低功率射頻電機試驗報告

申請廠商	Microchip Technology Inc. 2355 W Chandler Blvd, Chandler, AZ 85224, USA
製造廠商	Microchip Technology Inc.
產品名稱	Low-Power Long Range LoRa technology transceiver module
廠牌	Microchip
型號	RN2903A
發射功率	19.071dBm (Peak)
工作頻率	920MHz – 925MHz
調變方式	FHSS (PR-ASK, ASK)
法規	LP0002: 4.8.1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　民國106年06月15日
完成日期　民國106年07月21日

Testing Laboratory
0513

報告簽署人
張俊卿 簽章

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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

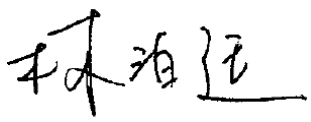
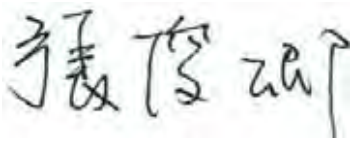
待測裝置已於台灣檢驗科技股份有限公司電子通訊實驗室，依據國家通訊傳播委員會於中華民國一百零五年八月頒佈之低功率射頻電機技術規範測試。

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 :**	**07/21/2017**
	林 泊 廷 / 工 程 師		
報告製作:		**日期 :**	**07/21/2017**
	黃 卿 雯 / 行 政		
報告審核:		**日期 :**	**07/21/2017**
	張 俊 卿 / 副 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06月14日起至107年06月13日止
測試場地	：	桃園市龜山區(華亞科技園區)科技一路2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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目錄 頁次

1 一般資料 6
2 適用規範 8
3 受測裝置之系統說明 12
4 量測儀器設備 13
5 電源線傳導干擾之量測 15
6 禁用頻帶輻射發射之量測 16
7 天線增益之要求 35
8 輸出峰值功率之量測 36
9 開放頻帶邊緣 100kHz 頻寬內之限制 42
10 6dB 頻寬之要求 46
11 載波頻率間隔之量測 52
12 載波頻率佔用週期之量測 55
13 功率頻譜密度 58
測試照片 63
產品照片 66

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1 一般資料

1.1 產品特性

產品名稱	Low-Power Long Range LoRa technology transceiver module
型號	RN2903A
產品商標	Microchip
Hardware Version	N/A
Software Version	N/A
使用電源	3.3Vdc
發射頻帶	920MHz – 925MHz
輸出功率	19.071dBm (Peak)
調變方式	FSK
頻道數	7
頻道表	920.200MHz, 920.800MHz, 921.400MHz,, 922.600MHz, 923.200MHz, 923.800MHz,, 924.800MHz,
Antenna Designation:	Dipole Antenna Part number: 3GD-D02, Supplier: N/A, Gain: 2dBi

採用跳頻與數位調變技術之複合系統(Hybrid systems)

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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(105.8.23 低功率0002(LP0002)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。

項次	測試項目	適用規範	測試結果	量測設備	備註
1	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4.1節	合格
2	禁用頻道之輻射發射	低功率射頻電機技術規範 4.8.1.3節	請參閱6.5節	請參閱4.2節	合格
3	天線增益之要求	低功率射頻電機技術規範 4.8.1.1節(2)	請參閱7.2節	----------	合格
4	輸出峰值功率	低功率射頻電機技術規範 4.8.1.1節 (1)	請參閱8.3節	請參閱4.3節	合格
5	頻帶邊緣之發射	低功率射頻電機技術規範 4.8.1.3節	請參閱9.3節	請參閱4.2節與4.3節	合格
6	6dB頻寬	低功率射頻電機技術規範 4.8.1.4節 (2),(A)	請參閱10.3節	請參閱4.3節	合格
7	載波頻率間隔	低功率射頻電機技術規範 4.8.1.4節 (1), (A)	請參閱11.3節	請參閱4.3節	合格
8	載波頻率之佔用週期	低功率射頻電機技術規範 4.8.1.4節 (3), (A)	請參閱12.3節	請參閱4.3節	合格
9	功率頻譜密度	低功率射頻電機技術規範 4.8.1.4節 (3), (B)	請參閱13.3節	請參閱4.3節	合格
	以下空白				

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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 *u*H 及50Ω 之電源線阻抗模據網路 (LISN)。頻率重疊處，以較低限值為準。

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

(2) 輻射之規定

依據NCC低功率射頻電機技術規範4.8.1.3節之要求，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 μV/m	干擾限制 dBμV/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4.8.1節 跳頻 (frequency hopping system) 之要求，使用頻率為922MHz~928MHz 或 920MHz~925MHz者 (依據106年2月23日第64次一致性會議記錄修訂)

(1) 峰值輸出功率之要求：

依據NCC低功率射頻電機技術規範4.8.1.1節(1)之規定，操作於922MHz~928 MHz之跳頻系統，其峰值輸出功率限制如下:

(a) 設置於室內或特殊場所者：最大峰值輸出功率 1 瓦（含）以下。
(b) 設置於室外者：最大峰值輸出功率 0.5 瓦（含）以下。
(c) 前揭（a）所稱特殊場所係指於某特定、封閉且管制人員進出之專屬區域（不限室內或室外）場所。

(2) 天線增益之要求：

依據NCC低功率射頻電機技術規範4.8.1.1節(2)之規定，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。

(3) 頻帶邊緣之要求：

依據NCC低功率射頻電機技術規範4.8.1.3節之規定，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。

(4) 其他限制事項：

依據NCC低功率射頻電機技術規範4.8.1.4節(1)跳頻系統之規定

(a) 跳頻系統之載波頻率頻道間隔應至少 25kHz 或跳頻頻道之 20dB 頻寬，兩者取較寬者。系統之跳頻頻道應依虛擬亂數排列，在各頻率之跳頻頻道上跳躍。每一發射機必須均等的使用每一頻率。
(b) 跳頻頻道之 20dB 頻寬及使用頻道數：當跳頻頻道之 20dB 頻寬小於或等於 250kHz 者，須至少使用 12 個(含)跳頻頻道。當跳頻頻道之 20dB 頻寬大於 250kHz 者，須至少使用 6 個(含)跳頻頻道。跳頻頻道之 20dB 頻寬最大不得超過 500kHz。
(c) 操作於跳頻頻道系統，其每一載波頻率在週期(跳頻頻道數乘以 0.4 秒)內，任一頻率每次出現佔用之平均時間不得超過 0.4 秒。

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依據NCC低功率射頻電機技術規範4.8.1.4節(2)數位調變技術系統之規定
(A) 6 dB頻寬至少應有500 kHz。
(B) 頻帶範圍內任意3 kHz頻寬內由發射機傳導至天線之功率頻譜密度均應小於或等於8 dBm。

依據NCC低功率射頻電機技術規範4.8.1.4節(3) 採用跳頻與數位調變技術之複合系統(Hybrid systems)：
(A) 複合系統之跳頻作業，關閉直接序列或數位調變作業時，其每一載波頻率在週期(跳頻頻道數乘以0.4 秒)內，每次出現所佔用之平均時間應小於或等於0.4 秒。
(B) 關閉跳頻作業之複合系統以數位調變技術作業時，應符合4.8.1.4其他限制事項(2)數位調變技術系統(B)之功率頻譜密度規定。

(5) 第64次一致性會議記錄: 查交通部業於106年2月22日交郵字第10650017402號公告修正「中華民國無線電頻率分配表」，新增920~925MHz供低功率物聯網設備（低功率射頻電機）在次要條件下使用。爰於低功率射頻電機技術規範尚未修正前，即日起低功率物聯網設備得使用920~925MHz，並依低功率射頻電機技術規範(LP0002)之4.8規定限制值，辦理型式認證。LP0002之4.8.1.4其他限制事項之(1)跳頻系統之(B)跳頻頻道之20dB頻寬及使用頻道數：當跳頻頻道之20 dB頻寬小於或等於250kHz者，得放寬為至少使用10 個(含)跳頻頻道。當跳頻頻道之20 dB頻寬大於250 kHz者，得放寬為至少使用5個(含)跳頻頻道。另LP0002之4.8.1.4其他限制事項之(3)採用跳頻與數位調變技術之複合系統，未規定6dB頻寬至少應有500kHz及最少跳頻頻道數。爰依據FCCKDB 453039，複合系統不要求6dB頻寬至少應有500kHz及最少跳頻頻道數。

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3 受測裝置之系統說明

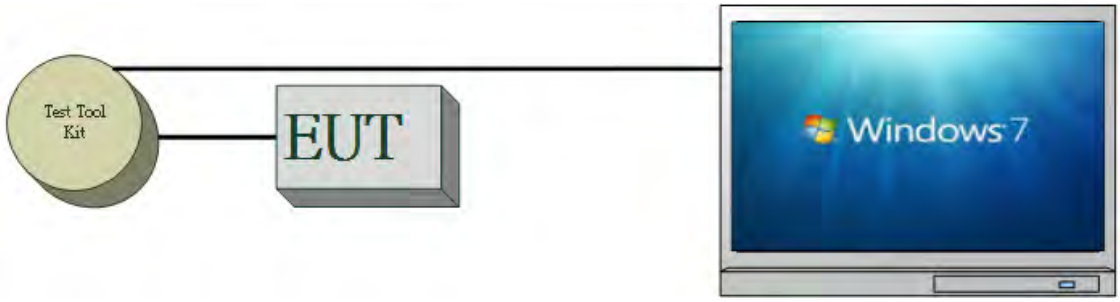
裝置名稱	製造者/申請者	型號
*Low-Power Long Range LoRa technology transceiver module	Microchip Technology Inc./ Microchip Technology Inc.	RN2903A

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	信號線線長(米)	電源線長(米)
1.	Notebook	Lenovo	L420	N/A	N/A	N/A
2.	Test Tool 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	ESCI 7	100950	12/12/2016	12/11/2017
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	08/30/2016	08/29/2017
LISN	Schwarzbeck	NSLK 8127	8127-648	06/18/2017	06/17/2018
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

4.2 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	ESU 40	100363	04/18/2017	04/17/2018
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2016	12/22/2017
Broadband Antenna	TESEQ	CBL 6112D	35240	11/03/2016	11/02/2017
Horn Antenna	ETS-Lindgren	3117	00143272	12/15/2016	12/16/2017
Horn Antenna	Schwarzbeck	BBHA9170	185	07/24/2016	07/23/2017
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2016	12/11/2017
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-18	10204	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-26	100780	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF27	12/12/2016	12/11/2017

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Site NSA	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
Site VSWR	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2017	05/03/2018
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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。

4.3 天線端傳導測試之量測儀器

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Power Meter	Anritsu	ML2496A	1326001	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315048	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315049	06/23/2017	06/22/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNACK	PE8210	RF29	12/12/2016	12/11/2017
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

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5 電源線傳導干擾之量測

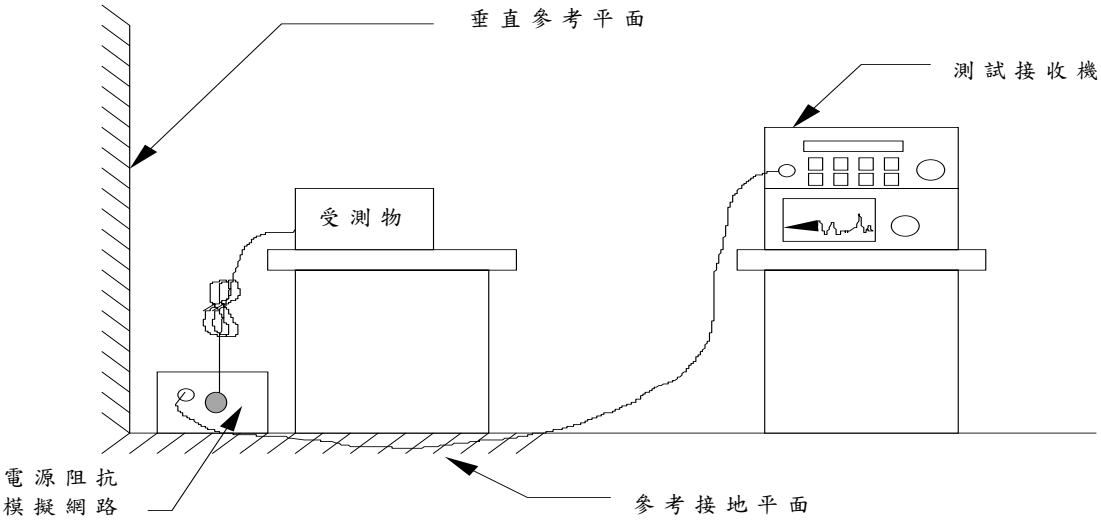
5.1 適用標準

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

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

結果值(QP/AV Level) = 儀器讀值(QP/AV Reading) + 校正因子

其中校正因子為：

饋線損失 + 電源阻抗模擬網路損失

5.5 傳導干擾之量測結果:

N/A

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6 禁用頻帶輻射發射之量測

6.1 適用標準

依據NCC低功率射頻電機技術規範4.8.1.3節之要求，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 0.8 米高的非金屬桌面，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

干擾值 = 讀值 + 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）

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)
Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)
Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.
"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.
"---" : denotes Noise Floor.

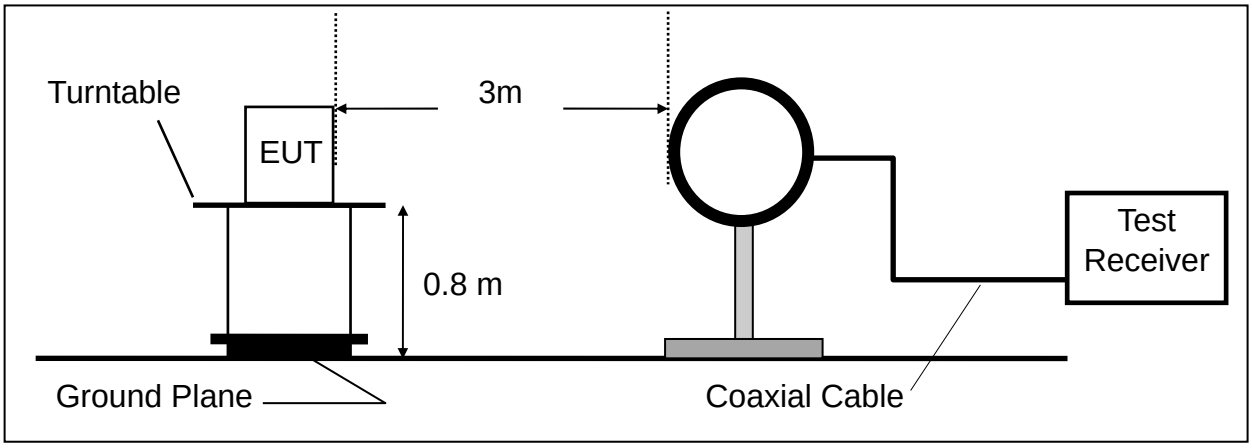
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

量測結果請見下頁。

註: 經評估後，比較 H PLAN、E1 PLAN 和E2 PLAN 測試值後發現 E2 PLAN為最差模式，故附上最差模式 H PLANE 數據。

6.4 輻射之測試配置

(A) 量測頻率低於 30MHz 以下之測試配置



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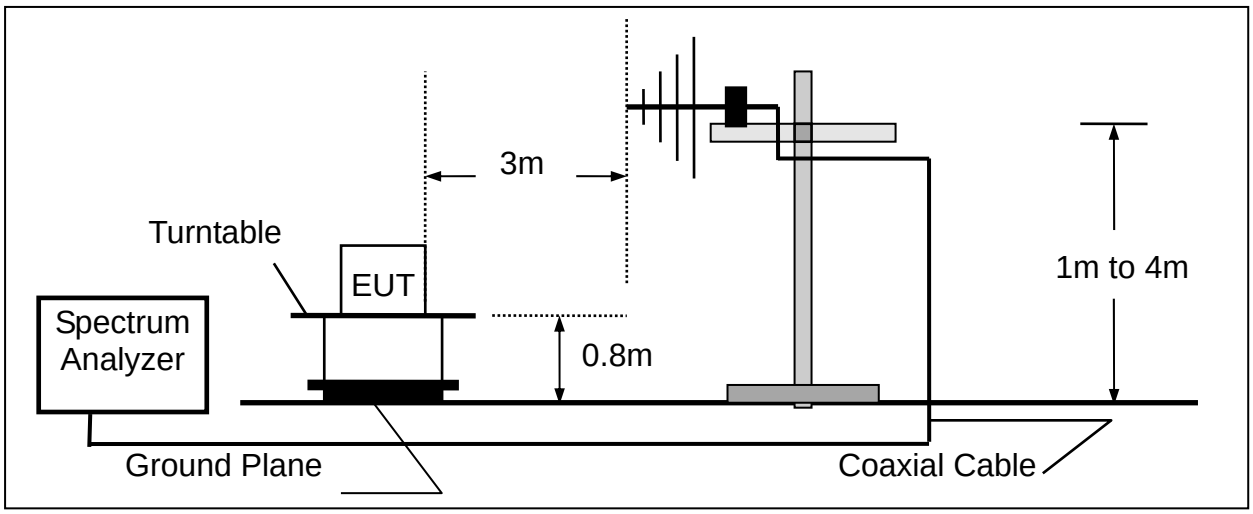
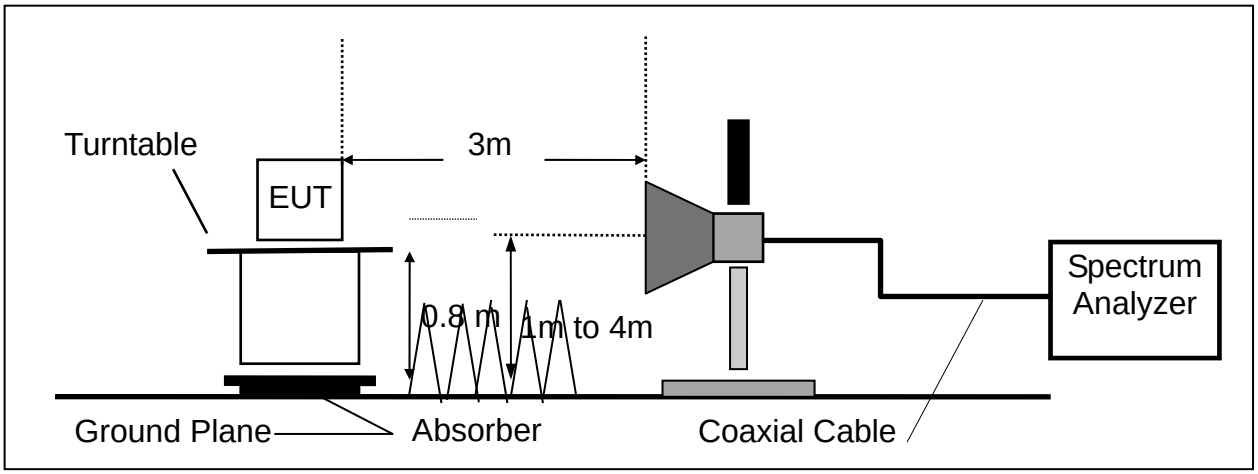
(B) 量測頻率 30MHz 至 1000MHz 之測試配置



(C) 量測頻率 1000MHz 以上之測試配置



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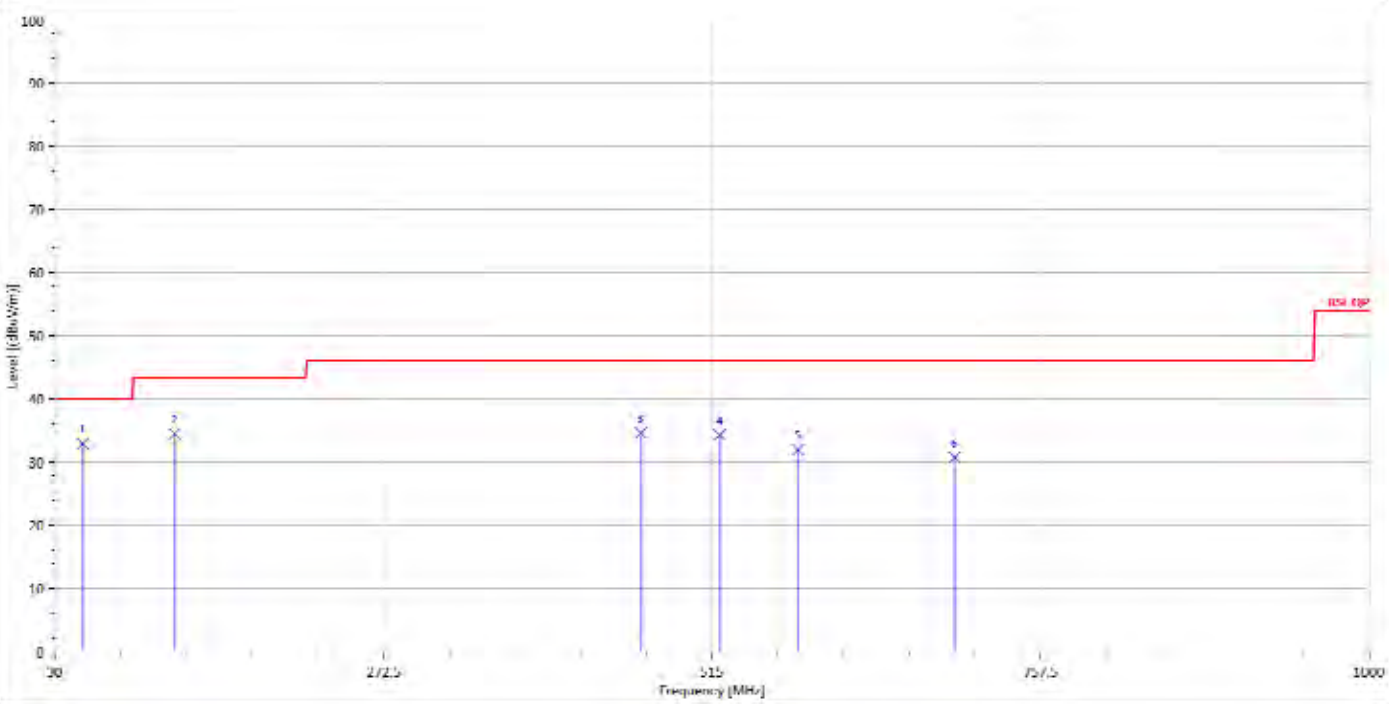
6.5 場強輻射之量測結果

6.5.1 發射機場強輻射之量測結果(1GHz 以下)

Operation Mode :	RFID	Test Date :	2017/7/4
Fundamental Frequency :	920.4 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
50.37	S	Peak	52.42	-19.55	32.87	40	-7.13
118.27	S	Peak	50.38	-15.92	34.47	43.5	-9.03
462.62	S	Peak	42.75	-8.14	34.61	46	-11.39
520.82	S	Peak	41.63	-7.35	34.28	46	-11.72
579.02	S	Peak	38.32	-6.38	31.94	46	-14.06
694.45	S	Peak	35.96	-5.28	30.68	46	-15.32

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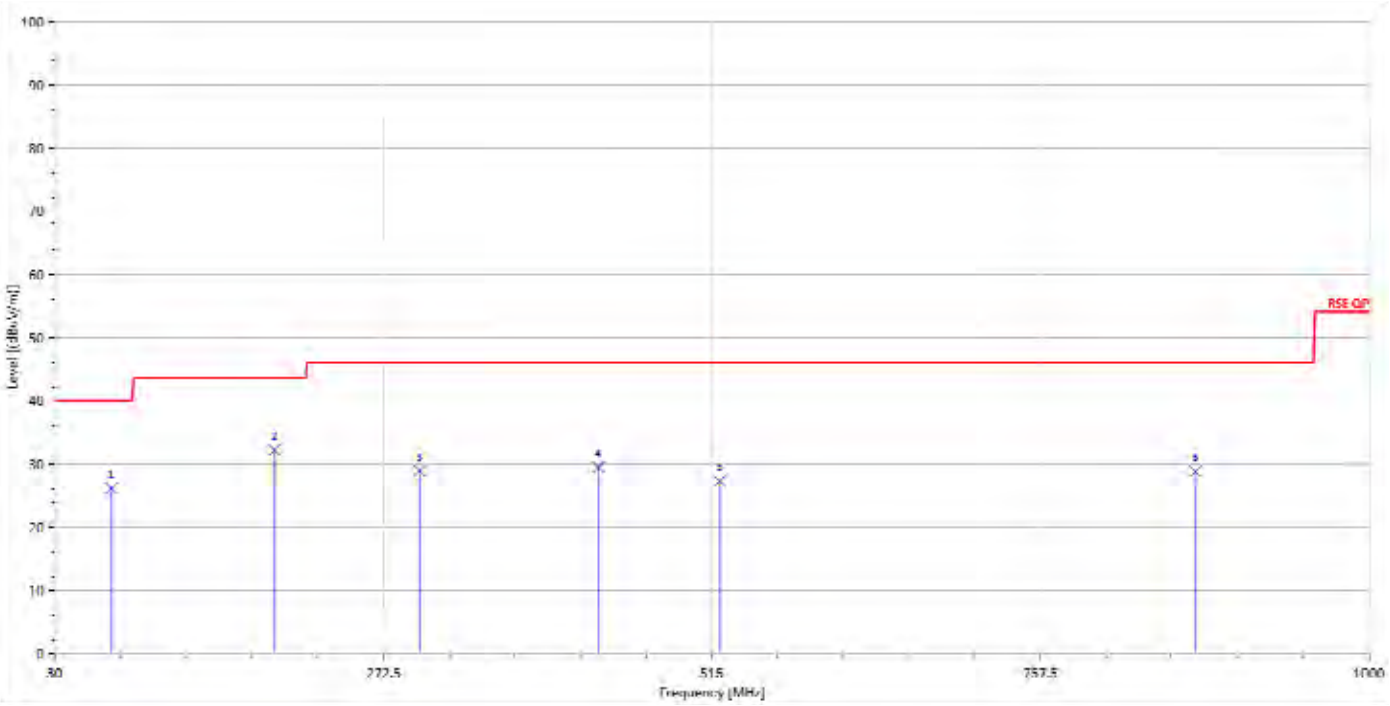
Operation Mode :	RFID	Test Date :	2017/7/4
Fundamental Frequency :	920.4 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
71.71	S	Peak	47.74	-21.65	26.10	40	-13.90
191.99	S	Peak	50.32	-18.13	32.19	43.5	-11.31
299.66	S	Peak	41.97	-13.11	28.86	46	-17.14
431.58	S	Peak	38.86	-9.39	29.47	46	-16.53
520.82	S	Peak	34.57	-7.35	27.22	46	-18.78
871.96	S	Peak	31.59	-2.82	28.77	46	-17.23

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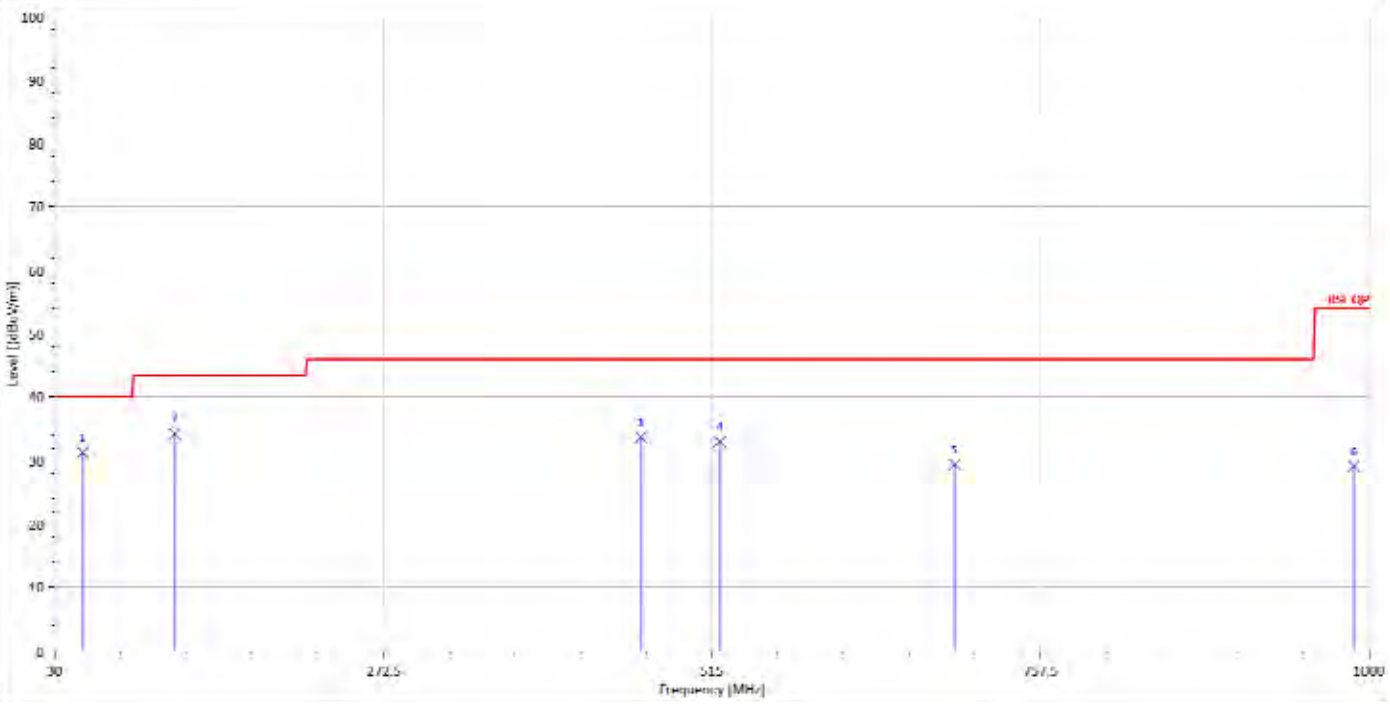
Operation Mode :	RFID	Test Date :	2017/7/5
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
50.37	S	Peak	50.88	-19.55	31.33	40	-8.67
118.27	S	Peak	50.19	-15.92	34.27	43.5	-9.23
462.62	S	Peak	41.89	-8.14	33.75	46	-12.25
520.82	S	Peak	40.41	-7.35	33.06	46	-12.94
694.45	S	Peak	34.72	-5.28	29.44	46	-16.56
989.33	S	Peak	29.80	-0.66	29.14	54	-24.86

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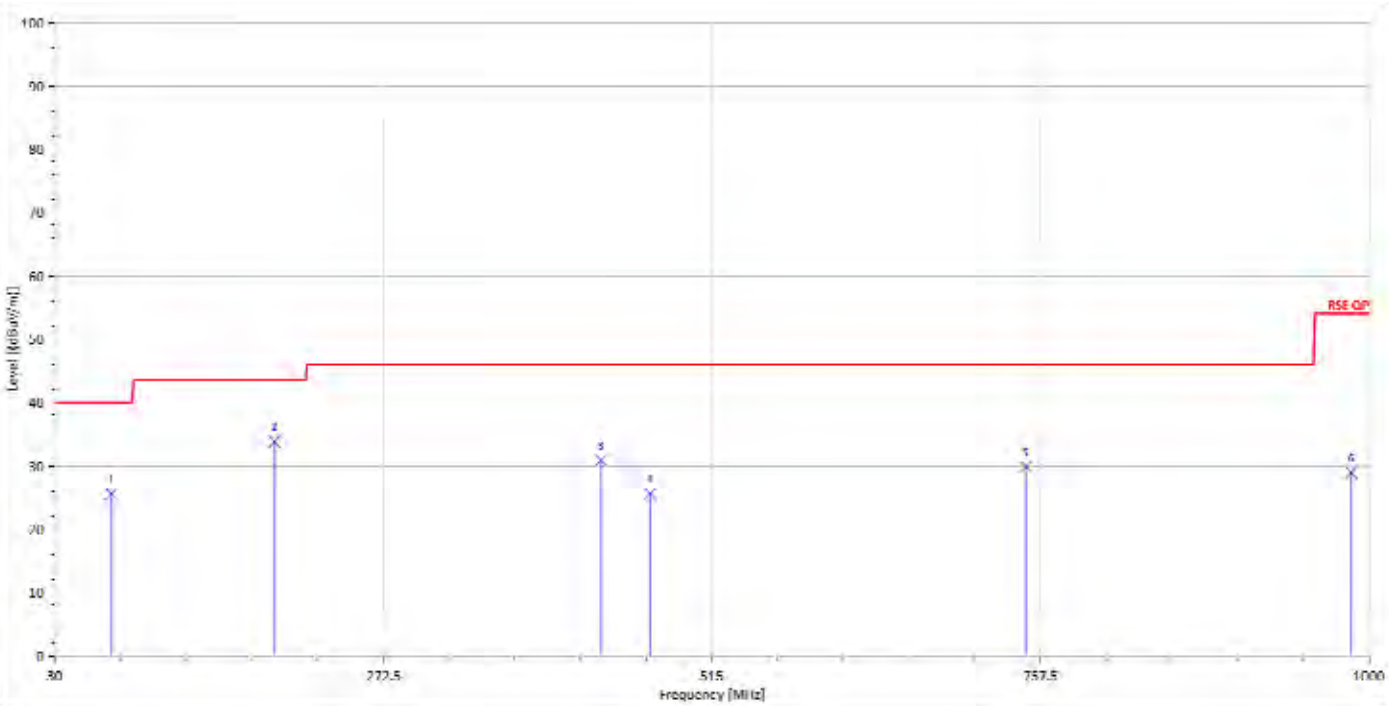
Operation Mode :	RFID	Test Date :	2017/7/5
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
71.71	S	Peak	47.20	-21.65	25.55	40	-14.45
191.99	S	Peak	51.95	-18.13	33.82	43.5	-9.68
433.52	S	Peak	40.46	-9.55	30.91	46	-15.09
469.41	S	Peak	33.32	-7.76	25.56	46	-20.44
746.83	S	Peak	34.14	-4.23	29.91	46	-16.09
987.39	S	Peak	29.50	-0.57	28.93	54	-25.07

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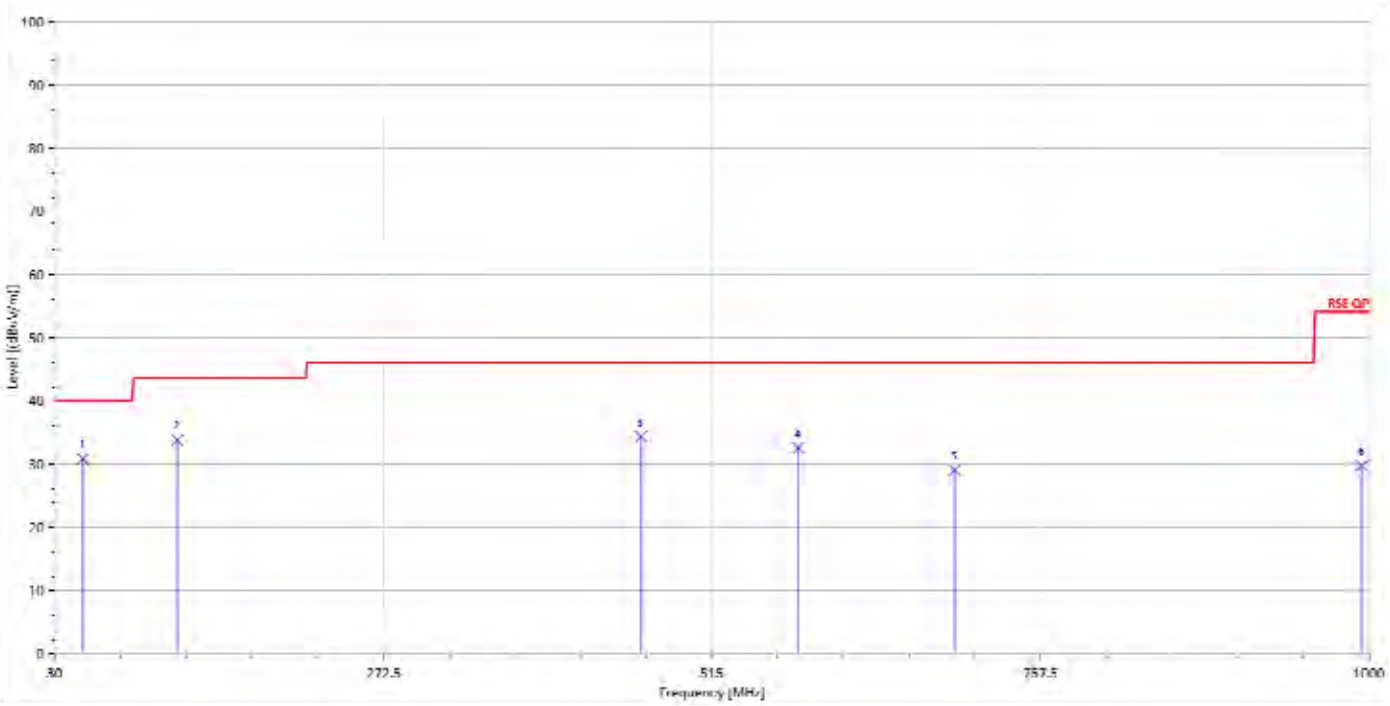
Operation Mode :	RFID	Test Date :	2017/7/5
Fundamental Frequency :	924.6 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
50.37	S	Peak	50.34	-19.55	30.79	40	-9.21
120.21	S	Peak	49.63	-15.84	33.79	43.5	-9.71
462.62	S	Peak	42.48	-8.14	34.34	46	-11.66
579.02	S	Peak	38.90	-6.38	32.52	46	-13.48
694.45	S	Peak	34.28	-5.28	29.00	46	-17.00
995.15	S	Peak	30.34	-0.66	29.68	54	-24.32

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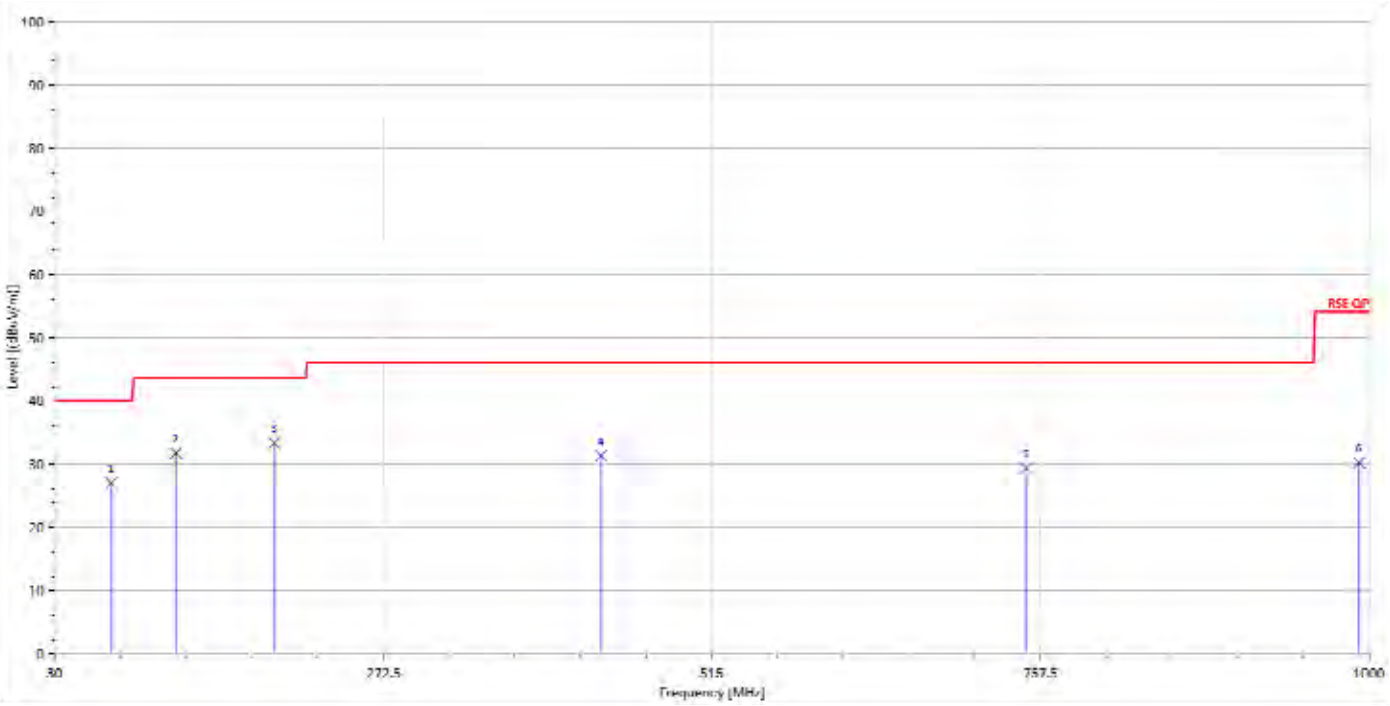
Operation Mode :	RFID	Test Date :	2017/7/5
Fundamental Frequency :	924.6 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
71.71	S	Peak	48.58	-21.65	26.93	40	-13.07
119.24	S	Peak	47.57	-15.88	31.70	43.5	-11.80
191.99	S	Peak	51.45	-18.13	33.32	43.5	-10.18
433.52	S	Peak	40.85	-9.55	31.30	46	-14.70
746.83	S	Peak	33.55	-4.23	29.32	46	-16.68
993.21	S	Peak	31.02	-0.84	30.18	54	-23.82

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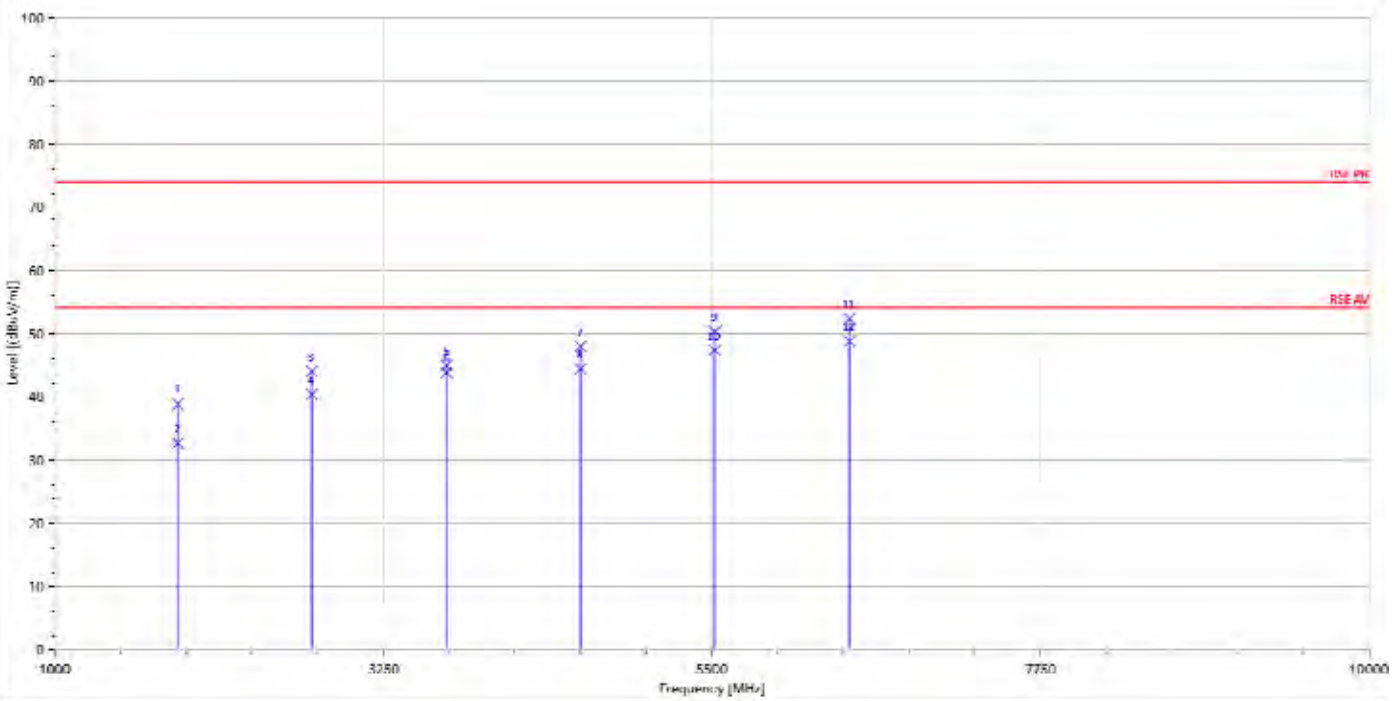
6.5.2 發射機場強輻射之量測結果(1GHz 以上)

Operation Mode :	RFID	Test Date :	2017/7/20
Fundamental Frequency :	920.4 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1840.80	H	Peak	39.98	-1.16	38.82	74	-35.18
1840.80	H	Average	33.81	-1.16	32.65	54	-21.35
2761.20	H	Peak	41.52	2.51	44.03	74	-29.97
2761.20	H	Average	37.80	2.51	40.31	54	-13.69
3681.60	H	Peak	40.13	4.81	44.94	74	-29.06
3681.60	H	Average	38.98	4.81	43.79	54	-10.21
4602.00	H	Peak	40.97	7.01	47.98	74	-26.02
4602.00	H	Average	37.42	7.01	44.43	54	-9.57
5522.40	H	Peak	41.29	9.09	50.38	74	-23.62
5522.40	H	Average	38.28	9.09	47.37	54	-6.63
6442.80	H	Peak	40.78	11.63	52.41	74	-21.59
6442.80	H	Average	37.17	11.63	48.80	54	-5.20

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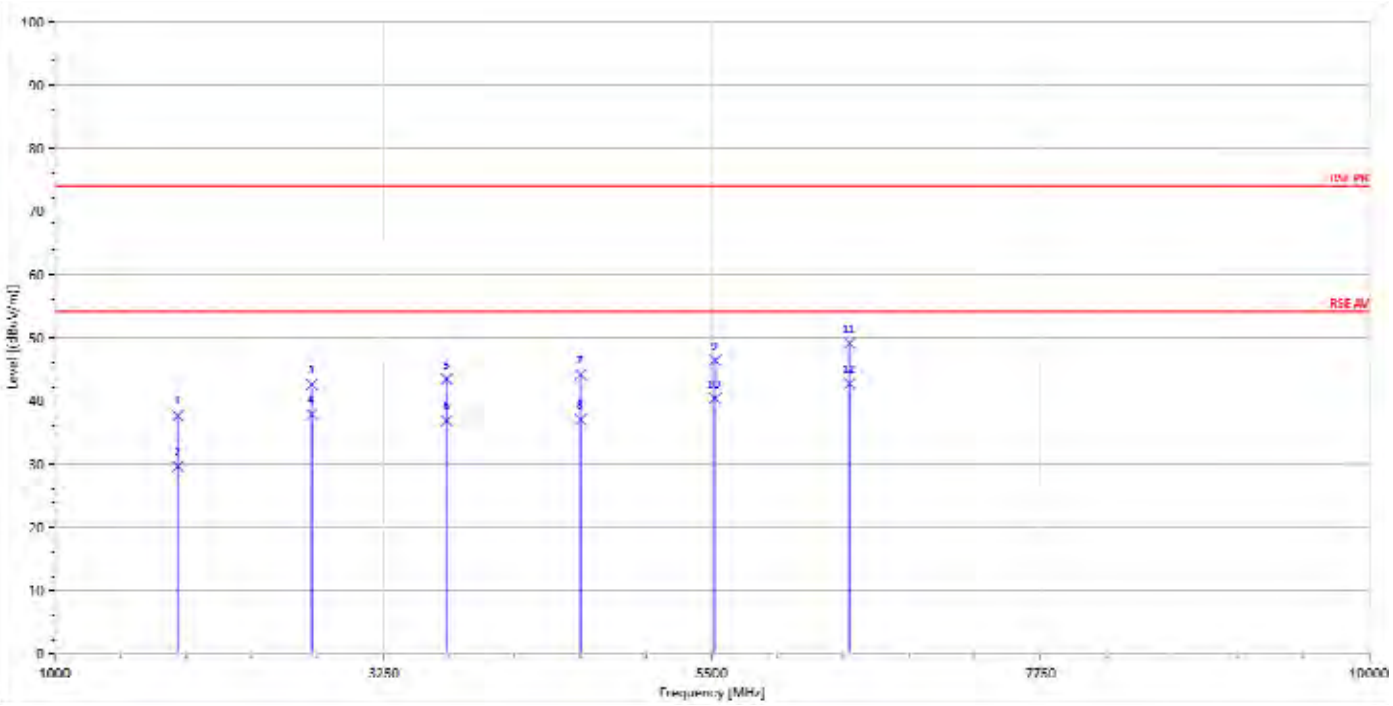
Operation Mode :	RFID	Test Date :	2017/7/20
Fundamental Frequency :	920.4 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1840.80	H	Peak	38.81	-1.16	37.65	74	-36.35
1840.80	H	Average	30.74	-1.16	29.58	54	-24.42
2761.20	H	Peak	40.02	2.51	42.53	74	-31.47
2761.20	H	Average	35.38	2.51	37.89	54	-16.11
3681.60	H	Peak	38.60	4.81	43.41	74	-30.59
3681.60	H	Average	32.06	4.81	36.87	54	-17.13
4602.00	H	Peak	37.13	7.01	44.14	74	-29.86
4602.00	H	Average	30.06	7.01	37.07	54	-16.93
5522.40	H	Peak	37.32	9.09	46.41	74	-27.59
5522.40	H	Average	31.21	9.09	40.30	54	-13.70
6442.80	H	Peak	37.50	11.63	49.13	74	-24.87
6442.80	H	Average	31.04	11.63	42.67	54	-11.33

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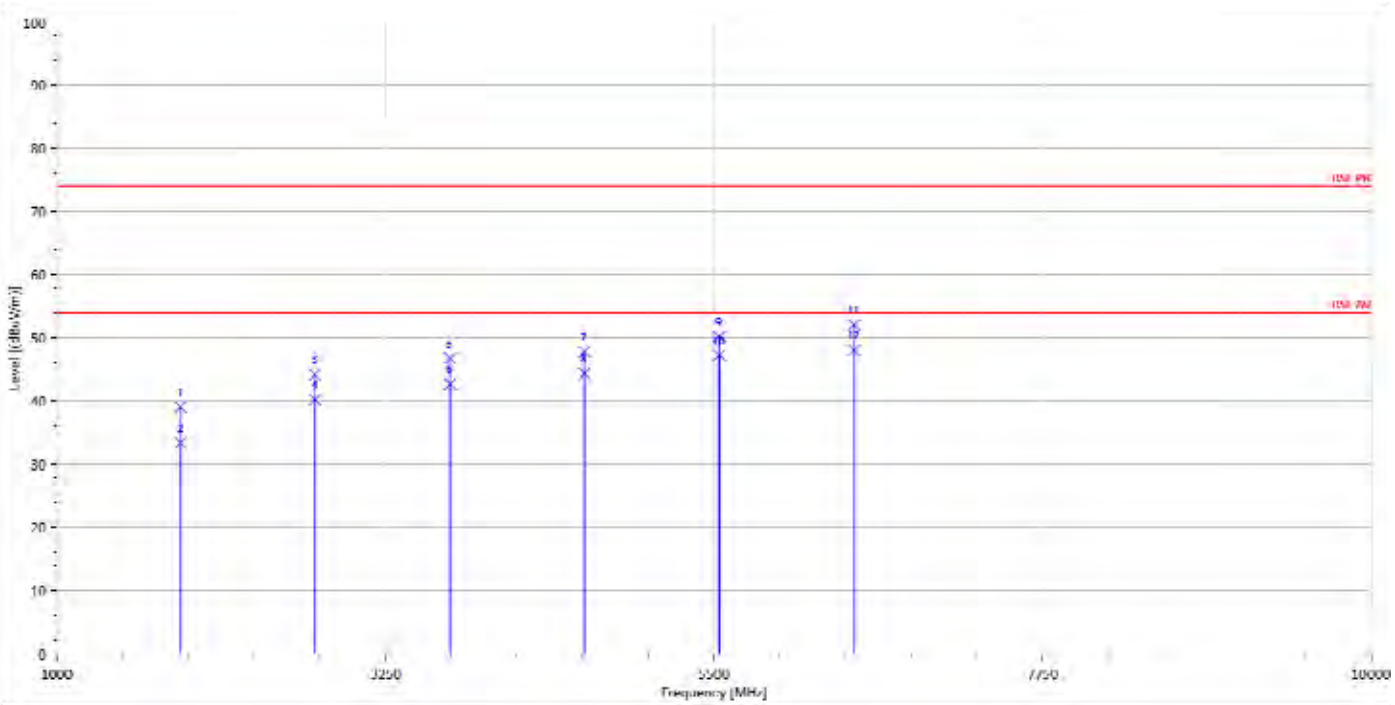
Operation Mode :	RFID	Test Date :	2017/7/17
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1846.00	H	Peak	40.17	-1.10	39.07	74	-34.93
1846.00	H	Average	34.45	-1.10	33.35	54	-20.65
2769.00	H	Peak	41.63	2.55	44.18	74	-29.82
2769.00	H	Average	37.71	2.55	40.26	54	-13.74
3692.00	H	Peak	41.93	4.79	46.72	74	-27.28
3692.00	H	Average	37.94	4.79	42.73	54	-11.27
4615.00	H	Peak	40.78	7.03	47.81	74	-26.19
4615.00	H	Average	37.31	7.03	44.34	54	-9.66
5538.00	H	Peak	41.39	8.79	50.18	74	-23.82
5538.00	H	Average	38.43	8.79	47.22	54	-6.78
6461.00	H	Peak	40.41	11.65	52.06	74	-21.94
6461.00	H	Average	36.37	11.65	48.02	54	-5.98

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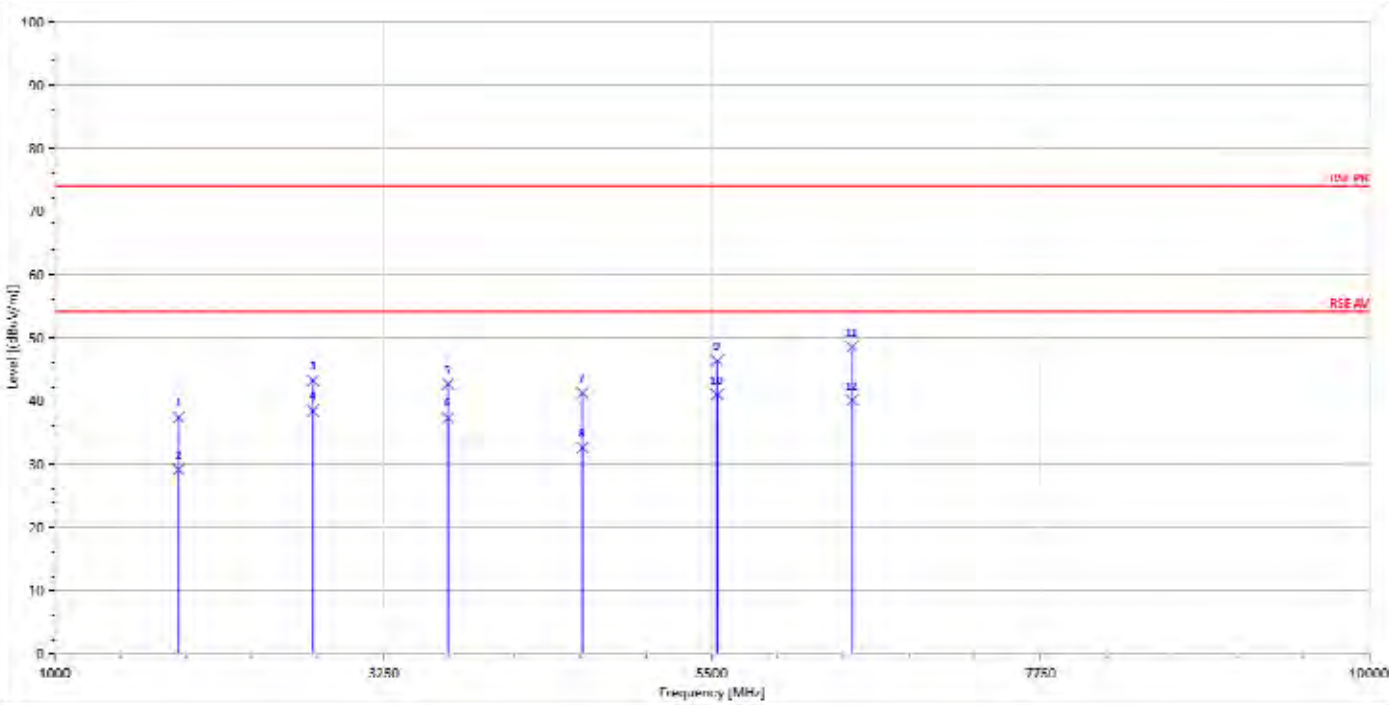
Operation Mode :	RFID	Test Date :	2017/7/17
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1846.00	H	Peak	38.51	-1.10	37.41	74	-36.59
1846.00	H	Average	30.17	-1.10	29.07	54	-24.93
2769.00	H	Peak	40.58	2.55	43.13	74	-30.87
2769.00	H	Average	35.84	2.55	38.39	54	-15.61
3692.00	H	Peak	37.82	4.79	42.61	74	-31.39
3692.00	H	Average	32.51	4.79	37.30	54	-16.70
4615.00	H	Peak	34.12	7.03	41.15	74	-32.85
4615.00	H	Average	25.54	7.03	32.57	54	-21.43
5538.00	H	Peak	37.59	8.79	46.38	74	-27.62
5538.00	H	Average	32.14	8.79	40.93	54	-13.07
6461.00	H	Peak	36.88	11.65	48.53	74	-25.47
6461.00	H	Average	28.34	11.65	39.99	54	-14.01

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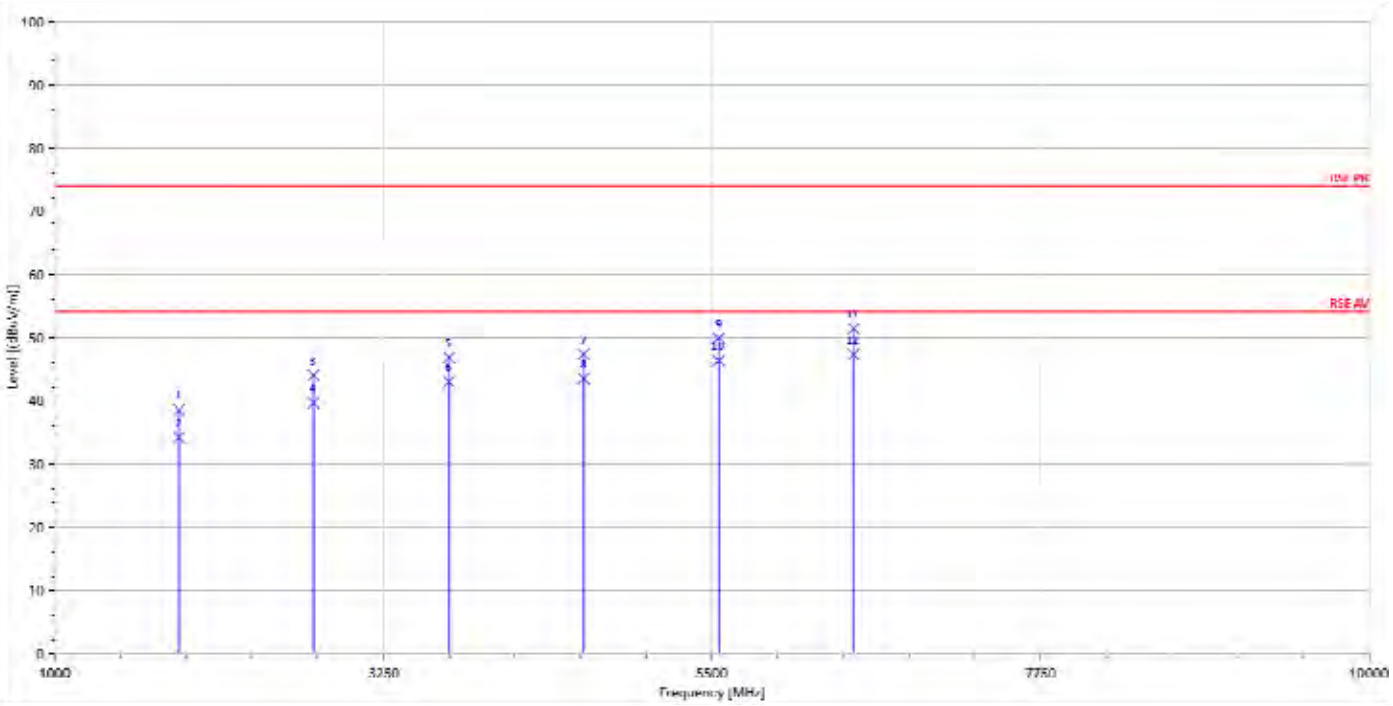
Operation Mode :	RFID	Test Date :	2017/7/20
Fundamental Frequency :	924.6 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1849.20	H	Peak	39.60	-1.07	38.53	74	-35.47
1849.20	H	Average	35.28	-1.07	34.21	54	-19.79
2773.80	H	Peak	41.42	2.58	44.00	74	-30.00
2773.80	H	Average	37.02	2.58	39.60	54	-14.40
3698.40	H	Peak	42.08	4.75	46.83	74	-27.17
3698.40	H	Average	38.22	4.75	42.97	54	-11.03
4623.00	H	Peak	40.35	7.04	47.39	74	-26.61
4623.00	H	Average	36.44	7.04	43.48	54	-10.52
5547.60	H	Peak	41.07	8.89	49.96	74	-24.04
5547.60	H	Average	37.45	8.89	46.34	54	-7.66
6472.20	H	Peak	39.76	11.74	51.50	74	-22.50
6472.20	H	Average	35.59	11.74	47.33	54	-6.67

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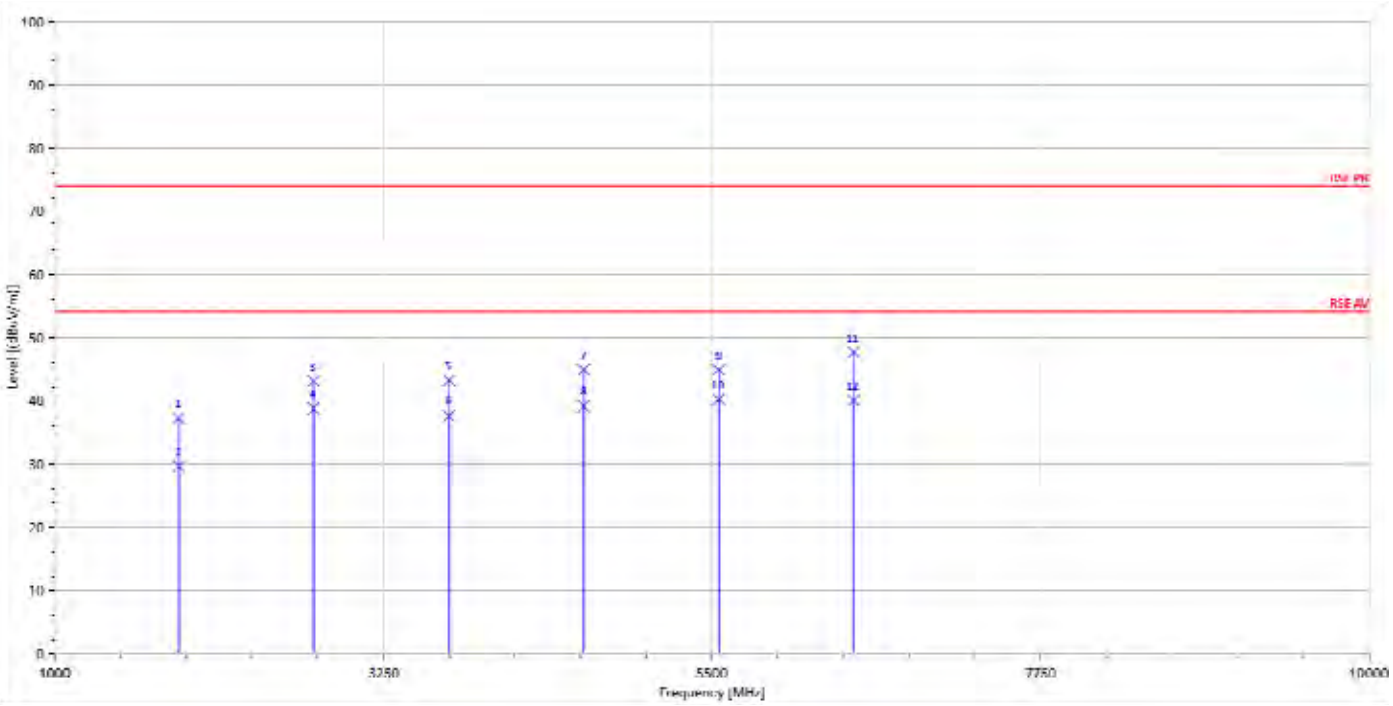
Operation Mode :	RFID	Test Date :	2017/7/20
Fundamental Frequency :	924.6 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1849.20	H	Peak	38.36	-1.07	37.29	74	-36.71
1849.20	H	Average	30.70	-1.07	29.63	54	-24.37
2773.80	H	Peak	40.47	2.58	43.05	74	-30.95
2773.80	H	Average	36.19	2.58	38.77	54	-15.23
3698.40	H	Peak	38.44	4.75	43.19	74	-30.81
3698.40	H	Average	32.87	4.75	37.62	54	-16.38
4623.00	H	Peak	37.87	7.04	44.91	74	-29.09
4623.00	H	Average	32.09	7.04	39.13	54	-14.87
5547.60	H	Peak	36.01	8.89	44.90	74	-29.10
5547.60	H	Average	31.28	8.89	40.17	54	-13.83
6472.20	H	Peak	35.96	11.74	47.70	74	-26.30
6472.20	H	Average	28.23	11.74	39.97	54	-14.03

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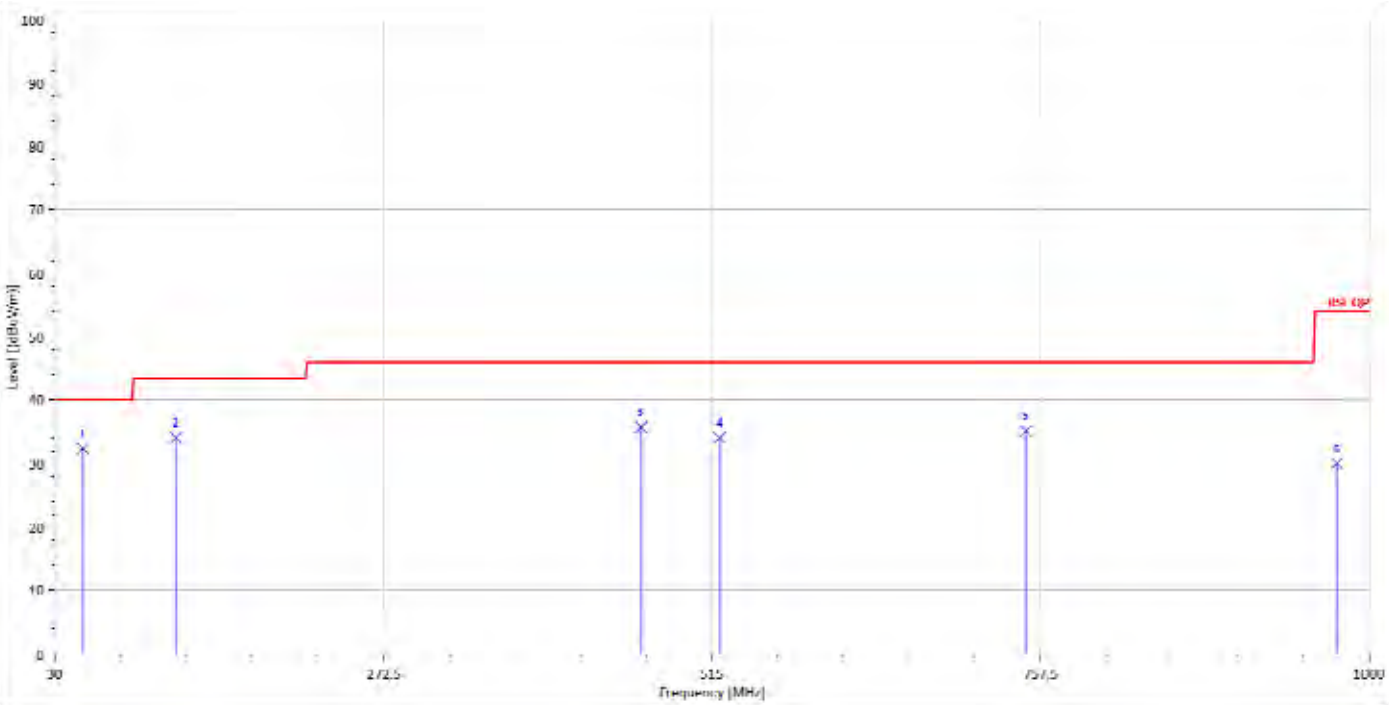
6.5.3 接收機場強輻射之量測結果(1GHz 以下)（最差模式）

Operation Mode :	RFID	Test Date :	2017/7/5
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Rx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
50.37	S	Peak	52.01	-19.55	32.46	40	-7.54
119.24	S	Peak	50.01	-15.88	34.14	43.5	-9.36
462.62	S	Peak	43.93	-8.14	35.79	46	-10.21
520.82	S	Peak	41.47	-7.35	34.12	46	-11.88
746.83	S	Peak	39.47	-4.23	35.24	46	-10.76
976.72	S	Peak	30.98	-0.92	30.06	54	-23.94

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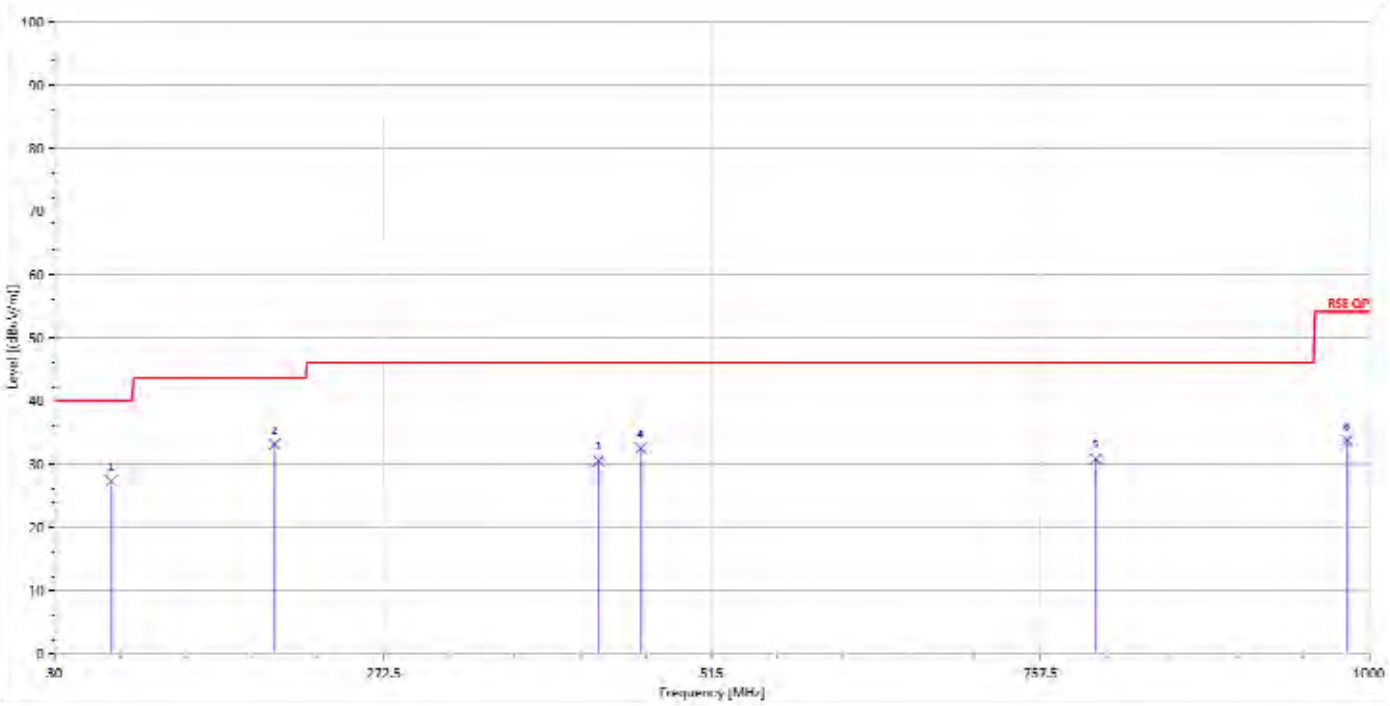
Operation Mode :	RFID	Test Date :	2017/7/5
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Rx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
71.71	S	Peak	48.88	-21.65	27.23	40	-12.77
191.99	S	Peak	51.25	-18.13	33.12	43.5	-10.38
431.58	S	Peak	39.88	-9.39	30.49	46	-15.51
462.62	S	Peak	40.60	-8.14	32.46	46	-13.54
798.24	S	Peak	34.68	-3.91	30.77	46	-15.23
984.48	S	Peak	34.53	-0.80	33.73	54	-20.27

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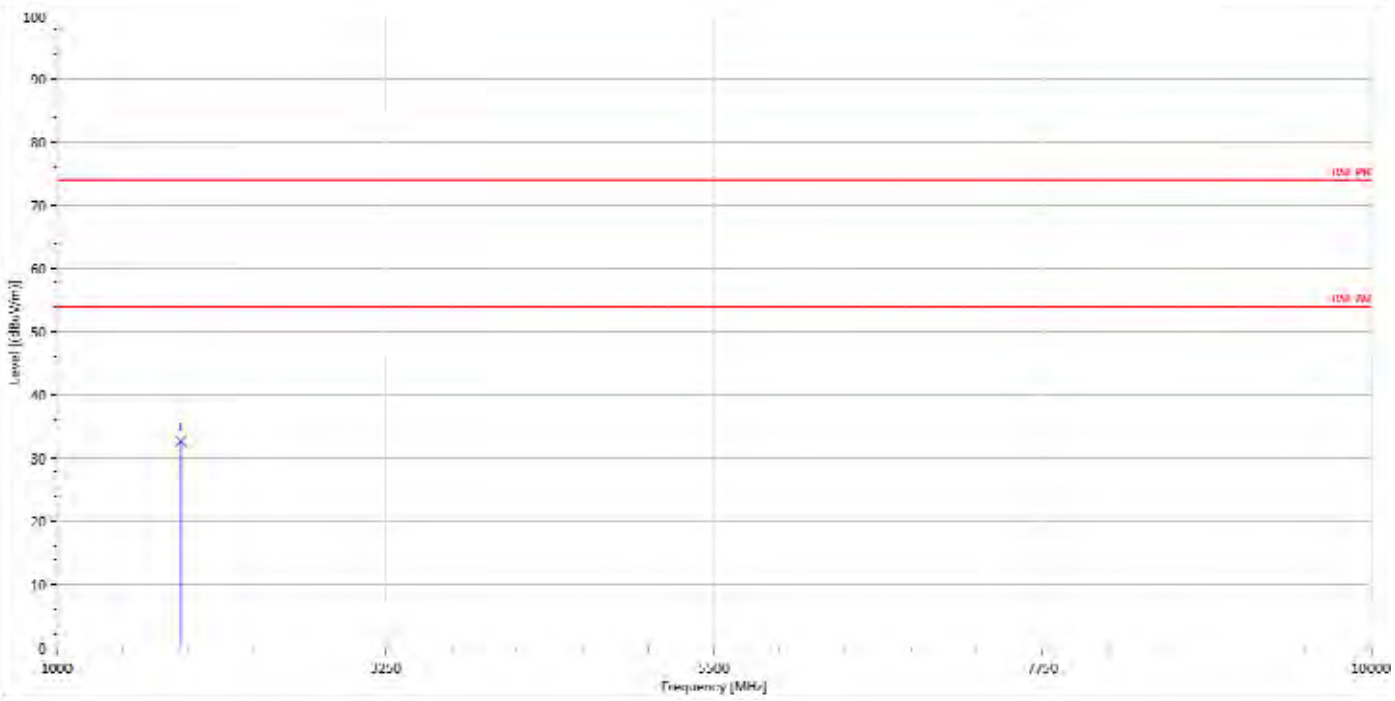
6.5.4 接收機場強輻射之量測結果(1GHz 以上)（最差模式）

Operation Mode :	RFID	Test Date :	2017/7/17
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Rx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1848.00	H	Peak	33.73	-1.07	32.65	74	-41.35

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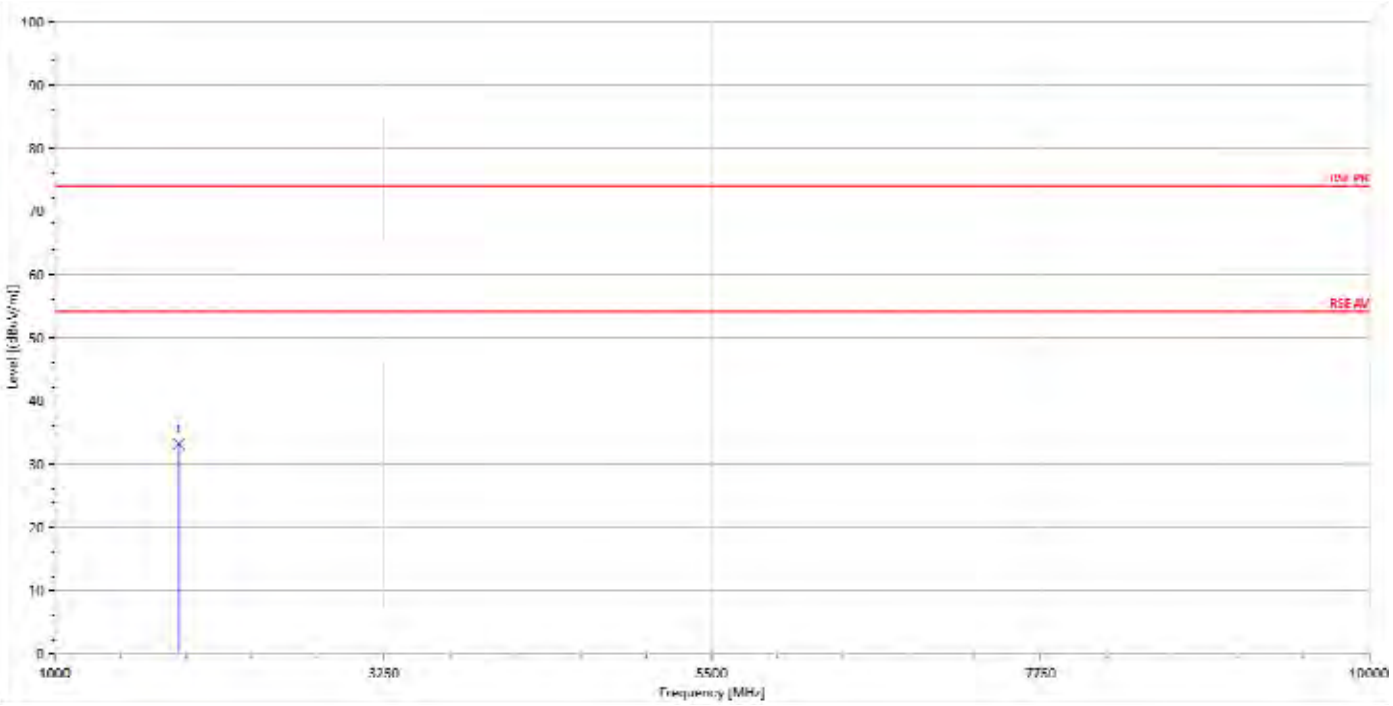
Operation Mode :	RFID	Test Date :	2017/7/17
Fundamental Frequency :	923 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Rx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1848.00	H	Peak	34.25	-1.07	33.18	74	-40.82

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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4.8.1.1節(2)之規定，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。

7.2 天線增益

此裝置使用天線如下:

Antenna Designation:	Dipole Antenna Part number: 3GD-D02, Supplier: N/A, Gain: 2dBi

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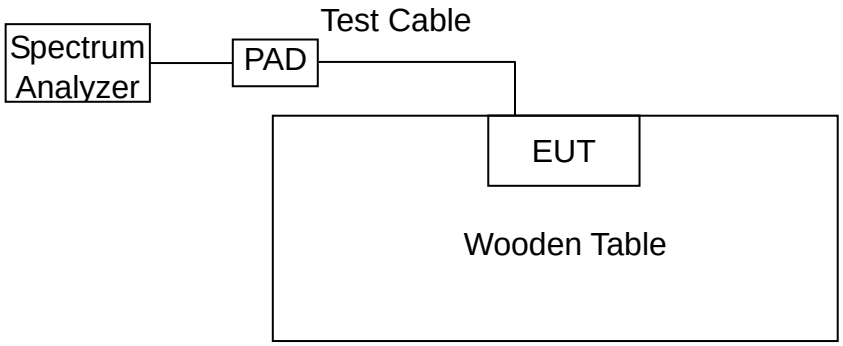
8 輸出峰值功率之量測

8.1 適用標準

依據NCC低功率射頻電機技術規範4.8.1.1節(1)之規定，操作於922MHz~928 MHz之跳頻系統，其峰值輸出功率限制如下:

(a) 設置於室內或特殊場所者：最大峰值輸出功率 1 瓦（含）以下。
(b) 設置於室外者：最大峰值輸出功率 0.5 瓦（含）以下。
(c) 前揭（a）所稱特殊場所係指於某特定、封閉且管制人員進出之專屬區域（不限室內或室外）場所。

8.2 輸出功率之測試配置



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8.3 輸出功率之量測結果

待測設備:	Low-Power Long Range LoRa technology transceiver module	型號:	RN2903A
環境溫度:	20℃	環境濕度:	65%
解析頻寬:	1M	視訊頻寬:	3M
Span:	5MHz	測試者:	

RFID (250k)					
Freq. (MHz)	**Peak Output Power (dBm)**	**Peak Output Power (mW)**	**Limit**		**RESULT**
920.265	**19.070**	**80.723**	30.00	dBm	PASS
923.000	19.015	79.707	30.00	dBm	PASS
924.695	19.035	80.075	30.00	dBm	PASS

RFID (500k)					
Freq. (MHz)	**Peak Output Power (dBm)**	**Peak Output Power (mW)**	**Limit**		**RESULT**
920.185	**19.071**	**80.742**	30.00	dBm	PASS
923.000	19.021	79.818	30.00	dBm	PASS
924.380	19.035	80.075	30.00	dBm	PASS

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輸出峰值功率之量測值 CH-Low (250k)

輸出峰值功率之量測值 CH-Mid (250k)

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輸出峰值功率之量測值 CH-High (250k)

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輸出峰值功率之量測值 CH-Low (500k)

輸出峰值功率之量測值 CH-Mid (500k)

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輸出峰值功率之量測值 CH-High (500k)

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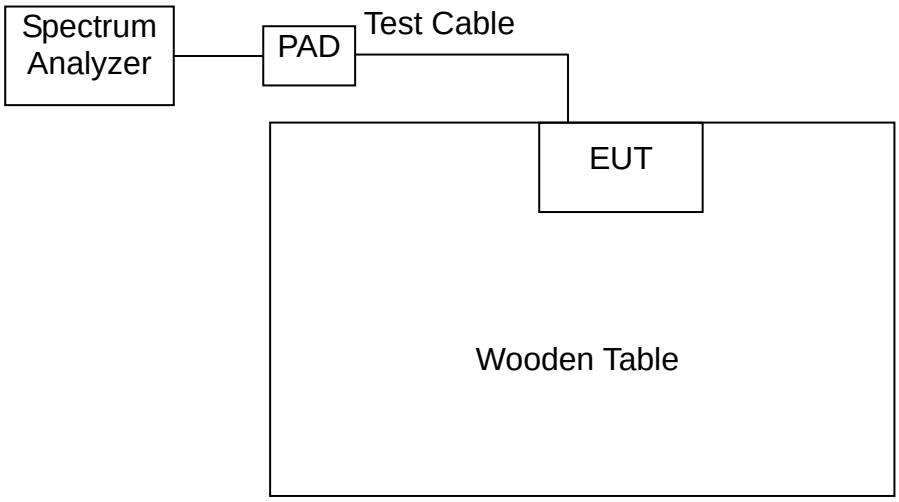
9 開放頻帶邊緣 100KHZ 頻寬內之限制

9.1 9.1 適用標準

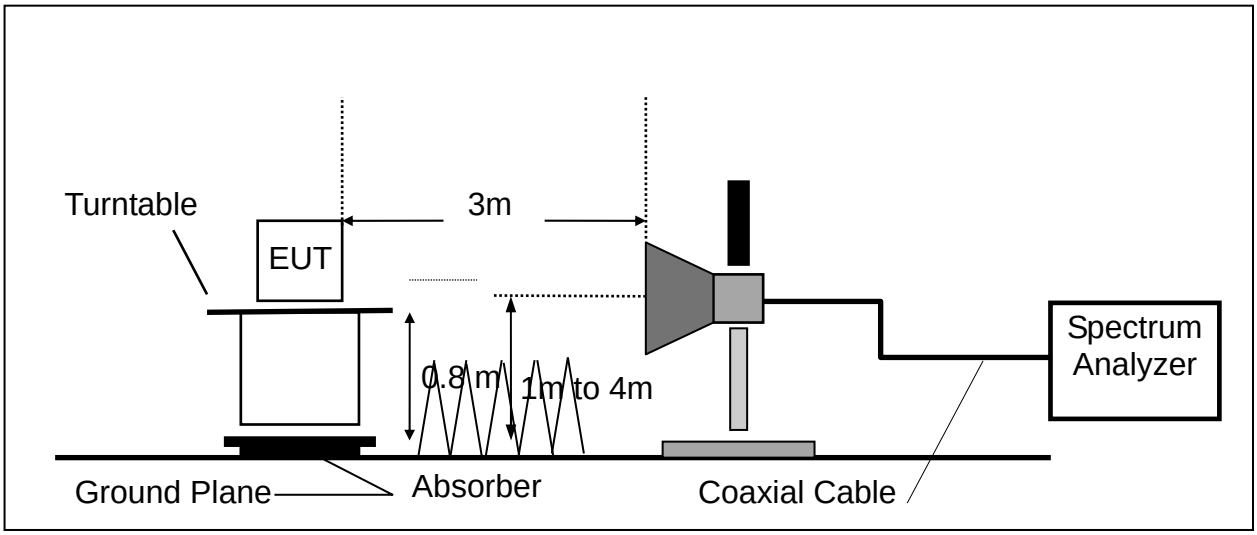
依據NCC低功率射頻電機技術規範4.8.1.3節之規定，使用頻帶範圍外之任意100kHz 內，發射器所產生的射頻功率相較於使用頻帶範圍中包含最高所需功率之100kHz 內的射頻功率，須衰減20分貝 (dB) ，以射頻傳導或輻射方式測量。此外，落於第2.7節禁用頻段之輻射發射，應符合第2.8節之規定。

9.2 9.2 開放頻帶邊緣之測試配置

a. 頻帶外發射傳導量測值



b. 禁用頻帶輻射量測值之測試配置



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9.3 9.3 開放頻帶邊緣之量測結果

測試設備:	Low-Power Long Range LoRa technology transceiver module	型號:	RN2903A
環境溫度:	20℃	環境濕度:	65%
解析 頻寬:	100kHz	視訊頻寬:	300kHz
Span:	Low: 3MHz / High: 4MHz	測試者:	

頻帶外發射傳導量測值

發射限制測試值 CH-Lower(下邊緣頻帶): 在 922MHz 之 100kHz 頻寬內最大值皆比主波低 20dB 以上。

發射限制測試值 CH-Higher(上邊緣頻帶): 在 928MHz 之 100kHz 頻寬內最大值皆比主波低 20dB 以上。

請參考附圖。

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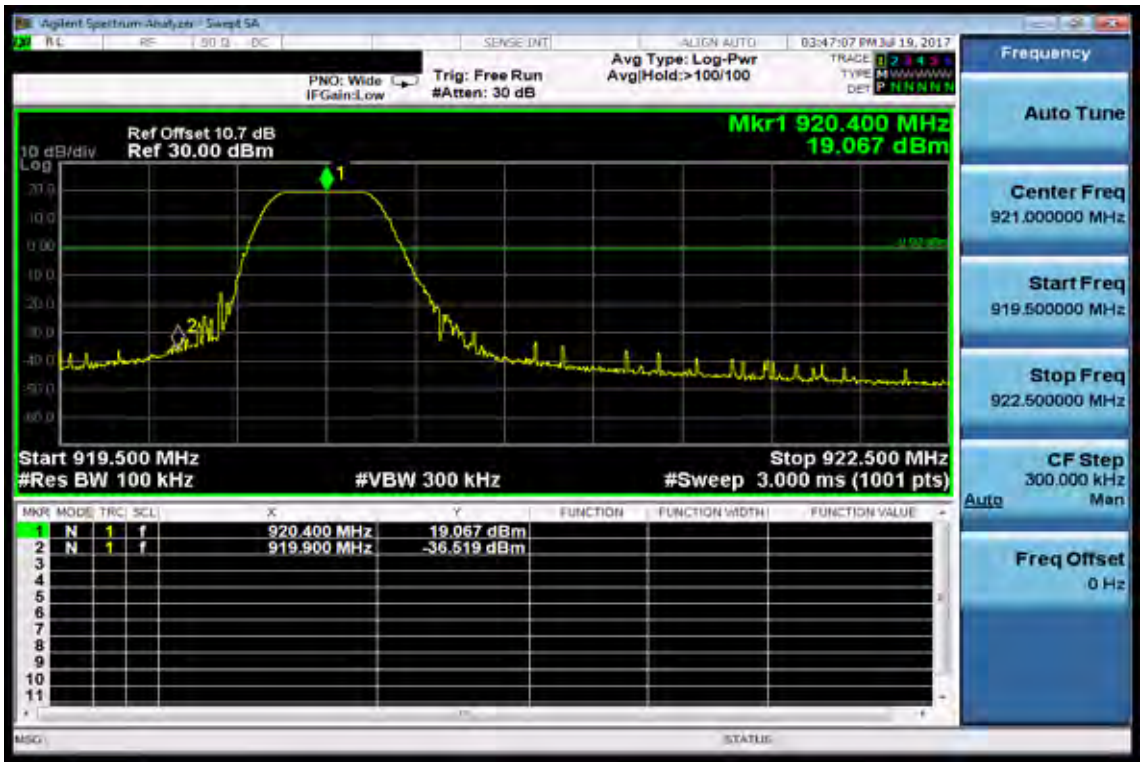
禁用頻帶及邊際頻帶傳導測試 (Non-Hopping) (250k)

CH Low



CH High

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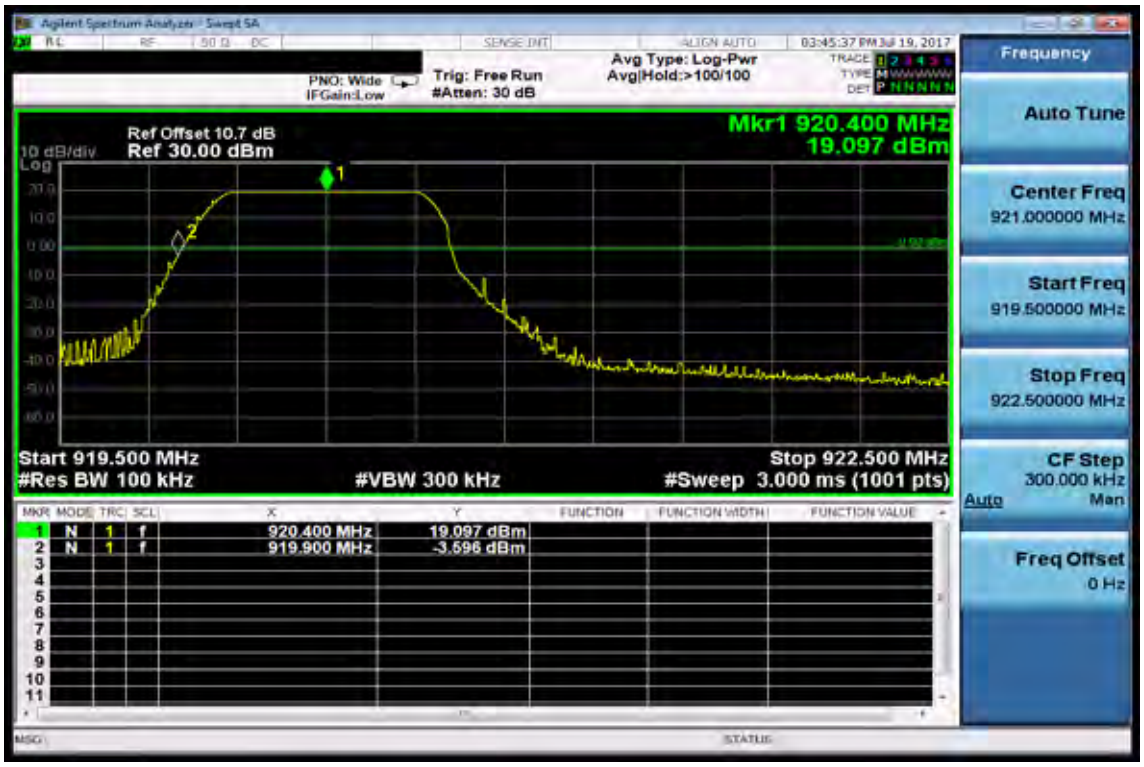
禁用頻帶及邊際頻帶傳導測試 (Non-Hopping) (500k)

CH Low



CH High

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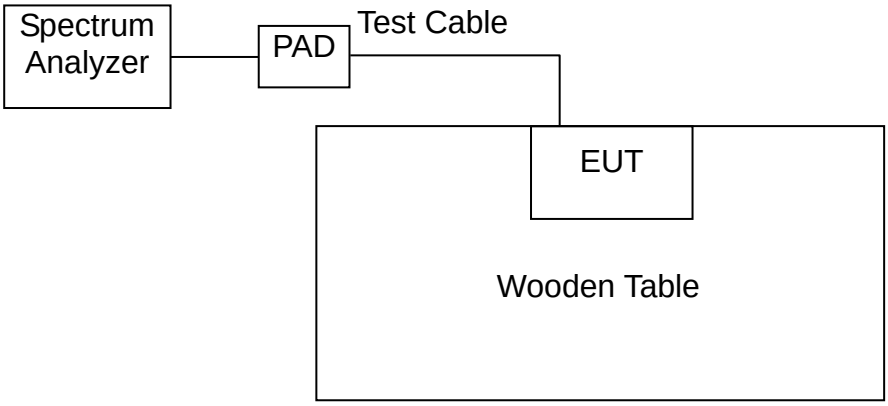
10 6dB 頻寬之要求

10.1 適用標準

依據NCC第64次一致性會議記錄:
LP0002之4.8.1.4其他限制事項之 (3)採用跳頻與數位調變技術之複合系統，未規定6dB頻寬至少應有500kHz及最少跳頻頻道數。爰依據FCCKDB 453039，複合系統不要求6dB頻寬至少應有500kHz及最少跳頻頻道數。

10.2 測試配置

圖 4: 發射頻寬之測試配置



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10.3 量測結果

測試設備:	Low-Power Long Range LoRa technology transceiver module	型號:	RN2903A
環境溫度:	20℃	環境濕度:	65%
解析 頻寬:	30kHz	視訊頻寬:	300kHz
Span:	1MHz	測試者:	

6dB Bandwidth: (250k)

CH	Bandwidth (kHz)
Lower	293.8
Mid	294.0
Higher	**296.8**

6dB Bandwidth: (500k)

CH	Bandwidth (kHz)
Lower	617.8
Mid	640.3
Higher	**650.9**

請參考附圖。

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6dB Bandwidth: (250k)

發射頻寬測試值 CH-Low

發射頻寬測試值 CH-Mid

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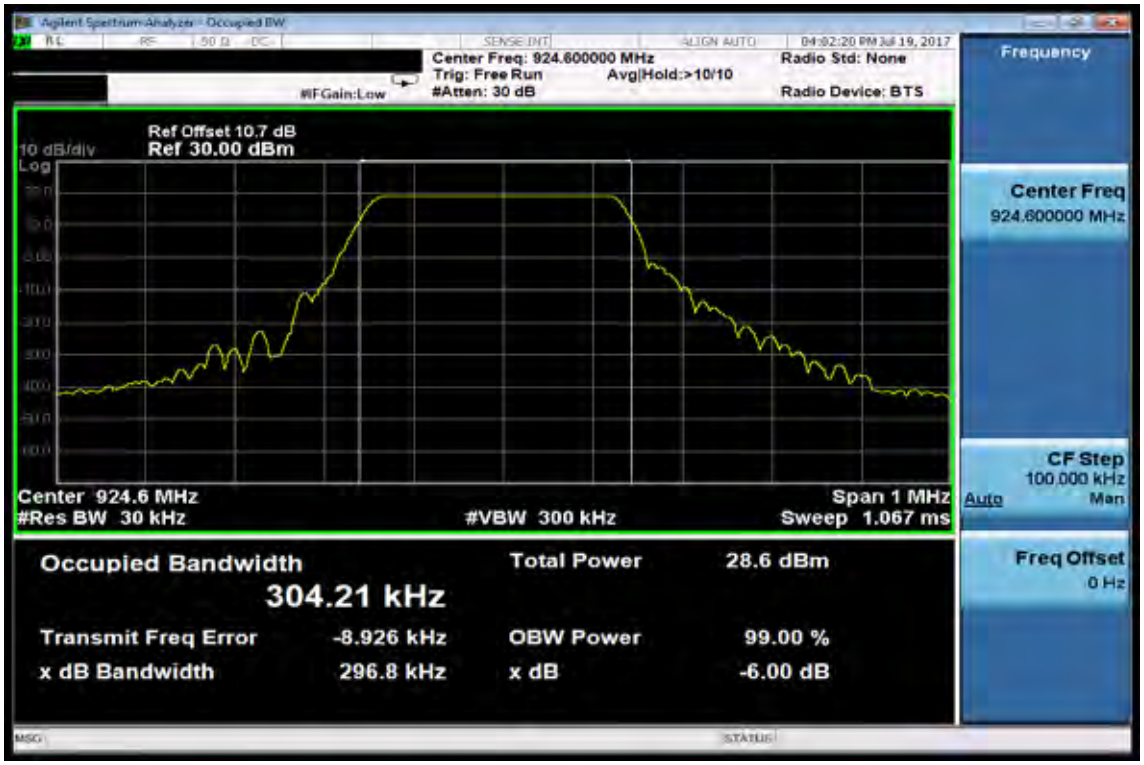
發射頻寬測試值 CH-High



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6dB Bandwidth: (500k)

發射頻寬測試值 CH-Low

發射頻寬測試值 CH-Mid

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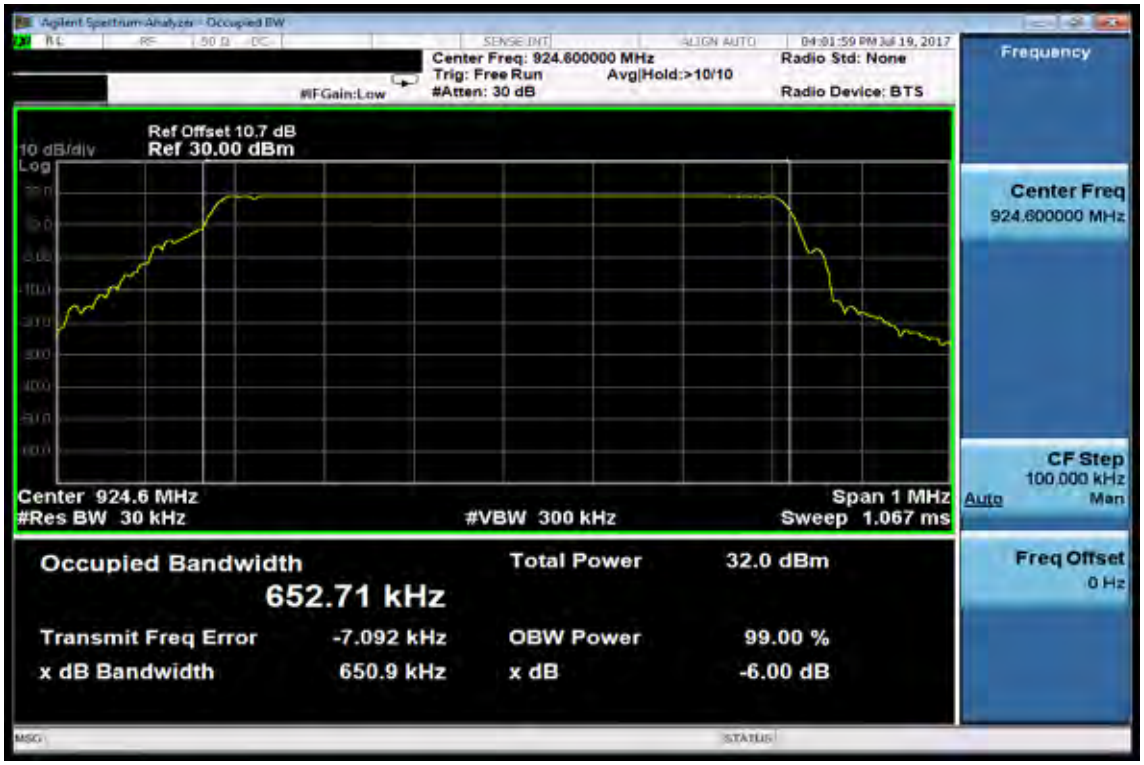
發射頻寬測試值 CH-High



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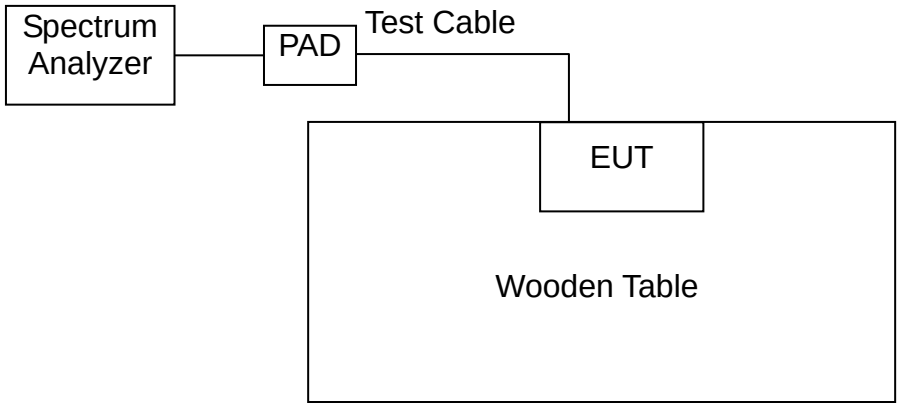
11 載波頻率間隔之量測

11.1 適用標準

依據NCC低功率射頻電機技術規範4.8.1.4節(1)跳頻系統之規定

(a) 跳頻系統之載波頻率頻道間隔應至少 25kHz 或跳頻頻道之 20dB 頻寬，兩者取較寬者。系統之跳頻頻道應依虛擬亂數排列，在各頻率之跳頻頻道上跳躍。每一發射機必須均等的使用每一頻率。

11.2 量測載波頻率間隔之配置



11.3 載波頻率間隔之量測結果

頻道	載波頻率間隔	最小限制值 (kHz)	依據 NCC 低功率射頻電機技術規範 4.8.1.4 節(a)之標準，故取載波頻率間隔之量測值。
CH Low	200kHz	711.3	
Ch High	200kHz	710.9	

請參考附圖。

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載波頻率間隔測試值

測試設備:	Low-Power Long Range LoRa technology transceiver module	型號:	RN2903A
環境溫度:	20℃	環境濕度:	65%
解析頻寬:	30kHz	視訊頻寬:	100kHz
Span:	2MHz	測試者:	

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頻道數:22

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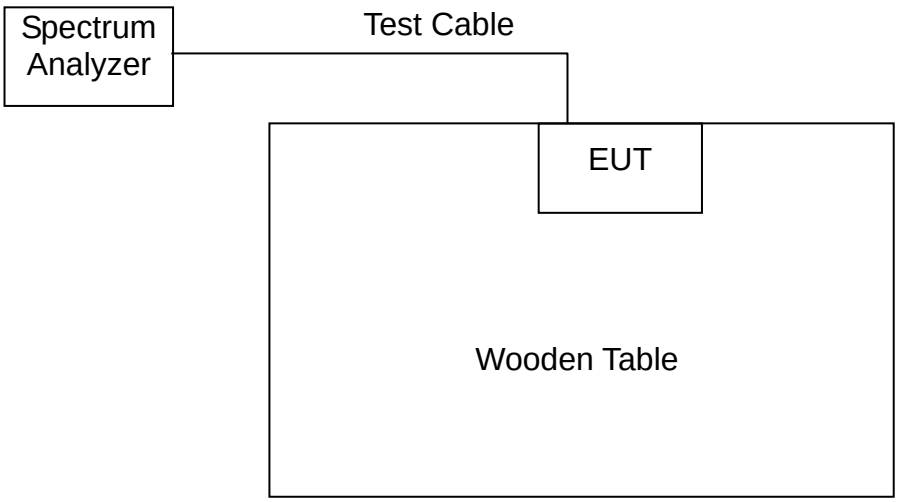
12 載波頻率佔用週期之量測

12.1 適用標準

依據 NCC 低功率射頻電機技術規範 4.8.1.4 節(3) 採用跳頻與數位調變技術之複合系統(Hybrid systems)之規定 (A) 複合系統之跳頻作業，關閉直接序列或數位調變作業時，其每一載波頻率在週期 (跳頻頻道數乘以 0.4 秒)內，每次出現所佔用之平均時間應小於或等於 0.4 秒。

12.2 量測物載波頻率佔用週期之配置



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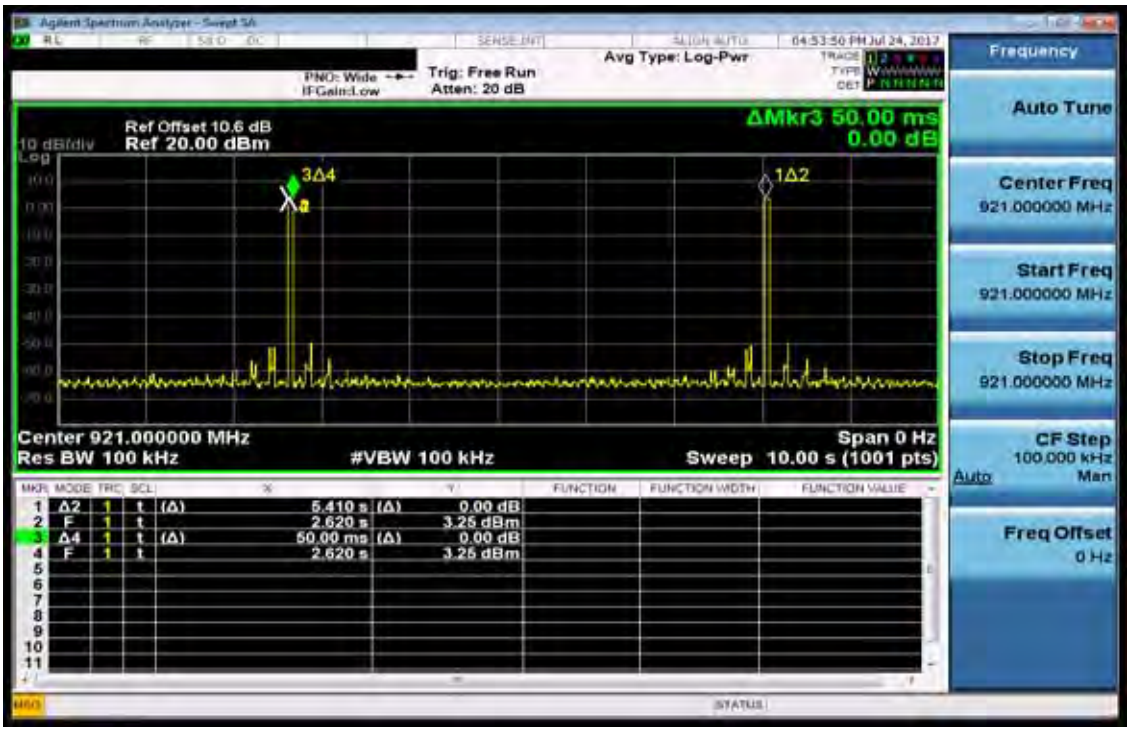
12.3 開放載波頻率佔用週期之量測結果:

測試設備:	Low-Power Long Range LoRa technology transceiver module	型號:	RN2903A
環境溫度:	20℃	環境濕度:	65%
解析頻寬:	1MHz	視訊頻寬:	3MHz
Span:	0Hz	測試者:	

載波頻率週期測試值 Hopping Mode

跳頻頻道數	周期=跳頻頻道數乘以 0.4 秒	週期脈衝次數	脈衝時間長度(ms)	測試結果(ms)	限制值(ms)
22	8800	1	52	52	400



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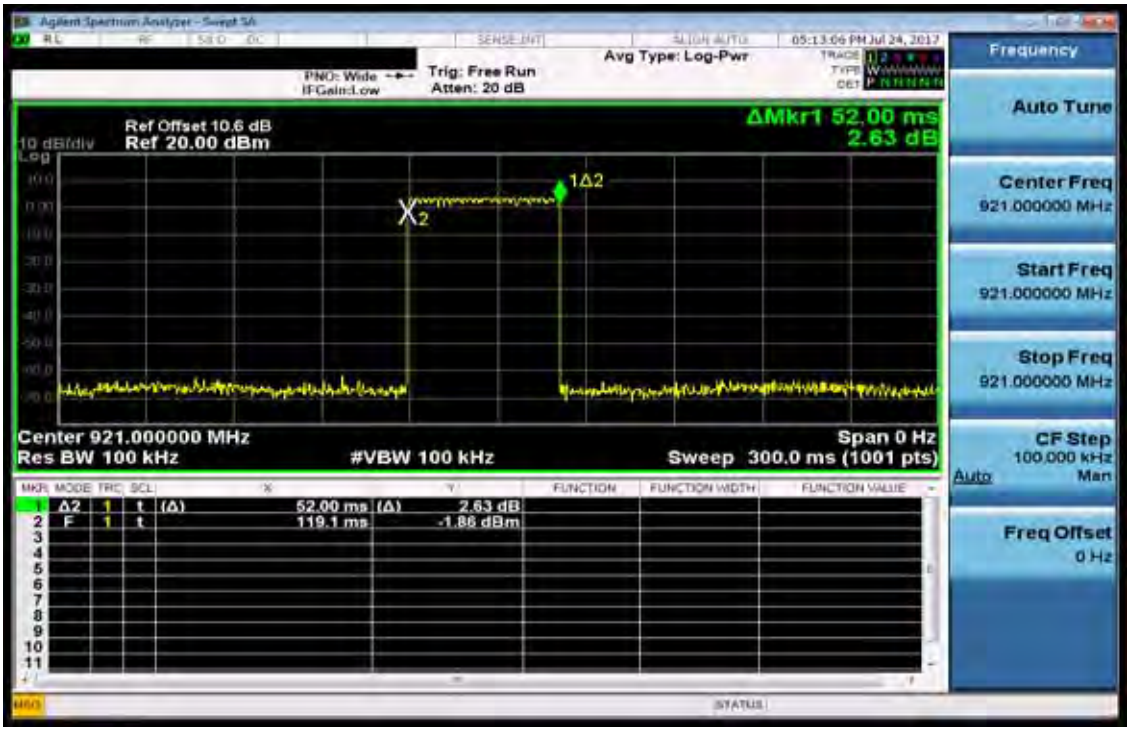

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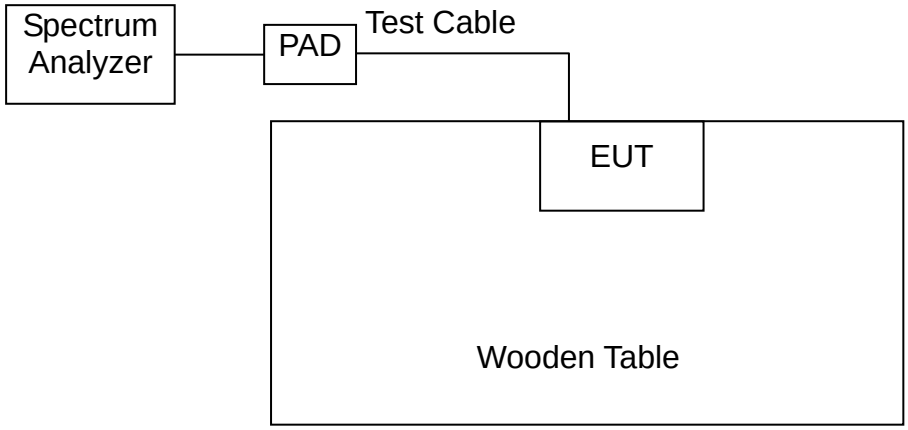
13 功率頻譜密度

13.1 13.1 適用標準

依據 NCC 低功率射頻電機技術規範 4.8.1.4 節(3) 採用跳頻與數位調變技術之複合系統(Hybrid systems)之規定 (B) 關閉跳頻作業之複合系統以數位調變技術作業時，應符合 4.8.1.4 其他限制事項(2)數位調變技術系統(B)之功率頻譜密度規定。

頻帶範圍內任意 3 kHz 頻寬內由發射機傳導至天線之功率頻譜密度均應小於或等於 8dBm。

13.2 量測頻道數之配置



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13.3 功率頻譜密度之量測結果

測試設備:	Low-Power Long Range LoRa technology transceiver module	型號:	RN2903A
環境溫度:	21℃	環境濕度:	63%
解析頻寬:	3kHz	視訊頻寬:	10KHz
Span:	1MHz	測試者:	

RFID 250KHz

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)
920.4	1.33	8
923	1.34	8
924.6	1.33	8

RFID 500KHz

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)
920.4	-1.32	8
923	-1.67	8
924.6	-1.36	8

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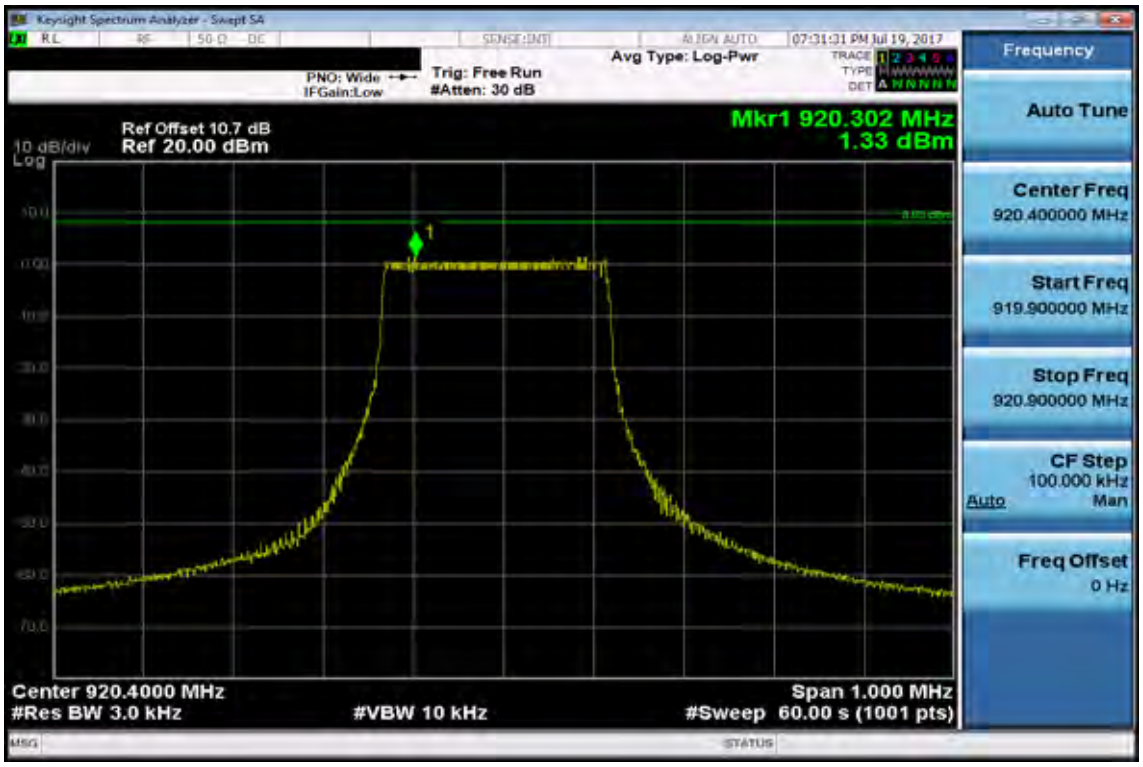
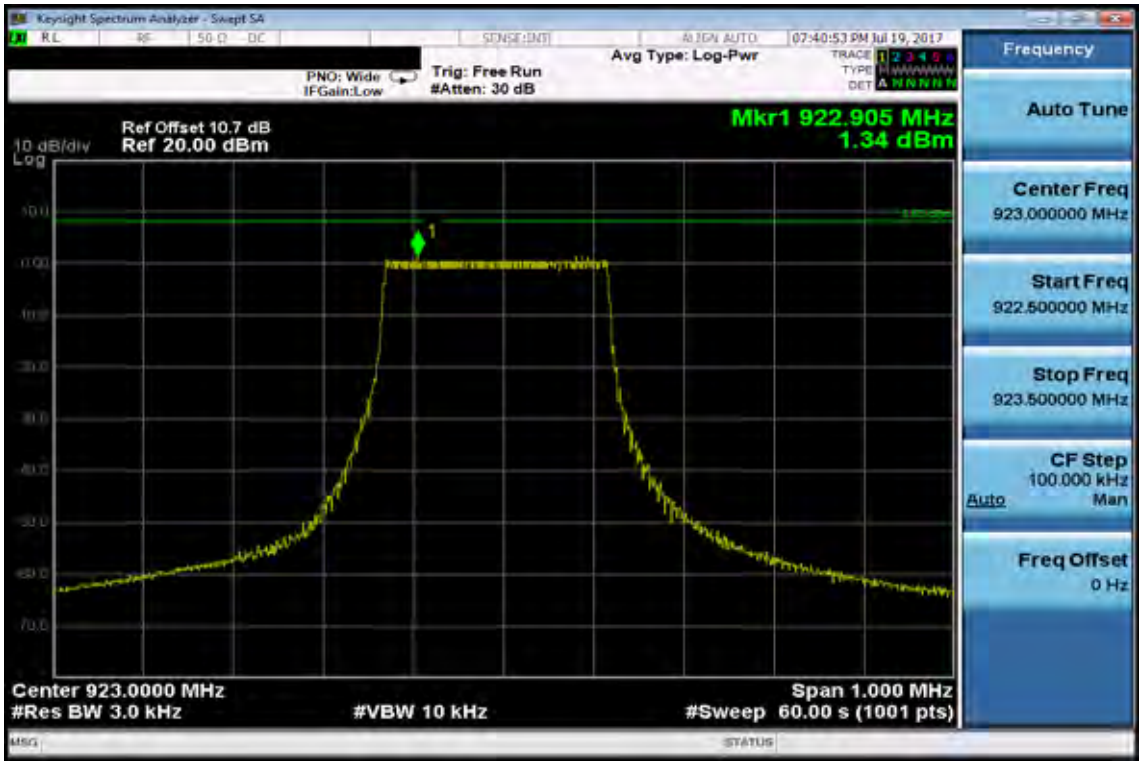
RFID 250KHz Test Data Plot

CH Low 功率密度量測值



CH Mid 功率密度量測值



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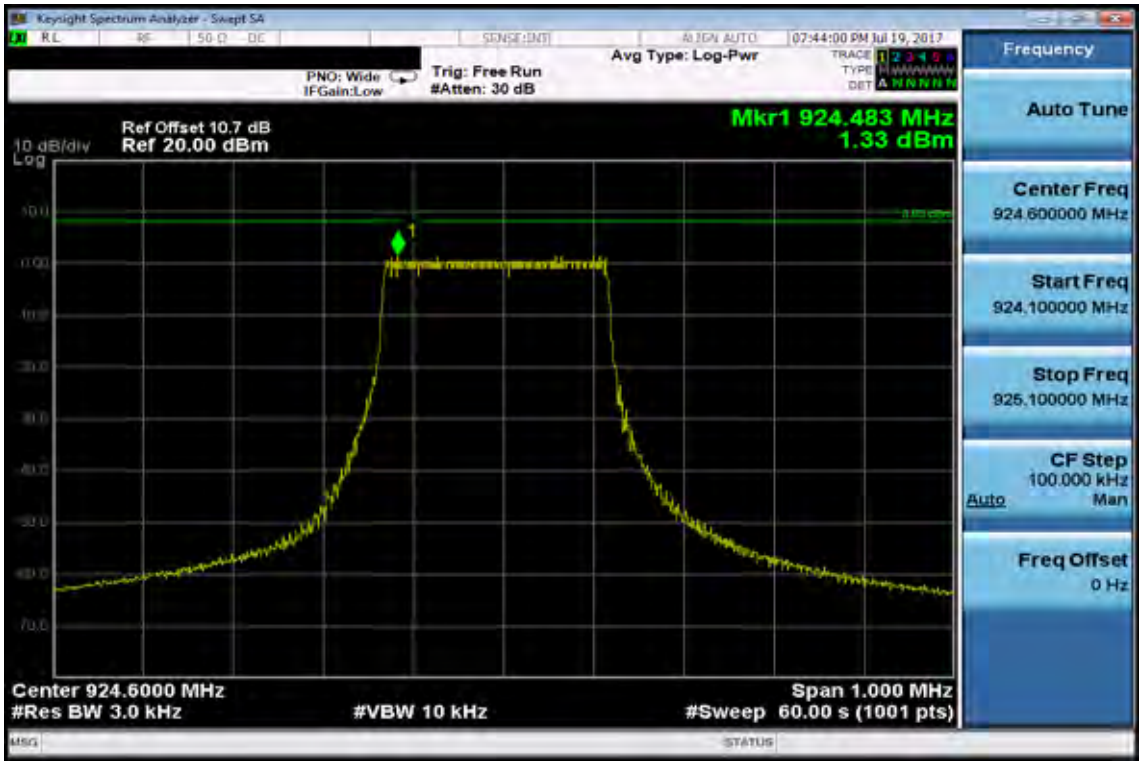
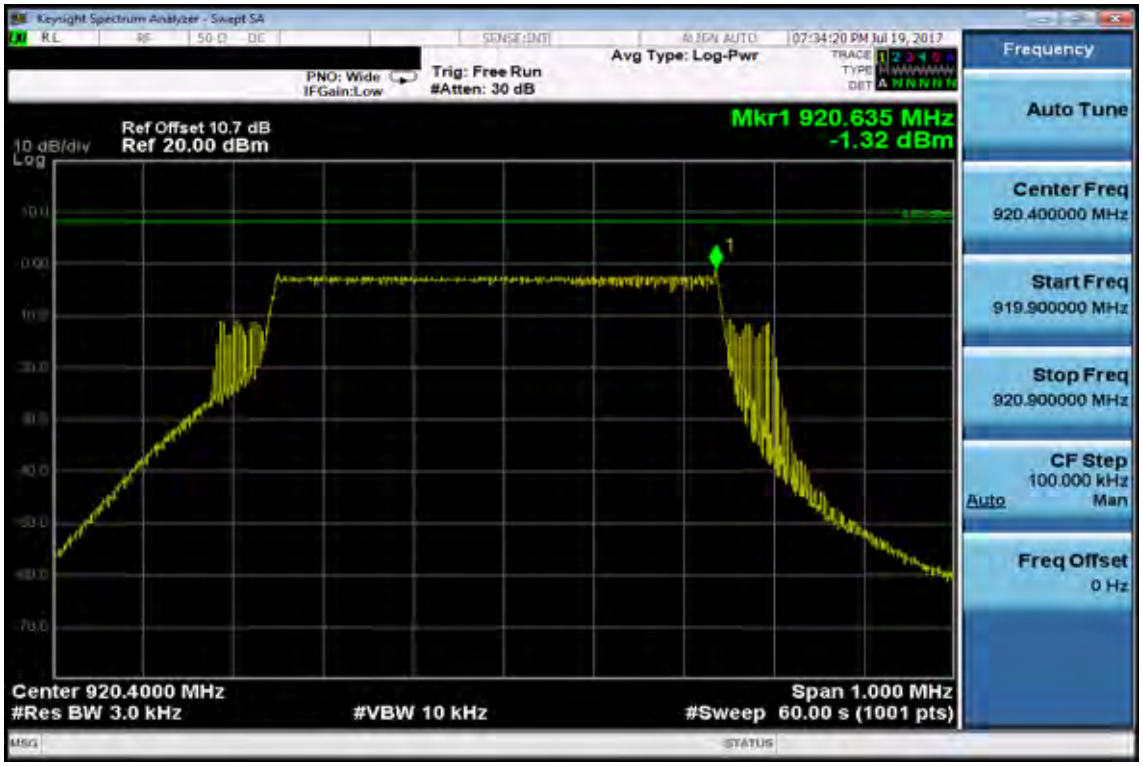
CH High 功率密度量測值



RFID 500KHz Test Data Plot

CH Low 功率密度量測值



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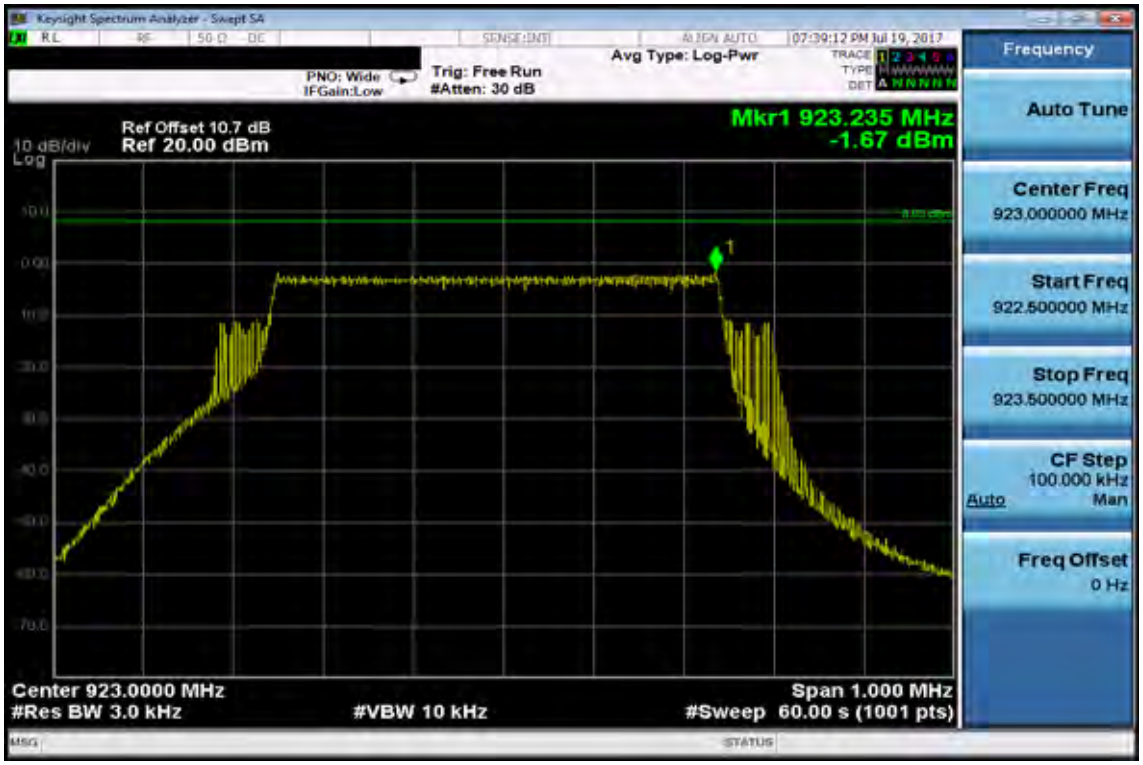
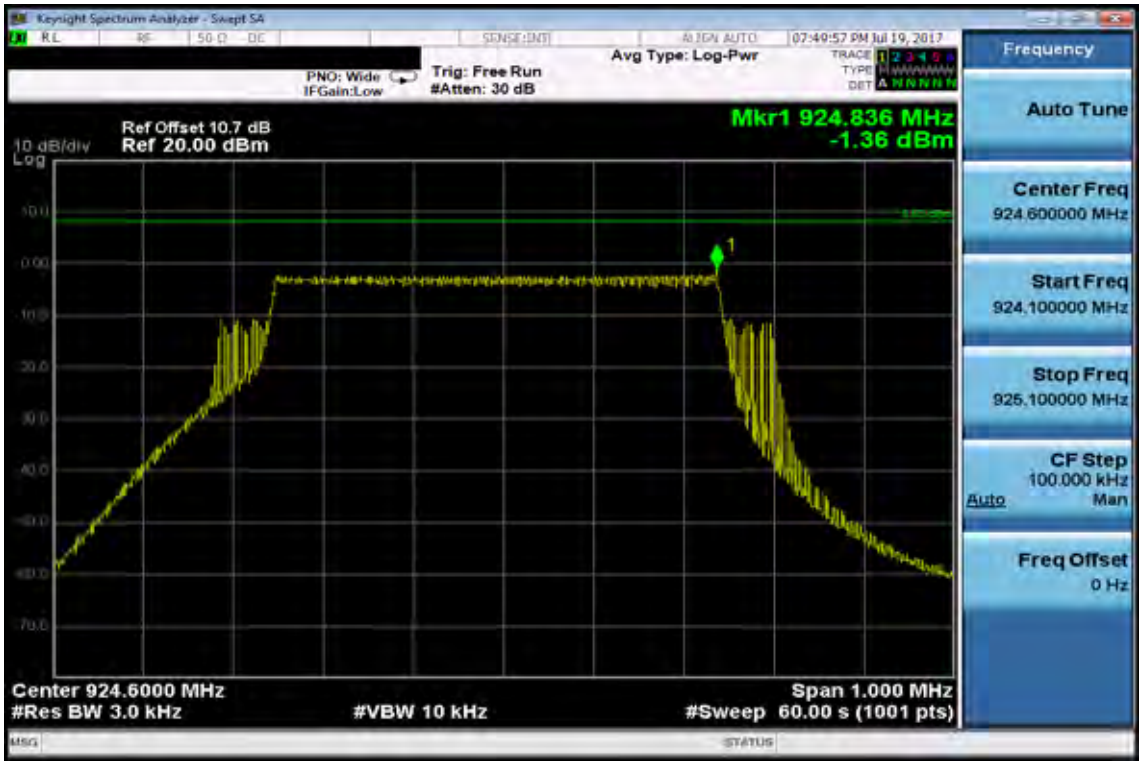
CH Mid 功率密度量測值



CH High 功率密度量測值



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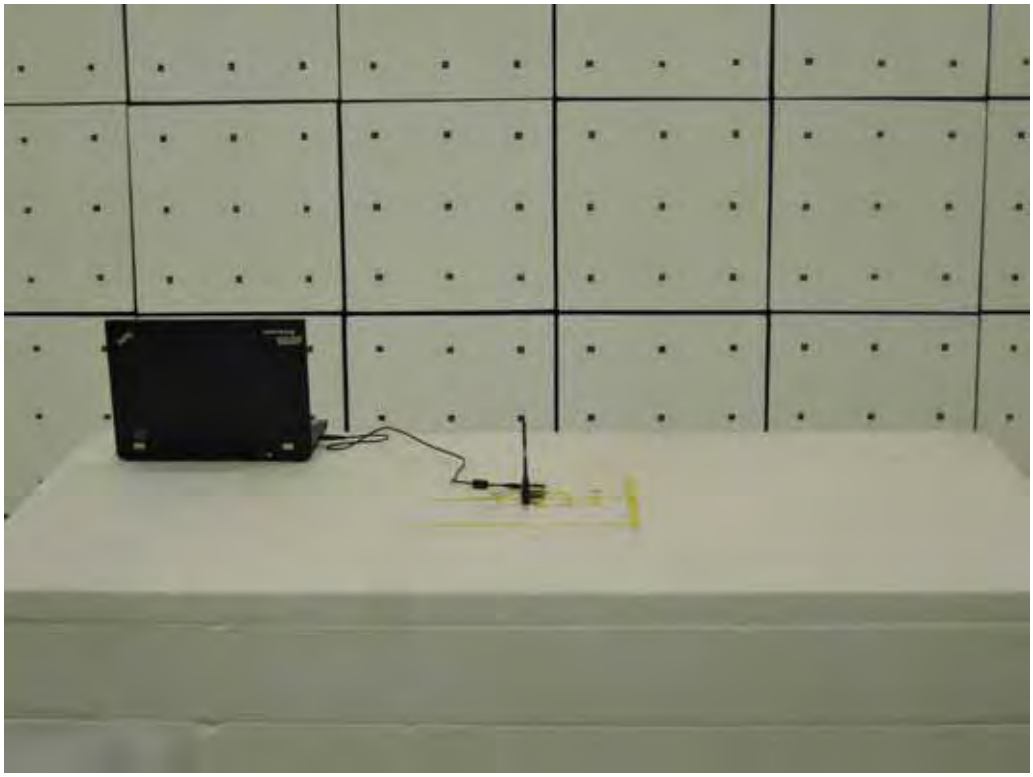
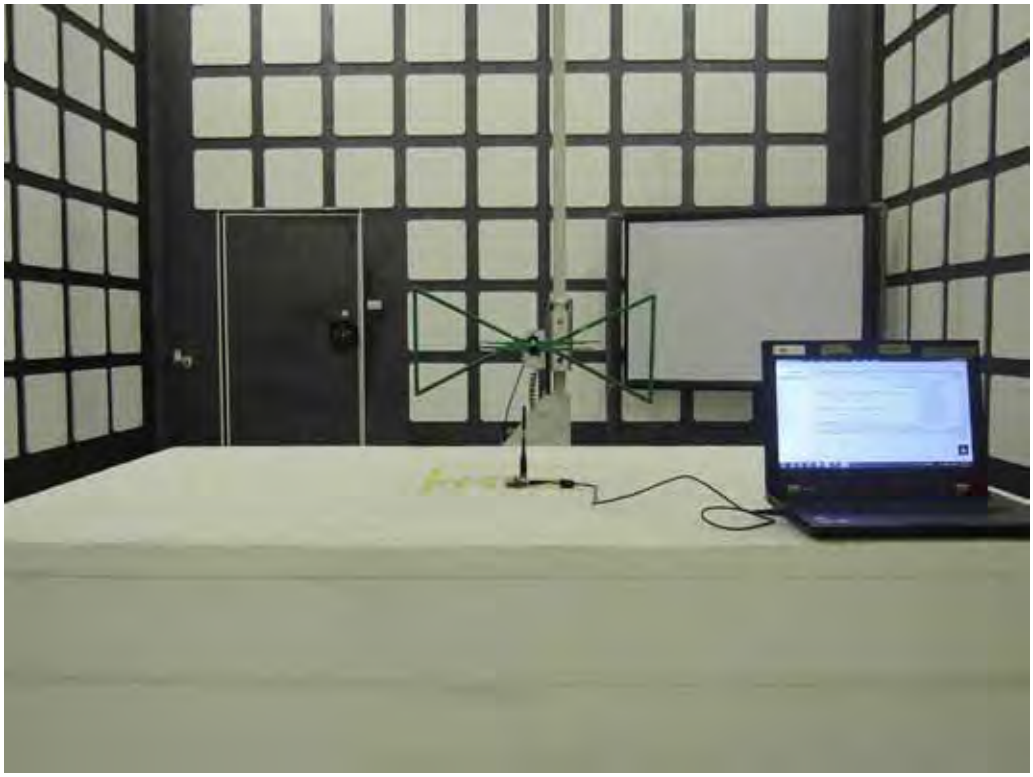
測 試 照 片

Radiated 量測之配置照片 (H Plan)(Below 1G)





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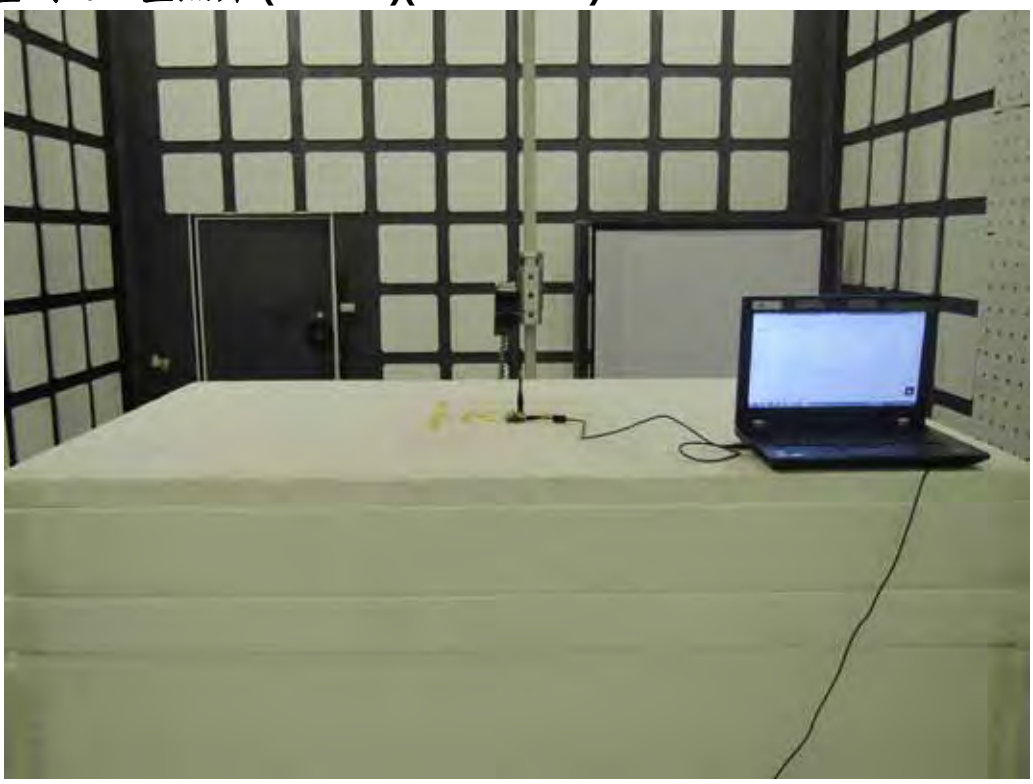
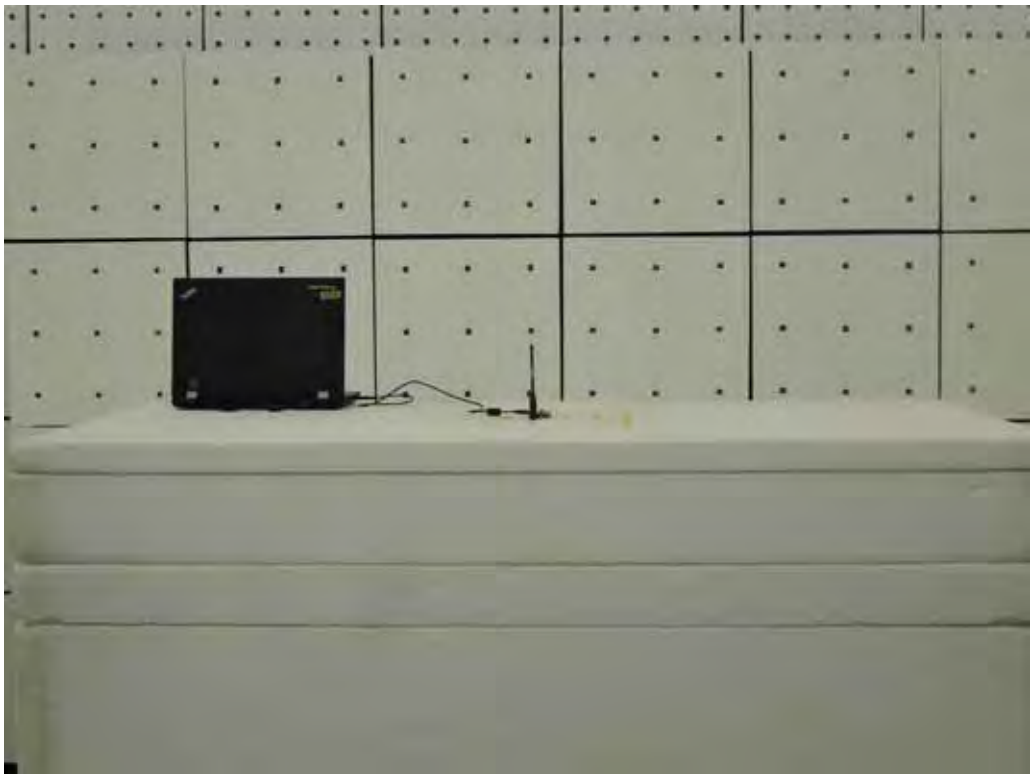
Radiated 量測之配置照片 (H Plan)(Above 1G)





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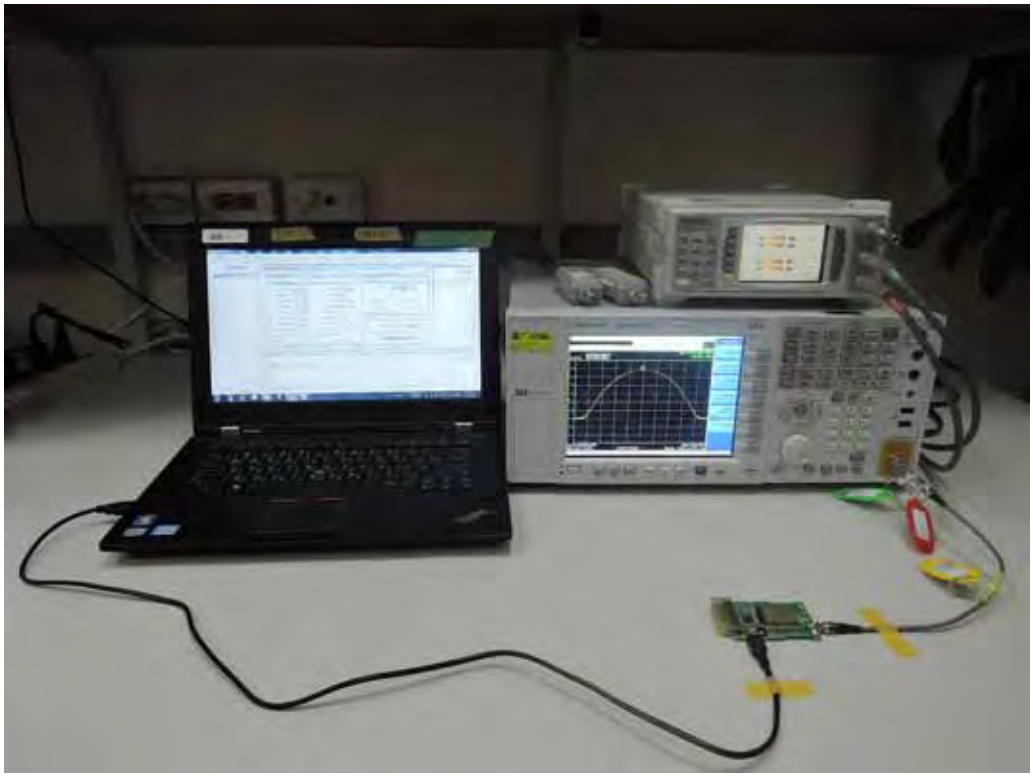
Conducted 量測之配置照片



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產 品 照 片

Please refer to the attached file (EUT Photo)

~ End of Report ~

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