

Universal Serial Bus 4 Type-C Test Fixture Product Specification



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Product Name	Version	Date	Comments
USB4 Type-C Test Fixture Series	01	Aug.31,2020	Initial release
Partial amendment text	02	Sep.3,2020	Update
Partial amendment text	03	Sep.15,2020	Update

1. Introduction

This document describes the Dimension and electrical specification for Universal Serial Bus 4 Type-C Test Fixture. This product specification is compatible with: USB3.2 Passive Cable Test.

2. Objectives

This specification provides the requirements for Test Fixture performances and test methods of Universal Serial Bus 4 Type-C Test Fixture.

3. Method of operation & Cleaning

3-1. Handling

Before each use of the Test Fixture, ensure that all connectors are clean.

3-2. Visual Inspection

Be sure to inspect all Test Fixture carefully before making a connection. Inspect all Test Fixture for metal particles, scratches, deformed threads, dents, or bent, broken, or misaligned center conductors. Do not use damaged Test Fixture.

Cleaning method

If necessary, clean the connectors using low-pressure (less than 60 PSI) compressed air or nitrogen with an effective oil-vapor filter and condensation trap. Clean the cable threads, if necessary, using a lint-free swab or cleaning cloth moistened with isopropyl alcohol. Always completely dry a connector before use. Do not use abrasives to clean the connectors. Re- inspect connectors, making sure no particles or residue remains.

3-3. Precautions

Before making any connections, review the “Handling Precautions” section. Follow these guidelines when making connections:

- Align Test Fixture carefully
- Make preliminary connection lightly
- To tighten, turn connector nut only
- Do not apply bending force to Test Fixture
- Do not over-tighten preliminary connections
- Do not twist or screw-in Test Fixture
- Use an appropriately sized torque wrench (depends on SMA / K-Type gender), and do not tighten past the “break” point of the torque wrench (normally set to 5 in-lbs.)

3-4. Calibration Through De-Embedding

The USB Type-C Test Adapters are fully passive components. Therefore, calibration compensating for the losses must occur within the test instrumentation that drives the USB. Creating S2P files. These files will soon be available to de-embedding the electrical length and losses within the Test Fixture up to the USB4 Type-C connector interface pads.

TFU-49R38



Figure 3-1. USB4 Type C Receptacle
High Speed Test Fixture

TFU-59R18



Figure 3-2. USB4 Type C Receptacle
Low Speed Test Fixture

4. Electrical Specification

Test Item		Requirements		Description
01	Single End Impedance (SMA Side)	TFU-49R38	50± 3.5 Ohm	Rise Time : 40ps (20%~80%)
		TFU-59R18	50± 3.5 Ohm	
02	Single End Impedance (PCB Side)	TFU-49R38	50± 2.5 Ohm	Rise Time : 40ps (20%~80%)
		TFU-59R18	50± 3.5 Ohm	
03	Insertion Loss (Bandwidth)	TFU-49R38	-5dB > 20GHz	Frequency Range = 10M~20GHz Number of point =2000 IFBW = 1KHz
		TFU-59R18	-7dB > 20GHz	

4-1. Testing Equipment

Item	Product Model	Name	Manufacturer
01	E5071C-TDR	300KHz~20GHz ENA Network Analyzer	Keysight
02	N4433A	200KHz~20GHz Electronic Calibration Module	Keysight

5. Mechanical Specification

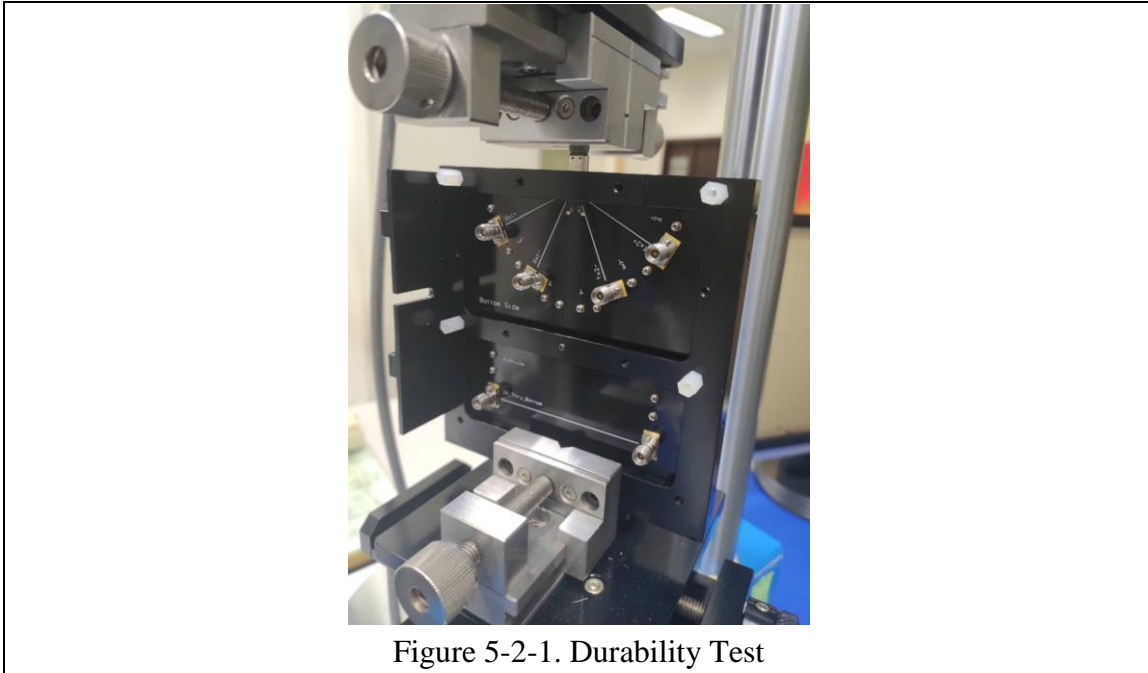
Test Item	Requirements		Description
Durability Test	TFU-49R38	NA	maximum rate of 200 cycles/hours
Differential Impedance	TFU-49R38	85± 9 Ohm	Rise Time : 40ps (20%~80%)
Insertion Loss	TFU-49R38	NA	Frequency Range = 10M~20GHz Number of point =2000 IFBW = 1KHz
	TFU-59R18		
Return Loss	TFU-49R38	NA	Frequency Range = 10M~20GHz Number of point =2000 IFBW = 1KHz
	TFU-59R18		

5-1. Testing Equipment

Item	Product Model	Name	Manufacturer
01	1220S	Auto Inserting Pulling Force (Tension, Compression) Tester	SE Testsystems
02	E5071C-TDR	300KHz~20GHz ENA Network Analyzer	Keysight
03	N4433A	200KHz~20GHz Electronic Calibration Module	Keysight

5-2. Test Conditions

5-2-1. Durability Test



5-2-2. Differential Impedance

1. Frequency Range = 10M~20GHz
2. Number of point =2000
3. IFBW = 1KHz

5-2-3. Insertion Loss

1. Frequency Range = 10M~20GHz
2. Number of point =2000
3. IFBW = 1KHz

5-2-4. Return Loss

1. Frequency Range = 10M~20GHz
2. Number of point =2000
3. IFBW = 1KHz

6. Testing Result

6-1. Single End (K-Type Side) Impedance

6-1-1. USB4 Type-C Receptacle High Speed Test Fixture				
Pair Num	Maximum	Minimum	Unit	Figure
SS-TX1p	50.22	47.68	Ω	6-1
SS-TX1n	50.87	47.64		
SS-RX1p	50.22	48.52		
SS-RX1n	50.27	48.29		
SS-TX2p	50.25	48.01		
SS-TX2n	50.41	48.54		
SS-RX2p	50.51	47.76		
SS-RX2n	50.46	47.56		
Dp	50.21	47.53		
Dn	50.26	47.54		
6-1-2. USB4 Type-C Receptacle High Speed Bandwidth (2X Calibration)				
Pair Num	Test mode	Value	Unit	Figure
2X_Thru_Top	Single mode S31	-4.51	dB	6-2
2X_Thru_Bottom	Single mode S31	-4.51		

6-2. Single End (SMA Side) Impedance

6-2-1. USB4 Type-C Receptacle Low Speed Test Fixture				
Pair Num	Maximum	Minimum	Unit	Figure
Dp	50.55	47.81	Ω	6-3
Dn	50.43	47.70		
SUB1	51.45	48.30		
SUB2	50.63	48.51		
CC1	50.45	47.74		
VBUS	51.18	48.59		
6-2-1. USB4 Type-C Receptacle Low Speed Bandwidth (2X Calibration)				
Pair Num	Test mode	Value	Unit	Figure
2X_Thru_Top	Single mode S31	-6.29	dB	6-4
2X_Thru_Bottom	Single mode S31	-6.35		

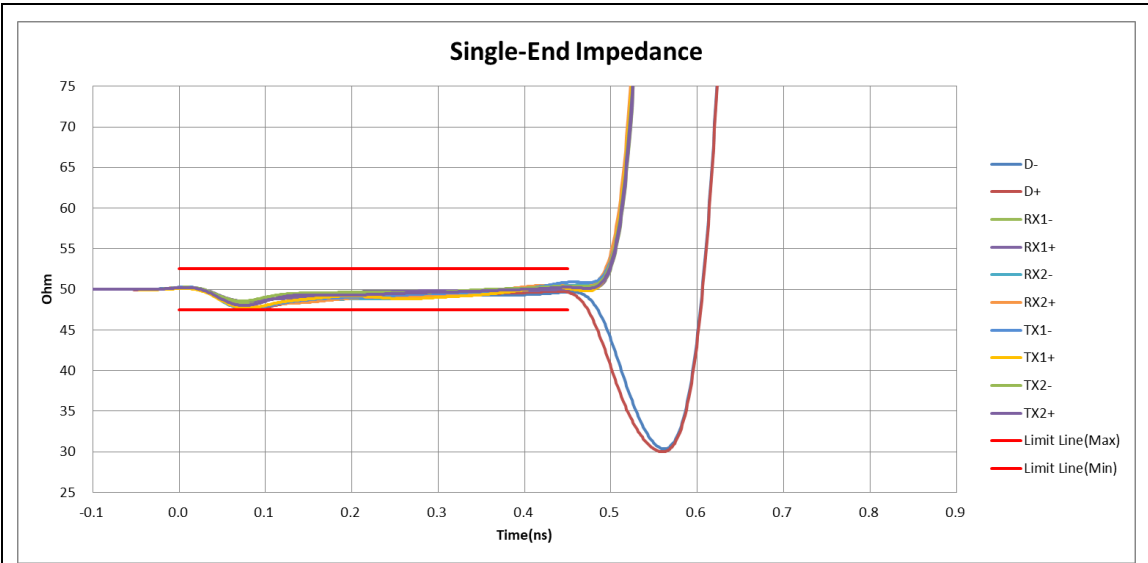


Figure 6-1. USB4 Type-C Receptacle High Speed Test Fixture Impedance



Figure 6-2. USB4 Type-C Receptacle High Speed Bandwidth (2X Calibration)

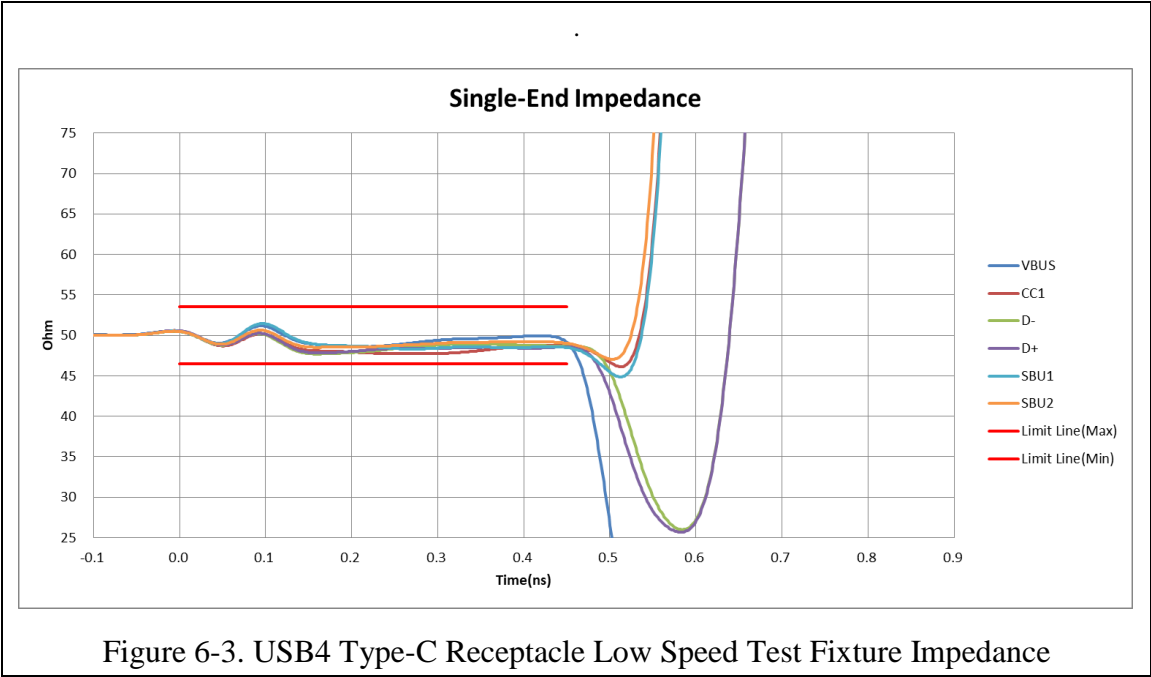


Figure 6-3. USB4 Type-C Receptacle Low Speed Test Fixture Impedance

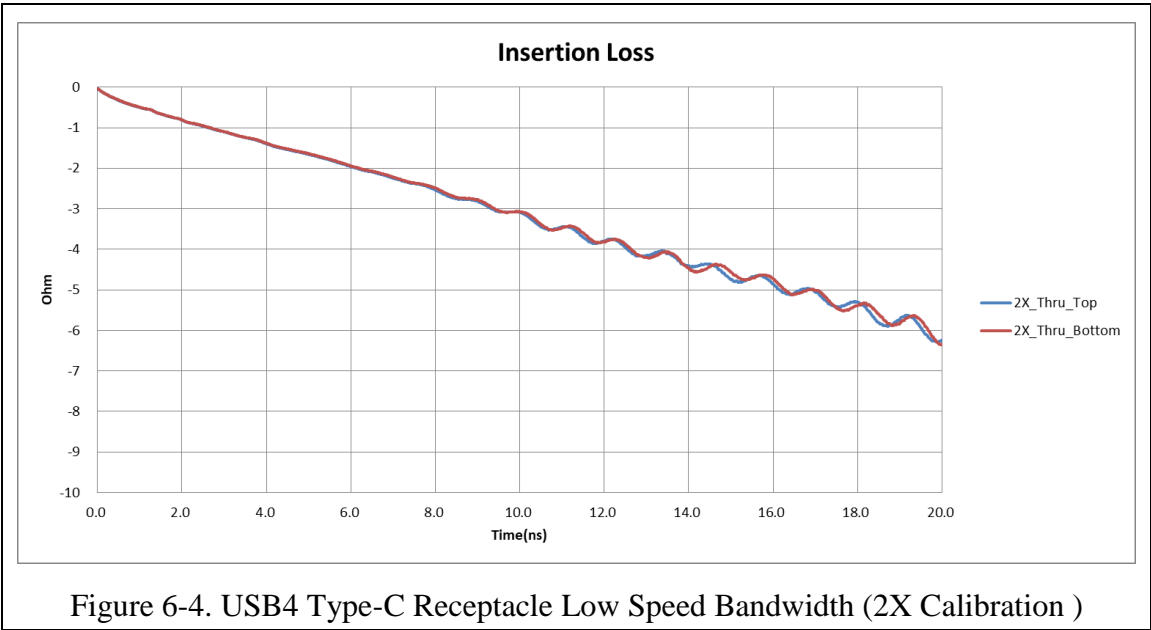
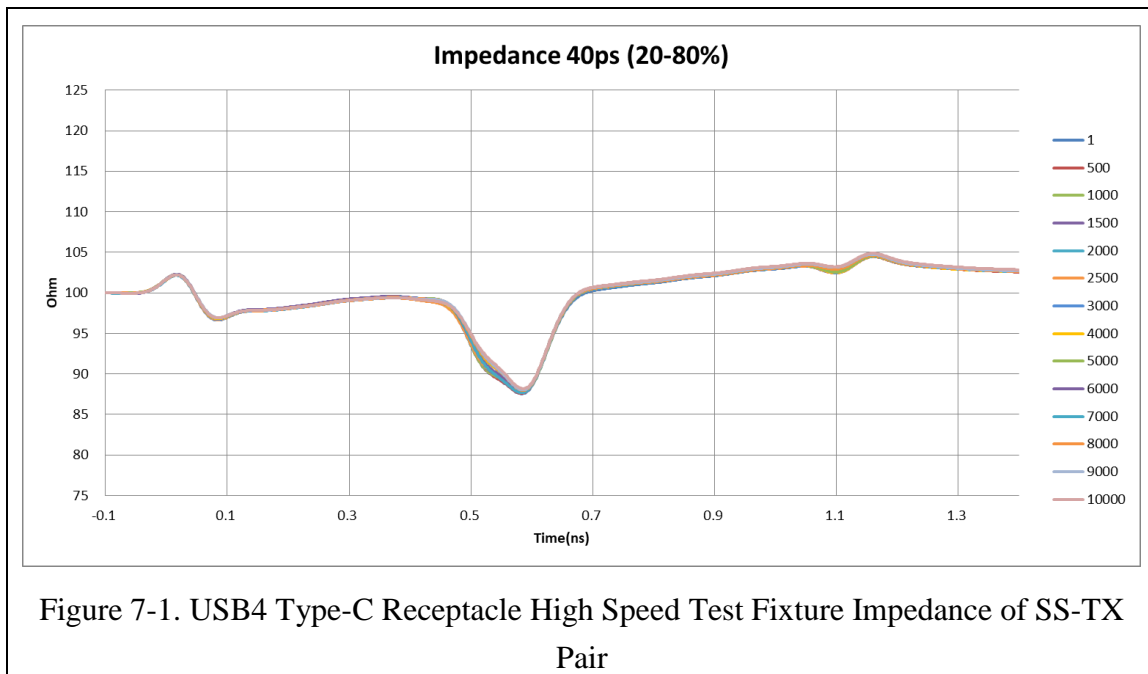


Figure 6-4. USB4 Type-C Receptacle Low Speed Bandwidth (2X Calibration)

7. Durability Test

7-1. Differential Impedance

Cycles	Minimum	Unit
1	87.57	Ω
500	87.62	
1000	87.86	
1500	87.80	
2000	87.92	
2500	87.87	
3000	87.96	
3500	88.00	
4000	87.89	
5000	87.90	
6000	87.68	
7000	87.98	
8000	88.03	
9000	88.18	
10000	87.57	



7-2. Insertion Loss



Figure 7-2. USB4 Type-C Receptacle High Speed Test Fixture Insertion Loss of SS-TX Pair

7-3. Return Loss

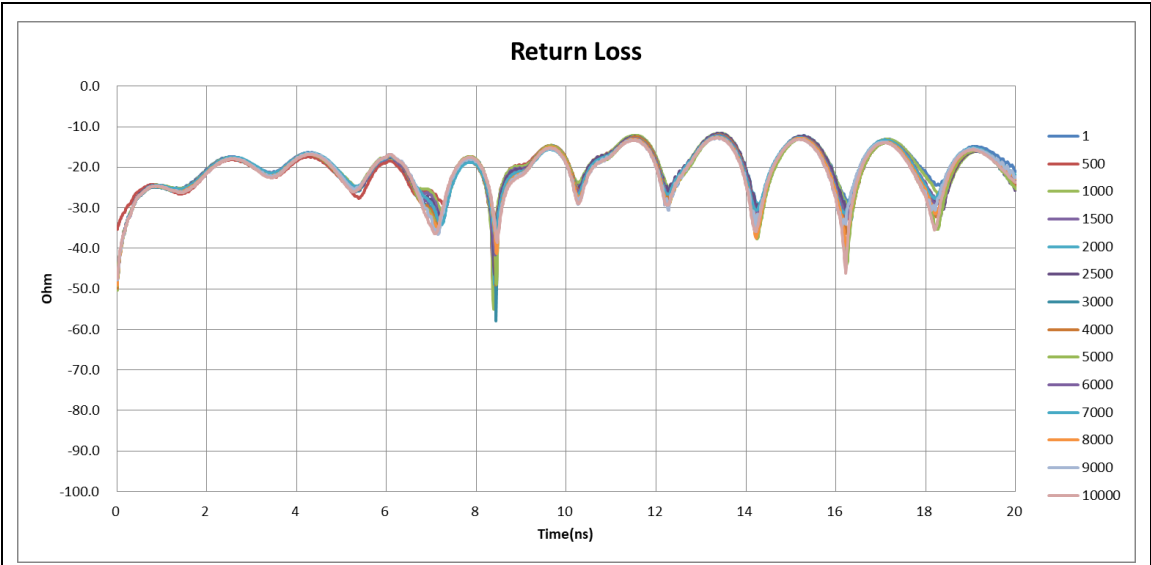


Figure 7-3. USB4 Type-C Receptacle High Speed Test Fixture Return Loss of SS-TX Pair

8. Reference materials

8-1 USB-IF Compliance Document

https://www.usb.org/sites/default/files/USB%20Type-C_Compliance%20Document_rev_2_0_April_29_2020.pdf

8-2. Keysight Test MOI

TBD

8-3. ROHDE & SCHWARZ Test MOI

TBD

Universal Serial Bus 4 Type-C Test Fixture Product Specification



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1. 簡介

本文介紹 Universal Serial Bus4 Type-C Test Fixture 的機械規格與電氣規格，此產品可兼容 USB3.2 Passive Cable 測試。

2. 目的

本規範提供了 Universal Serial Bus4 Type-C Test Fixture 的特性規格與測試結果。

3. 操作方式&清潔

3-1. 處理

在每次使用測試治具之前，確保所有連接器都乾淨。

3-2. 目測檢查

在連接之前，一定要仔細檢查所有的測試治具。檢查所有測試治具是否有金屬顆粒，划痕，變形螺紋，凹痕或彎曲，斷裂或中心導體未對齊。不要使用損壞的測試治具。

清潔方法

如需清潔，請使用低壓（小於 60 PSI）的壓縮空氣或氮氣與有效的油氣過濾器
和冷凝器。如有需要清潔內部，使用沾有異丙醇的清潔布清潔測試治具。清
潔後請確認連接器是否為乾燥狀態。請勿使用研磨劑清潔連接器。使用前確保連
接器內無殘留物。

3-3. 注意事項

在進行任何連接之前，請查看“注意事項”部分。連接時請遵循以下準則：

- 仔細對齊測試治具
- 輕微進行初步連接
- 確認 SMA/ K-Type 接頭對鎖狀態
- 不要對測試治具施加彎曲力
- 請勿使用磅數過高之扭力扳手(5 in-lbs 上)
- 測試治具端請勿旋轉或扭動
- 使用適當尺寸的扭矩扳手(取決於 SMA / K-Type 的規格), 並且不要擰過扭矩扳手的“斷開”點（通常設置為 5 in-lbs）。

3-4. 校正

USB4 Type-C 測試適配器是完全無源組件。因此，校準在驅動 USB 的測試
儀器中必須補償損失。創建 S2P 文件。這些文件將很快用於將測試夾具內的電氣
長度和損耗去除到 Type-C 連接器接口焊盤。

TFU-49R38



Figure 3-1. USB4 Type C Receptacle
High Speed Test Fixture

TFU-59R18



Figure 3-2. USB4 Type C Receptacle
Low Speed Test Fixture

4. 電氣規格

Test Item		Requirements		Description
01	Single End Impedance (SMA Side)	TFU-49R38	50± 3.5 Ohm	Rise Time : 40ps (20%~80%)
		TFU-59R18	50± 3.5 Ohm	
02	Single End Impedance (PCB Side)	TFU-49R38	50± 2.5 Ohm	Rise Time : 40ps (20%~80%)
		TFU-59R18	50± 3.5 Ohm	
03	Insertion Loss (Bandwidth)	TFU-49R38	-5dB > 20GHz	Frequency Range = 10M~20GHz Number of point =2000 IFBW = 1KHz
		TFU-59R18	-7dB > 20GHz	

4-1. 測試設備

Item	Product Model	Name	Manufacturer
01	E5071C-TDR	300KHz~20GHz ENA Network Analyzer	Keysight
02	N4433A	200KHz~20GHz Electronic Calibration Module	Keysight

5. 機械規格

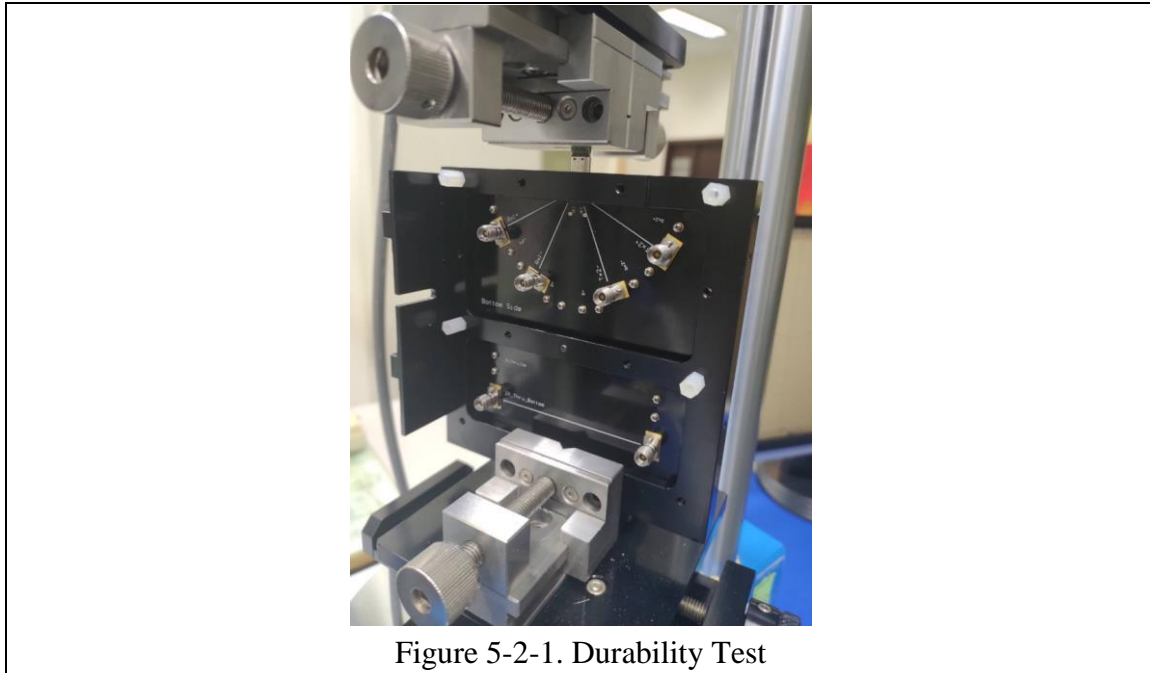
Test Item	Requirements		Description
Durability Test	TFU-23R2R	NA	maximum rate of 200 cycles/hours
Differential Impedance	TFU-23R2R	90± 9 Ohm	Rise Time : 40ps (20%~80%)
Insertion Loss	TFU-23C4R	NA	Frequency Range = 10M~20GHz Number of point =2000 IFBW = 1KHz
Return Loss	TFU-23R2R	NA	Frequency Range = 10M~20GHz Number of point =2000 IFBW = 1KHz

5-1. 測試設備

Item	Product Model	Name	Manufacturer
01	1220S	Auto Inserting Pulling Force (Tension, Compression) Tester	SE Testsystems
02	E5071C-TDR	300KHz~20GHz ENA Network Analyzer	Keysight
03	N4433A	200KHz~20GHz Electronic Calibration Module	Keysight

5-2. 校正

5-2-1. Durability Test



5-2-2. Differential Impedance

1. Frequency Range = 10M~20GHz
2. Number of point =2000
3. IFBW = 1KHz

5-2-3. Insertion Loss

1. Frequency Range = 10M~20GHz
2. Number of point =2000
3. IFBW = 1KHz

5-2-4. Return Loss

1. Frequency Range = 10M~20GHz
2. Number of point =2000
3. IFBW = 1KHz

6. 測試條件

6-1. Single End (K-Type Side) Impedance

6-1-1. USB4 Type-C Receptacle High Speed Test Fixture				
Pair Num	Maximum	Minimum	Unit	Figure
SS-TX1p	50.22	47.68	Ω	6-1
SS-TX1n	50.87	47.64		
SS-RX1p	50.22	48.52		
SS-RX1n	50.27	48.29		
SS-TX2p	50.25	48.01		
SS-TX2n	50.41	48.54		
SS-RX2p	50.51	47.76		
SS-RX2n	50.46	47.56		
Dp	50.21	47.53		
Dn	50.26	47.54		
6-1-2. USB4 Type-C Receptacle High Speed Bandwidth (2X Calibration)				
Pair Num	Test mode	Value	Unit	Figure
2X_Thru_Top	Single mode S31	-4.51	dB	6-2
2X_Thru_Bottom	Single mode S31	-4.51		

6-2. Single End (SMA Side) Impedance

6-2-1. USB4 Type-C Receptacle Low Speed Test Fixture				
Pair Num	Maximum	Minimum	Unit	Figure
Dp	50.55	47.81	Ω	6-3
Dn	50.43	47.70		
SUB1	51.45	48.30		
SUB2	50.63	48.51		
CC1	50.45	47.74		
VBUS	51.18	48.59		
6-2-1. USB4 Type-C Receptacle Low Speed Bandwidth (2X Calibration)				
Pair Num	Test mode	Value	Unit	Figure
2X_Thru_Top	Single mode S31	-6.29	dB	6-4
2X_Thru_Bottom	Single mode S31	-6.35		

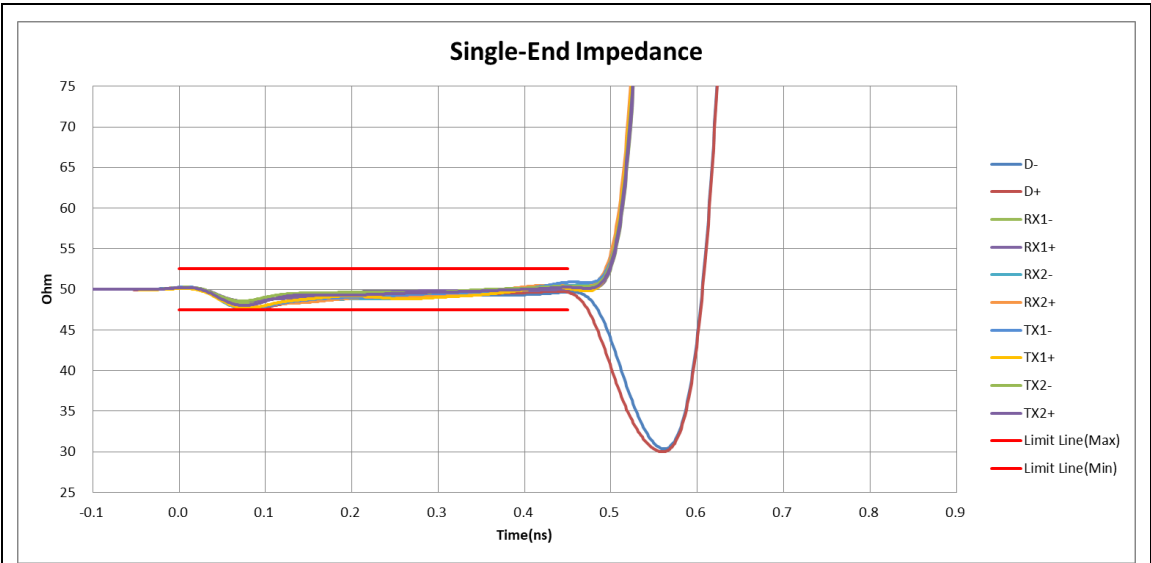


Figure 6-1. USB4 Type-C Receptacle High Speed Test Fixture Impedance

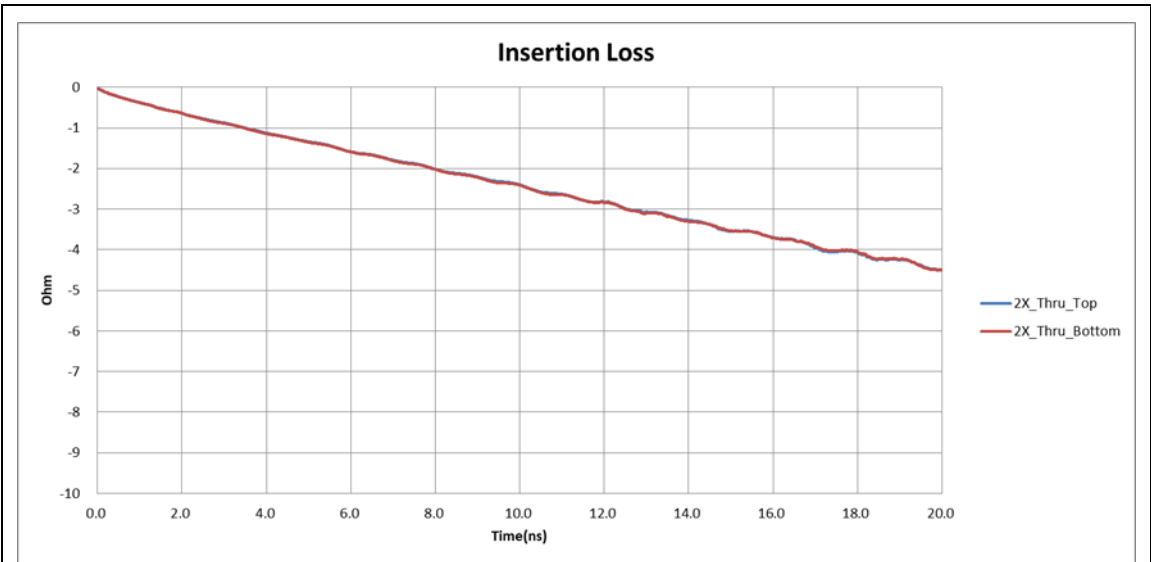


Figure 6-2. USB4 Type-C Receptacle High Speed Test Fixture 2X Calibration Impedance

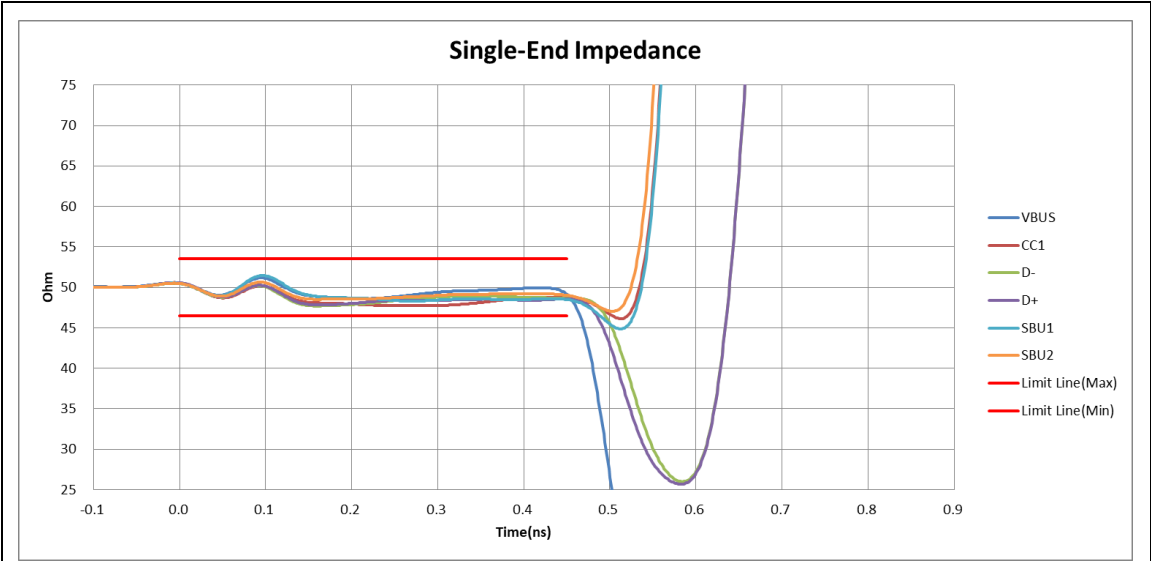


Figure 6-3. USB4 Type-C Receptacle Low Speed Test Fixture Impedance

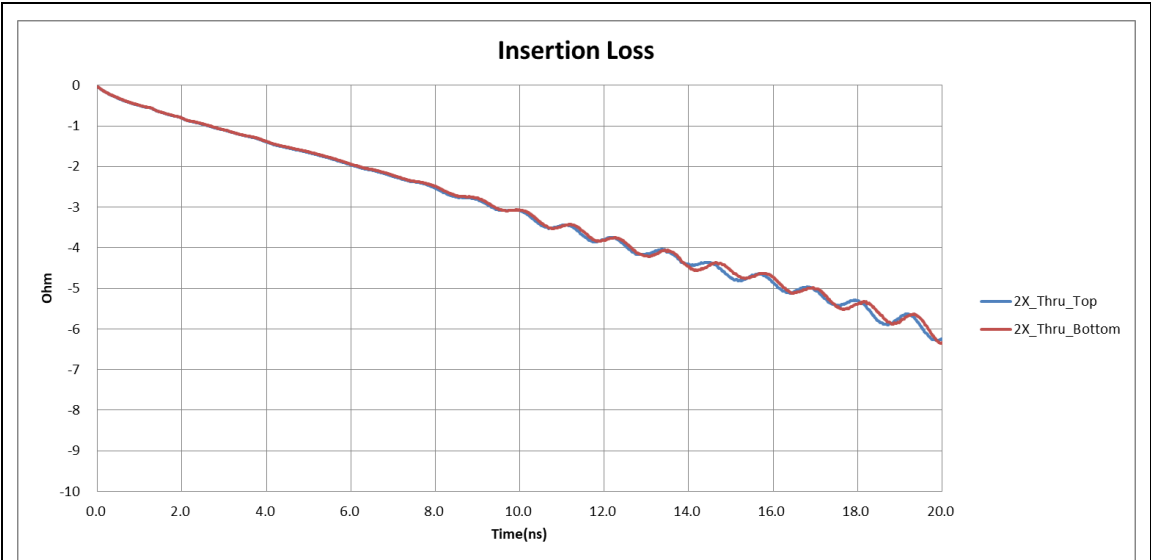
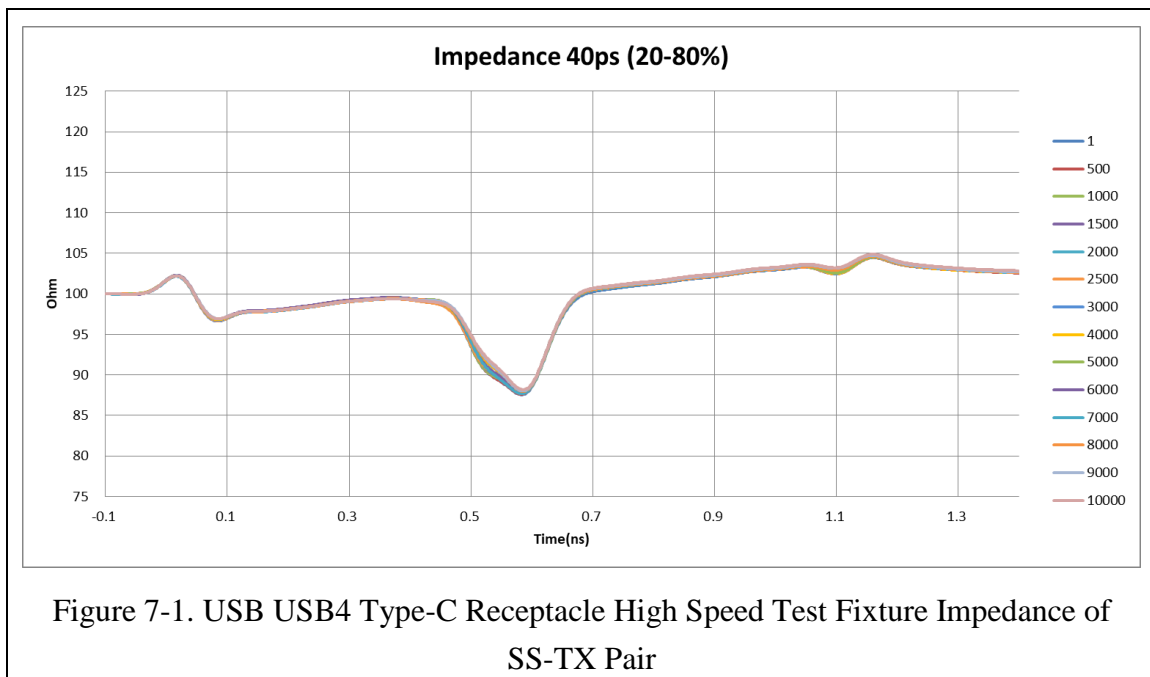


Figure 6-4. USB4 Type-C Receptacle Low Speed Test Fixture 2X Calibration Impedance

耐久性試驗

7-1. Differential Impedance

Cycles	Minimum	Unit
1	87.57	Ω
500	87.62	
1000	87.86	
1500	87.80	
2000	87.92	
2500	87.87	
3000	87.96	
3500	88.00	
4000	87.89	
5000	87.90	
6000	87.68	
7000	87.98	
8000	88.03	
9000	88.18	
10000	87.57	



7-2. Insertion Loss



Figure 7-2. USB USB4 Type-C Receptacle High Speed Test Fixture Insertion Loss of SS-TX Pair

7-3. Return Loss

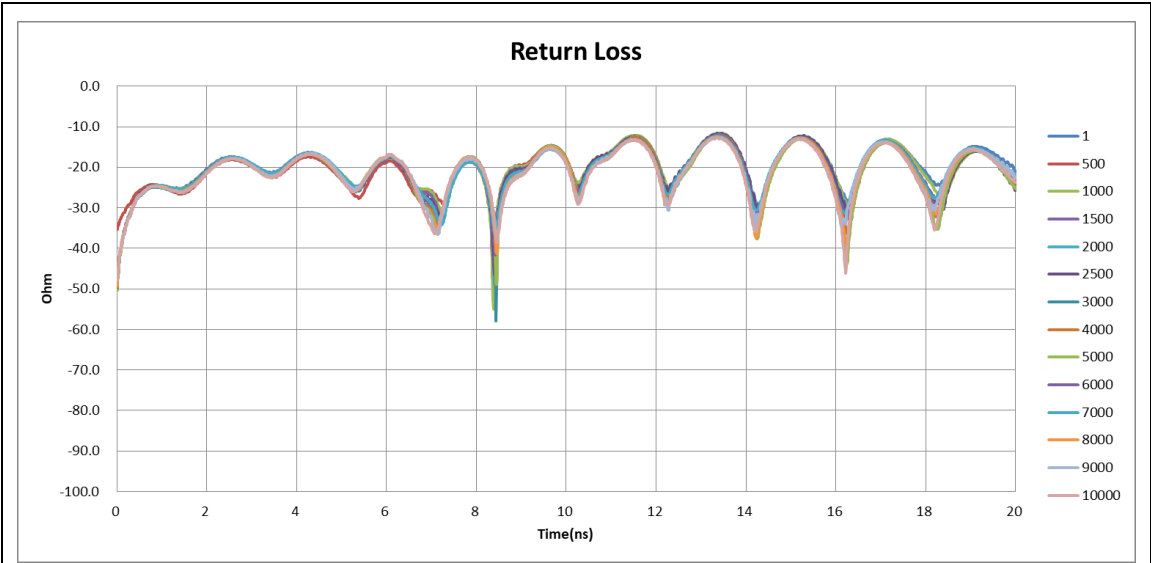


Figure 7-3. USB USB4 Type-C Receptacle High Speed Test Fixture Return Loss of SS-TX Pair

8. 參考資料

8-1 USB-IF Compliance Document

[https://www.usb.org/sites/default/files/USB%20Type-C_Compliance%20Document_r
ev_2_0_April_29_2020.pdf](https://www.usb.org/sites/default/files/USB%20Type-C_Compliance%20Document_rev_2_0_April_29_2020.pdf)

8-2. MOI

TBD