

低功率射頻電機試驗報告

申請廠商	鴻海精密工業股份有限公司 新北市土城區中山路66號
製造廠商	鴻海精密工業股份有限公司(台灣)
產品名稱	2x2 dual-band IEEE 802.11 a/b/g/n/ac and BT4.2 Combo Module
廠牌	Foxconn
型號	WBU034-EA
發射功率	-0.95dBm (Peak)
工作頻率	2402MHz – 2480MHz
調變方式	BT V4.2 dual mode LE (GFSK)
法規	LP0002: 3.10.1節

實驗室資訊

台灣檢驗科技股份有限公司 電子通訊實驗室

新北市新北產業園區五工路134號

認證有效期間：104年06月14日起至107年06月13日止

受理日期 105年08月05日

完成日期 108年07月23日

張俊卿



報告簽署人
張俊卿 簽章

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2017/70186	Rev.00	Initial creation of document	All	Aug. 11, 2017	Violetta Tang
ER/2017/70186-01	Rev.01	Revise standard section from and 3.10.5 to 3.10.1.5	9	Jul. 23, 2019	Violetta Tang

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測試標準

國家通訊傳播委員會低功率射頻電機技術規範

民國 105 年 8 月 23 日版本

待測裝置已於台灣檢驗科技股份有限公司電子通訊實驗室，依據國家通訊傳播委員會於中華民國一百零五年八月頒佈之低功率射頻電機技術規範測試。

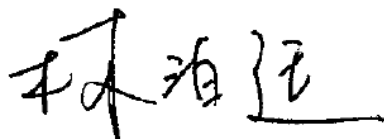
台灣檢驗科技股份有限公司根據此條文規範項目測試，測試各項數據皆能符合此規範規定之限度值。

台灣檢驗科技股份有限公司依低功率射頻電機技術規範審驗要點規範製作測試結果報告，測試結果評判為合格。

備註：

1. 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設備樣品負責。
2. 此份報告未經本公司同意，不得部份摘錄複製使用。

測試人員：



日期：

07/23/2019

林泊廷 / 工程師

報告製作：

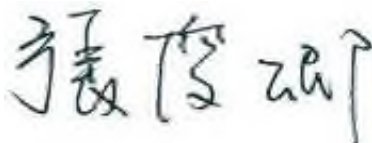


日期：

07/23/2019

湯宜瑩 / 行政

報告審核：



日期：

07/23/2019

張俊卿 / 經理

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測試實驗室資料:

實驗室認可登錄 : 中華民國實驗室認證體系

認可編號 : TAF 0513, 認可頻率範圍9kHz ~ 40GHz

認證有效期間 : 104年6月14日起至107年6月13日止

測試場地 : 新北市新北產業園區五工路134號

實驗室名稱 : 台灣檢驗科技股份有限公司
電子通訊實驗室

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

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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	2.586 dB
輻射干擾量測 (3m測距)	水平極化	9kHz - 30MHz	2.3dB
		30-167MHz	4.22dB
		167-500MHz	3.44dB
		0.5-1GHz	3.39dB
		1-18GHz	4.08dB
		18-40GHz	4.08dB
	垂直極化	9kHz - 30MHz	2.3dB
		30-180MHz	3.37dB
		180-417MHz	3.19dB
		0.417-1GHz	3.19dB
		1-18GHz	4.04dB
		18-40GHz	4.04dB
頻率誤差量測	範例一	2.4 GHz	290 Hz
	範例二	5 GHz	724.3 Hz
輸出功率	傳導方式	2.4 GHz	1.3 dB
		5 GHz	1.55 dB
有效輻射功率 (輻射方式)	水平極化	2.4GHz	4.21 dB
		5 GHz	4.62 dB
	垂直極化	2.4 GHz	4.42 dB
		5 GHz	4.74 dB
功率頻譜密度	傳導方式	2.4GHz	1.3dB
		5GHz	1.67dB
鄰頻道功率量測 (輻射方式)	水平極化	30-167MHz	4.22dB
		167-500MHz	3.44dB
		0.5-1GHz	3.39dB
	垂直極化	30-180MHz	3.37dB
		180-417MHz	3.19dB
		0.417-1GHz	3.19dB

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1 一般資料

1.1 產品描述

產品名稱	2x2 dual-band IEEE 802.11 a/b/g/n/ac and BT4.2 Combo Module
型號	WBU034-EA
產品商標	Foxconn
Hardware Version	MP
Software Version	N/A
使用電源	3.3Vdc from Test Kit

發射頻帶	2402MHz – 2480MHz
輸出功率	-0.95dBm (Peak)
調變方式	BT V4.2 dual mode LE (GFSK)
頻道數	40
天線型式/天線增益	PCB Antenna, Supplier: Hon Hai Precision Industry Co., Ltd. 1. Antenna: Model No.: WA-P-LA-03-242, Gain: 3.11dBi 2. Antenna: Model No.: WA-P-LA-03-243, Gain: 2.85dBi 3. Antenna: Model No.: WA-P-LA-03-244, Gain: 2.48dBi PIFA Antenna, Supplier: Hon Hai Precision Industry Co., Ltd. 1. Antenna: Model No.: W-M-D-B-N-2-0100, Gain: 3.82dBi 2. Antenna: Model No.: W-M-D-B-N-2-0260, Gain: 3.42dBi

本報告針對藍芽(LE)測試。

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1.2 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電機技術規範(LP0002, 105.8.23 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 63.10:2013、FCC CFR 47 15.247 之檢驗法。

低功率射頻電機技術規範3.10節

項次	測試項目	適用規範	測試結果	量測設備	備註
1	場強輻射	低功率射頻電機技術規範 3.10.1.5節	請參閱6.5節	請參閱4.1節	合格
2	電源線傳導干擾	低功率射頻電機技術規範 2.3節	請參閱5.5節	請參閱4.3節	合格
3	天線增益之要求	低功率射頻電機技術規範 3.10.1.3 (1) 節	請參閱7.2節	-----	合格
4	發頻頻寬	低功率射頻電機技術規範 3.10.1.6(2) (A) 節	請參閱8.3節	請參閱4.2節	合格
5	輸出峰值功率	低功率射頻電機技術規範 3.10.1.2(1) (C) 節	請參閱9.3節	請參閱4.2節	合格
6	開放頻帶邊緣之發射	低功率射頻電機技術規範 3.10.1.5節	請參閱10.3節	請參閱4.2節	合格
7	功率密度	低功率射頻電機技術規範 3.10.1.6(2) (B) 節	請參閱11.3節	請參閱4.2節	合格

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*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	0,20,39	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

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2 適用規範

2.1 規範要求 (一般規定)

(1) 傳導之規定

依據NCC低功率射頻電機技術規範之2.3節，以市電為電源之低功率射頻電機，其傳導回電源線上頻率自 150 kHz 至 30MHz 之射頻電壓 (在電源端子每一電源線對接地點) 不得超過下表所列之限值。測量時應經過 50 μ H 及50 Ω 之電源線阻抗模擬網路 (LISN)。頻率重疊處，以較低限值為準。

頻率(MHz)	傳導限制值 (dB μ V)	
	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

(2) 輻射之規定

依據NCC低功率射頻電機技術規範3.10.1.5之要求，其他開放頻帶外不必要之輻射需符合2.8節之一般限制要求，其電場強度不得超過下表之限值，且其不必要之發射皆不得大於主波發射強度。各頻段重疊處，以較嚴格之限制值為準。

頻率 MHz	測試距離 m	干擾限制 μ V/m	干擾限制 dB μ V/m
0.009 – 0.490	300	2,400/頻率 (kHz)	
0.490 – 1.705	30	24,000/頻率 (kHz)	
1.705 - 30	30	30	
30 - 88	3	100	40.0
88 – 216	3	150	43.5
216 – 960	3	200	46.0
960以上	3	500	54.0

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(3) 禁用頻帶限制之規定

依據NCC低功率射頻電機技術規範2.7節之要求，任何低功率射頻電機之主波皆不得使用下表所列各頻帶內之頻率；低功率射頻電機落於下表所列頻帶內之混附發射，其電場強度必須符合第2.8節的限制規定。

頻率 (MHz)	頻率 (MHz)	頻率 (MHz)
0.090~0.110	240.00~285.00	3260.0~3267.0
0.490~0.510	322.00~335.40	3332.0~3339.0
2.172~2.198	399.90~410.00	3345.8~3358.0
3.013~3.033	485.00~510.00	3500.0~4400.0
4.115~4.198	608.00~614.00	4500.0~5250.0
5.670~5.690	703.00~748.00	5350.0~5460.0
6.200~6.300	758.00~803.00	7250.0~7750.0
8.230~8.400	825.00~915.00	8025.0~8500.0
12.265~12.600	930.00~1240.0	9000.0~9200.0
13.340~13.430	1300.0~1427.0	9300.0~9500.0
14.965~15.020	1435.0~1626.5	10600~12700
16.700~16.755	1435.0~1626.5	13250~13400
19.965~20.020	1660.0~1770.0	14470~14500
25.500~25.700	1805.0~1865.0	15350~16200
37.475~38.275	1885.0~1900.0	17700~21400
73.500~75.400	1905.0~1985.0	22010~23120
108.00~138.00	2015.0~2025.0	23600~24000
149.90~150.05	2125.0~2165.0	31200~31800
156.70~156.90	2200.0~2300.0	36430~36500
162.01~167.17	2310.0~2390.0	38600 以上
167.72~173.20	2483.5~2900.0	

(4) 依據NCC低功率射頻電機技術規範2.11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2.8節之發射規定，且不得接收、解調第2.7節所列之頻率。

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2.2 規範要求 (特殊規定)

依據NCC低功率射頻電機技術規範3.10節 數位調變 (Digitally Modulated) 之要求，使用頻率為2.4 G至2.4835 GHz 及 5.725 GHz 至5.850 GHz

(A) 峰值輸出功率之要求

依據 NCC 低功率射頻電機技術規範 3.10.1.2(1) (A)(C)之規定，操作於 2400-2483.5 兆赫 (MHz)與 5725-5850 兆赫(MHz)之所有數位調變技術系統：1 瓦(W)以下。

除使用附件二之峰值輸出功率量測方式外，並得使用以最大傳導輸出功率(Maximum Conducted Output Power)作為量測方式。

最大傳導輸出功率，定義為發射器操作在最大功率時，輸出至所有天線及天線單元 (antenna elements) 之總發射功率對信號集 (signaling alphabet) 所有符號 (symbol) 之平均值。此平均值不含發射器停止或已降低發射功率位準之任何時間區段。器材可操作於不同調變模式等多種模式時，最大傳導輸出功率為各模式之總發射功率其中最高者。

(B) 天線增益之要求

依據NCC低功率射頻電機技術規範3.10.1.3之規定，進行固定式點對點操作時，應符合下列情現之一：依據NCC低功率射頻電機技術規範3.10.1.3 (1)之規定，操作頻率為2400-2483.5兆赫(MHz)者，其發射天線之方向性增益超過6dBi，每超過3dB應降低1dB之最大傳導輸出功率。

依據NCC低功率射頻電機技術規範3.10.1.3 (2)之規定，操作頻率為5725-5850兆赫(MHz)者，其發射天線之方向性增益超過6dBi，不需降低最大傳導輸出功率。

依據NCC低功率射頻電機技術規範3.10.1.3 (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。

(C) 發射限制之要求

依據NCC低功率射頻電機技術規範3.10.1.5之規定，帶外發射限制：操作頻帶範圍外之任意100 kHz 內，發射機所產生的射頻功率相較於使用頻帶範圍中包含最高所需功率之100 kHz 內的射頻功率，其衰減值限制如下：

(1) 輸出功率以附件二之峰值輸出功率方式測量者，至少須衰減20 dB，可使用射頻傳導或輻射方式測量。

(2) 輸出功率以3.10.1.2(1)(C)之最大傳導輸出功率測量方式者，至少須衰減30 dB。

此外，落於2.7 禁用頻段之輻射發射，應符合2.8 之規定。

(D) 頻寬之要求

依據NCC低功率射頻電機技術規範3.10.1.6(2) (A)規定，6dB之頻寬至少應500kHz。

(E) 功率密度之要求

依據NCC低功率射頻電機技術規範3.10.1.6(2) (B)規定，在使用頻率範圍之任意3千赫

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(kHz)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。

註: 此產品為點對多點操作。

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3 受測裝置之系統說明

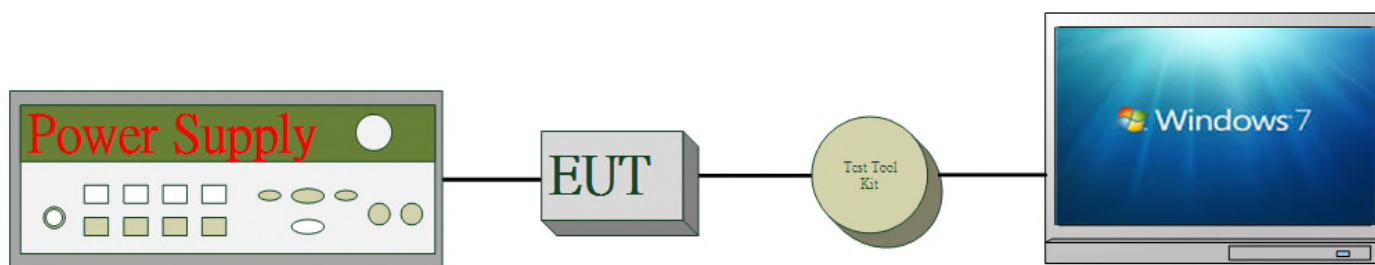
裝置名稱	製造者/申請者	型號
* 2x2 dual-band IEEE 802.11 a/b/g/n/ac and BT4.2 Combo Module	鴻海精密工業股份有限公司/ 鴻海精密工業股份有限公司	WBU034-EA

標記：“*”表欲申請之受測物。

3.1 待測物與測試設備系統圖

3.1.1 量測配置圖

Radiated Emission & Conduction & Conducted (Antenna Port)



3.2 輔助測試週邊設備名稱描述

編號	產品別	商標	型號	序號	信號線	電源線
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L430	N/A	Shielded	Unshielded
3.	DC Power Supply	HP	E3640A	KR93300208	N/A	Un-shielded
4.	Test Kit	N/A	N/A	N/A	N/A	N/A

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4 量測儀器設備

4.1 AC 電源端傳導干擾之量測儀器

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/11/2017	05/10/2018
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018
LISN	MESS TEC	FCC-LISN-50/250-25-2-01	4034	03/19/2017	03/18/2018
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017

4.2 天線端傳導測試之量測儀器

SGS Conducted Room					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017
DC Power Supply	Agilent	E3640A	MY52410006	11/05/2015	11/04/2016
Temperature Chamber	TERCHY	MHG-120LF	911009	05/17/2016	05/16/2017

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4.3 量測場強輻射之量測儀器

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/10/2016	05/09/2017
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/28/2016	01/27/2017
Loop Antenna	ETS.LINDGREN	6502	148045	09/07/2015	09/06/2016
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016
Horn antenna	ETS.LINDGREN	3117	123991	12/12/2015	12/11/2016
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2016	01/01/2017
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2016	01/01/2017
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2016	01/01/2017
3m Site NSA	SGS	966 chamber	N/A	07/01/2016	06/30/2017

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。

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/10/2017	05/09/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/28/2017	01/27/2018
Loop Antenna	ETS.LINDGREN	6502	148045	09/07/2016	09/06/2017
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2016	12/13/2017
Horn antenna	ETS.LINDGREN	3117	123991	12/12/2016	12/11/2017
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2017	01/01/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2017	01/01/2018
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2017	01/01/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018

Remark: Please note that the duration to conduct the test took place in the mean time when the calibration for several equipments is due, and therefore extra tables of equipment calibration is constructed to indicate the calibration work is still maintained.

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5 電源線傳導干擾之量測

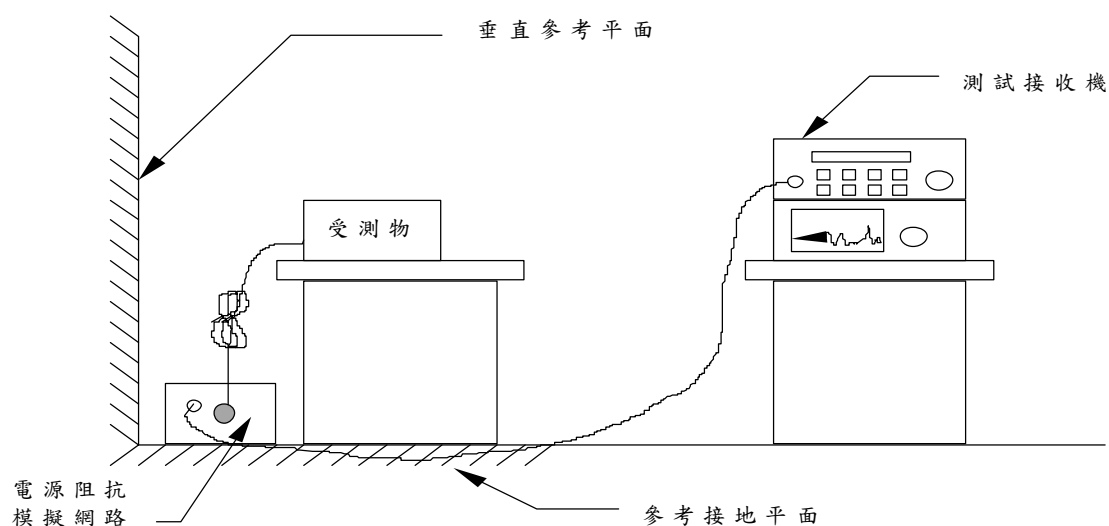
5.1 適用標準

依據NCC低功率射頻電機技術規範2.3節之要求。

5.2 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。

5.3 測試配置



5.4 干擾值之計算

電源傳導干擾電壓之計算公式如下

$$\text{結果值} = \text{儀器讀值}(QP/AV) + \text{校正因子}$$

其中校正因子為：

$$\text{饋線損失} + \text{電源阻抗模擬網路損失}$$

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5.5 傳導干擾之量測結果:

測試設備: 2x2 dual-band IEEE 802.11 a/b/g/n/ac
and BT4.2 Combo Module

6dB 頻寬: 10 kHz

量測天線: N/A

測試者:

柯有廷

型號: WBU034-EA

視訊頻寬: 10 kHz

檢測器: Average/Quasi-Peak

測試日期: Aug. 11, 2017

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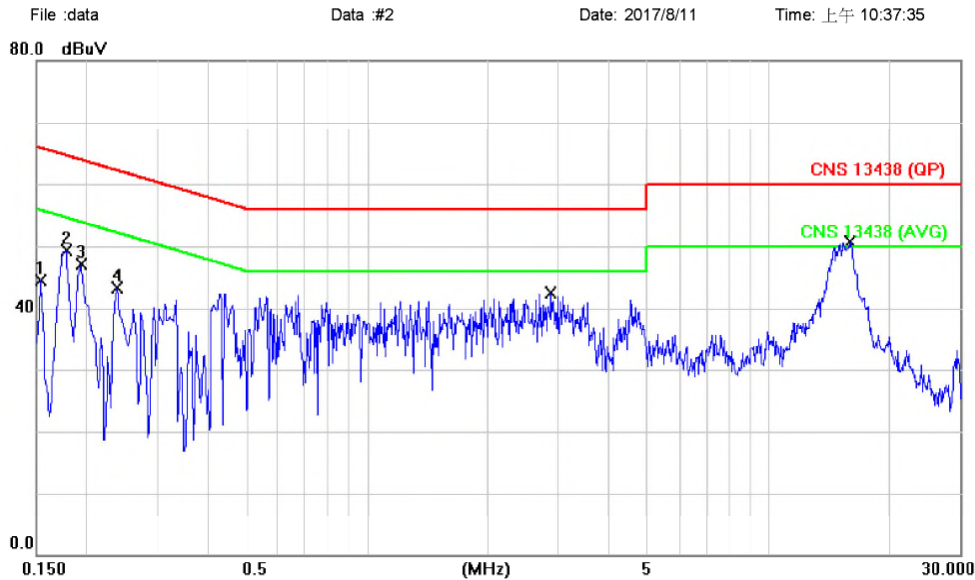
No.134, WuKung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803/新北市五股區新北產業園區五工路

Site: Conduction Room
Limit: CNS 13438 (QP)
Mode: Operation mode
Note:

Phase: L1
Power: AC 110V/60Hz

Temperature: 25 °C
Humidity: 85 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1540	44.43	0.00	44.43	65.78	-21.35	peak	
2		0.1780	49.27	0.00	49.27	64.58	-15.31	peak	
3		0.1940	47.15	0.00	47.15	63.86	-16.71	peak	
4		0.2380	43.24	0.00	43.24	62.17	-18.93	peak	
5		2.8740	38.60	0.03	38.63	56.00	-17.37	QP	
6		2.8740	29.30	0.03	29.33	46.00	-16.67	AVG	
7		15.8900	46.00	0.10	46.10	60.00	-13.90	QP	
8 *		15.8900	40.50	0.10	40.60	50.00	-9.40	AVG	

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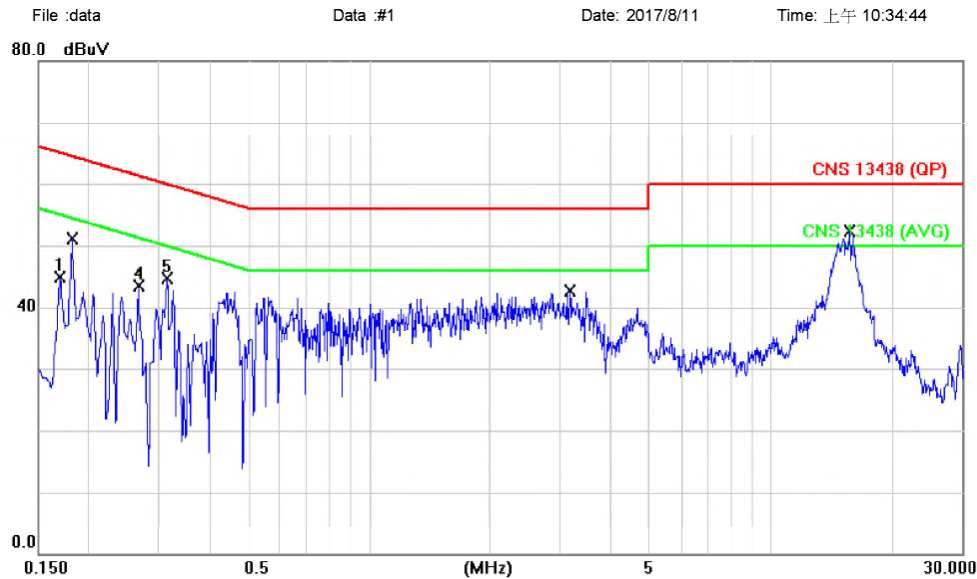
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Site: Conduction Room
 Limit: CNS 13438 (QP)
 Mode: Operation mode
 Note:

Phase: **N**
 Power: AC 110V/60Hz

Temperature: 25 °C
 Humidity: 85 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1700	44.86	0.00	44.86	64.96	-20.10	peak	
2		0.1820	49.30	0.00	49.30	64.39	-15.09	QP	
3		0.1820	34.70	0.00	34.70	54.39	-19.69	AVG	
4		0.2660	43.48	0.00	43.48	61.24	-17.76	peak	
5		0.3140	44.73	0.00	44.73	59.86	-15.13	peak	
6		3.1660	36.40	0.04	36.44	56.00	-19.56	QP	
7		3.1660	27.80	0.04	27.84	46.00	-18.16	AVG	
8		15.7500	45.90	0.10	46.00	60.00	-14.00	QP	
9 *		15.7500	40.50	0.10	40.60	50.00	-9.40	AVG	

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6 場強輻射之量測

6.1 適用標準

依據NCC低功率射頻電機技術規範3.10.1.5之要求，其他開放頻帶外不必要之輻射干擾需符合2.8節之一般限制要求。

6.2 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。

1GHz 以下先進行Peak 值量測，若Peak 以低於QP 限制值將不在進行QP 量測，否則，則進行QP 值量測，1GHz 以上先進行Peak 值量測，若Peak 以低於AV 限制值將不在進行AV值量測，否則，則進行AV 值量測。

9kHz~150kHz 測試

解析頻寬: 300Hz

視訊頻寬: 300Hz

量測天線: 6502

檢測器: Quasi-Peak

150kHz~30MHz 測試

解析頻寬: 10kHz

視訊頻寬: 10kHz

量測天線: 6502

檢測器: Quasi-Peak

1GHz 以下測試

解析頻寬: 100kHz

視訊頻寬: 100kHz

量測天線: VULB9168

檢測器: Quasi-Peak

1GHz 以上測試

量測天線:

3117

檢測器:

Peak, Average

頻譜分析儀設定

Peak: RBW: 1MHz ; VBW: 1MHz , Average: RBW: 1MHz ; VBW: 10Hz

註: 輻射量測僅放最差模式 (30MHz 以上)。

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6.3 場強度之計算

場強之計算公式如

$$\text{結果值} = \text{讀值} + \text{校正因子}$$

其中校正因子為：

天線因子+饋線損失+濾波器損失（若有使用）-放大器增益（若有使用）
量測結果請見下頁。

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

Note: Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

“F”: denotes Fundamental Frequency. ; “H”: denotes Harmonic Frequency.

“E”: denotes Band Edge Frequency. ; “S”: denotes Spurious Frequency.

“---”: denotes Noise Floor.

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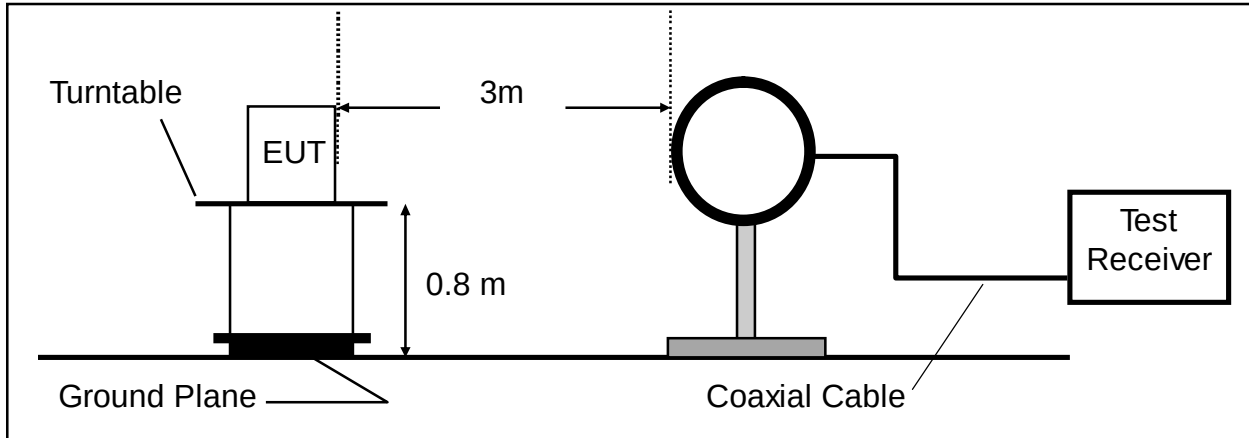
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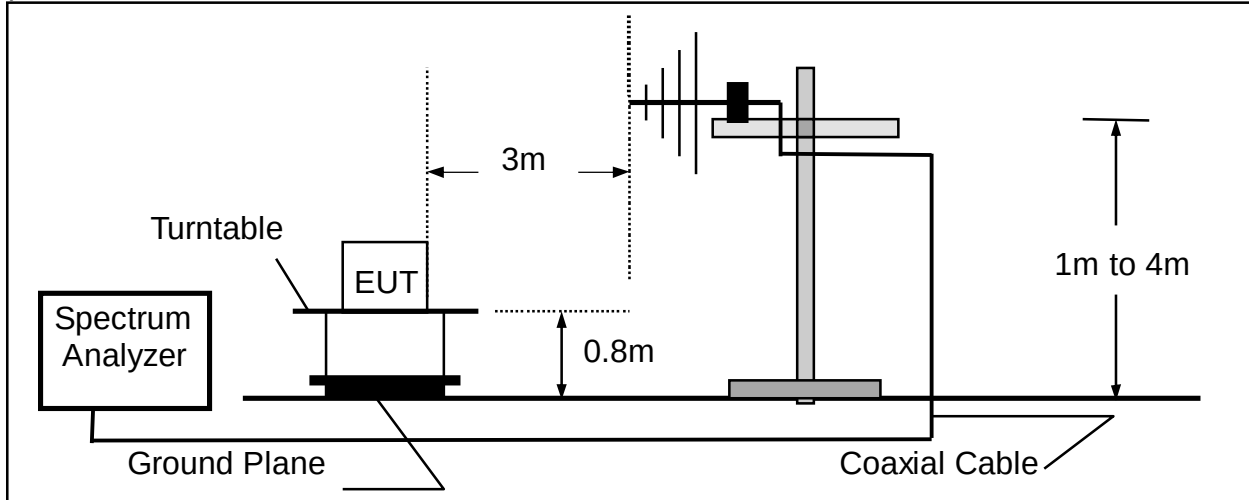
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6.4 輻射之測試配置

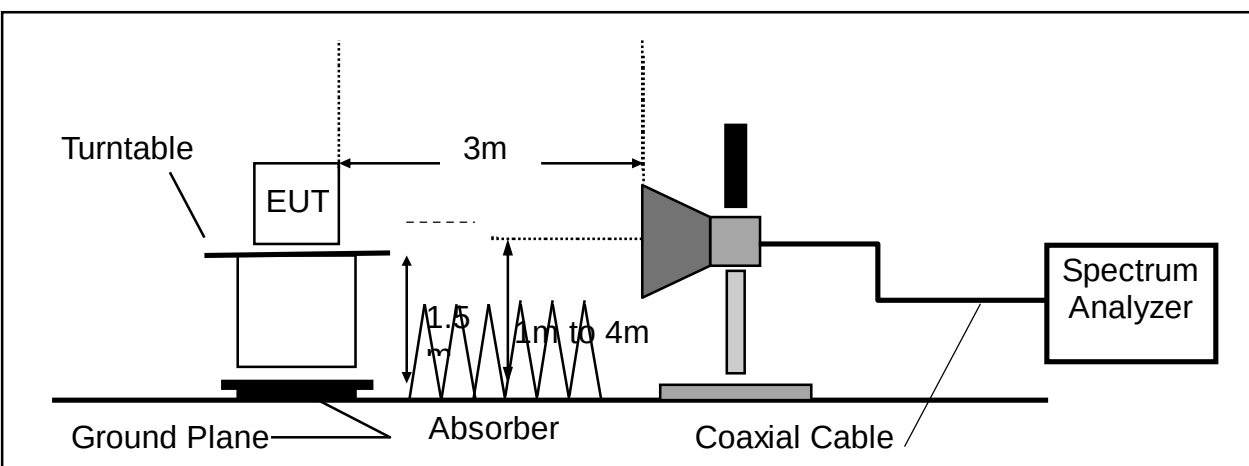
(A) 量測頻率低於 30MHz 以下之測試配置



(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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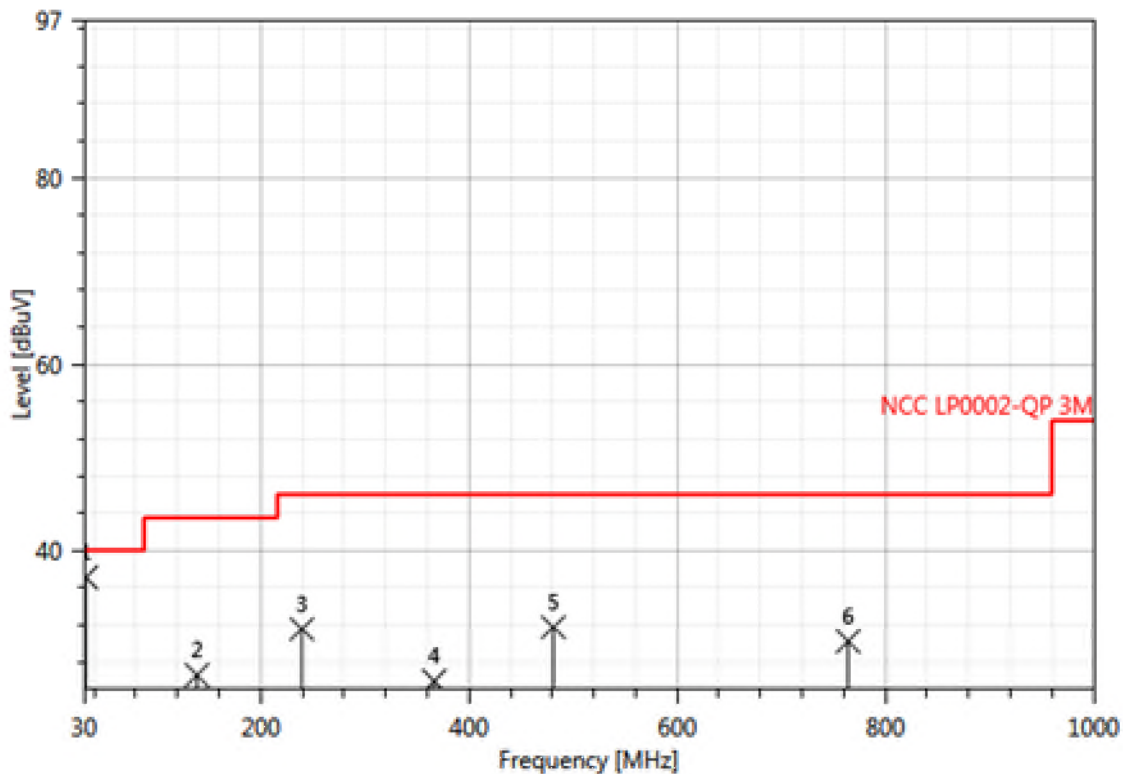
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6.5 場強輻射之量測結果

6.5.1 發射機場強輻射之量測結果(1GHz 以下) (PCB Antenna)

Operation Mode : BLE Test Date : 08/12/2016
 Fundamental Frequency : 2402 MHz Temp. / Humi. : 22 deg_C / 61 RH
 Operation Band : Tx CH LOW Test Engineer : Edward
 EUT Pol. : E2 Plane Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
31.94	S	Peak	37.11	46.22	-9.11	40.00	-2.89
138.64	S	Peak	26.58	35.07	-8.49	43.50	-16.92
239.52	S	Peak	31.54	39.66	-8.12	46.00	-14.46
366.59	S	Peak	25.93	30.66	-4.72	46.00	-20.07
481.05	S	Peak	31.74	34.11	-2.37	46.00	-14.26
764.29	S	Peak	30.18	27.21	2.97	46.00	-15.82

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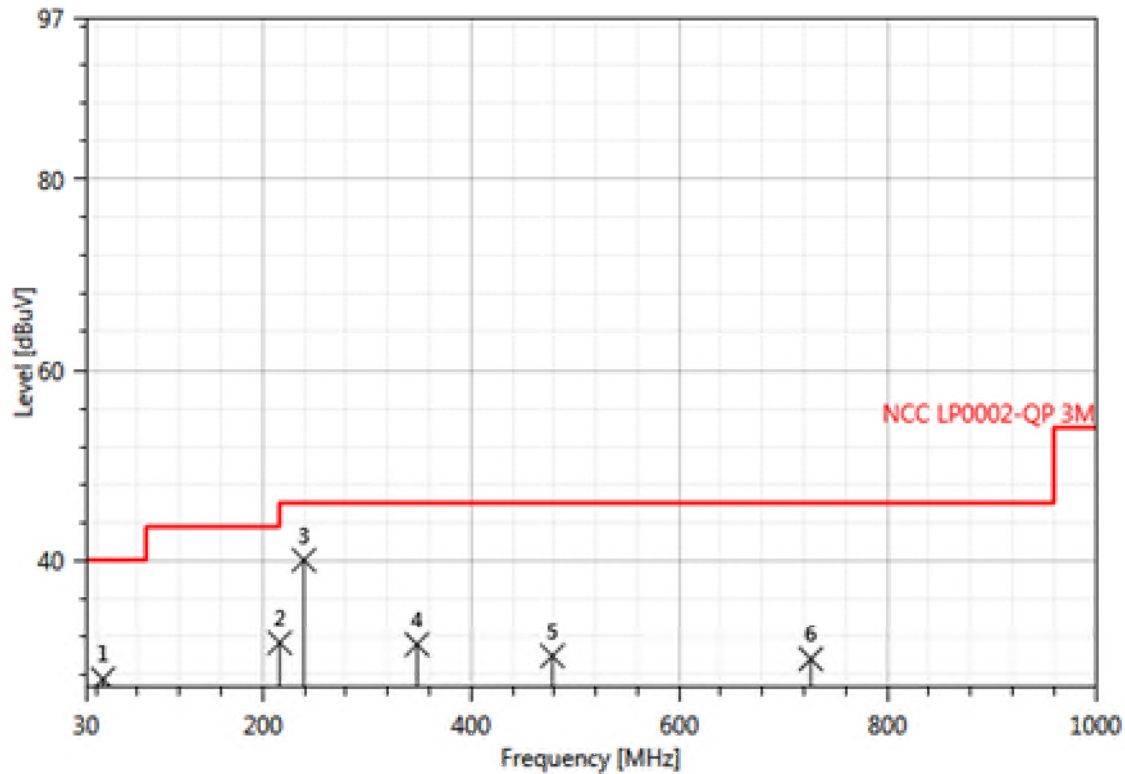
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Operation Mode : BLE
Fundamental Frequency : 2402 MHz
Operation Band : Tx CH LOW
EUT Pol. : E2 Plane

Test Date : 08/12/2016
Temp. / Humi. : 22 deg_C / 61 RH
Test Engineer : Edward
Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
46.49	S	Peak	27.48	35.39	-7.91	40.00	-12.52
216.24	S	Peak	31.27	40.70	-9.43	46.00	-14.73
239.52	S	Peak	40.02	48.13	-8.12	46.00	-5.98
348.16	S	Peak	31.10	36.04	-4.94	46.00	-14.90
478.14	S	Peak	29.90	32.33	-2.43	46.00	-16.10
726.46	S	Peak	29.58	27.84	1.74	46.00	-16.42

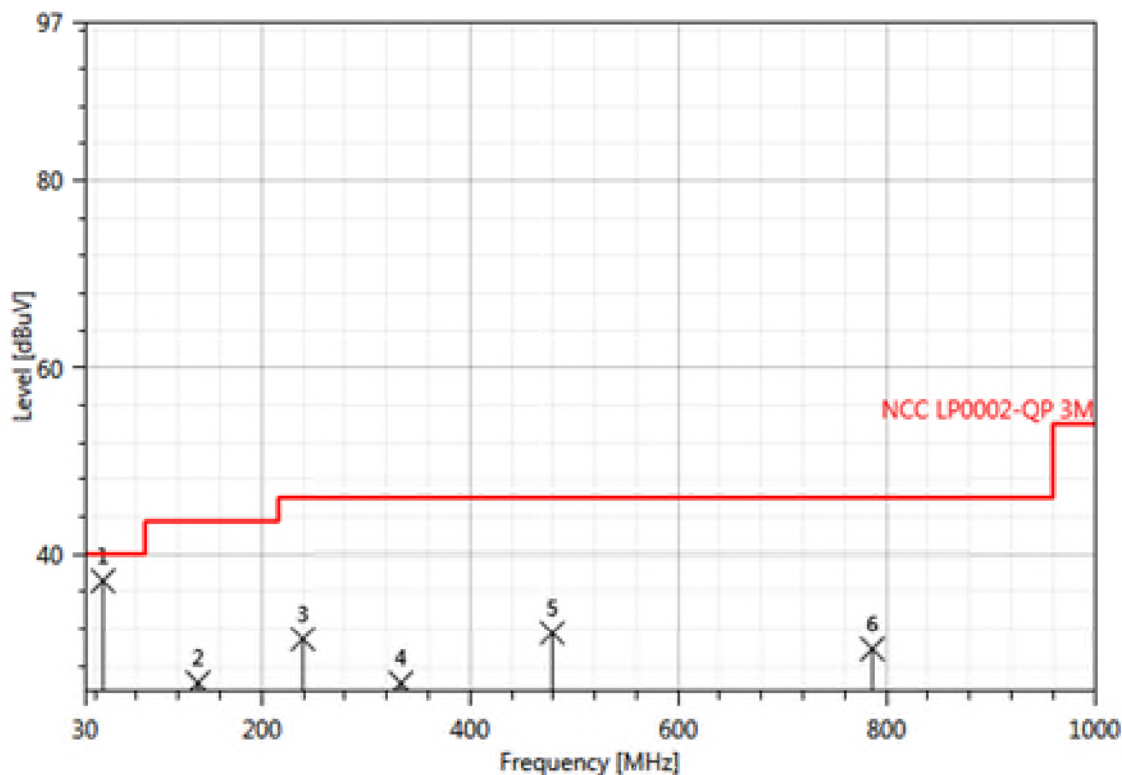
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Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2442 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
47.46	S	Peak	37.14	44.98	-7.85	40.00	-2.86
138.64	S	Peak	26.19	34.68	-8.49	43.50	-17.31
239.52	S	Peak	30.85	38.97	-8.12	46.00	-15.15
333.61	S	Peak	26.15	31.43	-5.28	46.00	-19.85
479.11	S	Peak	31.53	33.93	-2.39	46.00	-14.47
786.60	S	Peak	29.78	27.18	2.60	46.00	-16.22

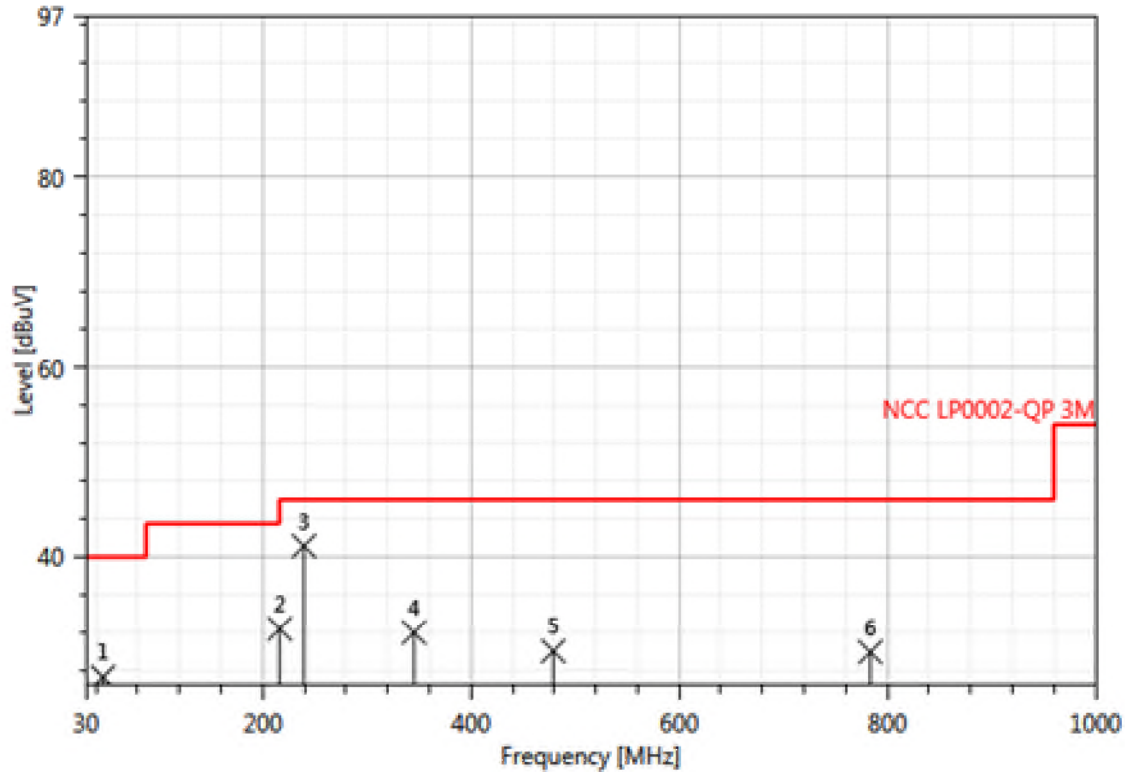
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Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2442 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
46.49	S	Peak	27.31	35.22	-7.91	40.00	-12.69
216.24	S	Peak	32.41	41.84	-9.43	46.00	-13.59
239.52	S	Peak	41.14	49.26	-8.12	46.00	-4.86
345.25	S	Peak	32.01	37.10	-5.09	46.00	-13.99
479.11	S	Peak	30.05	32.45	-2.39	46.00	-15.95
783.69	S	Peak	29.95	27.21	2.75	46.00	-16.05

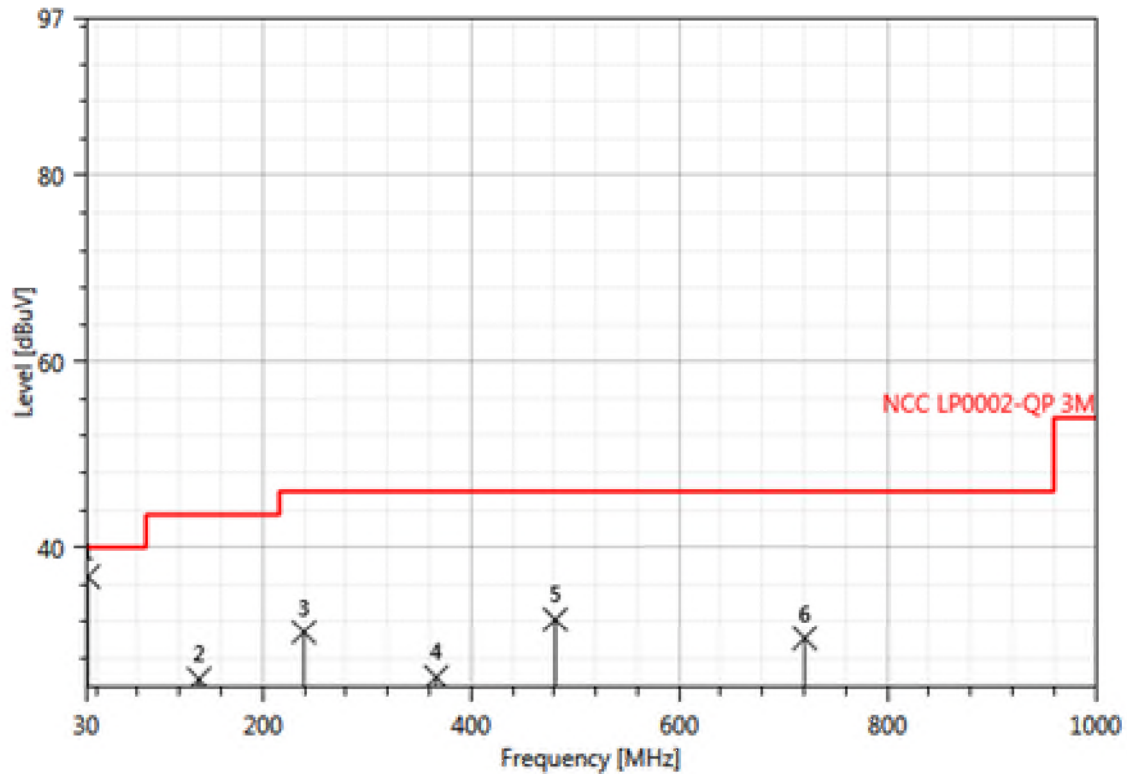
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Operation Mode : BLE
Fundamental Frequency : 2480 MHz
Operation Band : Tx CH HIGH
EUT Pol. : E2 Plane
Test Date : 08/12/2016
Temp. / Humi. : 22 deg_C / 61 RH
Test Engineer : Edward
Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
31.94	S	Peak	36.87	45.98	-9.11	40.00	-3.13
138.64	S	Peak	25.80	34.29	-8.49	43.50	-17.70
239.52	S	Peak	30.86	38.98	-8.12	46.00	-15.14
366.59	S	Peak	25.99	30.71	-4.72	46.00	-20.01
481.05	S	Peak	32.24	34.61	-2.37	46.00	-13.76
720.64	S	Peak	30.18	28.70	1.48	46.00	-15.82

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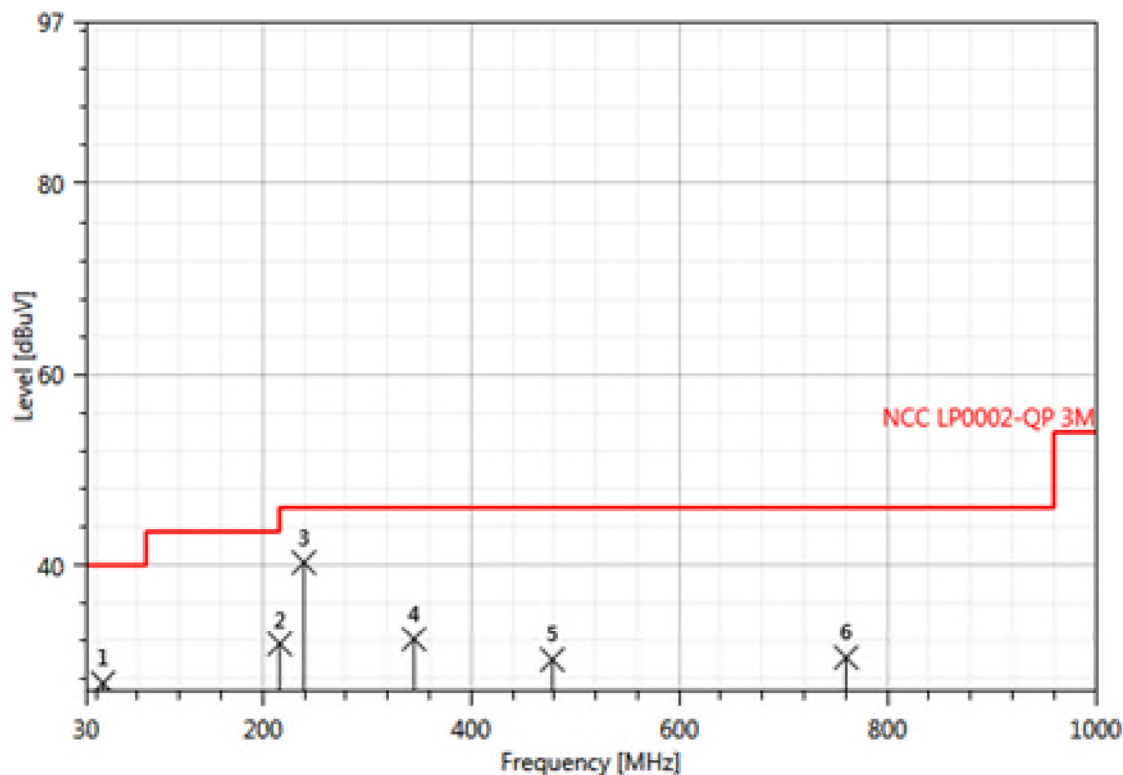
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Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2480 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH HIGH	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
46.49	S	Peak	27.59	35.50	-7.91	40.00	-12.41
216.24	S	Peak	31.69	41.12	-9.43	46.00	-14.31
239.52	S	Peak	40.27	48.39	-8.12	46.00	-5.73
345.25	S	Peak	32.20	37.29	-5.09	46.00	-13.80
478.14	S	Peak	30.04	32.47	-2.43	46.00	-15.96
760.41	S	Peak	30.25	27.30	2.95	46.00	-15.75

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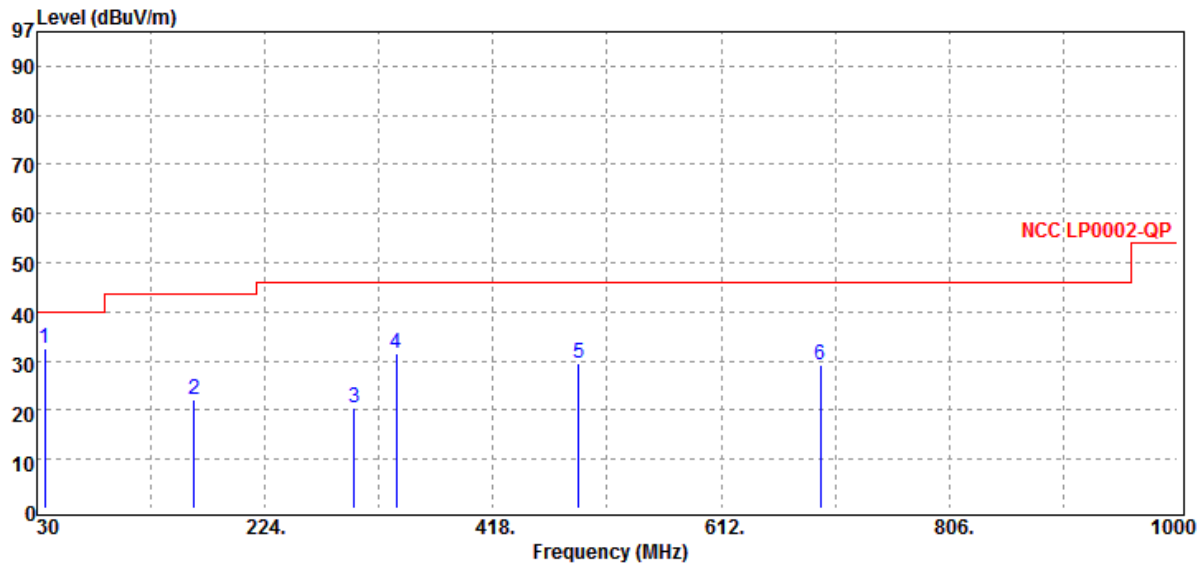
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6.5.2 發射機場強輻射之量測結果(1GHz 以下) (PIFA Antenna)

Operation Band	:BLE	Test Date	:2017-07-31
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
36.79	S	Peak	41.53	-8.84	32.69	40.00	-7.31
163.86	S	Peak	29.47	-7.45	22.02	43.50	-21.48
299.66	S	Peak	26.31	-5.93	20.38	46.00	-25.62
335.55	S	Peak	36.89	-5.32	31.57	46.00	-14.43
490.75	S	Peak	31.99	-2.53	29.46	46.00	-16.54
696.39	S	Peak	27.69	1.35	29.04	46.00	-16.96

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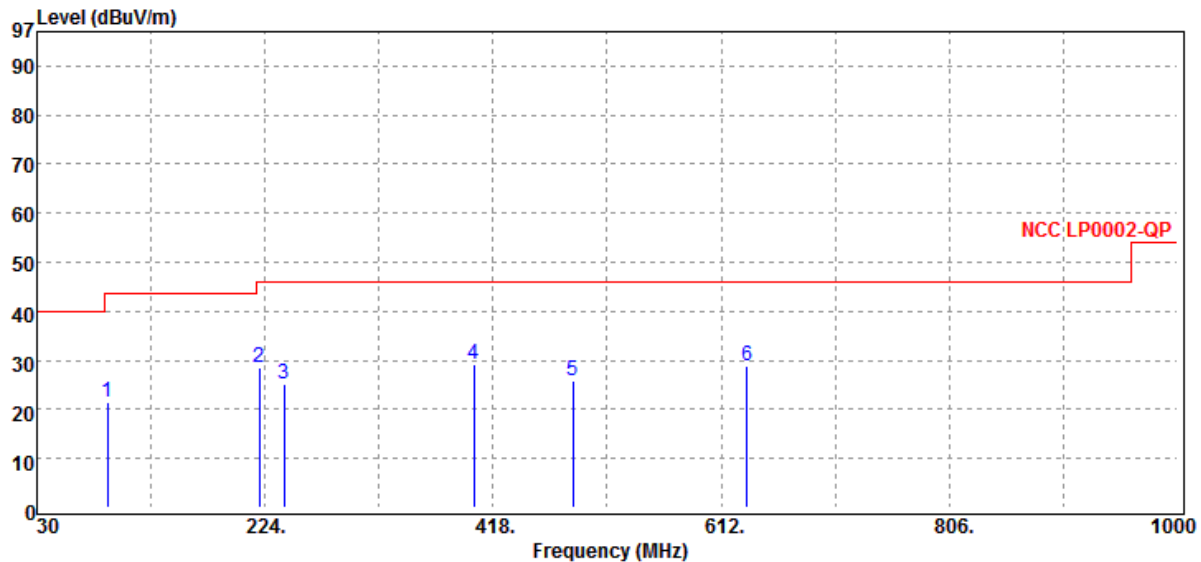
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Operation Band :BLE
Fundamental Frequency :2402 MHz
Operation Mode :Tx CH LOW
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
90.14	S	Peak	35.34	-13.73	21.61	43.50	-21.89
219.15	S	Peak	37.91	-9.28	28.63	46.00	-17.37
240.49	S	Peak	33.34	-8.04	25.30	46.00	-20.70
401.51	S	Peak	33.11	-3.95	29.16	46.00	-16.84
485.90	S	Peak	28.11	-2.33	25.78	46.00	-20.22
634.31	S	Peak	28.43	0.51	28.94	46.00	-17.06

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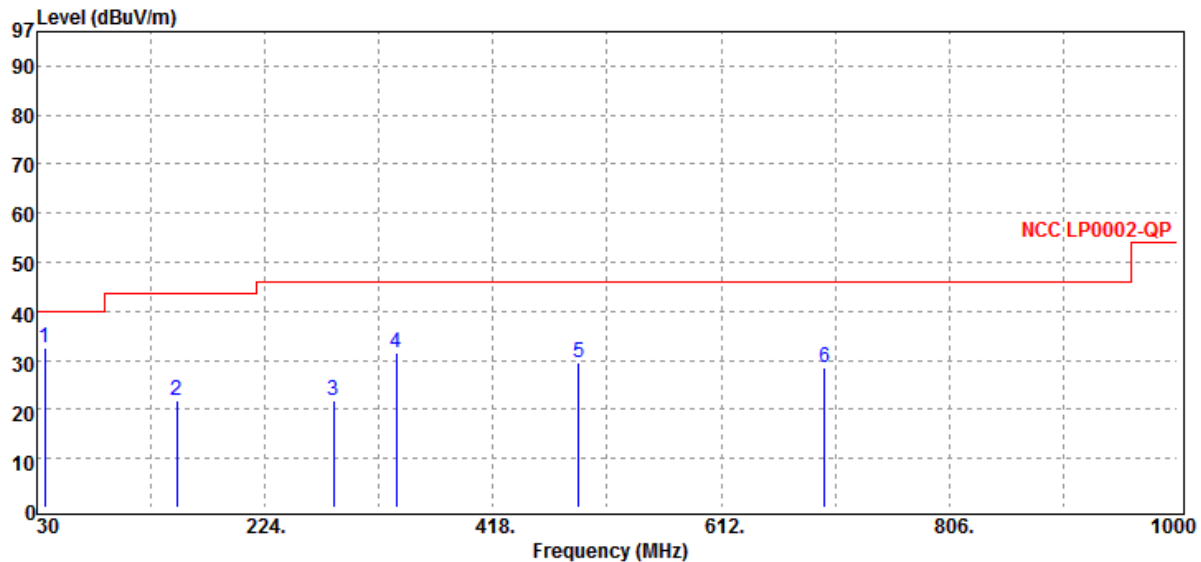
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Operation Band :BLE
Fundamental Frequency :2442 MHz
Operation Mode :Tx CH MID
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
36.79	S	Peak	41.45	-8.84	32.61	40.00	-7.39
149.31	S	Peak	29.71	-7.81	21.90	43.50	-21.60
282.20	S	Peak	27.97	-6.27	21.70	46.00	-24.30
335.55	S	Peak	36.92	-5.32	31.60	46.00	-14.40
490.75	S	Peak	32.12	-2.53	29.59	46.00	-16.41
700.27	S	Peak	27.21	1.44	28.65	46.00	-17.35

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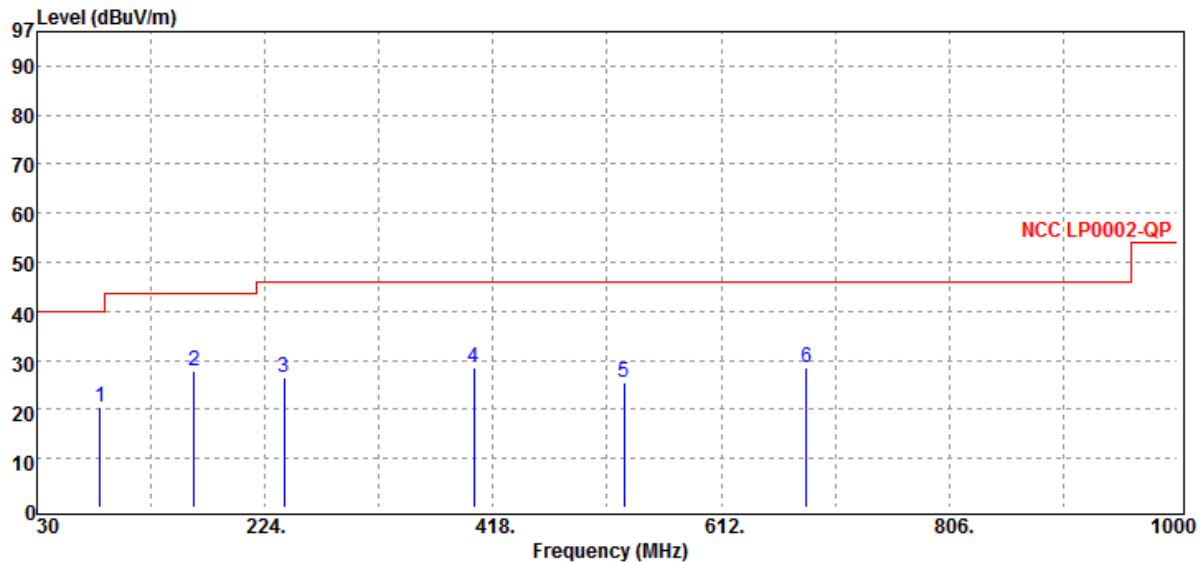
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Operation Band :BLE
Fundamental Frequency :2442 MHz
Operation Mode :Tx CH MID
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
83.35	S	Peak	33.30	-12.77	20.53	40.00	-19.47
163.86	S	Peak	35.33	-7.45	27.88	43.50	-15.62
240.49	S	Peak	34.62	-8.04	26.58	46.00	-19.42
401.51	S	Peak	32.55	-3.95	28.60	46.00	-17.40
529.55	S	Peak	26.84	-1.25	25.59	46.00	-20.41
684.75	S	Peak	27.12	1.28	28.40	46.00	-17.60

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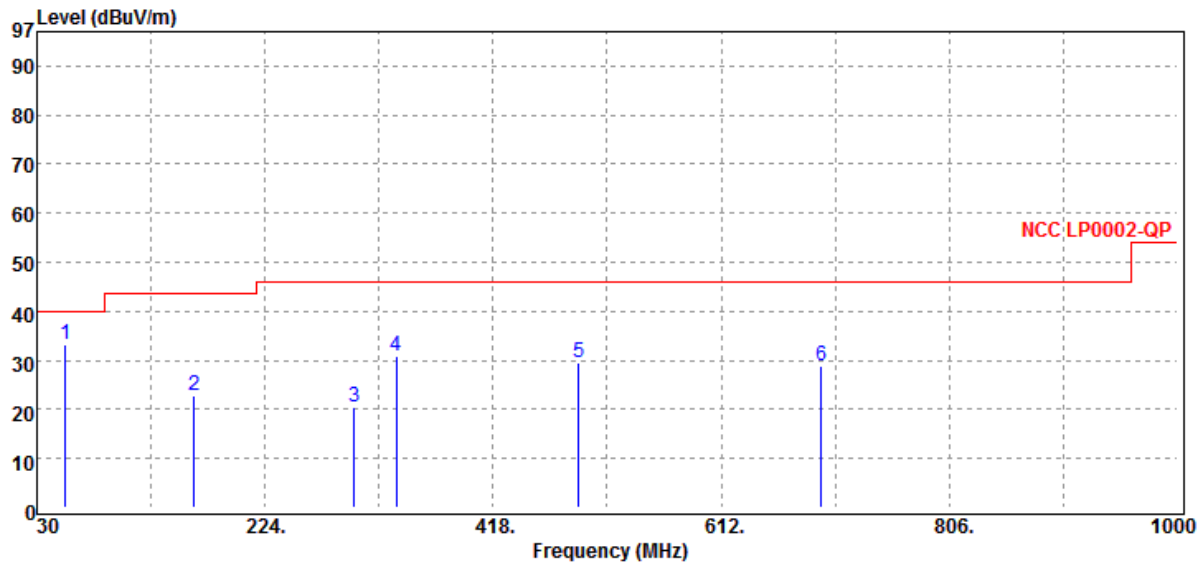
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Operation Band :BLE
Fundamental Frequency :2480 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
54.25	S	Peak	41.17	-7.82	33.35	40.00	-6.65
163.86	S	Peak	30.13	-7.45	22.68	43.50	-20.82
299.66	S	Peak	26.56	-5.93	20.63	46.00	-25.37
335.55	S	Peak	36.28	-5.32	30.96	46.00	-15.04
490.75	S	Peak	32.07	-2.53	29.54	46.00	-16.46
697.36	S	Peak	27.39	1.36	28.75	46.00	-17.25

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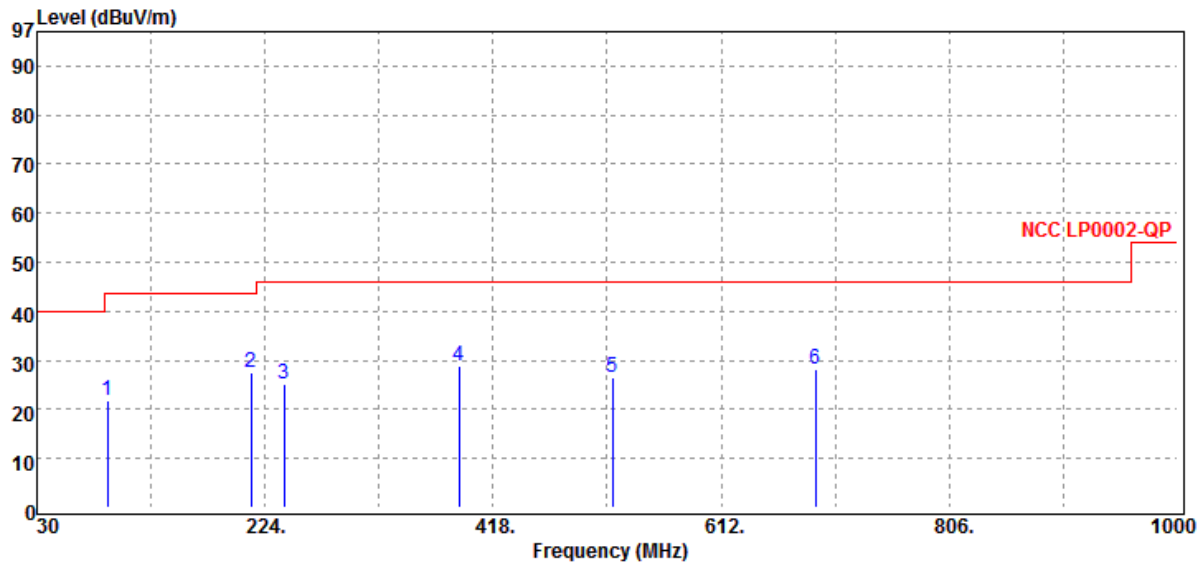
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Operation Band :BLE
Fundamental Frequency :2480 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
90.14	S	Peak	35.46	-13.73	21.73	43.50	-21.77
212.36	S	Peak	37.31	-9.65	27.66	43.50	-15.84
240.49	S	Peak	33.12	-8.04	25.08	46.00	-20.92
388.90	S	Peak	33.02	-4.29	28.73	46.00	-17.27
519.85	S	Peak	28.13	-1.62	26.51	46.00	-19.49
692.51	S	Peak	26.89	1.47	28.36	46.00	-17.64

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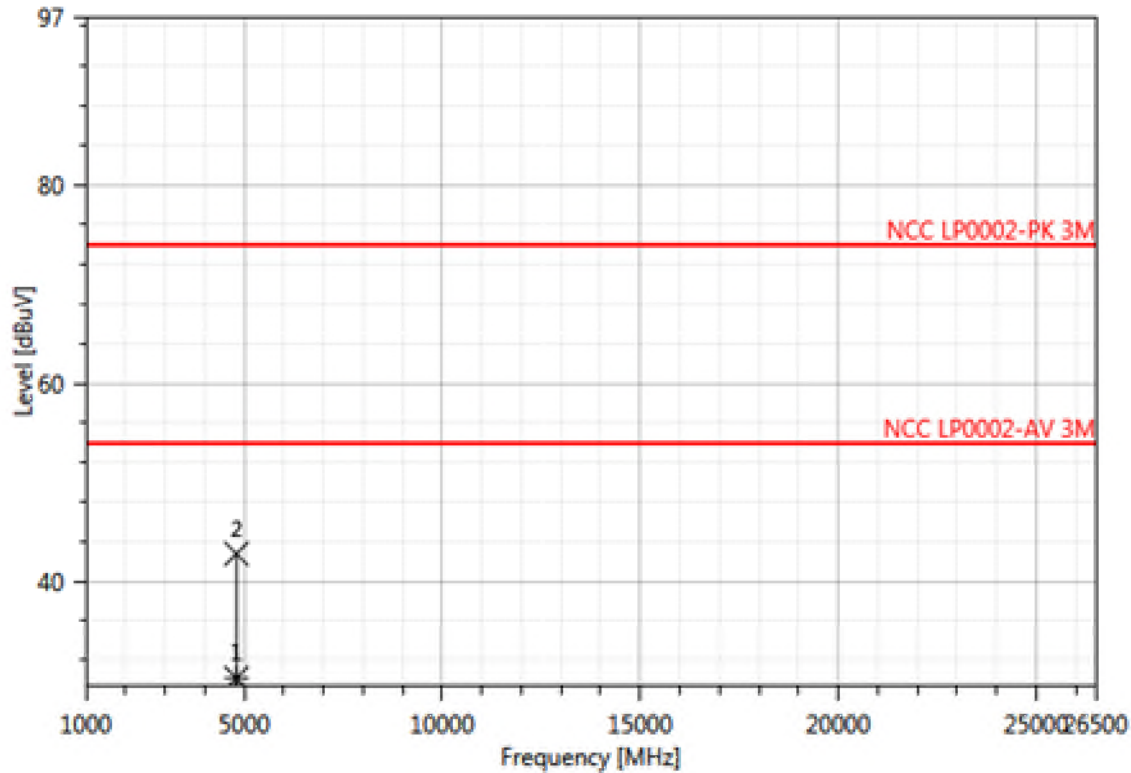
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6.5.3 發射機場強輻射之量測結果(1GHz 以上) (PCB Antenna)

Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2402 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH LOW	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
4804.00	H	Average	30.19	25.27	4.92	54.00	-23.81
4804.00	H	Peak	42.78	37.86	4.92	74.00	-31.22

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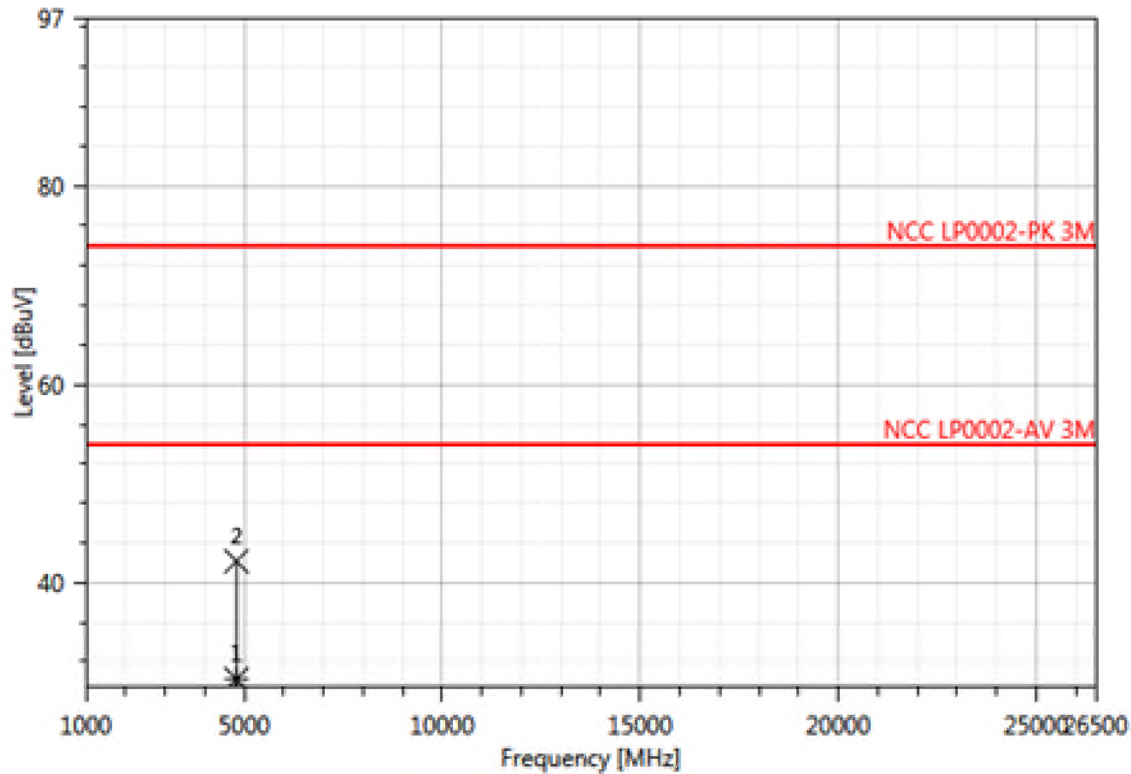
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Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2402 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH LOW	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
4804.00	H	Average	30.21	25.29	4.92	54.00	-23.79
4804.00	H	Peak	42.15	37.23	4.92	74.00	-31.85

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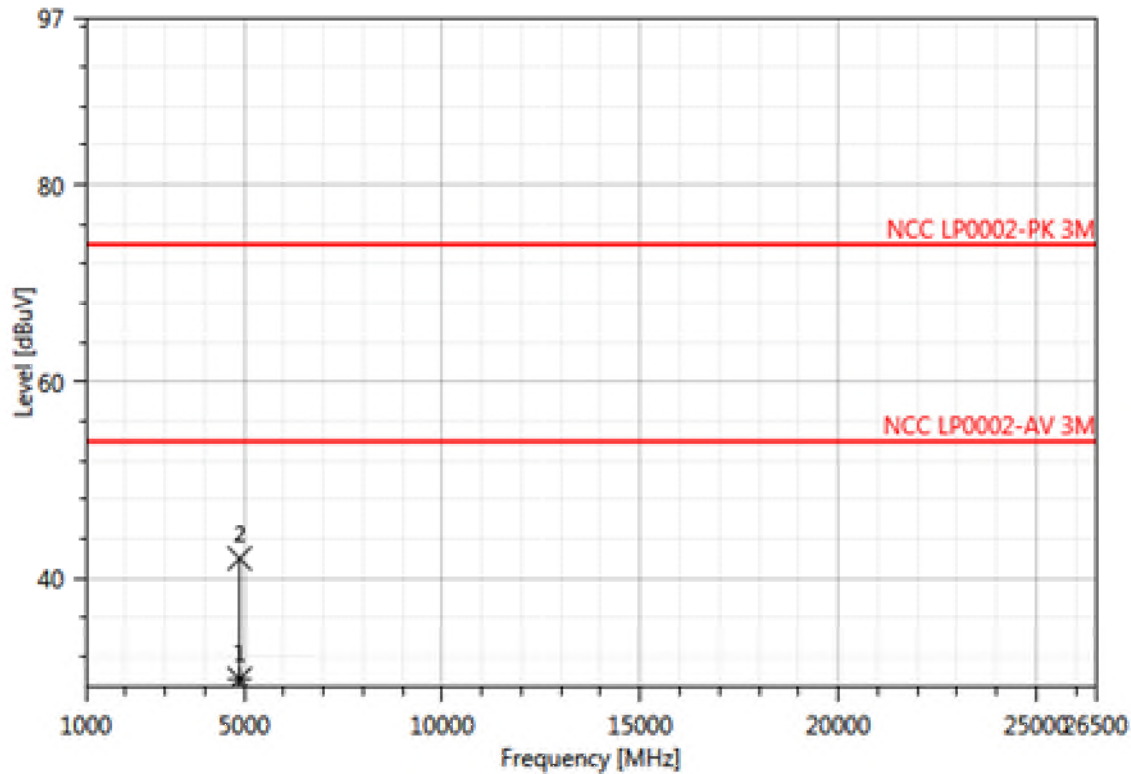
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Operation Mode : BLE
 Fundamental Frequency : 2442 MHz
 Operation Band : Tx CH MID
 EUT Pol. : E2 Plane
 Test Date : 08/12/2016
 Temp. / Humi. : 22 deg_C / 61 RH
 Test Engineer : Edward
 Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
4884.00	H	Average	29.75	24.56	5.19	54.00	-24.25
4884.00	H	Peak	42.05	36.86	5.19	74.00	-31.95

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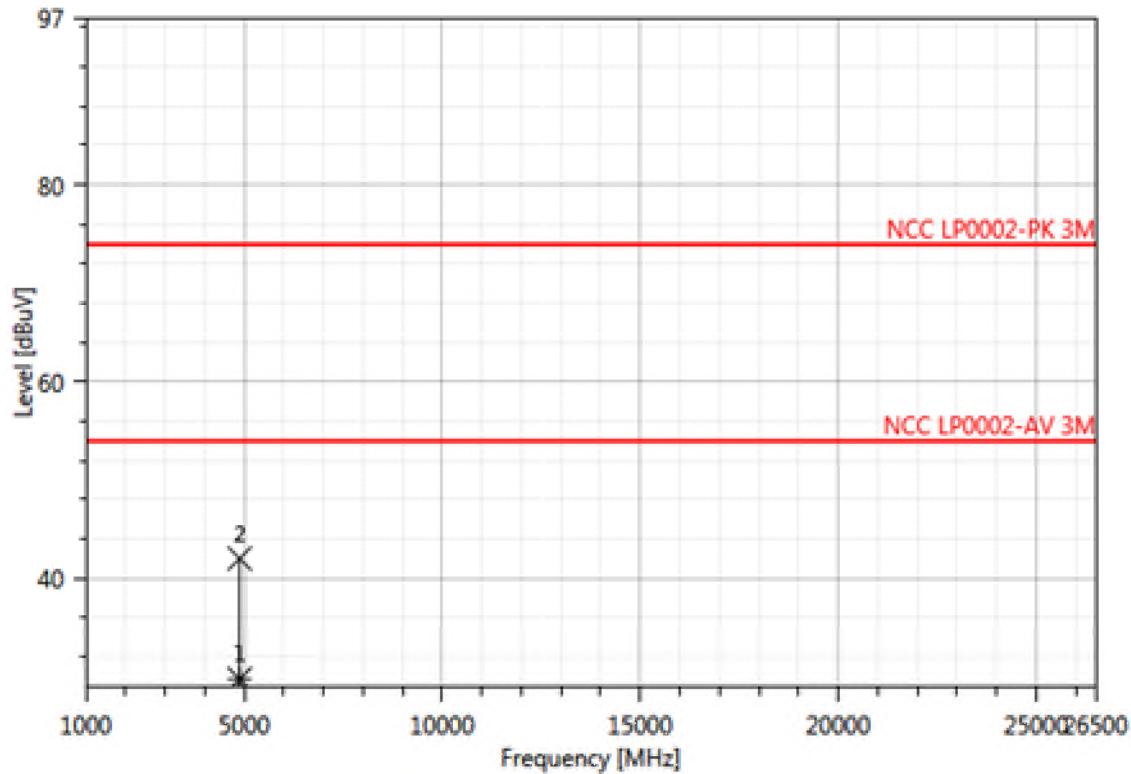
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Operation Mode : BLE
Fundamental Frequency : 2442 MHz
Operation Band : Tx CH MID
EUT Pol. : E2 Plane

Test Date : 08/12/2016
Temp. / Humi. : 22 deg_C / 61 RH
Test Engineer : Edward
Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
4884.00	H	Average	29.71	24.52	5.19	54.00	-24.29
4884.00	H	Peak	42.01	36.81	5.19	74.00	-31.99

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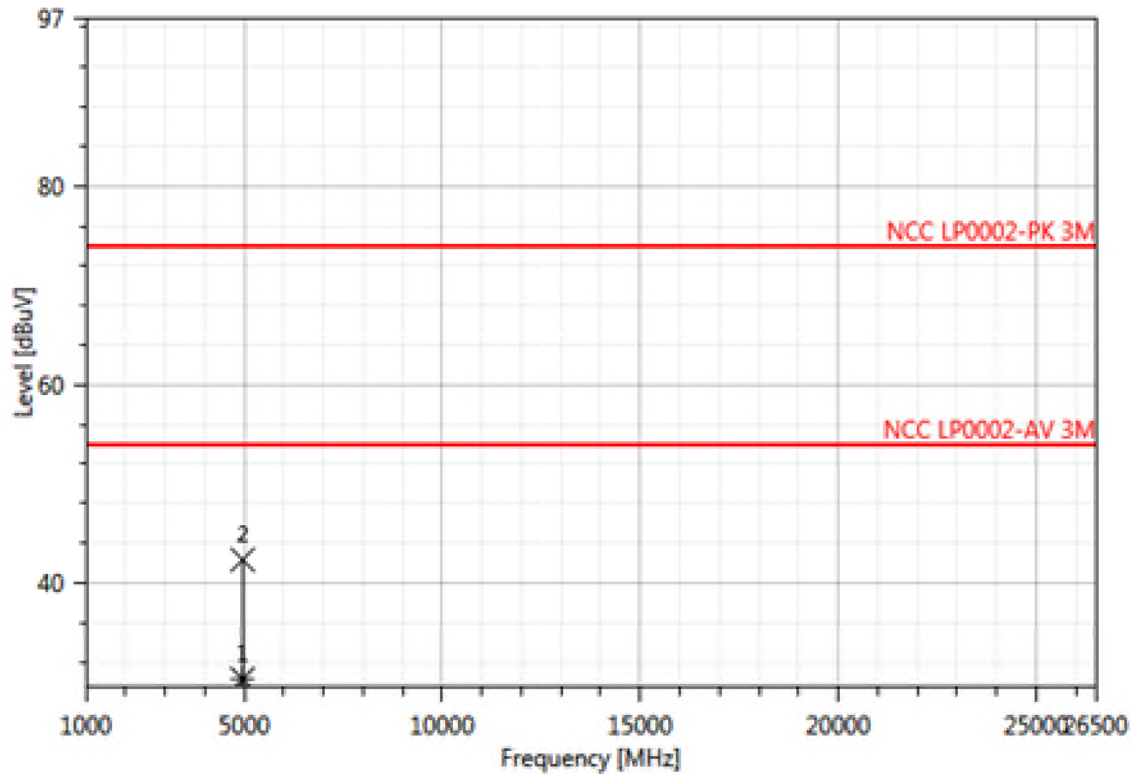
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Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2480 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH HIGH	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBμV/m	Spectrum FS dBμV/m	Factor dB	Limit @3m dBuV/m	Margin dB
4960.00	H	Average	30.26	24.97	5.29	54.00	-23.74
4960.00	H	Peak	42.33	37.04	5.29	74.00	-31.67

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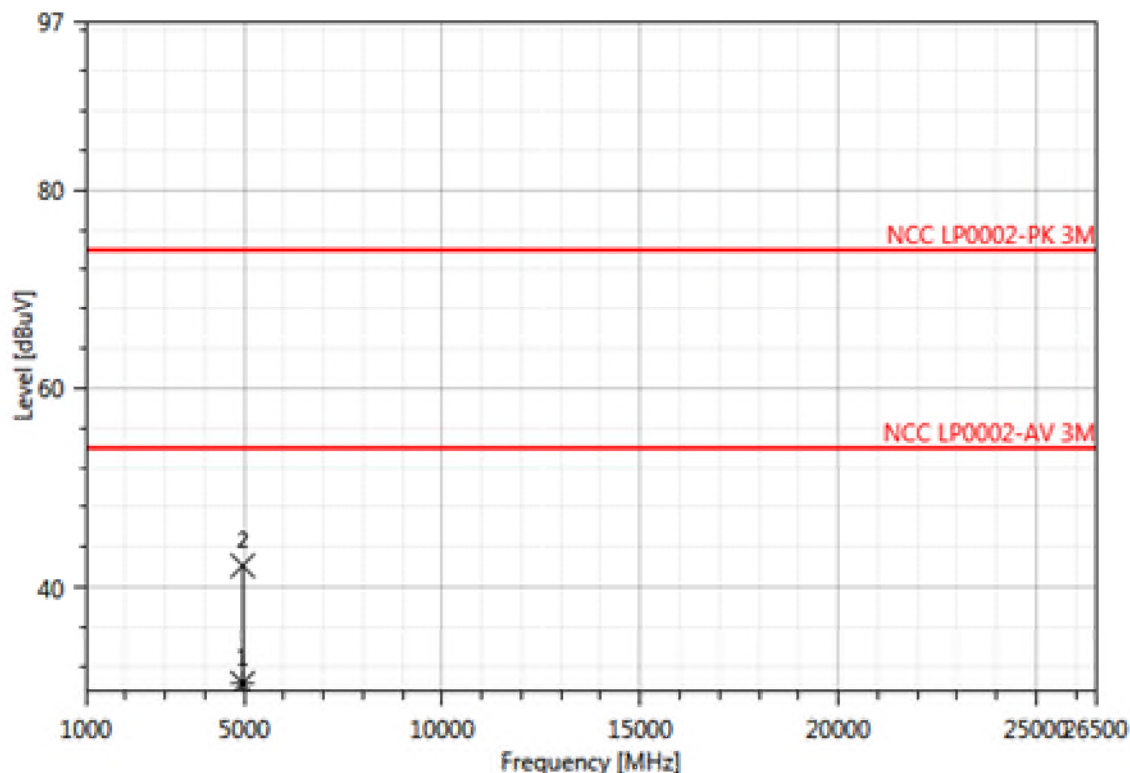
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Operation Mode :	BLE	Test Date :	08/12/2016
Fundamental Frequency :	2480 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Tx CH HIGH	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin
MHz	F/H/E/S	QP/AV/PK	dBμV/m	dBμV/m	dB	dBuV/m	dB
4960.00	H	Average	30.31	25.02	5.29	54.00	-23.69
4960.00	H	Peak	42.17	36.88	5.29	74.00	-31.83

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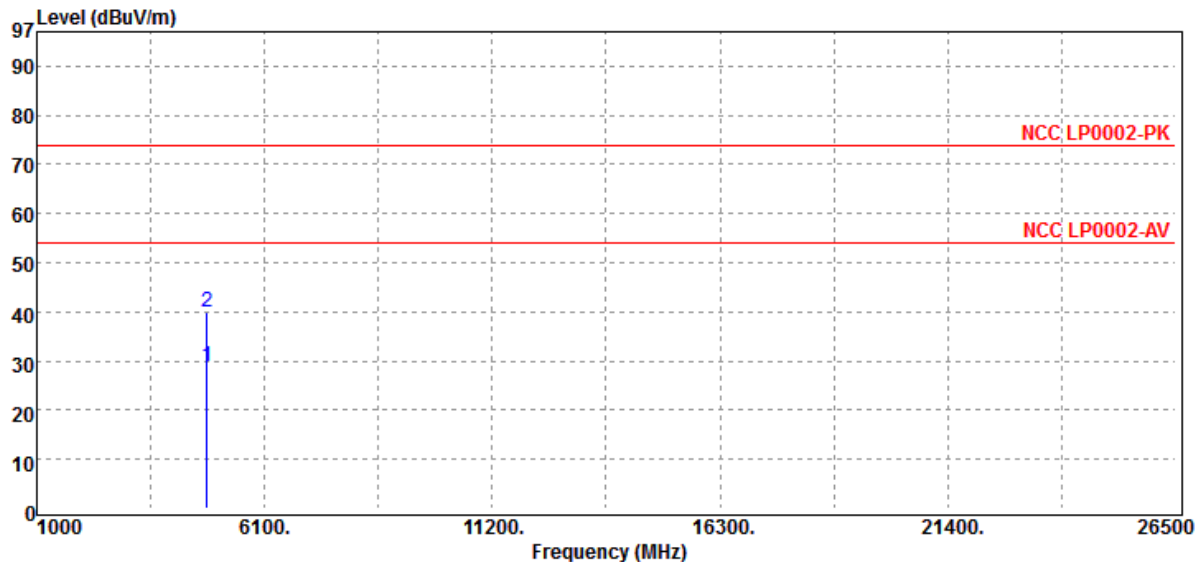
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6.5.4 發射機場強輻射之量測結果(1GHz 以上) (PIFA Antenna)

Operation Band	:BLE	Test Date	:2017-07-31
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
4804.00	H	Average	24.11	4.92	29.03	54.00	-24.97
4804.00	H	Peak	35.10	4.92	40.02	74.00	-33.98

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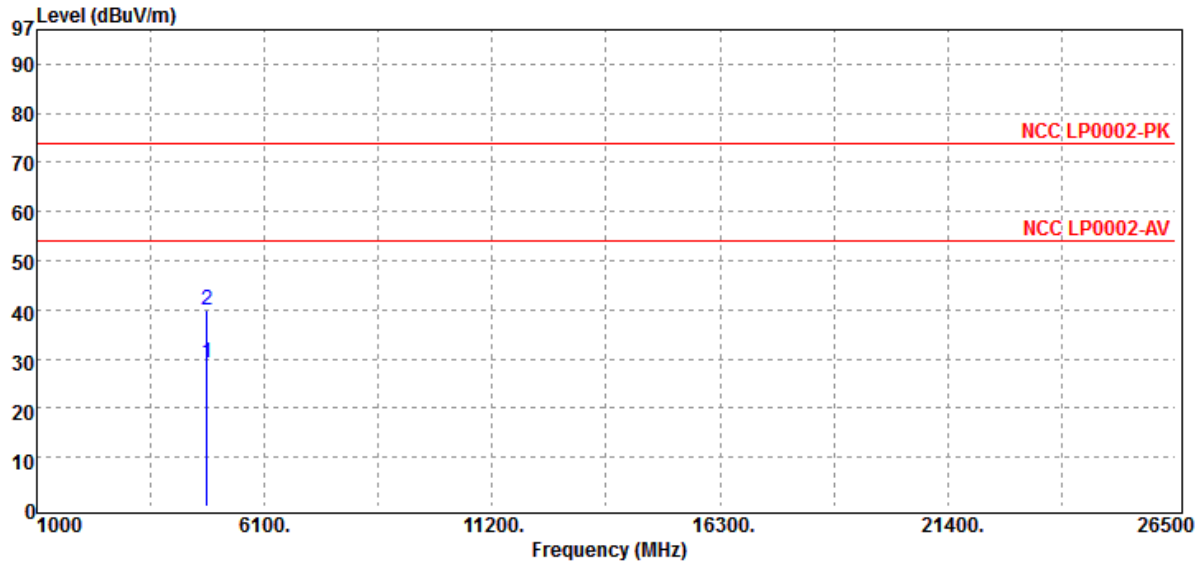
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Operation Band :BLE
Fundamental Frequency :2402 MHz
Operation Mode :Tx CH LOW
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
4804.00	H	Average	24.20	4.92	29.12	54.00	-24.88
4804.00	H	Peak	35.05	4.92	39.97	74.00	-34.03

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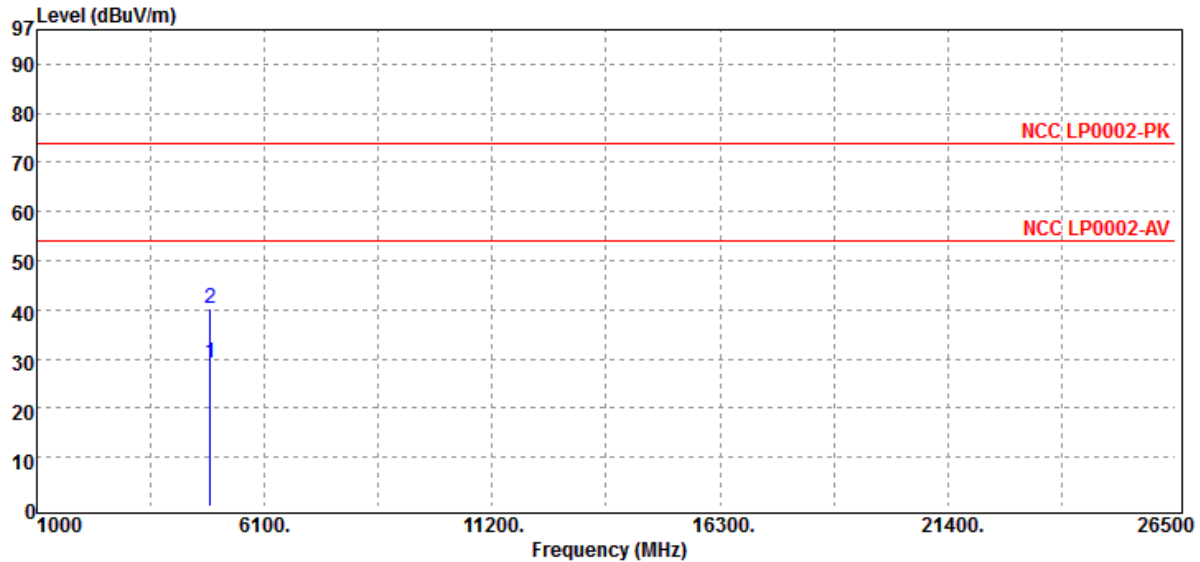
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Operation Band :BLE
Fundamental Frequency :2442 MHz
Operation Mode :Tx CH MID
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
4884.00	H	Average	24.08	5.20	29.28	54.00	-24.72
4884.00	H	Peak	35.02	5.20	40.22	74.00	-33.78

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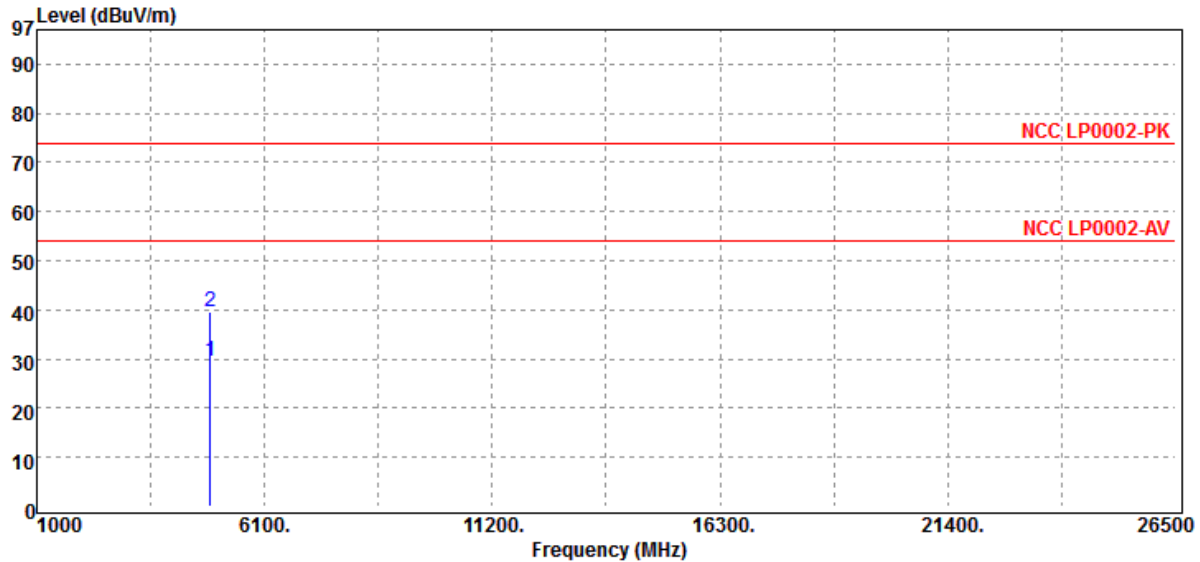
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Operation Band :BLE
Fundamental Frequency :2442 MHz
Operation Mode :Tx CH MID
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
4884.00	H	Average	24.17	5.20	29.37	54.00	-24.63
4884.00	H	Peak	34.54	5.20	39.74	74.00	-34.26

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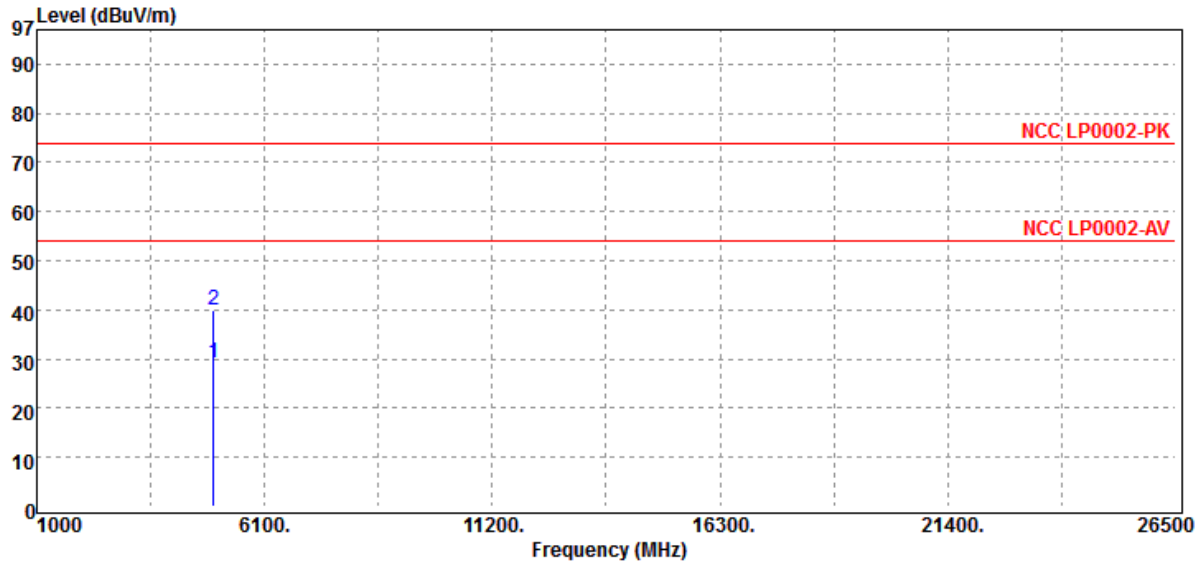
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Operation Band :BLE
Fundamental Frequency :2480 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
4960.00	H	Average	24.03	5.29	29.32	54.00	-24.68
4960.00	H	Peak	34.80	5.29	40.09	74.00	-33.91

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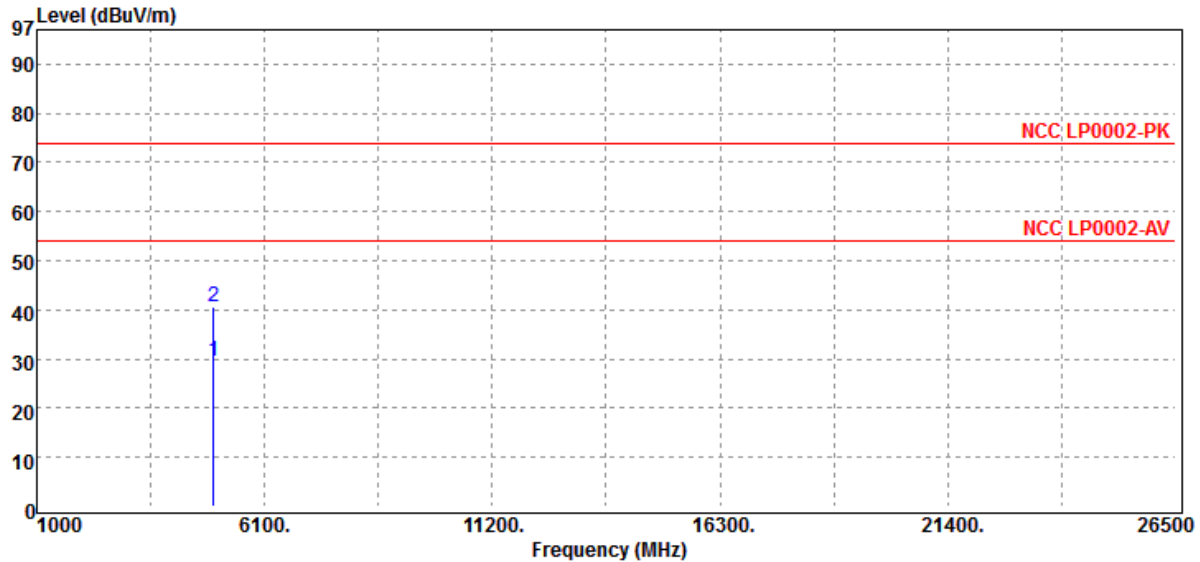
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Operation Band	:BLE	Test Date	:2017-07-31
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
4960.00	H	Average	24.24	5.29	29.53	54.00	-24.47
4960.00	H	Peak	35.48	5.29	40.77	74.00	-33.23

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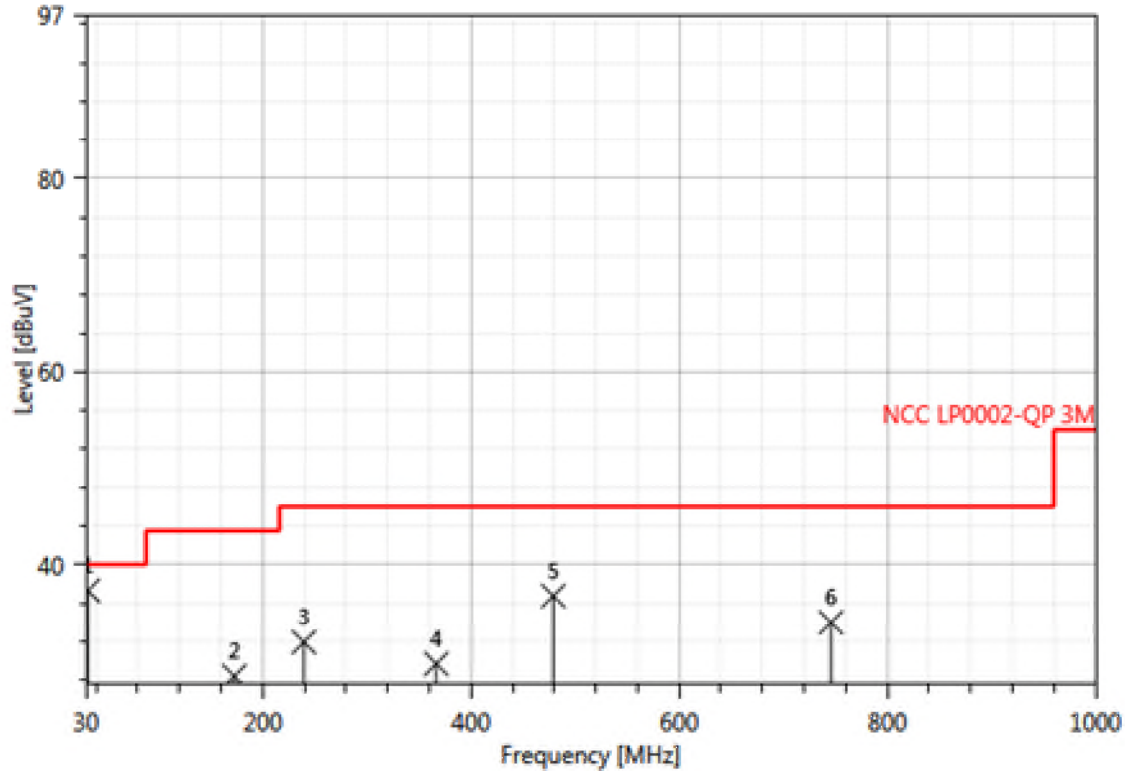
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6.5.5 接收機場強輻射之量測結果(1GHz 以下) (最差模式) (PCB Antenna)

Operation Mode : BLE Test Date : 08/13/2016
Fundamental Frequency : 2442 MHz Temp. / Humi. : 22 deg_C / 61 RH
Operation Band : Rx CH MID Test Engineer : Edward
EUT Pol. : E2 Plane Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
31.94	S	Peak	37.30	46.41	-9.11	40.00	-2.70
172.59	S	Peak	28.40	36.26	-7.86	43.50	-15.10
239.52	S	Peak	31.92	40.03	-8.12	46.00	-14.08
366.59	S	Peak	29.67	34.39	-4.72	46.00	-16.33
479.11	S	Peak	36.74	39.13	-2.39	46.00	-9.26
745.86	S	Peak	33.98	31.68	2.30	46.00	-12.02

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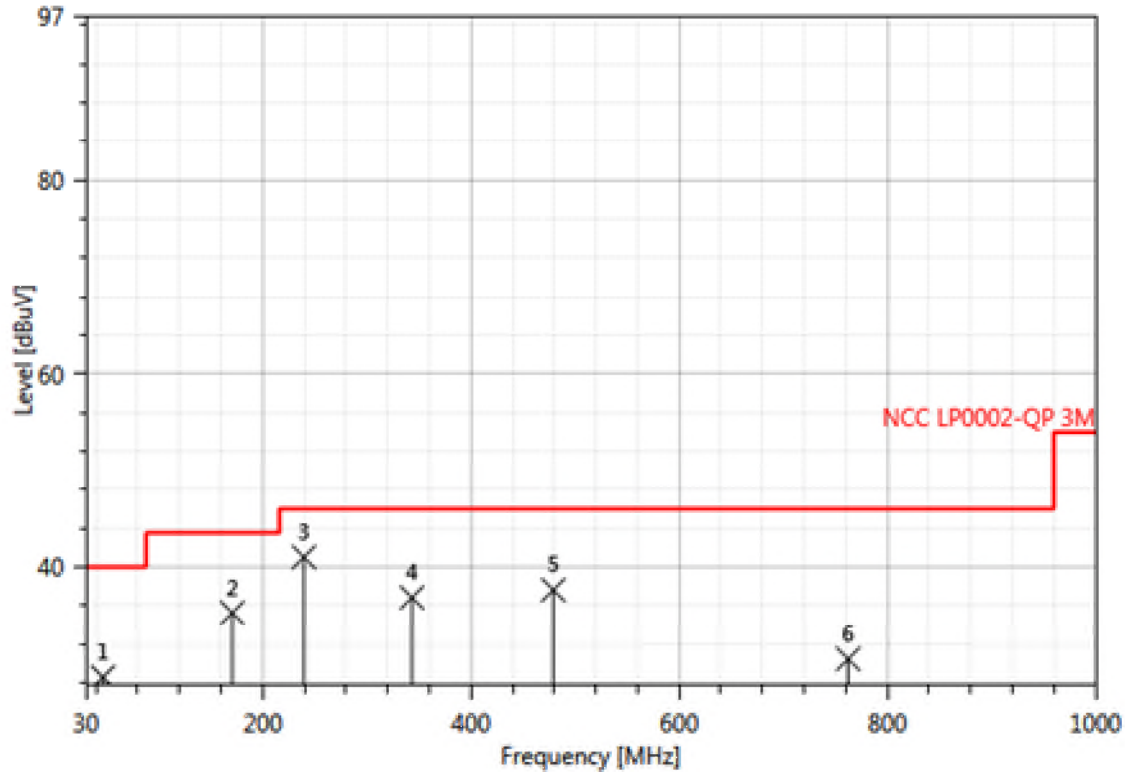
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Operation Mode :	BLE	Test Date :	08/13/2016
Fundamental Frequency :	2442 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Rx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS		@3m	
		QP/AV/PK	dBuV/m	dBuV/m	dB	dBuV/m	dB
46.49	S	Peak	28.57	36.47	-7.91	40.00	-11.43
170.65	S	Peak	35.25	42.91	-7.66	43.50	-8.25
239.52	S	Peak	41.01	49.12	-8.12	46.00	-4.99
343.31	S	Peak	36.83	41.95	-5.12	46.00	-9.17
479.11	S	Peak	37.61	40.00	-2.39	46.00	-8.39
762.35	S	Peak	30.45	27.56	2.89	46.00	-15.55

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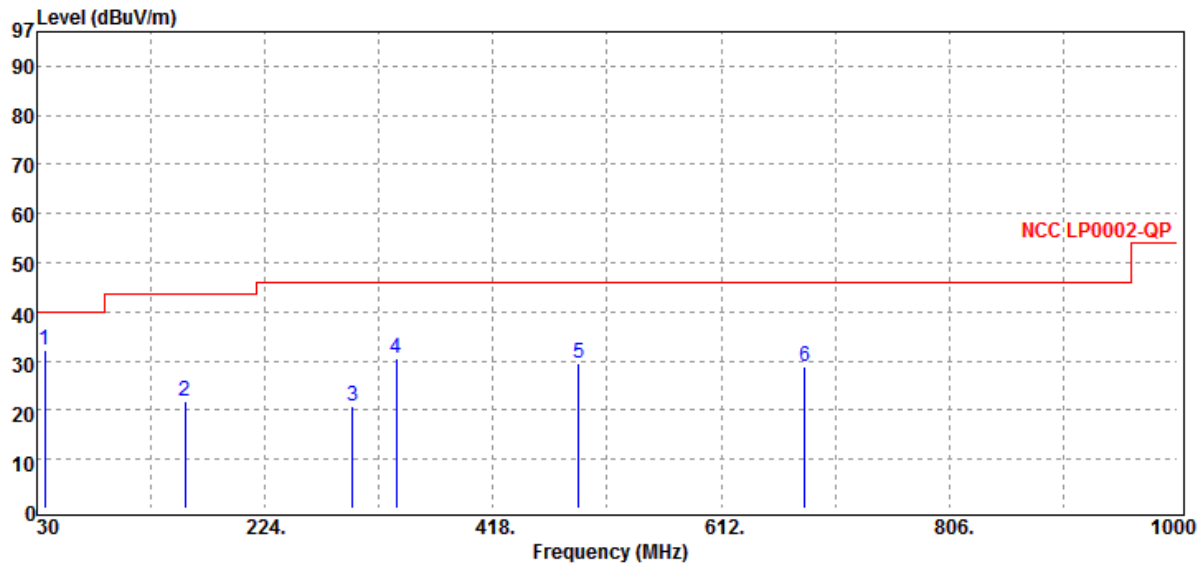
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6.5.6 接收機場強輻射之量測結果(1GHz 以下) (最差模式) (PIFA Antenna)

Operation Band	:BLE	Test Date	:2017-07-31
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Rx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
36.79	S	Peak	41.15	-8.84	32.31	40.00	-7.69
156.10	S	Peak	29.50	-7.61	21.89	43.50	-21.61
298.69	S	Peak	26.71	-5.95	20.76	46.00	-25.24
335.55	S	Peak	35.97	-5.32	30.65	46.00	-15.35
490.75	S	Peak	32.20	-2.53	29.67	46.00	-16.33
682.81	S	Peak	27.77	1.10	28.87	46.00	-17.13

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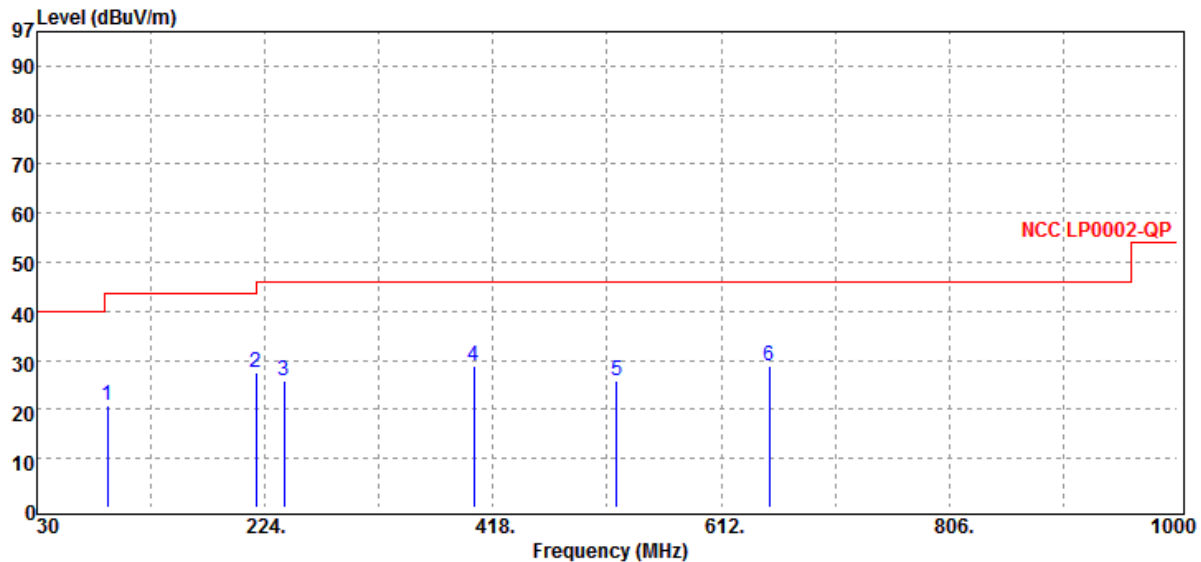
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Operation Band :BLE
Fundamental Frequency :2442 MHz
Operation Mode :Rx CH MID
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
90.14	S	Peak	34.40	-13.73	20.67	43.50	-22.83
216.24	S	Peak	37.03	-9.43	27.60	46.00	-18.40
240.49	S	Peak	33.96	-8.04	25.92	46.00	-20.08
401.51	S	Peak	32.79	-3.95	28.84	46.00	-17.16
522.76	S	Peak	27.48	-1.66	25.82	46.00	-20.18
652.74	S	Peak	28.27	0.53	28.80	46.00	-17.20

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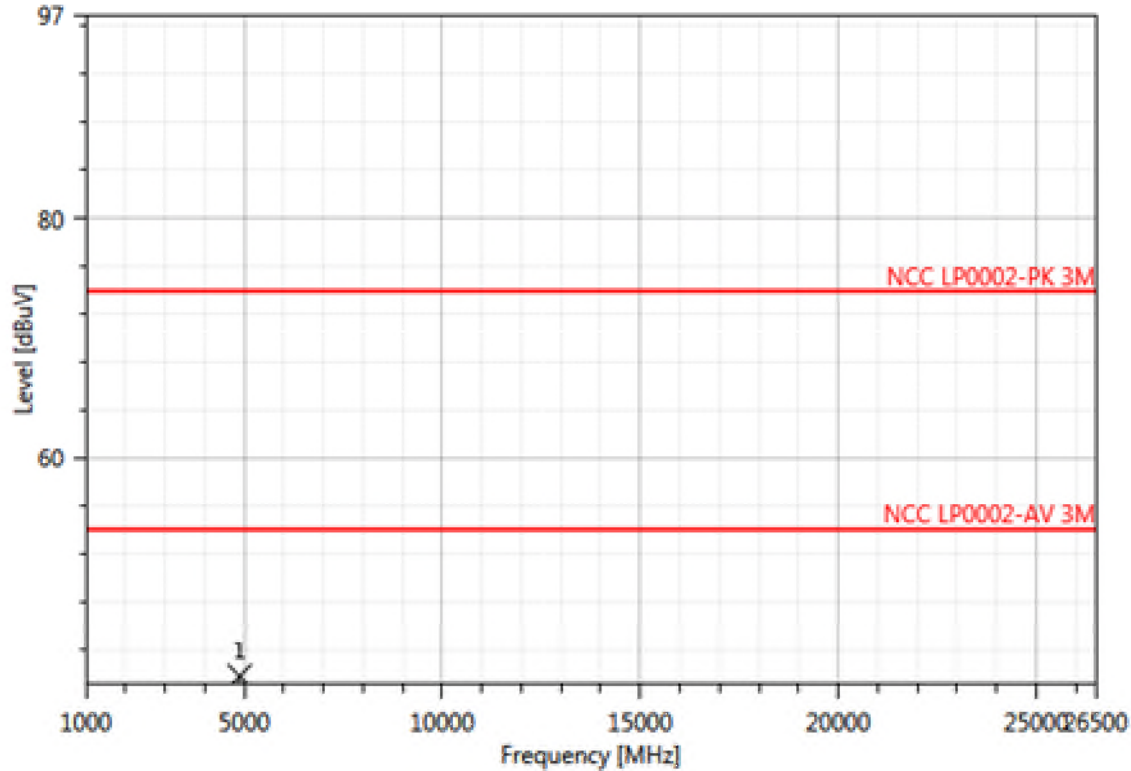
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6.5.7 接收模式場強輻射之量測結果(1GHz 以上) (最差模式) (PCB Antenna)

Operation Mode :	BLE	Test Date :	08/13/2016
Fundamental Frequency :	2442 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Rx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS	dB	@3m	dB
		QP/AV/PK	dBμV/m	dBμV/m		dBuV/m	
4884.00	H	Peak	41.74	36.55	5.19	74.00	-32.26

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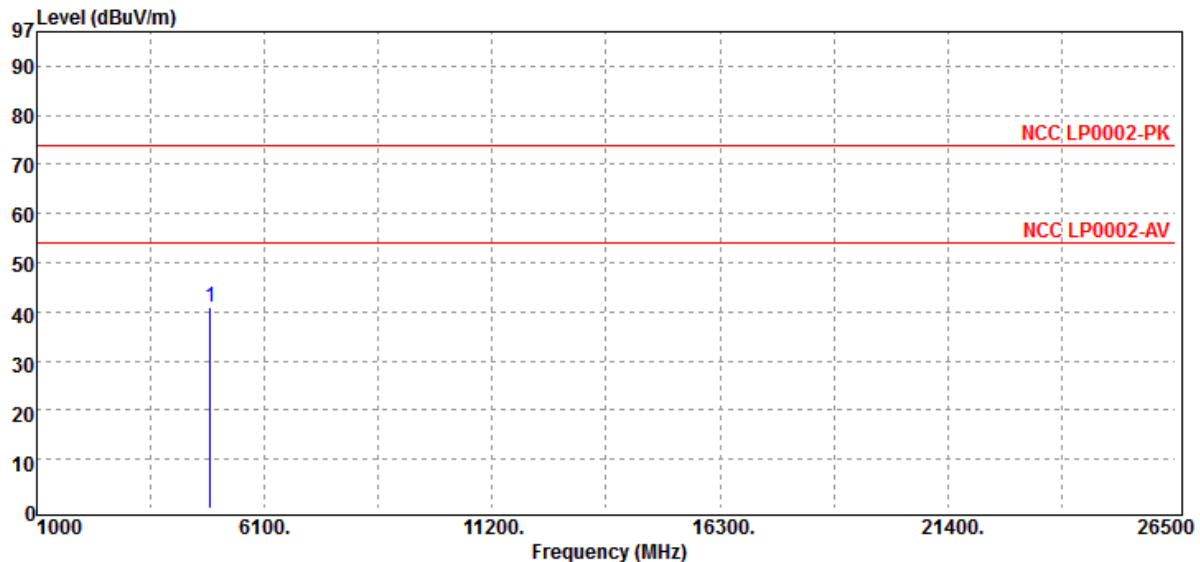
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6.5.8 接收模式場強輻射之量測結果(1GHz 以上) (最差模式) (PIFA Antenna)

Operation Band	:BLE	Test Date	:2017-07-31
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Rx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
4884.00	H	Peak	35.66	5.20	40.86	74.00	-33.14

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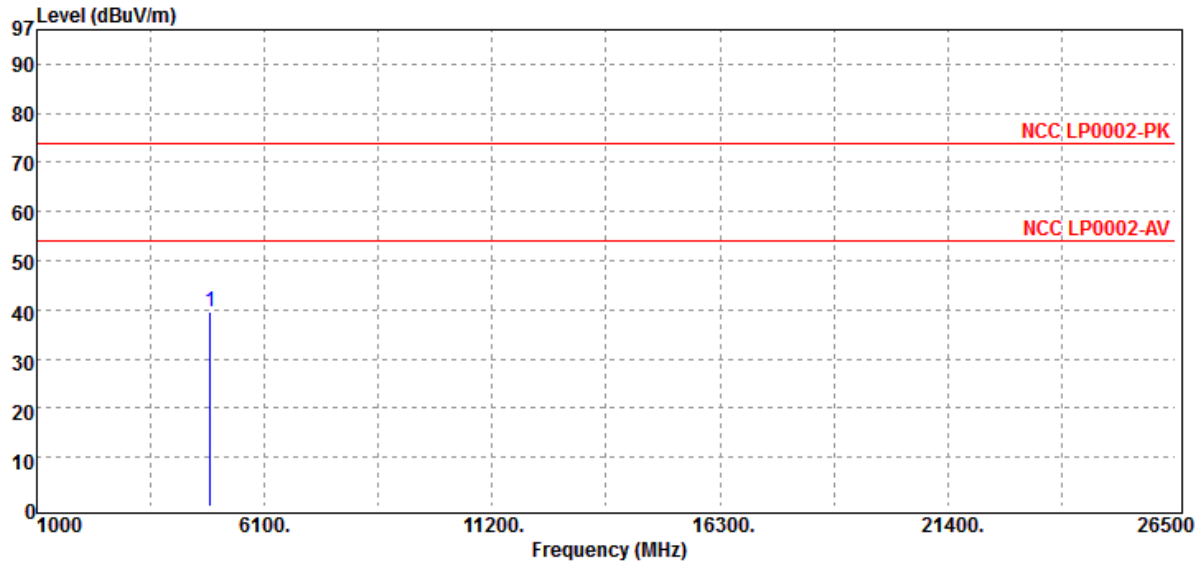
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Operation Band :BLE
Fundamental Frequency :2442 MHz
Operation Mode :Rx CH MID
EUT Pol. :H Plane

Test Date :2017-07-31
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
4884.00	H	Peak	34.32	5.20	39.52	74.00	-34.48

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7 天線增益之要求

7.1 適用標準

依據NCC低功率射頻電機技術規範3.10.1.3 (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低功率射頻電機技術規範3.10.1.3 (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低功率射頻電機技術規範3.10.1.3 (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。

7.2 天線增益

此裝置使用天線如下，詳細規格請參考附件天線規格書。

天線型式/天線增益	PCB Antenna, Supplier: Hon Hai Precision Industry Co., Ltd. 1. Antenna: Model No.: WA-P-LA-03-242, Gain: 3.11dBi 2. Antenna: Model No.: WA-P-LA-03-243, Gain: 2.85dBi 3. Antenna: Model No.: WA-P-LA-03-244, Gain: 2.48dBi
	PIFA Antenna, Supplier: Hon Hai Precision Industry Co., Ltd. 1. Antenna: Model No.: W-M-D-B-N-2-0100, Gain: 3.82dBi 2. Antenna: Model No.: W-M-D-B-N-2-0260, Gain: 3.42dBi

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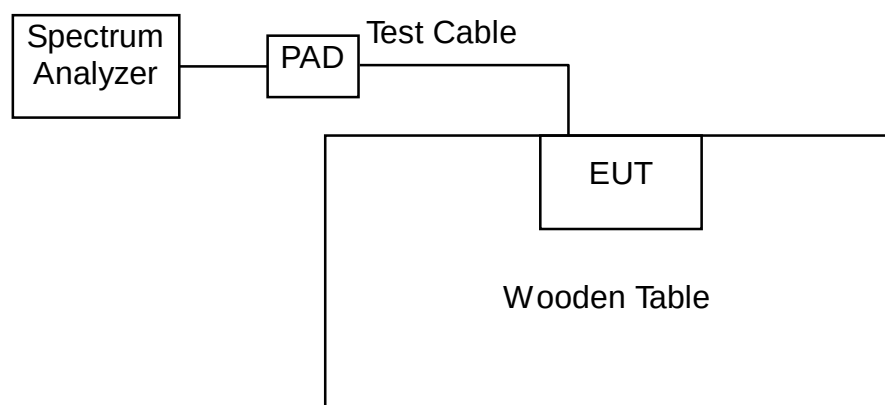
8 發射頻寬之要求

8.1 適用標準

對使用數位調變技術之低功率發射機，依據 NCC 低功率射頻電機技術規範 3.10.1.6(2) (A) 之規定，6dB 之頻寬至少應有 500kHz。

8.2 測試配置

圖 4: 發射頻寬之測試配置



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8.3 量測結果

測試設備: 2x2 dual-band IEEE 802.11 a/b/g/n/ac 型號: WBU034-EA
and BT4.2 Combo Module

解析頻寬: 100 kHz 視訊頻寬: 300 kHz

Span: 5MHz

測試者:

林有廷

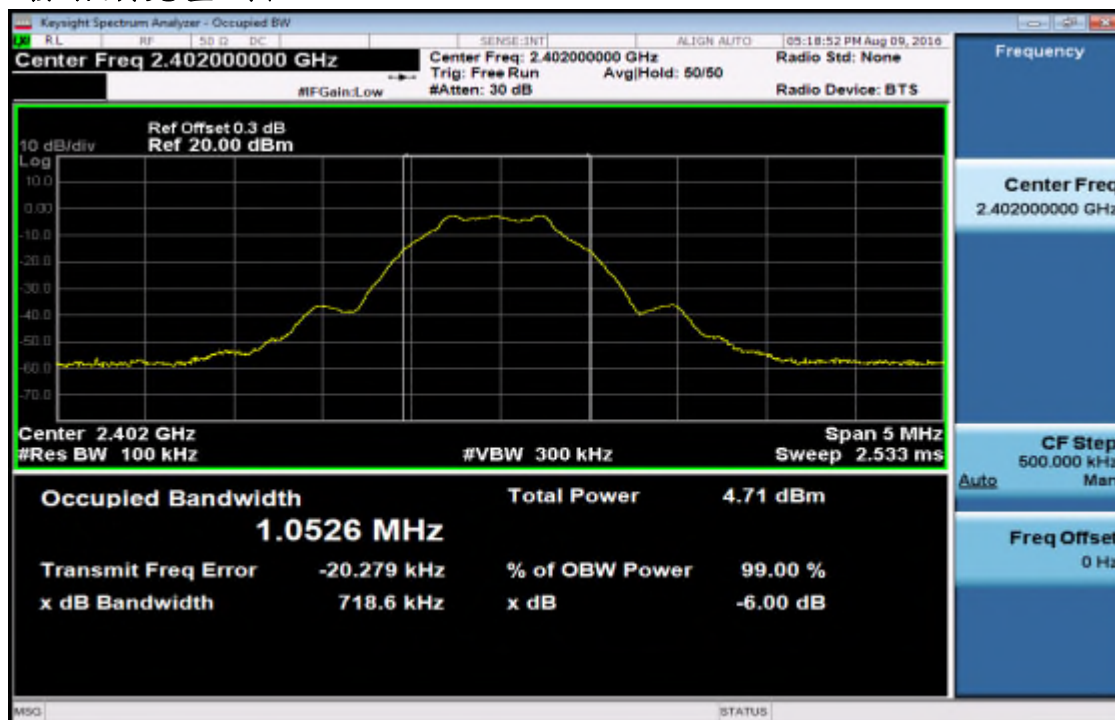
BLE

頻率 (MHz)	頻寬讀值 (kHz)	限制值 (kHz)	結果
2402	718.56	> 500	PASS
2442	721.4	> 500	PASS
2480	722.11	> 500	PASS

* offset 0.3dB

Test Data Plot

CH Low 發射頻寬量測值



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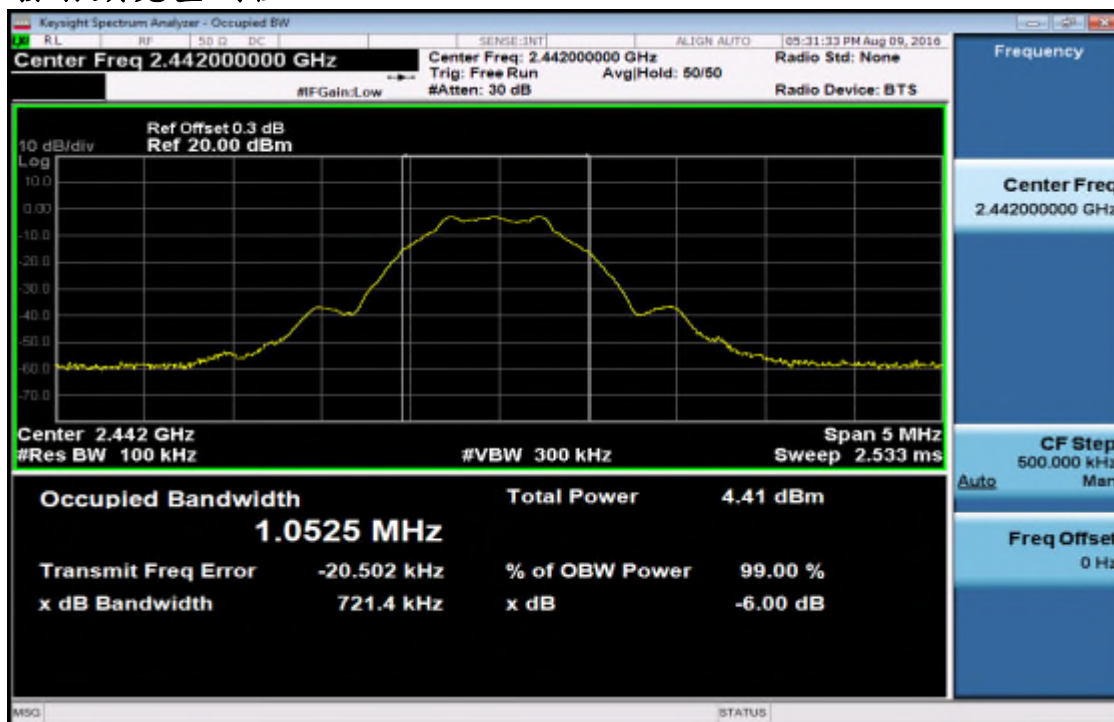
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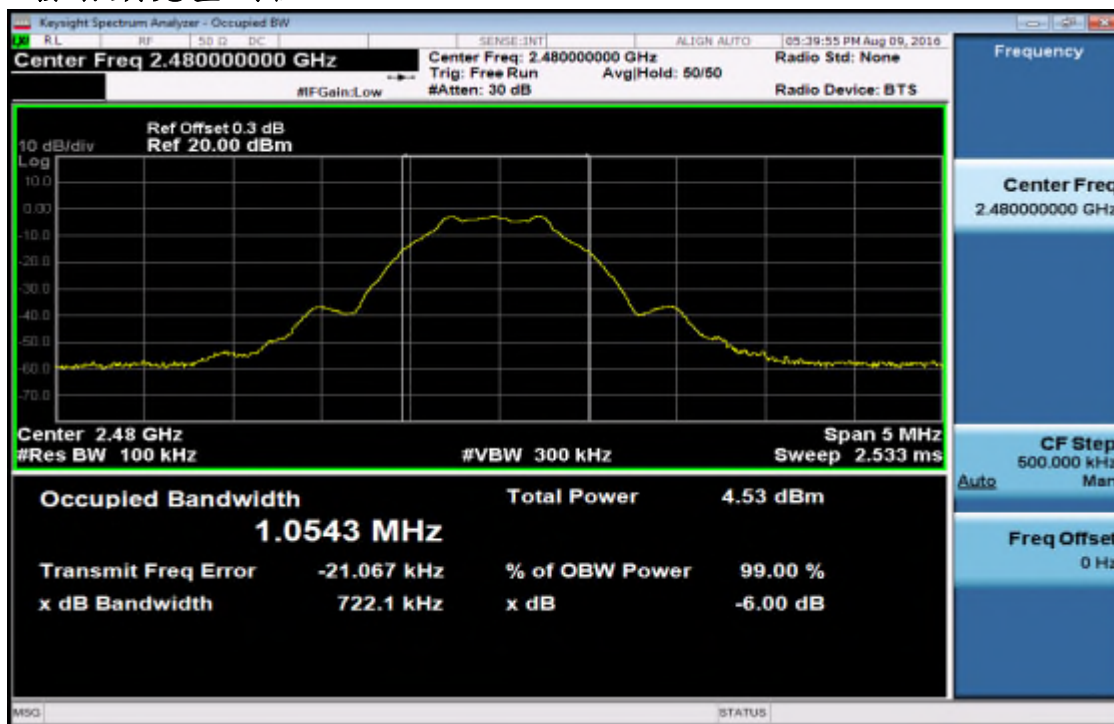
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CH Mid 發射頻寬量測值



CH High 發射頻寬量測值



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9 輸出峰值功率之量測

9.1 適用標準

依據 NCC 低功率射頻電機技術規範 3.10.1.2(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低功率射頻電機技術規範3.10.1.3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：

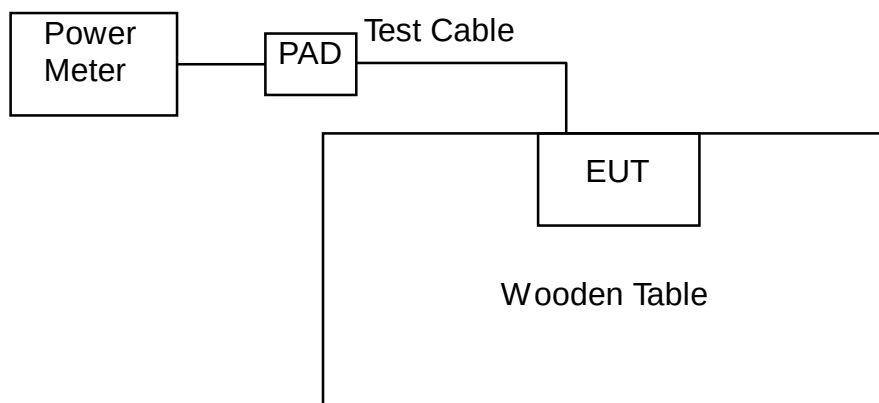
依據NCC低功率射頻電機技術規範3.10.1.3 (1)之規定，操作於2400-2483.5MHz 者，僅用於固定式點對點操作，其發射天線之方向性增益超過 6dBi，每超過3dB應降低1dB之峰值輸出功率。

依據NCC低功率射頻電機技術規範3.10.1.3 (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低功率射頻電機技術規範3.10.1.3 (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 輸出功率之測試配置



*註：此產品為點對多點操作

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9.3 輸出功率之量測結果

測試設備: 2x2 dual-band IEEE 802.11 a/b/g/n/ac and
BT4.2 Combo Module

型號: WBU034-EA

測試日期: Aug. 09, 2016

測試者: 柯有廷

BT4.0

Frequency (MHz)	Reading Power	Output Power (W)	Limit (W)
2402.00	-1.38	0.00073	1
2442.00	-1.19	0.00076	1
2480.00	-0.95	0.00080	1
Cable loss	0.3 dB		

*Note: 由 Power Meter 量測。

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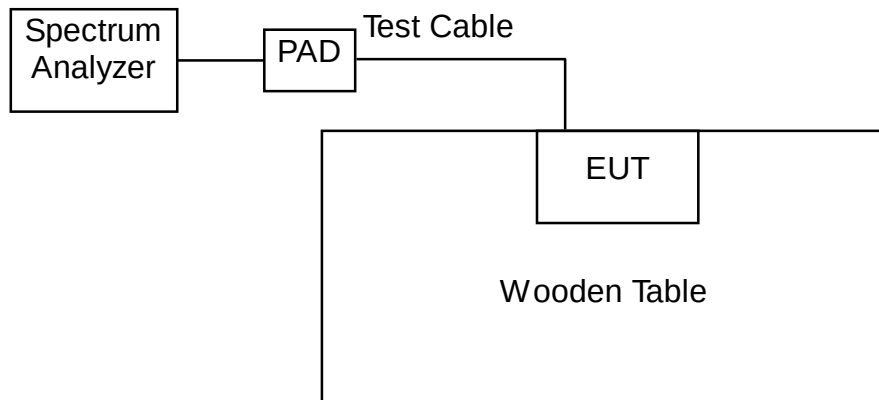
10 開放頻帶邊緣 100KHZ 頻寬內之限制

10.1 適用標準

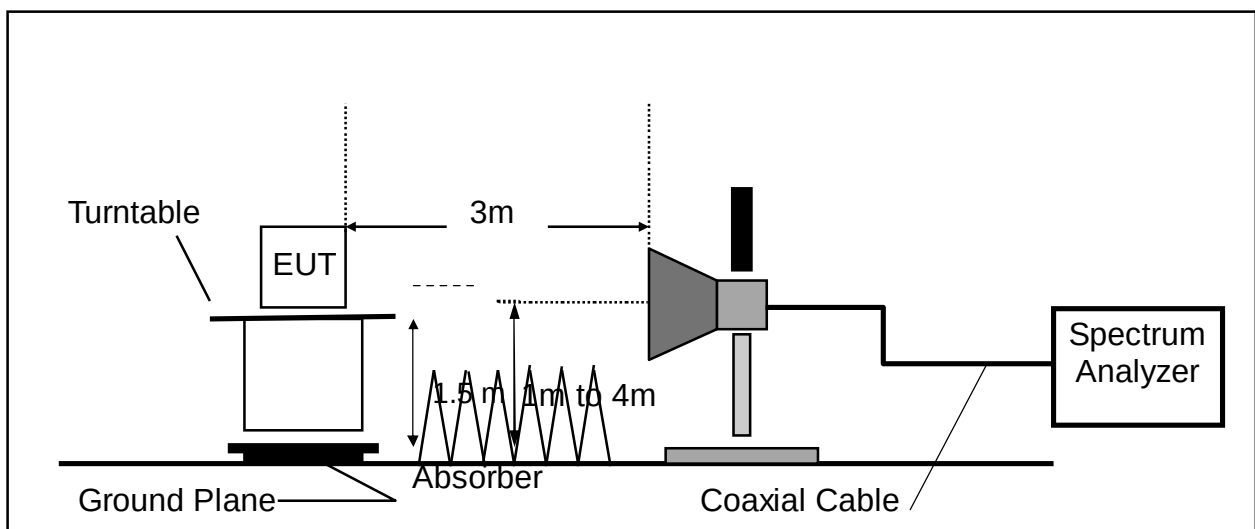
依據 NCC 低功率射頻電機技術規範 3.10.1.5 之規定，使用頻帶範圍外之任意 100kHz 內，發射器所產生的射頻功率相較於使用頻帶範圍中包含最高所需功率之 100kHz 內的射頻功率，須衰減 20 分貝 (dB)，以射頻傳導或輻射方式測量。此外，落於第 2.7 節禁用頻段之輻射發射，應符合第 2.8 節之規定。

10.2 開放頻帶邊緣之測試配置

(a) 傳導量測配置圖:



(b) 輻射量測配置圖:



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10.3 開放頻帶邊緣之量測結果

測試設備: 2x2 dual-band IEEE 802.11 a/b/g/n/ac and
BT4.2 Combo Module

解析頻寬: 100 kHz

Span: Low: 100MHz / High: 25MHz

型號: WBU034-EA

視訊頻寬: 300 kHz

測試者:

林有廷

1. 頻帶外發射傳導量測值

發射限制測試值 CH Low (下邊緣頻帶): 在 2400.00MHz 之 100kHz 頻寬內最大值皆比主波低 20dB 以上。

發射限制測試值 CH High(上邊緣頻帶): 在 2483.50MHz 之 100kHz 頻寬內最大值皆比主波低 20dB 以上。

$Actual\ FS(dB\mu V/m) = SPA.\ Reading\ level(dB\mu V) + Factor(dB)$

$Factor(dB) = Antenna\ Factor(dB\mu V/m) + Cable\ Loss(dB) - Pre_Amplifier\ Gain(dB)$

“F”: denotes Fundamental Frequency. ; “H”: denotes Harmonic Frequency.

“E”: denotes Band Edge Frequency. ; “S”: denotes Spurious Frequency.

“---”: denotes Noise Floor.

請參考附圖。

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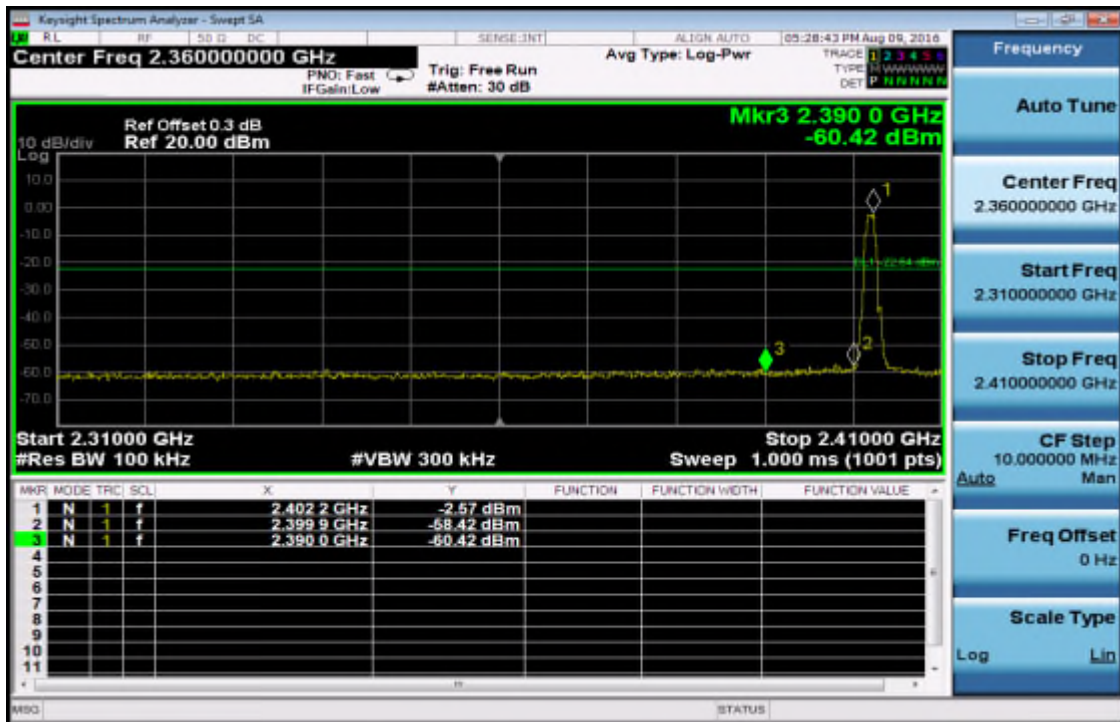
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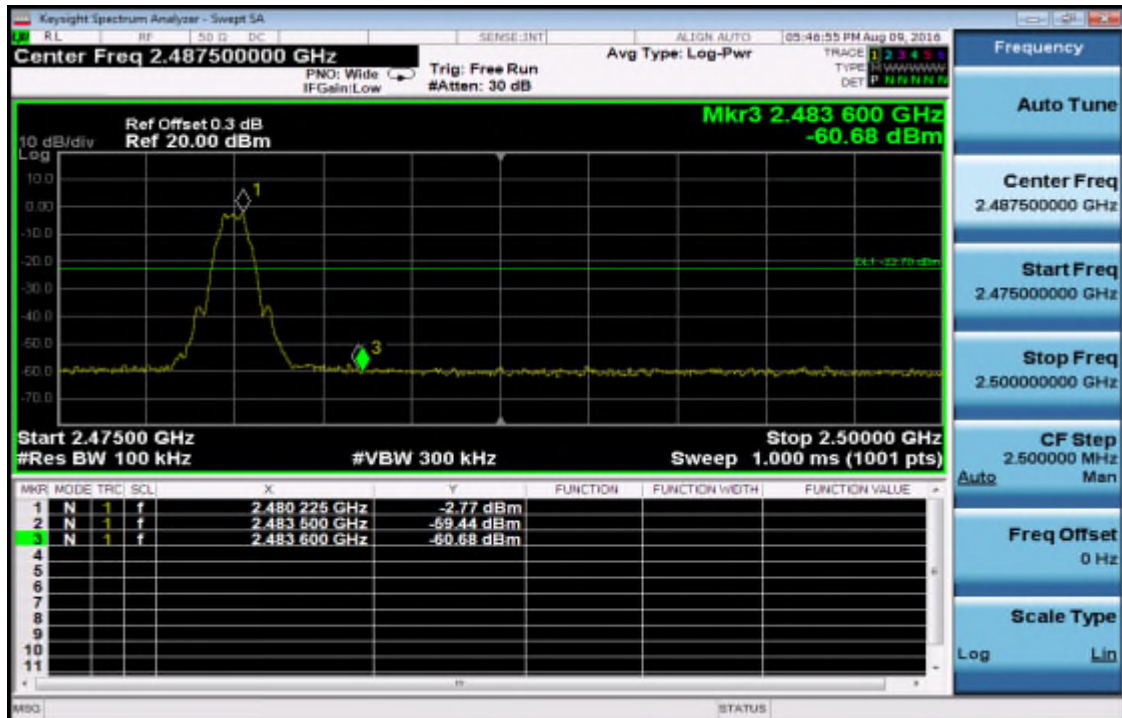
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禁用頻帶及邊際頻帶傳導測試

CH Low



CH High



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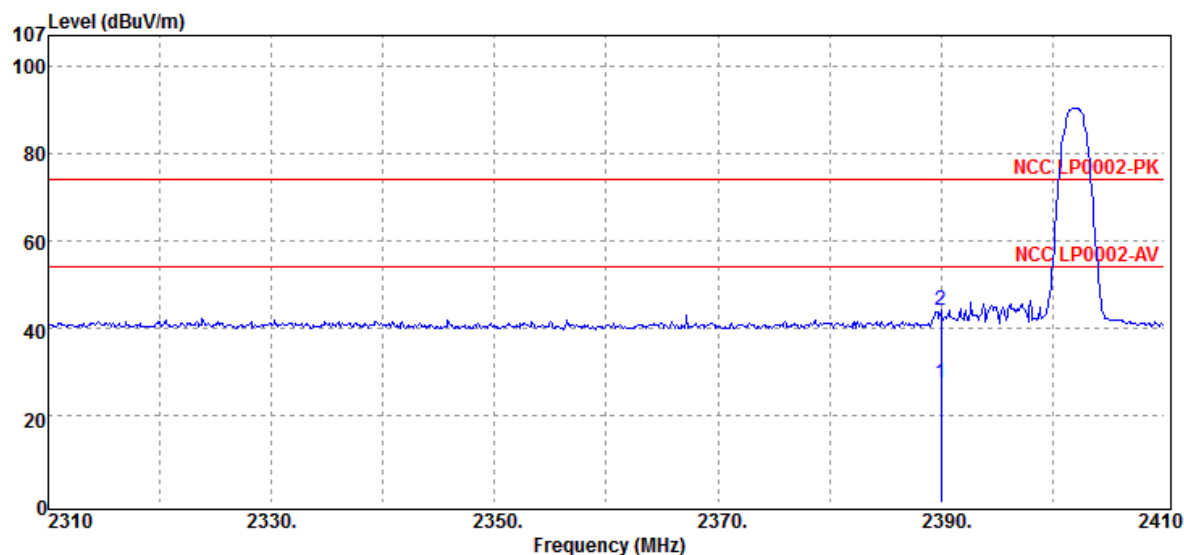
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2. 禁用頻帶輻射量測值

Channel Low (PCB Antenna)

Operation Mode :	BLE	Test Date :	08/05/2016
Fundamental Frequency :	2402 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Bandedge CH LOW	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin
MHz	F/H/E/S	QP/AV/PK	dBuV/m	dBuV/m	dB	dBuV/m	dB
2390.00	E	Average	27.54	29.28	-1.74	54.00	-26.46
2390.00	E	Peak	44.15	45.89	-1.74	74.00	-29.85

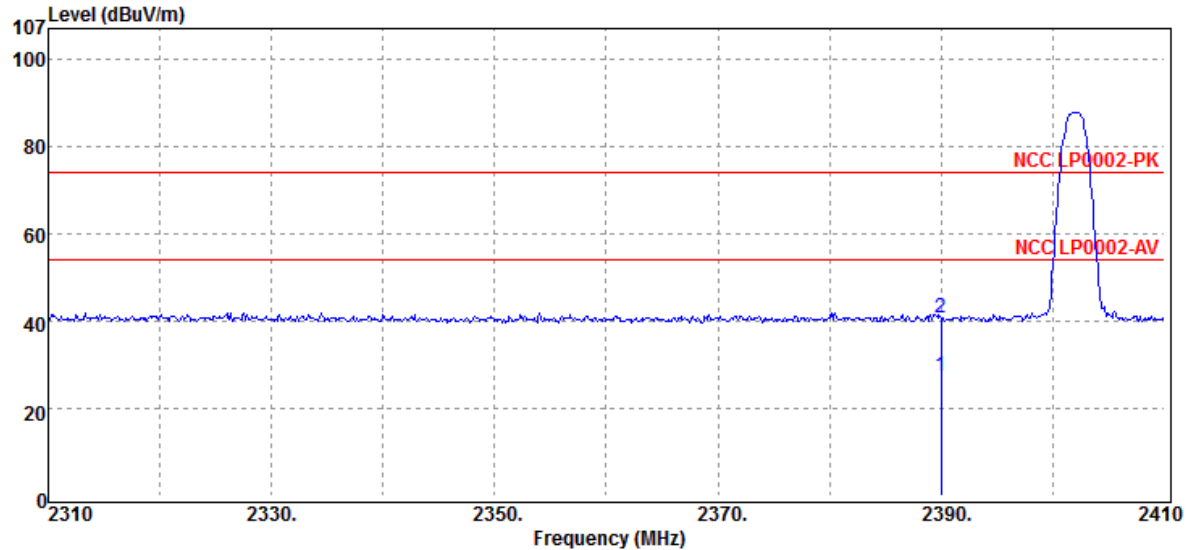
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Operation Mode : BLE Test Date : 08/05/2016
 Fundamental Frequency : 2402 MHz Temp. / Humi. : 22 deg_C / 61 RH
 Operation Band : Bandedge CH LOW Test Engineer : Edward
 EUT Pol. : E2 Plane Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
2390.00	E	Average	27.29	29.03	-1.74	54.00	-26.71
2390.00	E	Peak	40.70	42.44	-1.74	74.00	-33.30

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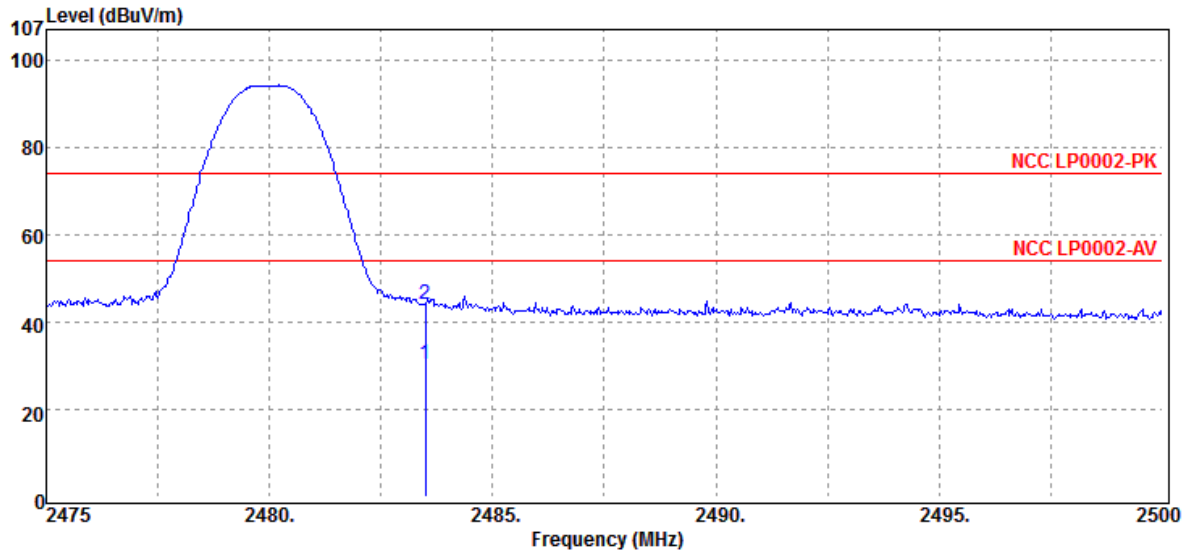
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Channel High (PCB Antenna)

Operation Mode :	BLE	Test Date :	08/05/2016
Fundamental Frequency :	2480 MHz	Temp. / Humi. :	22 deg_C / 61 RH
Operation Band :	Bandedge CH HIGH	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS		@3m	
		QP/AV/PK	dBuV/m	dBuV/m	dB	dBuV/m	dB
2483.50	E	Average	30.49	32.11	-1.62	54.00	-23.51
2483.50	E	Peak	44.08	45.69	-1.62	74.00	-29.92

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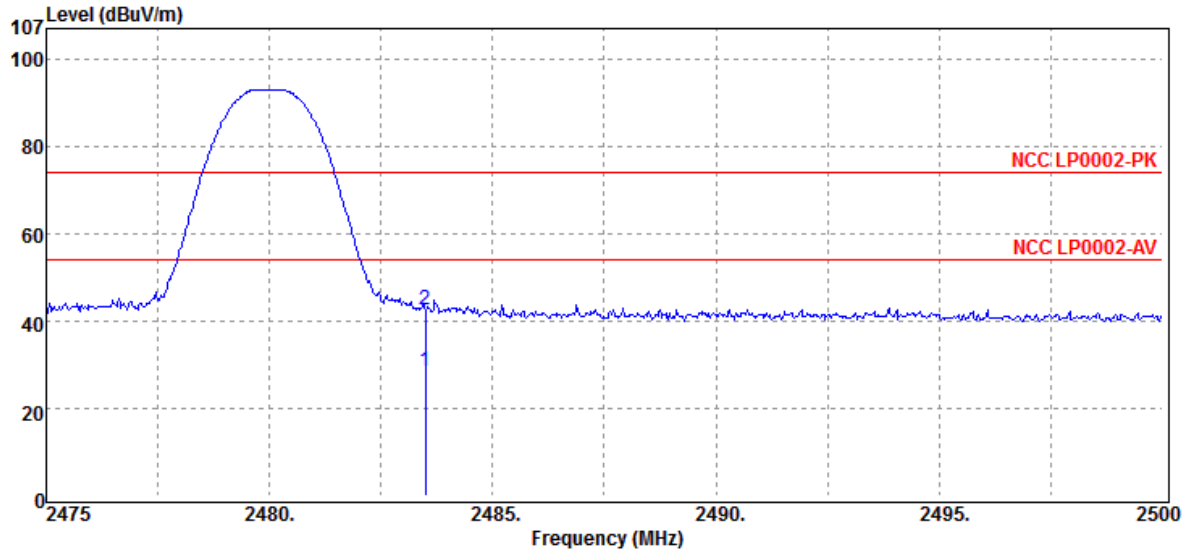
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Operation Mode : BLE Test Date : 08/05/2016
 Fundamental Frequency : 2480 MHz Temp. / Humi. : 22 deg_C / 61 RH
 Operation Band : Bandedge CH HIGH Test Engineer : Edward
 EUT Pol. : E2 Plane Measurement Antenna Pol. : HORIZONTAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS	dB	@3m	dB
2483.50	E	Average	28.54	30.16	-1.62	54.00	-25.46
2483.50	E	Peak	42.52	44.14	-1.62	74.00	-31.48

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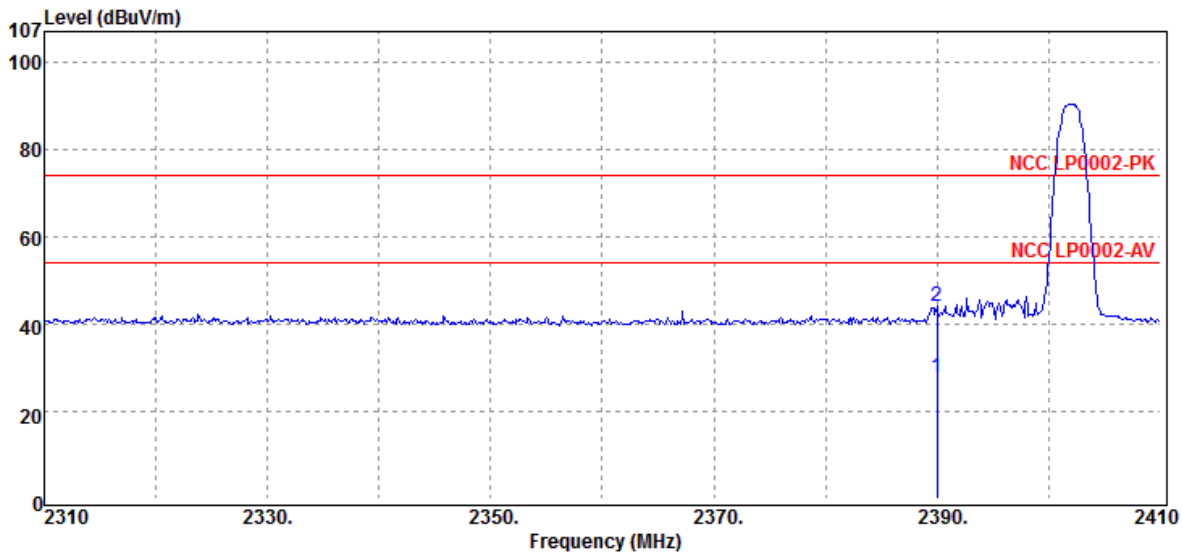
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Channel Low (PIFA Antenna)

Operation Band :BLE
Fundamental Frequency :2402 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :H Plane

Test Date :2017-08-01
Temp./Humi. :22 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2390.00	E	Average	29.64	-1.74	27.90	54.00	-26.10
2390.00	E	Peak	45.97	-1.74	44.23	74.00	-29.77

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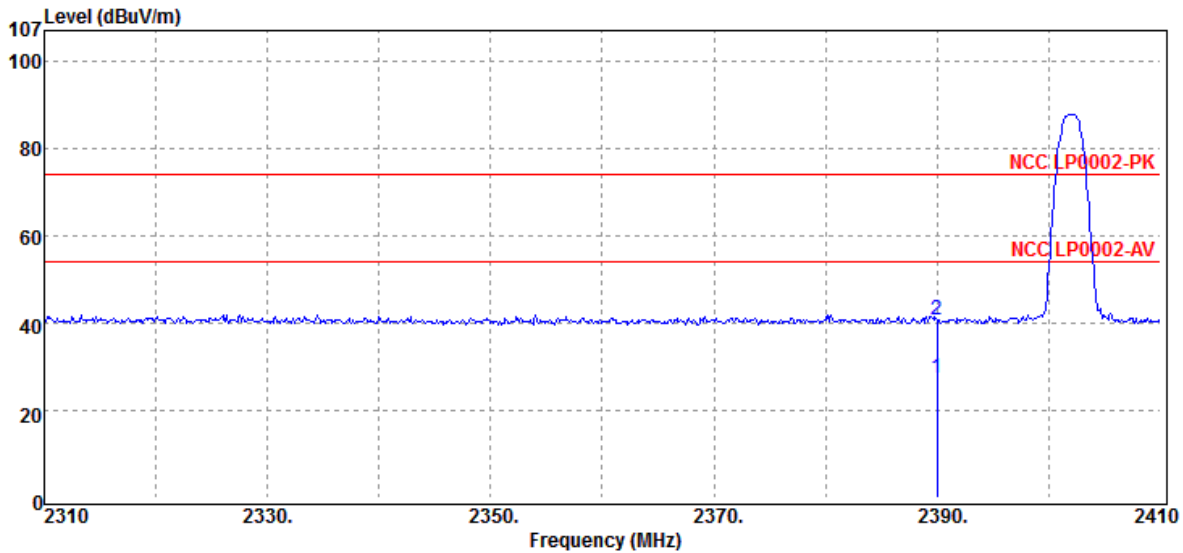
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Operation Band :BLE
Fundamental Frequency :2402 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :H Plane

Test Date :2017-08-01
Temp./Humi. :22 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2390.00	E	Average	29.31	-1.74	27.57	54.00	-26.43
2390.00	E	Peak	42.59	-1.74	40.85	74.00	-33.15

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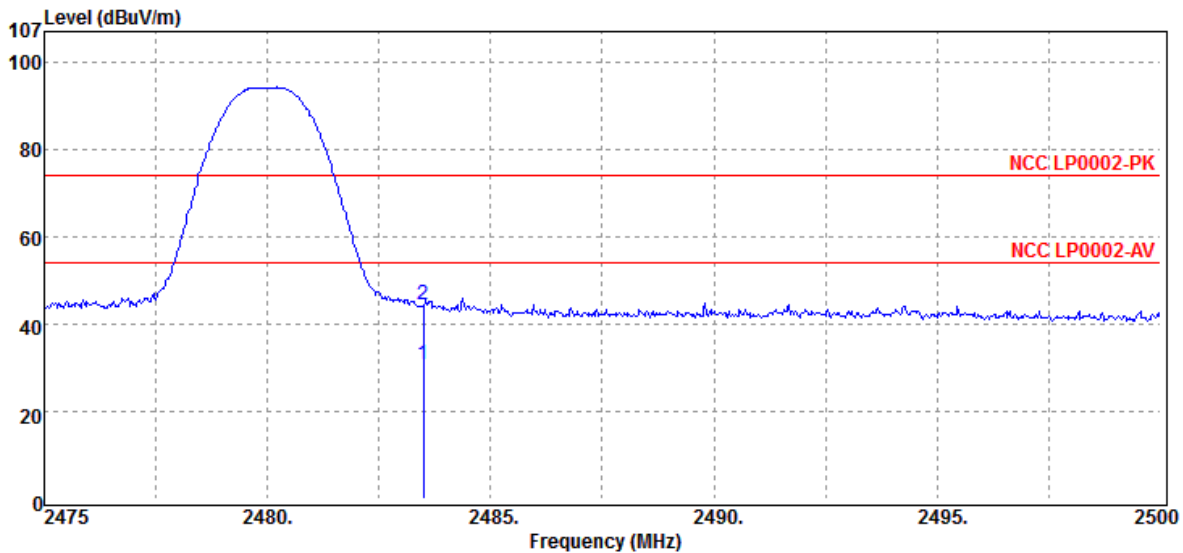
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Channel High (PIFA Antenna)

Operation Band :BLE
 Fundamental Frequency :2480 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :H Plane

Test Date :2017-08-01
 Temp./Humi. :22 deg_C / 61 RH
 Engineer :Tin
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	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
2483.50	E	Average	32.18	-1.62	30.56	54.00	-23.44
2483.50	E	Peak	45.87	-1.62	44.25	74.00	-29.75

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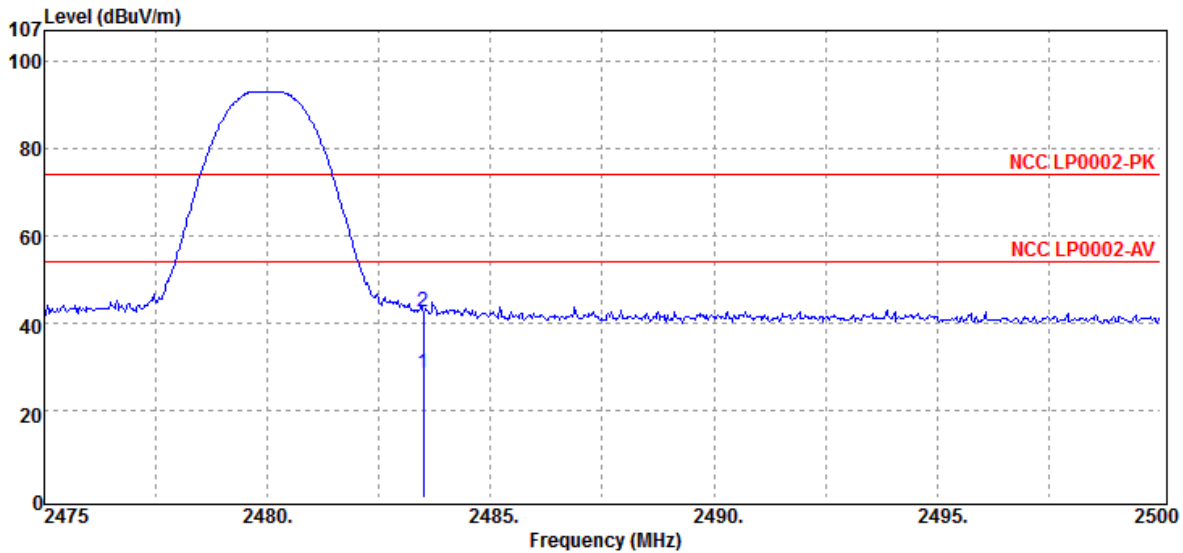
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Operation Band :BLE
Fundamental Frequency :2480 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :H Plane

Test Date :2017-08-01
Temp./Humi. :22 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2483.50	E	Average	30.09	-1.62	28.47	54.00	-25.53
2483.50	E	Peak	44.32	-1.62	42.70	74.00	-31.30

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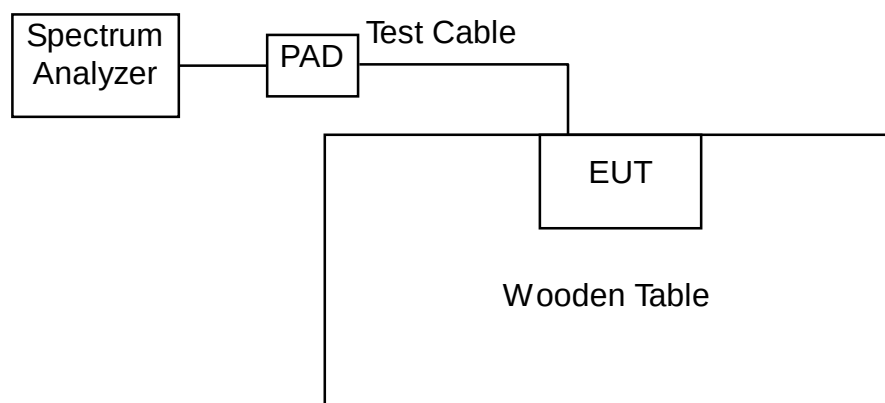
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11 功率密度之量測

11.1 適用標準

依據 NCC 低功率射頻電機技術規範 3.10.1.6(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。

11.2 功率密度之測試配置



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11.3 功率密度量測結果

測試設備: 2x2 dual-band IEEE 802.11 a/b/g/n/ac and
BT4.2 Combo Module

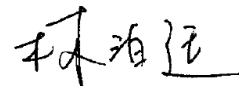
型號: WBU034-EA

解析頻寬: 3 kHz

視訊頻寬: 10 kHz

Span: 300 kHz

測試者:


BLE

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)
2402	-20.09	8
2442	-17.65	8
2480	-17.49	8

* offset 0.3 dB

Band Edge Limit

Frequency (MHz)	RF Power Density (dBm)	Bandedge Limit = PSD - 20dB (dBm)
2402	-2.64	-22.64
2480	-2.78	-22.78

NOTE: cable loss as 0.3dB that offsets in the spectrum

NOTE: Refer to next page for plots.

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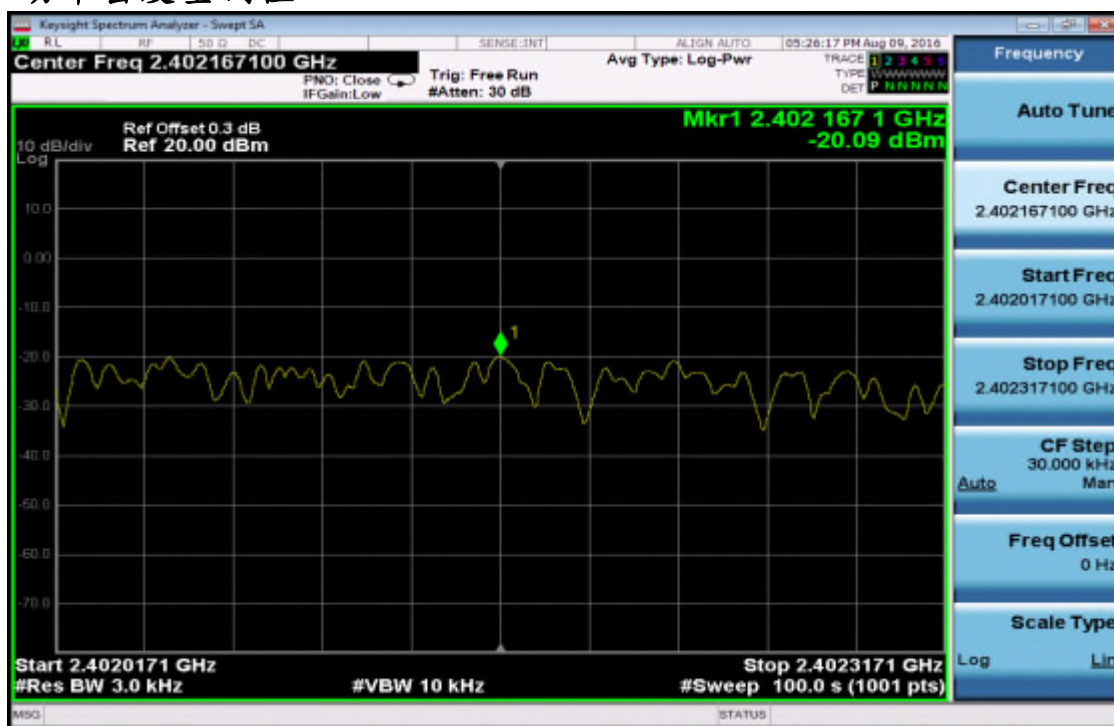
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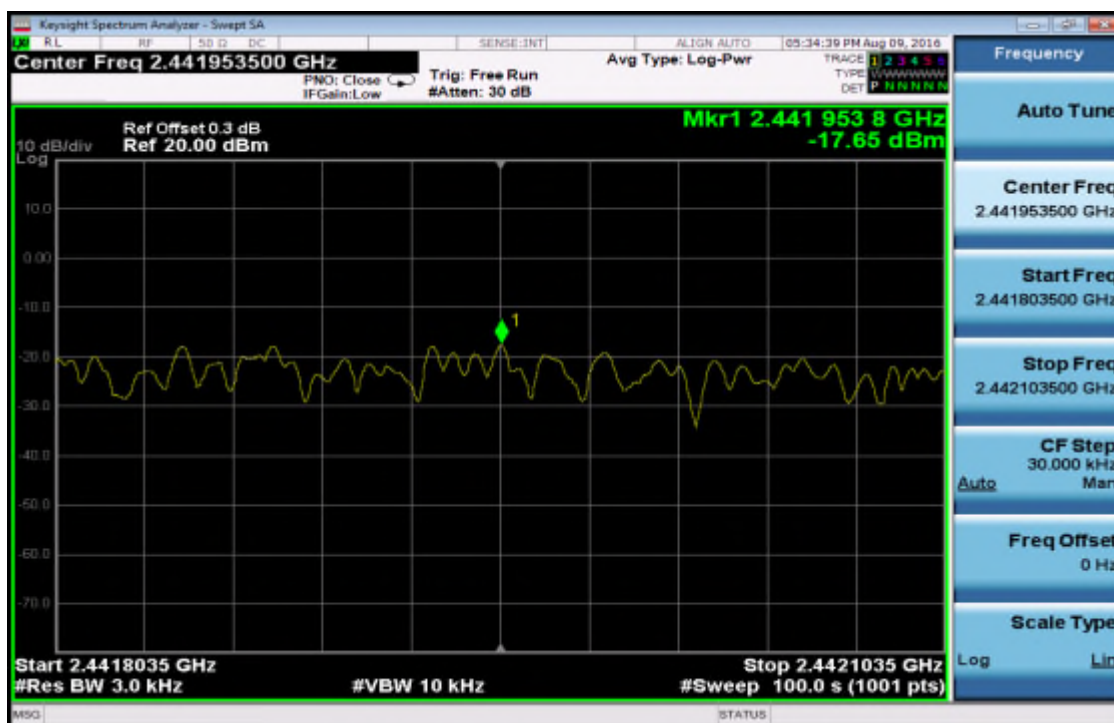
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Test Data Plot

CH Low 功率密度量測值



CH Mid 功率密度量測值



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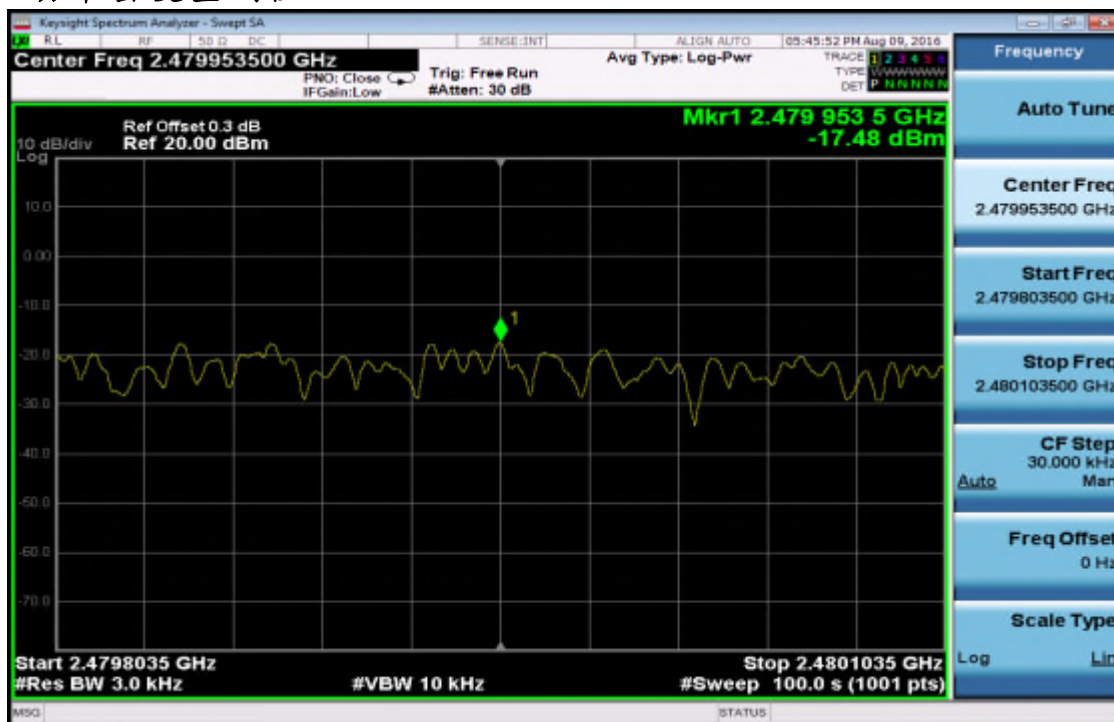
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CH High 功率密度量測值



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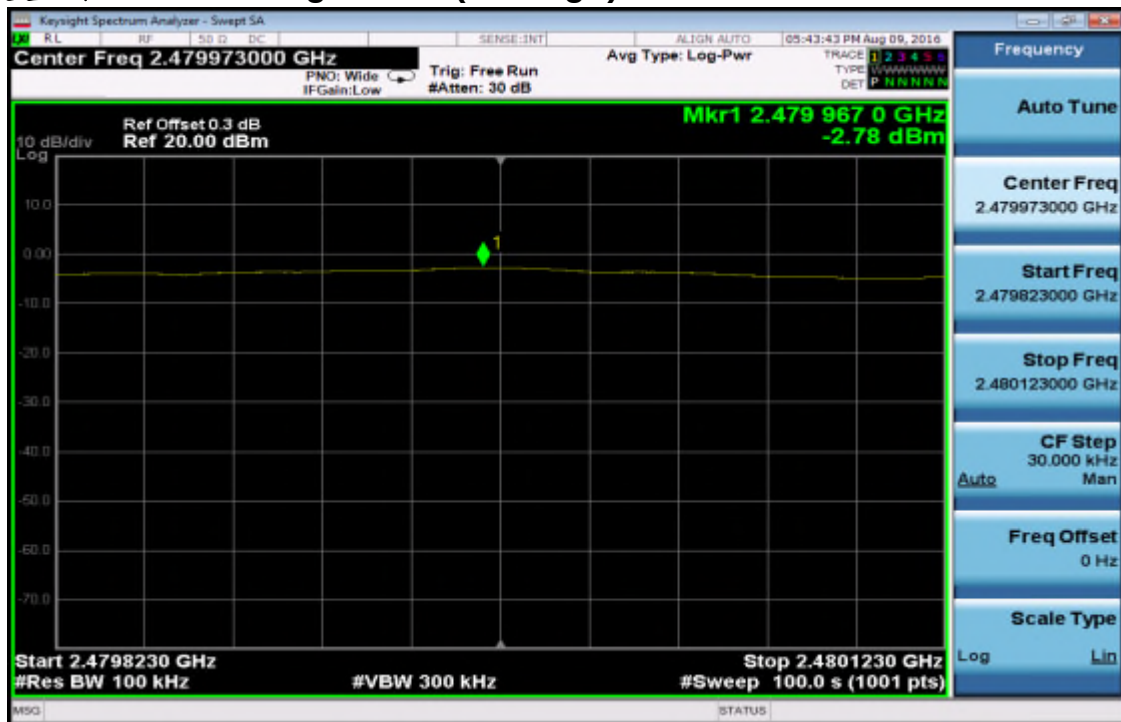
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功率密度量測 for Band Edge Limit (CH-Low)



功率密度量測 for Band Edge Limit (CH-High)



~ End of Report ~

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