

低功率射頻電機試驗報告

申請者	CRESTRON ELECTRONICS, INC.
申請地址	15 VOLVO DRIVE, ROCKLEIGH, NJ 07647, USA
製造廠商	CRESTRON ELECTRONICS, INC.
產品名稱	TABLETOP CONFERENCE SYSTEM
主型號	M201928001
系列型號	N/A
該產品樣品試驗 依據之試驗標準	低功率射頻電機技術規範 LP0002 109年版
試驗結果	合格

試驗室名稱:倍科檢驗科技有限公司(新北實驗室)
試驗室地址:新北市汐止區大同路二段 169 巷 70 號
電話:02-2647-6898 / 傳真:02-2647-6895
報告編號:RXZ210924002RF02
案件受理日期: 110 年 09 月 24 日
樣品接收日期: 110 年 09 月 24 日
測試日期: 110 年 09 月 25 日~110 年 09 月 29 日
報告發行日期: 110 年 10 月 25 日

附註:

1. 未經本實驗室書面許可，不得部份複製本報告內容。
2. 未經授權不得對本報告的內容或外觀進行任何更改，違者將受到法律追訴。
3. 本報告僅對檢送樣品負責，且分離使用無效。
4. 本報告需加本所負責人簽名始生效。
5. 測試結果之判定，無需考量量測不確定度符合性，除非經由顧客約定、法規或標準文件規範才需要評估。
6. 本實驗室不對申請者所提供之影響測試結果的訊息真實性負責。

報告發行紀錄:

版次	案號	報告號碼	發行日期	說明	修訂人員
0.0	RXZ210924002	RXZ210924002RF02	2021.10.25	報告發行	陳菱蓁

目錄

1. 一般描述	5
2. 測試規範	6
2.1 符合性聲明	6
2.2 適用規範及條文	6
2.3 限制使用之頻帶	7
3. 受測裝置之系統說明	8
3.1 待測物與測試設備系統圖	8
3.2 測試模式	9
3.3 測試軟件	10
3.4 隨貨附賣週邊設備名稱描述	10
3.5 未隨貨附賣，輔助測試週邊設備名稱描述(實驗室或廠商提供).....	10
3.6 測試描述	10
3.7 占空比評估	11
4. 電源線傳導干擾之量測	12
4.1 適用標準	12
4.2 測試方法	12
4.3 測試場地配置	12
4.4 干擾值之計算	12
4.5 傳導干擾之量測結果	13
5. 場強輻射之量測	15
5.1 適用標準	15
5.2 測試方法	15
5.3 測試擺設圖	16
5.4 量測設定	17
5.5 場強度之計算	17
5.6 場強輻射之量測結果	17
6. 天線增益之要求	40

6.1	適用標準	40
6.2	天線增益	40
7.	發射頻寬之要求	41
7.1	適用標準	41
7.2	測試方法	41
7.3	發射頻寬之量測結果	42
8.	輸出峰值功率之量測	46
8.1	適用標準	46
8.2	測試方法	46
8.3	輸出功率之量測結果	47
9.	開放頻帶邊緣 100kHz 頻寬內之限制	48
9.1	適用標準	48
9.2	測試方法	48
9.3	測試配置	48
9.4	開放頻帶邊緣之量測結果	48
10.	功率密度之量測	60
10.1	適用標準	60
10.2	測試方法	60
10.3	功率密度之量測結果	61
11.	電波曝露量之評估	65
11.1	適用標準	65
11.2	電波曝露量之結果	66
12.	量測儀器一覽表	67
13.	試驗室之測試不確定度	69

1. 一般描述

產品名稱	TABLETOP CONFERENCE SYSTEM
主 型 號	M201928001
系列型號	N/A
差異說明	N/A
廠 牌	CRESTRON
申 請 者	CRESTRON ELECTRONICS, INC.
地 址	15 VOLVO DRIVE, ROCKLEIGH, NJ 07647, USA
製造廠商	CRESTRON ELECTRONICS, INC.
製造廠址	15 VOLVO DRIVE, ROCKLEIGH, NJ 07647, USA
使用頻率	2402~2480MHz
使用頻道數	40 Channels
傳輸速率	BLE(1M) Mode: 1Mbps BLE(2M) Mode: 2Mbps
調變方式	BLE(1M) Mode: GFSK BLE(2M) Mode: GFSK
EUT供電方式	48V/500mA from POE
備註	無。

2. 測試規範

2.1 符合性聲明

本測試報告之所有項目皆依據國家通訊傳播委員會 LP0002 低功率射頻電機技術規範適用規範及條文。

2.2 適用規範及條文

低功率射頻電機技術規範4.10節(DTS)

項次	測試項目	適用規範	測試結果
1.	電源線傳導干擾	3.3節	符合規範
2.	場強輻射	3.5節& 3.6節	符合規範
3.	天線增益之要求	4.10.1.3節	符合規範
4.	發射頻寬	4.10.1.6節	符合規範
5.	輸出峰值功率	4.10.1.2節	符合規範
6.	開放頻帶邊緣之發射	4.10.1.5節	符合規範
7.	功率密度	4.10.1.6(2)(B)節	符合規範
8.	電波曝露量	6.20.2.2節	符合規範

報告簽署人： 徐士珩

徐士珩

測試者： 李宥陞

李宥陞

報告製作員： 陳蓁蓁

陳蓁蓁

2.3 限制使用之頻帶

根據低功率射頻電機技術規範，任何低功率射頻電機之主波皆不得使用下表所列各頻帶內之頻率；低功率射頻電機落於下表所列頻帶內之混附發射，其電場強度必須符合限制規定。

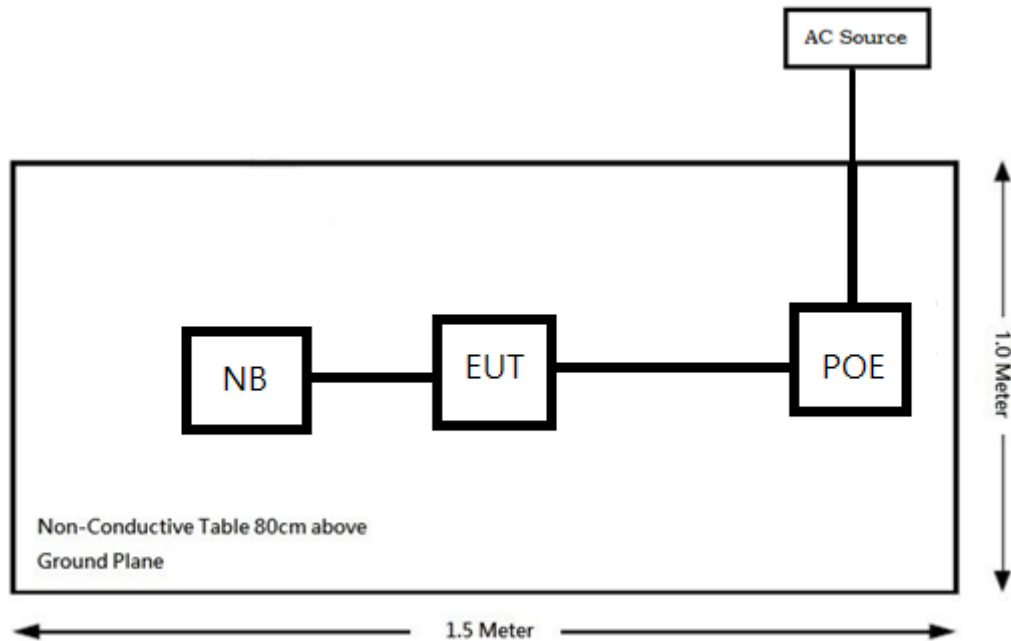
頻率 (MHz)	頻率 (MHz)	頻率 (MHz)
0.090 - 0.110	167.72 - 173.20	3260.0 - 3267.0
0.490 - 0.510	240.00 - 285.00	3332.0 - 3339.0
2.172 - 2.198	322.00 - 335.40	3345.8 - 3358.0
3.013 - 3.033	399.90 - 410.00	3500.0 - 4400.0
4.115 - 4.198	608.00 - 614.00	4500.0 - 5250.0
5.670 - 5.690	703.00 - 748.00	5350.0 - 5460.0
6.200 - 6.300	758.00 - 803.00	7250.0 - 7750.0
8.230 - 8.400	825.00 - 915.00	8025.0 - 8500.0
12.265 - 12.600	930.00 - 1240.0	9000.0 - 9200.0
13.340 - 13.430	1300.0 - 1427.0	9300.0 - 9500.0
14.965 - 15.020	1435.0 - 1626.5	10600 - 12700
16.700 - 16.755	1660.0 - 1785.0	13250 - 13400
19.965 - 20.020	1805.0 - 1880.0	14470 - 14500
25.500 - 25.700	1885.0 - 1900.0	15350 - 16200
37.475 - 38.275	1905.0 - 1985.0	17700 - 21400
73.500 - 75.400	2010.0 - 2025.0	22010 - 23120
108.00 - 138.00	2110.0 - 2170.0	23600 - 24000
149.90 - 150.05	2200.0 - 2300.0	31200 - 31800
156.70 - 156.90	2310.0 - 2390.0	36430 - 36500
162.01 - 167.17	2483.5 - 2900.0	38600 以上

3. 受測裝置之系統說明

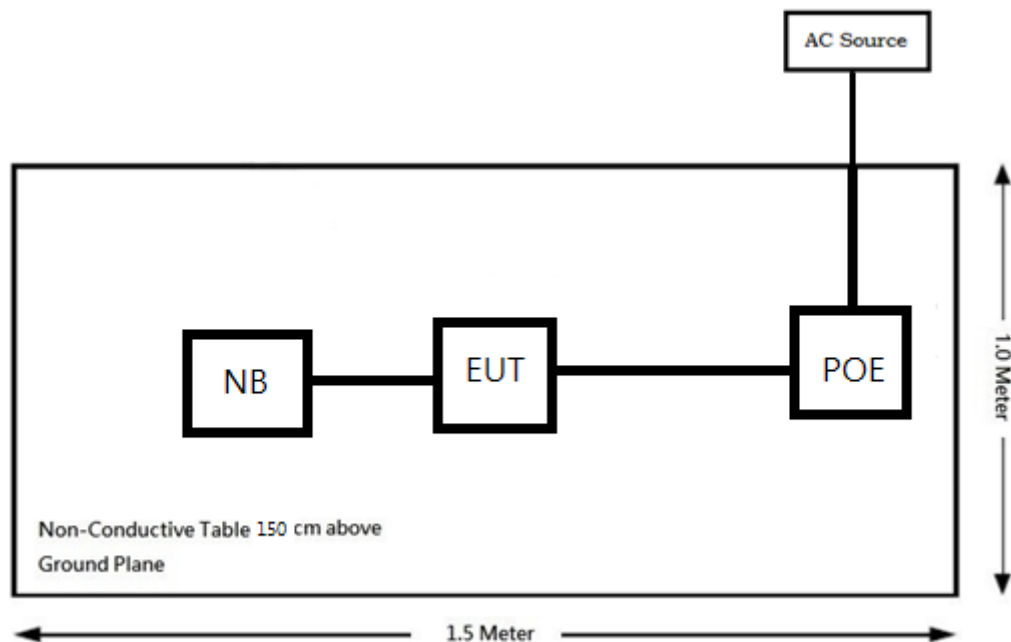
3.1 待測物與測試設備系統圖

Radiation :

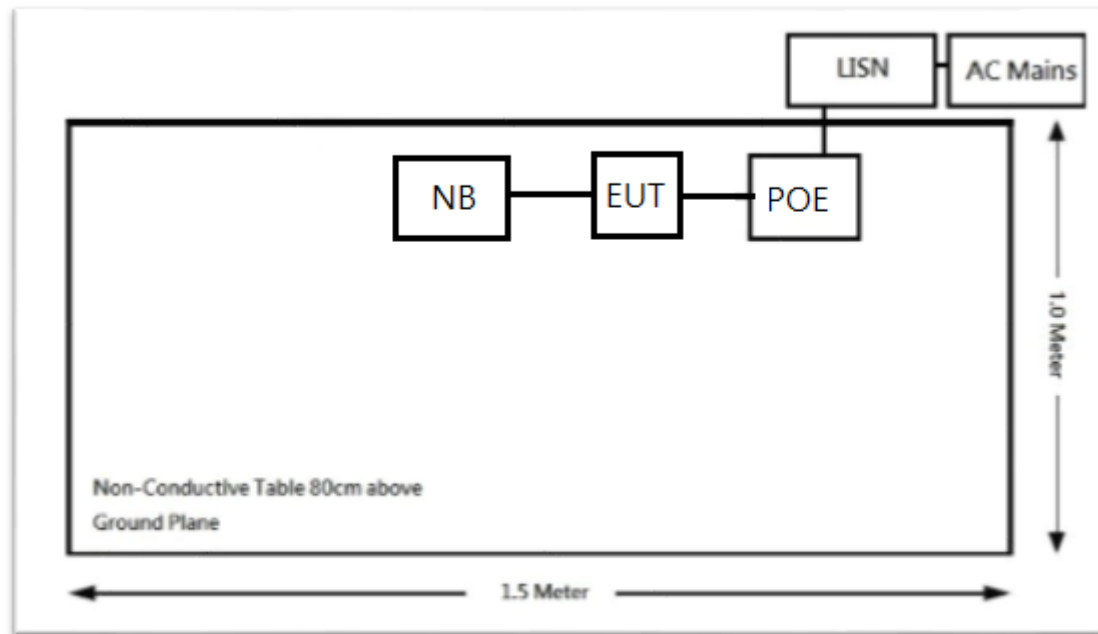
Below 1GHz



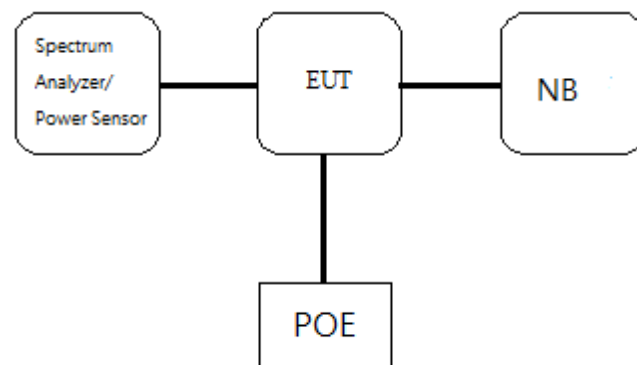
Above 1GHz:



Conduction:



Conducted:



3.2 測試模式

Pre-Scan

Mode 1: Full System (model: M201928001) for all test item.

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available.

Final Test

Mode 1: Full System (model: M201928001) for all test item.

The system was configured for testing in engineering mode, which was provided by manufacturer.

3.3 測試軟件

The test software was used "Telnet V1.0"

Test Frequency		Low	Mid	High
Power Level Setting	BLE 1M	Default	Default	Default
	BLE 2M	Default	Default	Default

3.4 隨貨附賣週邊設備名稱描述

序號	設備名稱	廠牌	型號
1	POE	SHENZHEN GOSPELL DIGITAL TECHNOLOGY	G0720-480-050
2	LAN Cable	DEHAO	3.6m
3	LAN Cable	DEHAO	3.6m
4	USB Cable	SURE-FIRE	1.8m

3.5 未隨貨附賣・輔助測試週邊設備名稱描述(實驗室或廠商提供)

序號	設備名稱	廠牌	型號
1	NB	DELL	E6410

3.6 測試描述

1.將 EUT 連接到 POE 在連接到筆電之 LAN Port

2.開啟 Telnet 192.168.0.160

3.依照對應的頻率與調製下指令

hccmd 03 0c 00

1M/2M

hccmd 1E 20 03 00 25 00

1E:1M, 34:2M

03:00:2402・03 13:2440, 03 27:2480

3.7 占空比評估

Duty cycle = Tx on(ms)/(Tx on+off(ms))

Duty factor = $10 \cdot \log(1/TXon)$

	BLE (1M) Mode	BLE (2M) Mode
Duty cycle	0.63	0.31
Duty factor	2.01	5.09

4. 電源線傳導干擾之量測

4.1 適用標準

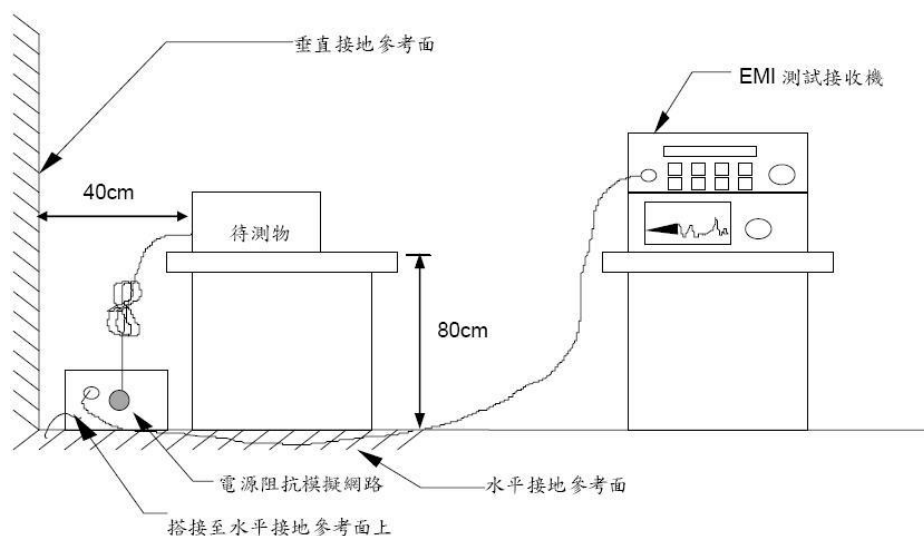
依據國家通訊傳播委員會低功率射頻電機技術規範之3.3節，電源傳導干擾之限制要求如下：

頻率 (MHz)	傳導限制值 (dBμV)	
	準峰值 (Quasi – peak)	平均值(Average)
0.15 – 0.5	66 – 56	56 - 46
0.5 – 5	56	46
5 - 30	60	50

4.2 測試方法

將待測物置於0.8米高的非金屬桌面，使其在工作狀態，待測物電源線接至電源線阻抗穩定網路上，從測試接收機記錄頻率由0.15MHz至30MHz之間之電源線傳導放射強度。

4.3 測試場地配置



4.4 干擾值之計算

電源傳導干擾電壓之計算公式如下

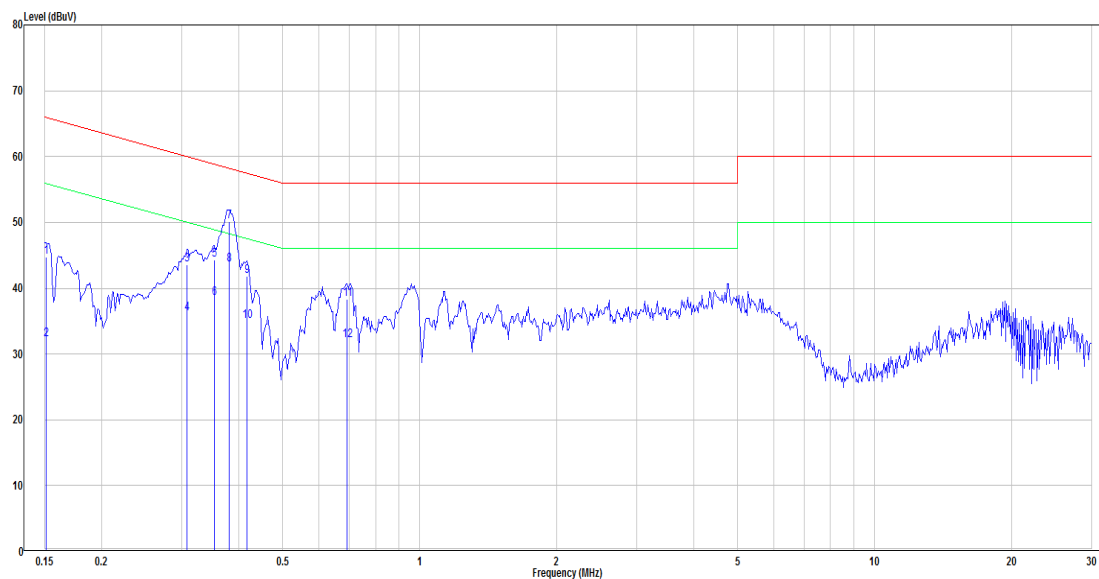
$$\text{干擾值} = \text{讀值} + \text{校正因子}$$

其中校正因子為：饋線損失 + 電源阻抗模擬網路損失

4.5 傳導干擾之量測結果

Job No.:	RXZ210924002	Phase.:	Line
Standard:	limit\RF\NCC LP0002-QP.csv	Power:	AC 110V/60Hz
Test item:	Conduction Test	Test By:	Jason
Temp.(°C)/Hum.(%RH):	28°C/42%		
Description:	BLE		

2021-09-29 11:03:10



No.	Frequency (MHz)	Reading (dBμV)	Correct Factor(dB)	Result (dBμV)	Limit (dBμV)	Over limit (dB)	Remark
1	0.151	25.19	19.59	44.78	65.96	-21.18	QP
2	0.151	12.54	19.59	32.13	55.96	-23.83	Average
3	0.308	24.05	19.58	43.63	60.02	-16.39	QP
4	0.308	16.58	19.58	36.16	50.02	-13.86	Average
5	0.354	24.70	19.58	44.28	58.87	-14.59	QP
6	0.354	18.85	19.58	38.43	48.87	-10.44	Average
7	0.381	30.59	19.58	50.17	58.25	-8.08	QP
8	0.381	24.05	19.58	43.63	48.25	-4.62	Average
9	0.417	22.27	19.58	41.85	57.51	-15.66	QP
10	0.417	15.32	19.58	34.90	47.51	-12.61	Average
11	0.694	18.68	19.60	38.28	56.00	-17.72	QP
12	0.694	12.48	19.60	32.08	46.00	-13.92	Average

Note:

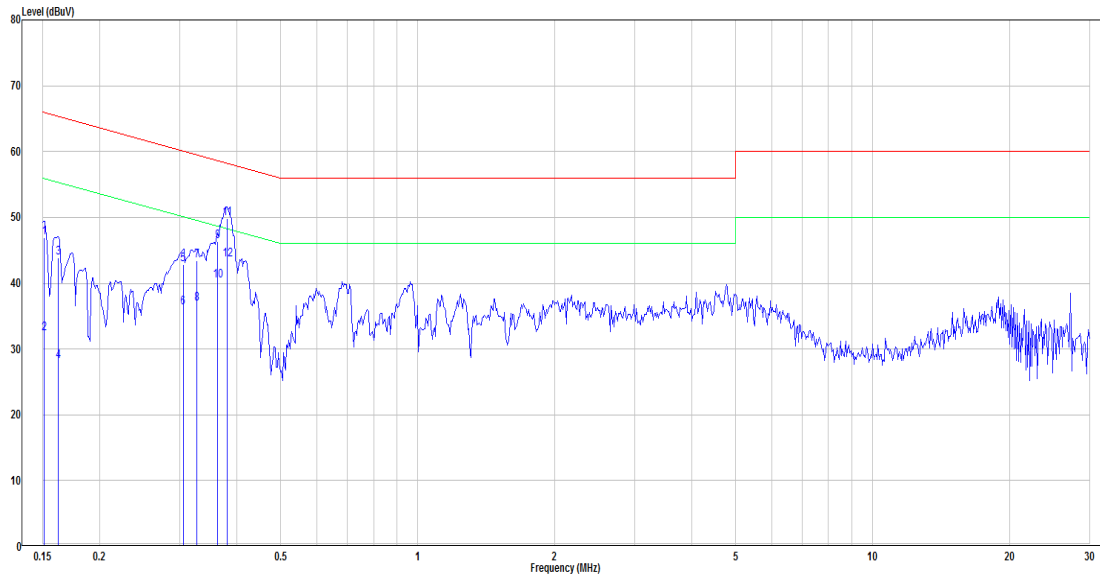
Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

Job No.:	RXZ210924002	Phase.:	Neutral
Standard:	limit\RF\NCC LP0002-QP.csv	Power:	AC 110V/60Hz
Test item:	Conduction Test	Test By:	Jason
Temp.(°C)/Hum.(%RH):	28°C/42%		
Description:	BLE		

2021-09-29 11:09:43



No.	Frequency (MHz)	Reading (dBμV)	Correct Factor(dB)	Result (dBμV)	Limit (dBμV)	Over limit (dB)	Remark
1	0.151	27.28	19.59	46.88	65.96	-19.08	QP
2	0.151	12.75	19.59	32.34	55.96	-23.61	Average
3	0.162	24.24	19.59	43.83	65.34	-21.51	QP
4	0.162	8.49	19.59	28.08	55.34	-27.26	Average
5	0.305	23.33	19.58	42.91	60.10	-17.19	QP
6	0.305	16.70	19.58	36.28	50.10	-13.82	Average
7	0.327	23.83	19.58	43.41	59.53	-16.12	QP
8	0.327	17.33	19.58	36.91	49.53	-12.62	Average
9	0.363	26.70	19.58	46.28	58.65	-12.37	QP
10	0.363	20.73	19.58	40.32	48.65	-8.33	Average
11	0.381	30.29	19.58	49.87	58.25	-8.39	QP
12	0.381	24.02	19.58	43.60	48.25	-4.65	Average

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

5. 場強輻射之量測

5.1 適用標準

依據國家通訊傳播委員會低功率射頻電機技術規範3.5之要求，其他開放頻帶外不必要之輻射干擾需符合3.6節之一般限制要求。

頻率 (MHz)	測試距離 (m)	干擾限制 ($\mu\text{V/m}$)	干擾限制 (dB $\mu\text{V/m}$)
0.009 – 0.490 (含)	300	2,400/頻率(千赫)	128.5-93.8(註1)
0.490 (不含) – 1.705 (含)	30	24,000 /頻率(千赫)	73.8-63(註2)
1.705 (不含) – 30 (不含)	30	30	69.5(註3)
30 (含) – 88 (含)	3	100	40.0
88 (不含) – 216 (含)	3	150	43.5
216 (不含) – 960 (含)	3	200	46.0
960 (不含)以上	3	500	54.0

註 1: 其干擾限制值 = $20 \cdot \text{LOG}(2400/F) + 40 \cdot \text{LOG}(300/\text{量測距離})$

註 2: 其干擾限制值 = $20 \cdot \text{LOG}(24000/F) + 40 \cdot \text{LOG}(30/\text{量測距離})$

註 3: 其干擾限制值 = $20 \cdot \text{LOG}(30) + 40 \cdot \text{LOG}(30/\text{量測距離})$

5.2 測試方法

將待測物置於1.5米高的非金屬桌面，使其在工作狀態，接收天線置於3米外相同的高度。待測物分別要垂直或水平放置，而且桌面要360度旋轉，另外接收天線也要從1.0米至4.0米升降變化，以找出最大的輻射電場強度，接收天線置於水平、垂直極向各執行測試一次。若量測頻率低於30兆赫(MHz)時，得於所規定距離以內進行測試，但應盡量避免於近場做測試。當測試距離較規定距離為近時，測試結果應以插補系數換算至規定距離之值：對同一輻射方向最少兩個距離作量測以決定適當的插補系數或線性距離平方反比(40dB/10倍距離)。

5.3 測試擺設圖

圖 1 :量測頻率9kHz~ 30MHz之測試配置

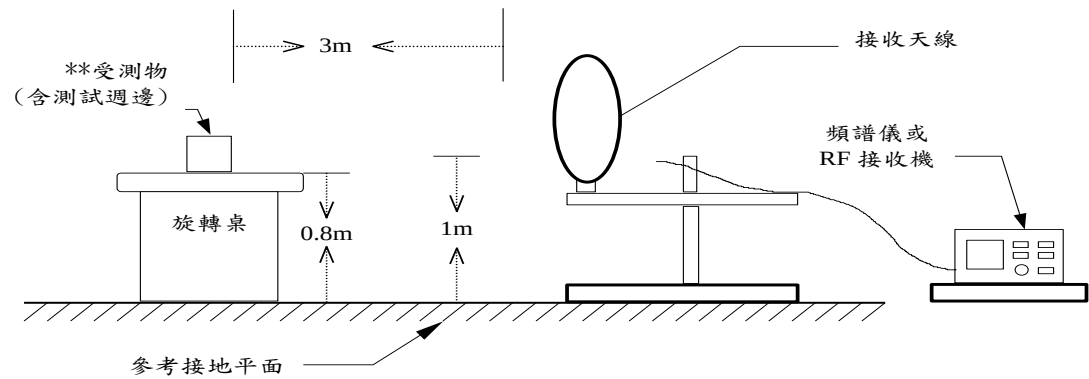


圖 2 :量測頻率30MHz~1GHz之測試配置

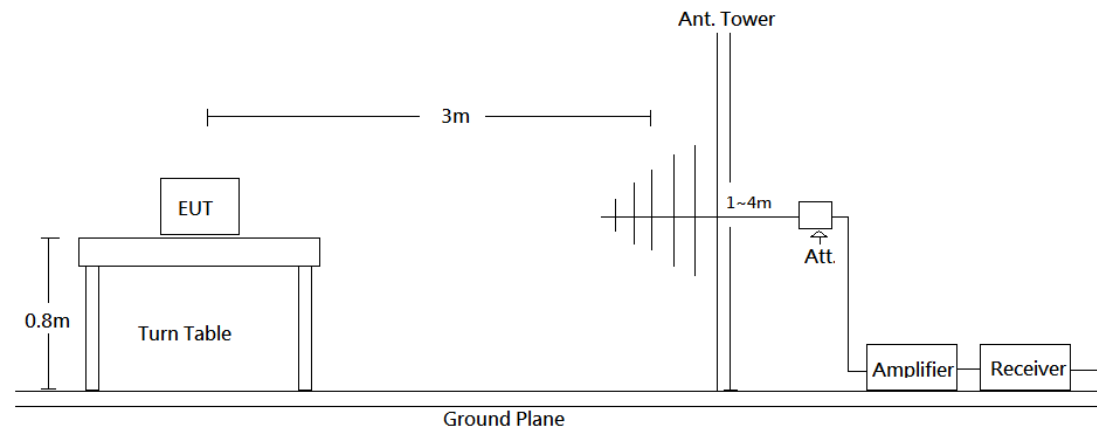
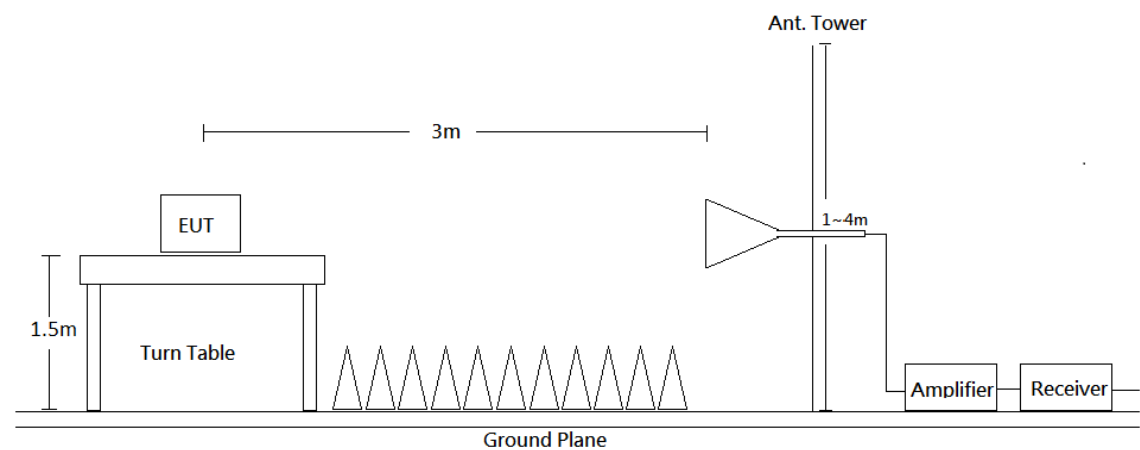


圖 3 : 量測頻率1GHz以上之測試配置



5.4 量測設定

1GHz以下:

頻譜分析儀設定: Quasi-Peak: RBW = VBW: 120kHz

1GHz以上:

頻譜分析儀設定: Peak: RBW: 1MHz; VBW: 1MHz /

Average: RBW: 1MHz; VBW: 10Hz

5.5 場強度之計算

場強之計算公式如

干擾值 = 讀值 + 校正因子

其中校正因子為：

天線因子 + 饋線損失 + 濾波器損失 (若有使用) - 放大器增益 (若有使用)。

5.6 場強輻射之量測結果

發射機 / 接收機 其它不必要之訊號 (9kHz ~ 30MHz)

此頻率之干擾值低於限制值20dB以下，被考量為背景雜訊值並不予記錄。

發射機 / 接收機 其它不必要之訊號 (30MHz ~ 1GHz)

此案件測試模式分別為CH Low、Mid、High，經驗證後最差模式BLE-1M Mode 2402MHz為Worse。此產品經3軸X、Y、Z，評估X軸為最差。

發射機 其它不必要之訊號 (1GHz ~ 26.5GHz)

此案件測試模式分別為CH Low、Mid、High。此產品經3軸X、Y、Z，評估X軸為最差。

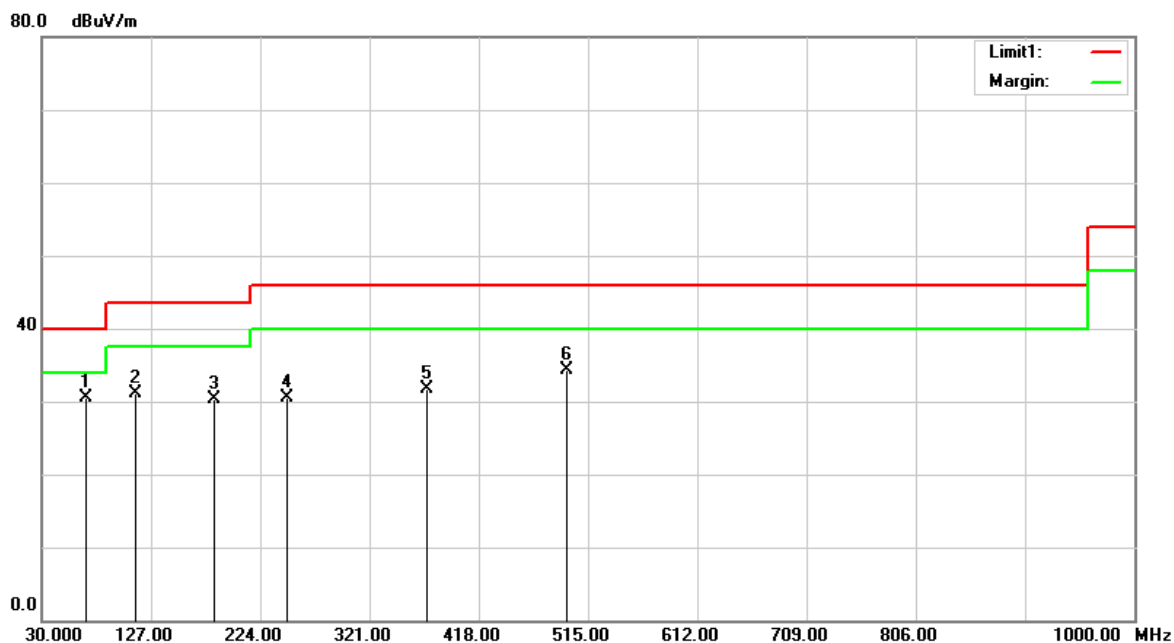
接收機 其它不必要之訊號 (1GHz ~ 26.5GHz)

此案件測試模式分別為CH Low、Mid、High，經驗證後最差模式CH Low為Worse。

此產品經3軸X、Y、Z，評估X軸為最差。

場強輻射之量測值 (TX / 1GHz 以下)

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 _ 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 06:55:38
		Test By:	Ken
Description:	BLE_1M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
68.8000	46.90	-16.30	30.60	40.00	-9.40	100	320	peak
113.4200	42.30	-11.20	31.10	43.50	-12.40	100	296	peak
183.2600	43.38	-12.98	30.40	43.50	-13.10	100	270	peak
248.2500	42.88	-12.29	30.59	46.00	-15.41	100	198	peak
372.4100	40.31	-8.59	31.72	46.00	-14.28	100	55	peak
496.5700	39.94	-5.71	34.23	46.00	-11.77	100	68	peak

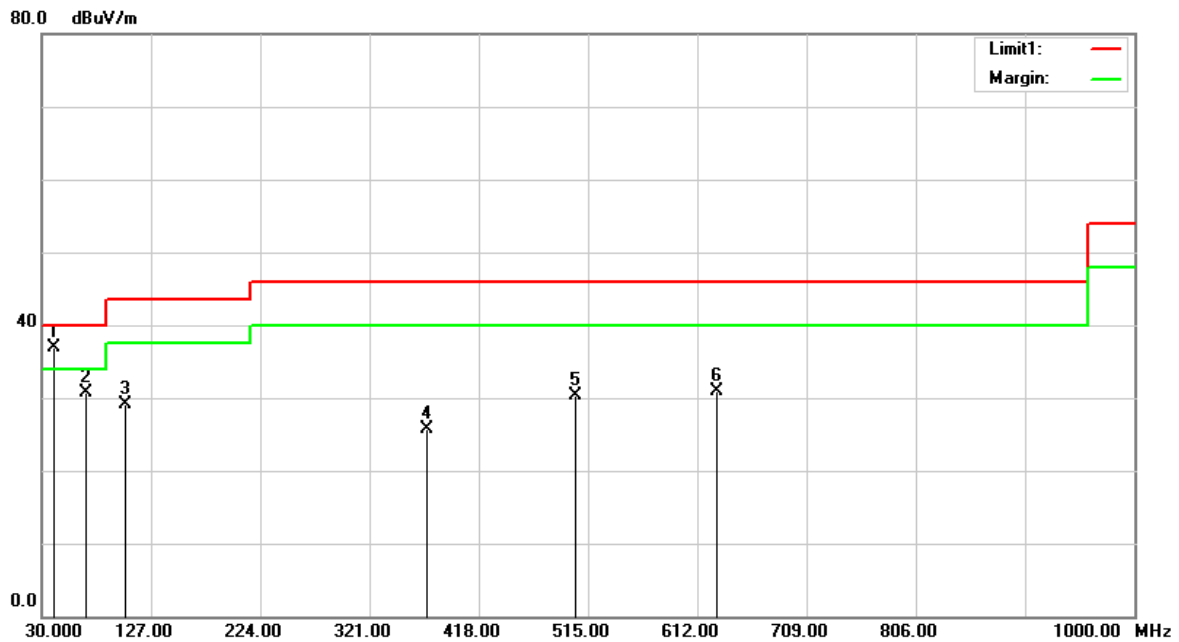
Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 _ 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 06:58:09
		Test By:	Ken
Description:	BLE_1M-TX-2402-X_Axis		



Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
(MHz)	(dBμV)	Factor(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)	
40.6700	48.07	-11.14	36.93	40.00	-3.07	100	244	peak
68.8000	46.91	-16.30	30.61	40.00	-9.39	100	85	peak
104.6900	41.85	-12.78	29.07	43.50	-14.43	100	340	peak
372.4100	34.33	-8.59	25.74	46.00	-20.26	100	310	peak
503.3600	36.05	-5.67	30.38	46.00	-15.62	100	36	peak
629.4600	35.48	-4.60	30.88	46.00	-15.12	100	15	peak

Note:

Result = Reading + Correct Factor

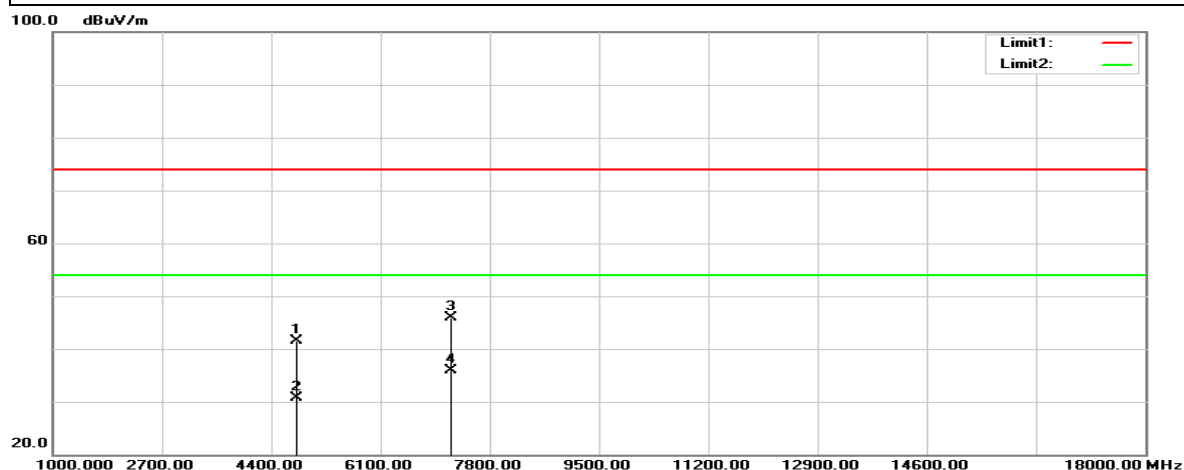
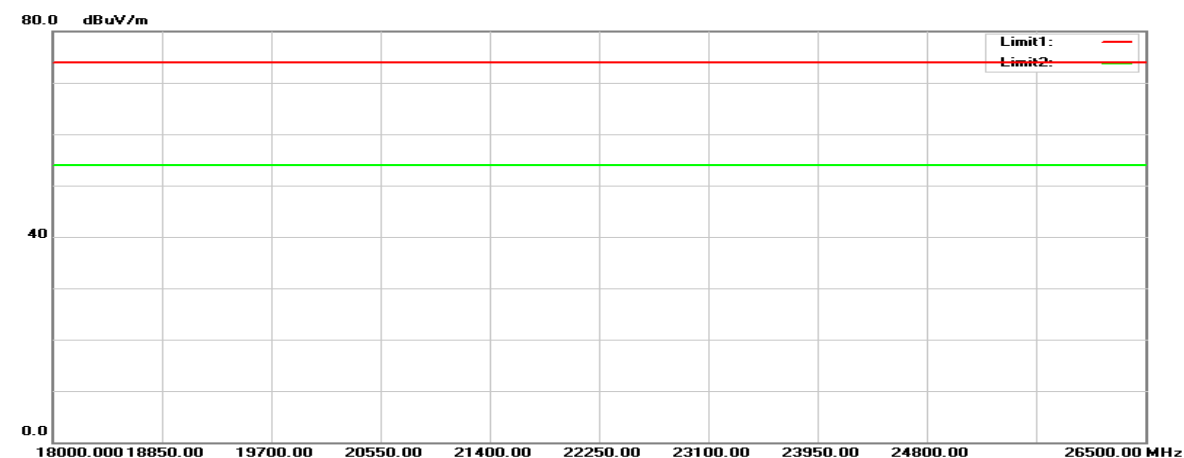
Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

發射機其它不必要之訊號 (TX / 1GHz 以上)

場強輻射之量測值

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:14:15
		Test By:	Ken
Description:	BLE_1M-TX-2402-X_Axis		



Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
(MHz)	(dBμV)	Factor(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)	
4804.000	44.78	-3.28	41.50	74.00	-32.50	150	91	peak
4804.000	33.88	-3.28	30.60	54.00	-23.40	150	91	AVG
7206.000	42.89	3.10	45.99	74.00	-28.01	150	178	peak
7206.000	32.78	3.10	35.88	54.00	-18.12	150	178	AVG

Note:

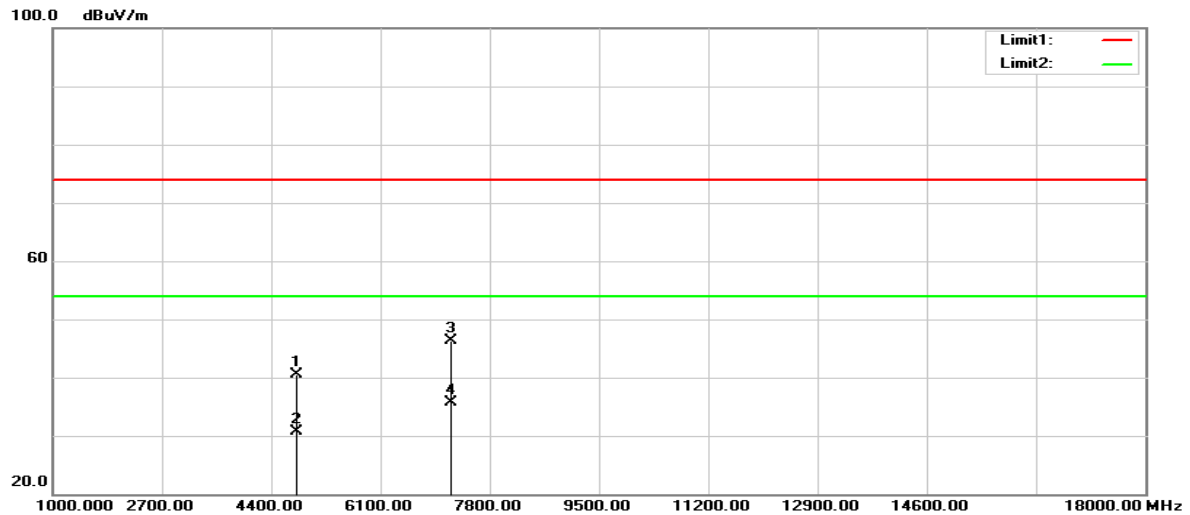
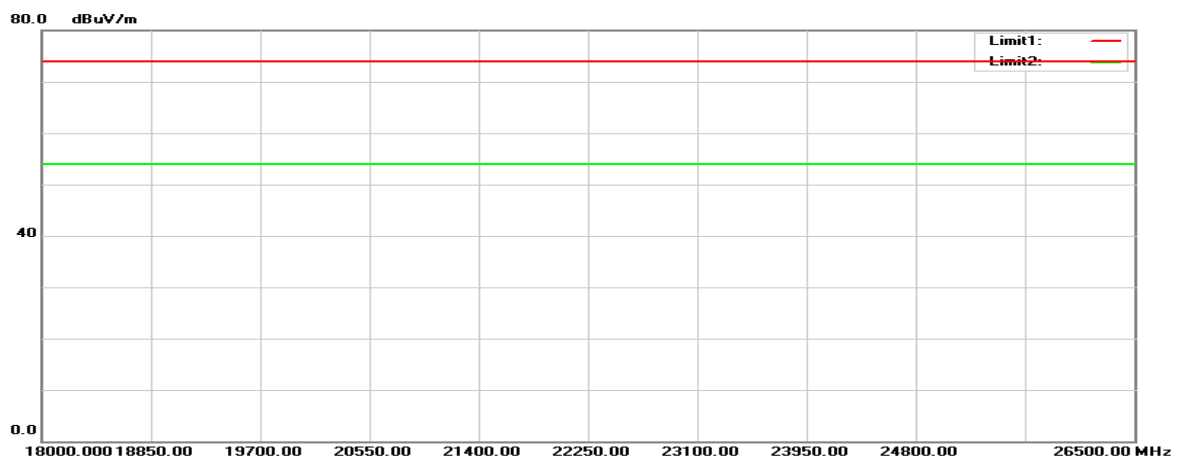
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:20:48
		Test By:	Ken
Description:	BLE_1M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4804.000	43.70	-3.28	40.42	74.00	-33.58	150	345	peak
4804.000	33.93	-3.28	30.65	54.00	-23.35	150	345	AVG
7206.000	43.25	3.10	46.35	74.00	-27.65	150	156	peak
7206.000	32.57	3.10	35.67	54.00	-18.33	150	156	AVG

Note:

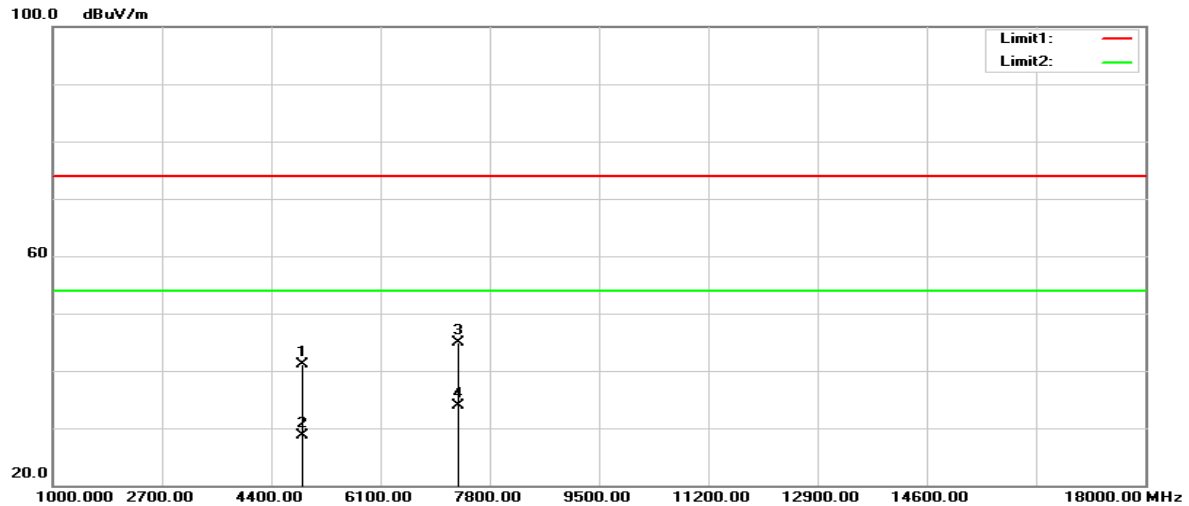
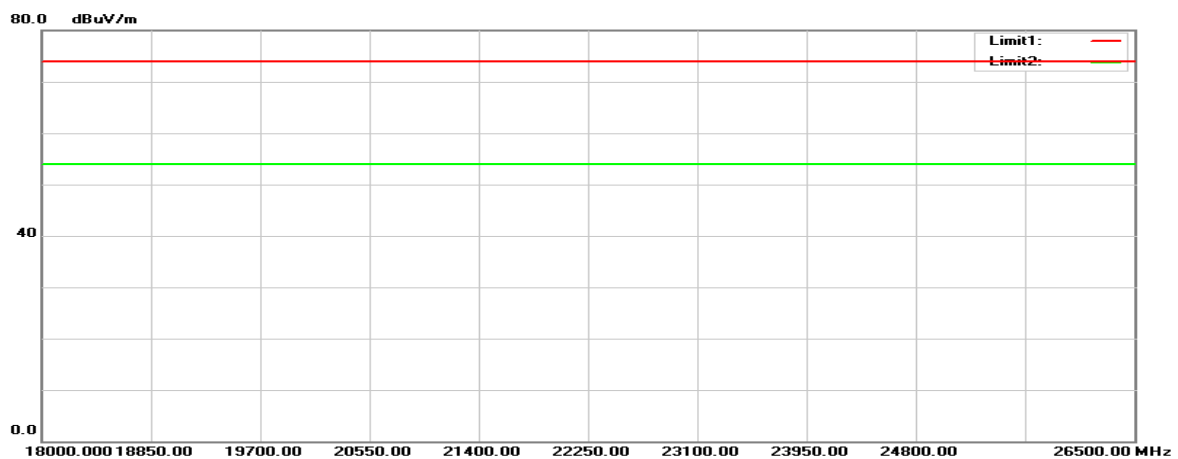
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:29:59
		Test By:	Ken
Description:	BLE_1M-TX-2440-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4880.000	44.08	-3.03	41.05	74.00	-32.95	150	359	peak
4880.000	31.68	-3.03	28.65	54.00	-25.35	150	359	AVG
7320.000	40.80	4.07	44.87	74.00	-29.13	150	66	peak
7320.000	29.88	4.07	33.95	54.00	-20.05	150	66	AVG

Note:

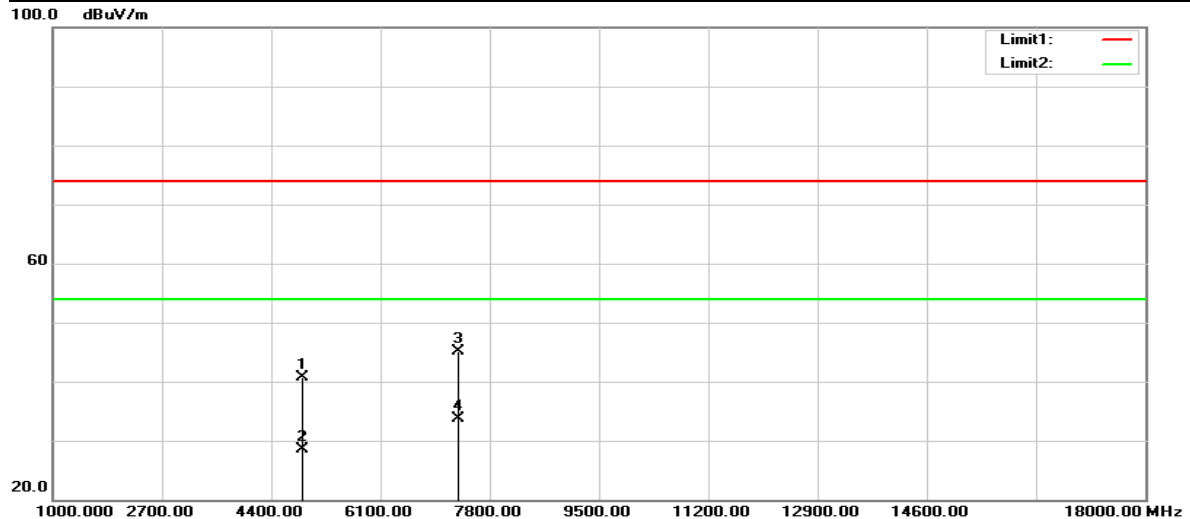
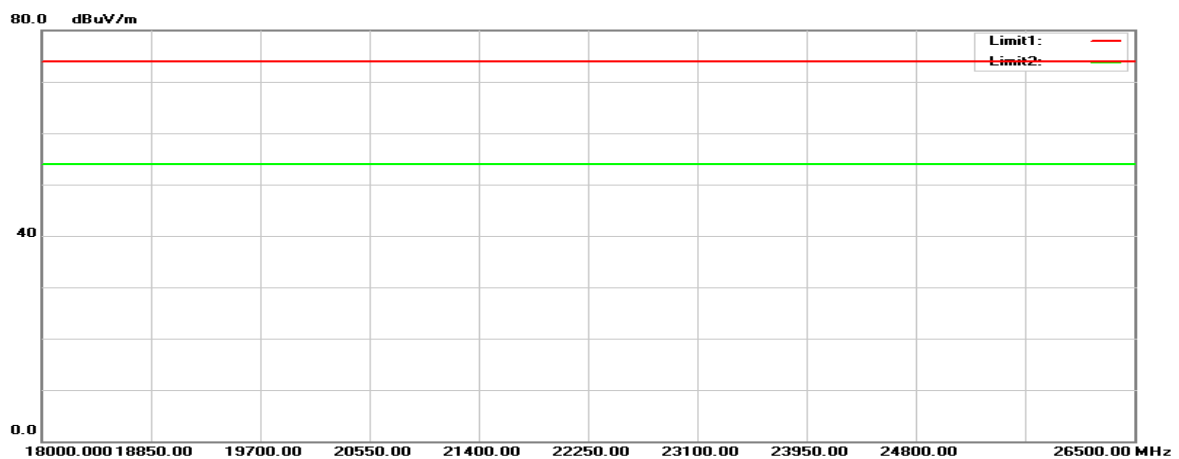
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:33:11
		Test By:	Ken
Description:	BLE_1M-TX-2440-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4880.000	43.78	-3.03	40.75	74.00	-33.25	150	267	peak
4880.000	31.56	-3.03	28.53	54.00	-25.47	150	267	AVG
7320.000	40.94	4.07	45.01	74.00	-28.99	150	104	peak
7320.000	29.72	4.07	33.79	54.00	-20.21	150	104	AVG

Note:

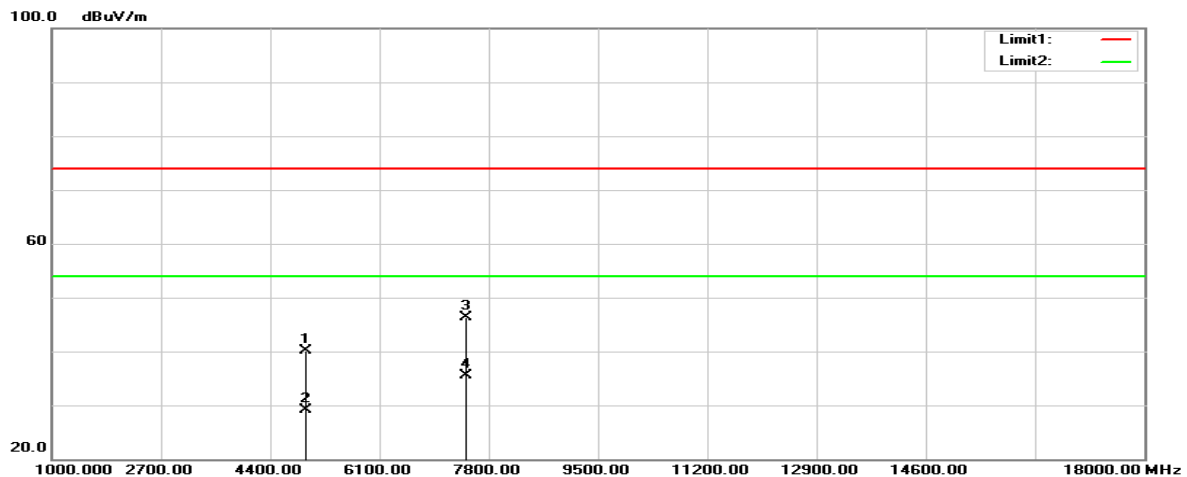
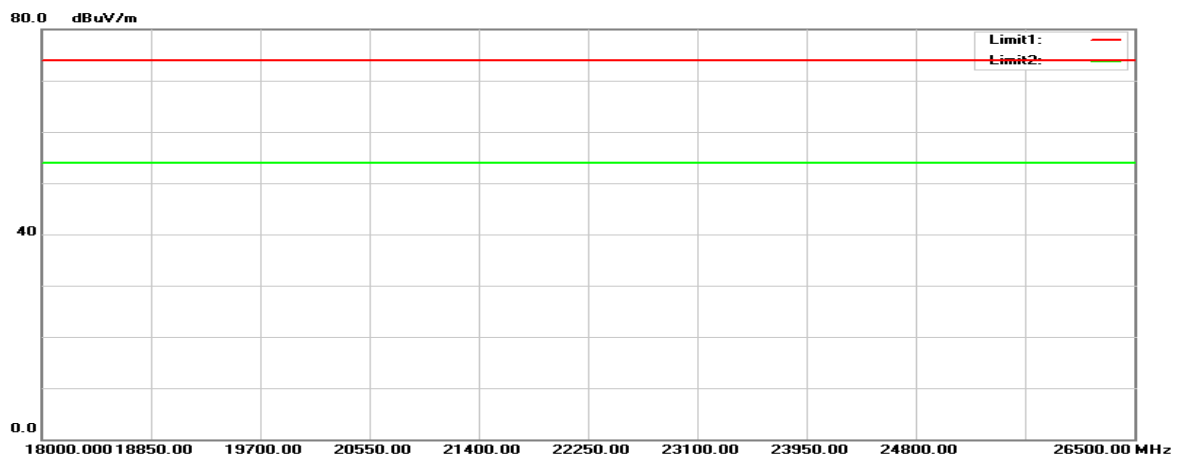
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:36:10
		Test By:	Ken
Description:	BLE_1M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4960.000	42.76	-2.69	40.07	74.00	-33.93	150	179	peak
4960.000	31.74	-2.69	29.05	54.00	-24.95	150	179	AVG
7440.000	42.03	4.25	46.28	74.00	-27.72	150	5	peak
7440.000	31.24	4.25	35.49	54.00	-18.51	150	5	AVG

Note:

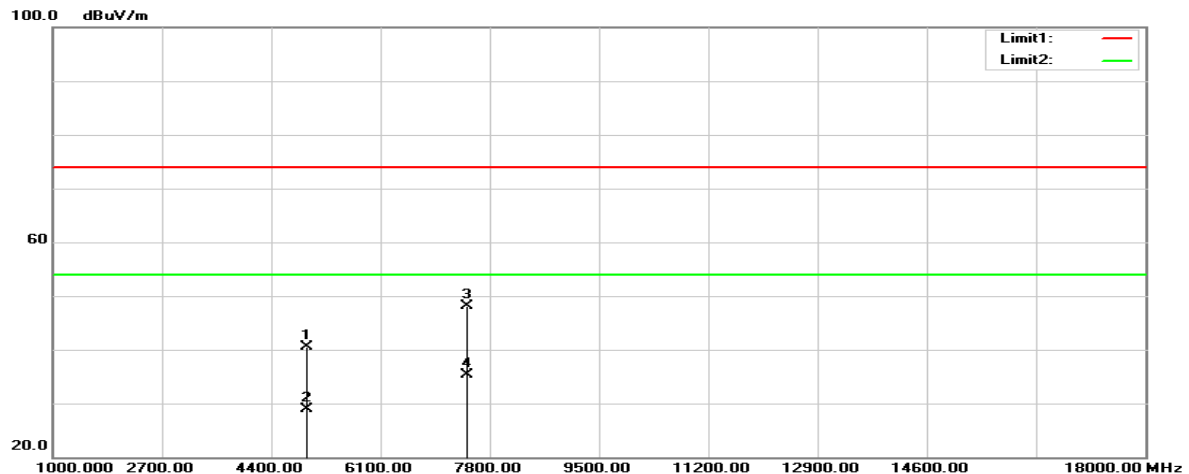
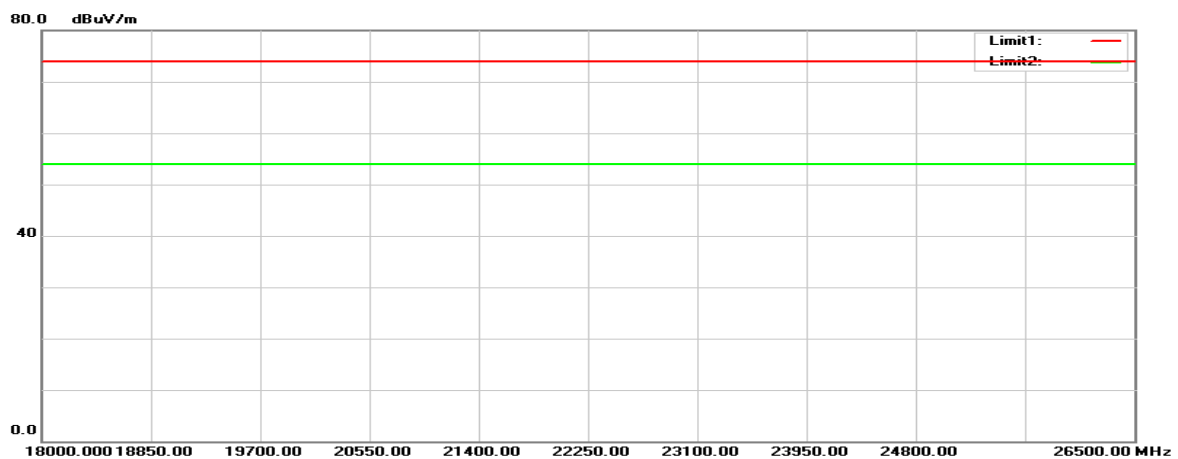
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:38:22
		Test By:	Ken
Description:	BLE_1M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4960.000	43.15	-2.69	40.46	74.00	-33.54	150	136	peak
4960.000	31.69	-2.69	29.00	54.00	-25.00	150	136	AVG
7440.000	43.85	4.25	48.10	74.00	-25.90	150	339	peak
7440.000	31.07	4.25	35.32	54.00	-18.68	150	339	AVG

Note:

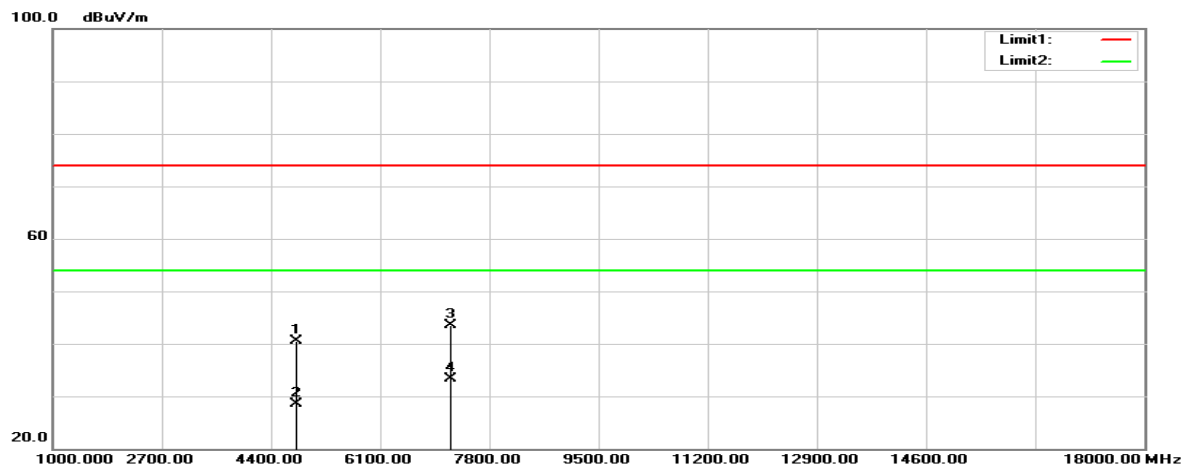
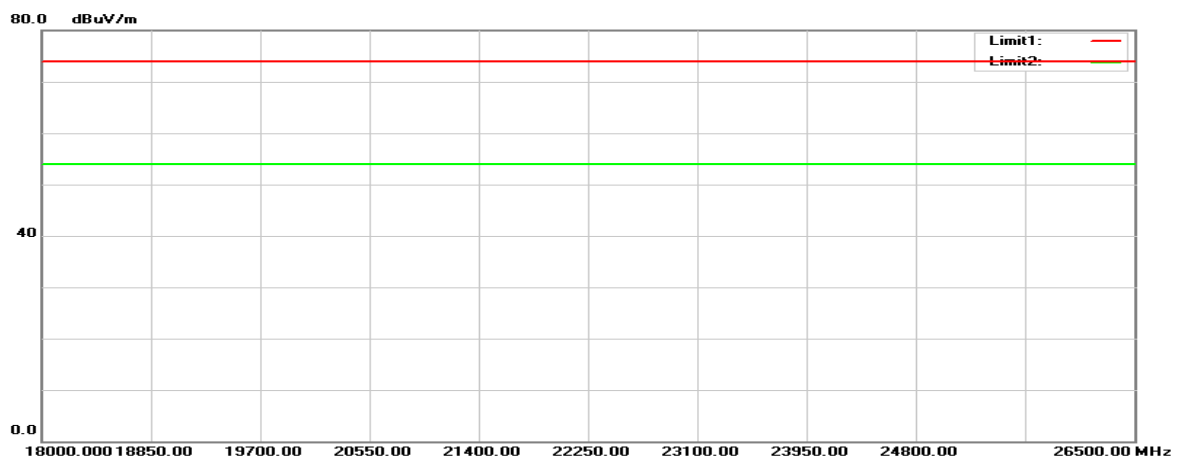
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:41:19
		Test By:	Ken
Description:	BLE_2M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4804.000	43.78	-3.28	40.50	74.00	-33.50	150	104	peak
4804.000	31.72	-3.28	28.44	54.00	-25.56	150	104	AVG
7206.000	40.47	3.10	43.57	74.00	-30.43	150	1	peak
7206.000	30.27	3.10	33.37	54.00	-20.63	150	1	AVG

Note:

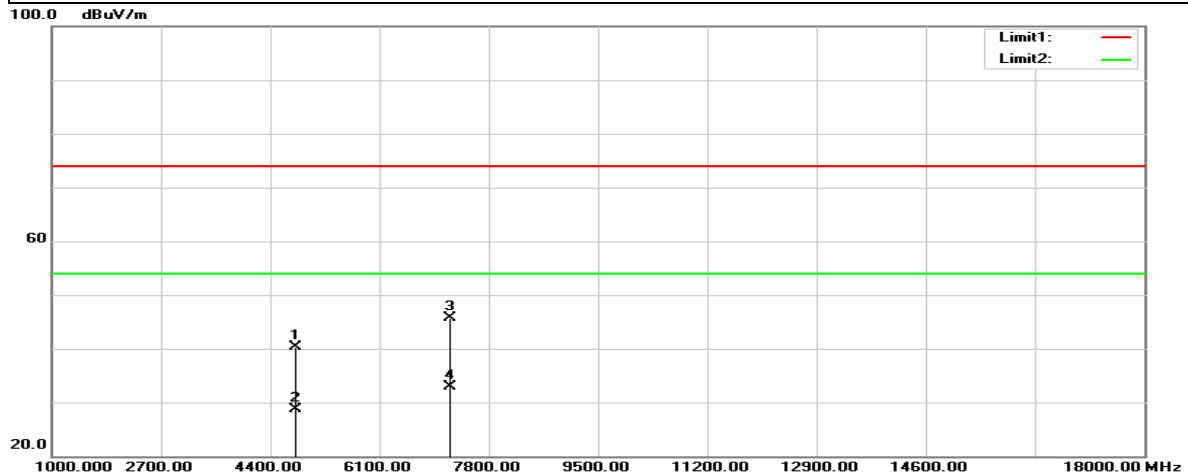
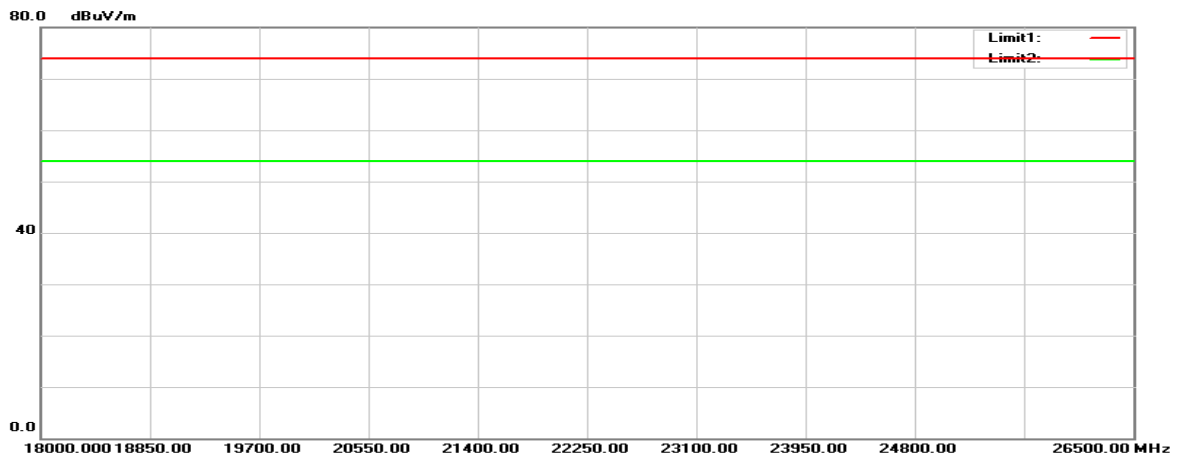
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:43:44
		Test By:	Ken
Description:	BLE_2M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4804.000	43.63	-3.28	40.35	74.00	-33.65	150	2	peak
4804.000	31.92	-3.28	28.64	54.00	-25.36	150	2	AVG
7206.000	42.54	3.10	45.64	74.00	-28.36	150	354	peak
7206.000	29.87	3.10	32.97	54.00	-21.03	150	354	AVG

Note:

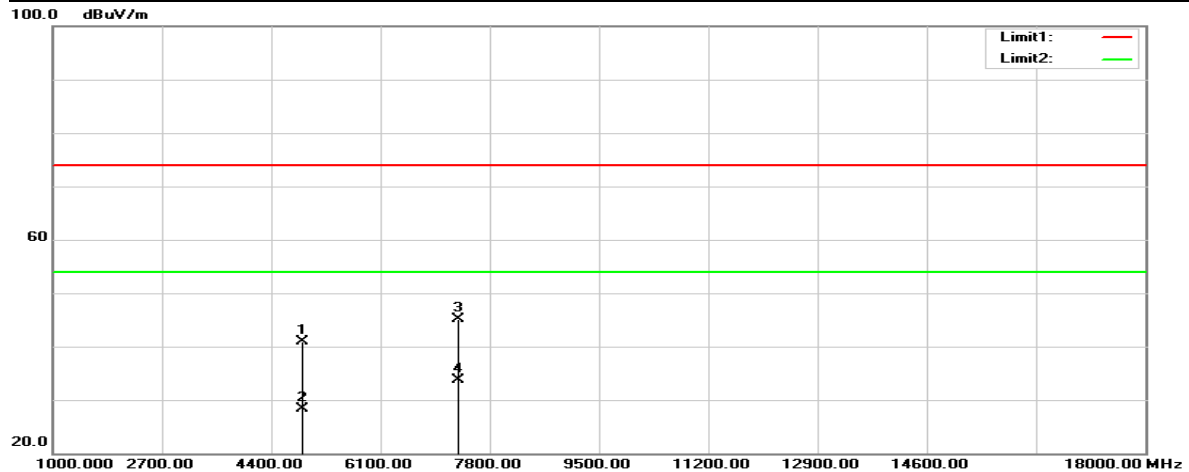
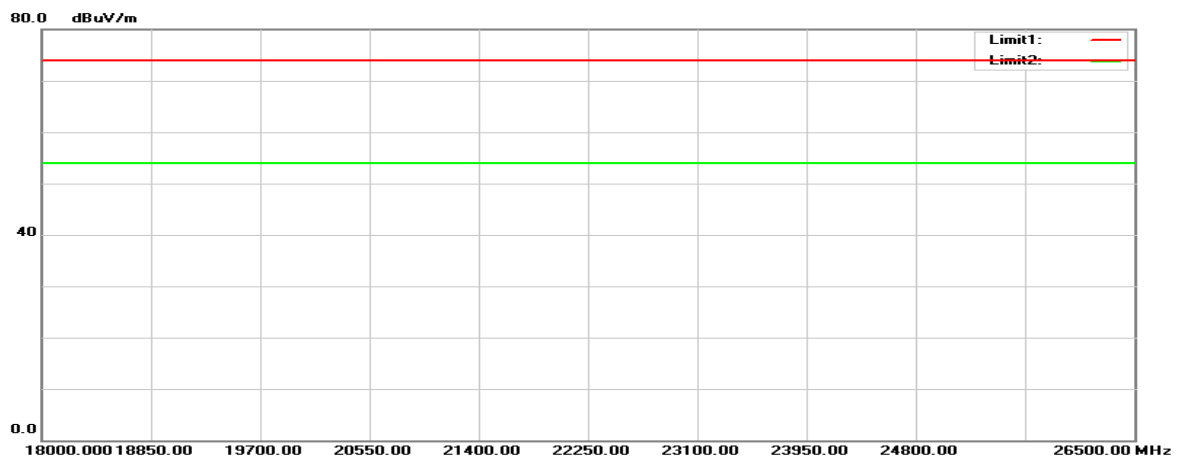
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:46:34
		Test By:	Ken
Description:	BLE_2M-TX-2440-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4880.000	43.84	-3.03	40.81	74.00	-33.19	150	359	peak
4880.000	31.38	-3.03	28.35	54.00	-25.65	150	359	AVG
7320.000	40.99	4.07	45.06	74.00	-28.94	150	5	peak
7320.000	29.56	4.07	33.63	54.00	-20.37	150	5	AVG

Note:

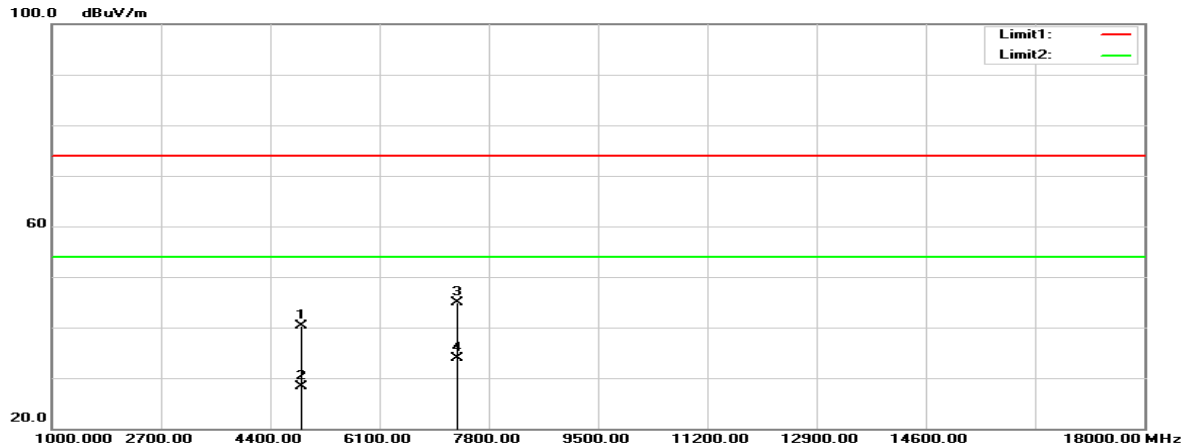
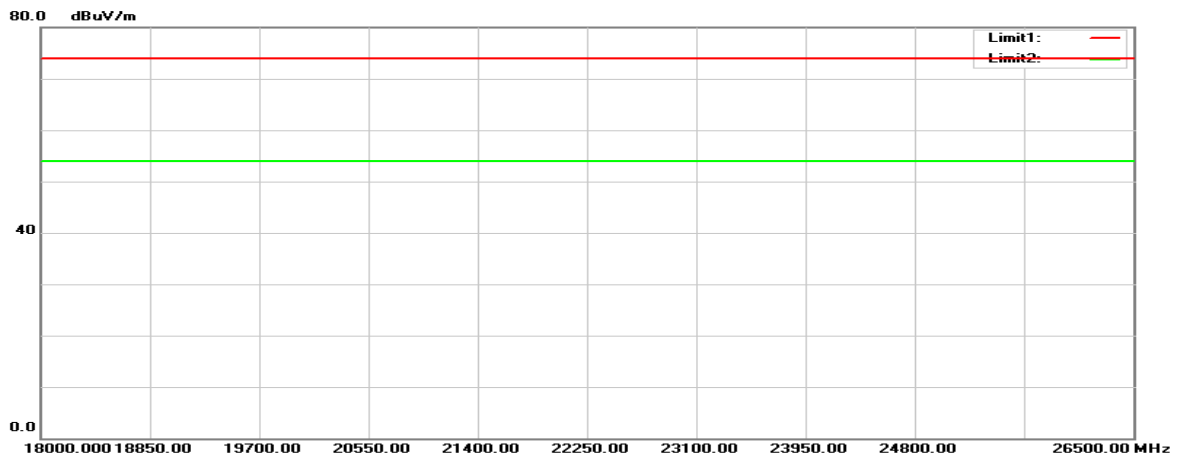
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:49:34
		Test By:	Ken
Description:	BLE_2M-TX-2440-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4880.000	43.42	-3.03	40.39	74.00	-33.61	150	336	peak
4880.000	31.39	-3.03	28.36	54.00	-25.64	150	336	AVG
7320.000	40.90	4.07	44.97	74.00	-29.03	150	124	peak
7320.000	29.77	4.07	33.84	54.00	-20.16	150	124	AVG

Note:

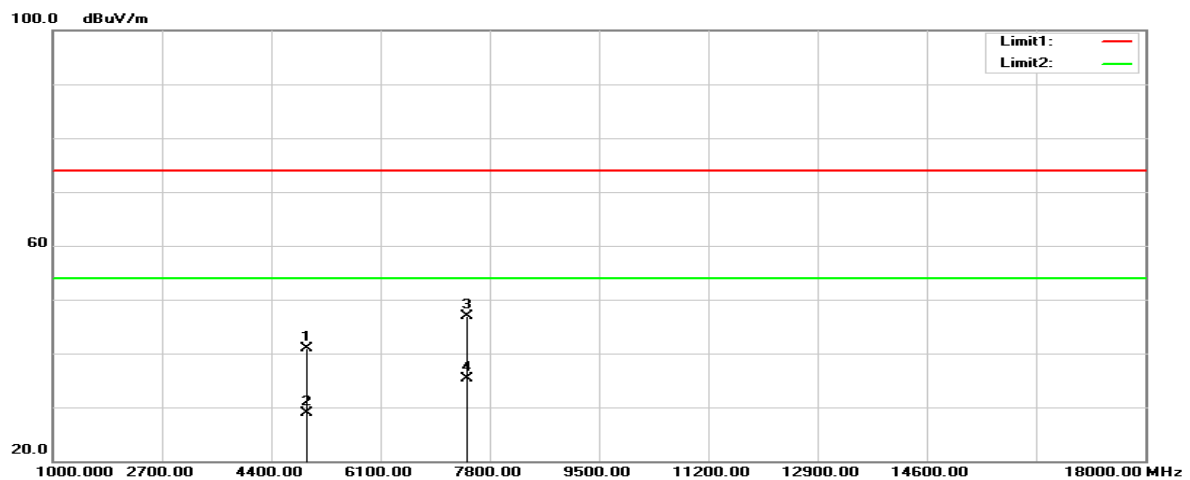
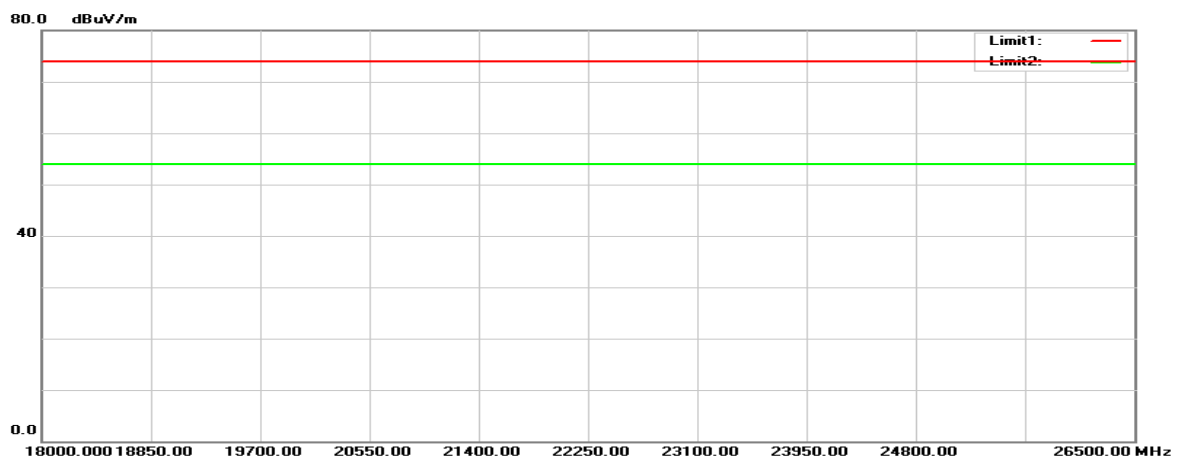
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:52:15
		Test By:	Ken
Description:	BLE_2M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4960.000	43.54	-2.69	40.85	74.00	-33.15	150	231	peak
4960.000	31.59	-2.69	28.90	54.00	-25.10	150	231	AVG
7440.000	42.68	4.25	46.93	74.00	-27.07	150	277	peak
7440.000	31.02	4.25	35.27	54.00	-18.73	150	277	AVG

Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:55:00
		Test By:	Ken
Description:	BLE_2M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4960.000	42.68	-2.69	39.99	74.00	-34.01	150	209	peak
4960.000	31.45	-2.69	28.76	54.00	-25.24	150	209	AVG
7440.000	43.29	4.25	47.54	74.00	-26.46	150	277	peak
7440.000	31.10	4.25	35.35	54.00	-18.65	150	277	AVG

Note:

Result = Reading + Correct Factor

Margin = Result – Limit

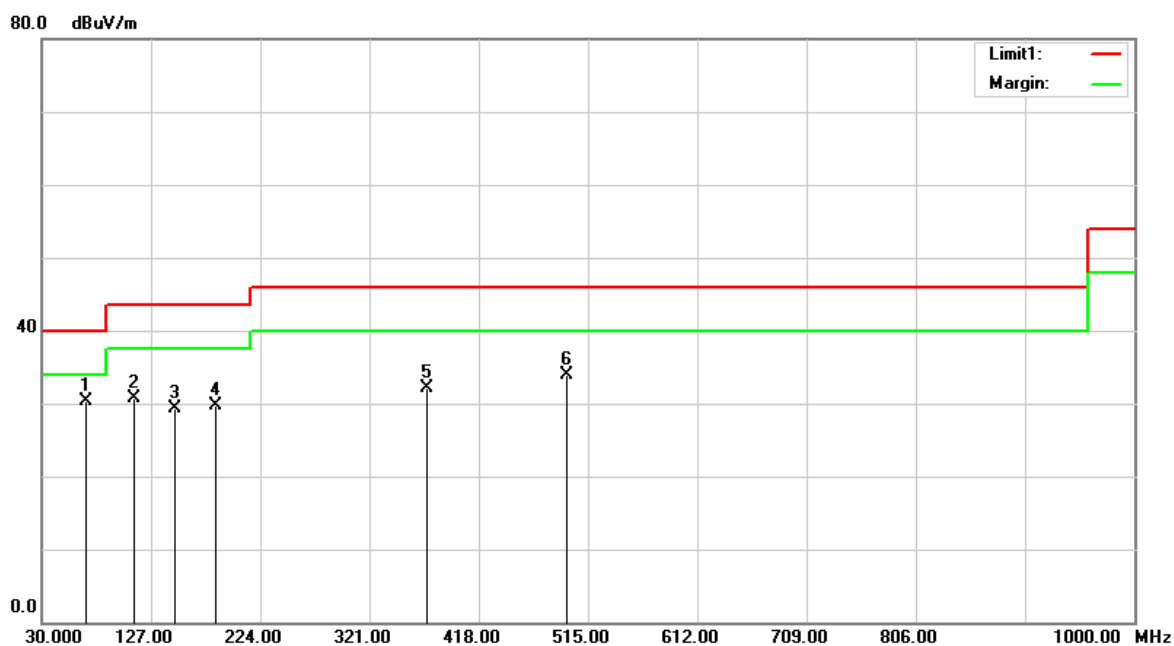
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

接收機其它不必要之訊號 (RX / 1GHz 以下)

場強輻射之量測值

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 _3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 07:00:59
		Test By:	Ken
Description:	BLE_1M-RX-2402-X_Axis		



Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
68.8000	46.51	-16.30	30.21	40.00	-9.79	100	334	peak
112.4500	41.97	-11.36	30.61	43.50	-12.89	100	298	peak
148.3400	40.33	-11.00	29.33	43.50	-14.17	100	282	peak
184.2300	42.63	-12.97	29.66	43.50	-13.84	100	284	peak
372.4100	40.64	-8.59	32.05	46.00	-13.95	100	59	peak
496.5700	39.69	-5.71	33.98	46.00	-12.02	100	41	peak

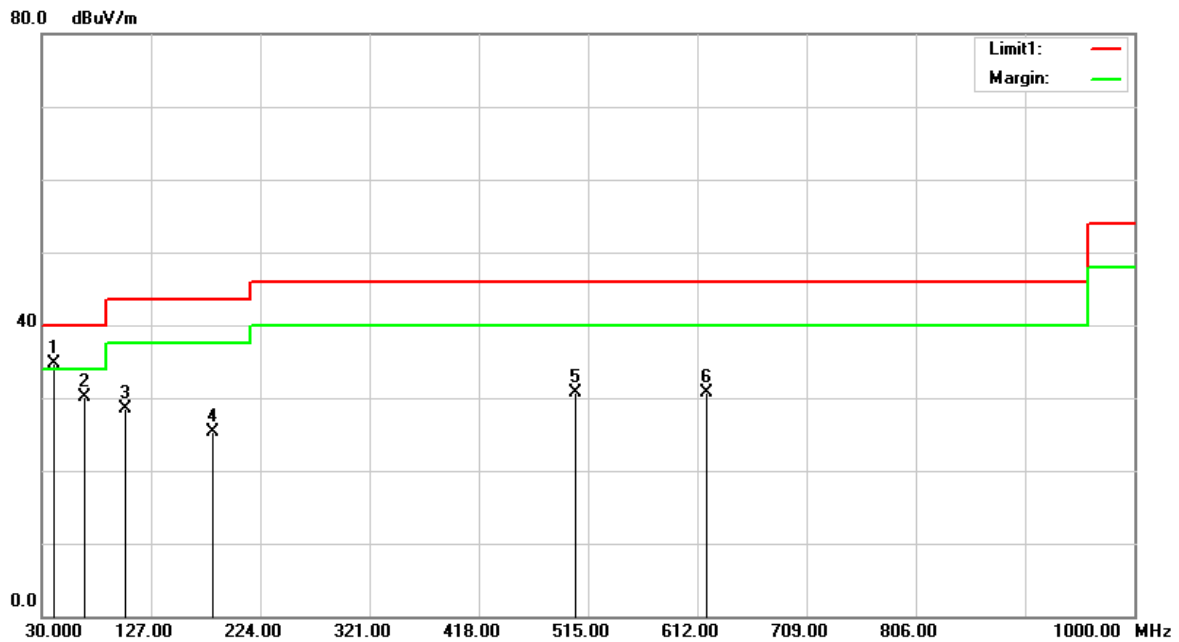
Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 _ 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 07:03:52
		Test By:	Ken
Description: BLE_1M-RX-2402-X_Axis			



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
40.6700	45.93	-11.14	34.79	40.00	-5.21	100	276	QP
67.8300	46.45	-16.28	30.17	40.00	-9.83	100	97	peak
103.7200	41.76	-13.26	28.50	43.50	-15.00	100	358	peak
181.3200	38.22	-12.92	25.30	43.50	-18.20	100	239	peak
503.3600	36.40	-5.67	30.73	46.00	-15.27	100	35	peak
620.7300	35.67	-4.87	30.80	46.00	-15.20	100	27	peak

Note:

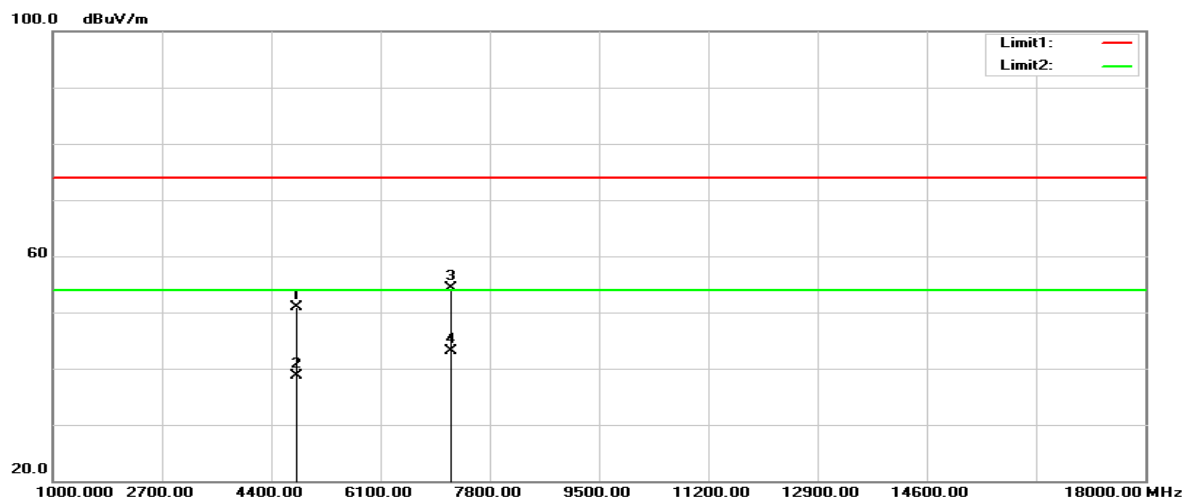
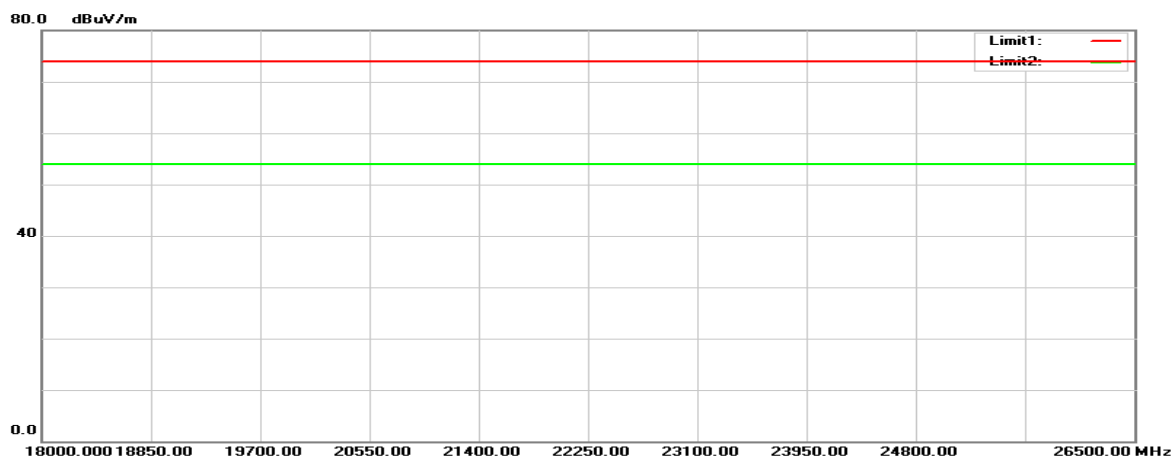
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

場強輻射之量測值 (RX / 1GHz 以上)

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/27	Time:下午 11:58:08
		Test By:	Ken
Description:	BLE_1M-RX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4804.000	54.13	-3.28	50.85	74.00	-23.15	150	228	peak
4804.000	41.99	-3.28	38.71	54.00	-15.29	150	228	AVG
7206.000	51.16	3.10	54.26	74.00	-19.74	150	168	peak
7206.000	39.91	3.10	43.01	54.00	-10.99	150	168	AVG

Note:

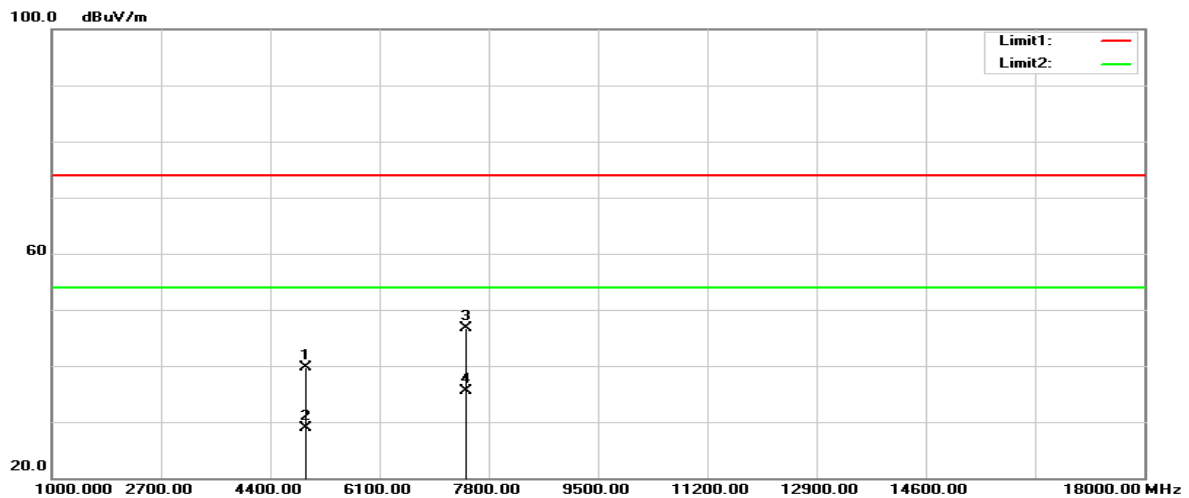
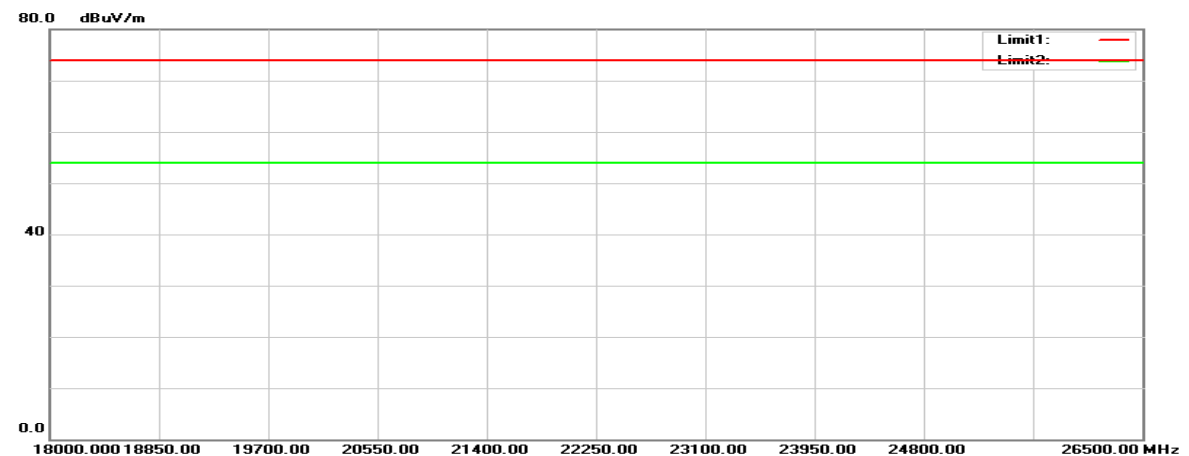
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.9(°C)/64%RH	Date:2021/9/28	Time:上午 12:01:12
		Test By:	Ken
Description:	BLE_1M-RX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
4960.000	42.38	-2.69	39.69	74.00	-34.31	150	178	peak
4960.000	31.58	-2.69	28.89	54.00	-25.11	150	178	AVG
7440.000	42.38	4.25	46.63	74.00	-27.37	150	170	peak
7440.000	31.25	4.25	35.50	54.00	-18.50	150	170	AVG

Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

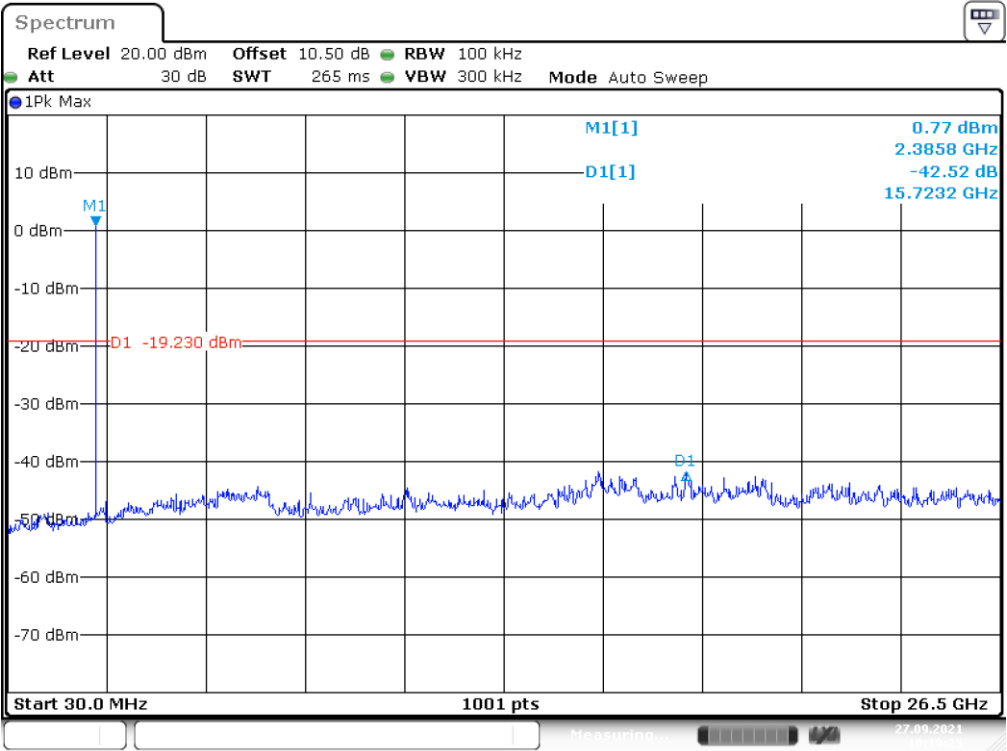
Other emissions from 18GHz~26.5GHz are 20 dB below the limits. No recording in the test.

Conducted Spurious Emissions:

環境溫度	25.4°C	測試日期	2021-09-27
環境濕度	44%	測試人員	李宥陞

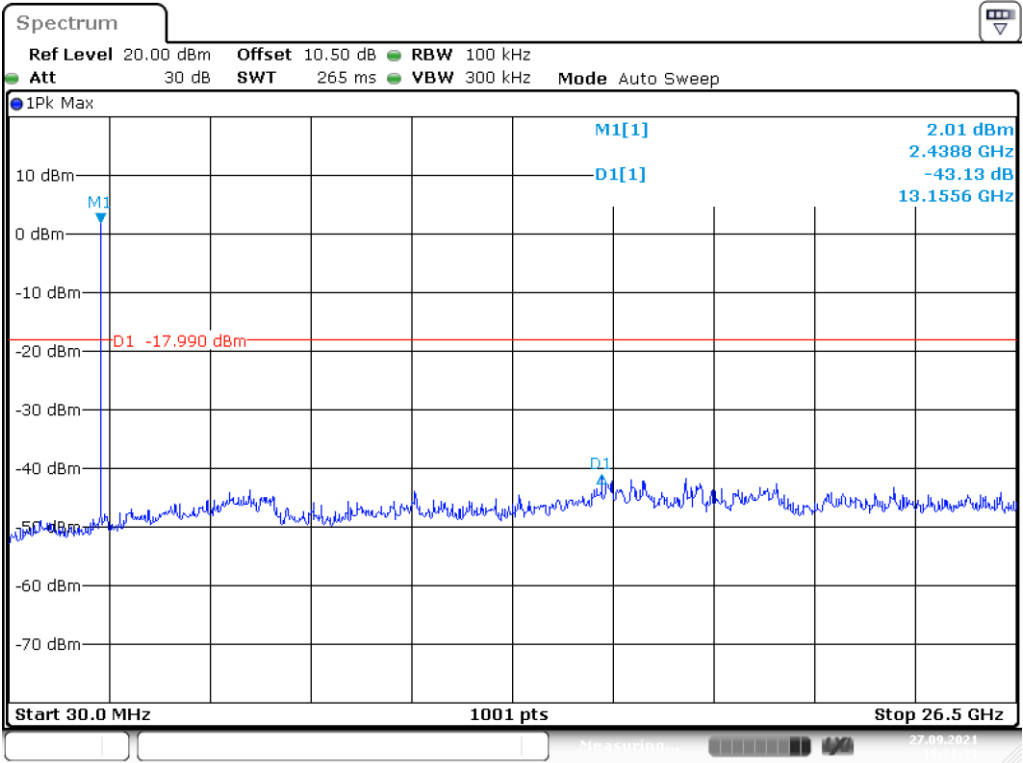
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE(1M) mode				
Low	2402	42.52	≥ 20	PASS
Mid	2440	43.13	≥ 20	PASS
High	2480	44.22	≥ 20	PASS
BLE(2M) mode				
Low	2402	40.27	≥ 20	PASS
Mid	2440	41.93	≥ 20	PASS
High	2480	40.47	≥ 20	PASS

BLE (1M) Mode
Low Channel



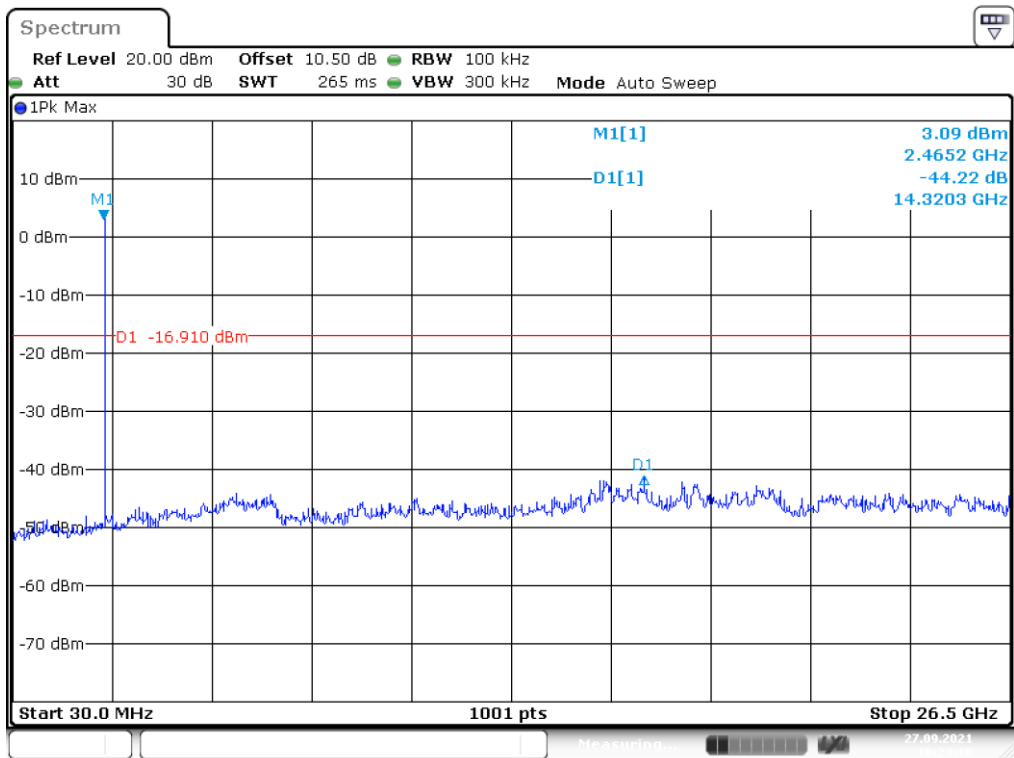
Date: 27.SEP.2021 10:19:26

Middle Channel



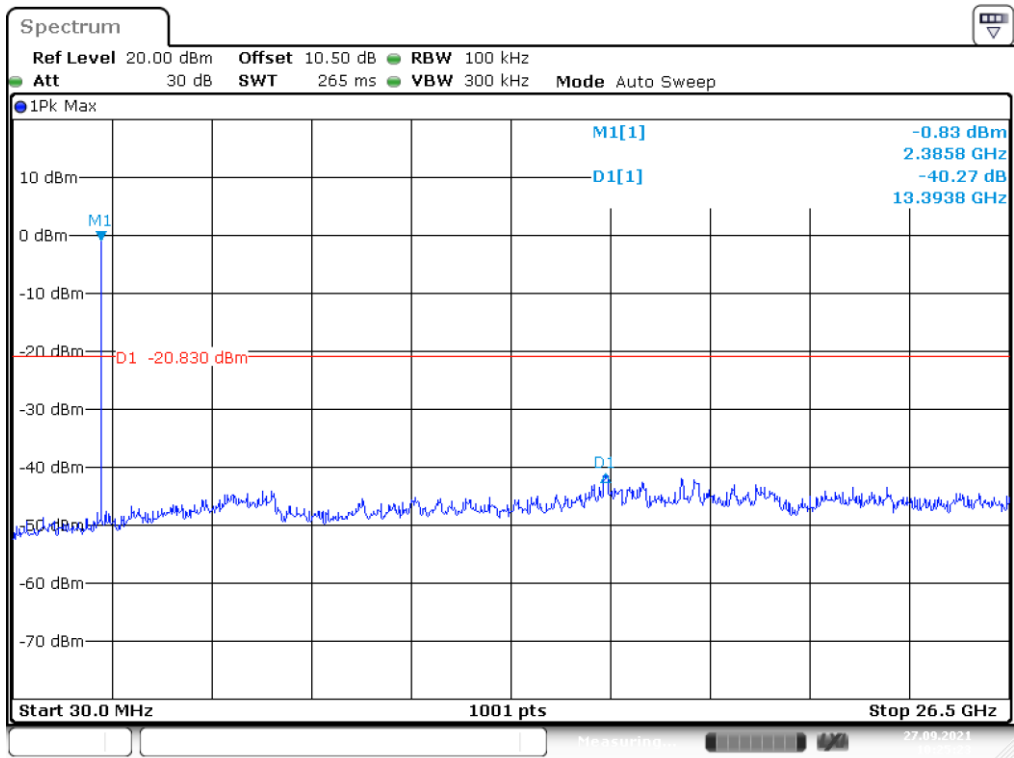
Date: 27.SEP.2021 10:21:21

High Channel



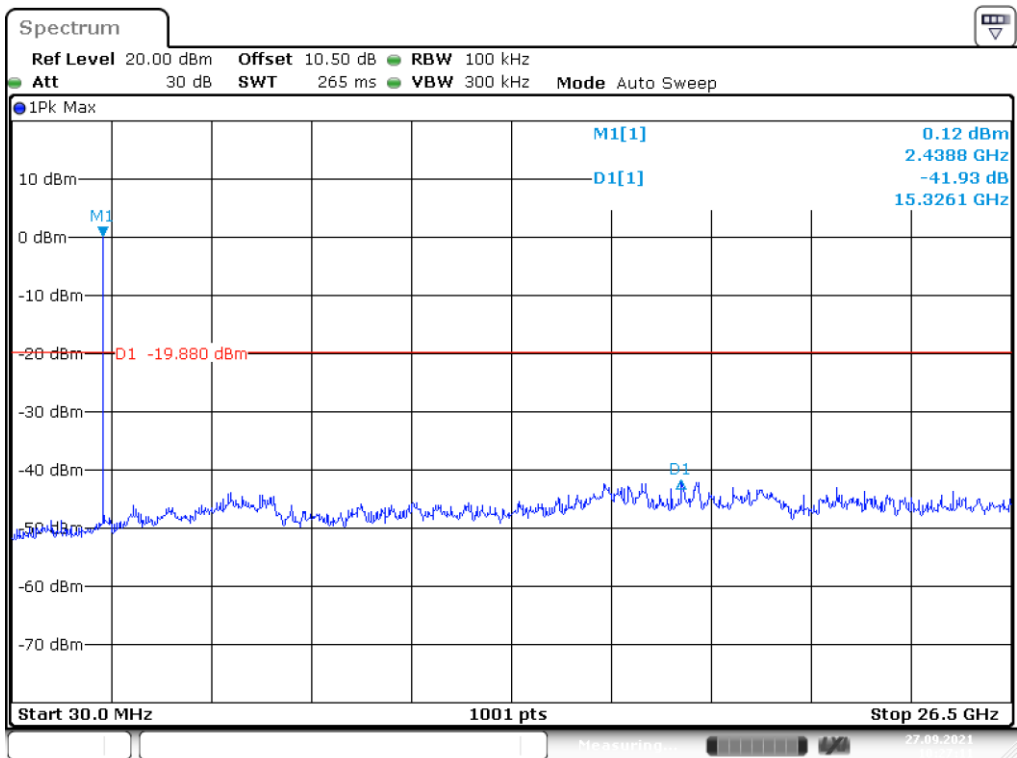
Date: 27.SEP.2021 10:23:18

BLE (2M) Mode
Low Channel



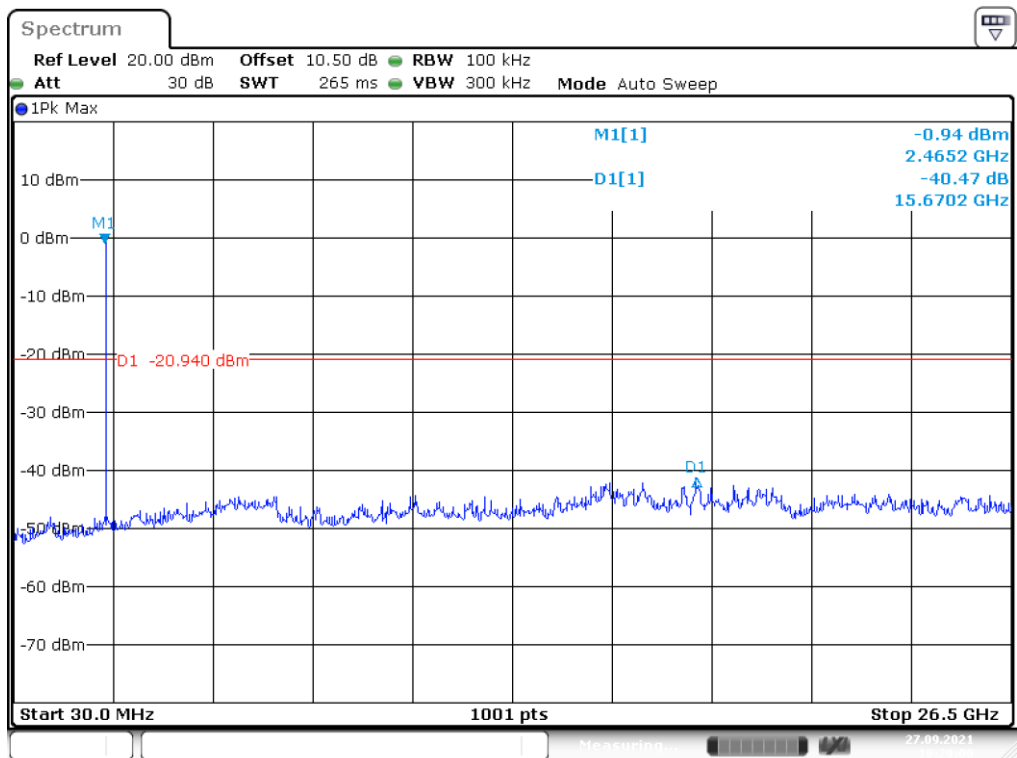
Date: 27.SEP.2021 10:25:23

Middle Channel



Date: 27.SEP.2021 10:27:11

High Channel



Date: 27.SEP.2021 10:29:01

6. 天線增益之要求

6.1 適用標準

依據低功率射頻電機技術規範之規定，應符合下列敘述其中之一：

進行固定式點對點操作時，其發射天線之方向性增益超過6 dBi，每超過3 dBi，最大傳導輸出功率限制值應降低1 dB。

操作頻率為5725 MHz ~ 5850 MHz且進行固定式點對點操作時，其發射天線之方向性增益超過6 dBi，不需降低最大傳導輸出功率。

使用超過6 dBi方向增益之發射天線時，應依超過6 dBi天線方向增益的dBi總量，等量減少最大傳導輸出功率限制值。

6.2 天線增益

此裝置使用的天線明細如下：

2.4GHz 天線型態	廠牌	型號	Gain
Dipole Antenna	Rengfeng	RF11C03132S	4.5 dBi

** 其詳細規格資料，請參見：天線規格。

判定結果：符合規範

7. 發射頻寬之要求

7.1 適用標準

對使用跳頻系統之低功率發射機依據低功率射頻電機技術規範之規定，跳頻系統之載波頻率頻道間隔應大於或等於25 kHz或跳頻頻道之20 dB頻寬，兩者取較寬者。但操作頻率為2400 MHz ~ 2483.5 MHz頻段且輸出功率應小於或等於125 mW跳頻系統，其載波頻率頻道間隔不得小於25 kHz或跳頻頻道20 dB頻寬之三分之二，兩者取較寬者。系統之跳頻頻道應依虛擬亂數排列，在各頻率之跳頻頻道上跳躍。每一發射機必須均等的使用每一頻率。系統接收機應具有與發射機跳躍頻道頻寬相匹配之輸入頻寬，且應隨所發射之訊號同步偏移接收頻率。

對使用數位調變技術之低功率發射機，依據低功率射頻電機技術規範之規定，6 dB之頻寬至少應有500 kHz。

7.2 測試方法

測量時，頻譜分析儀之解析頻寬為100kHz，視訊頻寬不小於解析頻寬。為求得精確測量，頻率掃描範圍(Span)遠大於解析頻寬。

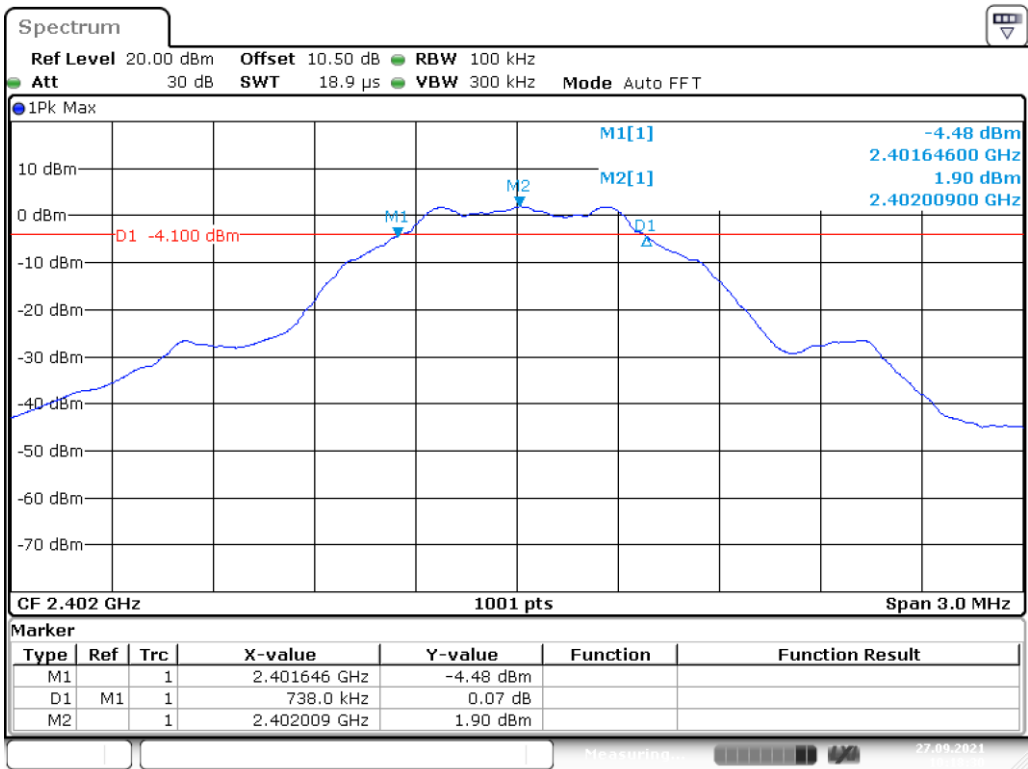
7.3 發射頻寬之量測結果

環境溫度	25.4°C	測試日期	2021-09-27
環境濕度	44%	測試人員	李宥陞

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Result
BLE(1M) mode				
Low	2402	0.74	>500	PASS
Mid	2440	0.74		PASS
High	2480	0.74		PASS
BLE(2M) mode				
Low	2402	1.13	>500	PASS
Mid	2440	1.12		PASS
High	2480	1.12		PASS

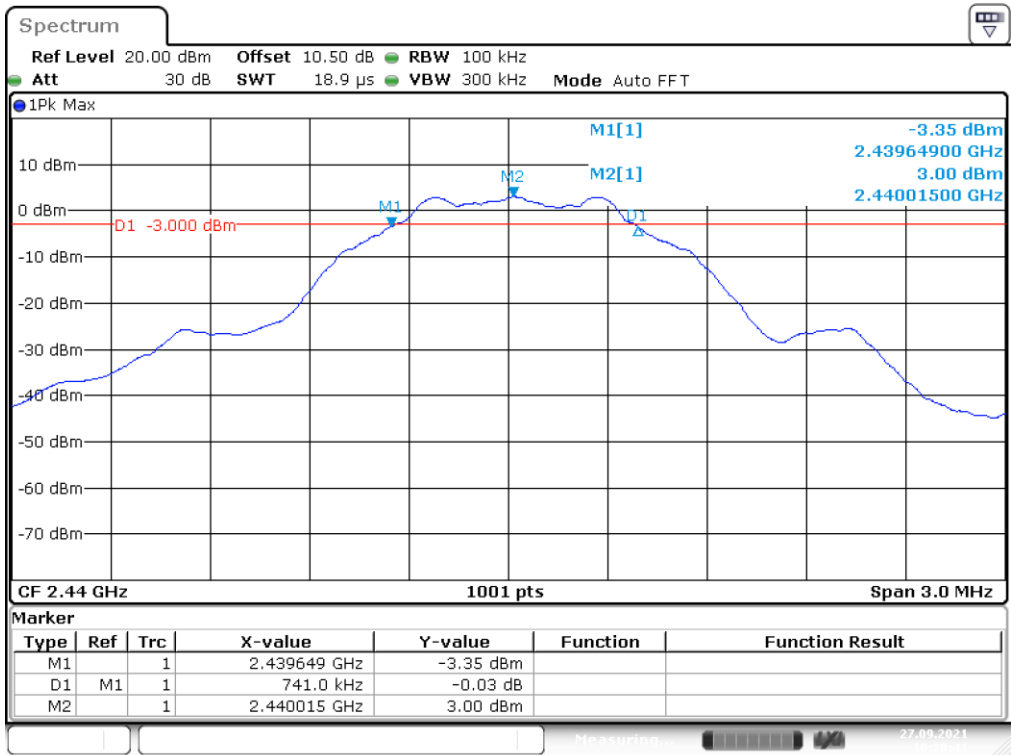
6 dB Emission Bandwidth

BLE(1M) Mode
Low Channel



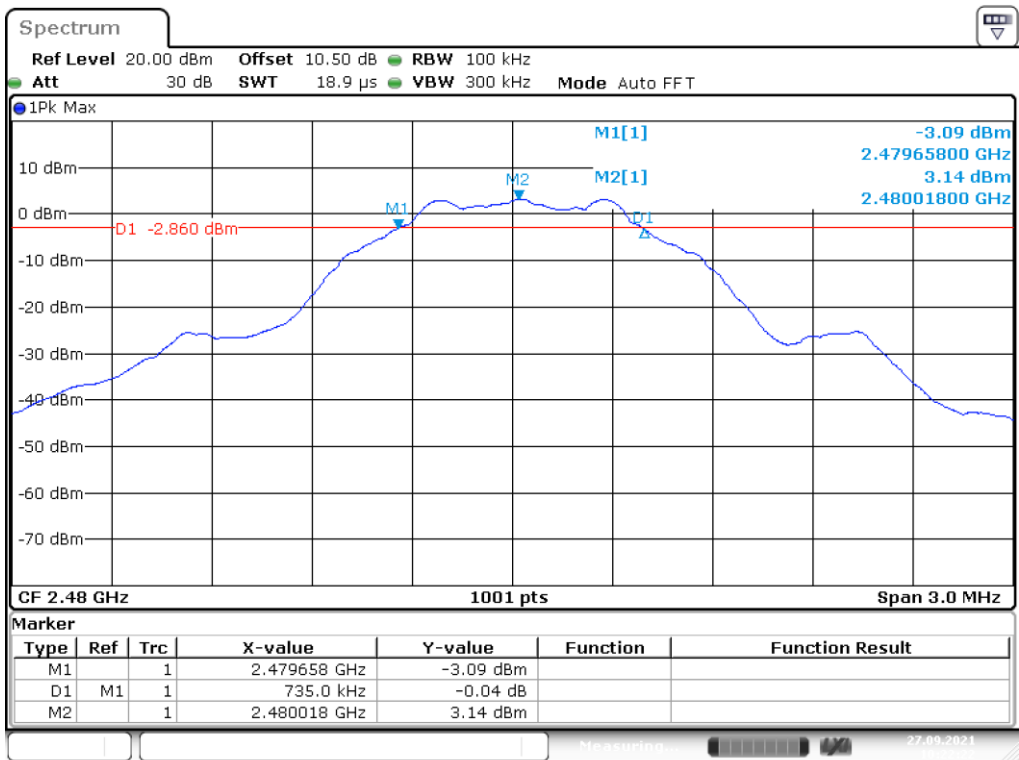
Date: 27.SEP.2021 10:18:30

Middle Channel



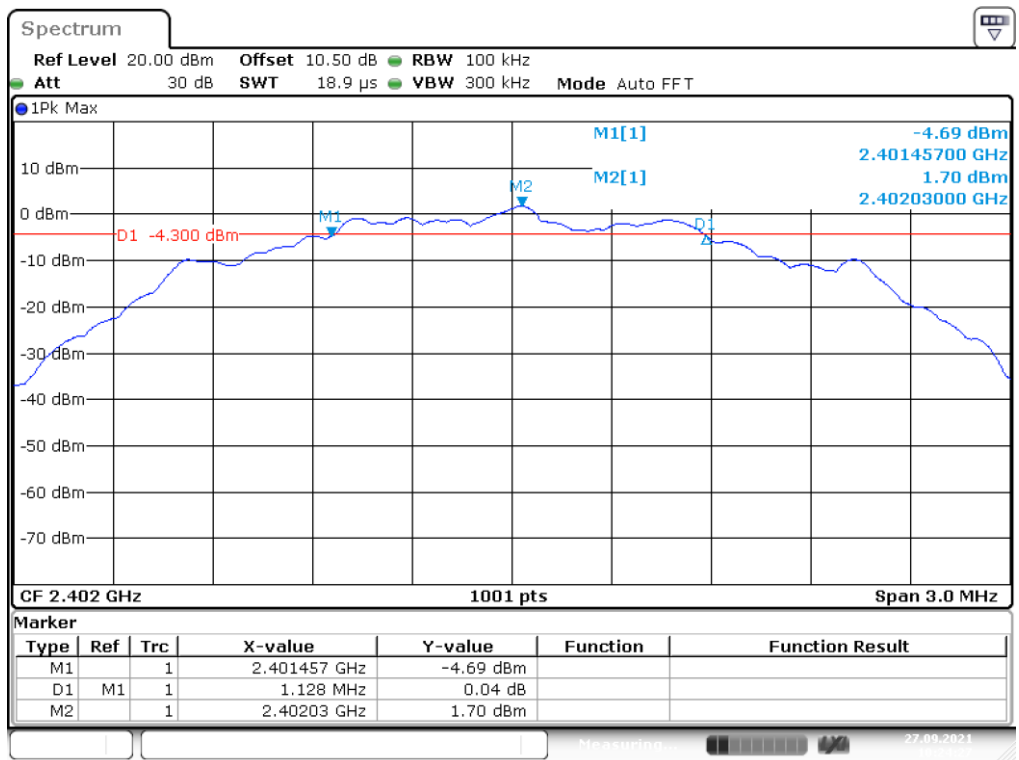
Date: 27.SEP.2021 10:20:41

High Channel



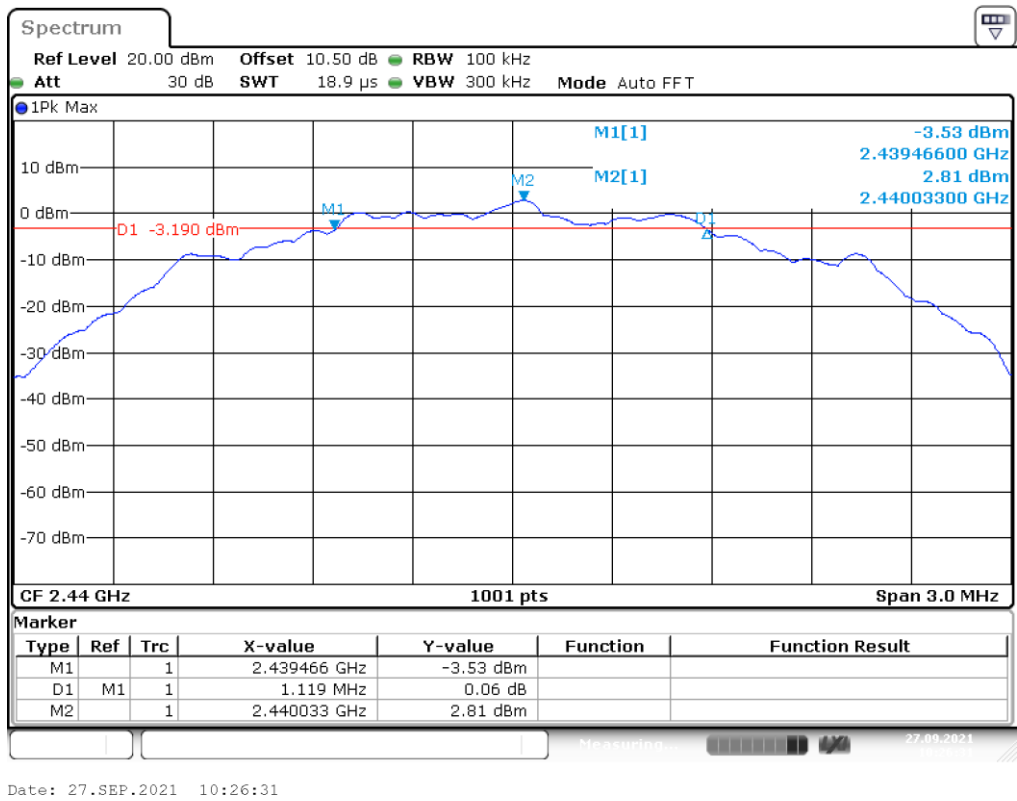
Date: 27.SEP.2021 10:22:22

BLE(2M) Mode
Low Channel

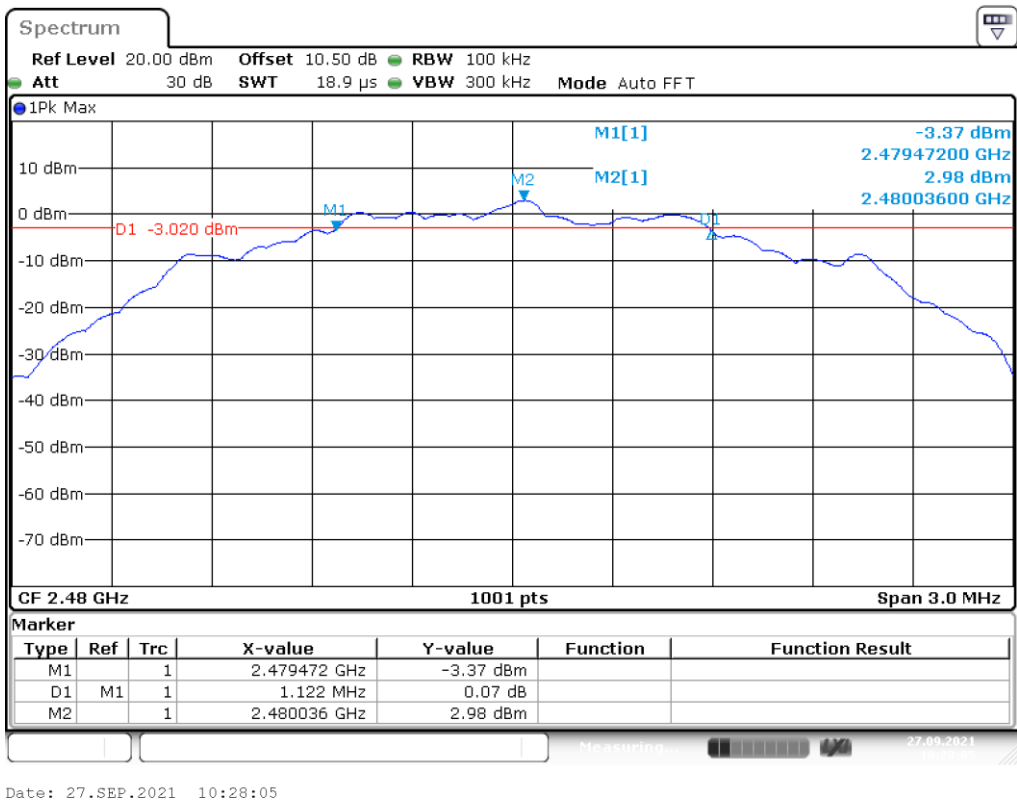


Date: 27.SEP.2021 10:24:27

Middle Channel



High Channel



8. 輸出峰值功率之量測

8.1 適用標準

依據低功率射頻電機技術規範之規定，跳頻系統至少使用75個跳頻頻道：1 W(含)以下；跳頻系統依規定操作於2400 MHz ~ 2483.5 MHz之展頻跳頻系統，須使用至少15個無重疊的頻道，在0.4秒乘以跳頻頻道數之週期內，任一頻率占用之平均時間應小於或等於0.4秒，應使用智慧型跳頻技術：0.125 W(含)以下；數位調變技術系統：1 W(含)以下。

8.2 測試方法

1. 將受測物的RF埠經由一條50歐姆纜線連接至功率分析儀。
2. 設定量測頻率為量測頻道。
3. 紀錄最大峰值輸出功率。

上述之測試步驟應注意外接之衰減與纜線損失。

8.3 輸出功率之量測結果

環境溫度	25.4℃	測試日期	2021-09-27
環境濕度	44%	測試人員	李宥陞

Channel	Frequency (MHz)	Peak Output Power (dBm)	Output Power (W)	Limit (W)	Result
BLE(1M) mode					
Low	2402	2.83	0.002	1	PASS
Mid	2440	3.96	0.002		PASS
High	2480	4.03	0.003		PASS
BLE(2M) mode					
Low	2402	2.89	0.002	1	PASS
Mid	2440	3.96	0.002		PASS
High	2480	4.07	0.003		PASS

9. 開放頻帶邊緣 100kHz 頻寬內之限制

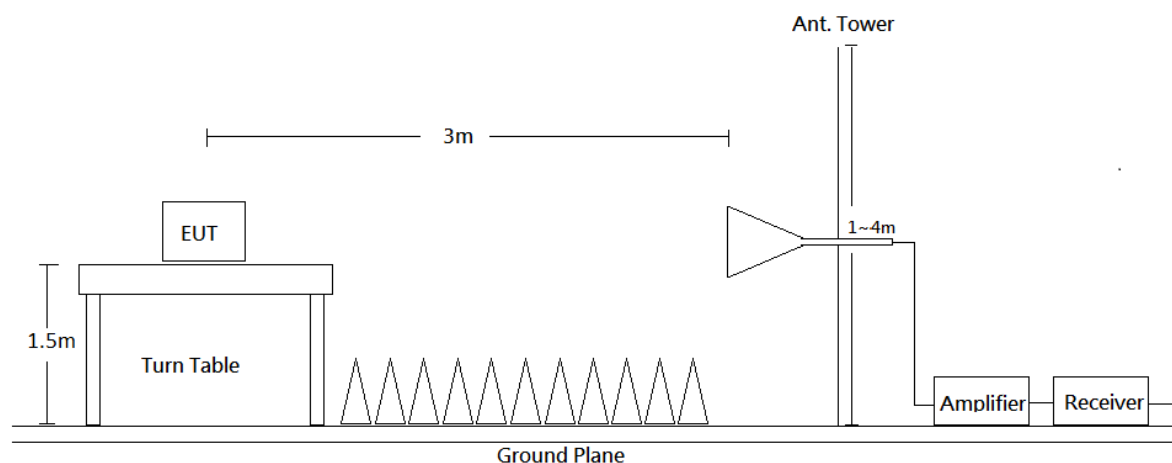
9.1 適用標準

依據低功率射頻電機技術規範之規定，使用頻帶範圍外之任意100 kHz內，發射器所產生的射頻功率相較於使用頻帶範圍中包含最高所需功率之100 kHz內的射頻功率，峰值輸出功率方式測量者須衰減20分貝(dB)，以射頻傳導或輻射方式測量。最大傳導輸出功率測量方式者，至少須衰減30 dB。此外，落於禁用頻段之輻射發射，應符合規定。

9.2 測試方法

1. 頻率掃描範圍足以涵蓋操作在最靠近頻帶邊緣之頻道的發射波峰位準以及任何落於許可頻帶外之調變產物。
2. 解析頻寬大於1%頻率掃描範圍寬度，視訊頻寬不小於解析頻寬。掃描時間為自動，檢波功能為峰值，訊號軌跡為最大保留(Max Hold)。
3. 將標記設定於在頻帶邊緣上的發射，或將標記設定於最大之頻帶外調變產物上若其位準大於頻帶邊緣上的發射。啟動標記差值之功能，利用標記至波峰功能(Marker to Peak)功能以標記頻帶內發射之波峰，所顯示之標記差值必須符合指定之限制值。以上述相同的步驟決定由跳頻功能所產生的任何混附波是否亦符合規定之限制值。

9.3 測試配置



依據 ANSI C63.10:2020 架設

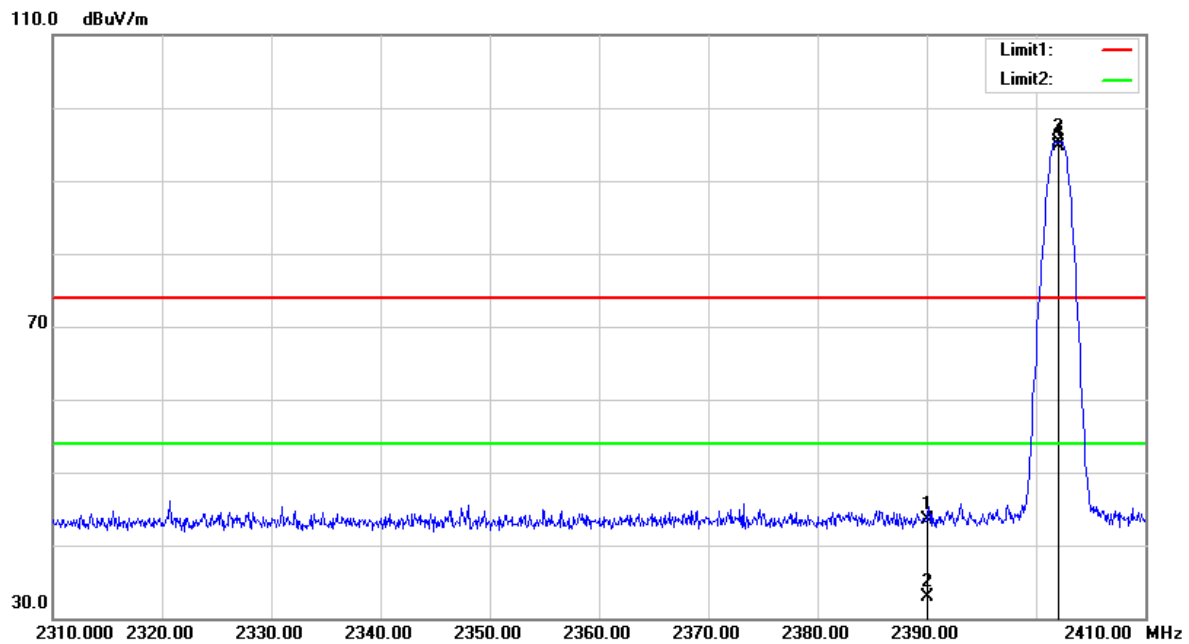
9.4 開放頻帶邊緣之量測結果

請參考附圖

判定結果: 符合規範

發射限制測試 BLE(1M) Mode / CH Low

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:12:58
		Test By:	Ken
Description:	BLE_1M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2390.000	53.67	-10.23	43.44	74.00	-30.56	149	94	peak
2390.000	43.23	-10.23	33.00	54.00	-21.00	149	94	AVG
2402.000	105.36	-10.14	95.22	N/A	N/A	149	94	peak
2402.000	104.87	-10.14	94.73	N/A	N/A	149	94	AVG

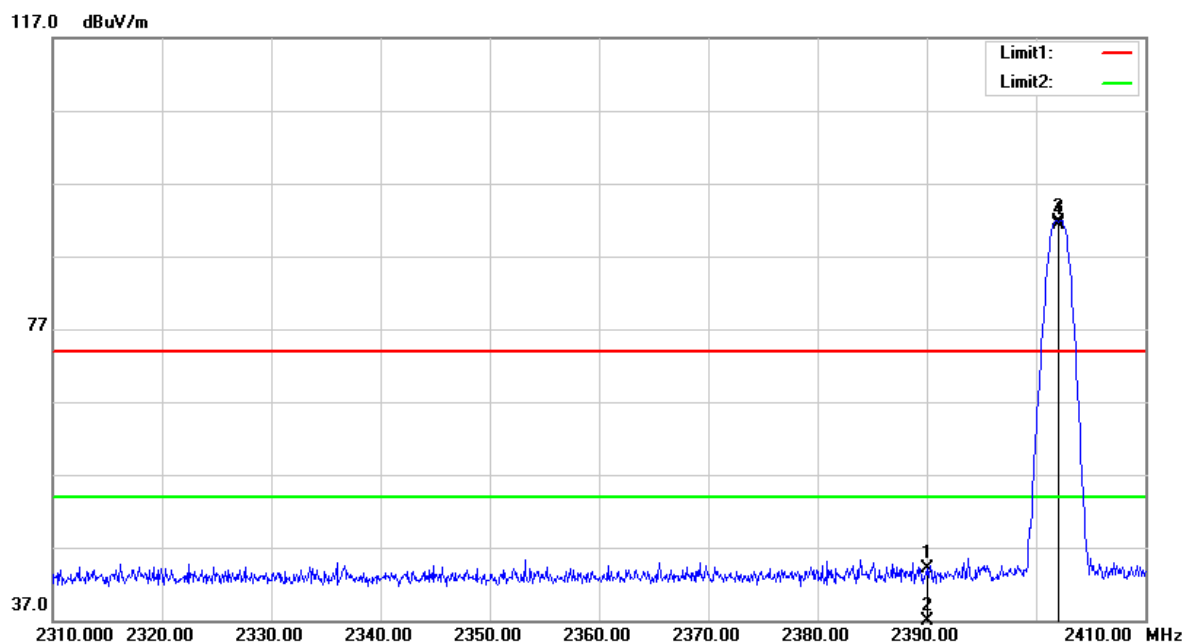
Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:46:37
		Test By:	Ken
Description:	BLE_1M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2390.000	54.36	-10.23	44.13	74.00	-29.87	138	341	peak
2390.000	43.36	-10.23	33.13	54.00	-20.87	138	341	AVG
2402.000	101.87	-10.14	91.73	N/A	N/A	138	341	peak
2402.000	101.37	-10.14	91.23	N/A	N/A	138	341	AVG

Note:

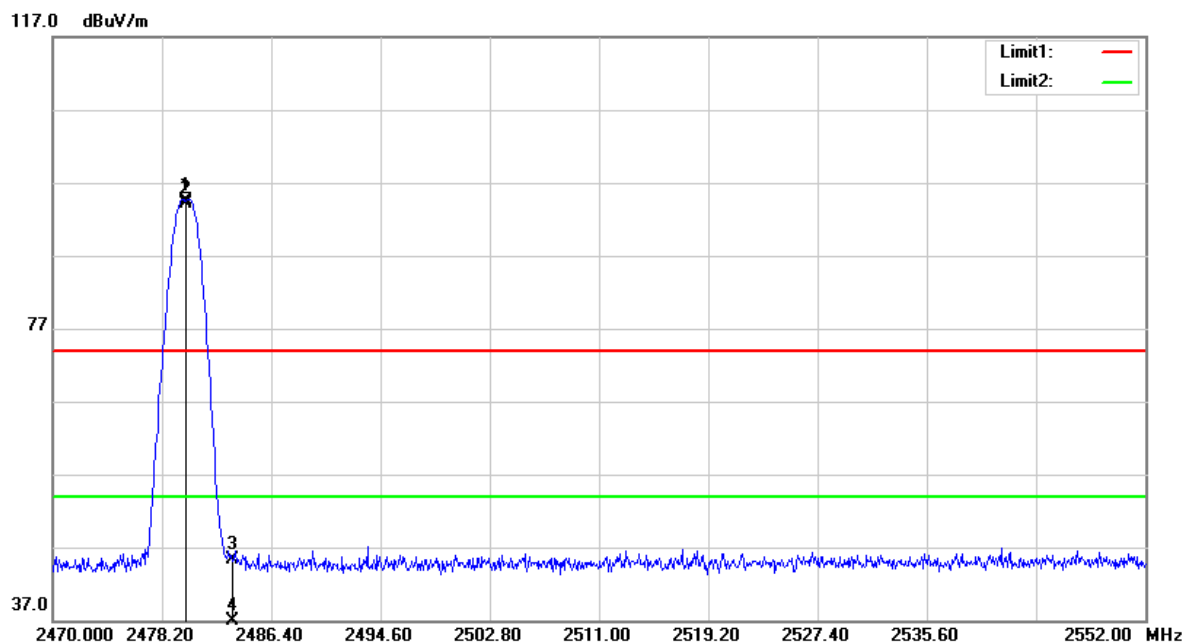
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

發射限制測試 BLE(1M) Mode / CH High

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:31:22
		Test By:	Ken
Description:	BLE_1M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2480.000	103.87	-9.31	94.56	N/A	N/A	152	103	peak
2480.000	103.35	-9.31	94.04	N/A	N/A	152	103	AVG
2483.500	54.46	-9.26	45.20	74.00	-28.80	152	103	peak
2483.500	43.56	-9.26	34.30	54.00	-19.70	152	103	AVG

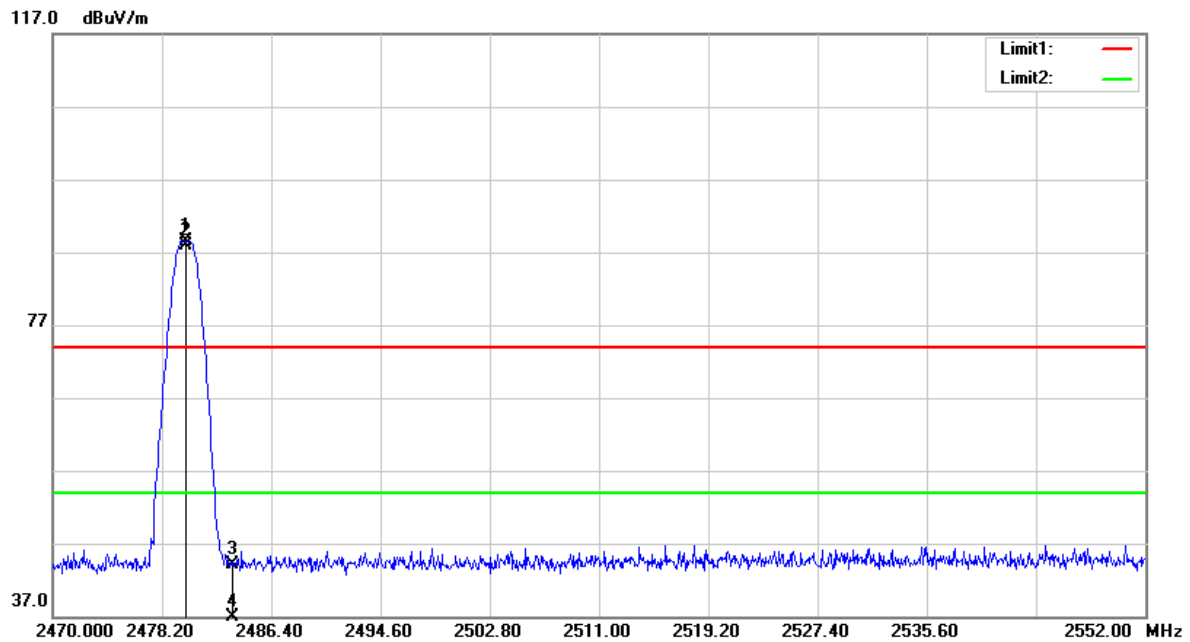
Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:52:38
		Test By:	Ken
Description:	BLE_1M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2480.000	97.81	-9.31	88.50	N/A	N/A	132	357	peak
2480.000	97.31	-9.31	88.00	N/A	N/A	132	357	AVG
2483.500	53.32	-9.26	44.06	74.00	-29.94	132	357	peak
2483.500	42.49	-9.26	33.23	54.00	-20.77	132	357	AVG

Note:

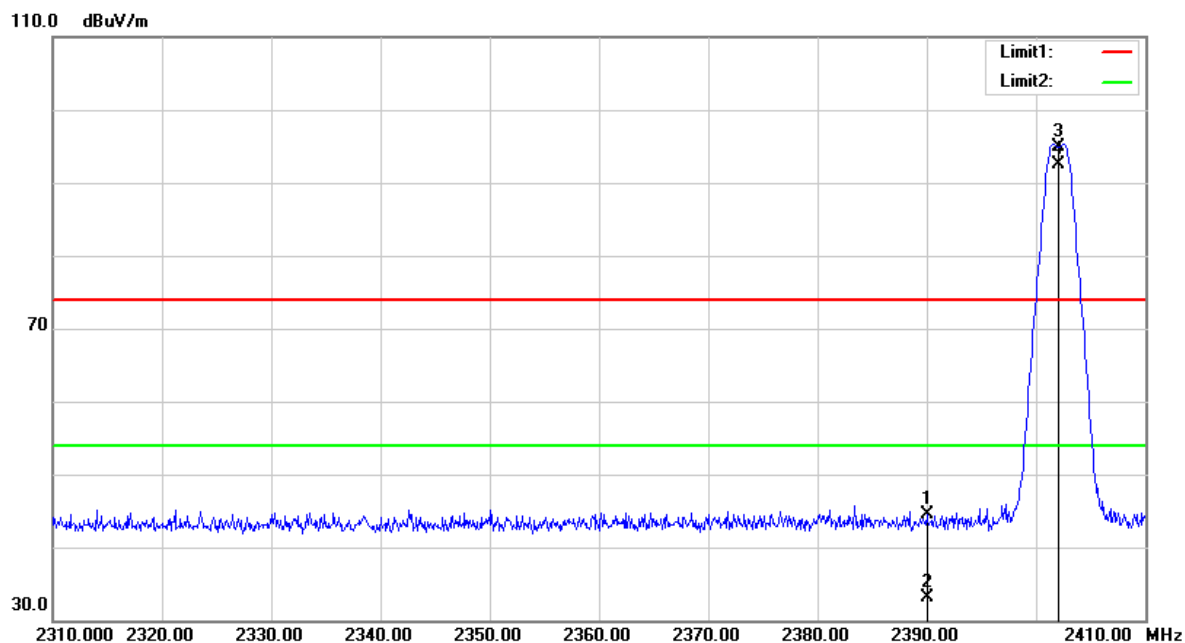
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

發射限制測試 BLE(2M) Mode / CH Low

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:16:50
		Test By:	Ken
Description:	BLE_2M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2390.000	54.82	-10.23	44.59	74.00	-29.41	152	97	peak
2390.000	43.36	-10.23	33.13	54.00	-20.87	152	97	AVG
2402.000	105.04	-10.14	94.90	N/A	N/A	152	97	peak
2402.000	102.61	-10.14	92.47	N/A	N/A	152	97	AVG

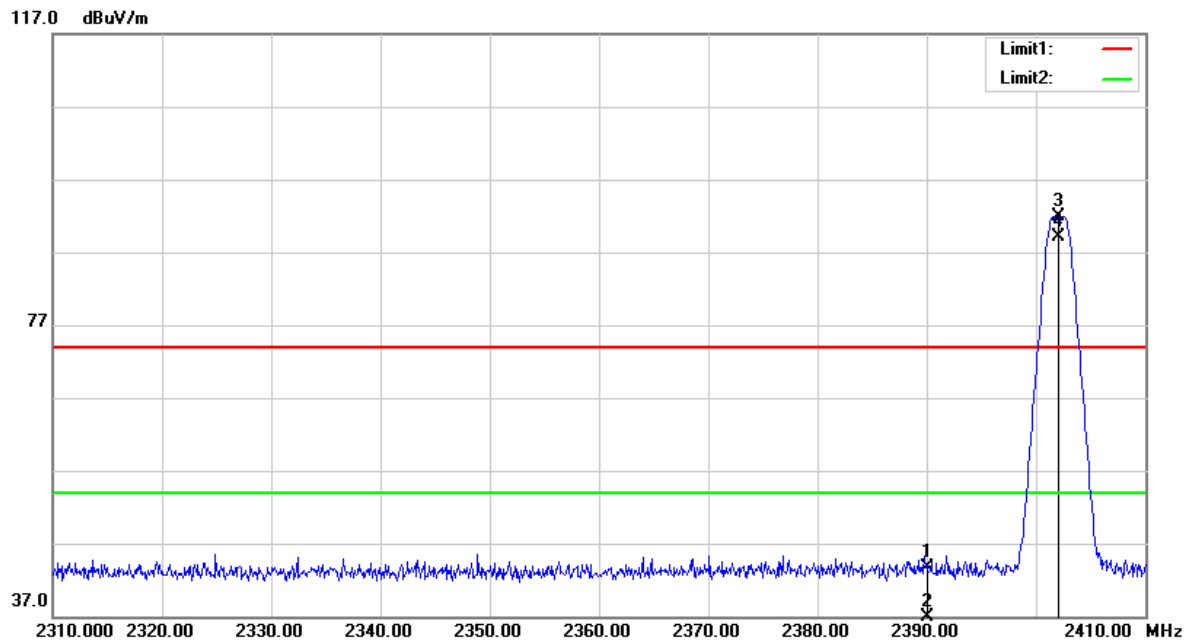
Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Job No.:	RXZ210924002	Ant.Polar.:	Vertical
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:48:06
		Test By:	Ken
Description:	BLE_2M-TX-2402-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2390.000	53.94	-10.23	43.71	74.00	-30.29	125	336	peak
2390.000	43.30	-10.23	33.07	54.00	-20.93	125	336	AVG
2402.000	102.04	-10.14	91.90	N/A	N/A	125	336	peak
2402.000	99.20	-10.14	89.06	N/A	N/A	125	336	AVG

Note:

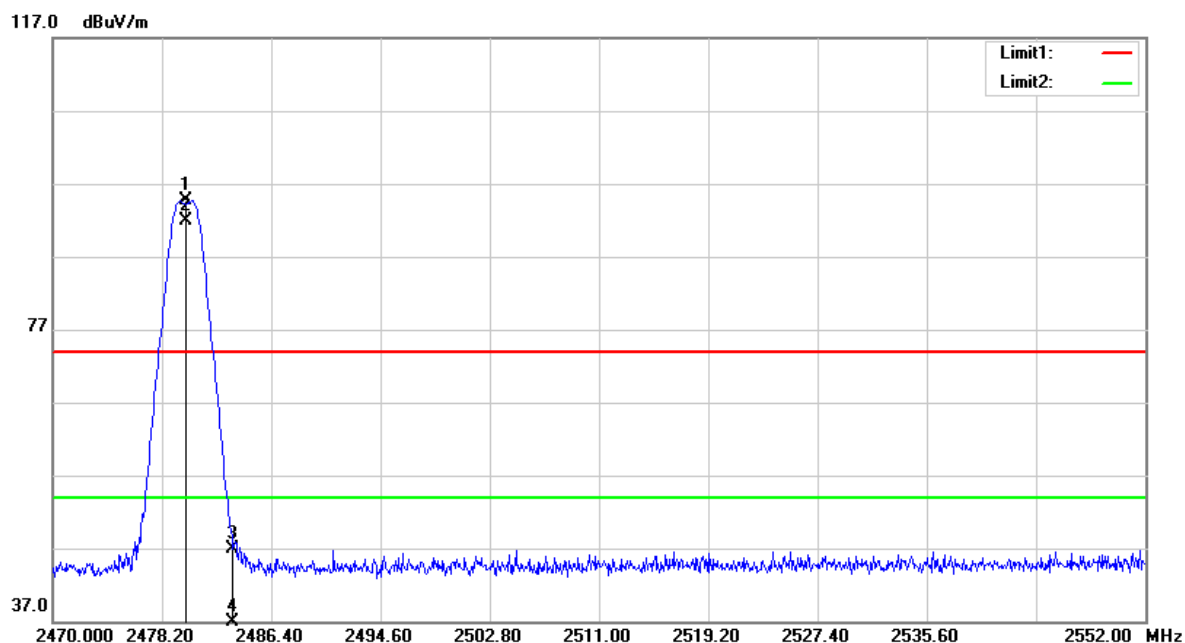
Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

發射限制測試 BLE(2M) Mode / CH High

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:34:08
		Test By:	Ken
Description:	BLE_2M-TX-2480-X_Axis		



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2480.000	104.00	-9.31	94.69	N/A	N/A	136	99	peak
2480.000	101.13	-9.31	91.82	N/A	N/A	136	99	AVG
2483.500	56.21	-9.26	46.95	74.00	-27.05	136	99	peak
2483.500	45.16	-9.26	35.90	54.00	-18.10	136	99	AVG

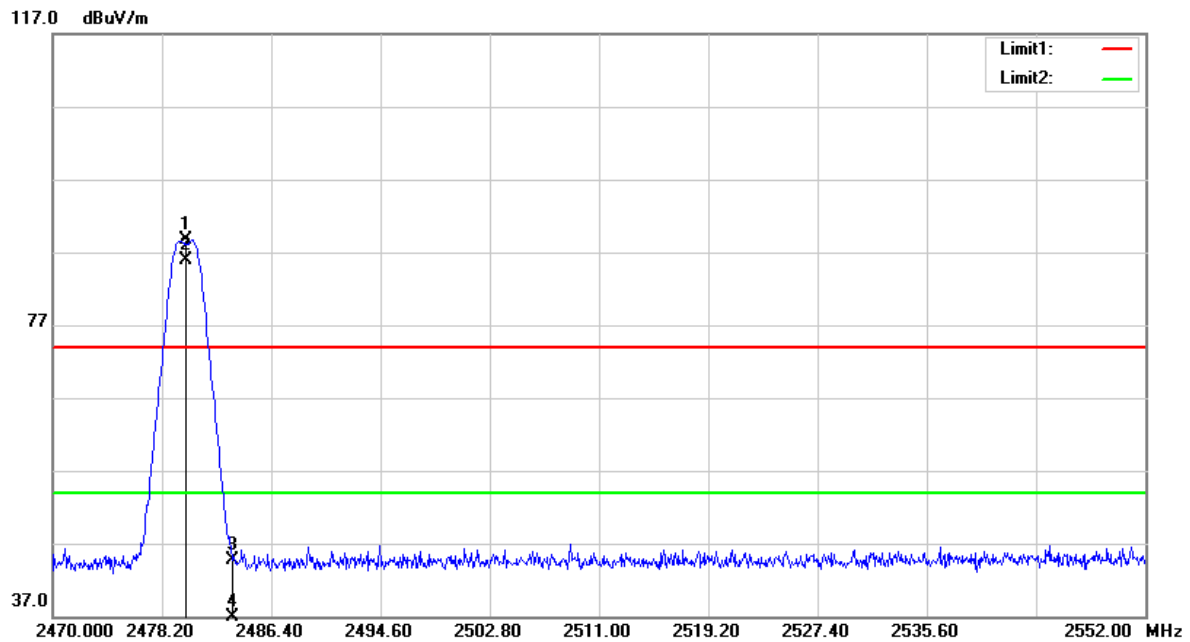
Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Job No.:	RXZ210924002	Ant.Polar.:	Horizontal
Standard:	NCC LP0002 4.10.1 Peak 3m	Test Distance:	3m
Test item:	Radiation Test	Power:	AC 110V/60Hz
Temp.(°C)/Hum.(%RH):	24.5(°C)/62%RH	Date:2021/9/25	Time:下午 07:54:15
		Test By:	Ken
Description:		BLE_2M-TX-2480-X_Axis	



Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
2480.000	97.96	-9.31	88.65	N/A	N/A	142	336	peak
2480.000	95.22	-9.31	85.91	N/A	N/A	142	336	AVG
2483.500	53.91	-9.26	44.65	74.00	-29.35	142	336	peak
2483.500	43.16	-9.26	33.90	54.00	-20.10	142	336	AVG

Note:

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

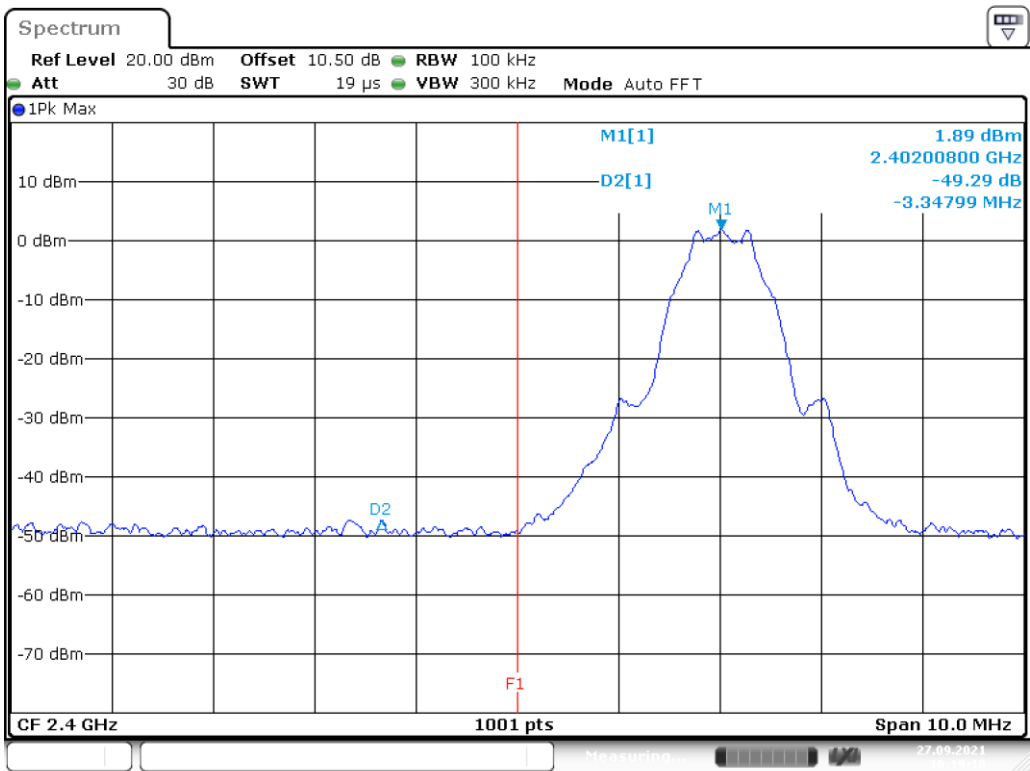
Conducted Bandedge

環境溫度	25.4°C	測試日期	2021-09-27
環境濕度	44%	測試人員	李宥陞

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE(1M) mode				
Low	2402	49.29	≥ 20	PASS
High	2480	51.04	≥ 20	PASS
BLE(2M) mode				
Low	2402	31.67	≥ 20	PASS
High	2480	50.74	≥ 20	PASS

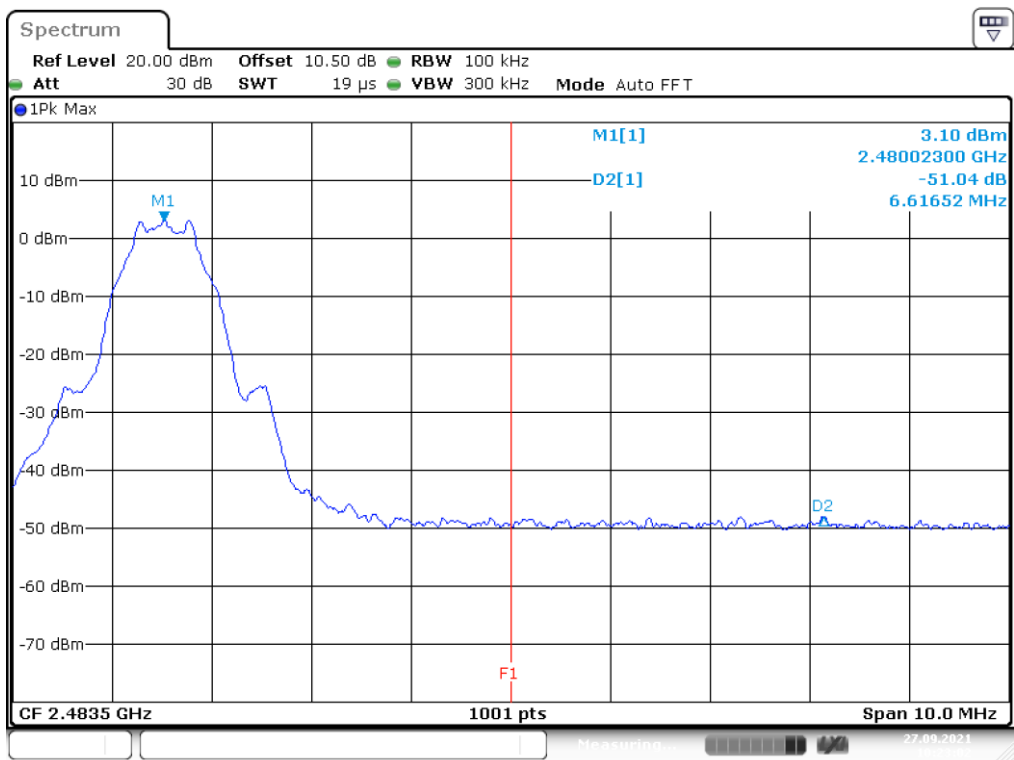
Conducted Band Edges

BLE(1M) Mode / CH Low



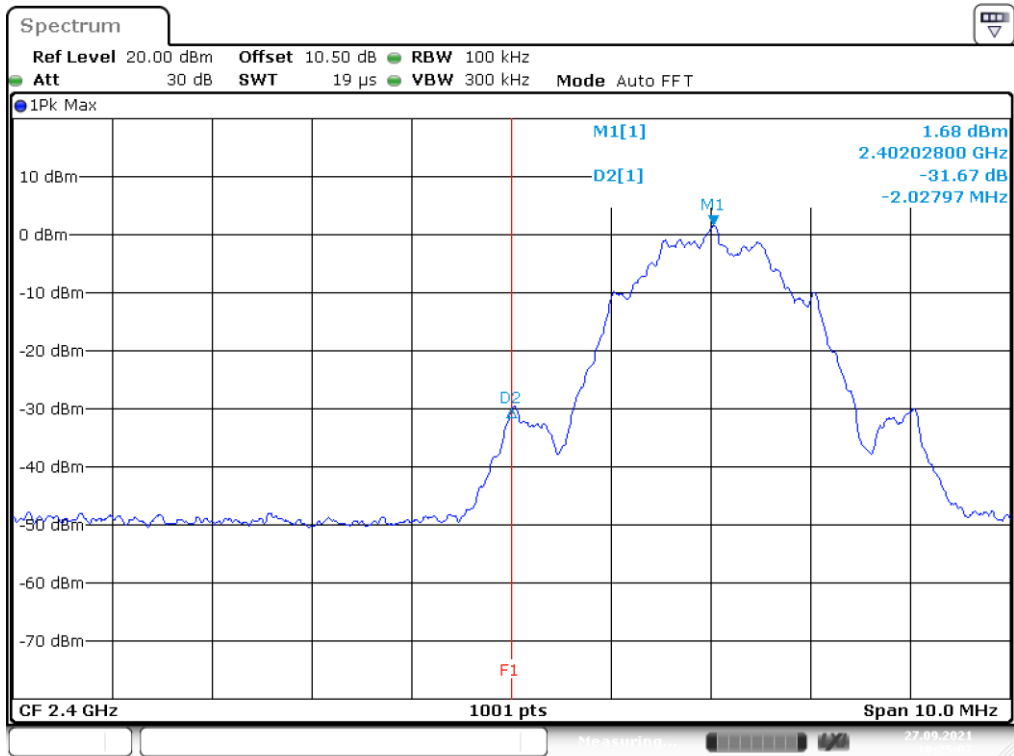
Date: 27.SEP.2021 10:19:10

BLE(1M) Mode / CH High

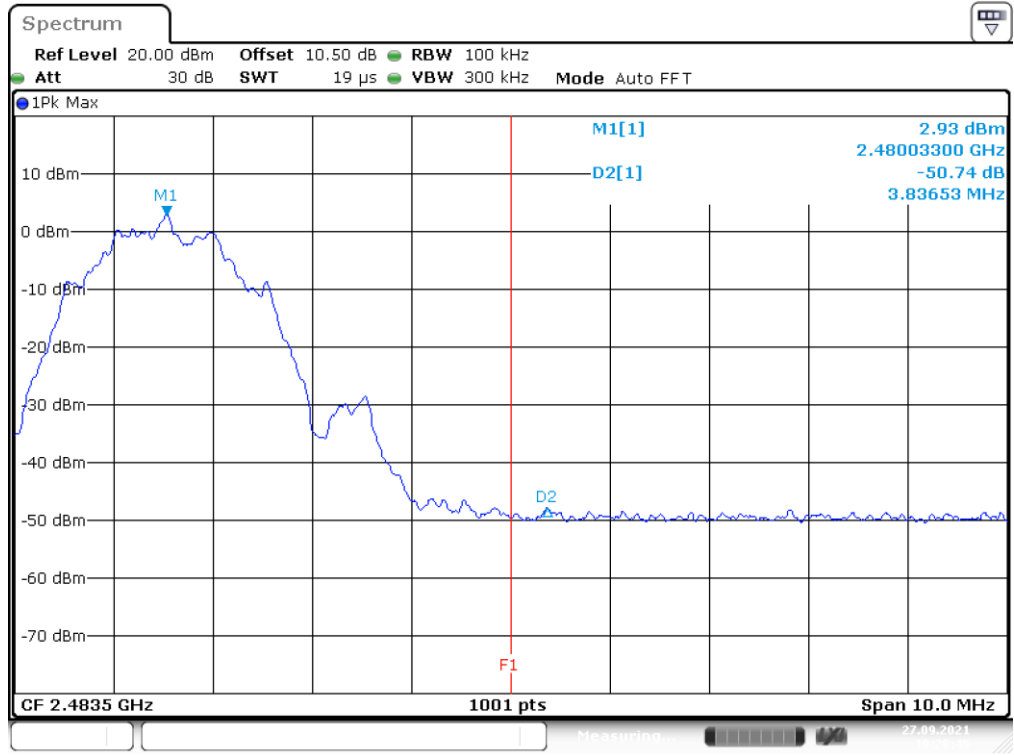


Date: 27.SEP.2021 10:23:02

BLE(2M) Mode / CH Low



BLE(2M) Mode / CH High



10. 功率密度之量測

10.1 適用標準

依據低功率射頻電機技術規範規定，在使用頻率範圍之任一3 kHz頻寬內，由發射機傳導至天線之功率頻譜密度在任意傳輸期間內，皆小於或等於8毫分貝(dBm)，且應依規定方式降低功率頻譜密度限制值。

10.2 測試方法

1. 將發射機之天線埠經由適當之衰減直接連至測試儀器。找出發射峰值並擴展於通帶內，設定解析頻寬為3 kHz，視訊頻寬大於解析頻寬，掃描時間為頻率掃描範圍除以3 kHz。所測得之峰值位準必須應小於或等於8dBm。
2. 若受測裝置之頻譜線間隔小於3kHz，測量時應將解析頻寬降低以使頻譜線間隔大於3kHz，所測得之數據再藉加總3kHz頻帶內所有個別頻譜線之功率(即標準化至3kHz)以決定是否符合規定。

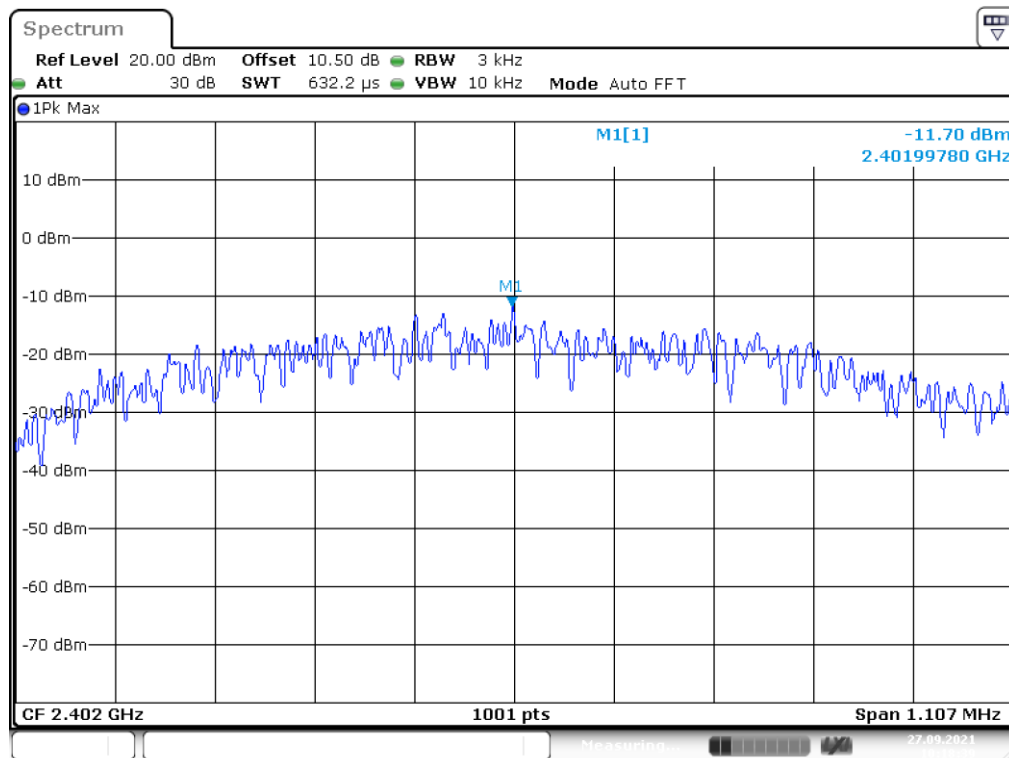
10.3 功率密度之量測結果

環境溫度	25.4°C	測試日期	2021-09-27
環境濕度	44%	測試人員	李宥陞

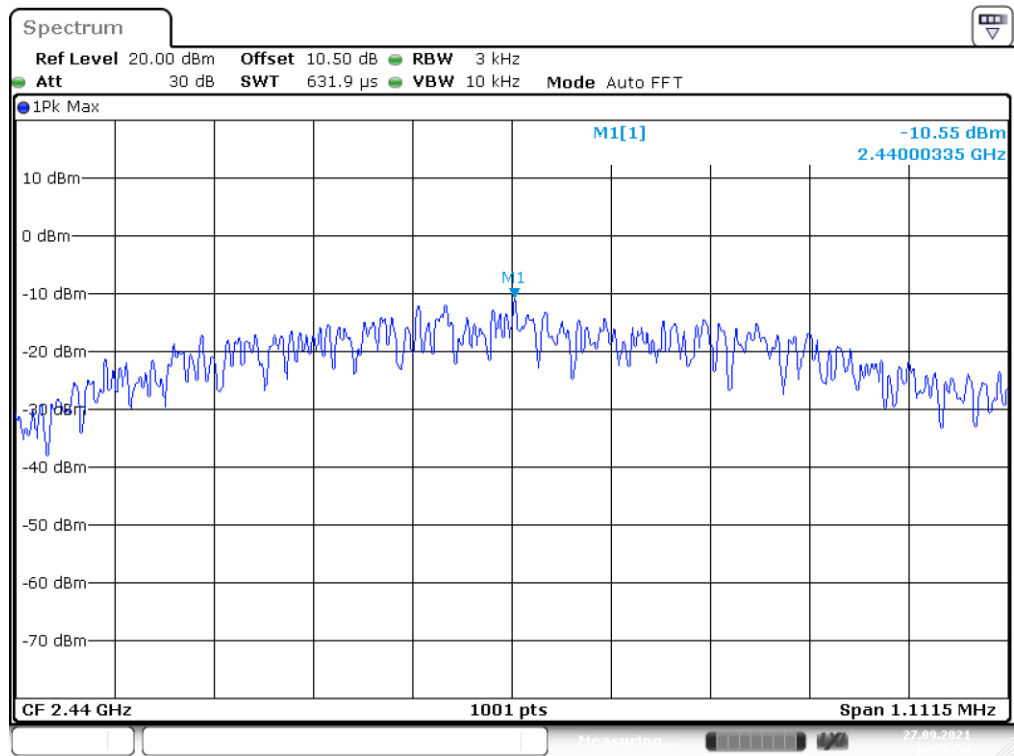
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Result
BLE(1M) mode				
Low	2402	-11.70	8.00	PASS
Mid	2440	-10.55		PASS
High	2480	-10.37		PASS
BLE(2M) mode				
Low	2402	-14.79	8.00	PASS
Mid	2440	-13.65		PASS
High	2480	-13.50		PASS

PSD

BLE(1M) Mode Low Channel

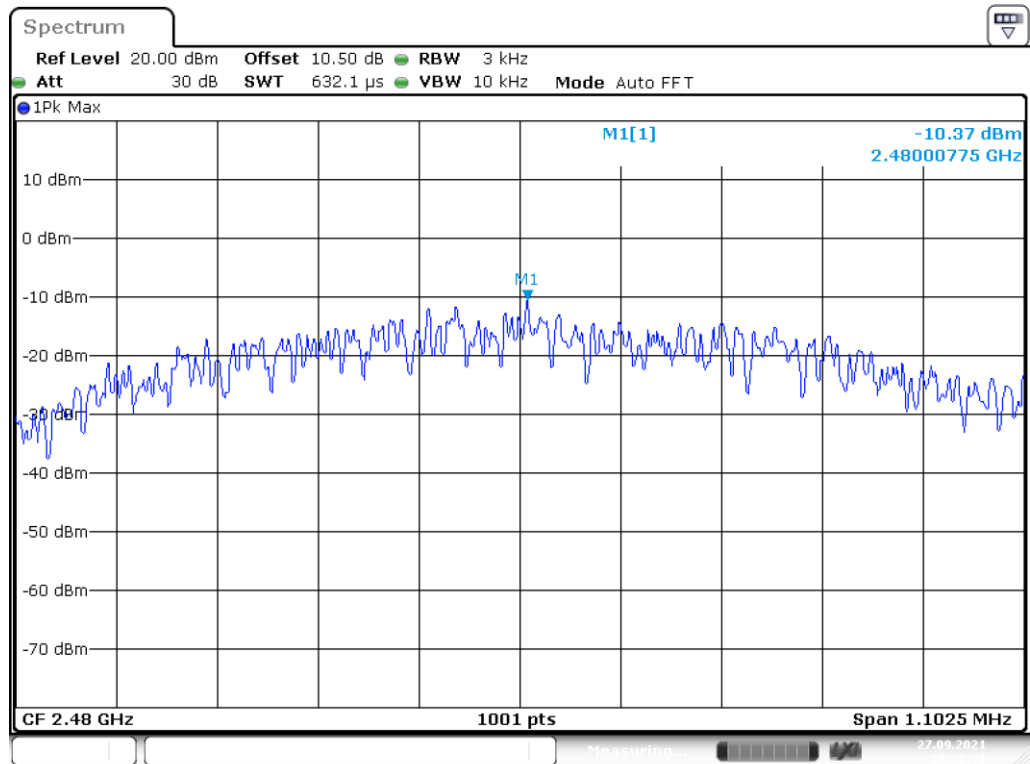


BLE(1M) Mode Middle Channel



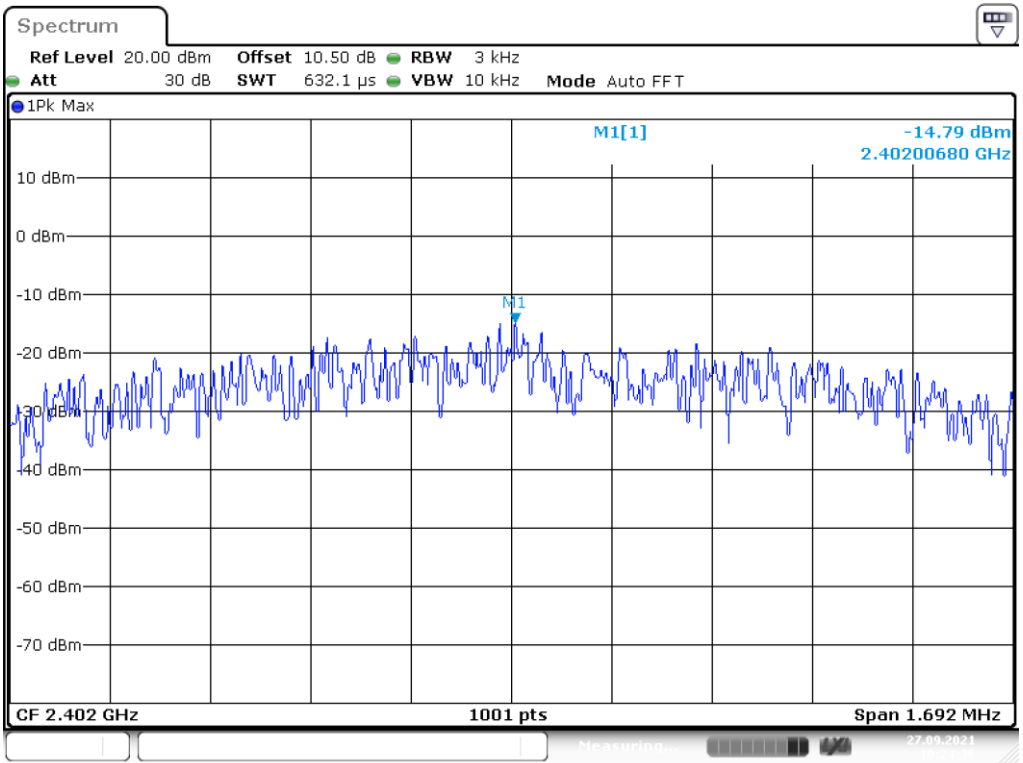
Date: 27.SEP.2021 10:20:50

BLE(1M) Mode High Channel



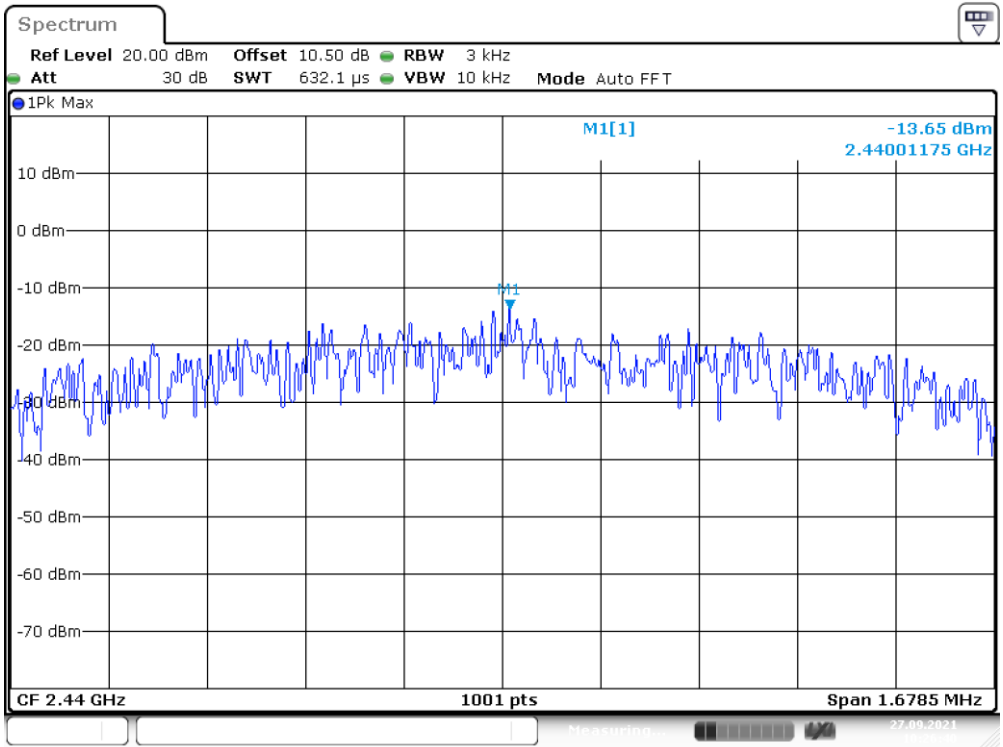
Date: 27.SEP.2021 10:22:32

BLE(2M) Mode Low Channel



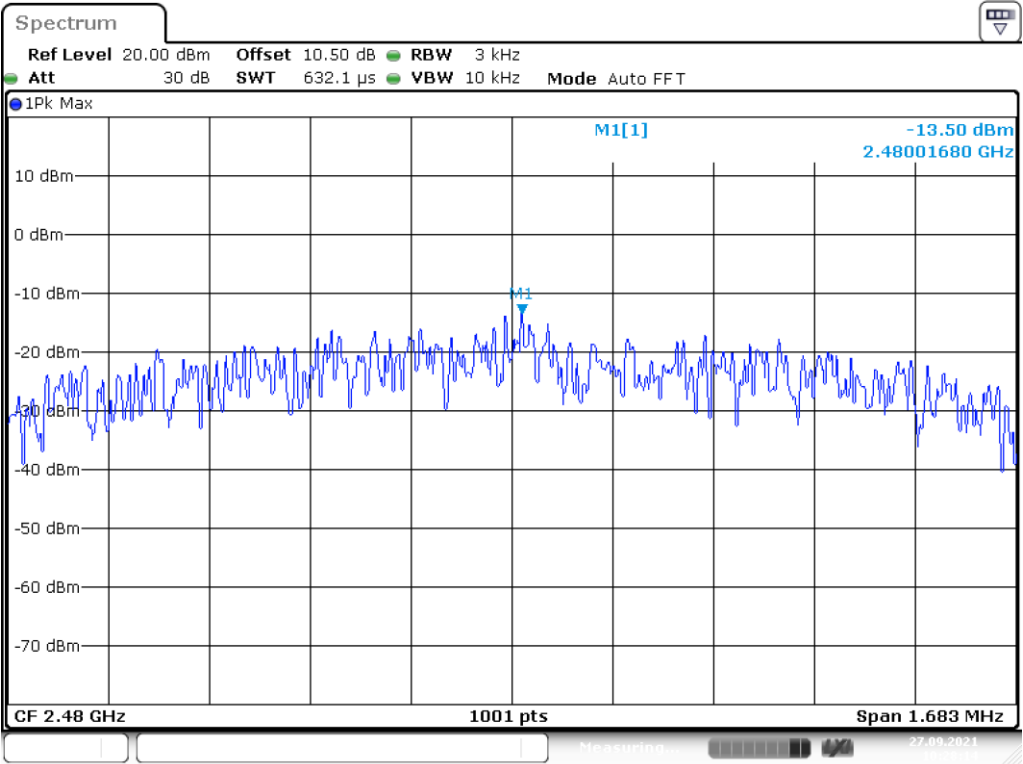
Date: 27.SEP.2021 10:24:36

BLE(2M) Mode Middle Channel



Date: 27.SEP.2021 10:26:40

BLE(2M) Mode High Channel



Date: 27.SEP.2021 10:28:14

11. 電波曝露量之評估

11.1 適用標準

依據低功率射頻電機技術規範之規定，若受測物於正常操作模式下，其發射機距離人體 20 公分以上者，可測試最大曝露允許值(Maximum Permissible Exposure · MPE)以證明其符合電波曝露量之要求。

限制值

5.20.2.2 一般人/不可控制之曝露

頻率範圍 (MHz)	電場強度 (V/m)	磁場強度 (A/m)	功率密度 (mW/cm ²)	平均時間 (分)
0.3~1.34	614	1.63	*100	30
1.34~30	824/f	2.19/f	*180/f ²	30
30~300	27.5	0.073	0.2	30
300~1,500	-	-	f/1500	30
1,500~100,000	-	-	1.0	30

註 1：標記*表平面波等效功率密度。

註 2：f 表測試頻率，單位：MHz。

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

11.2 電波曝露量之結果

Test mode: BLE mode

Frequency (MHz)	Power		Antenna Gain		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBm)	(mW)	(dBi)	(numeric.)			
2402 ~ 2480	4.07	2.553	4.50	2.82	20	0.00143	1

電磁波曝露量 MPE 標準值

1mW/cm²，送測產品實測值為：0.00143 mW/cm²

12. 量測儀器一覽表

儀器名稱	廠商	型號	序號	校驗日期	下次校驗日
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101612	2020/12/30	2021/12/29
LISN	Rohde & Schwarz	ENV216	101248	2021/6/8	2022/6/7
EMI Test Receiver	Rohde & Schwarz	ESR3	102099	2021/6/9	2022/6/8
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2021/7/29	2022/7/29
RF Cable	EMEC	EM-CB5D	1	2021/6/11	2022/6/11
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room (966-A)					
Active Loop Antenna	ETS-Lindgren	6502	35796	2021/3/16	2022/3/15
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2021/1/19	2022/1/18
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2020/11/12	2021/11/11
Horn Antenna	EMCO	SAS-571	1020	2021/4/23	2022/4/22
Horn Antenna	ETS-Lindgren	3116	62638	2021/8/11	2022/8/10
Preamplifier	Sonoma	310N	130602	2021/6/8	2022/6/7
Preamplifier	A.H. system Inc.	PAM-0118P	466	2020/11/5	2021/11/4
Microwave Preamplifier	EM Electronics Corporation	EM18G40G	60656	2020/12/30	2021/12/29
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2021/1/7	2022/1/6
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2021/2/1	2022/1/31
Coaxial Cable	COMMATE	PEWC	8Dr	2020/12/25	2021/12/24
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2021/2/1	2022/1/31
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2020/12/25	2021/12/24
Cable	EMC	EMC105-SM-SM-10000	201003	2021/2/3	2022/2/2

Software	Farad	EZ EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2021/1/7	2022/1/6
Cable	UTIFLEX	UFA210A	9435	2020/10/8	2021/10/7
Power Sensor	KEYSIGHT	U2021XA	MY5408001 8	2021/1/28	2022/1/27
Attenuator	MINI-CIRCUITS	BW-S10W5+	1419	2021/1/28	2022/1/27

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.

13. 試驗室之測試不確定度

測試項目	測試場地 / 測試頻率	不確定度
傳導干擾電壓量測	AC Line Conduction	± 3.82 (dB)
輻射干擾場強量測 (測試距離: 3m)	3M Chamber / 30~1000MHz	± 5.46 (dB)
	3M Chamber / 1~6GHz	± 5.24 (dB)
	3M Chamber / 6~18GHz	± 5.62 (dB)
	3M Chamber / 18~40GHz	± 5.86 (dB)
佔用頻寬	Conducted	± 0.35 (MHz)
輸出功率	Conducted	± 0.93 (dB)
直量雜散	Conducted	± 1.69 (dB)
功率密度	Conducted	± 0.93 (dBm/kHz)

- a) 必要為試驗結果作解釋時，依 ISO/IEC 17025 第 7.8.3.1 要求，實驗室得決定是否在測試報告上包含量測不確定度評估結果。
- b) 測試證書/報告中提供量測不確定度資訊時，通常應使用 “ $y \pm U$ (y 和 U 的單位)” 或類似的表述方式；量測結果的數值與其量測不確定度亦可以列表方式表達。視需要，擴充不確定度也可以用相對擴充不確定度 $U / |y|$ 的方式表達，如指數或百分比。應在證書/報告中註明不確定度的涵蓋因子及涵蓋機率(或信賴水準)，可以使用以下文字描述：
- 「本報告的擴充不確定度，係以組合標準不確定度乘以涵蓋因子 k ($k=2$) 來表示，相應之涵蓋機率(或信賴水準)約為 95 %。」

***** END OF REPORT *****