Commercial inspection report of MOS Equipment USB Lightning

Project Number: 4791127880

File Number: N/A

Test Lab: Underwriters Laboratories Taiwan Co., Ltd

Tester: Dylan Su

Issue Date: 2024-03-29

Applicant Information

Applicant: MOS EQUIPMENT

Applicant's address: 26 Castilian Dr Ste D Goleta, CA, 93117-5565 US.

Contact: Damian Gover

Contact Information: Damian@mosequipment.com

Test Location

Address: No. 35, Sec. 2, ZhongYang S. Road, Beitou, Taipei City 112 Taiwan

Product Information

Product Type: USB 2.0 Std-A to Lightning Cable Assembly

Product Model: MOS Equipment USB Lightning Cable

Sample Card Number: 6957480

Date of Received: 2024-02-27.

Product Appearance

Test Item Information

Test No.	Test Name	Result
1	Power Efficiency	Completed

Test Samples Information

Sample Card No.	Date Received	Test No.	Specimen No.
6957480	2024-02-27	1	S1

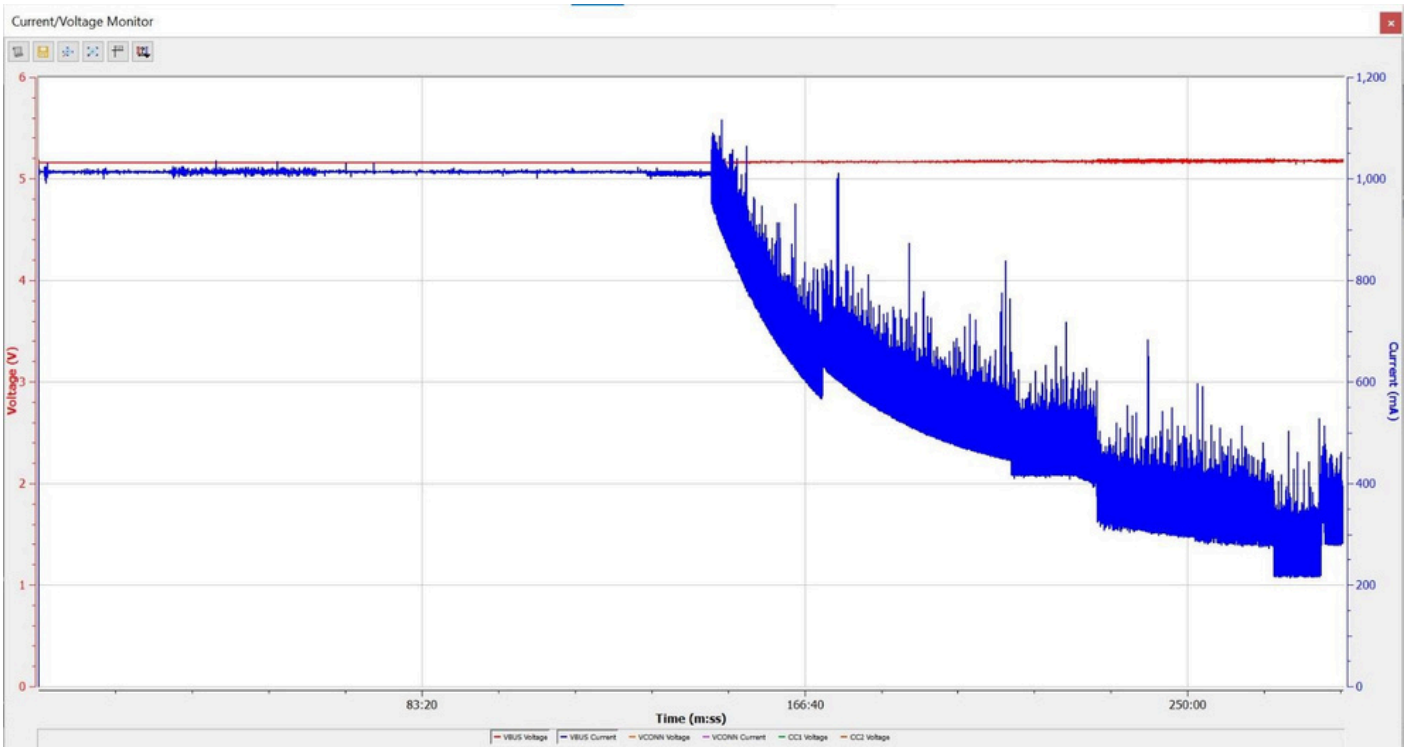
Power Efficiency:

Sample Card No.:	***6957480***	*Quantity:*	*1*
Sample type:	*Cable Assembly*	*Tested by:*	*Dylan Su*
Test date:	*2024-02-28*		

Test Procedure:

1. *Connect iPhone X to the charger bundled with iPhone X with the cable samples and a protocol analyzer between iPhone X and charger.*
2. *Charge the iPhone X from battery level 0% to 100%.*
3. *Use the protocol analyzer to capture the voltage and current.*

Test Result:



D+/D- Pair Attenuation:

Sample Card No.:	***6767499***	*Quantity:*	*3*
Sample type:	*Cable Assembly*	*Tested by:*	*Dylan Su*
Ambient Temp.:	*21.8 °C*	*Humidity:*	*42 % RH*
Test date:	*2023-12-25*		

Test Procedure:

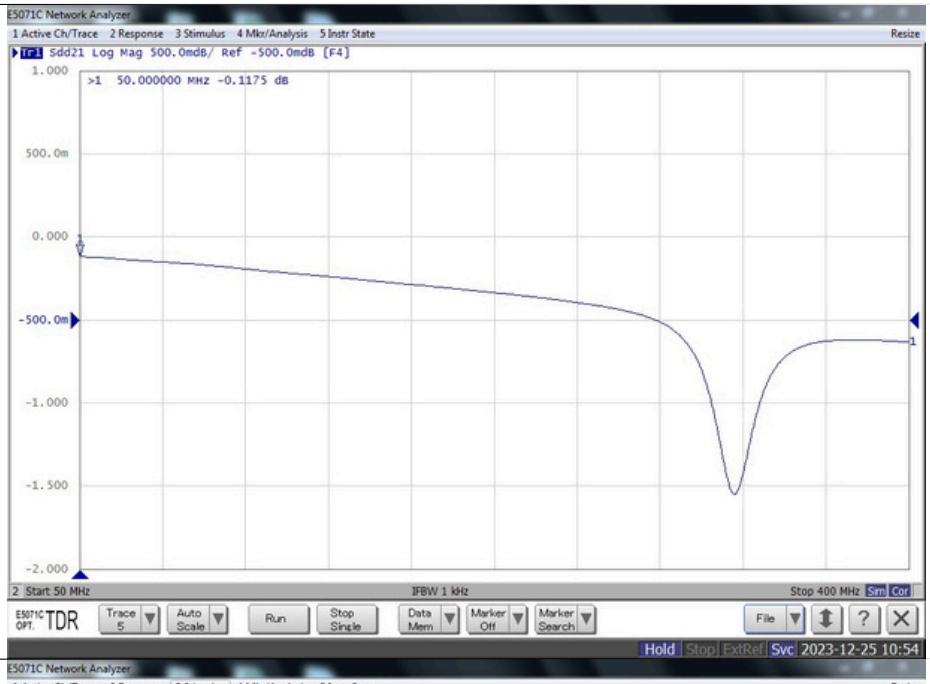
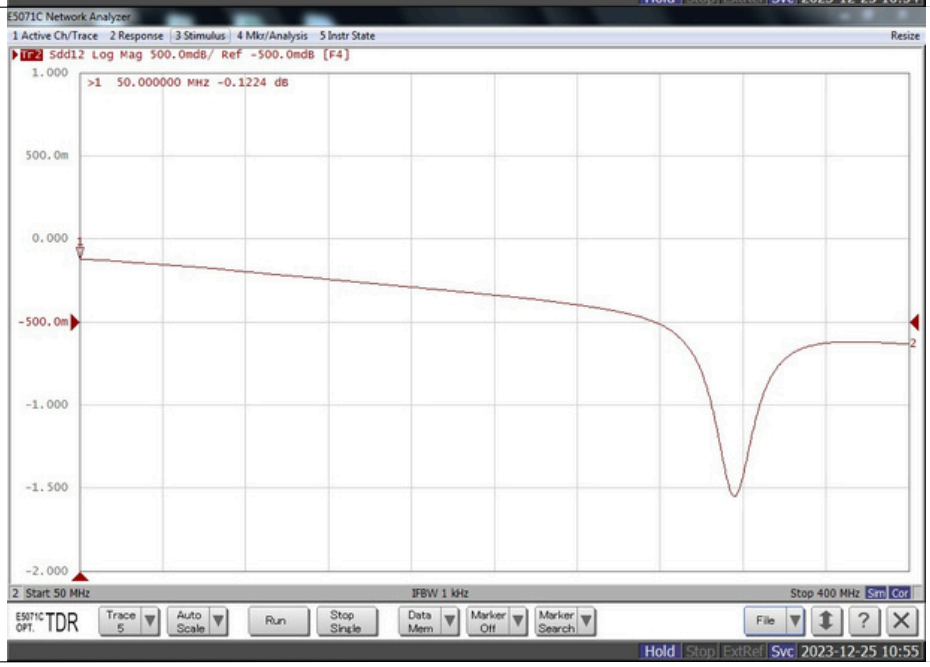
1. Connect the ENA port to appropriate DUT pins by the following table, I defined the Lightning connector as A-side and Std-A connector as B-side.

E5071C Port 1	*Port 2*	*Port 3*	*Port 4*			
Test Fixtures	*A-side D+*	*A-side D-*	*B-side D+*	*B-side D-*		

2. Measure the SDD21 and SDD12 and save the diagram or raw data.

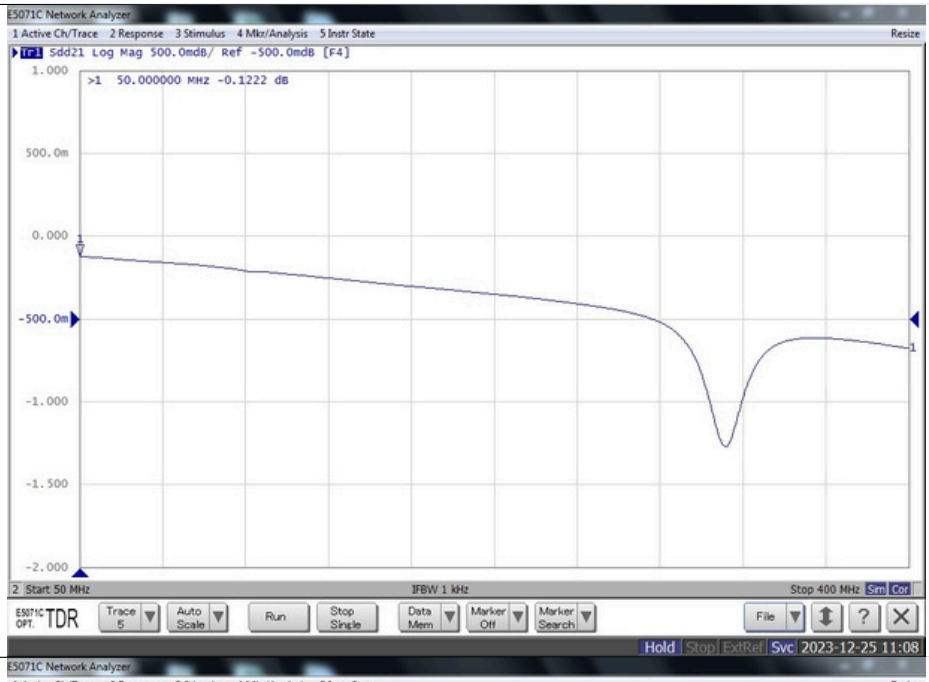
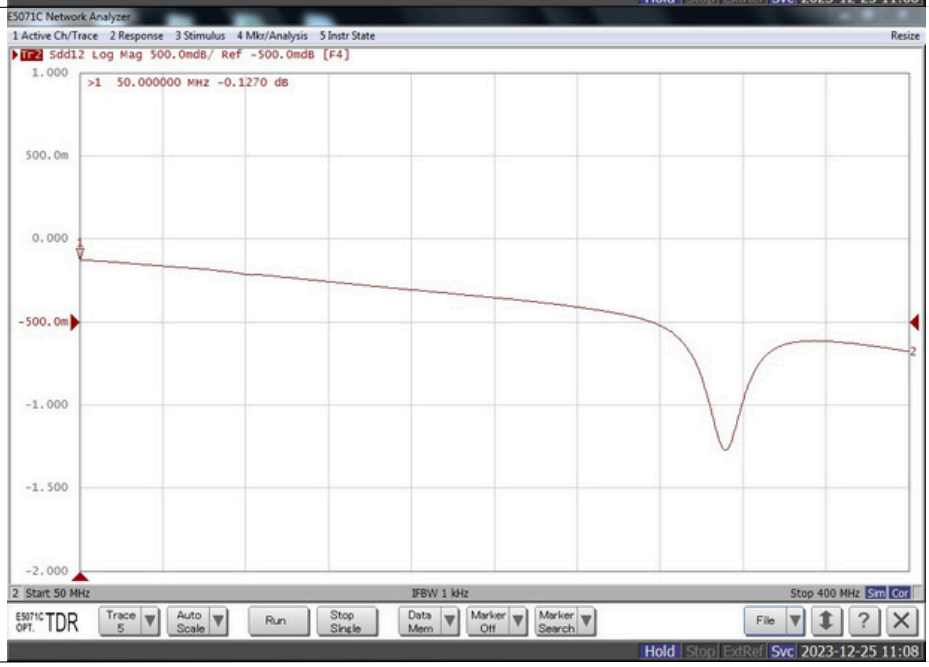
D+/D- Pair Attenuation (CON'D):

Test Result:

	S4
SDD21	
SDD12	

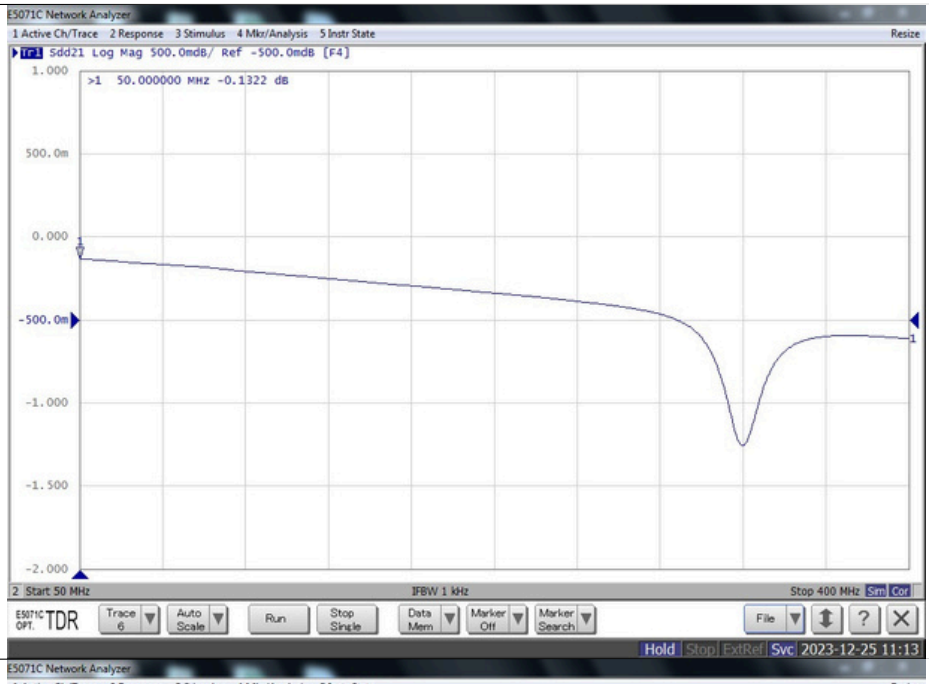
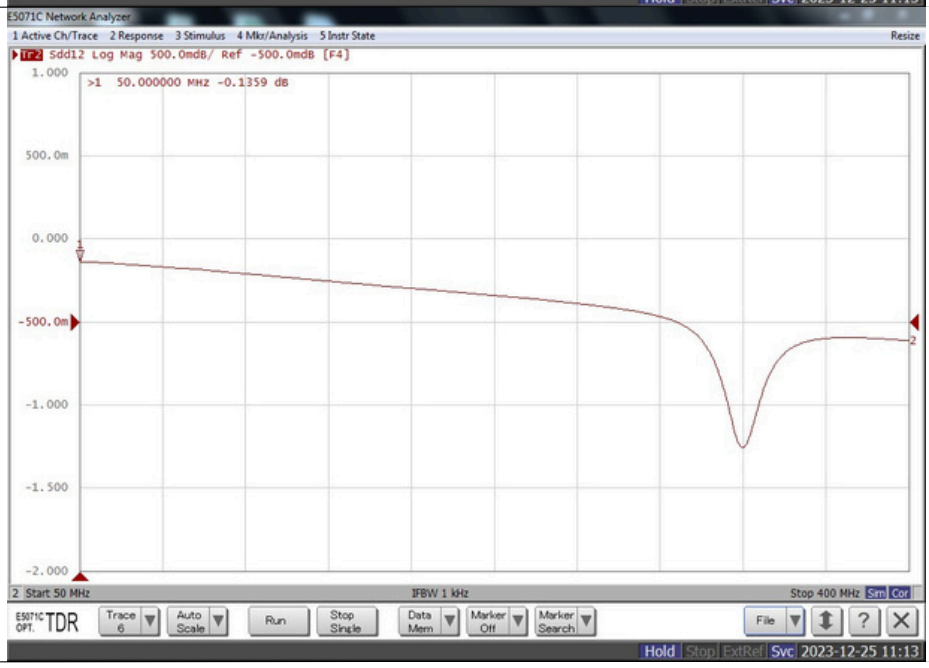
D+/D- Pair Attenuation (CON'D):

Test Result (CON'D):

	S5
SDD21	
SDD12	

D+/D- Pair Attenuation (CON'D):

Test Result (CON'D):

	S6
SDD21	
SDD12	

D+/D- Pair Differential Impedance:

Sample Card No.:	**6767499**	Quantity:	3
Sample type:	Cable Assembly	Tested by:	Dylan Su
Ambient Temp.:	21.8 °C	Humidity:	42 % RH
Test date:	2023-12-25		

Test Procedure:

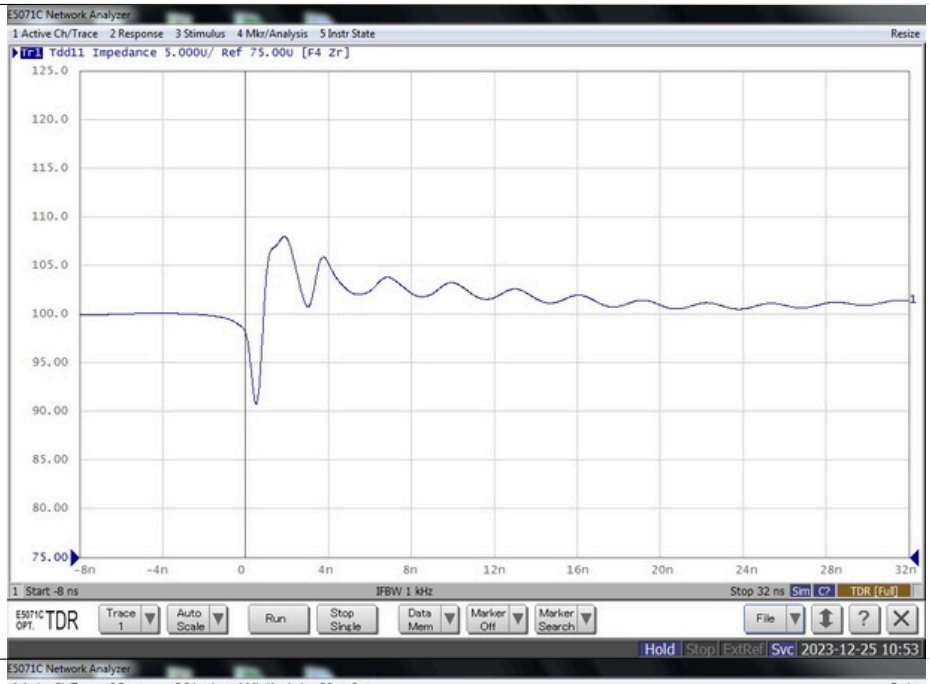
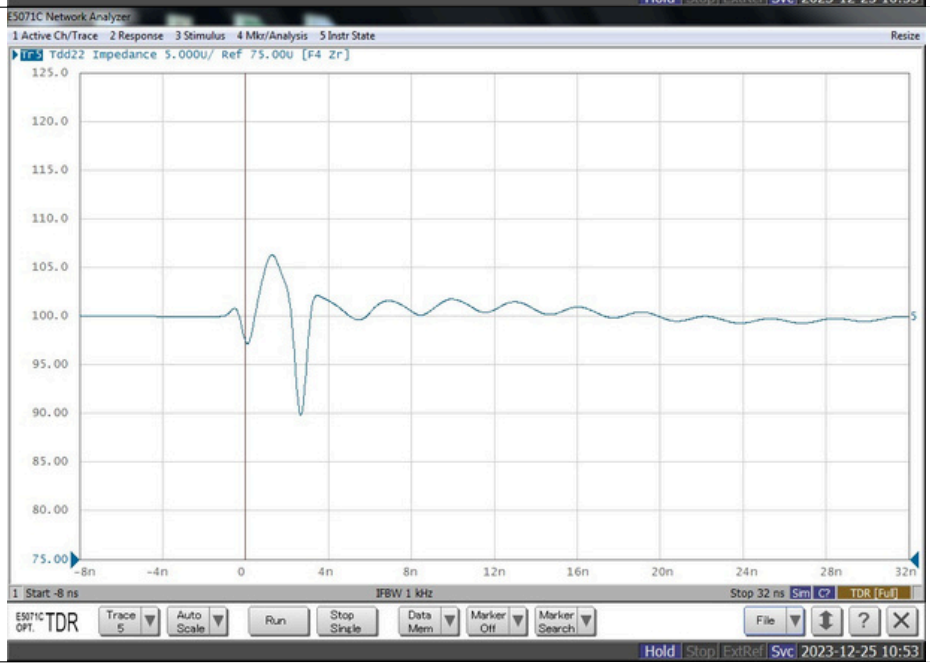
1. The D+/D- pair impedance is typically measured with a TDR. The 1X THRU in the calibration card should be used to calibrate the rise time to be 400 ps (20%-80%) entering the reference plane.
2. Connect the ENA port to appropriate DUT pins by the following table, I defined the Lightning connector as A-side and Std-A connector as B-side.

E5071C Port	1 Port	2 Port	3 Port	4
Test Fixtures	A-side D+	A-side D-	B-side D+	B-side D-

3. Measure the TDD11 and TDD22 and save the diagram or raw data.

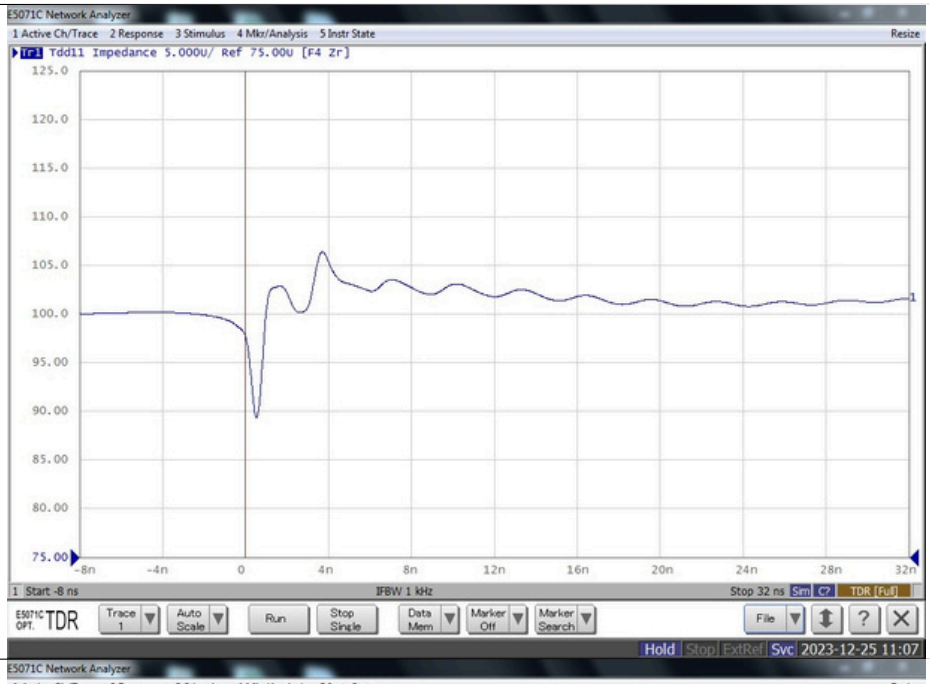
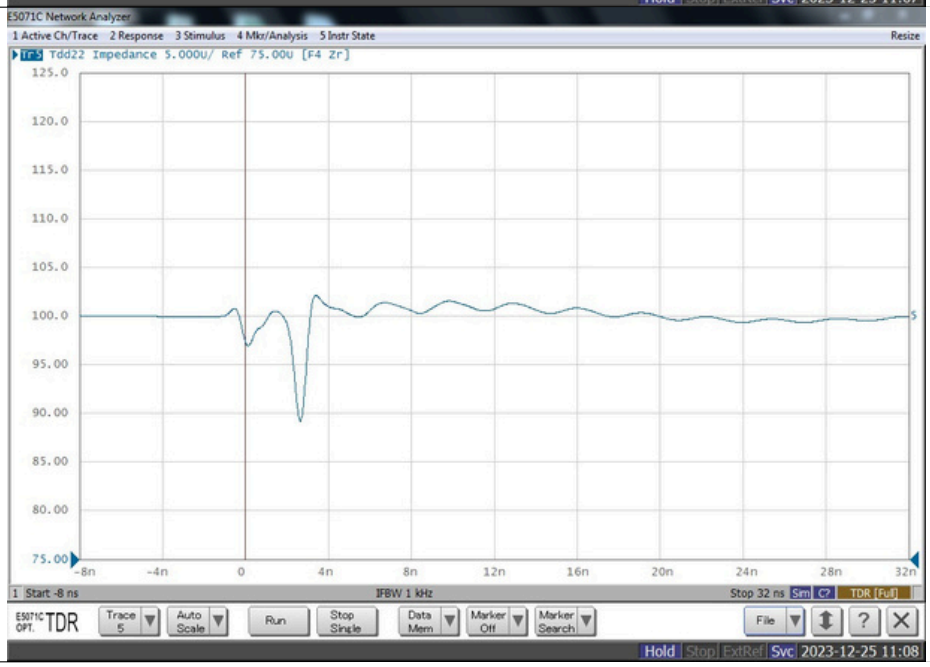
D+/D- Pair Differential Impedance (CON'D):

Test Result:

	S4
TDD11	
TDD22	

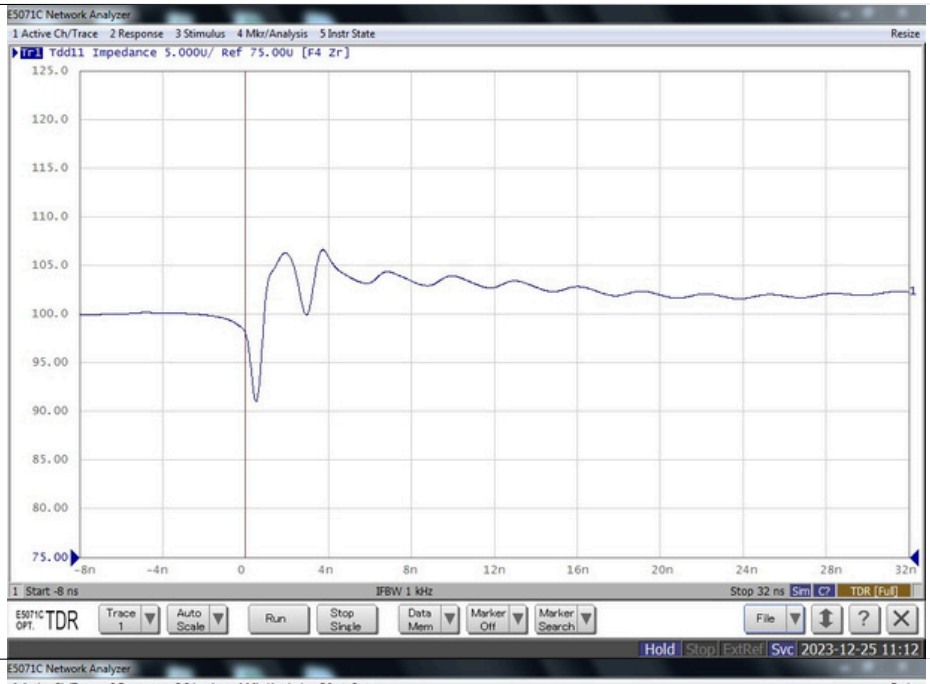
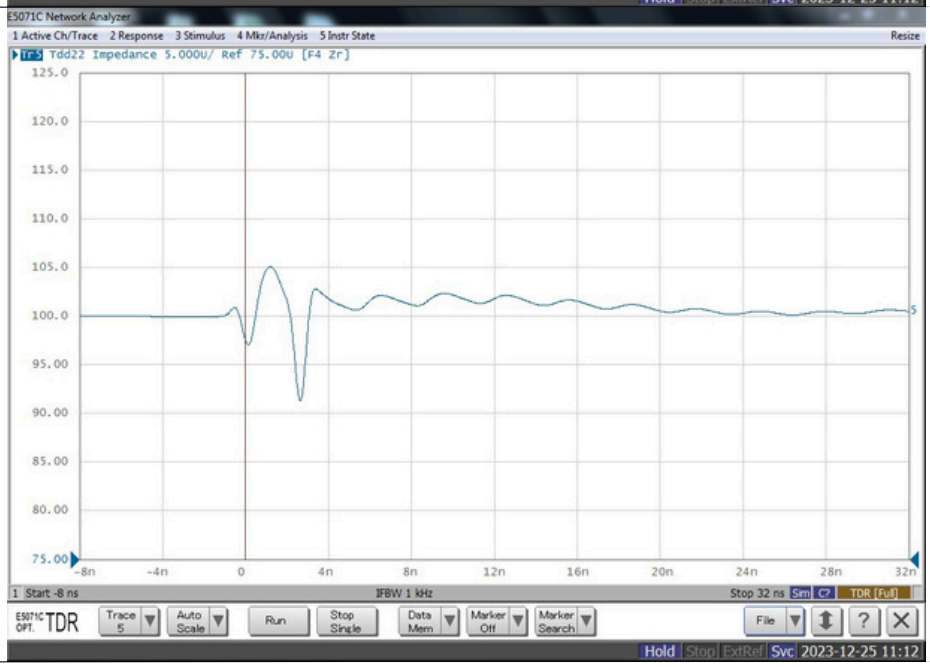
D+/D- Pair Differential Impedance (CON'D):

Test Result (CON'D):

	S5
TDD11	
TDD22	

D+/D- Pair Differential Impedance (CON'D):

Test Result (CON'D):

	S6
TDD11	
TDD22	

D+/D- Pair Propagation Delay:

Sample Card No.:	**6767499**	Quantity:	3
Sample type:	Cable Assembly	Tested by:	Dylan Su
Ambient Temp.:	21.8 °C	Humidity:	42 % RH
Test date:	2023-12-25		

Test Procedure:

1. The D+/D- pair propagation delay are measured typically with a TDT. The 1X THRU in the calibration card should be used to calibrate the rise time to be 400 ps (20%-80%) at 50% voltage crossing entering the reference plane.
2. Connect the ENA port to appropriate DUT pins by the following table, I defined the Lightning connector as A-side and Std-A connector as B-side.

E5071C Port 1	Port 2	Port 3	Port 4			
Test Fixtures	A-side D+	A-side D-	B-side D+	B-side D-		

1. Measure the TDD21 and TDD12.
2. Use marker search function to find the delay time on 200mV and record this time as propagation delay.

Test Result:

Specimen number	D+/D- pair propagation delay, ns	
	TDD21	TDD12
S4	1.5763	1.5764
S5	1.579	1.5791
S6	1.5669	1.5666

D+/D- Intra-Pair Skew:

Sample Card No.:	***6767499***	*Quantity:*	*3*
Sample type:	*Cable Assembly*	*Tested by:*	*Dylan Su*
Ambient Temp.:	*21.8 °C*	*Humidity:*	*42 % RH*
Test date:	*2023-12-25*		

Test Procedure:

1. The D+/D- pair intra-pair skew are measured typically with a TDT. The 1X THRU in the calibration card should be used to calibrate the rise time to be 400 ps (20%-80%) at 50% voltage crossing entering the reference plane.

2. Connect the ENA port to appropriate DUT pins by the following table, I defined the Lightning connector as A-side and Std-A connector as B-side.

E5071C Port 1	*Port 2*	*Port 3*	*Port 4*		
Test Fixtures	*A-side D+*	*A-side D-*	*B-side D+*	*B-side D-*	

3. Use single ended mode to measure the T31, T13, T42 and T24.

4. Add an equation "S31-S32" on T31 and "S42-S41" on T42

5. Add an equation "S13-S14" on T13 and "S24-S23" on T24

6. Use marker search function to find the delay time on 100mV and record this time as intra-pair skew.

Test Result:

Specimen number	*D+/D- intra-pair skew, ps*	
	T31-T42	*T13-T24*
S4	*9.6107*	*5.2378*
S5	*2.2845*	*4.2239*
S6	*9.1434*	*1.0339*

D+ and D- DC Resistance:

Sample Card No.:	***6767499***	*Quantity:*	*3*
Sample type:	*Cable Assembly*	*Tested by:*	*Dylan Su*
Ambient Temp.:	*21.8 °C*	*Humidity:*	*42 % RH*
Test date:	*2023-12-25*		

Test Procedure:

1. Ohmmeter measurement from connector to connector of the D+ line and the D- line.

Test Result:

Specimen number	*D+ line resistance, Ω*	*D- line resistance, Ω*
S4	*0.9*	*0.9*
S5	*0.8*	*0.9*
S6	*0.9*	*0.8*

Error Rate Testing:

Sample Card No.:	***6767499***	*Quantity:*	*3*
Sample type:	*Cable Assembly*	*Tested by:*	*Dylan Su*
Ambient Temp.:	*23.8 °C*	*Humidity:*	*39.3 % RH*
Test date:	*2023-12-25*		

Test Procedure:

1. Connect the samples to the Data Out and Data In channel of Keysight Bert.

2. Use the error rate detector function of Keysight Bert to capture the error rate around 1 minute.

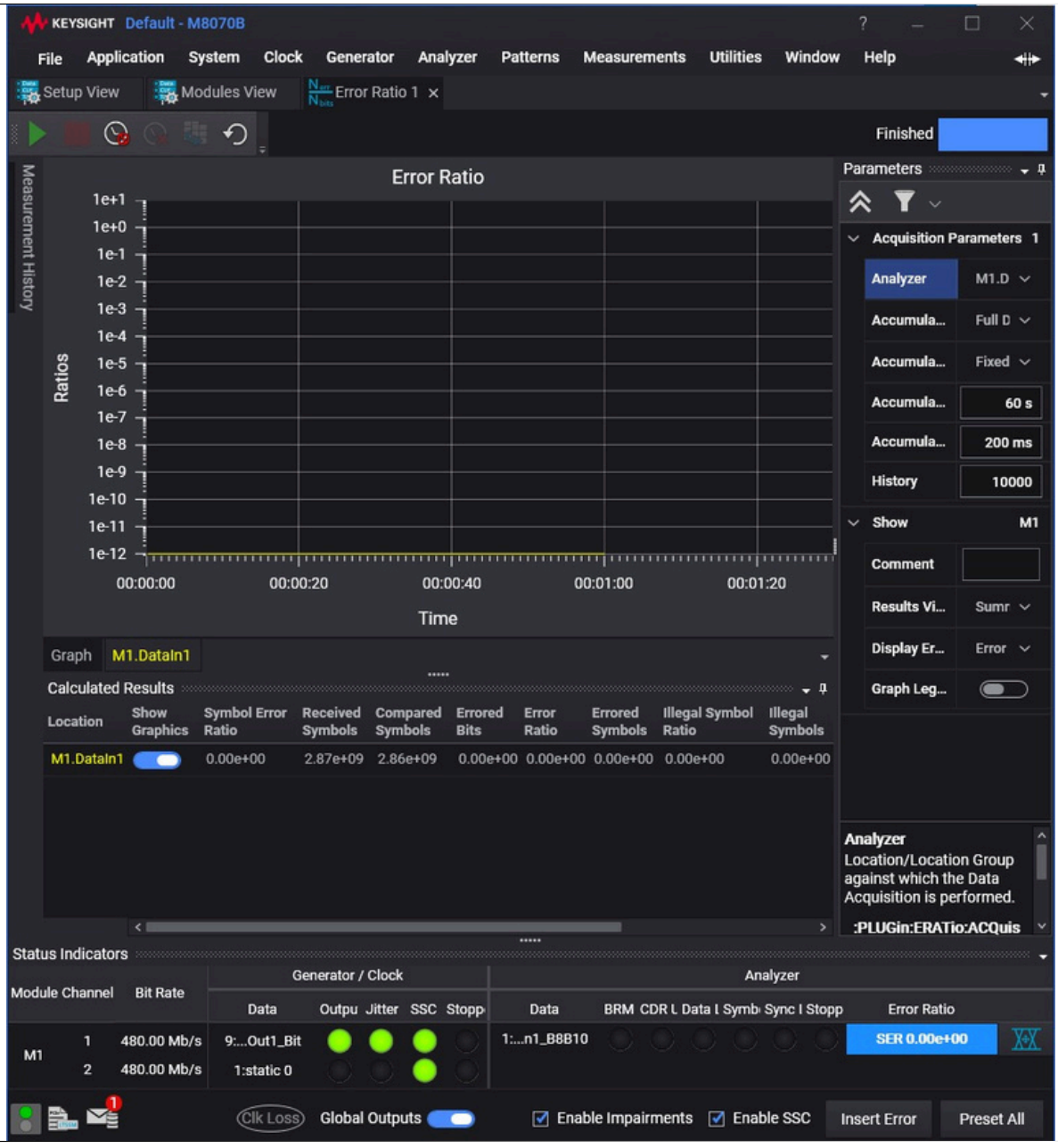
Test Result:

Specimen number	*Errored Bits*	*Errored Ratio*	*Errored Symbols*
S4	*0*	*0*	*0*
S5	*0*	*0*	*0*
S6	*0*	*0*	*0*

Error Rate Testing (CON'D):

Test Result (CON'D):

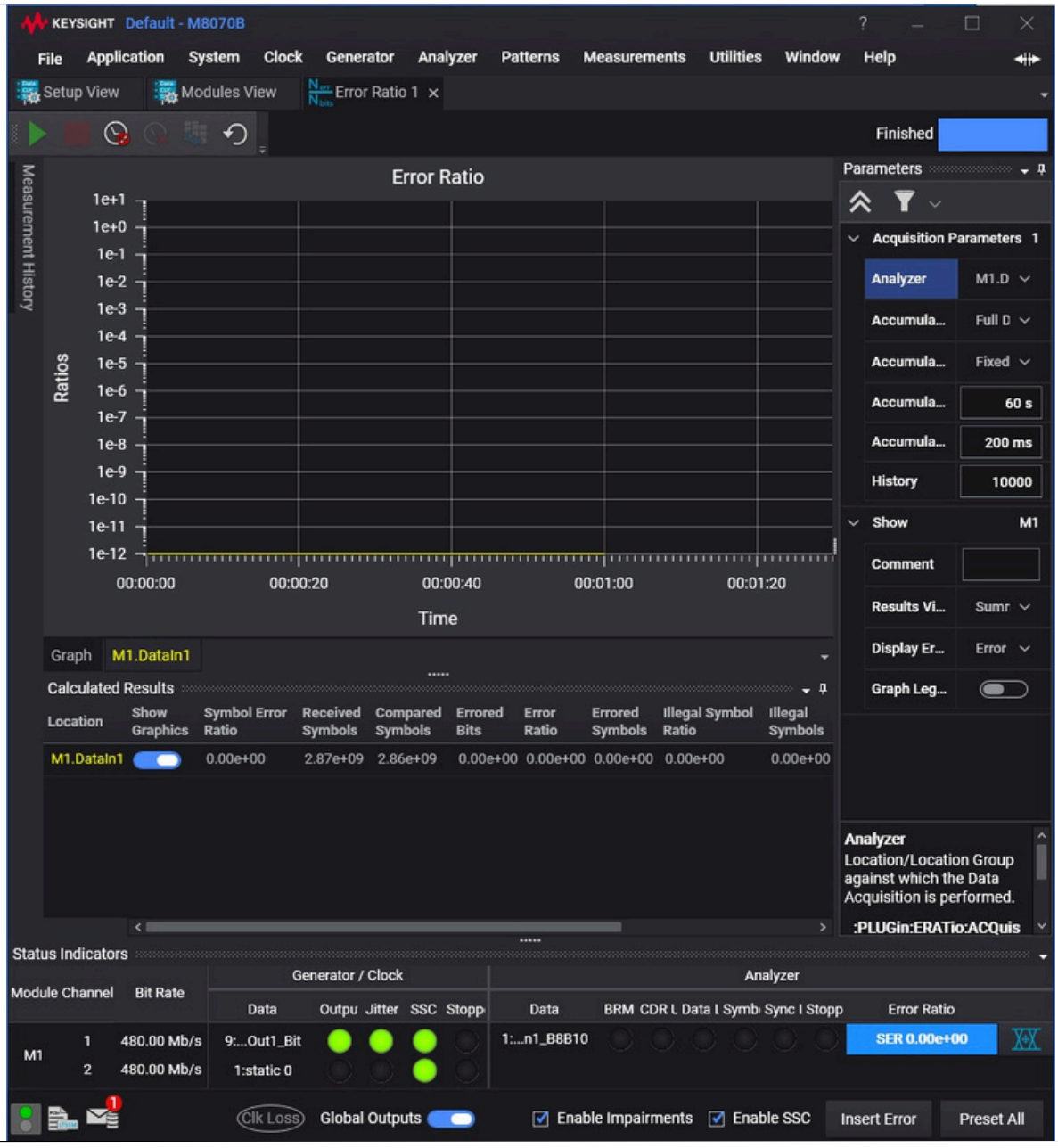
S4



Error Rate Testing (CON'D):

Test Result (CON'D):

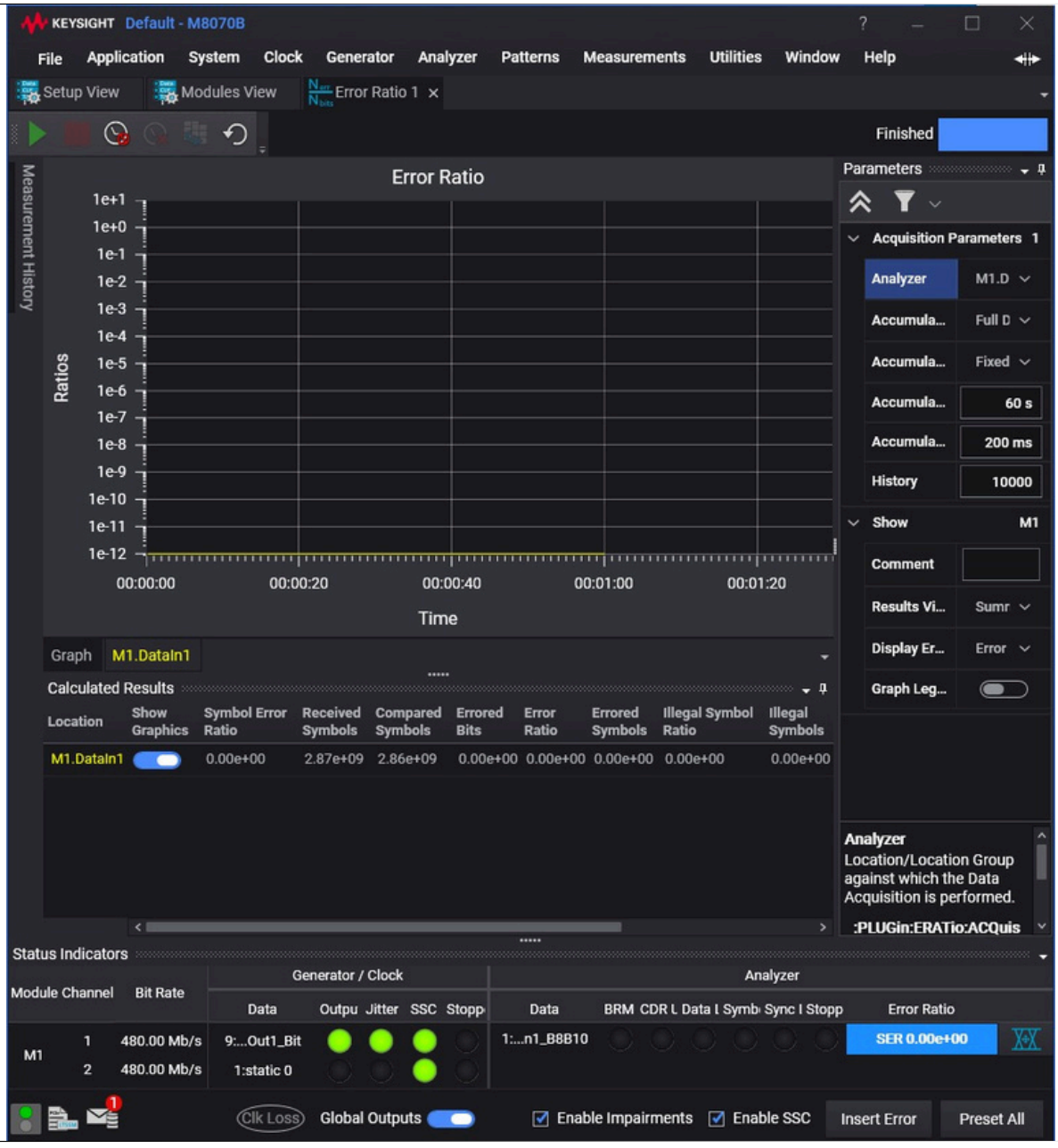
S5



Error Rate Testing (CON'D):

Test Result (CON'D):

S6



Compatibility Testing:

Sample Card No.:	***6767499***	*Quantity:*	*3*
Sample type:	*Cable Assembly*	*Tested by:*	*Dylan Su*
Ambient Temp.:	*21.6 °C*	*Humidity:*	*43.8 % RH*
Test date:	*2023-12-25*		

Test Procedure:

1. Connect the charger that bundled with iPhone X to iPhone X through cable samples. 2. Confirm cable samples work with the charger and iPhone X.

Test Result:

Specimen number	*Function*
S4	*Normal*
S5	*Normal*
S6	*Normal*