

低功率射頻器材試驗報告



申請廠商	SKULLCANDY, INC. 6301 N Landmark Dr Park City UT 84098, Utah United States of America
製造廠商	SKULLCANDY, INC. 6301 N Landmark Dr Park City UT 84098, Utah United States of America
產品名稱	Dime 2
廠牌	Skullcandy
型號	S2DBW
型號差異	N/A
報告號碼	E2/2021/70082
技術標準	LP0002, 4.10.1 節
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Approved By: _____


裴笛翰

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。

Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/70082	Rev.00	Original.	Aug.27,2021	Viola Su

Note:

- 1 、 Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
- 2 、 Measurement results in the original test report E2/2021/70079 are partially leveraged in this test report.

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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： 110年06月14日起至113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 C	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。			

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			1.53	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		1.53	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。

3 一般資料

3.1 產品描述

產品名稱	Dime 2		
廠牌	Skullcandy		
型號	S2DBW		
型號差異	N/A		
使用電源	3.7Vdc from Rechargeable Li-polymer Battery		
	Battery	廠牌:東莞益鑫電子科技有限公司; Model NO.:SL390912	
備註	本器材為右耳耳機		

3.2 射頻特性

發射頻帶	2402MHz – 2480MHz
輸出功率	3.44 dBm (Peak)
調變方式	BT Single mode LE (GFSK)
頻道數	40

3.3 天線資訊

Antenna Type	BRAND	Model No.	Freq. (MHz)	Peak Antenna Gain (dBi)
FPC Antenna	SKULLCANDY, INC.	S2DMW	2.4GHz	-0.64
Note: Antenna information is provided by the applicant.				

3.4 配件資訊

以下不附賣配件經申請者切結，器材不隨貨提供並由實驗室提供併同檢驗。

是否附賣		配件	廠牌	型號	Power Rating (Vdc)
Yes	No				
☒	☐	USB cable	ZD	ZD-356	N/A
☒	☐	充電盒	Skullcandy	S2DBW	N/A
☒	☐	電池(耳機)	東莞益鑫電子科技有限公司	SL390912	3.7V, 20mA
☒	☐	電池(充電盒)	東莞益鑫電子科技有限公司	SL551135	3.7V, 150mAh
☐	☒	測試治具	AIROHA	C295	N/A
☐	☒	Adapter	HONG SHAING	MUC-5K	5V
☐	☒	USB Cable	DIKE	SH-USB 3M	N/A

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	符合
2	電源線傳導干擾	低功率射頻器材技術規範 3.3節	符合
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	符合
4	發射頻寬	低功率射頻器材技術規範 4.10.1.6(2) (A) 節	符合
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	符合
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	符合
7	功率密度	低功率射頻器材技術規範 4.10.1.6(2) (B) 節	符合

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
RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	0,20,39	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

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。

7 測試配置

7.1 待測物與測試週邊配置圖

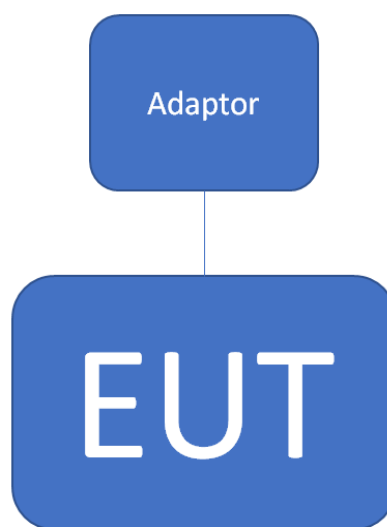
Conducted (Antenna Port) Setup



Radiated Setup



Conduction Setup



7.2 測試週邊描述

編號	產品別	商標	型號	序號	版本
1.	Test Software	audix	e3	20923 sgs Ver.9	N/A
2.	Notebook	Lenovo	L420	S0011721	N/A
3.	USB TO UART_OVO	AIROHA	C295	ZD-356	N/A
4.	D7 Power supply	Hola	DP-3003	D7070035	N/A
5.	Adapter	HONG SHAING	MUC-5K	AC-USB012	N/A
6.	Test Software	audix	e3	Ver. 6.11-20180419c	N/A
7.	USB cable	ZD	ZD-356	N/A	N/A
8.	Test Software	SGS	Radio Test Software	v21.07.19	N/A
9.	DC Power Supply	HOLA	DP-3003	D7070035	N/A
10.	USB Cable	DIKE	SH-USB 3M	N/A	N/A
11.	AB1561_AB1562_AB1563_Airoha_Tool_Kit(ATK)	N/A	N/A	N/A	V1.3.7.918

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 C					
EQUIPMENT TYPE	MFR/BRAND	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	04/27/2021	04/26/2022
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
Adapter	HONG SHAING	MUC-5K	AC-USB012	N.C.R	N.C.R
USB Cable	ZD	ZD-356	N/A	N.C.R	N.C.R

Note: N.C.R refers to Not Calibrated Required

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。

8.2 天線端傳導測試之量測儀器

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR/BRAND	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/25/2021	06/25/2022
Power Meter	Anritsu	ML2496A	1804002	04/14/2021	04/13/2022
Power Sensor	Anritsu	MA2411B	1726105	04/14/2021	04/13/2022
Power Sensor	Anritsu	MA2411B	1726106	04/14/2021	04/13/2022
DC Power Supply	HOLA	DP-3003	D7070035	05/28/2021	05/27/2022
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF156	11/19/2020	11/18/2021
治具	AIROHA	C295	N/A	N.C.R	N.C.R
Test Software	SGS	Radio Test Software	v21.07.19	N/A	N/A

Note: N.C.R refers to Not Calibrated Required

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8.3 量測場強輻射之量測儀器

Radiated Emission Test Site: SAC G					
EQUIPMENT TYPE	MFR/BRAND	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWAZBECK	VULB 9168	1206	02/22/2021	02/21/2022
Horn Antenna	Schwarzbeck	DRH18-E	210105A18E	04/09/2021	04/08/2022
Horn Antenna	Schwarzbeck	BBHA9170	185	07/30/2020	07/29/2021
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022
3m Site NSA	SGS	966 chamber G	N/A	03/30/2021	03/29/2022
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/19/2020	11/18/2021
Pre-Amplifier	EMC Instruments	EMC330N	980781	03/15/2021	03/14/2022
Pre-Amplifier	EMC Instruments	EMC118A45 SE	980815	03/15/2021	03/14/2022
Attenuator	Marvelous	MVE2213-30	RF04	11/19/2020	11/18/2021
High Pass Filter	R&S	F13 HPF 3GHz	RF175	11/19/2020	11/18/2021
Lowpass Filter	Woken	EWT-56-0019	RF173	11/19/2020	11/18/2021
High Pass Filter	R&S	HPF7.0	RF176	11/19/2020	11/18/2021
Notch Filter	Woken	EWT-54-0037	RF204	11/19/2020	11/18/2021
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/19/2020	11/18/2021
D7 Power supply	Hola	DP-3003	D7070035	05/28/2021	05/27/2022
USB TO UART_OVO	AIROHA	C295	ZD-356	N.C.R	N.C.R
USB Cable	DIKE	SH-USB 3M	N/A	N.C.R	N.C.R
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R
Coaxial Cable	EMC Instruments	EMC104-SM-SM-8000-5000-5000	210219、210220、210221	03/15/2021	03/14/2022
Notebook	Lenovo	L420	S0011721	N/A	N/A
治具	AIROHA	C295	N/A	N.C.R	N.C.R

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9 電源線傳導干擾之量測

9.1 適用標準

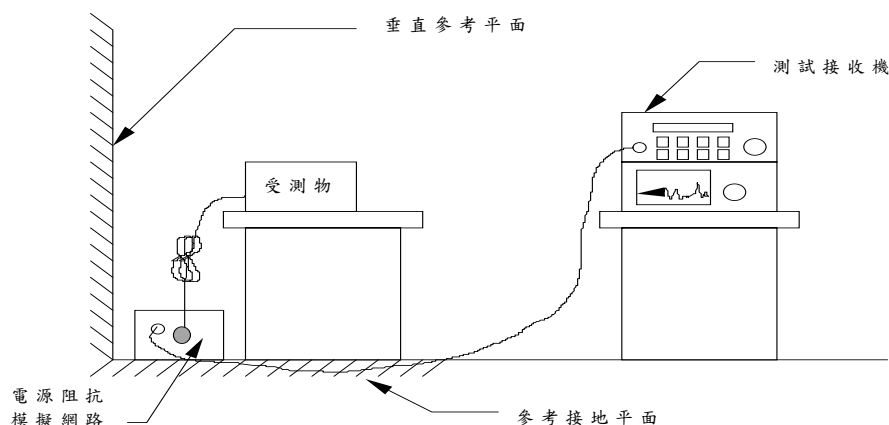
依據NCC低功率射頻器材技術規範之3.3節，以市電為電源之低功率射頻器材，其傳導回電源線上頻率自150 kHz~30 百萬赫(MHz) 之射頻電壓(在電源端子每一電源線對接地點)應小於或等於下表所列之限制值。測量時應經過50 微亨利(uH)及50 歐姆(Ω)之電源線阻抗穩定網路。頻率重疊處，以較低限制值為準。

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)

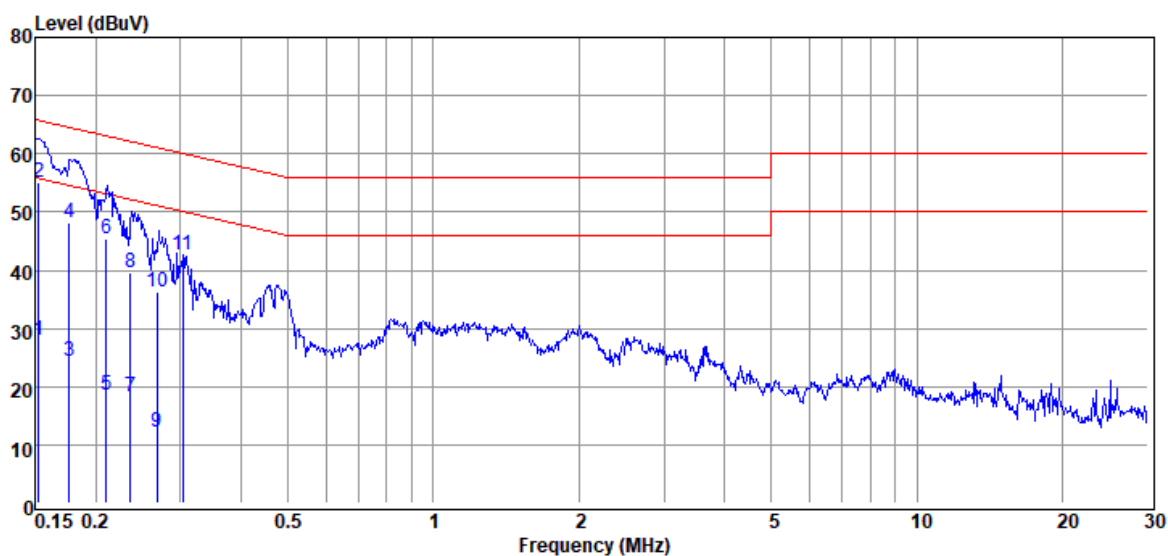
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9.5 傳導干擾之量測結果:

Report Number	:E2/2021/70079	Test Site	:Conduction C
Test Mode	:System	Test Date	:2021-07-26
Power	:110V/60Hz	Temp./Humi.	:24.1/59
Probe	:L1	Engineer	:Jack Tseng
Note	:Adapter: AC-USB012		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	17.64	10.31	27.95	55.86	-27.91
0.15	QP	44.89	10.31	55.20	65.86	-10.66
0.18	Average	14.10	10.30	24.40	54.64	-30.24
0.18	QP	37.94	10.30	48.24	64.64	-16.40
0.21	Average	8.16	10.30	18.46	53.19	-34.73
0.21	QP	35.12	10.30	45.42	63.19	-17.77
0.24	Average	8.01	10.30	18.31	52.21	-33.90
0.24	QP	29.28	10.30	39.58	62.21	-22.63
0.27	Average	1.95	10.31	12.26	51.16	-38.90
0.27	QP	25.92	10.31	36.23	61.16	-24.93
0.30	Peak	32.33	10.32	42.65	60.15	-17.50

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Report Number :E2/2021/70079

Test Site :Conduction C

Test Mode :System

Test Date :2021-07-26

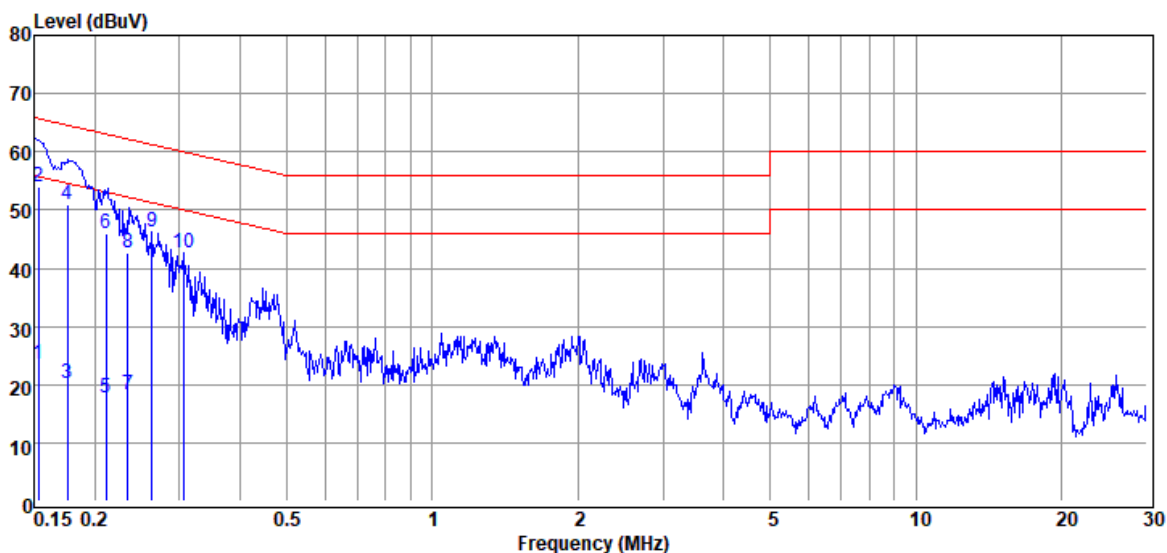
Power :110V/60Hz

Temp./Humi. :24.1/59

Probe :N

Engineer :Jack Tseng

Note :Adapter: AC-USB012



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.15	Average	13.21	10.31	23.52	55.82	-32.30
0.15	QP	43.74	10.31	54.05	65.82	-11.77
0.18	Average	9.98	10.30	20.28	54.68	-34.40
0.18	QP	40.71	10.30	51.01	64.68	-13.67
0.21	Average	7.54	10.30	17.84	53.14	-35.30
0.21	QP	35.67	10.30	45.97	63.14	-17.17
0.23	Average	7.99	10.30	18.29	52.30	-34.01
0.23	QP	32.45	10.30	42.75	62.30	-19.55
0.26	Peak	35.92	10.31	46.23	61.34	-15.11
0.31	Peak	32.25	10.32	42.57	60.10	-17.53

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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。

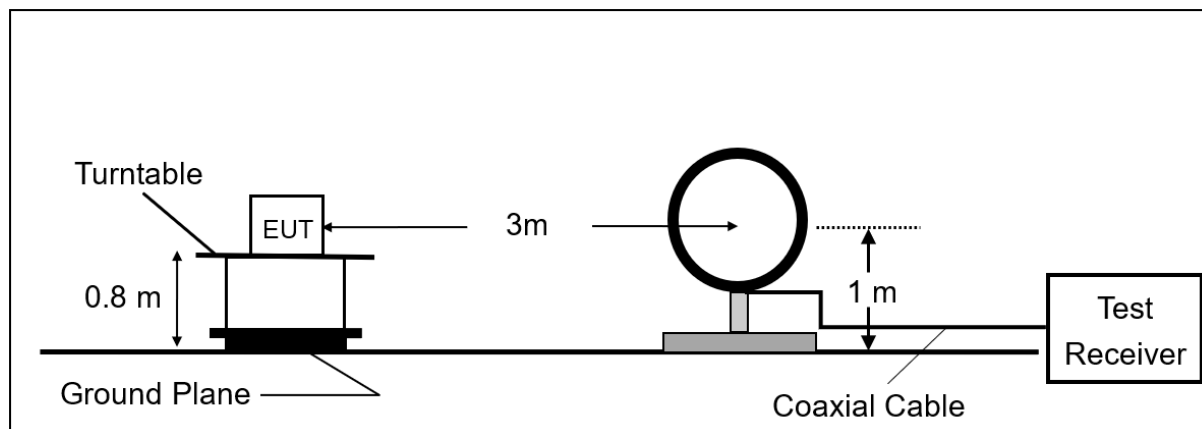
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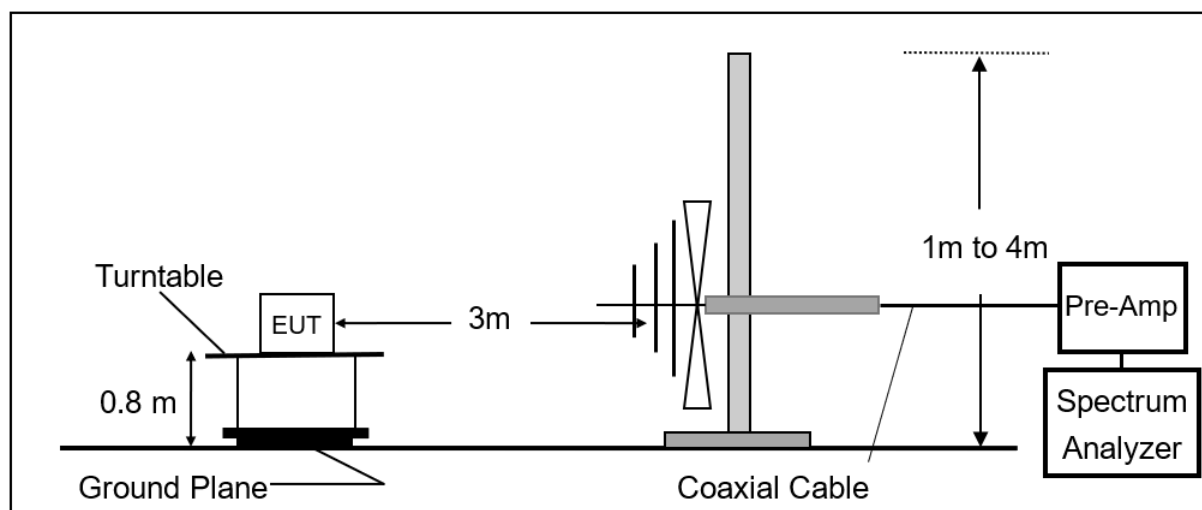
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10.4 輻射之測試配置

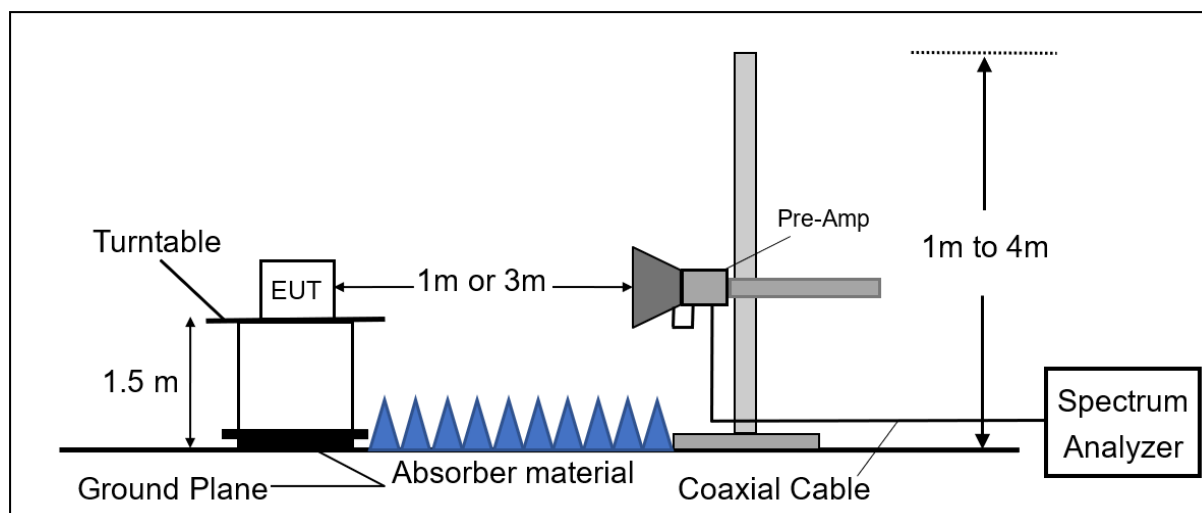
(A) 量測頻率低於 30MHz 以下之測試配置



(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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10.5 場強輻射之量測結果

10.5.1 禁用頻帶輻射量測值

Mode: BLE 1M

Report Number :E2/2021/70082

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-07-23

Test Frequency :2402 MHz

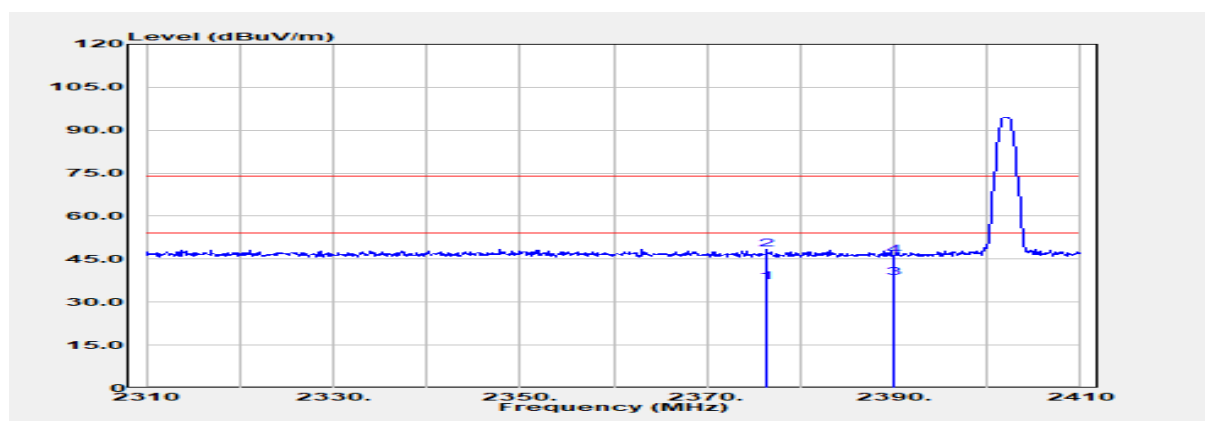
Temp./Humi. :19.8/71

Test Mode :BE CH LOW

Antenna Pol. :Vertical

EUT Pol :H Plane

Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2376.400	Average	40.60	-3.73	36.86	54.00	-17.14
2376.400	Peak	52.20	-3.73	48.47	74.00	-25.53
2390.000	Average	42.30	-3.80	38.50	54.00	-15.50
2390.000	Peak	50.03	-3.80	46.23	74.00	-27.77

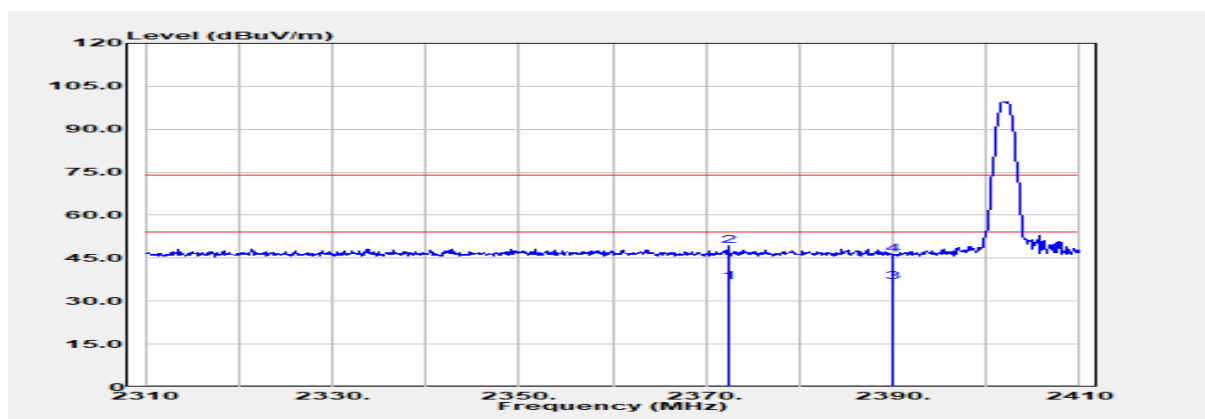
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2402 MHz
Test Mode :BE CH LOW
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-23
Temp./Humi. :19.8/71
Antenna Pol. :Horizontal
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2372.400	Average	40.39	-3.70	36.69	54.00	-17.31
2372.400	Peak	52.88	-3.70	49.18	74.00	-24.82
2390.000	Average	40.57	-3.80	36.77	54.00	-17.23
2390.000	Peak	50.11	-3.80	46.31	74.00	-27.69

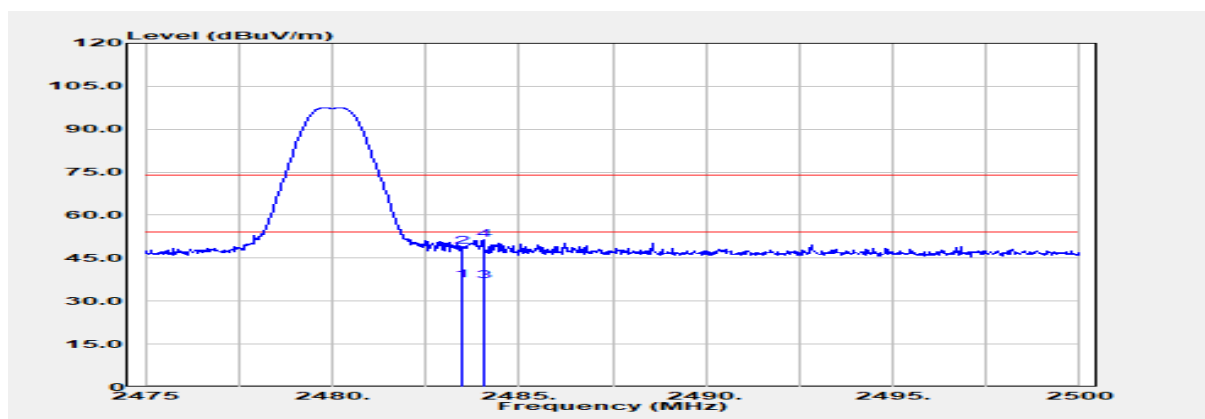
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :BE CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-23
Temp./Humi. :19.8/71
Antenna Pol. :Vertical
Engineer :Jack Tseng



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	41.35	-3.92	37.43	54.00	-16.57
2483.500	Peak	52.97	-3.92	49.05	74.00	-24.95
2484.050	Average	41.04	-3.92	37.13	54.00	-16.87
2484.050	Peak	55.35	-3.92	51.44	74.00	-22.56

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Report Number :E2/2021/70082

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-07-23

Test Frequency :2480 MHz

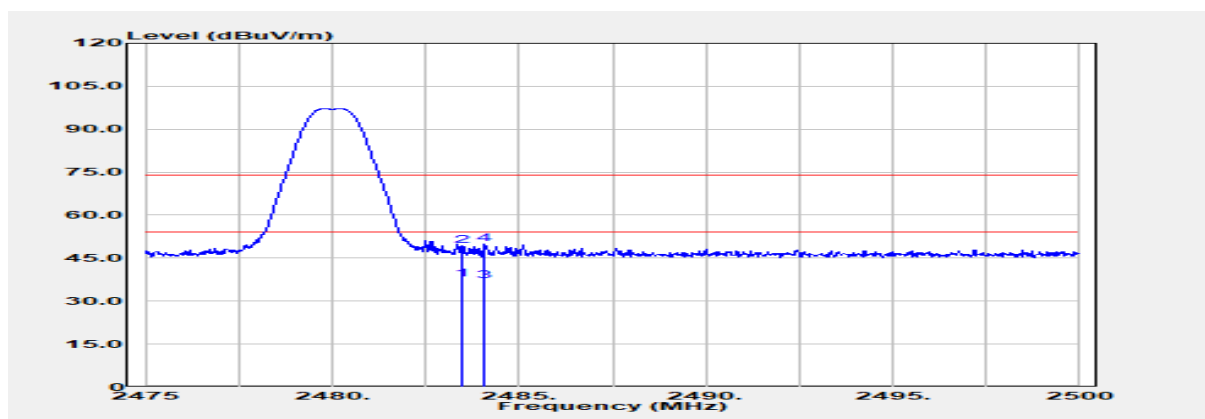
Temp./Humi. :19.8/71

Test Mode :BE CH HIGH

Antenna Pol. :Horizontal

EUT Pol :H Plane

Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2483.500	Average	41.39	-3.92	37.47	54.00	-16.53
2483.500	Peak	53.14	-3.92	49.22	74.00	-24.78
2484.075	Average	40.97	-3.92	37.06	54.00	-16.94
2484.075	Peak	53.88	-3.92	49.96	74.00	-24.04

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10.5.2 發射機場強輻射之量測結果(1GHz 以下)

Mode: BLE 1M

Report Number :E2/2021/70082

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-07-26

Test Frequency :2442 MHz

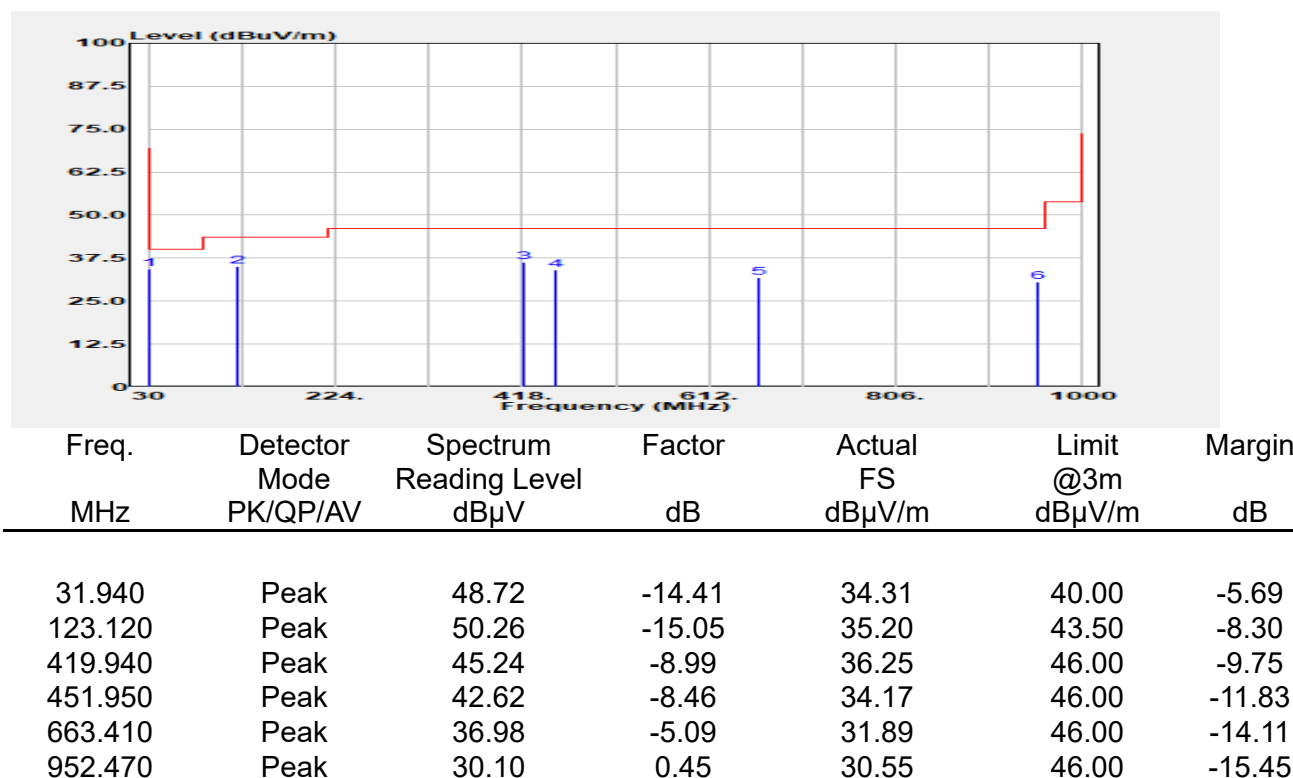
Temp./Humi. :19.3/70

Test Mode :TX CH MID

Antenna Pol. :Vertical

EUT Pol :H Plane

Engineer :Jack Tseng



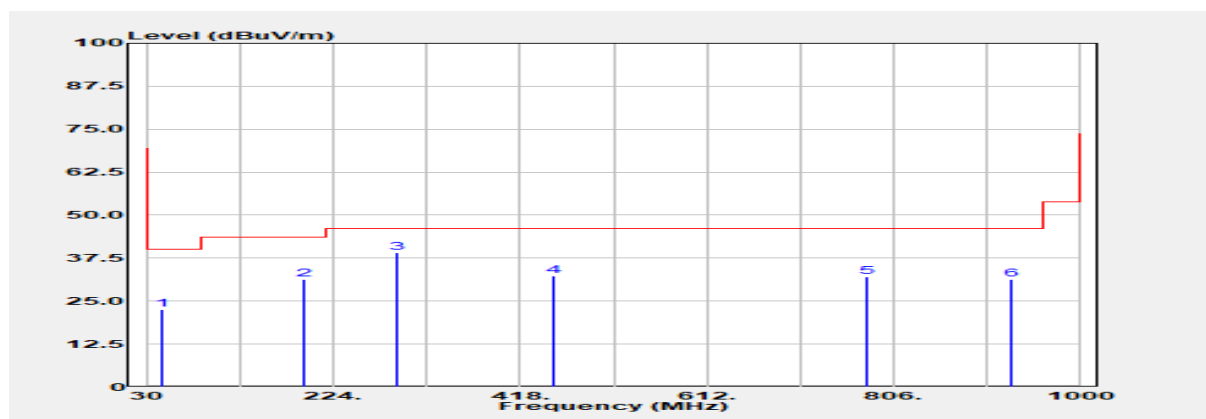
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Report Number :E2/2021/70082
 Operation Mode :BLE 1M
 Test Frequency :2442 MHz
 Test Mode :TX CH MID
 EUT Pol :H Plane

Test Site :SAC G
 Test Date :2021-07-26
 Temp./Humi. :19.3/70
 Antenna Pol. :Horizontal
 Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
46.490	Peak	35.41	-12.93	22.48	40.00	-17.52
193.930	Peak	47.46	-16.09	31.37	43.50	-12.13
290.930	Peak	51.73	-12.65	39.08	46.00	-6.92
451.950	Peak	40.74	-8.46	32.28	46.00	-13.72
777.870	Peak	34.61	-2.52	32.09	46.00	-13.91
929.190	Peak	31.78	-0.35	31.43	46.00	-14.57

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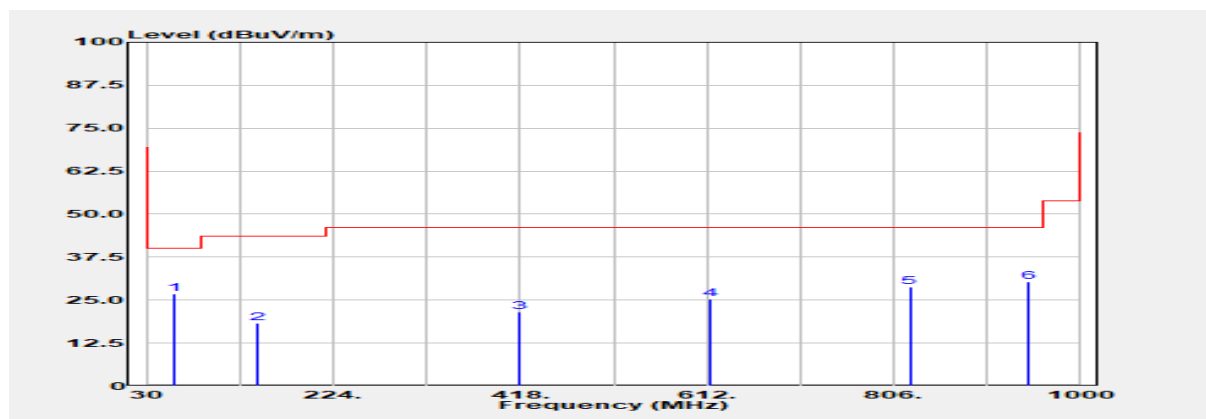
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10.5.3 Fully System

Report Number :E2/2021/70079
Operation Mode :System
Test Frequency :System
Test Mode :System
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-26
Temp./Humi. :19.3/70
Antenna Pol. :Vertical
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
59.100	Peak	40.51	-13.61	26.90	40.00	-13.10
144.460	Peak	31.31	-13.07	18.24	43.50	-25.26
416.060	Peak	31.07	-9.44	21.63	46.00	-24.37
615.880	Peak	31.35	-6.00	25.35	46.00	-20.65
822.490	Peak	30.71	-1.96	28.75	46.00	-17.25
946.650	Peak	30.05	0.18	30.22	46.00	-15.78

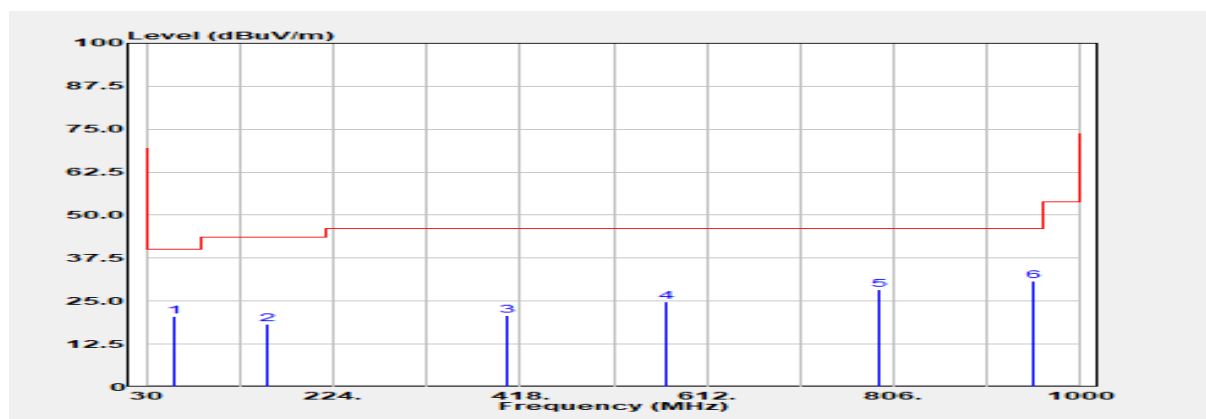
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Report Number :E2/2021/70079
Operation Mode :System
Test Frequency :System
Test Mode :System
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-26
Temp./Humi. :19.3/70
Antenna Pol. :Horizontal
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
58.130	Peak	33.96	-13.44	20.52	40.00	-19.48
156.100	Peak	31.30	-13.08	18.22	43.50	-25.28
405.390	Peak	30.58	-9.74	20.84	46.00	-25.16
570.290	Peak	30.54	-5.76	24.78	46.00	-21.22
790.480	Peak	30.61	-2.28	28.33	46.00	-17.67
950.530	Peak	30.66	0.29	30.95	46.00	-15.05

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10.5.5 發射機場強輻射之量測結果(1GHz 以上)

Mode: BLE 1M

Report Number :E2/2021/70082

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-07-23

Test Frequency :2402 MHz

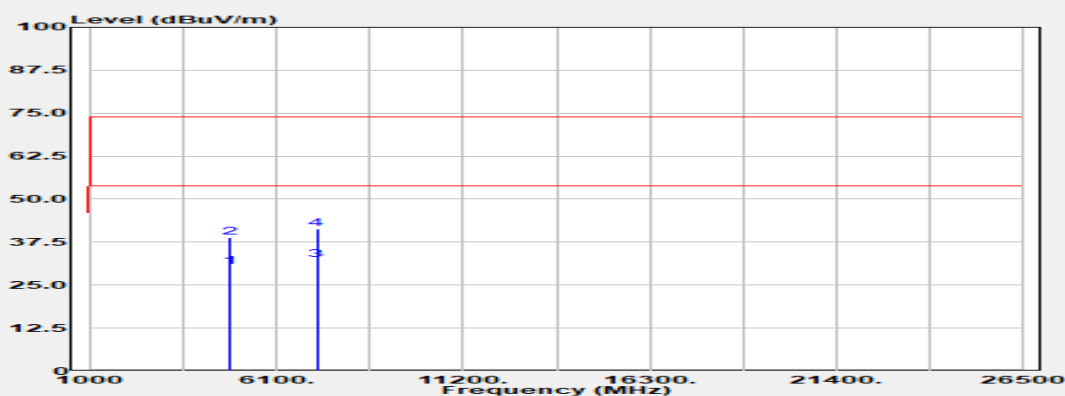
Temp./Humi. :19.8/71

Test Mode :TX CH LOW

Antenna Pol. :Vertical

EUT Pol :H Plane

Engineer :Jack Tseng



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	27.26	3.14	30.40	54.00	-23.60
4804.000	Peak	35.83	3.14	38.97	74.00	-35.03
7206.000	Average	25.23	7.22	32.45	54.00	-21.55
7206.000	Peak	34.21	7.22	41.43	74.00	-32.57

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Report Number :E2/2021/70082

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-07-23

Test Frequency :2402 MHz

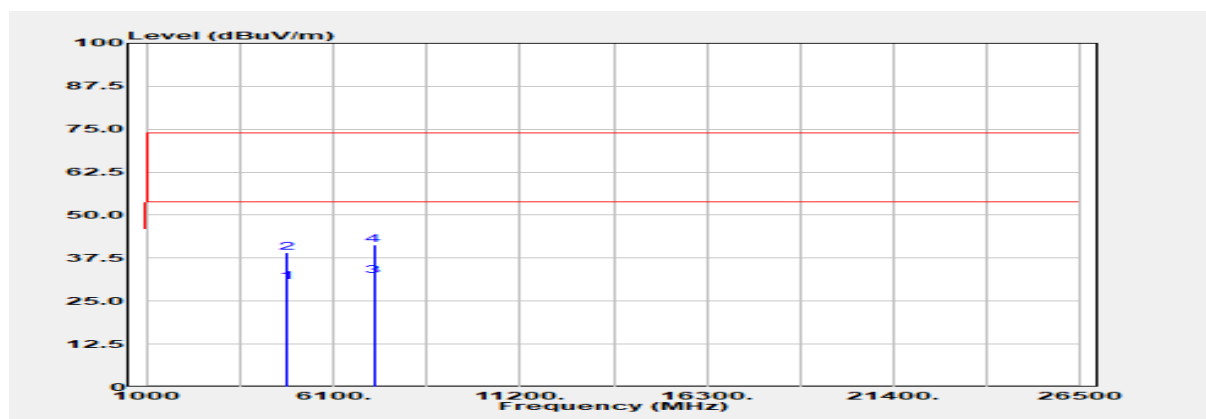
Temp./Humi. :19.8/71

Test Mode :TX CH LOW

Antenna Pol. :Horizontal

EUT Pol :H Plane

Engineer :Jack Tseng



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	27.53	3.14	30.66	54.00	-23.34
4804.000	Peak	35.87	3.14	39.01	74.00	-34.99
7206.000	Average	25.10	7.22	32.32	54.00	-21.68
7206.000	Peak	34.14	7.22	41.36	74.00	-32.64

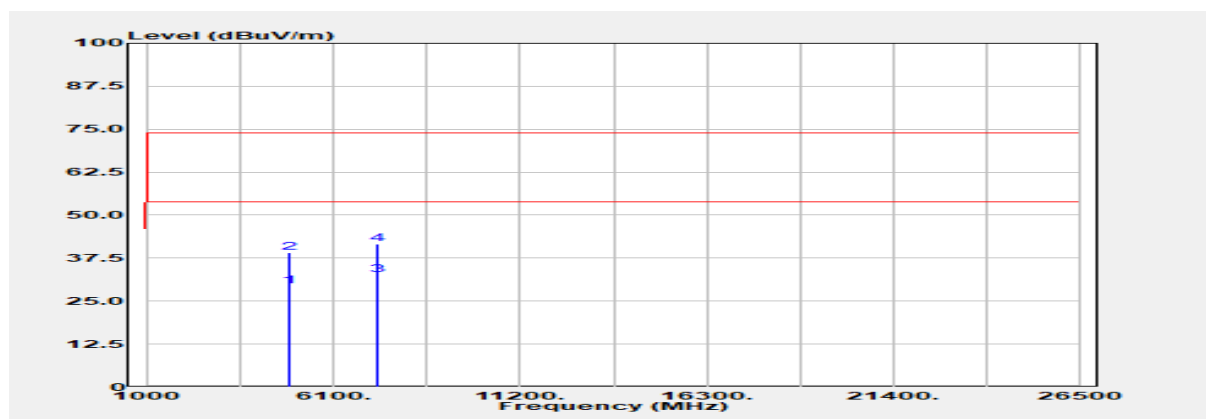
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-23
Temp./Humi. :19.8/71
Antenna Pol. :Vertical
Engineer :Jack Tseng



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	26.05	3.30	29.35	54.00	-24.65
4884.000	Peak	35.90	3.30	39.20	74.00	-34.80
7326.000	Average	24.80	7.68	32.48	54.00	-21.52
7326.000	Peak	33.97	7.68	41.65	74.00	-32.35

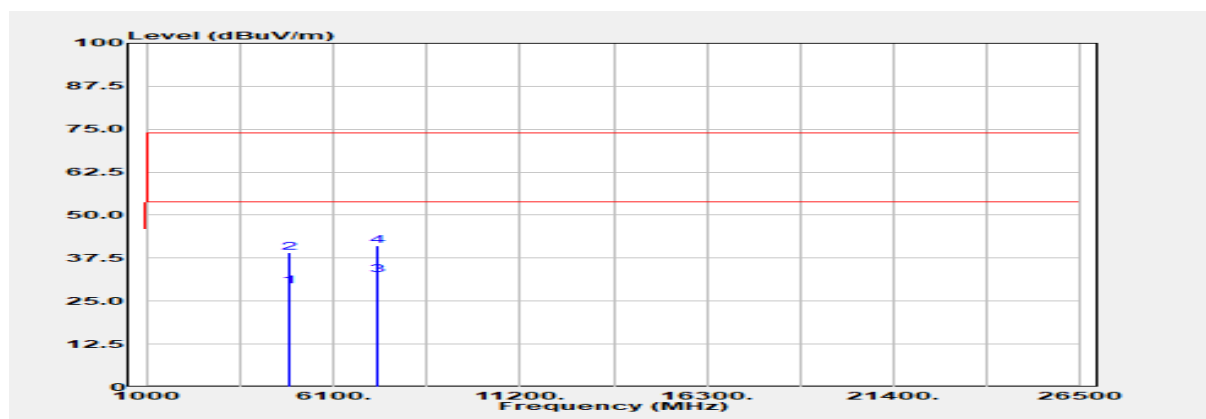
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-23
Temp./Humi. :19.8/71
Antenna Pol. :Horizontal
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4884.000	Average	25.99	3.30	29.29	54.00	-24.71
4884.000	Peak	35.80	3.30	39.10	74.00	-34.90
7326.000	Average	24.92	7.68	32.59	54.00	-21.41
7326.000	Peak	33.38	7.68	41.06	74.00	-32.94

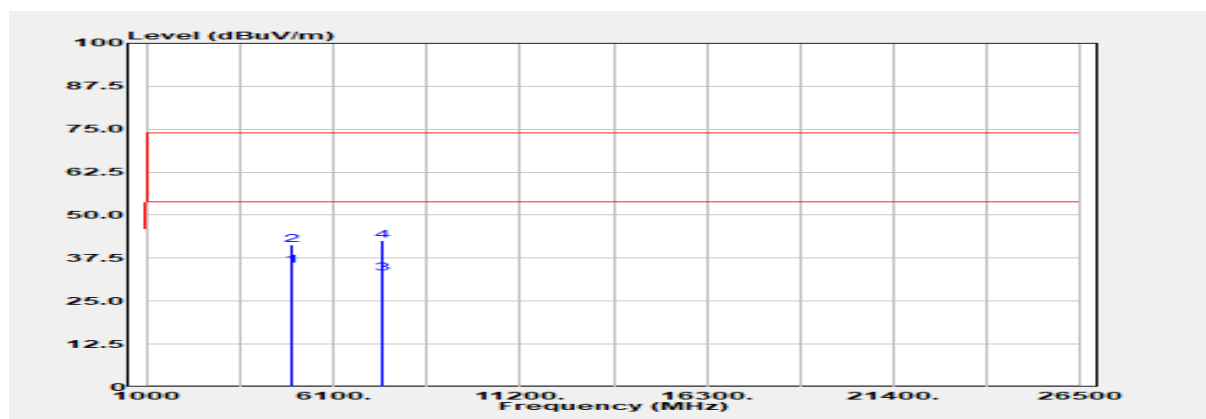
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :TX CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-23
Temp./Humi. :19.8/71
Antenna Pol. :Vertical
Engineer :Jack Tseng



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	31.99	3.42	35.41	54.00	-18.59
4960.000	Peak	37.85	3.42	41.27	74.00	-32.73
7440.000	Average	24.86	8.11	32.97	54.00	-21.03
7440.000	Peak	34.42	8.11	42.53	74.00	-31.47

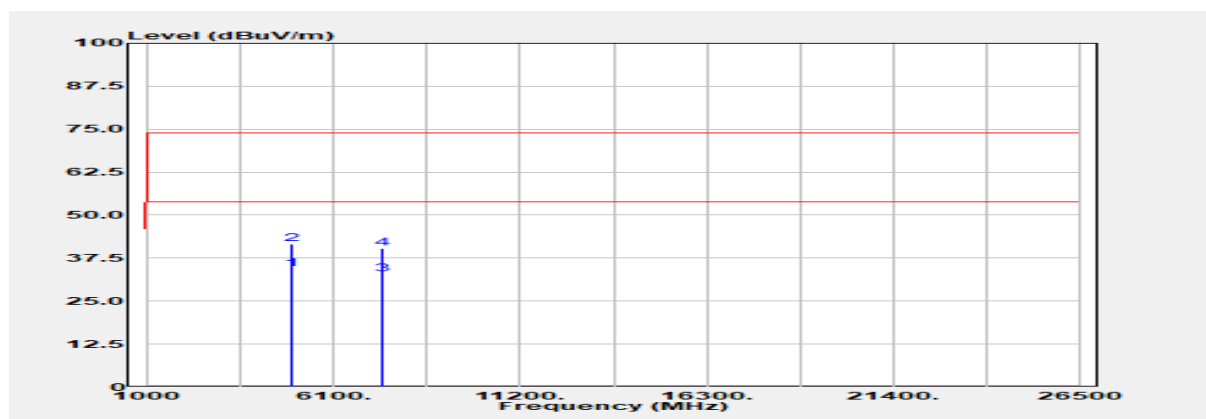
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :TX CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-23
Temp./Humi. :19.8/71
Antenna Pol. :Horizontal
Engineer :Jack Tseng



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	30.81	3.42	34.23	54.00	-19.77
4960.000	Peak	38.12	3.42	41.54	74.00	-32.46
7440.000	Average	24.82	8.11	32.93	54.00	-21.08
7440.000	Peak	32.32	8.11	40.43	74.00	-33.57

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10.5.6 接收機場強輻射之量測結果(1GHz 以下) (最差模式)

Mode: BLE 1M

Report Number :E2/2021/70082

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-07-26

Test Frequency :2442 MHz

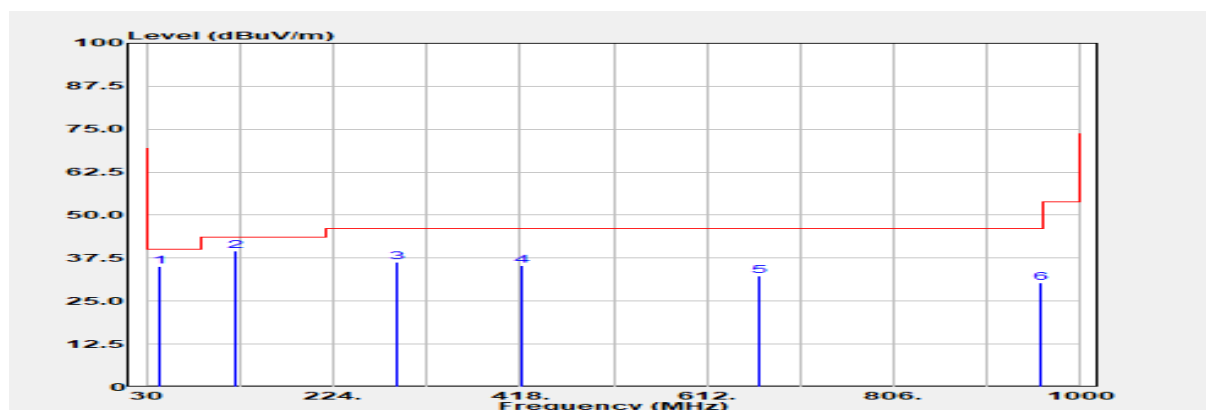
Temp./Humi. :19.3/70

Test Mode :RX CH MID

Antenna Pol. :Vertical

EUT Pol :H Plane

Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
44.550	Peak	48.26	-13.06	35.20	40.00	-4.80
122.150	Peak	54.56	-15.06	39.50	43.50	-4.00
289.960	Peak	49.07	-12.66	36.41	46.00	-9.59
418.970	Peak	44.39	-9.10	35.29	46.00	-10.71
666.320	Peak	37.08	-4.81	32.27	46.00	-13.73
957.320	Peak	29.89	0.55	30.44	46.00	-15.56

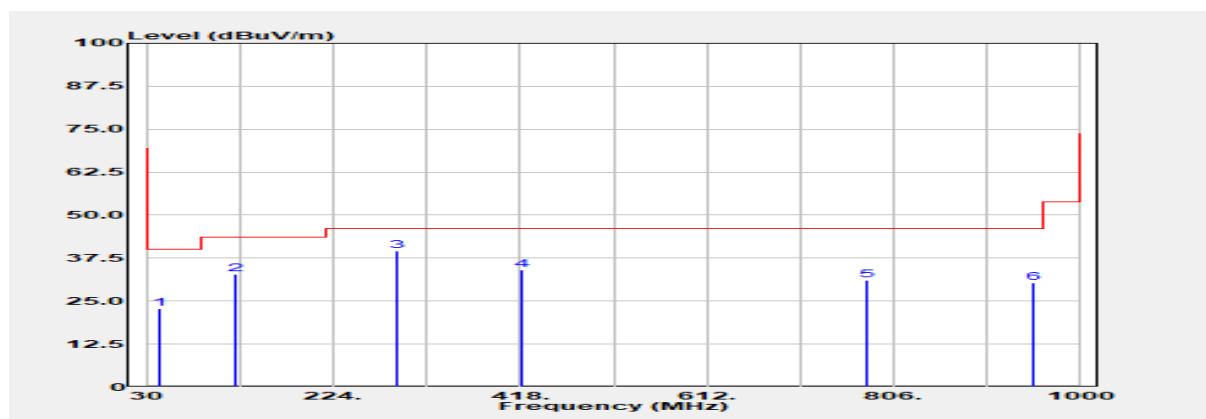
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Report Number :E2/2021/70082
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :RX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-26
Temp./Humi. :19.3/70
Antenna Pol. :Horizontal
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
44.550	Peak	35.80	-13.06	22.74	40.00	-17.26
122.150	Peak	47.84	-15.06	32.78	43.50	-10.72
289.960	Peak	52.20	-12.66	39.54	46.00	-6.46
418.970	Peak	43.24	-9.10	34.14	46.00	-11.86
777.870	Peak	33.65	-2.52	31.13	46.00	-14.87
951.500	Peak	30.00	0.37	30.37	46.00	-15.63

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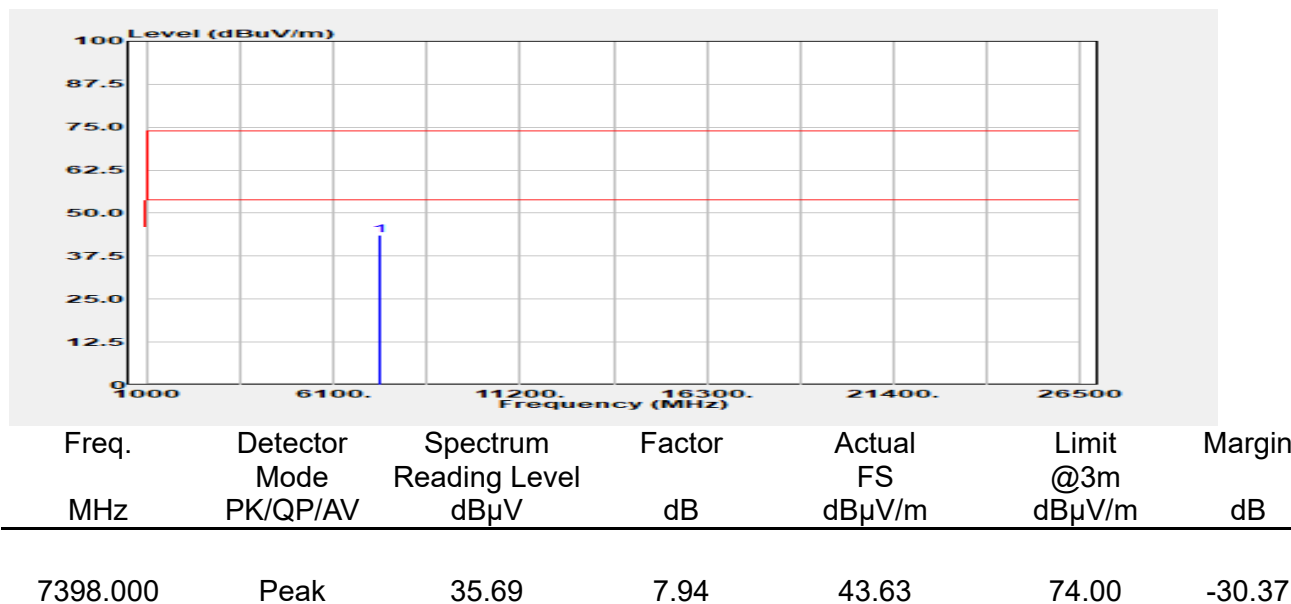
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10.5.7 接收模式場強輻射之量測結果(1GHz 以上) (最差模式)

Mode: BLE 1M

Report Number	:E2/2021/70080	Test Site	:SAC G
Operation Mode	:BLE 1M	Test Date	:2021-07-30
Test Frequency	:2442 MHz	Temp./Humi.	:19.8/71
Test Mode	:RX CH MID	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Jack Tseng



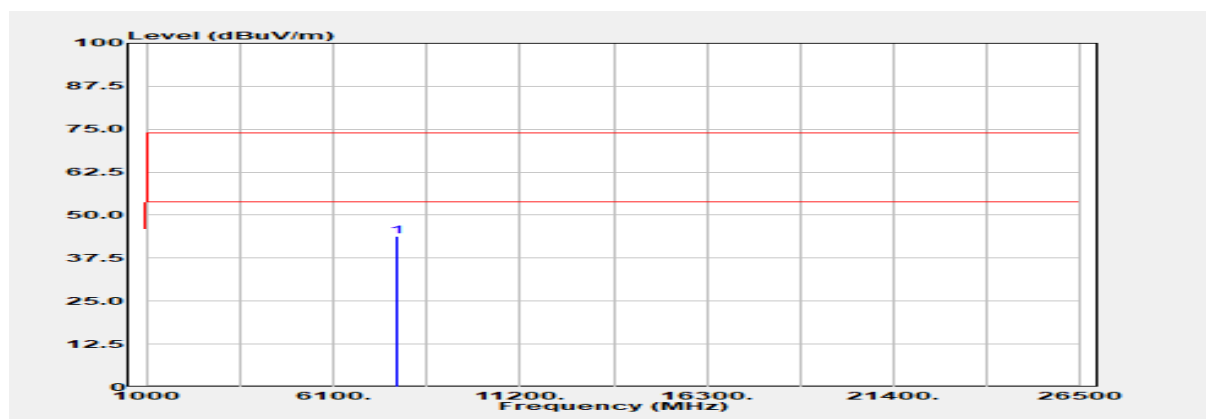
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Report Number :E2/2021/70080
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :RX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-07-30
Temp./Humi. :19.8/71
Antenna Pol. :Horizontal
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
7853.000	Peak	35.19	8.65	43.84	74.00	-30.16

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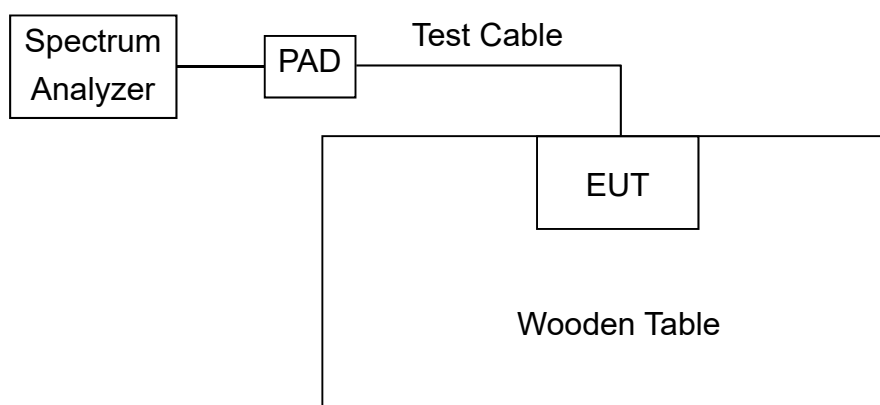
11 發射頻寬之要求

11.1 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。

11.2 測試配置

圖 4: 發射頻寬之測試配置



11.3 量測結果

BLE 1M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.7185	≥ 0.5	PASS
2442	0.7224	≥ 0.5	PASS
2480	0.7221	≥ 0.5	PASS

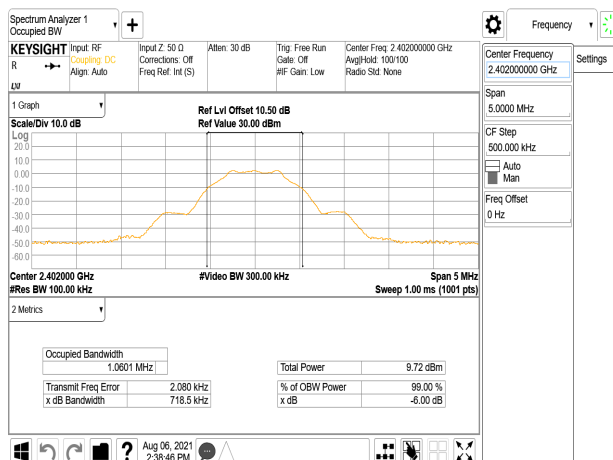
Refer next page for test plots

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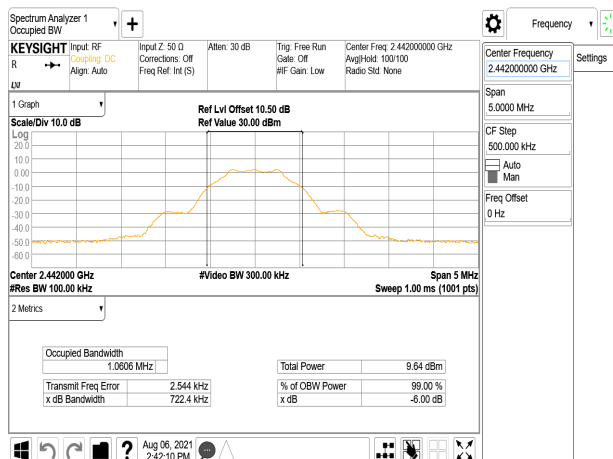
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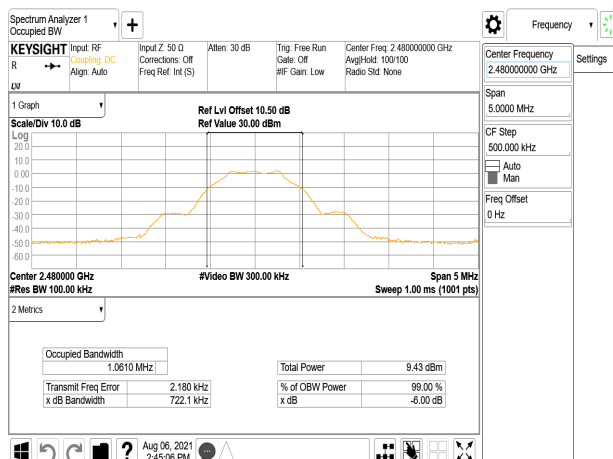
OBW_BLE 1M_LowCH00-2402MHz



OBW_BLE 1M_MidCH20-2442MHz



OBW_BLE 1M_HighCH39-2480MHz



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12 輸出峰值功率之量測

12.1 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。

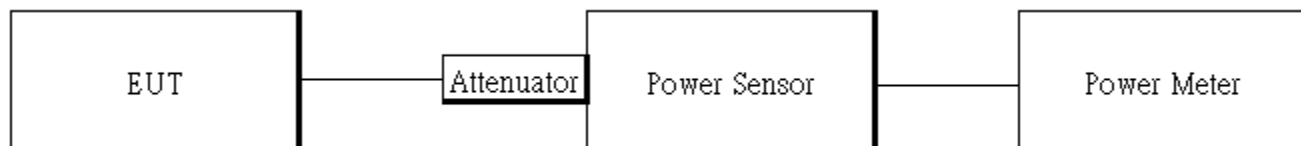
依據NCC低功率射頻器材技術規範4.10.1.3 (3)之規定，用於點對多點操作時，如其發射天線之方向性增益超過 6dBi，應依所超過之dB數等量降低最大傳導輸出功率。

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。

12.2 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)。

12.3 測試配置



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12.4 量測方式

12.4.1 載波頻率工作週期儀器設定

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

12.4.2 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。

12.5 量測結果

12.5.1 載波頻率工作週期

Duty Cycle

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

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

12.5.2 輸出功率

BLE 1M mode:

CH	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	46	3.44	30
Mid	2442	46	3.32	30
High	2480	46	3.23	30
CH	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit (dBm)
Low	2402	46	3.39	30
Mid	2442	46	3.27	30
High	2480	46	3.17	30

***Note: Measured by power meter, cable loss 10.5 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.**

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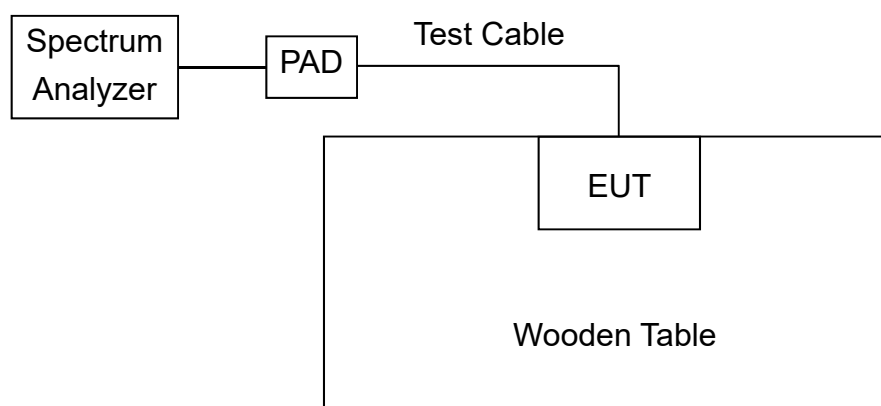
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13 帶外發射限制

13.1 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。

13.2 帶外發射測試配置



13.3 帶外發射量測結果

BLE 1M_Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	2.31	-17.69
2442	2.23	-17.77
2480	2.03	-17.97

NOTE: cable loss as 10.5dB that offsets in the spectrum

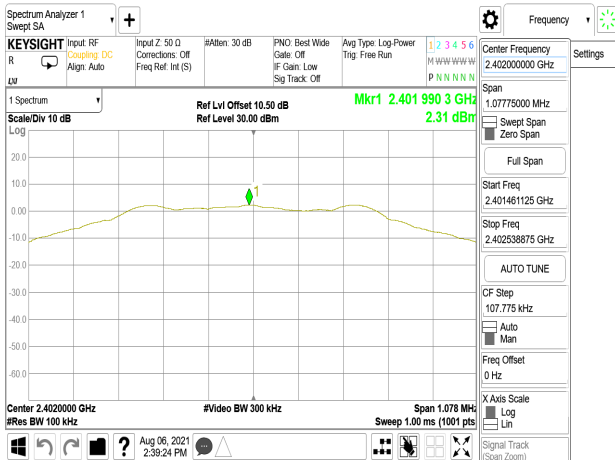
NOTE: Refer to next page for plots.

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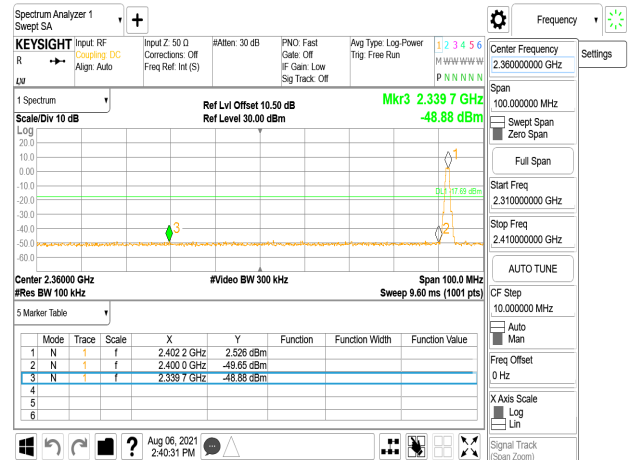
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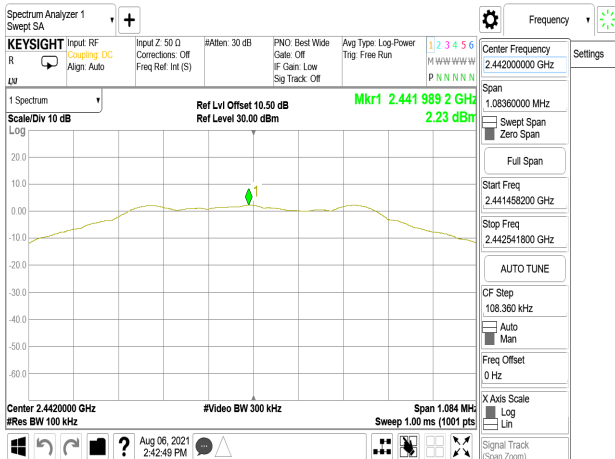
Reference Level_BLE 1M_LowCH00-2402MHz



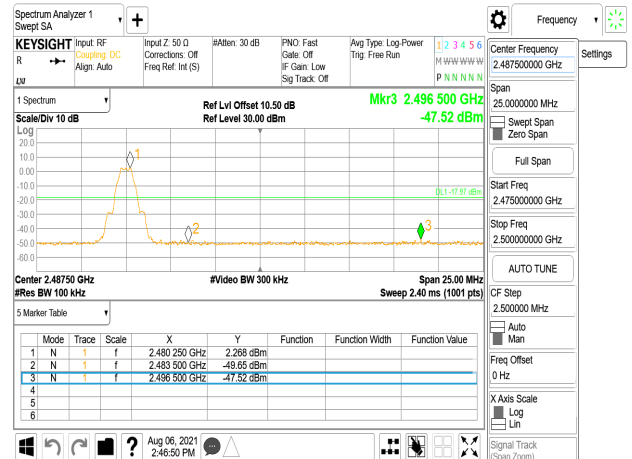
Band Edge_BLE 1M_LowCH00-2402MHz



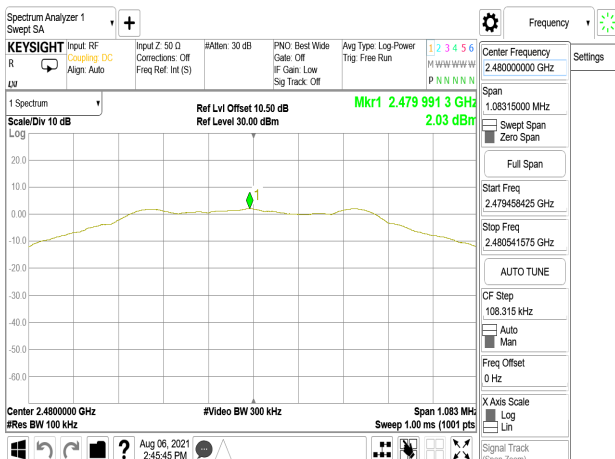
Reference Level_BLE 1M_MidCH20-2442MHz



Band Edge_BLE 1M_HighCH39-2480MHz



Reference Level_BLE 1M_HighCH39-2480MHz

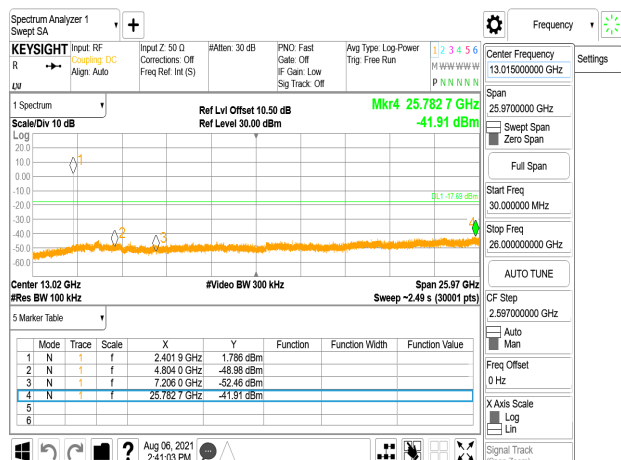


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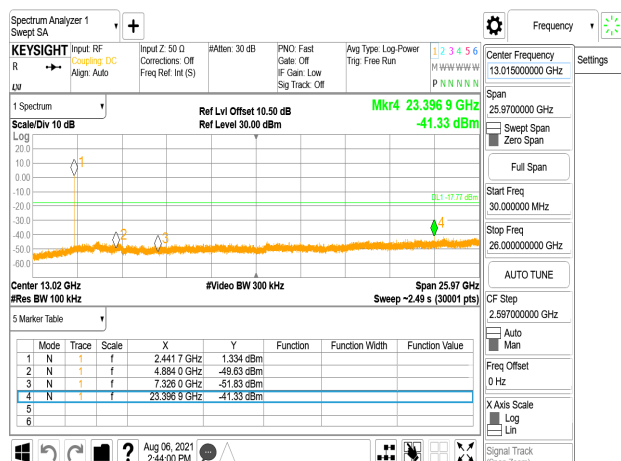
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Spurious Emission_BLE 1M_LowCH00-2402MHz



Spurious Emission_BLE 1M_MidCH20-2442MHz



Spurious Emission_BLE 1M_HighCH39-2480MHz



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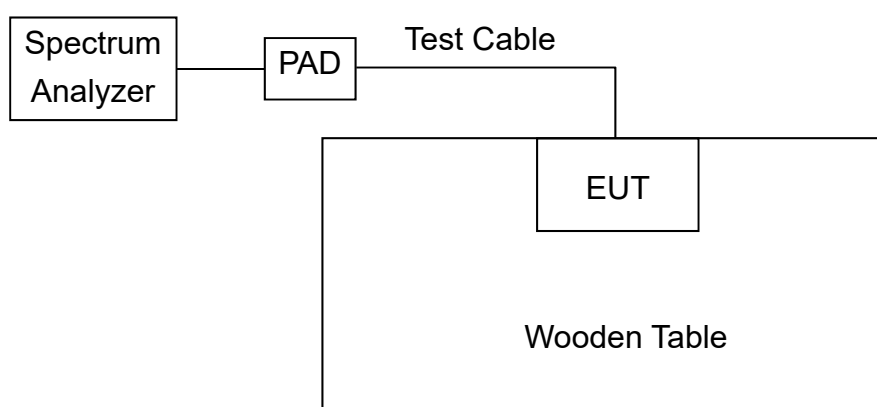
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14 功率密度之量測

14.1 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。

14.2 功率密度之測試配置



14.3 功率密度量測結果

BLE 1M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-12.110	8	PASS
2442	-12.190	8	PASS
2480	-12.370	8	PASS

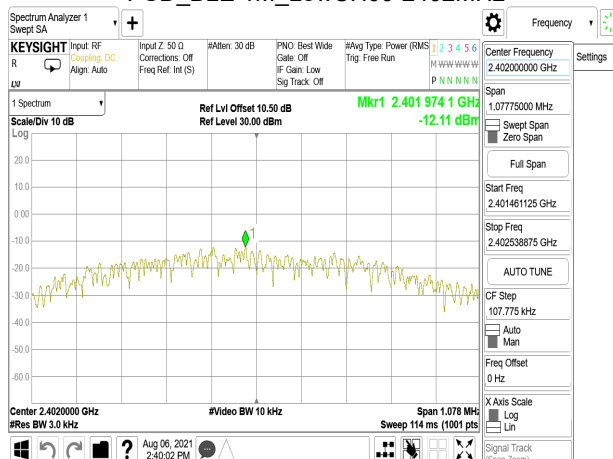
NOTE: cable loss as 10.5dB that offsets in the spectrum

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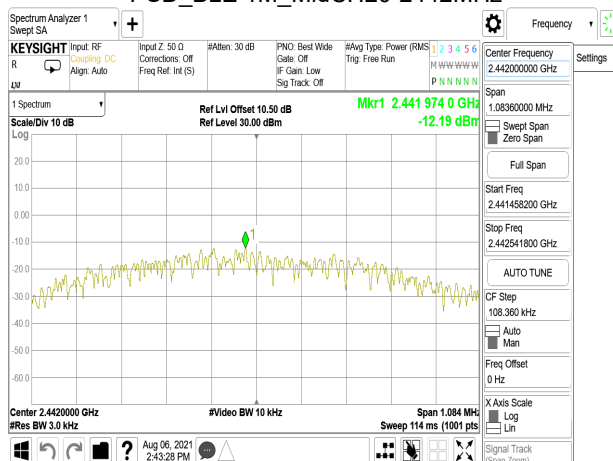
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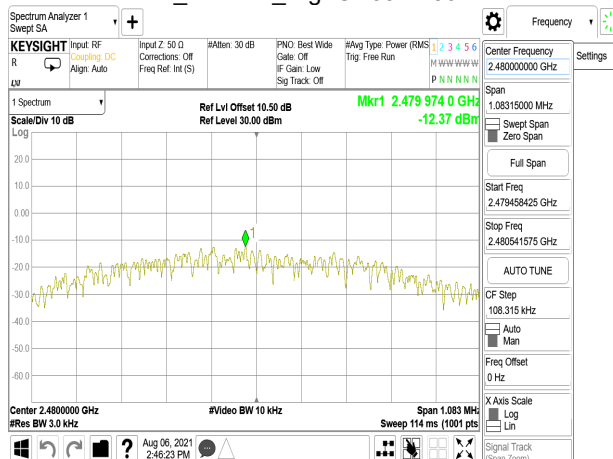
PSD_BLE 1M_LowCH00-2402MHz



PSD_BLE 1M_MidCH20-2442MHz



PSD_BLE 1M_HighCH39-2480MHz



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~ End of Report ~

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