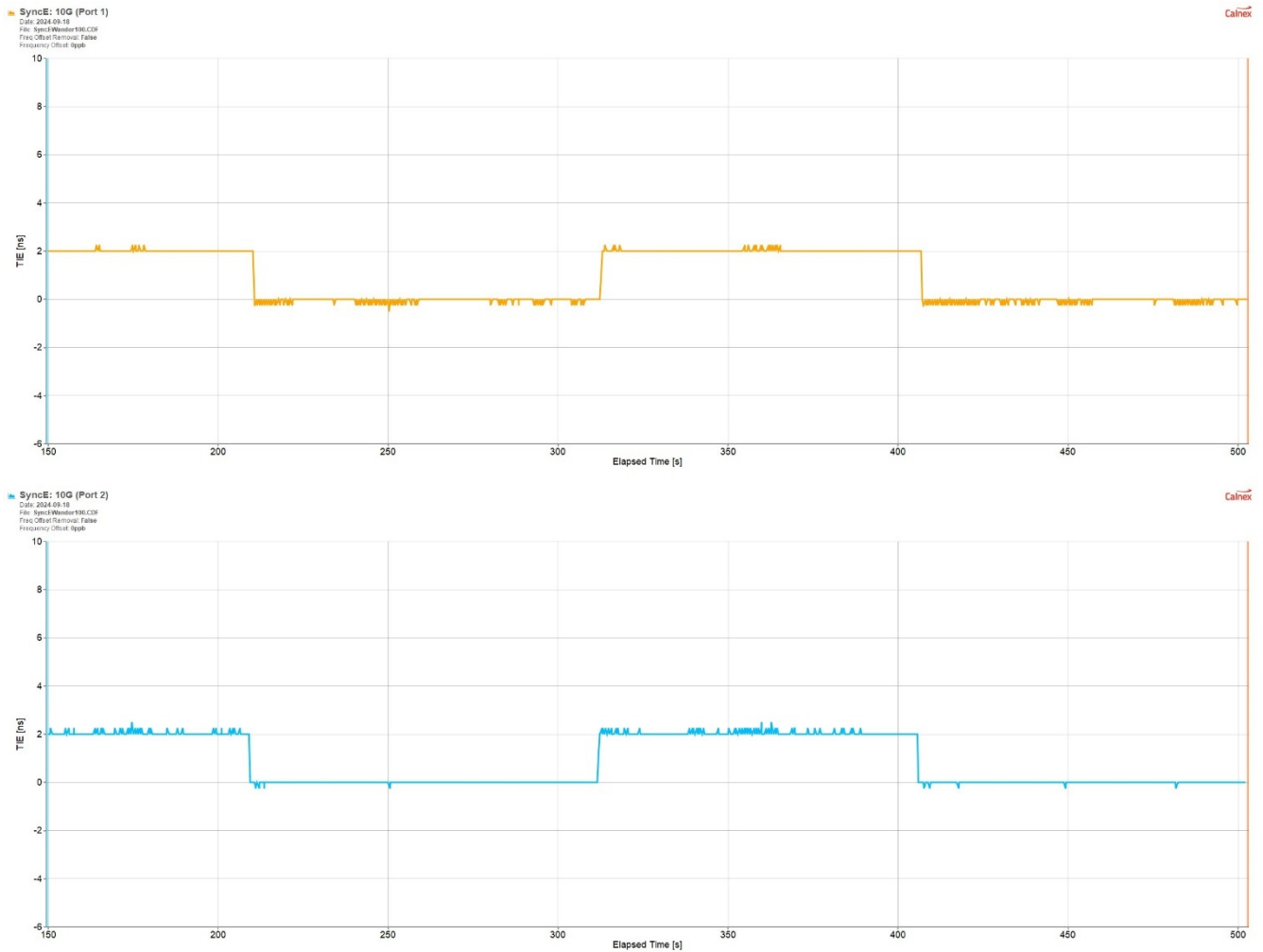
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
109	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
150	Start Data Capture	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
211	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
313	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
407	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.2.2.1 ONEPPS Analysis



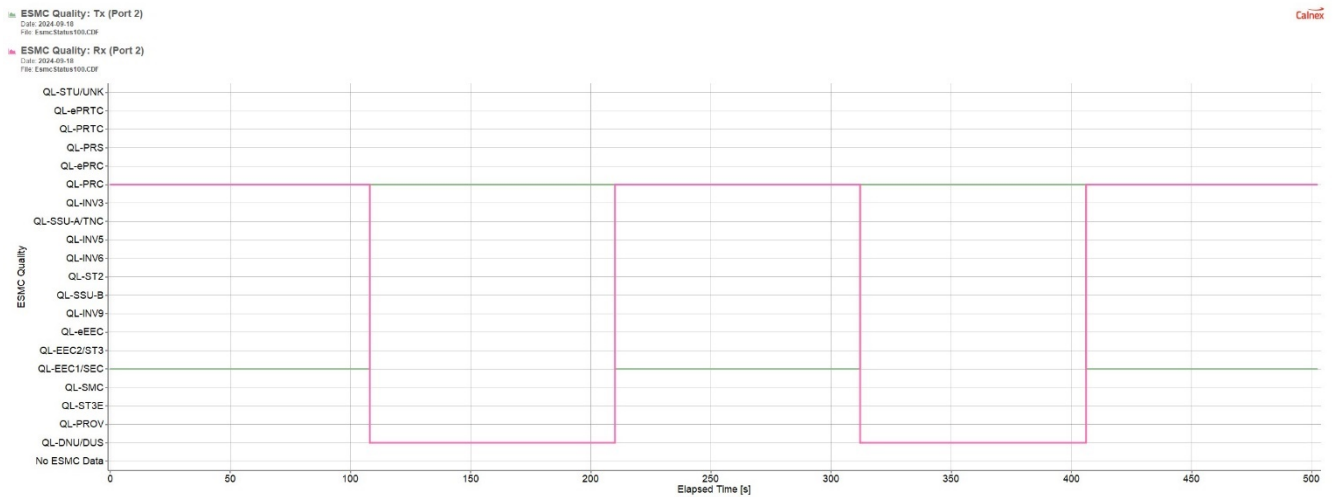
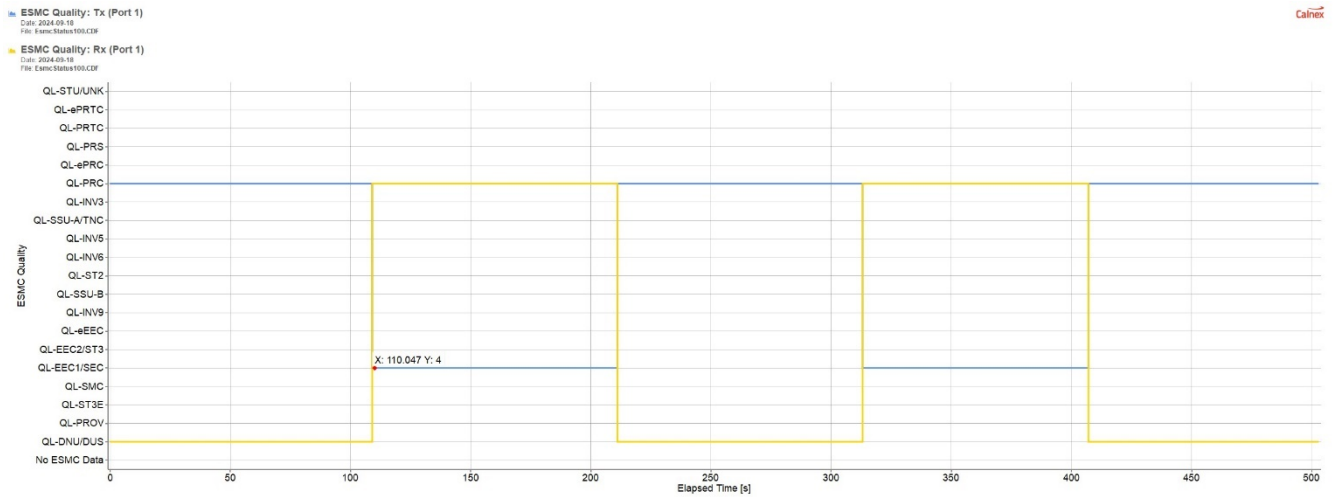
Pk-Pk [ns]	4.75
Mean [ns]	-4.811
Min [ns]	-6.033
Max [ns]	-1.553

4.2.2.2 TIE Analysis



Port 1	
Pk-Pk [ns]	2.75
Mean [ns]	0.865
Min [ns]	-0.25
Max [ns]	2.5
Port 2	
Pk-Pk [ns]	2.75
Mean [ns]	0.786
Min [ns]	-0.25
Max [ns]	2.5

4.2.2.3 ESMC Analysis



4.2.3 Standalone Unicast BC

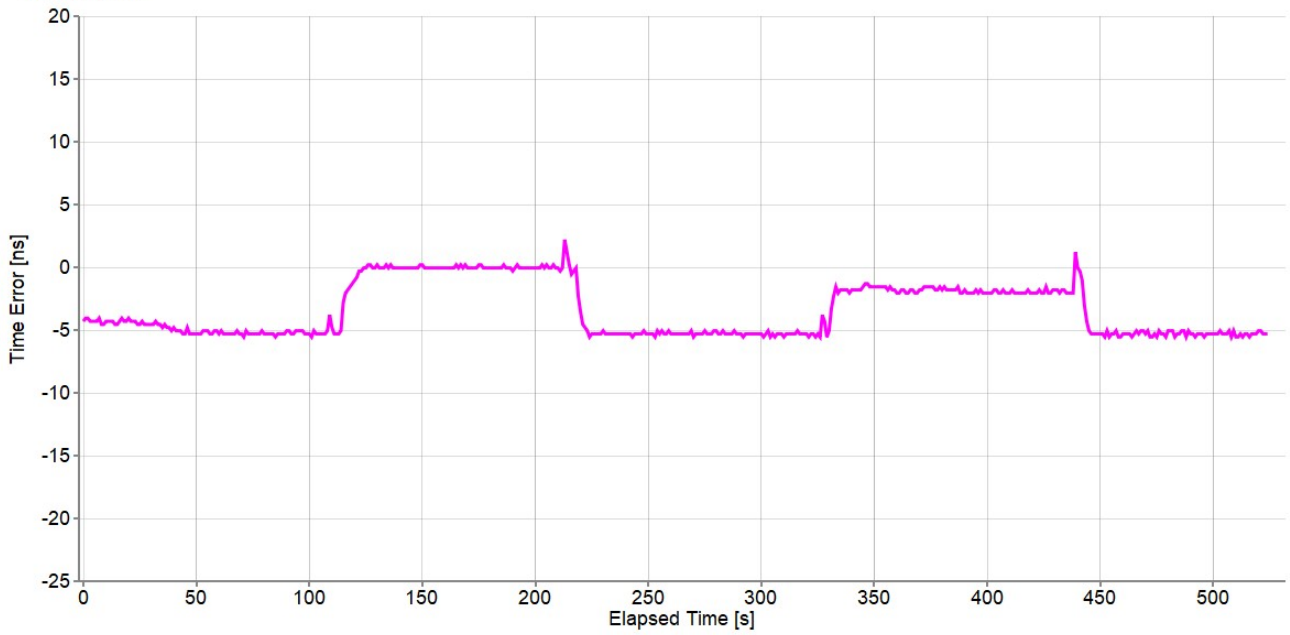
Test Description	SyncE Switchover – Two Masters, Two SyncE
Report Date	2024-09-20 12:02:25
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-18 21:03:54
Test Duration	00:00:08:48
Test Configuration	1

Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
110	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
214	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
329	Port 1 Clock Class 7 and QL EEC Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
440	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.2.3.1 ONEPPS Analysis

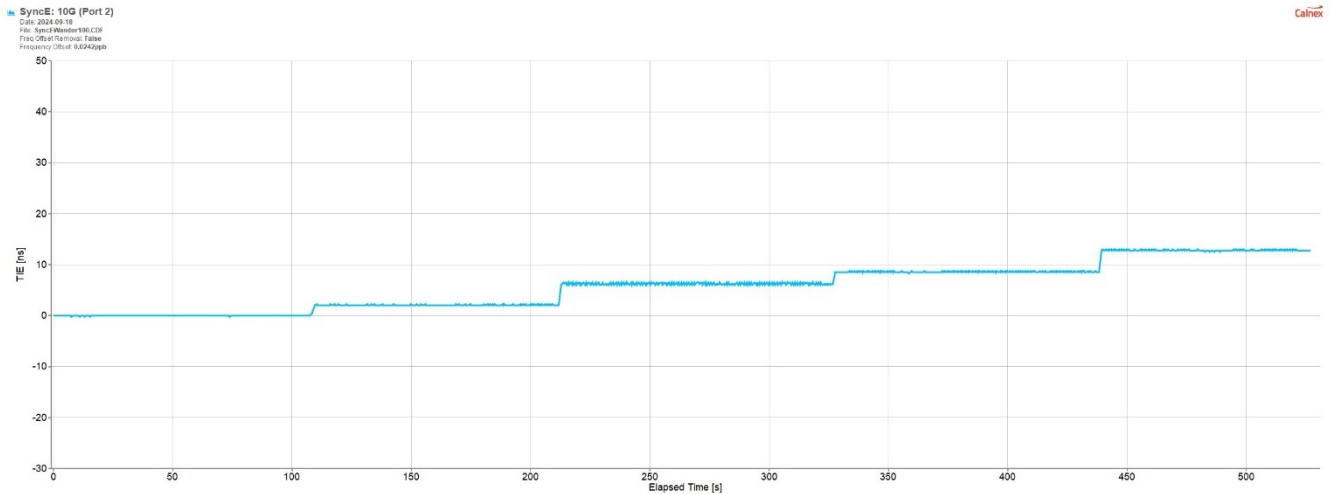
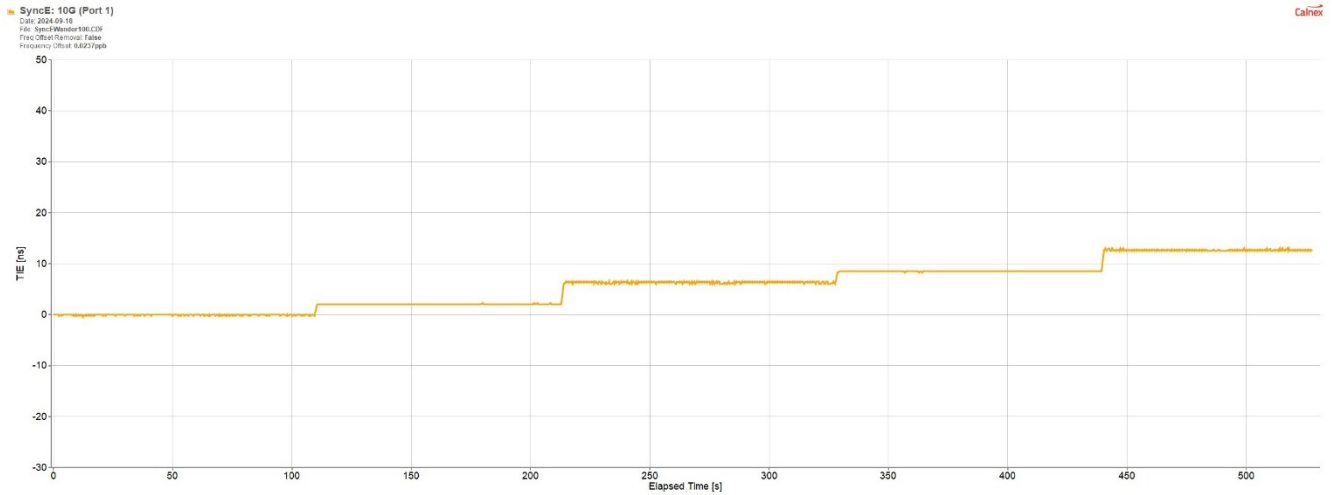


1pps TE Absolute
 Date: 2024-09-18
 File: OnePpsAccuracyTod100.CDF
 Offset Removal Applied: False
 Zero Offset: -4.303ns



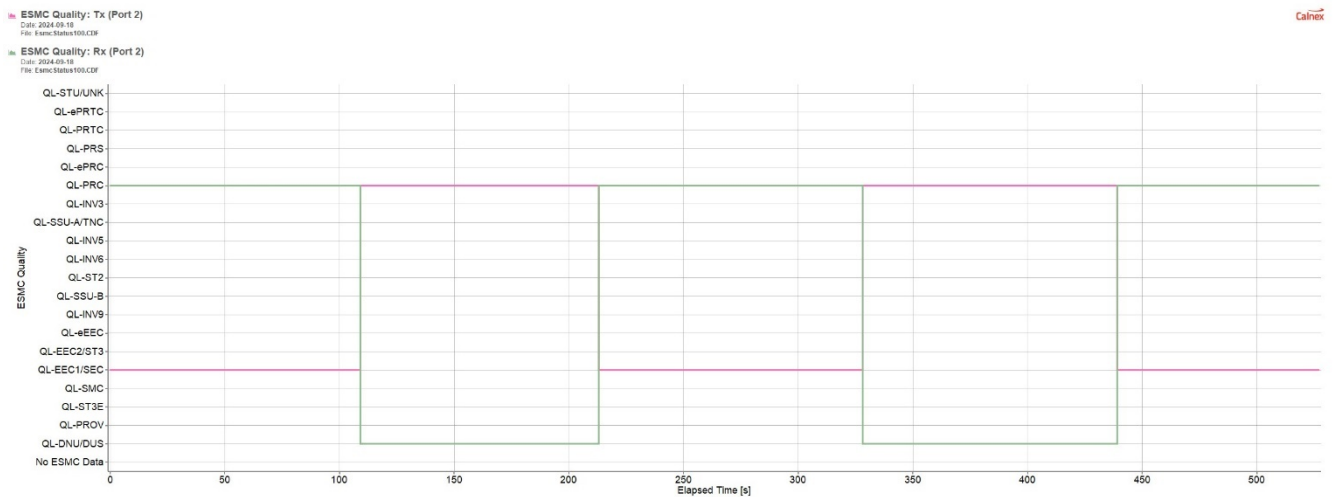
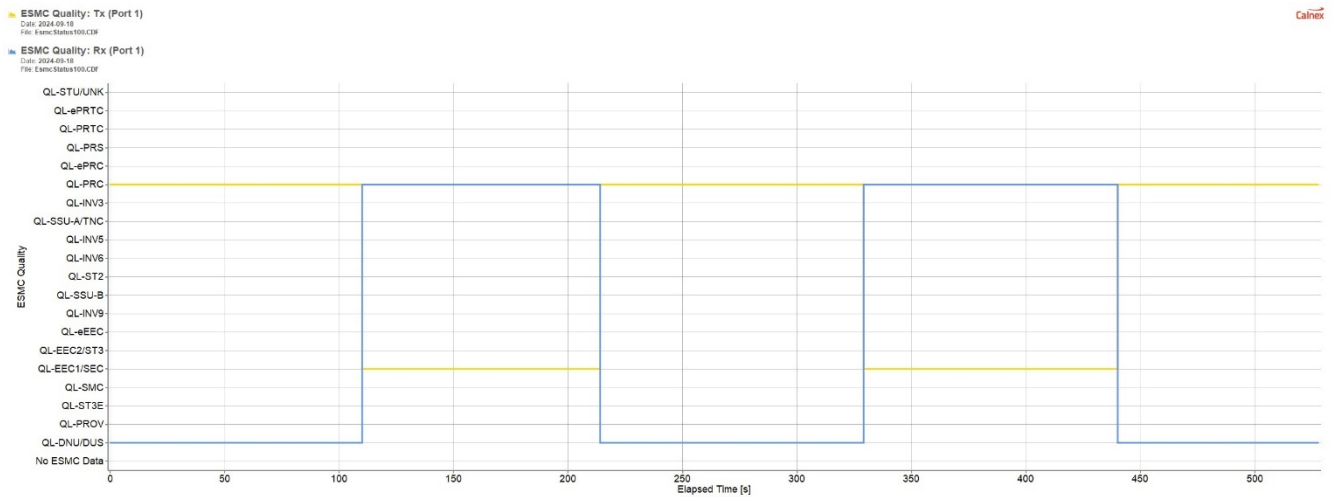
Pk-Pk [ns]	
Mean [ns]	
Min [ns]	
Max [ns]	

4.2.3.2 TIE Analysis



Port 1	
Pk-Pk [ns]	13.5
Mean [ns]	5.658
Min [ns]	-0.5
Max [ns]	13
Port 2	
Pk-Pk [ns]	13
Mean [ns]	5.9696
Min [ns]	-0.25
Max [ns]	13

4.2.3.3 ESMC Analysis



4.2.4 External Servo Unicast BC

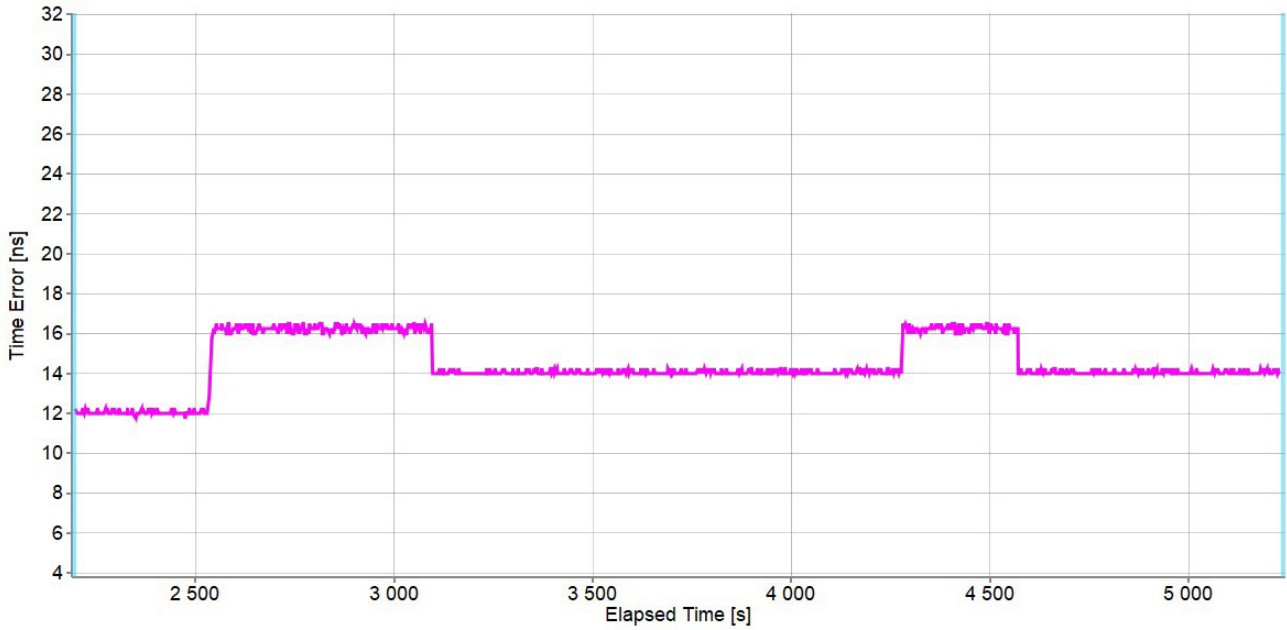
Test Description	SyncE Switchover – Two Masters, Two SyncE
Report Date	2024-09-20 12:08:54
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-19 12:06:08
Test Duration	00:01:27:13
Test Configuration	1

Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
152	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
1097	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
1616	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
2041	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
2200	Start Data Capture	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
2532	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
3096	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
4278	Port 1 Clock Class 7 and QL EEC1 Port 2 Clock Class 6 and QL PRC	Paragon Neo Port 2	Paragon Neo Port 2 (PRC)
4571	Port 1 Clock Class 6 and QL PRC Port 2 Clock Class 6 and QL EEC1	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.2.4.1 ONEPPS Analysis

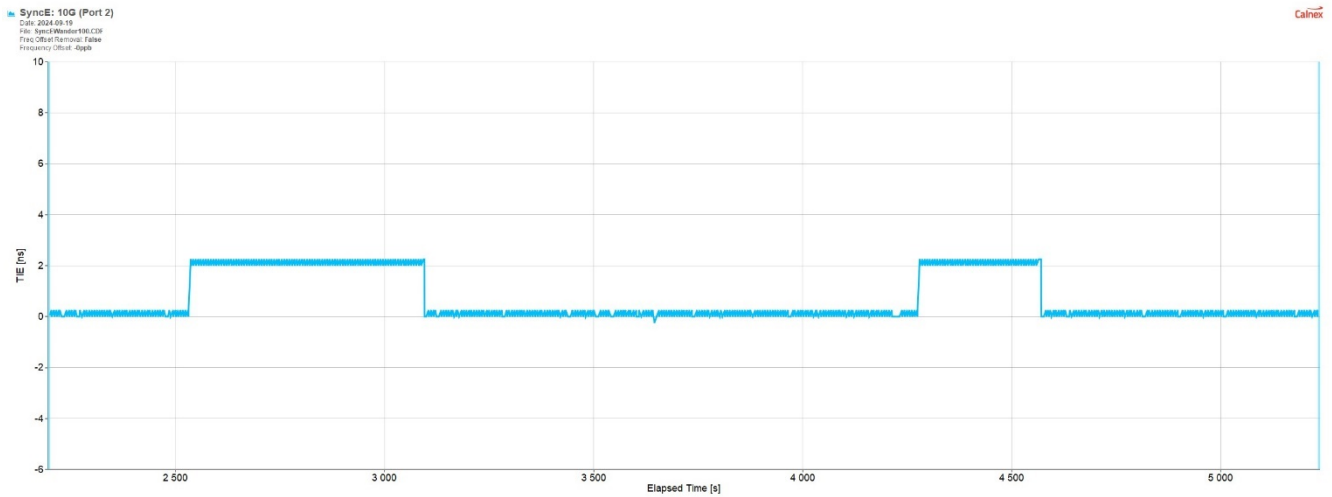
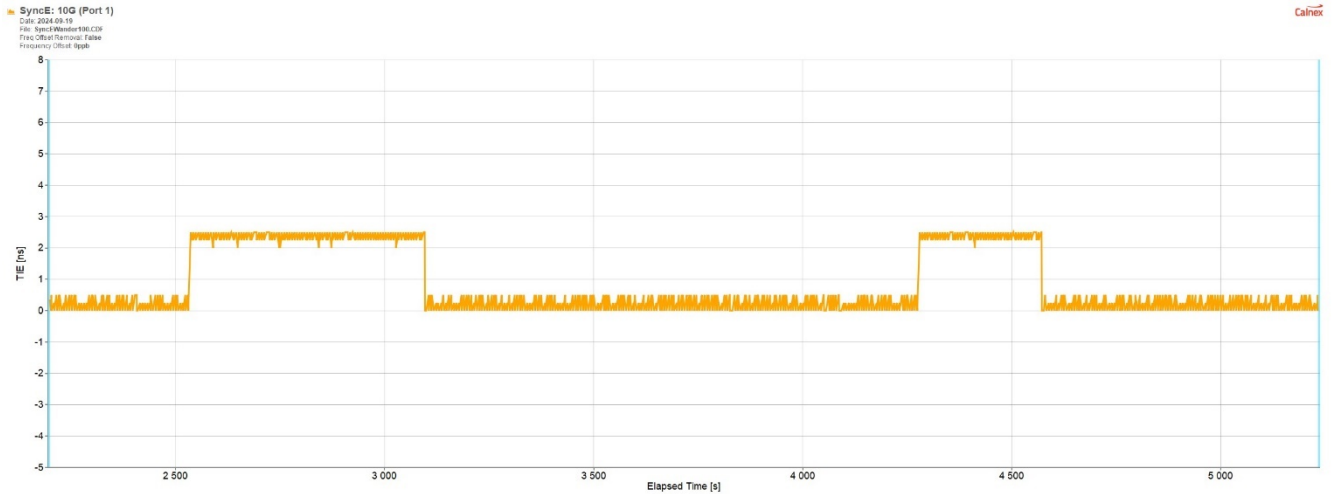


1pps TE Relative
 Date: 2024-09-19
 File: OnePpsAccuracyTod100.CDF
 Offset Removal Applied: True
 Zero Offset: 0ns



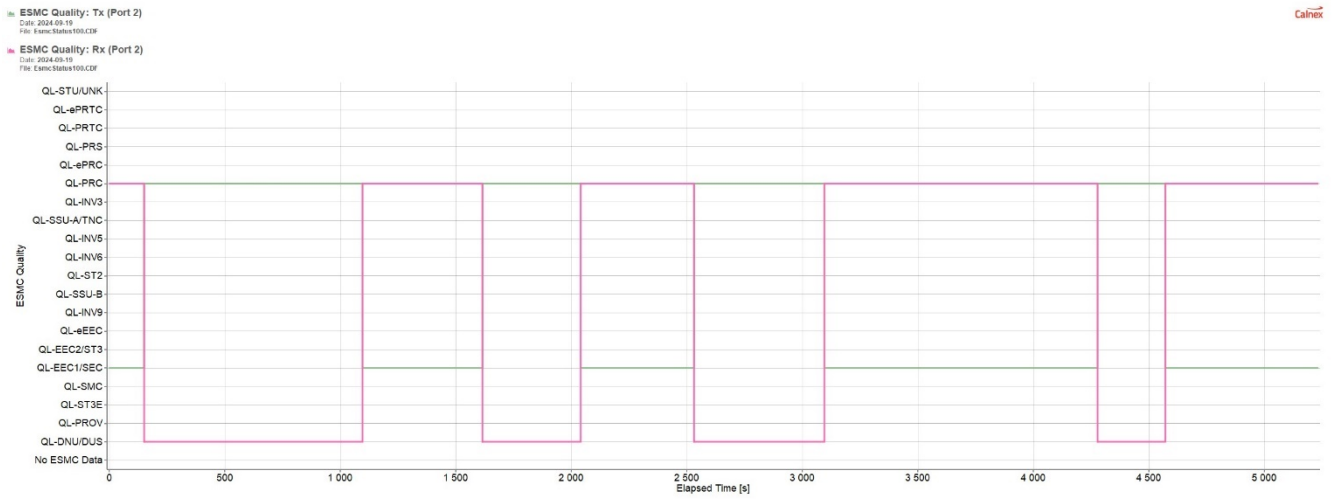
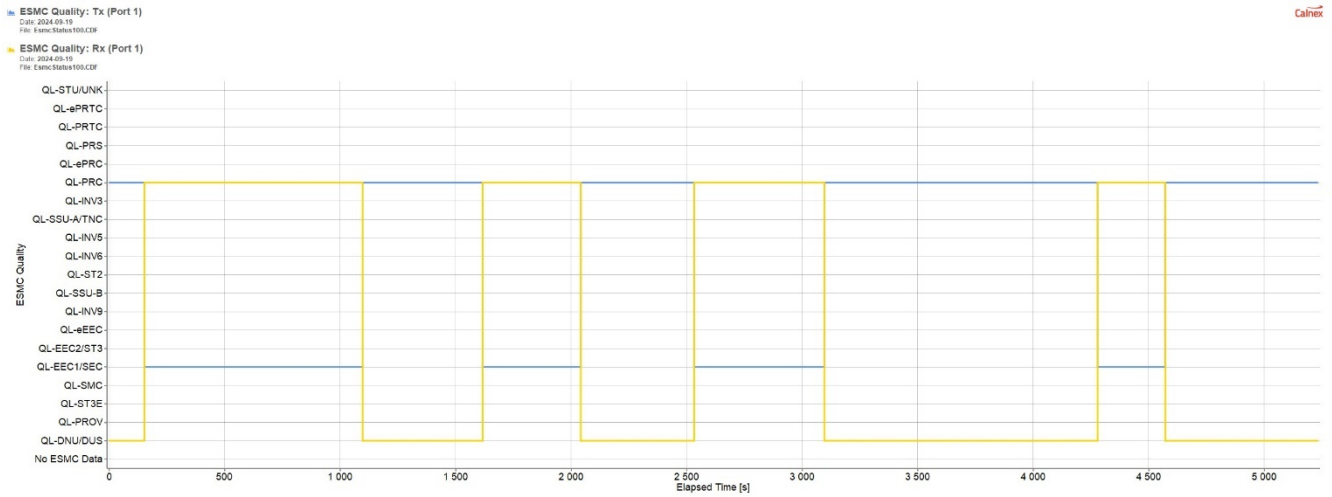
Pk-Pk [ns]	4.75
Mean [ns]	14.27
Min [ns]	11.75
Max [ns]	16.5

4.2.4.2 TIE Analysis



Port 1	
Pk-Pk [ns]	2.5
Mean [ns]	0.809
Min [ns]	0
Max [ns]	2.5
Port 2	
Pk-Pk [ns]	2.5
Mean [ns]	0.64
Min [ns]	-0.25
Max [ns]	2.25

4.2.4.3 ESMC Analysis



4.3 Two Masters, One SyncE Source

This test shows the effect of switching PTP Masters while keeping the same SyncE source.

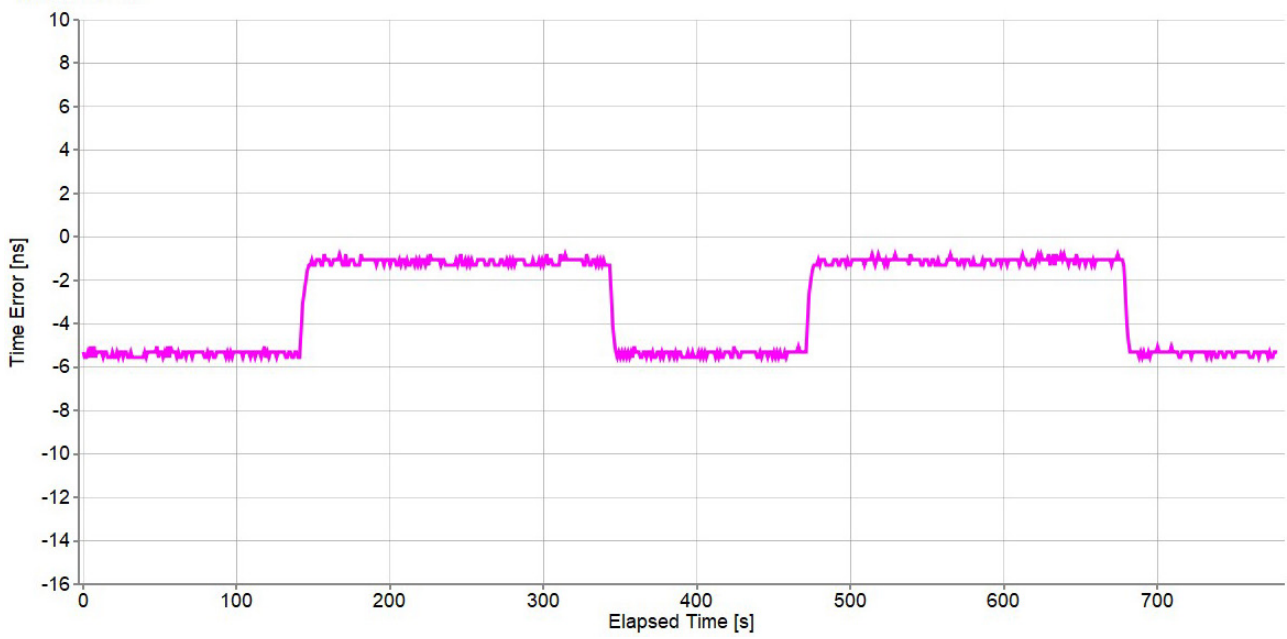
Both masters come from the Calnex Paragon Neo for these tests and the device is operated in Slave Clock mode (see [Test Configuration 1](#)).

4.3.1 Standalone Multicast BC

Test Description	SyncE Switchover – Two Masters, One SyncE
Report Date	2024-09-20 12:17:49
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-19 13:47:23
Test Duration	00:00:13:02
Test Configuration	1

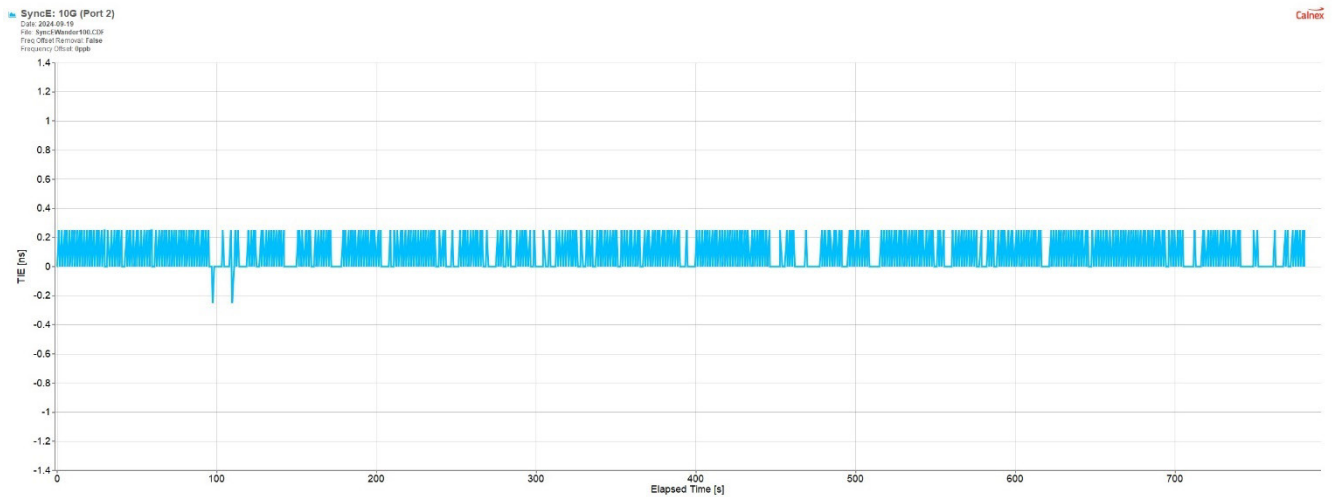
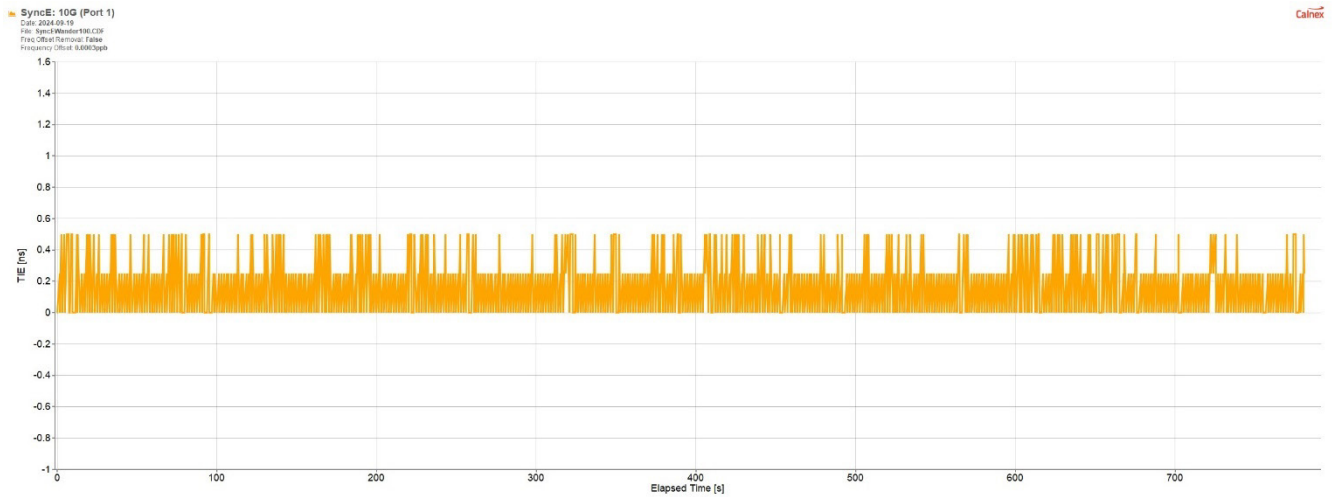
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
141	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
343	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
470	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
678	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.3.1.1 ONEPPS Analysis



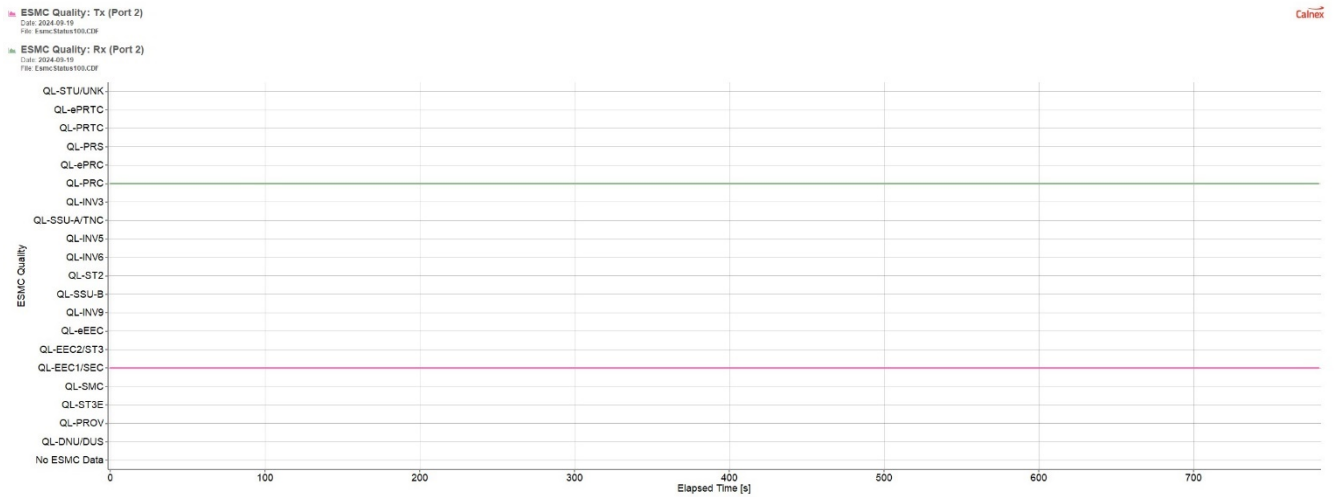
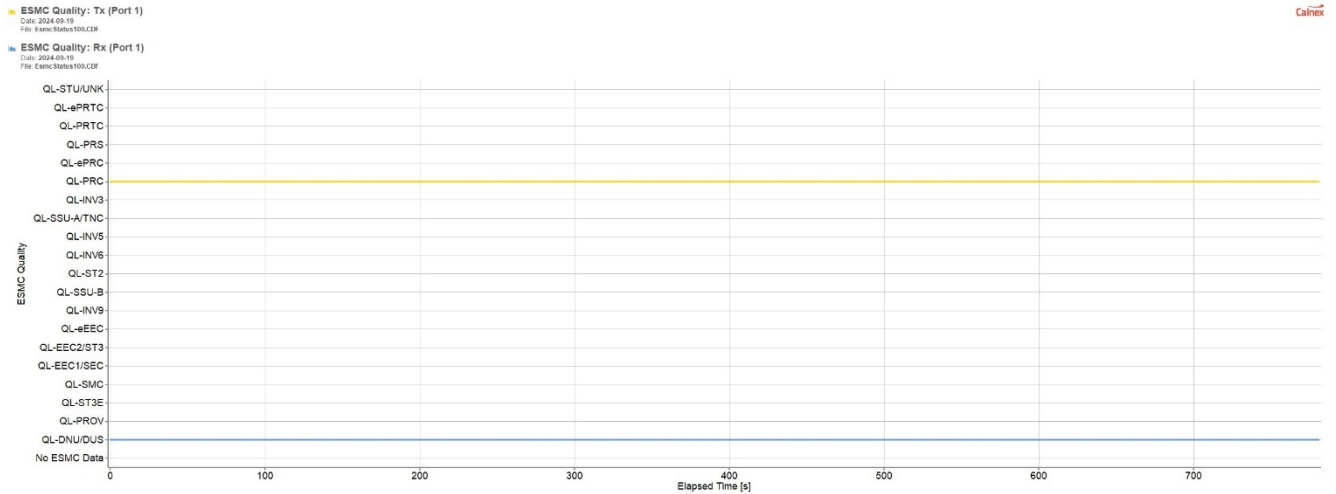
Pk-Pk [ns]	4.75
Mean [ns]	-3.153
Min [ns]	-5.553
Max [ns]	-0.803

4.3.1.2 TIE Analysis



Port 1	
Pk-Pk [ns]	0.5
Mean [ns]	0.146
Min [ns]	0
Max [ns]	0.5
Port 2	
Pk-Pk [ns]	0.5
Mean [ns]	0.028
Min [ns]	-0.25
Max [ns]	0.25

4.3.1.3 ESMC Analysis



4.3.2 External Servo Multicast BC

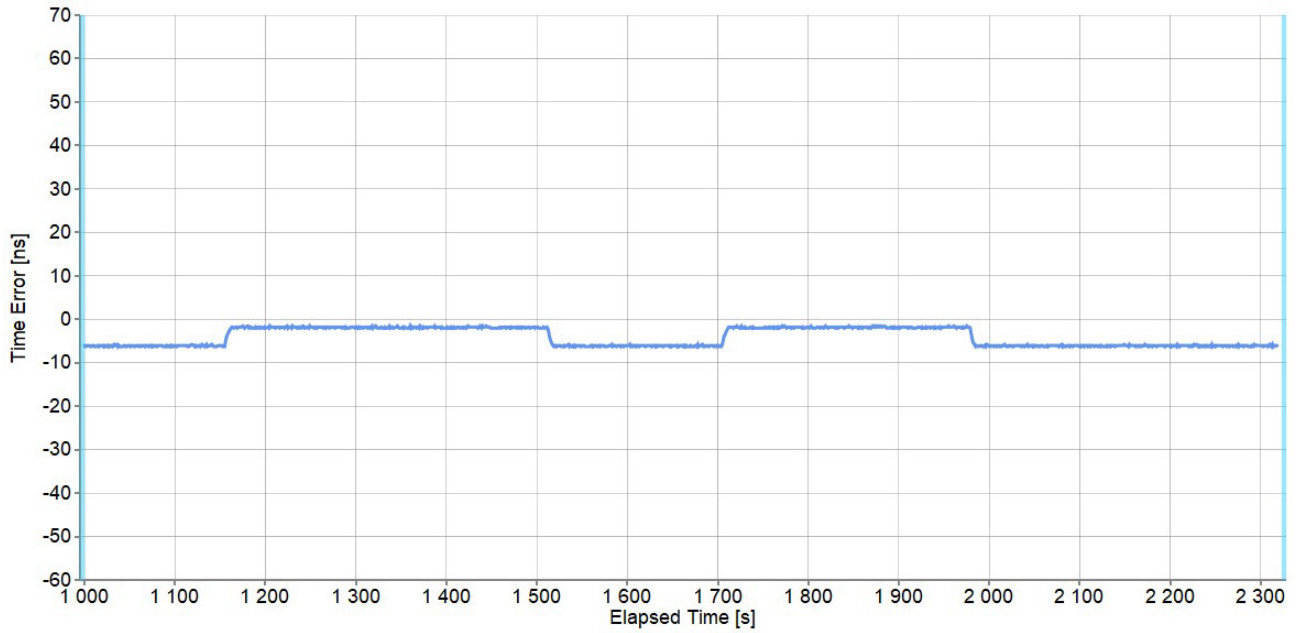
Test Description	SyncE Switchover – Two Masters, One SyncE
Report Date	2024-09-20 12:23:42
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-19 14:03:19
Test Duration	00:00:38:44
Test Configuration	1

Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
1155	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
1512	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
1705	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
1979	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.3.2.1 ONEPPS Analysis

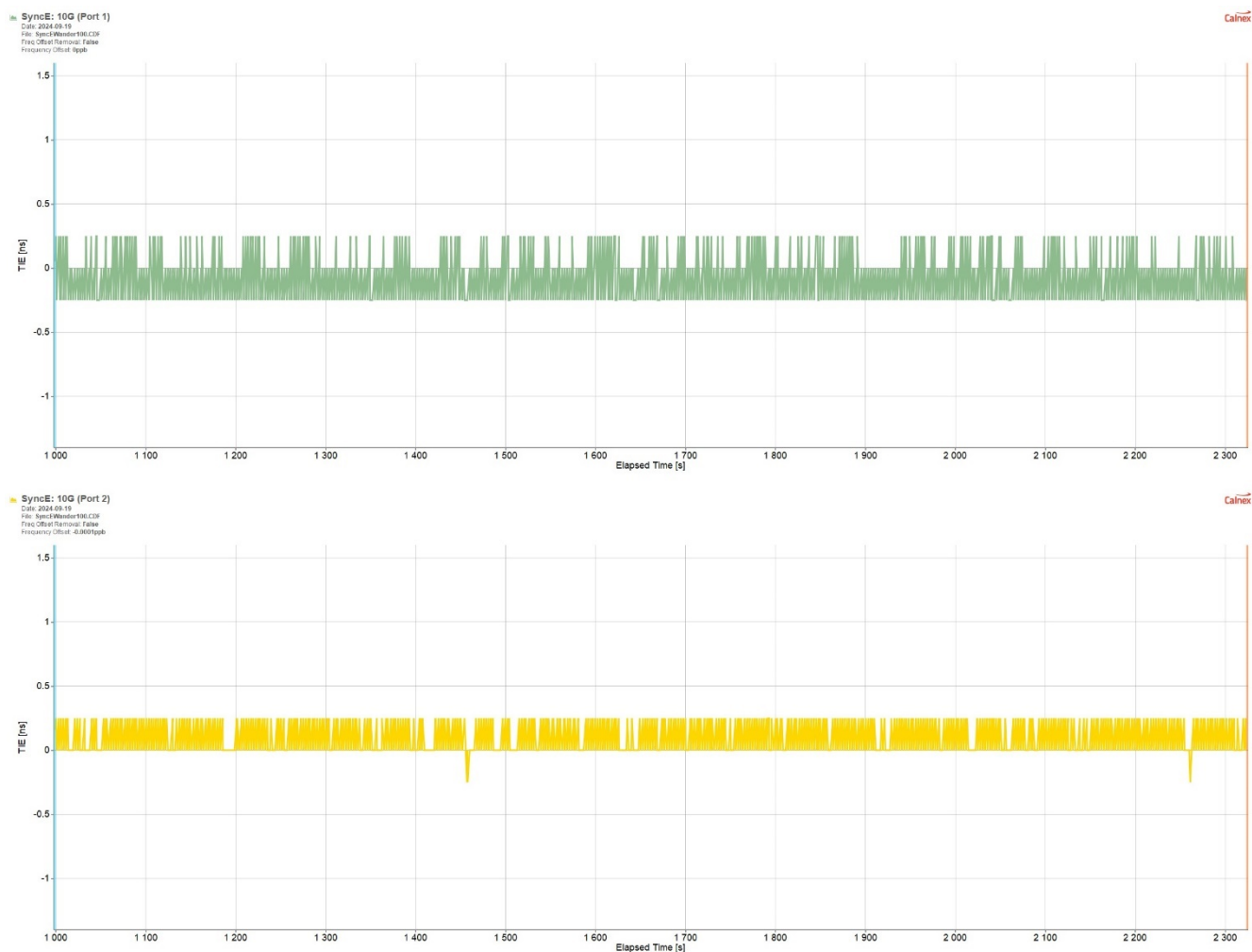


1pps TE Absolute
 Date: 2024-09-19
 File: OnePpsAccuracyTod100.CDF
 Offset Removal Applied: False
 Zero Offset: -6.053ns



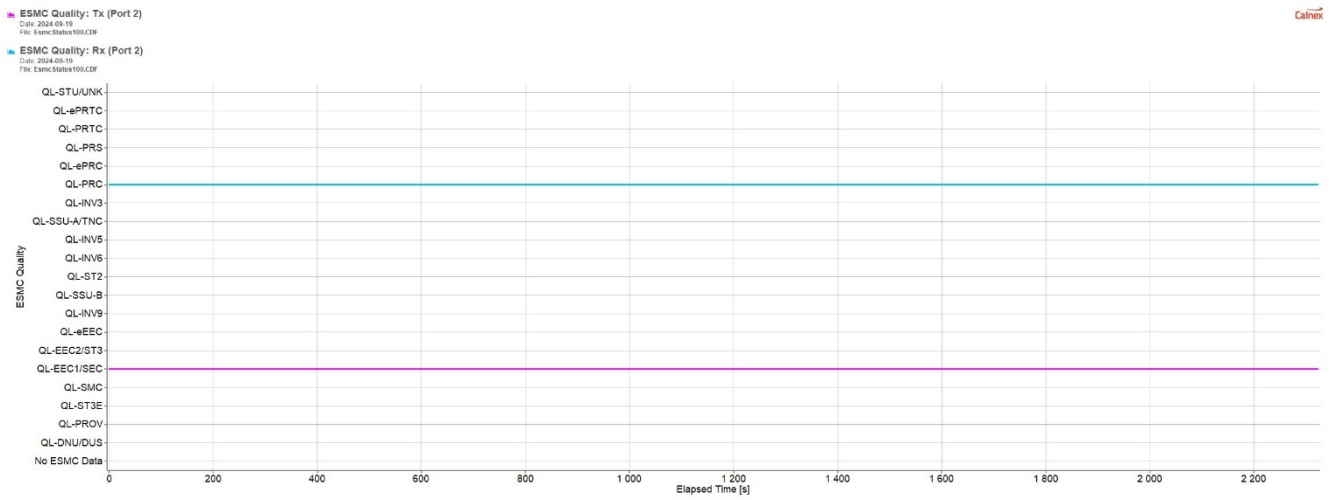
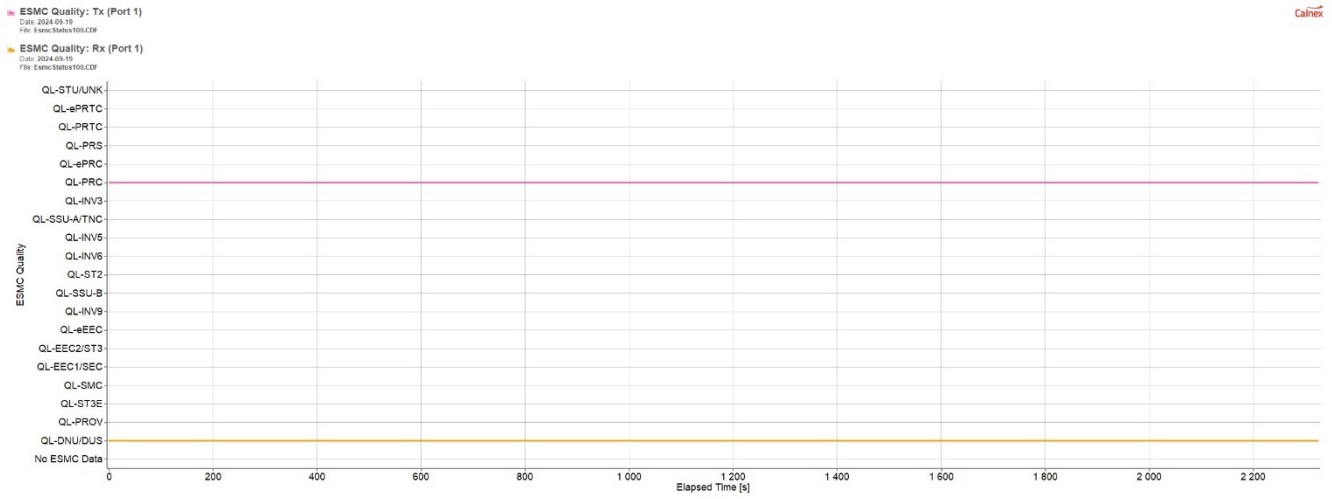
Pk-Pk [ns]	4.75
Mean [ns]	-4.106
Min [ns]	-6.303
Max [ns]	-1.553

4.3.2.1.1 TIE Analysis



Port 1	
Pk-Pk [ns]	0.5
Mean [ns]	-0.104
Min [ns]	-0.25
Max [ns]	0.25
Port 2	
Pk-Pk [ns]	0.5
Mean [ns]	0.026
Min [ns]	-0.25
Max [ns]	0.25

4.3.2.2 ESMC Analysis

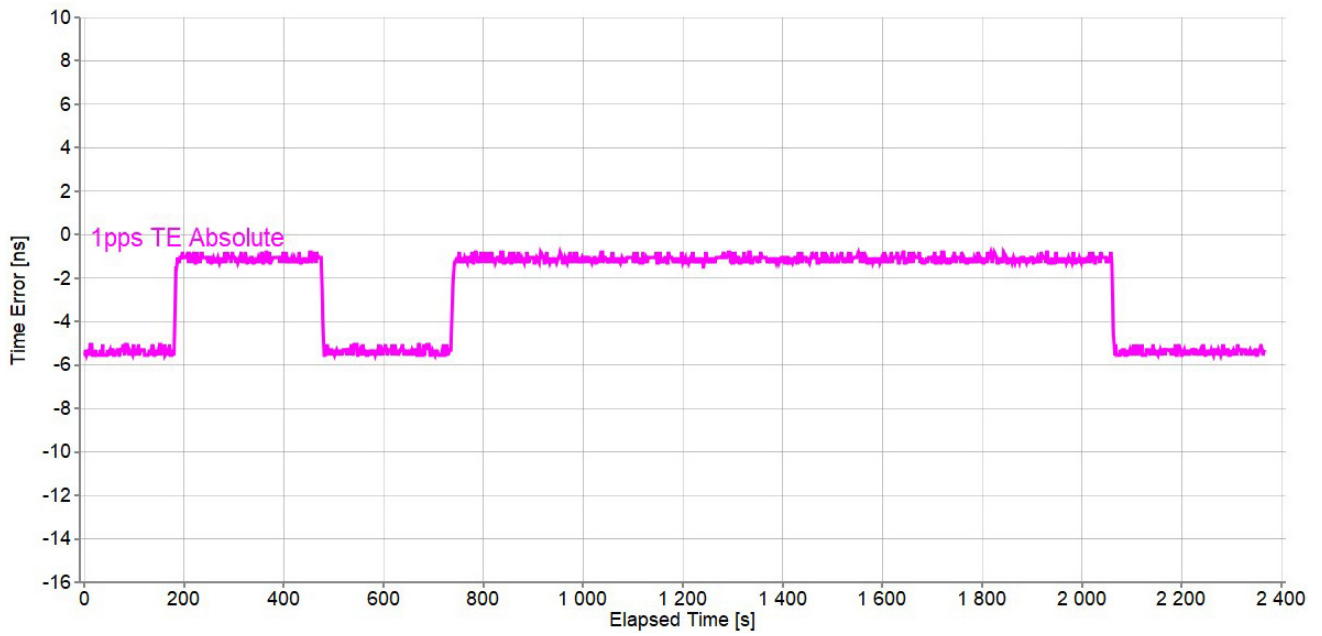


4.3.3 Standalone Unicast BC

Test Description	SyncE Switchover – Two Masters, One SyncE
Report Date	2024-09-20 12:29:53
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-19 14:44:33
Test Duration	00:00:39:31
Test Configuration	1

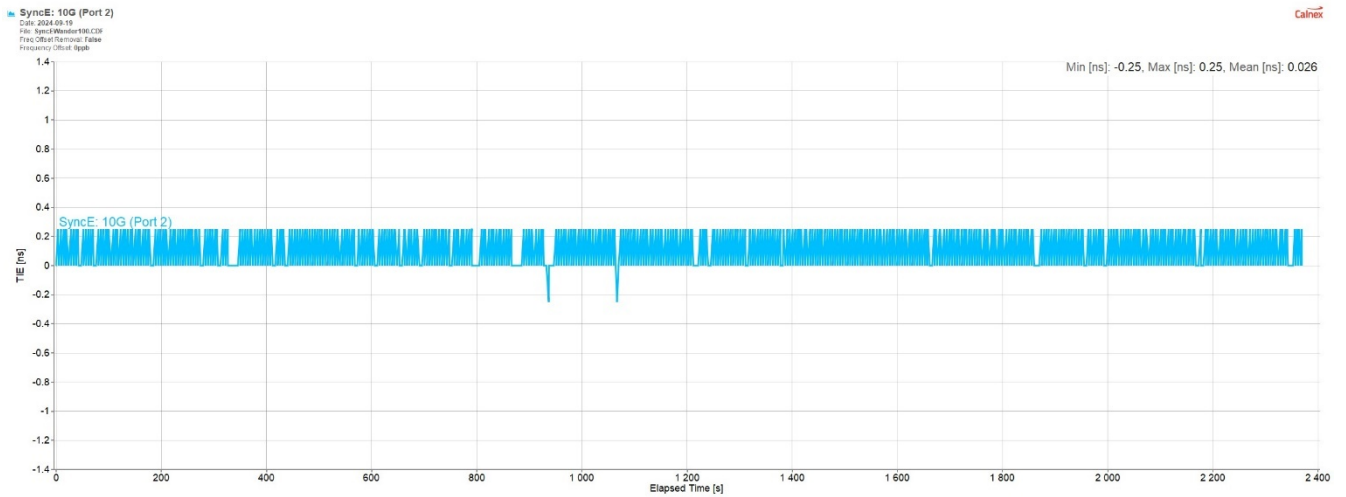
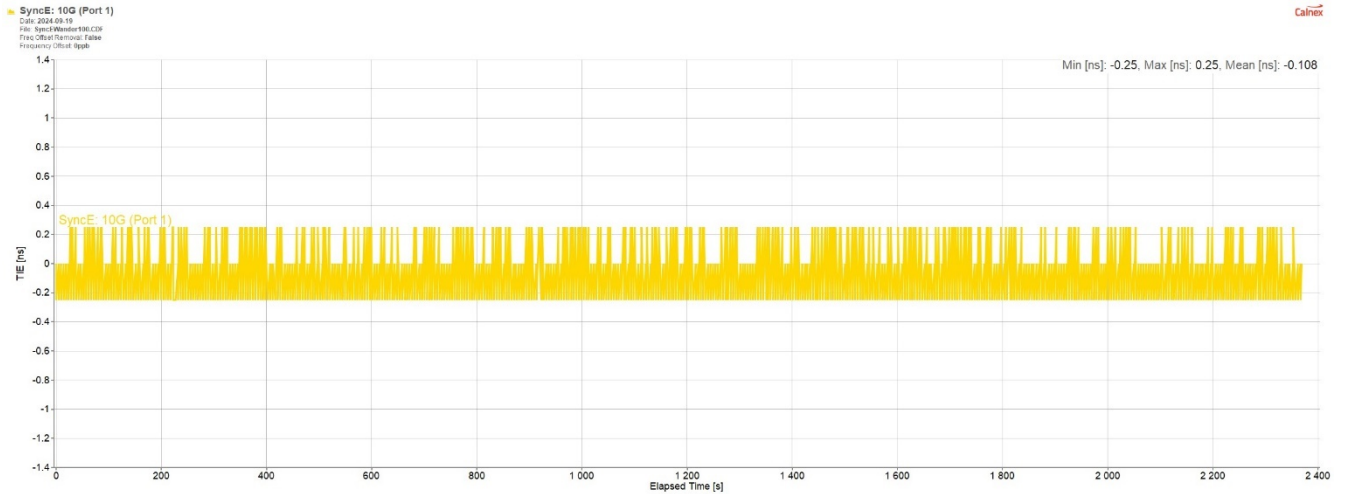
Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
180	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
473	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
735	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
2066	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.3.3.1 ONEPPS Analysis



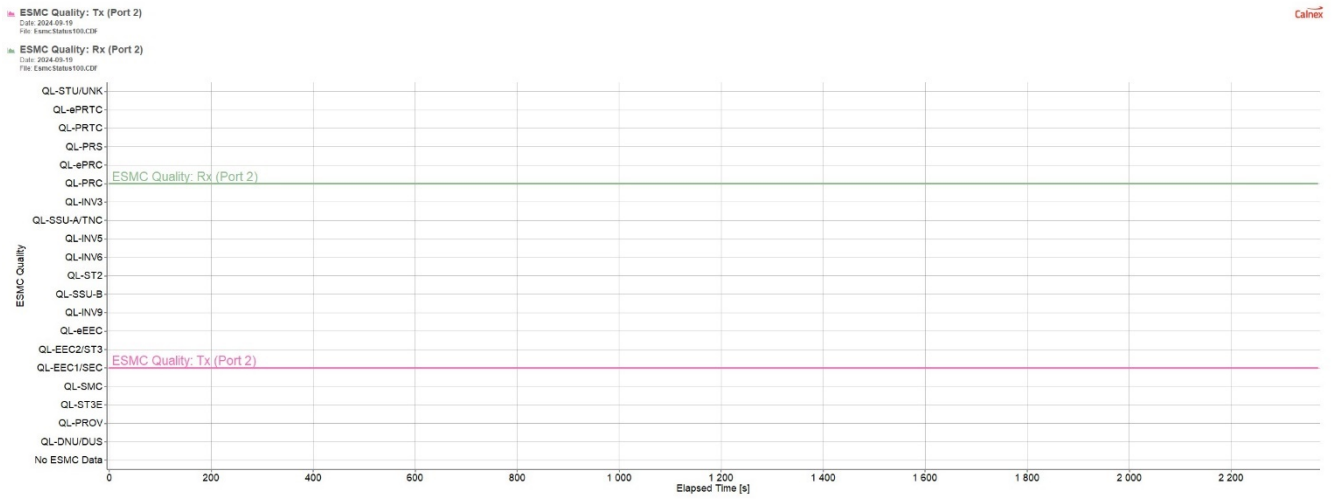
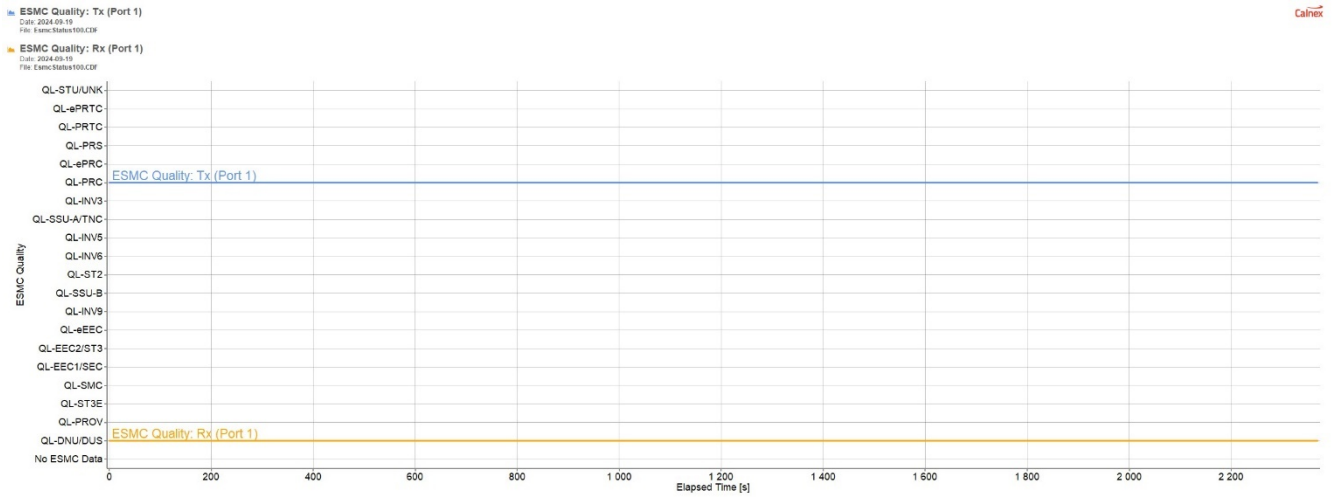
Pk-Pk [ns]	4.75
Mean [ns]	-2.468
Min [ns]	-5.553
Max [ns]	-0.803

4.3.3.2 TIE Analysis



Port 1	
Pk-Pk [ns]	0.5
Mean [ns]	-0.108
Min [ns]	-0.25
Max [ns]	0.25
Port 2	
Pk-Pk [ns]	0.5
Mean [ns]	0.026
Min [ns]	-0.25
Max [ns]	0.25

4.3.3.3 ESMC Analysis



4.3.4 External Servo Unicast BC

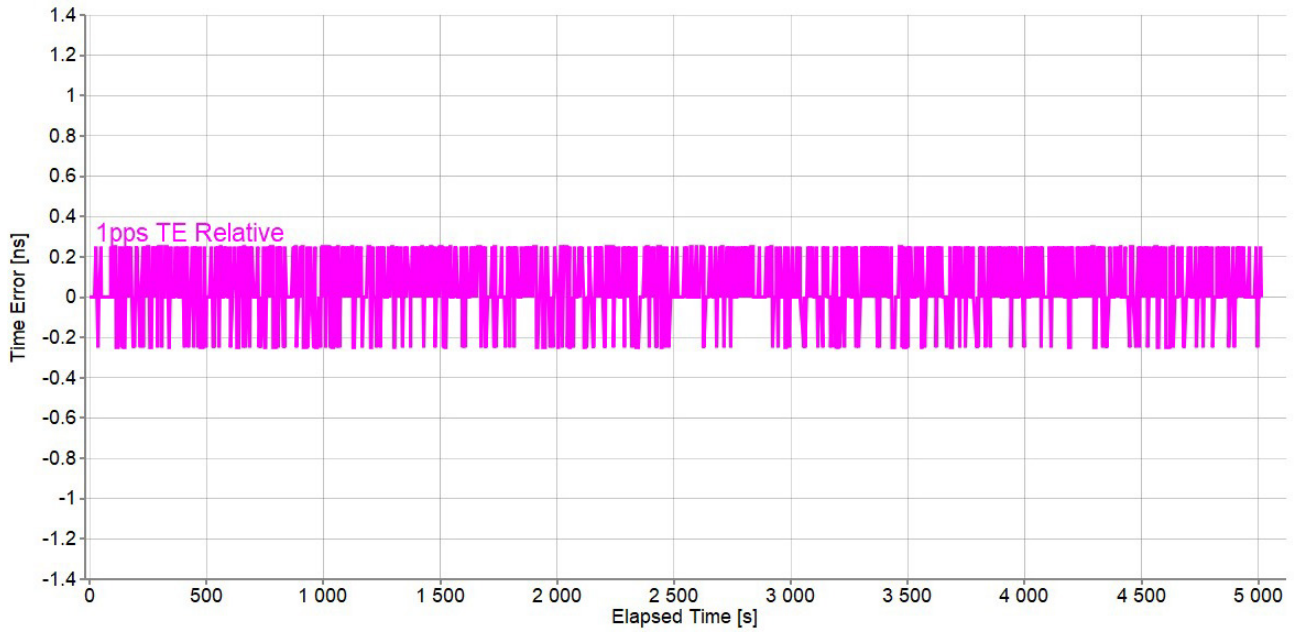
Test Description	SyncE Switchover – Two Masters, One SyncE
Report Date	2024-09-20 13:02:42
Packet Rate (pkt/s)	16
Beginning of Test	2024-09-19 16:11:40
Test Duration	00:01:23:36
Test Configuration	1

Time (s)	Event	PTP Master	SyncE Source
0	Start	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
1705	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
2357	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)
3349	Port 1 Clock Class 7 Port 2 Clock Class 6	Paragon Neo Port 2	Paragon Neo Port 1 (PRC)
4432	Port 1 Clock Class 6 Port 2 Clock Class 6	Paragon Neo Port 1	Paragon Neo Port 1 (PRC)

4.3.4.1 ONEPPS Analysis

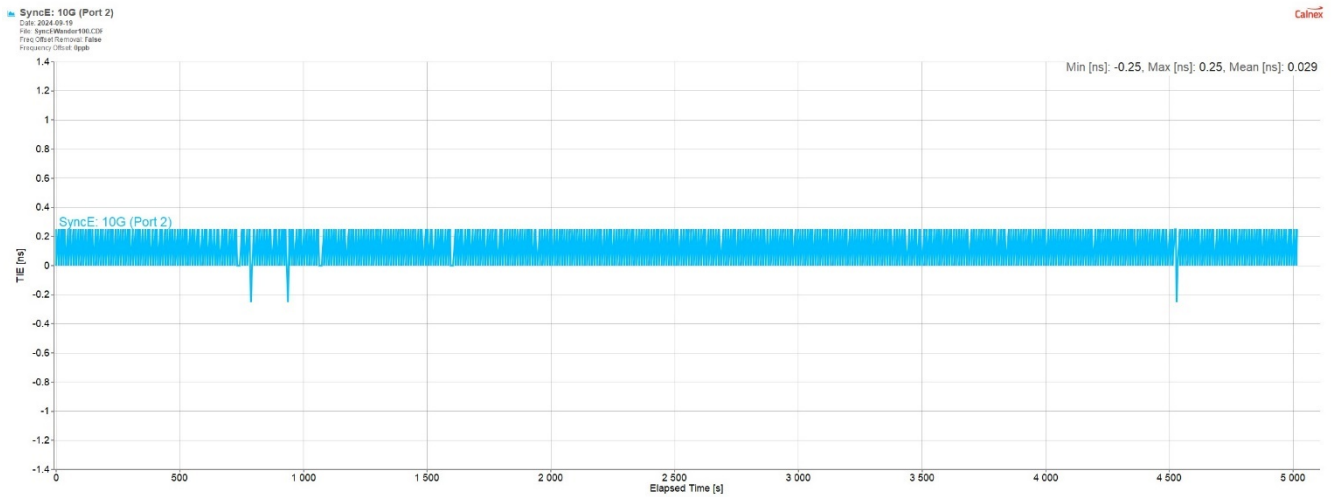
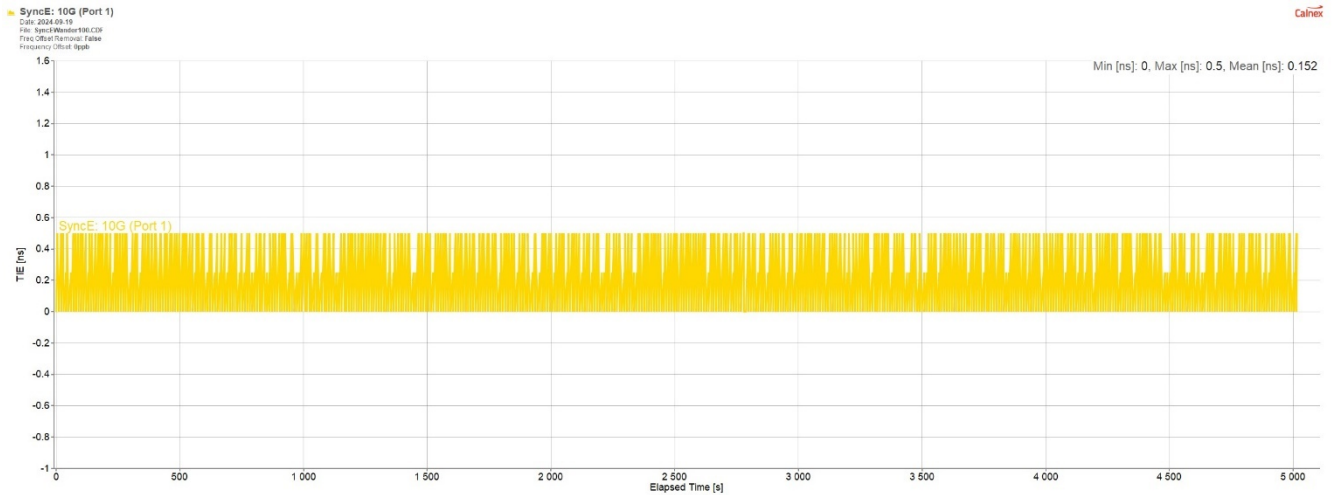


1pps TE Relative
 Date: 2024-09-19
 File: OnePpsAccuracyTod100.CDF
 Offset Removal Applied: True
 Zero Offset: 0ns



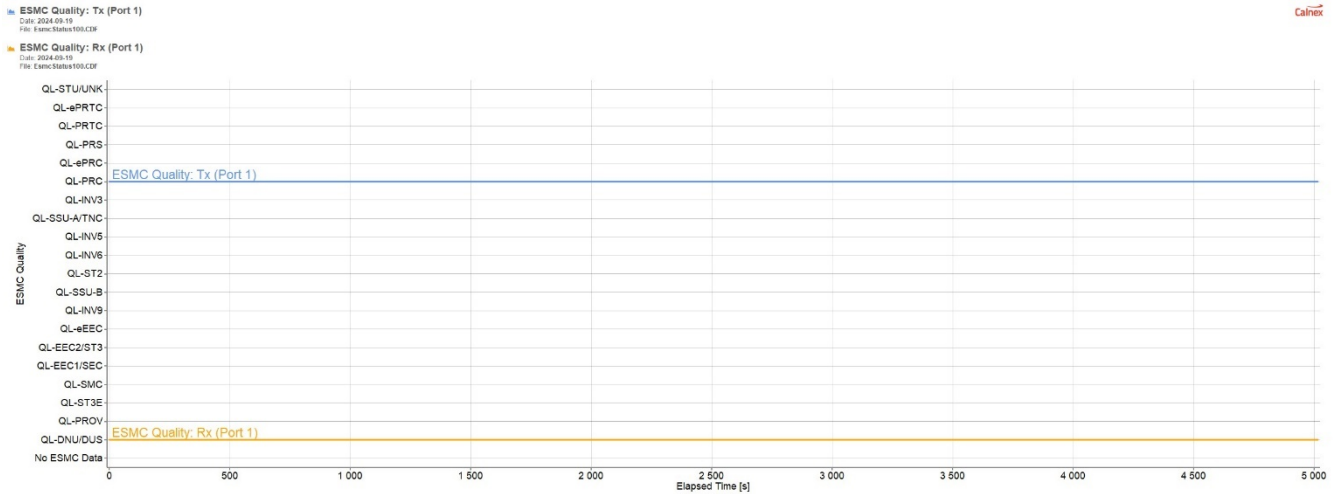
Pk-Pk [ns]	0.5
Mean [ns]	0.013
Min [ns]	-0.25
Max [ns]	0.25

4.3.4.2 TIE Analysis



Port 1	
Pk-Pk [ns]	0.5
Mean [ns]	0.132
Min [ns]	0
Max [ns]	0.5
Port 2	
Pk-Pk [ns]	0.5
Mean [ns]	0.029
Min [ns]	-0.25
Max [ns]	0.25

4.3.4.3 ESMC Analysis



5. Configuration Files

5.1 TCS File

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

5.2 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
```


5.3 Standalone ptp4l cfg Files

5.3.1 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
```

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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

5.3.2 Unicast SC (Two 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
```

5.3.3 Multicast BC

See section 5.3 of the [ZCU670 Multicast Boundary Clock Performance Validation Report](#).

5.3.4 Multicast SC (Two Masters)

```
#
# Telecom G.8275.1 T-TSC example configuration containing those attributes
# which either differ from the defaults or are relevant to the profile.
#
[global]
domainNumber 24

slaveOnly 1
masterOnly 0

twoStepFlag 1

# Announce messages
announceReceiptTimeout 3
logAnnounceInterval -3

# Sync/Delay_Req/Delay_Resp messages - 16 packets-per-second, -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 L2

# 01:1B:19:00:00:00 Forwardable multi-cast address
# 01:80:C2:00:00:0E Non-forwardable multi-cast address
ptp_dst_mac 01:1B:19:00:00:00

[eth1]
[eth2]
```

5.4 External Servo ptp4l cfg Files

5.4.1 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
```

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```
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
```

5.4.2 Unicast SC (Two 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
```

5.4.3 Multicast BC

See section 5.4 of the [ZCU670 Multicast Boundary Clock Performance Validation Report](#).

5.4.4 Multicast SC (Two Ports)

```
#
# PCM4L
#
# Telecom G.8275.1 T-TSC example configuration containing those attributes
# which either differ from the defaults or are relevant to the profile.
#
[global]
domainNumber 24

# Announce messages
announceReceiptTimeout 3
logAnnounceInterval -3

# Sync/Delay_Req/Delay_Resp messages - 16 packets-per-second, -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 pcm41

free_running 1
slave_event_monitor /var/run/pcm41
tsproc_mode raw
tx_timestamp_timeout 5
sanity_freq_limit 0

network_transport L2

01:1B:19:00:00:00 Forwardable multi-cast address
01:80:C2:00:00:0E Non-forwardable multi-cast address
ptp_dst_mac 01:1B:19:00:00:00

[eth1]
[eth2]

5.5 Pcm4l json File

5.5.1 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,
        "tsDeviceExtttsChannel": 0,
        "tsDeviceExtttsCorrectionNs": 0
      }
    ],
    "charDevice": "/dev/rsmu0",

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

  "deviceConfig":
  {
    "oscillatorType": "Tcxo",
    "dpll11588Instance": 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
    }
  }
]
}

```

5.5.2 Adaptive Time (PTS/G.8273.4)

```
{
  "versionId": "4.3",
  "testModeEnable": 0,
  "referenceTrackerType": "AdaptiveTime",
  "remoteUdsAddress": "/var/run/ptp41",
  "localUdsAddress": "/var/run/pcm41",

  "stepWindowSeconds": 1,

  "phc41Config":
  {
    "dcoDevice": "/dev/ptp0",
    "tsDevice":
    [
      {
        "tsDeviceName": "/dev/ptp1",
        "tsDevicePinIndex": -1,
        "tsDeviceExtttsChannel": 0,
        "tsDeviceExtttsCorrectionNs": 0
      }
    ],
    "charDevice": "/dev/rsmu0",

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

  "deviceConfig":
  {
    "oscillatorType": "Tcxo",
    "dpll11588Instance": 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
}
]
}
```

5.6 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_dp11_idx 0
holdover_ql SEC
holdover_tmr 10
hoff_tmr 300
wtr_tmr 10
advanced_holdover_en 0
pcm41_if_en 1
pcm41_if_ip_addr 127.0.0.1
pcm41_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
```


6. Revision History

Revision	Date	Description
1.00	Dec 13, 2024	Initial release.

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