

低功率射頻器材試驗報告



申請廠商	SKULLCANDY, INC.
製造廠商	6301 N Landmark Dr Park City UT 84098, Utah United States of America
產品名稱	SKULLCANDY, INC.
廠牌	Push Active
型號	Skullcandy
型號差異	S2BPW
報告號碼	N/A
技術標準	E2/2021/30080
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	民國110年5月10日

Approved By: _____

林耀鵬 / 副主任

待測裝置已於台灣檢驗科技股份有限公司射頻實驗中心，依據國家通訊傳播委員會於中華民國一百零九年七月頒佈之低功率射頻器材技術規範測試。

台灣檢驗科技股份有限公司根據此條文規範項目測試，測試各項數據皆能符合此規範規定之限度值。

報告中所描述之測試結果和待測設備的架構組合，均根據實際量測情況作詳實的記錄，且本測試報告僅對上述待測樣品負責。

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/30080	00	Original.	民國 110 年 5 月 10 日	Susan Lin

Note:

- 1、Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
- 2、電源線傳導干擾及 Fully System 測試模式在各個無線功能全開下進行測試，經評估為最差模式。
- 3、測試報告 E2/2021/30079 之電源線傳導干擾及 Fully system 場強輻射測試數據，沿用於此報告中。

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1 測試實驗室資料:

1.1 認可登錄資訊:

實驗室認可登錄： 中華民國實驗室認證體系

認可編號： TAF 3702

認證有效期間： 109年01月30日起至110年06月13日止

實驗室名稱： 台灣檢驗科技股份有限公司射頻實驗中心

實驗室地址： 新北市新北產業園區五工路134號

電話： 886-2-22993939

傳真： 886-2-22982698

1.2 實驗室場地資訊

測試場地	測試場地編號		
	SAC 1	SAC 3	Conduction 1
新北市新北產業園區五工路 134 號	Conducted 1	Conducted 2	Conducted 3
	Conducted 4	Conducted 5	Conducted 6
	SAC C	SAC D	SAC G
桃園市龜山區(華亞科技園區)科技一路 2 號	Conduction A	Conducted A	Conducted B
	Conducted C	Conducted D	Conducted E
	Conducted F	Conducted G	
註: 測試場地編號記錄於每項測試之儀器清單, 用以表示測試場地地址。			

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2 實驗室之量測不確定度

量測項目	量測不確定度			
	(擴充不確定度)			
傳導干擾量測	電源線	0.15-30MHz	2.34	dB
輻射干擾量測 (3m 測距)	水平極化	9kHz - 30MHz	2.64	dB
		30-1000MHz	4.45	dB
		1-18GHz	4.81	dB
		18-40GHz	4.52	dB
	垂直極化	9kHz - 30MHz	2.64	dB
		30-1000MHz	4.93	dB
		1-18GHz	4.81	dB
		18-40GHz	4.52	dB
頻率誤差量測			1.54	Hz
輸出功率	傳導方式		1	dB
有效輻射功率 (輻射方式)	水平極化	30-1000MHz	2	dB
		1-40GHz	3	dB
	垂直極化	30-1000MHz	2.33	dB
		1-40GHz	3	dB
功率頻譜密度	傳導方式		1.54	dB
鄰頻道功率量測 (輻射方式)	水平極化	30-1000MHz	2	dB
	垂直極化	30-1000MHz	2.33	dB
Transmitter Spurious Emission		33GHz-50GHz	3.8	dB
		50GHz-60GHz	4.67	dB
		60GHz-90GHz	4.81	dB
		90GHz-140GHz	4.57	dB
		140GHz-200GHz	5.42	dB

附註: 1. K=2 即代表測試結果具有95%的量測可信度。

2. 本報告中的符合性判定僅依據試驗結果，不考慮其試驗結果的量測不確定度。

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3 一般資料

3.1 產品描述

產品名稱	Push Active	
廠牌	Skullcandy	
型號	S2BPW	
型號差異	N/A	
充電盒	Model No.: S2BPW Brand: Skullcandy	
使用電源	3.7 Vdc from Battery	
	Battery:	Model No.: SL1254B Brand: Dongguan Sunly Battery Technology Co., Ltd.

3.2 射頻特性

發射頻帶	2402MHz – 2480MHz
輸出功率	10.88 dBm (Peak)
調變方式	BT Dual mode LE (GFSK)
頻道數	40
天線型式/天線增益	PCB Antenna, Gain: 3.03dBi Model No.: S2BPW, Supplier: SKULLCANDY, INC

本案經申請者切結器材不提供隨貨配件，配件由實驗室提供併同檢驗，產品名稱: Adapter，Brand: Sony，型號: AC-0400-TW，產品名稱: NB Adapter，Brand: Lenovo，型號: 45N0119。配件由申請者提供併同檢驗，產品名稱: USB cable，Brand: ZD，型號: ZD-KLT-202004，產品名稱: 測試治具，Brand: AIROHA，型號: C295。

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4 測試方法之依據

本測試報告之所有項目皆依據國家通訊傳播委員會低功率射頻器材技術規範(LP0002, 109.7.1 版本)如無國家標準可適用者，得依美國 EIA、IEEE ANSI 檢驗法檢驗，及美國 FCC 47 CFR Part 2 有關檢驗之規定及參考 ANSI C63.10:2013、FCC CFR 47 15.247 之檢驗法。

低功率射頻器材技術規範4.10節

項次	測試項目	適用規範	測試結果
1	場強輻射	低功率射頻器材技術規範 3.5 & 3.6 節	合格
2	電源線傳導干擾	低功率射頻器材技術規範 3.3節	合格
3	天線增益之要求	低功率射頻器材技術規範 4.10.1.3 (1) 節	合格
4	發頻頻寬	低功率射頻器材技術規範 4.10.1.6(2) (A) 節	合格
5	輸出峰值功率	低功率射頻器材技術規範 4.10.1.2(1) (C) 節	合格
6	開放頻帶邊緣之發射	低功率射頻器材技術規範 4.10.1.5節	合格
7	功率密度	低功率射頻器材技術規範 4.10.1.6(2) (B) 節	合格

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5 測試模式

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	20	GFSK	1
Fully system				
RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE (TX)	0 to 39	0,20,39	GFSK	1
Bluetooth LE (RX)	0 to 39	20	GFSK	1

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	0,20,39	GFSK	1

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6 適用規範

禁用頻帶限制之規定

依據NCC低功率射頻器材技術規範3.5節之要求，任何低功率射頻器材之主波皆不得使用下表所列各頻帶內之頻率；低功率射頻器材落於下表所列頻帶內之混附發射，其電場強度必須符合第3.6節的限制規定。

頻率 (MHz)	頻率 (MHz)	頻率 (MHz)
0.090~0.110	240.00~285.00	3332.0~3339.0
0.490~0.510	322.00~335.40	3345.8~3358.0
2.172~2.198	399.90~410.00	3500.0~4400.0
3.013~3.033	485.00~510.00	4500.0~5250.0
4.115~4.198	608.00~614.00	5350.0~5460.0
5.670~5.690	703.00~748.00	7250.0~7750.0
6.200~6.300	758.00~803.00	8025.0~8500.0
8.230~8.400	825.00~915.00	9000.0~9200.0
12.265~12.600	930.00~1240.0	9300.0~9500.0
13.340~13.430	1300.0~1427.0	10600~12700
14.965~15.020	1435.0~1626.5	13250~13400
16.700~16.755	1660.0~1785.0	14470~14500
19.965~20.020	1805.0~1880.0	15350~16200
25.500~25.700	1885.0~1900.0	17700~21400
37.475~38.275	1905.0~1985.0	22010~23120
73.500~75.400	2010.0~2025.0	23600~24000
108.00~138.00	2110.0~2170.0	31200~31800
149.90~150.05	2200.0~2300.0	36430~36500
156.70~156.90	2310.0~2390.0	38600 以上
162.01~167.17	2483.5~2900.0	
167.72~173.20	3260.0~3267.0	

依據NCC低功率射頻器材技術規範3.9節之要求，收、發信機為成套銷售者，收、發信機應一併送審或提供經型式認證合格之對應收、發信機之送審資料；送信機之輻射電場強度不得超過第3.6節之發射規定，且不得接收、解調第3.5節所列之頻率。

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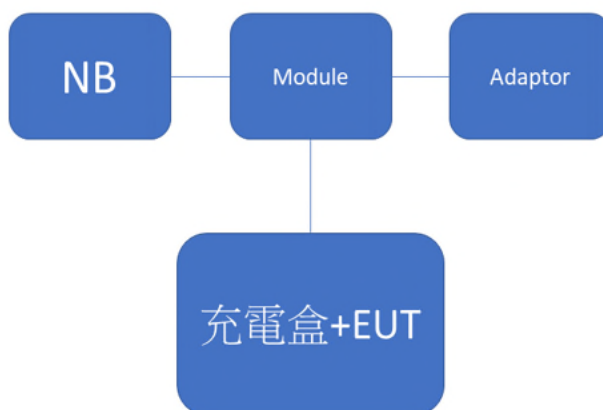
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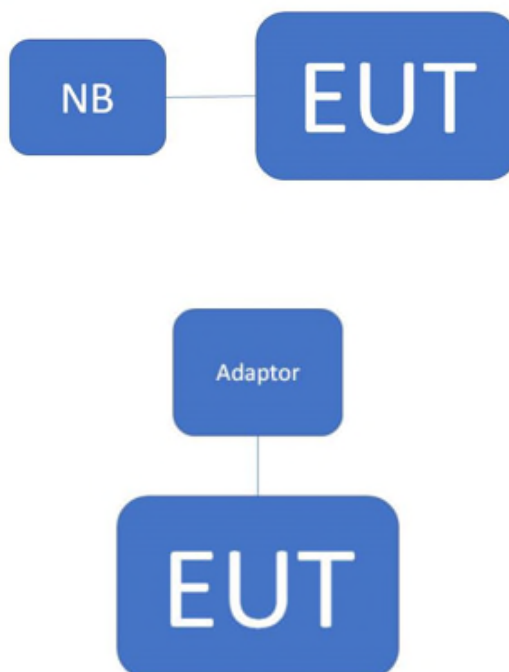
7 測試配置

7.1 待測物與測試週邊配置圖

Conducted (Antenna Port) & Radiated Emission



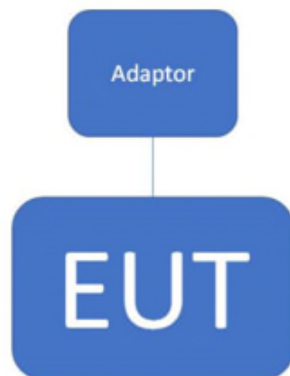
Conduction (AC Power Line)



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Radiated Emission_System



7.2 測試週邊描述

編號	產品別	商標	版本	型號	序號
1.	AB1565	N/A	68 Lab Test Tool	N/A	N/A
2.	Notebook	Lenovo	N/A	L420	S0012467
3.	Adapter	Sony	N/A	AC-0400-TW	3504600
4.	NB Adapter	Lenovo	N/A	45N0119	11S45N0119Z1Z HXT1CEAA2
5.	充電盒	Skullcandy	N/A	S2BPW	N/A
6.	測試治具	AIROHA	N/A	C295	N/A

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8 量測儀器設備

8.1 AC 電源端傳導干擾之量測儀器

Radiated Emission Test Site: Conduction A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	Ver. 6.11-20180419c	N.C.R	N.C.R
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	03/25/2021	03/24/2022
EMI Test Receiver	R&S	ESCI	101342	04/28/2020	04/27/2021
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2021	03/26/2022
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2021	03/26/2022
USB Cable	MI	SJX10ZM	USB to Type-c	N.C.R	N.C.R

8.2 天線端傳導測試之量測儀器

Conducted Emission Test Site: Conducted C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/22/2021	03/21/2022
Attenuator	Marvelous	MVE2213-10	RF13	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF69	11/19/2020	11/18/2021
Power Meter	Anritsu	ML2496A	1512003	07/23/2020	07/22/2021
Power Sensor	Anritsu	MA2411B	1339378	07/23/2020	07/22/2021
Power Sensor	Anritsu	MA2411B	1339379	07/23/2020	07/22/2021

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8.3 量測場強輻射之量測儀器

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	TESEQ	CBL 6112D	35240	09/08/2020	09/07/2021
Horn Antenna	Schwarzbeck	BBHA9170	184	12/11/2020	12/10/2021
Horn Antenna	Schwarzbeck	BBHA9120D	1187	01/11/2021	01/10/2022
Loop Antenna	ETS.LINDGREN	6502	143303	04/28/2020	04/27/2021
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R
EMI Test Receiver	R&S	ESU 40	100363	04/29/2020	04/28/2021
Pre-Amplifier	EMC Instruments	EMC330	980096	11/19/2020	11/18/2021
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/19/2020	11/18/2021
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2020	10/26/2021
Attenuator	Woken	WATT-218FS-10	RF03	11/19/2020	11/18/2021
Band Rejection Filter	Micro-Tronics	BRM50701-01	RF201	11/19/2020	11/18/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/19/2020	11/18/2021
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/19/2020	11/18/2021

註: 以上部份設備跟量測值沒有影響，且沒有直接關聯，因此不需要進行校正。

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9 電源線傳導干擾之量測

9.1 適用標準

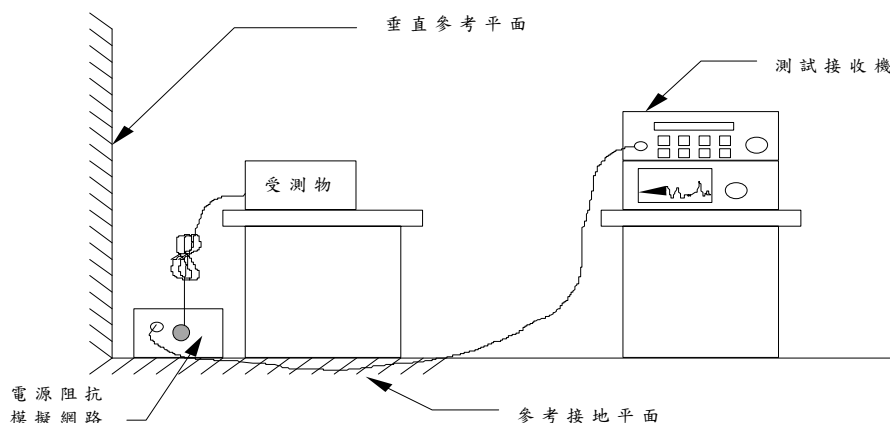
依據NCC低功率射頻器材技術規範之3.3節，以市電為電源之低功率射頻器材，其傳導回電源線上頻率自150 kHz~30 百萬赫(MHz) 之射頻電壓(在電源端子每一電源線對接地點)應小於或等於下表所列之限制值。測量時應經過50 微亨利(uH)及50 歐姆(Ω)之電源線阻抗穩定網路。頻率重疊處，以較低限制值為準。

頻率(MHz)	傳導限制值 (dBuV)	
	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

9.2 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的峰值量側(Peak)並提供掃描圖，Mark 最大的六個頻率點進行準峰值量測(QP),如果準峰值QP結果值已低於AV限制值時將不再進行AV值的量測。

9.3 測試配置



9.4 干擾值之計算

電源傳導干擾電壓之計算公式＝

儀器讀值(QP/AV) + 校正因子 (饋線損失 + 電源阻抗模擬網路損失)

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9.5 傳導干擾之量測結果:

Report Number :E2/2021/30079

Test Site :Conduction Room C

Test Mode :System

Test Date :2021-04-13

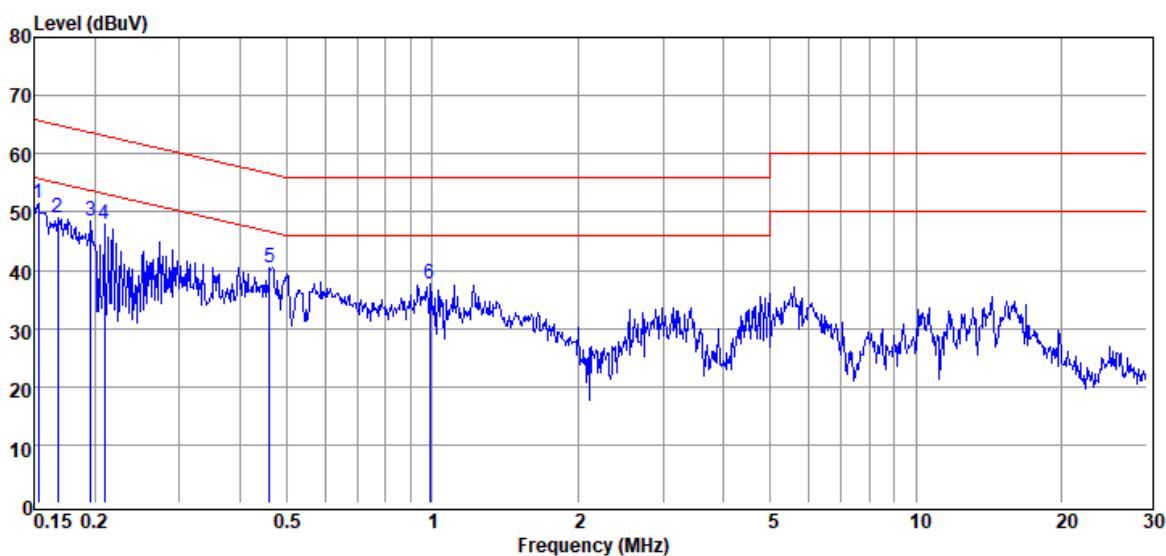
Power :110V/60Hz

Temp./Humi. :22.9/68

Probe :L1

Engineer :Ashton Chiu

Note: : NB Mode 0% (NB電池電量)



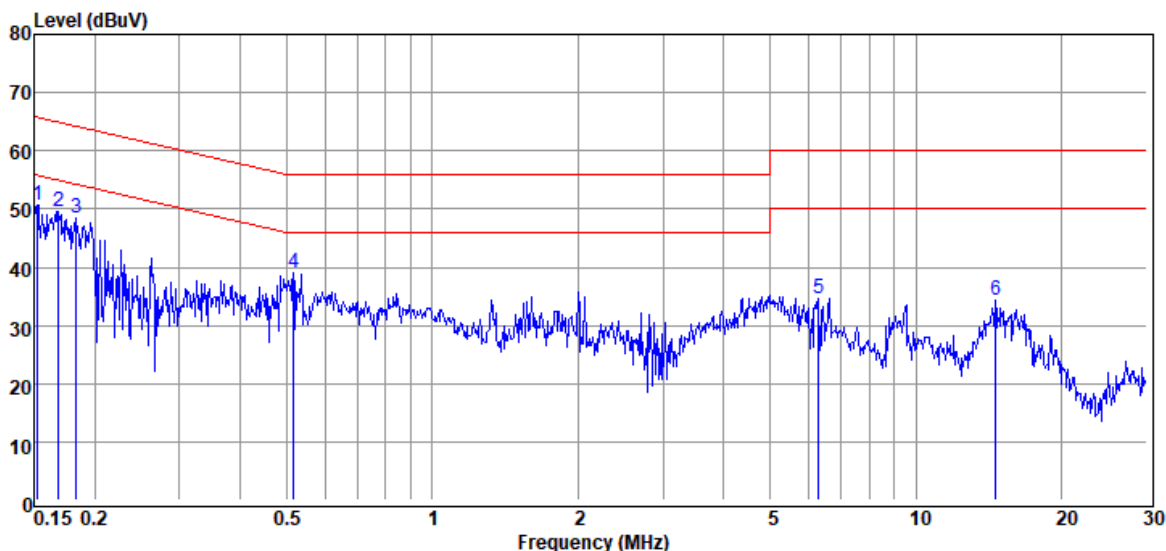
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV	Limit dBUV	Margin dB
0.15	Peak	41.05	10.30	51.35	65.82	-14.47
0.17	Peak	38.62	10.30	48.92	65.08	-16.16
0.20	Peak	38.07	10.30	48.37	63.76	-15.39
0.21	Peak	37.54	10.30	47.84	63.23	-15.39
0.46	Peak	30.10	10.31	40.41	56.67	-16.26
0.99	Peak	27.36	10.34	37.70	56.00	-18.30

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.9/68
Probe :N Engineer :Ashton Chiu
Note: : NB Mode 0% (NB電池電量)



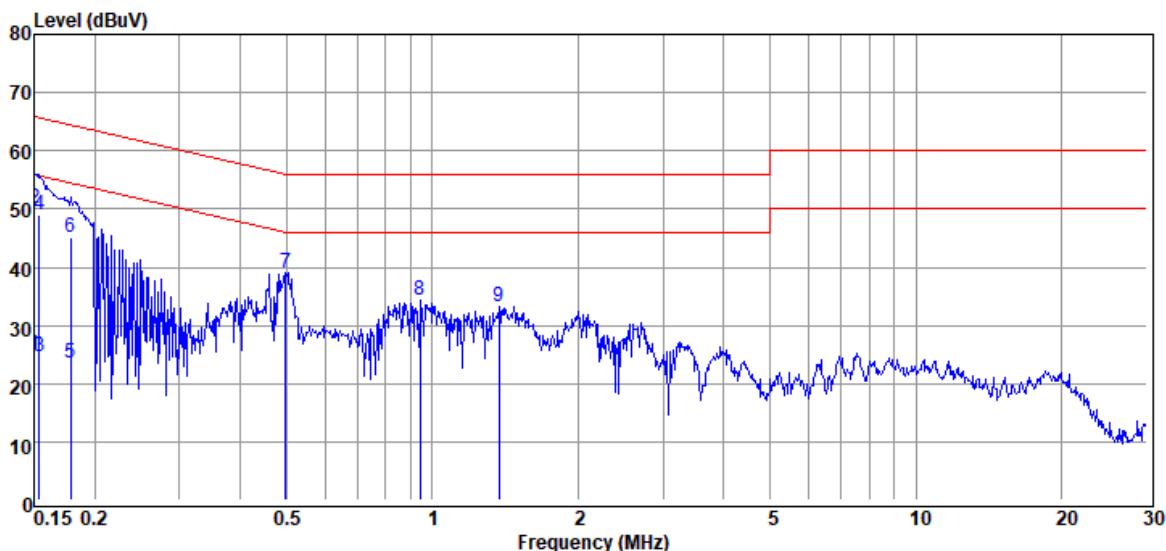
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Peak	40.25	10.31	50.56	65.87	-15.31
0.17	Peak	39.31	10.31	49.62	65.03	-15.41
0.18	Peak	38.23	10.30	48.53	64.33	-15.80
0.52	Peak	28.79	10.32	39.11	56.00	-16.89
6.29	Peak	24.00	10.63	34.63	60.00	-25.37
14.59	Peak	23.56	10.86	34.42	60.00	-25.58

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.9/68
Probe :L1 Engineer :Ashton Chiu
Note: : Adapter Mode 0%(電池盒電量)



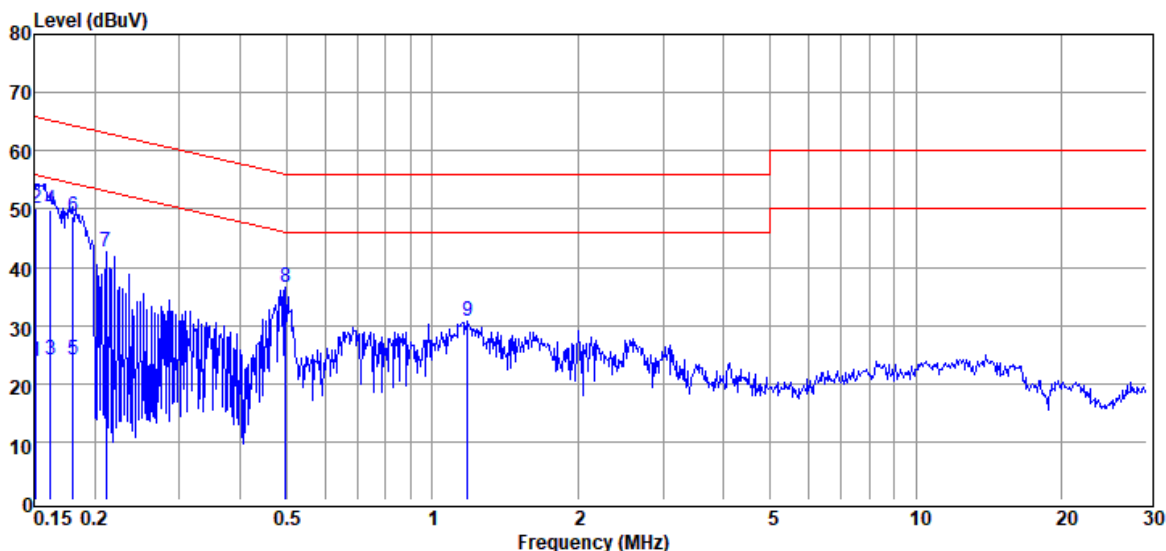
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	14.50	10.30	24.80	56.00	-31.20
0.15	QP	39.70	10.30	50.00	66.00	-16.00
0.15	Average	14.40	10.30	24.70	55.78	-31.08
0.15	QP	38.80	10.30	49.10	65.78	-16.68
0.18	Average	13.10	10.30	23.40	54.55	-31.15
0.18	QP	34.70	10.30	45.00	64.55	-19.55
0.50	Peak	28.82	10.31	39.13	56.05	-16.92
0.94	Peak	23.93	10.34	34.27	56.00	-21.73
1.37	Peak	22.52	10.72	33.24	56.00	-22.76

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.9/68
Probe :N Engineer :Ashton Chiu
Note: : Adapter Mode 0%(電池盒電量)



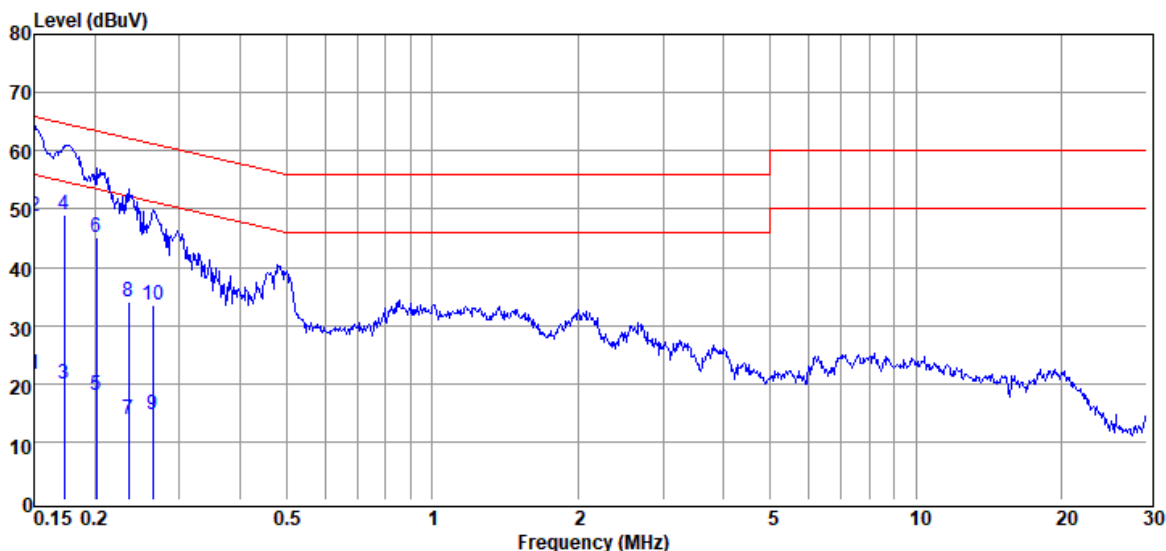
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	13.39	10.31	23.70	55.91	-32.21
0.15	QP	39.69	10.31	50.00	65.91	-15.91
0.16	Average	13.79	10.31	24.10	55.34	-31.24
0.16	QP	39.49	10.31	49.80	65.34	-15.54
0.18	Average	13.80	10.30	24.10	54.46	-30.36
0.18	QP	38.30	10.30	48.60	64.46	-15.86
0.21	Peak	32.41	10.30	42.71	63.14	-20.43
0.50	Peak	26.15	10.32	36.47	56.05	-19.58
1.18	Peak	20.18	10.55	30.73	56.00	-25.27

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.7/69
Probe :L1 Engineer :Ashton Chiu
Note: : Adapter Mode 50%(電池盒電量)



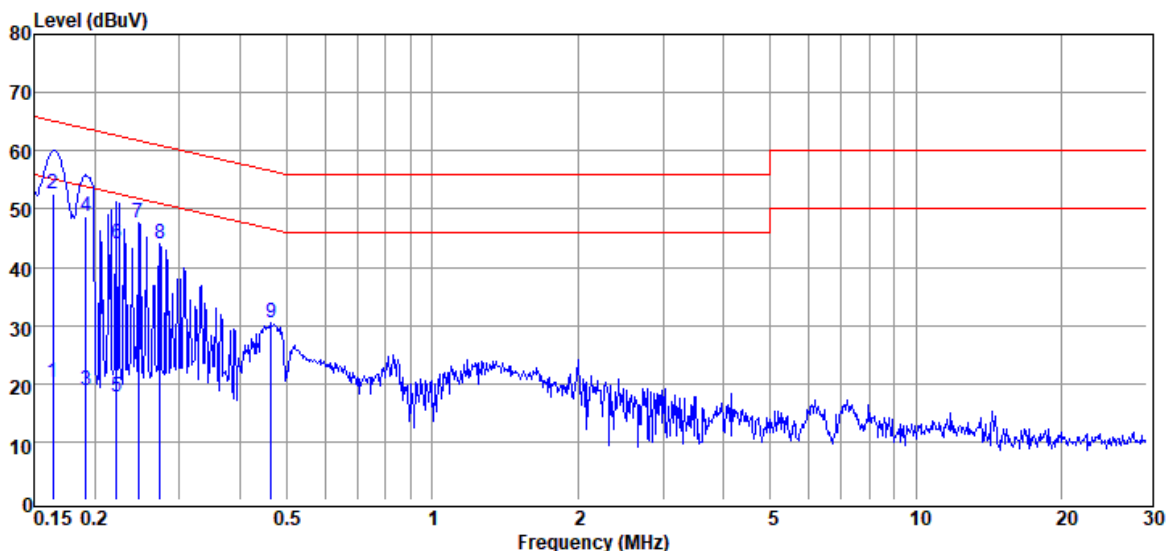
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	11.20	10.30	21.50	56.00	-34.50
0.15	QP	38.40	10.30	48.70	66.00	-17.30
0.17	Average	9.70	10.30	20.00	54.81	-34.81
0.17	QP	38.60	10.30	48.90	64.81	-15.91
0.20	Average	7.83	10.30	18.13	53.54	-35.41
0.20	QP	34.76	10.30	45.06	63.54	-18.48
0.24	Average	3.61	10.30	13.91	52.26	-38.35
0.24	QP	23.80	10.30	34.10	62.26	-28.16
0.26	Average	4.31	10.31	14.62	51.29	-36.67
0.26	QP	23.20	10.31	33.51	61.29	-27.78

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.7/69
Probe :N Engineer :Ashton Chiu
Note: : Adapter Mode 50%(電池盒電量)



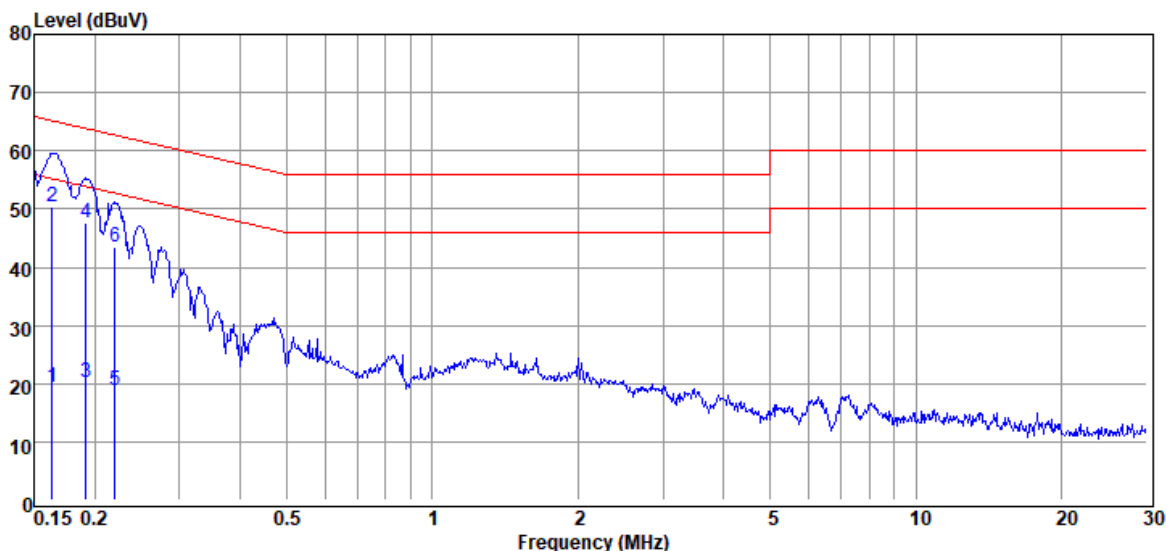
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.16	Average	10.01	10.31	20.32	55.25	-34.93
0.16	QP	42.22	10.31	52.53	65.25	-12.72
0.19	Average	8.53	10.30	18.83	53.93	-35.10
0.19	QP	38.33	10.30	48.63	63.93	-15.30
0.22	Average	7.50	10.30	17.80	52.74	-34.94
0.22	QP	33.66	10.30	43.96	62.74	-18.78
0.25	Peak	37.30	10.30	47.60	61.86	-14.26
0.27	Peak	33.74	10.31	44.05	61.03	-16.98
0.46	Peak	20.06	10.32	30.38	56.63	-26.25

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.8/67
Probe :L1 Engineer :Ashton Chiu
Note: : Adapter Mode 100%(電池盒電量)

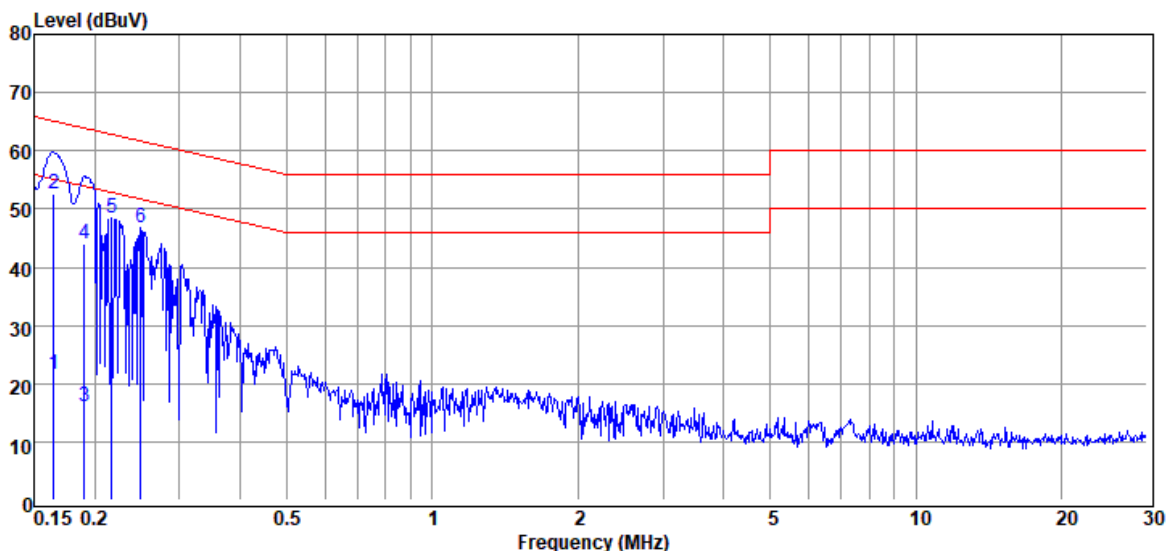


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.16	Average	9.00	10.30	19.30	55.30	-36.00
0.16	QP	40.20	10.30	50.50	65.30	-14.80
0.19	Average	9.90	10.30	20.20	53.93	-33.73
0.19	QP	37.40	10.30	47.70	63.93	-16.23
0.22	Average	8.50	10.30	18.80	52.79	-33.99
0.22	QP	33.20	10.30	43.50	62.79	-19.29

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Report Number :E2/2021/30079 Test Site :Conduction Room C
Test Mode :System Test Date :2021-04-13
Power :110V/60Hz Temp./Humi. :22.8/67
Probe :N Engineer :Ashton Chiu
Note: : Adapter Mode 100%(電池盒電量)



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.17	Average	11.20	10.26	21.46	55.21	-33.75
0.17	QP	42.30	10.26	52.56	65.21	-12.65
0.19	Average	5.90	10.26	16.16	54.02	-37.86
0.19	QP	33.80	10.26	44.06	64.02	-19.96
0.22	Peak	38.09	10.26	48.35	62.92	-14.57
0.25	Peak	36.39	10.26	46.65	61.78	-15.13

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10 場強輻射之量測

10.1 適用標準

依據NCC低功率射頻器材技術規範3.6 之要求，低功率射頻器材其電場強度應小於或等於下表之限制值，且其不必要之發射皆不得大於主波發射強度，此外，落於3.5禁用頻段之輻射發射，應符合3.6之規定。

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

10.2 量測方法

將待測物置於非金屬桌面，測試頻率1GHz以下時，使用桌高0.8 米，1GHz以上時，使用桌高1.5米，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。

以下為頻譜儀的設定：

頻率	RBW	VBW	Detector
9kHz~150kHz	300Hz	300Hz	Quasi-Peak
150kHz~30MHz	10kHz	10kHz	Quasi-Peak
1GHz以下	100kHz	100kHz	Peak / Quasi-Peak
1GHz以上	1MHz	3MHz	Peak
1GHz以上 Duty Cycle ≥ 98%	1MHz	10Hz	Average
1GHz以上 Duty Cycle < 98%	1MHz	1/T	Average

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10.3 場強計算

1. Distance extrapolation = $40 \cdot \log (\text{Required Distance(m)} / \text{Test Distance(m)})$
2. Emission level (dB μ V/m) = $20 \log \text{Emission level } (\mu\text{V/m})$
3. Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)
Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

註:

9 kHz ~ 30MHz 之輻射量測皆低於限制值 20dB 以上，依據LP0002 6.13規定混附發射毋需記錄。

輻射量測僅放最差模式（30MHz 以上）。

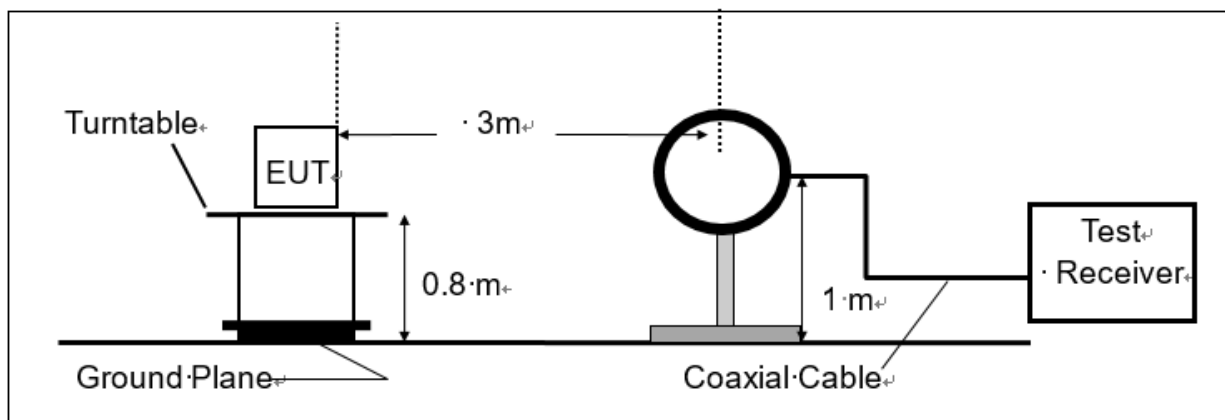
比較 H Plane、E1 Plane 和 E2 Plane 測試值後，附上最差模式數據。

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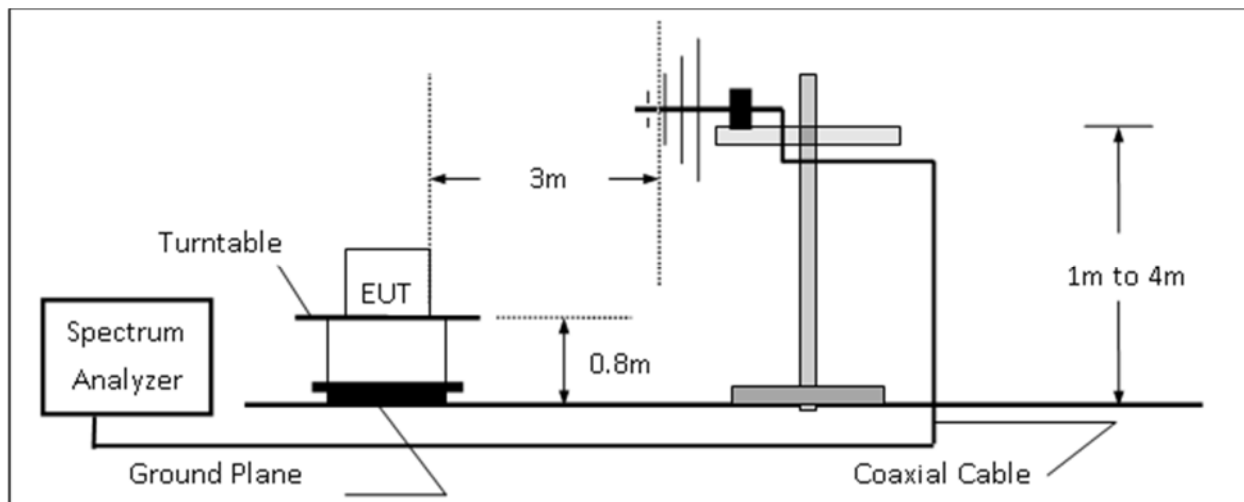
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10.4 輻射之測試配置

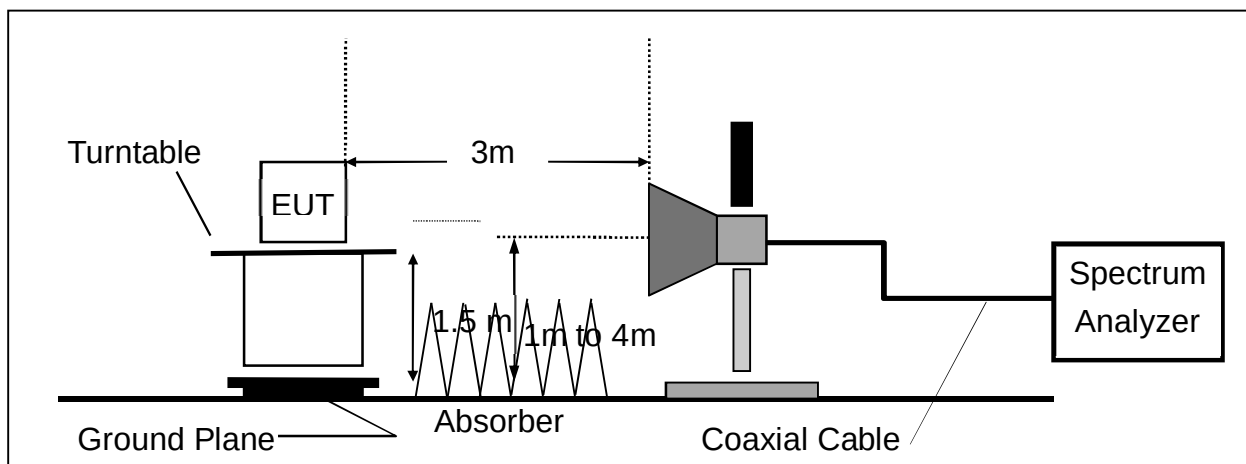
(A) 量測頻率低於 30MHz 以下之測試配置



(B) 量測頻率 30MHz 至 1000MHz 之測試配置



(C) 量測頻率 1000MHz 以上之測試配置



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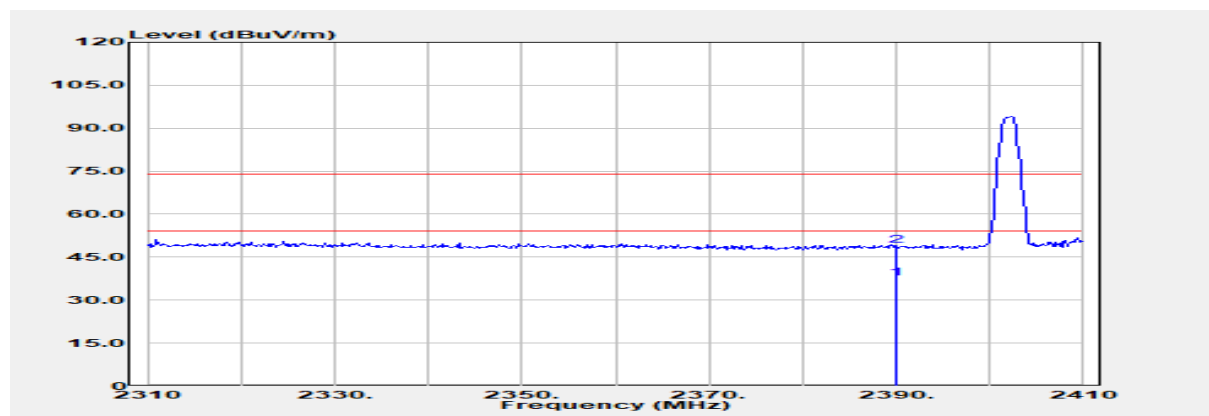
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10.5 場強輻射之量測結果

10.5.1 禁用頻帶輻射量測值

Report Number :E2/2021/30080
 Operation Mode :BLE 1M
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :H Plane

Test Site :966 Chamber C
 Test Date :2021-04-10
 Temp./Humi. :21.9/54
 Antenna Pol. :Vertical
 Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.000	Average	32.53	5.18	37.71	54.00	-16.29
2390.000	Peak	43.98	5.18	49.16	74.00	-24.84

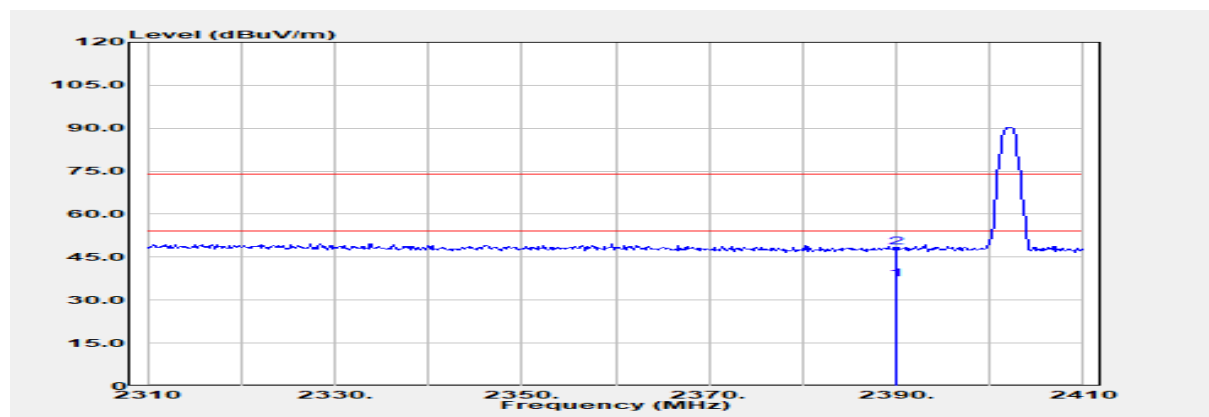
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Report Number :E2/2021/30080
Operation Mode :BLE 1M
Test Frequency :2402 MHz
Test Mode :BE CH LOW
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-10
Temp./Humi. :21.9/54
Antenna Pol. :Horizontal
Engineer :Enzo Chang



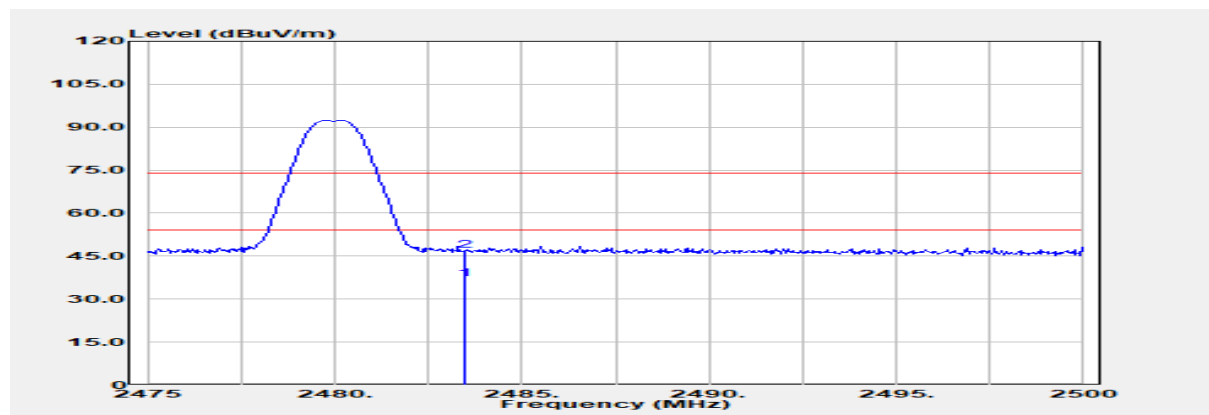
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.000	Average	32.17	5.18	37.35	54.00	-16.65
2390.000	Peak	43.12	5.18	48.30	74.00	-25.70

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Report Number :E2/2021/30080
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :BE CH HIGH
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-10
Temp./Humi. :21.9/54
Antenna Pol. :Vertical
Engineer :Enzo Chang



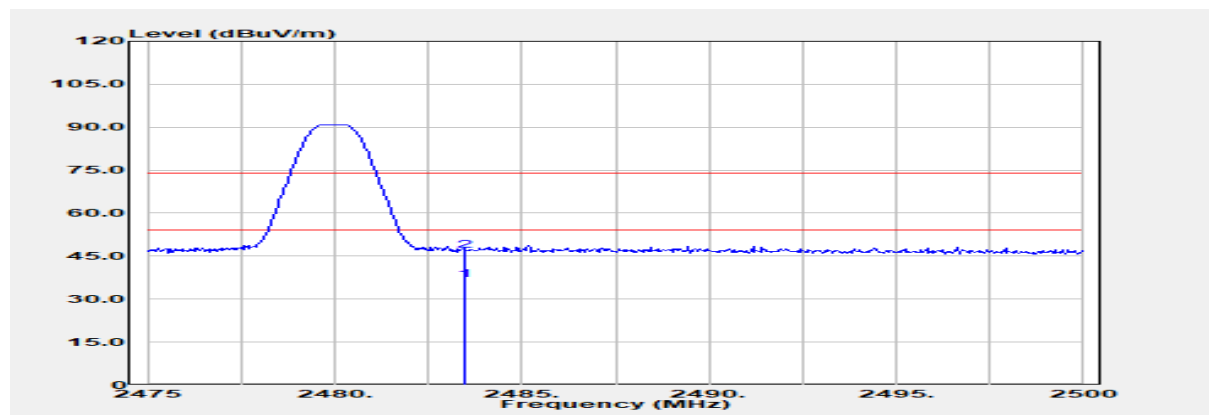
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	32.97	4.04	37.01	54.00	-16.99
2483.500	Peak	42.89	4.04	46.93	74.00	-27.07

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Report Number :E2/2021/30080
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :BE CH HIGH
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-10
Temp./Humi. :21.9/54
Antenna Pol. :Horizontal
Engineer :Enzo Chang



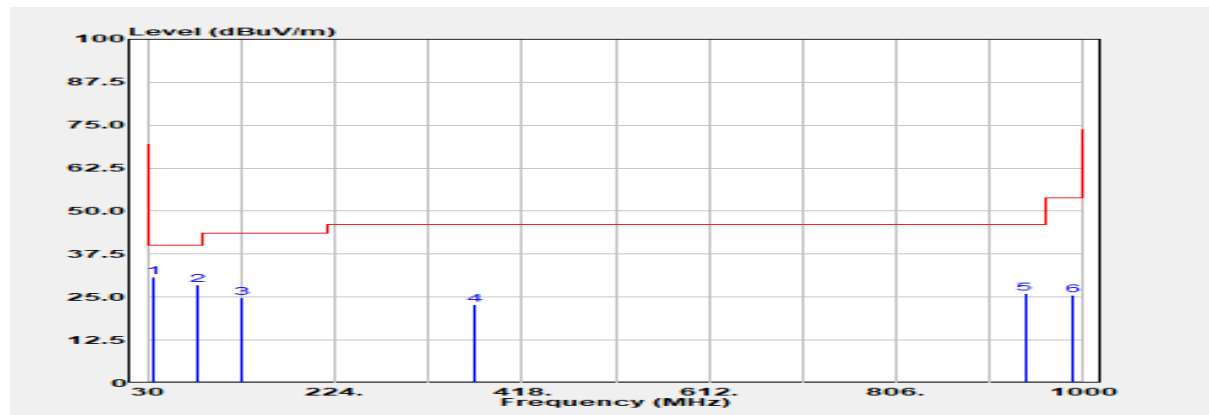
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	32.71	4.04	36.75	54.00	-17.25
2483.500	Peak	42.87	4.04	46.91	74.00	-27.09

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10.5.2 發射機場強輻射之量測結果(1GHz 以下)

Report Number	:E2/2021/30082	Test Site	:966 Chamber C
Operation Mode	:BLE 1M	Test Date	:2021-04-12
Test Frequency	:2442 MHz	Temp./Humi.	:23.2/63
Test Mode	:TX CH MID	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
36.218	Peak	40.85	-10.03	30.82	40.00	-9.18
82.853	Peak	50.32	-21.64	28.68	40.00	-11.32
127.933	Peak	41.60	-16.91	24.69	43.50	-18.81
368.878	Peak	36.65	-13.76	22.89	46.00	-23.11
939.375	Peak	31.54	-5.57	25.97	46.00	-20.03
989.119	Peak	30.32	-4.85	25.47	54.00	-28.53

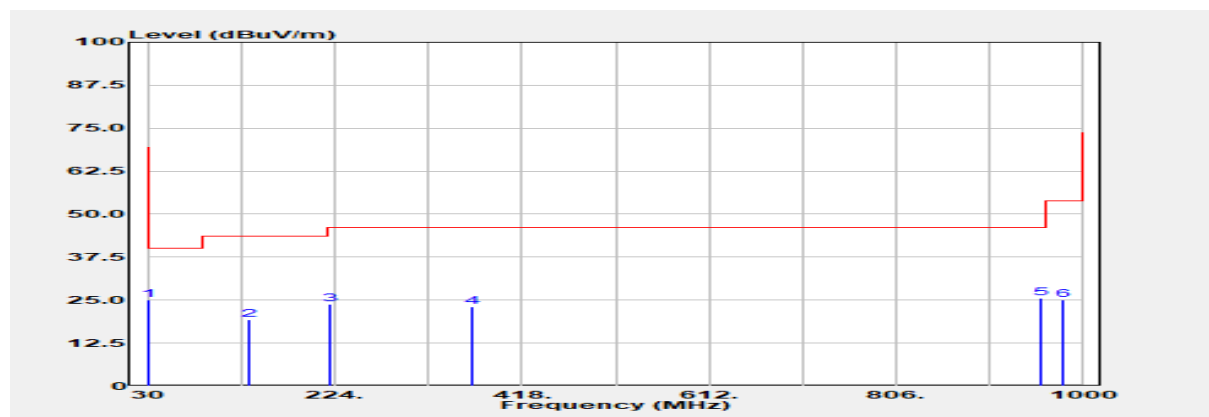
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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-12
Temp./Humi. :23.2/63
Antenna Pol. :Horizontal
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
31.554	Peak	32.29	-7.29	25.00	40.00	-15.00
135.705	Peak	36.32	-17.08	19.24	43.50	-24.26
219.647	Peak	43.47	-19.59	23.87	46.00	-22.13
367.324	Peak	36.81	-13.66	23.16	46.00	-22.84
956.474	Peak	31.11	-5.47	25.64	46.00	-20.36
979.792	Peak	29.96	-4.79	25.17	54.00	-28.83

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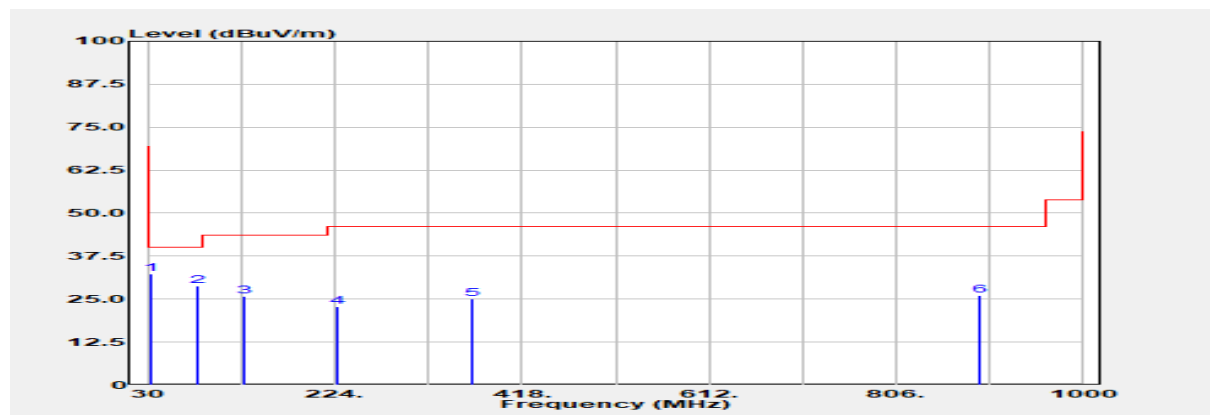
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Fully System

Report Number :E2/2021/30079
Operation Mode :System
Test Frequency :System
Test Mode :System
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-12
Temp./Humi. :22.2/65
Antenna Pol. :VERTICAL
Engineer :Ashton Chiu



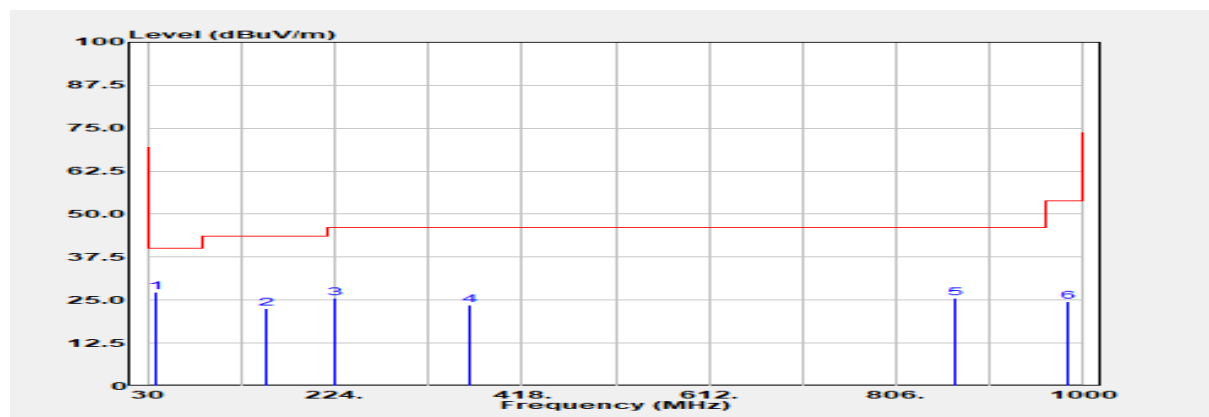
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
34.663	Peak	41.15	-8.86	32.29	40.00	-7.71
82.853	Peak	50.51	-21.64	28.87	40.00	-11.13
131.042	Peak	42.89	-16.98	25.91	43.50	-17.59
227.420	Peak	41.83	-18.92	22.91	46.00	-23.09
367.324	Peak	38.74	-13.66	25.08	46.00	-20.92
892.740	Peak	31.98	-5.82	26.16	46.00	-19.84

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Report Number :E2/2021/30079
Operation Mode :System
Test Frequency :System
Test Mode :System
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-12
Temp./Humi. :22.2/65
Antenna Pol. :HORIZONTAL
Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
37.772	Peak	38.17	-10.79	27.38	40.00	-12.62
152.805	Peak	40.84	-18.33	22.51	43.50	-20.99
224.311	Peak	44.73	-19.22	25.51	46.00	-20.49
362.660	Peak	37.22	-13.71	23.51	46.00	-22.49
867.869	Peak	32.26	-6.63	25.62	46.00	-20.38
984.455	Peak	29.83	-5.18	24.66	54.00	-29.34

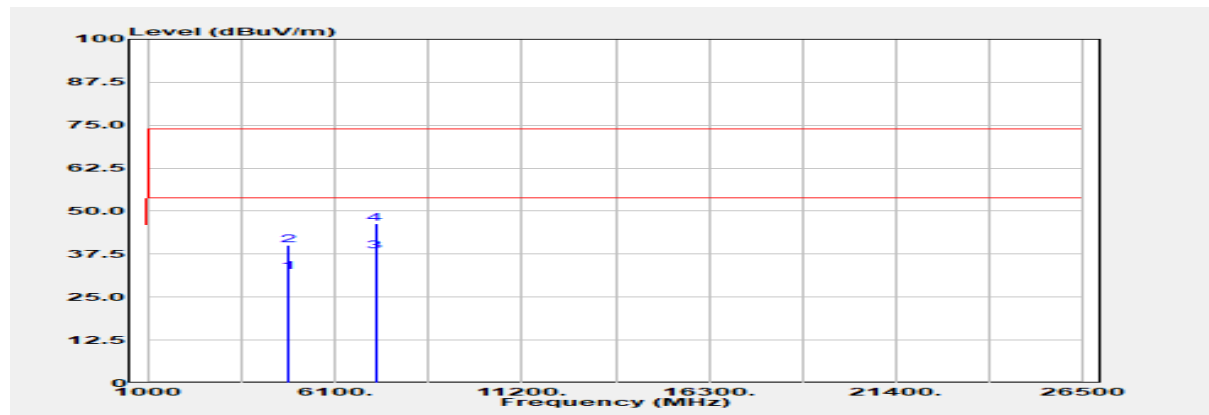
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10.5.3 發射機場強輻射之量測結果(1GHz 以上)

Report Number	:E2/2021/30082	Test Site	:966 Chamber C
Operation Mode	:BLE 1M	Test Date	:2021-04-08
Test Frequency	:2402 MHz	Temp./Humi.	:22.1/61
Test Mode	:TX CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4804.000	Average	21.53	10.87	32.40	54.00	-21.60
4804.000	Peak	29.28	10.87	40.15	74.00	-33.85
7206.000	Average	21.02	17.27	38.29	54.00	-15.71
7206.000	Peak	29.17	17.27	46.45	74.00	-27.55

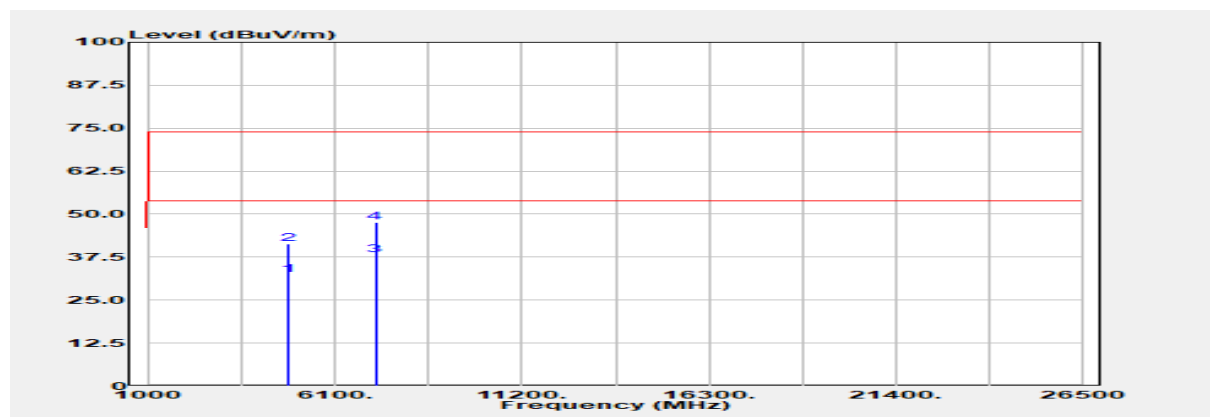
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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2402 MHz
Test Mode :TX CH LOW
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-08
Temp./Humi. :22.1/61
Antenna Pol. :Horizontal
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.000	Average	21.44	10.87	32.31	54.00	-21.69
4804.000	Peak	30.40	10.87	41.27	74.00	-32.73
7206.000	Average	20.89	17.27	38.16	54.00	-15.84
7206.000	Peak	30.31	17.27	47.58	74.00	-26.42

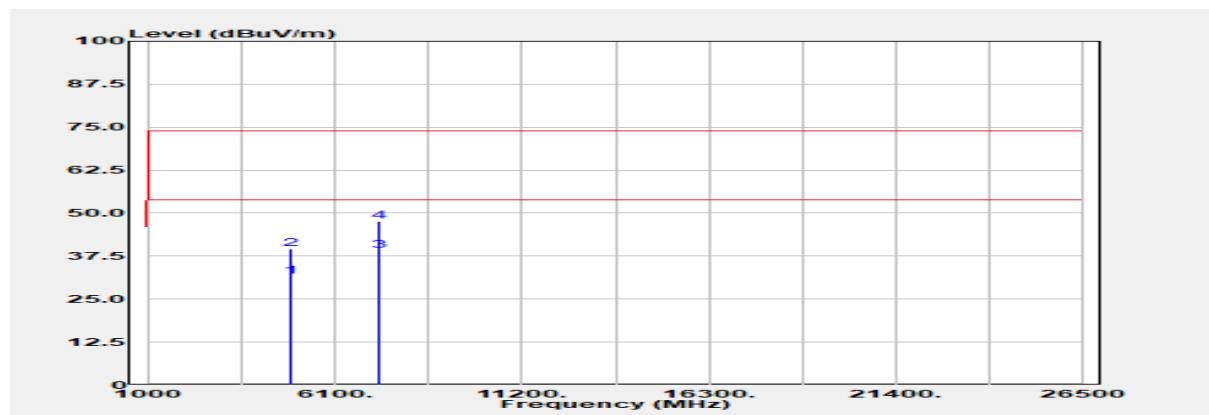
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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-08
Temp./Humi. :22.1/61
Antenna Pol. :Vertical
Engineer :Enzo Chang



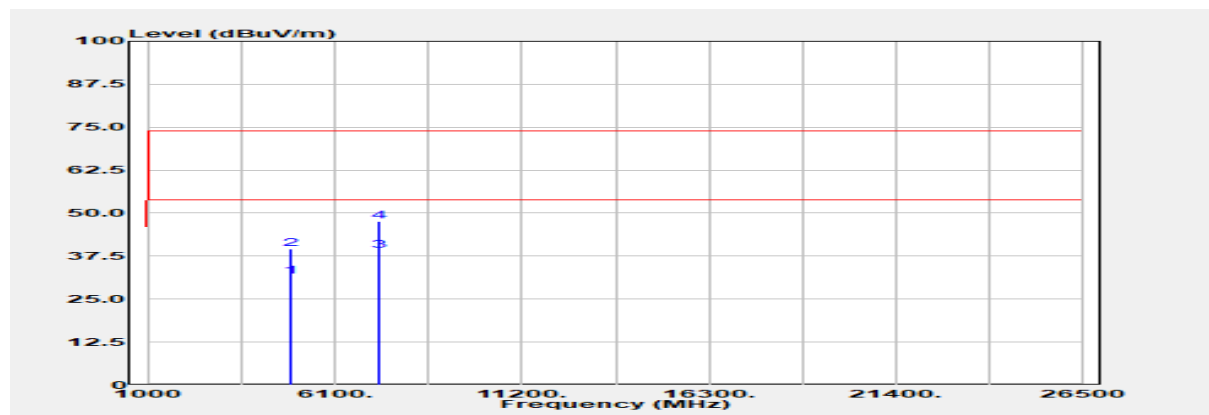
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.000	Average	21.48	10.16	31.64	54.00	-22.36
4884.000	Peak	29.56	10.16	39.71	74.00	-34.29
7326.000	Average	20.92	18.20	39.12	54.00	-14.88
7326.000	Peak	29.41	18.20	47.61	74.00	-26.39

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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-08
Temp./Humi. :22.1/61
Antenna Pol. :Horizontal
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.000	Average	21.41	10.16	31.57	54.00	-22.43
4884.000	Peak	29.36	10.16	39.52	74.00	-34.48
7326.000	Average	20.82	18.20	39.02	54.00	-14.98
7326.000	Peak	29.38	18.20	47.58	74.00	-26.42

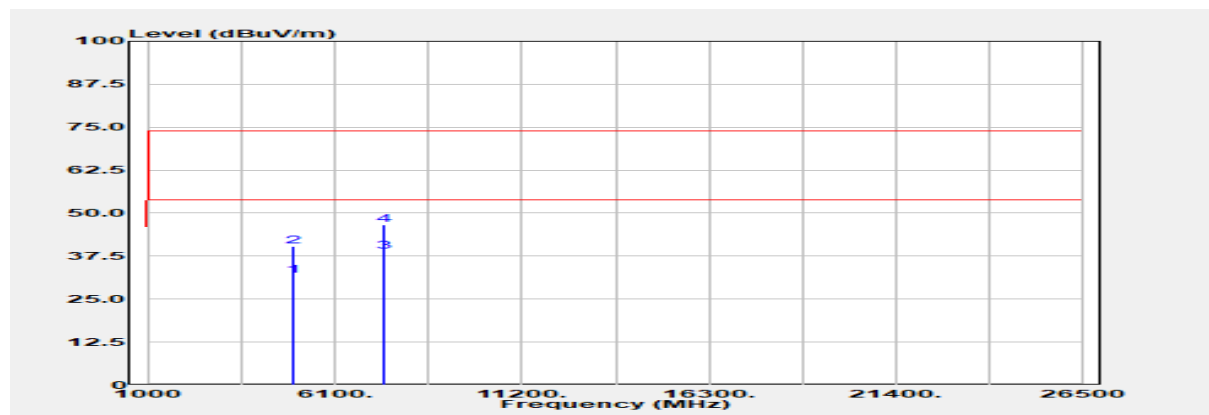
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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :TX CH HIGH
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-08
Temp./Humi. :22.1/61
Antenna Pol. :Vertical
Engineer :Enzo Chang



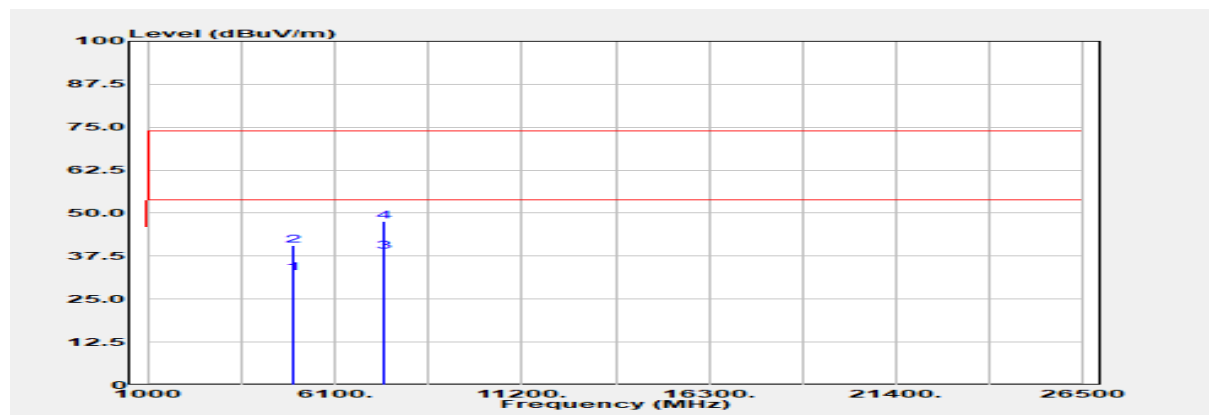
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.000	Average	21.53	10.20	31.73	54.00	-22.27
4960.000	Peak	30.24	10.20	40.44	74.00	-33.56
7440.000	Average	21.03	17.86	38.89	54.00	-15.11
7440.000	Peak	28.73	17.86	46.59	74.00	-27.41

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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :TX CH HIGH
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-08
Temp./Humi. :22.1/61
Antenna Pol. :Horizontal
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.000	Average	22.49	10.20	32.69	54.00	-21.31
4960.000	Peak	30.45	10.20	40.65	74.00	-33.35
7440.000	Average	21.06	17.86	38.92	54.00	-15.08
7440.000	Peak	29.65	17.86	47.51	74.00	-26.49

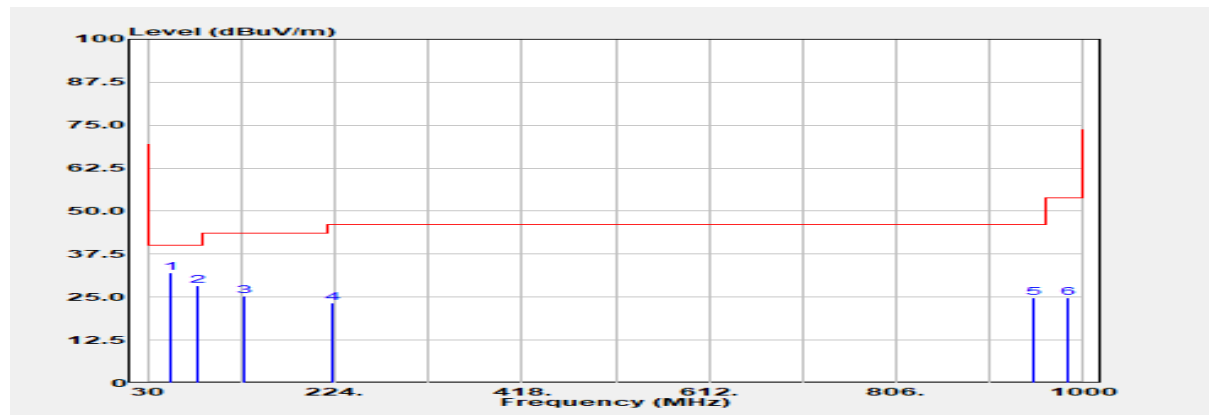
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10.5.4 接收機場強輻射之量測結果(1GHz 以下) (最差模式)

Report Number	:E2/2021/30082	Test Site	:966 Chamber C
Operation Mode	:BLE 1M	Test Date	:2021-04-12
Test Frequency	:2442 MHz	Temp./Humi.	:23.2/63
Test Mode	:RX CH MID	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
53.317	Peak	54.34	-22.16	32.18	40.00	-7.82
82.853	Peak	49.92	-21.64	28.28	40.00	-11.72
129.487	Peak	42.24	-16.89	25.35	43.50	-18.15
222.756	Peak	42.72	-19.35	23.37	46.00	-22.63
948.702	Peak	30.20	-5.30	24.90	46.00	-21.10
984.455	Peak	30.11	-5.18	24.94	54.00	-29.06

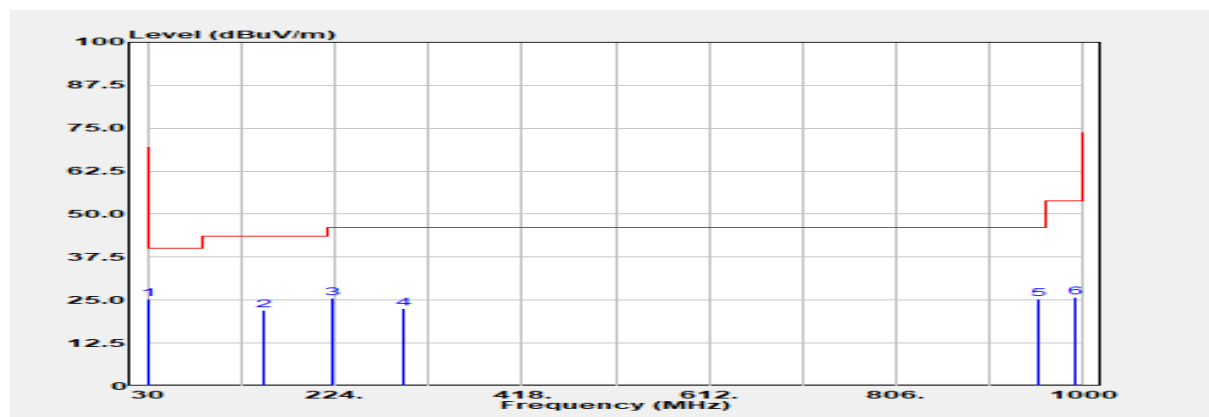
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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :RX CH MID
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-12
Temp./Humi. :23.2/63
Antenna Pol. :HORIZONTAL
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
31.554	Peak	32.55	-7.29	25.26	40.00	-14.74
149.696	Peak	40.00	-18.01	21.99	43.50	-21.51
222.756	Peak	45.02	-19.35	25.67	46.00	-20.33
295.817	Peak	37.96	-15.51	22.45	46.00	-23.55
953.365	Peak	30.58	-5.22	25.36	46.00	-20.64
992.228	Peak	30.57	-4.82	25.75	54.00	-28.25

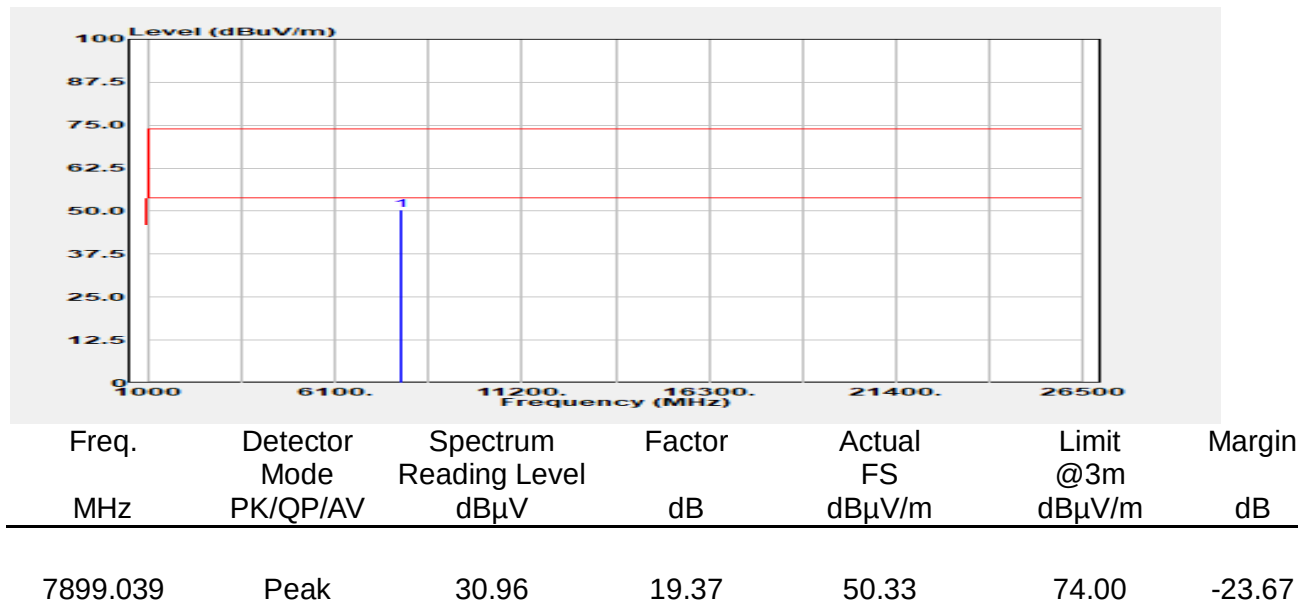
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10.5.5 接收模式場強輻射之量測結果(1GHz 以上) (最差模式)

Report Number	:E2/2021/30082	Test Site	:966 Chamber C
Operation Mode	:BLE 1M	Test Date	:2021-04-09
Test Frequency	:2442 MHz	Temp./Humi.	:21.5/55
Test Mode	:RX CH MID	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Enzo Chang



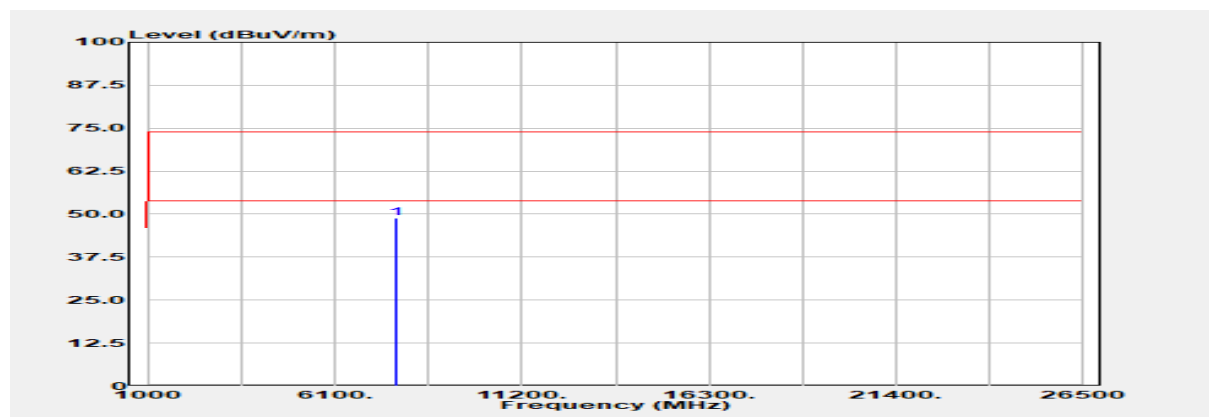
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Report Number :E2/2021/30082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :RX CH MID
EUT Pol :H Plane

Test Site :966 Chamber C
Test Date :2021-04-09
Temp./Humi. :21.5/55
Antenna Pol. :Horizontal
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
7798.077	Peak	30.13	18.74	48.87	74.00	-25.13

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11 天線增益之要求

11.1 適用標準

依據NCC低功率射頻器材技術規範4.10.1.3 (1)之規定，操作於2400-2483.5MHz 者，僅用於固定式點對點操作，其發射天線之方向性增益超過 6dBi，每超過3dB應降低1dB之峰值輸出功率。

依據NCC低功率射頻器材技術規範4.10.1.3 (2)之規定，操作於5725-5850MHz 者，其發射天線之方向性增益超過 6dBi，無須降低峰值輸出功率。

依據NCC低功率射頻器材技術規範4.10.1.3 (2)之規定，用於點對多點操作時，如其發射天線之方向性增益超過 6dBi，應依所超過之dB數等量降低最大傳導輸出功率。

註：固定式點對點操作使用方式，並不包括使用點對多點之系統、全向性之應用以及發射相同資訊之共同安裝的多重發射機。展頻或數位調變之發射器需要專業安裝，該設備操作者或安裝者有責任確認該系統是限用於固定式、點對點之操作，隨機所附之使用手冊必須包含此訊息以告知使用者或安裝者須負之責任。

11.2 天線增益

此裝置使用天線如下：

天線型式/天線增益	PCB Antenna, Gain: 3.03dBi Model No.: S2BPW, Supplier: SKULLCANDY,INC
-----------	--

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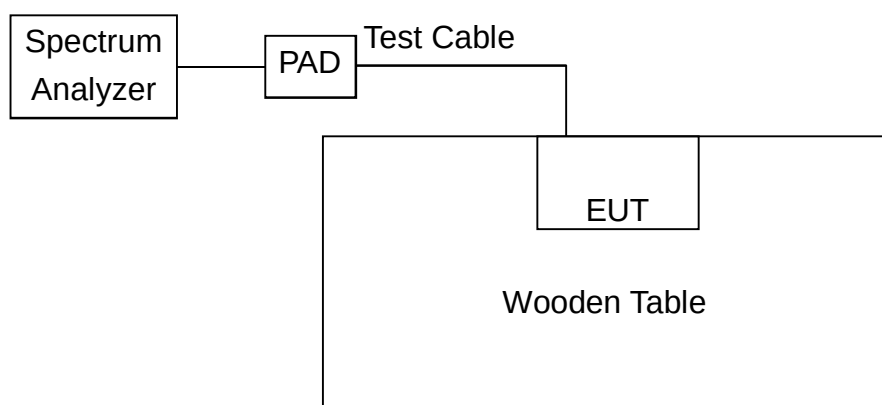
12 發射頻寬之要求

12.1 適用標準

對使用數位調變技術之低功率發射機，依據NCC低功率射頻器材技術規範4.10.1.6(2) (A)之規定，6dB之頻寬至少應有500kHz。

12.2 測試配置

圖 4: 發射頻寬之測試配置



12.3 量測結果

BLE mode

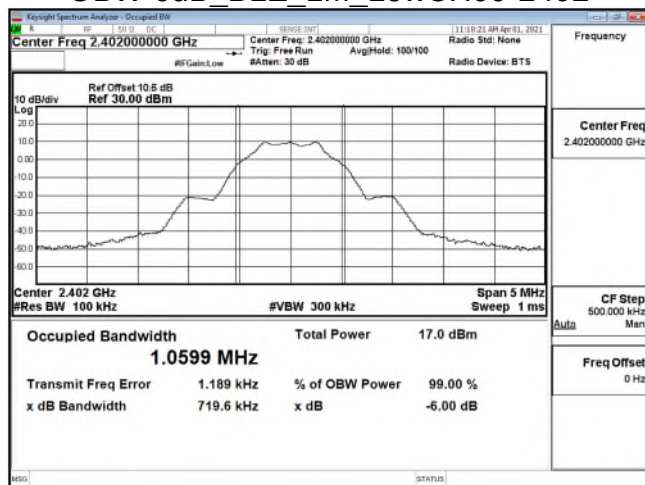
Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.7196	≥ 0.5	PASS
2442	0.721	≥ 0.5	PASS
2480	0.7196	≥ 0.5	PASS

Refer next page for test plots

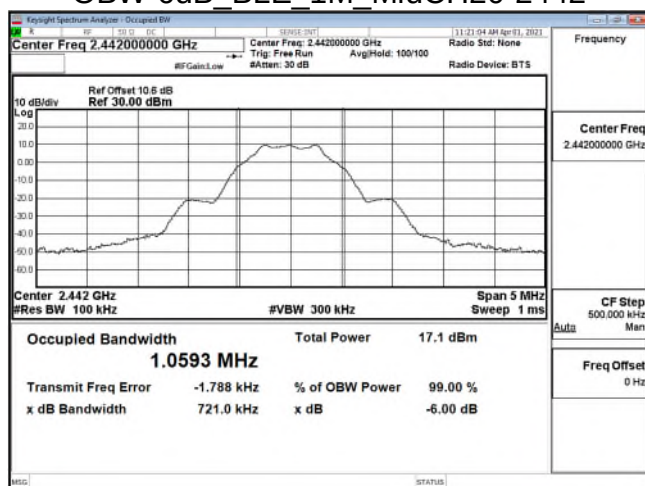
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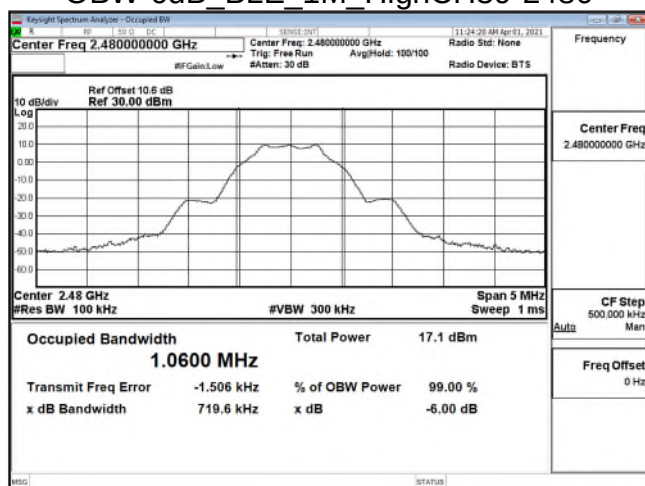
OBW 6dB_BLE_1M_LowCH00-2402



OBW 6dB_BLE_1M_MidCH20-2442



OBW 6dB_BLE_1M_HighCH39-2480



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13 輸出峰值功率之量測

13.1 適用標準

依據 NCC 低功率射頻器材技術規範 4.10.1.2(1) (A)(C)之規定，操作於 2400-2483.5MHz 與 5725-5850MHz 之所有數位調變技術系統：1 Watt(含)以下。

依據NCC低功率射頻器材技術規範4.10.1.3之規定，用於非固定式點對點操作時，若其發射天線之方向性增益超過6dBi，應依所超過之dB數等量降低峰值輸出功率。如用於固定式點對點操作時，應符合下列情現之一：

依據NCC低功率射頻器材技術規範4.10.1.3 (1)之規定，操作於2400-2483.5MHz 者，僅用於固定式點對點操作，其發射天線之方向性增益超過 6dBi，每超過3dB應降低1dB之峰值輸出功率。

依據NCC低功率射頻器材技術規範4.10.1.3 (2)之規定，操作於5725-5850MHz 者，其發射天線之方向性增益超過 6dBi，無須降低峰值輸出功率。

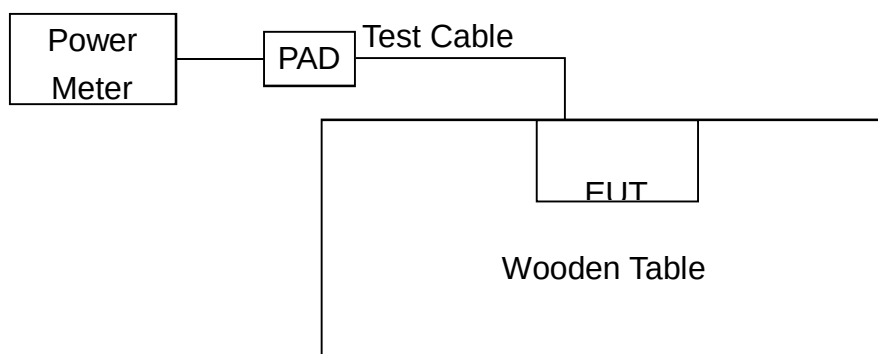
依據NCC低功率射頻器材技術規範4.10.1.3 (3)之規定，用於點對多點操作時，如其發射天線之方向性增益超過 6dBi，應依所超過之dB數等量降低最大傳導輸出功率。

註：固定式點對點操作使用方式，並不包括使用點對多點之系統、全向性之應用以及發射相同資訊之共同安裝的多重發射機。展頻或數位調變之發射器需要專業安裝，該設備操作者或安裝者有責任確認該系統是限用於固定式、點對點之操作，隨機所附之使用手冊必須包含此訊息以告知使用者或安裝者須負之責任。

13.2 載波頻率工作週期之量測

在進行功率測量前，應檢查每種模式的工作週期以補償工作週期校正因子 (Duty Factor)。

13.3 測試配置



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13.4 量測方式

13.4.1 載波頻率工作週期儀器設定

Span = Zero, RBW = 8MHz, VBW = 8MHz, Detector = Peak

13.4.2 輸出功率量測

1. 將 EUT 置於發射模式。
2. 移除天線，使用 low loss cable 連接 EUT 的 antenna port 及 power meter。
3. 紀錄最大功率讀值。

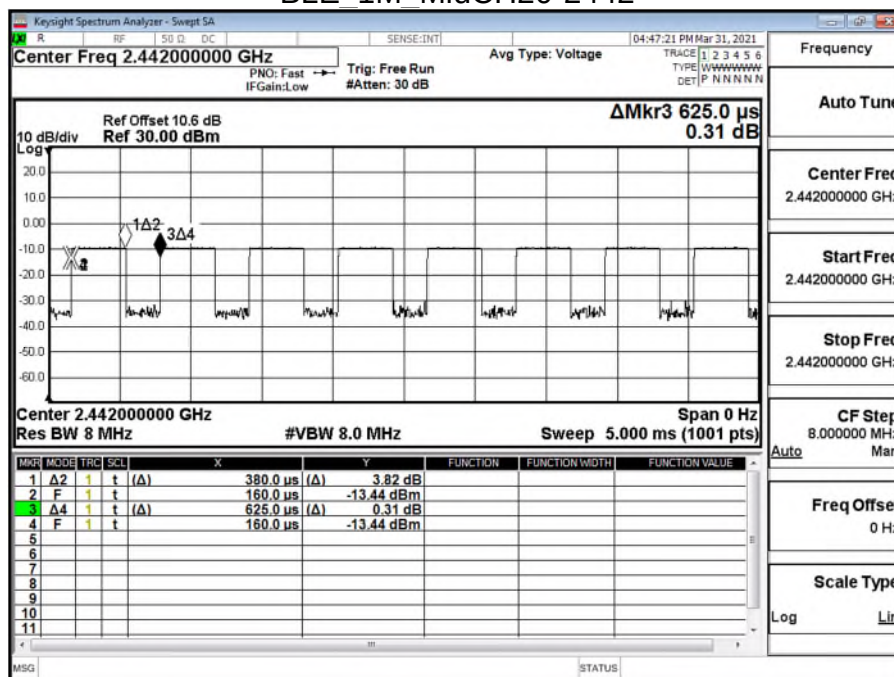
13.5 量測結果

13.5.1 載波頻率工作週期

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE	61.00	2.15	2.63	3.00

Duty Cycle Factor:10*log(1/(61/100))=2.15

BLE_1M_MidCH20-2442



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13.5.2 輸出功率

CH	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit
Low	2402	default	10.88	1 Watt = 30 dBm
Mid	2442	default	10.79	1 Watt = 30 dBm
High	2480	default	10.73	1 Watt = 30 dBm
CH	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
Low	2402	default	10.51	1 Watt = 30 dBm
Mid	2442	default	10.67	1 Watt = 30 dBm
High	2480	default	10.50	1 Watt = 30 dBm

**Note: Measured by power meter, cable loss 10.6 dB + Duty cycle factor has been offset to the power meter for Avg. power and cable loss has been offset for Peak power measurement.*

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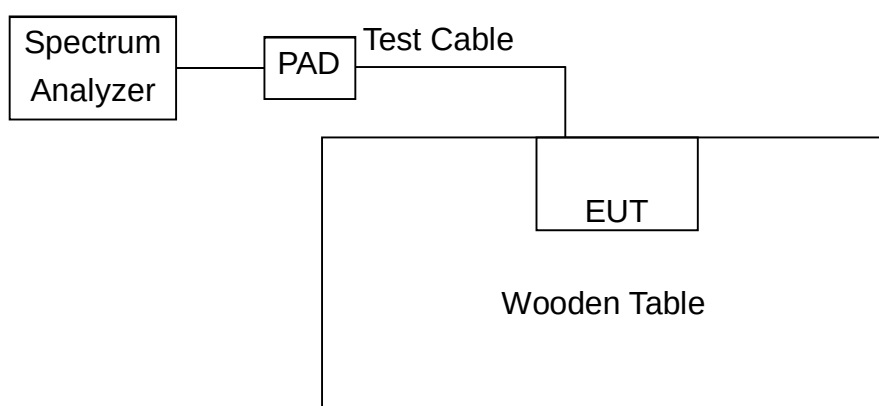
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14 帶外發射限制

14.1 適用標準

依據 NCC 低功率射頻器材技術規範 4.10.1.5 之規定，操作頻帶範圍外之任意 100kHz 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 100kHz 內的射頻功率，須衰減 20 分貝 (dB)，以射頻傳導或輻射方式測量。此外，落於第 3.5 節禁用頻段之輻射發射，應符合第 3.6 節之規定。

14.2 帶外發射測試配置



14.3 帶外發射量測結果

Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	9.63	-10.37
2442	9.71	-10.29
2480	9.66	-10.34

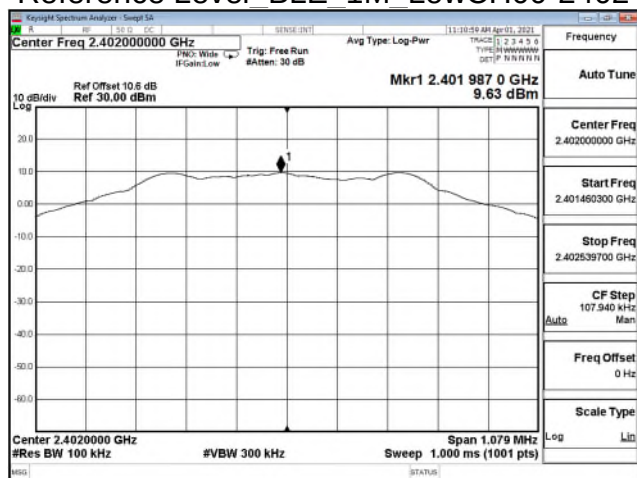
NOTE: cable loss as 10.6dB that offsets in the spectrum

NOTE: Refer to next page for plots.

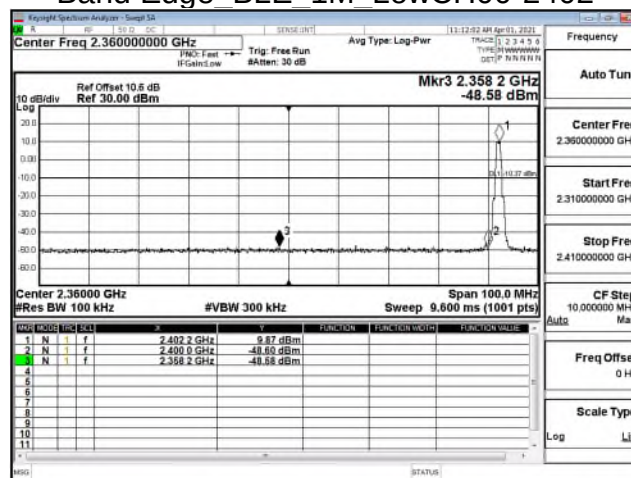
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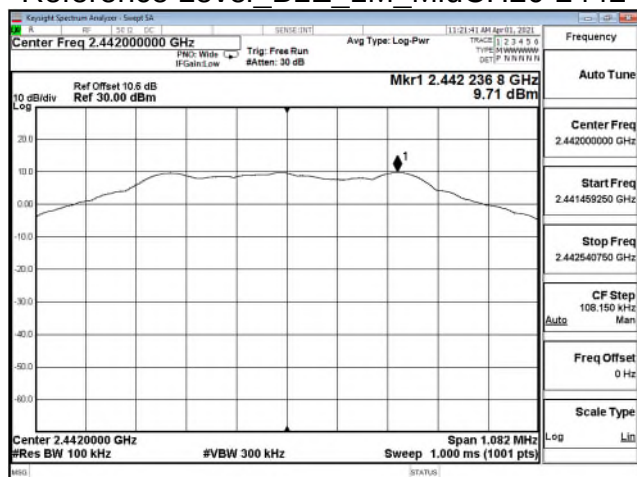
Reference Level BLE 1M LowCH00-2402



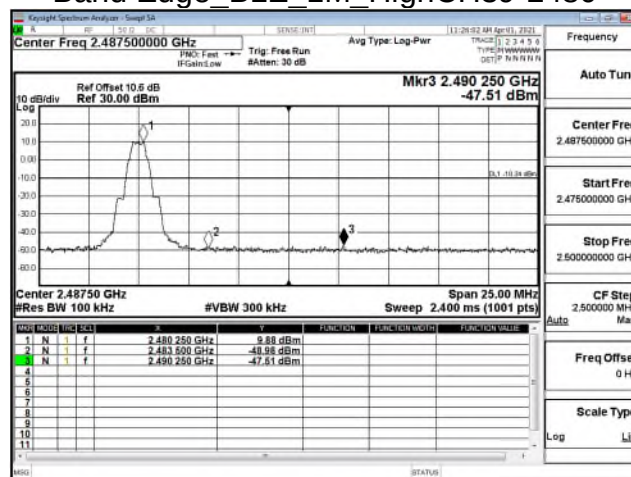
Band Edge BLE 1M LowCH00-2402



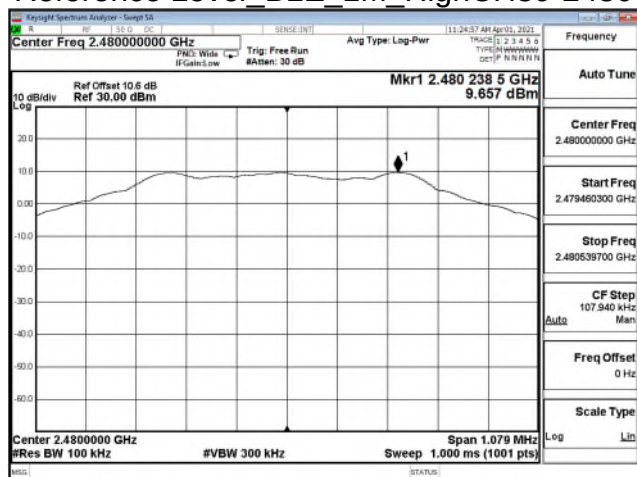
Reference Level BLE 1M MidCH20-2442



Band Edge BLE 1M HighCH39-2480



Reference Level BLE 1M HighCH39-2480

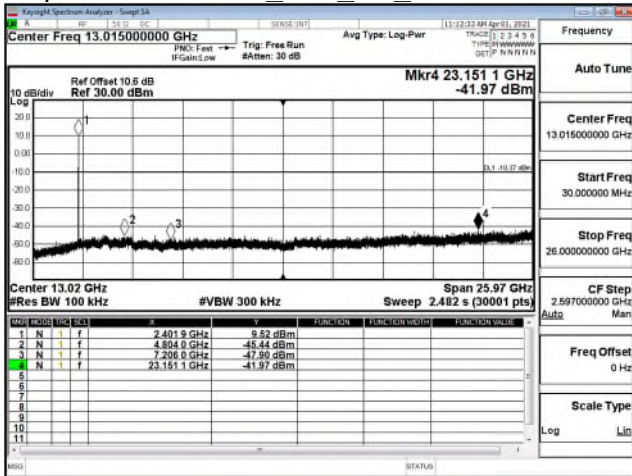


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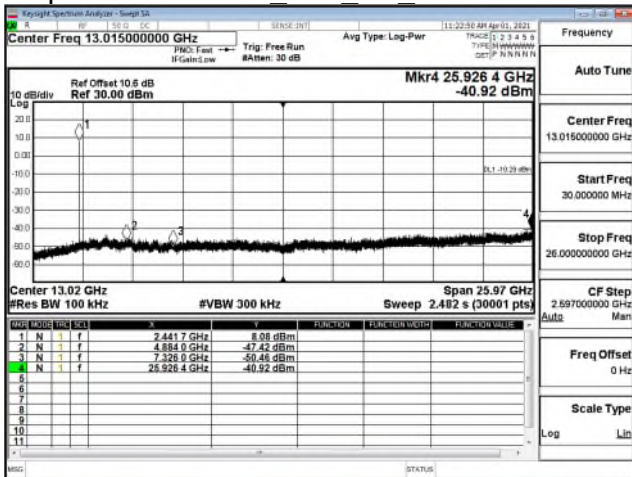
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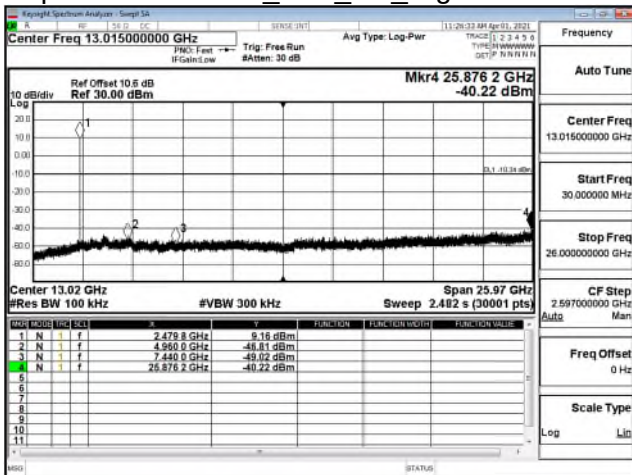
Spurious Emission_BLE_1M_LowCH00-2402



Spurious Emission_BLE_1M_MidCH20-2442



Spurious Emission_BLE_1M_HighCH39-2480



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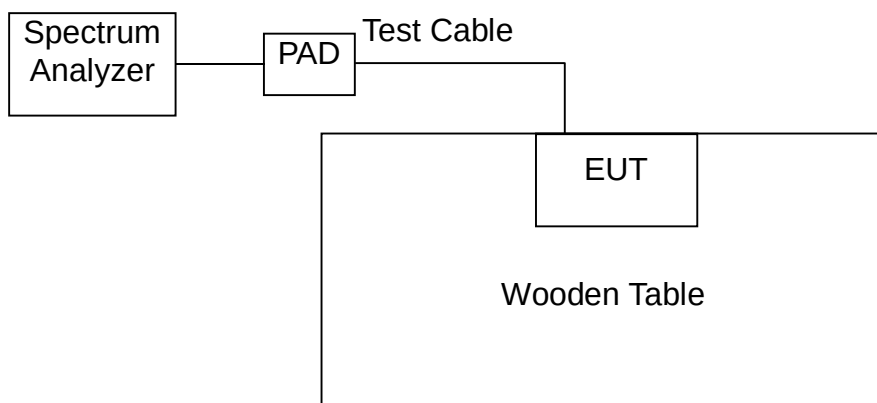
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15 功率密度之量測

15.1 適用標準

依據 NCC 低功率射頻器材技術規範 4.10.1.6(2) (B)規定，對數位調變之展頻系統，在使用頻率範圍之任意 3kHz 頻寬內，由發射 1 機傳導至天線之峰值發射電功率密度在任意期間內，皆不得大於 8dBm。

15.2 功率密度之測試配置



15.3 功率密度量測結果

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-4.760	8	PASS
2442	-4.690	8	PASS
2480	-4.780	8	PASS

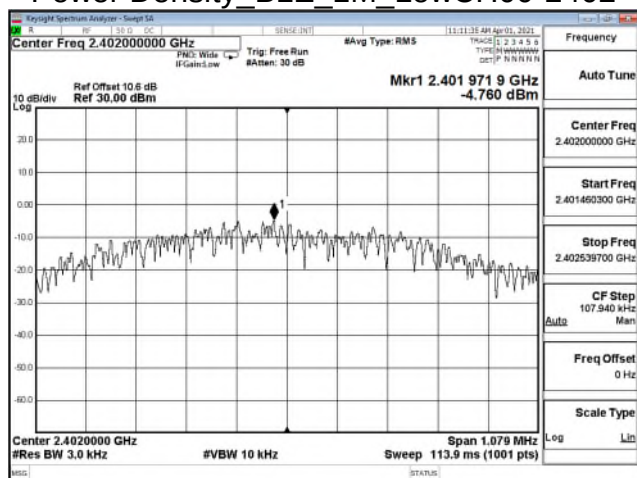
NOTE: cable loss as 10.6dB that offsets in the spectrum

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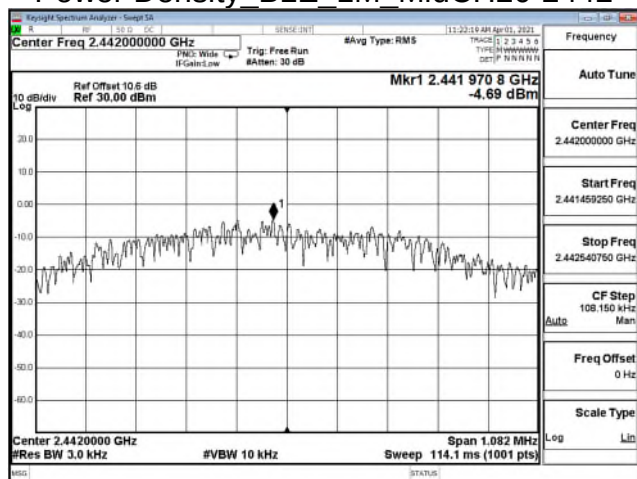
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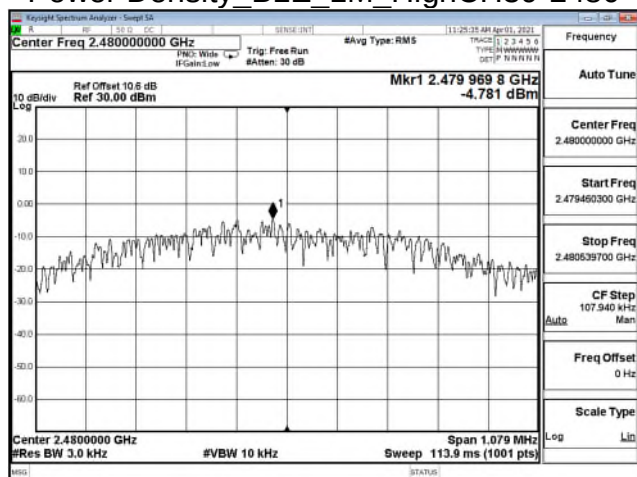
Power Density_BLE_1M_LowCH00-2402



Power Density_BLE_1M_MidCH20-2442



Power Density_BLE_1M_HighCH39-2480



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~ End of Report ~

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