

低功率射頻器材試驗報告



申請廠商 財欣國際股份有限公司
台北市內湖區瑞光路583巷26號7樓
製造廠商 杭州塗鴉信息技術有限公司
產品名稱 WiFi-Bluetooth Module
廠牌 Tuya
型號 WBR1
型號差異 N/A
報告號碼 E2/2021/80026
技術標準 LP0002, 4.10.1 節
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報告發行日期 民國110年10月28日

Approved By: _____

黃威豪

黃威豪

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。

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/80026	00	Original.	民國 110 年 10 月 28 日	郭玉婷

Note:

- 1、Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
- 2、測試報告 E2/2021/80025 之電源線傳導干擾測試數據，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： 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		
新北市新北產業園區五工路 134 號	SAC 1	SAC 3	Conduction 1
	Conducted 1	Conducted 2	Conducted 3
	Conducted 4	Conducted 5	Conducted 6
桃園市龜山區(華亞科技園區)科技一路 2 號	SAC C	SAC D	SAC G
	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。			

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2 實驗室量測不確定度

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。

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3 一般資料

3.1 產品描述

產品名稱	WiFi-Bluetooth Module
廠牌	Tuya
型號	WBR1
型號差異	N/A
使用電源	3.3Vdc

3.2 射頻特性

Radio Technology:	BLE
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	4.94 dBm

3.3 天線資訊

Antenna Type	Brand	Antenna Model No.	Freq. (MHz)	Peak Antenna Gain (dBi)
printed	Tuya	WBR1	2402-2480	2.54

Note:

1. Antenna information is provided by the applicant.

3.4 配件資訊

是否附賣		配件	廠牌	型號	Power Rating (Vdc)
Yes	No				
☐	☒	Test Kit	Tuya	WBR1	N/A

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4 測試方法依據

本測試報告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 有關檢驗規定及參考 ANSI C63.10:2013、FCC CFR 47 15.247 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

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5 測試模式

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
Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case E2 position was reported.				

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

禁用頻帶限制規定

依據NCC低功率射頻器材技術規範3.5節要求，任何低功率射頻器材主波皆不得使用下表所列各頻帶內頻率；低功率射頻器材落於下表所列頻帶內混附發射，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對應收、發信機送審資料；送信機輻射電場強度不得超過第3.6節發射規定，且不得接收、解調第3.5節所列頻率。

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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) Emission



7.2 測試週邊

編號	產品別	商標	版本	型號	序號
1.	定頻工程軟體	Realted	1V0	AmbevaZ2 Mptool	N/A
2.	Notebook	Lenovo	N/A	T420	S0012599
3.	Notebook	Lenovo	N/A	T480	P0002027
4.	Test Kit	Tuya	N/A	WBR1	N/A

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8 電源線傳導干擾量測

8.1 適用標準

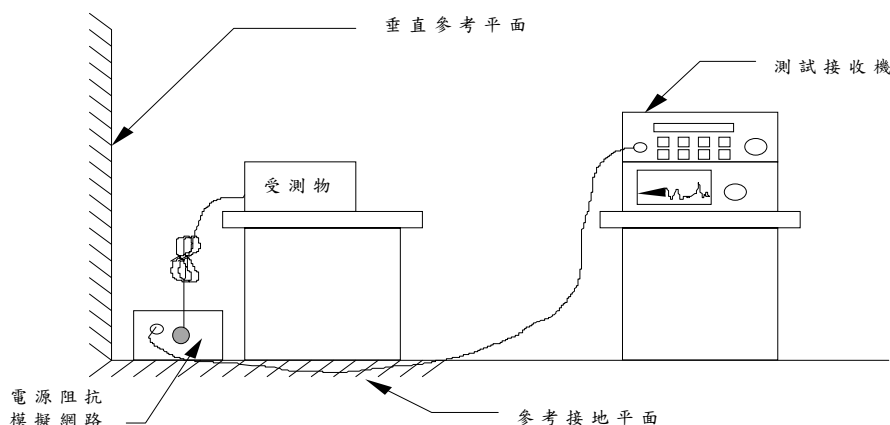
依據NCC低功率射頻器材技術規範3.3節，以市電為電源低功率射頻器材，其傳導回電源線上頻率自150 kHz~30 百萬赫(MHz) 射頻電壓(在電源端子每一電源線對接地點)應小於或等於下表所列限制值。測量時應經過50 微亨利(uH)及50 歐姆(Ω)電源線阻抗穩定網路。頻率重疊處，以較低限制值為準。

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

8.2 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。

8.3 測試配置



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8.4 量測儀器

Radiated Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	20923 sgs Ver.9	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
Test Kit	Tuya	WBR1	N/A	N.C.R	N.C.R
USB Cable	Bravo-u	AM-AF 1.8M	N/A	N.C.R	N.C.R
Notebook	Lenovo	T480	P0002027	N/A	N/A

8.5 干擾值計算

電源傳導干擾電壓計算公式 =

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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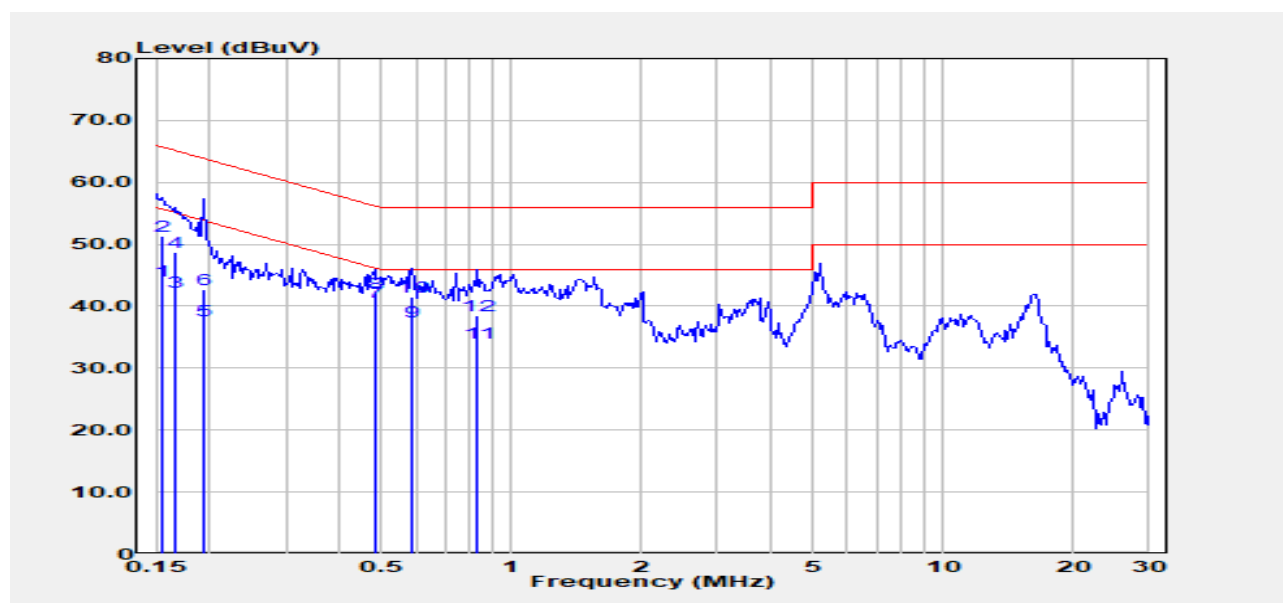
SGS Taiwan Ltd.
台灣檢驗科技股份有限公司

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8.6 傳導干擾量測結果:

Report Number	:E2/2021/80025	Test Site	:Conduction C
Test Mode	:System	Test Date	:2021-09-02
Power	:110V/60Hz	Temp./Humi.	:23.8/63
Probe	:L1	Engineer	:Jack Tseng



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
0.155	Average	33.90	10.30	44.20	55.74	-11.54
0.155	QP	41.10	10.30	51.40	65.74	-14.34
0.167	Average	32.10	10.30	42.40	55.12	-12.72
0.167	QP	38.40	10.30	48.70	65.12	-16.42
0.193	Average	27.40	10.30	37.70	53.89	-16.19
0.193	QP	32.50	10.30	42.80	63.89	-21.09
0.481	Average	30.30	10.31	40.61	46.32	-5.71
0.481	QP	31.70	10.31	42.01	56.32	-14.31
0.589	Average	27.10	10.32	37.42	46.00	-8.58
0.589	QP	31.10	10.32	41.42	56.00	-14.58
0.835	Average	23.70	10.33	34.03	46.00	-11.97
0.835	QP	28.20	10.33	38.53	56.00	-17.47

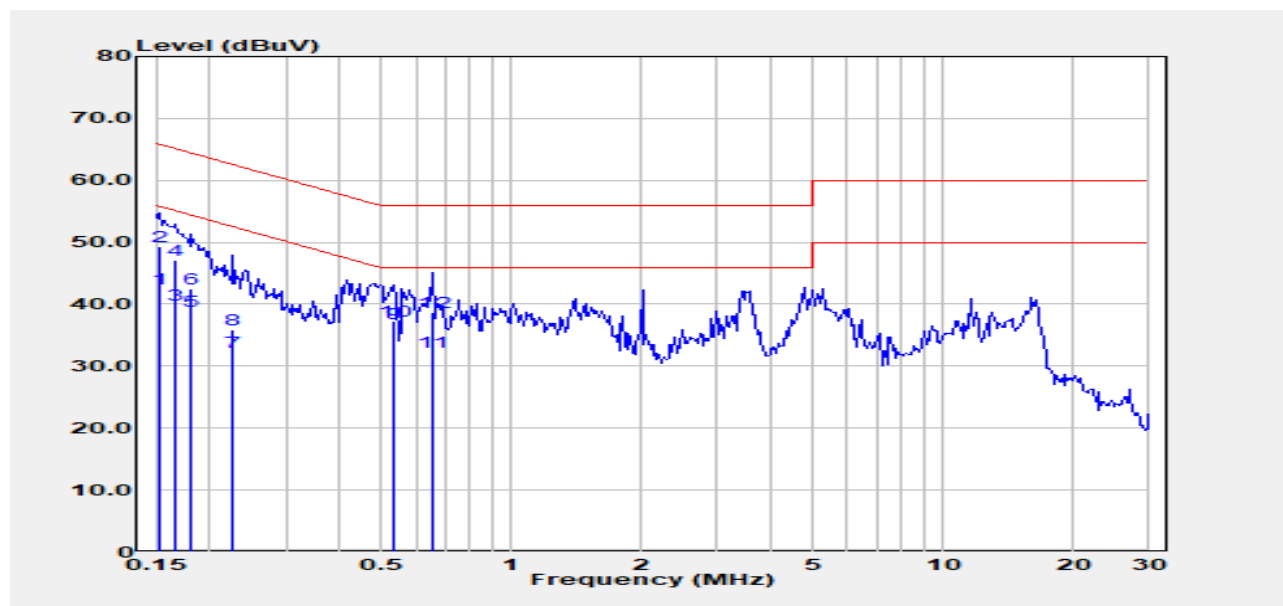
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Report Number :E2/2021/80025
Test Mode :System
Power : 110V/60Hz
Probe :N

Test Site :Conduction C
Test Date :2021-09-02
Temp./Humi. :23.8/63
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Average	32.10	10.31	42.41	55.82	-13.41
0.153	QP	39.10	10.31	49.41	65.82	-16.41
0.167	Average	29.60	10.31	39.91	55.12	-15.21
0.167	QP	36.90	10.31	47.21	65.12	-17.91
0.182	Average	28.50	10.30	38.80	54.42	-15.61
0.182	QP	32.20	10.30	42.50	64.42	-21.91
0.227	Average	22.00	10.30	32.30	52.57	-20.26
0.227	QP	25.50	10.30	35.80	62.57	-26.76
0.535	Average	26.50	10.33	36.83	46.00	-9.17
0.535	QP	27.00	10.33	37.33	56.00	-18.67
0.654	Average	22.00	10.33	32.33	46.00	-13.67
0.654	QP	28.40	10.33	38.73	56.00	-17.27

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9 輸出峰值功率量測

9.1 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。

9.2 載波頻率工作週期量測

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)。

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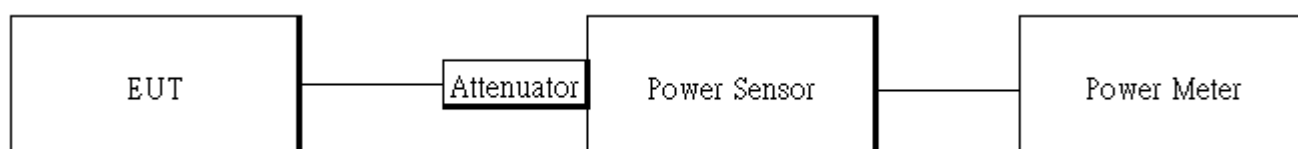
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9.3 量測儀器

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
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
Attenuator	Marvelous	WATT-218FS-10	RF15	11/19/2020	11/18/2021

9.4 測試配置



9.5 量測方式

9.5.1 載波頻率工作週期儀器設定

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

9.5.2 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。

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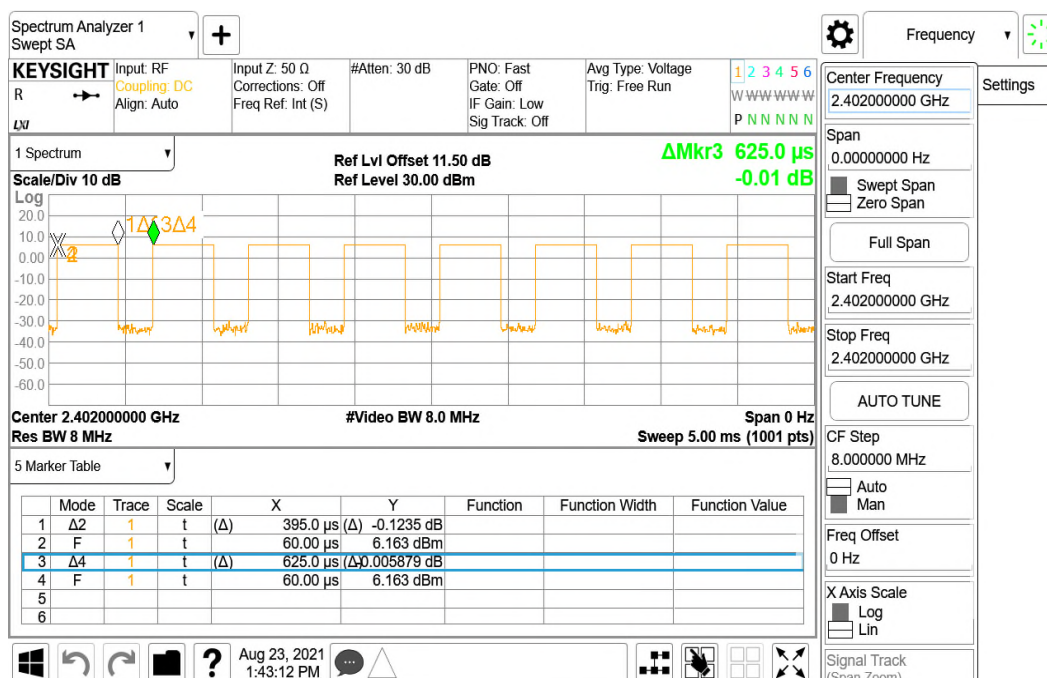
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9.6 量測結果

9.6.1 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 1M	63.00	2.01	2.53	3.00

BLE_1M_LowCH00-2402



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9.6.2 輸出功率

BLE 1M mode:

CH	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	0x27	4.94	30
Mid	2442	0x27	4.85	30
High	2480	0x27	4.74	30
CH	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit (dBm)
Low	2402	0x27	4.87	30
Mid	2442	0x27	4.78	30
High	2480	0x27	4.70	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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10 發射頻寬要求

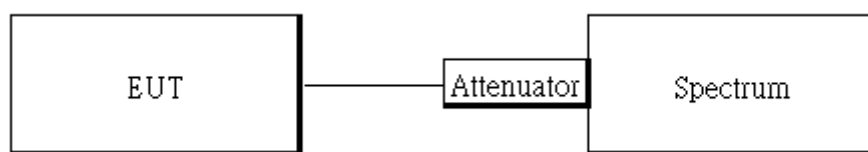
10.1 適用標準

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。

10.2 量測儀器

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/25/2021	06/25/2022
Attenuator	Marvelous	WATT-218FS-10	RF15	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF158	11/19/2020	11/18/2021
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Test Software	Realtek	AmebaZ2_mptool	1v0	N.C.R	N.C.R
Test Kit	Tuya	WBR1	N/A	N.C.R	N.C.R

10.3 測試配置



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10.4 測試方法

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set the spectrum analyzer as
RBW= 100 kHz ,
VBW = 3 X RBW,
Span= 2 to 5 times of the OBW,
Sweep=auto,
Detector = Peak, and Max hold for -6dB Bandwidth test.

10.5 量測結果

BLE 1M mode

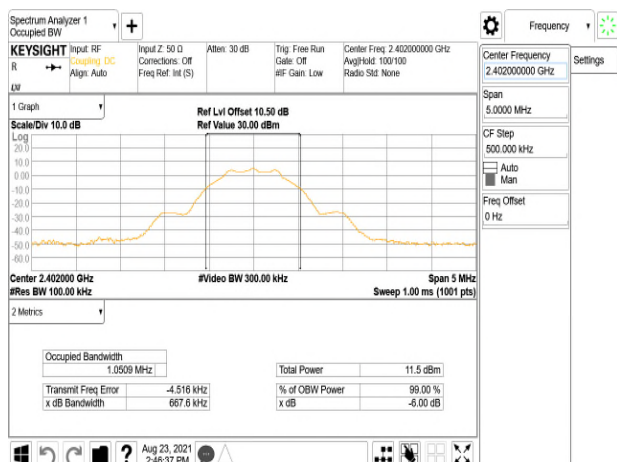
Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.6676	≥ 0.5	PASS
2442	0.6749	≥ 0.5	PASS
2480	0.6534	≥ 0.5	PASS

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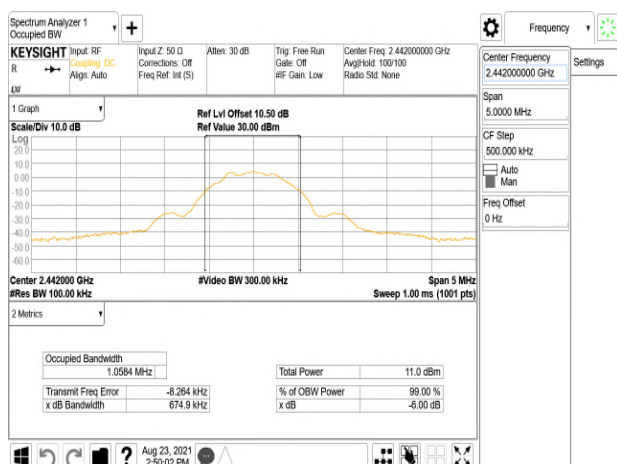
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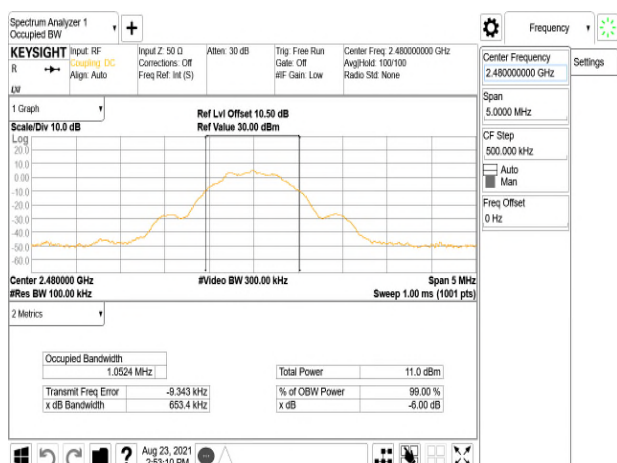
OBW_BLE 1M_LowCH00-2402MHz



OBW_BLE 1M_MidCH20-2442MHz



OBW_BLE 1M_HighCH39-2480MHz



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11 帶外發射限制

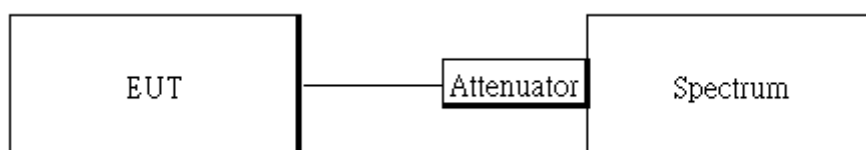
11.1 適用標準

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。

11.2 量測儀器

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/25/2021	06/25/2022
Attenuator	Marvelous	WATT-218FS-10	RF15	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF158	11/19/2020	11/18/2021
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Test Software	Realtek	AmebaZ2_mptool	1v0	N.C.R	N.C.R
Test Kit	Tuya	WBR1	N/A	N.C.R	N.C.R

11.3 帶外發射測試配置



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11.4 量測方法

11.4.1 Reference Level of Emission Limit:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

11.4.2 Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Set DL as the limit = reading on marker of reference level measurement – 20dBm
7. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
8. Repeat above procedures until all default test channel (low and high) was complete.

11.4.3 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set RBW = 100 kHz & VBW=300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

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11.5 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	4.72	-15.28
2442	4.15	-15.85
2480	4.27	-15.73

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

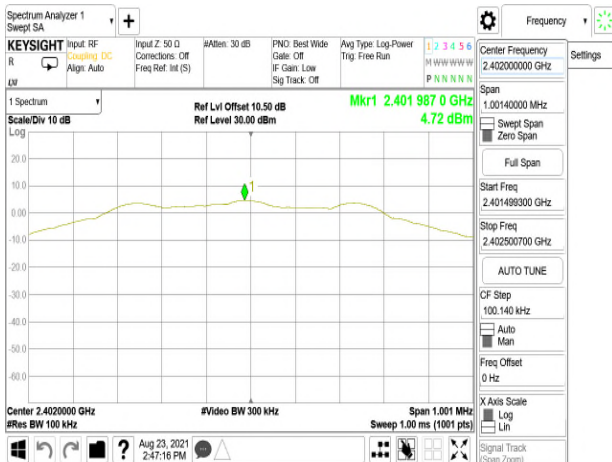
NOTE: Refer to next page for plots.

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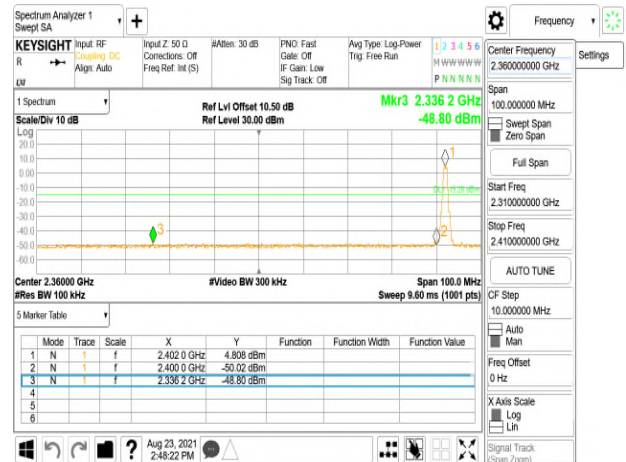
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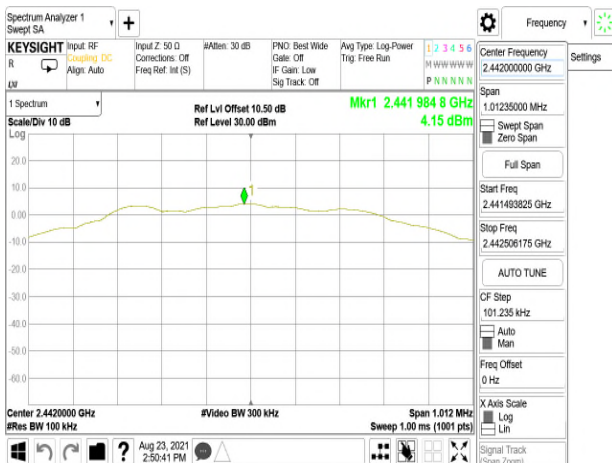
Reference Level_BLE 1M_LowCH00-2402MHz



Band Edge_BLE 1M_LowCH00-2402MHz



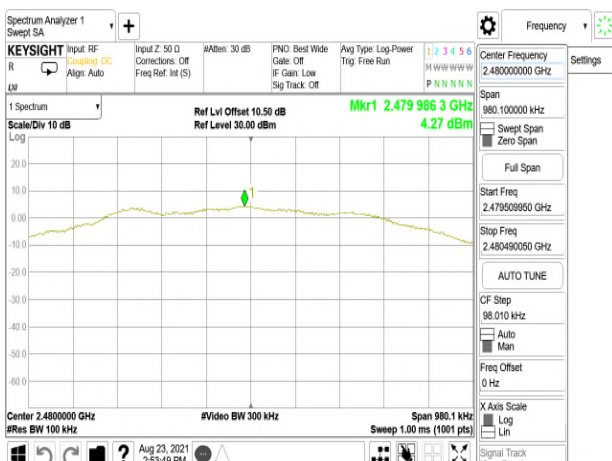
Reference Level_BLE 1M_MidCH20-2442MHz



Band Edge_BLE 1M_HighCH39-2480MHz



Reference Level_BLE 1M_HighCH39-2480MHz



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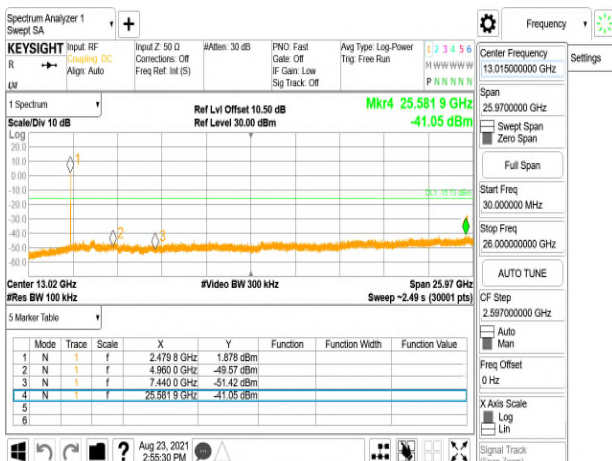
Spurious Emission_BLE 1M_LowCH00-2402MHz



Spurious Emission_BLE 1M_MidCH20-2442MHz



Spurious Emission_BLE 1M_HighCH39-2480MHz



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12 場強輻射量測

12.1 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

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12.2 量測儀器

Radiated Emission Test Site: SAC G					
EQUIPMENT TYPE	MFR	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	184	12/11/2020	12/10/2021
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	EMC118A45SE	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
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
Test Kit	Tuya	WBR1	N/A	N.C.R	N.C.R
USB Cable	Bravo-u	AM-AF 1.8M	N/A	N.C.R	N.C.R
Notebook	Lenovo	T480	P0002027	N/A	N/A

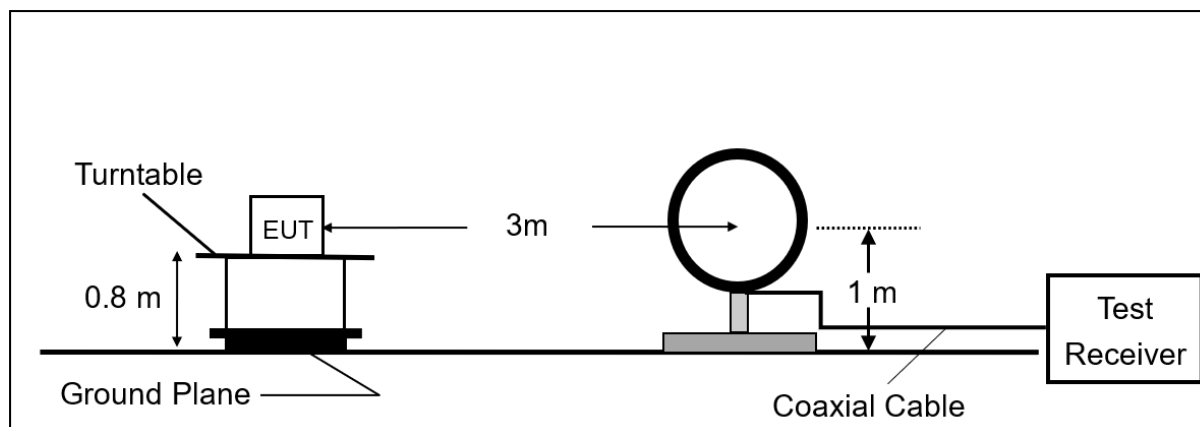
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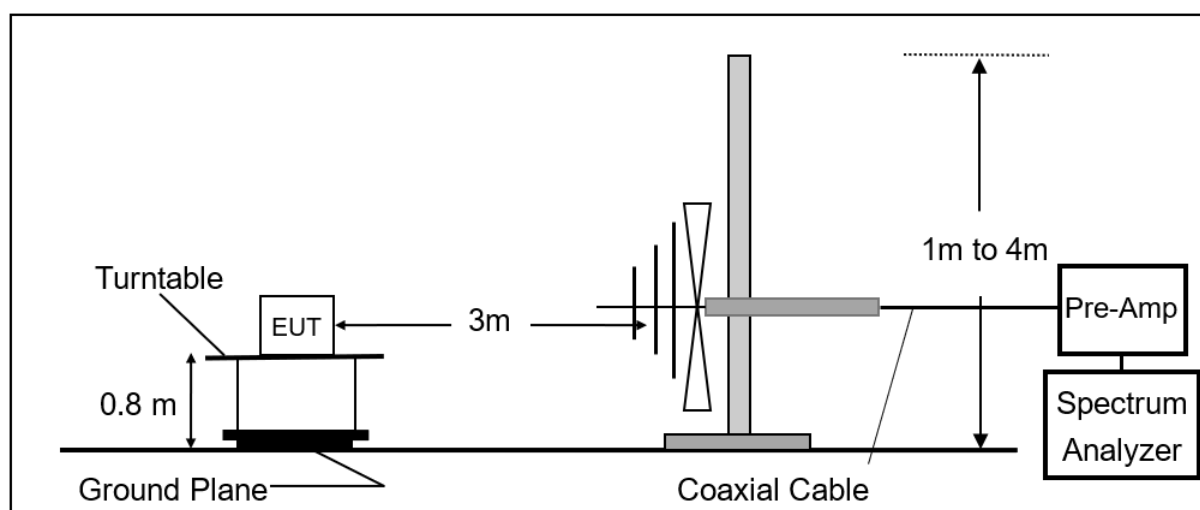
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12.3 輻射測試配置

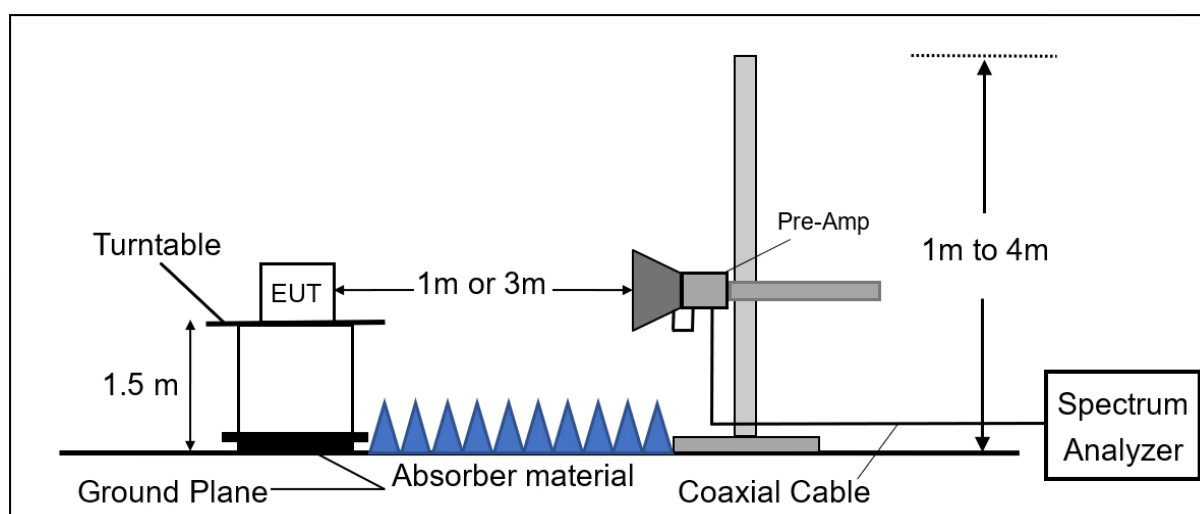
(A) 量測頻率低於 30MHz 以下測試配置



(B) 量測頻率 30MHz 至 1000MHz 測試配置



(C) 量測頻率 1000MHz 以上測試配置



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12.4 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
30MHz~1GHz	100kHz	300kHz	Peak
30MHz~1GHz	120kHz	360kHz	Quasi-Peak
1GHz以上 Maximum Emission Measurements	1MHz	3MHz	Peak
1GHz以上 Duty Cycle ≥ 98% Average Emission Measurements	1MHz	10Hz	Peak
1GHz以上 Duty Cycle < 98% Average Emission Measurements	1MHz	1/T	Peak

12.5 場強計算

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

註：

9 kHz ~ 30MHz 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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12.6 禁用頻帶邊緣量測

Report Number :E2/2021/80026

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-08-23

Test Frequency :2402 MHz

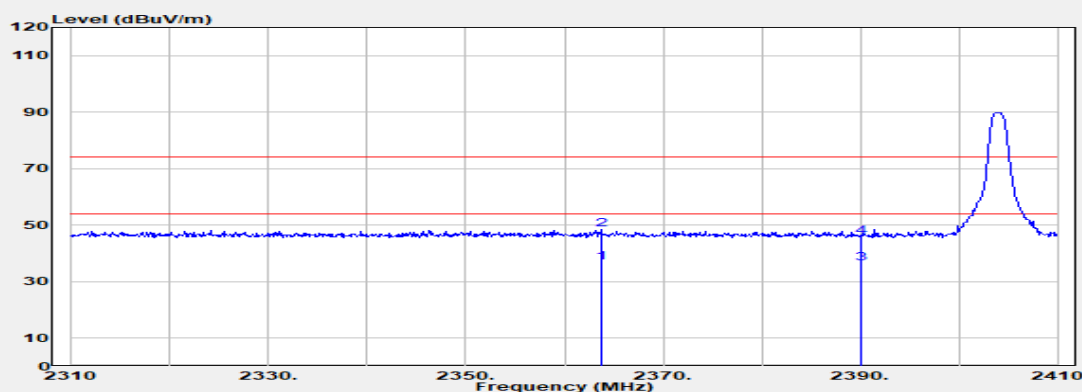
Temp./Humi. :24.5/59

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 dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2363.700	Average	40.36	-3.64	36.72	54.00	-17.28
2363.700	Peak	52.13	-3.64	48.50	74.00	-25.50
2390.000	Average	40.09	-3.80	36.28	54.00	-17.72
2390.000	Peak	49.71	-3.80	45.91	74.00	-28.09

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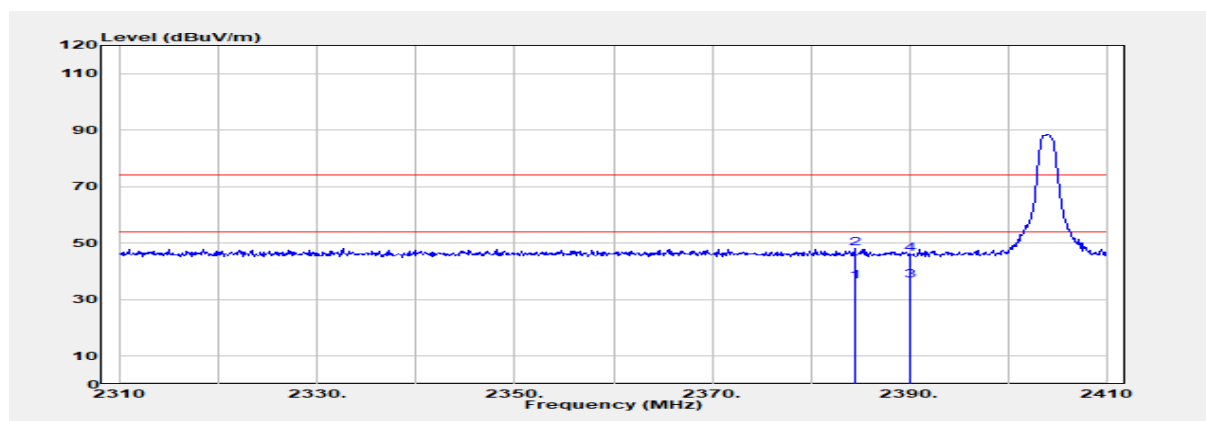
SGS Taiwan Ltd.
台灣檢驗科技股份有限公司

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號
t (886-2) 2299-3279 f (886-2) 2298-0488

www.sgs.com.tw

Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2402 MHz
Test Mode :BE CH LOW
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
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
2384.500	Average	40.35	-3.78	36.57	54.00	-17.43
2384.500	Peak	51.88	-3.78	48.10	74.00	-25.90
2390.000	Average	40.47	-3.80	36.67	54.00	-17.33
2390.000	Peak	49.98	-3.80	46.18	74.00	-27.82

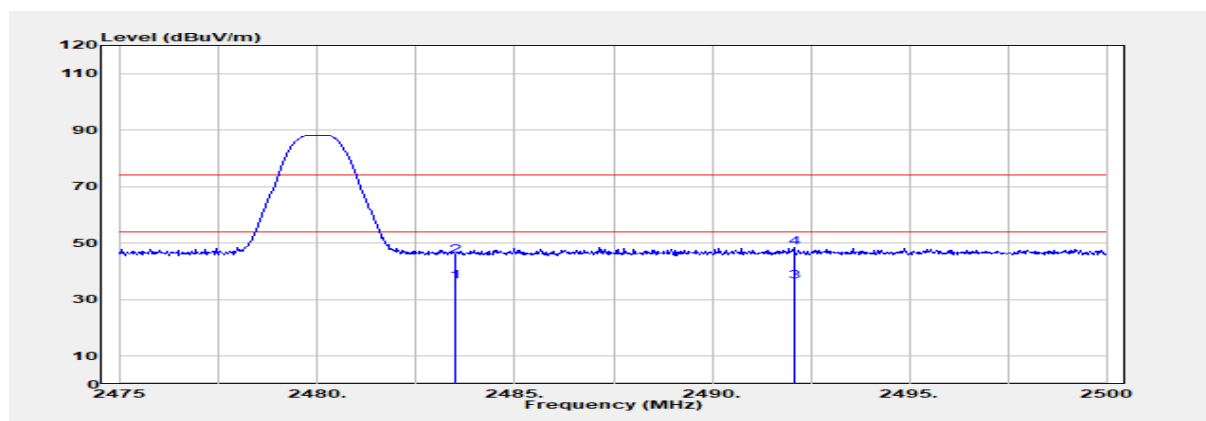
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :BE CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
Antenna Pol. :Vertical
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
2483.500	Average	40.31	-3.92	36.39	54.00	-17.61
2483.500	Peak	49.59	-3.92	45.67	74.00	-28.33
2492.075	Average	40.35	-3.87	36.47	54.00	-17.53
2492.075	Peak	52.30	-3.87	48.43	74.00	-25.57

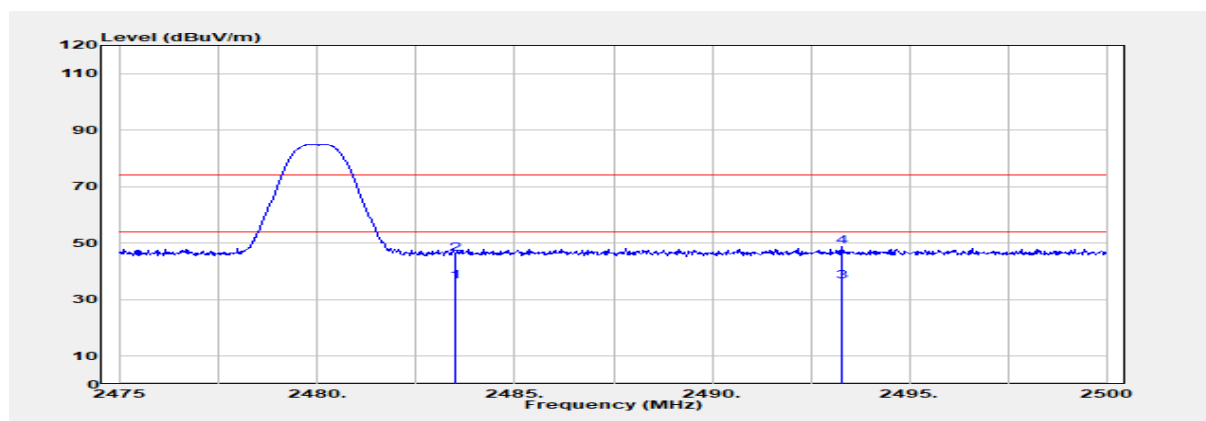
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :BE CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
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
2483.500	Average	40.33	-3.92	36.41	54.00	-17.59
2483.500	Peak	50.24	-3.92	46.32	74.00	-27.68
2493.275	Average	40.25	-3.87	36.38	54.00	-17.62
2493.275	Peak	52.58	-3.87	48.71	74.00	-25.29

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12.7 禁用頻帶內輻射量測

Report Number :E2/2021/80026

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-08-24

Test Frequency :2442 MHz

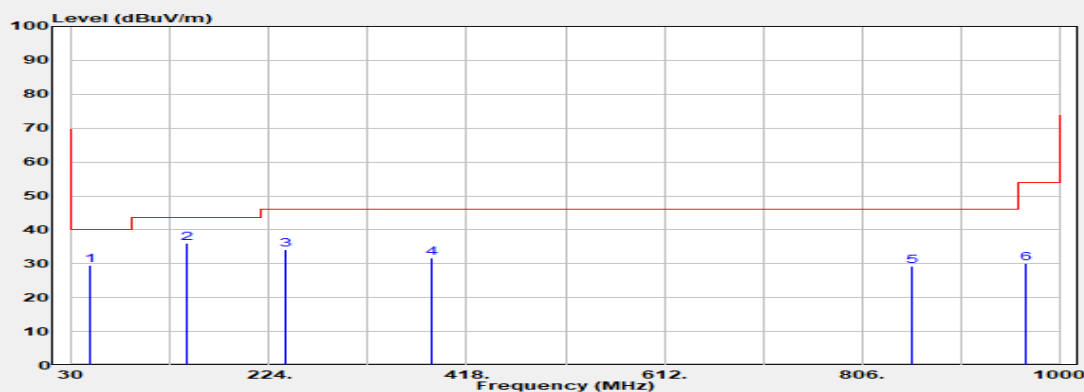
Temp./Humi. :23.3/63

Test Mode :TX CH MID

Antenna Pol. :VERTICAL

EUT Pol :E1 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
48.430	Peak	42.55	-12.98	29.56	40.00	-10.44
143.490	Peak	49.10	-13.15	35.96	43.50	-7.54
239.520	Peak	48.96	-14.72	34.24	46.00	-11.76
383.080	Peak	41.88	-10.27	31.61	46.00	-14.39
854.500	Peak	30.32	-1.01	29.31	46.00	-16.69
967.020	Peak	29.68	0.32	30.00	54.00	-24.00

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Report Number :E2/2021/80026

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-08-24

Test Frequency :2442 MHz

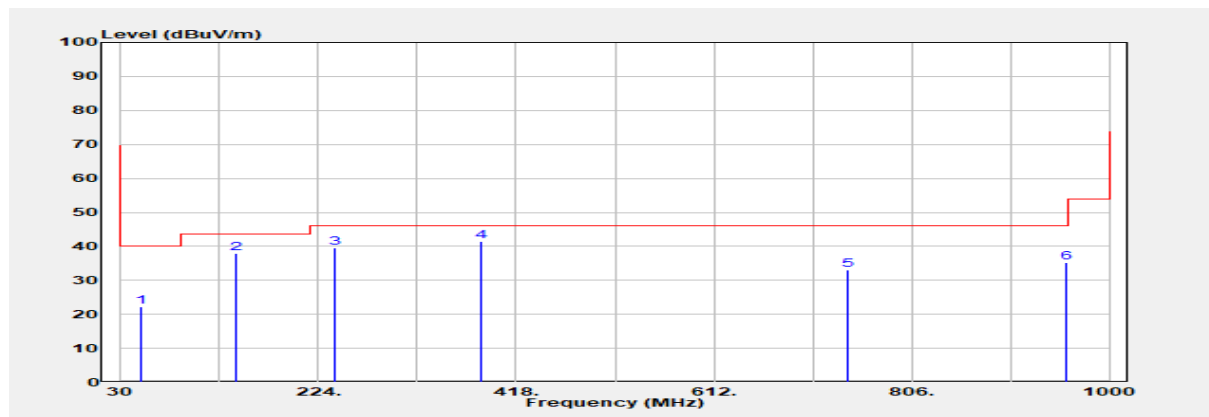
Temp./Humi. :23.3/63

Test Mode :TX CH MID

Antenna Pol. :HORIZONTAL

EUT Pol :E1 Plane

Engineer :Ashton Chiu



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
49.400	Peak	35.14	-13.02	22.12	40.00	-17.88
143.490	Peak	51.02	-13.15	37.87	43.50	-5.63
239.520	Peak	54.20	-14.72	39.48	46.00	-6.52
383.080	Peak	51.60	-10.27	41.33	46.00	-4.67
742.950	Peak	36.52	-3.35	33.17	46.00	-12.83
958.290	Peak	34.71	0.50	35.21	46.00	-10.79

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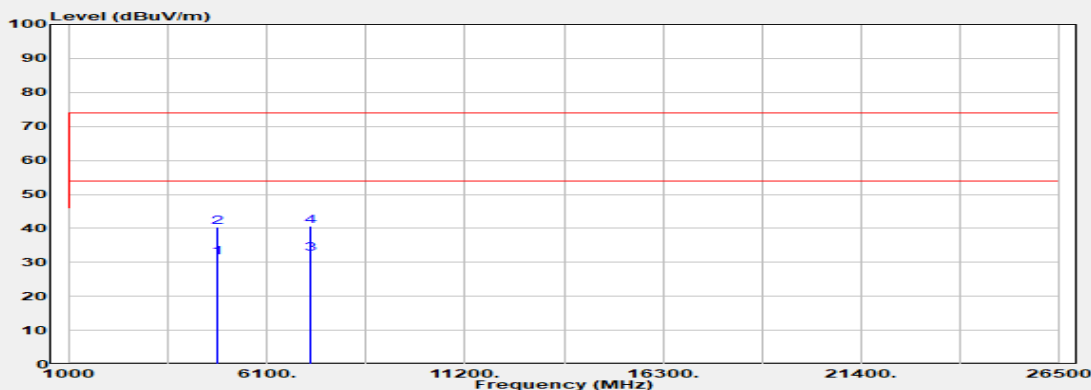
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2402 MHz
Test Mode :TX CH LOW
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
Antenna Pol. :Vertical
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
4804.000	Average	28.38	3.14	31.52	54.00	-22.48
4804.000	Peak	37.11	3.14	40.25	74.00	-33.75
7206.000	Average	25.36	7.22	32.58	54.00	-21.42
7206.000	Peak	33.52	7.22	40.74	74.00	-33.26

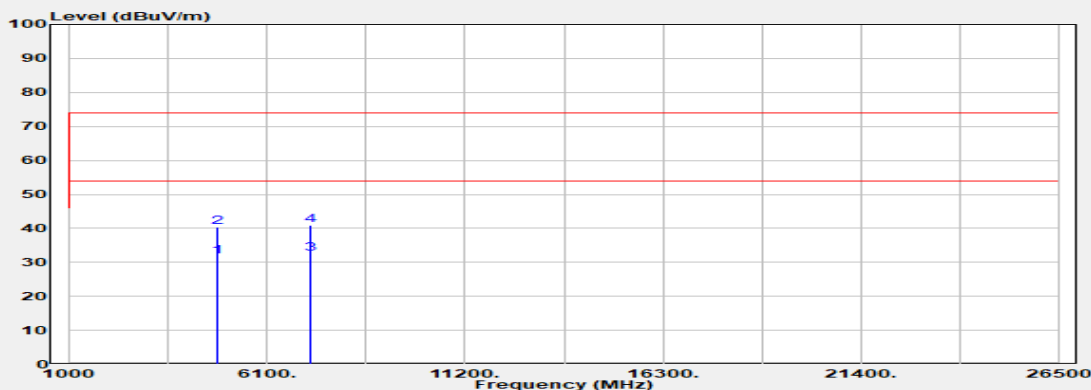
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2402 MHz
Test Mode :TX CH LOW
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
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
4804.000	Average	28.47	3.14	31.61	54.00	-22.39
4804.000	Peak	37.15	3.14	40.29	74.00	-33.71
7206.000	Average	25.36	7.22	32.58	54.00	-21.42
7206.000	Peak	33.66	7.22	40.88	74.00	-33.12

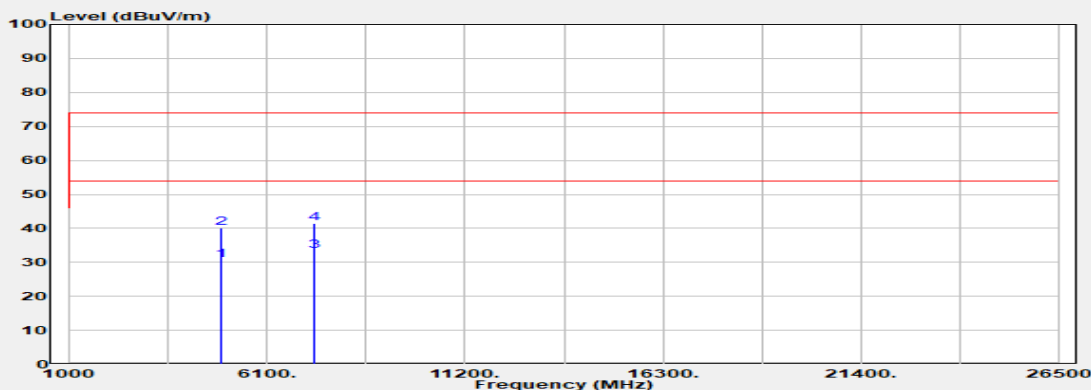
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
Antenna Pol. :Vertical
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	27.21	3.30	30.51	54.00	-23.49
4884.000	Peak	36.83	3.30	40.13	74.00	-33.87
7326.000	Average	25.69	7.68	33.36	54.00	-20.64
7326.000	Peak	33.69	7.68	41.37	74.00	-32.63

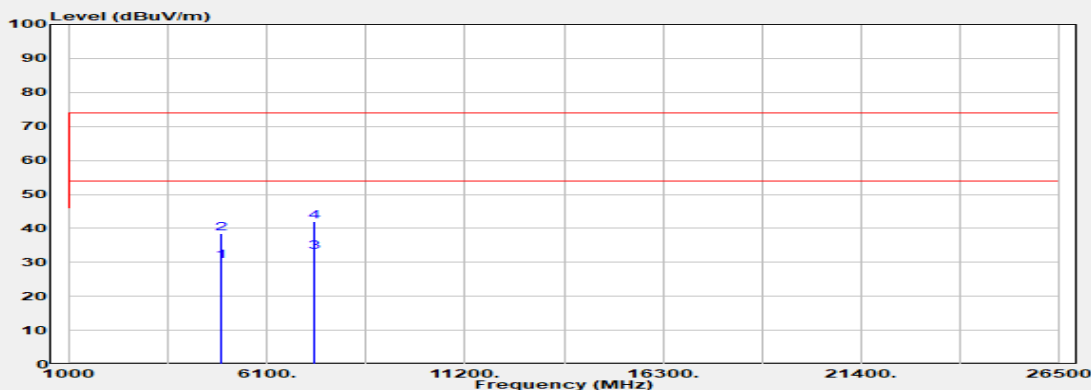
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :TX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
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	27.11	3.30	30.41	54.00	-23.59
4884.000	Peak	35.25	3.30	38.55	74.00	-35.45
7326.000	Average	25.42	7.68	33.10	54.00	-20.90
7326.000	Peak	34.42	7.68	42.10	74.00	-31.90

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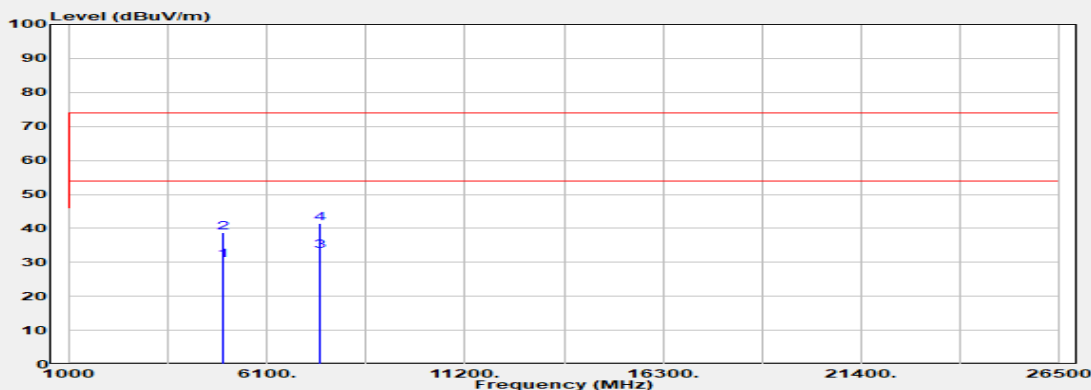
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :TX CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
Antenna Pol. :Vertical
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
4960.000	Average	27.23	3.42	30.65	54.00	-23.35
4960.000	Peak	35.44	3.42	38.86	74.00	-35.14
7440.000	Average	25.09	8.11	33.20	54.00	-20.80
7440.000	Peak	33.45	8.11	41.56	74.00	-32.44

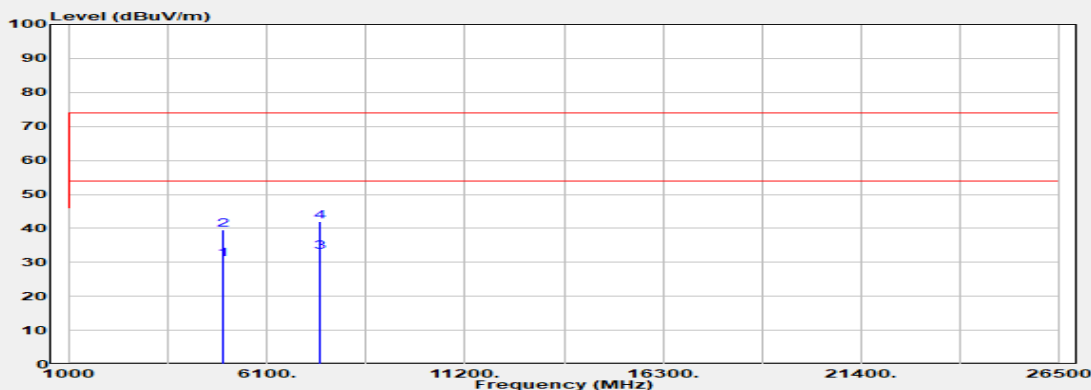
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2480 MHz
Test Mode :TX CH HIGH
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
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
4960.000	Average	27.39	3.42	30.81	54.00	-23.19
4960.000	Peak	36.24	3.42	39.66	74.00	-34.34
7440.000	Average	25.06	8.11	33.17	54.00	-20.83
7440.000	Peak	33.81	8.11	41.92	74.00	-32.08

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12.8 接收機場強輻射量測

Report Number :E2/2021/80026

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-08-24

Test Frequency :2442 MHz

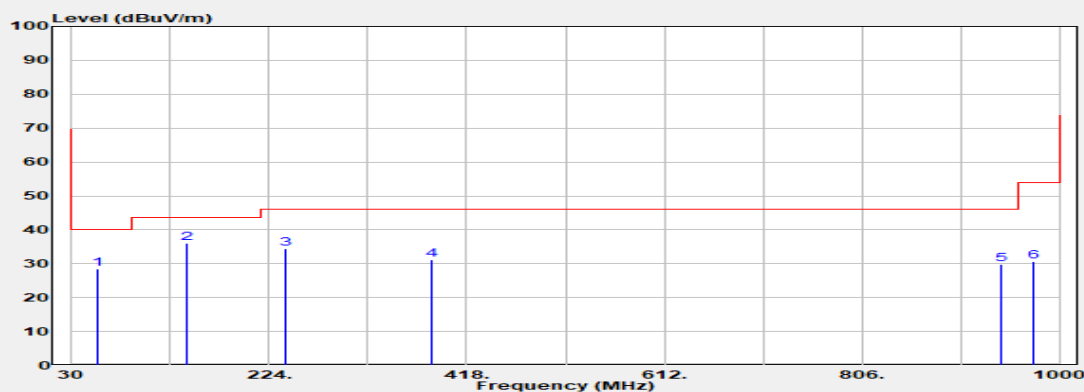
Temp./Humi. :23.3/63

Test Mode :RX CH MID

Antenna Pol. :VERTICAL

EUT Pol :E1 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
56.190	Peak	41.73	-13.32	28.41	40.00	-11.59
143.490	Peak	49.11	-13.15	35.96	43.50	-7.54
239.520	Peak	49.11	-14.72	34.39	46.00	-11.61
383.080	Peak	41.48	-10.27	31.21	46.00	-14.79
943.740	Peak	29.84	0.08	29.92	46.00	-16.08
974.780	Peak	30.49	0.09	30.58	54.00	-23.42

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SGS Taiwan Ltd.
台灣檢驗科技股份有限公司

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Report Number :E2/2021/80026

Test Site :SAC G

Operation Mode :BLE 1M

Test Date :2021-08-24

Test Frequency :2442 MHz

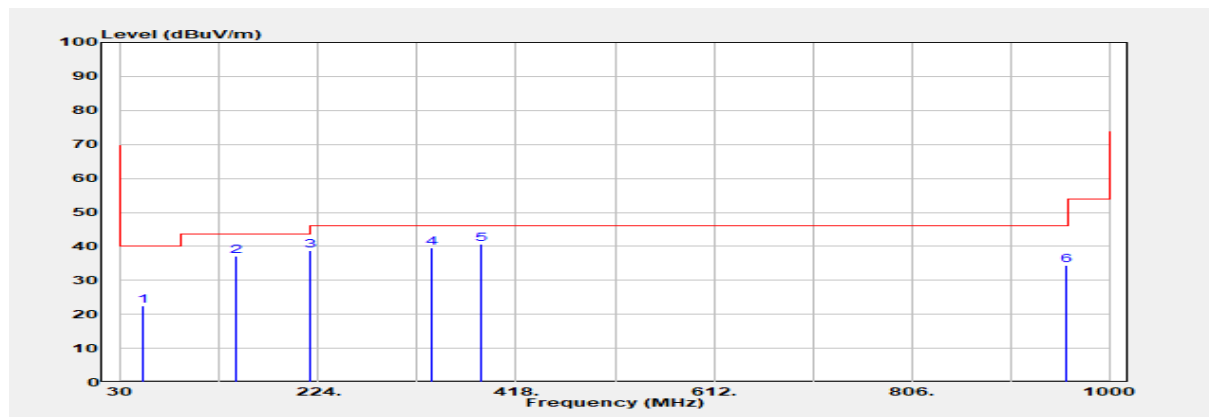
Temp./Humi. :23.3/63

Test Mode :RX CH MID

Antenna Pol. :HORIZONTAL

EUT Pol :E1 Plane

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
52.310	Peak	35.74	-13.14	22.61	40.00	-17.39
143.490	Peak	50.26	-13.15	37.11	43.50	-6.39
215.270	Peak	55.20	-16.34	38.86	43.50	-4.64
335.550	Peak	50.95	-11.50	39.45	46.00	-6.55
383.080	Peak	50.89	-10.27	40.62	46.00	-5.38
958.290	Peak	33.93	0.50	34.44	46.00	-11.56

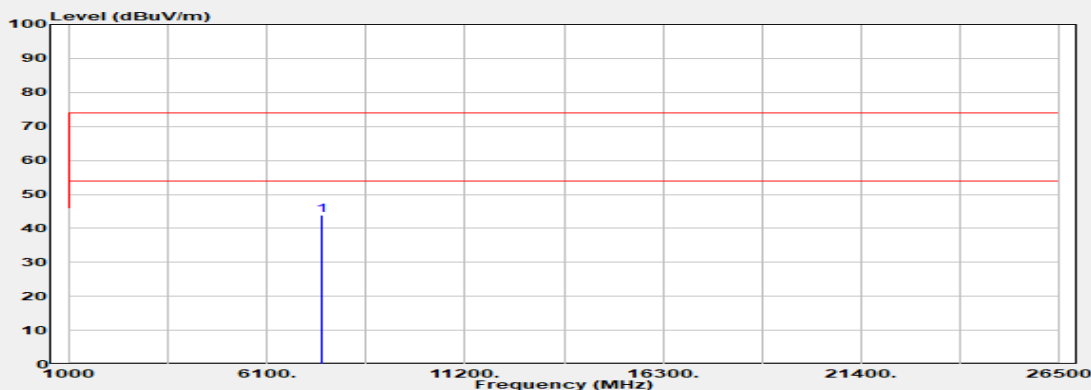
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :RX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
Antenna Pol. :Vertical
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
7524.000	Peak	36.07	7.91	43.98	74.00	-30.02

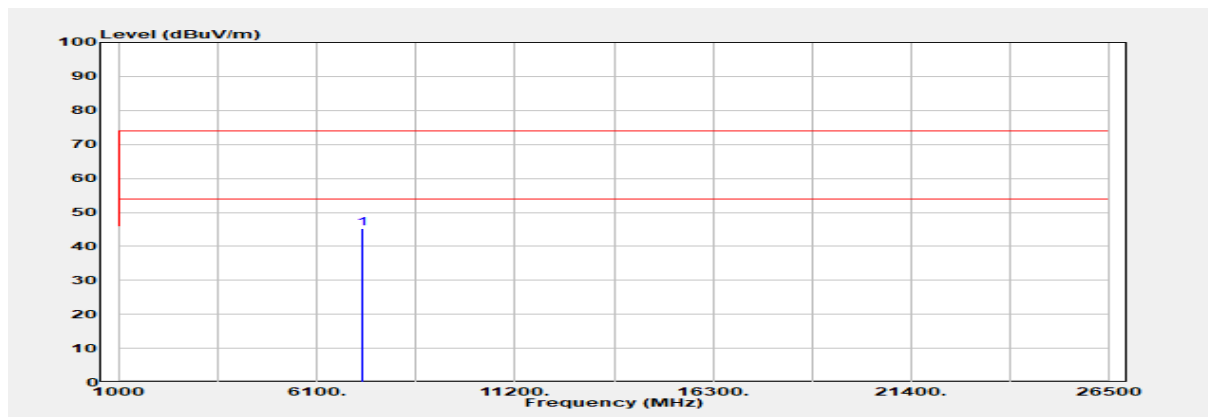
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Report Number :E2/2021/80026
Operation Mode :BLE 1M
Test Frequency :2442 MHz
Test Mode :RX CH MID
EUT Pol :H Plane

Test Site :SAC G
Test Date :2021-08-23
Temp./Humi. :24.5/59
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
7237.000	Peak	37.66	7.53	45.20	74.00	-28.80

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13 功率密度量測

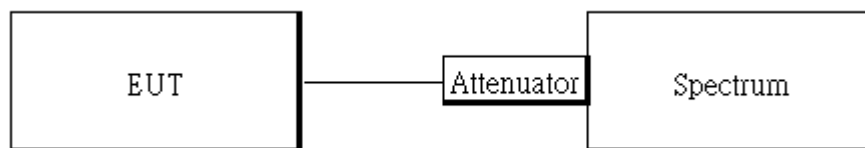
13.1 適用標準

依據 NCC 低功率射頻器材技術規範 4.10.1.6(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。

13.2 量測儀器

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/25/2021	06/25/2022
Attenuator	Marvelous	WATT-218FS-10	RF15	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF158	11/19/2020	11/18/2021
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Test Software	Realtek	AmebaZ2_mptool	1v0	N.C.R	N.C.R
Test Kit	Tuya	WBR1	N/A	N.C.R	N.C.R

13.3 功率密度測試配置



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13.4 量測方法

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & the VBW = 10 kHz
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

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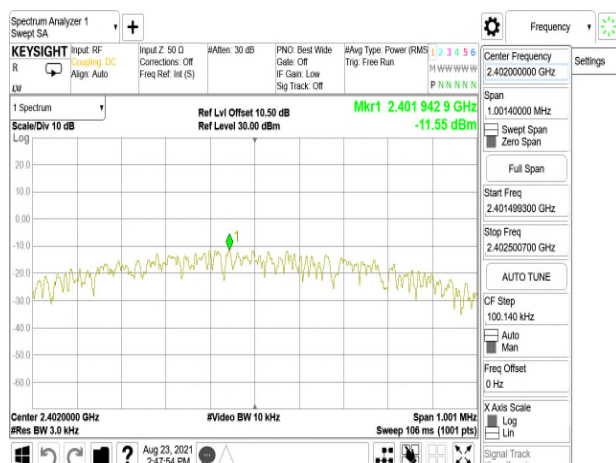
13.5 功率密度量測結果

BLE 1M mode

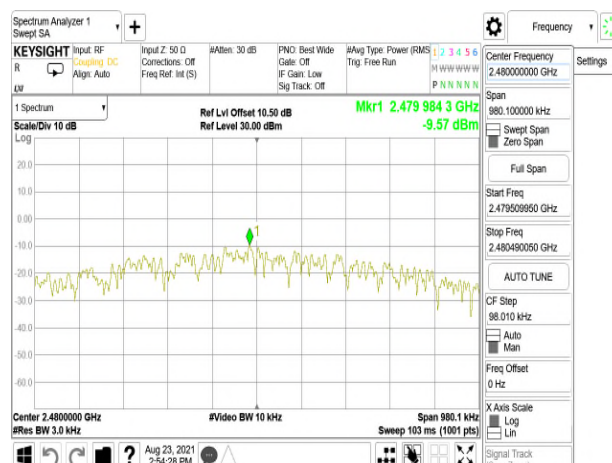
Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-11.55	8	PASS
2442	-10.57	8	PASS
2480	-9.57	8	PASS

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

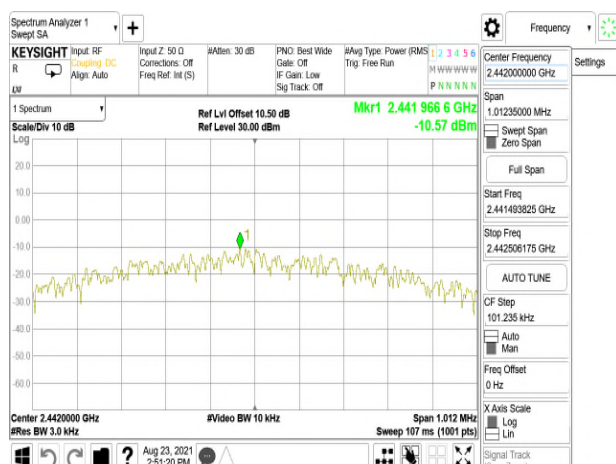
PSD_BLE 1M_LowCH00-2402MHz



PSD_BLE 1M_HighCH39-2480MHz



PSD_BLE 1M_MidCH20-2442MHz



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~ End of Report ~

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