

低功率射頻電機測試報告

報告編號:

RT190527C33A

申請者

Panasonic Corporation

產品名稱

Wireless LAN

型號

WL17A

製造廠商

Panasonic Corporation

商標或廠牌

Panasonic

該產品樣品試驗

國家通訊傳播委員會低功率射頻電機技術規範

依據之試驗標準

107 年 1 月修訂

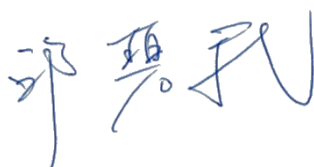
試驗結果

合格

香港商立德國際商品試驗有限公司桃園分公司 林口實驗室

日期 108 年 08 月 12 日

報告簽署人簽章:



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報告發行紀錄

Issue No.	Description	Date Issued
RT190527C33A	Original release	108 年 08 月 12 日

證 明 書

發行日期：108 年 08 月 12 日

產 品 名 稱： Wireless LAN
商 標： Panasonic
型 號： WL17A
申 請 者： Panasonic Corporation
量 測 規 範： 低功率射頻電機技術規範 LP0002
ANSI C63.10-2013

香港商立德國際商品試驗有限公司桃園分公司在此證明上述待測設備樣品一組(型號：WL17A)搭配平台：Notebook (廠牌：Panasonic / 型號：FZ-55)。收件日期 108 年 07 月 24 日，於 108 年 07 月 28 日至 108 年 08 月 19 日，已在本公司的標準測試場地完成量測。此報告僅記錄帶外輻射、電源線傳導干擾、傳導輸出功率及 DFS 之測試數據，其他測試項目請參照原模組報告 (BV CPS Report No.: RT190527C33 R1)。報告中所描述之測試結果和待測設備的架構組合，均根據樣品實際的量測情況作詳實的記錄。

立德桃園分公司依“低功率射頻電機技術規範”、“低功率電波輻射性電機管理辦法”及“電信管制射頻器材審驗辦法”製作測試結果報告。

特 此 證 明 ！

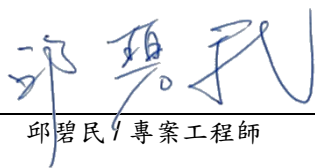
報告製作者：



吳宜芳 / 主任

， 日 期： 108 年 08 月 12 日

審 核 者：



邱碧民 / 專案工程師

， 日 期： 108 年 08 月 12 日

香港商立德國際商品試驗有限公司桃園分公司

實驗室地址：新北市林口區嘉寶里 14 鄰 47-2 號

此份報告不得摘錄複製，除全份複製外，需經實驗室書面同意。



1 低功率射頻電機量測記錄表

申請廠商: Panasonic Corporation

製造廠商: Panasonic Corporation

申請廠商地址: 1-10-12 Yagumohigashi-machi, Moriguchi, Osaka 570-0021 JAPAN

產品名稱: Wireless LAN

廠牌: Panasonic

型號: WL17A

量測單位名稱: 香港商立德國際商品試驗有限公司桃園分公司

林口實驗室華亞檢測部

量測單位地址: 桃園市龜山區文化里華亞二路 19 號

量測單位認可編號: TAF 2021 (9 kHz ~ 40 GHz)

量測規範: 低功率射頻電機技術規範 LP0002

ANSI C63.10-2013

KDB 558074

KDB 662911

KDB 789033

WLAN 2.4 GHz 頻段概要

項次	量測項目	規 範	量測結果判定
1	帶外發射	低功率射頻電機技術規範 3.10.1.5 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	合格
3	峰值傳導輸出功率	低功率射頻電機技術規範 3.10.1.2 節	合格

WLAN 5.150~5.250 GHz 頻段概要

項次	量測項目	規 範	量測結果判定
1	電源線傳導干擾	低功率射頻電機技術規範 2.3 節	合格
2	帶外發射	低功率射頻電機技術規範 4.7.4 節	合格
3	最大傳導輸出功率	低功率射頻電機技術規範 4.7.3.1 節	合格

WLAN 5.250~5.350 GHz 频段概要

項次	量測項目	規 範	量測結果判定
1	電源線傳導干擾	低功率射頻電機技術規範2.3節	合格
2	帶外發射	低功率射頻電機技術規範4.7.4節	合格
3	最大傳導輸出功率	低功率射頻電機技術規範4.7.3.2節	合格
4	發射功率控制(TPC)及動態頻率選擇(DFS)	低功率射頻電機技術規範4.7.7.1及4.7.7.2 節	合格

WLAN 5.470~5.725 GHz 频段概要

項次	量測項目	規 範	量測結果判定
1	電源線傳導干擾	低功率射頻電機技術規範2.3節	合格
2	帶外發射	低功率射頻電機技術規範4.7.4節	合格
3	最大傳導輸出功率	低功率射頻電機技術規範4.7.3.2節	合格
4	發射功率控制(TPC)及動態頻率選擇(DFS)	低功率射頻電機技術規範4.7.7.1及4.7.7.2 節	合格

WLAN 5.725~5.850 GHz 频段概要

項次	量測項目	規 範	量測結果判定
1	電源線傳導干擾	低功率射頻電機技術規範2.3節	合格
2	帶外發射	低功率射頻電機技術規範4.7.4節	合格
3	最大傳導輸出功率	低功率射頻電機技術規範4.7.3.3節	合格
4	6 dB 頻寬	低功率射頻電機技術規範4.7.5節	合格

最大暴露允許值(Maximum Permissible Exposure , MPE)

項次	量測項目	規 範	量測結果判定
1	電波暴露量	低功率射頻電機技術規範第 5.20.2 節	合格

備註：量測結果之判定不考慮量測不確定度的貢獻。

2 一般敘述

2.1 待測設備

產品名稱：	Wireless LAN	
型號：	WL17A	
額定電源：	5 Vdc (host equipment)	
調變方式：	Wireless LAN	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
傳輸速率：	Wireless LAN	802.11b: 11.0/ 5.5/ 2.0/ 1.0 Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0 Mbps 802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0 Mbps 802.11n: up to 400. Mbps 802.11ac: up to 866.7 Mbps
載波頻率：	Wireless LAN	2.4 GHz: 2412 ~ 2472 MHz 5.0 GHz: 5180 ~ 5240 MHz, 5260 ~ 5320 MHz, 5500 ~ 5720 MHz, 5745 ~ 5825 MHz
頻道數：	Wireless LAN	2.4 GHz: 802.11b, 802.11g, 802.11n (HT20): 13 802.11n (HT40): 9 5.0 GHz: 5180 ~ 5240 MHz 802.11a, 802.11n (HT20): 4 802.11n (HT40): 2 802.11ac (VHT80): 1 5260 ~ 5320 MHz: 802.11a, 802.11n (HT20): 4 802.11n (HT40): 2 802.11ac (VHT80): 1 5500 ~ 5720 MHz: 802.11a, 802.11n (HT20): 12 802.11n (HT40): 6 802.11ac (VHT80): 3 5745 ~ 5825 MHz: 802.11a, 802.11n (HT20): 5 802.11n (HT40): 2 802.11ac (VHT80): 1

發射功率：	Wireless LAN	2.4 GHz: 802.11b: 19.27 dBm 802.11g: 22.40 dBm 802.11n (HT20): 22.37 dBm 802.11n (HT40): 22.36 dBm 5.0 GHz: 5180 ~ 5240 MHz: 802.11a: 15.82 dBm 802.11ac (VHT20): 15.82 dBm 802.11ac (VHT40): 14.87 dBm 802.11ac (VHT80): 13.79 dBm 5260 ~ 5320 MHz: 802.11a: 15.87 dBm 802.11ac (VHT20): 15.83 dBm 802.11ac (VHT40): 14.87 dBm 802.11ac (VHT80): 13.86 dBm 5500 ~ 5720 MHz: 802.11a: 15.89 dBm 802.11ac (VHT20): 15.87 dBm 802.11ac (VHT40): 14.84 dBm 802.11ac (VHT80): 13.86 dBm 5745 ~ 5825 MHz: 802.11a: 15.85 dBm 802.11ac (VHT20): 15.87 dBm 802.11ac (VHT40): 14.88 dBm 802.11ac (VHT80): 13.89 dBm
天線種類：	見註 0	
電源線類別：	N/A	
信號線類別：	見註 3	
配件：	見註 3	

註：

1. 此待測物之技術的種類為2Tx / 2Rx之組合。

Modulation Mode	Tx Function
802.11b	1TX
802.11g	2TX
802.11a	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX
802.11ac (VHT20)	2TX
802.11ac (VHT40)	2TX
802.11ac (VHT80)	2TX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40, therefore investigated worst case to representative mode in test report. (最終測試模式請見註4)

2. 此待測設備搭配測試的天線，其資料如下：

	頻帶 (MHz)	天線型式	天線型號	商標	接頭型式	增益 (dBi)	
						Main	Aux.
WLAN	2412 ~ 2462	PIFA	WL17A	Panasonic Corporation	I-pex	-0.61	-1.21
	5180 ~ 5240					1.03	0.05
	5260 ~ 5320					1.17	0.26
	5500 ~ 5720					2.70	0.23
	5745 ~ 5825					1.55	-0.43

3. 此待測設備搭配使用之配件請參閱產品照編號: 190527C33

4. 此報告中，場強輻射量測經過評估後以下列測試模式進行最終量測。

量測項目	發射	接收
2412 ~ 2462 MHz		
1 GHz 以上量測	802.11n (HT40): Ch 9, 11	802.11n (HT40): Ch 11
其它不必要之訊號	802.11n (HT40): Ch 11	802.11n (HT40): Ch 11
5180 ~ 5240 MHz, 5260 ~ 5320 MHz, 5500 ~ 5720 MHz & 5745 ~ 5825 MHz		
1 GHz 以上量測	802.11n (HT40): Ch 102	802.11n (HT40): Ch 102
其它不必要之訊號	802.11n (HT40): Ch 102	802.11n (HT40): Ch 102

5. 此報告中傳輸模式，電源線傳導干擾量測之外的測試項目，以DSSS調變技術和OFDM調變技術分別進行測試並記錄最終量測結果於報告中。

6. 此報告中，測試模式評估如下

(1) 電源線傳導干擾量測經預掃後以模式2具有較大干擾值，故以其模式進行最終測試。

(2) 場強輻射量測以模式1~2評估完整測試。

模式	測試狀態
1	WLAN 2.4G + NB + Adapter
2	WLAN 5G + NB + Adapter

7. 此待測設備，經評估三個正交軸方位評估測試擺設方式：平躺、垂直、側放，其各擺放最大干擾值之位置如下表，故以此擺放方式進行最終量測，並將測試結果紀錄。

	WLAN 2.4 GHz	WLAN 5 GHz
擺放方式	平躺	平躺

此裝置各頻道的中心頻率如下：

2.4 GHz 頻段：

802.11b, 802.11g, 802.11n (HT20):

頻道	對應頻率 (MHz)	頻道	對應頻率 (MHz)
01	2412	08	2447
02	2417	09	2452
03	2422	10	2457
04	2427	11	2462
05	2432	12	2467
06	2437	13	2472
07	2442		

802.11n (HT40):

頻道	對應頻率 (MHz)	頻道	對應頻率 (MHz)
03	2422	08	2447
04	2427	09	2452
05	2432	10	2457
06	2437	11	2462
07	2442		

5 GHz 频段:

802.11a, 802.11n (HT20):

頻道	對應頻率 (MHz)	頻道	對應頻率 (MHz)
36	5180	120	5600
40	5200	124	5620
44	5220	128	5640
48	5240	132	5660
52	5260	136	5680
56	5280	140	5700
60	5300	144	5720
64	5320	149	5745
100	5500	153	5765
104	5520	157	5785
108	5540	161	5805
112	5560	165	5825
116	5580		

802.11n (HT40):

頻道	對應頻率 (MHz)	頻道	對應頻率 (MHz)
38	5190	118	5590
46	5230	126	5630
54	5270	134	5670
62	5310	142	5710
102	5510	151	5755
110	5550	159	5795

802.11ac (VHT80):

頻道	對應頻率 (MHz)	頻道	對應頻率 (MHz)
42	5210	122	5610
58	5290	138	5690
106	5530	155	5775

詳細之規格請參考使用說明書。

2.2 輔助測試之週邊設備描述

待測設備於受測時均接上其所屬的配件或一般用途之相關設備；下列輔助設備或配件測試中所使用的配備，以形成一個代表待測物實際運作的受測系統。

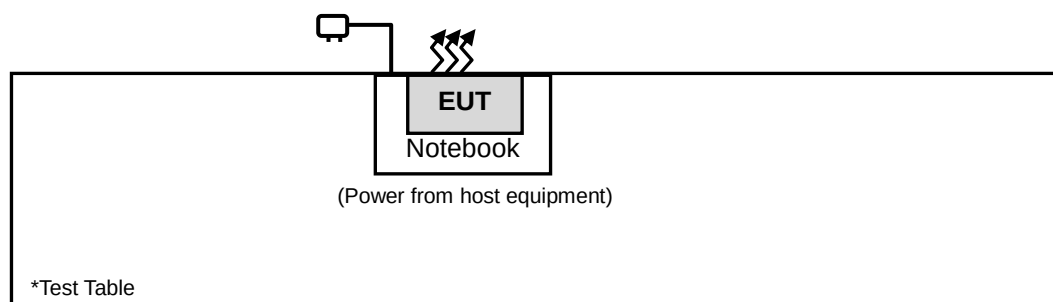
No.	Product	Brand	Model No.	Serial No.	FCC ID
1	Notebook	Panasonic	FZ-55	N/A	N/A

No.	Signal Cable Description Of The Above Support Units
1	N/A

NOTE:

1. All power cords of the above support units are non shielded (1.8m).
2. Item 1 was provided by client.

2.3 測試架構圖



3 適用規範

3.1 規範要求

►WLAN 頻段部分:

(1) 傳導之規定

依據國家通訊傳播委員會低功率射頻電機技術規範之 2.3 節，電源傳導干擾之限制要求如下：

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

(註)：隨頻率之對數遞減。

(2) 帶外發射之規定

(1) 操作於 2.4000~2.4835 GHz band:

依據國家通訊傳播委員會低功率射頻電機技術規範 3.10.1.5 節之要求，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。

(2) 操作於 5.15~5.35 GHz 及 5.470~5.725 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.4.1 節之要求，帶外發射之有效等向輻射功率 (EIRP) $\leq$ -27 dBm/MHz。

(3) 操作於 5.725~5.850 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.4.2 節之要求，所有頻帶邊緣向外 5 MHz 內頻率之發射，有效等向輻射功率(EIRP) $\leq$ 27 dBm/MHz~15.6 dBm/MHz (以線性法計算對應之限制值)；所有頻帶邊緣向外 5 MHz~25 MHz，有效等向輻射功率 35 (EIRP) $\leq$ 15.6 dBm/MHz~10 dBm/MHz (以線性法計算對應之限制值)；所有頻帶邊緣外 25 MHz~75 MHz，有效等向輻射功率(EIRP) $\leq$ 10 dBm/MHz~-27 dBm/MHz (以線性法計算對應之限制值)；所有頻帶邊緣外 $\geq$ 75 MHz 的頻率之發射，有效等向輻射功率(EIRP) $\leq$ -27 dBm/MHz；有關遮罩限制值詳圖 1。

在 5.725~5.850 GHz 頻段操作且天線增益大於 10 dBi 之設備於 106 年 3 月 2 日前得適用 3.10.1.5 帶外發射限制；在 5.725~5.850 GHz 頻段操作且天線增益小於等於 10 dBi 之設備於 107 年 3 月 2 日前得適用 3.10.1.5 帶外發射限制規定。

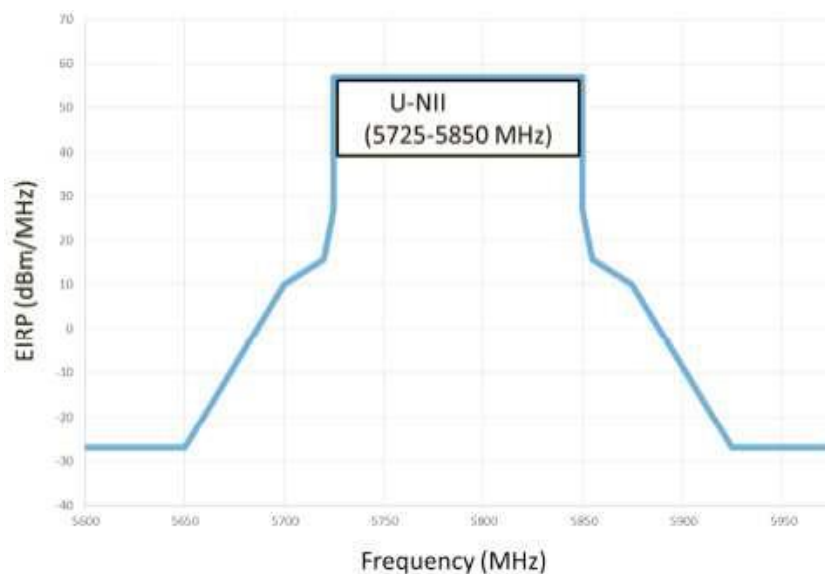


圖 1

在 1 GHz 以下不必要之發射，應符合 2.8 之規定。此外，落於 2.7 禁用頻段之輻射發射，應符合 2.8 之規定。

頻率(兆赫)	電場強度(微伏/公尺)	測距(公尺)
0.009 - 0.490 (含)	2,400/頻率(千赫)	300
0.490 (不含) - 1.705 (含)	24,000/頻率(千赫)	30
1.705 (不含) - 30 (不含)	30	30
30 (含) - 88 (含)	100	3
88 (不含)- 216 (含)	150	3
216 (不含)- 960 (含)	200	3
960 (不含)以上	500	3

(3) 天線之規定

天線規格不受第 2.2 節規定之限制。

(4) 天線增益之要求

低功率發射機，依據國家通訊傳播委員會低功率射頻電機技術規範 3.10.1.3 節及 4.7.3 節之規定如下：

(1) 操作於 2.400~2.4835 GHz 頻段：

- (A) 進行固定式點對點操作時，其發射天線之方向性增益超過 6 dBi，每超過 3 dBi，最大傳導輸出功率限制值應降低 1 dB。
- (B) 天線以多向波束發射方式(含同時發射或循序發射)將訊號導向多個接收機或接收機群組時，應符合下列規定：
 - (a) 非同時發射多向波束者，所有載波或頻道傳輸至所有天線陣列或陣列群之總和傳導輸出功率應符合 3.10.1.2 之功率限制值。如天線/天線陣列群之方向性增益超過 6 dBi，每超過 3 dBi，總和傳導輸出功率限制值應降低 1 dB。方向性增益值應計算如下：
 - (i) 方向性增益值= $10\log(\text{天線陣列之單元數目}) + \text{各單元中最高之方向性增益值}$ 。
 - (ii) 天線陣列間之遮蔽效應或波束干涉損失能充分佐證時，方向性增益得低於(i)計算數值。
 - (b) 同時發射多向波束於相同或不同頻道者，其每一波束功率應符合(a)之功率限制值。如發射波束有重疊現象，功率應降低，以確保總和傳導輸出功率符合(a)之限制值。同時發射的所有波束總和傳導輸出功率不大於(a) 總和傳導輸出功率限制值加 8 dB。方向性增益值計算同(a)。
 - (c) 發射機之天線具備單向波束功能者，應符合(1)(A)及(3)後段之規定。

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

(2) 操作於 5.15~5.25 GHz 頻段：

- (A) 供戶外操作使用：使用超過 6 dBi 方向增益之發射天線時，應依超過 6 dBi 天線方向增益的 dBi 總量，等量減少最大傳導輸出功率及最大功率頻譜密度。在水平面仰角超過 30 度時，其最大 EIRP 應小於或等於 21 dBm。
- (B) 供室內操作使用：使用超過 6 dBi 方向增益之發射天線時，應依超過 6 dBi 天線方向增益的 dBi 總量，等量減少最大傳導輸出功率及最大功率頻譜密度。
- (C) 供固定式點對點操作使用：使用超過 23 dBi 方向增益之指向性天線時，應依超過 23 dBi 天線方向增益的 dBi 總量，等量減少最大傳導輸出功率及最大功率頻譜密度。固定式點對點操作，不包括點對多點系統、全方向性應用及多台共站發射機傳送相同資訊。
- (D) 供用戶端裝置(Client Device)操作使用：使用超過 6 dBi 方向增益之發射天線時，應依超過 6 dBi 天線方向增益的 dBi 總量，等量減少最大傳導輸出功率及最大功率頻譜密度。

(3) 操作於 5.25~5.35 GHz 與 5.470~5.725 GHz 頻段：

使用超過 6 dBi 方向增益之發射天線時，應依超過 6 dBi 天線方向增益的 dBi 總量，等量減少最大傳導輸出功率及最大功率頻譜密度。

(4) 操作於 5.725~5.850 GHz 頻段：

- (A) 供固定式點對點操作時，使用方向增益超過 6 dBi 之發射天線，可不需對應減少發射器之傳導輸出功率限制值。
- (B) 除(A)外，使用超過 6 dBi 方向增益之發射天線時，應依超過 6 dBi 天線方向增益的 dBi 總量，等量減少最大傳導輸出功率及最大功率頻譜密度。

(5) 6 dB 頻寬之要求

(1) 操作於 2.400~2.4835 GHz 頻段：

對使用數位調變技術(digital modulation techniques)系統之低功率發射機，依據國家通訊傳播委員會低功率射頻電機技術規範 3.10.1.6 節之規定，6 dB 頻寬至少應有 500 kHz。

(2) 操作於 5.725~5.850 GHz 頻段：

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.5 節之規定，其 6 dB 頻寬至少應有 500 kHz。

(6) 傳導輸出功率之要求

(1) 操作於 2.4000~2.4835 GHz band:

依據國家通訊傳播委員會低功率射頻電機技術規範 3.10.1.2 節之規定：

數位調變技術系統：1 W(含)以下。

(2) 操作於 5.15~5.25 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.3.1 節之要求:

(A) 供戶外操作使用/供室內操作使用/供固定式點對點操作使用：最大傳導輸出功率應小於或等於 1 W。

(B) 供用戶端裝置(Client Device)操作使用：最大傳導輸出功率應小於或等於 250 mW。

(3) 操作於 5.25~5.35 GHz 及 5.470~5.725 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.3.2 節之規定，最大傳導輸出功率應小於或等於 250 mW 或 11 dBm+10log B (B 是 26 dB 發射頻寬，單位 MHz)之較小者。

(4) 操作於 5.725~5.850 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.3.3 節之規定，最大傳導輸出功率應小於或等於 1 W。

(7) 功率頻譜密度之要求

(1) 操作於 2.4000~2.4835 GHz band:

依據國家通訊傳播委員會低功率射頻電機技術規範 3.10.1.6 節之規定，在使用頻率範圍之任一 3 kHz 頻寬內，由發射機傳導至天線之功率頻譜密度在任意傳輸期間內，皆小於或等於 8 毫分貝(dBm)，且應

依 3.10.1.3 之方式降低功率頻譜密度限制值。

(2) 操作於 5.15~5.25 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.3.1 節之要求:

(A) 供戶外操作使用/供室內操作使用/供固定式點對點操作使用: 在任何 1 MHz 頻帶中最大功率頻譜密度應小於或等於 17 dBm。

(B) 供用戶端裝置(Client Device)操作使用: 在任何 1 MHz 頻帶中最大功率頻譜密度應小於或等於 11 dBm。

(3) 操作於 5.25~5.35 GHz 及 5.470~5.725 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.3.2 節之規定, 最大功率頻譜密度在任何 1 MHz 頻帶中應小於或等於 11 dBm。

(4) 操作於 5.725 GHz~5.850 GHz 頻段:

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.3.3 節之規定, 在任何 500 kHz 頻帶中最大功率頻譜密度應小於或等於 30 dBm。

(8) 發射功率控制(TPC)及動態頻率選擇(DFS)之要求

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.7.1 及 4.7.7.2 節之規定。

發射功率控制(TPC): 操作於 5.25~5.35 GHz 與 5.470~5.725 GHz 頻段的設備, 應具備發射功率控制功能。設備必須至少具有 6 dB 低於平均 EIRP 30 dBm 的能力。EIRP 低於 500 mW 之系統不須具備 TPC 功能。

動態頻率選擇(DFS): 操作於 5.25~5.35 GHz 與 5.470~5.725 GHz 頻段之設備應具備動態頻率選擇雷達偵測功能並啟動之, 以完整偵測使用頻帶內之雷達訊號, 避免與雷達系統同頻道操作。相關規定如下:

(1) 最低動態頻率選擇的偵測門檻

(A) 最大 EIRP 為 200 mW~1 W 之設備, 其最低動態頻率選擇的偵測門檻值為-64 dBm。

(B) 最大 EIRP 低於 200 mW, 且功率頻譜密度小於 10 dBm/MHz 之設備, 其最低動態頻率選擇的偵測門檻值為-62 dBm。

(C) 最大 EIRP 低於 200 mW, 且功率頻譜密度大於或等於 10 dBm/MHz 之設備, 其最低動態頻率選擇的偵測門檻值為-64 dBm。

(D) 此偵測門檻值為 1 微秒內之平均接收功率, 並以 0 dBi 天線為參考基準。頻道初始設定得由系統隨機選取或使用者手動選取。

(2) 操作模式: 動態頻率選擇之規定適用於以下之操作模式:

(A) 頻道可用性檢查時間之規定, 適用於主控運作模式。

(B) 頻道移動時間之規定, 適用於主控及受控運作模式。

(3) 頻道可用性檢查時間: 設備必須檢查其可在某一頻道上起始傳送之前是否有雷達系統已經操作在該頻道上, 以及何時其必須移動到另一新的頻道, 在 60 秒內若沒有偵測到功率位準大過上述之干擾門檻值的雷達訊號時, 設備才可開始使用該頻道。

(4) 頻道移動時間: 在偵測到雷達的存在後, 所有在該操作頻道上的所有傳輸須在 10 秒內停止, 在偵測到雷達訊號後, 該期間內的傳輸應維持最多 200 毫秒的正常通訊。另外, 間歇性的管理與控制訊號可在剩餘的時間中傳送, 以便撤離該操作頻道。

(5) 不可佔用期間: 某一頻道已被頻道可用性檢查或"服務中"監視顯示含有雷達系統, 至少須有 30 分鐘的不可佔用期間。不可佔用期間起始於偵測到雷達系統的當時。

(9) 無線資訊傳輸設備必須擁有安全功能之要求

依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.7.3 節之規定, 無線資訊傳輸設備必須擁有安全功能, 以保護未經授權之一方更改軟體。製造商應提出符合本節規定之相關證明文件或符合性聲明。

(10) 依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.7.4 節之規定, 製造商必須在操作於 U-NII 頻段上之數位調變系統中提供安全功能, 使第三方團體無法重寫程式, 使其操作於非經認證之設定。該軟體必須避免發射機操作於非經認證之頻率、輸出功率、調變形式或其他射頻參數。製造商可使用私有網路, 只有經授權的用戶能下載軟體、進行軟體式電子簽章或硬體式的韌體更新, 新的軟體可以被合法的載入到設備中, 同時又能符合上述事項, 並於應用程式中描述設備授權的方法。

(11) 依據國家通訊傳播委員會低功率射頻電機技術規範 4.7.7.5 節之規定，製造商必須確保 DFS 功能無法被無線資訊傳輸設備之操作者取消。

(12) 電波暴露量之評估

依據國家通訊傳播委員會低功率射頻電機技術規範 5.20.2 節之規定，若受測物於正常操作模式下，其發射機距離人體 20 公分以上者，可測試最大暴露允許值(Maximum Permissible Exposure, MPE)以證明其符電波暴露量之要求。

限制值如下：

(1) 職業性/可控制之暴露

頻率範圍 (MHz)	電場強度 (V/m)	磁場強度 (A/m)	功率密度 (mW/cm ²)	平均時間 (minutes)
0.3 - 3.0	614	1.63	*100	6
3 - 30	1842/f	4.89/f	*900/f ²	6
30 - 300	61.4	0.163	1.0	6
300 - 1,500	---	---	f/300	6
1,500 - 100,000	---	---	5.0	6

註 1：標記*表平面波等效功率密度。

註 2：f 表測試頻率，單位：百萬赫(MHz)。

(2) 一般人/不可控制之暴露

頻率範圍 (MHz)	電場強度 (V/m)	磁場強度 (A/m)	功率密度 (mW/cm ²)	平均時間 (minutes)
0.3 - 3.0	614	1.63	*100	30
3 - 30	1842/f	4.89/f	*180/f ²	30
30 - 300	27.5	0.073	1.0	30
300 - 1,500	---	---	f/1500	30
1,500 - 100,000	---	---	1.0	30

註 1：標記*表平面波等效功率密度。

註 2：f 表測試頻率，單位：百萬赫(MHz)。

3.2 限制使用之頻帶

除本規範另有規定外，任何低功率射頻電機之主波皆不得使用下表所列各頻段之頻率；低功率射頻電機落於下表所列頻段之混附發射，其電場強度必須符合 2.8 之限制規定。

頻率(兆赫)	頻率(兆赫)	頻率(兆赫)
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	

2.4 GHz 頻段測試紀錄結果

4 帶外發射之量測

4.1 適用標準

請見本報告 3.1 節第(2)的規定。

4.2 量測方法

在電波暗室，將待測物置於 0.8 米高的非金屬桌面，使其操作在工作狀態。接收天線置於 3 米距離。桌面要 360 度旋轉，另外接收天線從離地 1 米至 4 米升降變化，以找出最大的輻射電場強度，接收天線分別置於水平、垂直極化各執行測試一次。

Note: 對於 1 GHz 以上場強輻射的測試，待測物則置於 1.5 米高的非金屬桌面

發射諧波：

Peak 為 RBW = 1 MHz, VBW = 3 MHz ;

Average

802.11b 為 RBW = 1 MHz, VBW = 10 Hz

802.11g 為 RBW = 1 MHz, VBW = 1 kHz

802.11n (HT20) 為 RBW = 1 MHz, VBW = 3 kHz

802.11n (HT40) 為 RBW = 1 MHz, VBW = 3 kHz

接收諧波：

Below 1 GHz

Peak 為 RBW = 120 kHz, VBW = 360 kHz ; Quasi-Peak 為 RBW = 120 kHz, VBW = 120 kHz

Above 1 GHz:

Peak 為 RBW = 1 MHz, VBW = 3 MHz ; Average 為 RBW = 1 MHz, VBW = 3 kHz

其它不必要之訊號

Peak 為 RBW = 120 kHz, VBW = 360 kHz ; Quasi-Peak 為 RBW = 120 kHz, VBW = 120 kHz

4.3 量測儀器

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 20, 2018	Aug. 19, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 25, 2018	Nov. 24, 2019
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 27, 2018	Nov. 26, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 25, 2018	Nov. 24, 2019
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
Preamplifier Agilent	310N	187226	Jun. 18, 2019	Jun. 17, 2020
Preamplifier Agilent	83017A	MY39501357	Jun. 18, 2019	Jun. 17, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 12, 2018	Oct. 11, 2019
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-S MS-100-SMS-120+RF C-SMS-100-SMS-400)	Jun. 18, 2019	Jun. 17, 2020
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-S MS-100-SMS-24)	Jun. 18, 2019	Jun. 17, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

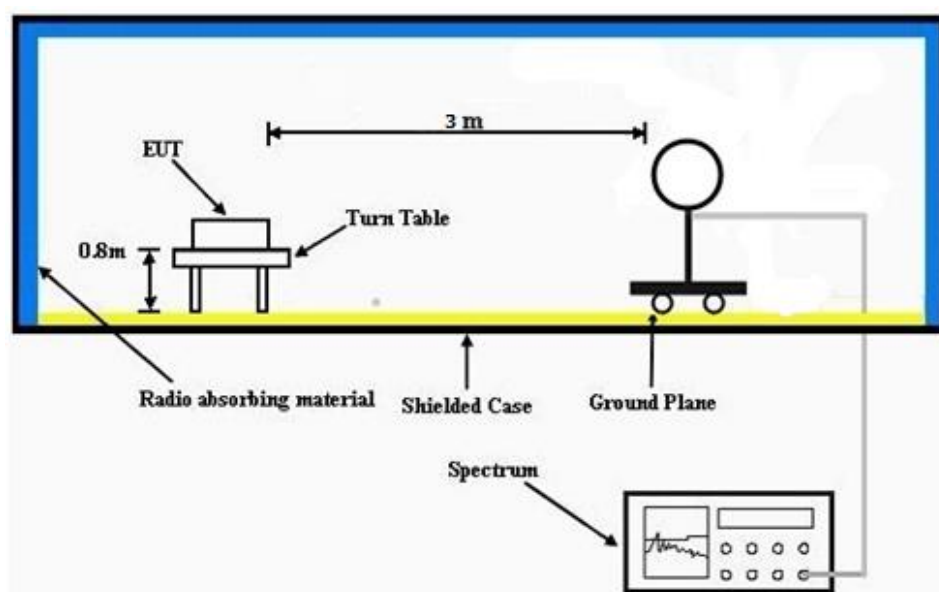
NOTE:

1. The calibration interval of the above test instruments is 12 or 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HsinTien Chamber 1.
3. The horn antenna and preamplifier (model: 83017A) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The FCC Designation Number is TW0011. The number will be varied with the Lab location and scope as attached.
5. The IC Site Registration No. is 7450I-1.
6. The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.

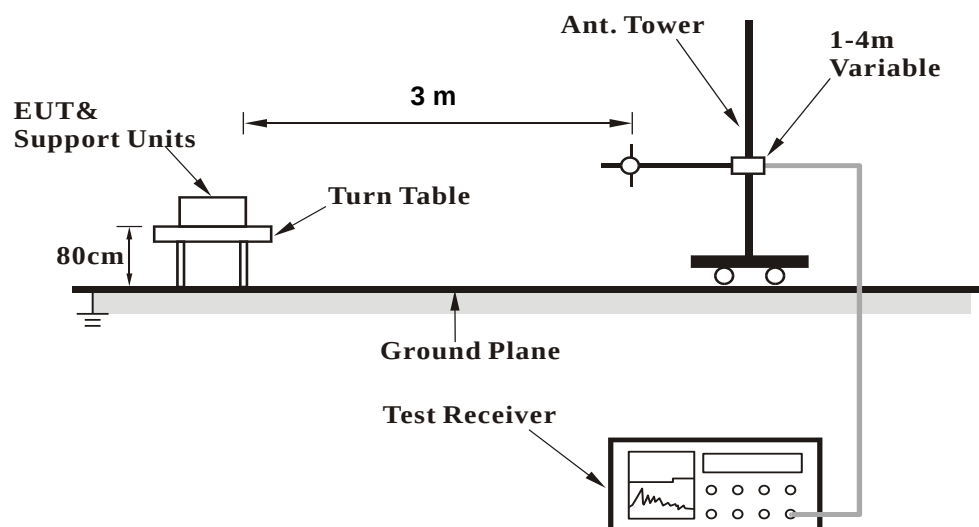
Measurement	Frequency	Uncertainty
Radiated emissions	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.94 dB

4.4 測試配置

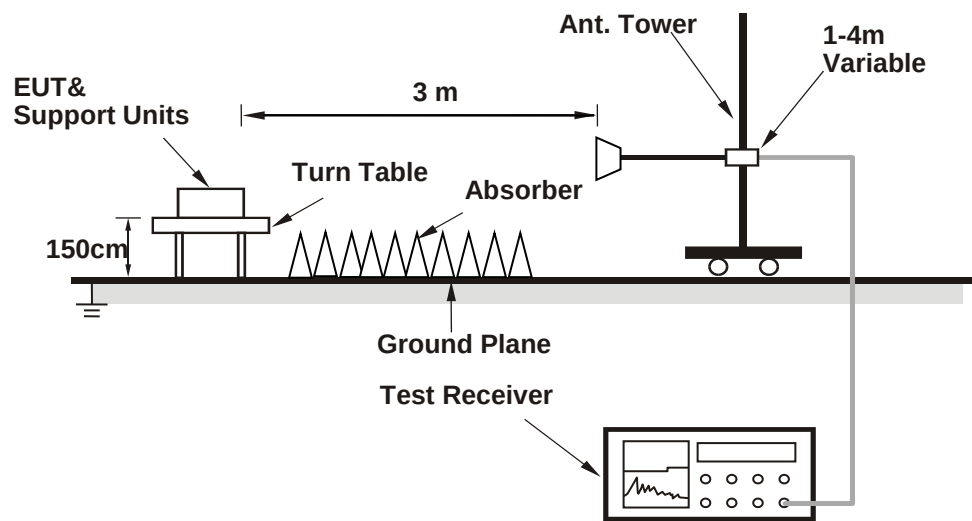
<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range below 1 GHz>



<Frequency Range above 1 GHz>



4.5 場強度之計算

場強之計算公式如下：

結果值 Emission level (dBuV/m) = 機器讀值 Raw Value (dBuV) + 校正因子 Correction Factor (dB/m)

餘裕度 Margin(dB) = 結果值 Emission level (dBuV/m) - 限制值 Limit value (dBuV/m)

量測結果請見下頁。

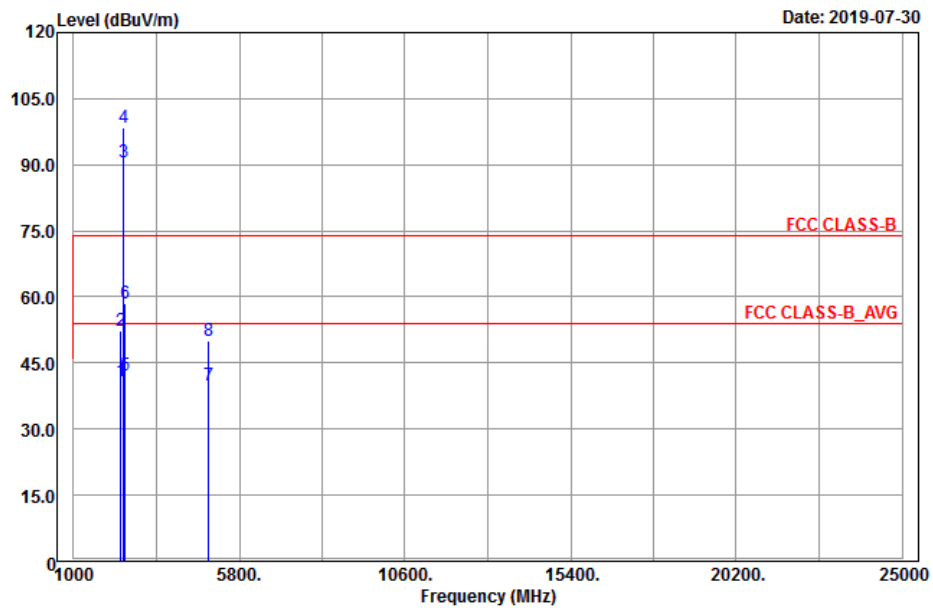
4.6 量測結果

4.6.1 發射諧波

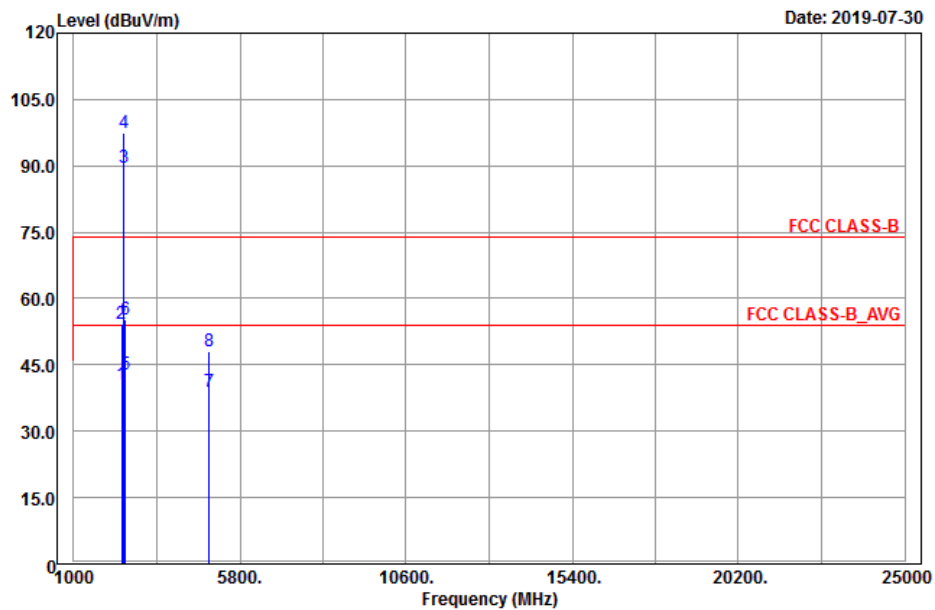
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 9	Frequency Range	1 GHz ~ 25 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



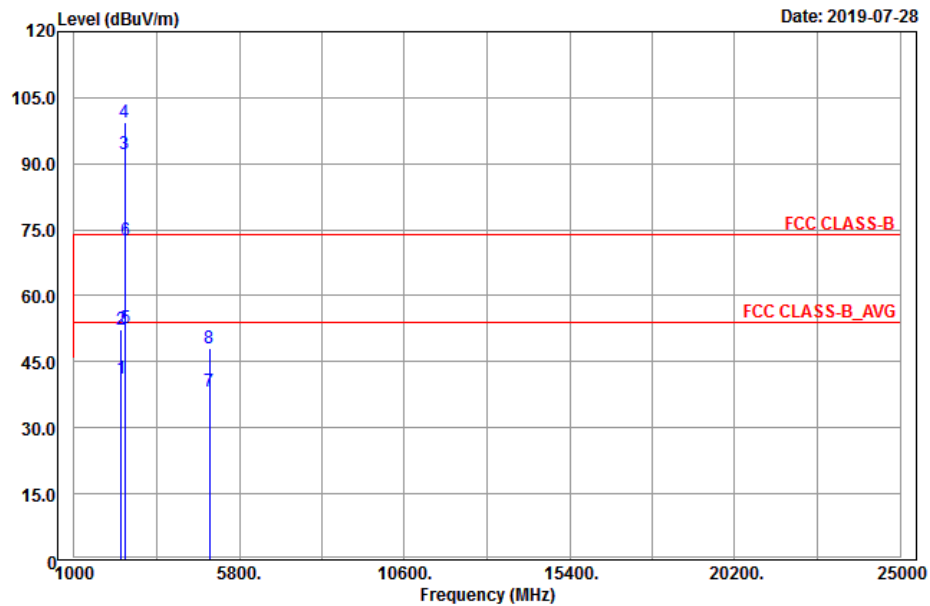
Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2373.72	40.94	36.49	4.45	54	-13.06	128	338	Average
2373.72	52.4	47.95	4.45	74	-21.6	128	338	Peak
2452	90.63	86.03	4.6			128	338	Average
2452	98.42	93.82	4.6			128	338	Peak
2483.76	42.13	37.47	4.66	54	-11.87	128	338	Average
2483.76	58.38	53.72	4.66	74	-15.62	128	338	Peak
4904	40.04	29.9	10.14	54	-13.96	132	168	Average
4904	49.94	39.8	10.14	74	-24.06	132	168	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386.5	40.68	36.19	4.49	54	-13.32	101	18	Average
2386.5	54.11	49.62	4.49	74	-19.89	101	18	Peak
2452	89.63	85.03	4.6			101	18	Average
2452	97.6	93	4.6			101	18	Peak
2483.6	42.74	38.08	4.66	54	-11.26	101	18	Average
2483.6	55.17	50.51	4.66	74	-18.83	101	18	Peak
4904	39.04	28.9	10.14	54	-14.96	173	195	Average
4904	48.11	37.97	10.14	74	-25.89	173	195	Peak

Remarks:

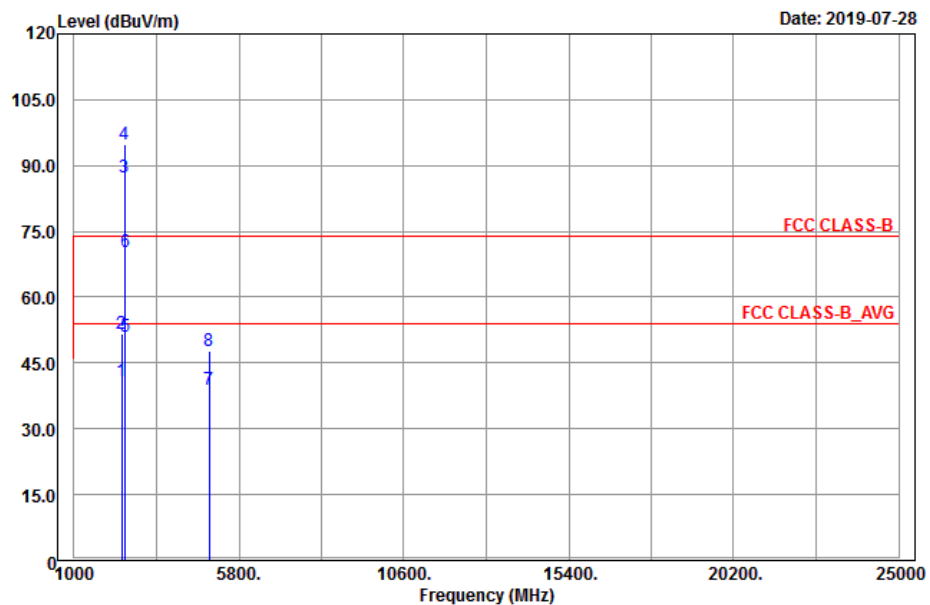
1. Emission Level = Read Level + Factor
Margin Value = Emission Level – Limit value
2. 2452 MHz: Fundamental Frequency.
3. The other emission levels were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2369.76	41.14	36.69	4.45	54	-12.86	129	336	Average
2369.76	52.34	47.89	4.45	74	-21.66	129	336	Peak
2462	92.19	87.57	4.62			129	336	Average
2462	99.53	94.91	4.62			129	336	Peak
2483.6	52.6	47.94	4.66	54	-1.4	129	336	Average
2483.6	72.49	67.83	4.66	74	-1.51	129	336	Peak
4924	38.11	27.86	10.25	54	-15.89	122	165	Average
4924	48.2	37.95	10.25	74	-25.8	122	165	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2383.62	40.95	36.48	4.47	54	-13.05	101	18	Average
2383.62	51.72	47.25	4.47	74	-22.28	101	18	Peak
2462	87.32	82.7	4.62			101	18	Average
2462	94.67	90.05	4.62			101	18	Peak
2483.52	50.89	46.23	4.66	54	-3.11	101	18	Average
2483.52	70.14	65.48	4.66	74	-3.86	101	18	Peak
4924	38.82	28.57	10.25	54	-15.18	179	245	Average
4924	47.72	37.47	10.25	74	-26.28	179	245	Peak

Remarks:

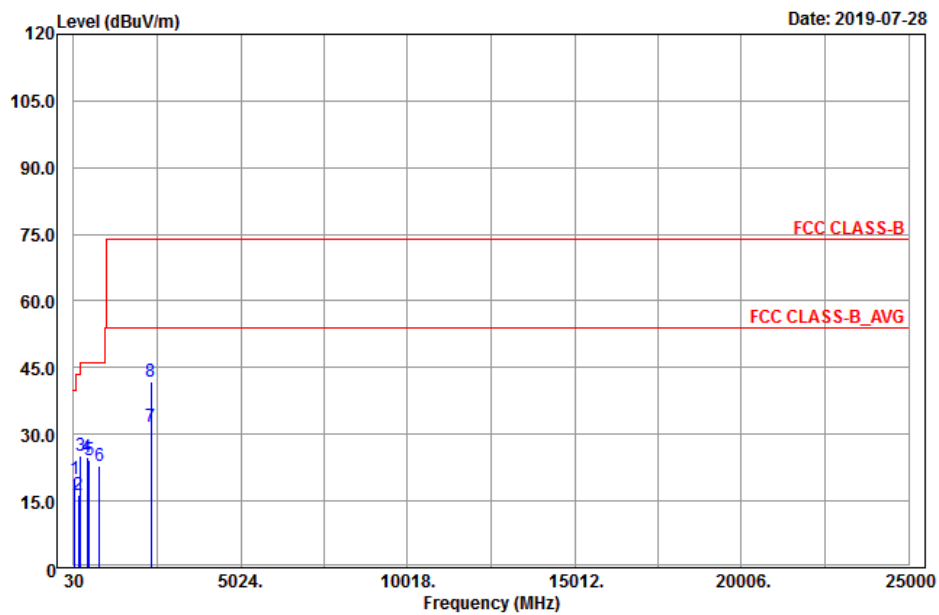
1. Emission Level = Read Level + Factor
Margin Value = Emission Level – Limit value
2. 2462 MHz: Fundamental Frequency.
3. The other emission levels were very low against the limit.

4.6.2 接收諧波

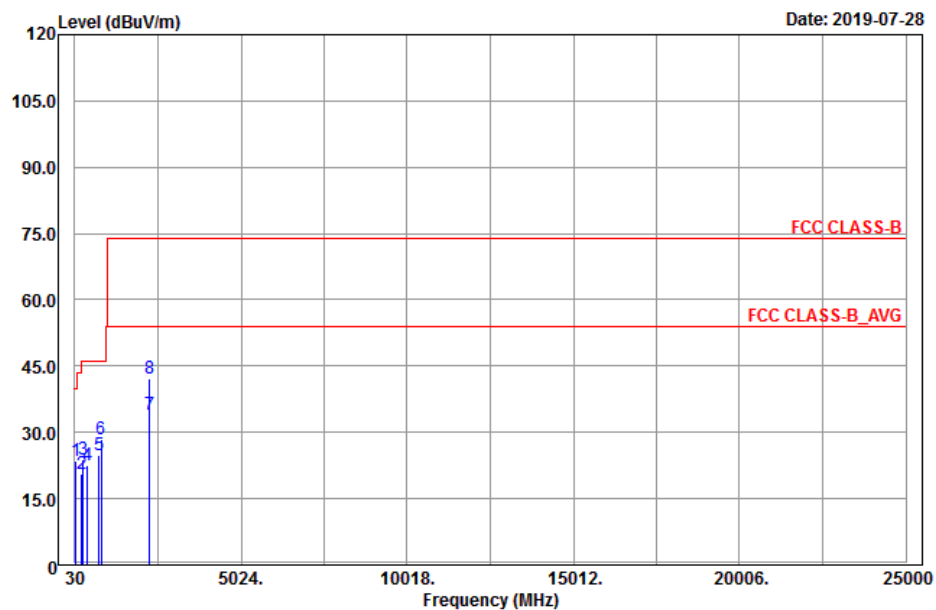
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 25 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Above 1 GHz: Peak (PK) & Average (AV) Below 1 GHz: Peak (PK) or Quasi-Peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
54.3	20.06	37.17	-17.11	40	-19.94	124	166	Peak
167.16	16.46	38.2	-21.74	43.5	-27.04	105	152	Peak
227.1	25.02	43.73	-18.71	46	-20.98	145	5	Peak
430.2	25.01	39.45	-14.44	46	-20.99	199	340	Peak
507.2	24.29	37.33	-13.04	46	-21.71	180	14	Peak
808.9	22.92	31.14	-8.22	46	-23.08	143	33	Peak
2350	31.71	26.83	4.88	54	-22.29	107	7	Average
2350	41.71	36.83	4.88	74	-32.29	107	7	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
55.92	23.55	40.89	-17.34	40	-16.45	139	9	Peak
234.12	20.63	39.05	-18.42	46	-25.37	148	143	Peak
284.34	23.74	41.04	-17.3	46	-22.26	105	203	Peak
417.6	22.62	37.2	-14.58	46	-23.38	105	14	Peak
748	24.86	33.99	-9.13	46	-21.14	179	55	Peak
827.1	28.54	36.33	-7.79	46	-17.46	220	340	Peak
2278	34.06	29.38	4.68	54	-19.94	154	4	Average
2278	42.06	37.38	4.68	74	-31.94	154	4	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin Value = Emission Level – Limit value
2. The other emission levels were very low against the limit.

4.6.3 其它不必要之訊號

9 kHz ~ 30 MHz Data:

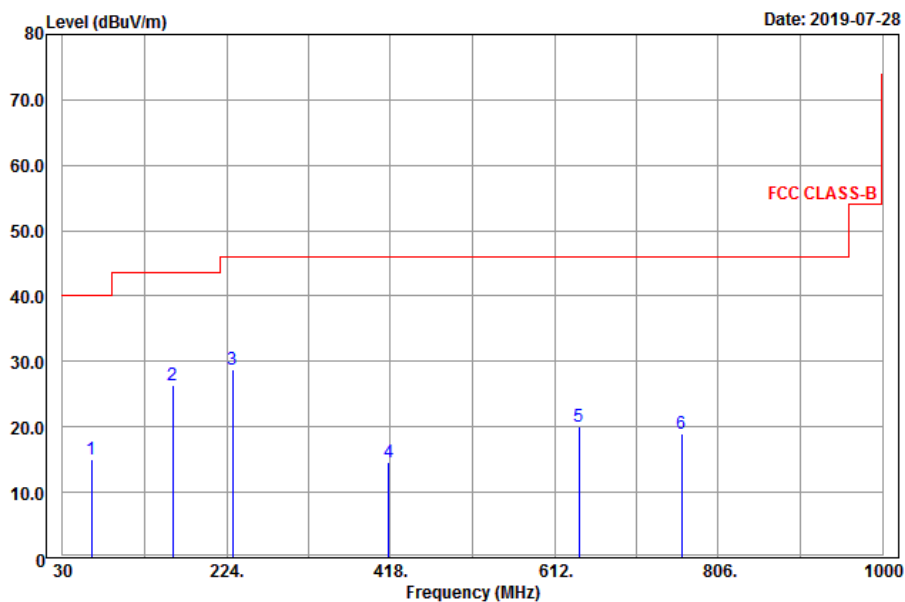
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Data:

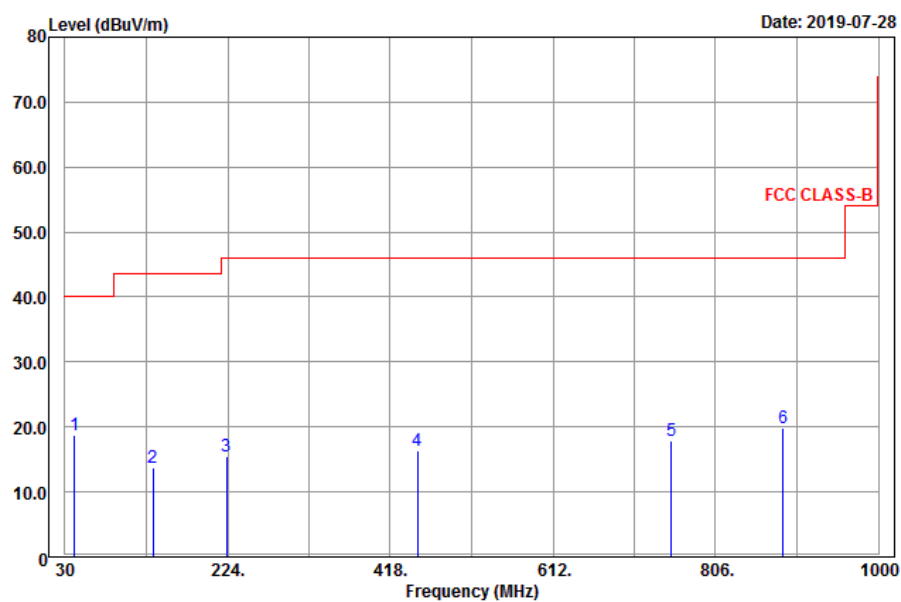
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 1 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Peak (PK) or Quasi-Peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
64.56	15.11	34.34	-19.23	40	-24.89	135	201	Peak
160.41	26.46	48.46	-22	43.5	-17.04	195	333	Peak
231.42	28.68	47.18	-18.5	46	-17.32	167	151	Peak
416.2	14.68	29.29	-14.61	46	-31.32	167	243	Peak
640.9	20.08	30.94	-10.86	46	-25.92	133	24	Peak
762.7	18.89	27.85	-8.96	46	-27.11	198	256	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
41.34	18.65	36.35	-17.7	40	-21.35	189	221	Peak
135.3	13.66	35.88	-22.22	43.5	-29.84	175	161	Peak
222.51	15.57	34.71	-19.14	46	-30.43	103	239	Peak
450.5	16.38	30.45	-14.07	46	-29.62	145	265	Peak
753.6	17.9	26.97	-9.07	46	-28.1	160	357	Peak
886.6	19.8	26.51	-6.71	46	-26.2	152	216	Peak

Remarks:

1. Emission Level = Read Level + Factor
Margin Value = Emission Level – Limit value
2. The other emission levels were very low against the limit.

4.7 量測結果判定

依據測試數據結果，符合低功率射頻電機技術規範之要求。

5 峰值傳導輸出功率之量測

5.1 適用標準

請見本報告 3.1 節第(4)及(6)項的規定。

5.2 量測方法

- 將待測物輸出經由衰減器接到功率計上。
- 設定待測物處於連續發射狀態。
- 計算其輸出功率峰值。

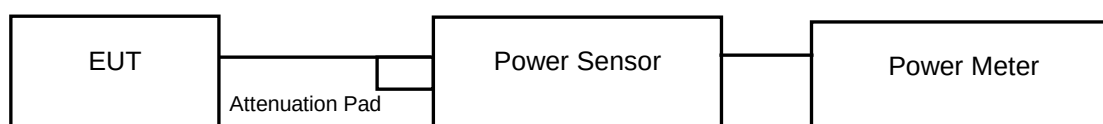
5.3 量測儀器

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Power Meter Anritsu	ML2495A	1232002	Dec. 17, 2018	Dec. 16, 2019
Power Sensor Anritsu	MA2411B	1207325	Dec. 17, 2018	Dec. 16, 2019

Note:

- The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
- The measurement uncertainty is 1.393 dB, which is calculated as per the document ETSI TR 100 028. This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.
- Measurement Bandwidth of ML2495A is 65 MHz greater than 6 dB bandwidth of emission.

5.4 測試配置



5.5 量測結果

操作模式	發射	測試日期	108 年 08 月 02 日
量測場地溫度	25 °C	量測場地濕度	60 % RH
測試者	Wayne Lin		

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	83.368	19.21	30	Pass
6	2437	84.528	19.27	30	Pass
11	2462	83.56	19.22	30	Pass
12	2467	84.528	19.27	30	Pass
13	2472	82.985	19.19	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.35	19.22	169.659	22.30	30	Pass
6	2437	19.42	19.36	173.796	22.40	30	Pass
11	2462	19.42	19.19	170.483	22.32	30	Pass
12	2467	19.17	19.15	164.828	22.17	30	Pass
13	2472	19.21	19.19	166.353	22.21	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.31	19.29	170.228	22.31	30	Pass
6	2437	19.19	19.16	165.399	22.19	30	Pass
11	2462	19.10	19.09	162.379	22.11	30	Pass
12	2467	19.21	19.18	166.162	22.21	30	Pass
13	2472	19.46	19.25	172.448	22.37	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	19.21	19.20	166.544	22.22	30	Pass
6	2437	19.36	19.34	172.199	22.36	30	Pass
9	2452	19.10	19.08	162.193	22.10	30	Pass
10	2457	19.40	19.21	170.464	22.32	30	Pass
11	2462	16.29	16.01	82.462	19.16	30	Pass

5.6 量測結果判定

依據測試數據結果，符合低功率射頻電機技術規範之要求。

U-NII 頻段測試紀錄結果

6 帶外發射之量測

6.1 適用標準

待測物操作頻帶	適用標準
☒ 5.15 GHz~5.25 GHz	請見本報告 3.1 節第(2)項(2)的規定
☒ 5.25 GHz~5.35 GHz	請見本報告 3.1 節第(2)項(2)的規定
☒ 5.470 GHz~5.725 GHz	請見本報告 3.1 節第(2)項(2)的規定
☒ 5.725 GHz~5.850 GHz	請見本報告 3.1 節第(2)項(3)的規定

6.2 量測方法

在電波暗室，將待測物置於 0.8 米高的非金屬桌面，使其操作在工作狀態。接收天線置於 3 米距離。桌面要 360 度旋轉，另外接收天線從離地 1 米至 4 米升降變化，以找出最大的輻射電場強度，接收天線分別置於水平、垂直極化各執行測試一次。

Note: 對於 1 GHz 以上場強輻射的測試，待測物則置於 1.5 米高的非金屬桌面

發射諧波：

Peak 為 RBW = 1 MHz, VBW = 3 MHz ;

Average

802.11a 為 RBW = 1 MHz, VBW = 1 kHz

802.11n (HT20) 為 RBW = 1 MHz, VBW = 1 kHz

802.11n (HT40) 為 RBW = 1 MHz, VBW = 3 kHz

802.11ac (VHT80) 為 RBW = 1 MHz, VBW = 10 kHz

接收諧波：

Below 1 GHz

Peak 為 RBW = 120 kHz, VBW = 360 kHz ; Quasi-Peak 為 RBW = 120 kHz, VBW = 120 kHz

Above 1 GHz:

Peak 為 RBW = 1 MHz, VBW = 3 MHz ; Average 為 RBW = 1 MHz, VBW = 3 kHz

其它不必要之訊號

Peak 為 RBW = 120 kHz, VBW = 360 kHz ; Quasi-Peak 為 RBW = 120 kHz, VBW = 120 kHz

6.3 量測儀器

同 4.3 節

6.4 測試配置

同 4.4 節

6.5 場強度之計算

場強之計算公式如下：

結果值 Emission level (dBuV/m) = 機器讀值 Raw Value (dBuV) + 校正因子 Correction Factor (dB/m)

餘裕度 Margin(dB) = 結果值 Emission level (dBuV/m) - 限制值 Limit value (dBuV/m)

*有效等向輻射功率限制值轉換場強值如下：

Applicable To			Limit	
789033 D02 General UNII Test Procedure New Rules v02r01			Field Strength at 3 m	
			PK: 74 (dBμV/m)	AV: 54 (dBμV/m)
操作頻帶	Applicable To		EIRP Limit	Equivalent Field Strength at 3 m
5150~5250 MHz	技術規範 4.7.4.1 節		PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
5250~5350 MHz	技術規範 4.7.4.1 節			
5470~5725 MHz	技術規範 4.7.4.1 節			
5725~5850 MHz	☒	技術規範 4.7.4.2 節	PK: -27 (dBm/MHz) ^{*1} PK: 10 (dBm/MHz) ^{*2} PK: 15.6 (dBm/MHz) ^{*3} PK: 27 (dBm/MHz) ^{*4}	PK: 68.2 (dBμV/m) ^{*1} PK: 105.2 (dBμV/m) ^{*2} PK: 110.8 (dBμV/m) ^{*3} PK: 122.2 (dBμV/m) ^{*4}
	☐	技術規範 4.7.4.7 節	適用 3.10.1.5 節帶外發射限制	
*1 beyond 75 MHz or more above of the band edge.				
*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.				
*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.				
*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.				

備註：有效等向輻射功率限制值轉換場強之公式如下：

$$E = (30PG)^{1/2} / d$$

E: 以最寬解析頻寬所測得之最大場強值，單位：V/m。

G: 發射天線相對於全向性輻射器之數值增益。

d: 測試場強的距離，單位：m。

P: 求得之功率，單位：W。

量測結果請見下頁。

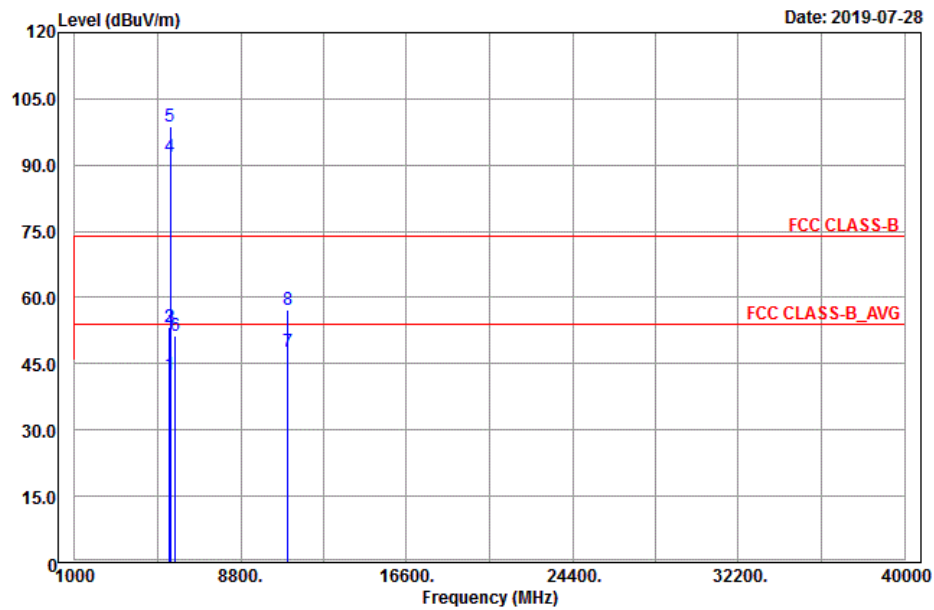
6.6 量測結果

6.6.1 發射諧波

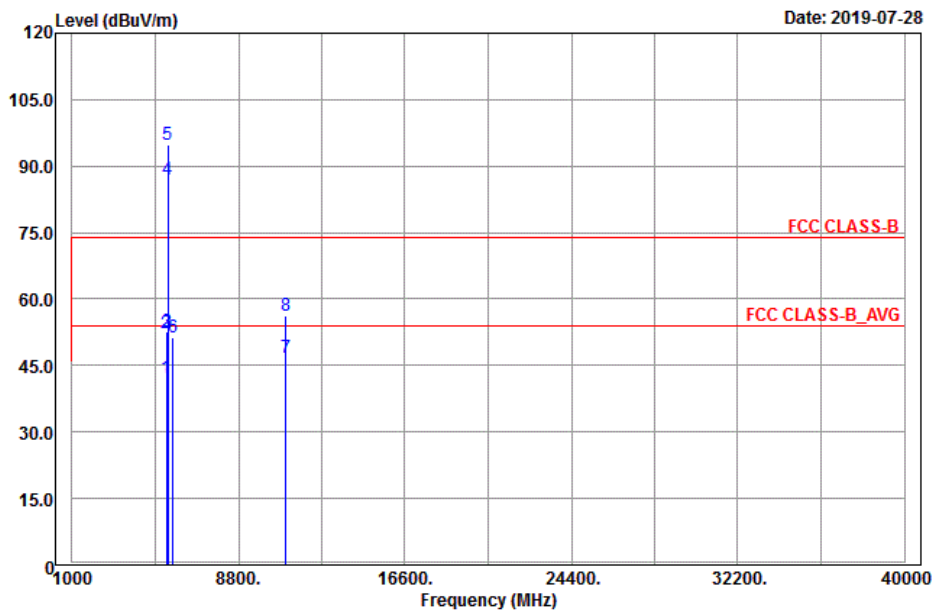
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 102	Frequency Range	1 GHz ~ 40 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
5459.76	42.4	31.89	10.51	54	-11.6	192	50	Average
5459.76	53.35	42.84	10.51	74	-20.65	192	50	Peak
*5469.68	53.26	42.73	10.53	68.2	-14.94	192	50	Peak
5510	91.86	81.26	10.6			192	50	Average
5510	98.68	88.08	10.6			192	50	Peak
*5725.72	51.45	40.53	10.92	68.2	-16.75	192	50	Peak
11020	47.73	31.57	16.16	54	-6.27	125	195	Average
11020	57.22	41.06	16.16	74	-16.78	125	195	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
5433.84	42.16	31.68	10.48	54	-11.84	164	91	Average
5433.84	52.37	41.89	10.48	74	-21.63	164	91	Peak
*5469.04	52.62	42.09	10.53	68.2	-15.58	164	91	Peak
5510	86.82	76.22	10.6			164	91	Average
5510	94.9	84.3	10.6			164	91	Peak
*5725.64	51.25	40.33	10.92	68.2	-16.95	164	91	Peak
11020	46.73	30.57	16.16	54	-7.27	168	195	Average
11020	56.29	40.13	16.16	74	-17.71	168	195	Peak

Remarks:

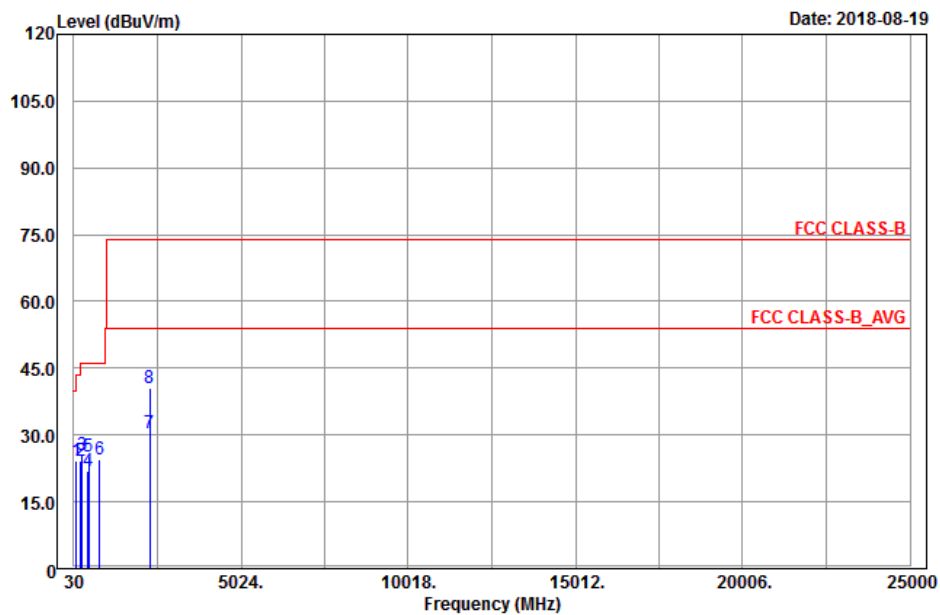
1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin Value = Emission Level – Limit value
2. 5510 MHz: Fundamental Frequency
3. *: Out of Restricted Band
4. The other emission levels were very low against the limit.

6.6.2 接收諧波

802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 102	Frequency Range	30 MHz ~ 40 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Above 1 GHz: Peak (PK) & Average (AV) Below 1 GHz: Peak (PK) or Quasi-Peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
99.12	24.06	42.84	-18.78	43.5	-19.44	119	264	Peak
233.31	24.12	42.54	-18.42	46	-21.88	151	146	Peak
278.94	25.47	42.83	-17.36	46	-20.53	124	203	Peak
447.7	21.92	36.04	-14.12	46	-24.08	134	226	Peak
483.4	25.15	38.59	-13.44	46	-20.85	180	111	Peak
801.2	24.56	32.94	-8.38	46	-21.44	146	147	Peak
2290	30.5	25.74	4.76	54	-23.5	154	98	Average
2290	40.5	35.74	4.76	74	-33.5	154	98	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
57.54	18.74	36.24	-17.5	40	-21.26	109	104	Peak
227.64	20.28	38.94	-18.66	46	-25.72	180	1	Peak
283.26	20.85	38.16	-17.31	46	-25.15	164	13	Peak
417.6	24.62	39.2	-14.58	46	-21.38	152	22	Peak
577.9	24.12	35.89	-11.77	46	-21.88	154	118	Peak
808.9	25.05	33.27	-8.22	46	-20.95	190	103	Peak
2279	33.11	28.43	4.68	54	-20.89	144	17	Average
2279	43.11	38.43	4.68	74	-30.89	144	17	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin Value = Emission Level – Limit value
2. The other emission levels were very low against the limit.

6.6.3 其它不必要之訊號

9 kHz ~ 30 MHz Data:

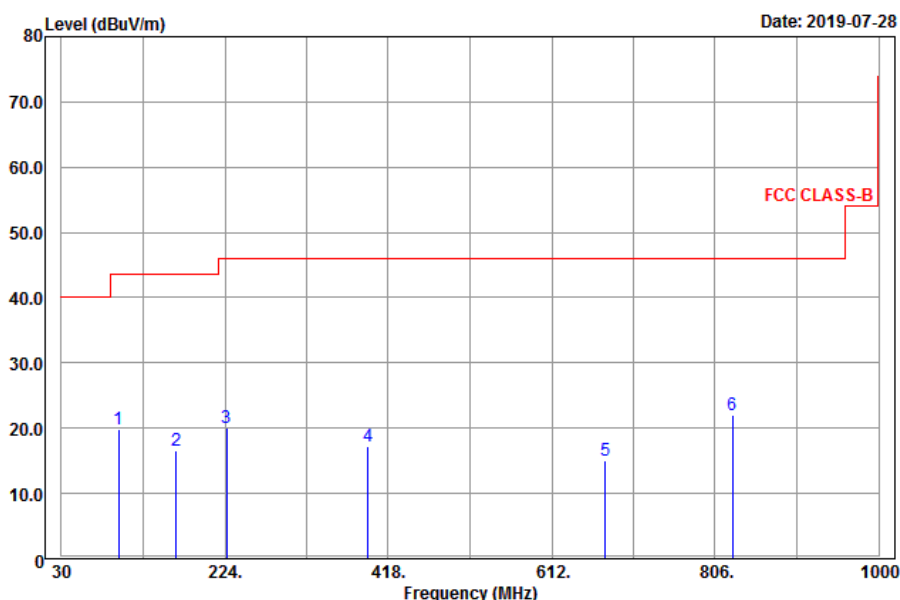
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Data:

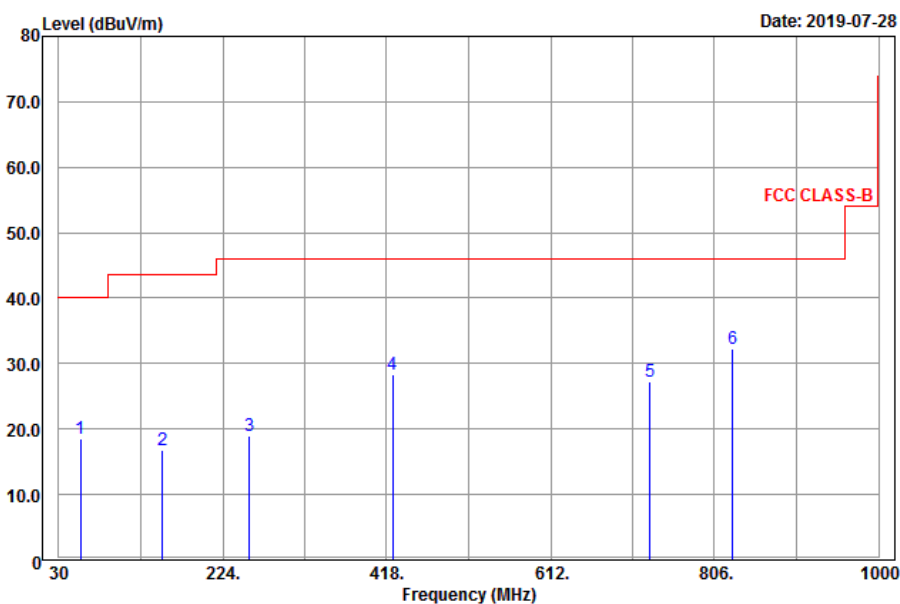
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 102	Frequency Range	30 MHz ~ 1 GHz
Input Power	110 Vac, 60 Hz	Detector Function	Peak (PK) or Quasi-Peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
98.04	19.74	38.59	-18.85	43.5	-23.76	124	163	Peak
166.35	16.55	38.29	-21.74	43.5	-26.95	152	222	Peak
225.75	20.03	38.78	-18.75	46	-25.97	180	18	Peak
393.8	17.25	32.25	-15	46	-28.75	180	196	Peak
675.9	14.94	25.14	-10.2	46	-31.06	124	2	Peak
826.4	21.95	29.77	-7.82	46	-24.05	124	155	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
55.92	18.54	35.88	-17.34	40	-21.46	159	29	Peak
152.85	16.84	39.09	-22.25	43.5	-26.66	124	116	Peak
255.72	19.03	36.77	-17.74	46	-26.97	180	100	Peak
425.3	28.39	42.88	-14.49	46	-17.61	142	221	Peak
729.8	27.24	36.59	-9.35	46	-18.76	157	188	Peak
827.1	32.18	39.97	-7.79	46	-13.82	124	233	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

Margin Value = Emission Level – Limit value

2. The other emission levels were very low against the limit.

6.7 量測結果判定

依據測試數據結果，符合低功率射頻電機技術規範之要求。

7 峰值傳導輸出功率量測及發射頻寬之要求

7.1 適用標準

待測物操作頻帶	適用標準
☒ 5.15 GHz~5.25 GHz	請見本報告 3.1 節第(4)項(2)及(6)項(2)的規定
☒ 5.25 GHz~5.35 GHz	請見本報告 3.1 節第(4)項(3)及(6)項(3)的規定
☒ 5.470 GHz~5.725 GHz	請見本報告 3.1 節第(4)項(3)及(6)項(3)的規定
☒ 5.725 GHz~5.850 GHz	請見本報告 3.1 節第(4)項(4)及(6)項(4)的規定

7.2 量測方法

輸出峰值功率量測方法:

11a, 11n/ac(HT20/VTH20), 11n/ac(HT40/VHT40):

- 將待測物輸出經由衰減器接到功率計上。
- 設定待測物處於連續發射狀態，設置功率計的 gate 功能確保量測功率皆為 Burst on 的功率。
- 計算其輸出功率峰值。

11ac(VHT80):

- 將待測物輸出經由衰減器接到頻譜分析儀上。
- 設定待測物處於連續發射狀態，量測方法依照 FCC KDB 789033。
- 計算其輸出功率峰值。

For transmission above 5.725 GHz where the EBW crosses 5.725 GHz

- 將待測物輸出接到頻譜分析儀上。
- 設定待測物處於連續發射狀態。
- 設定頻譜掃瞄寬為 26 dB occupied bandwidth。
- 設置解析頻寬為 1 MHz，視訊頻寬為 3 倍的解析頻寬。
- 設置測試掃瞄點數要大於 2 倍的(span/RBW)。
- 設置檢波器為 RMS。
- 設置掃瞄時間為 auto。
- 設置 Trigger 模式為 free run (當 Duty cycle 大於 98 %)；設置 Trigger 模式為 Video trigger (當 Duty cycle 小於 98 %)。
- 設置 Trace mode 為 average 至少 100 次。
- 待掃描結果穩定。
- 使用頻譜的內建 band power 功能，量測 26 dB bandwidth 內最大功率值。

發射頻寬量測方法:

- 將待測物輸出經由衰減器接到頻譜分析儀上。
- 設定待測物處於連續發射狀態。
- 最大輸出功率峰值減 26 dB 的最大頻率範圍。

7.3 量測儀器

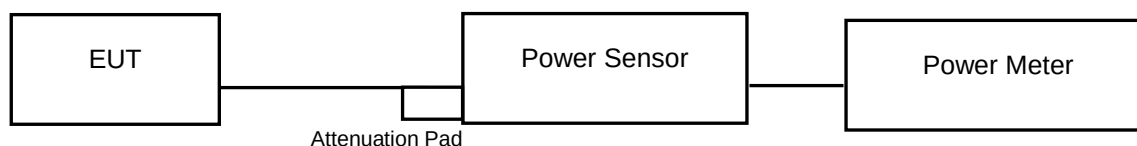
Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Power Meter	ML2495A	1232002	Dec. 17, 2018	Dec. 16, 2019
Power Sensor	MA2411B	1207325	Dec. 17, 2018	Dec. 16, 2019
Spectrum Analyzer R&S	FSU43	101261	Apr. 19, 2019	Apr. 18, 2020

Note:

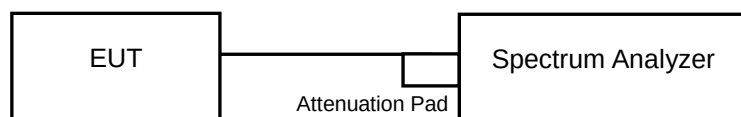
- The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
- The measurement uncertainty is 207 Hz, which is calculated as per the document ETSI TR 100 028. This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k=2$.

7.4 測試配置

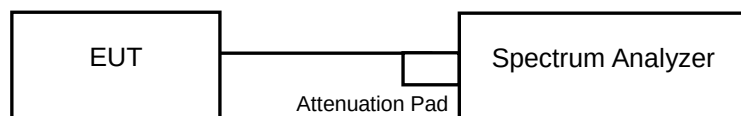
輸出峰值功率測試配置:



or



發射頻寬之測試配置:



7.5 量測結果

操作模式	發射	測試日期	108 年 08 月 02 日
量測場地溫度	25 °C	量測場地濕度	60 % RH
測試者	Wayne Lin		

802.11a

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	12.83	12.75	38.023	15.80	24	Pass
40	5200	12.78	12.76	37.847	15.78	24	Pass
48	5240	12.83	12.78	38.154	15.82	24	Pass
52	5260	12.87	12.84	38.595	15.87	24	Pass
60	5300	12.88	12.79	38.42	15.85	24	Pass
64	5320	12.78	12.77	37.89	15.79	24	Pass
100	5500	12.85	12.77	38.198	15.82	24	Pass
116	5580	12.89	12.86	38.774	15.89	24	Pass
140	5700	12.90	12.86	38.818	15.89	24	Pass
144	5720 (U-NII-2C)	11.49	11.39	27.865	14.45	22.87	Pass
144	5720 (U-NII-3)	6.97	7.20	10.225	10.10	30	Pass
149	5745	12.89	12.79	38.465	15.85	30	Pass
157	5785	12.76	12.71	37.544	15.75	30	Pass
165	5825	12.80	12.78	38.022	15.80	30	Pass

Note:

For U-NII-2A, U-NII-2C Band:

Chain 0

1. $11 \text{ dBm} + 10\log(21.92) = 24.4 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(21.78) = 24.38 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(21.89) = 24.4 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(21.57) = 24.33 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(21.42) = 24.3 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(21.59) = 24.34 \text{ dBm} > 24 \text{ dBm}$.
7. $11 \text{ dBm} + 10\log(15.39) = 22.87 \text{ dBm} < 24 \text{ dBm}$.

Chain 1

1. $11 \text{ dBm} + 10\log(21.65) = 24.35 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(21.68) = 24.36 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(21.91) = 24.40 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(21.84) = 24.39 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(21.75) = 24.37 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(21.72) = 24.36 \text{ dBm} > 24 \text{ dBm}$.
7. $11 \text{ dBm} + 10\log(15.72) = 22.96 \text{ dBm} < 24 \text{ dBm}$.

802.11ac (VHT20)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
36	5180	12.82	12.79	38.154	15.82	24	Pass
40	5200	12.77	12.71	37.587	15.75	24	Pass
48	5240	12.82	12.80	38.198	15.82	24	Pass
52	5260	12.82	12.79	38.154	15.82	24	Pass
60	5300	12.87	12.76	38.244	15.83	24	Pass
64	5320	12.80	12.78	38.022	15.80	24	Pass
100	5500	12.84	12.81	38.33	15.84	24	Pass
116	5580	12.87	12.85	38.639	15.87	24	Pass
140	5700	12.80	12.76	37.935	15.79	24	Pass
144	5720 (U-NII-2C)	11.43	11.38	27.64	14.42	23.02	Pass
144	5720 (U-NII-3)	7.00	7.03	10.059	10.03	30	Pass
149	5745	12.85	12.83	38.462	15.85	30	Pass
157	5785	12.87	12.83	38.551	15.86	30	Pass
165	5825	12.88	12.84	38.64	15.87	30	Pass

Note:

For U-NII-2A, U-NII-2C Band:

Chain 0

1. $11 \text{ dBm} + 10\log(21.73) = 24.37 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(21.55) = 24.33 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(21.97) = 24.41 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(22.06) = 24.43 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(21.67) = 24.35 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(22.00) = 24.42 \text{ dBm} > 24 \text{ dBm}$.
7. $11 \text{ dBm} + 10\log(15.94) = 23.02 \text{ dBm} < 24 \text{ dBm}$.

Chain 1

1. $11 \text{ dBm} + 10\log(21.80) = 24.38 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(21.68) = 24.36 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(21.94) = 24.41 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(21.72) = 24.36 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(21.73) = 24.37 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(21.75) = 24.37 \text{ dBm} > 24 \text{ dBm}$.
7. $11 \text{ dBm} + 10\log(15.97) = 23.03 \text{ dBm} < 24 \text{ dBm}$.

802.11ac (VHT40)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
38	5190	11.89	11.78	30.519	14.85	24	Pass
46	5230	11.89	11.82	30.658	14.87	24	Pass
54	5270	11.81	11.77	30.202	14.80	24	Pass
62	5310	11.87	11.85	30.693	14.87	24	Pass
102	5510	11.83	11.80	30.377	14.83	24	Pass
110	5550	11.57	11.55	28.644	14.57	24	Pass
134	5670	11.84	11.81	30.447	14.84	24	Pass
142	5710 (U-NII-2C)	10.96	10.92	24.833	13.95	24	Pass
142	5710 (U-NII-3)	4.10	4.15	5.17	7.13	30	Pass
151	5755	11.88	11.85	30.728	14.88	30	Pass
159	5795	11.80	11.77	30.167	14.80	30	Pass

Note:

For U-NII-2A, U-NII-2C Band:

Chain 0

1. $11 \text{ dBm} + 10\log(46.04) = 27.63 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(45.66) = 27.59 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(45.88) = 27.61 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(45.74) = 27.60 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(45.93) = 27.62 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(37.48) = 26.73 \text{ dBm} > 24 \text{ dBm}$.

Chain 1

1. $11 \text{ dBm} + 10\log(45.25) = 27.55 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(44.98) = 27.53 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(45.65) = 27.59 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(45.30) = 27.56 \text{ dBm} > 24 \text{ dBm}$.
5. $11 \text{ dBm} + 10\log(45.44) = 27.57 \text{ dBm} > 24 \text{ dBm}$.
6. $11 \text{ dBm} + 10\log(37.77) = 26.77 \text{ dBm} > 24 \text{ dBm}$.

802.11ac (VHT80)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
42	5210	10.79	10.76	23.907	13.79	24	Pass
58	5290	10.87	10.83	24.324	13.86	24	Pass
106	5530	10.88	10.81	24.296	13.86	24	Pass
122	5610	10.78	10.75	23.852	13.78	24	Pass
138	5690 (U-NII-2C)	10.57	10.49	22.596	13.54	24	Pass
138	5690 (U-NII-3)	-0.44	0.24	1.9604	2.92	30	Pass
155	5775	10.89	10.86	24.464	13.89	30	Pass

Note:

For U-NII-2A, U-NII-2C Band:

Chain 0

1. $11 \text{ dBm} + 10\log(83.64) = 30.22 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(83.42) = 30.21 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(83.75) = 30.22 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(76.64) = 29.84 \text{ dBm} > 24 \text{ dBm}$.

Chain 1

1. $11 \text{ dBm} + 10\log(82.35) = 30.15 \text{ dBm} > 24 \text{ dBm}$.
2. $11 \text{ dBm} + 10\log(82.45) = 30.16 \text{ dBm} > 24 \text{ dBm}$.
3. $11 \text{ dBm} + 10\log(82.51) = 30.16 \text{ dBm} > 24 \text{ dBm}$.
4. $11 \text{ dBm} + 10\log(76.83) = 29.85 \text{ dBm} > 24 \text{ dBm}$.

8 電源線傳導干擾之量測

8.1 適用標準

請見本報告 3.1 節第(1)項的規定。

8.2 量測方法

將待測物置於 0.8 米高的非金屬桌面，使其操作在工作狀態，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 0.15 MHz 至 30 MHz 之間之電源線傳導放射強度。

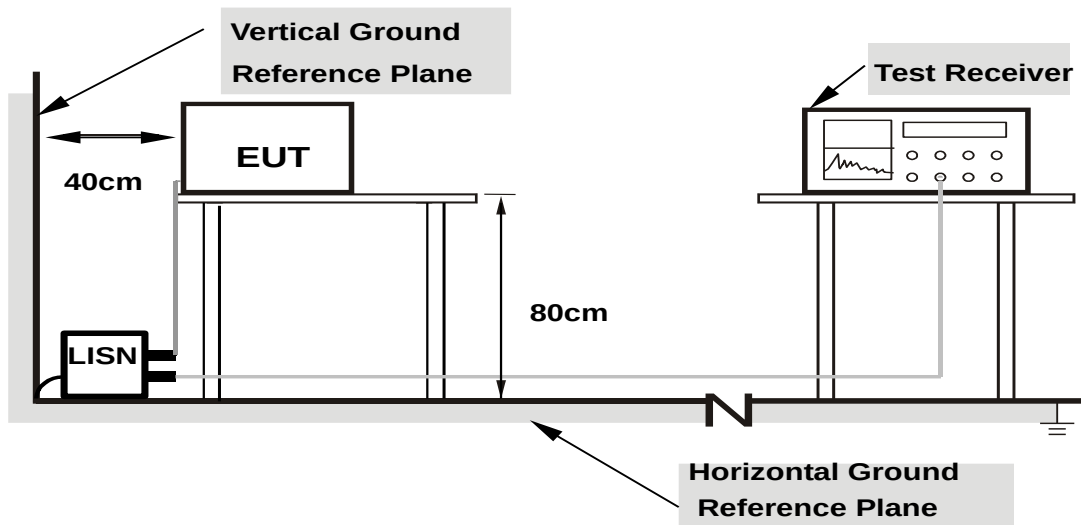
8.3 量測儀器

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 10, 2018	Dec. 09, 2019
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2018	Sep. 04, 2019
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 21, 2019	Feb. 20, 2020
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 19, 2018	Aug. 18, 2019
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-12040.
4. The measurement uncertainty is 2.94 dB, which is calculated as per the document CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.

8.4 測試配置



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

8.5 干擾值之計算

餘裕度 Margin(dB)= 結果值 Emission level (dBuV)-限制值 Limit value (dBuV)

電源傳導干擾電壓之計算公式如下

結果值 Emission level (dBuV)=校正因子 Correction Factor (dB)+儀器讀值 Reading value (dBuV)

其中校正因子 Correction Factor (dB)為：

饋線損失+電源阻抗模擬網路損失

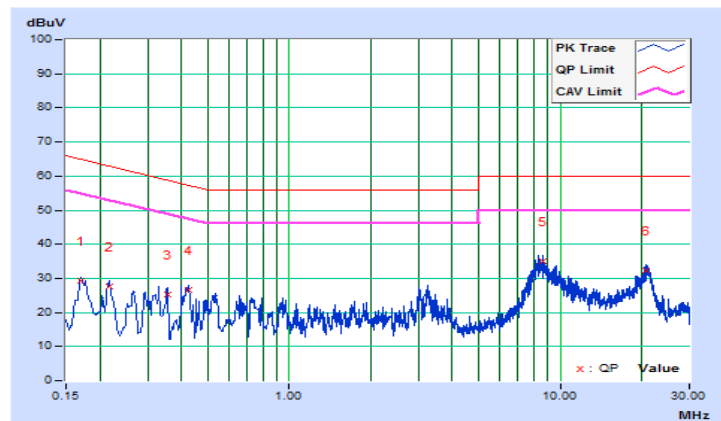
8.6 量測結果

量測頻率範圍	150kHz ~ 30MHz	檢測器與頻寬	準峰值 (QP) / 平均值 (AV), 9kHz
量測電壓值	110Vac, 60Hz	量測場地溫濕度	25°C, 65%RH
測試者	Thomas Wei	測試日期	2019/8/1
測試模式	Mode 2		

量測電源端點：火線 (L1)										
No	頻率 (MHz)	修正 因子 (dB)	量測讀值 (dBuV)		干擾值 (dBuV)		限制值 (dBuV)		餘裕 (dB)	
			準峰值	平均值	準峰值	平均值	準峰值	平均值	準峰值	平均值
1	0.16955	9.84	19.51	11.97	29.35	21.81	64.98	54.98	-35.63	-33.17
2	0.21647	9.85	17.70	11.02	27.55	20.87	62.95	52.95	-35.40	-32.08
3	0.35483	9.87	15.30	9.93	25.17	19.80	58.85	48.85	-33.68	-29.05
4	0.42370	9.88	16.75	6.66	26.63	16.54	57.38	47.38	-30.75	-30.84
5	8.59951	10.13	24.72	14.83	34.85	24.96	60.00	50.00	-25.15	-25.04
6	20.85736	10.25	22.17	12.81	32.42	23.06	60.00	50.00	-27.58	-26.94

附註：

1. 其它頻率的干擾值對限制值而言非常低，所以未記錄。
2. 餘裕值(dB) = 干擾值(dBuV) - 限制值(dBuV)
3. 干擾值(dBuV) = 修正因子(dB) + 量測讀值(dBuV)

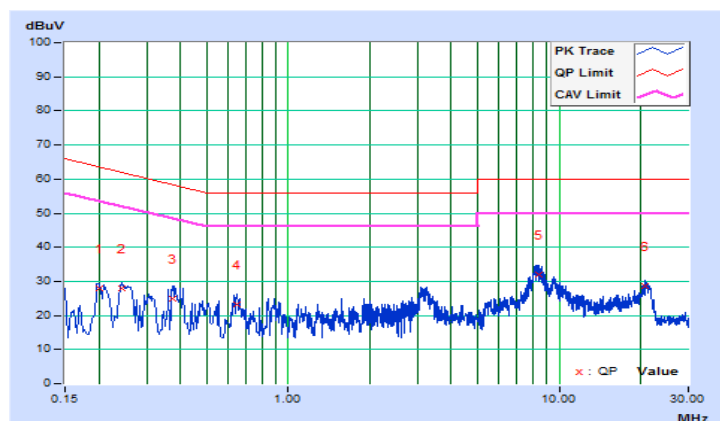


量測頻率範圍	150kHz ~ 30MHz	檢測器與頻寬	準峰值 (QP) / 平均值 (AV), 9kHz
量測電壓值	110Vac, 60Hz	量測場地溫濕度	25°C, 65%RH
測試者	Thomas Wei	測試日期	2019/8/1
測試模式	Mode 2		

量測電源端點：中性線 (N)										
No	頻率 (MHz)	修正因子 (dB)	量測讀值 (dBuV)		干擾值 (dBuV)		限制值 (dBuV)		餘裕 (dB)	
			準峰值	平均值	準峰值	平均值	準峰值	平均值	準峰值	平均值
1	0.20083	9.84	18.27	8.21	28.11	18.05	63.58	53.58	-35.47	-35.53
2	0.24343	9.85	18.16	10.83	28.01	20.68	61.98	51.98	-33.97	-31.30
3	0.37287	9.87	15.20	7.58	25.07	17.45	58.44	48.44	-33.37	-30.99
4	0.64657	9.87	13.25	9.76	23.12	19.63	56.00	46.00	-32.88	-26.37
5	8.36882	10.12	22.02	8.03	32.14	18.15	60.00	50.00	-27.86	-31.85
6	20.82608	10.31	18.23	3.00	28.54	13.31	60.00	50.00	-31.46	-36.69

附註：

1. 其它頻率的干擾值對限制值而言非常低，所以未記錄。
2. 餘裕值(dB) = 干擾值(dBuV) - 限制值(dBuV)
3. 干擾值(dBuV) = 修正因子(dB) + 量測讀值(dBuV)



8.7 量測結果判定

依據測試數據結果，符合低功率射頻電機技術規範之要求。

9 電波暴露量之評估

9.1 適用標準

請見本報告 3.1 節第(12)項的規定。

9.2 評估方法

a) 以 5.5、7.5 節所測得的最大輸出功率值再加上待測物天線的增益值(Gain)帶入下面公式換算出待測物所輻射的功率密度。

$$b) P_d = (P_{out} * G) / (4 * \pi * r^2)$$

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

9.3 評估結果

Frequency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Pass/Fail
2412 ~ 2472	22.40	2.40	20	0.060	1	Pass
5180 ~ 5240	15.82	4.04	20	0.019	1	Pass
5260 ~ 5320	15.87	4.18	20	0.020	1	Pass
5500 ~ 5720	15.89	5.71	20	0.029	1	Pass
5745 ~ 5825	15.87	5.71	20	0.029	1	Pass

Note:

1. For 2.4GHz Band: Directional gain = $-0.61 + 10 \log(2) = 2.40$
2. For 5G B1 Band: Directional gain = $1.03 + 10 \log(2) = 4.04$
3. For 5G B2 Band: Directional gain = $1.17 + 10 \log(2) = 4.18$
4. For 5G B3 Band: Directional gain = $2.7 + 10 \log(2) = 5.71$
5. For 5G B4 Band: Directional gain = $2.7 + 10 \log(2) = 5.71$

10 待測物照片

請參照 BV CPS 報告編號：190527C33

附錄：動態頻率選擇

1 EUT Information

1.1 Operating Frequency Bands and Mode of EUT

Table 1: Operating frequency bands and mode of EUT

Operational Mode	Operating Frequency Range	
	5250 ~ 5350 MHz	5470 ~ 5725 MHz
Client without radar detection and ad hoc function	✓	✓

1.2 EUT Software and Firmware Version

Table 2: The EUT software/firmware version

No.	Product	Model No.	Software/Firmware Version
1	Wireless LAN	WL17A	1030.33.306.2018

1.3 Description of Available Antennas to the EUT

Table 3: Antenna list

Ant No.	Antenna Type	Operation Frequency Range (MHz)	Max. Gain (dBi)
1	PIFA	5250~5350	1.17
1	PIFA	5470~5725	2.70

1.4 EUT Maximum Conducted Power

Table 4: The measured conducted output power

802.11a

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	15.87	38.595
5470~5725	15.89	38.818

802.11n (HT20)

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	15.83	38.244
5470~5725	15.87	38.639

802.11n (HT40)

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	14.87	30.693
5470~5725	14.84	30.447

802.11ac (VHT80)

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	13.86	24.324
5470~5725	13.86	24.296

1.5 EUT Maximum E.I.R.P. Power

Table 5: The E.I.R.P output power list

802.11a

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	17.04	50.528
5470~5725	18.59	72.282

802.11n (HT20)

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	17.00	50.068
5470~5725	18.57	71.949

802.11n (HT40)

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	16.04	40.183
5470~5725	17.54	56.695

802.11ac (VHT80)

Frequency Band (MHz)	Max. Power	
	Output Power (dBm)	Output Power (mW)
5250~5350	15.03	31.845
5470~5725	16.56	45.241

1.6 Transmit Power Control (TPC)

U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW. Maximum EIRP of this device is 72.282 mW which less than 500 mW, therefore it's not require TPC function.

TPC	E.I.R.P	LP0002 4.7.7.1
	> 500mW	The TPC mechanism is required for system with an E.I.R.P. of above 500mW
√	< 500mW	The TPC mechanism is not required for system with an E.I.R.P. of less 500mW

1.7 Statement of Manufacturer

Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user. **And the device doesn't have Ad Hoc mode on DFS frequency band.**

2 U-NII DFS Rule Requirements

2.1 Working Modes and Required Test Items

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables 6 and 7 for the applicability of DFS requirements for each of the operational modes.

Table 6: Applicability of DFS Requirements Prior to Use a Channel

Requirement	Operational Mode		
	Master	Client without radar detection	Client with radar detection
Non-Occupancy Period	✓	✓ note	✓
DFS Detection Threshold	✓	Not required	✓
Channel Availability Check Time	✓	Not required	Not required
U-NII Detection Bandwidth	✓	Not required	✓

Note: Per KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02 section (b)(5/6), If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear. An analyzer plot that contains a single 30-minute sweep on the original channel.

Table 7: Applicability of DFS Requirements during Normal Operation

Requirement	Operational Mode	
	Master or Client with radar detection	Client without radar detection
DFS Detection Threshold	✓	Not required
Channel Closing Transmission Time	✓	✓
Channel Move Time	✓	✓
U-NII Detection Bandwidth	✓	Not required

Additional requirements for devices with multiple bandwidth modes	Master or Client with radar detection	Client without radar detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All Other Tests	Any single BW mode	Not required

Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

2.2 Test Limits and Radar Signal Parameters

Detection Threshold Values

Table 8: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.

Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Table 9: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second periods. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100 % of the U-NII 99 % transmission power bandwidth. See Note 3

Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

Parameters of DFS Test Signals

Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Table 10: Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a. Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A.	Roundup $\left\lceil \frac{1}{360} \cdot \frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right\rceil$	60 %	30
2	1-5	150-230	23-29	60 %	30
3	6-10	200-500	16-18	60 %	30
4	11-20	200-500	12-16	60 %	30
Aggregate (Radar Types 1-4)				80 %	120

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.

Table 11: Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80 %	30

Three subsets of trials will be performed with a minimum of ten trials per subset. The subset of trials differ in where the Long Pulse Type 5 Signal is tuned in frequency.

a) the Channel center frequency
b) tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the low edge of the UUT Occupied Bandwidth
c) tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the high edge of the UUT Occupied Bandwidth

It include 10 trails for every subset, the formula as below,

For subset case 1: the center frequency of the signal generator will remain fixed at the center of the UUT Channel.

For subset case 2: to retain 90% frequency overlap between the radar signal and the UUT Occupied Bandwidth, the center frequency of the signal generator will vary for each of the ten trials in subset case 2. The center frequency of the signal generator for each trial is calculated by:

$$FL + (0.4 * \text{Chirp Width [in MHz]})$$

For subset case 3: to retain 90% frequency overlap between the radar signal and the UUT Occupied Bandwidth, the center frequency of the signal generator will vary for each of the ten trials in subset case 3. The center frequency of the signal generator for each trial is calculated by:

$$FH - (0.4 * \text{Chirp Width [in MHz]})$$

Table 12: Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70 %	30

3 Test & Support Equipment List

3.1 Test Instruments

Table 1: Test Instruments List

Description & Manufacturer	Model No.	Brand	Date Of Calibration	Due Date Of Calibration
Spectrum analyzer	ESR	R&S	Mar 06, 2019	Mar 05, 2020
Signal generator	MXG	KEYSIGHT	Dec 24, 2018	Dec 23, 2019
Horn antenna	BBHA 9120 D	Schwarzbeck	Nov 25, 2018	Nov. 24, 2019
RF coaxial cable	SUCOFLEX 104	HUBER SUHNER	Aug. 23, 2018	Aug. 22, 2019

3.2 Description of Support Units

Table 2: Support Unit information

No.	Product	Brand	Model No.	ID	Spec.
1	Router	NETGEAR	R7800	PY315100319	5G Ant gain : 1.61dBi Maximum EIRP : 25.47dBm

NOTE: This device was functioned as a ☒ Master ☐ Slave device during the DFS test.

Table 3: Software/Firmware information

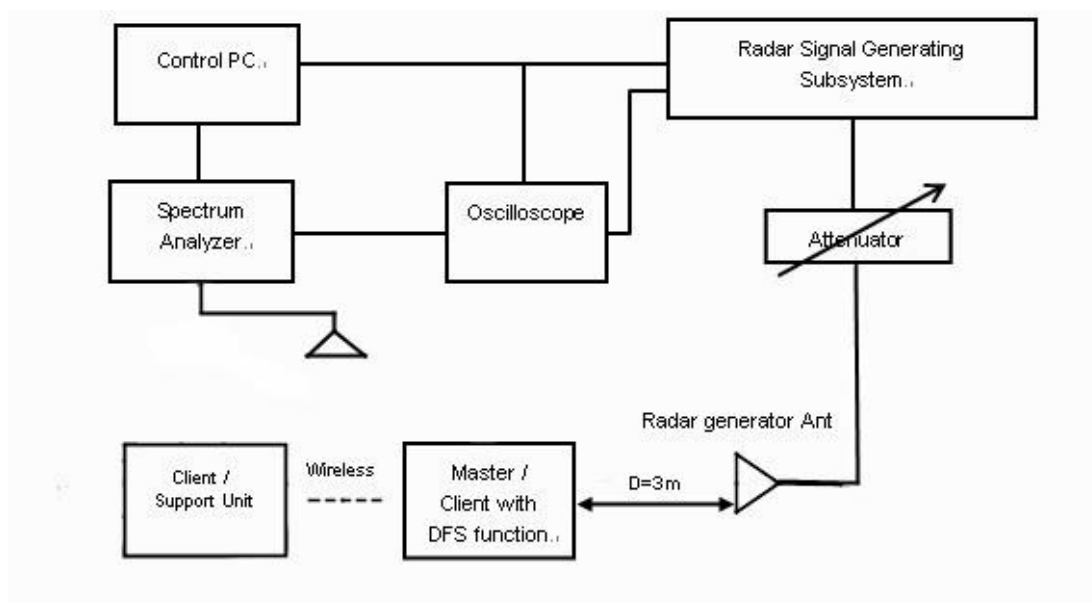
No.	Product	Model No.	Software/Firmware Version
1.	Router	R7800	V1.0.2.36

4 Test Procedure

4.1 ADT DFS Measurement System

A complete ADT DFS Measurement System consists of two subsystems: (1) the Radar Signal Generating Subsystem and (2) the Traffic Monitoring Subsystem. The control PC is necessary for generating the Radar waveforms in Table 10, 11 and 12. The traffic monitoring subsystem is specified to the type of unit under test (UUT).

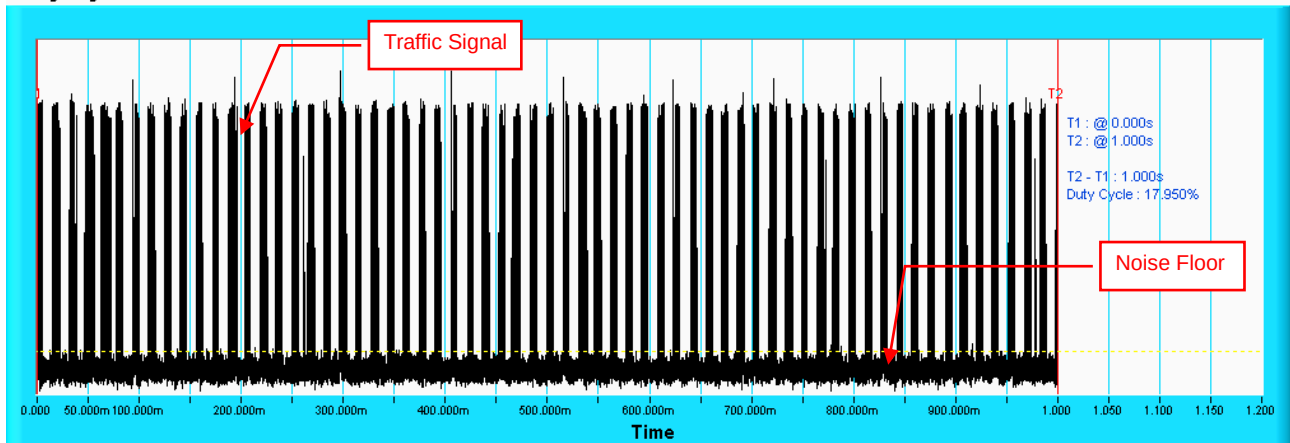
Radiated Setup Configuration of DFS Measurement System



System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:

	a) The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.
	b) Software to ping the client is permitted to simulate data transfer but must have random ping intervals.
✓	c) Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17 % or greater.
	d) Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.

Wireless Traffic Loading Duty Cycle

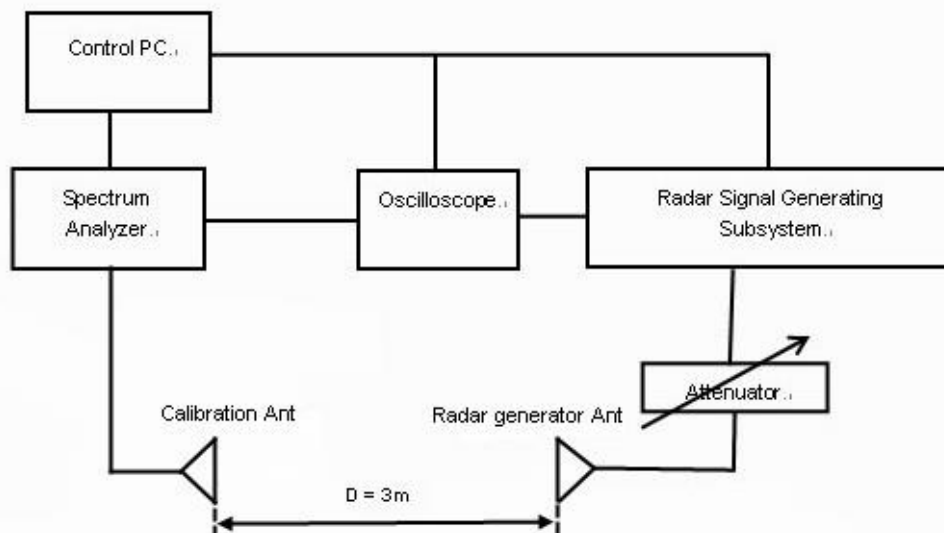


4.2 Calibration of DFS Detection Threshold Level

The measured channel is 5500 MHz, 5510 MHz and 5530 MHz. The radar signal was the same as transmitted channels, and injected into the antenna of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time. The calibrated detection threshold level is set to -64 dBm. The tested level is lower than required level hence it provides margin to the limit.

Radiated setup configuration of Calibration of DFS Detection Threshold Level

The radar signal generate system is generating waveform pattern of radar types. The amplitude of the radar signal generator system is adjusted to yield a level of - 64 dBm as measured on the spectrum analyzer. The interference detection threshold level is lower than - 64dBm hence it provides margin to the limit.

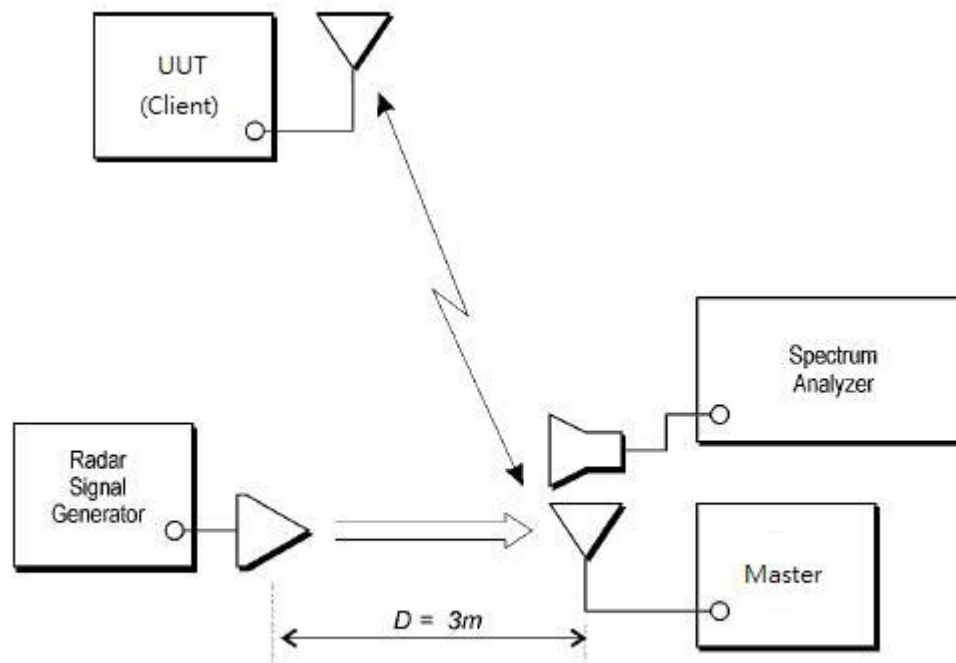


4.3 Deviation from Test Standard

No deviation.

4.4 Radiated Test Setup Configuration

4.4.1 Client without Radar Detection Mode



5 Test Results

5.1 Summary of Test Results

Clause	Test Parameter	Remarks	Pass / Fail
4.7.7	DFS Detection Threshold	Not Applicable	NA
4.7.7	Channel Availability Check Time	Not Applicable	NA
4.7.7	Channel Move Time	Applicable	Pass
4.7.7	Channel Closing Transmission Time	Applicable	Pass
4.7.7	Non- Occupancy Period	Applicable	Pass
4.7.7	Uniform Spreading	Not Applicable	NA
4.7.7	U-NII Detection Bandwidth	Not Applicable	NA
4.7.7	Non-associated test	Applicable	Pass
4.7.7	Non-Co-Channel test	Applicable	Pass

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

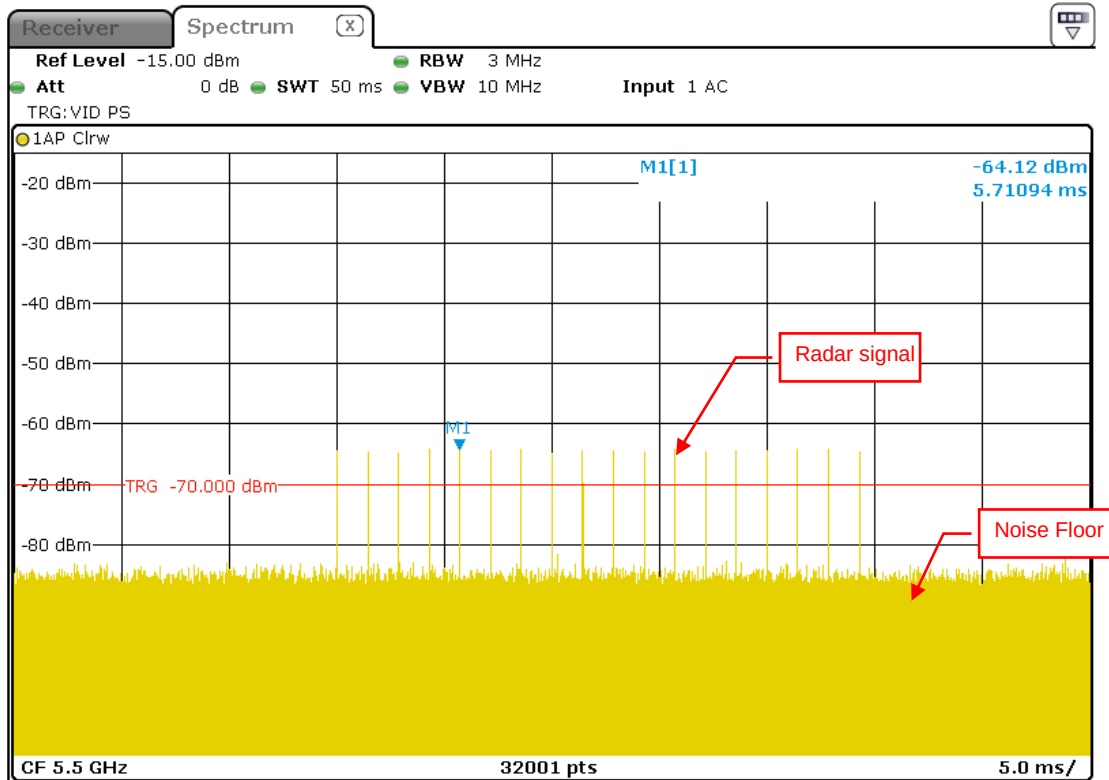
5.2 Test Results

5.2.1 Test Mode: Device operating in Client without Radar Detection Mode

Client with injection at the Master. (The radar test signals are injected into the Master Device)

DFS Detection Threshold

For a detection threshold level of -64 dBm, the required signal strength at Master antenna location is -64 dBm.

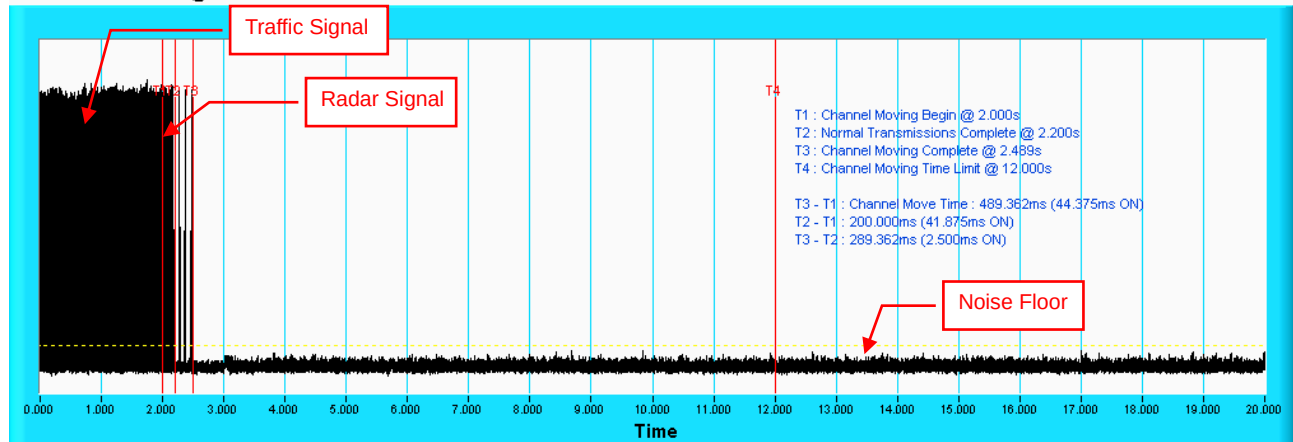


Radar Signal 0

5.2.2 Channel Closing Transmission and Channel Move Time

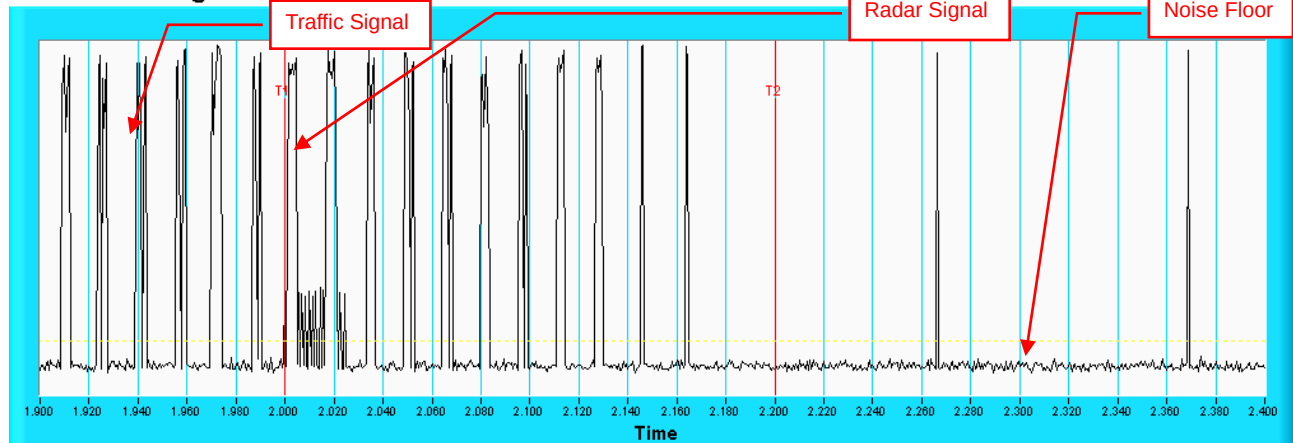
Radar Signal 0
802.11n HT20

Channel Closing Transmission Time & Channel Move Time



NOTE: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200ms from T1. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

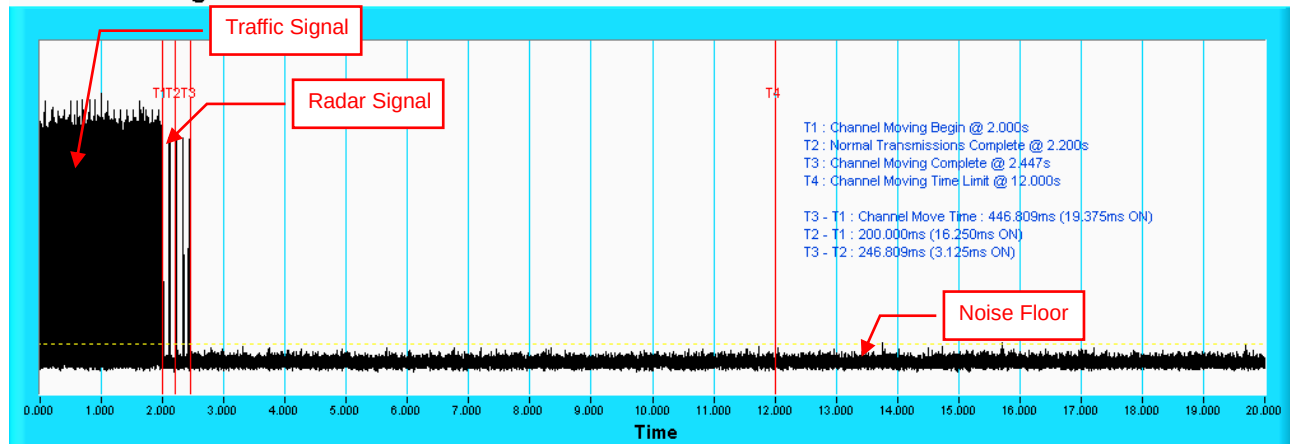
Channel Closing Transmission Time & Channel Move Time



NOTE: An expanded plot for the device vacates the channel in the required 500 ms.

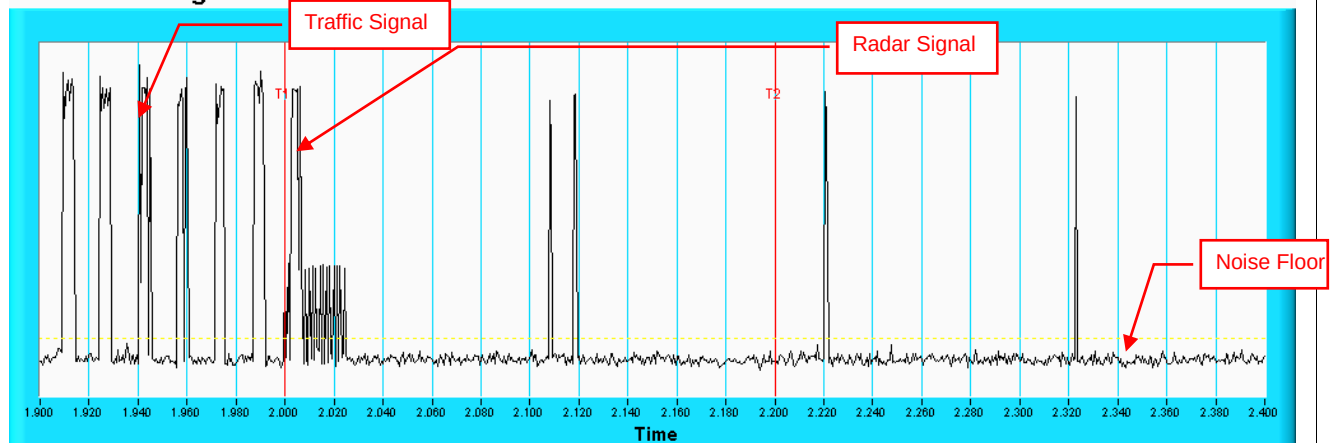
Radar signal 0 802.11n HT40

Channel Closing Transmission Time & Channel Move Time



NOTE: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200 ms from T1. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

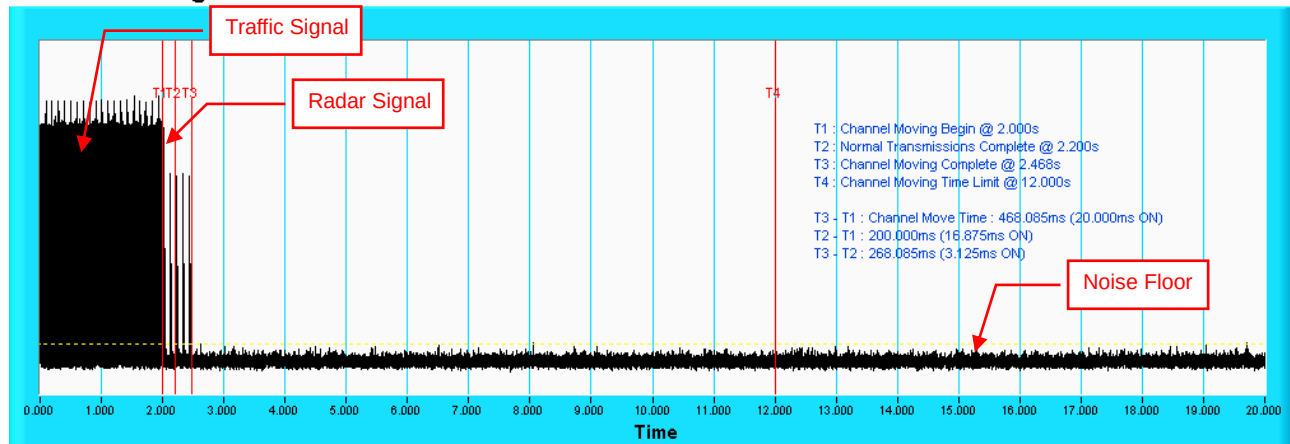
Channel Closing Transmission Time & Channel Move Time



NOTE: An expanded plot for the device vacates the channel in the required 500ms.

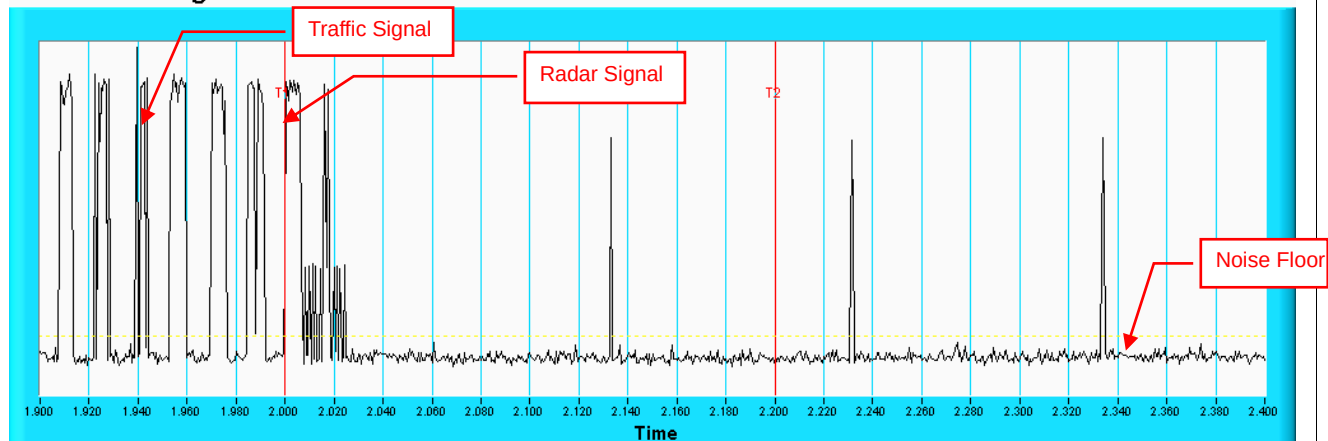
Radar signal 0 802.11n HT80

Channel Closing Transmission Time & Channel Move Time



NOTE: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200ms from T1. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

Channel Closing Transmission Time & Channel Move Time



NOTE: An expanded plot for the device vacates the channel in the required 500 ms.

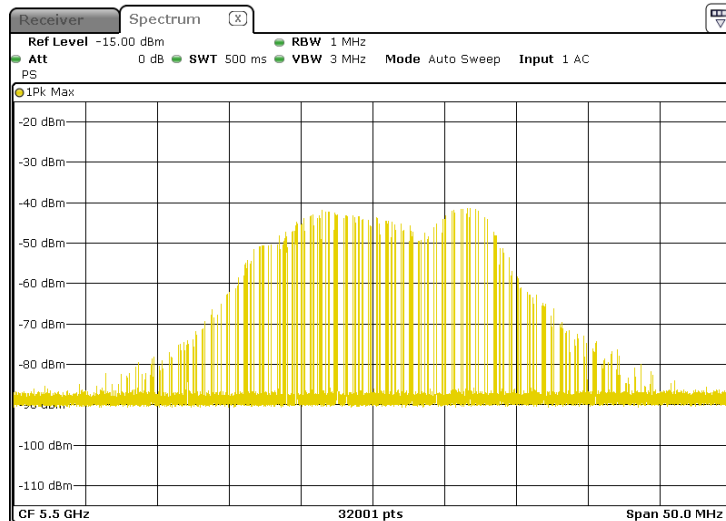
5.2.3 Non-Occupancy Period

Associate test:

During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.

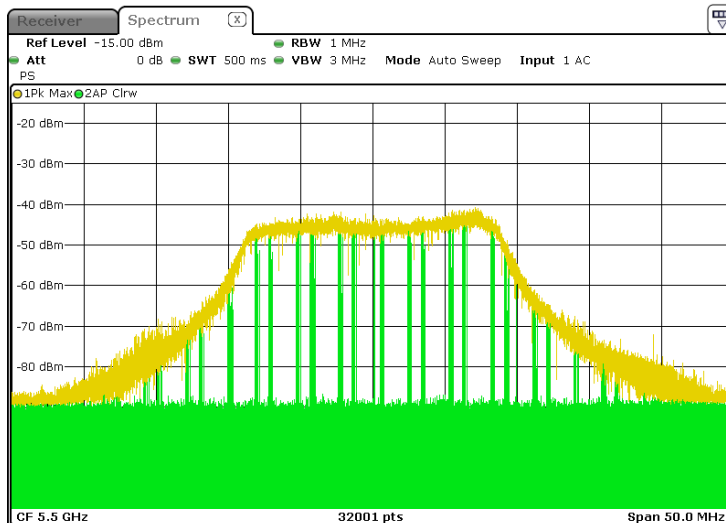
- 1) EUT (Client) links with master on 5500 MHz.

Waveform of EUT links up with Master



- 2) Client plays specified files via master.

Waveform of transmission



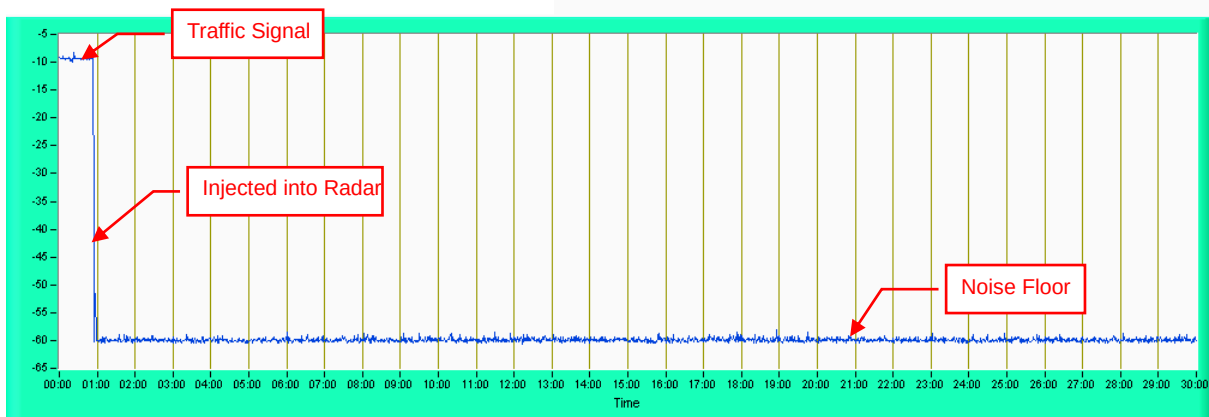
3) Radar signal 1 is applied to the Master device and WiFi traffic signal stop immediately.

Radar signal applied to the master and traffic stopped as described in section 6.2.2.

4) 5500 MHz has been monitored in 30 minutes period. In this period, no any transmission occurs.

Plot of 30 minutes period

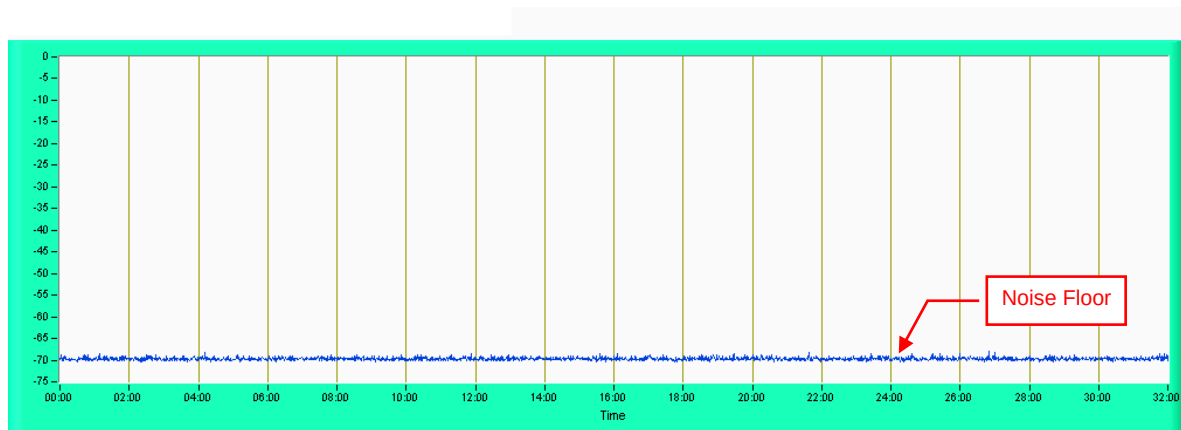
802.11n HT20



5.2.4 Non-associated test

Master was off.

During the 30 minutes observation time, the UUT did not make any transmissions in the DFS band after UUT power up.



5.2.5 Non- Co-Channel Test

The UUT was investigated after radar was detected the channel and made sure no co-channel operation with radars.

5.2.6 Test Setup photo

請參閱附件（測試設置照片）

6 檢測實驗室基本資料

立德國際商品試驗有限公司桃園分公司提供產業界最佳的檢測以及諮詢服務。
本公司為 ISO/IEC 17025 認可實驗室。

如您有任何問題或建議，請與下列實驗室聯絡：

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Tel: 886-2-26052180

Fax: 886-2-26051924

新竹 EMC / RF 及通訊實驗室：

Tel: 886-3-6668565

Fax: 886-3-6668323

華亞 EMC / RF / Safety 實驗室：

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

您也可以在我们的網站內找到各實驗室的地圖。

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