

RC38312Ax/RC38x08Ax (FC3W) ITU-T G.8262, G.8262.1

This report describes the compliance testing results of the Renesas the RC38312Ax / RC38x08Ax (FemtoClock™3 Wireless/FC3W) PLLs to ITU-T G.8262 option 1, ITU-T G.8262 option 2, and ITU-T G.8262.1. Also described are the compliance testing results of eEEC standards for phase transients due to synchronization rearrangement operations, phase transient tolerance, wander transfer, wander generation, and holdover.

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1. Description of Tests and Setup

This report discusses the results for the SyncE compliance testing of Renesas RC38312Ax / RC38x08Ax (FemtoClock3 Wireless/FC3W) PLLs. PLL configurations were tested for conformity to ITU-T G.8262, G.8262.1 standards for wander generation, wander transfer, phase transient tolerance, holdover, phase transient due to input signal interruptions, and phase transient due to synchronization rearrangement operations.

The testing was performed on the RC38312A1 device, but the results also apply to the RC38312A2, RC38x08A1 and RC38x08A2 devices.

The synchronization rearrangement of the network is introduced through automatic reference switching between two clock inputs or through disconnecting the qualified reference clock input. A frequency generator is used to introduce phase transients and wander on the input clocks. An additional frequency counter is used to measure wander and phase transients.

Figure 1 shows a diagram of the test setup.

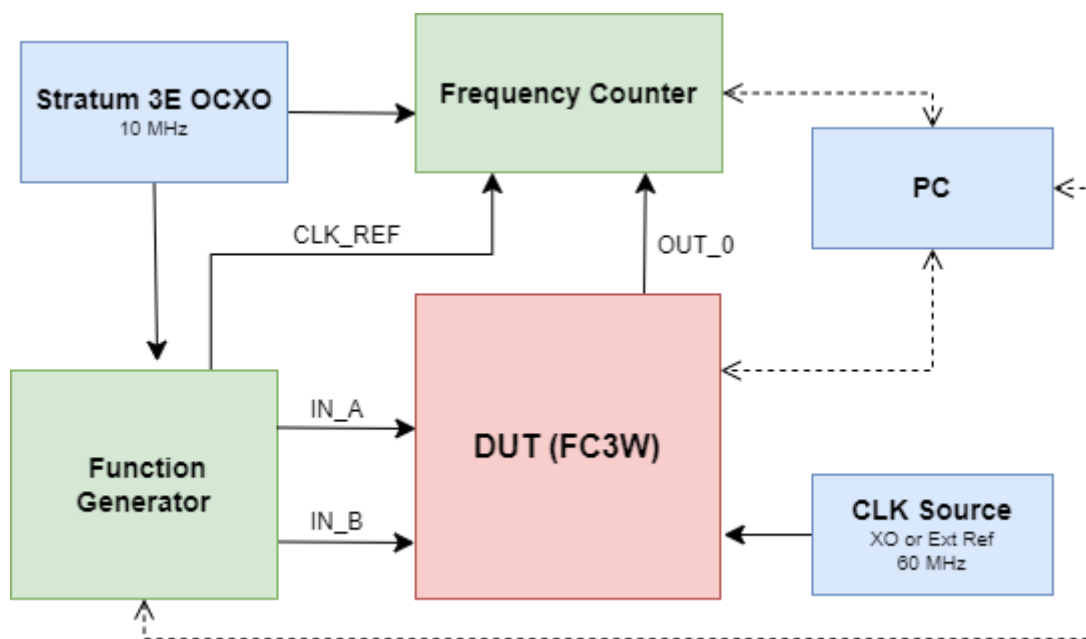


Figure 1. Complete Test Setup

A Stratum 3E OCXO acts as a stable and accurate clock source. Its output serves as the reference clock for the Frequency Counter and Function Generator.

The DUT locks to the reference clock input generated by the function generator. The Renesas FC3W DPLL can lock to virtually any frequency between 1kHz and 1GHz and produce virtually any output frequency from 4kHz to 1GHz. The Renesas FC3W DPLL supports a digital low-pass filter where its bandwidth and phase slope limit is set based on the standard ITU-T G.8262 Opt1/Opt2 or ITU-T G.8262.1 eEEC to test their compliances.

Fractional Frequency Offset (FFO) Maximum Time Interval Error (MTIE) and Time Deviation (TDEV) plots are calculated from the measurements taken from frequency counter. Masks are included on the plots for metrics specified in the standard.

2. Test Equipment Information

Table 1. Test Equipment

Test Equipment Description	Model	Corresponding Block in Figure 1
Frequency Reference	Rakon STP3384LF	Stratum 3E OCXO
ClockMatrix Evaluation Board	ClockMatrix 8A34001E 144BGA EVB	Frequency Counter
ClockMatrix Evaluation Board	ClockMatrix 8A34001E 144BGA EVB	Function Generator
ClockMatrix Evaluation Board	ClockMatrix 8A34001E 144BGA EVB	CLK Source

3. PLL Settings Information

The tables in this section highlight the required PLL settings that are configured for the testing showcased in this document.

In addition to configuring the PLLs, the device combo bus is also configured to provide the correct clock steering to the APLL and FODs. Figure 2 shows the combo bus settings for the configurations tested for this document. The jitter attenuator DPLL (DPLL0) and the System DPLL (DPLL2) must be configured to provide frequency steering to the APLL. This means that the frequency accuracy of the APLL will be a summation of the SyncE reference clock accuracy and the TCXO accuracy. FOD0, FOD1, and FOD2 should receive frequency steering from the System DPLL only. Thus, the frequency accuracy of the FODs will be determined by the frequency accuracy of the TCXO.

Table 2. PLL Settings Based on Compliance Standard Table

Compliance Standard No.	ITU-T G.8262 Option 1	ITU-T G.8262 Option 2	ITU-T G.8262.1 eEEC	Register Name in RICBox ¹
Input Frequency (MHz)	25.00	25.00	25.00	input_freq_clkin1
Output Frequency (MHz)	25.00	25.00	25.00	out0_freq_goal
PLL Bandwidth (Hz)	1.2/10.0	0.1	3	dpll0_normal_bandwidth_goal
Phase Slope Limit (μs/s)	7.500	0.885	7.500	dpll0_phase_slope_limit_goal
Max Phase Lock Error (ns)	250	600	250	dpll0_lock_threshold_goal
Damping Factor	<0.2 dB	<0.2 dB	<0.2 dB	dpll0_normal_gain_peaking_goal

¹ Exact register names depend on the inputs, outputs, and DPLLs used in the configuration.

Table 3. Other PLL Settings used for Compliance Testing

Setting	Value	Register Name in RICBox ²
Holdover History	15s	TOP.DPLL[0].DPLL_HOLDOVER_CNFG.holdover_history
DPLL Operation Mode	JA	operation_mode_dp1l0
Los_mon_enable	True (for both references)	Los_mon_enable_ref1
Freq_mon_enable	True (for both references)	Freq_mon_enable_ref1
Holdover BW	0.1Hz (G.8262.1/G.8262 EEC1), 0.01Hz (G.8262 EEC2)	dp1l0_holdover_bandwidth_goal
Acquire BW	10x normal bandwidth	dp1l0_acquire_bandwidth_goal
Ap1l Goal Frequency	10.2GHz	ap1l_freq_goal
XTAL/XO Input Frequency	60MHz	input_freq_xtal
Hitless Switching	True/False	top.DPLL[0].DPLL_REF_FB_CNFG.dp1l_hitless_en

Table 4. System DPLL PLL Settings

Setting	Value	Register Name in RICBox ³
PLL Bandwidth (Hz)	300 Hz	dp1l2_normal_bandwidth_goal
Phase Slope Limit (μs/s)	256000 ns/s	dp1l2_phase_slope_limit_goal
Max Phase Lock Error (ns)	None	dp1l2_lock_threshold_goal
Damping Factor	None	dp1l2_normal_gain_peaking_goal

Table 5. Combo Bus Settings

Setting	Value	Register Name in RICBox ³
PLL Steering from DPLL0 to AP1L	Enabled	combo_dp1l0_to_ap1l
PLL Steering from DPLL0 to AP1L	Enabled	combo_dp1l2_to_ap1l
PLL Steering from DPLL2 to FOD0	Enabled	combo_dp1l2_to_fod0
PLL Steering from DPLL2 to FOD0	Enabled	combo_dp1l2_to_fod1
PLL Steering from DPLL2 to FOD0	Enabled	combo_dp1l2_to_fod2

² Exact register names depend on the inputs, outputs, and DPLLs used in the configuration.

³ Exact register names depend on the DPLL used in the configuration.

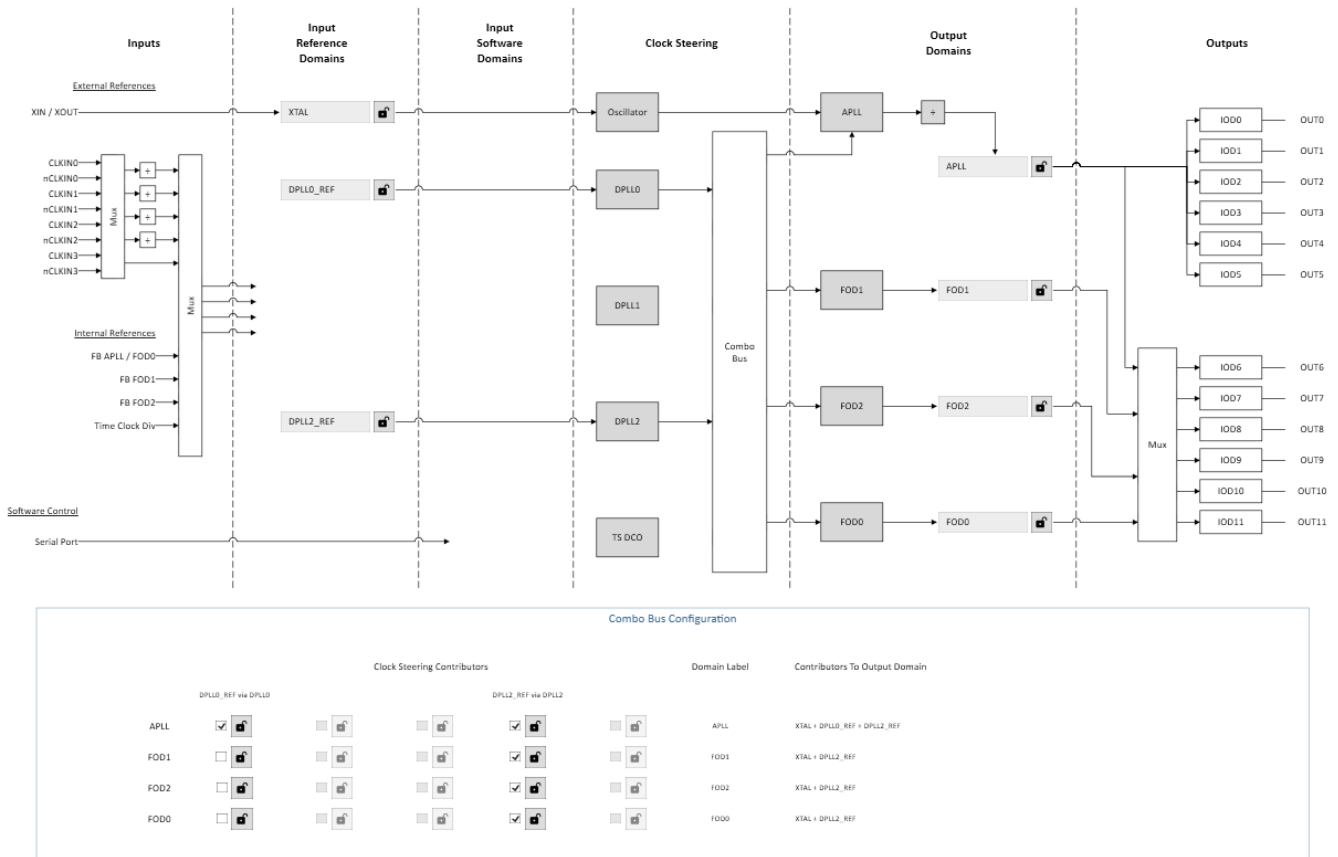


Figure 2. Combo Bus Window in RICBox

4. Compliance Summary

Table 6 summarizes the results of the compliance testing.

Table 6. Compliance Results

Test	ITU-T G.8262 Option 1	ITU-T G.8262 Option 2	ITU-T G.8262.1 eEEC
Phase Transient with Hitless Switching Enabled	Pass	Pass	Pass
Phase Discontinuity with Hitless Switching Enabled	Pass	Pass	Pass
Short Term Phase Transient with Hitless Switching Enabled	Pass	Pass	Pass
Phase Transient with Hitless Switching Disabled	Pass	Pass	Pass
Phase Discontinuity with Hitless Switching Disabled	Pass	Pass	Pass
Short Term Phase Transient with Hitless Switching Disabled	Pass	Pass	Pass
Wander Generation	Pass	Pass	Pass
Wander Transfer	Pass	Pass	Pass

5. Frequency Accuracy

Frequency accuracy at free-run is determined by the system oscillator used. For more information, see application note [AN-807](#).

Note: The DUT only contributes to the initial frequency offset (a1) and transition phase shift (c) on entry into holdover. The drift (b) and frequency offset due to temperature (a2) comes from the local oscillator

5.1 Option 1

Refer to section G.813 Option 1 / G.8262 Option 1 (see Table 8 in [AN-807](#)).

5.2 Option 2

Refer to section GR-1244-CORE and GR-253-CORE Stratum 3 / G.812 Type IV / G.8262 Option 2 (see Table 7 in [AN-807](#)).

5.3 Enhanced Option

The enhanced option can also be used for both Options 1 and 2. Refer to section G.8262.1 Enhanced Synchronous Ethernet/OTN Equipment Clock (see Table 6 in [AN-807](#)).

6. Transient Tests with Hitless Switching Enabled

6.1 Phase Transient

Transient response requirement reflects the system response in situations where the input signal is affected by disturbances or transmission failures, thus resulting in phase transients at the synchronous EEC (Ethernet Equipment Clock) output. Short interruptions, switching between different reference clock signals, loss of reference etc., are categorized as transients, thus resulting in phase transients at the EEC output (see [Figure 1](#) for the equipment configuration).

In this test, the reference clock inputs are provided on IN_A and IN_B from the Frequency Generator. The PLL is locked to the clock signal from IN_A for a period of time before producing a phase transient by turning off IN_A. The DPLL goes into holdover and tries to lock to any other qualified clocks. IN_B is simultaneously available from the Frequency Generator, and the DPLL switches to this clock which is very close in phase alignment to the original clock. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter. The results of the given transient are plotted against the applicable standard profiles.

6.1.1. Phase Transient – G.8262 EEC Option 1, 1.2Hz

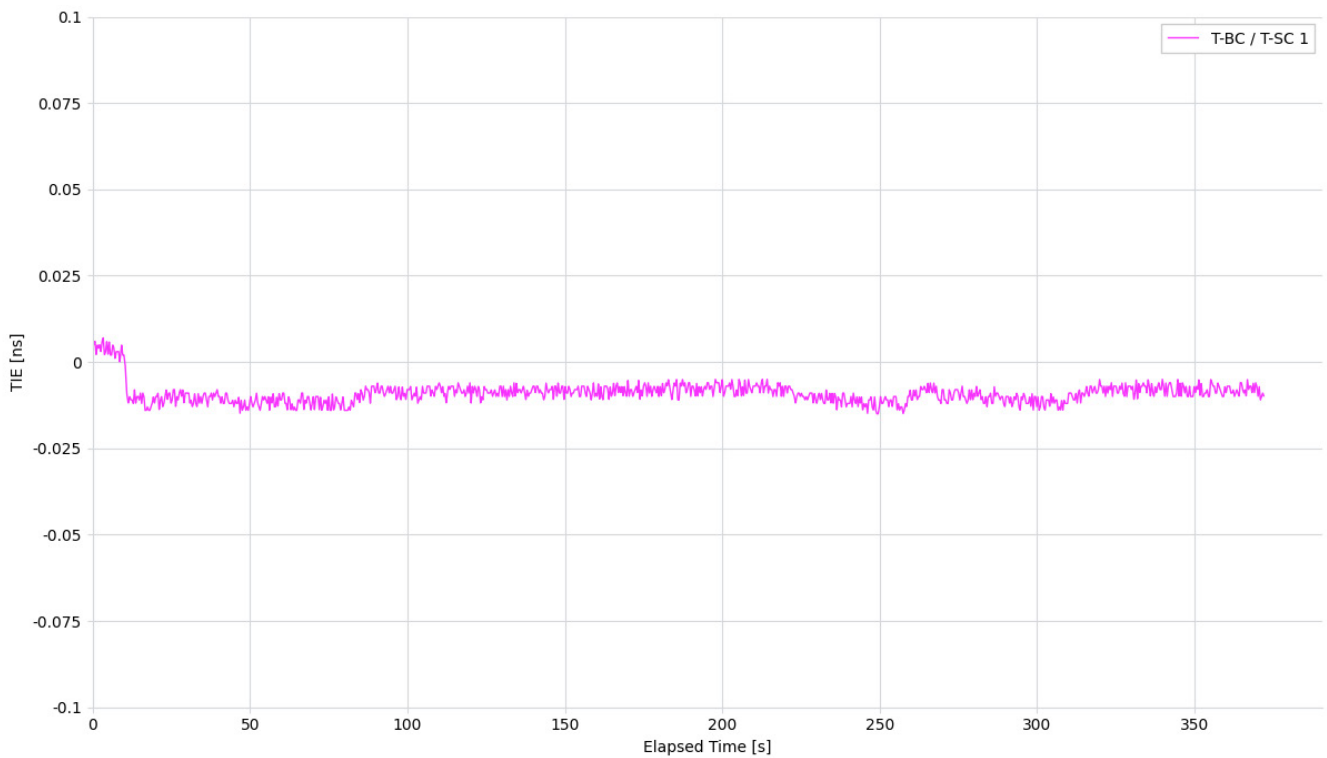


Figure 3. Phase Transient – G.8262 EEC Option 1, 1.2Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.009
Min [ns]	-0.015
Max [ns]	0.007
Max-Min [ns]	0.022

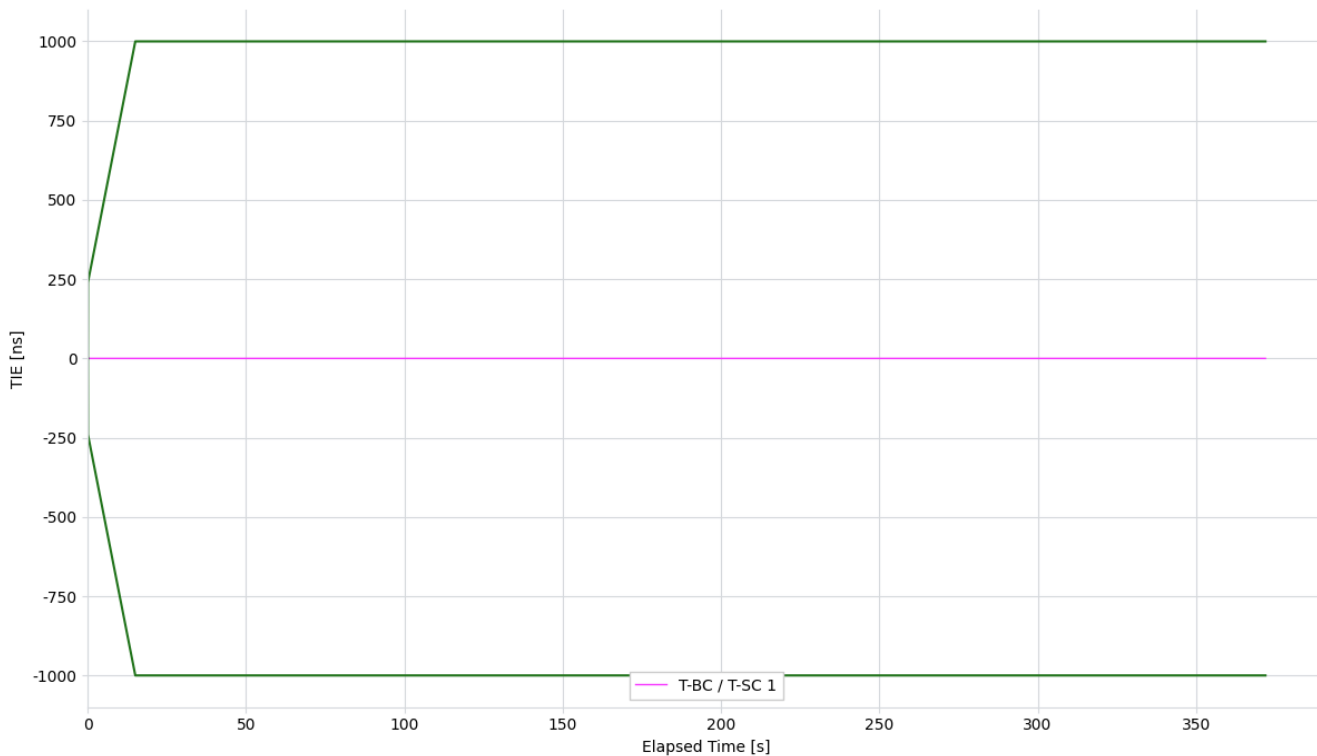


Figure 4. Phase Transient – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.009
Min [ns]	-0.015
Max [ns]	0.007
Max-Min [ns]	0.022

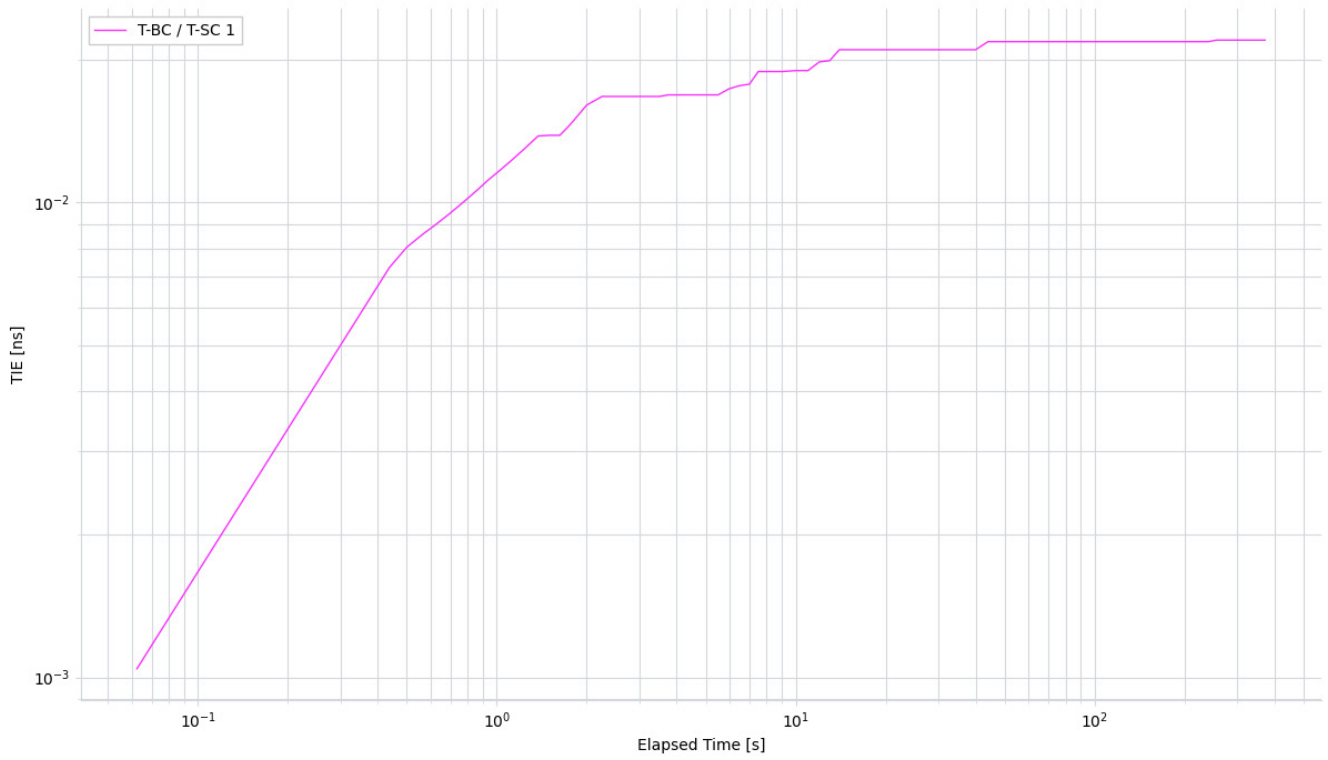


Figure 5. Phase Transient – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.022
Max-Min [ns]	0.021

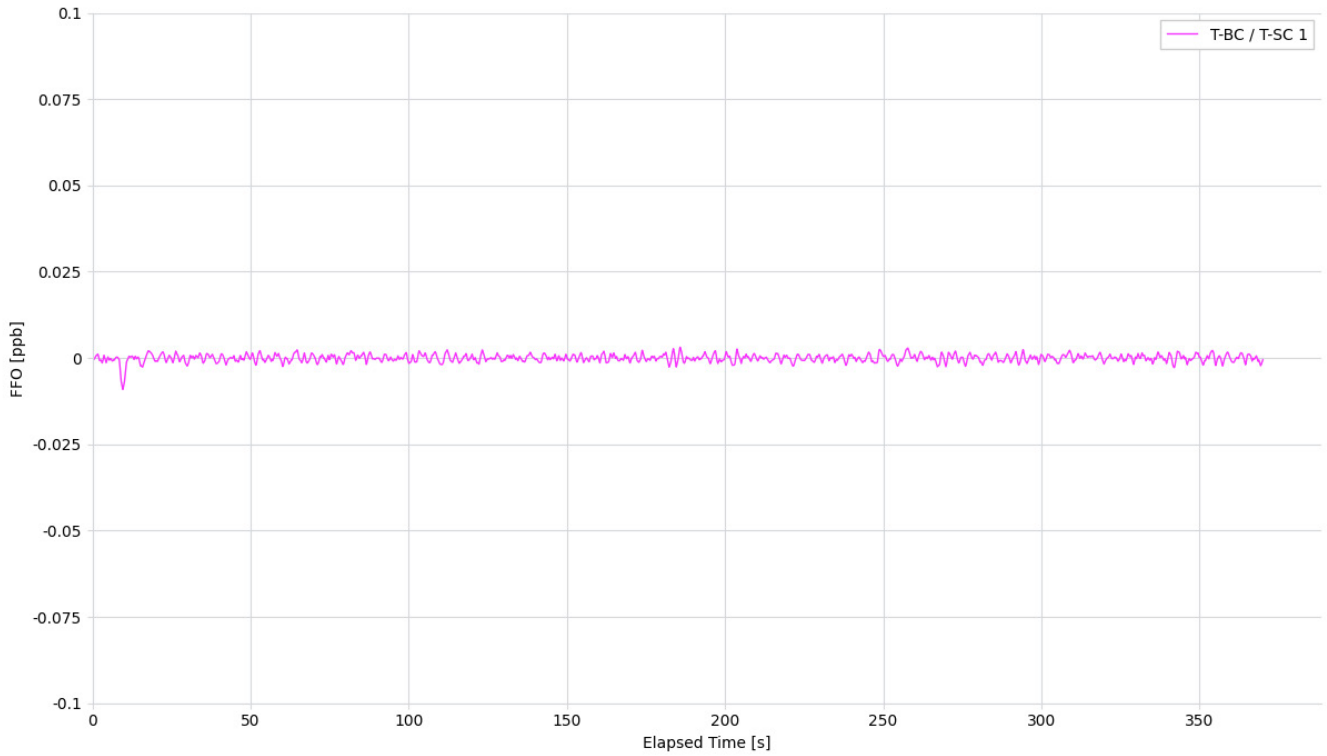


Figure 6. Phase Transient – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.009
Max [ppb]	0.003
Max-Min [ppb]	0.012

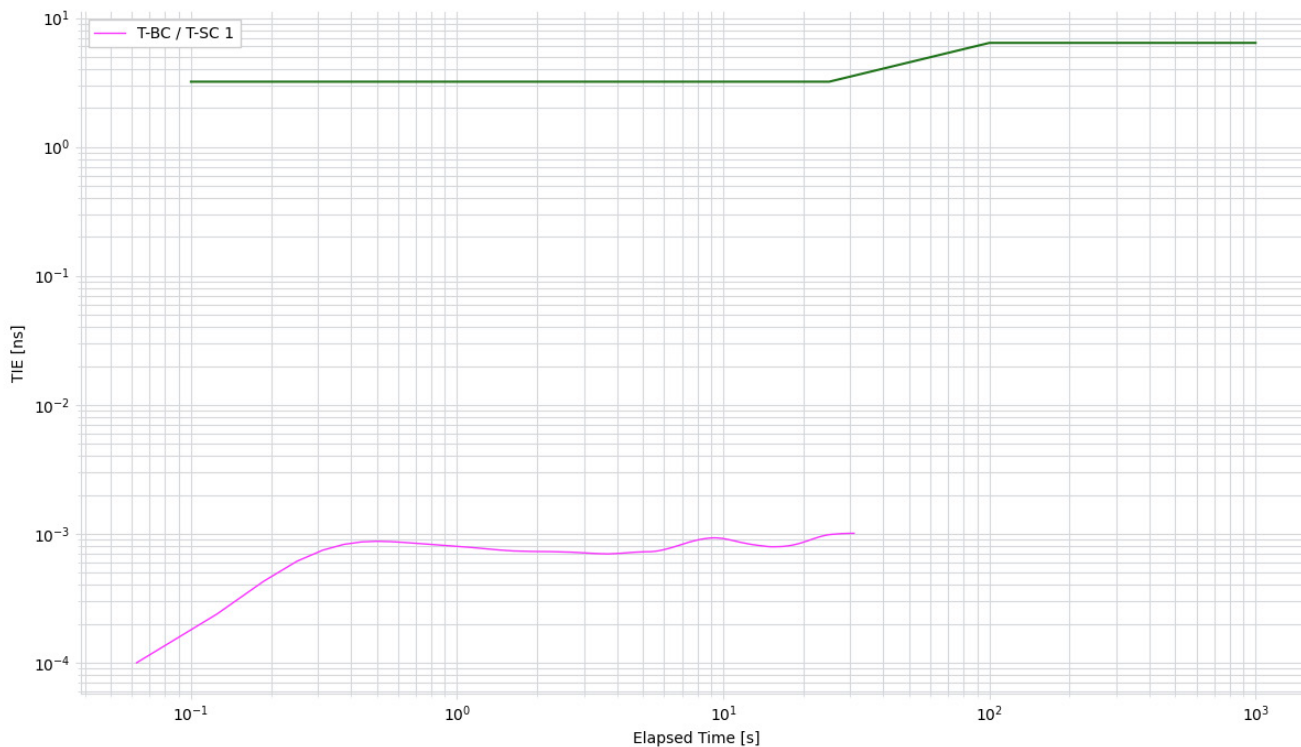


Figure 7. Phase Transient – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.1.2. Phase Transient – G.8262 EEC Option 1, 10Hz

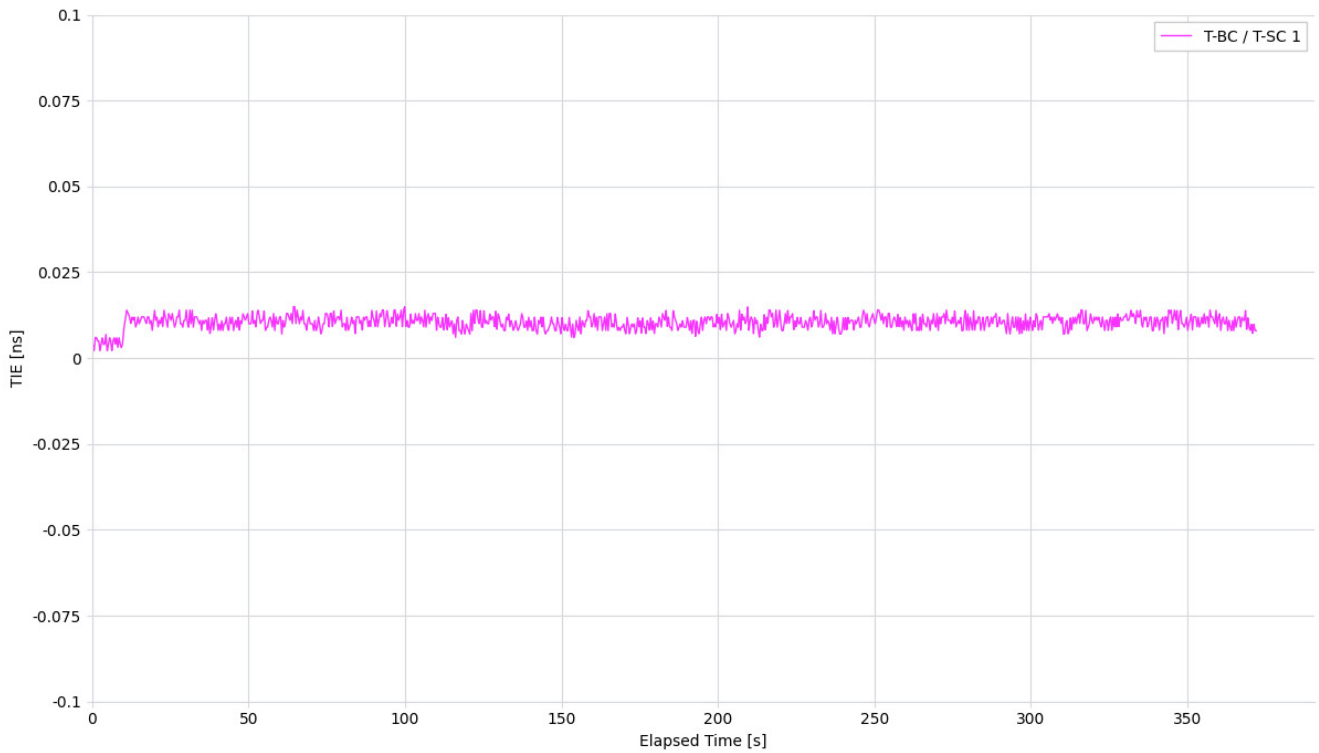


Figure 8. Phase Transient – G.8262 EEC Option 1, 10Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	0.01
Min [ns]	0.002
Max [ns]	0.015
Max-Min [ns]	0.013

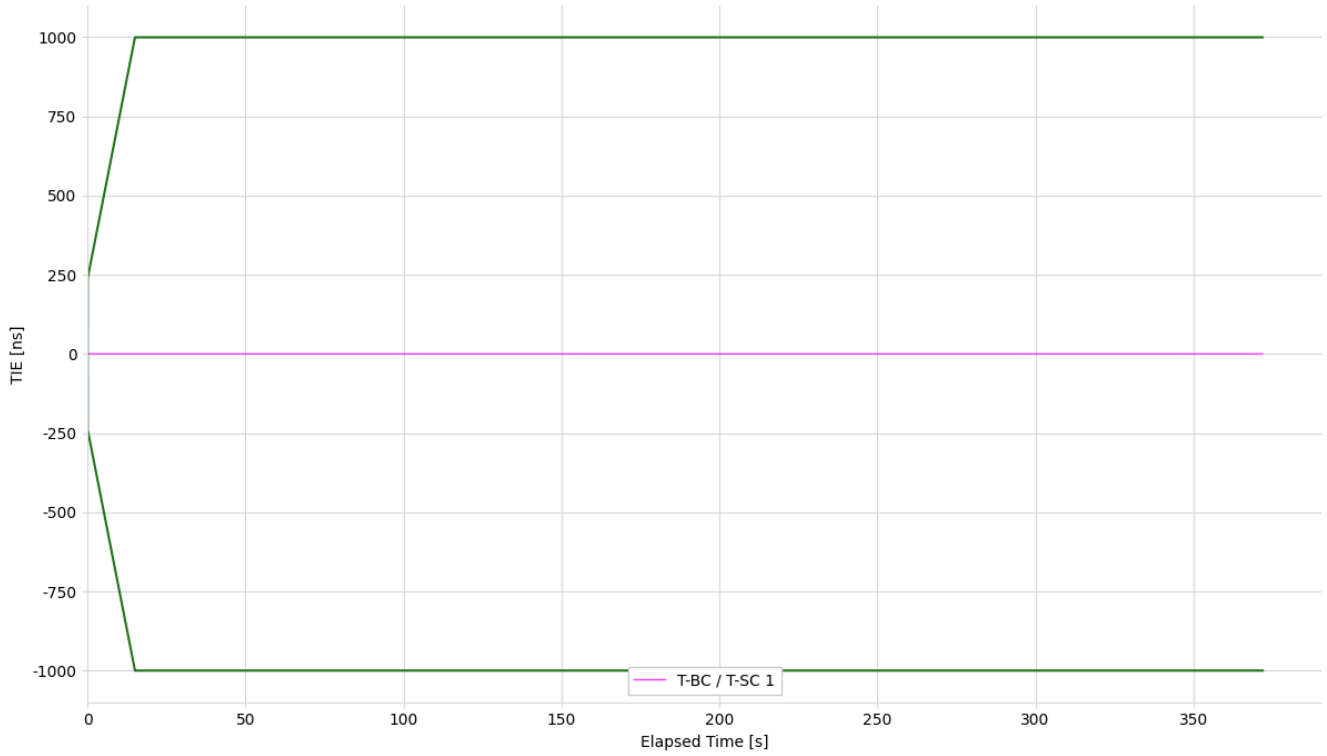


Figure 9. Phase Transient – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.01
Min [ns]	0.002
Max [ns]	0.015
Max-Min [ns]	0.013

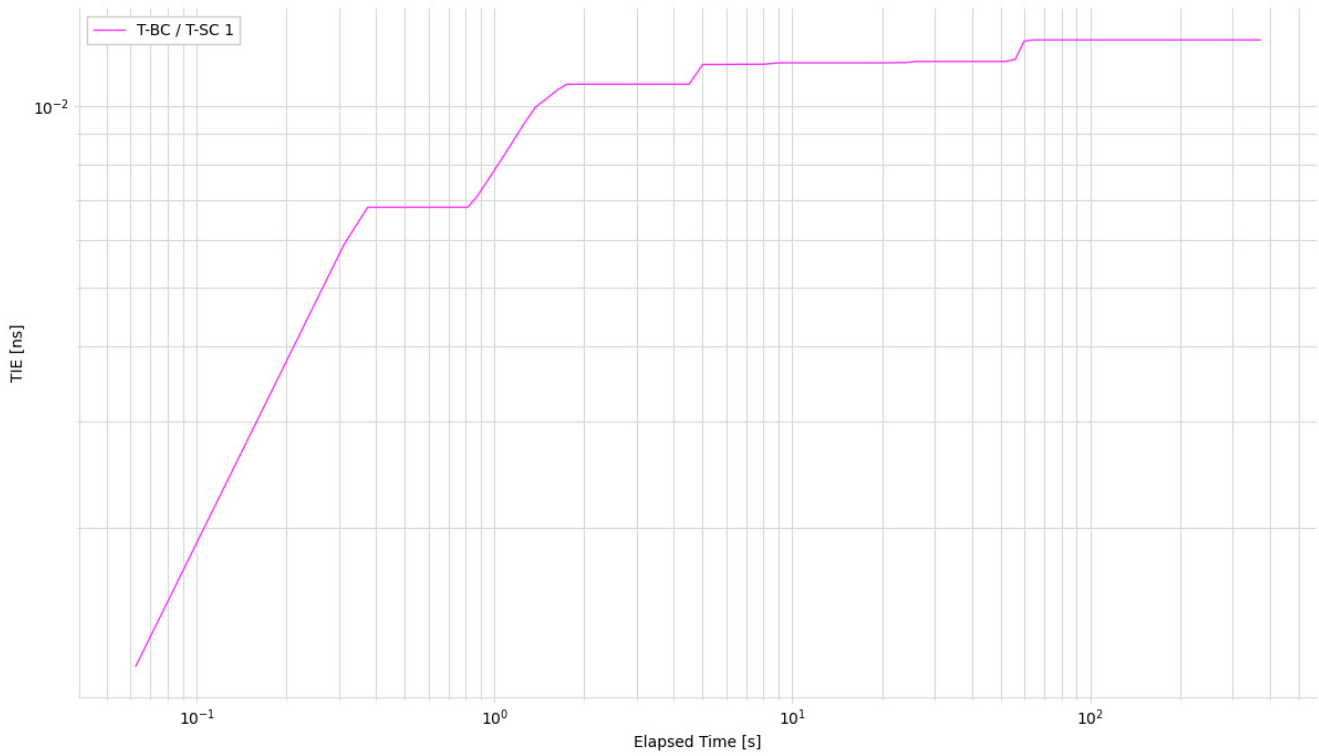


Figure 10. Phase Transient – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.013
Max-Min [ns]	0.012

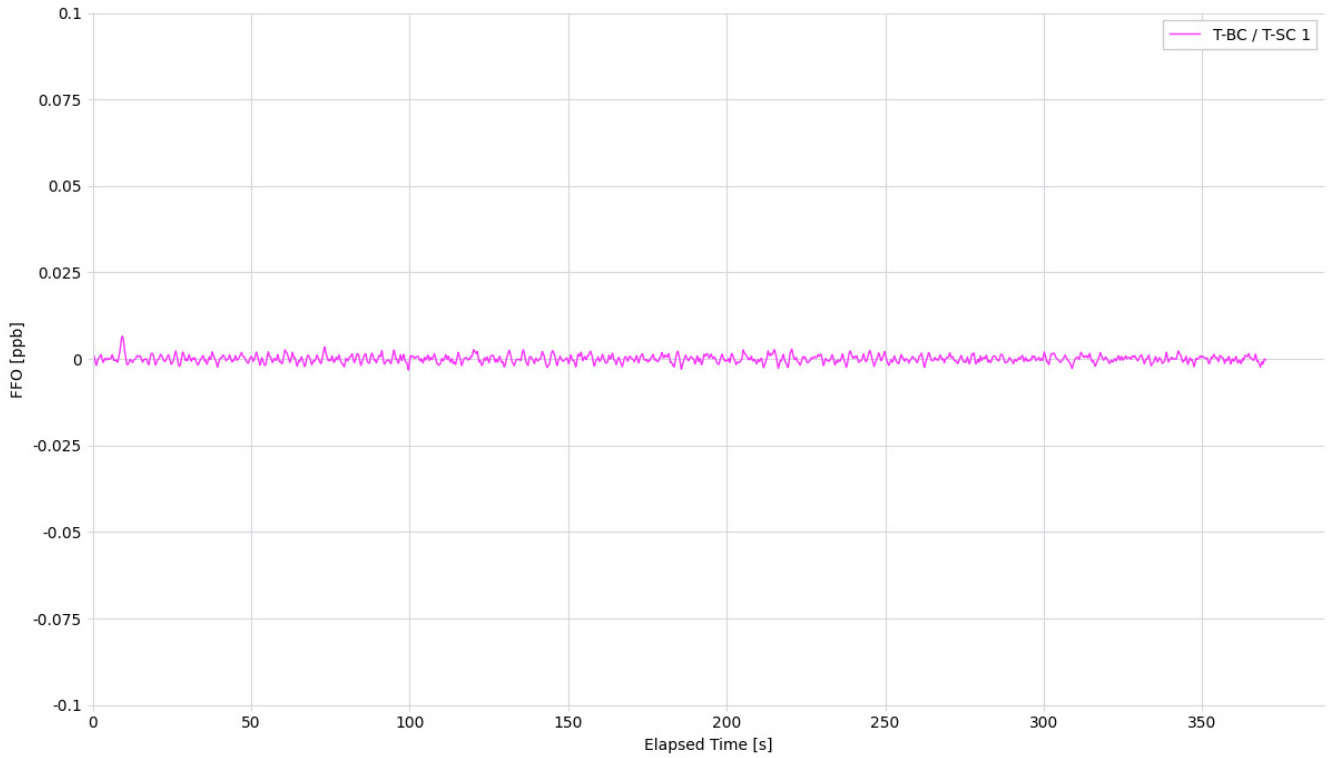


Figure 11. Phase Transient – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.003
Max [ppb]	0.007
Max-Min [ppb]	0.01

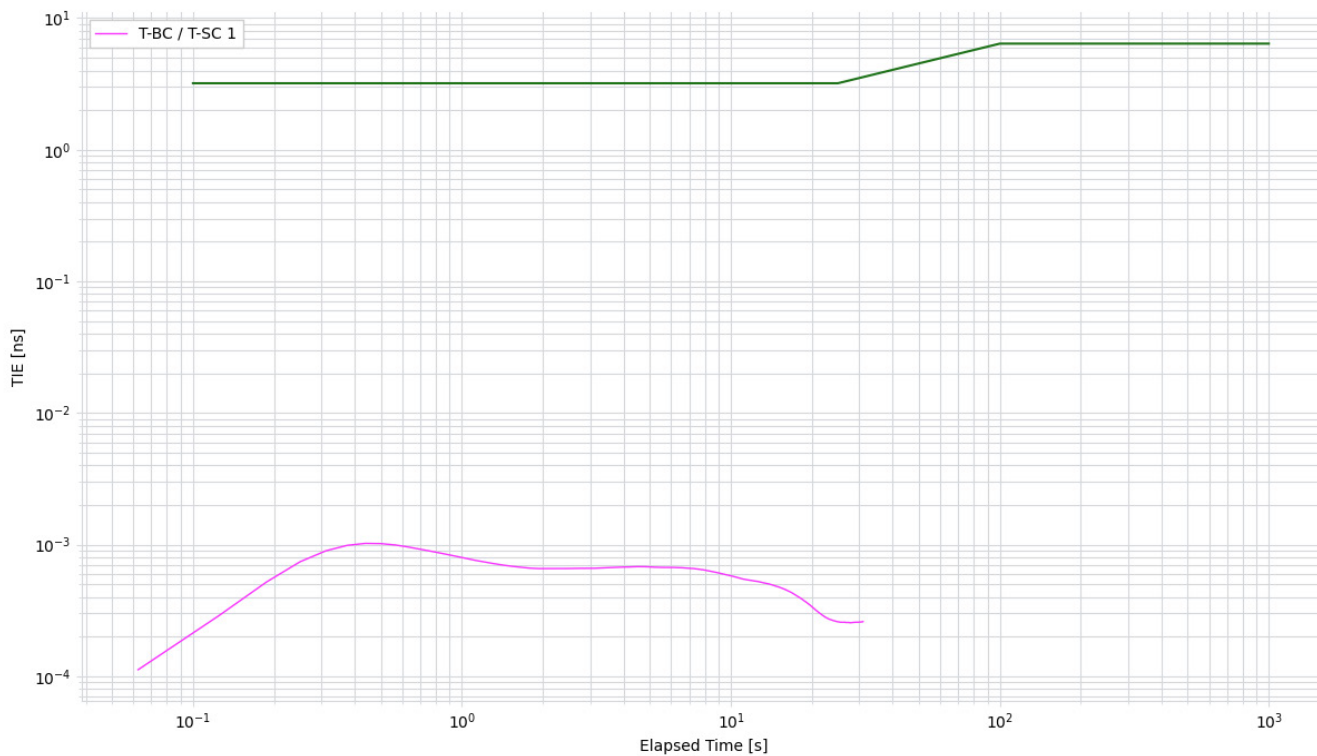


Figure 12. Phase Transient – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.1.3. Phase Transient – G.8262 EEC Option 2, 0.1Hz

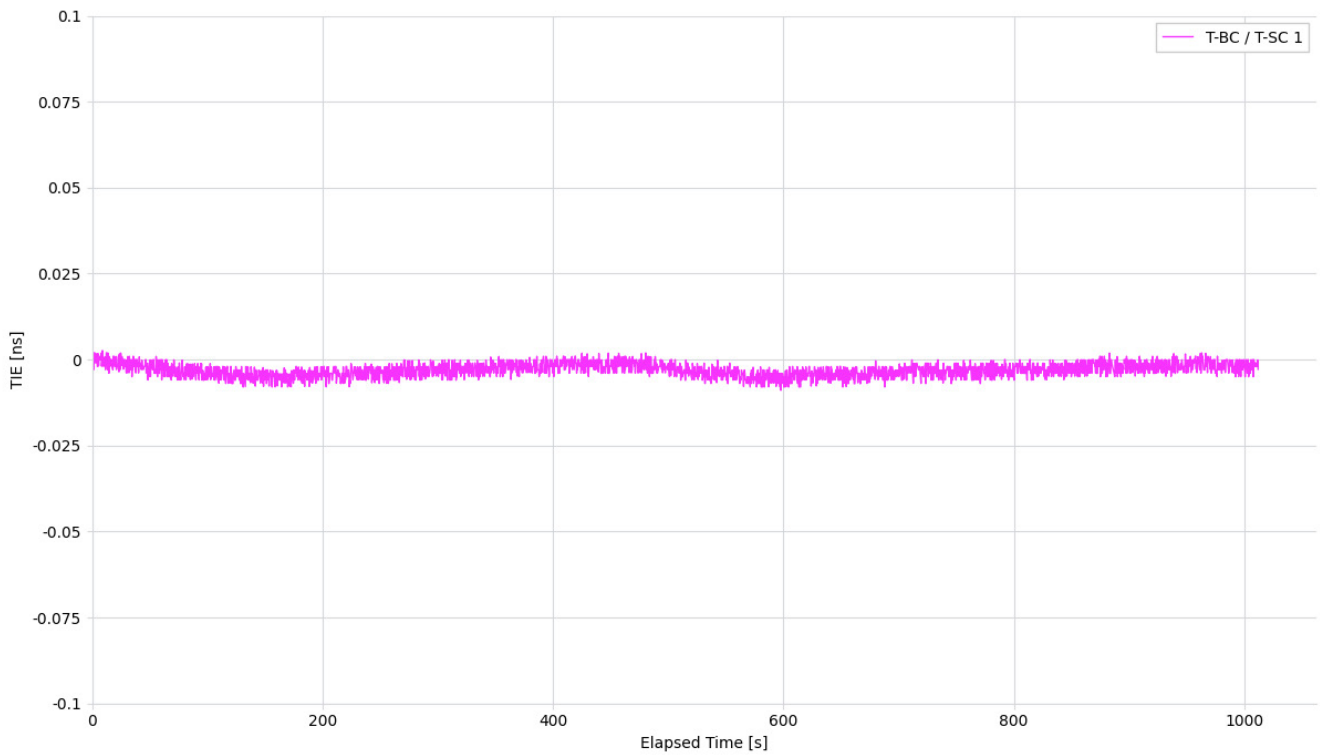


Figure 13. Phase Transient – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.003
Min [ns]	-0.009
Max [ns]	0.003
Max-Min [ns]	0.012

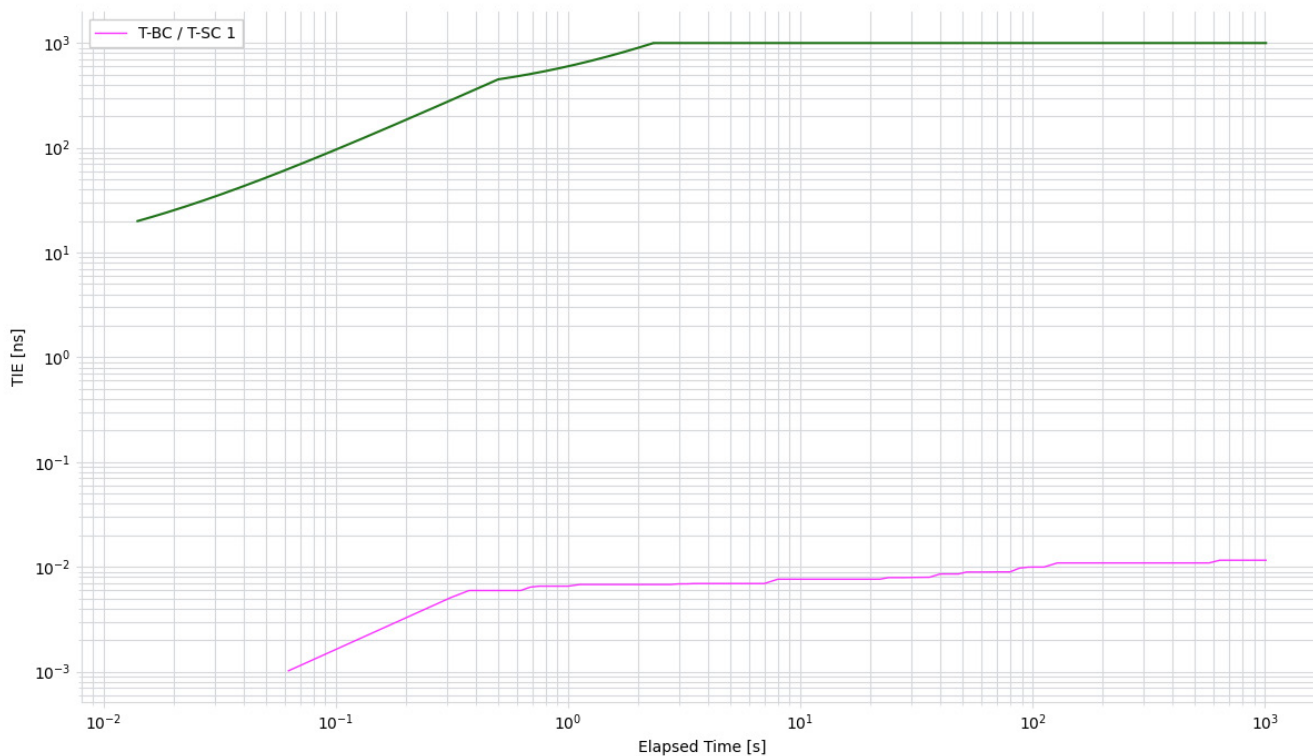


Figure 14. Phase Transient – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.012
Max-Min [ns]	0.011

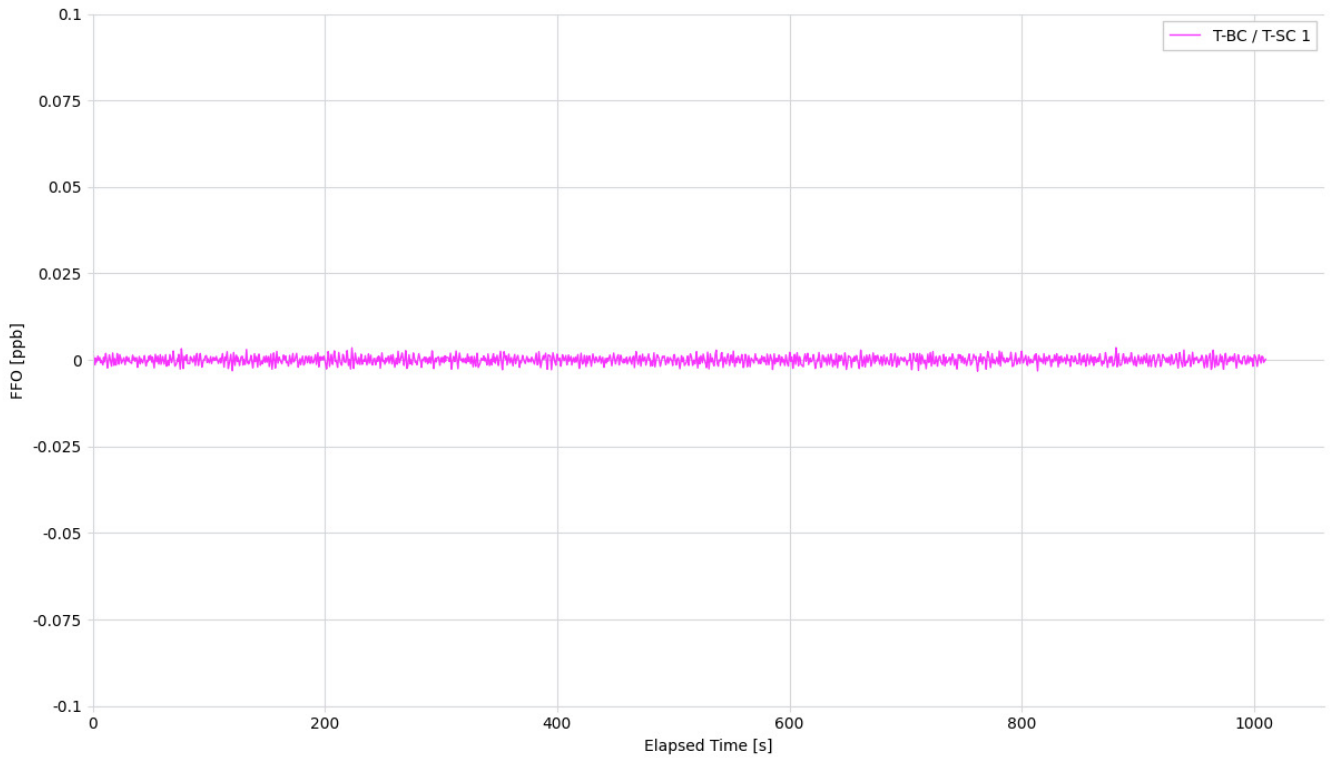


Figure 15. Phase Transient – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.003
Max [ppb]	0.004
Max-Min [ppb]	0.007

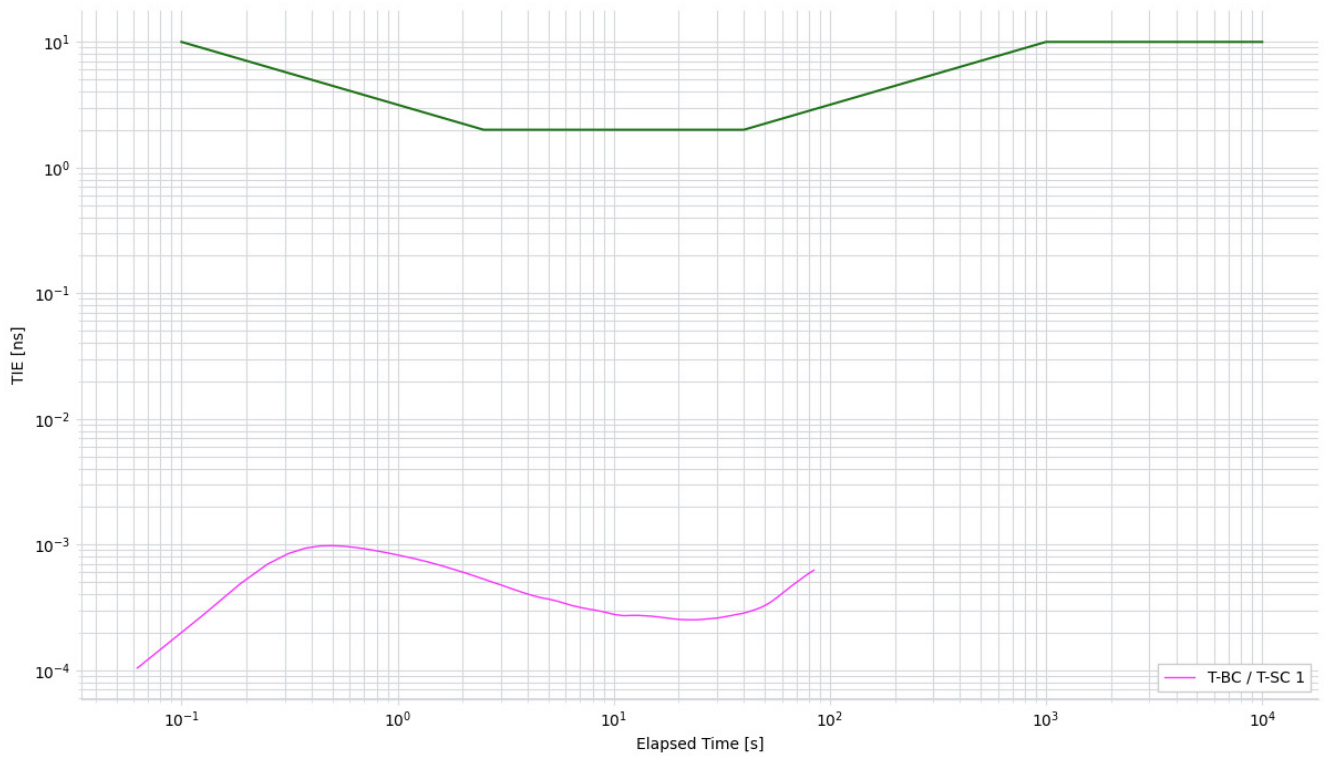


Figure 16. Phase Transient – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.1.4. Phase Transient – G.8262.1 eEEC, 3Hz

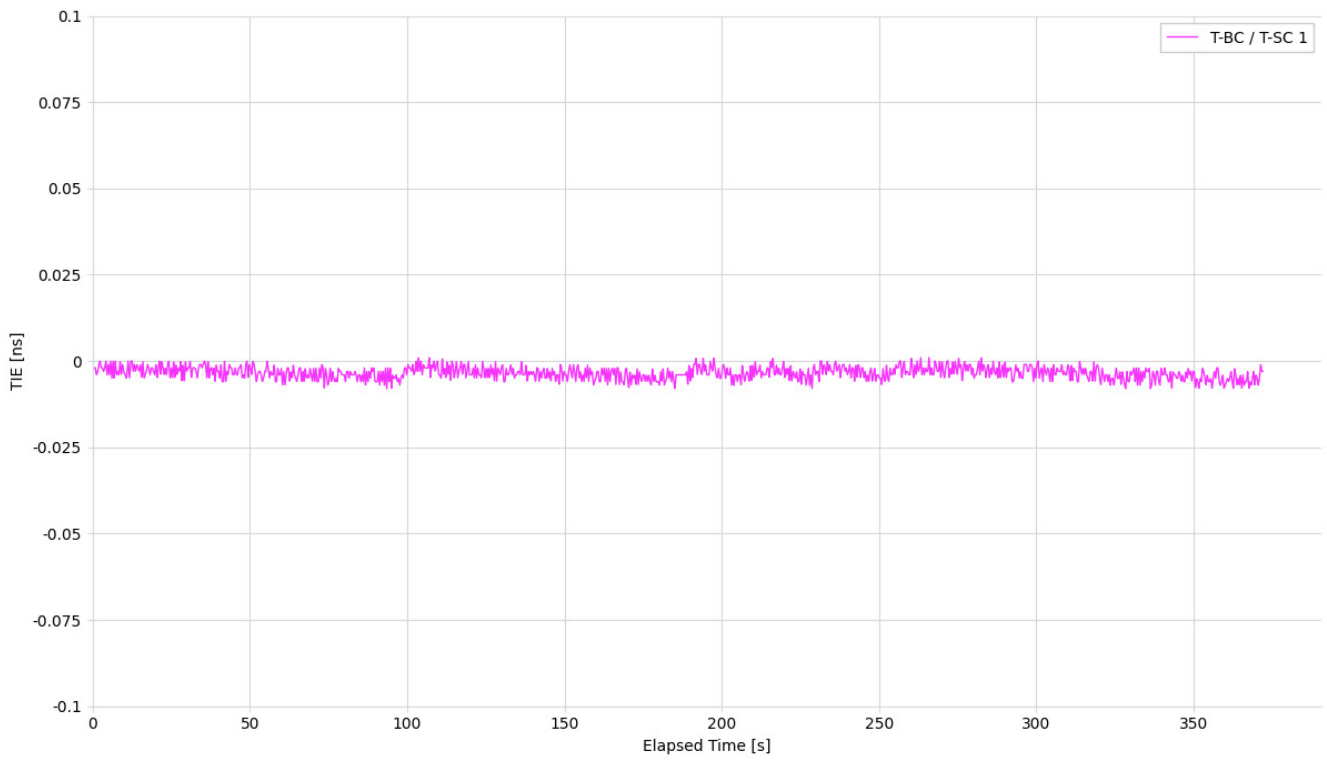


Figure 17. Phase Transient – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.003
Min [ns]	-0.008
Max [ns]	0.001
Max-Min [ns]	0.009

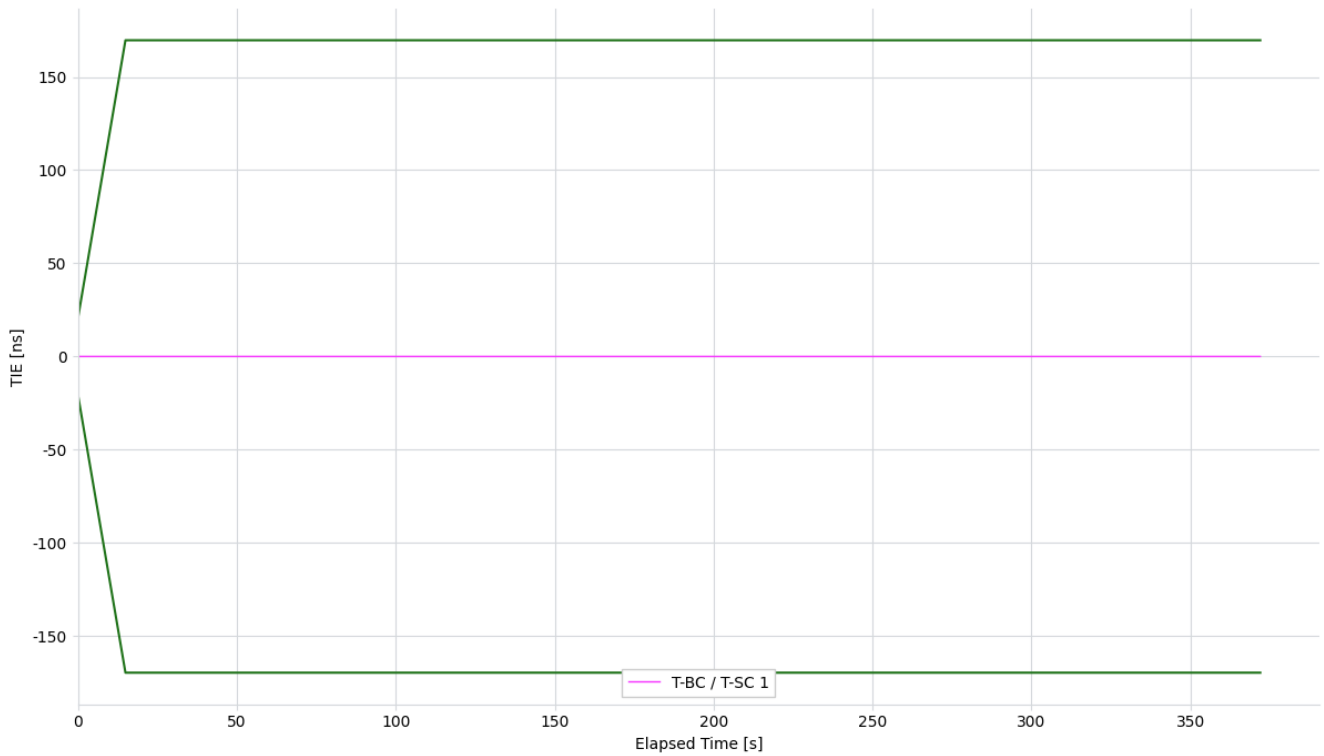


Figure 18. Phase Transient – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.003
Min [ns]	-0.008
Max [ns]	0.001
Max-Min [ns]	0.009

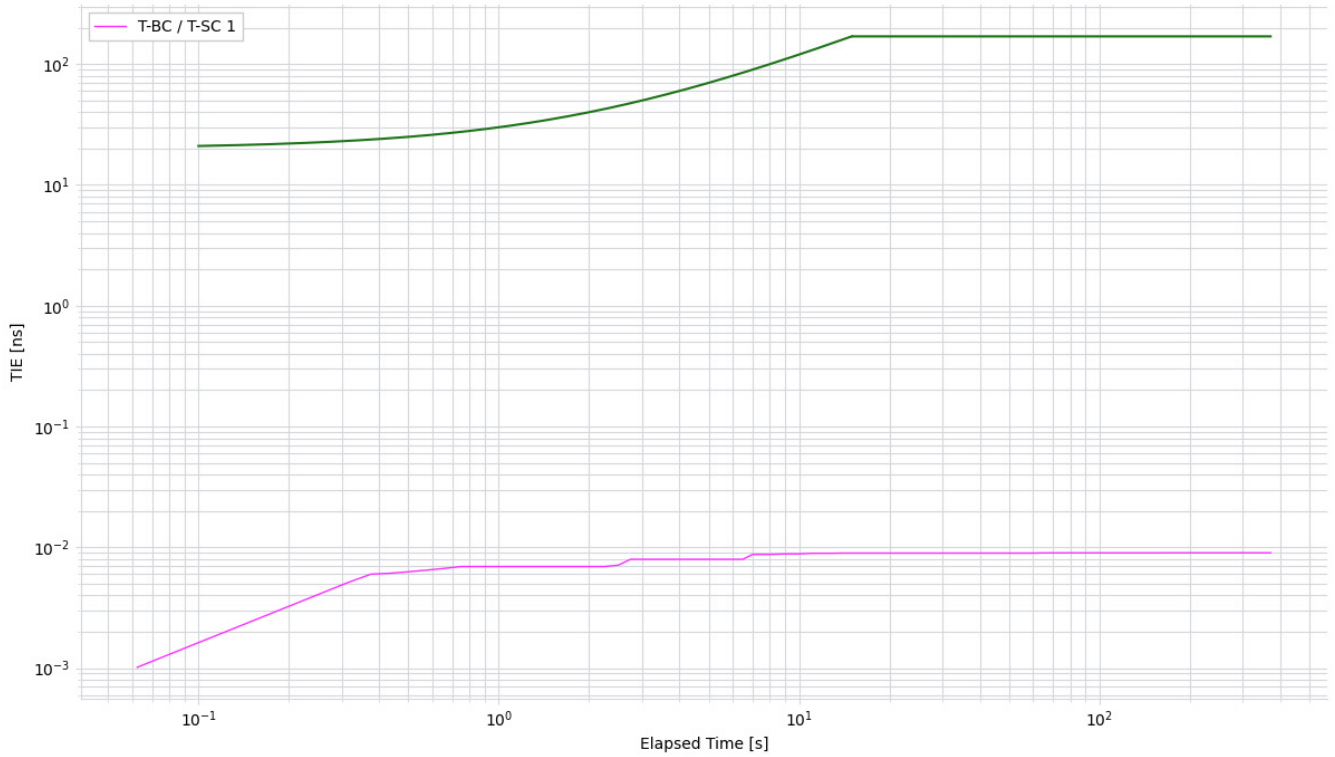


Figure 19. Phase Transient – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.009
Max-Min [ns]	0.008

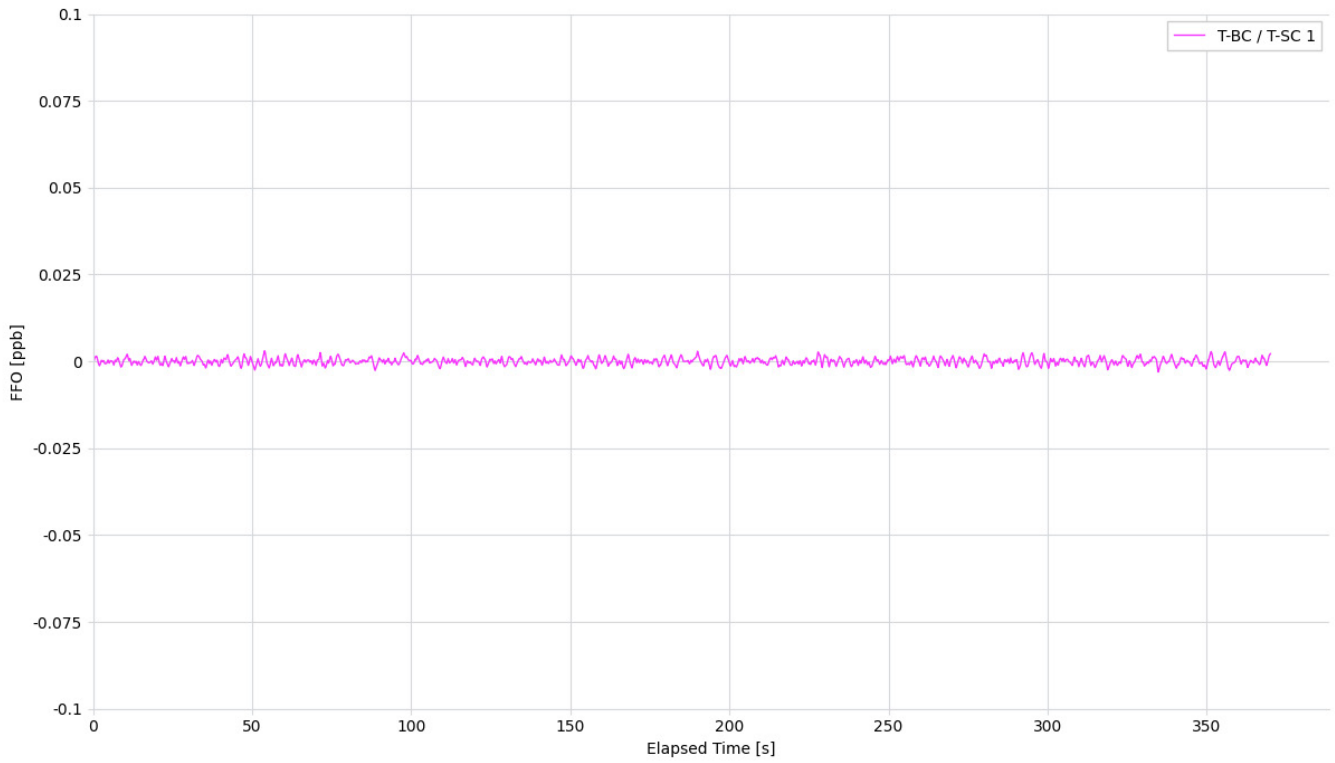


Figure 20. Phase Transient – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.006

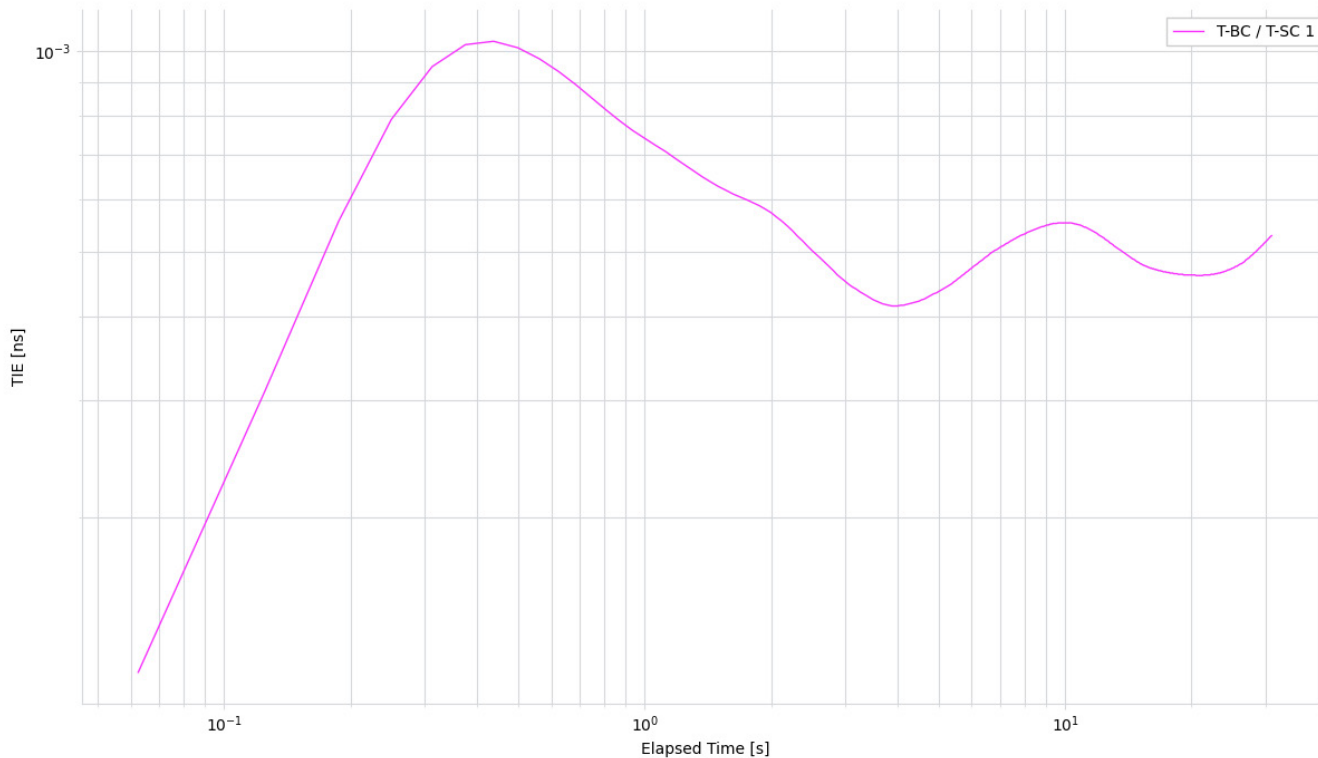


Figure 21. Phase Transient – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.2 Phase Discontinuity

Phase discontinuity requirement reflects the performance of the DUT in cases when the (selected) input reference is lost due to a failure in the reference path and a second reference input signal, traceable to the same reference clock, is available simultaneously, or shortly after the detection of the failure (see Figure 1 for the equipment configuration).

The test was carried out by providing reference clock inputs on IN_A and IN_B from the Frequency Generator which are 180° out of phase from each other. The PLL is locked to the clock signal from IN_A for a given period of time before producing a phase transient by turning off the signal to IN_A from the waveform generator while the signal at IN_B is simultaneously available to the DUT. The DPLL will try to lock to the reference signal on IN_B. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter. The results of the given transient are plotted against the applicable standard profiles.

6.2.1. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz

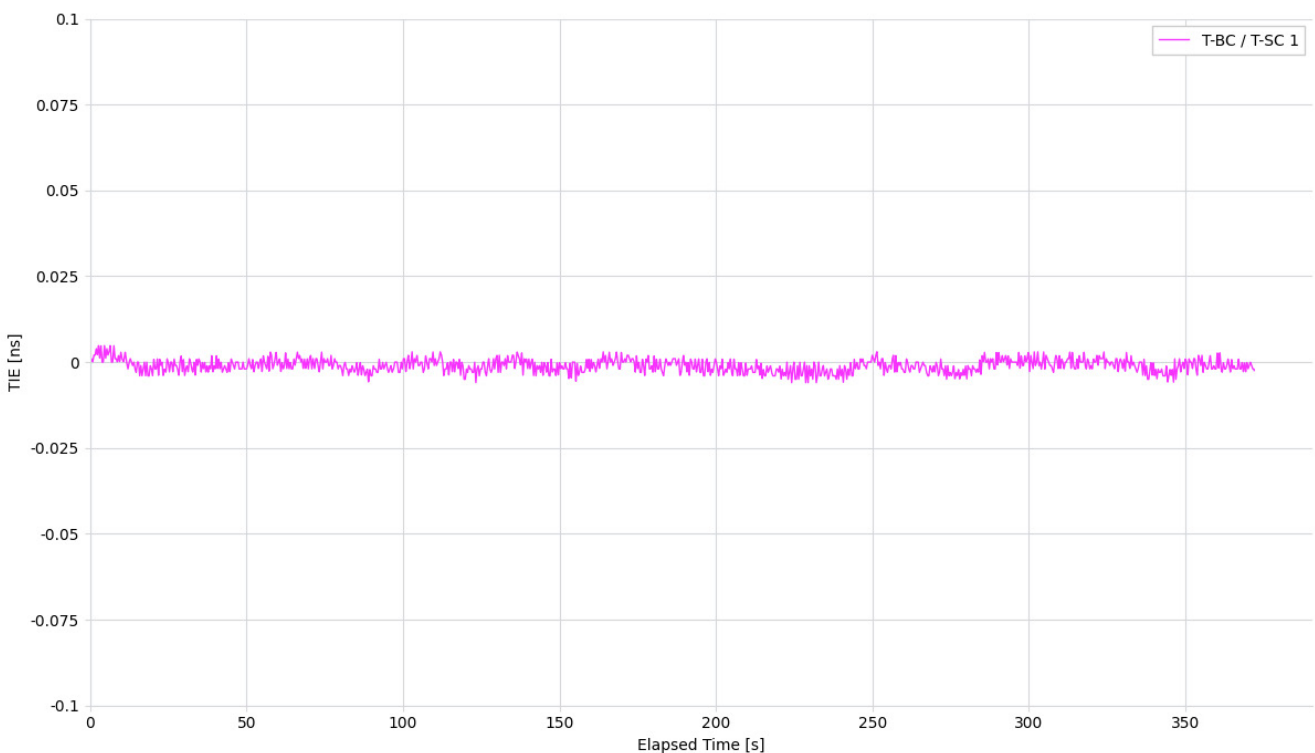


Figure 22. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.001
Min [ns]	-0.006
Max [ns]	0.005
Max-Min [ns]	0.011

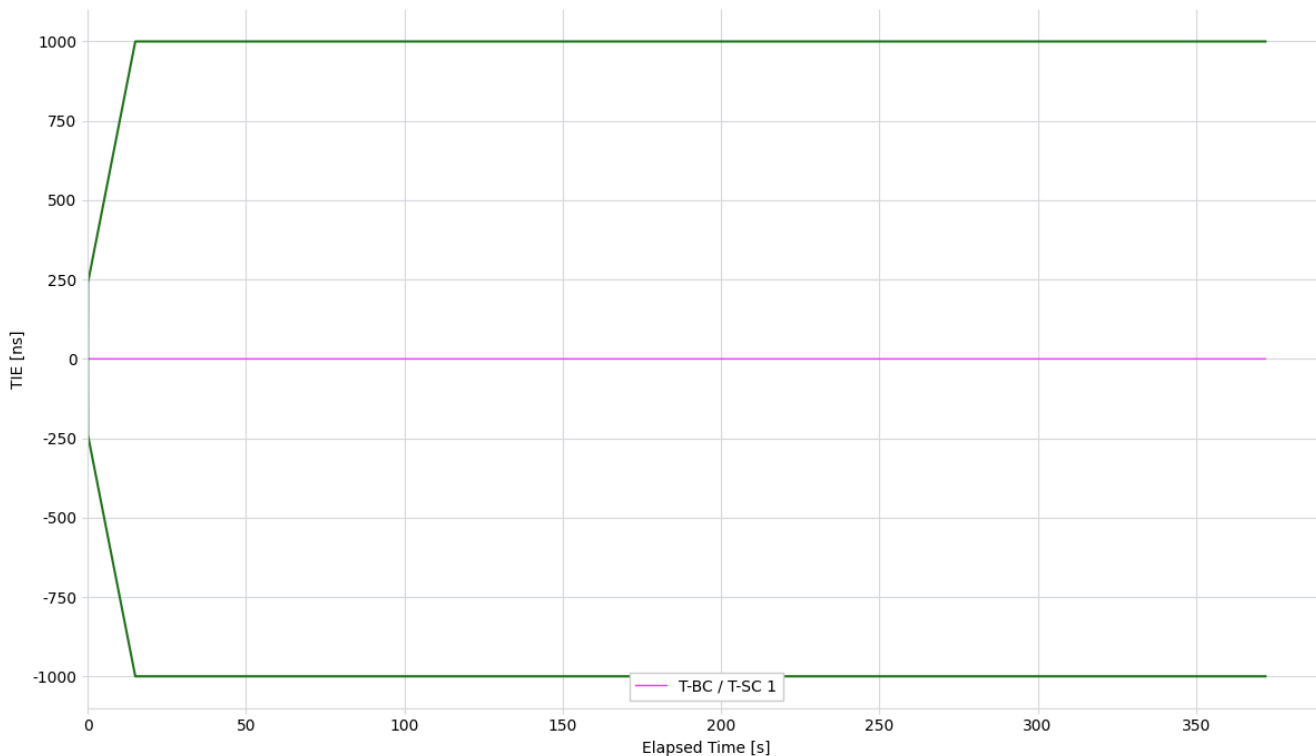


Figure 23. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.001
Min [ns]	-0.006
Max [ns]	0.005
Max-Min [ns]	0.011

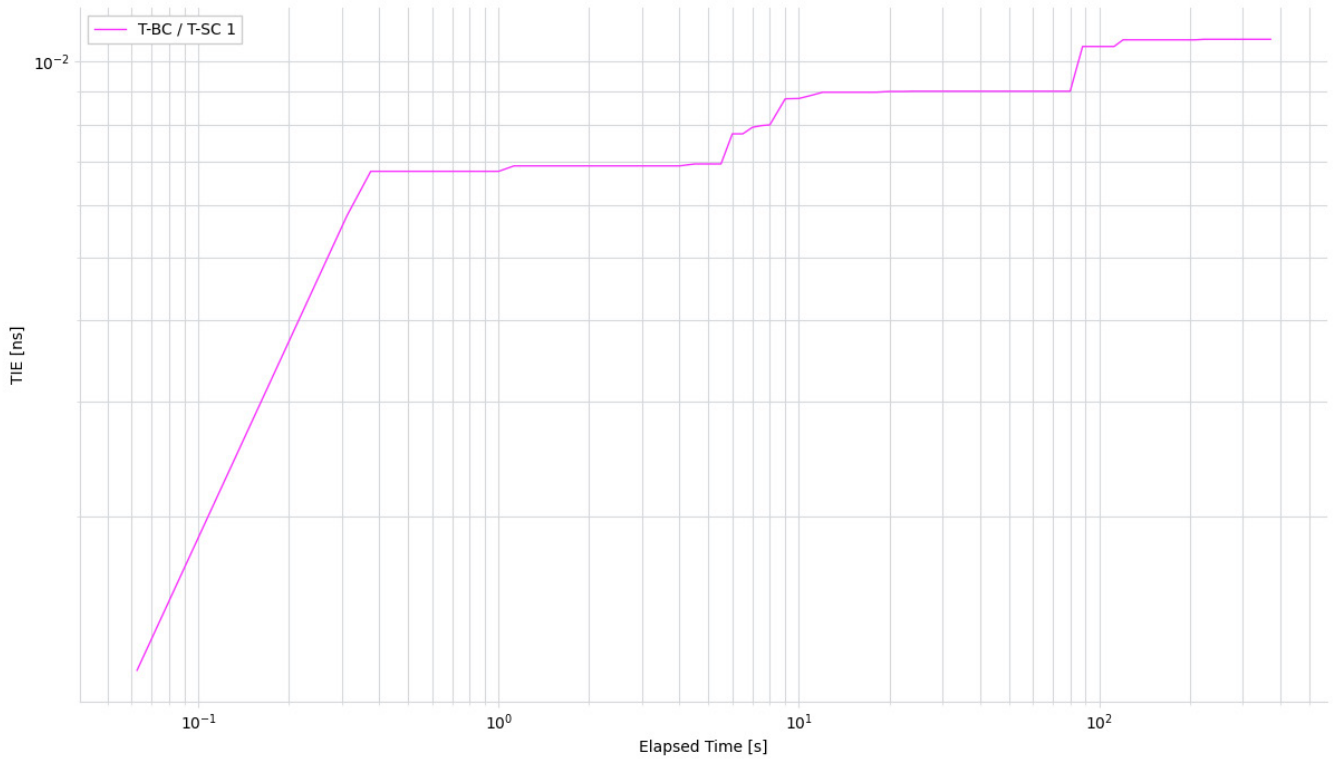


Figure 24. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.011
Max-Min [ns]	0.01

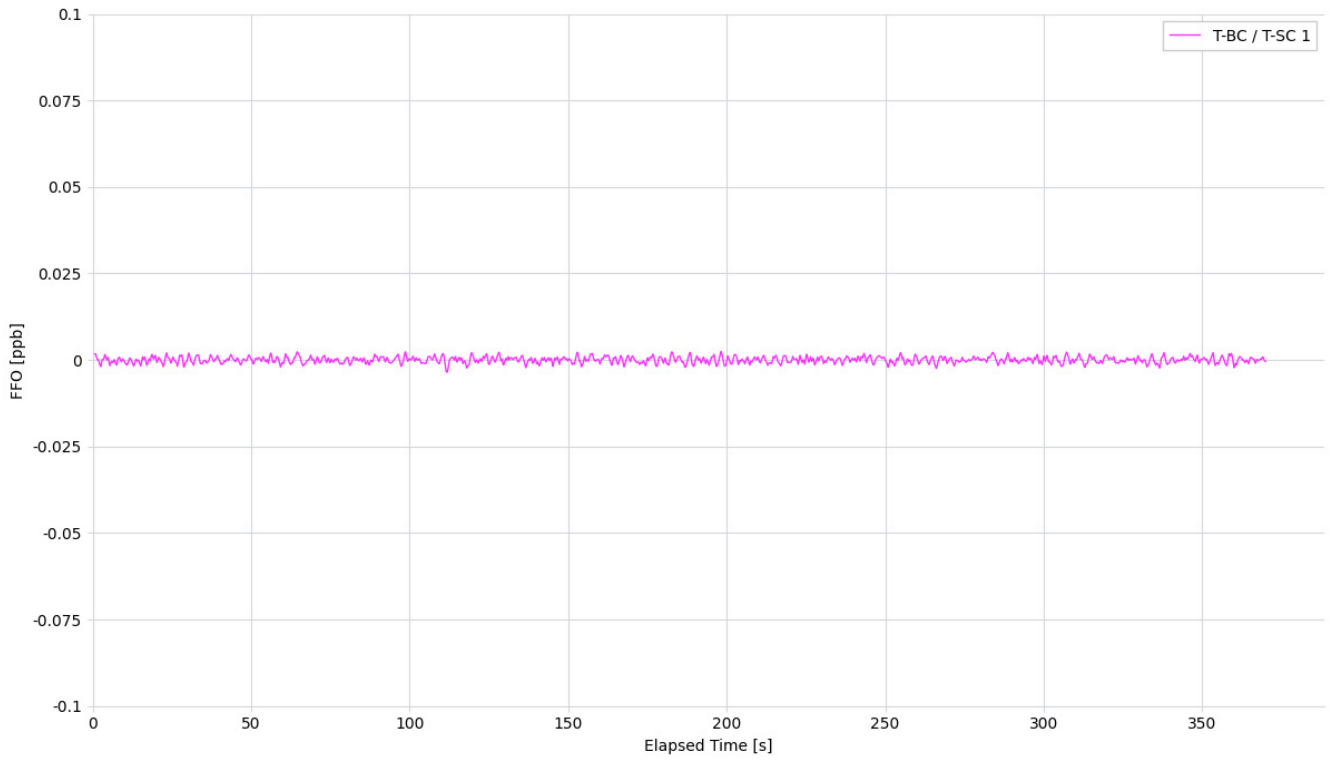


Figure 25. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.004
Max [ppb]	0.002
Max-Min [ppb]	0.006

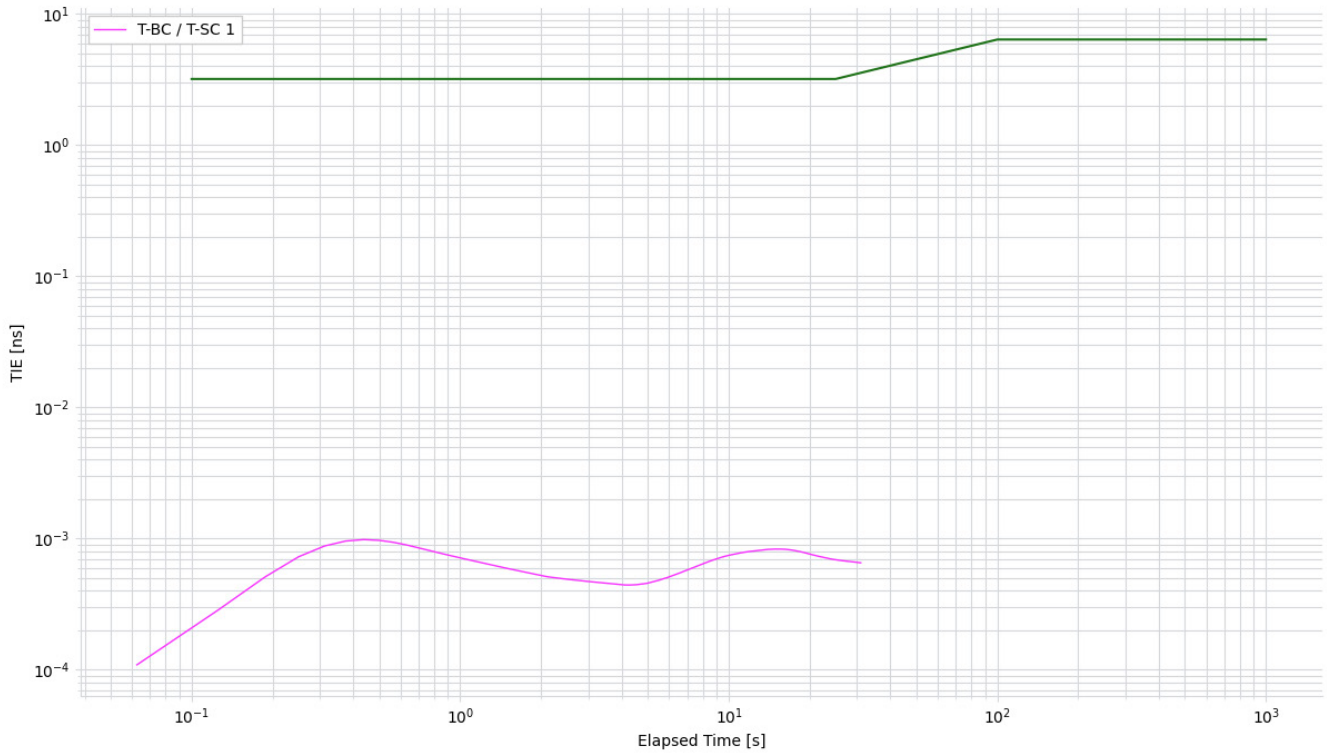


Figure 26. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.2.2. Phase Discontinuity – G.8262 EEC Option 1, 10Hz

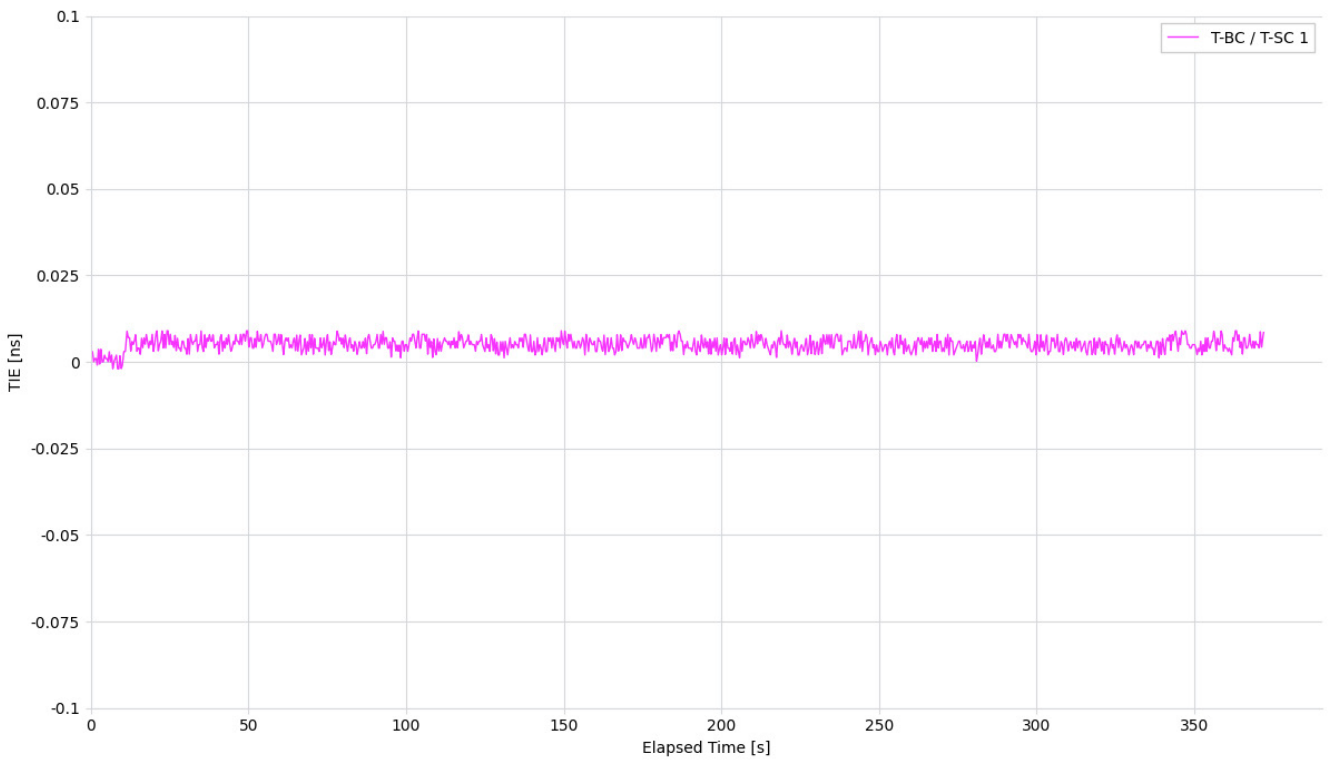


Figure 27. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	0.005
Min [ns]	-0.002
Max [ns]	0.009
Max-Min [ns]	0.011

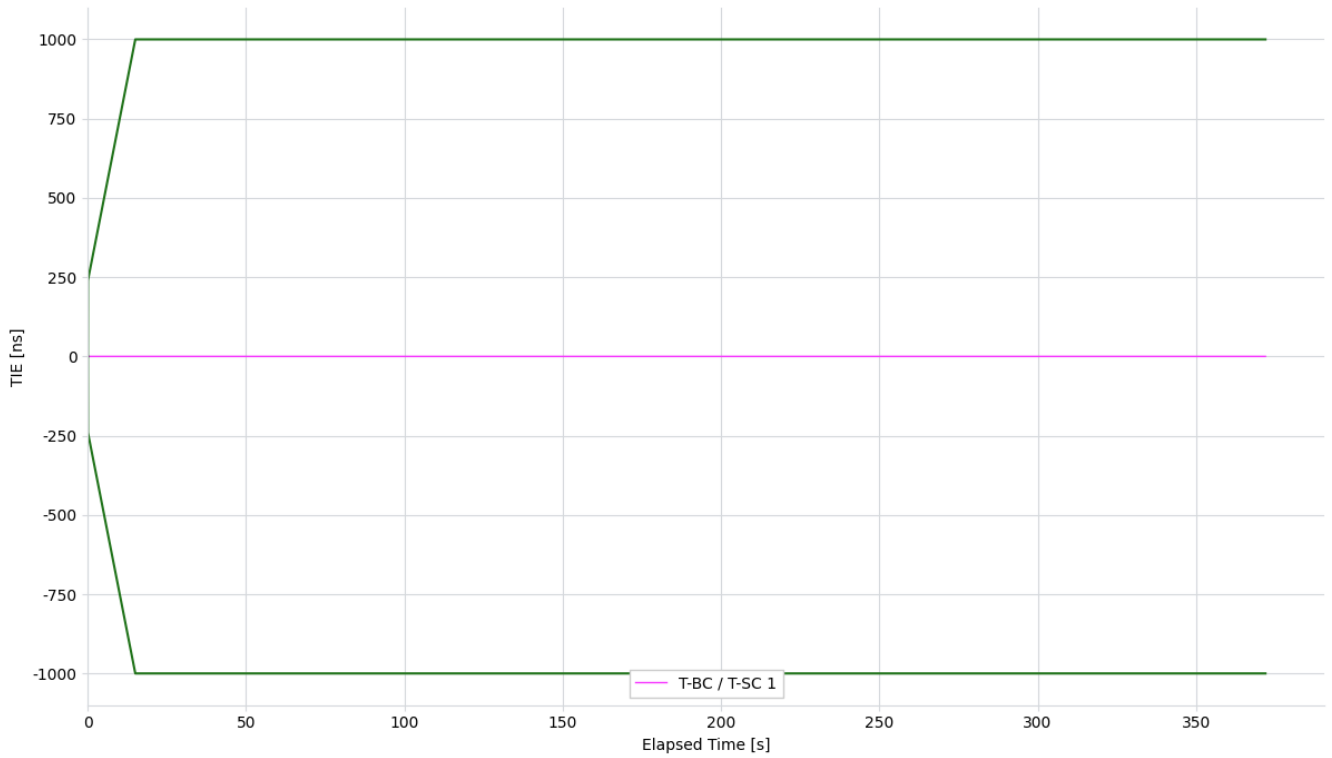


Figure 28. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.005
Min [ns]	-0.002
Max [ns]	0.009
Max-Min [ns]	0.011

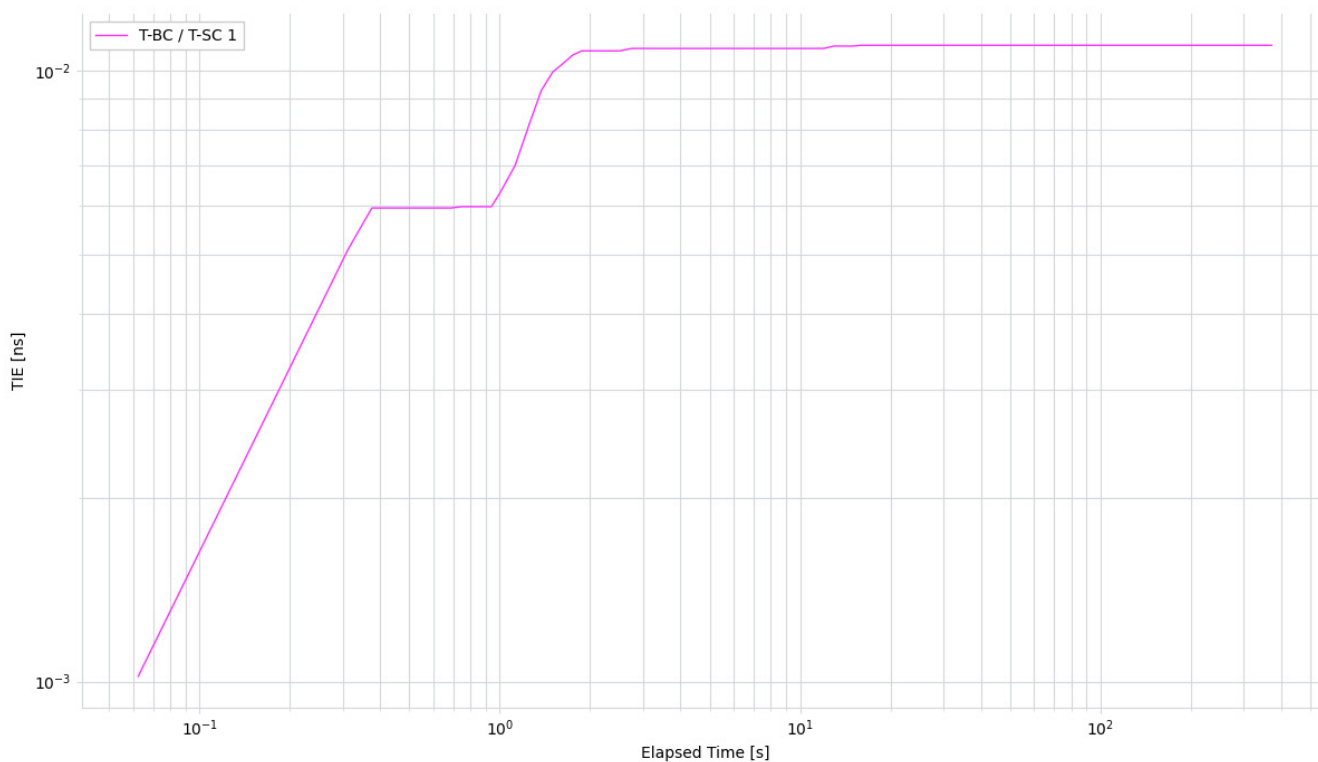


Figure 29. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.011
Max-Min [ns]	0.01

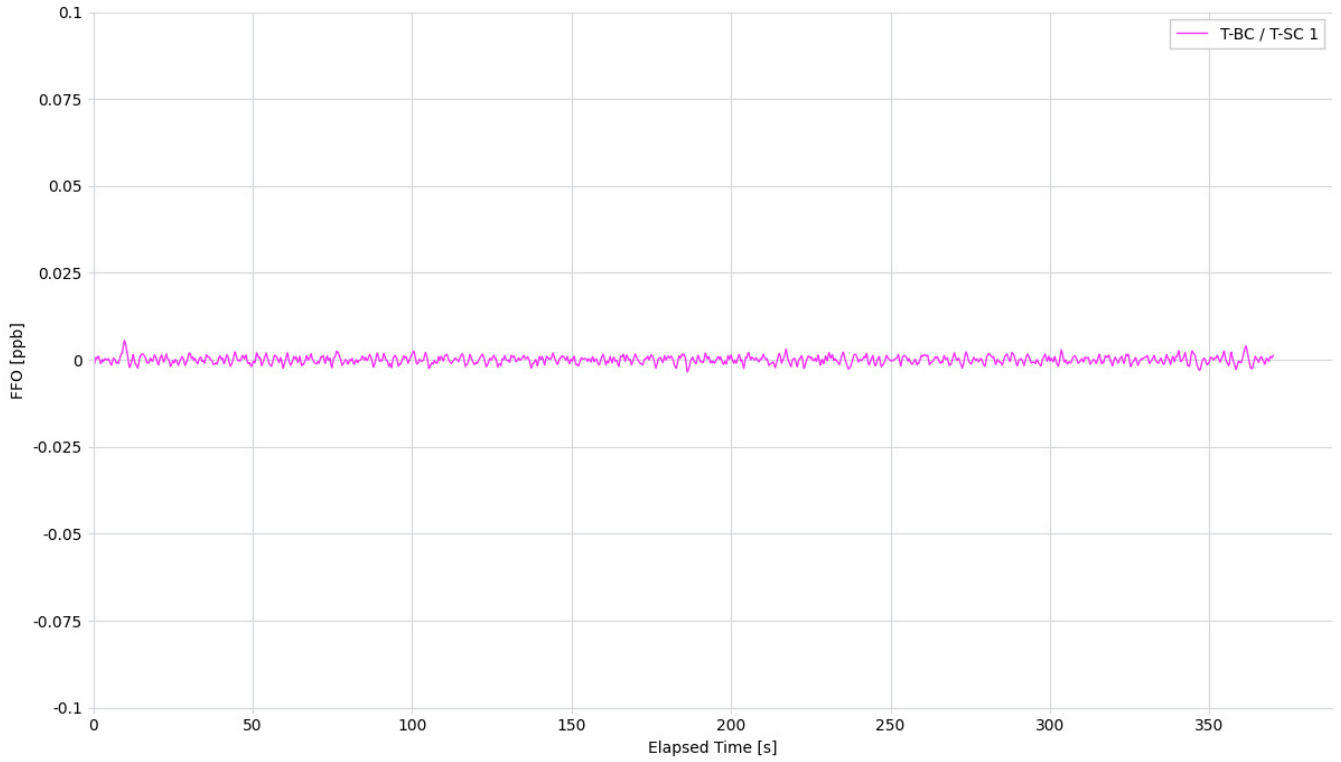


Figure 30. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.003
Max [ppb]	0.006
Max-Min [ppb]	0.009

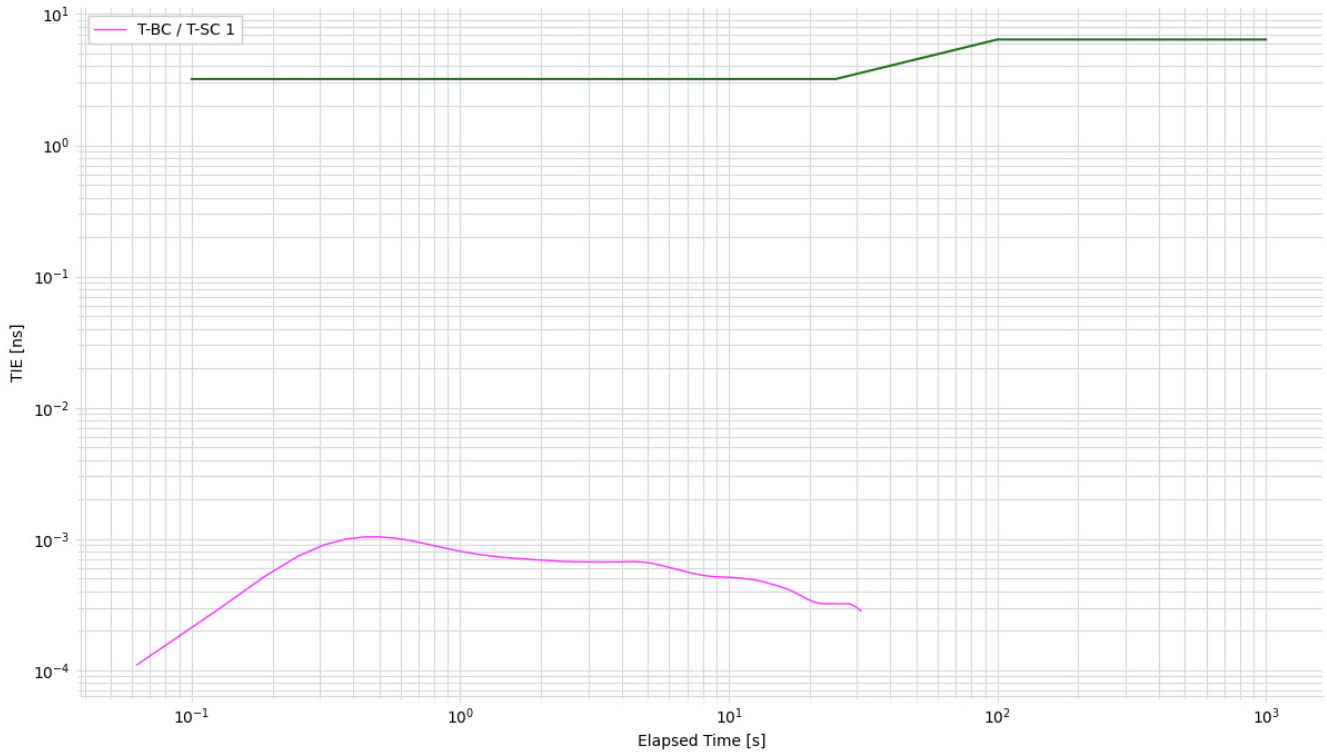


Figure 31. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.2.3. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz

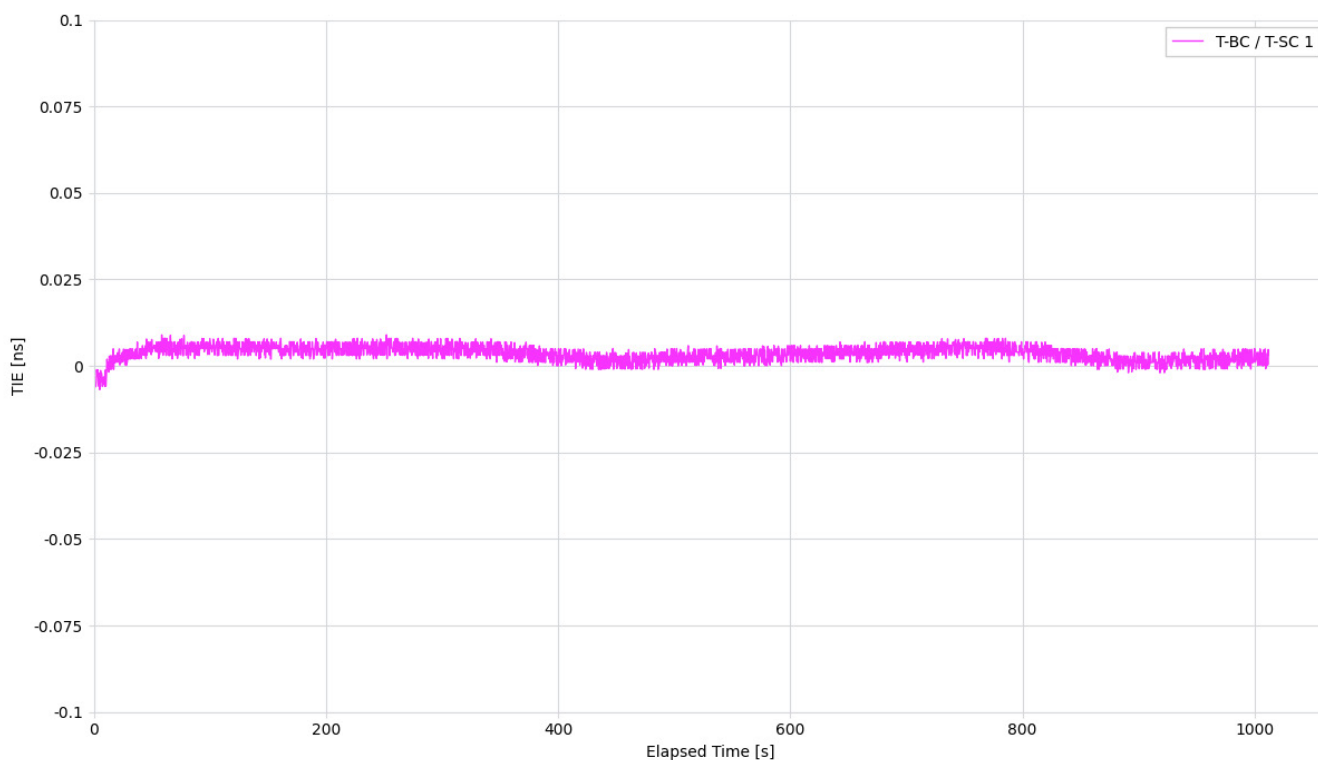


Figure 32. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.004
Min [ns]	-0.007
Max [ns]	0.009
Max-Min [ns]	0.016

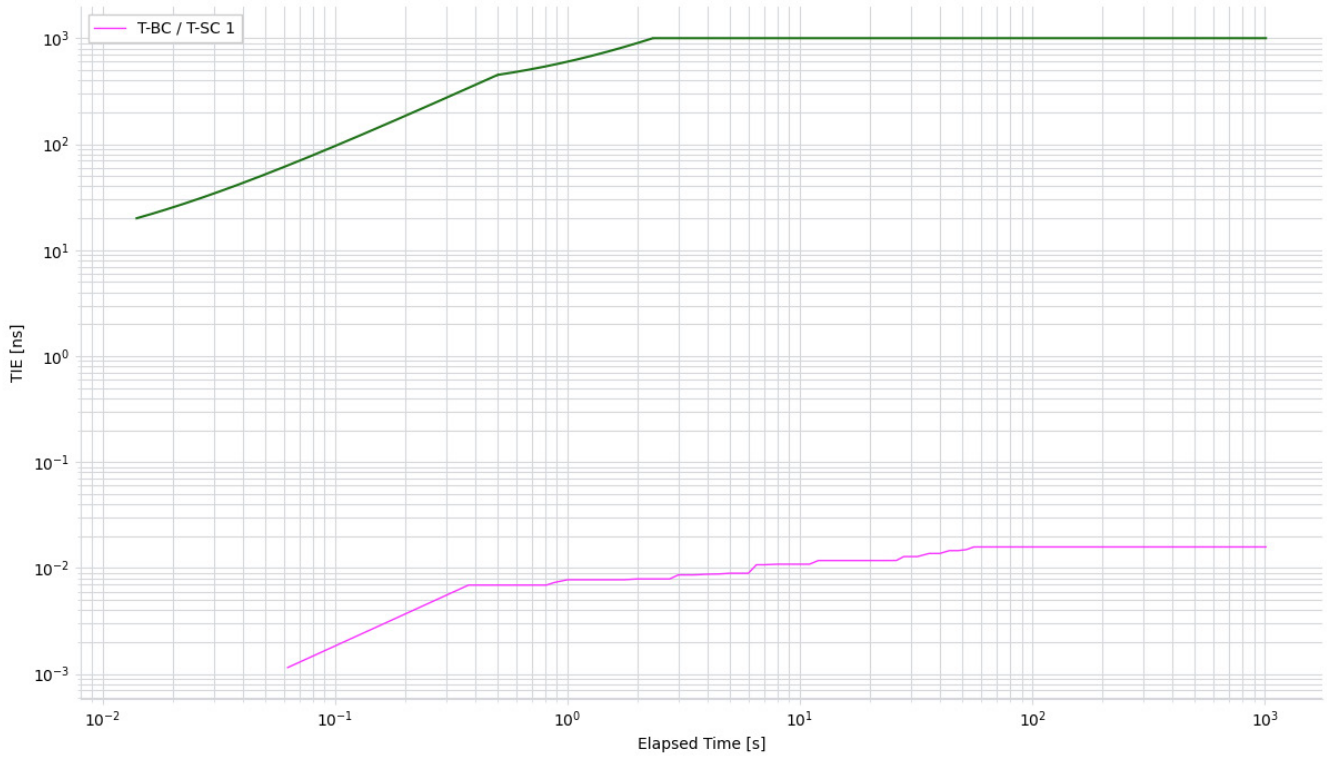


Figure 33. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.016
Max-Min [ns]	0.015

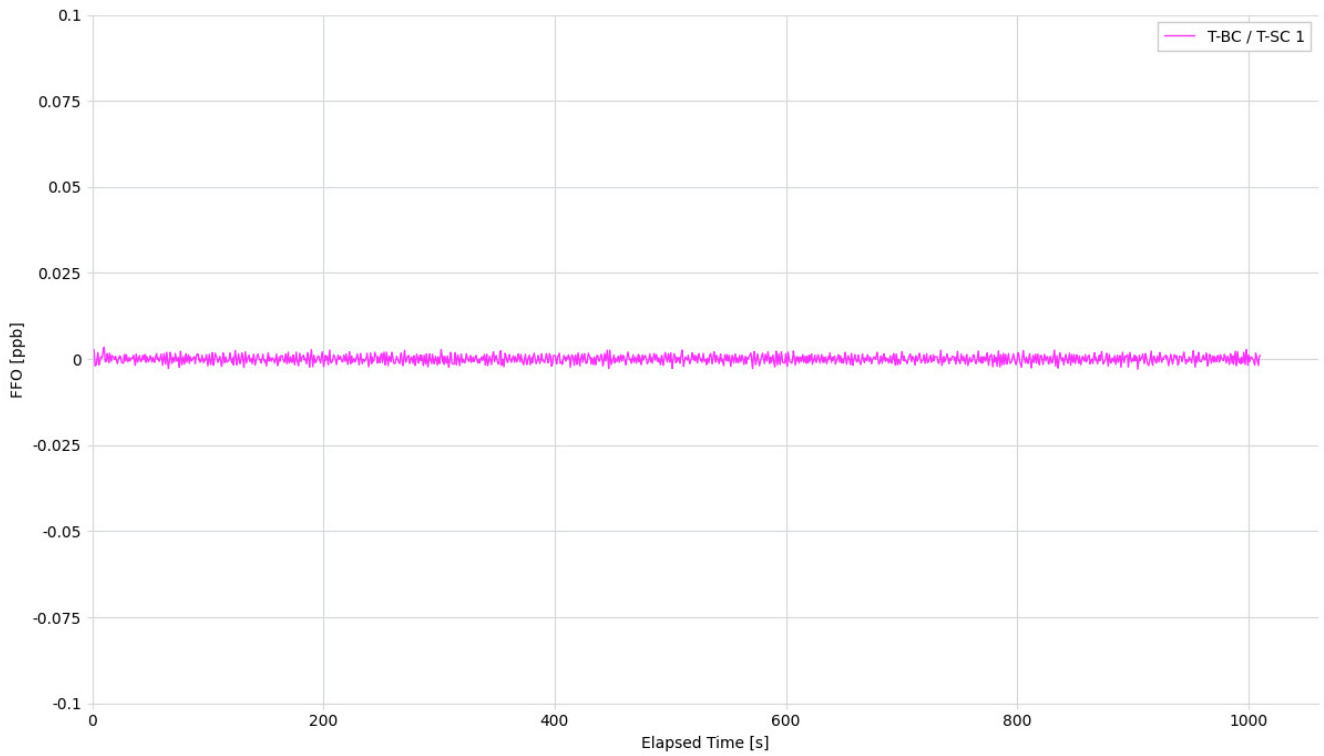


Figure 34. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.006

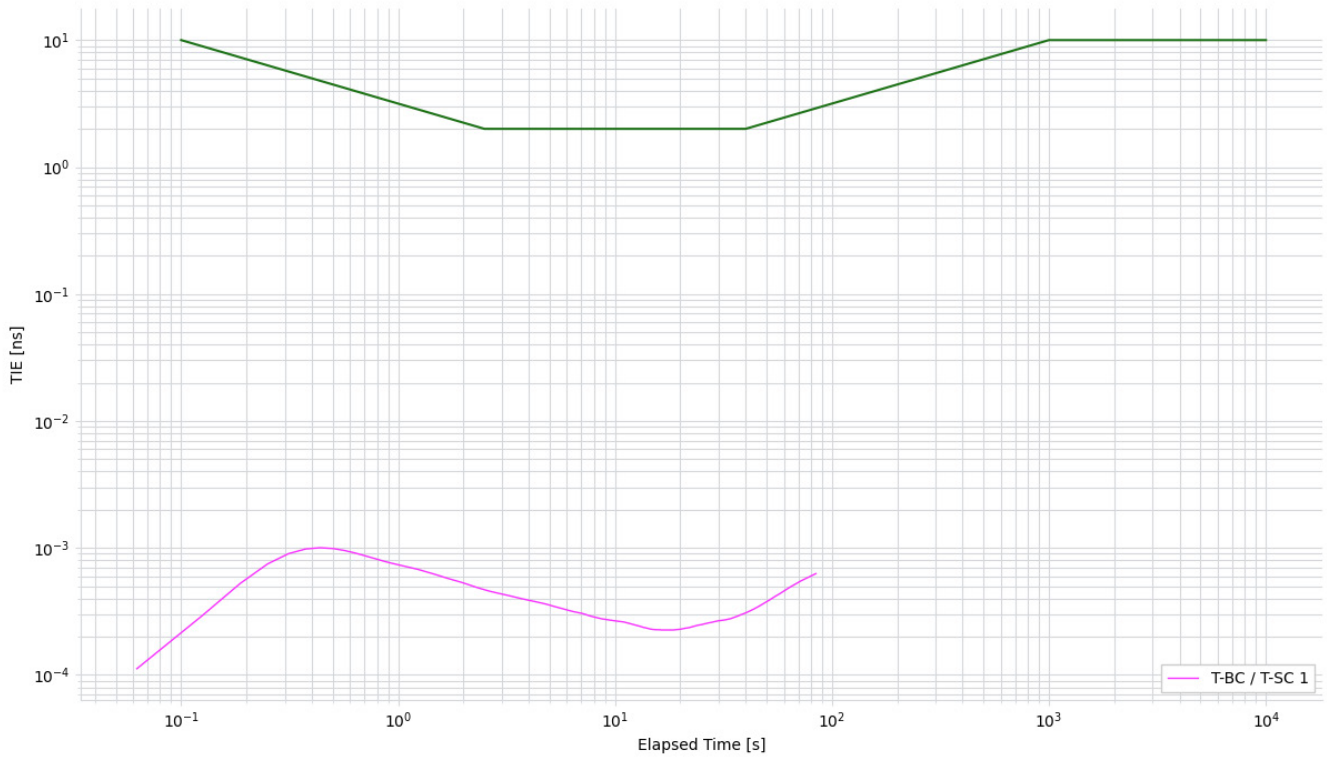


Figure 35. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.2.4. Phase Discontinuity – G.8262.1 eEEC, 3Hz

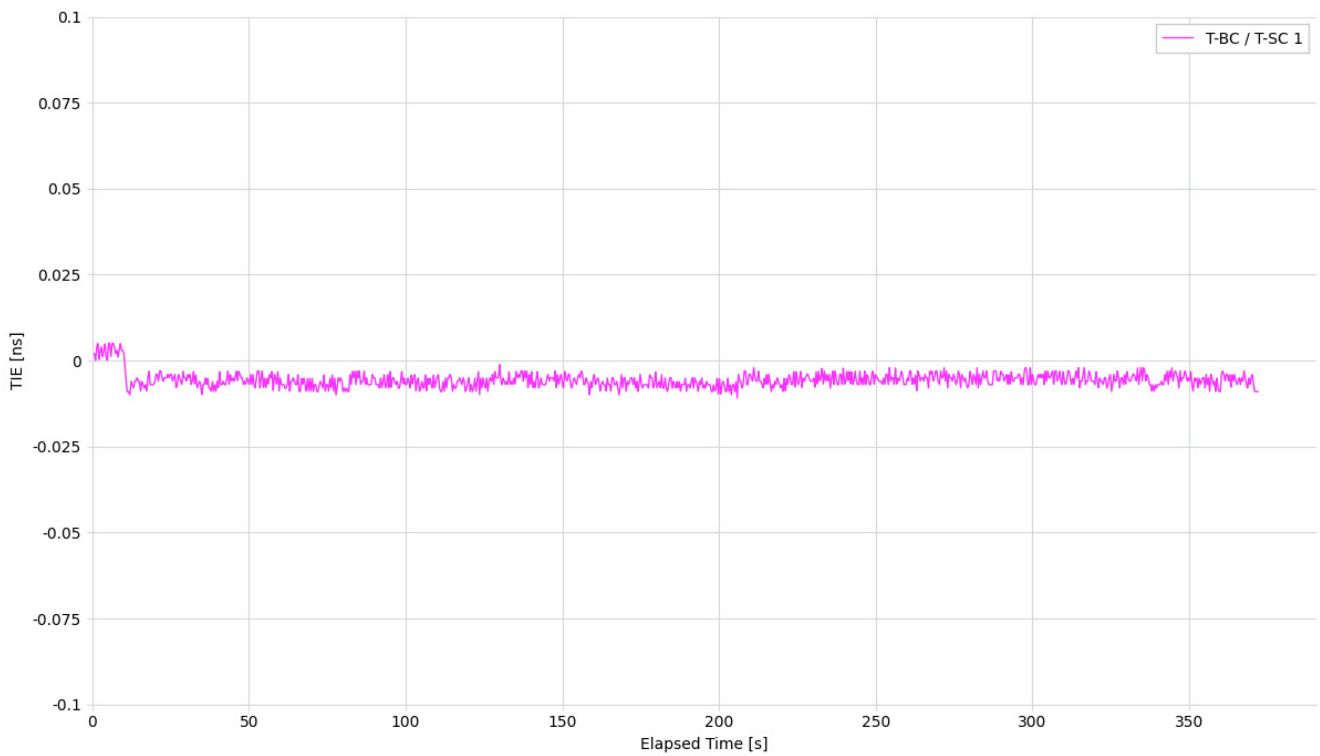


Figure 36. Phase Discontinuity – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.006
Min [ns]	-0.011
Max [ns]	0.005
Max-Min [ns]	0.016

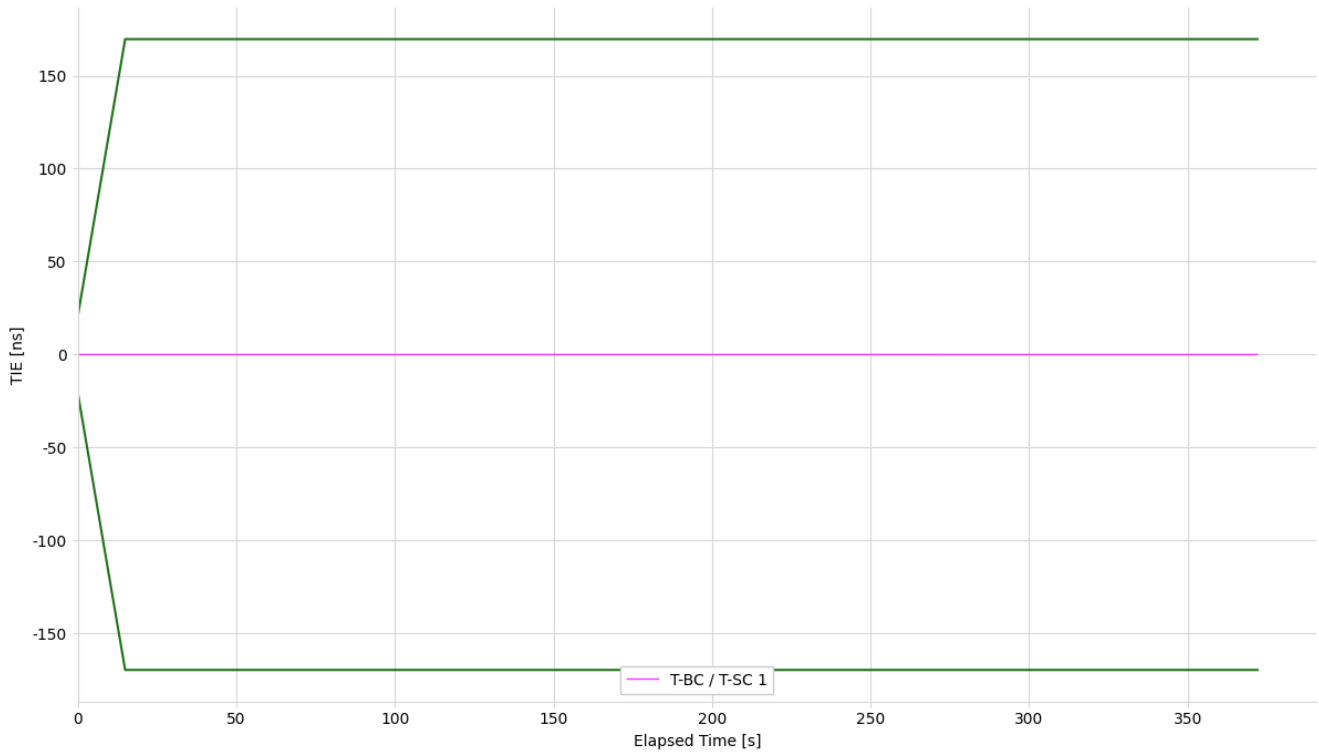


Figure 37. Phase Discontinuity – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.006
Min [ns]	-0.011
Max [ns]	0.005
Max-Min [ns]	0.016

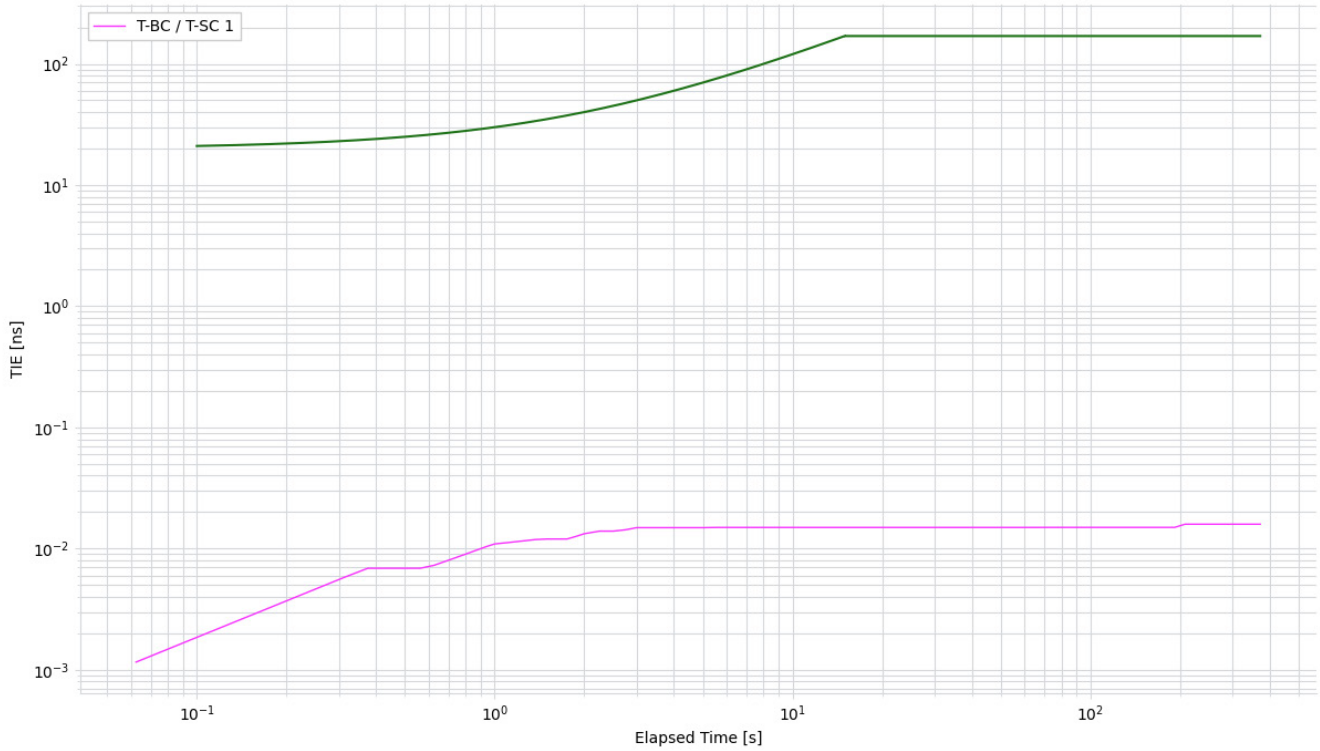


Figure 38. Phase Discontinuity – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.016
Max-Min [ns]	0.015

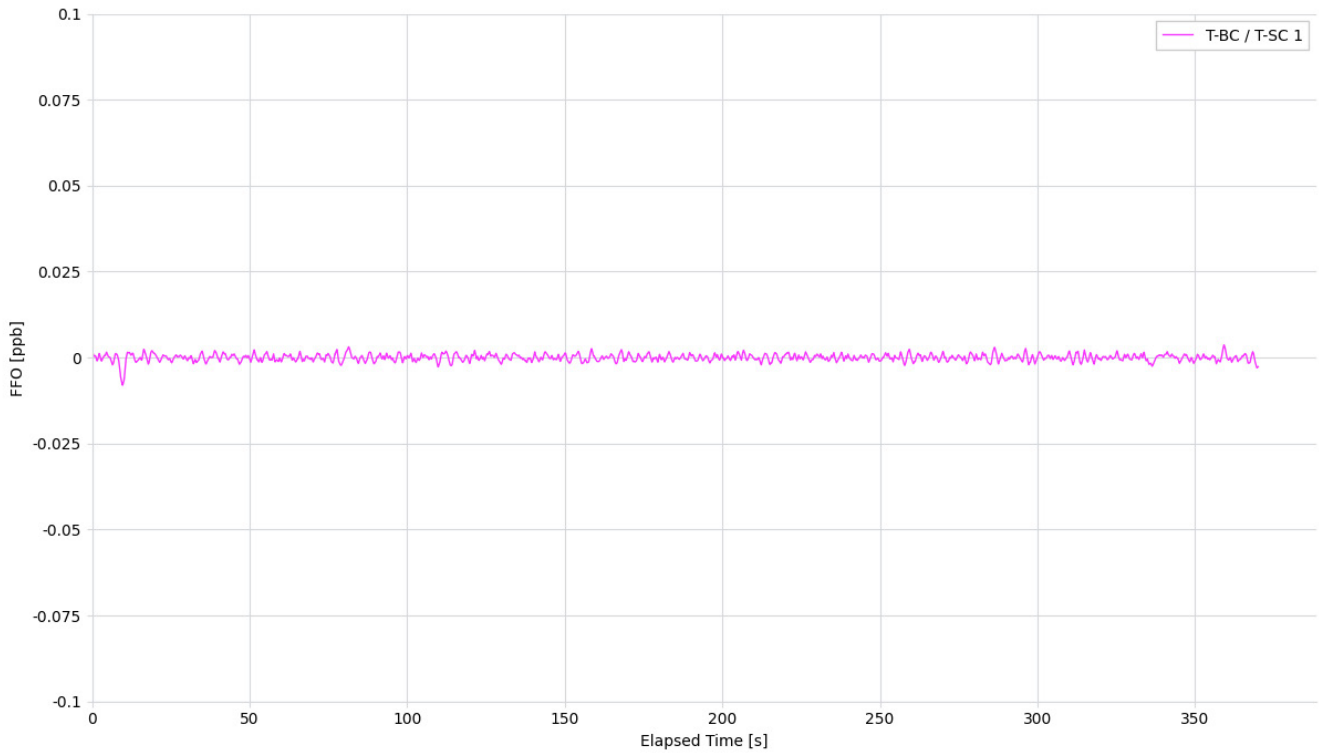


Figure 39. Phase Discontinuity – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.008
Max [ppb]	0.004
Max-Min [ppb]	0.012

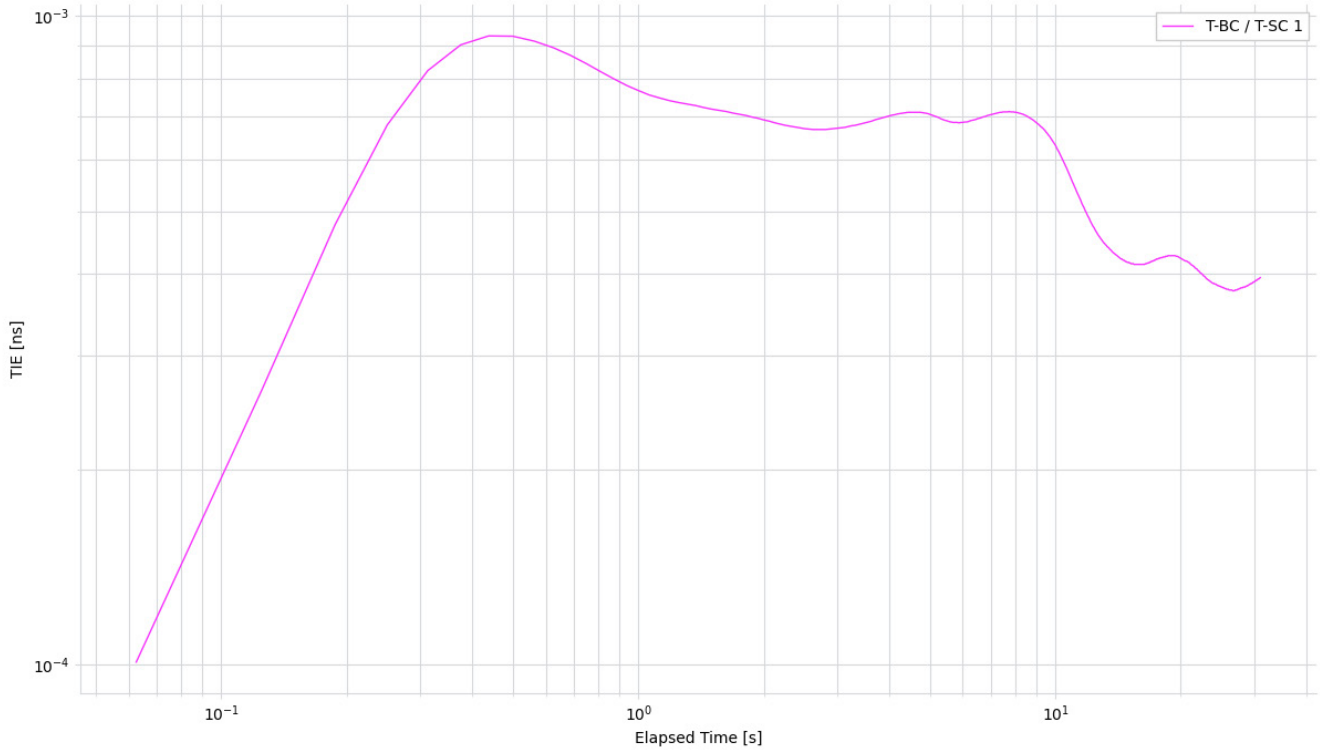


Figure 40. Phase Discontinuity – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

6.3 Short-term Phase Transient Response

Short-term phase transient response requirement reflects the performance of the DUT in cases when the (selected) input reference is lost due to a failure in the reference path and a second reference input signal, traceable to the same reference clock, is available simultaneously, or shortly after the detection of the failure (see [Figure 1](#) for the equipment configuration).

The test was carried out by providing reference clock inputs on IN_A and IN_B from the Frequency Generator which are 180° out of phase from each other. The PLL is locked to the clock signal from IN_A for a period of time. A transient is produced by turning off the input reference signal for 11 seconds, and during this time, the clock on IN_B is unavailable. The DPLL goes into holdover during the 11 second period as no other reference is available. After 11 seconds, the reference signal on IN_B is turned ON and PLL locks to the newly available reference signal. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter. The results of the given transient are plotted against the applicable standard profiles.

- Locked to IN_A → Holdover (11s) → Locked to IN_B

6.3.1. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz

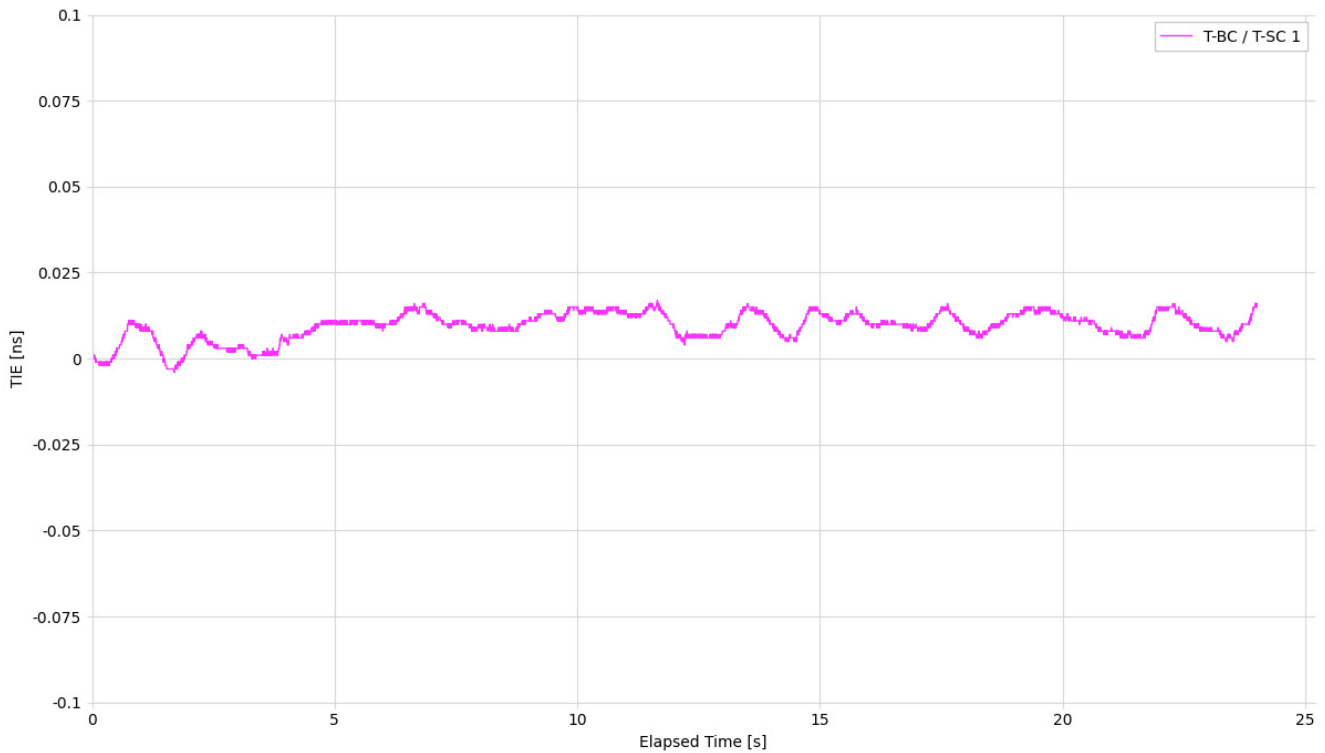


Figure 41. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	0.009
Min [ns]	-0.004
Max [ns]	0.017
Max-Min [ns]	0.021

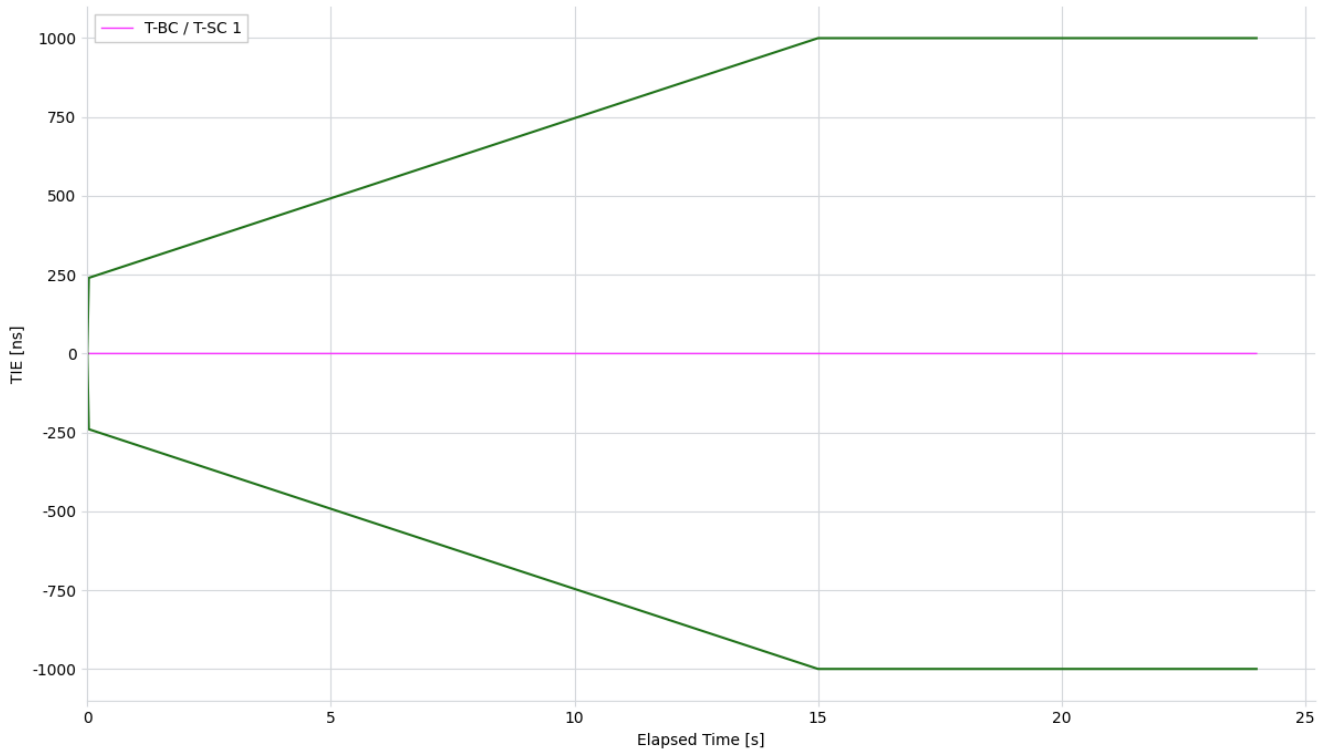


Figure 42. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.009
Min [ns]	-0.004
Max [ns]	0.017
Max-Min [ns]	0.021

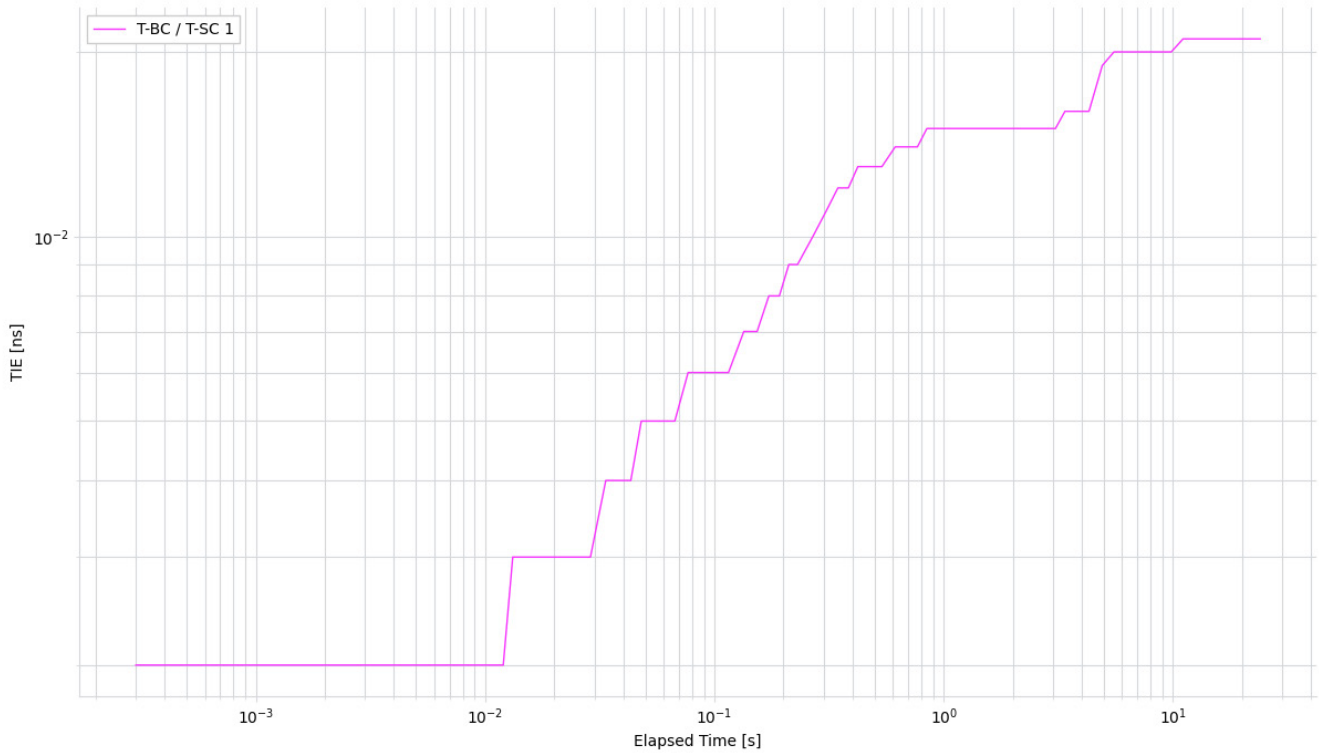


Figure 43. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.002
Max [ns]	0.021
Max-Min [ns]	0.019

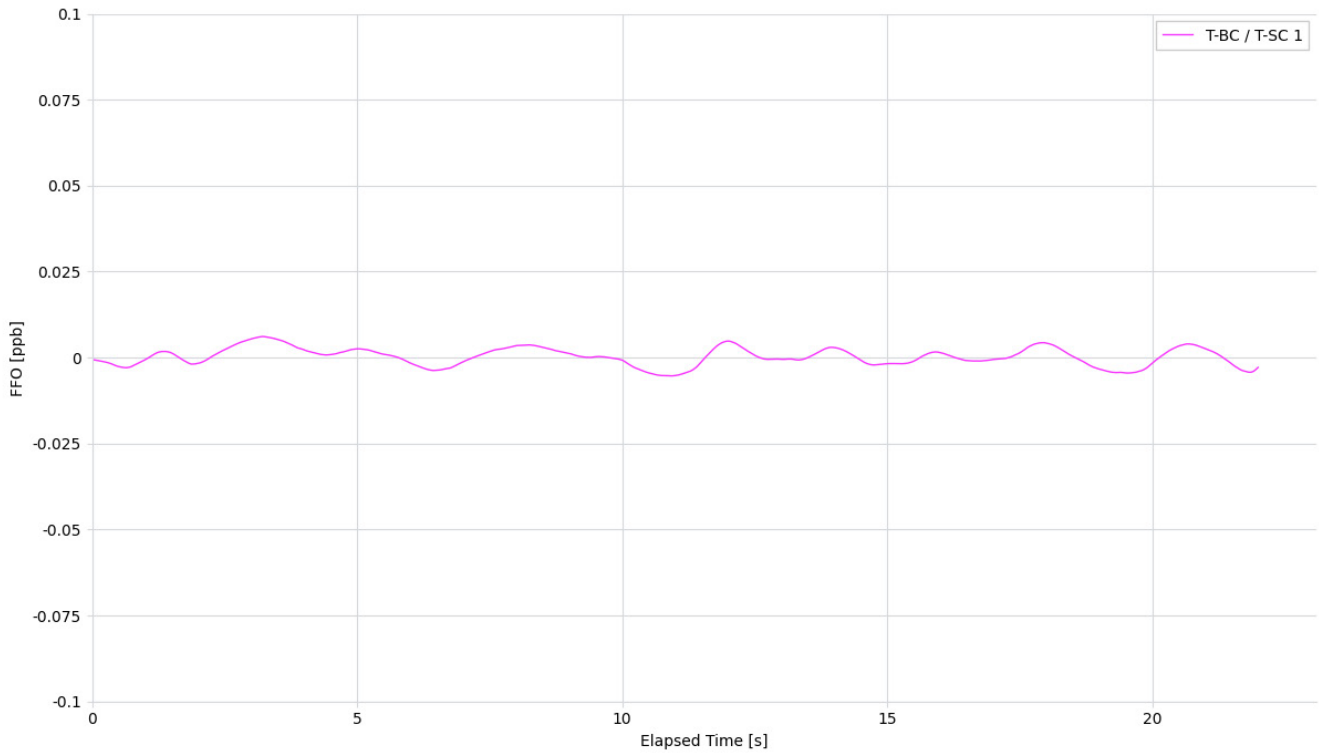


Figure 44. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.005
Max [ppb]	0.006
Max-Min [ppb]	0.011

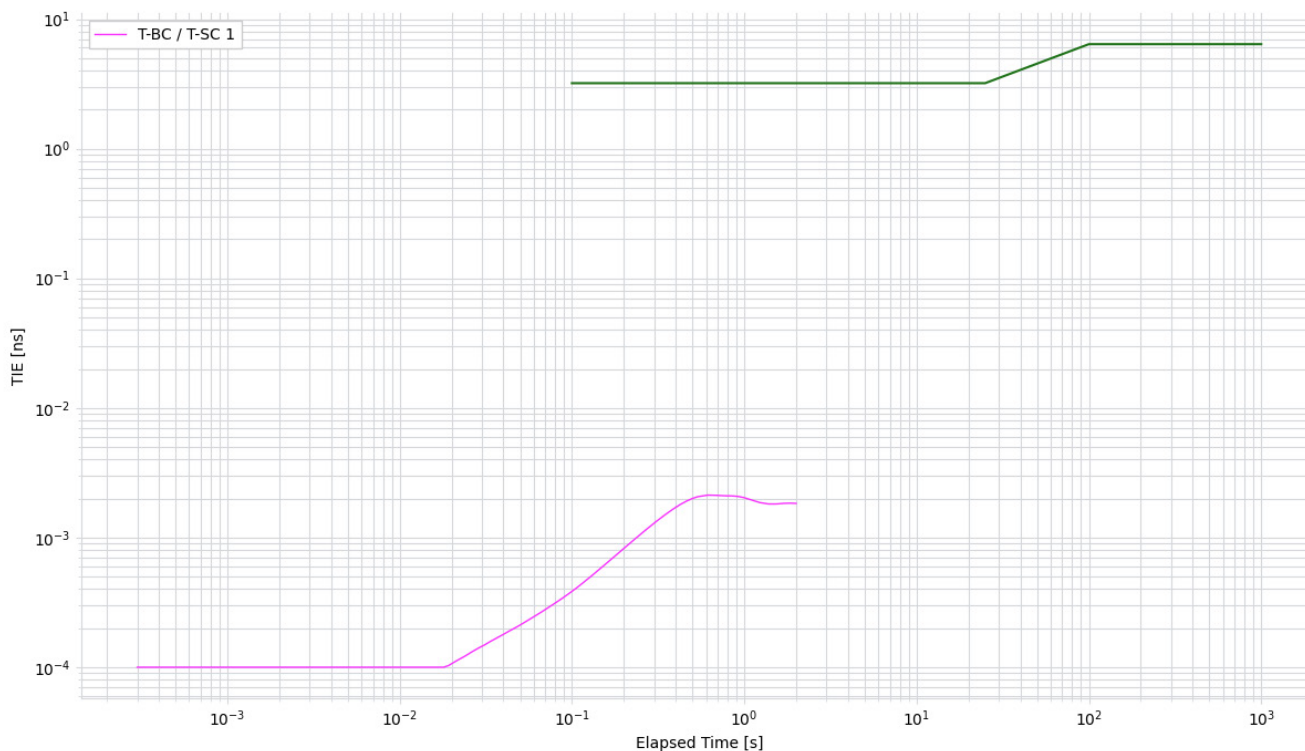


Figure 45. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.002
Max-Min [ns]	0.002

6.3.2. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz

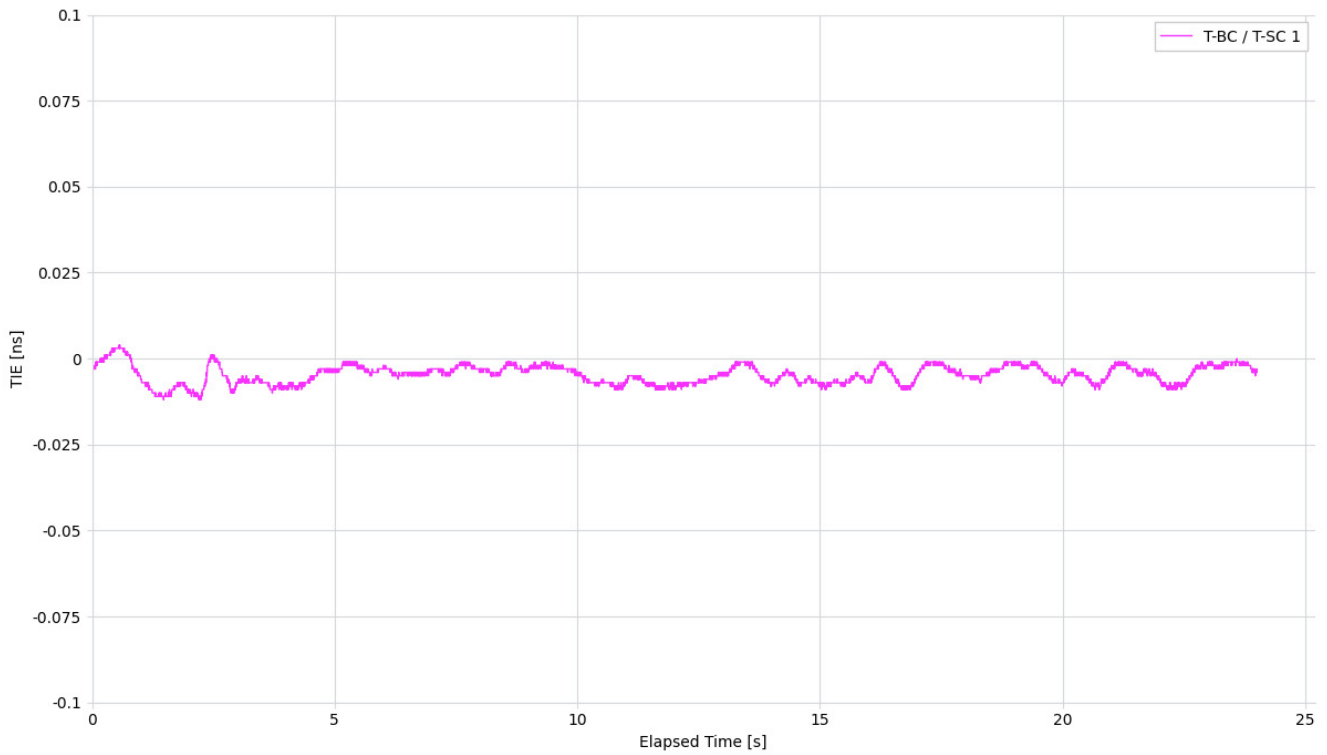


Figure 46. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.005
Min [ns]	-0.012
Max [ns]	0.004
Max-Min [ns]	0.016

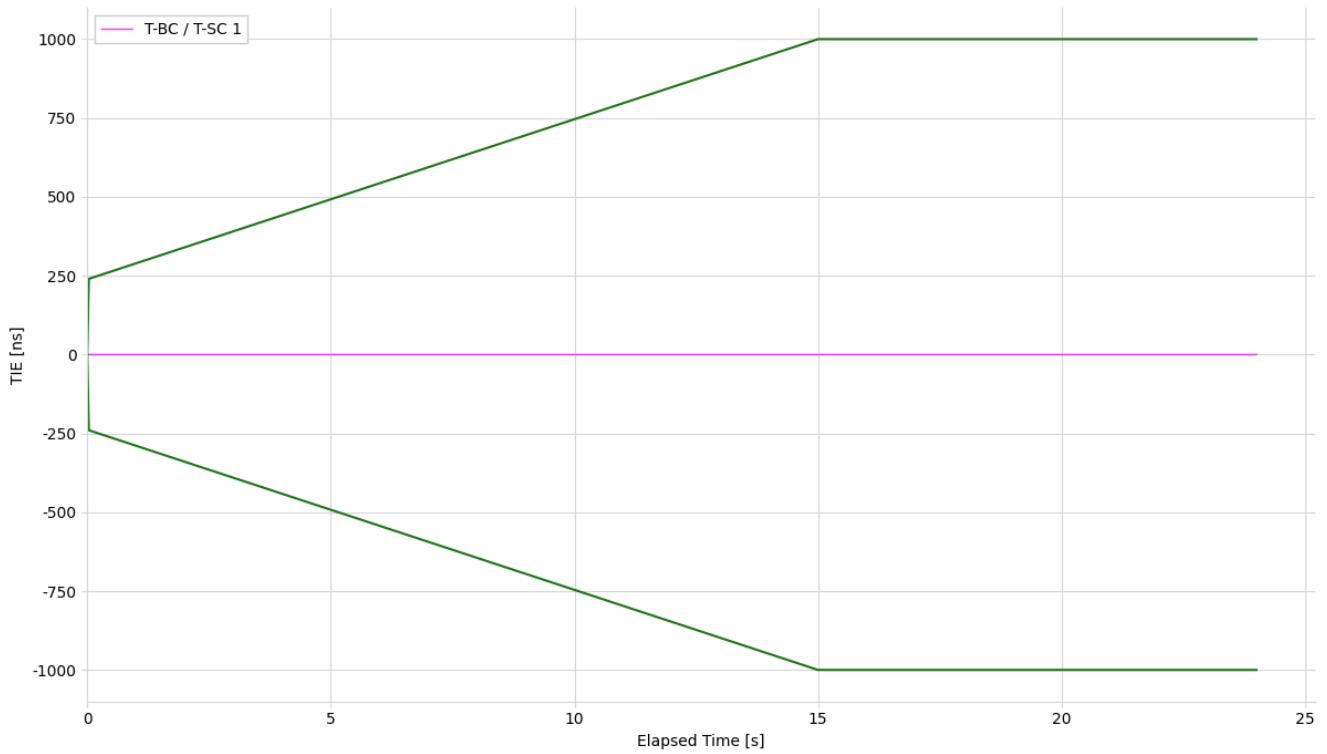


Figure 47. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.005
Min [ns]	-0.012
Max [ns]	0.004
Max-Min [ns]	0.016

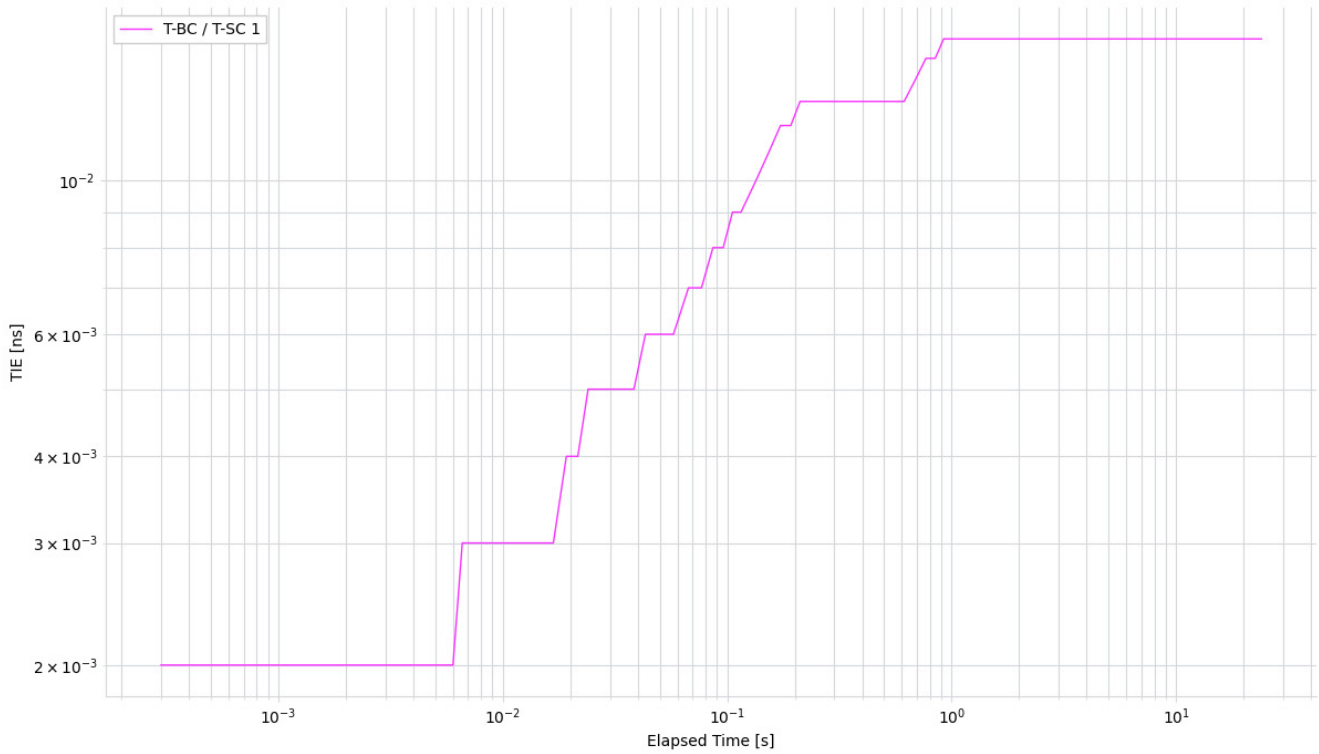


Figure 48. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.002
Max [ns]	0.016
Max-Min [ns]	0.014

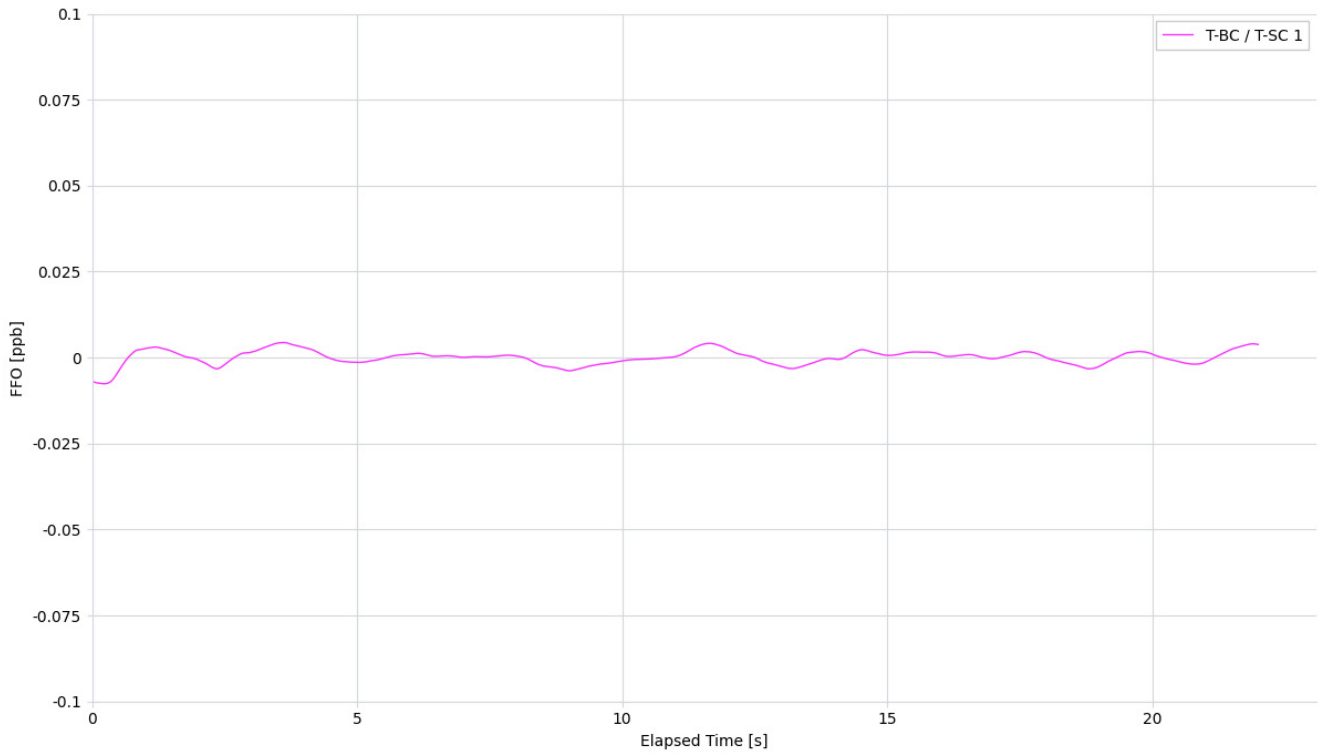


Figure 49. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.008
Max [ppb]	0.004
Max-Min [ppb]	0.012

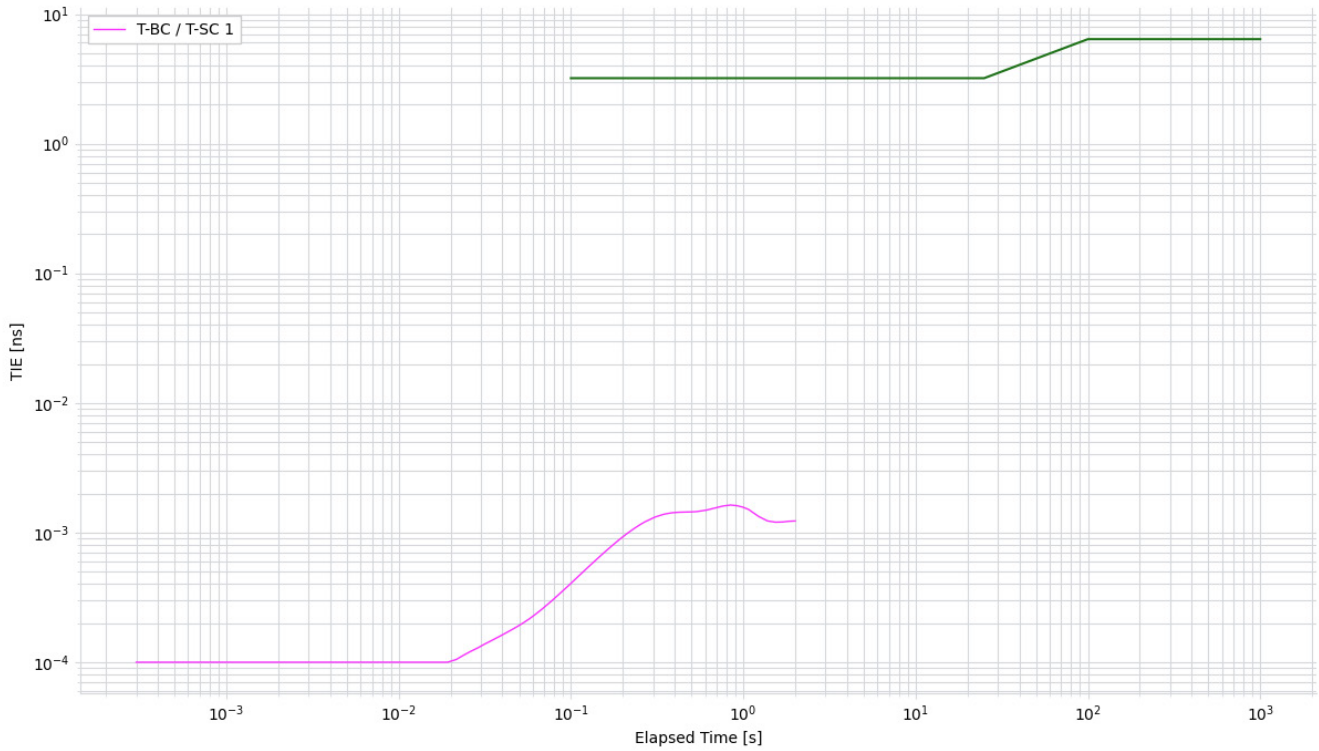


Figure 50. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.002
Max-Min [ns]	0.002

6.3.3. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz

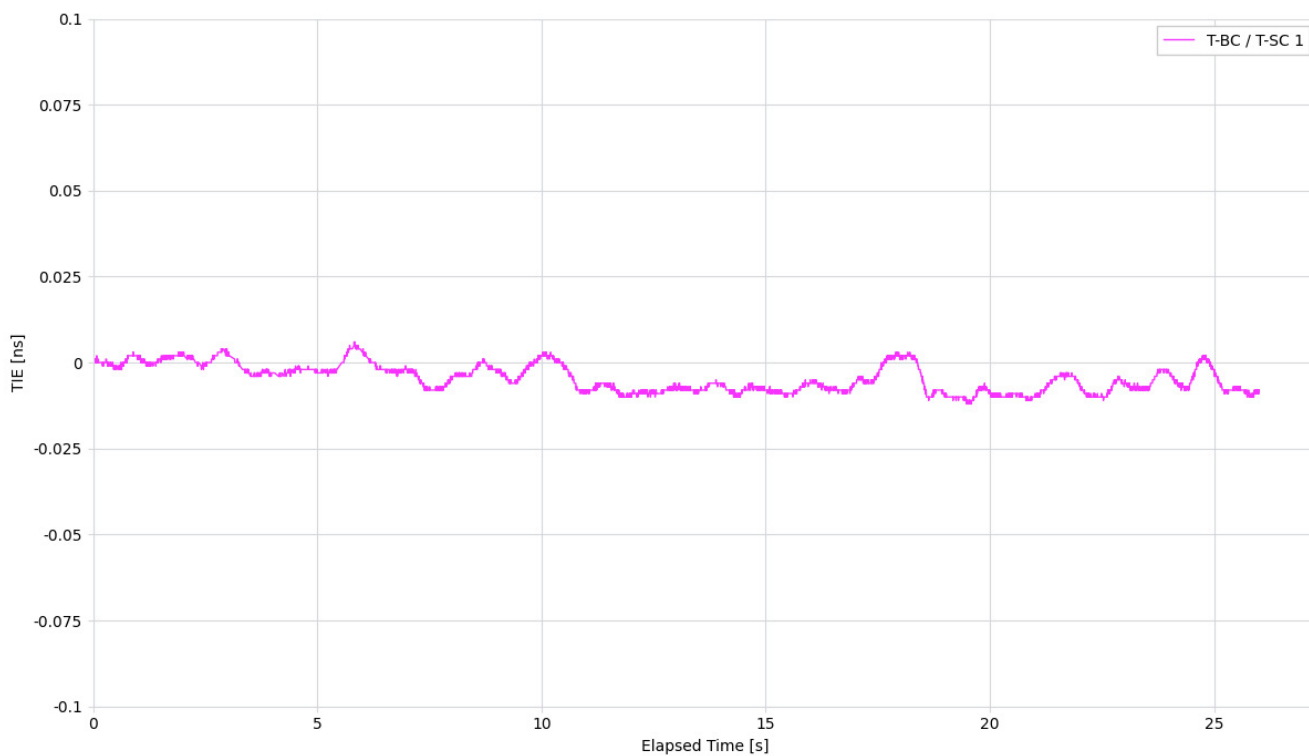


Figure 51. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.005
Min [ns]	-0.012
Max [ns]	0.006
Max-Min [ns]	0.018

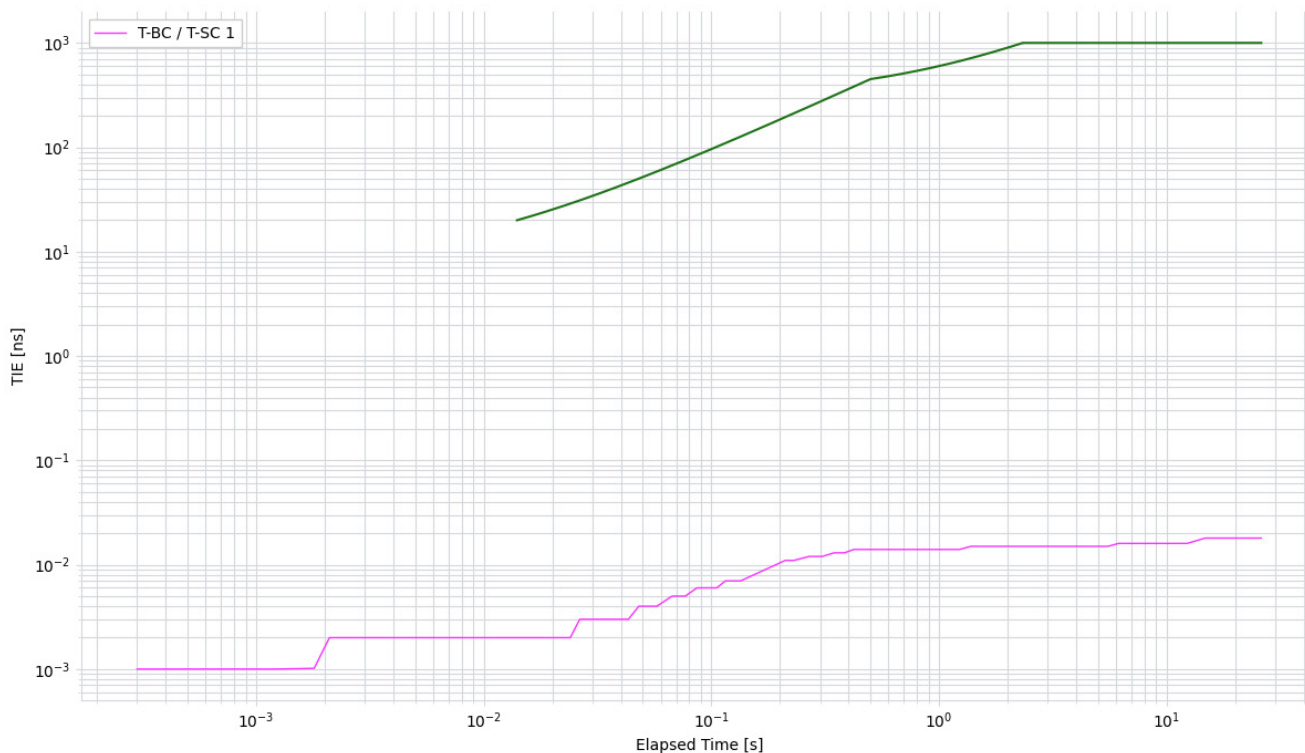


Figure 52. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.018
Max-Min [ns]	0.017

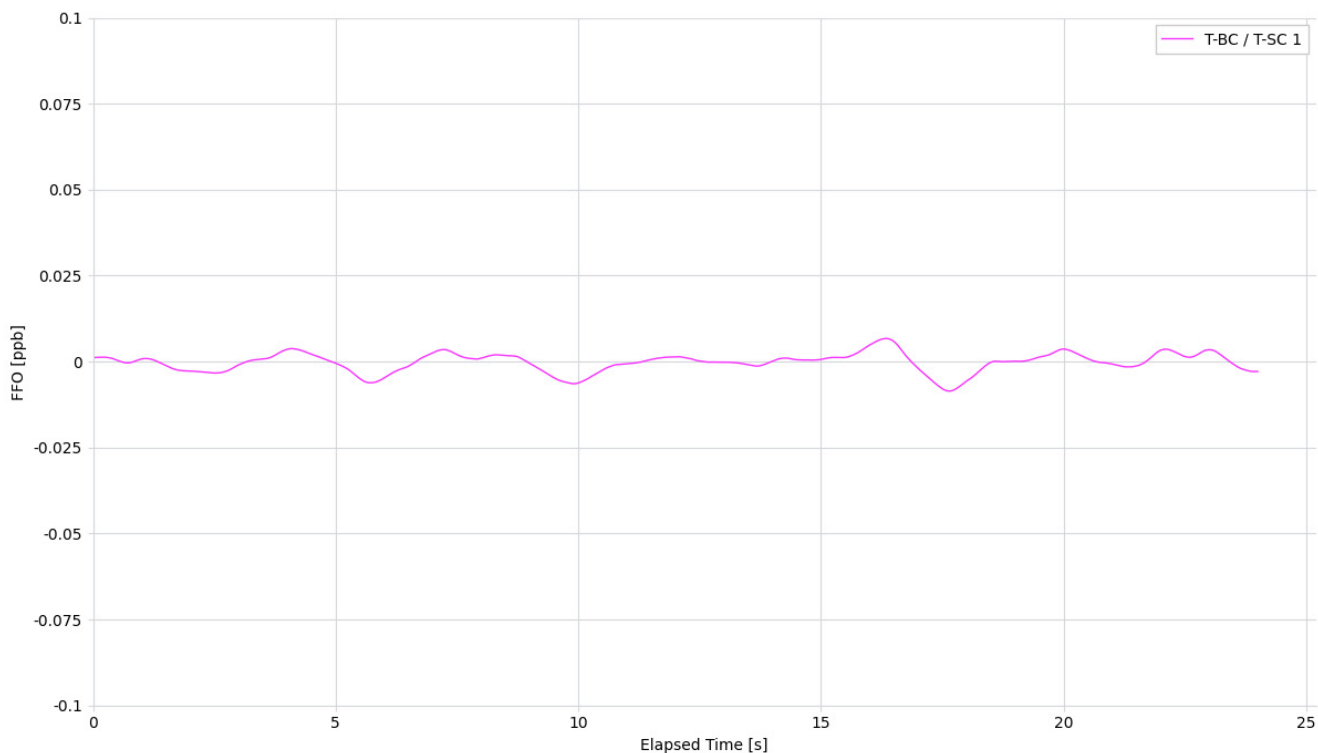


Figure 53. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.009
Max [ppb]	0.007
Max-Min [ppb]	0.015

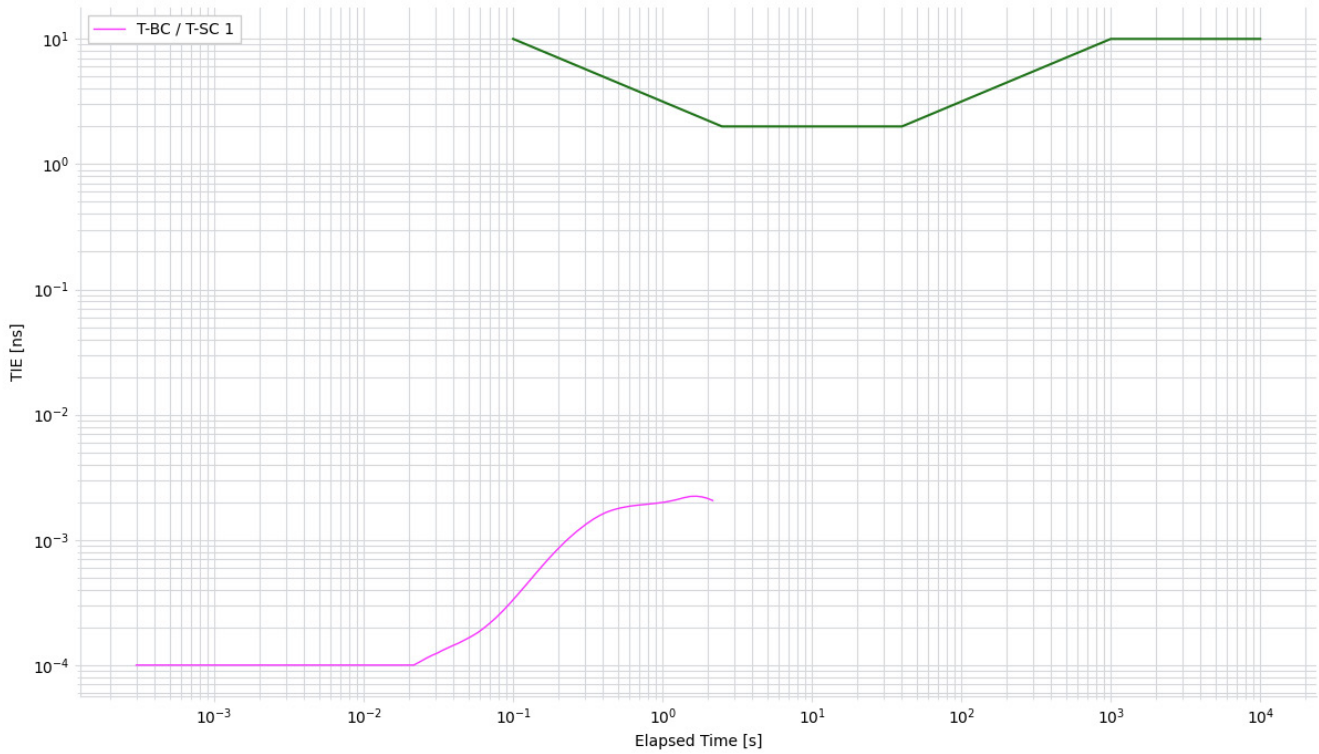


Figure 54. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.002
Max-Min [ns]	0.002

6.3.4. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz

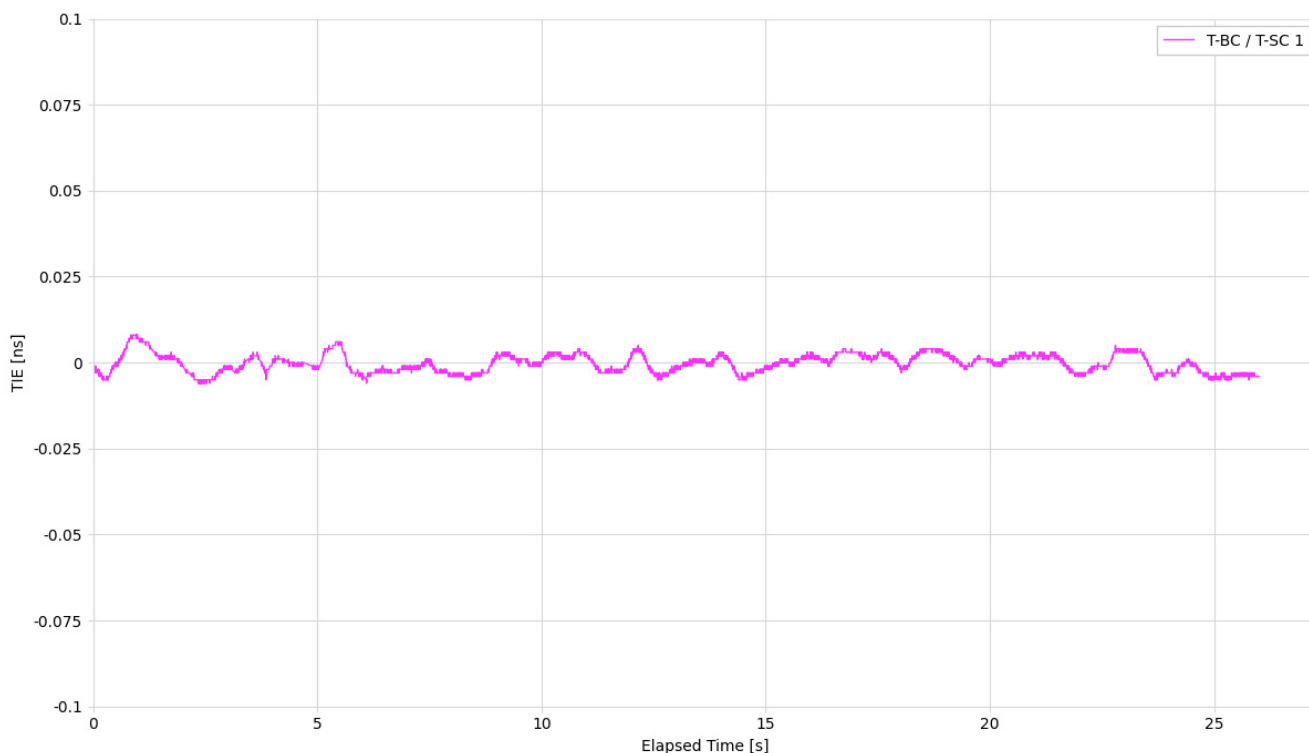


Figure 55. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.0
Min [ns]	-0.006
Max [ns]	0.008
Max-Min [ns]	0.014

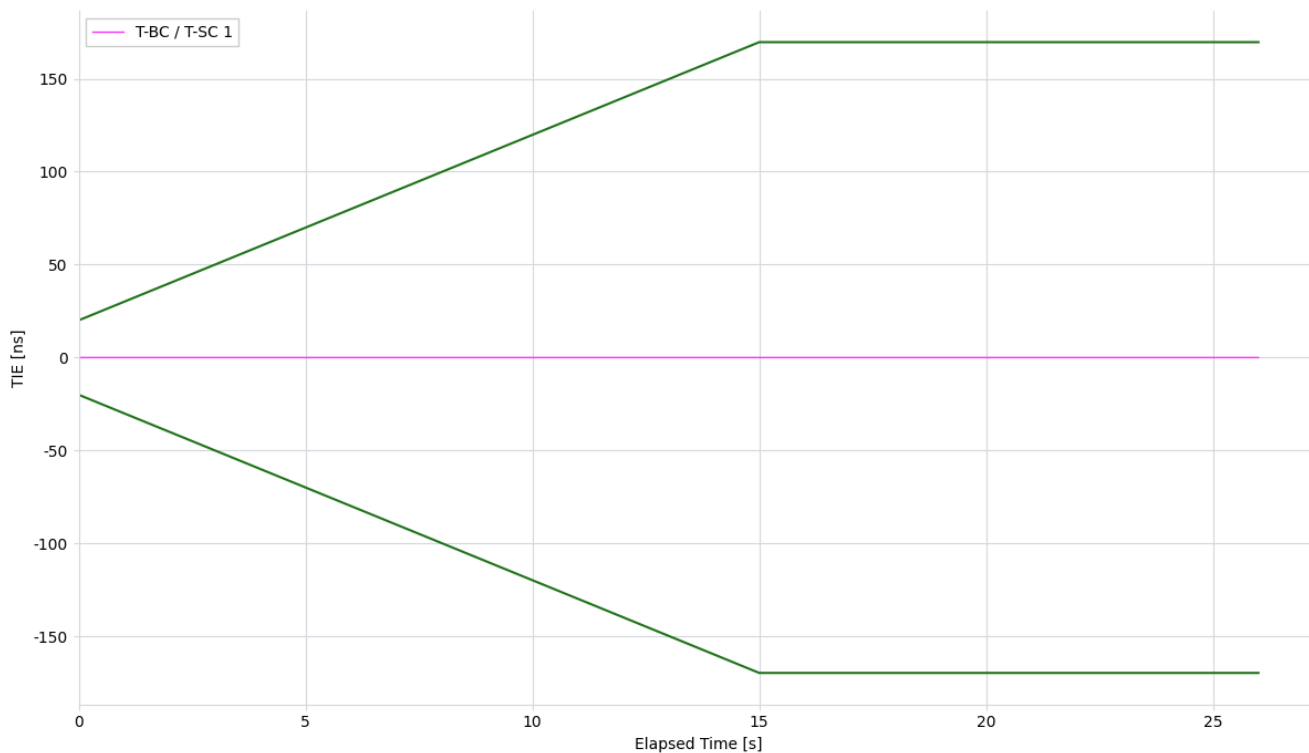


Figure 56. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.0
Min [ns]	-0.006
Max [ns]	0.008
Max-Min [ns]	0.014

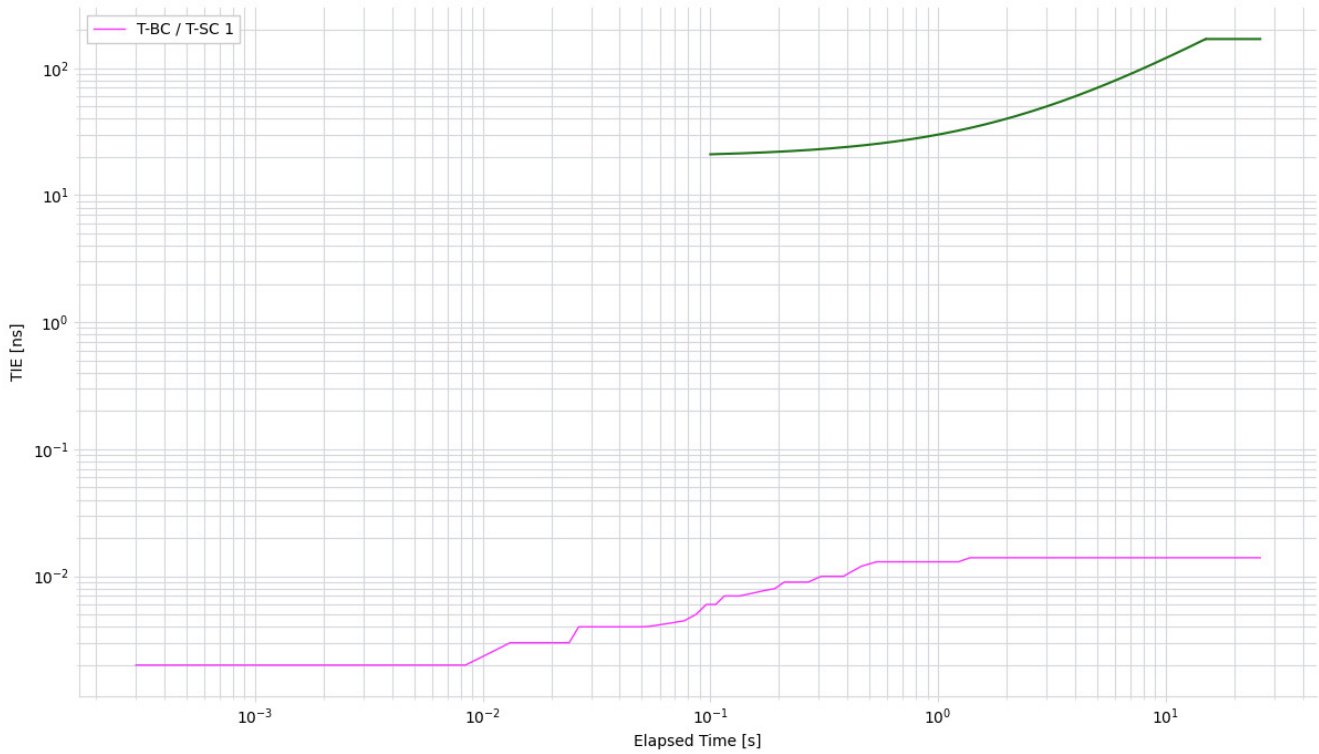


Figure 57. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.002
Max [ns]	0.014
Max-Min [ns]	0.012

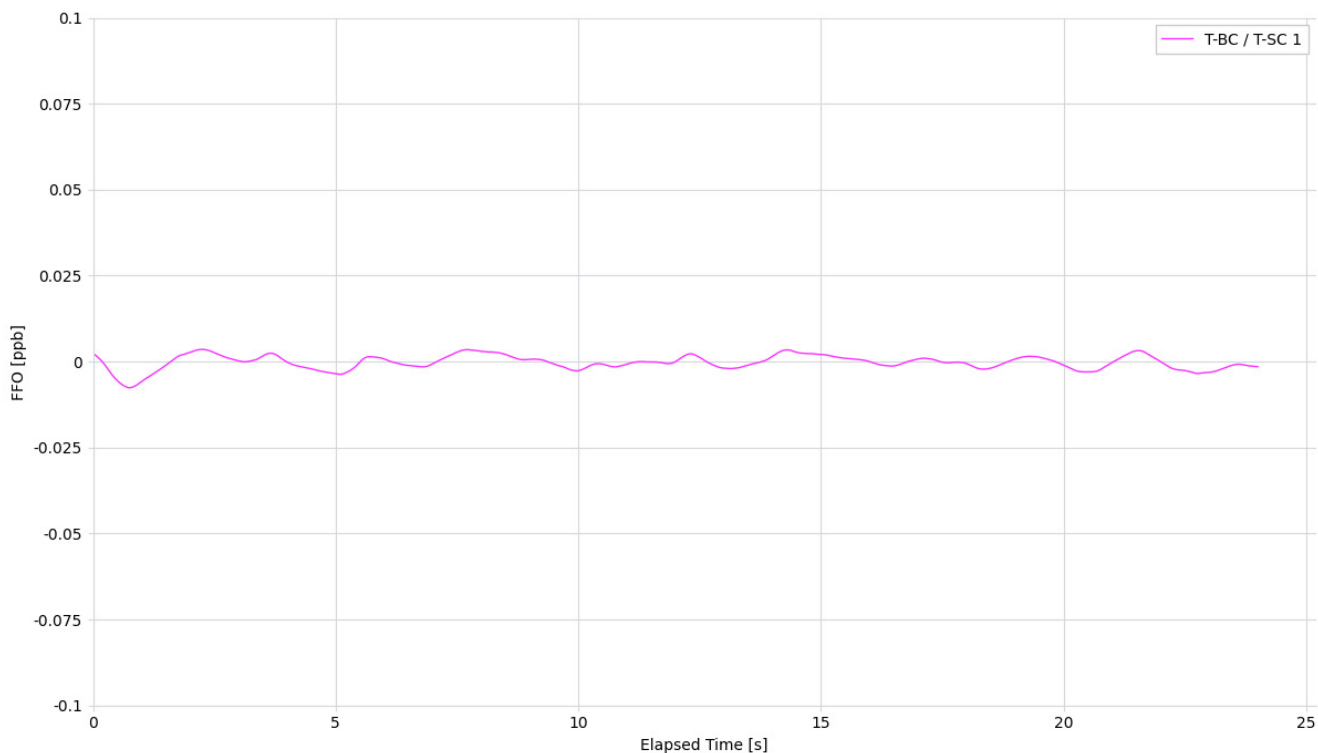


Figure 58. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.008
Max [ppb]	0.004
Max-Min [ppb]	0.011

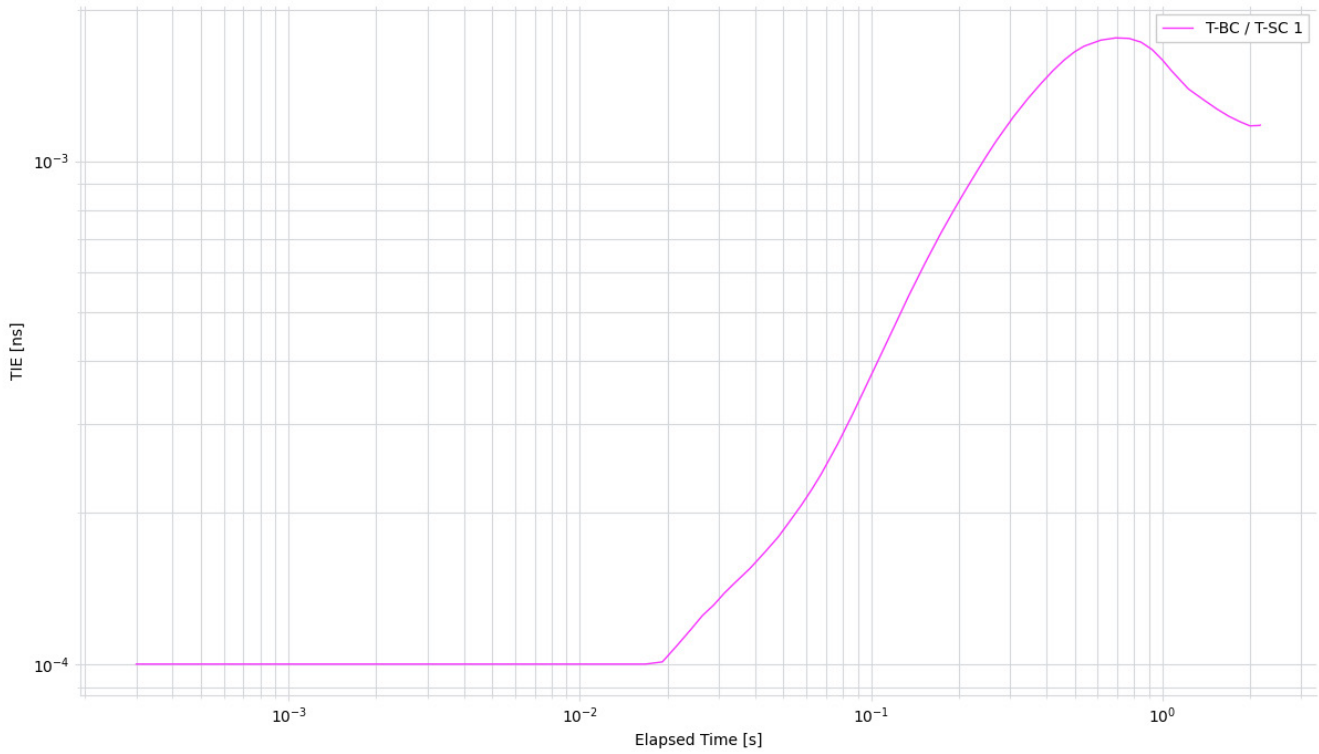


Figure 59. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.002
Max-Min [ns]	0.002

7. Transient Tests with Hitless Switching Disabled

7.1 Phase Transient

Transient response requirement reflects the system response in situations where the input signal is affected by disturbances or transmission failures, resulting in phase transients at the synchronous EEC (Ethernet Equipment Clock) output. Short interruptions, switching between different reference clock signals, loss of reference etc., are categorized as transients, resulting in phase transients at the EEC output (see Figure 1 for the equipment configuration).

In this test, the reference clock inputs are provided on IN_A and IN_B from the Frequency Generator. The PLL is locked to the clock signal from IN_A for a period of time before producing a phase transient by turning off IN_A. The DPLL goes into holdover and tries to lock to any other qualified clocks. IN_B is simultaneously available from the Frequency Generator and the DPLL switches to this clock which is very close in phase alignment to the original clock. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter. The results of the given transient are plotted against the applicable standard profiles.

7.1.1. Phase Transient – G.8262 EEC Option 1, 1.2Hz

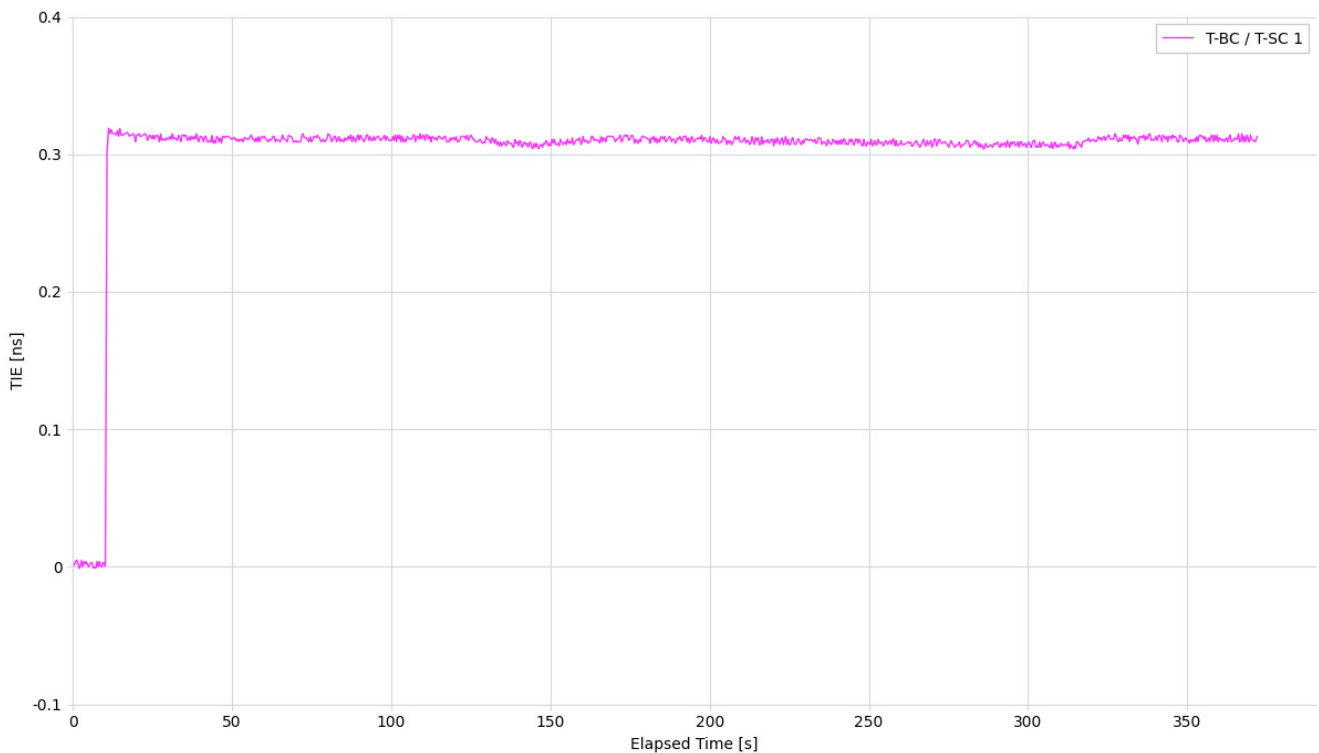


Figure 60. Phase Transient – G.8262 EEC Option 1, 1.2Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	0.301
Min [ns]	-0.001
Max [ns]	0.319
Max-Min [ns]	0.32

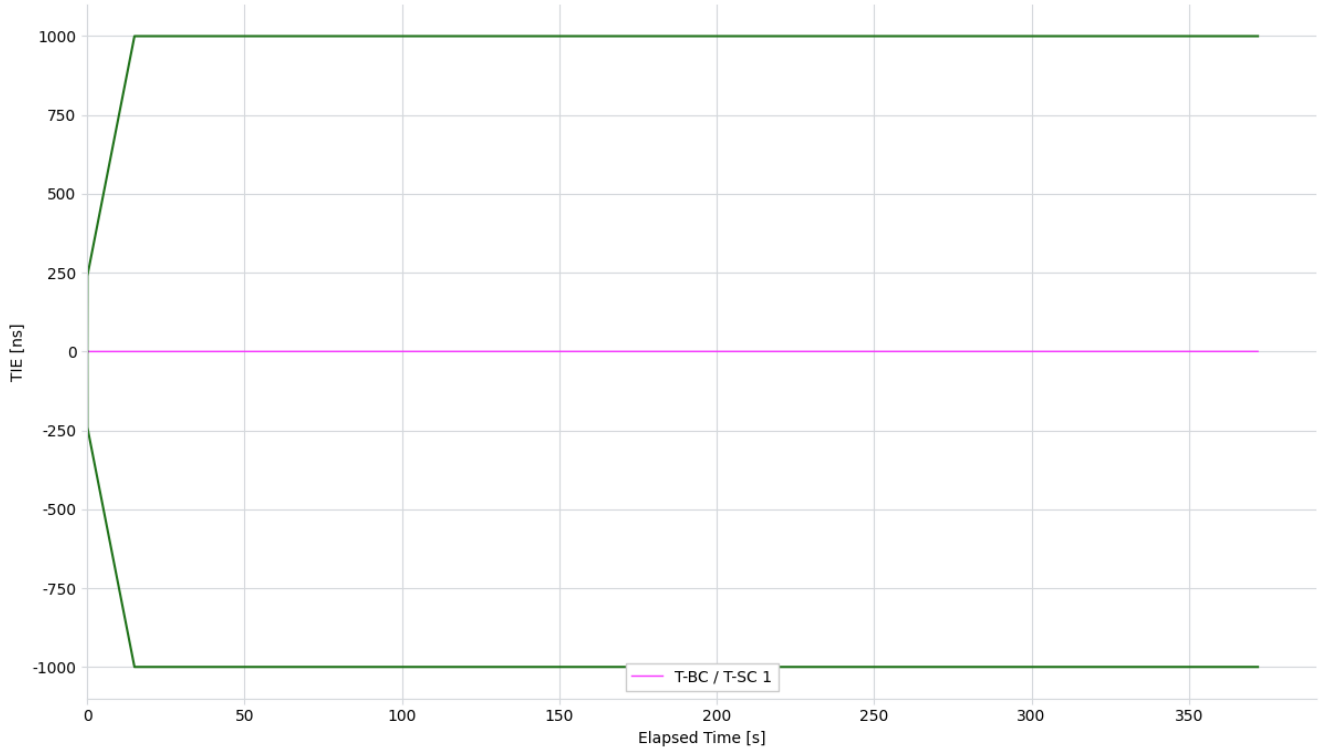


Figure 61. Phase Transient – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.301
Min [ns]	-0.001
Max [ns]	0.319
Max-Min [ns]	0.32

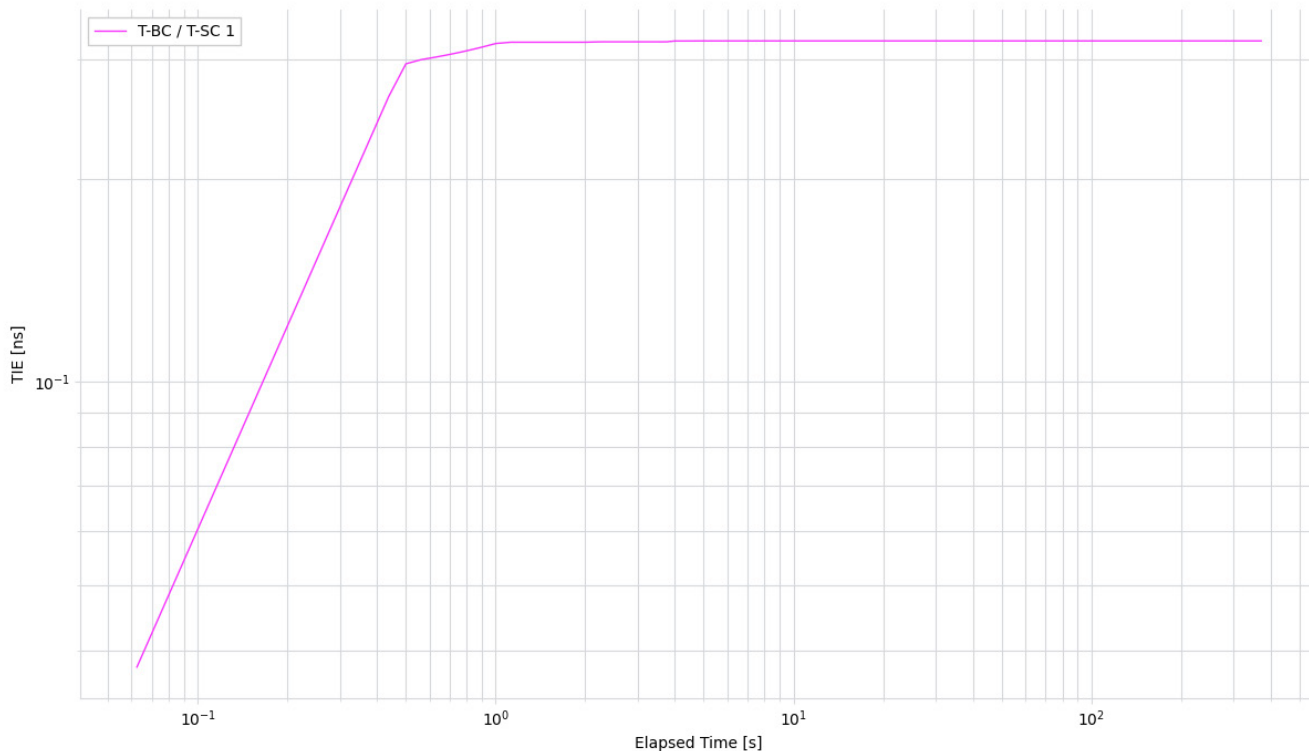


Figure 62. Phase Transient – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.038
Max [ns]	0.32
Max-Min [ns]	0.282

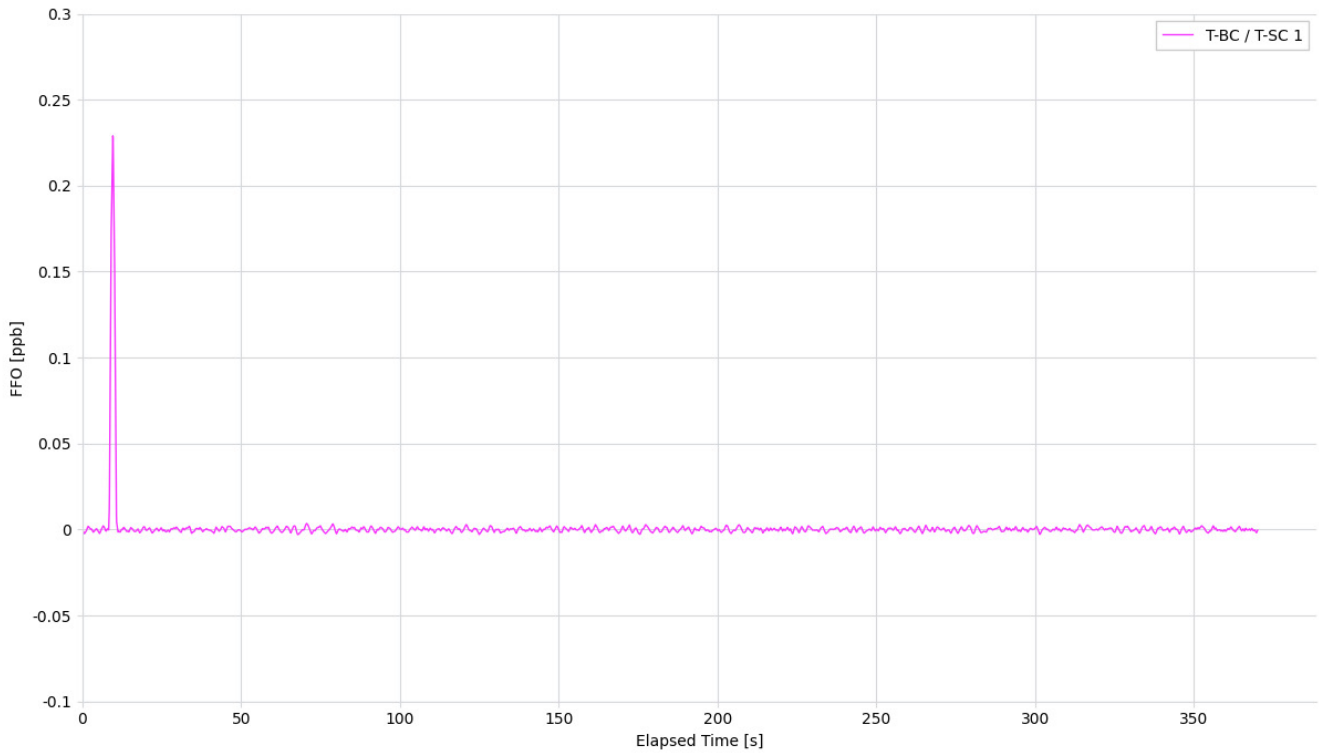


Figure 63. Phase Transient – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.001
Min [ppb]	-0.003
Max [ppb]	0.229
Max-Min [ppb]	0.232

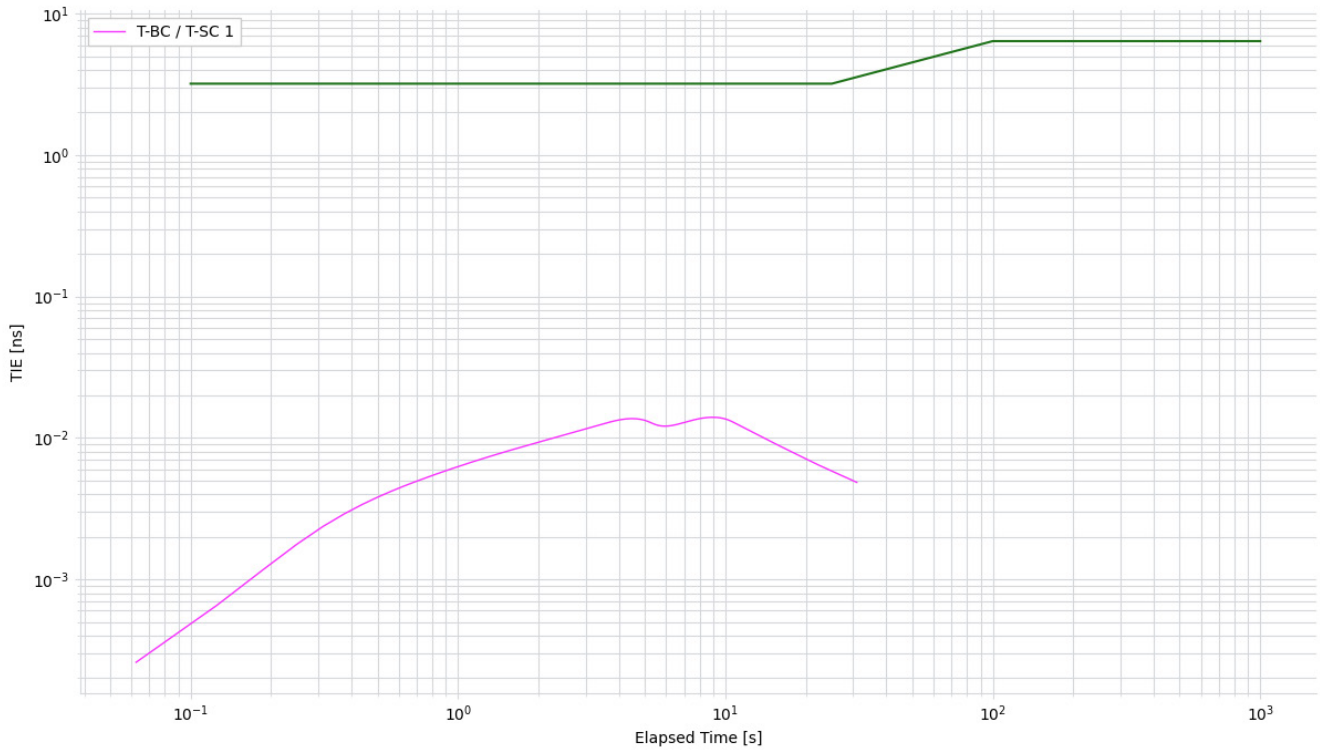


Figure 64. Phase Transient – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.014
Max-Min [ns]	0.014

7.1.2. Phase Transient – G.8262 EEC Option 1, 10Hz

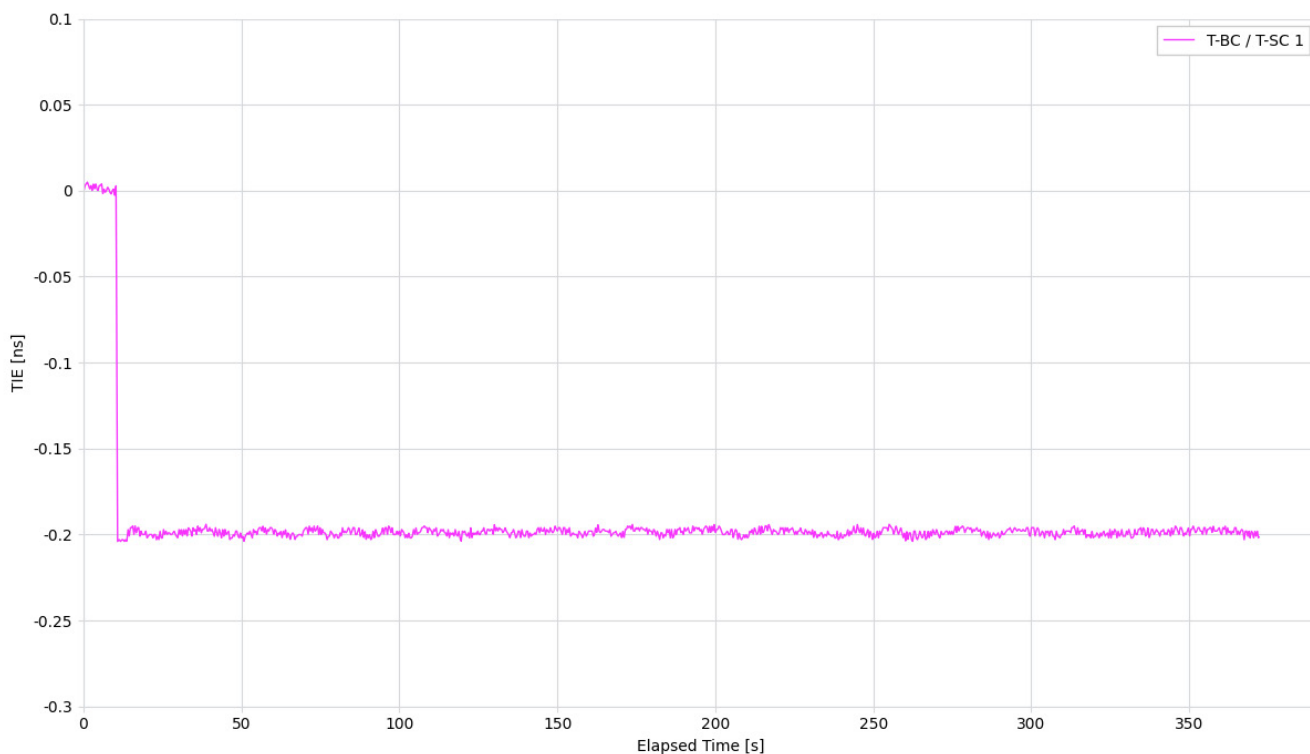


Figure 65. Phase Transient – G.8262 EEC Option 1, 10Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.193
Min [ns]	-0.204
Max [ns]	0.005
Max-Min [ns]	0.209

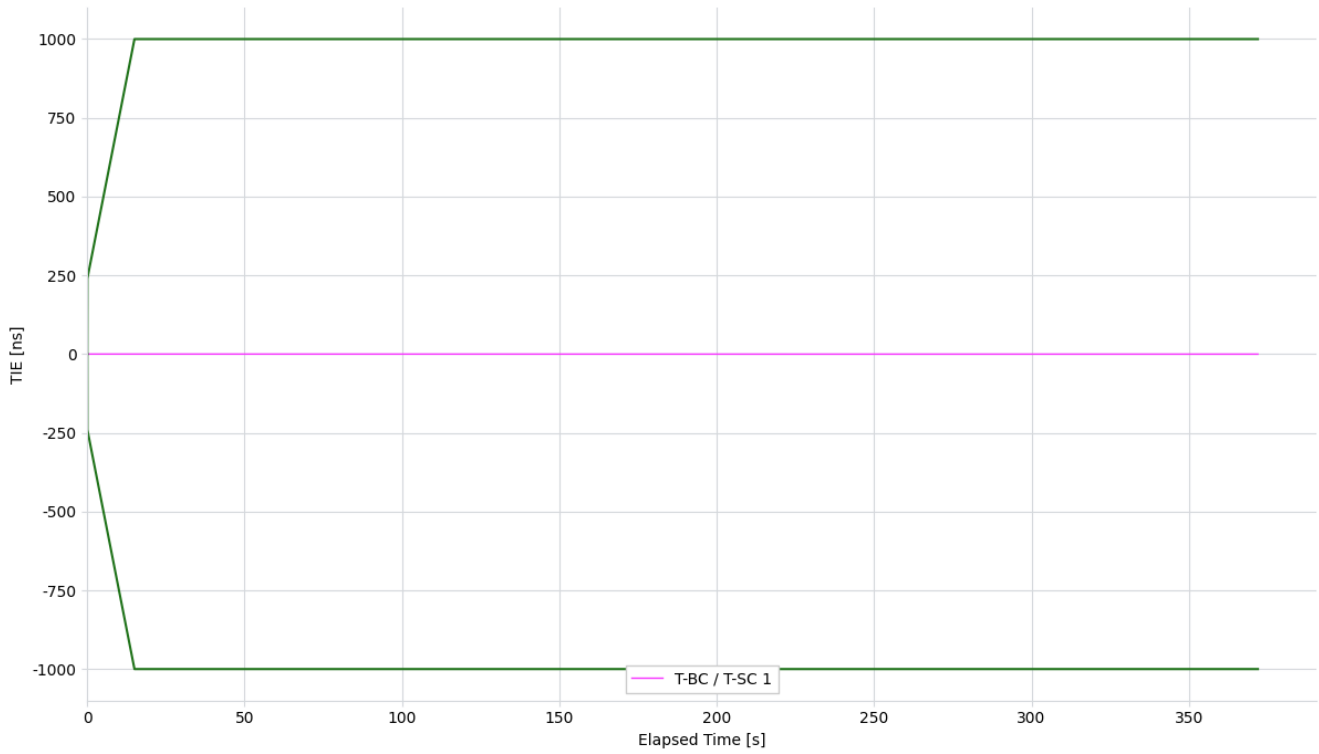


Figure 66. Phase Transient – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.193
Min [ns]	-0.204
Max [ns]	0.005
Max-Min [ns]	0.209

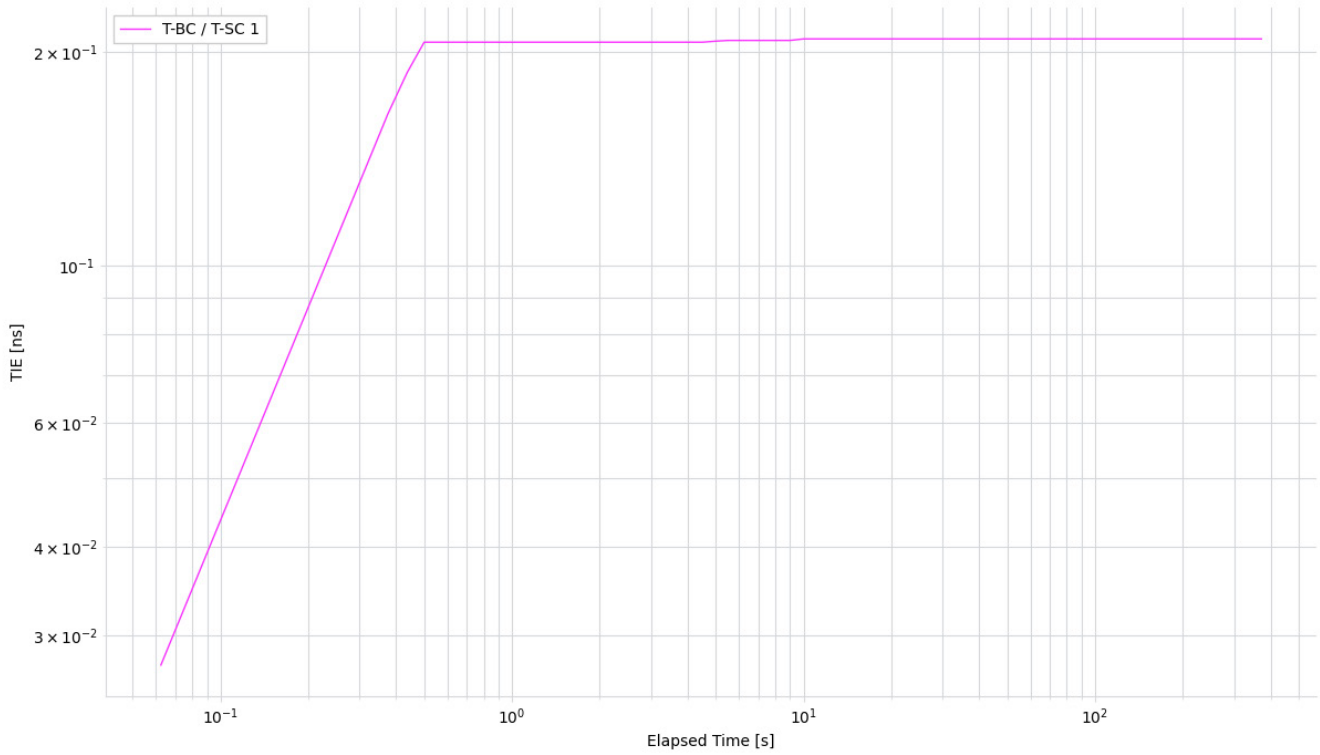


Figure 67. Phase Transient – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.027
Max [ns]	0.209
Max-Min [ns]	0.182

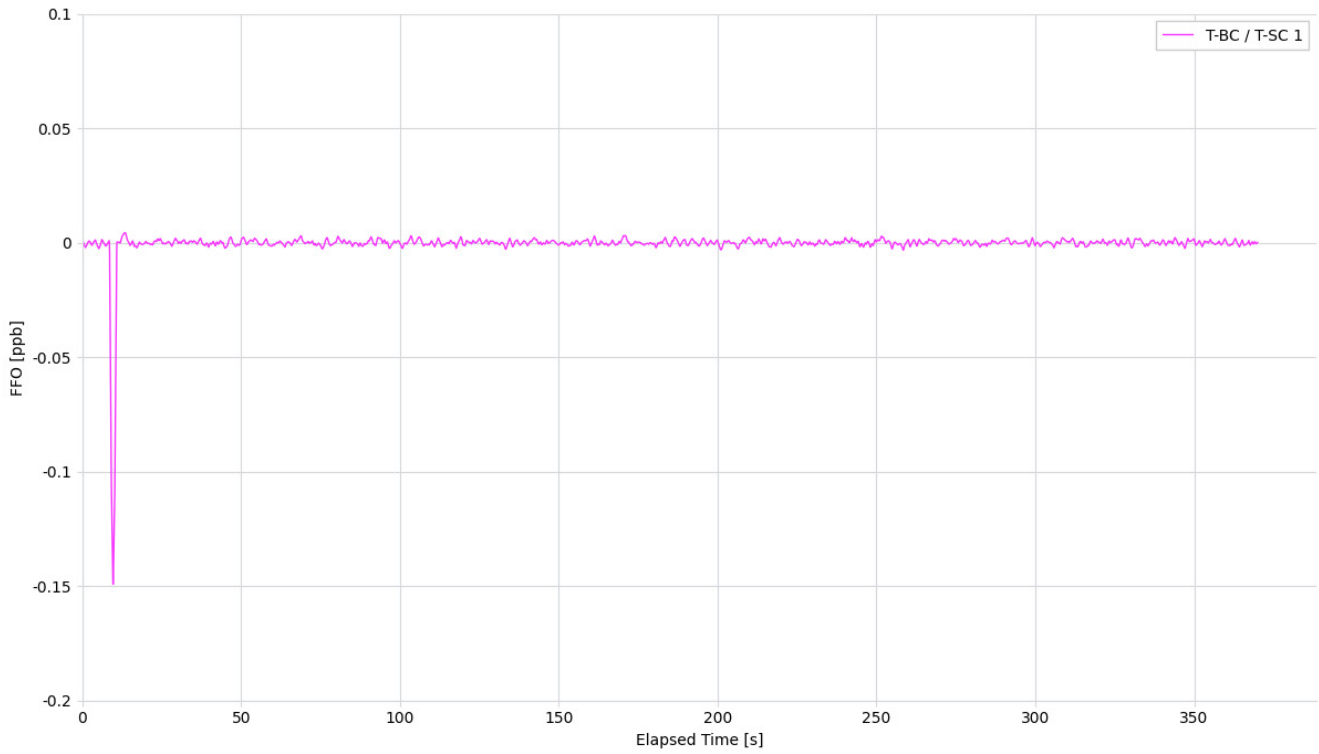


Figure 68. Phase Transient – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.001
Min [ppb]	-0.149
Max [ppb]	0.004
Max-Min [ppb]	0.154

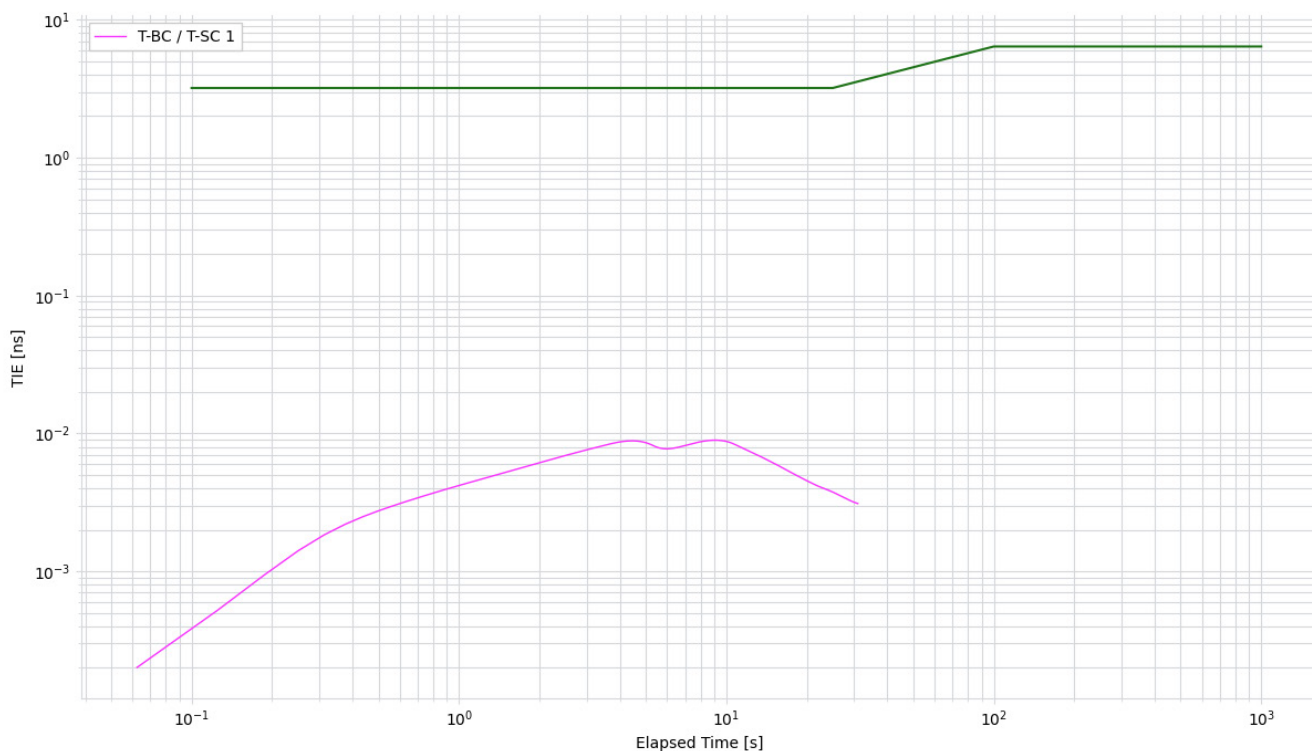


Figure 69. Phase Transient – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.009
Max-Min [ns]	0.009

7.1.3. Phase Transient – G.8262 EEC Option 2, 0.1Hz

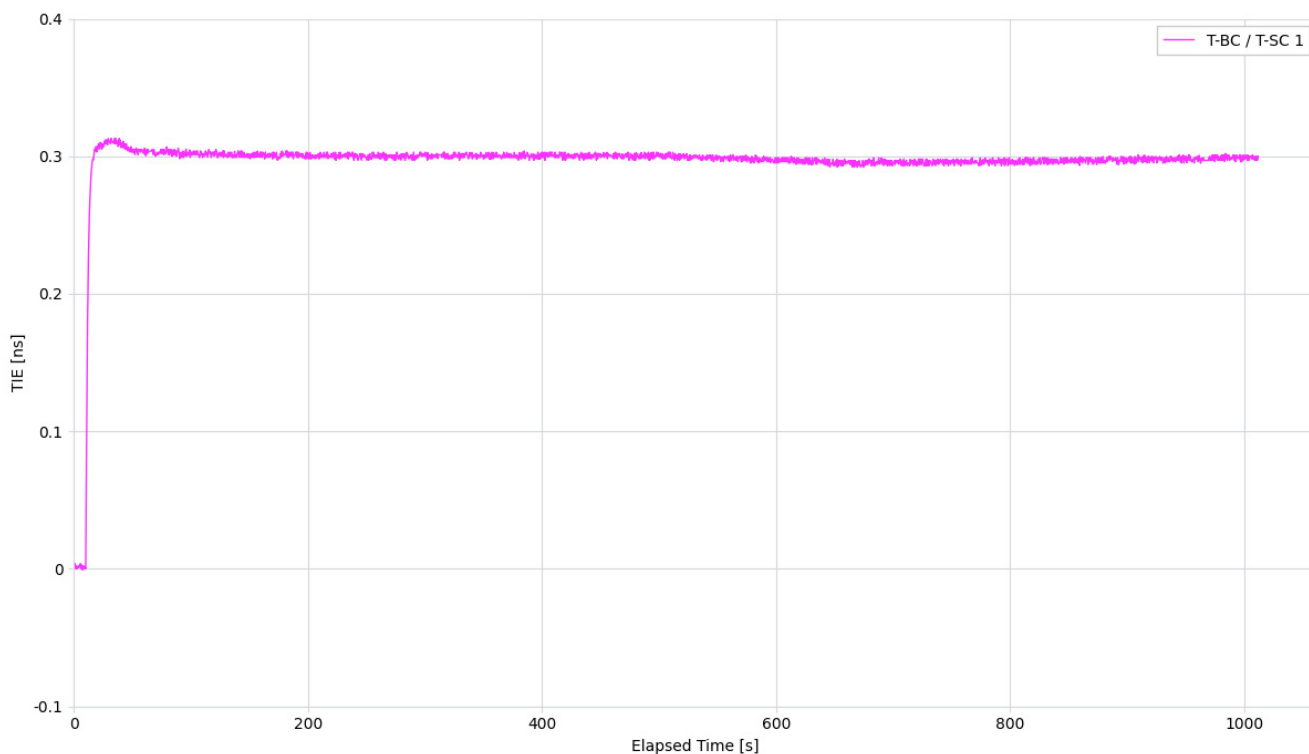


Figure 70. Phase Transient – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.296
Min [ns]	-0.001
Max [ns]	0.313
Max-Min [ns]	0.314

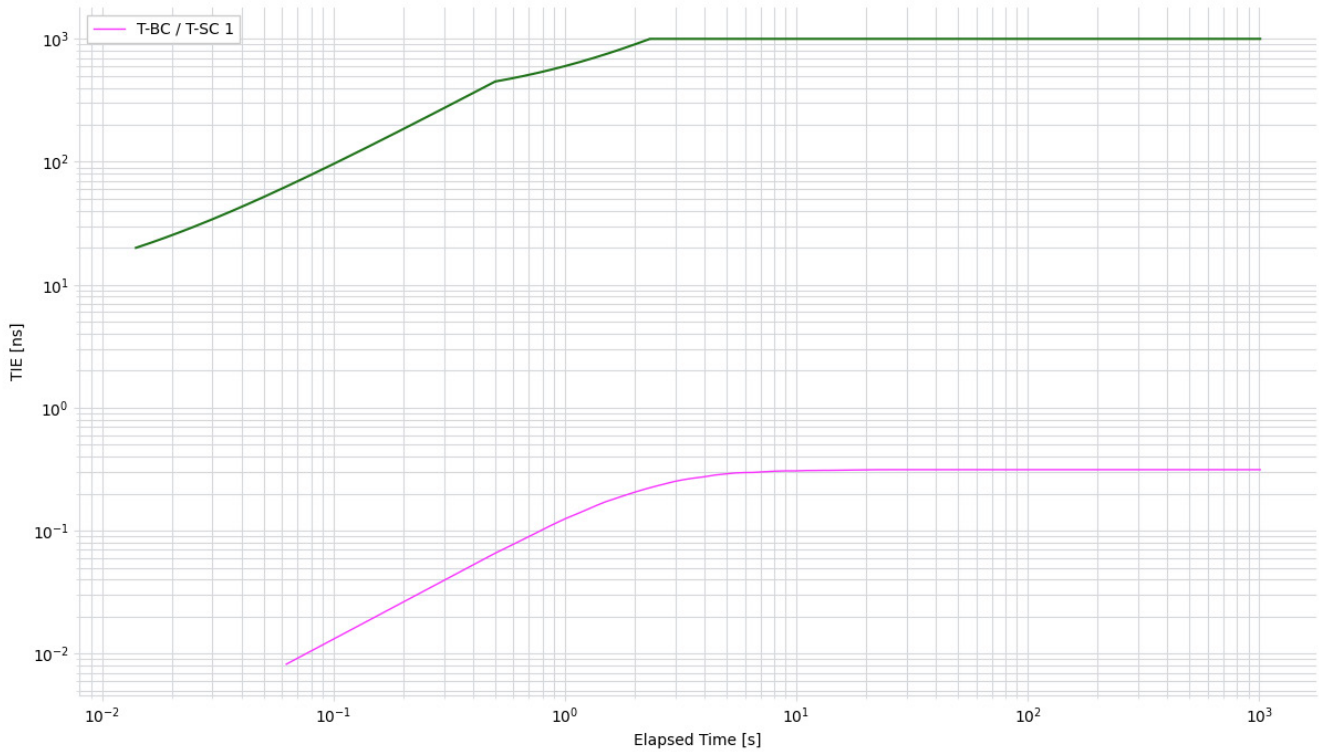


Figure 71. Phase Transient – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.008
Max [ns]	0.314
Max-Min [ns]	0.306

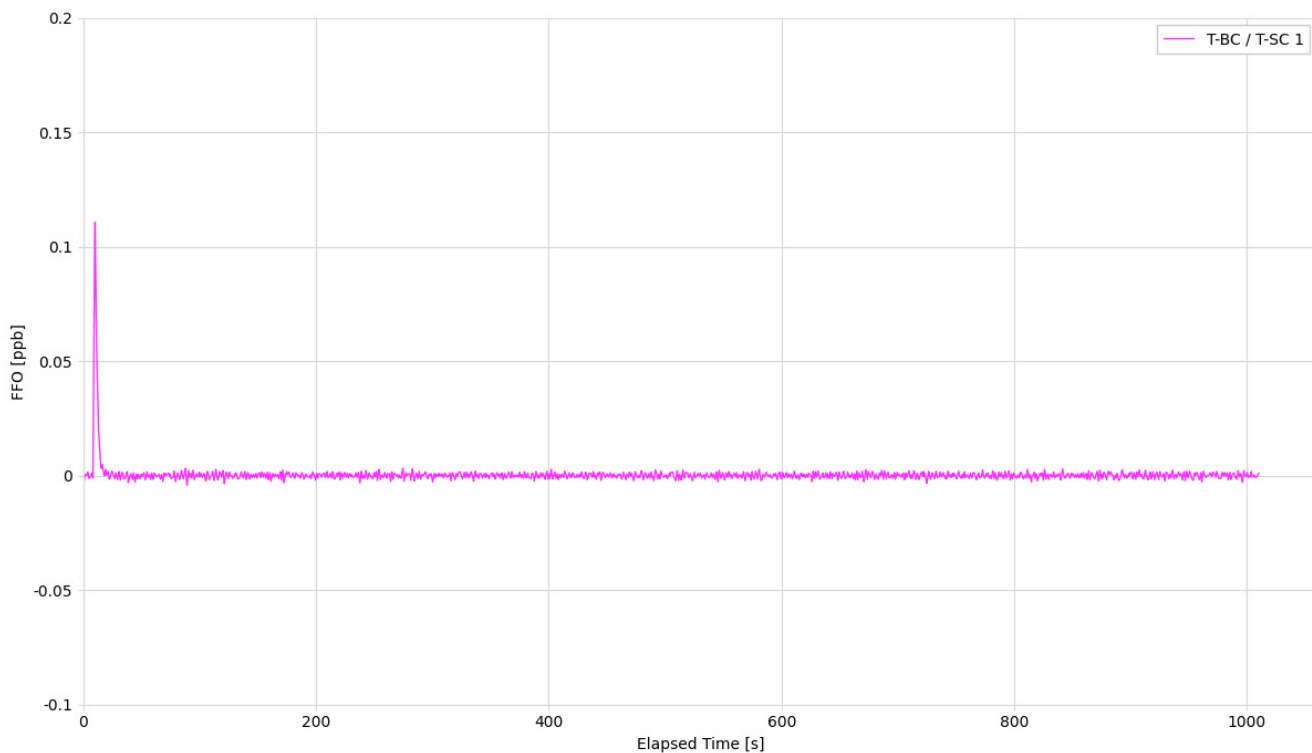


Figure 72. Phase Transient – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.004
Max [ppb]	0.111
Max-Min [ppb]	0.115

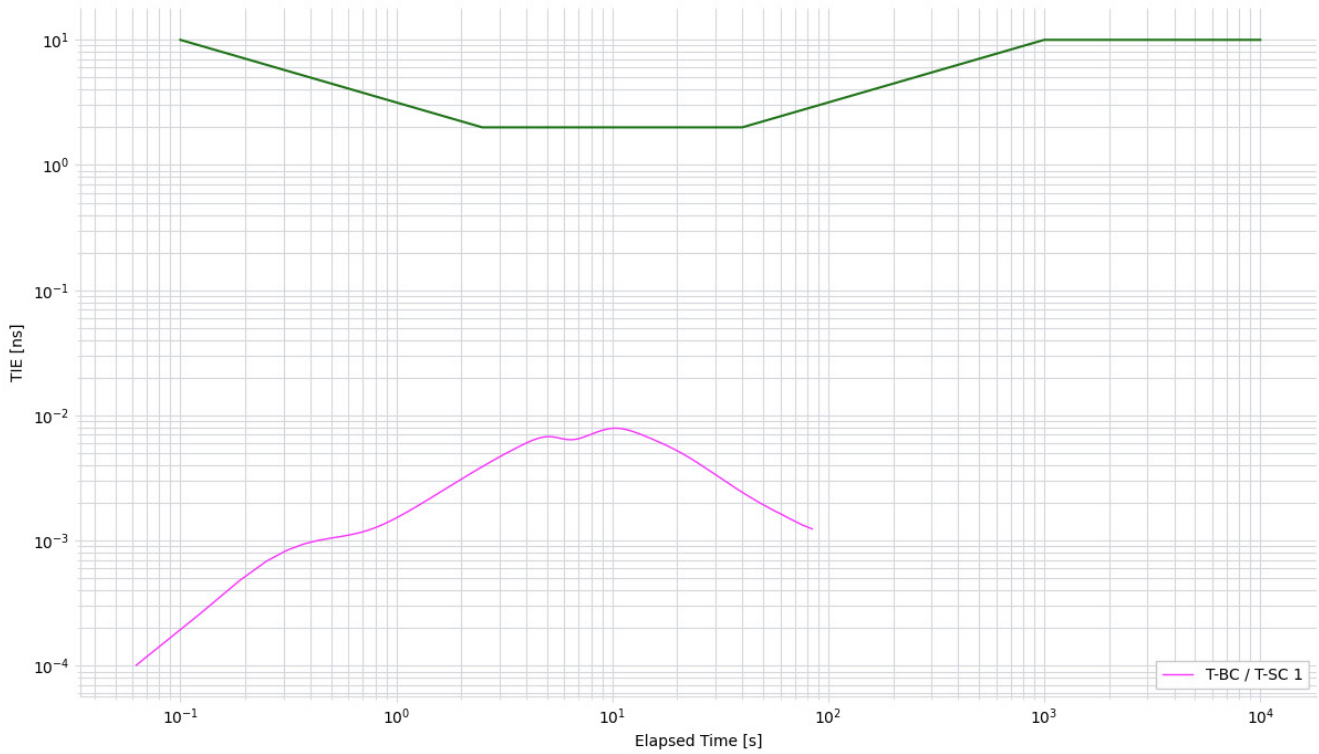


Figure 73. Phase Transient – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.008
Max-Min [ns]	0.008

7.1.4. Phase Transient – G.8262.1 eEEC, 3Hz

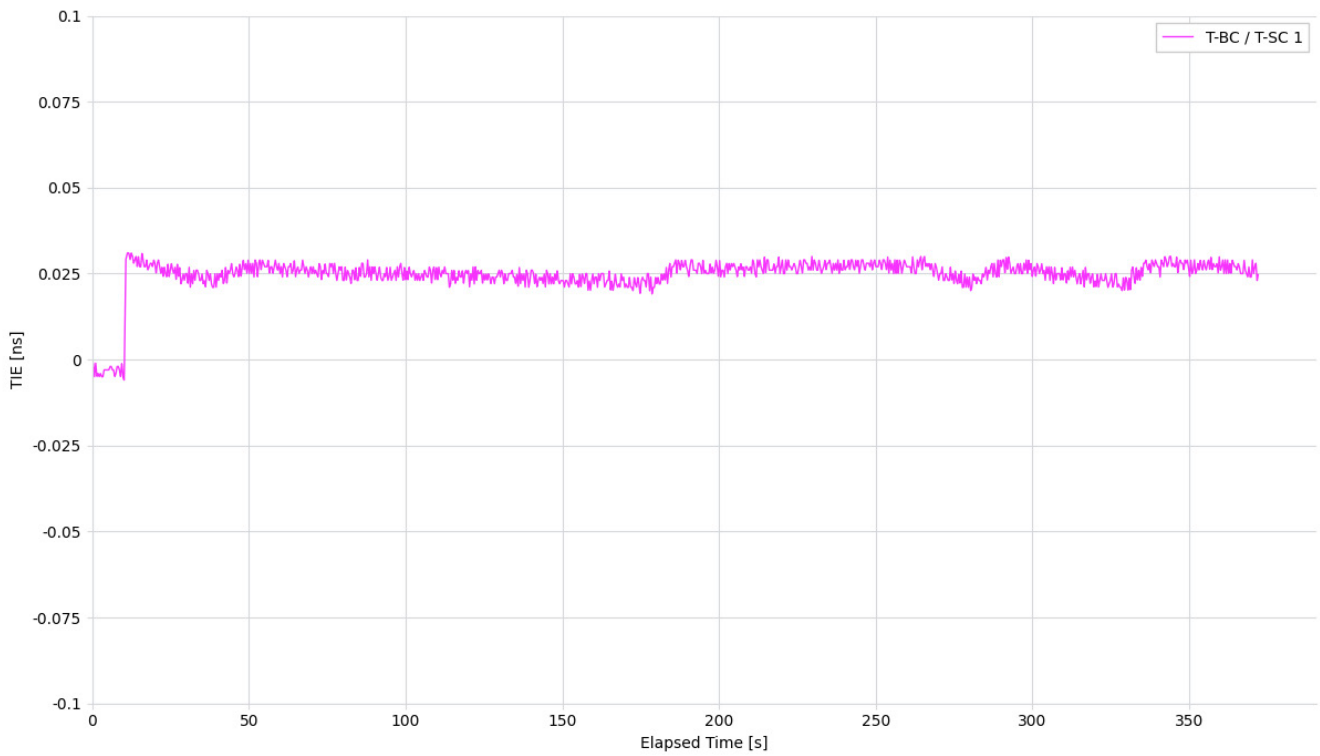


Figure 74. Phase Transient – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	0.025
Min [ns]	-0.006
Max [ns]	0.031
Max-Min [ns]	0.037

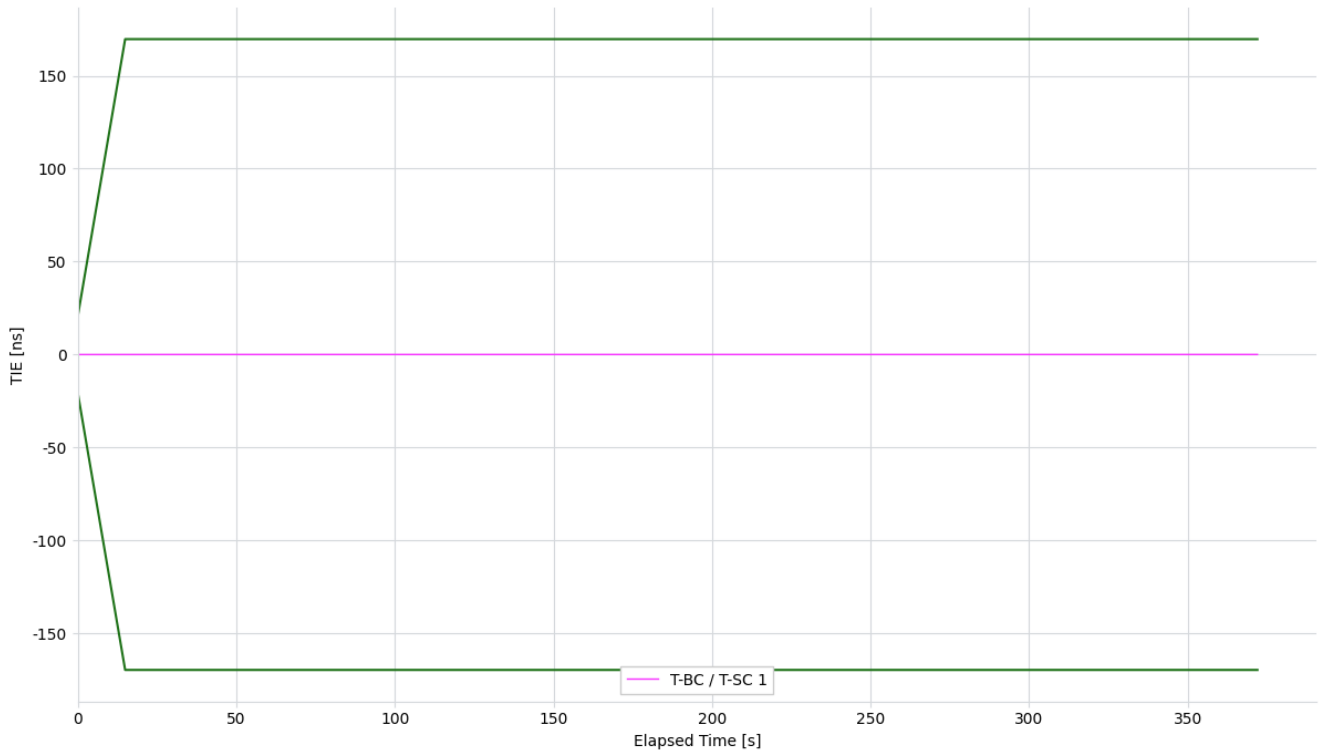


Figure 75. Phase Transient – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.025
Min [ns]	-0.006
Max [ns]	0.031
Max-Min [ns]	0.037

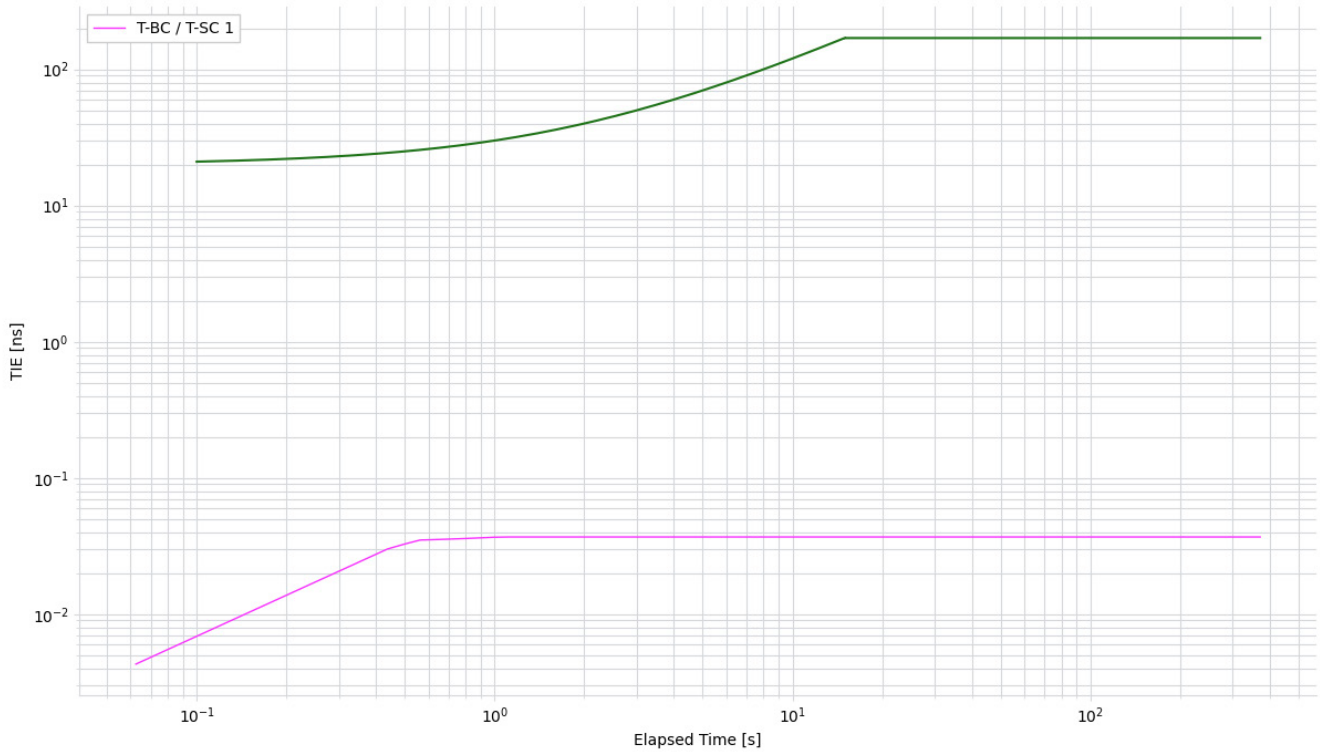


Figure 76. Phase Transient – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.004
Max [ns]	0.037
Max-Min [ns]	0.033

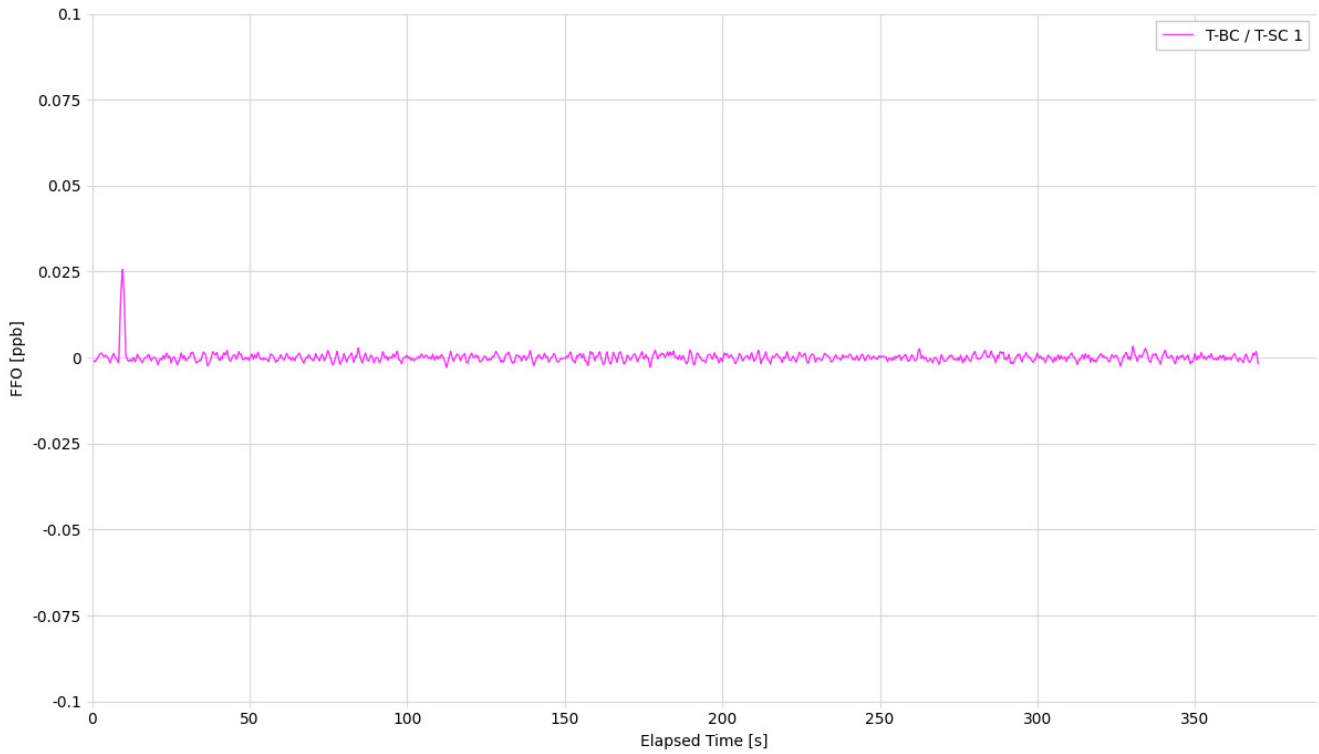


Figure 77. Phase Transient – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.003
Max [ppb]	0.026
Max-Min [ppb]	0.028

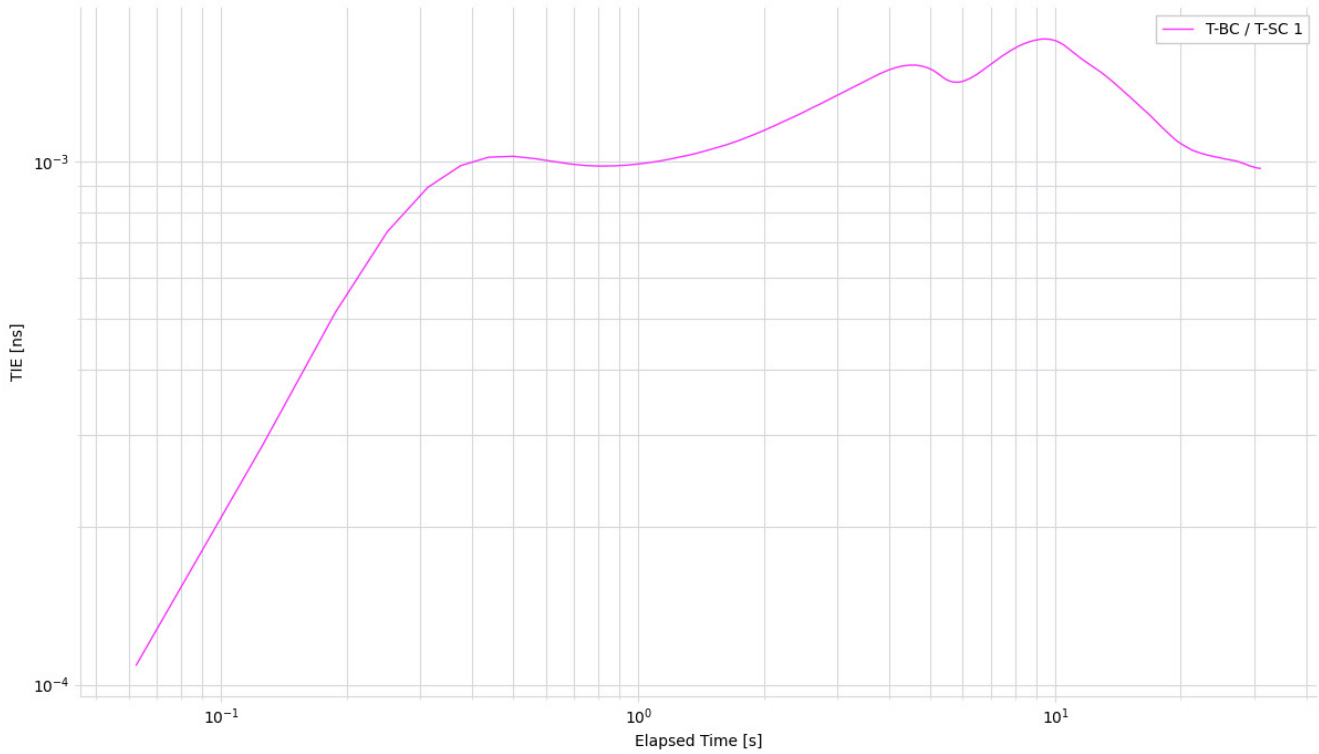


Figure 78. Phase Transient – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.002
Max-Min [ns]	0.002

7.2 Phase Discontinuity

Phase discontinuity requirement reflects the performance of the DUT in cases when the (selected) input reference is lost due to a failure in the reference path and a second reference input signal, traceable to the same reference clock, is available simultaneously or shortly after the detection of the failure (see Figure 1 for the equipment configuration).

The test was carried out by providing reference clock inputs on IN_A and IN_B from the Frequency Generator, which are 180° out of phase from each other. The PLL is locked to the clock signal from IN_A for a given period of time before producing a phase transient by turning off the signal to IN_A from the waveform generator, while the signal at IN_B is simultaneously available to the DUT. The DPLL will try to lock to the reference signal on IN_B. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter. The results of the given transient are plotted against the applicable standard profiles.

7.2.1. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz

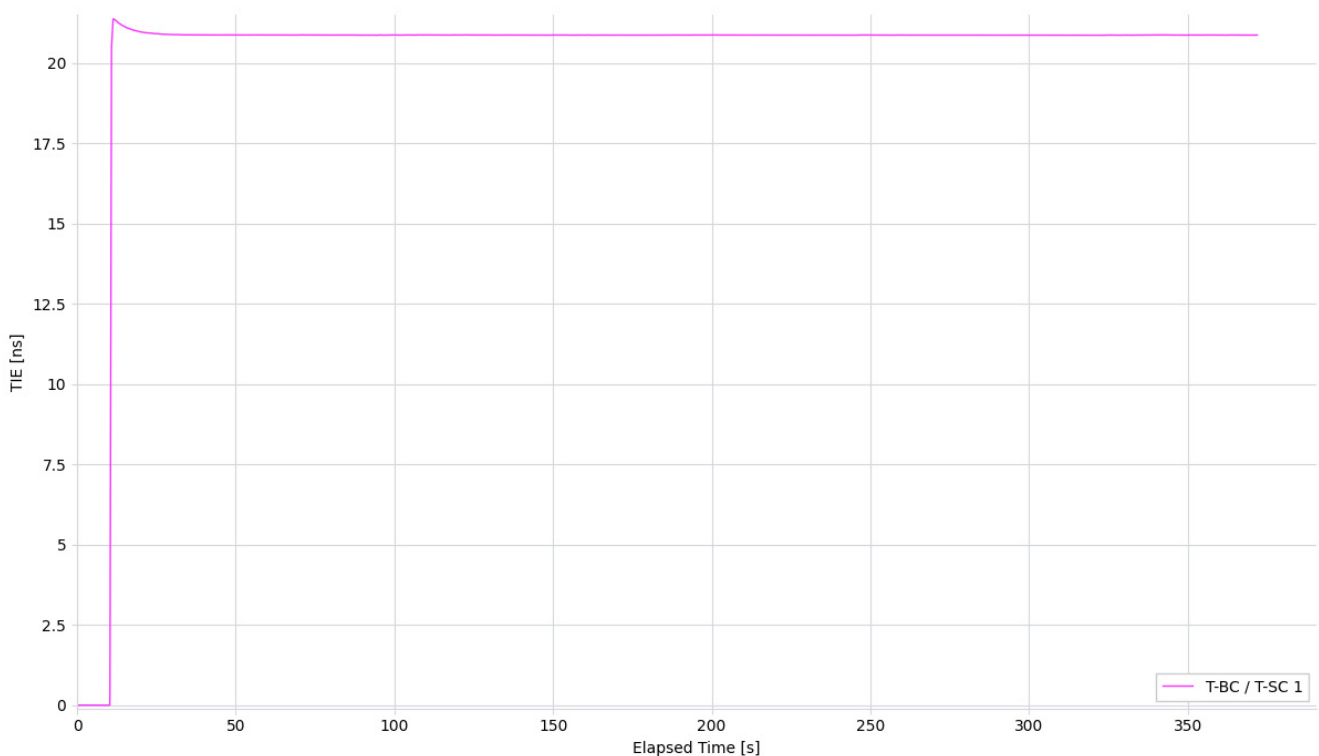


Figure 79. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz

	T-BC / T-SC 1
Mean [ns]	20.275
Min [ns]	0.001
Max [ns]	21.363
Max-Min [ns]	21.362

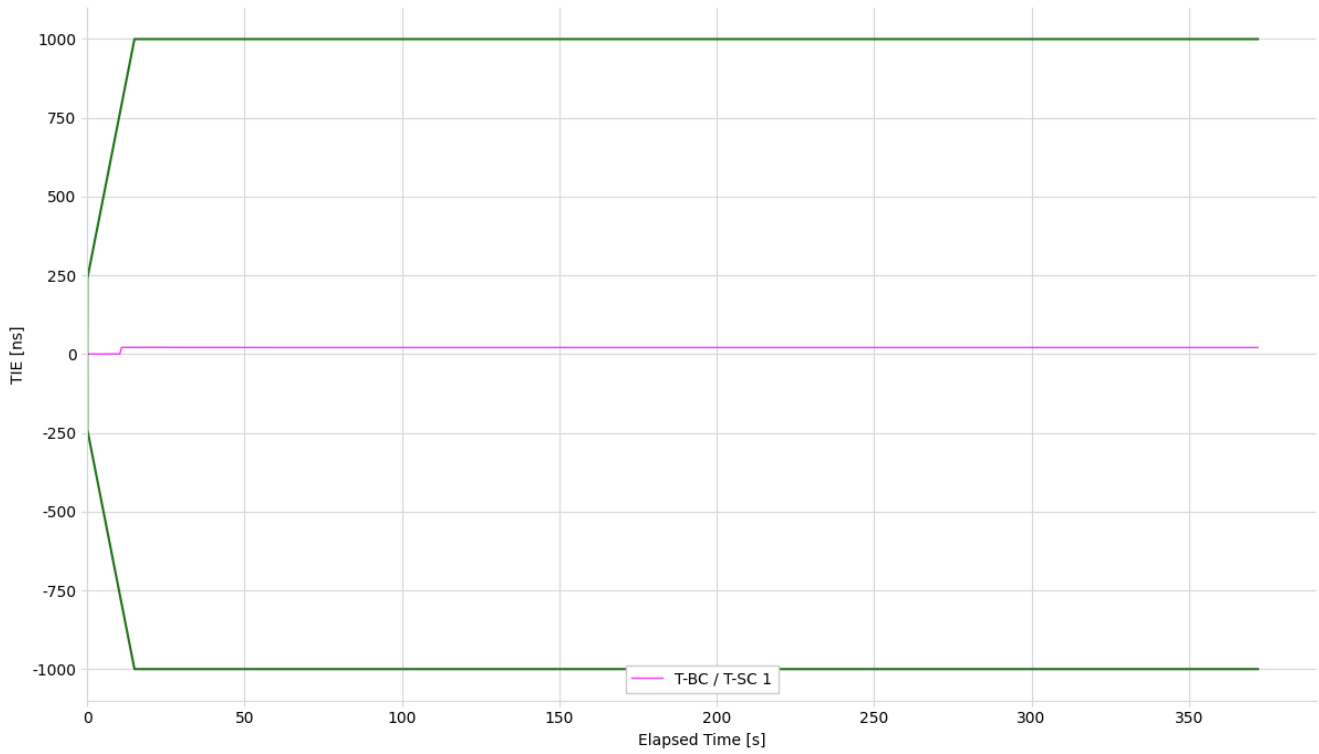


Figure 80. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	20.275
Min [ns]	0.001
Max [ns]	21.363
Max-Min [ns]	21.362

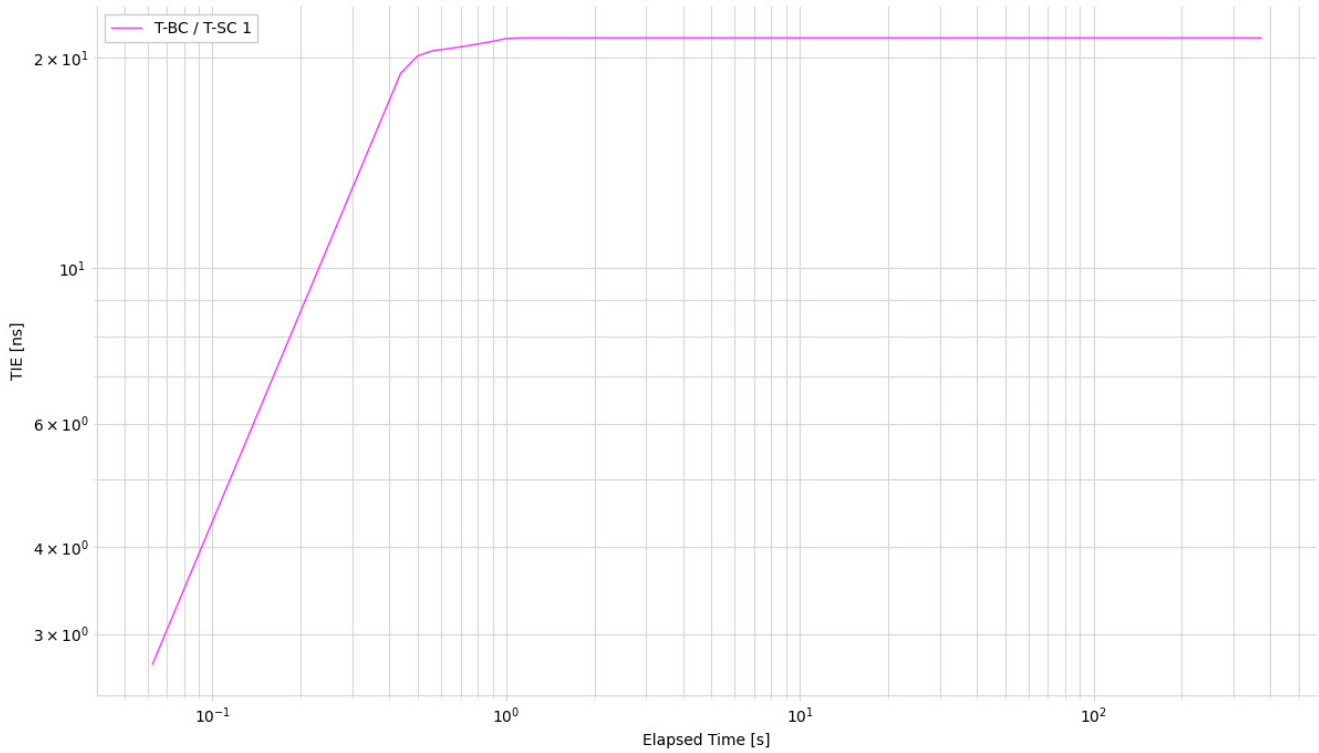


Figure 81. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	2.717
Max [ns]	21.362
Max-Min [ns]	18.645

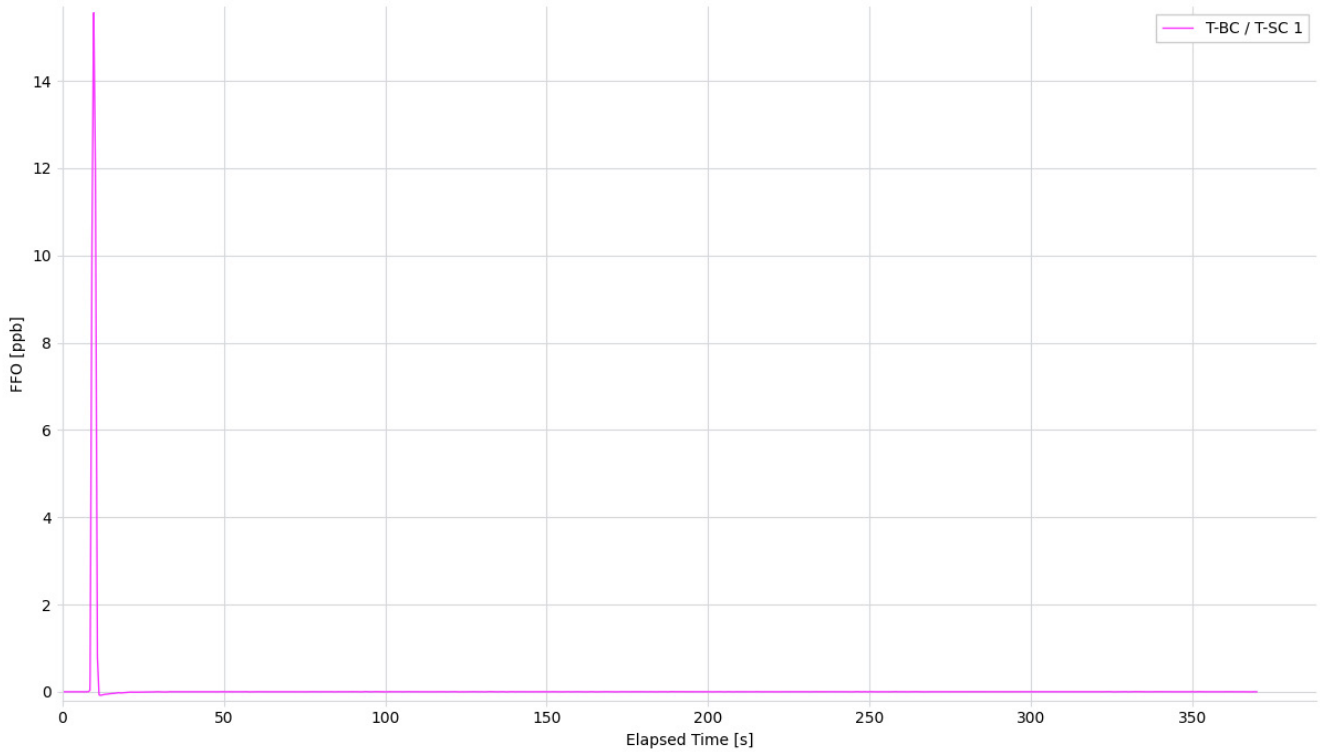


Figure 82. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.056
Min [ppb]	-0.082
Max [ppb]	15.558
Max-Min [ppb]	15.639

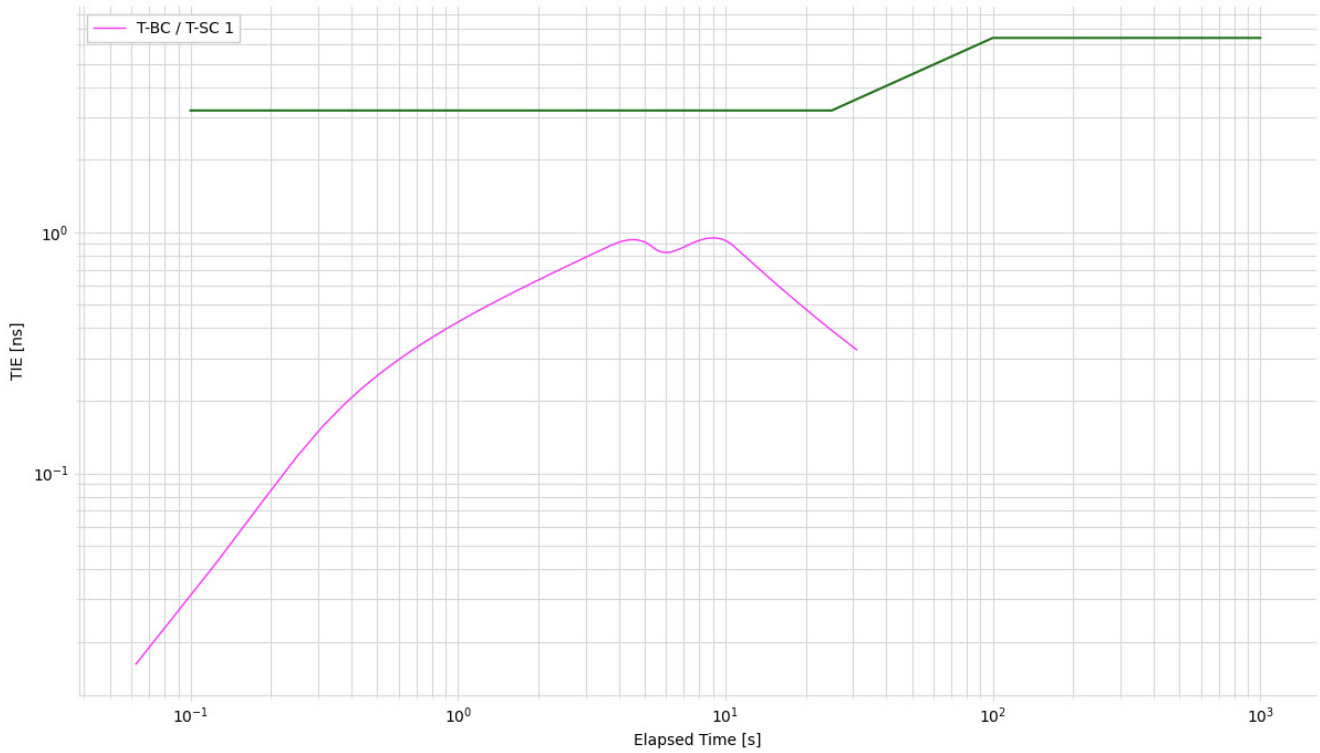


Figure 83. Phase Discontinuity – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.016
Max [ns]	0.947
Max-Min [ns]	0.931

7.2.2. Phase Discontinuity – G.8262 EEC Option 1, 10Hz

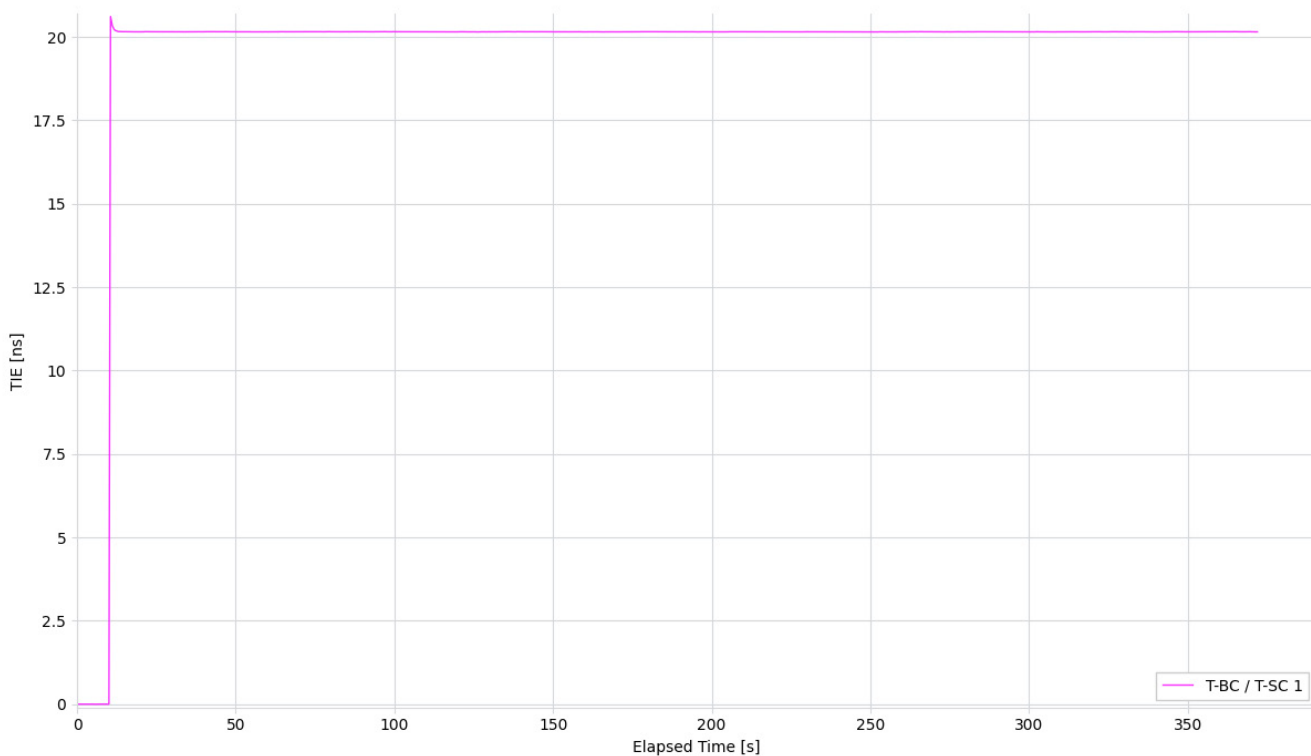


Figure 84. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	19.596
Min [ns]	-0.003
Max [ns]	20.613
Max-Min [ns]	20.616

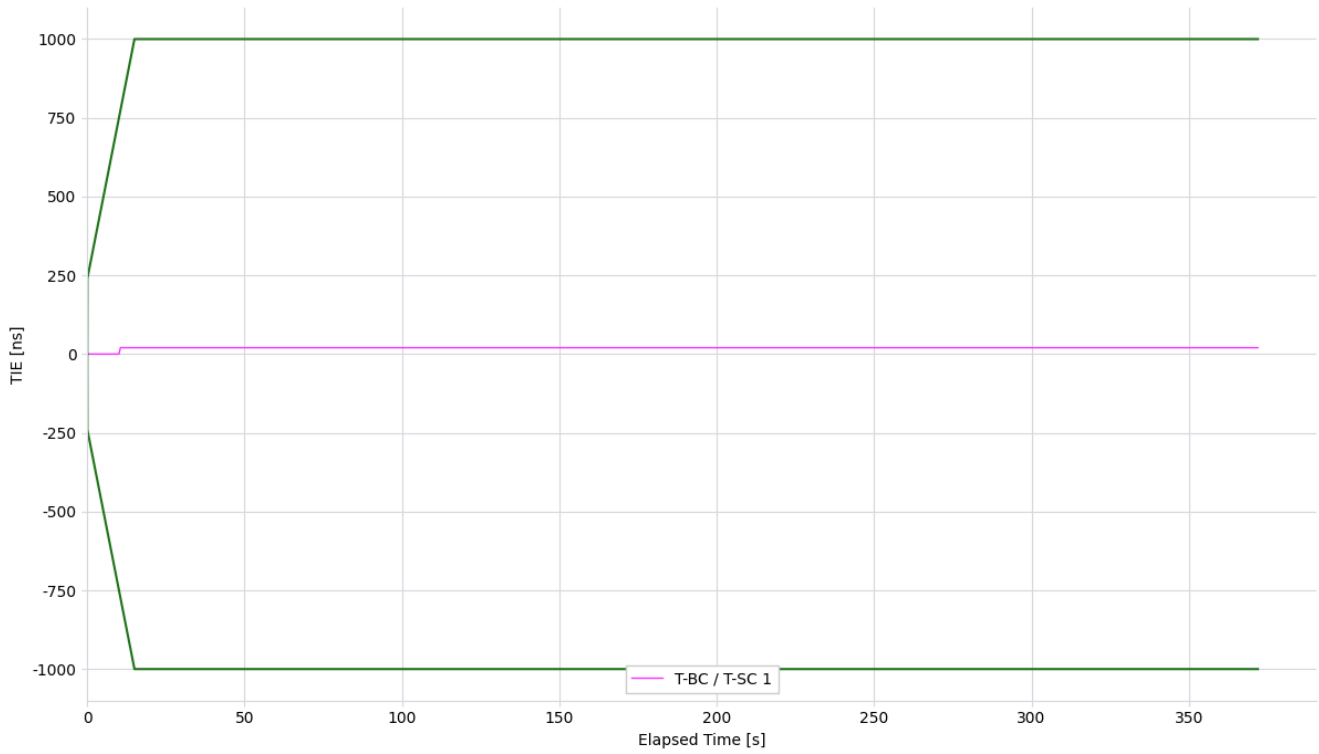


Figure 85. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	19.596
Min [ns]	-0.003
Max [ns]	20.613
Max-Min [ns]	20.616

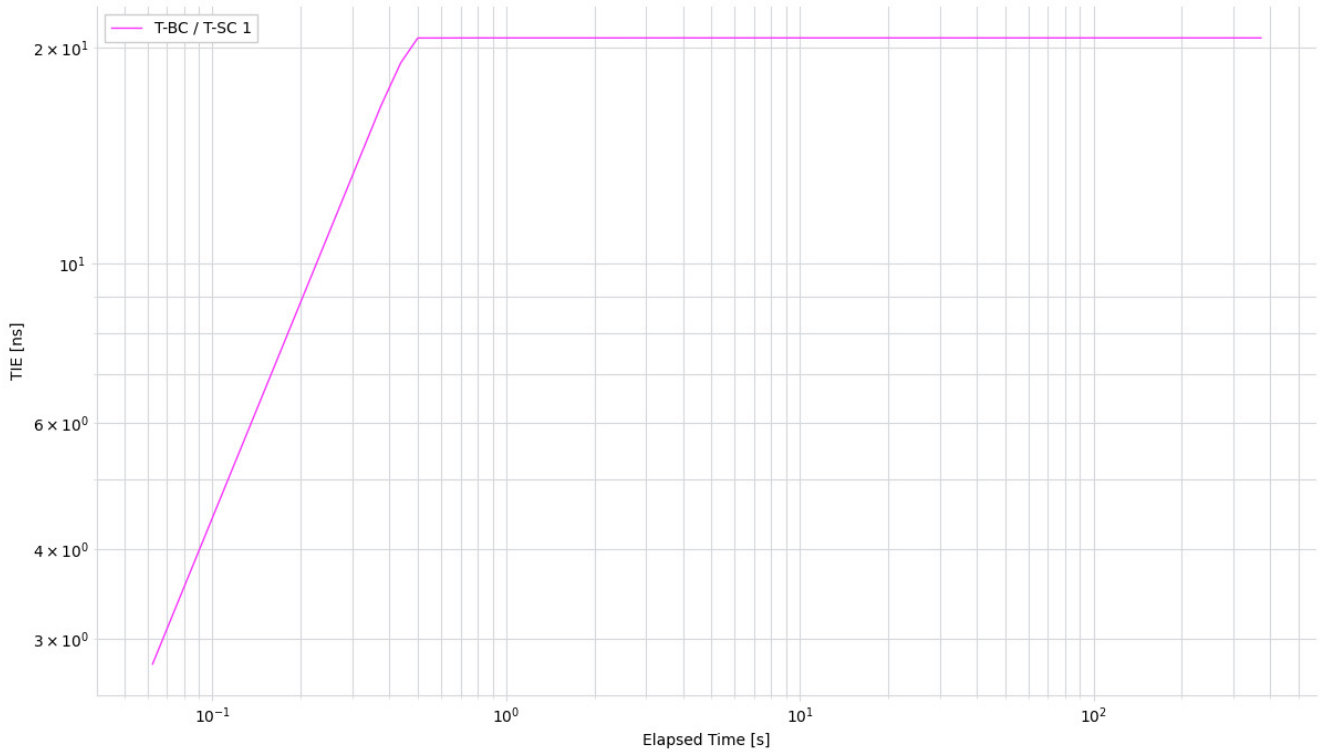


Figure 86. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	2.765
Max [ns]	20.616
Max-Min [ns]	17.851

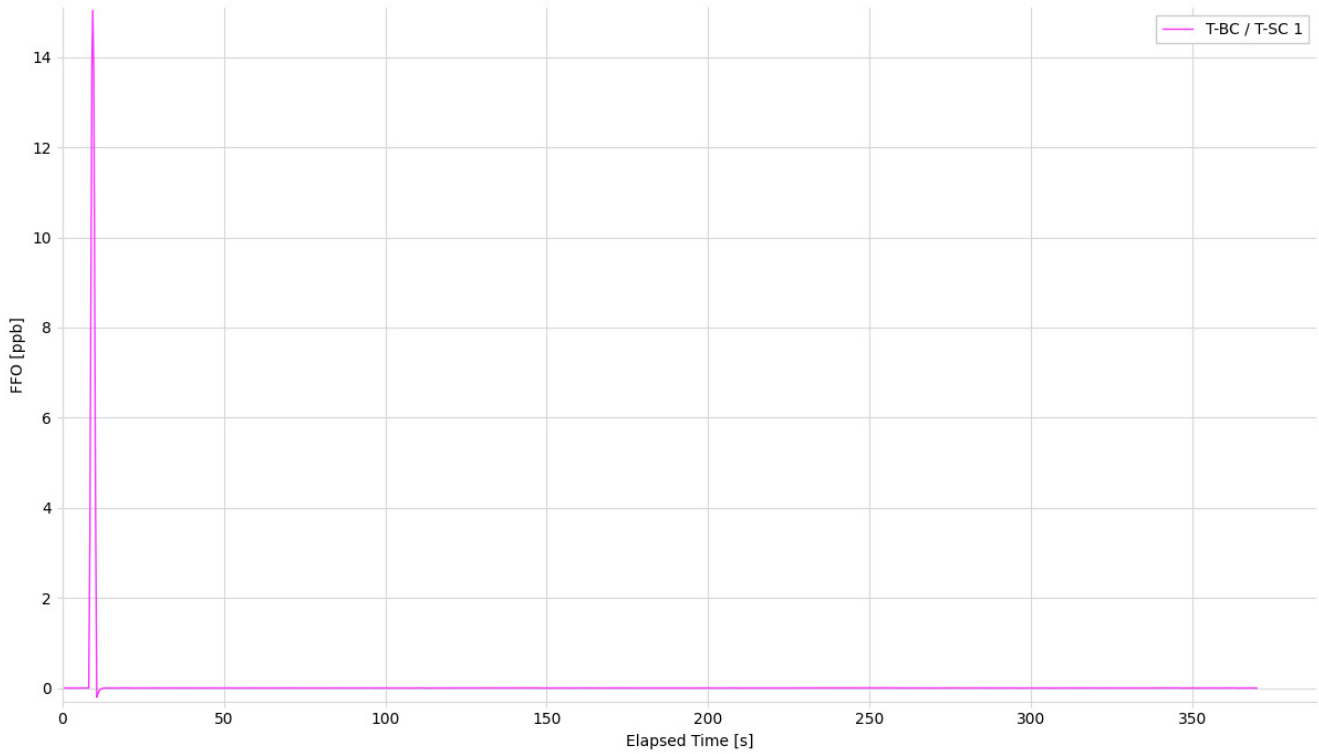


Figure 87. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.055
Min [ppb]	-0.206
Max [ppb]	15.037
Max-Min [ppb]	15.243

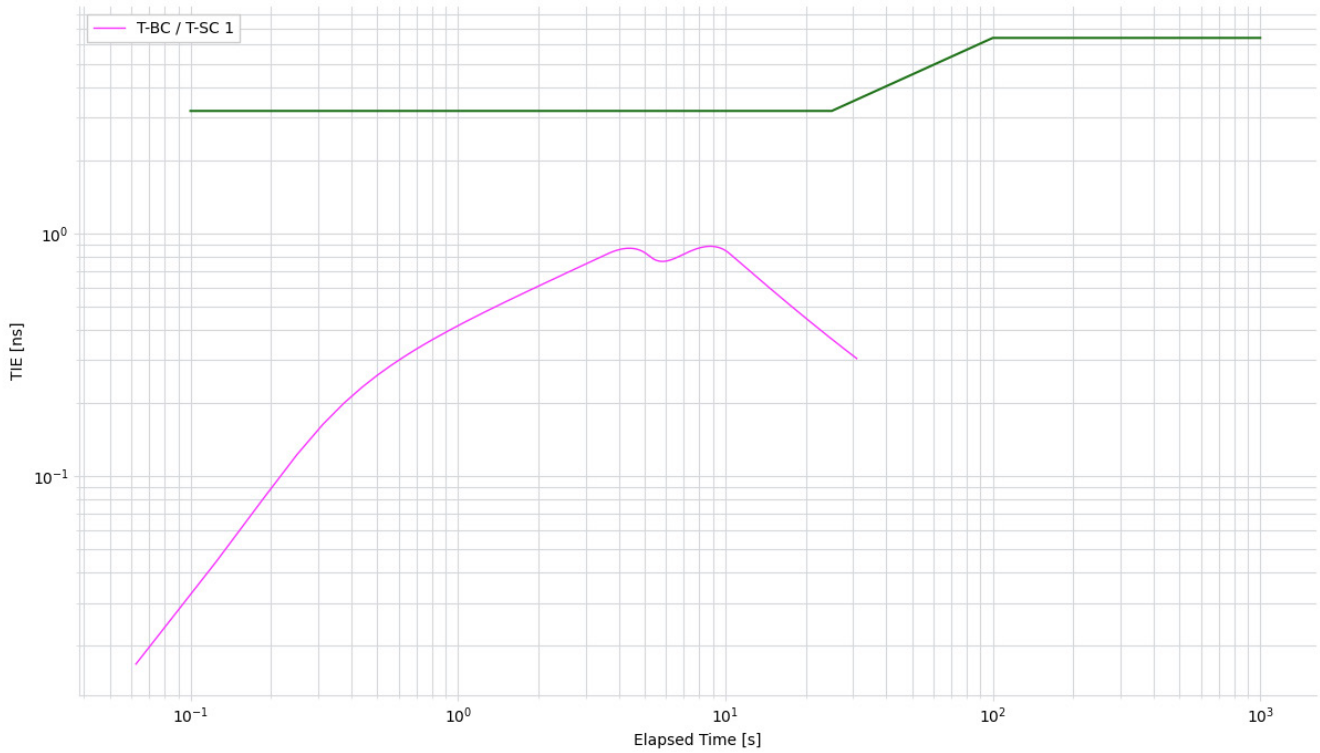


Figure 88. Phase Discontinuity – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.017
Max [ns]	0.885
Max-Min [ns]	0.869

7.2.3. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz

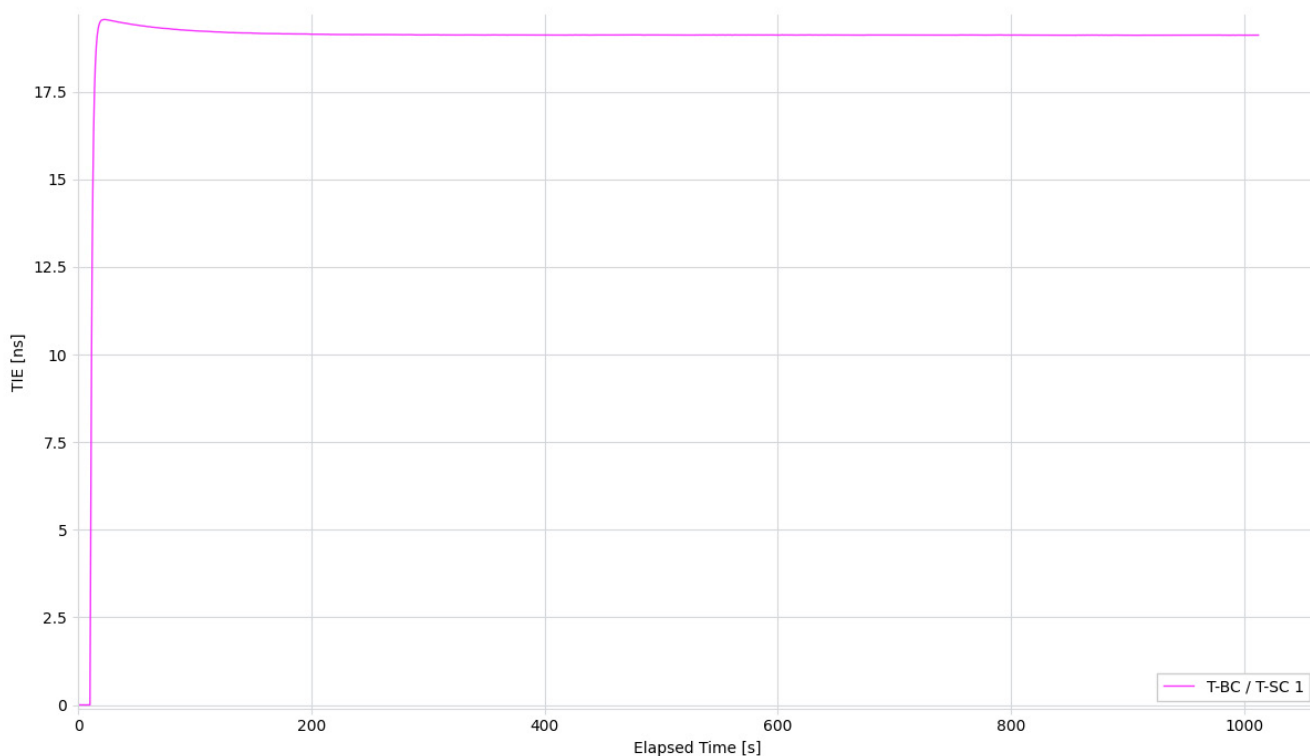


Figure 89. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	18.92
Min [ns]	0.0
Max [ns]	19.562
Max-Min [ns]	19.562

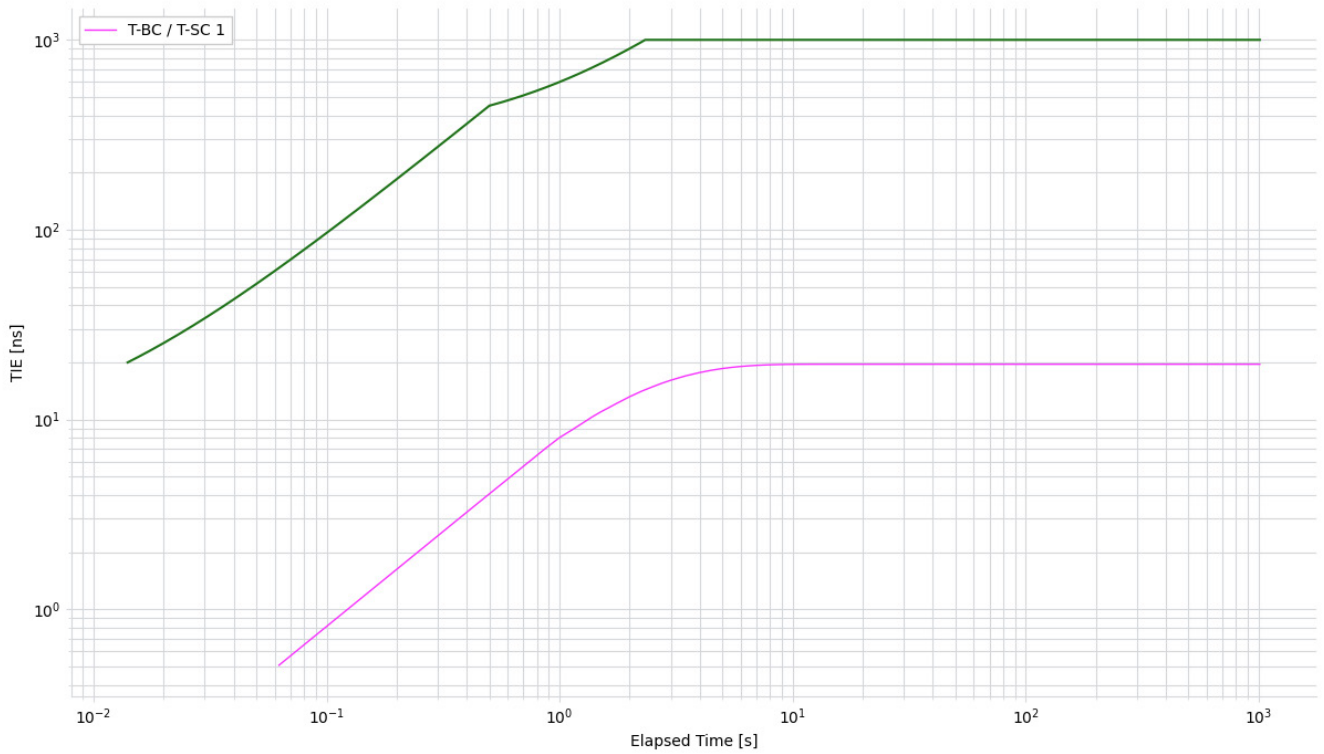


Figure 90. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.508
Max [ns]	19.562
Max-Min [ns]	19.054

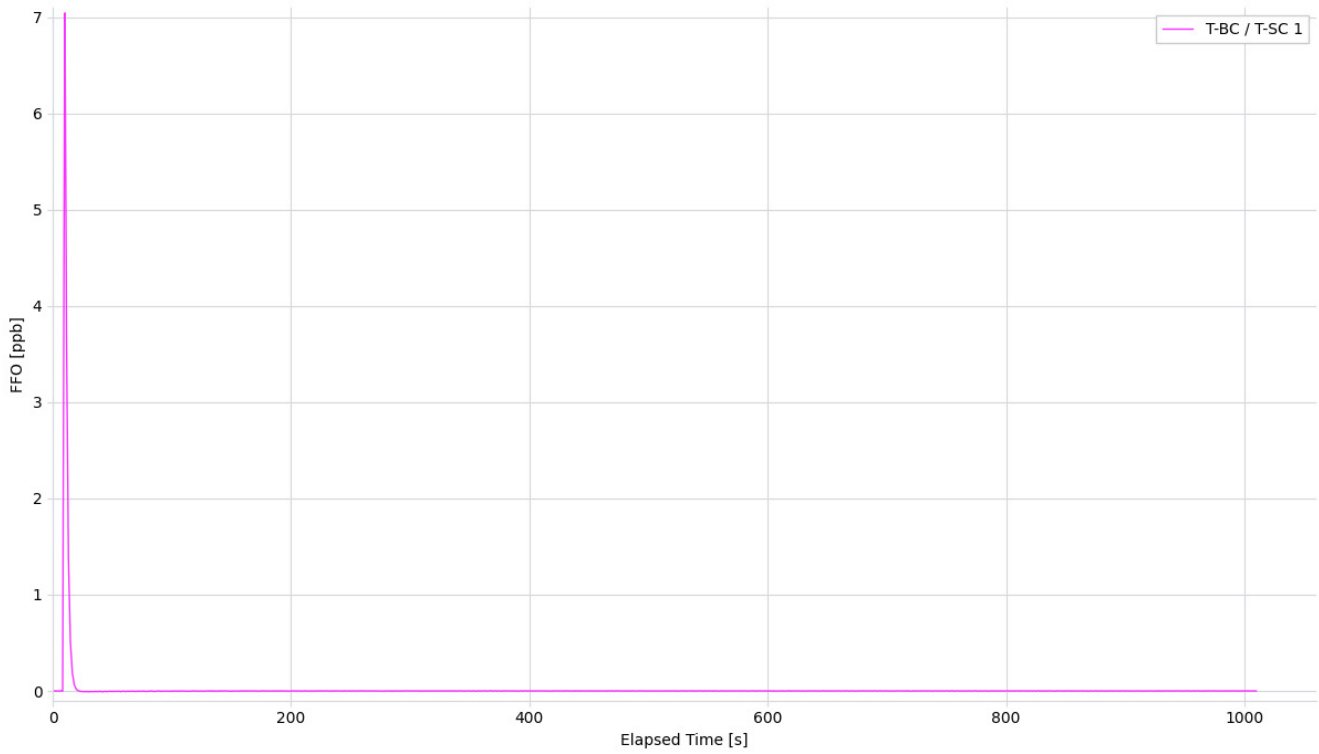


Figure 91. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.02
Min [ppb]	-0.009
Max [ppb]	7.045
Max-Min [ppb]	7.053

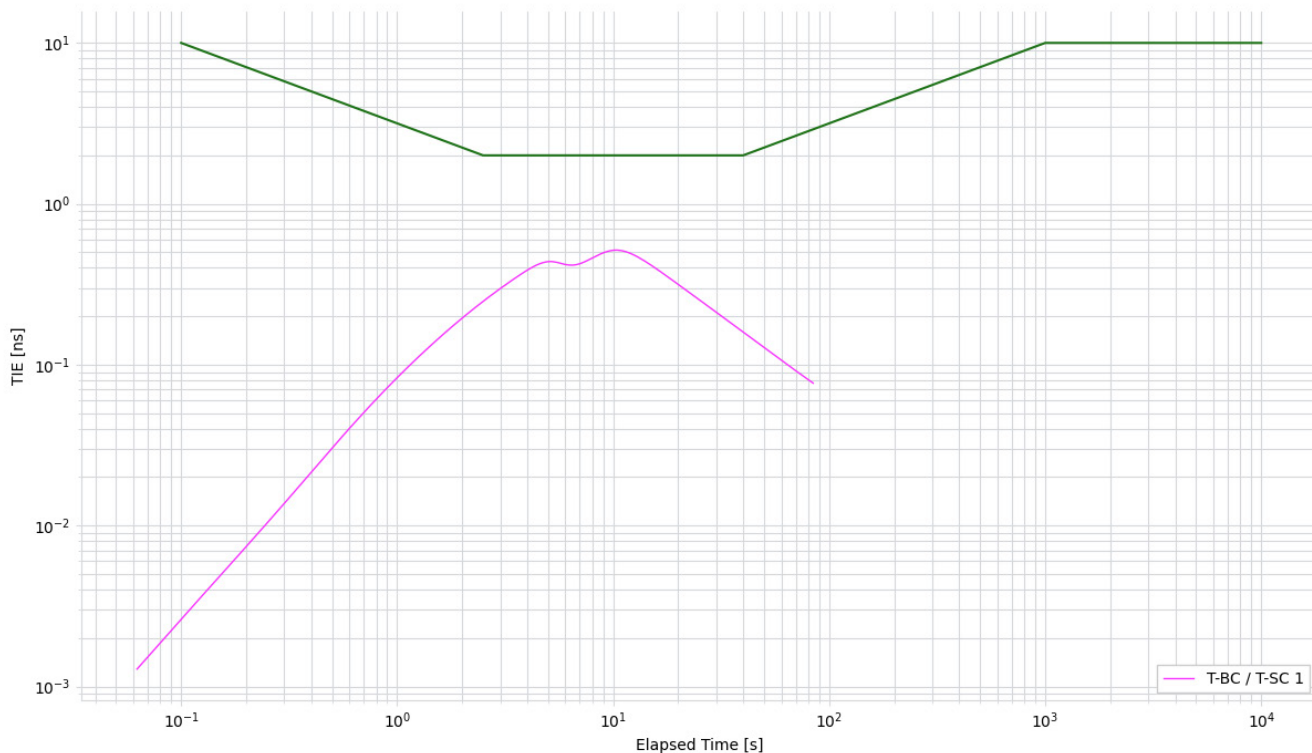


Figure 92. Phase Discontinuity – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.515
Max-Min [ns]	0.514

7.2.4. Phase Discontinuity – G.8262.1 eEEC, 3Hz

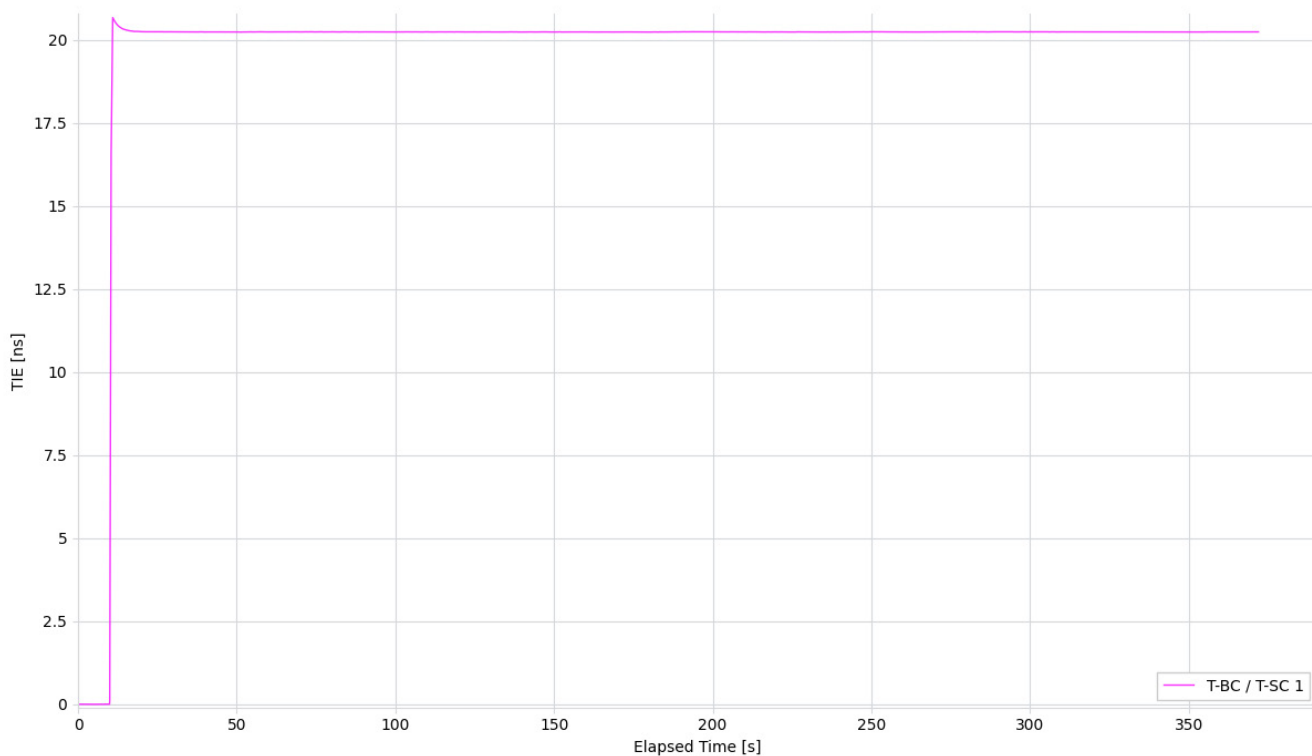


Figure 93. Phase Discontinuity – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	19.689
Min [ns]	-0.005
Max [ns]	20.678
Max-Min [ns]	20.683

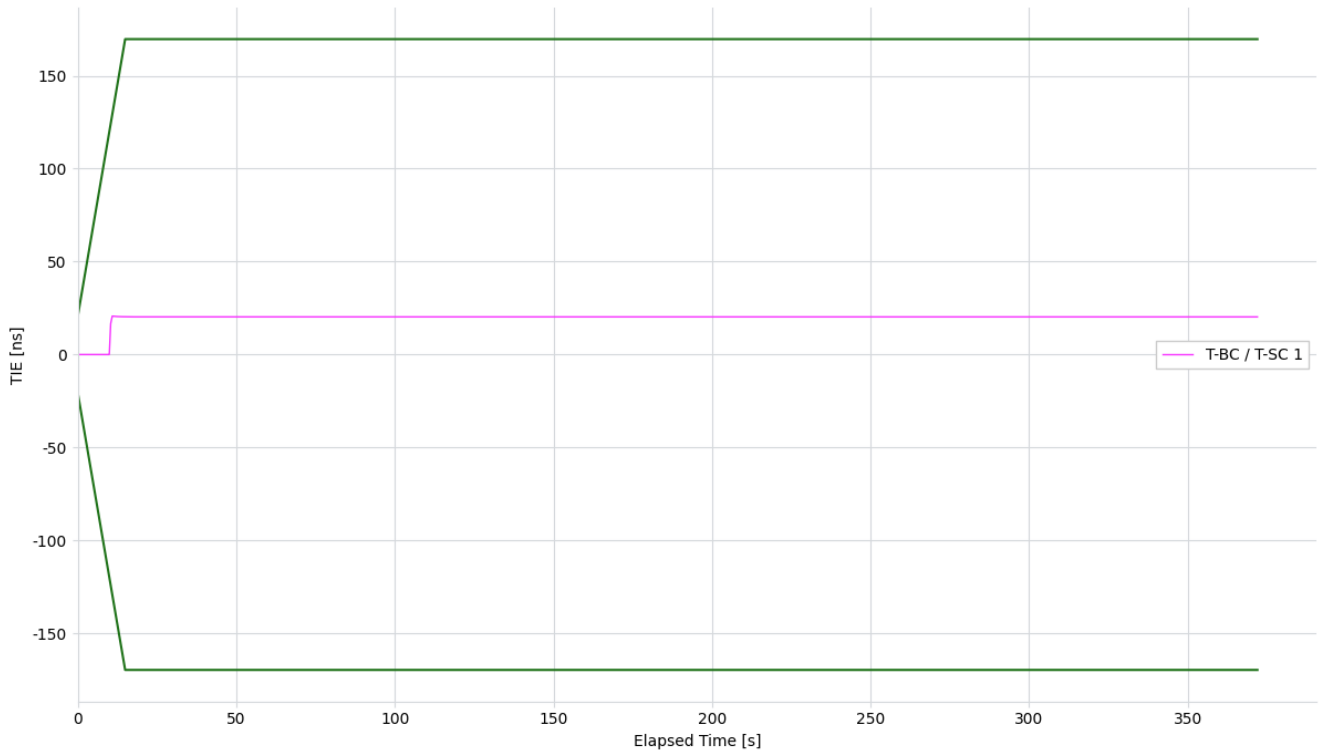


Figure 94. Phase Discontinuity – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	19.689
Min [ns]	-0.005
Max [ns]	20.678
Max-Min [ns]	20.683

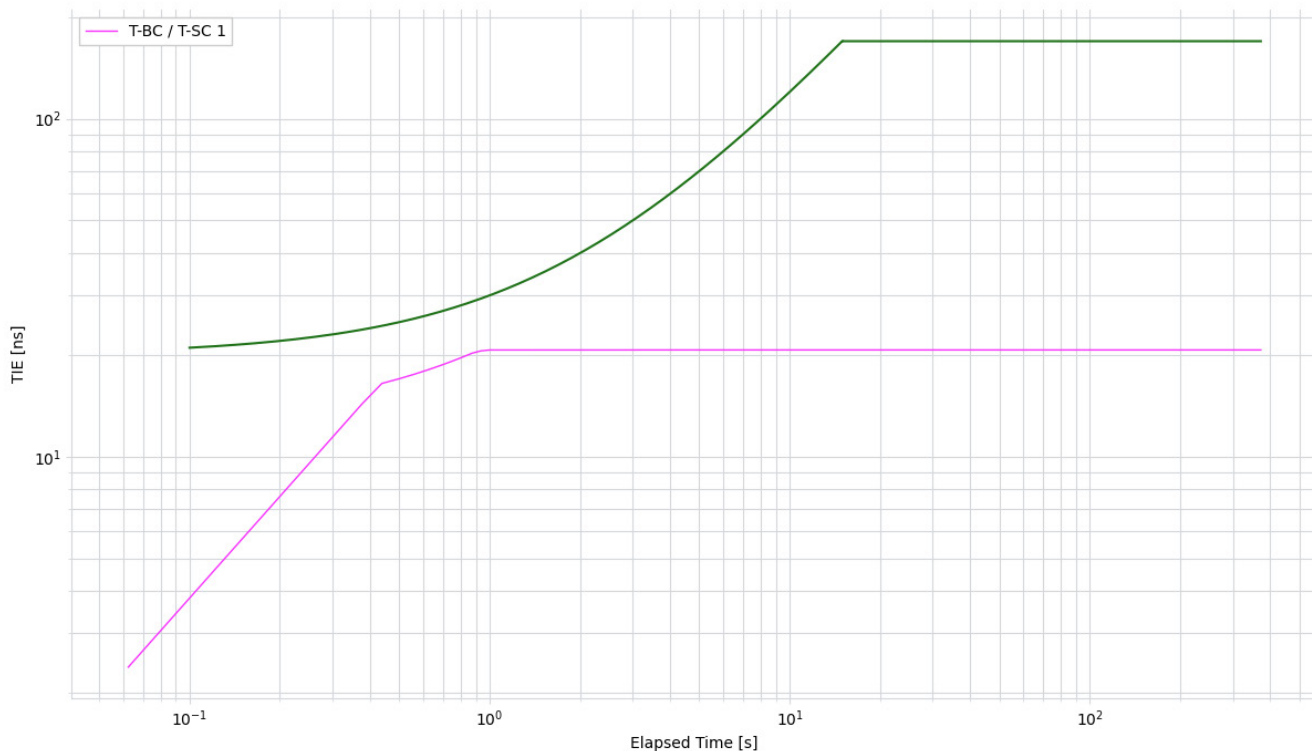


Figure 95. Phase Discontinuity – G.8262.1 eEEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	2.382
Max [ns]	20.683
Max-Min [ns]	18.302

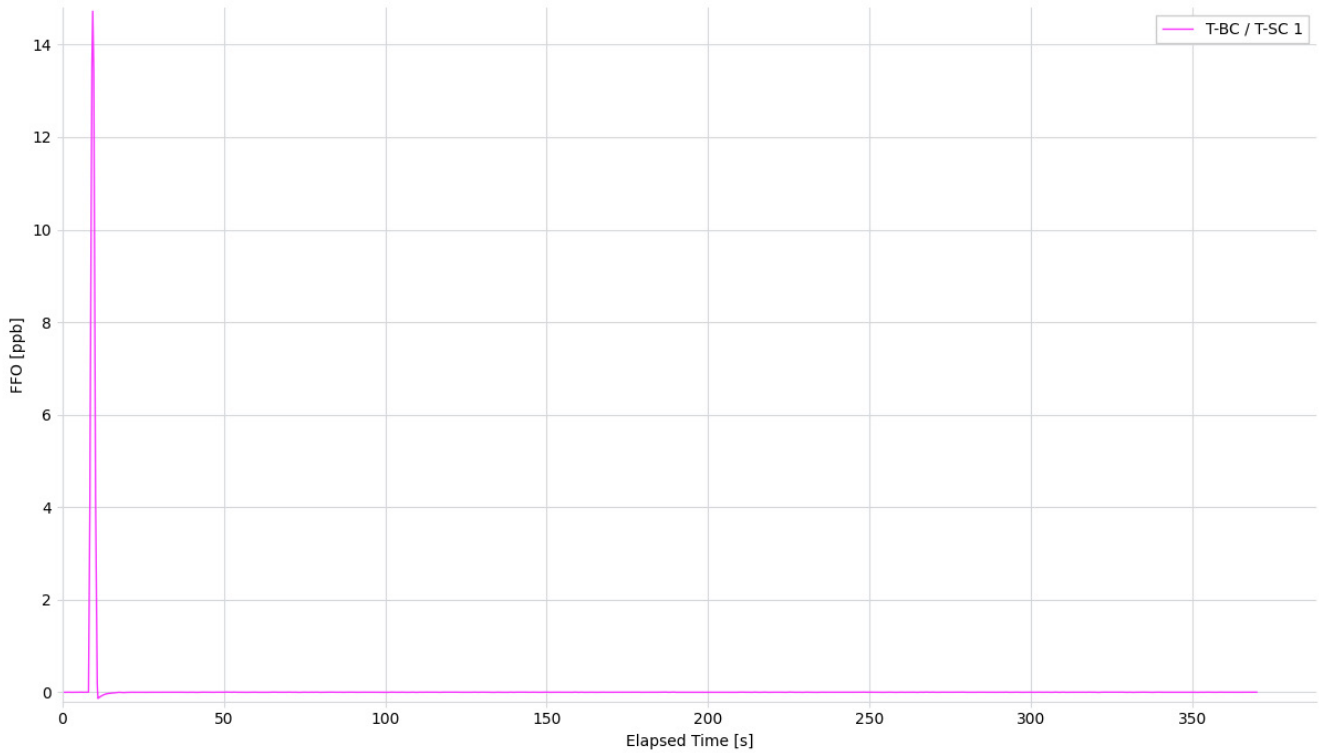


Figure 96. Phase Discontinuity – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.055
Min [ppb]	-0.135
Max [ppb]	14.721
Max-Min [ppb]	14.856

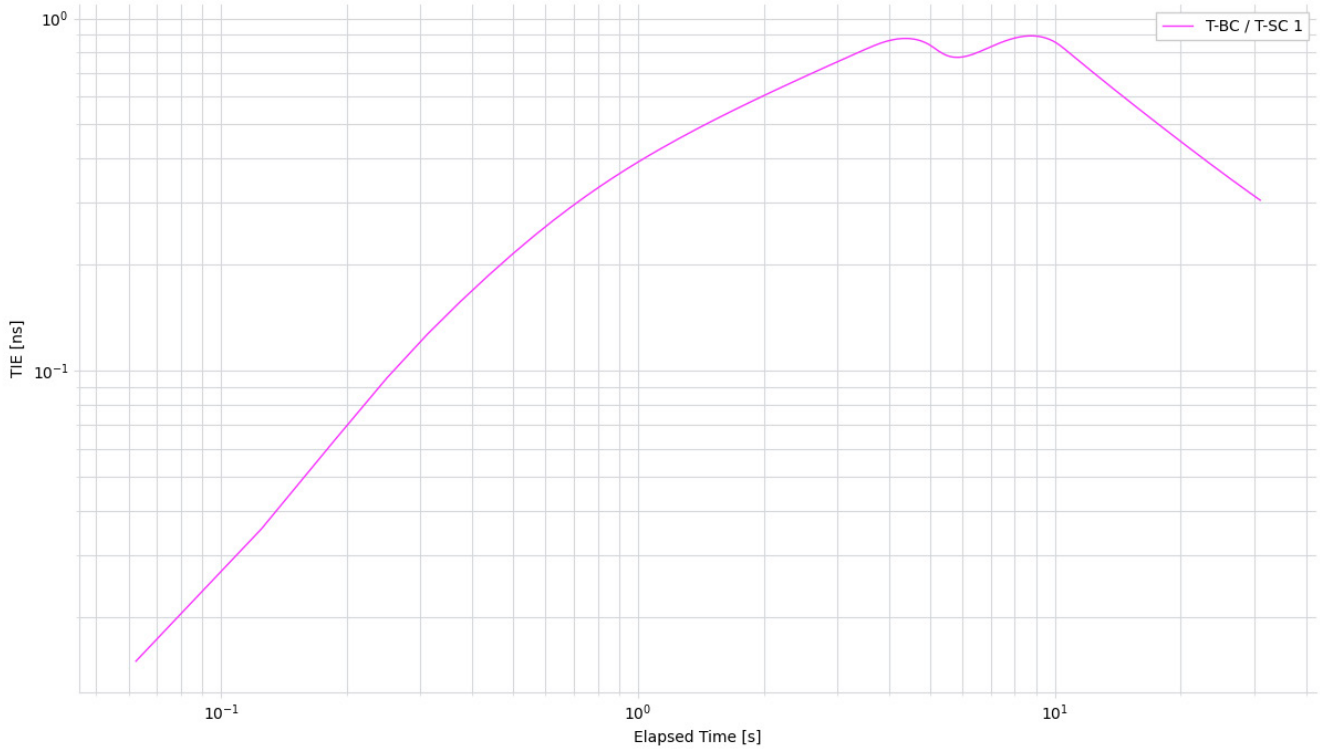


Figure 97. Phase Discontinuity – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.015
Max [ns]	0.893
Max-Min [ns]	0.878

7.3 Short-term Phase Transient Response

Short-term phase transient response requirement reflects the performance of the DUT in cases when the (selected) input reference is lost due to a failure in the reference path and a second reference input signal, traceable to the same reference clock, is available simultaneously, or shortly after the detection of the failure (see Figure 1 for the equipment configuration).

The test was carried out by providing reference clock inputs on IN_A and IN_B from the Frequency Generator which are 180° out of phase from each other. The PLL is locked to the clock signal from IN_A for a period of time. A transient is produced by turning off the input reference signal for 11 seconds and during this time the clock on IN_B is unavailable. The DPLL goes into holdover during the 11 second period as no other reference is available. After 11 seconds, the reference signal on IN_B is turned ON and PLL locks to the newly available reference signal. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter. The results of the given transient are plotted against the applicable standard profiles.

- Locked to IN_A → Holdover (11s) → Locked to IN_B

7.3.1. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz

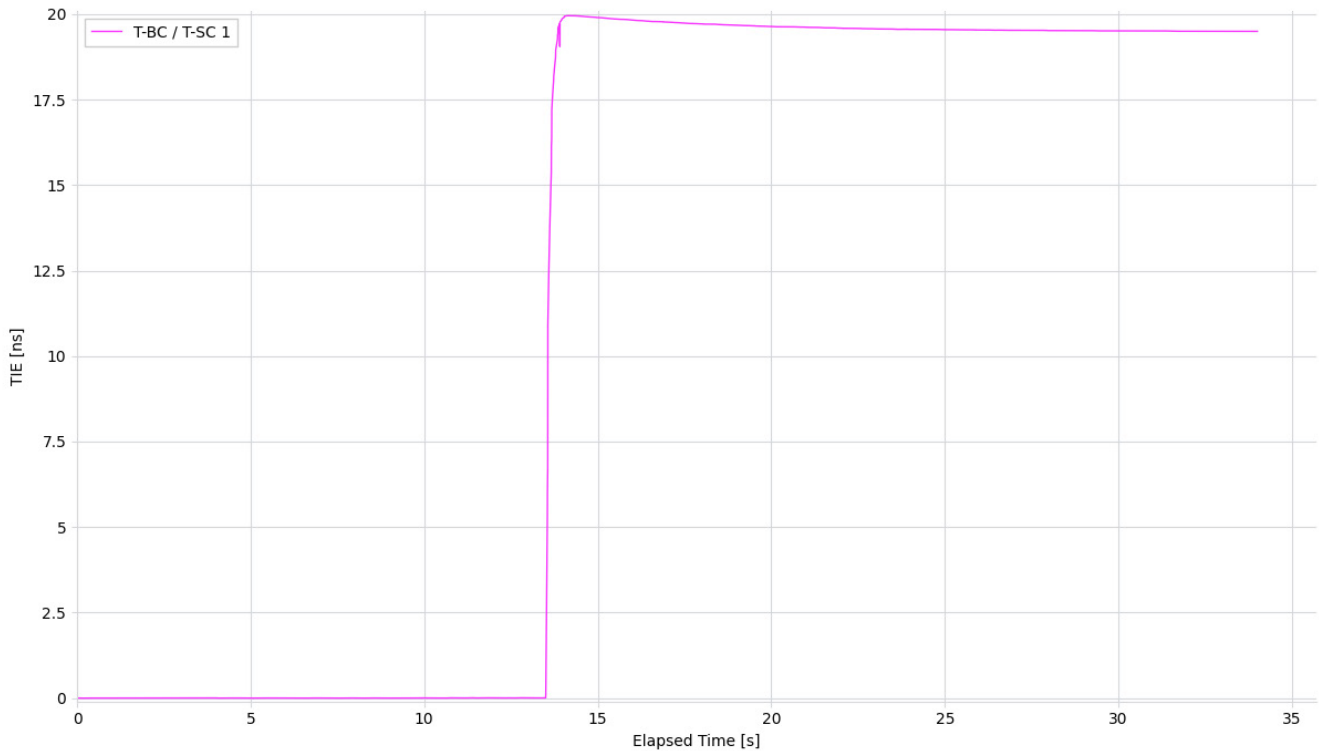


Figure 98. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	11.772
Min [ns]	-0.003
Max [ns]	19.956
Max-Min [ns]	19.959

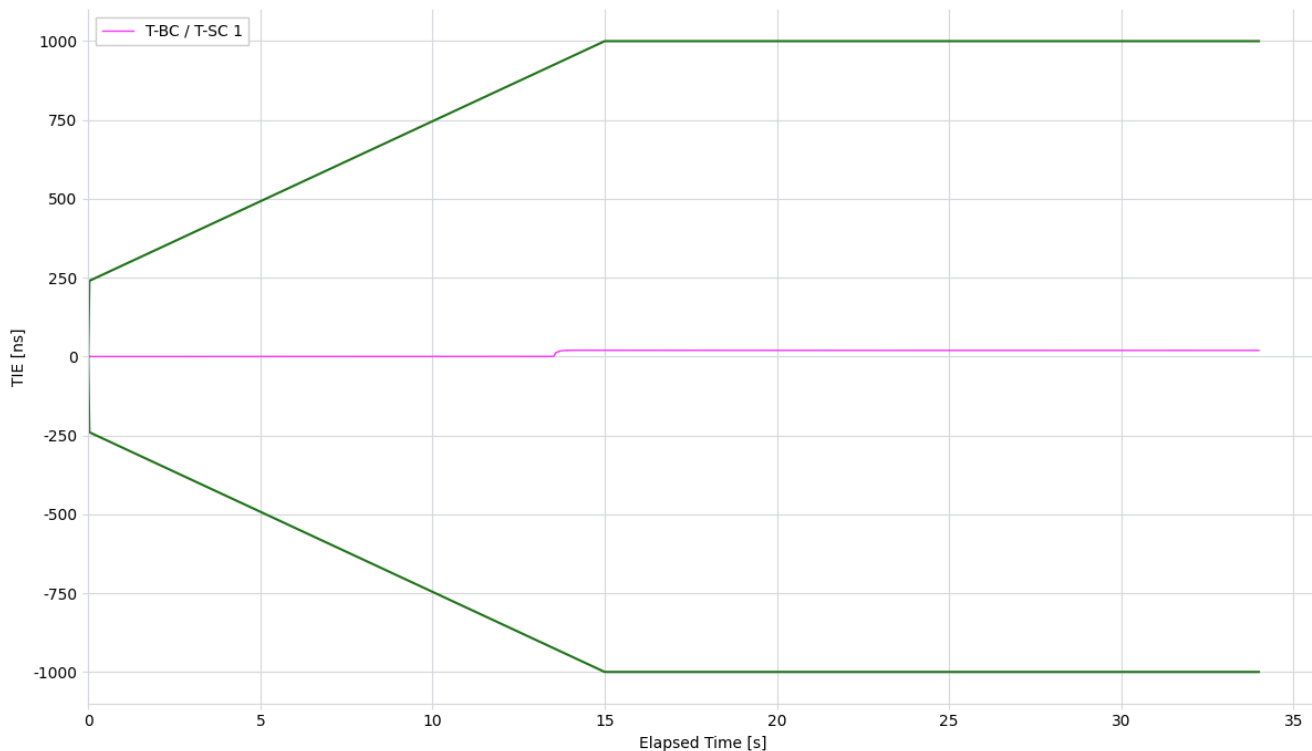


Figure 99. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	11.772
Min [ns]	-0.003
Max [ns]	19.956
Max-Min [ns]	19.959

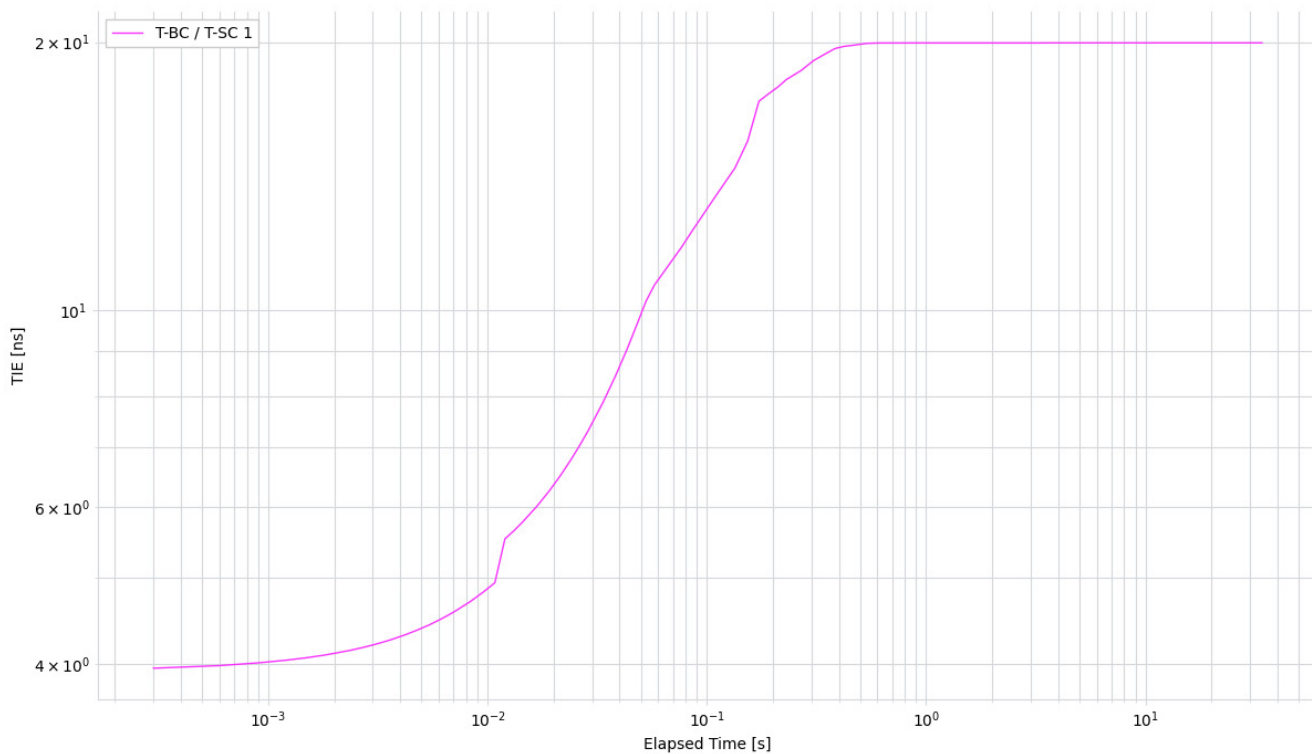


Figure 100. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	3.955
Max [ns]	19.959
Max-Min [ns]	16.004

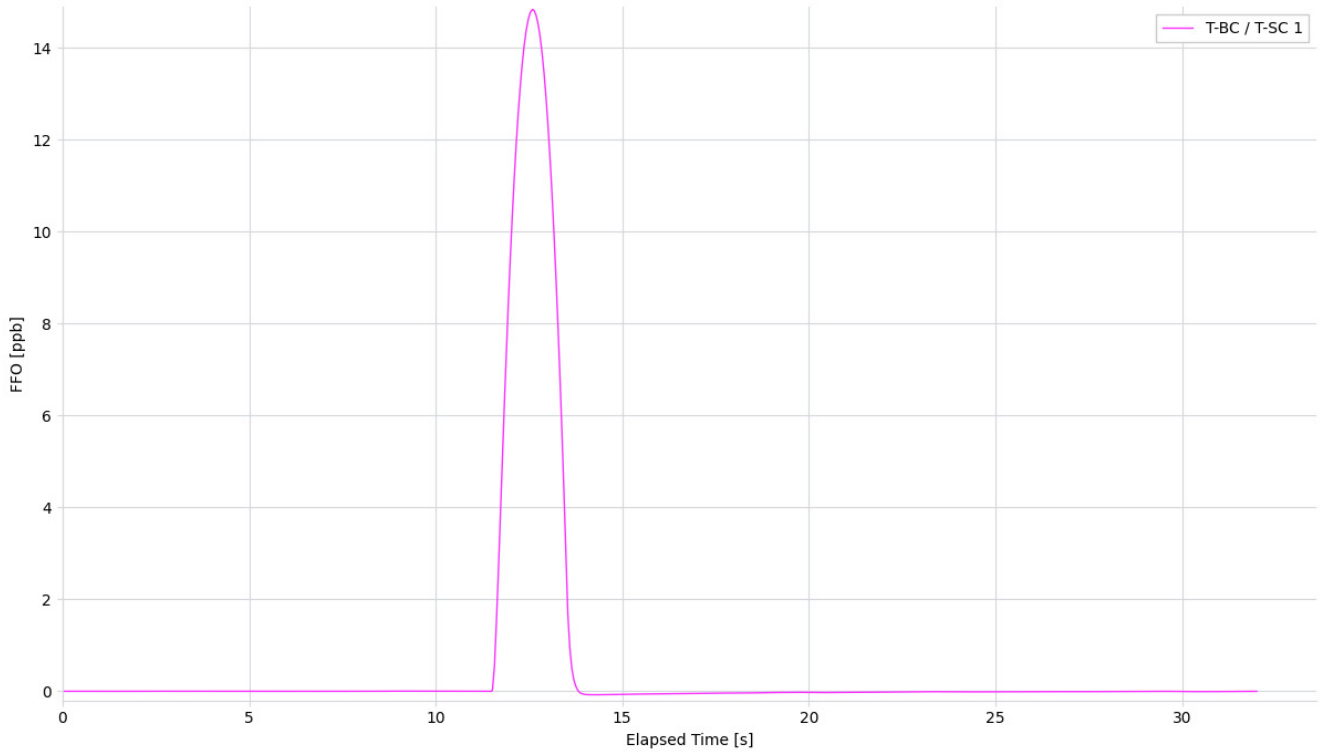


Figure 101. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.609
Min [ppb]	-0.076
Max [ppb]	14.837
Max-Min [ppb]	14.912

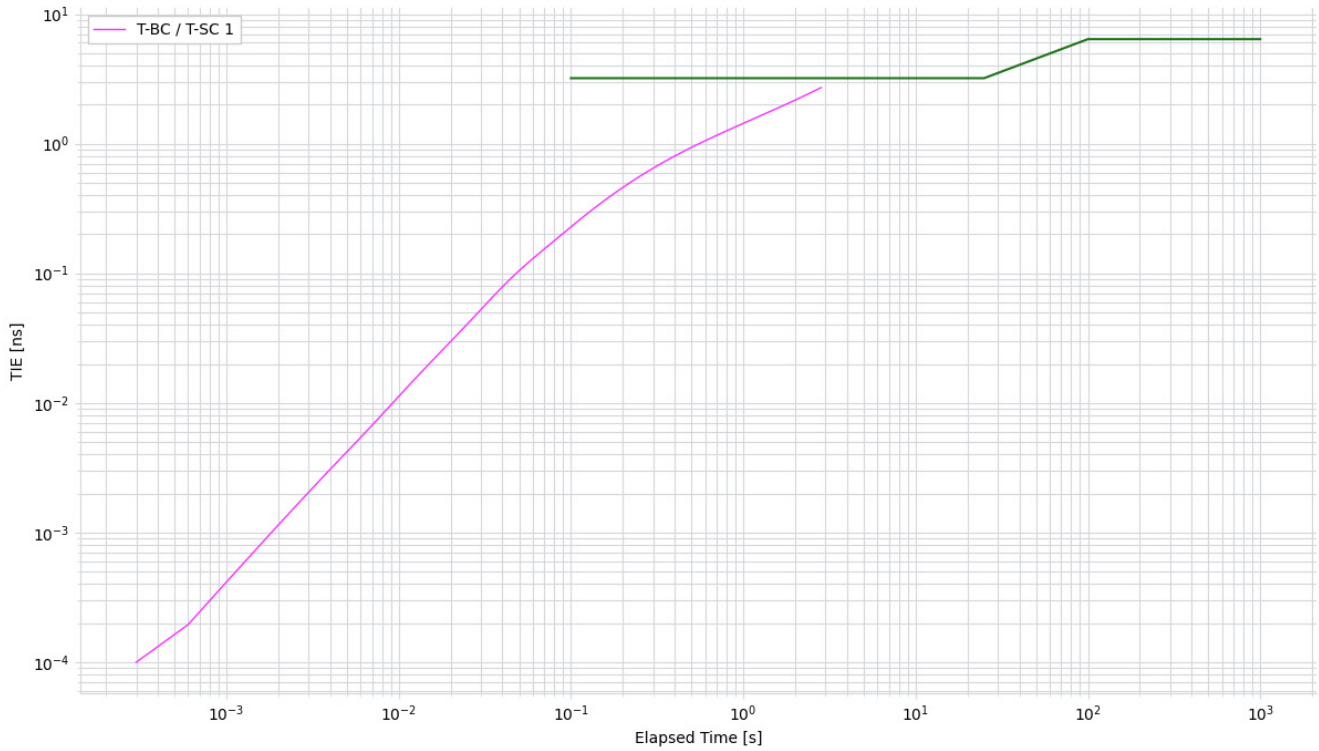


Figure 102. Short-term Phase Transient Response – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	2.708
Max-Min [ns]	2.708

7.3.2. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz

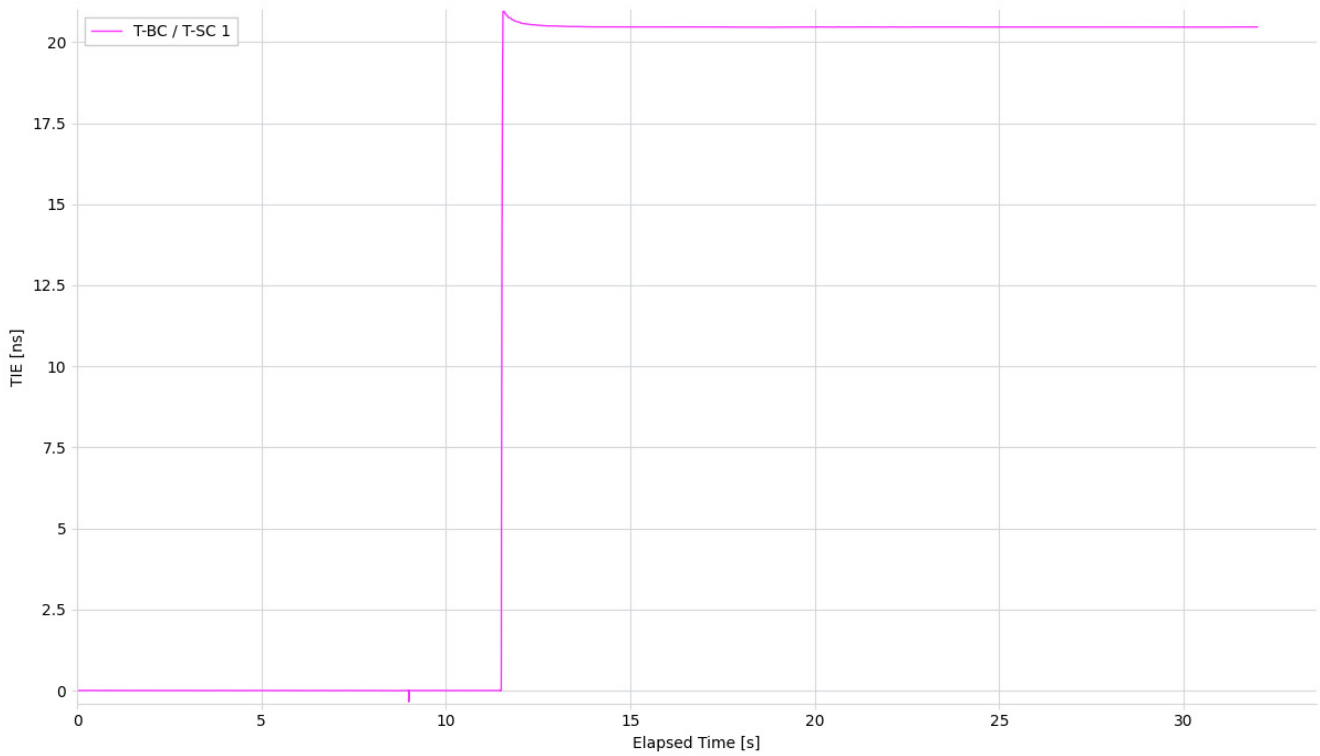


Figure 103. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	13.104
Min [ns]	-0.348
Max [ns]	20.948
Max-Min [ns]	21.296

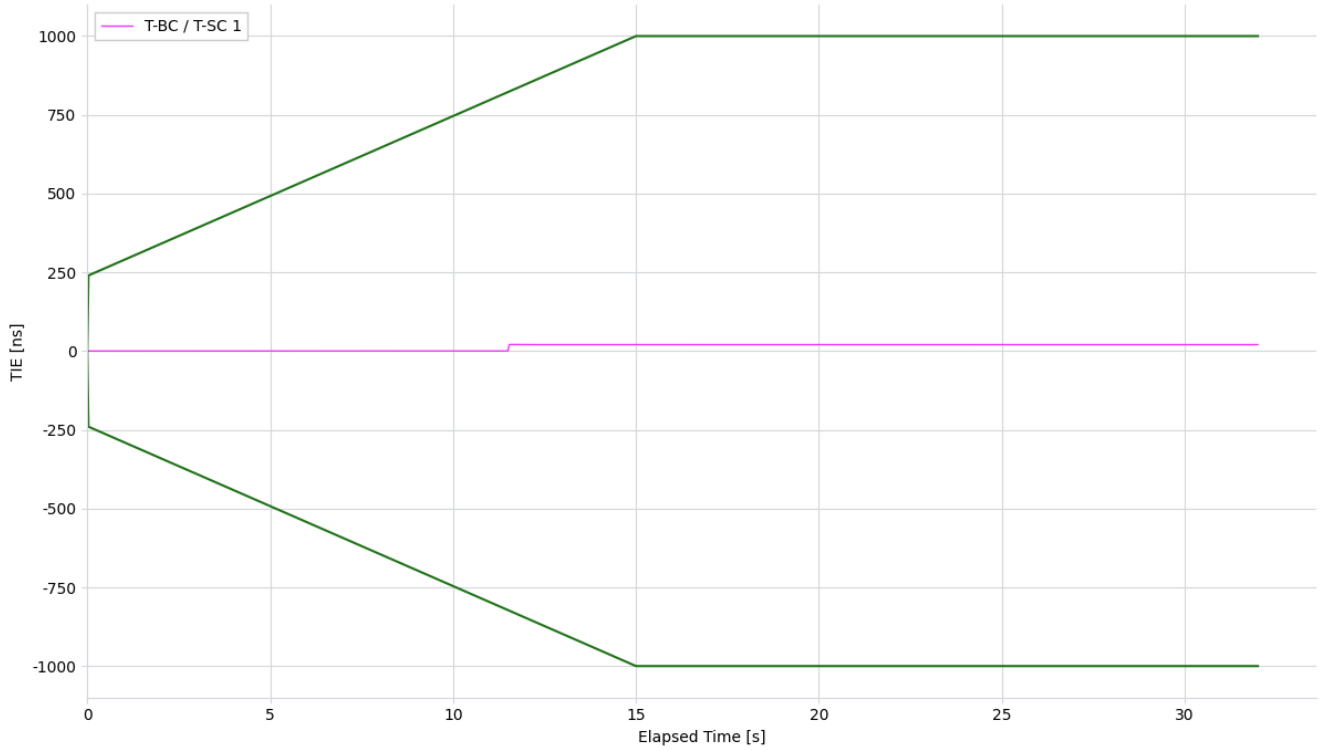


Figure 104. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	13.104
Min [ns]	-0.348
Max [ns]	20.948
Max-Min [ns]	21.296

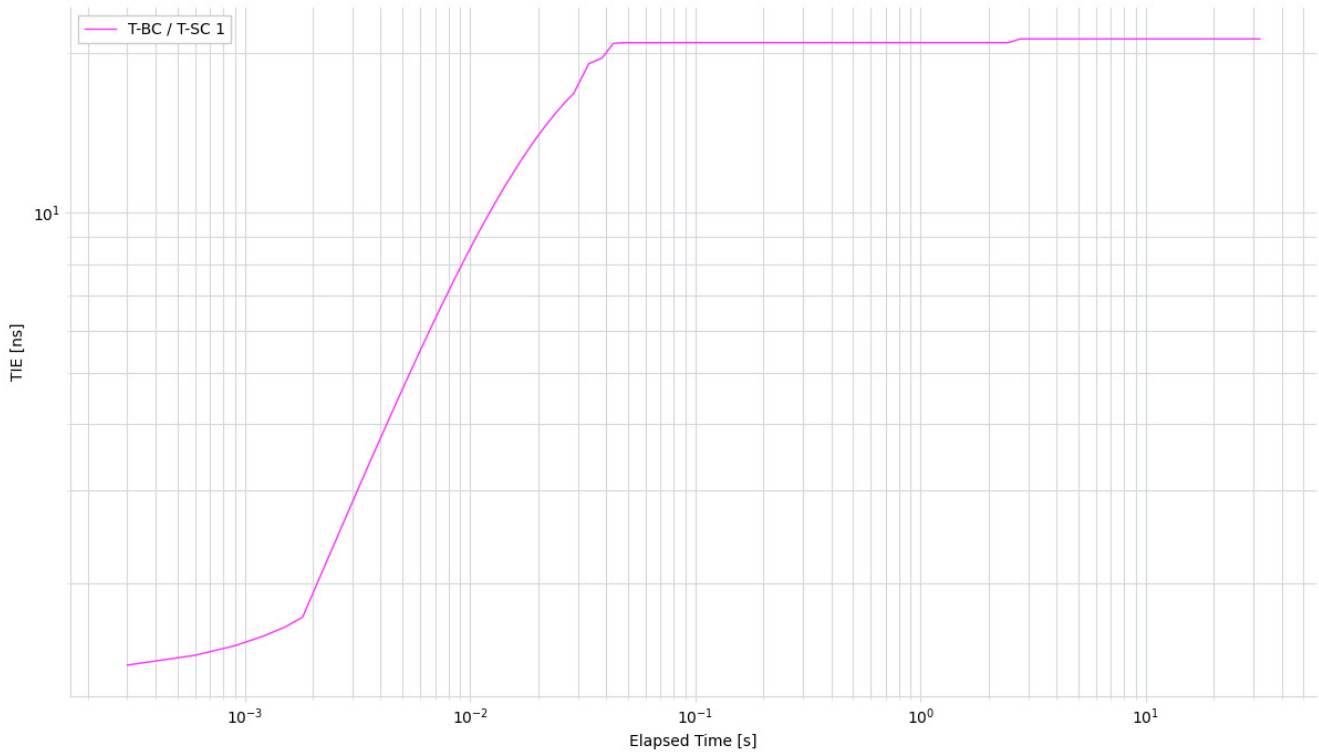


Figure 105. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	1.402
Max [ns]	21.296
Max-Min [ns]	19.894

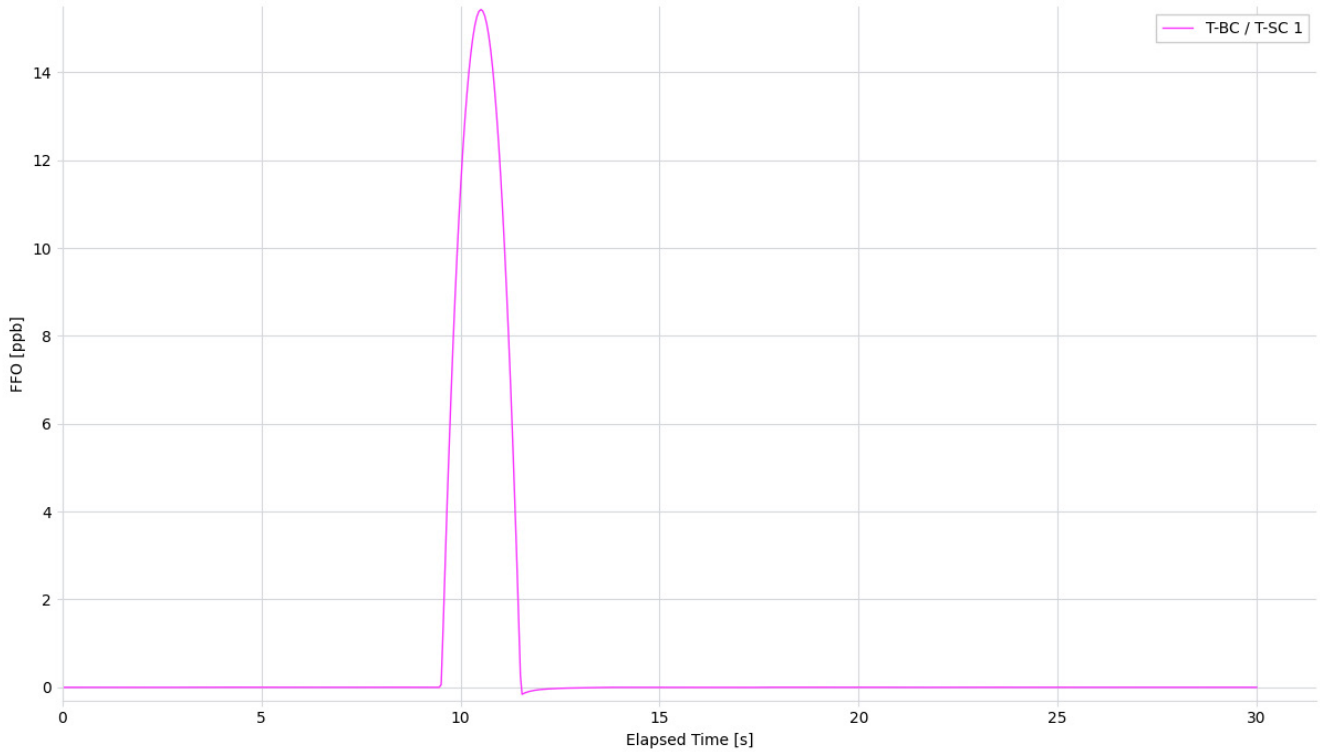


Figure 106. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.681
Min [ppb]	-0.159
Max [ppb]	15.433
Max-Min [ppb]	15.592

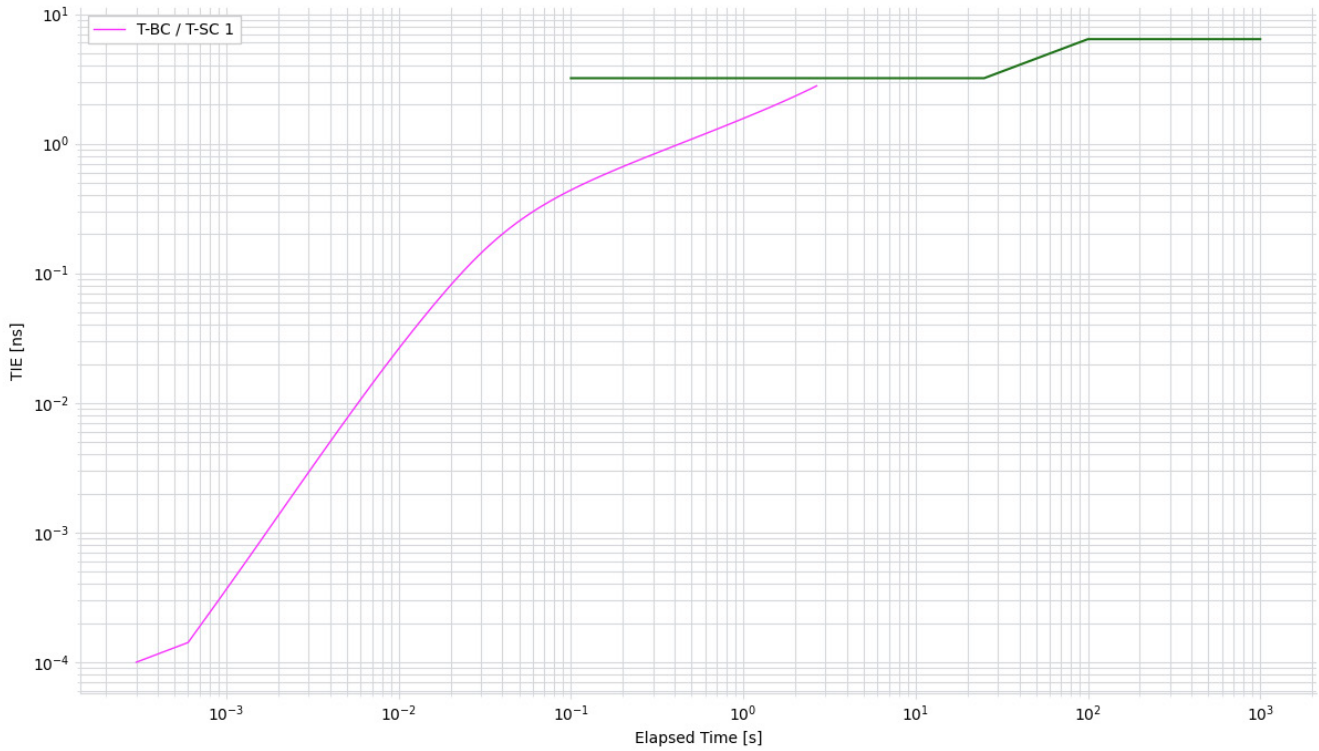


Figure 107. Short-term Phase Transient Response – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	2.793
Max-Min [ns]	2.793

7.3.3. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz

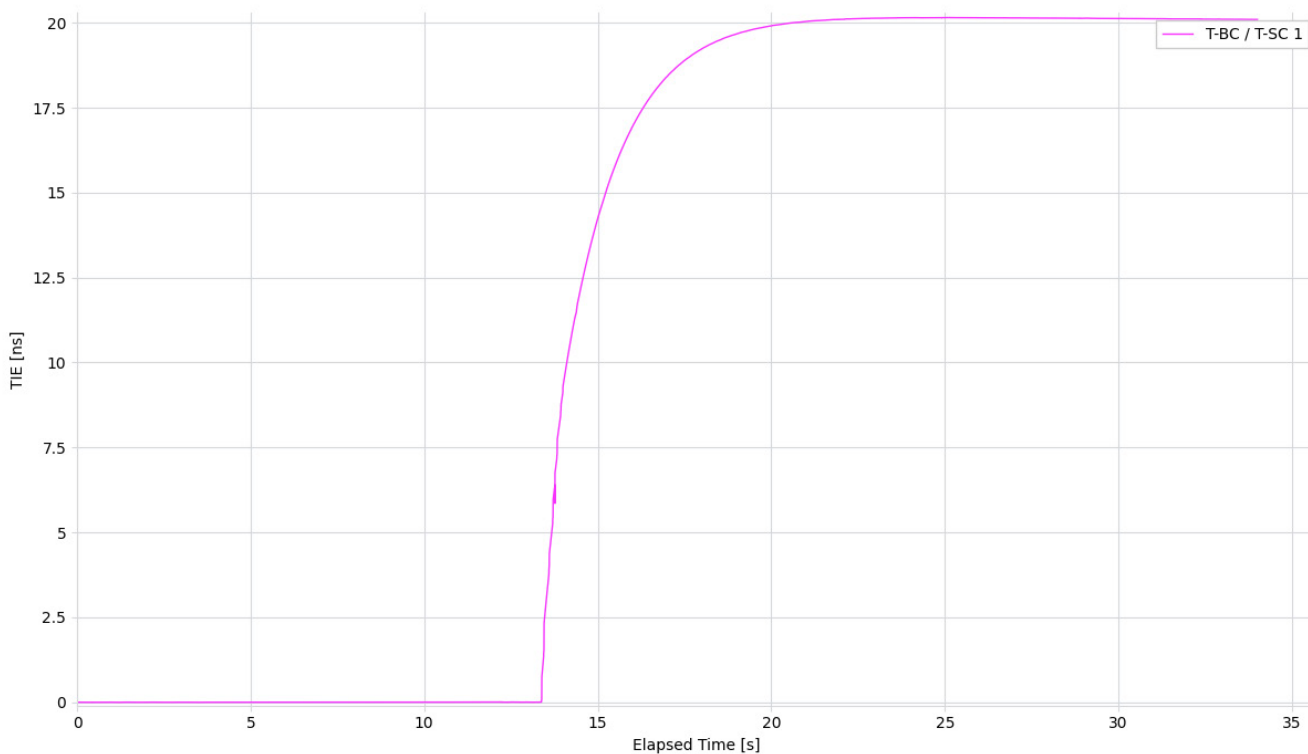


Figure 108. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	11.428
Min [ns]	-0.005
Max [ns]	20.154
Max-Min [ns]	20.159

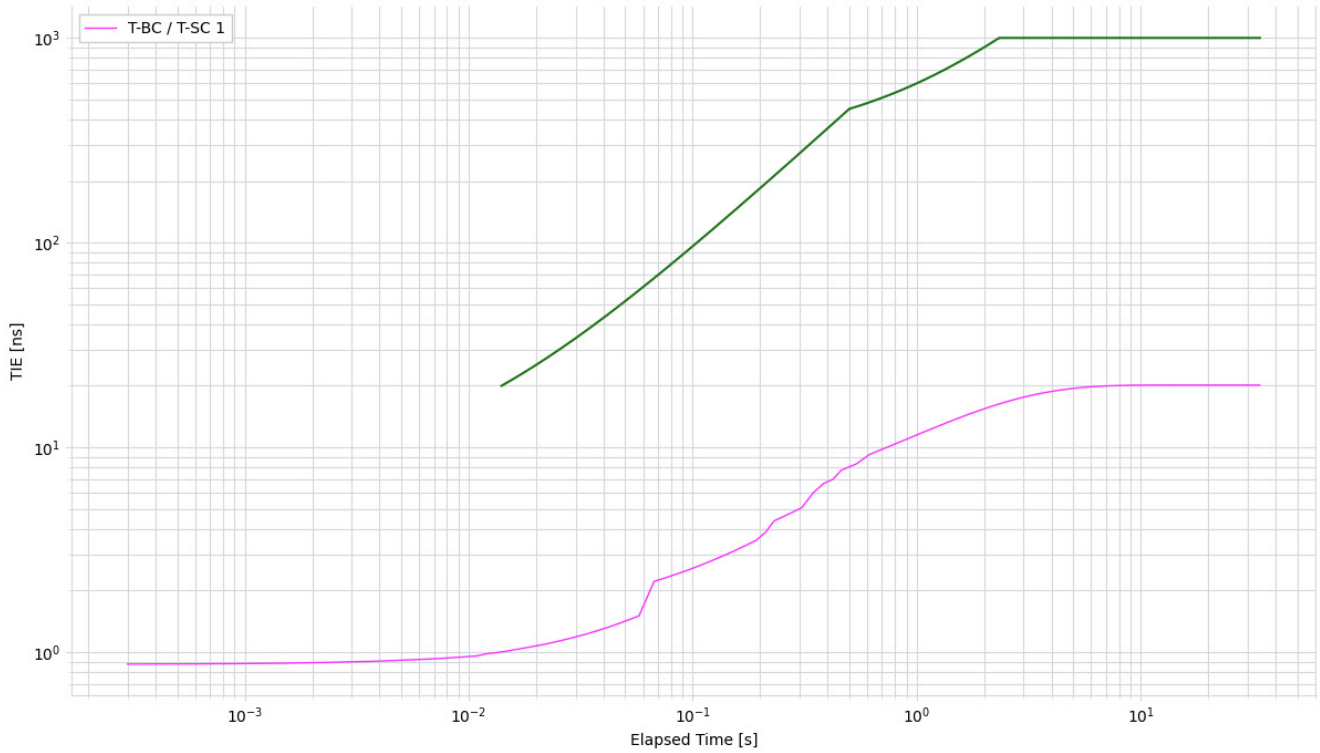


Figure 109. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.875
Max [ns]	20.159
Max-Min [ns]	19.284

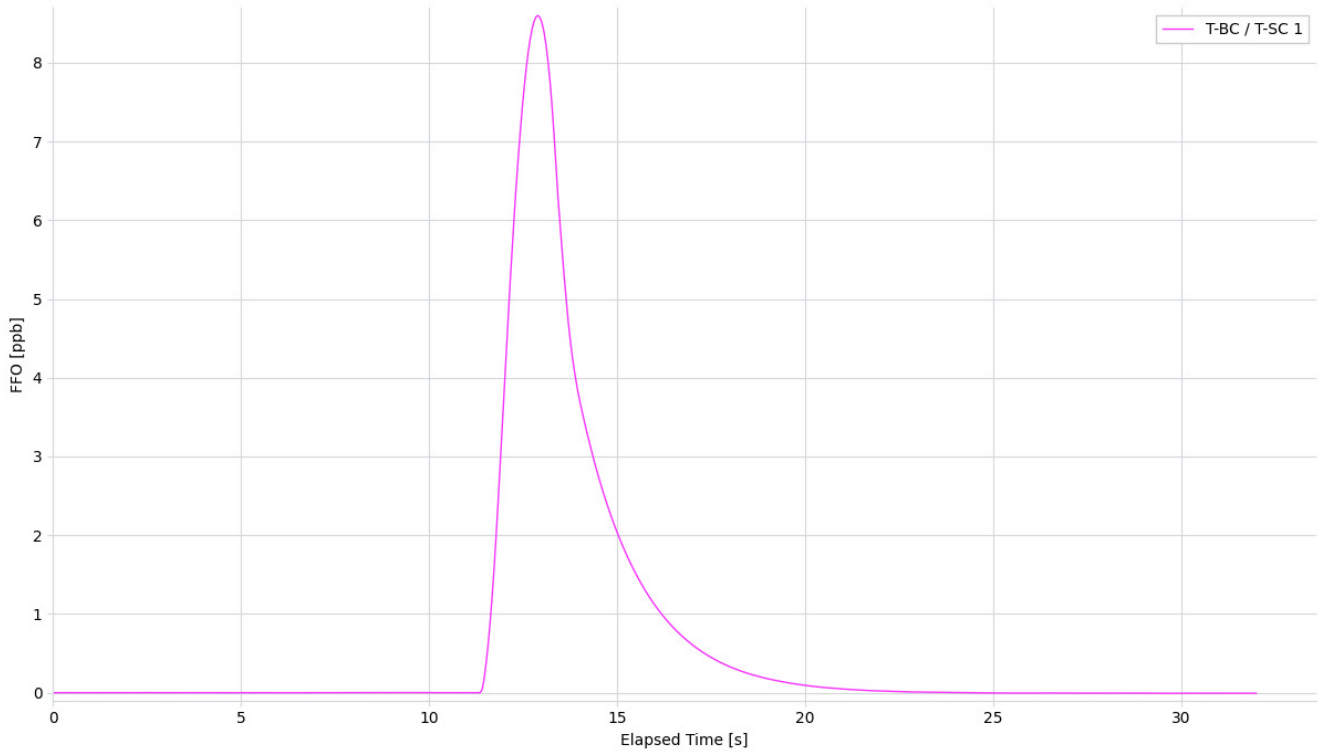


Figure 110. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.628
Min [ppb]	-0.008
Max [ppb]	8.599
Max-Min [ppb]	8.607

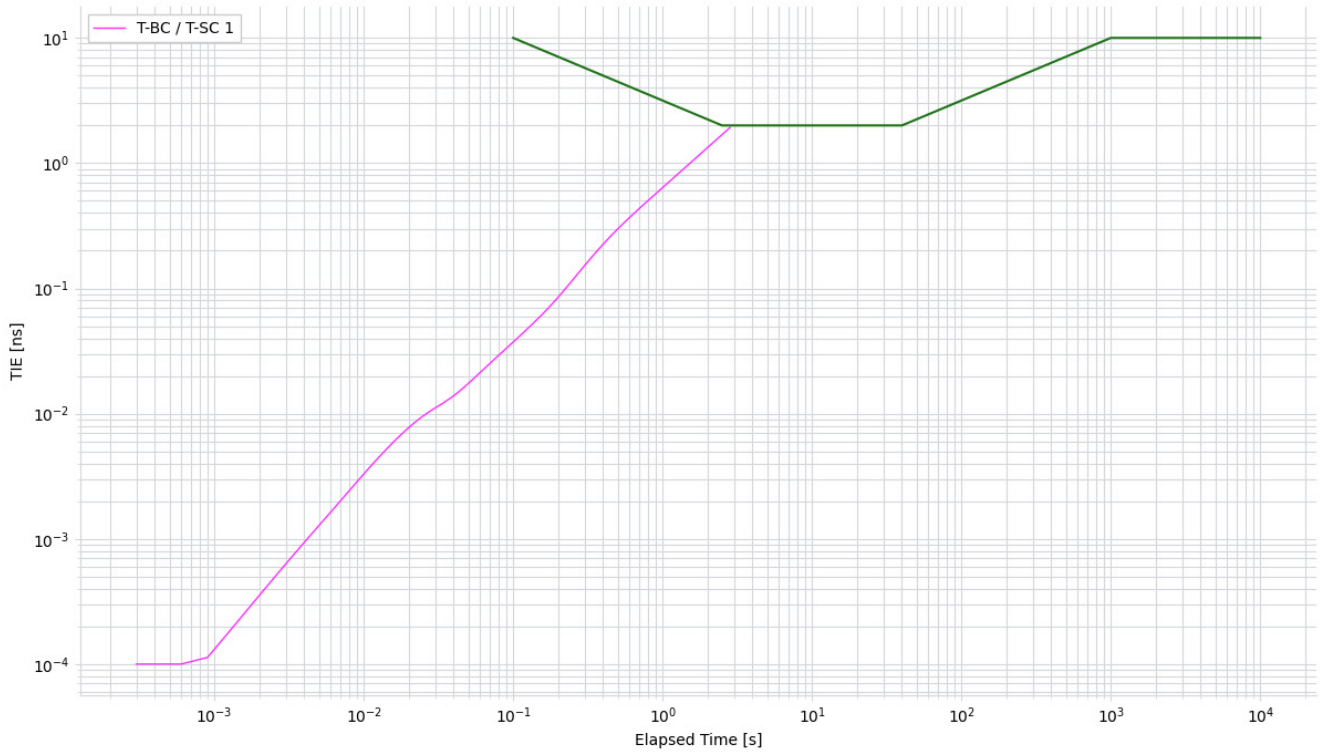


Figure 111. Short-term Phase Transient Response – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	1.928
Max-Min [ns]	1.928

7.3.4. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz

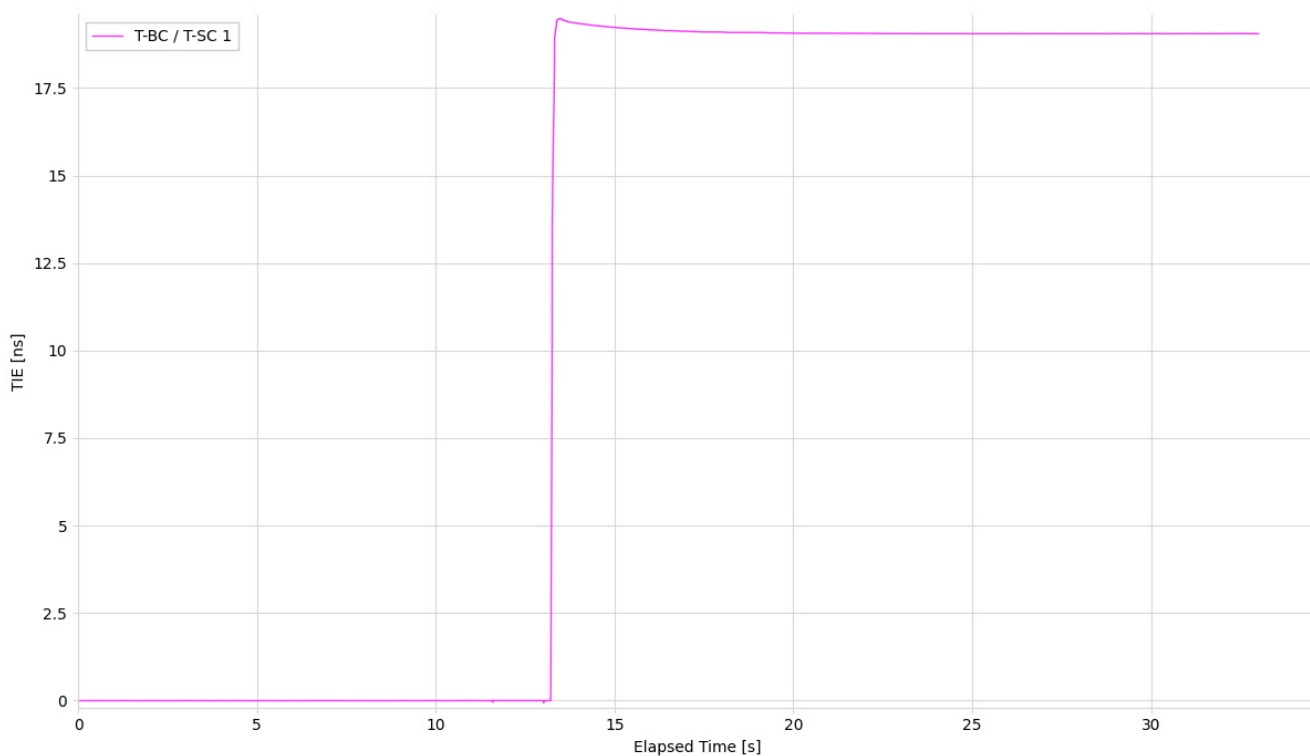


Figure 112. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	11.425
Min [ns]	-0.065
Max [ns]	19.486
Max-Min [ns]	19.551

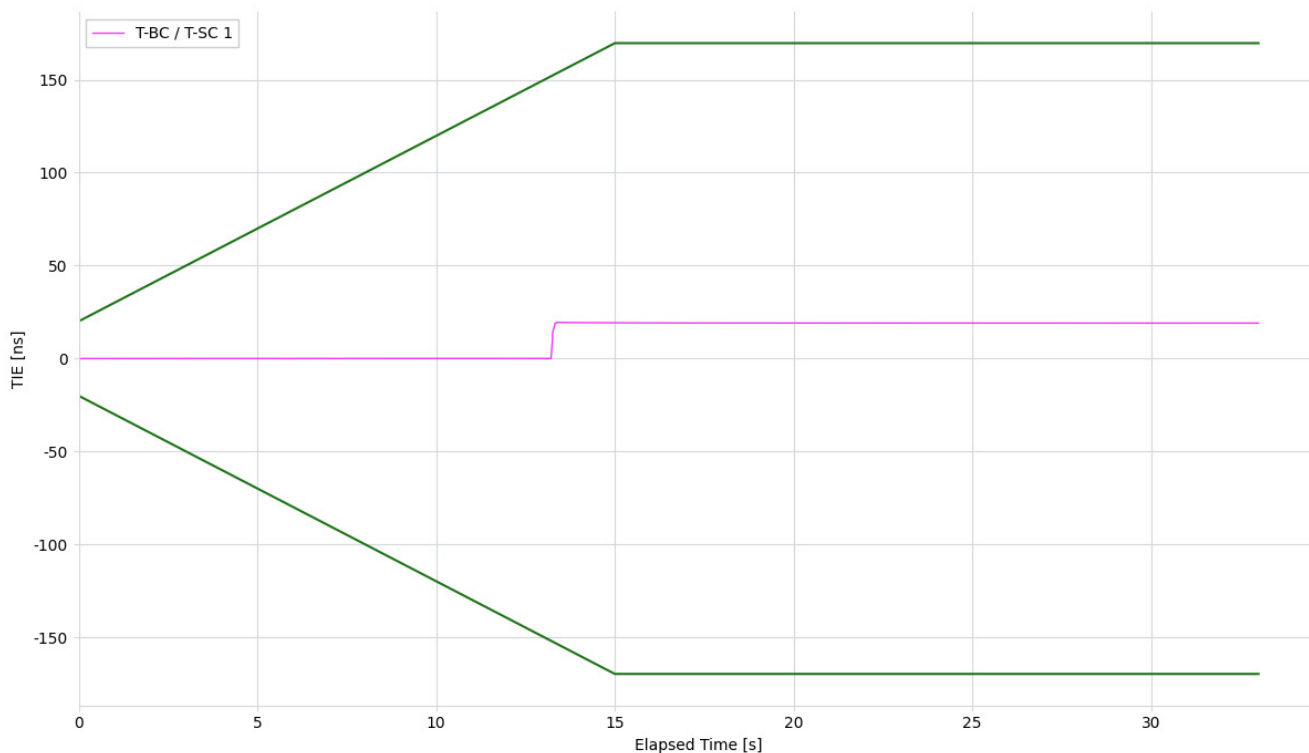


Figure 113. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	11.425
Min [ns]	-0.065
Max [ns]	19.486
Max-Min [ns]	19.551

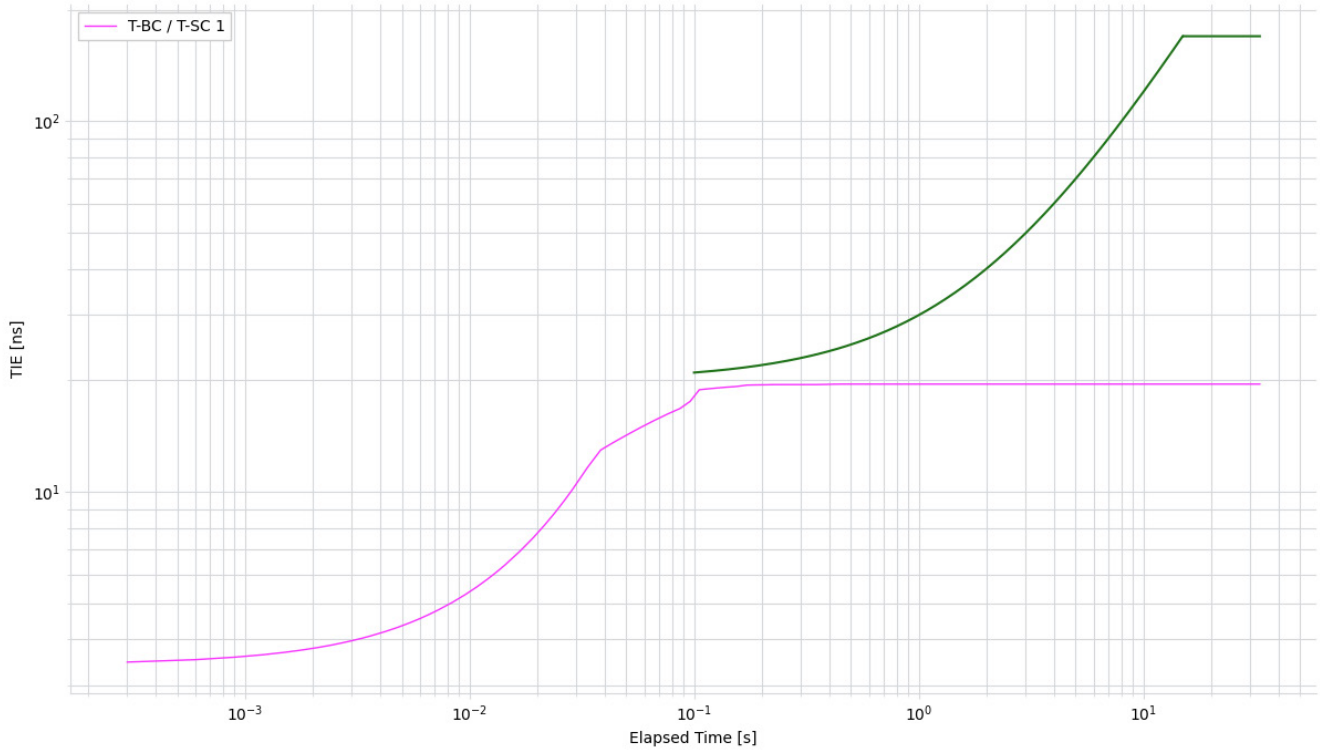


Figure 114. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	3.477
Max [ns]	19.551
Max-Min [ns]	16.074

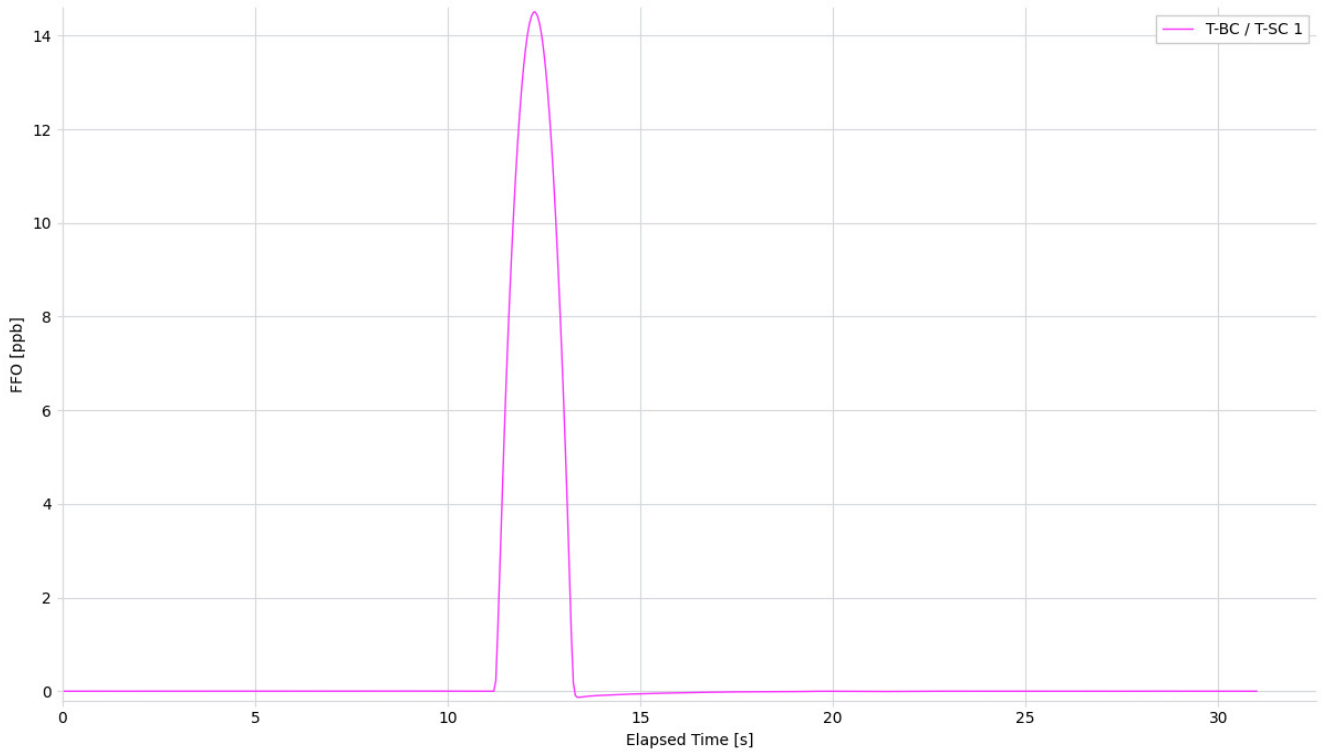


Figure 115. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.614
Min [ppb]	-0.132
Max [ppb]	14.508
Max-Min [ppb]	14.64

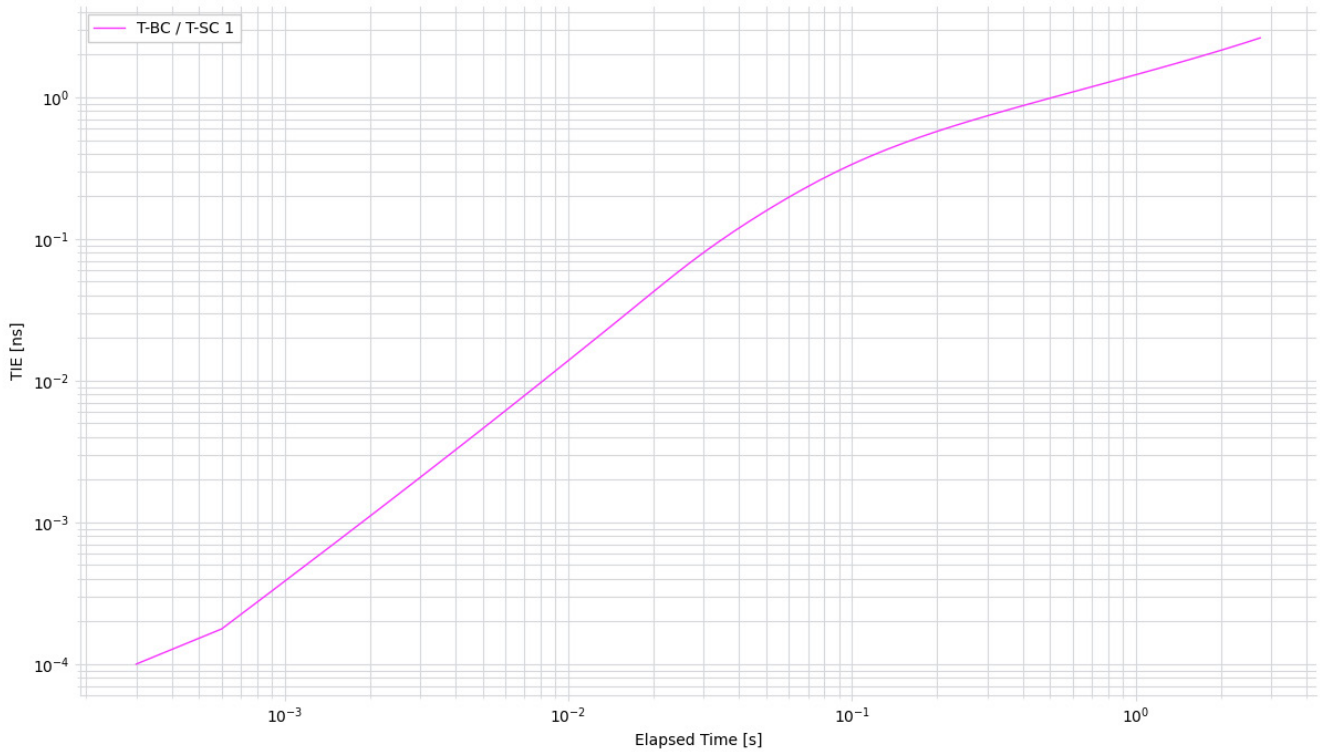


Figure 116. Short-term Phase Transient Response – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	2.629
Max-Min [ns]	2.629

8. Wander Generation

The wander generation requirement checks for the noise generated by the DUT, and while the PLL is locked to an input clock signal that is wander free, it should not generate any wander exceeding the MTIE mask given by the applicable standard (see Figure 1 for the equipment configuration).

The wander generation is carried out by providing a reference clock from the Frequency Generator on IN_A. The PLL should not produce/add any wander to the output beyond standard allowed value. The test is run for 2 hours. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter.

8.1 Wander Generation – G.8262 EEC Option 1, 1.2Hz

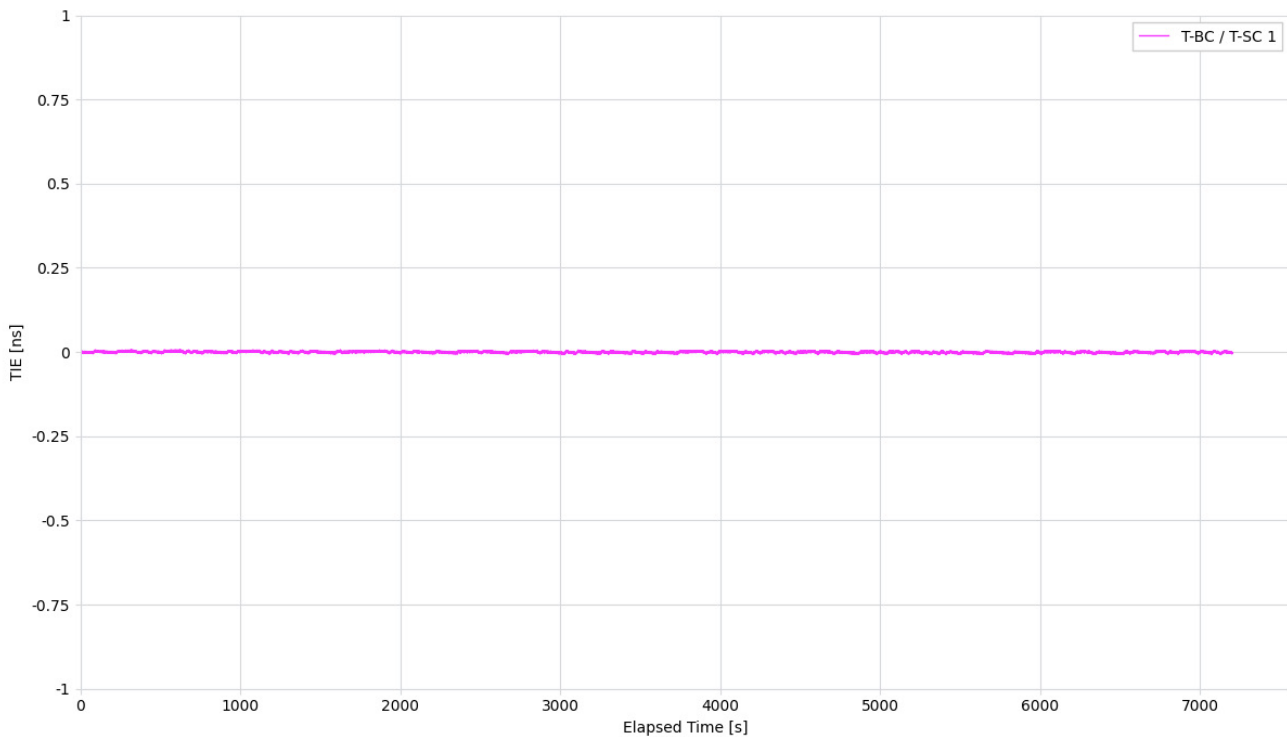


Figure 117. Wander Generation – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.0
Min [ns]	-0.008
Max [ns]	0.007
Max-Min [ns]	0.015

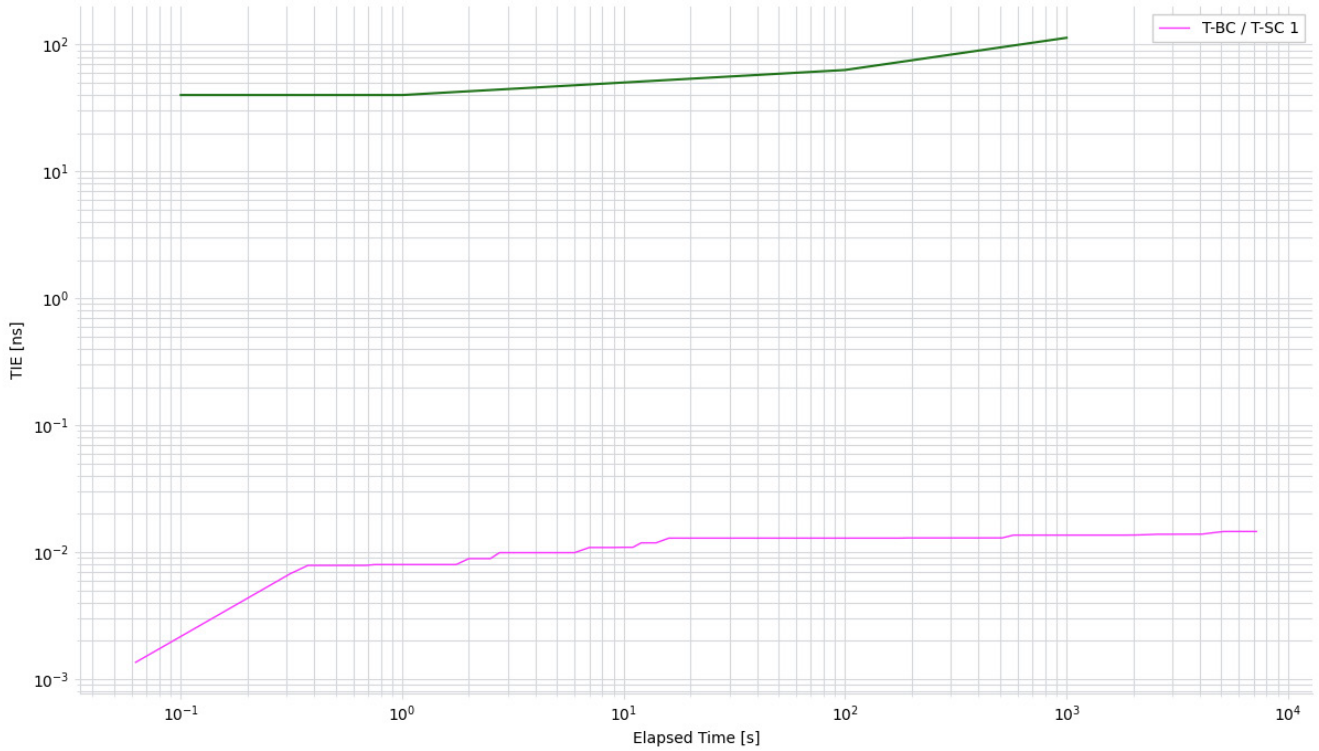


Figure 118. Wander Generation – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.015
Max-Min [ns]	0.013

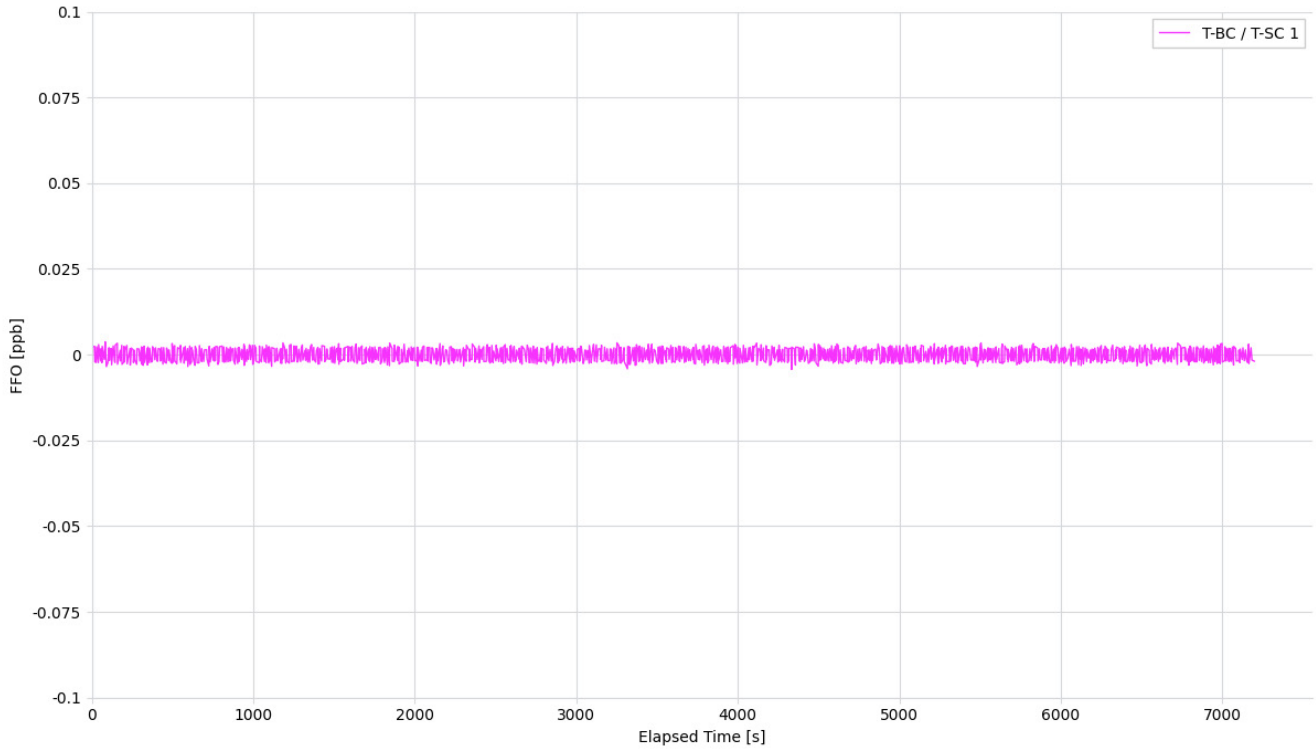


Figure 119. Wander Generation – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.004
Max [ppb]	0.004
Max-Min [ppb]	0.008

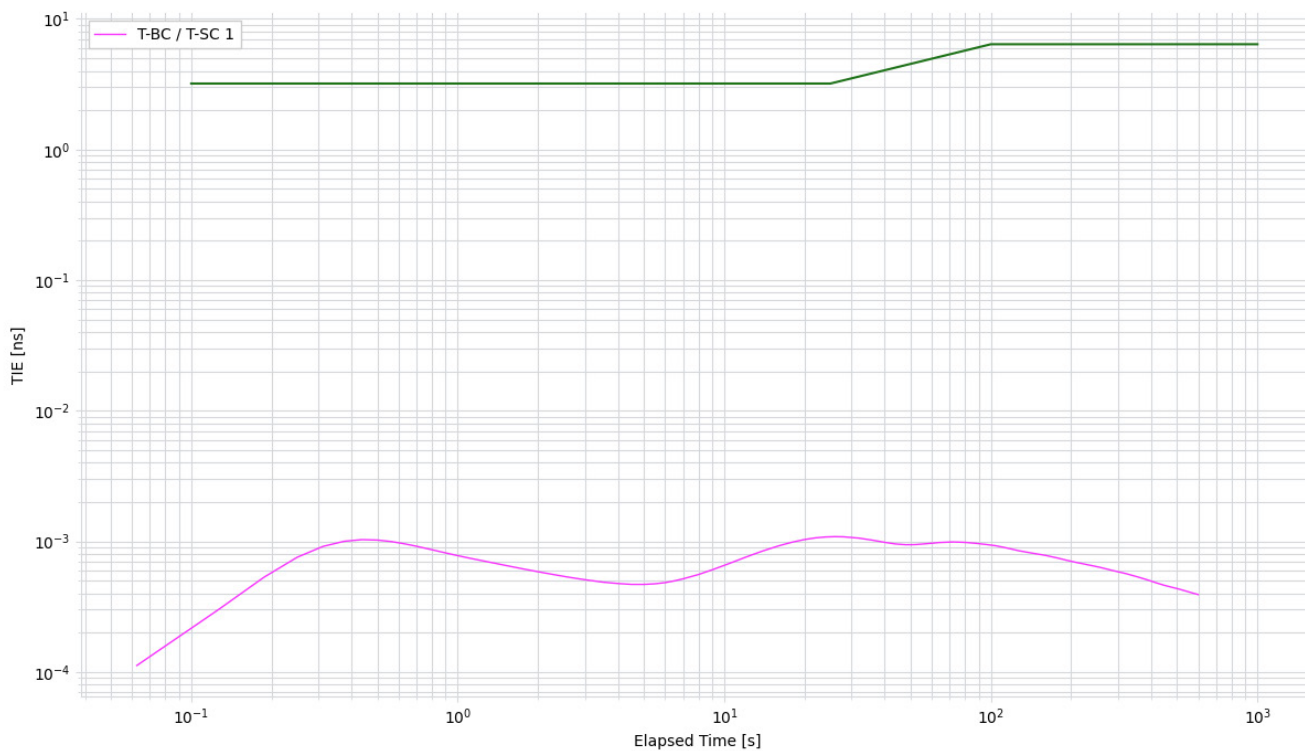


Figure 120. Wander Generation – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

8.2 Wander Generation – G.8262 EEC Option 1, 10Hz

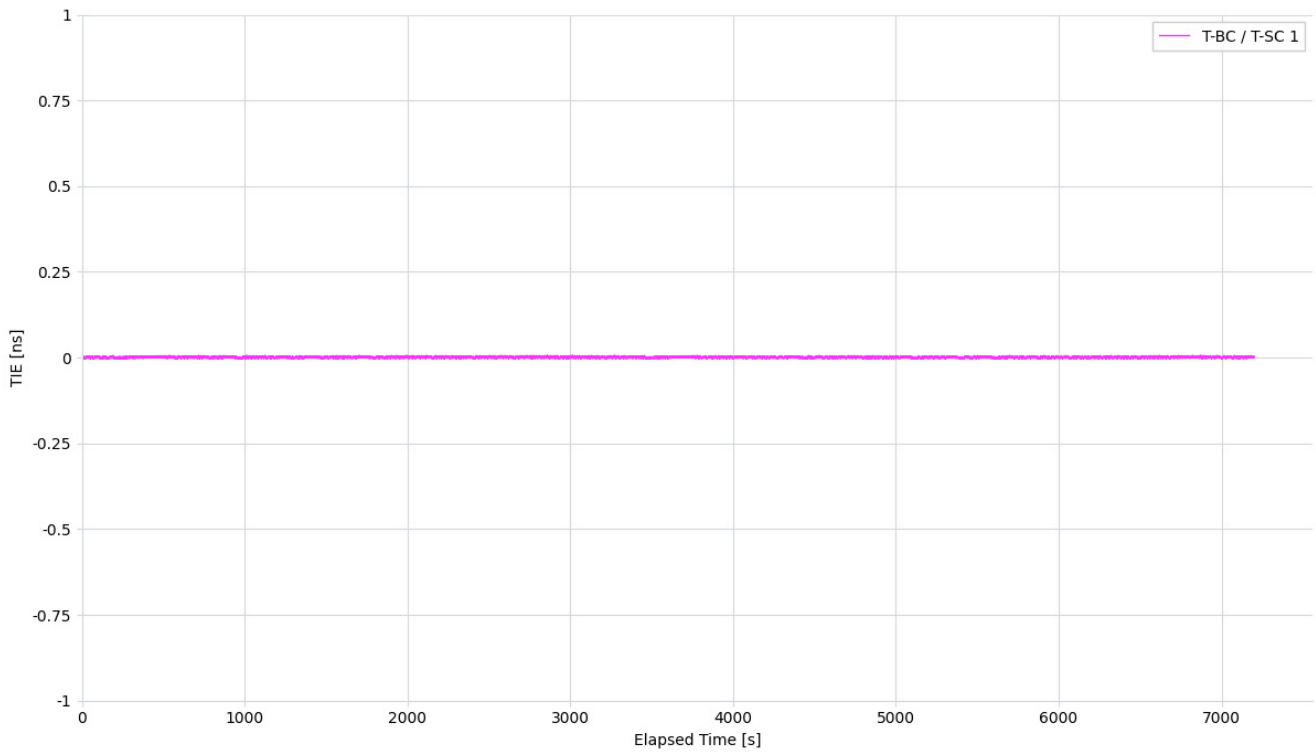


Figure 121. Wander Generation – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.001
Min [ns]	-0.005
Max [ns]	0.007
Max-Min [ns]	0.012

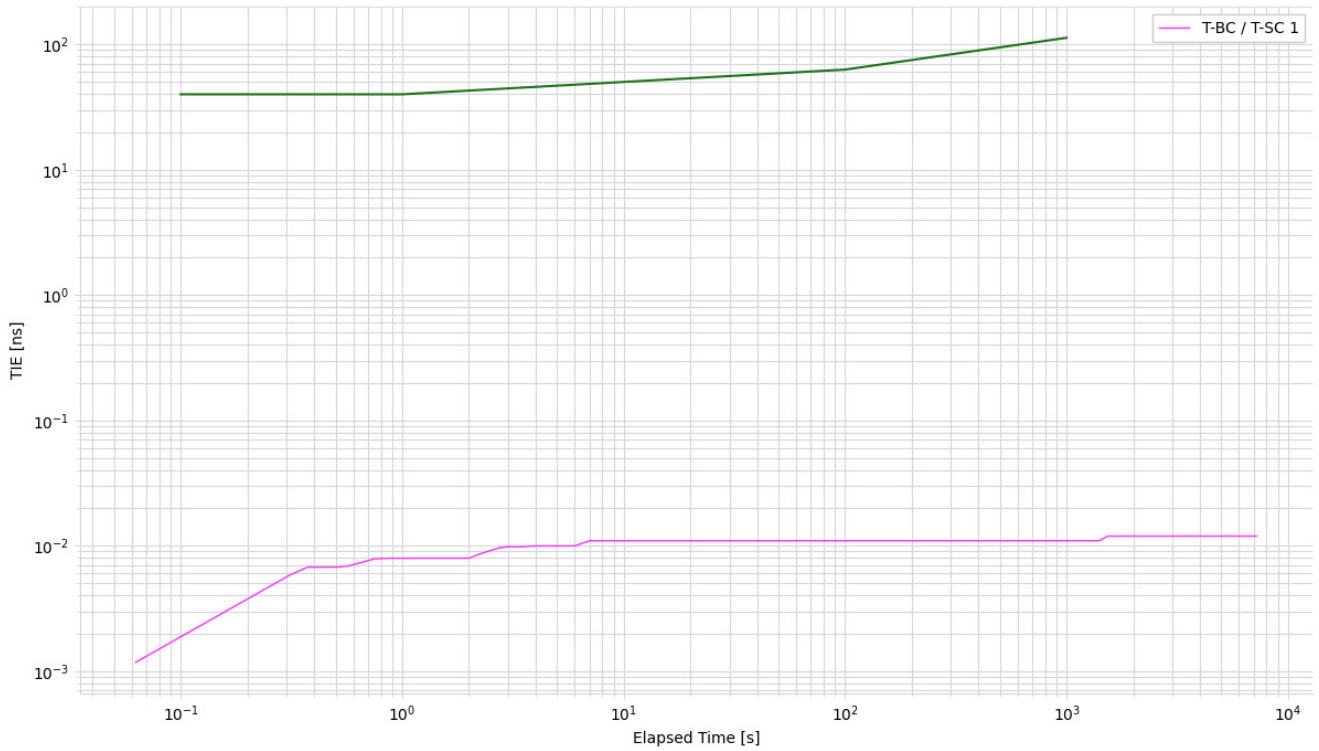


Figure 122. Wander Generation – G.8262 EEC Option 1, 10Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.012
Max-Min [ns]	0.011

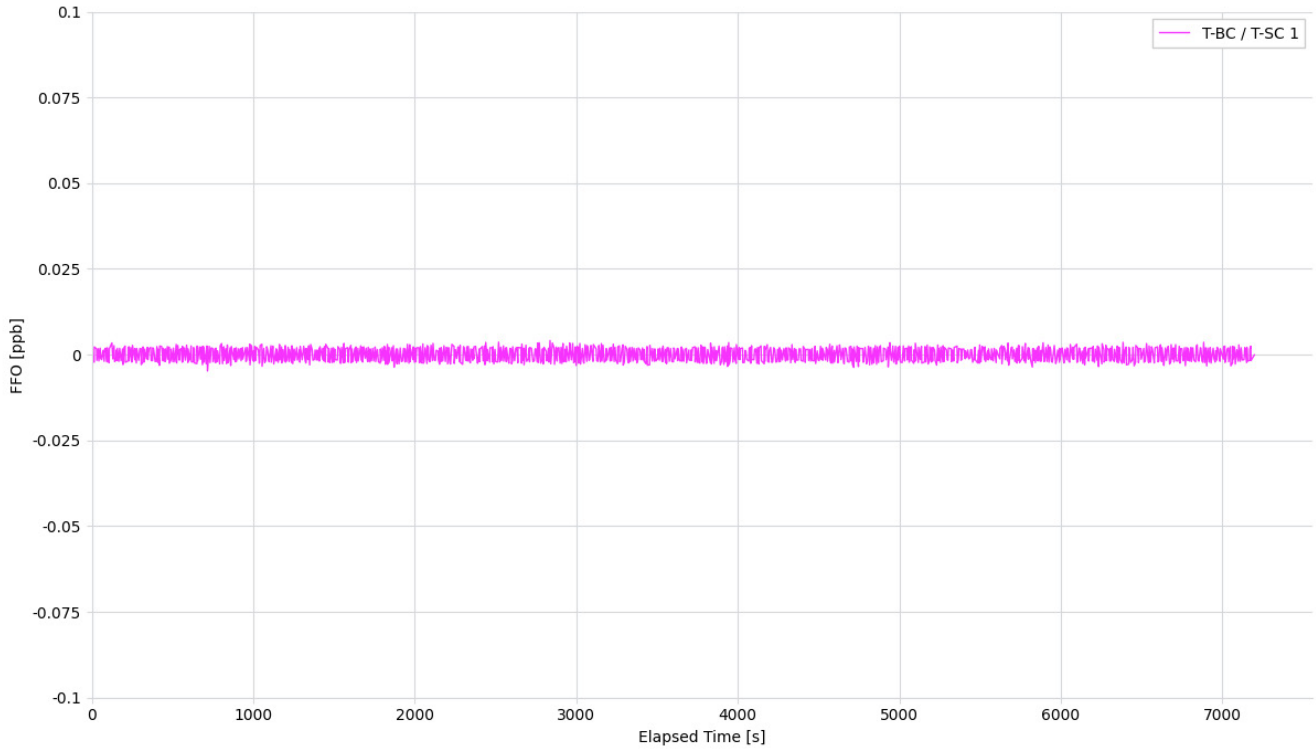


Figure 123. Wander Generation – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.005
Max [ppb]	0.004
Max-Min [ppb]	0.009

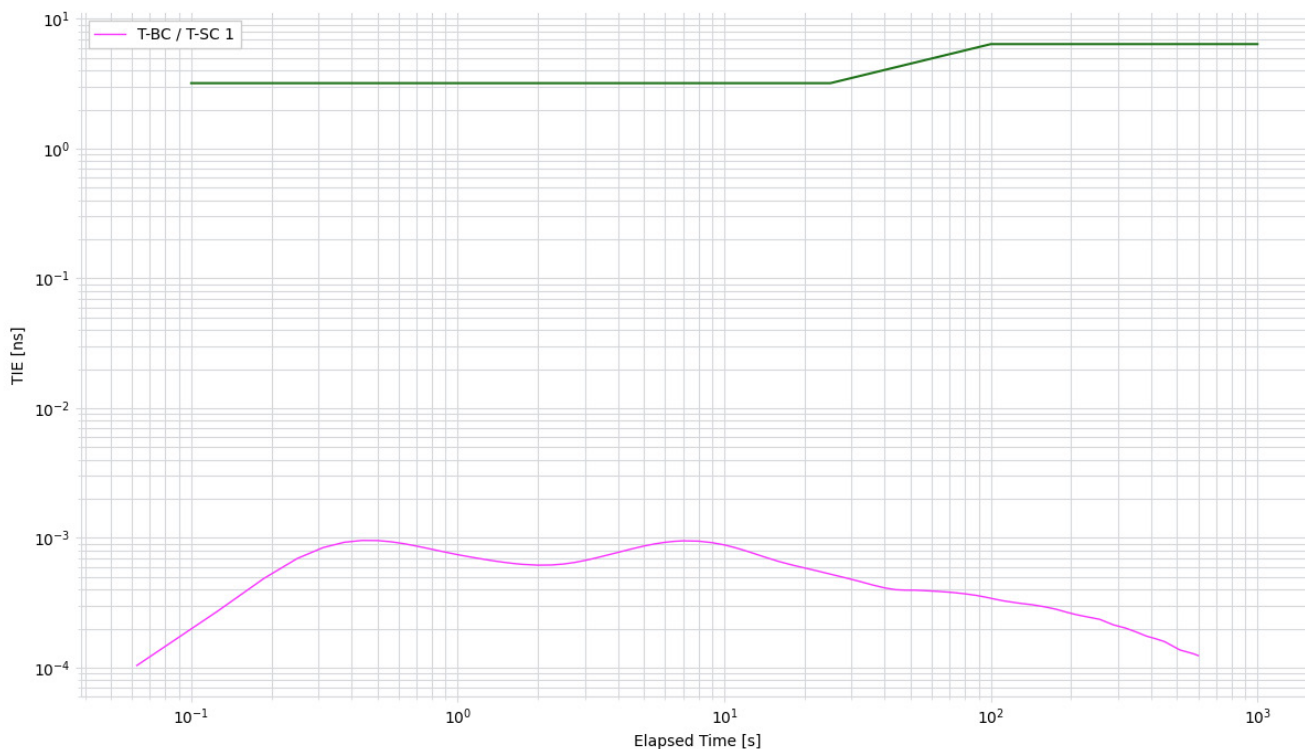


Figure 124. Wander Generation – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

8.3 Wander Generation – G.8262 EEC Option 2, 0.1Hz

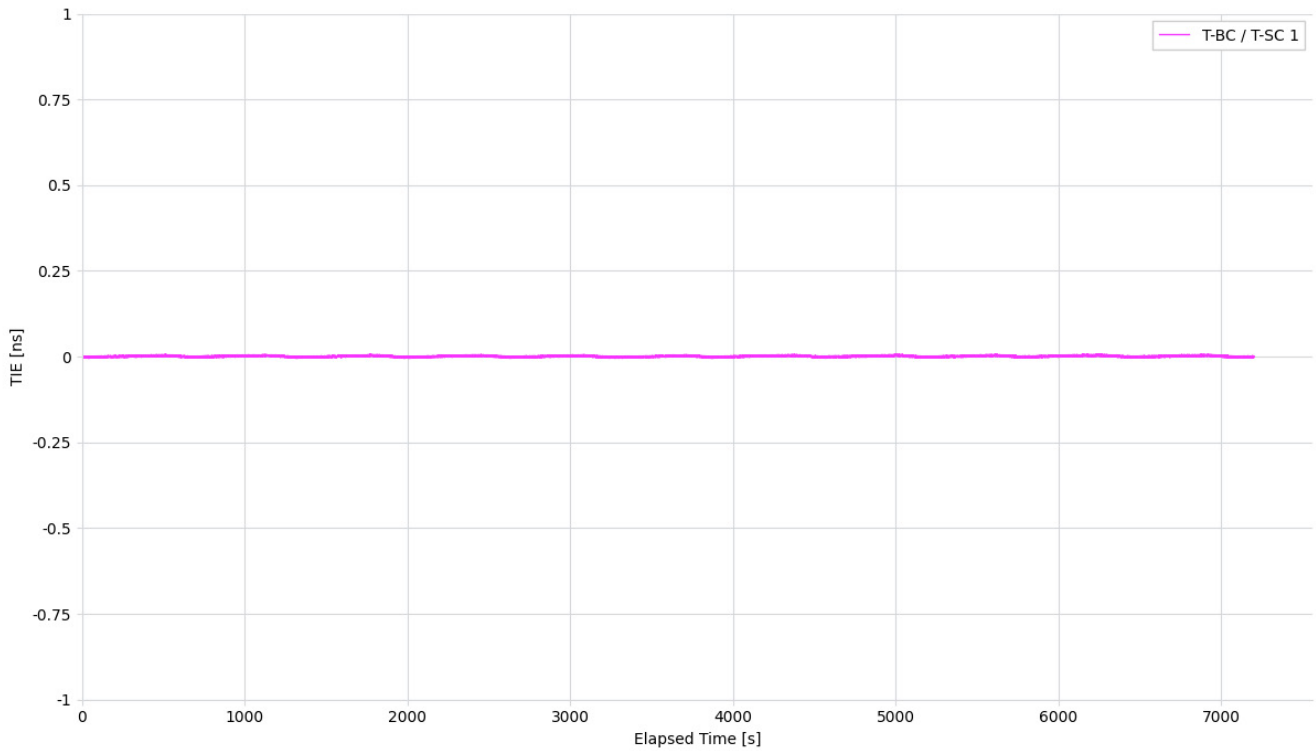


Figure 125. Wander Generation – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.001
Min [ns]	-0.005
Max [ns]	0.007
Max-Min [ns]	0.012

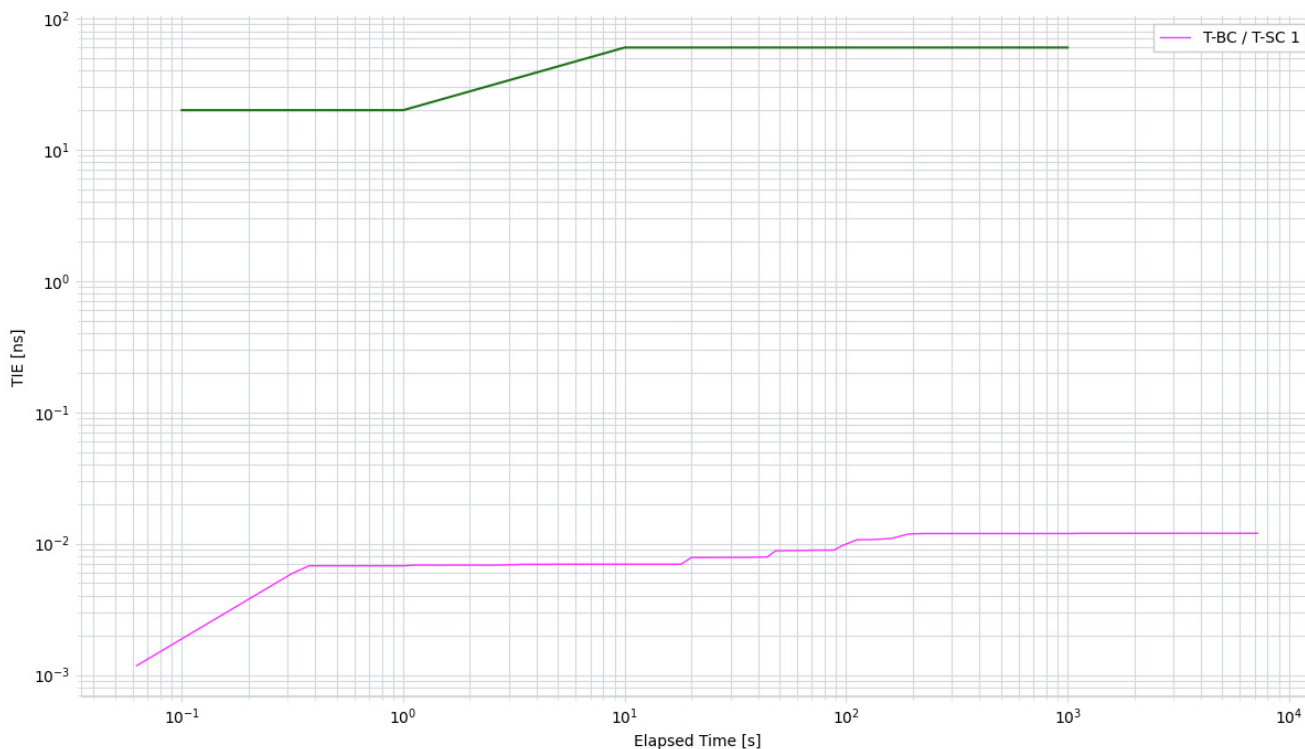


Figure 126. Wander Generation – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.012
Max-Min [ns]	0.011

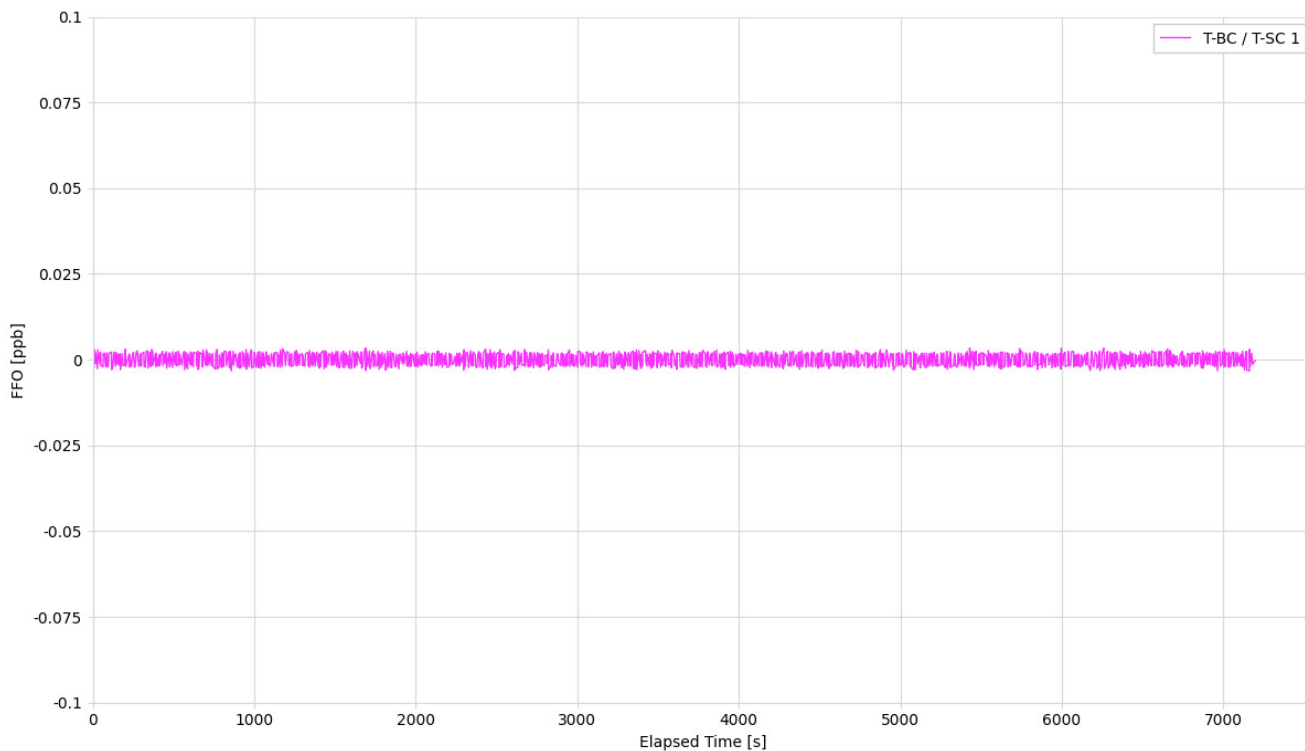


Figure 127. Wander Generation – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.007

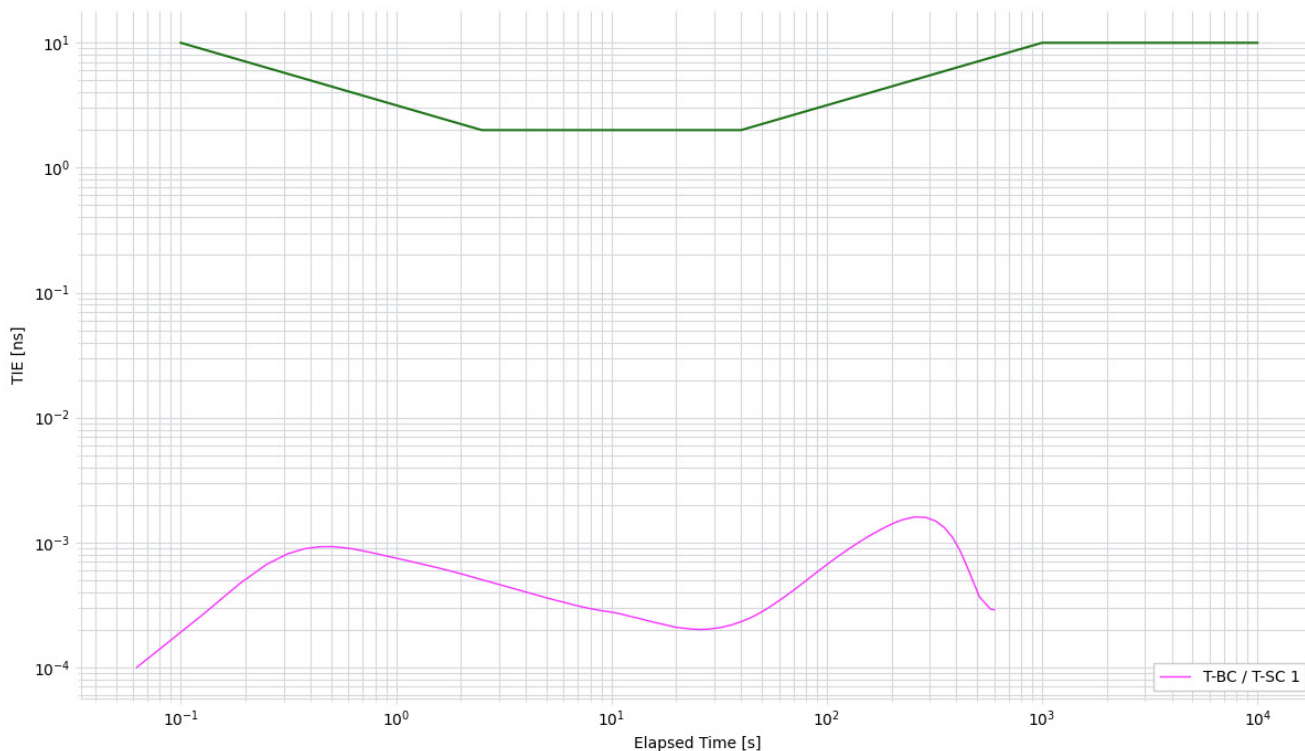


Figure 128. Wander Generation – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.002
Max-Min [ns]	0.002

8.4 Wander Generation – G.8262.1 eEEC, 3Hz

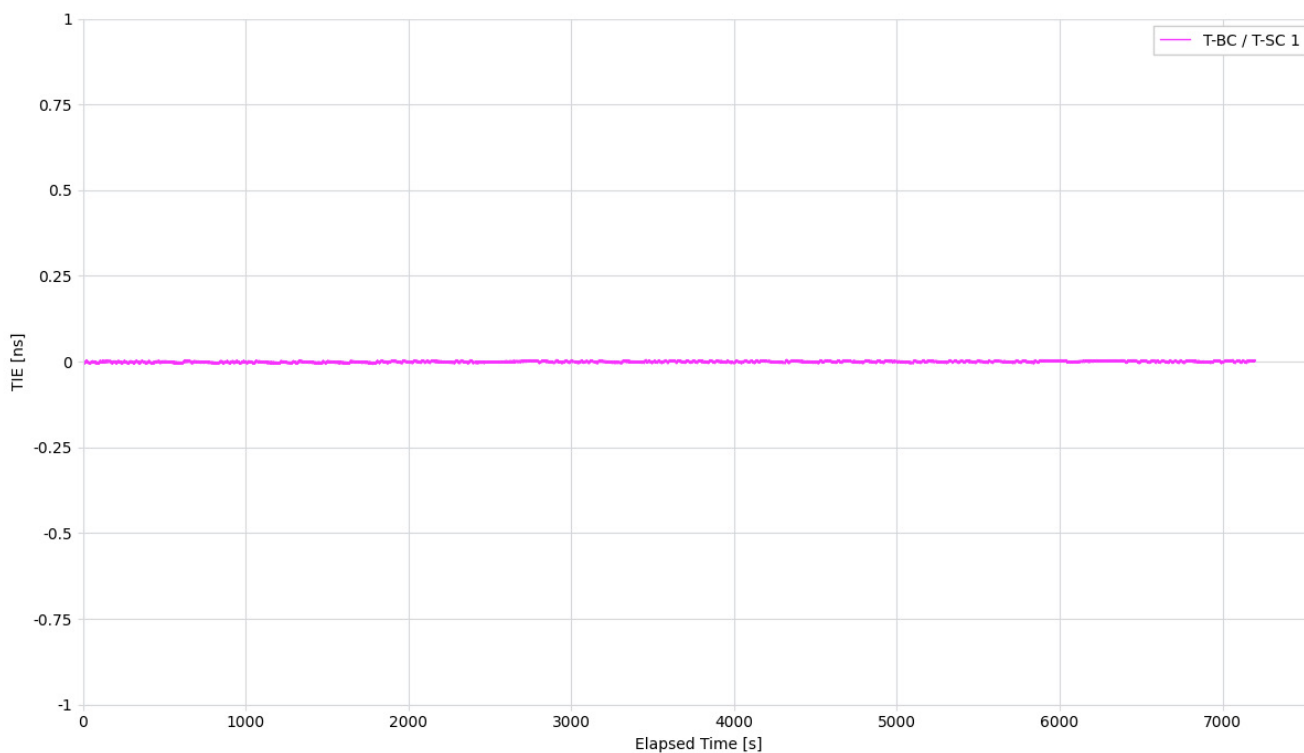


Figure 129. Wander Generation – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.0
Min [ns]	-0.008
Max [ns]	0.006
Max-Min [ns]	0.014

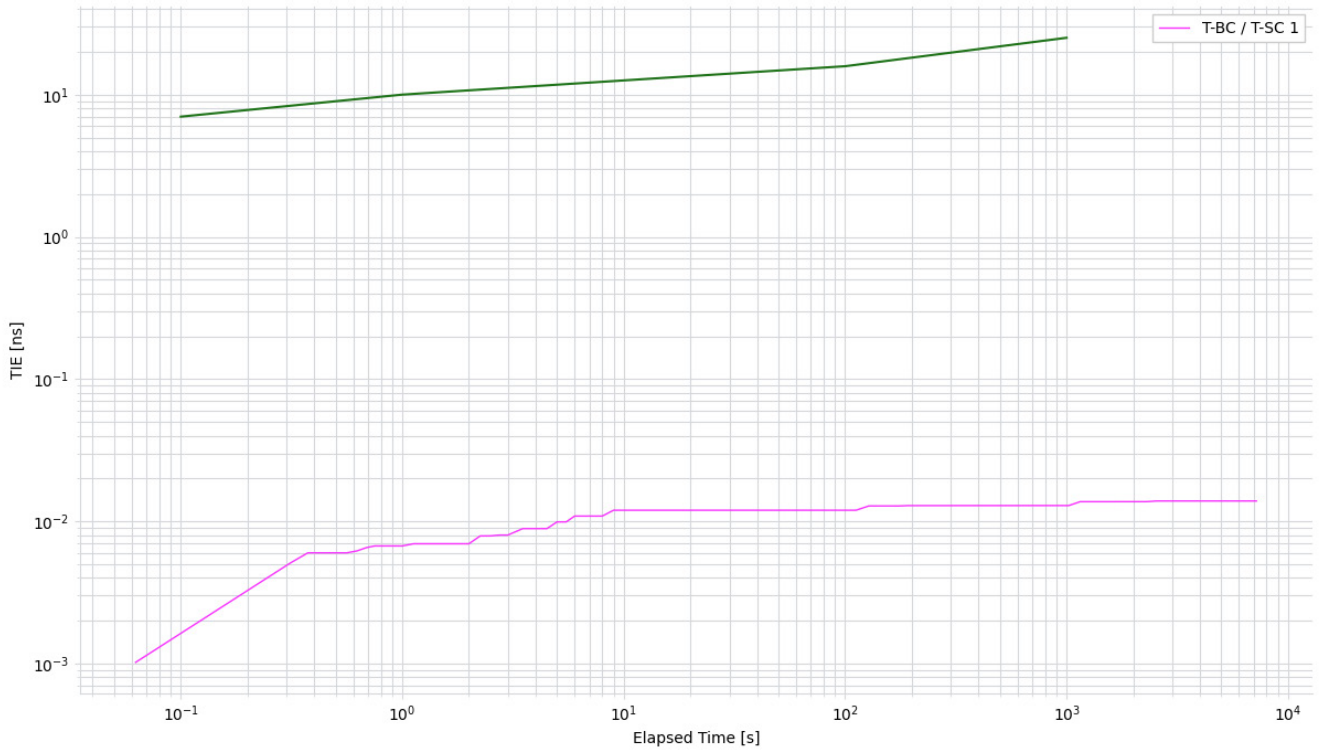


Figure 130. Wander Generation – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.014
Max-Min [ns]	0.013

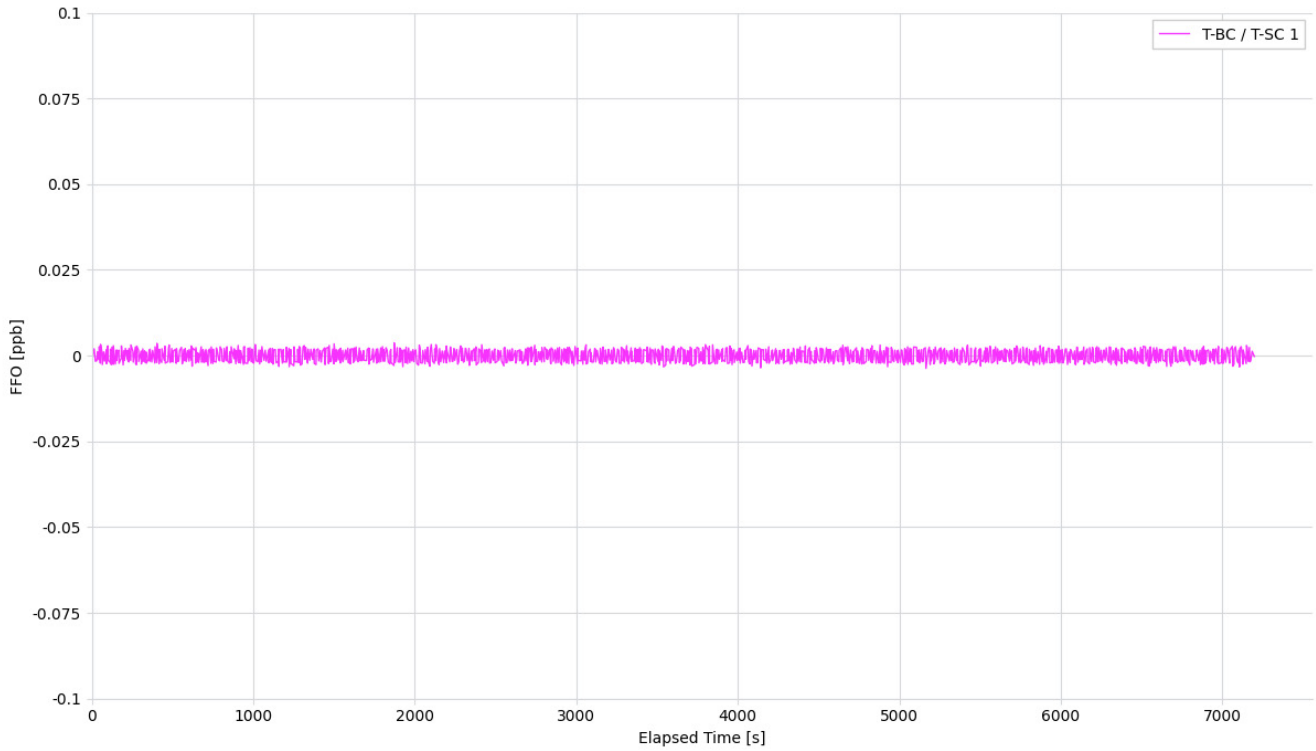


Figure 131. Wander Generation – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.004
Max [ppb]	0.004
Max-Min [ppb]	0.007

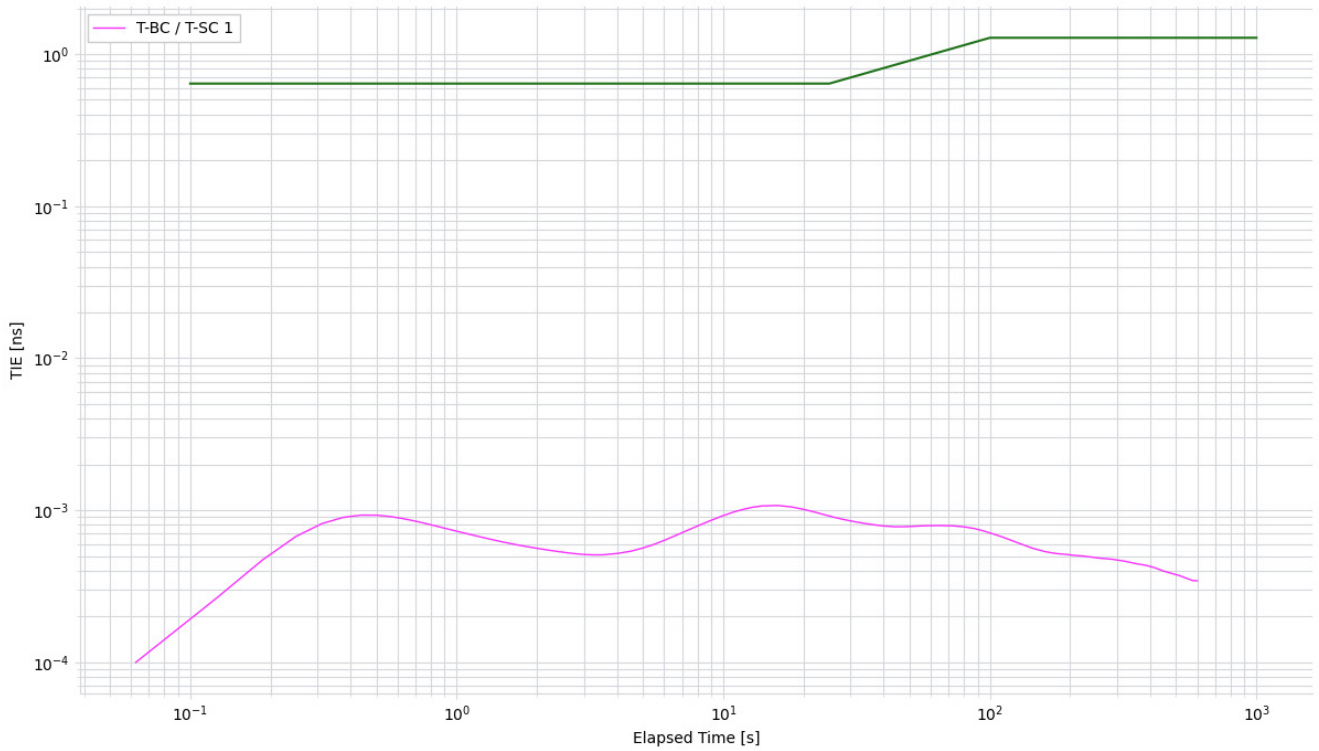


Figure 132. Wander Generation – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

9. Holdover

The holdover requirement checks for the phase time error after the loss of a clock input when the PLL is in holdover state. While in holdover, the PLL should produce phase time error that exceeds the phase time error requirements given by the applicable standard (see Figure 1 for the equipment configuration).

The holdover test is carried out by providing a reference clock from the Frequency Generator on IN_A. The PLL is locked to this wander-free reference for 2 hours. The input clock IN_A is then disabled for 40 minutes and the PLL goes into holdover state. The output from the DUT is available on OUT_0 and the phase time error is captured using the Frequency Counter.

9.1 Holdover – G.8262 EEC Option 1, 1.2Hz

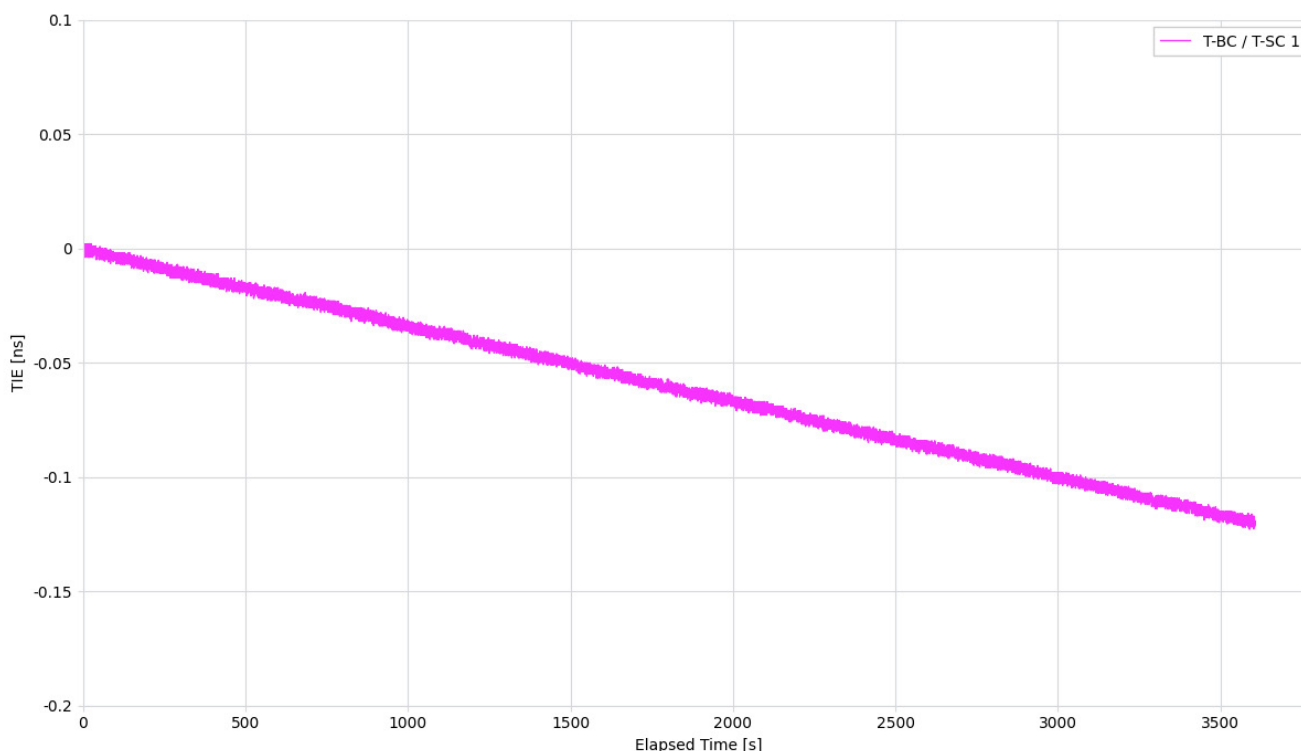


Figure 133. Holdover – G.8262 EEC Option 1, 1.2Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.06
Min [ns]	-0.123
Max [ns]	0.002
Max-Min [ns]	0.125

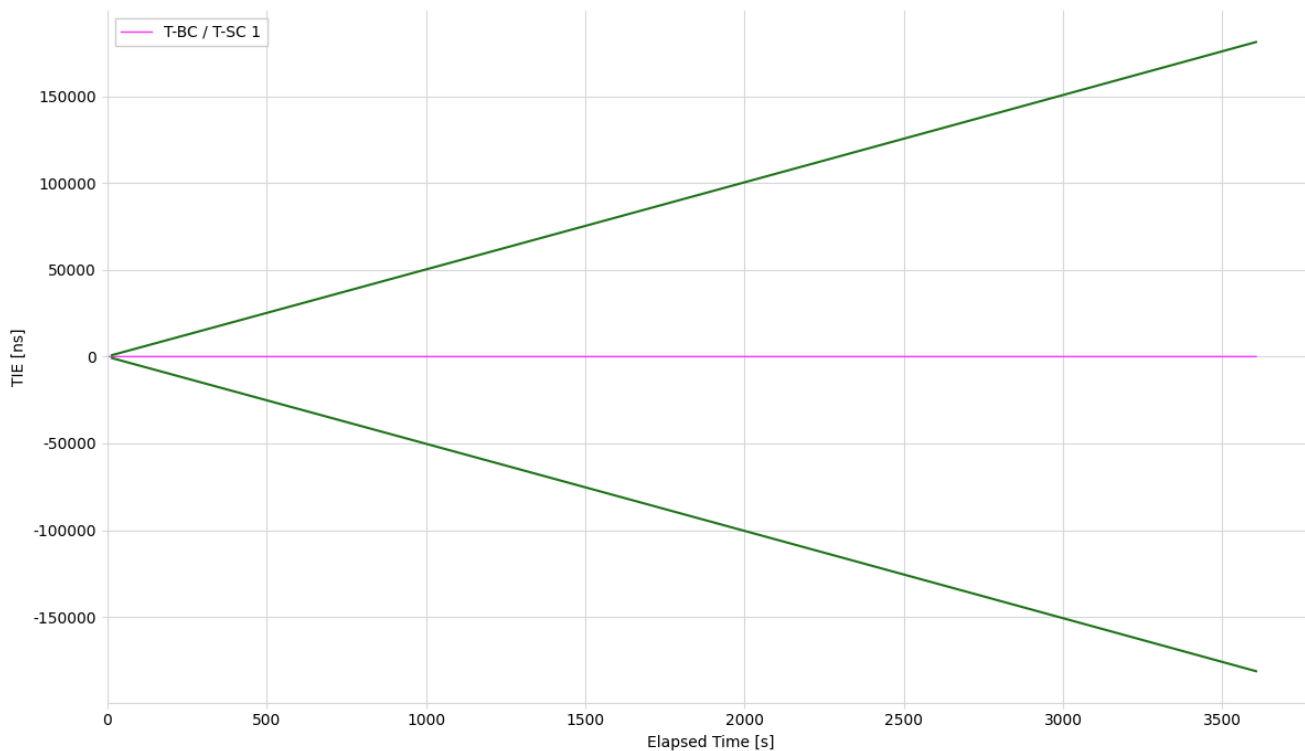


Figure 134. Holdover – G.8262 EEC Option 1, 1.2Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.06
Min [ns]	-0.123
Max [ns]	0.002
Max-Min [ns]	0.125

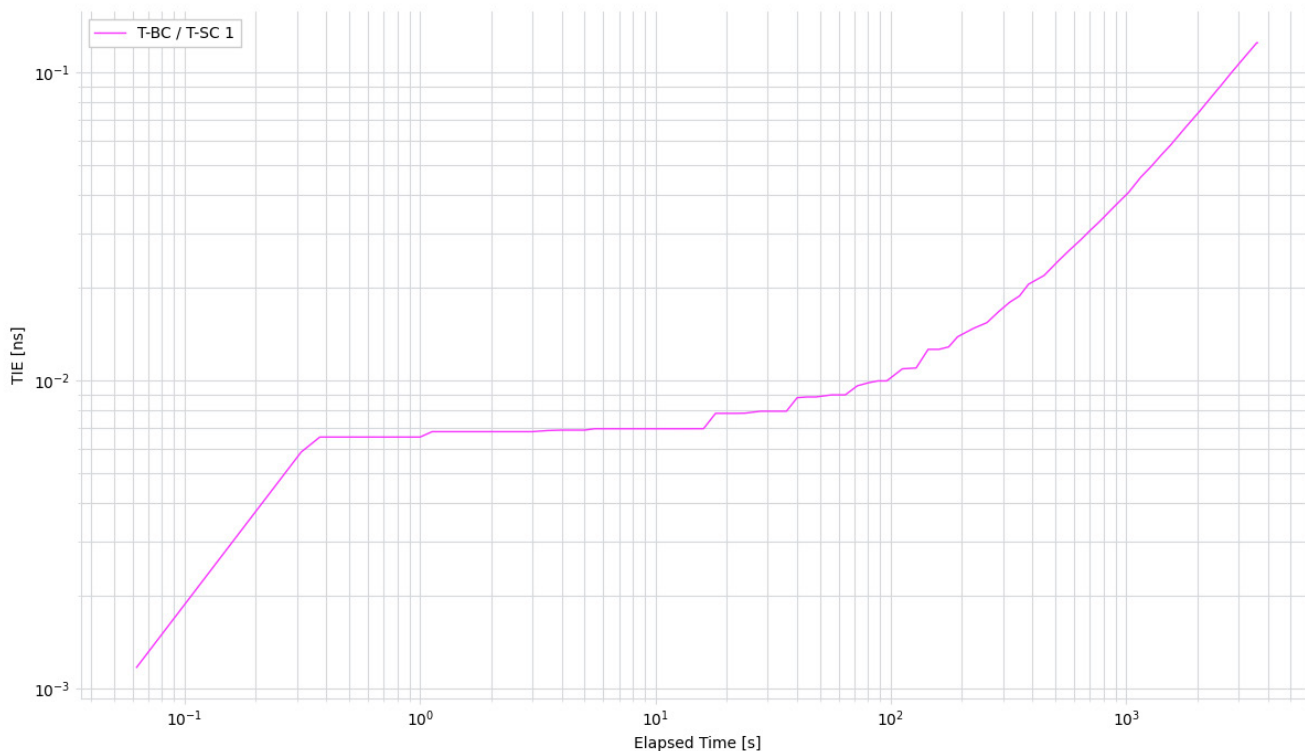


Figure 135. Holdover – G.8262 EEC Option 1, 1.2Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.125
Max-Min [ns]	0.124

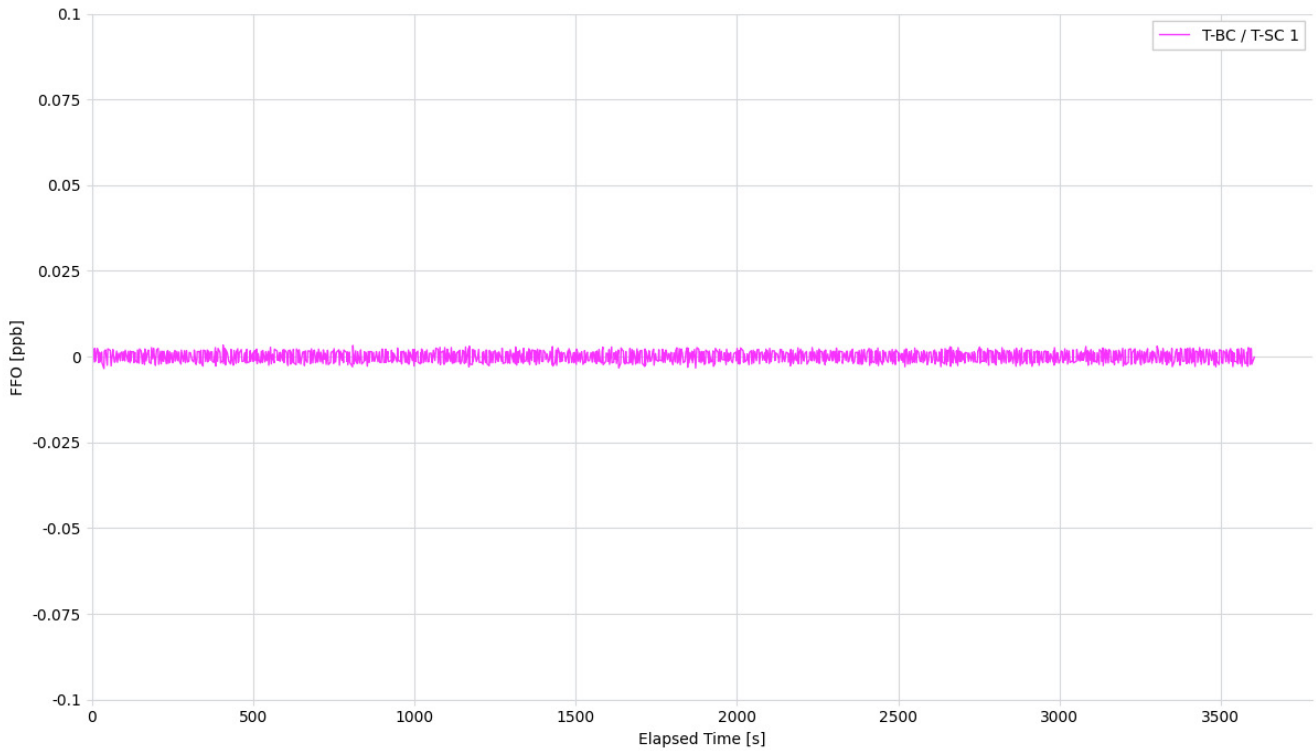


Figure 136. Holdover – G.8262 EEC Option 1, 1.2Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.007

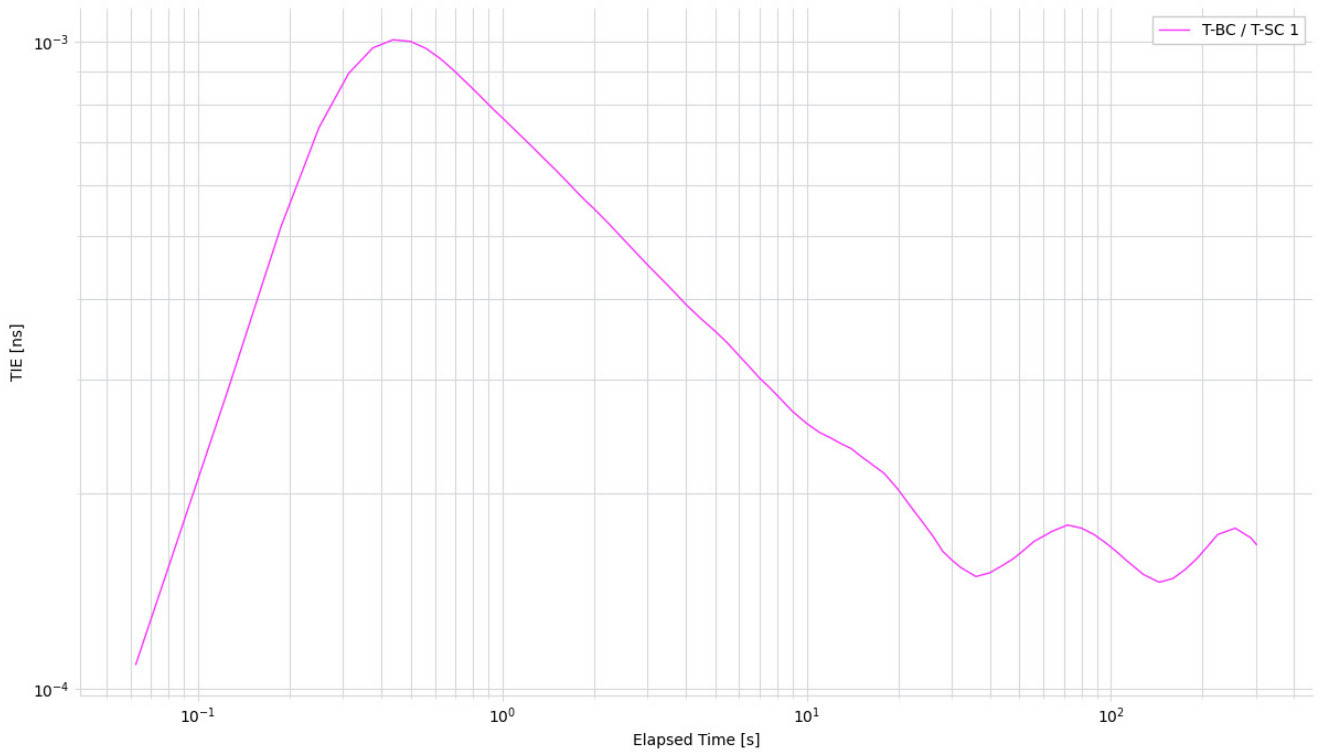


Figure 137. Holdover – G.8262 EEC Option 1, 1.2Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

9.2 Holdover – G.8262 EEC Option 1, 10Hz

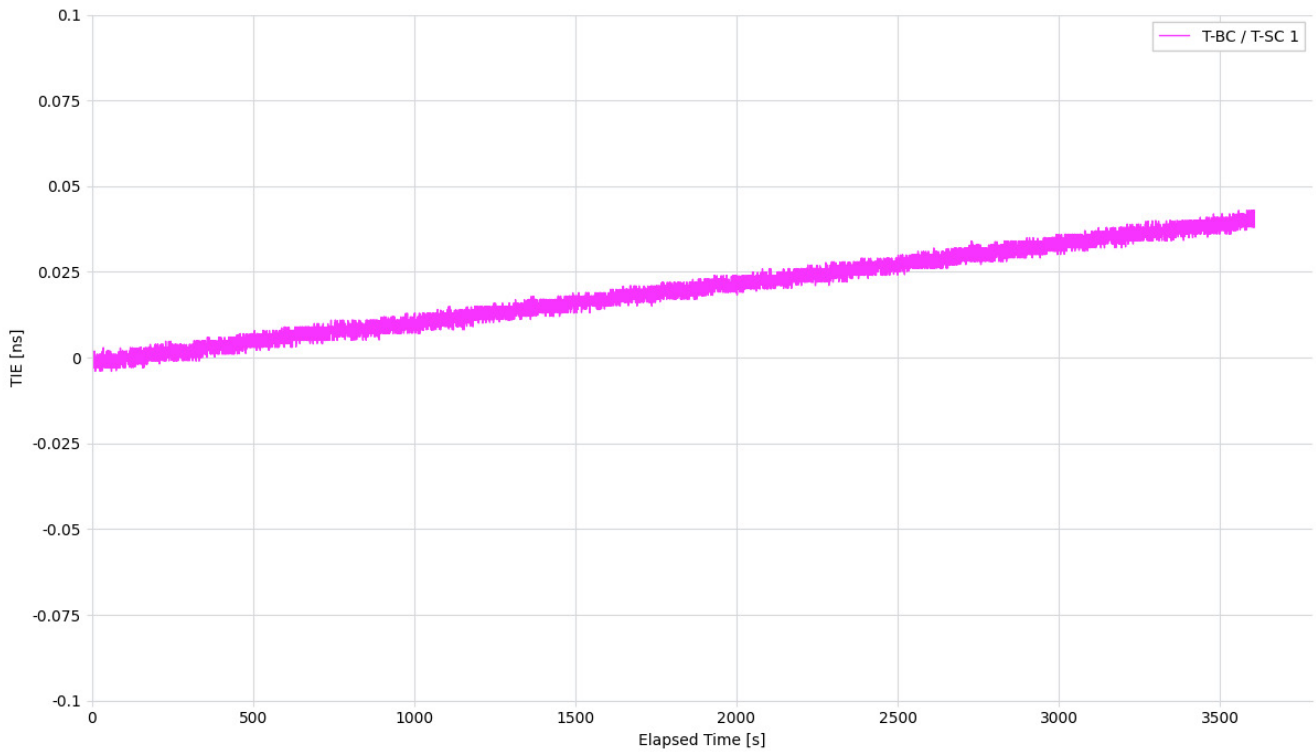


Figure 138. Holdover – G.8262 EEC Option 1, 10Hz

	T-BC / T-SC 1
Mean [ns]	0.019
Min [ns]	-0.004
Max [ns]	0.043
Max-Min [ns]	0.047



Figure 139. Holdover – G.8262 EEC Option 1, 10Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.019
Min [ns]	-0.004
Max [ns]	0.043
Max-Min [ns]	0.047

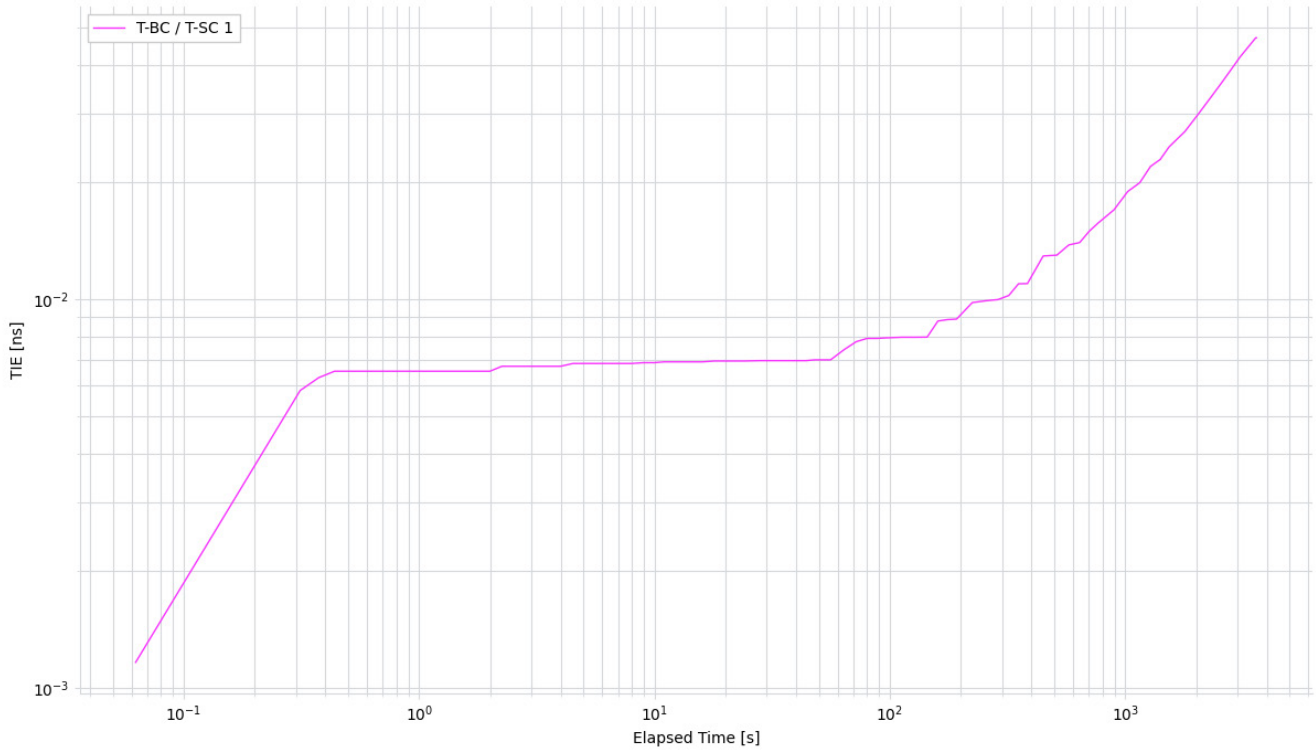


Figure 140. Holdover – G.8262 EEC Option 1, 10Hz – MTI

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.047
Max-Min [ns]	0.046

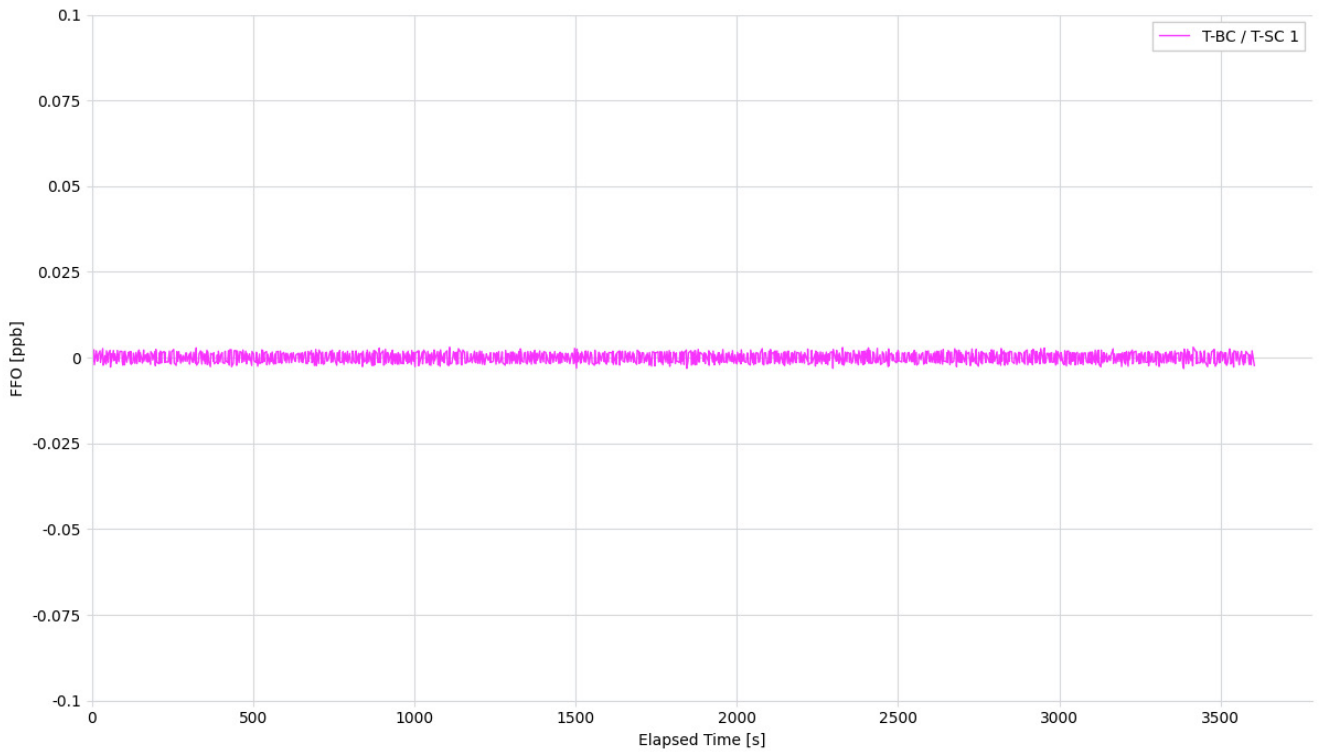


Figure 141. Holdover – G.8262 EEC Option 1, 10Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.006

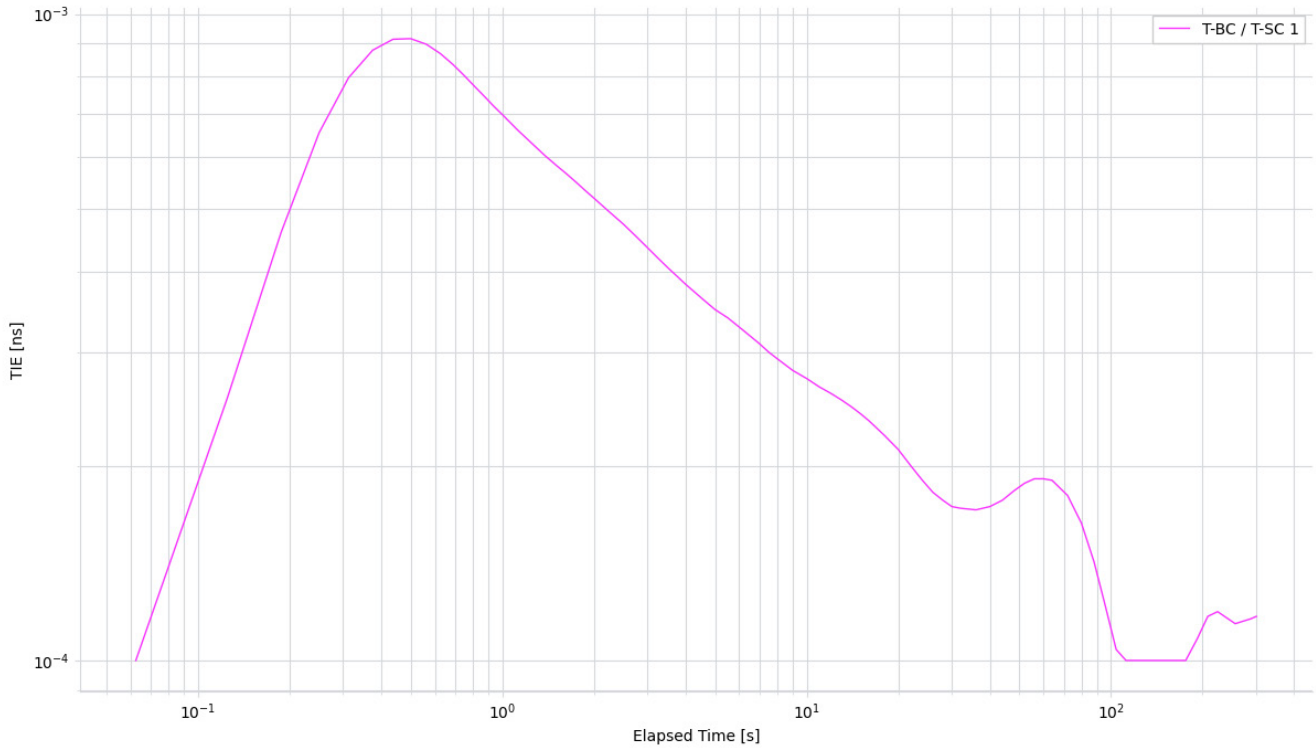


Figure 142. Holdover – G.8262 EEC Option 1, 10Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

9.3 Holdover – G.8262 EEC Option 2, 0.1Hz

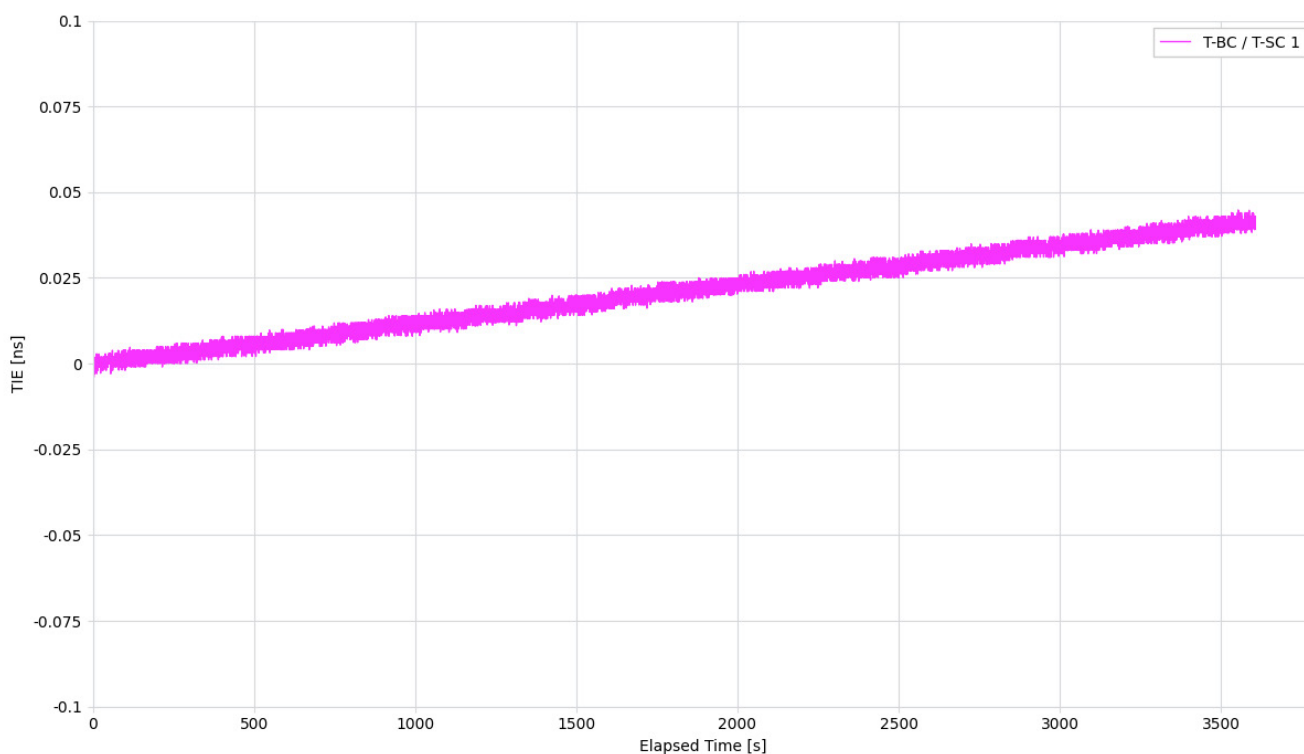


Figure 143. Holdover – G.8262 EEC Option 2, 0.1Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	0.021
Min [ns]	-0.004
Max [ns]	0.045
Max-Min [ns]	0.049

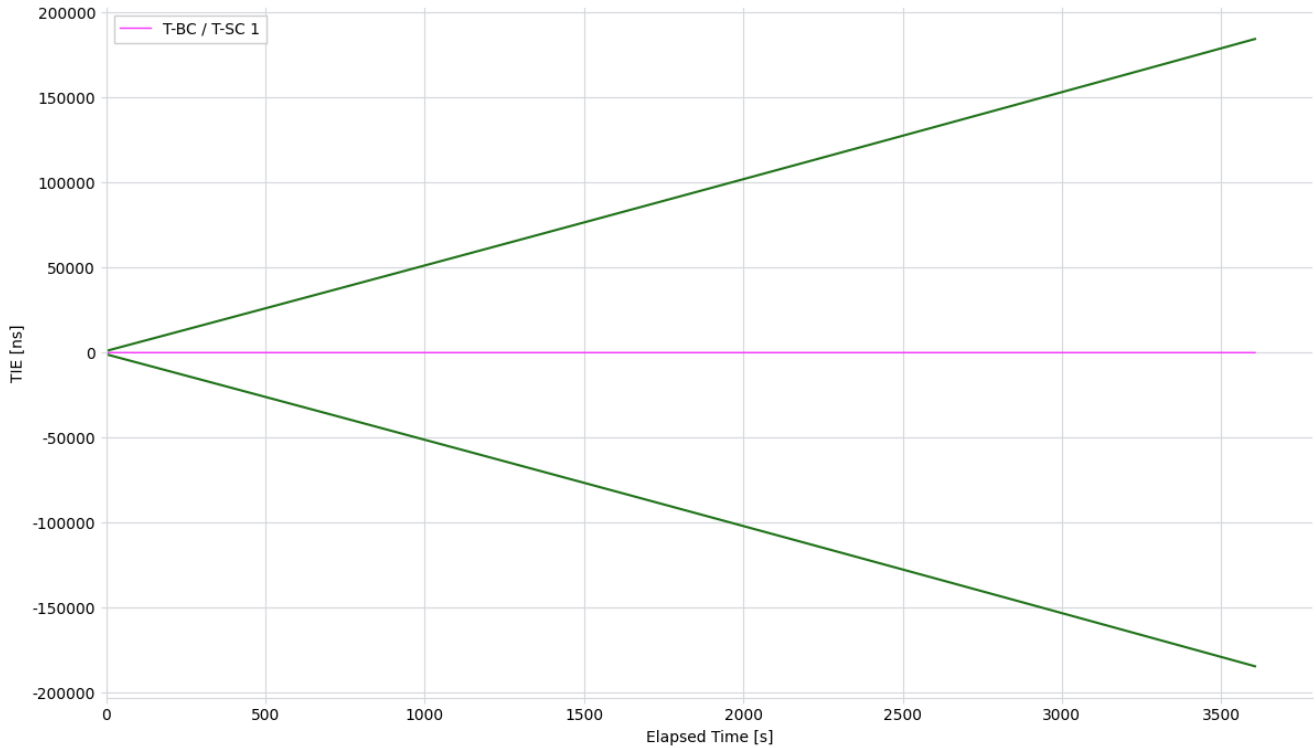


Figure 144. Holdover – G.8262 EEC Option 2, 0.1Hz – TIE

	T-BC / T-SC 1
Mean [ns]	0.021
Min [ns]	-0.004
Max [ns]	0.045
Max-Min [ns]	0.049

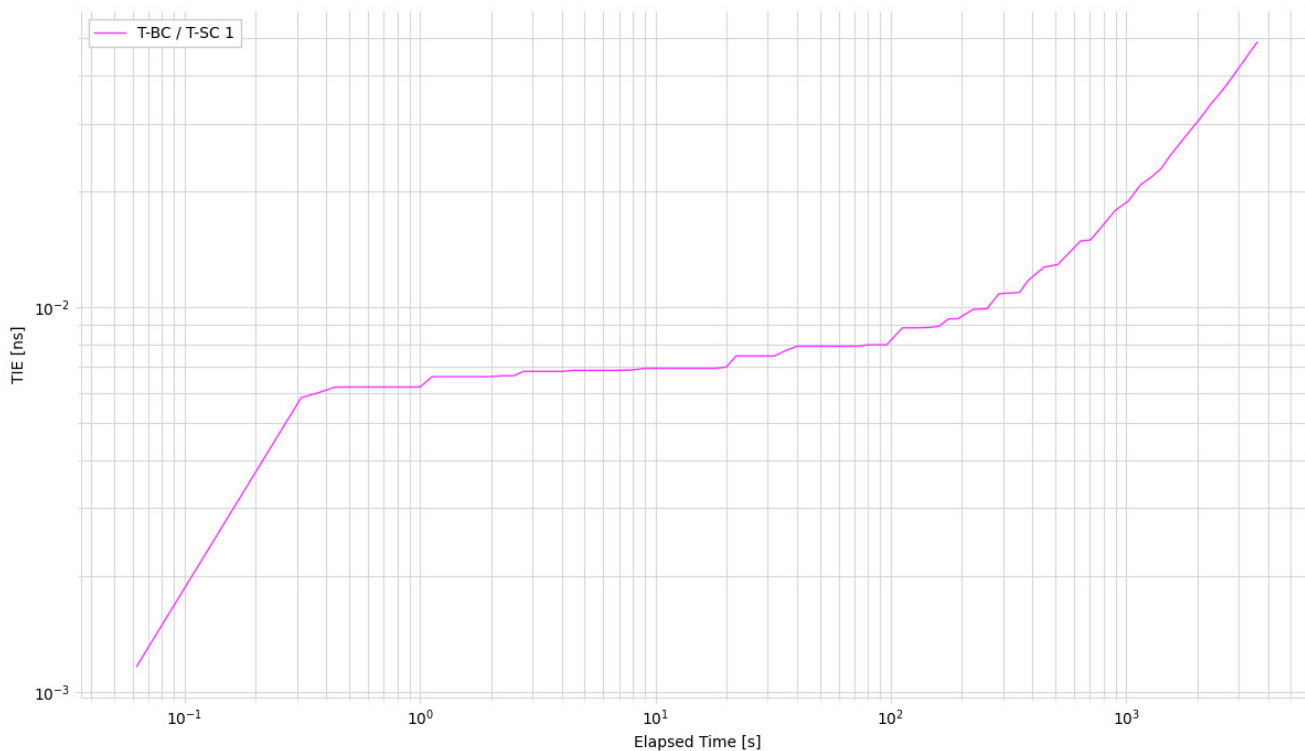


Figure 145. Holdover – G.8262 EEC Option 2, 0.1Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.049
Max-Min [ns]	0.048

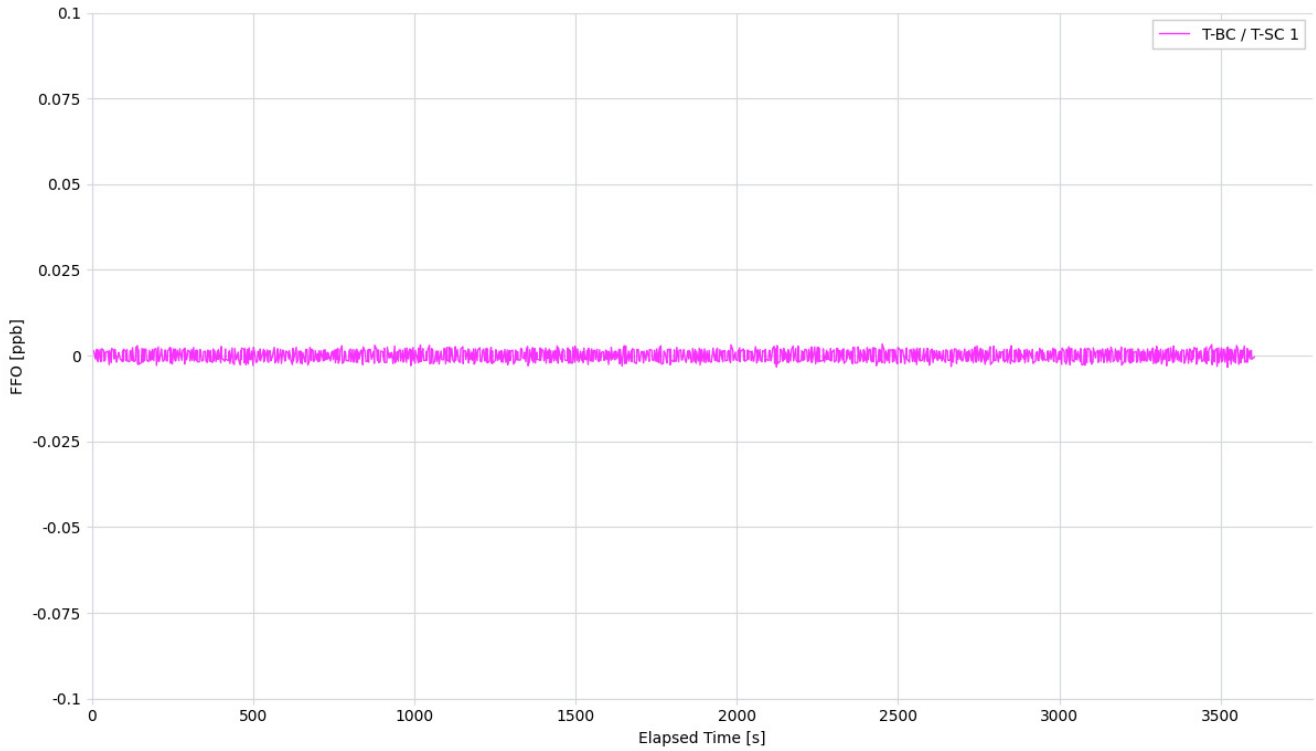


Figure 146. Holdover – G.8262 EEC Option 2, 0.1Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.007

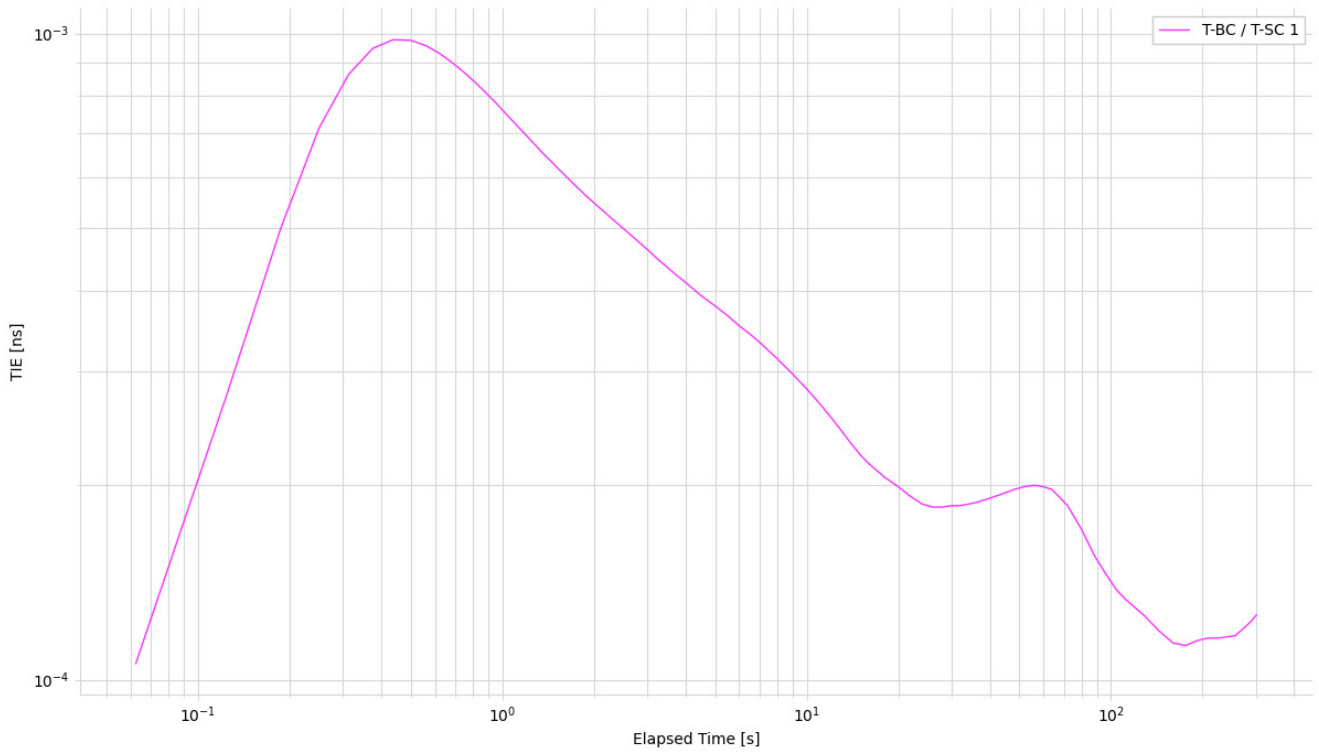


Figure 147. Holdover – G.8262 EEC Option 2, 0.1Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

9.4 Holdover – G.8262.1 eEEC, 3Hz

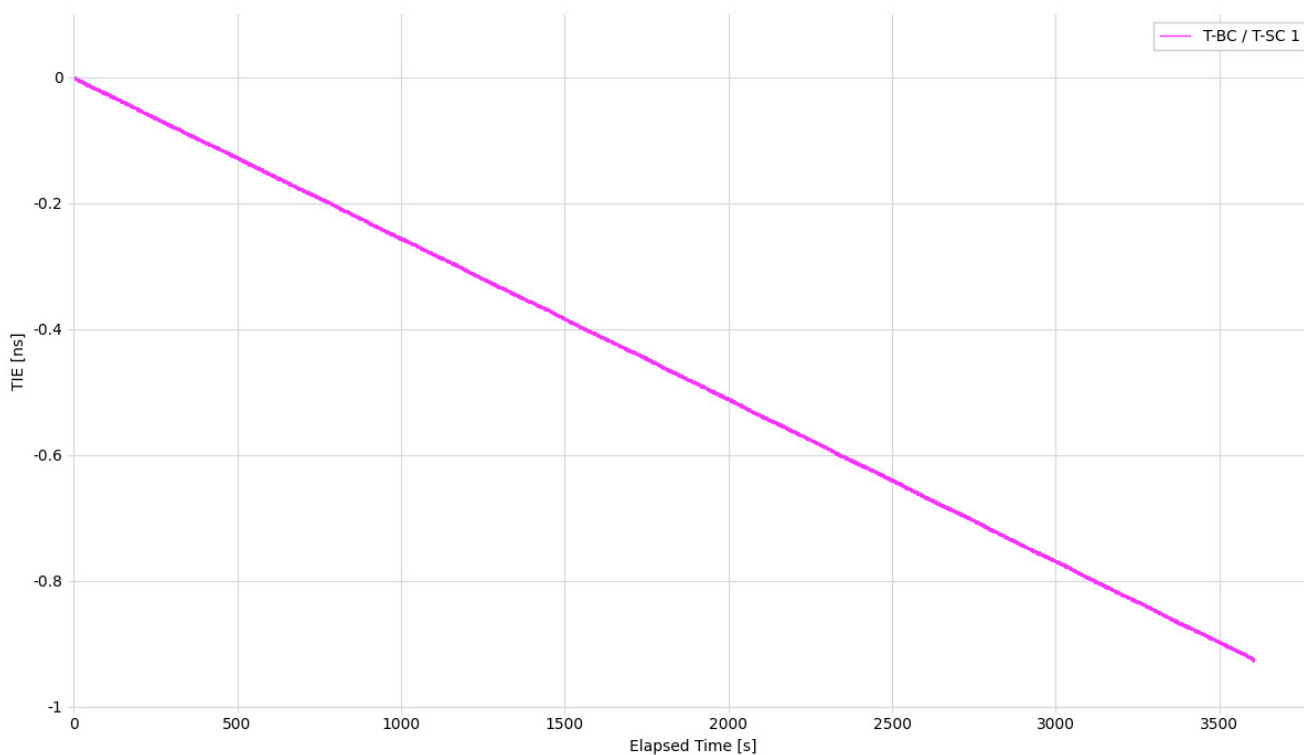


Figure 148. Holdover – G.8262.1 eEEC, 3Hz – TIE (no mask)

	T-BC / T-SC 1
Mean [ns]	-0.462
Min [ns]	-0.929
Max [ns]	0.0
Max-Min [ns]	0.929

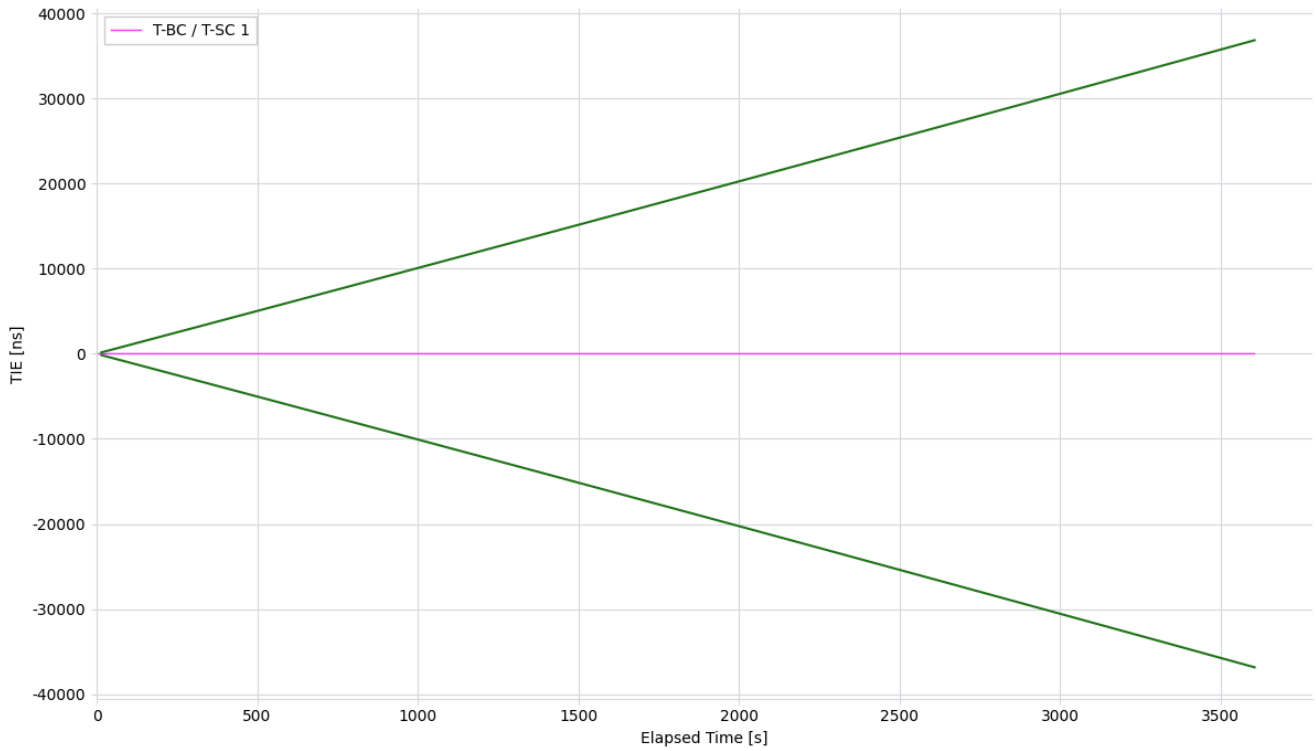


Figure 149. Holdover – G.8262.1 eEEC, 3Hz – TIE

	T-BC / T-SC 1
Mean [ns]	-0.462
Min [ns]	-0.929
Max [ns]	0.0
Max-Min [ns]	0.929

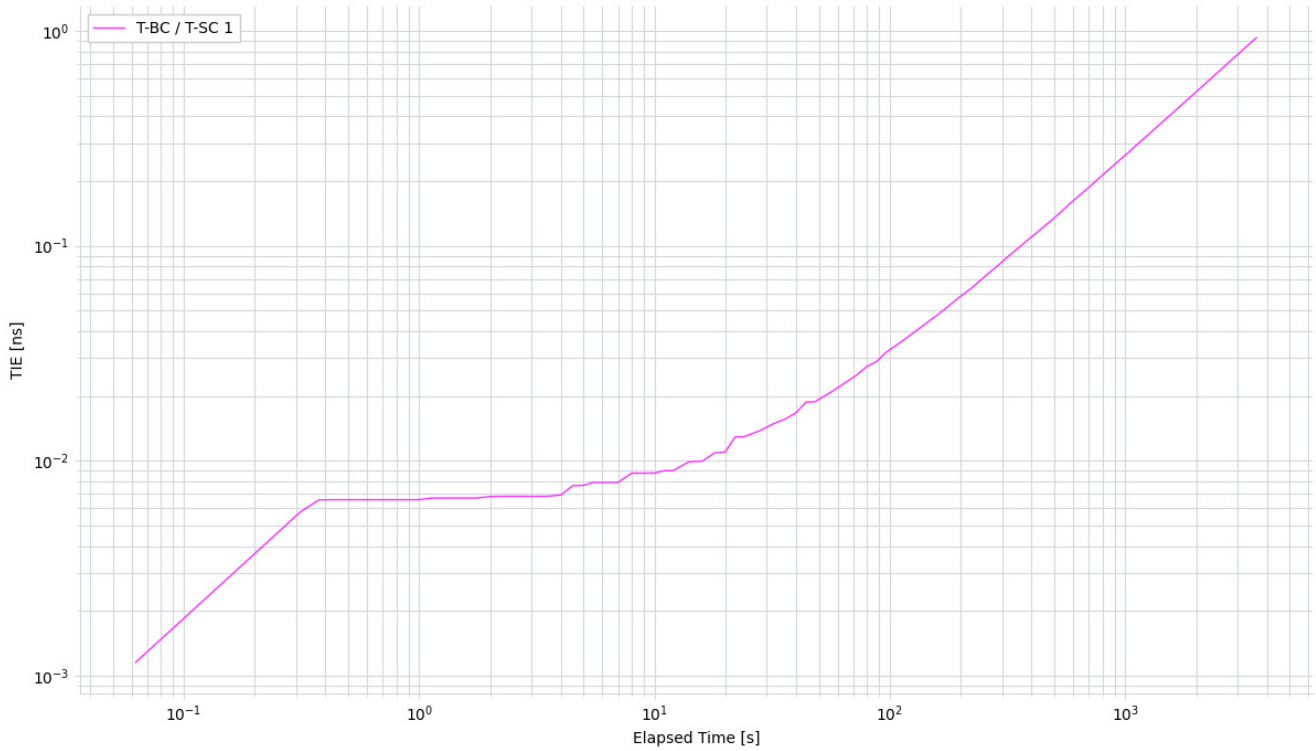


Figure 150. Holdover – G.8262.1 eEEC, 3Hz – MTIE

	T-BC / T-SC 1
Min [ns]	0.001
Max [ns]	0.929
Max-Min [ns]	0.928

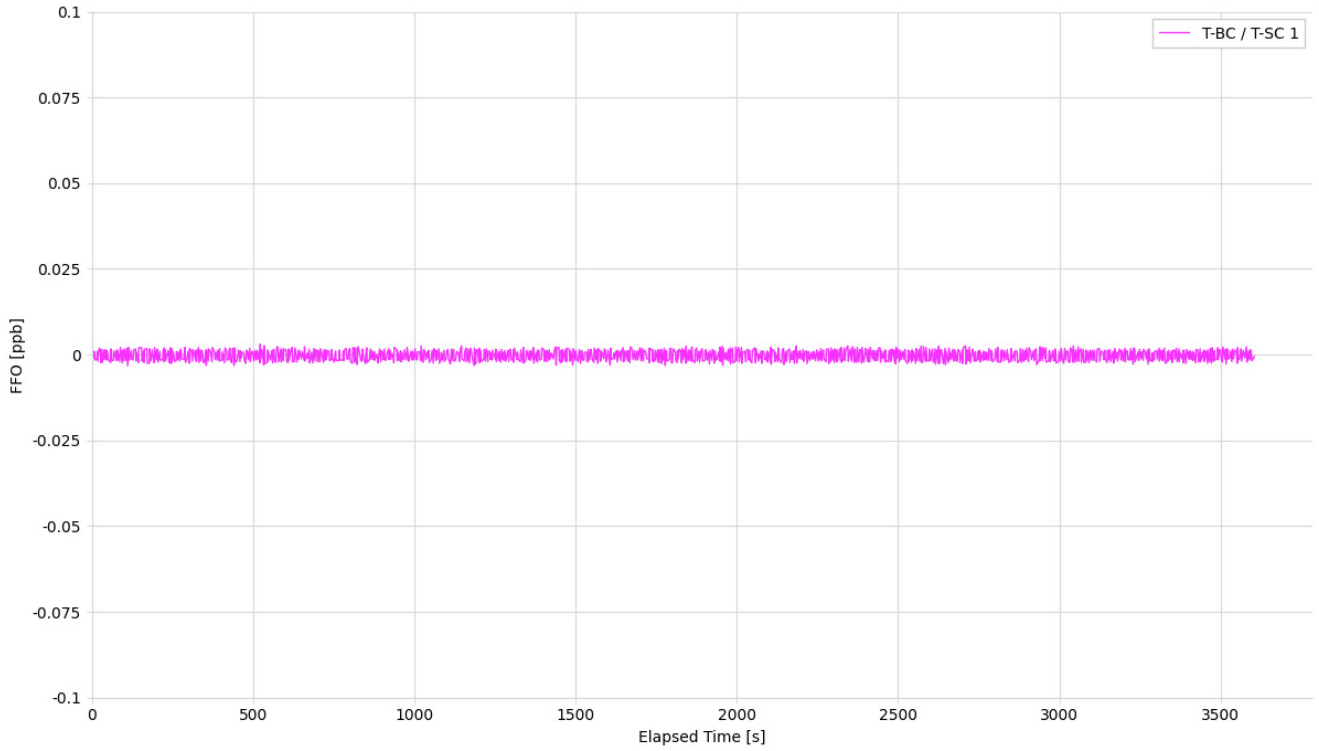


Figure 151. Holdover – G.8262.1 eEEC, 3Hz – FFO

	T-BC / T-SC 1
Mean [ppb]	-0.0
Min [ppb]	-0.003
Max [ppb]	0.003
Max-Min [ppb]	0.006

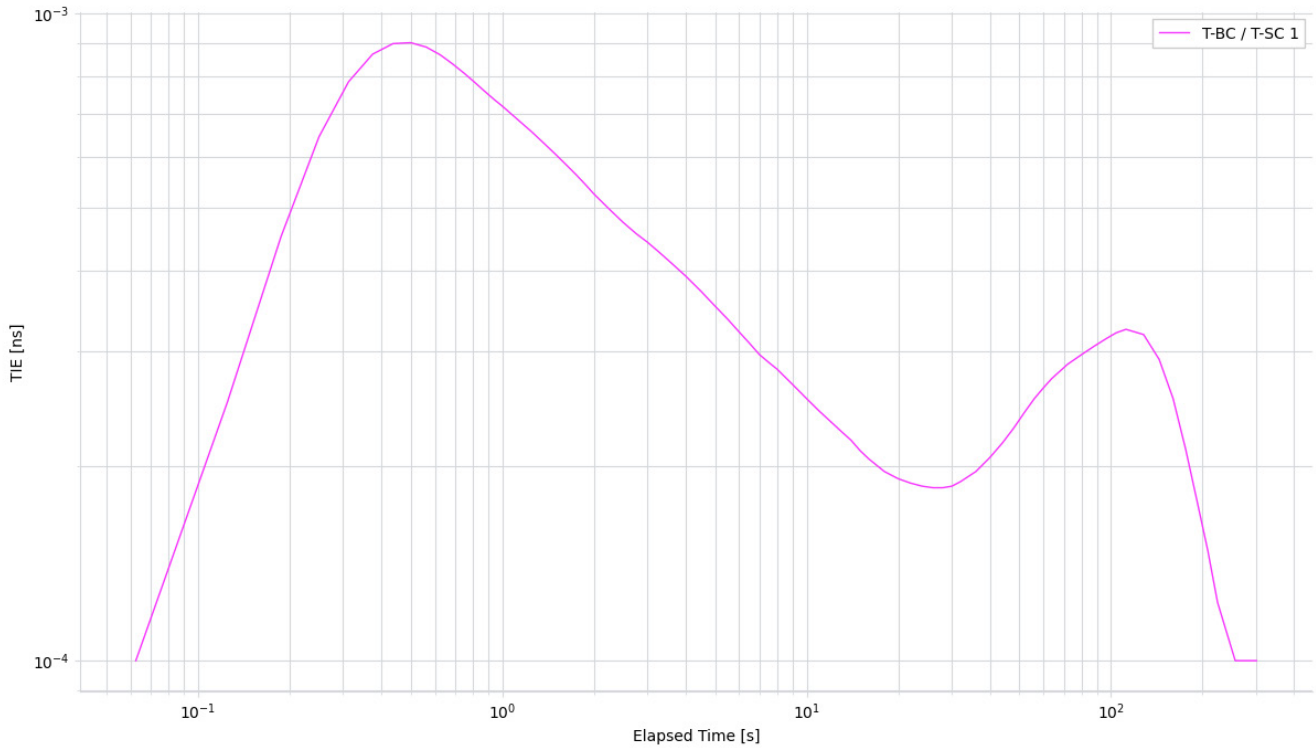


Figure 152. Holdover – G.8262.1 eEEC, 3Hz – TDEV

	T-BC / T-SC 1
Min [ns]	0.0
Max [ns]	0.001
Max-Min [ns]	0.001

10. Wander Transfer

The wander transfer requirement checks the ability of the PLL to filter wander on an input clock (see [Figure 1](#) for the equipment configuration).

The PLL can be viewed as a low pass filter for the difference between the actual input phase and the idea input phase of the reference. The bandwidths for this filter are defined in the applicable standard. For ITU-T G.8262 EEC Option 1 clocks and ITU-T G.8262.1 eEEEC clocks, the wander transfer characteristics are evaluated by applying sinusoidal wander to the input clock at various amplitudes and frequencies from a table defined in the standard. This requirement simultaneously checks the wander tolerance requirement. The wander tolerance requirement is passed if during the wander transfer test:

- There are no alarms
- The clock does not switch reference
- The clock does not go into holdover

10.1 Wander Transfer – G.8262 EEC Option 1, 1.2Hz

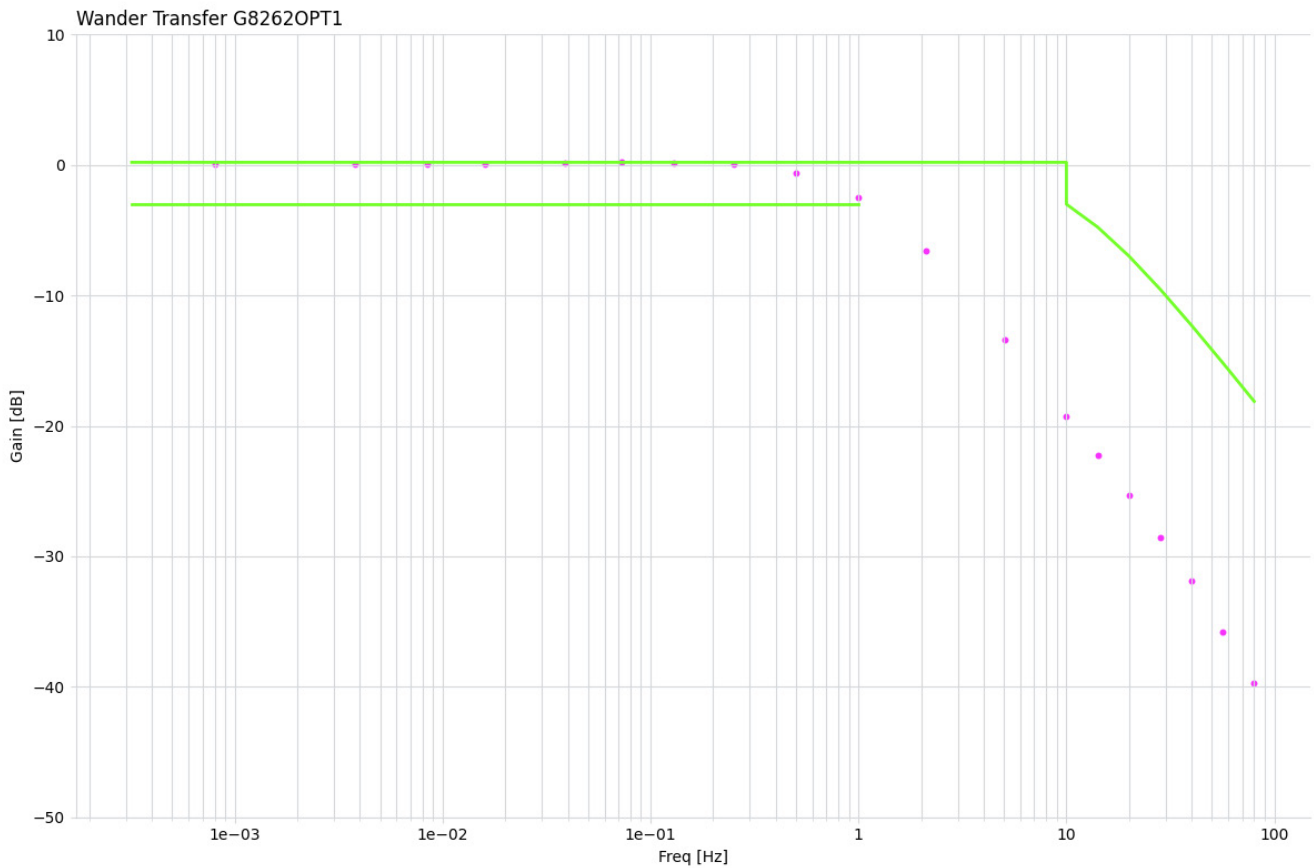


Figure 153. Wander Transfer – G.8262 EEC Option 1, 1.2Hz – Phase_Gain

10.1.1. Wander Transfer Gain Peaking for Standard G.8262 EEC Option 1, 1.2Hz

Point #	Frequency (Hz)	Amplitude (ns)	Pk-Pk Output (ns)	Gain (dB)	Upper Gain Limit (dB)	Lower Gain Limit (dB)
1	80.000	250	2.579	-39.73	-18.1	-
2	56.569	250	4.044	-35.823	-15.1	-
3	40.000	250	8.343	-31.875	-12.0	-
4	28.284	250	9.305	-28.584	-9.0	-
5	20.000	250	13.502	-25.351	-6.0	-
6	14.140	250	19.265	-22.263	-3.0	-
7	10.000	250	27.305	-19.234	0.2	-
8	5.0650	250	53.295	-13.425	0.2	-
9	2.1040	250	116.804	-6.61	0.2	-
10	1.0000	250	188.202	-2.466	0.2	-3.0
11	0.5000	250	232.85	-0.617	0.2	-3.0
12	0.2500	250	250.699	0.024	0.2	-3.0
13	0.1300	250	255.528	0.19	0.2	-3.0
14	0.0730	438	448.101	0.198	0.2	-3.0
15	0.0388	825	841.386	0.171	0.2	-3.0
16	0.0160	2000	2017.621	0.076	0.2	-3.0
17	0.0084	2000	2008.734	0.038	0.2	-3.0
18	0.0038	2000	2008.633	0.037	0.2	-3.0
19	0.0008	2000	2009.141	0.04	0.2	-3.0

10.2 Wander Transfer – G.8262 EEC Option 1, 10Hz

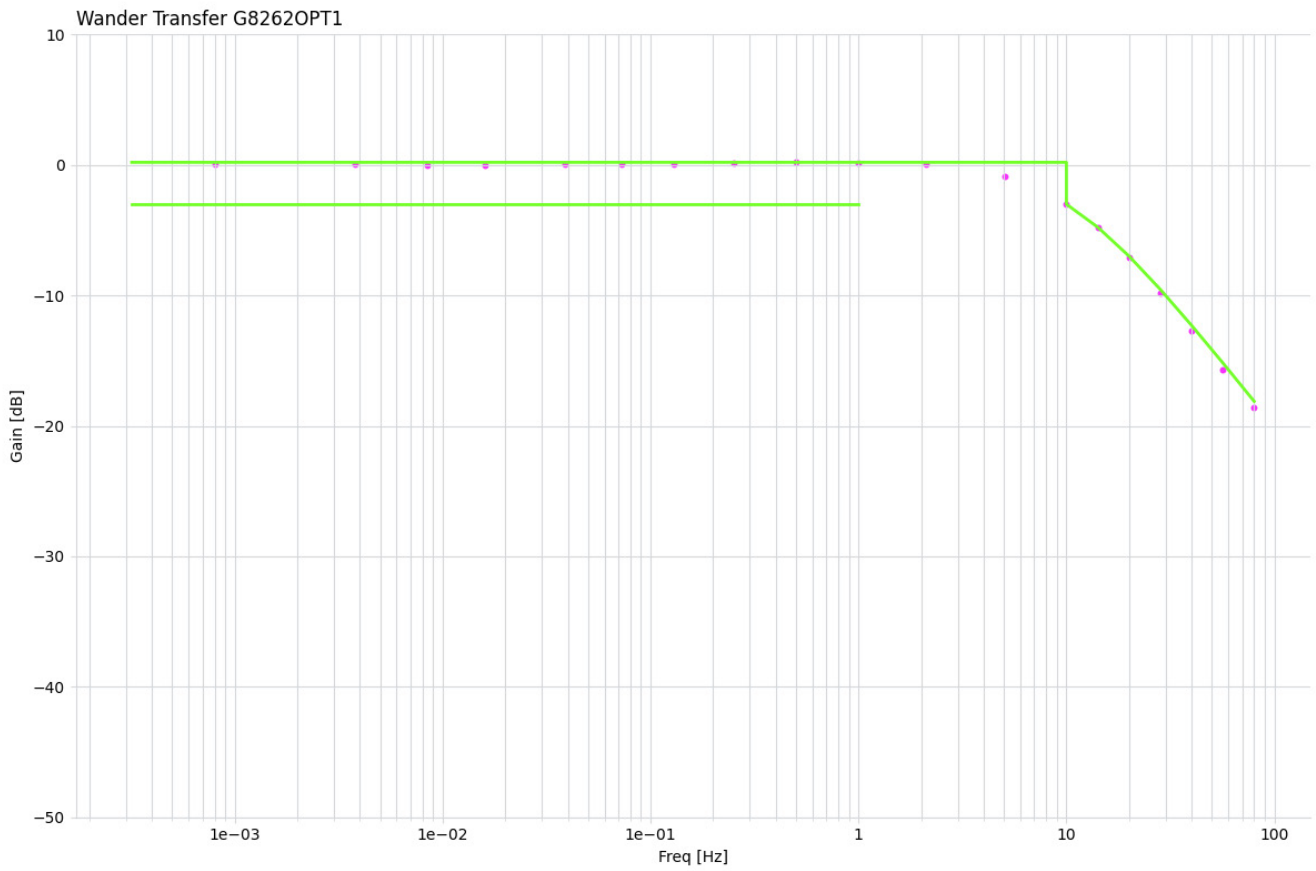


Figure 154. Wander Transfer – G.8262 EEC Option 1, 10Hz – Phase_Gain

10.2.1. Wander Transfer Gain Peaking for Standard G.8262 EEC Option 1, 10Hz

Point #	Frequency (Hz)	Amplitude (ns)	Pk-Pk Output (ns)	Gain (dB)	Upper Gain Limit (dB)	Lower Gain Limit (dB)
1	80.000	250	29.328	-18.613	-18.1	-
2	56.569	250	41.058	-15.691	-15.1	-
3	40.000	250	57.947	-12.698	-12.0	-
4	28.284	250	80.904	-9.799	-9.0	-
5	20.000	250	110.434	-7.097	-6.0	-
6	14.140	250	143.705	-4.809	-3.0	-
7	10.000	250	177.583	-2.971	0.2	-
8	5.0650	250	227.136	-0.833	0.2	-
9	2.1040	250	250.8	0.028	0.2	-
10	1.0000	250	254.946	0.17	0.2	-3.0
11	0.5000	250	255.554	0.191	0.2	-3.0
12	0.2500	250	253.481	0.12	0.2	-3.0
13	0.1300	250	251.263	0.044	0.2	-3.0
14	0.0730	438	439.659	0.033	0.2	-3.0
15	0.0388	825	826.965	0.021	0.2	-3.0
16	0.0160	2000	2004.52	0.02	0.2	-3.0
17	0.0084	2000	2003.808	0.017	0.2	-3.0
18	0.0038	2000	2005.383	0.023	0.2	-3.0
19	0.0008	2000	2007.21	0.031	0.2	-3.0

10.3 Wander Transfer – G.8262 EEC Option 2, 0.1Hz

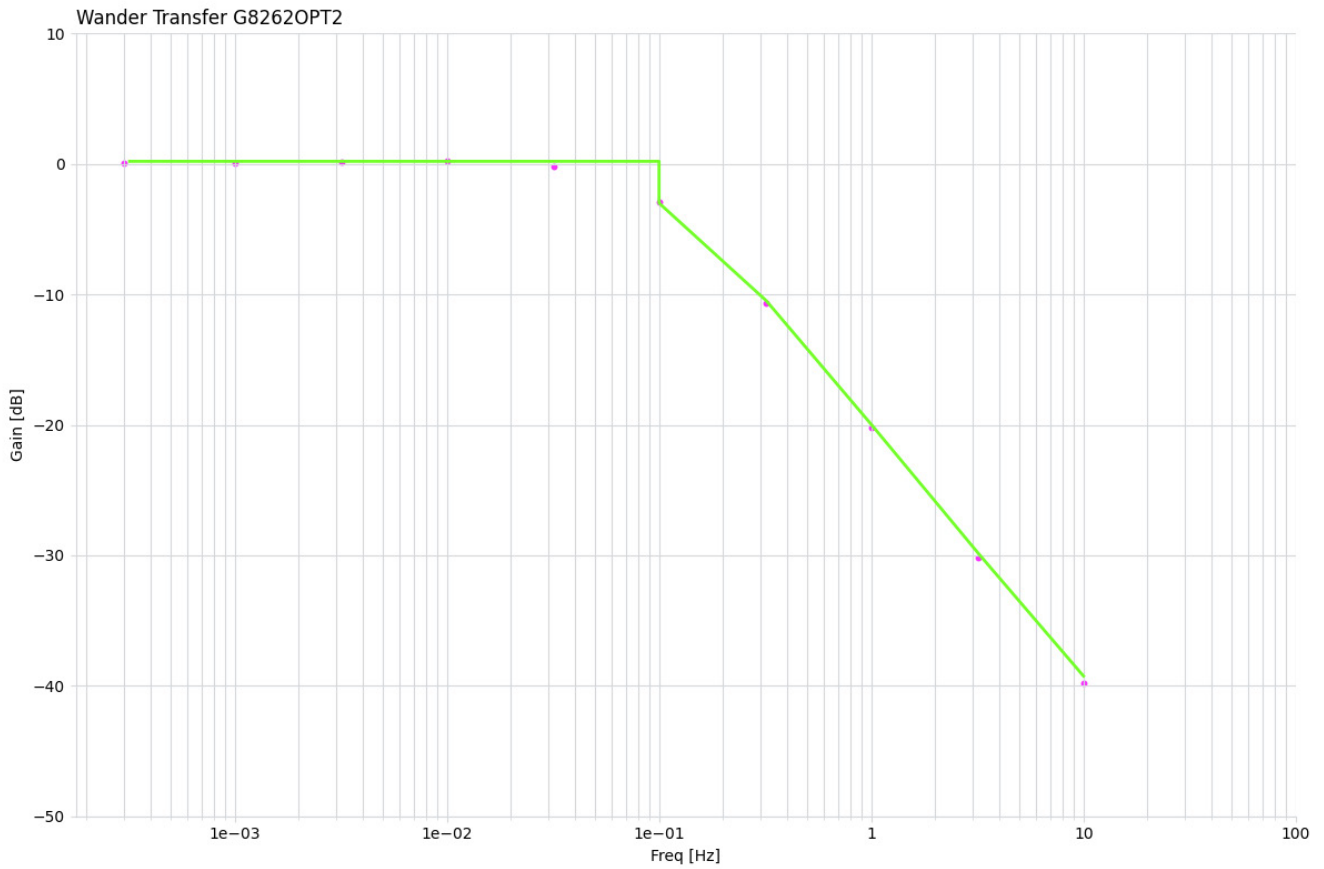


Figure 155. Wander Transfer – G.8262 EEC Option 2, 0.1Hz – Phase_Gain

10.3.1. Wander Transfer Gain Peaking for Standard G.8262 EEC Option 2, 0.1Hz

Point #	Frequency (Hz)	Amplitude (ns)	Pk-Pk Output (ns)	Gain (dB)	Upper Gain Limit (dB)
1	10.000	300	3.064	-39.815	-39.8
2	3.2000	300	9.304	-30.2	-29.9
3	1.0000	301	29.48	-20.181	-19.8
4	0.3200	303	88.893	-10.652	-9.9
5	0.1000	308	219.322	-2.949	0.2
6	0.0320	325	317.329	-0.207	0.2
7	0.0100	380	388.675	0.196	0.2
8	0.0032	550	560.467	0.164	0.2
9	0.0010	1000	1007.592	0.066	0.2
10	0.0003	1007	1013.482	0.056	0.2

10.4 Wander Transfer – G.8262.1 eEEC, 3Hz

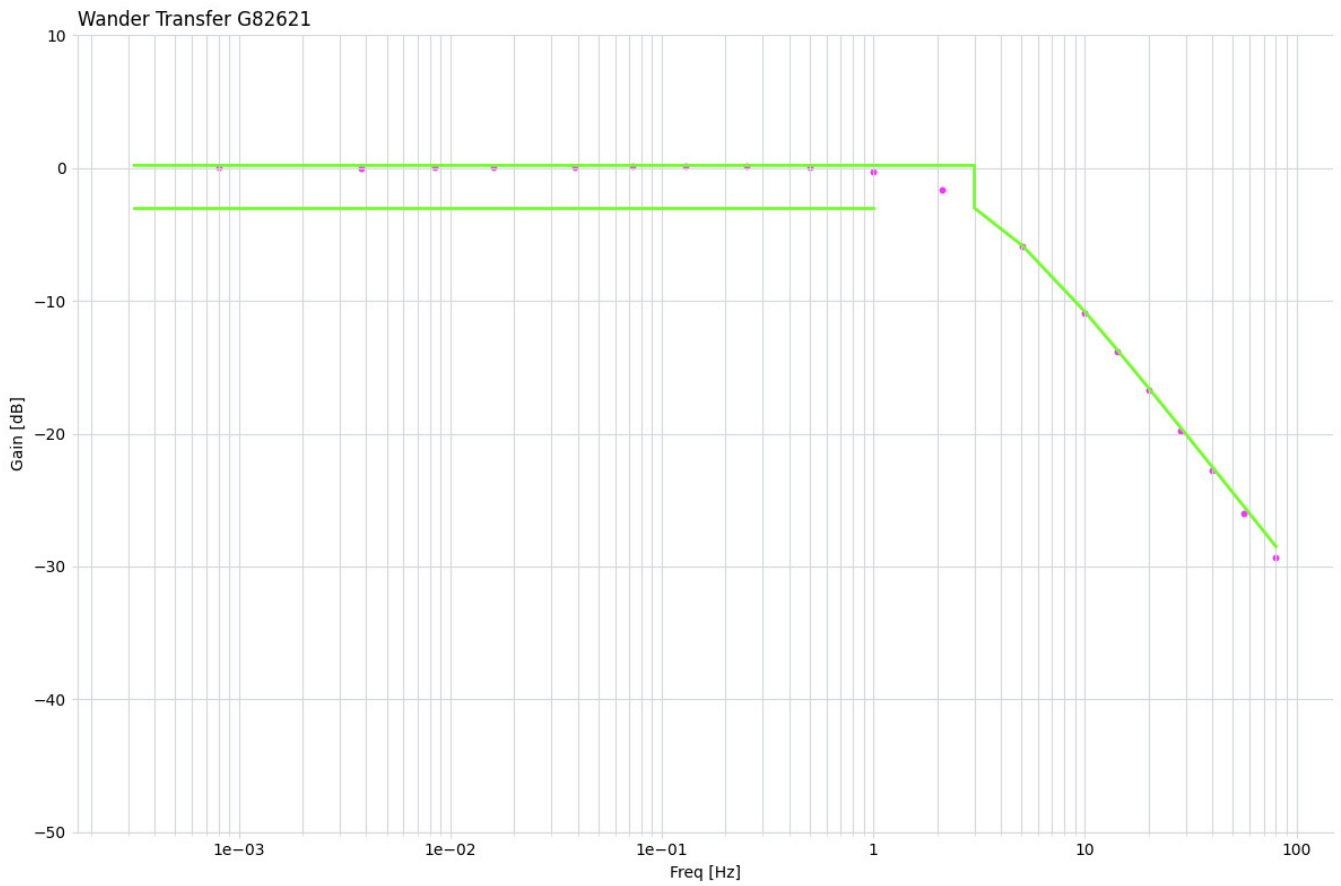


Figure 156. Wander Transfer – G.8262.1 eEEC, 3Hz – Phase_Gain

10.4.1. Wander Transfer Gain Peaking for Standard G.8262.1 eEEC, 3Hz

Point #	Frequency (Hz)	Amplitude (ns)	Pk-Pk Output (ns)	Gain (dB)	Upper Gain Limit (dB)	Lower Gain Limit (dB)
1	80.000	250	8.545	-29.325	-28.5	-
2	56.569	250	12.49	-26.028	-25.5	-
3	40.000	250	18.103	-22.804	-22.5	-
4	28.284	250	25.737	-19.748	-19.5	-
5	20.000	250	36.458	-16.723	-16.5	-
6	14.140	250	51.071	-13.795	-13.5	-
7	10.000	250	71.196	-10.91	-10.5	-
8	5.0650	250	126.967	-5.885	-4.5	-
9	2.1040	250	207.366	-1.624	0.2	-3.0
10	1.0000	250	242.407	-0.268	0.2	-3.0
11	0.5000	250	252.773	0.096	0.2	-3.0
12	0.2500	250	255.301	0.182	0.2	-3.0
13	0.1300	250	254.869	0.168	0.2	-3.0
14	0.0730	438	443.723	0.113	0.2	-3.0
15	0.0388	825	831.179	0.065	0.2	-3.0
16	0.0160	2000	2006.652	0.029	0.2	-3.0
17	0.0084	2000	2005.484	0.024	0.2	-3.0
18	0.0038	2000	2003.96	0.017	0.2	-3.0
19	0.0008	2000	2007.11	0.031	0.2	-3.0

11. Phase Noise and RMS Jitter

The data in this section displays phase noise plots and RMS jitter a RC38312A200 device when using the G.8262 option 1, G.8262 option 2, and G.8262.1 eEEC register settings in Table 2 and Table 3. The System DLL reference clock, CLKIN3, is supplied by a Rakon E6241LF, 12.8MHz TCXO. The RF_Out output of a Rohde & Schwarz SMA100B is used to supply the 25MHz reference clock, CLKIN1, for the jitter attenuator DLL, DPLL0. The XIN input is supplied by a NDK RNA5024A, 54MHz XO. A 156.25MHz HCSL, internally terminated output from the RC38312A200 EVB, is connected through a Prodyn BIB-100F balun to a Keysight FSWP signal source analyzer. Figure 157 shows a block diagram of the measurement setup.

The FSWP phase noise plots shown in this section each simultaneously plot two phase noise traces. The two traces are of the same signal with different FSWP trace smoothing and spur suppression settings. Trace 1 has smoothing disabled, thus any spurs on the carrier are visible and accounted for in the RMS jitter value. Trace 2 has smoothing enabled, thus any spurs on the carrier are reduced to better showcase the noise floor. The RMS jitter for Trace 2 is more reflective of an ideal carrier with no spurs.

Table 7. Summary of RMS Jitter Measurements

XTAL Frequency	TCXO Frequency	Profile	Bandwidth	RMS Jitter
49.152MHz	12.8MHz	ITU-T G.8262 EEC Option 1	1.2Hz	59.170fs
		ITU-T G.8262 EEC Option 1	10Hz	59.852fs
		ITU-T G.8262 EEC Option 2	0.1Hz	58.949fs
		ITU-T G.8262.1 eEEC	3Hz	58.775fs

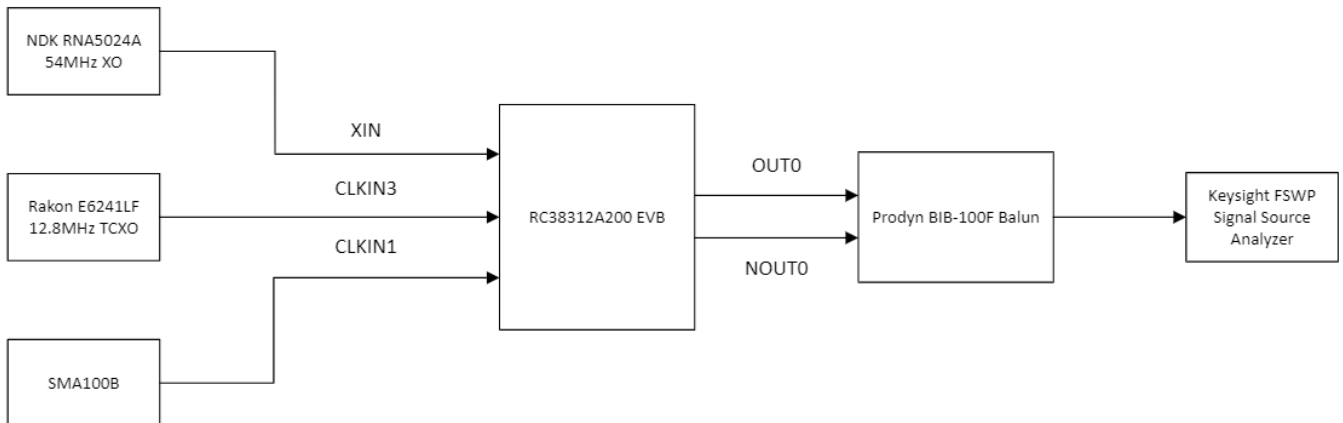


Figure 157. Phase Noise and RMS Jitter Measurement Setup

11.1 Phase Noise and RMS Jitter: ITU-T G.8262 EEC Option 1, 1.2Hz Bandwidth, 54MHz XO, 12.8MHz TXCO

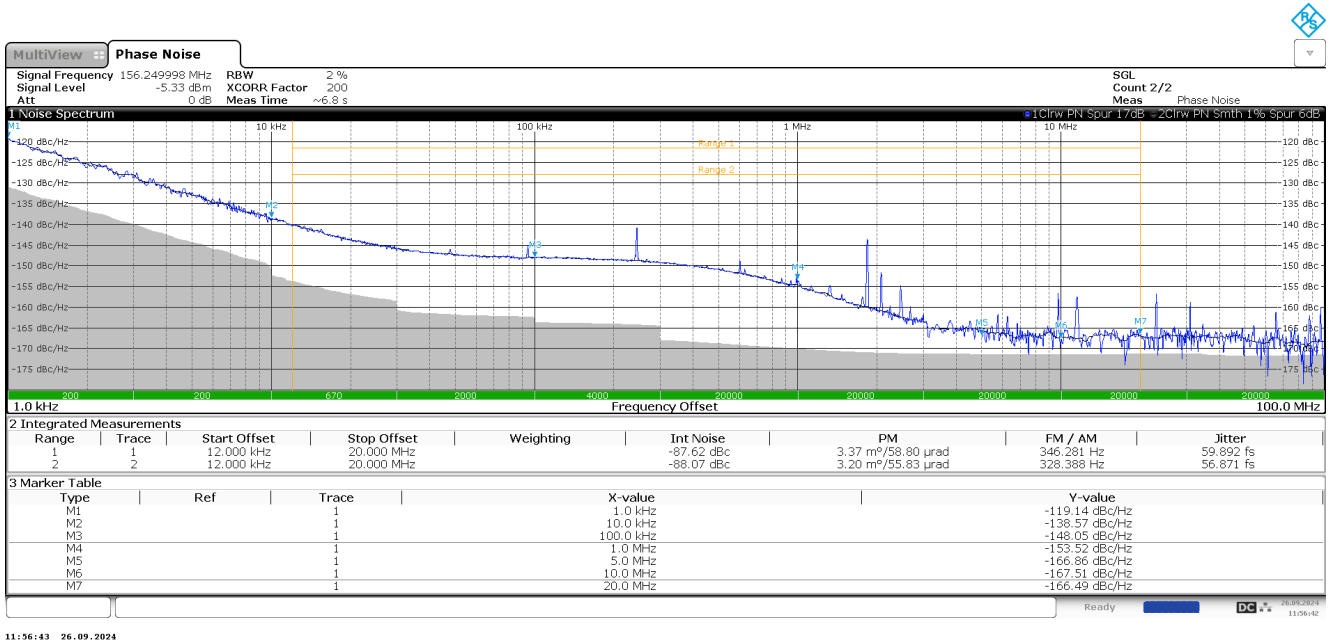


Figure 158. Phase Noise and RMS Jitter for ITU-T G.8262 EEC Option 1, 1.2Hz Bandwidth, 156.25MHz Output, Using a 54MHz XO and a 12.8MHz TCXO

11.2 Phase Noise and RMS Jitter: ITU-T G.8262 EEC Option 1, 10Hz Bandwidth, 54MHz XO, 12.8MHz TXCO

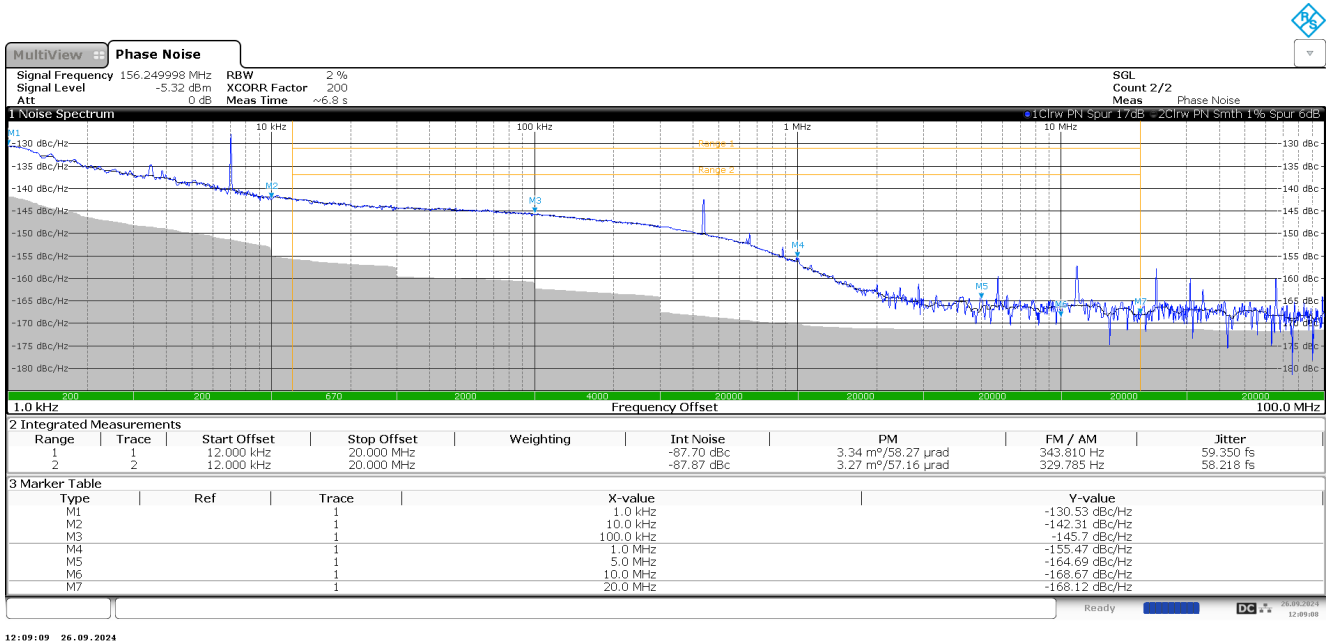


Figure 159. Phase Noise and RMS Jitter for ITU-T G.8262 EEC Option 1, 10Hz Bandwidth, 156.25MHz Output, Using a 54MHz XO and a 12.8MHz TCXO

11.3 Phase Noise and RMS Jitter: ITU-T G.8262 EEC Option 2, 0.1Hz Bandwidth, 54MHz XO, 12.8MHz TXCO

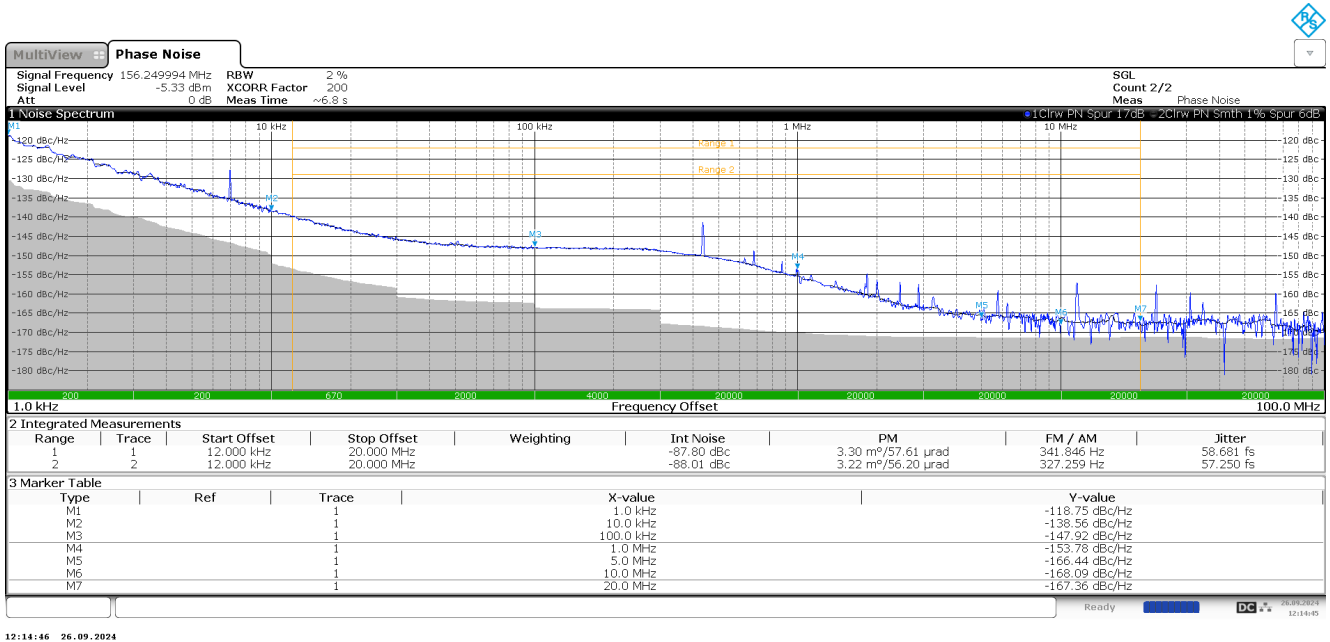


Figure 160. Phase Noise and RMS Jitter for ITU-T G.8262 EEC Option 2, 0.1Hz Bandwidth, 156.25MHz Output, Using a 54MHz XO and a 12.8MHz TCXO

11.4 Phase Noise and RMS Jitter: ITU-T G.8262.1 eEEC, 3Hz Bandwidth, 54MHz XO, 12.8MHz TXCO

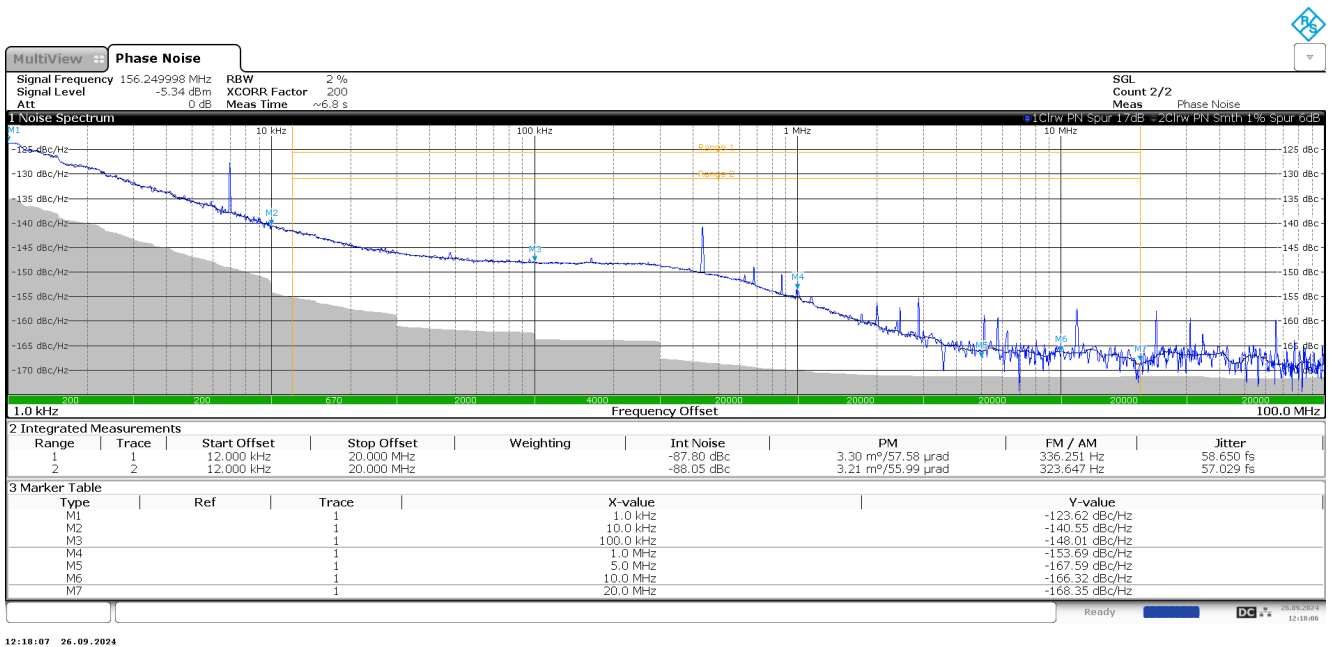


Figure 161. Phase Noise and RMS Jitter for ITU-T G.8262 eEEC, 3Hz Bandwidth, 156.25MHz Output, Using a 54MHz XO and a 12.8MHz TCXO

12. Revision History

Revision	Date	Description
1.00	Oct 4, 2024	Initial release.

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