



BF7264B+ MIPI M-PHY UFS2.1
方案說明

目錄

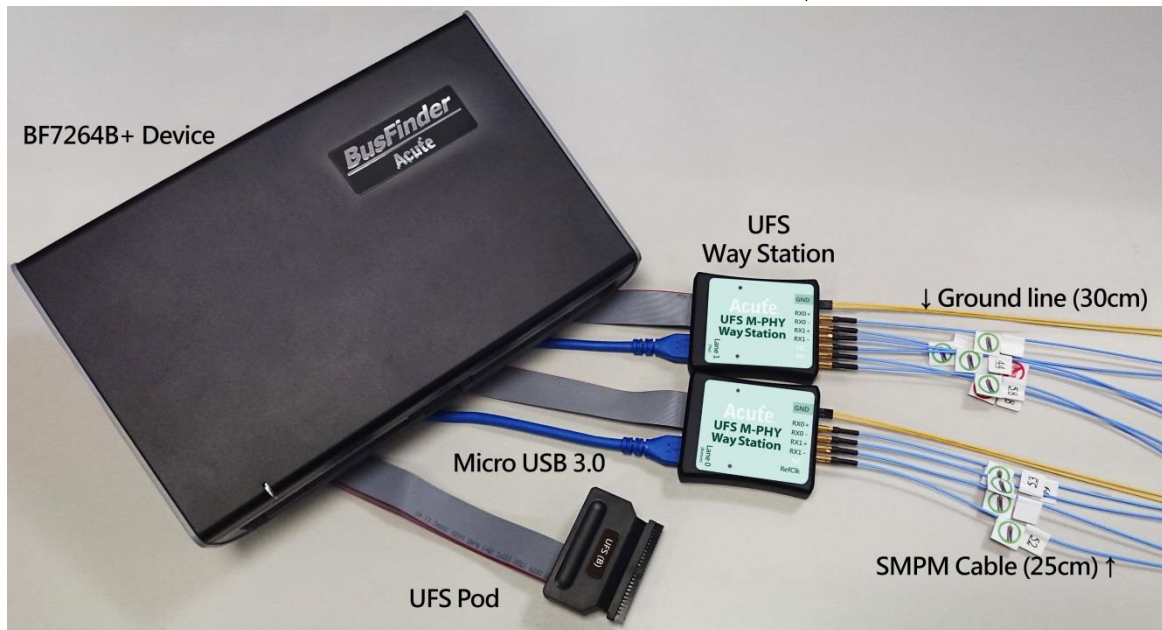
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概況

此方案僅於 BF7264B+產品適用，除主機可繼續使用原 BF6264B 及 BF7264B 功能外，增加 MIPI M-PHY UFS2.1 分析儀功能(可解析 UFS3.1 命令組)。

MIPI M-PHY UFS2.1 方案，規格內容如下：

1. BF7264B+，32Gb RAM，搭配 MIPI M-PHY UFS2.1 探棒組



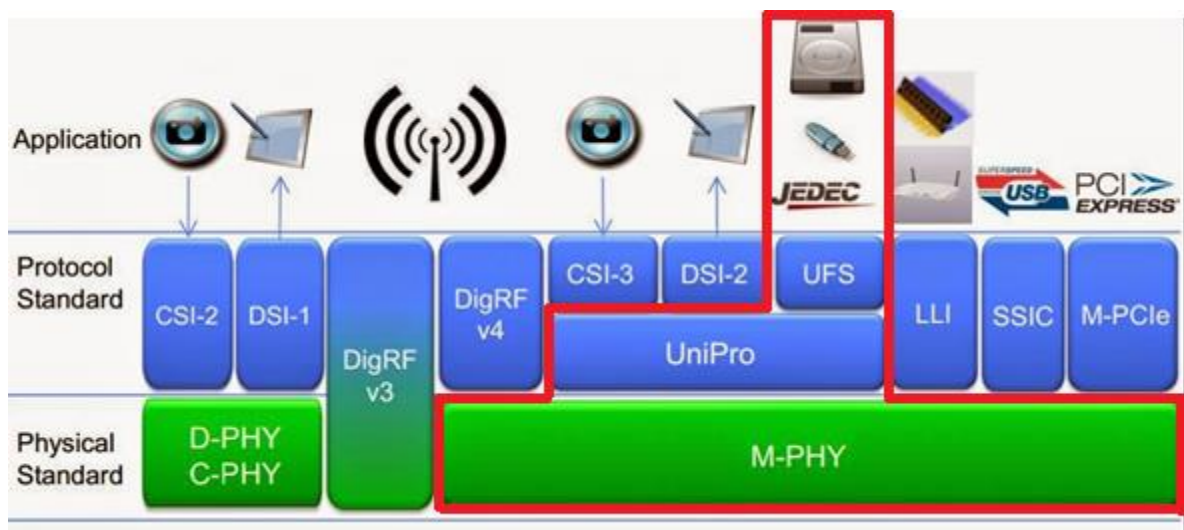
2. 完整支援 MIPI M-PHY UFS2.1 以及支援 UFS3.1 命令

MIPI M-PHY 3.0, Up to 5.8Gbps, 2 Lanes

MIPI Unipro 1.8

JEDEC UFS 2.1 Gear 3, Rate A / B

JEDEC UFS 3.1 commands



3. 可同時顯示 Unipro 及 UFS 協定封包資料以表格方式呈現，包含指令解析

The screenshot displays three main components of the Acute software interface:

- Unipro Table (Left):** A table showing Unipro protocol data with columns for time, host, device, and sequence number. It lists various events such as 'Start of Burst', 'Data Frame TCO', and 'EOF EVEN'.
- UFS Table (Middle):** A table showing UFS protocol data with columns for time, host, device, and sequence number. It lists various events such as 'QREQ (READ FLAG)', 'QRESP (READ FLAG)', and 'CMD (TEST UNIT READY)'.
- Detail Window (Right):** A detailed view of a command, specifically 'CMD (START STOP UNIT)'. It shows the command structure with fields like 'Transaction Code', 'Sense Data', 'LUN', and 'Task Tag'. Below the structure, it provides a bit-level breakdown of the command fields, such as 'R Flag Bit= 0', 'S/W Flag Bit= 0', and 'LUN= 208'.

Unipro

UFS

Detail

4. 使用 32Gb RAM 搭配硬碟串流來儲存 Unipro, UFS 通訊資料，可完整節錄待測物從 Low Power Mode 初始化到 High Speed Mode 的流程
5. 提供 Data Filter 功能，可將不必要的資料濾除以節省記憶體
6. 提供 Search 資料功能
7. 提供 CRC Packet 計算及錯誤顯示
8. Unipro, UFS 命令統計功能，包含封包總數、各類別指令數量以及錯誤數量統計

The image shows two screenshots of software statistics windows. The top-left window displays Unipro statistics, and the top-right window displays UFS statistics. The bottom-left window shows a detailed view of SOF statistics, and the bottom-right window shows a detailed view of command statistics.

統計	Txns	Bytes
Unipro	4856976	
L2	437601	
SOF	437601	
AFC TC0	3981770	
AFC TC1	8	
NAC	0	
COF TC0	0	
EOF EVEN	437597	
EOF ODD	0	
L1.5	2530	
L1	213	
HIBERN8	5	
STALL	2	
SLEEP	3	
LINE RESET	4	
LINE CONFIG	0	
PREPARE	199	
Error Packets	118	

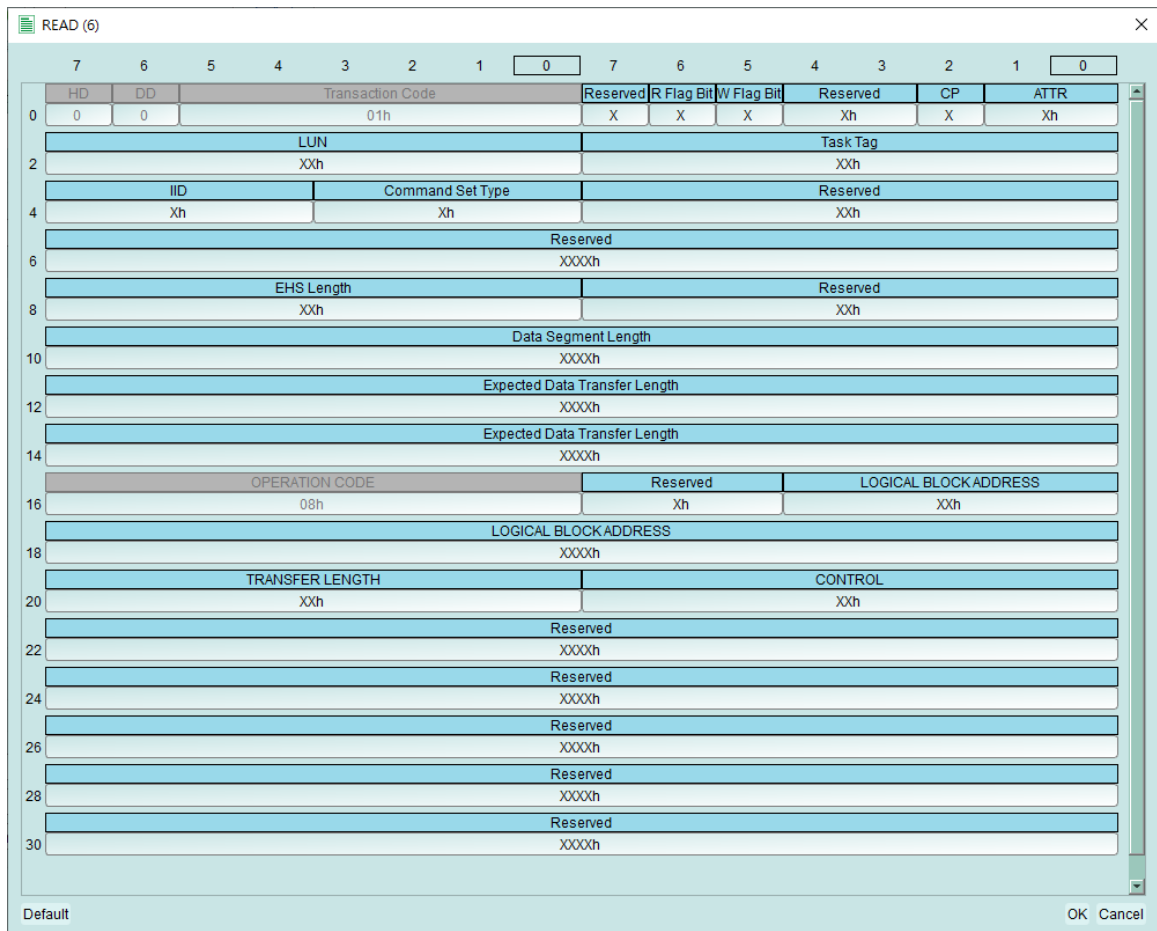
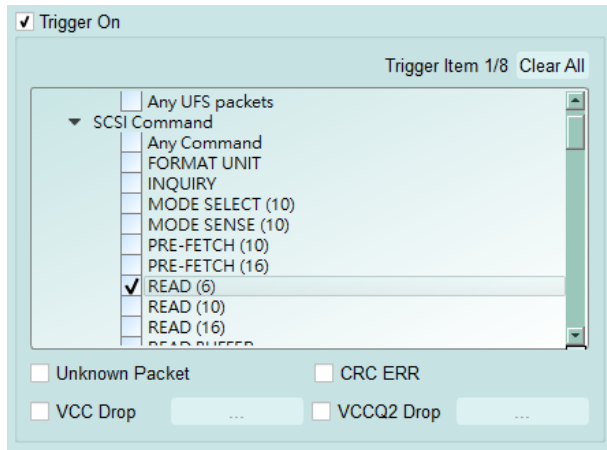
統計	Txns	Bytes
UFS		
SCSI Command	283	
UFS Protocol	27373	
QUERY REQUEST	56	
QUERY RESPONSE	56	
TASK MANAGEM...	0	
RESERVED		

統計	Txns	Bytes
SOF	437601	
Host	342	
Device	437259	

統計	Txns
NOP OUT	3
NOP IN	3
RESPONSE	282
READ(10) DATA(DATA IN)	27049
REQUEST SENSE RESPONSE(DATA IN)	15
INQUIRY RESPONSE(DATA IN)	2
Unknwon	19

9. Unipro, UFS 命令觸發功能

- 觸發參數包含命令與參數資料可依據不同種類封包填入數值,
- 涵蓋所有 Unipro, UFS Packet,
- 可觸發 CRC Error, Unknown packet
- 可觸發 VCC drop, VCCQ2 drop
- 可透過 Trigger-Out 接孔同步觸發外部的示波器



10. 報告區進階使用方法

- a. **雙報告關聯:** Unipro 與 UFS 報告互相關聯，雙擊可追蹤另一報告區對應資料。
ex: 點擊 Unipro 區報告，可關聯至 UFS 對應報告。

Timestamp (h:m:s.ms.us.ns dur)	Host	Device	Timestamp	Host	Device	Task	Tag	Data
1280	16:15:03.796.342.673 13.33.	Filler(2x)	2					
1281	16:15:03.796.342.703 29.99.	AFC TCO CReq=0	3	16:15:03.783.717.515 0 (Ma...	NOP OUT		00	00 00 00 00
1282	16:15:03.796.342.729 26.66.	Filler(2x)	4	16:15:03.783.838.943 221.4...			00	20 00 00 00
1283	16:15:03.796.342.756 26.66.	AFC TCO CReq=0	5	16:15:03.792.935.487 8.95ms	CMD (TEST UNIT READY)		01	01 00 00 00
1284	16:15:03.796.342.783 26.66.	Filler(2x)	6	16:15:03.792.940.406 4.91us		RESPONSE	01	21 00 00 00
1285	16:15:03.796.342.813 29.99.	AFC TCO CReq=0	7	16:15:03.793.956.611 1.01ms	CMD (TEST UNIT READY)		02	01 00 00 00
1286	16:15:03.796.342.839 26.66.	AFC TCO CReq=0	8	16:15:03.793.960.981 4.36us		RESPONSE	02	21 00 00 00
1287	16:15:03.796.342.893 53.32.	AFC TCO CReq=0	9	16:15:03.793.985.555 24.57...	CMD (READ (10))		03	01 40 00 00
1288	16:15:03.796.342.906 13.33.	EOF EVEN	10	16:15:03.794.209.246 223.6...		DATA IN	03	22 00 00 00
1289	16:15:03.796.342.919 13.33.	AFC TCO CReq=0	11	16:15:03.794.238.410 29.16...		RESPONSE	03	21 00 00 00
1290	16:15:03.796.342.933 13.33.	Filler(6x)	12	16:15:03.794.310.372 71.96...	CMD (READ (10))		04	01 40 00 00
1291	16:15:03.796.342.976 43.32.	Filler(4x)	13	16:15:03.794.372.383 62.01...		DATA IN	04	22 00 00 00
1292	16:15:03.796.343.029 53.32.	AFC TCO CReq=0	14	16:15:03.794.401.543 29.16...		RESPONSE	04	21 00 00 00
1293	16:15:03.796.343.056 26.66.	Filler(2x)	15	16:15:03.796.251.568 1.05ms	CMD (READ (10))		05	01 40 00 00
1294	16:15:03.796.343.086 29.99.	AFC TCO CReq=0	16	16:15:03.796.313.495 61.92...		DATA IN	05	22 00 00 00
1295	16:15:03.796.343.112 26.66.	Filler(6x)	17	16:15:03.796.342.659 29.16...		RESPONSE	05	21 00 00 00
1296	16:15:03.796.343.306 193.3.	AFC TCO CReq=0	18	16:15:03.796.362.107 19.44...	CMD (READ (10))		06	01 40 00 00
1297	16:15:03.796.343.332 26.66.	Filler(2x)	19	16:15:03.796.424.391 62.28...		DATA IN	06	22 00 00 00
1298	16:15:03.796.343.359 26.66.	AFC TCO CReq=0	20	16:15:03.796.453.551 29.16...		RESPONSE	06	21 00 00 00
1299	16:15:03.796.343.386 26.66.	Filler(2x)	21	16:15:03.796.491.171 37.61...	CMD (READ (10))		07	01 40 00 00
1300	16:15:03.796.343.412 26.66.	AFC TCO CReq=0	22	16:15:03.796.553.098 61.92...		DATA IN	07	22 00 00 00
1301	16:15:03.796.343.442 29.99.	Filler(6x)	23	16:15:03.796.582.262 29.16...		RESPONSE	07	21 00 00 00
1302	16:15:03.796.362.107 18.66.	Data Frame TCO	24	16:15:03.796.592.558 10.29...	CMD (READ (10))		08	01 40 00 00
1303	16:15:03.796.362.354 246.6.	EOF EVEN	25	16:15:03.796.655.115 62.55...		DATA IN	08	22 00 00 00
1304	16:15:03.796.362.381 26.66.	Filler(4x)	26	16:15:03.796.684.275 29.16...		RESPONSE	08	21 00 00 00
1305	16:15:03.796.363.270 889.9.	AFC TCO CReq=0	27	16:15:03.797.375.309 691.0...	CMD (READ (10))		09	01 40 00 00
1306	16:15:03.796.363.324 53.32.	Filler(6x)	28	16:15:03.797.450.942 75.63...		DATA IN	09	22 00 00 00
1307	16:15:03.796.363.350 26.66.	AFC TCO CReq=0	29	16:15:03.797.480.105 29.16...		DATA IN	09	22 00 00 00
1308	16:15:03.796.363.407 56.66.	Filler(4x)	30	16:15:03.797.509.266 29.16...		DATA IN	09	22 00 00 00
1309	16:15:03.796.424.351 60.98.	Data Frame TCO	31	16:15:03.797.539.430 29.16...		DATA IN	09	22 00 00 00
1310	16:15:03.796.426.281 1.89us	EOF EVEN	32	16:15:03.797.567.593 29.16...		DATA IN	09	22 00 00 00
1311	16:15:03.796.426.307 26.66.	Data Frame TCO	33	16:15:03.797.596.754 29.16...		DATA IN	09	22 00 00 00
1312	16:15:03.796.426.681 373.2.	AFC TCO CReq=0	34	16:15:03.797.625.918 29.16...		DATA IN	09	22 00 00 00
1313	16:15:03.796.426.707 26.66.	Filler(2x)	35	16:15:03.797.655.081 29.16...		DATA IN	09	22 00 00 00
1314	16:15:03.796.426.734 26.66.	AFC TCO CReq=0	36	16:15:03.797.684.242 29.16...		DATA IN	09	22 00 00 00
1315	16:15:03.796.426.764 29.99.	Filler(2x)	37	16:15:03.797.713.405 29.16...		DATA IN	09	22 00 00 00
1316	16:15:03.796.426.791 26.66.	AFC TCO CReq=0	38	16:15:03.797.742.566 29.16...		DATA IN	09	22 00 00 00
1317	16:15:03.796.426.817 26.66.	Filler(2x)	39	16:15:03.797.771.730 29.16...		DATA IN	09	22 00 00 00
1318	16:15:03.796.426.844 26.66.	AFC TCO CReq=0	40	16:15:03.797.800.893 29.16...		DATA IN	09	22 00 00 00
1319	16:15:03.796.426.871 26.66.	AFC TCO CReq=0	41	16:15:03.797.830.054 29.16...		DATA IN	09	22 00 00 00
1320	16:15:03.796.426.927 56.66.	AFC TCO CReq=0	42	16:15:03.797.859.218 29.16...		DATA IN	09	22 00 00 00
1321	16:15:03.796.426.954 26.66.	AFC TCO CReq=0	43	16:15:03.797.888.381 29.16...		DATA IN	09	22 00 00 00
1322	16:15:03.796.427.011 56.66.	Filler(4x)	44	16:15:03.797.917.542 29.16...		DATA IN	09	22 00 00 00
1323	16:15:03.796.428.201 1.19us	EOF EVEN	45	16:15:03.797.946.705 29.16...		DATA IN	09	22 00 00 00

- b. **統計列表:** 以統計功能快速分類並可追蹤資料位置

開啟統計列表

LUN	Timestamp	Host	Device	LUN	Task Tag	Logical Block Addr	Transfer Length	Data
17	2.833.827.313 0			00	17	0000	01 40 00 17 00 00 00.	
275	2.841.782.943 7.95ms			00	1F	0000	02 40 00 1F 00 00 00.	
293	2.843.839.161 1.55ms			01	26	0000	01 40 01 26 00 00 00.	
311	2.844.730.048 1.39ms			02	2D	0000	01 40 02 2D 00 00 00.	
329	2.846.085.928 1.35ms			03	34	0000	01 40 03 34 00 00 00.	

Acute BusFinder (Ver:1.4.48)

File Capture Cursor

Connect Protocol Protocol Analyzer Hide Waveforms Run Search All Field 0 f1047 To bottom Window Save to text Stack DSO Tuning

Time/Lamp	Host	Device	Task	Tag	Data	Info
171	16:15:03.802.069.263 29.16.	DATA IN	12	22 00 80	12 00 00 00.	
172	16:15:03.802.097.427 29.16.	DATA IN	12	22 00 80	12 00 00 00.	
173	16:15:03.802.126.587 29.16.	DATA IN	12	22 00 80	12 00 00 00.	
174	16:15:03.802.155.751 29.16.	DATA IN	12	22 00 80	12 00 00 00.	
175	16:15:03.802.184.912 29.16.	DATA IN	12	22 00 80	12 00 00 00.	
176	16:15:03.802.214.075 29.16.	RESPONSE	12	21 00 80	12 00 00 00.	
177	16:15:03.802.223.738 9.66us	CMD (READ (10))	13	01 40 80	13 00 00 00.	
178	16:15:03.802.286.105 62.96.	DATA IN	13	22 00 80	13 00 00 00.	
179	16:15:03.802.348.366 36.16.	RESPONSE	13	22 00 80	13 00 00 00.	
180	16:15:03.802.389.394 74.12.	CMD (READ (10))	14	01 40 80	14 00 00 00.	
181	16:15:03.802.450.979 29.16.	DATA IN	14	22 00 80	14 00 00 00.	
182	16:15:03.802.480.979 29.16.	RESPONSE	14	22 00 80	14 00 00 00.	
183	16:15:03.802.514.842 33.66.	CMD (READ (10))	15	01 40 80	15 00 00 00.	
184	16:15:03.802.577.839 62.99.	DATA IN	15	22 00 80	15 00 00 00.	
185	16:15:03.802.607.003 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
186	16:15:03.802.636.163 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
187	16:15:03.802.665.327 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
188	16:15:03.802.694.491 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
189	16:15:03.802.723.651 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
190	16:15:03.802.752.813 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
191	16:15:03.802.781.975 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
192	16:15:03.802.811.139 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
193	16:15:03.802.840.303 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
194	16:15:03.802.869.463 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
195	16:15:03.802.898.627 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
196	16:15:03.802.927.791 29.16.	DATA IN	15	22 00 80	15 00 00 00.	
197	16:15:03.802.956.951 29.16.	DATA IN	15	22 00 80	15 00 00 00.	

Navigator

Description	Trans	Bytes
UFS		
SCSI Command	152	
UFS Protocol	797	
QUERY REQUEST	48	
TASK RESPONSE	48	
TASK MANAGEM...	9	
RESERVED		

Statistics	Trans	Bytes
TEST UNIT READY	10	
READ (10)	133	
REQUEST SENSE	7	
START STOP UNIT	1	
INQUIRY	1	

Detail Navigator Hide Items

Search List [UnPro] Trigger List Statistics List Bookmark List [UnPro] Search List [UFS] Bookmark List [UFS]

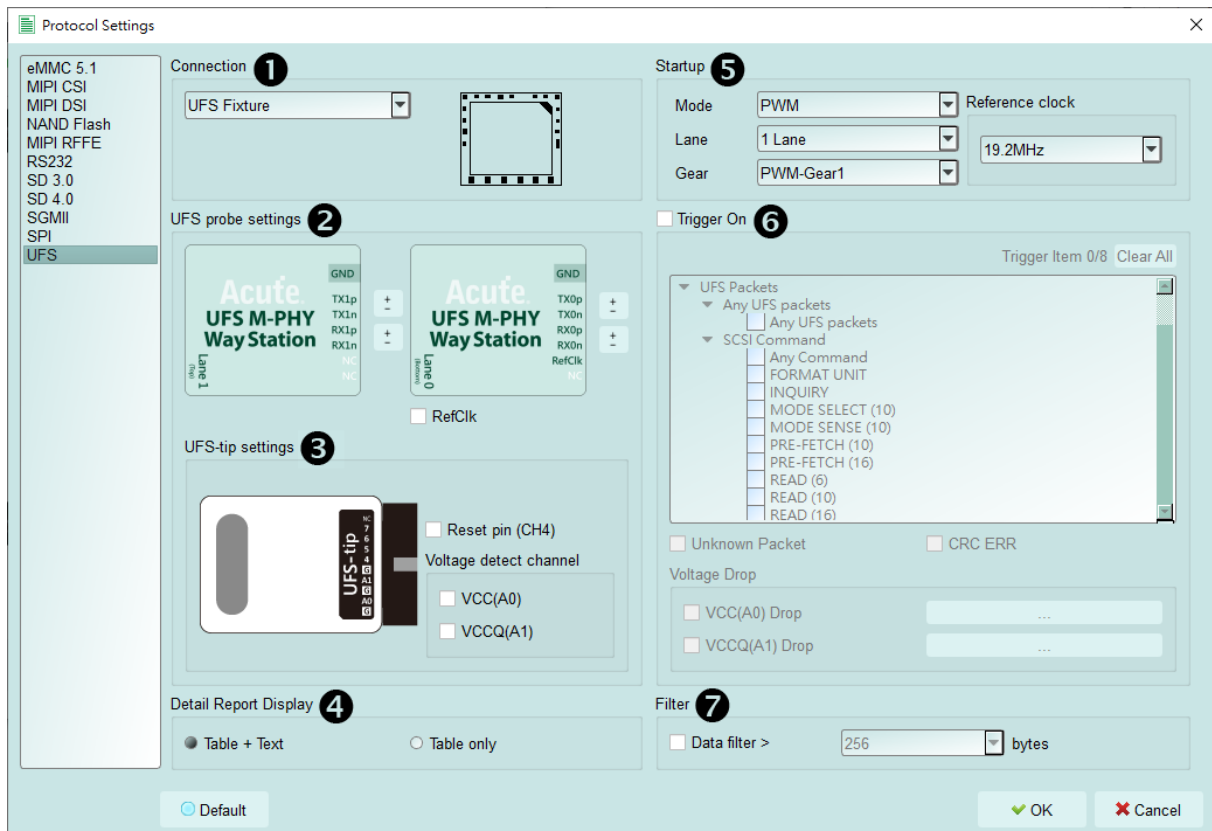
Statistics List

Use No.	Time/Lamp (0:m:s:ms:us)	Host	Device
180	16:15:03.802.389.394 74.12us	CMD (READ (10))	
181	16:15:03.802.450.979 29.16us	CMD (READ (10))	
177	16:15:03.802.223.738 9.66us	CMD (READ (10))	
180	16:15:03.802.389.394 74.12us	CMD (READ (10))	
183	16:15:03.802.514.842 33.66us	CMD (READ (10))	
206	16:15:03.802.198.800 9.36us	CMD (READ (10))	
213	16:15:03.861.979.811 828.26us	CMD (READ (10))	

Packet: 190026 (6.0) [Device not found] [00:00:02/00:00:00] [OK]

Protocol Analyzer: usdbf41.BPW*

11. UFS Settings



1. **Connection:** 需選擇 BF7264B+與待測物的連接方式
2. **UFS way station Settings:** 可交換同一 Lane 之 p/n, 並可選擇是否要量測 Ref-Clk.
3. **UFS tip Settings:**
 - a. 可開啟 UFS Reset pin 之判斷, 需接上 reset pin 於 UFS probe 之 LA tip CH4 位置
 - b. 電壓偵測通道 A0, A1
4. **Detail Report Display:** 可選擇是否需要文字描述的解析方式
5. **Startup:** 需設定於擷取當下, 待測物所運行之模式; 必須設定 Reference clock, 可選擇 19.2 / 26 / 38.4 / 52 MHz 選項 (無論 Ref-CLK 是否有接上, 正確數值必須給定)
6. **Trigger On:** 可設定 Unipro/UFS packets, 共 8 組, 以及 Unknown Packet, CRC error 觸發選項, 另加入兩組電壓偵測可使用
7. **Filter:** 開啟後將會濾除大於設定值之封包後方資料

FAQ

1. 支援 UFS 第幾版的規格，是否有 Differential 對數或 port 數限制呢？

A：MIPI M-PHY 3.0, Up to 5.8Gbps, 2 Lanes
MIPI Unipro 1.8
JEDEC UFS 2.1 Gear 3, Rate A / B
JEDEC UFS 3.1 commands

2. 量測時是否會影響訊號品質？

A：外接的儀器量測必然會有部分的負載效應影響，我們採用 SMPM Coaxial Cable 的连接方式來降低對待測物干擾並提升訊號品質。

3. 是否有支援訊號發送 (Tx) 功能？

A：不支援訊號發送功能

4. 量測時須注意的事項

a. 接線問題判斷與排除方法：

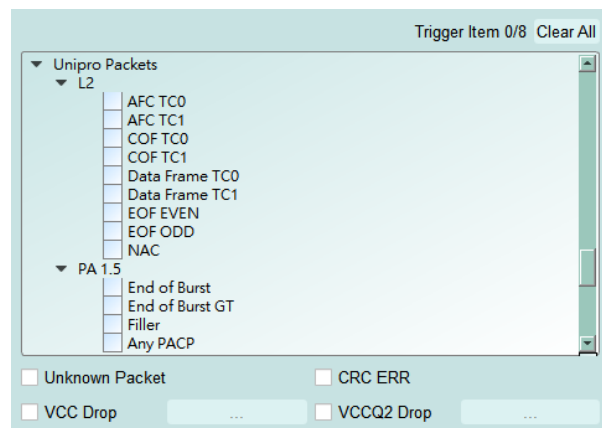
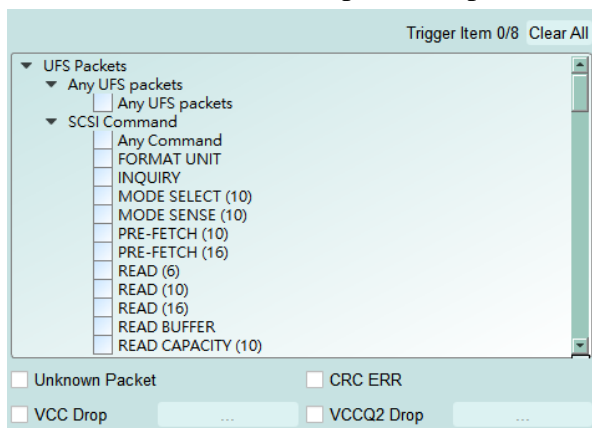
請確實按手冊探棒與待測物連接方式進行連接。若量測起來 PWM 正常，但無法看到任何 HS data 或只能上 1 Lane 而無法上 2 Lane 時，就應先檢查接線是否有錯誤。

b. Reference clock 設定方式：

在 Settings 有提供 Ref Clk 19.2MHz(default) / 26MHz / 38.4MHz / 52MHz 四個選項。若不清楚所使用的 Ref clk 為何時，可按下列方式做判斷。若 PWM 正常，但 HS Data 都是錯誤的，請嘗試調整 Ref Clk 為其他頻率再抓一次。

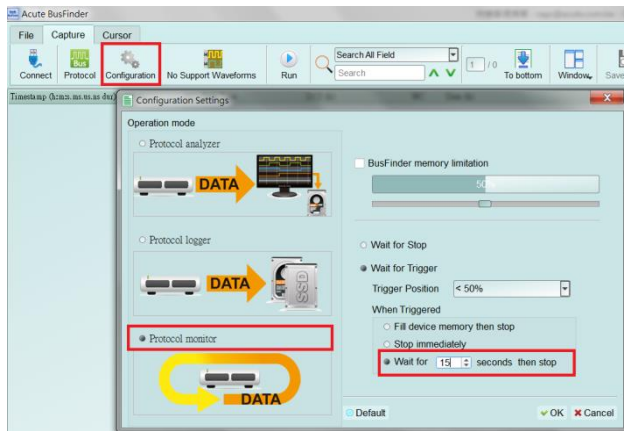
5. 有指定某個 Unipro, UFS packet 做為 trigger 點的功能嗎？

A：可以指定特定的 Unipro, UFS packet 或是 Error 進行觸發。



6. 是否可以自行設定一個 Unipro, UFS 起始點，指定抓取多少時間內的 Data?

A: 可以將起始條件設定在觸發項目後，到工作模式選單內調整為資料監控儀模式，並指定擷取時間長度。



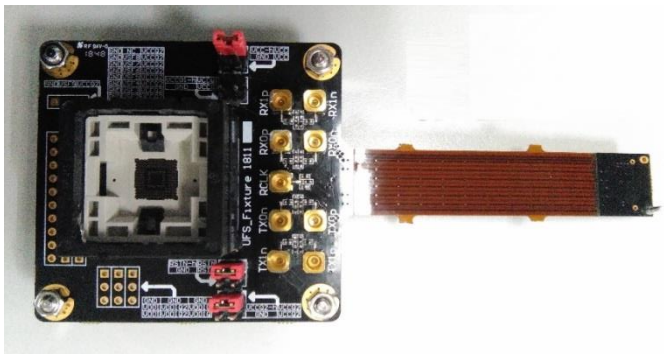
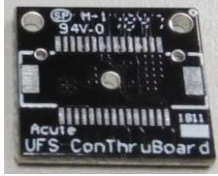
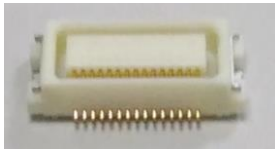
探棒與待測物連接方式

a. 使用 UFS Fixture (連接器)方式連接

使用時機：

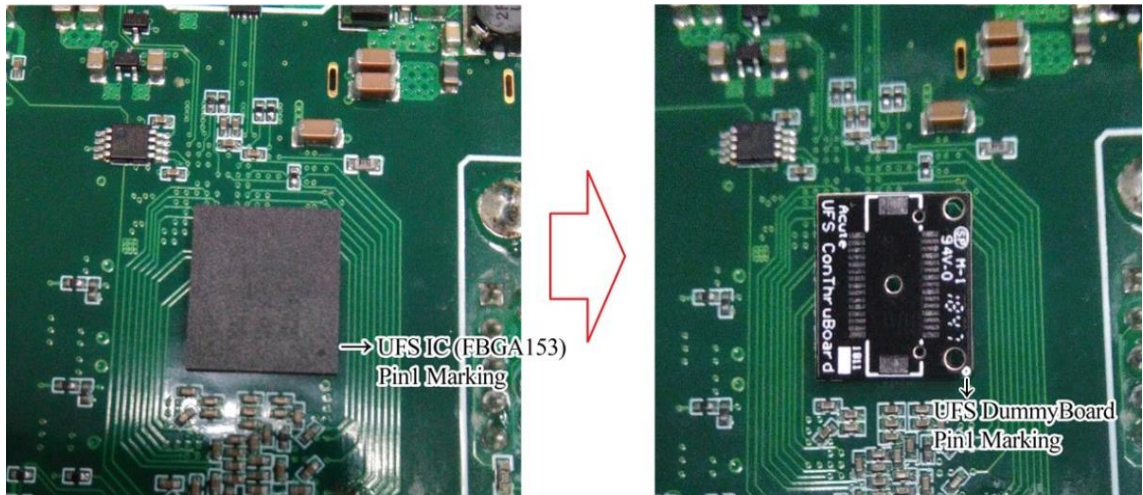
若 Host 有多套時可用連接器的方式，方便更換 Host 與 UFS Chip，以及不需要跳線直接使用 SMPM Cable 連接 Way Station。

由於連接器使用軟排線延伸訊號，只適合應用於 UFS Chip 周邊元件不干涉的情況。

零件列表	
1. 連接器主板(Con Fixture)	
2. 連接器小板(Con Dummy Board)	 <p style="color: red;">背面需植 0.3mm 錫球</p>
3. 連接器 DF17-30DS-0.5V (HiRose Connector)	

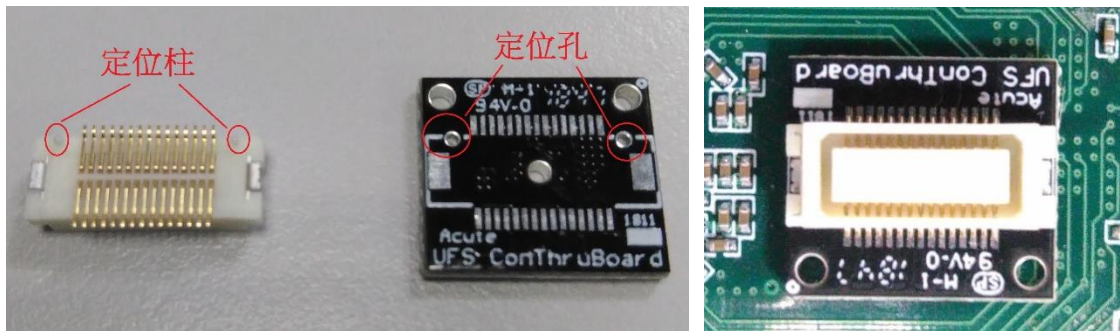
Step1: 將待測物上的 UFS IC 拔起，拔起來的 UFS IC 需重新植錫球。

Step2: 將連接器小板，焊在已拆下 UFS IC 位置。



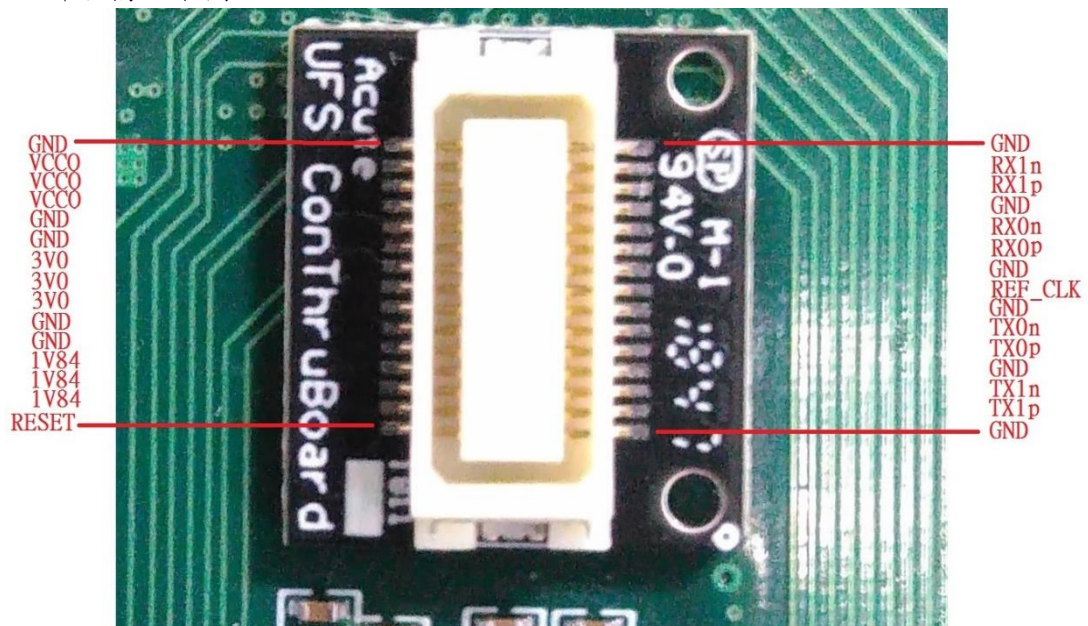
焊接連接器小板時請注意 Pin1 方向

Step3: 將連接器(DF17-30DS-0.5V)放在連接器小板上，在焊接之前請先注意連接器背後定位柱方向與小板定位孔位置

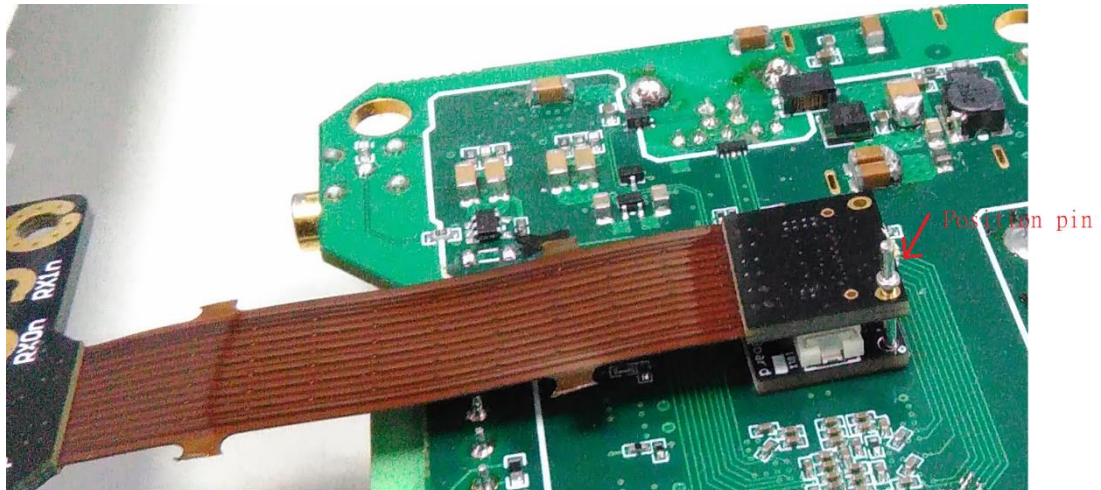


Step4: 連接器放置小板確認完成開始焊接，焊接完成後確認 pin 腳之間有無短路。

Pin 腳名稱如下圖



Step5: 連接主板，連接前請先注意主板連接器上定位針與小板定位孔位置

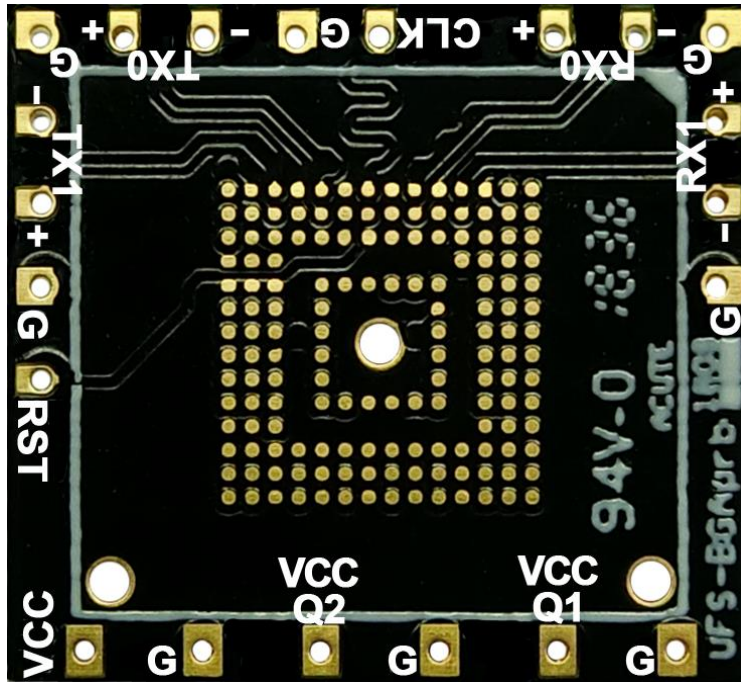


- Step6: 將拔起來的 UFS IC 放進連接器主板 UFS Socket (FBGA153 Socket)，完成。
b. 使用增高板搭配 End-Tip 方式連接

使用時機：

若原 UFS Chip 周邊元件干涉，無法使用 UFS Fixture 時以及 UFS Chip 周邊沒有測試點(Test point)可進行跳線時，就需拔除原 UFS Chip，以增高板墊高之後再從測試點接上 End-Tip 後再使用 SMPM Cable 連接 Way Station。

零件列表	
增高板	
End-tip 軟板	
End-Tip 軟板連接器	
<p>組合完成</p>	



增高板腳位圖

c. 使用 End-Tip 方式連接

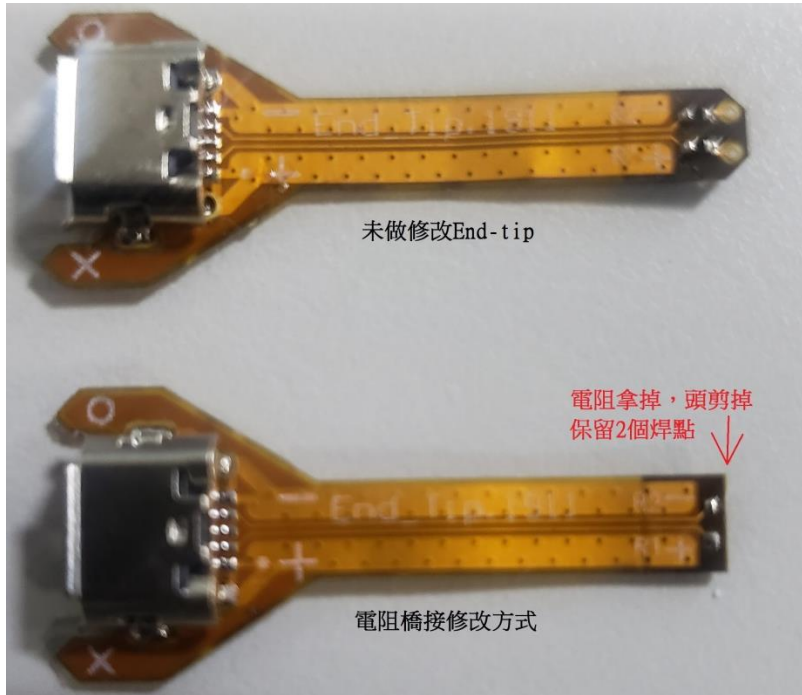
若待測板已留有測試點(Test point)可進行跳線時，可直接使用 End-Tip 接上測試，就不需使用增高板。

UFS 標配的 End-tip 軟板上面的電阻為 250ohm，一般的情況下可直接使用。

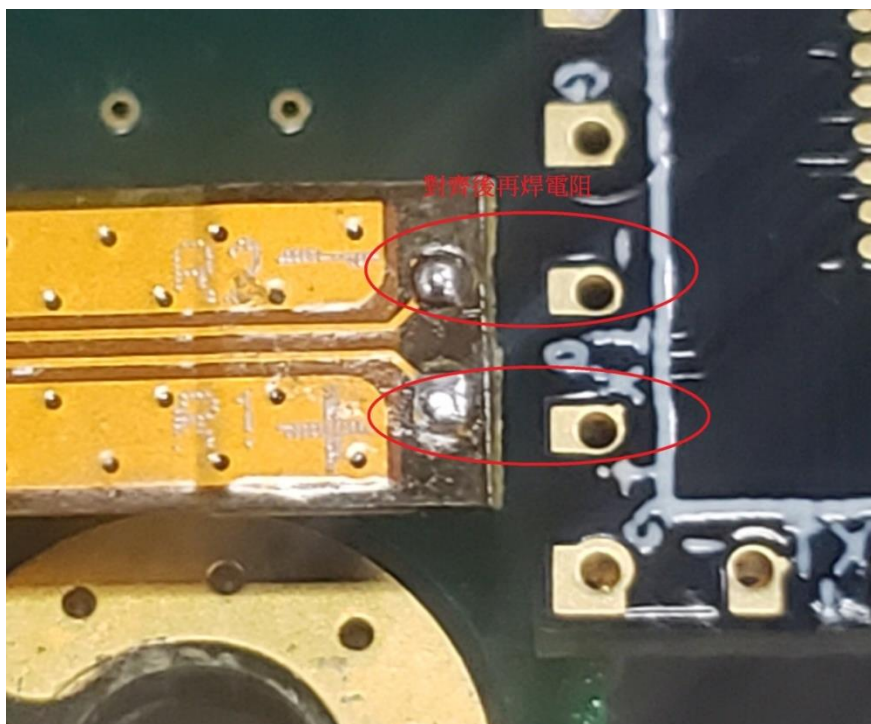
若希望縮短跳線距離以提升訊號品質，可按照下列方式以電阻橋接方式(如下圖)，End-tip 要做修改。

修改流程:

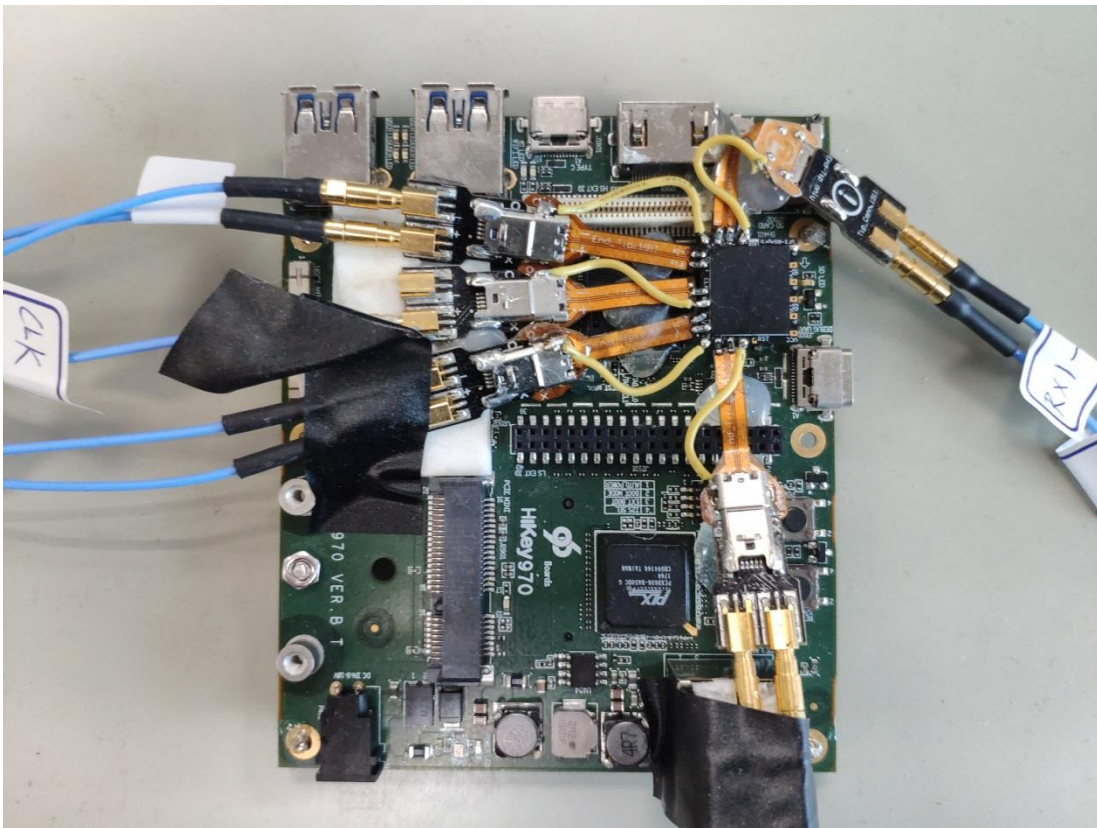
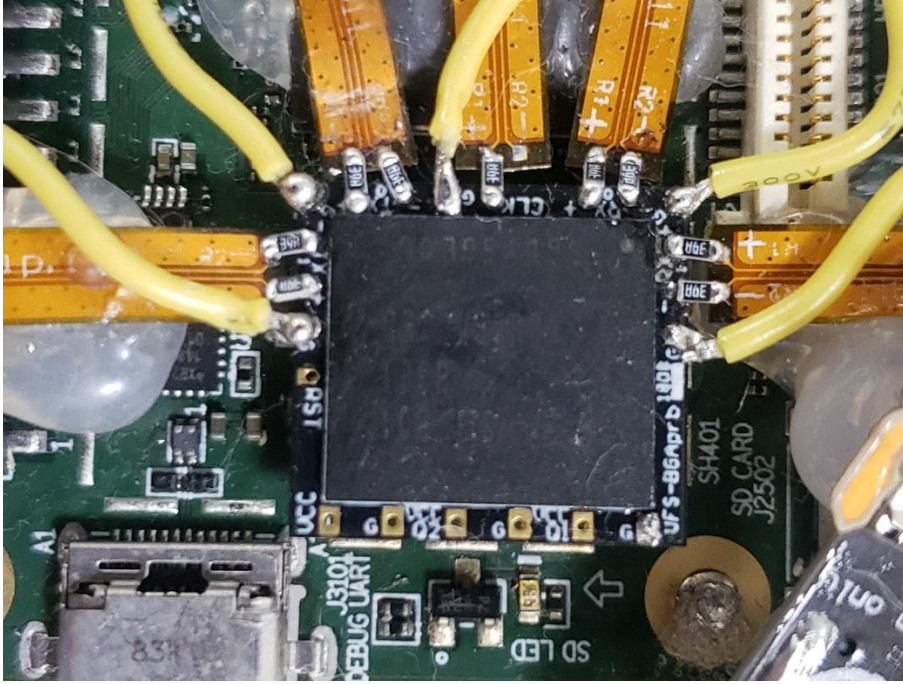
Step1: 電阻拿掉，頭剪掉，保留 2 個焊點。



Step2: 改完後 End-tip 上面的 P/N 焊點與增高板的 P/N 焊點對齊，對齊後再將電阻 250ohm 焊上去，4 組 data +1 條 clk 焊完後再焊接地線。



完成示意圖。此種方式因距離最短使得訊號品質會比 End-tip 跳線連接的方式來的
好。



Way Station 連接方式

1. UFS Probe 請安裝於 BusFinder 7264B+ 的 Slot B 插槽
2. Way Station 轉接盒各有一個 USB Type B 插孔，請使用對應之 USB Cable 安裝於主機正面插孔。安裝時，請按照 Way Station 銘板標示之 Top/Botom 安裝即可。

