

低功率射頻電機試驗報告

申請廠商 Marquardt GmbH
Schloss-Str. 16, 78604 Rietheim-Weilheim, Germany

製造廠商 Marquardt GmbH

產品名稱 Vehicle Key

廠牌 Porsche

型號 PK3

電場強度 30.52dB μ V/m@21.85kHz(RX)

工作頻率 21.85 kHz (接收)

調變方式 BPSK-Signal

法規章節 LP0002 2.11

實驗室資訊

台灣檢驗科技股份有限公司 電子暨通訊實驗室

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10月30日

完成日期 民國106年11月06日

張俊卿

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暨通訊實驗室，依據國家通訊傳播委員會於中華民國一百年六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：

陳柏均

日期：

11/09/2017

陳柏均 / 工程師

報告製作：

湯宜萱

日期：

11/09/2017

湯宜萱 / 行政

報告審核：

張俊卿

日期：

11/09/2017

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 : 新北市新北產業園區五工路134號

實驗室名稱 : 台灣檢驗科技股份有限公司
電子暨通訊實驗室

實驗室地址 : 新北市新北產業園區五工路134號

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

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1 一般資料

1.1 產品描述

產品名稱	Vehicle Key
型號	PK3
產品商標	Porsche
SW version:	N/A
HW version:	N/A
使用電源	3VDC from Battery
產品特性	屬於無線接收裝置，頻率為 21.85 kHz。

21.85 kHz

接收頻帶	21.85 kHz
電場強度	67.57dB μ V/m@21.85kHz(RX)
調變方式	BPSK-Signal
頻道數	1Channel: 21.85 kHz
天線型式	3D-Coil Antenna

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1.2 測試方法之依據

本測試報告之所有項目皆依據國家通訊傳播委員會低功率射頻電機技術規範(LP0002, 105.8.23版本) 如無國家標準可適用者，得依美國EIA、IEEE ANSI檢驗法檢驗，及美國FCC 47 CFR Part 2有關檢驗之規定及參考ANSI 63.10:2013之檢驗法。

一般規定項目

項次	測試項目	適用規範	測試結果	量測設備	備註
1	待測試產品確認	低功率射頻電機技術規範 2.1節	N/A	N/A	符合
2	天線之要求	低功率射頻電機技術規範 2.2節	N/A	N/A	符合
3	電源線傳導干擾	低功率射頻電機技術規範 2.3節	N/A	N/A	無AC電源不適用
4	不得發射減幅波	低功率射頻電機技術規範 2.4節	N/A	N/A	符合
5	禁用頻帶確認	低功率射頻電機技術規範 2.7節	N/A	N/A	符合
6	輻射電場強度	低功率射頻電機技術規範 3.4.2(5.1)節	合格	合格	符合
7	手冊內容確認	低功率射頻電機技術規範 2.10節	N/A	N/A	符合
8	是否成套銷售	低功率射頻電機技術規範 2.11節	N/A	N/A	否 此報告僅針對接收機部份
	以下空白				

註: 以上標示“N/A”之欄位，意指“不適用”。

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2 適用規範

依據NCC低功率射頻電機技術規範2.11節，收信機之輻射電場強度不得超過2.8節之規定，即如上表之『其他發射之限制值』，其限制值如下：(一般規定)

頻率 MHz	測試距離 m	其他發射之限制值	
		dB μ V/m	μ V/m
0.009 – 0.490 (含)	300		2,400 / 頻率 (千赫)
0.490 (不含) – 1.705 (含)	30		24,000 / 頻率 (千赫)
1.705 (不含) – 30 (含)	30		30
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
960以上	3	54.0	500

(1) 傳導之規定

依據NCC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 (dB μ V)	
	準峰值 (Quasi – peak)	平均值 (Average)
0.15 – 0.5	66 – 56	56 - 46
0.5 – 5	56	46
5 - 30	60	50

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(2) 限制使用之頻帶

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(兆赫)	頻率(兆赫)	頻率(兆赫)
0.090 - 0.110	162.01 - 167.17	3500.0 - 4400.0
0.490 - 0.510	167.72 - 173.20	4500.0 - 5250.0
2.172 - 2.198	240.00 - 285.00	5350.0 - 5460.0
3.013 - 3.033	322.00 - 335.40	7250.0 - 7750.0
4.115 - 4.198	399.90 - 410.00 (註 1)	8025.0 - 8500.0
5.670 - 5.690	608.00 - 614.00	9000.0 - 9200.0
6.200 - 6.300	825.00 - 915.00	9300.0 - 9500.0
8.230 - 8.400	935.00 - 1240.0	10600 - 12700
12.265 - 12.600	1300.0 - 1427.0	13250 - 13400
13.340 - 13.430	1435.0 - 1626.5	14470 - 14500
14.965 - 15.020	1660.0 - 1755.0	15350 - 16200
16.700 - 16.755	1805.0 - 1850.0	17700 - 21400
19.965 - 20.020	2200.0 - 2300.0	22010 - 23120
25.500 - 25.700	2310.0 - 2390.0	23600 - 24000
37.475 - 38.275	2483.5 - 2500.0	31200 - 31800
73.500 - 75.400	2655.0 - 2900.0	36430 - 36500
108.00 - 138.00	3260.0 - 3267.0	38600 以上 (註 2)
149.90 - 150.05	3332.0 - 3339.0	
156.70 - 156.90	3345.8 - 3358.0	

註 1：402MHz-405MHz MICS 器材（第 4.11 節）除外。

註 2：76GHz-77GHz車輛雷達感測系統器材（第3.13節）除外。

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3 受測裝置之系統說明

裝置名稱	製造者/代理者	型 號
* Vehicle Key	Marquardt GmbH / Marquardt GmbH	PK3

3.1 待測物與測試設備系統圖

Configuration of Tested System



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
1	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	ESCI7	100760	05/11/2017	05/10/2018
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018
LISN	MESS TEC	FCC-LISN-50/250-25-2-01	4034	03/19/2017	03/18/2018
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017

4.2. 量測場強輻射之量測儀器

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2017	09/19/2018
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/04/2017	08/03/2018
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2017	01/02/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/03/2017	01/02/2018
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/05/2017	01/04/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018

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。

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5 電源線傳導干擾之量測

5.1 適用標準

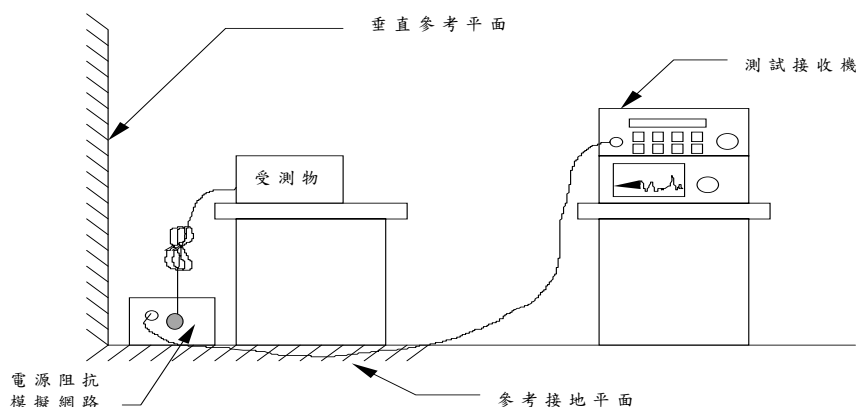
依據NCC低功率射頻電機技術規範2.3節之要求。

5.2 測試方法

將待測物置於0.8米高的非金屬桌面，使其在工作狀態，待測物電源線接至電源線阻抗穩定網路上，從測試接收機記錄頻率由 0.15MHz 至 30MHz 之間之電源線傳導放射強度。

5.3 測試配置

圖 3：傳導干擾之量測配置



5.4 干擾值之計算

電源傳導干擾電壓之計算公式如下

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

其中校正因數為：

$$\text{饋線損失} + \text{電源阻抗模擬網路損失}$$

5.5 傳導干擾之量測結果

N/A，此產品使用 DC 3V 電池，故無須測試。

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6 場強輻射之量測

6.1 適用標準

依據NCC低功率射頻電機技術規範2.9節之要求，其主波電場強度及不必要之輻射干擾需符合表2.8之限制要求。

6.2 量測方法

將待測物置於 1.5 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，1 GHz 以上將待測物置於 1.5 米高的非金屬桌面，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

30MHz 以下測試

解析頻寬:	100kHz	視訊頻寬:	100kHz
量測天線:	VULB9168	檢測器:	Quasi-Peak

30MHz 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:由於 9KHz ~ 30MHz 之電場強度量測不到，故輻射干擾由 30MHz 開始量測。

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6.3 場強度之計算

A. 場強之計算公式如下

結果值 = 讀值 + 校正因數

AV level = Peak level + AV correct factor

如果是 pulse modulation

AV correction factor = $20\log(\text{Ton}/100\text{ms})$

其中校正因數為：

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

註：經評估比較 H PLAN、E1 PLAN 和 E2 PLAN 測試值，附上最差模式 H PLAN 數據。

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

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

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

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

“---” : denotes Noise Floor.

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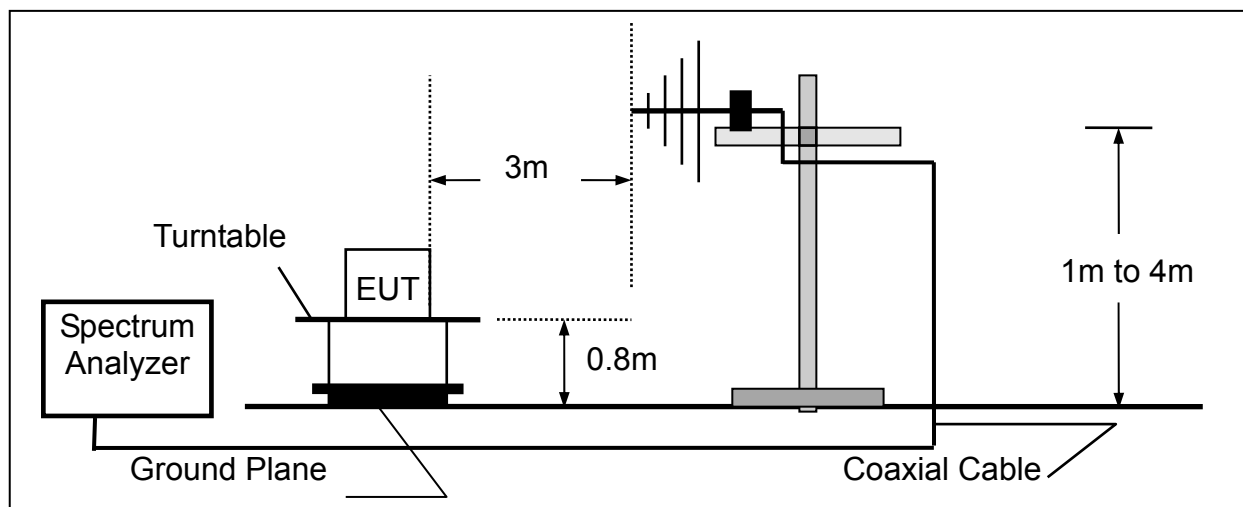
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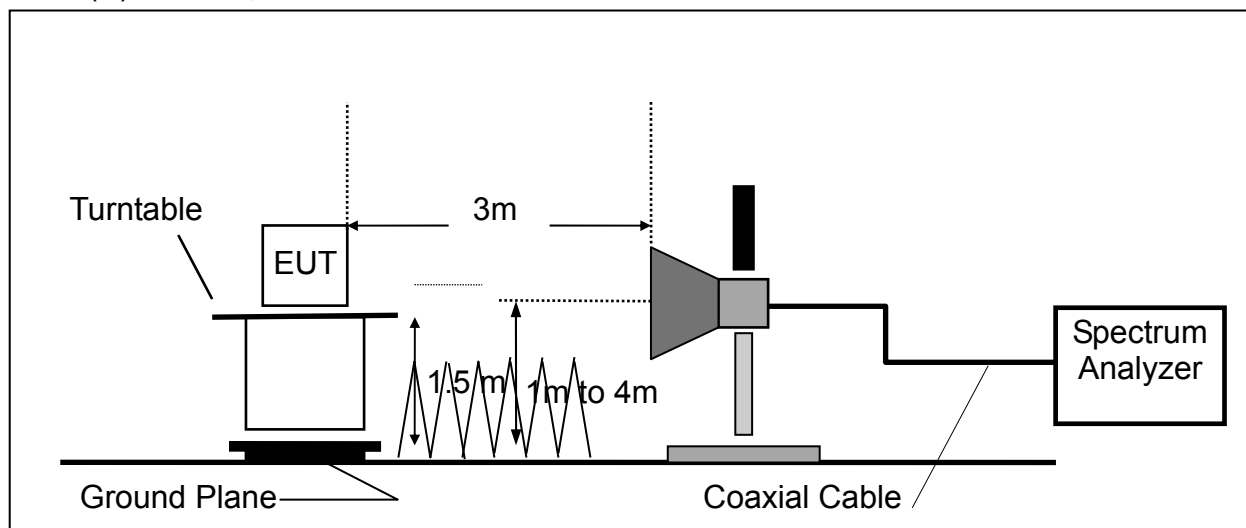
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6.4 輻射之測試配置

(A) 量測頻率 1000MHz 以下之測試配置



(B) 量測頻率 1000MHz 以上之測試配置



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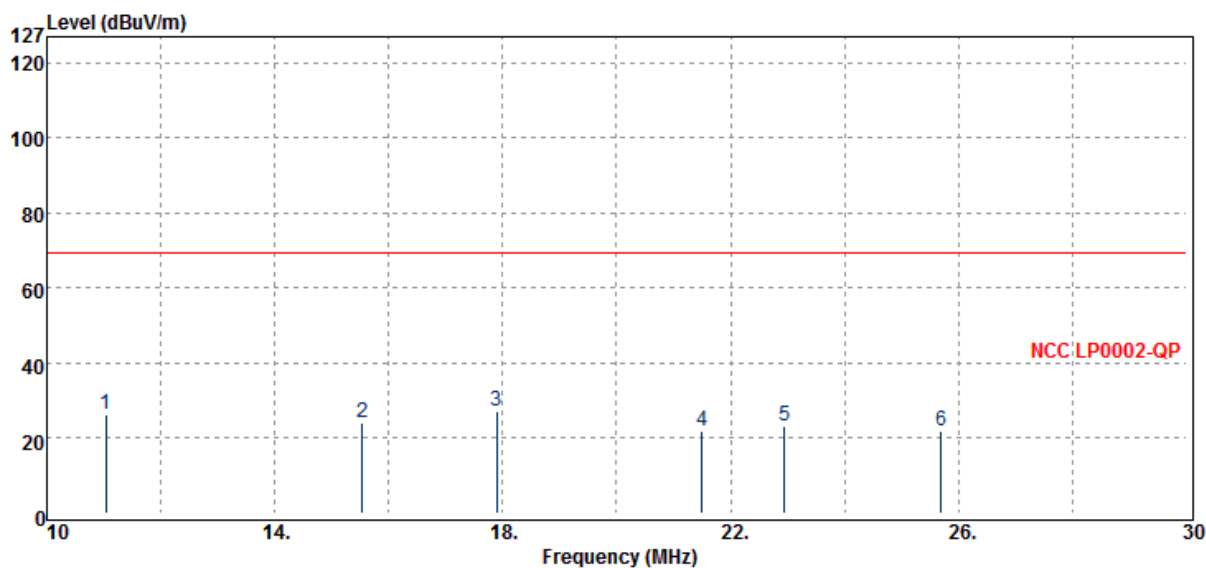
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6.5 場強輻射之量測結果

A. 其他不必要之訊號 (一般規定之 2.8 節)

接收機場強輻射之量測結果(30MHz 以下)

Operation Band	:21.85 kHz	Test Date	:2017-10-30
Fundamental Frequency	:21.85 kHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Rx	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
11.04	S	Peak	14.93	11.36	26.29	69.54	-43.25
15.54	S	Peak	12.63	11.47	24.10	69.54	-45.44
17.90	S	Peak	15.83	11.53	27.36	69.54	-42.18
21.50	S	Peak	10.68	11.13	21.81	69.54	-47.73
22.94	S	Peak	12.40	10.72	23.12	69.54	-46.42
25.70	S	Peak	11.90	10.03	21.93	69.54	-47.61

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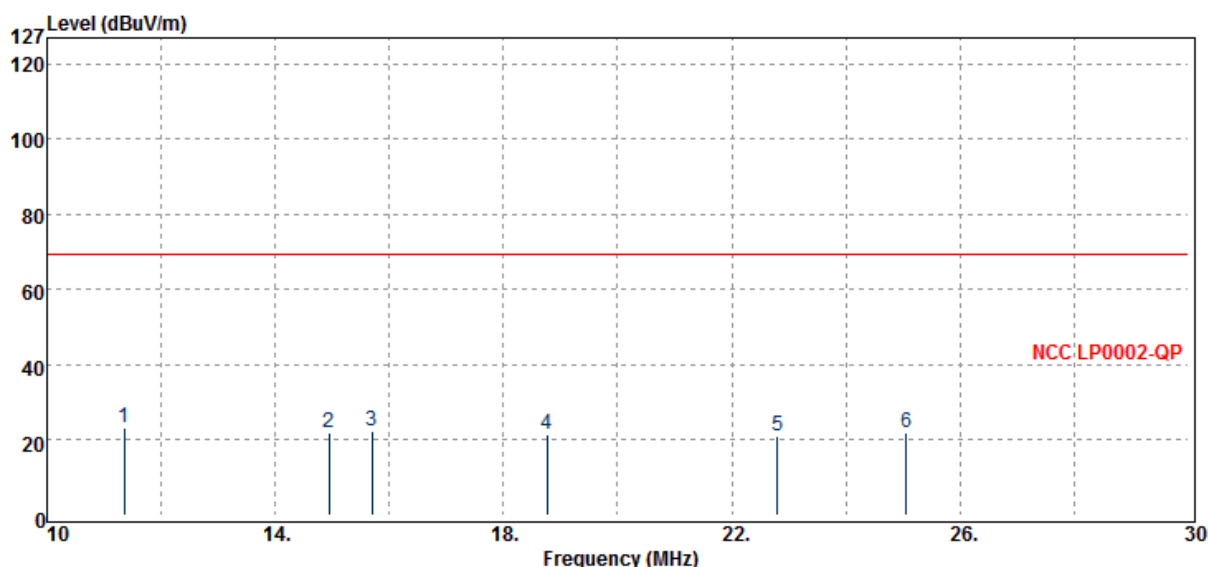
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Operation Band	:21.85 kHz	Test Date	:2017-10-30
Fundamental Frequency	:21.85 kHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Rx	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
11.36	S	Peak	11.85	11.38	23.23	69.54	-46.31
14.94	S	Peak	10.64	11.47	22.11	69.54	-47.43
15.70	S	Peak	11.11	11.49	22.60	69.54	-46.94
18.76	S	Peak	10.03	11.55	21.58	69.54	-47.96
22.80	S	Peak	10.17	10.76	20.93	69.54	-48.61
25.06	S	Peak	11.86	10.18	22.04	69.54	-47.50

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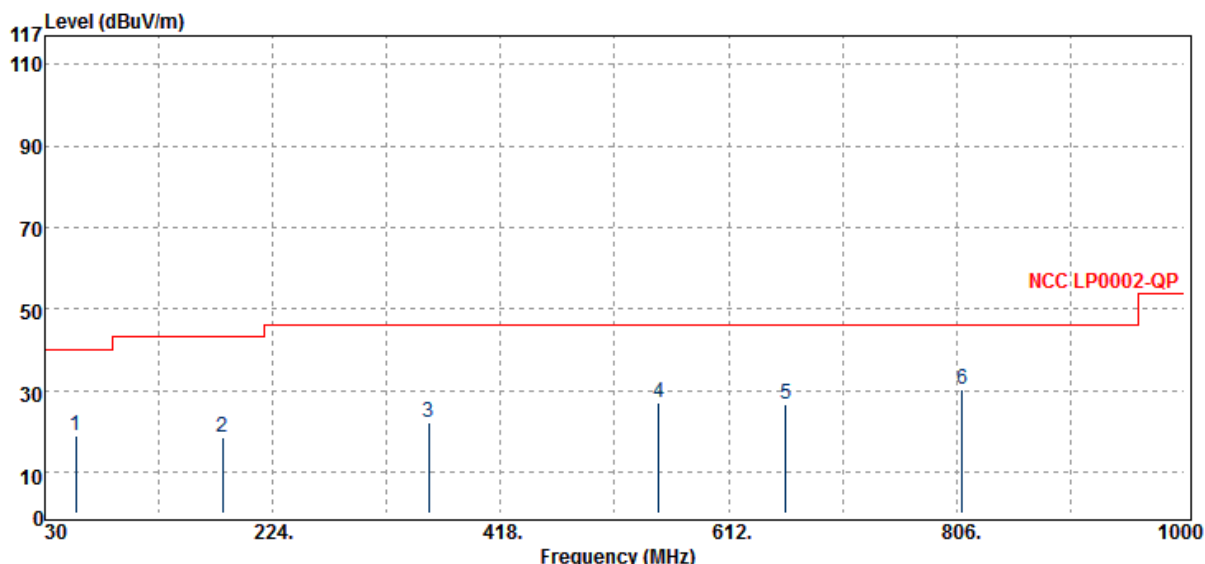
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接收機場強輻射之量測結果(30MHz 以上)

Operation Band	:21.85 kHz	Test Date	:2017-10-30
Fundamental Frequency	:21.85 kHz	Temp./Humi.	:23 deg_C / 54 RH
Operation Mode	:Rx	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
56.19	S	Peak	26.93	-7.91	19.02	40.00	-20.98
181.32	S	Peak	27.27	-8.73	18.54	43.50	-24.96
356.89	S	Peak	26.85	-4.74	22.11	46.00	-23.89
552.83	S	Peak	28.68	-1.48	27.20	46.00	-18.80
660.50	S	Peak	26.37	0.47	26.84	46.00	-19.16
810.85	S	Peak	27.25	3.27	30.52	46.00	-15.48

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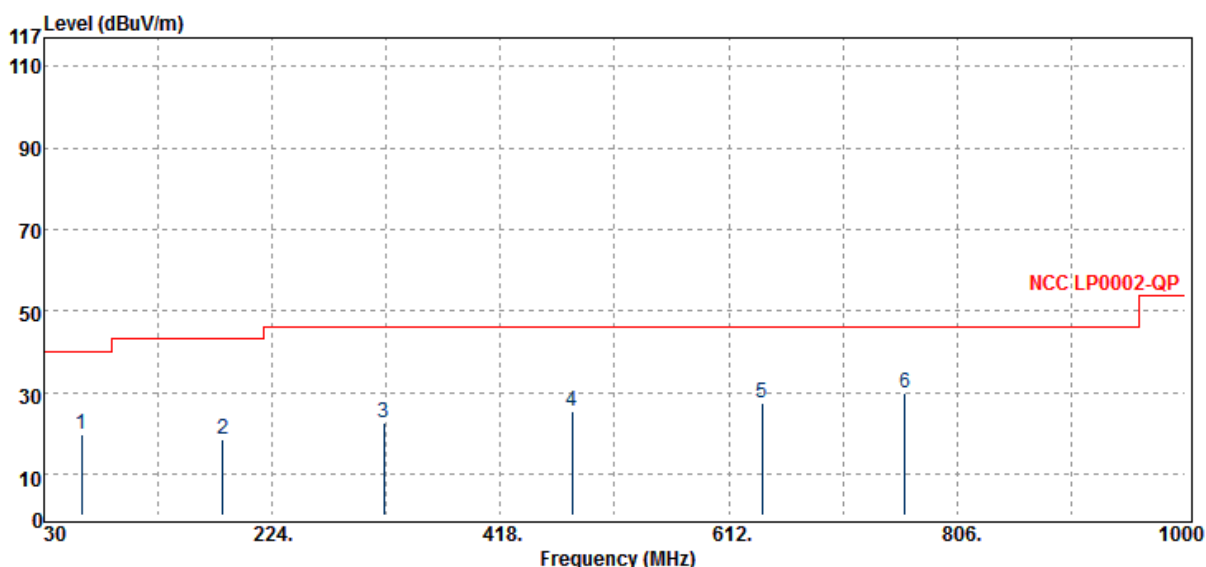
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Operation Band	:21.85 kHz	Test Date	:2017-10-30
Fundamental Frequency	:21.85 kHz	Temp./Humi.	:23 deg_C / 54 RH
Operation Mode	:Rx	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
62.01	S	Peak	28.41	-8.47	19.94	40.00	-20.06
182.29	S	Peak	27.47	-8.82	18.65	43.50	-24.85
319.06	S	Peak	28.15	-5.42	22.73	46.00	-23.27
479.11	S	Peak	28.01	-2.39	25.62	46.00	-20.38
640.13	S	Peak	27.28	0.43	27.71	46.00	-18.29
761.38	S	Peak	26.90	2.92	29.82	46.00	-16.18

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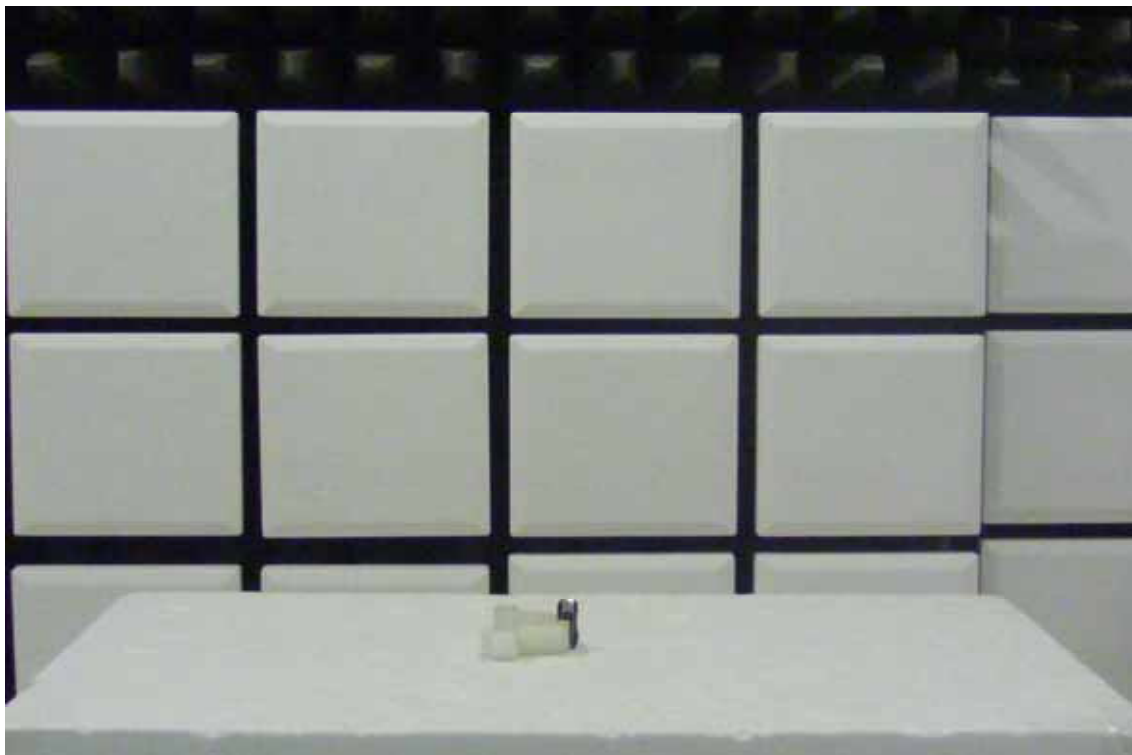
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測試照片

輻射干擾測試照片_30MHz 以下



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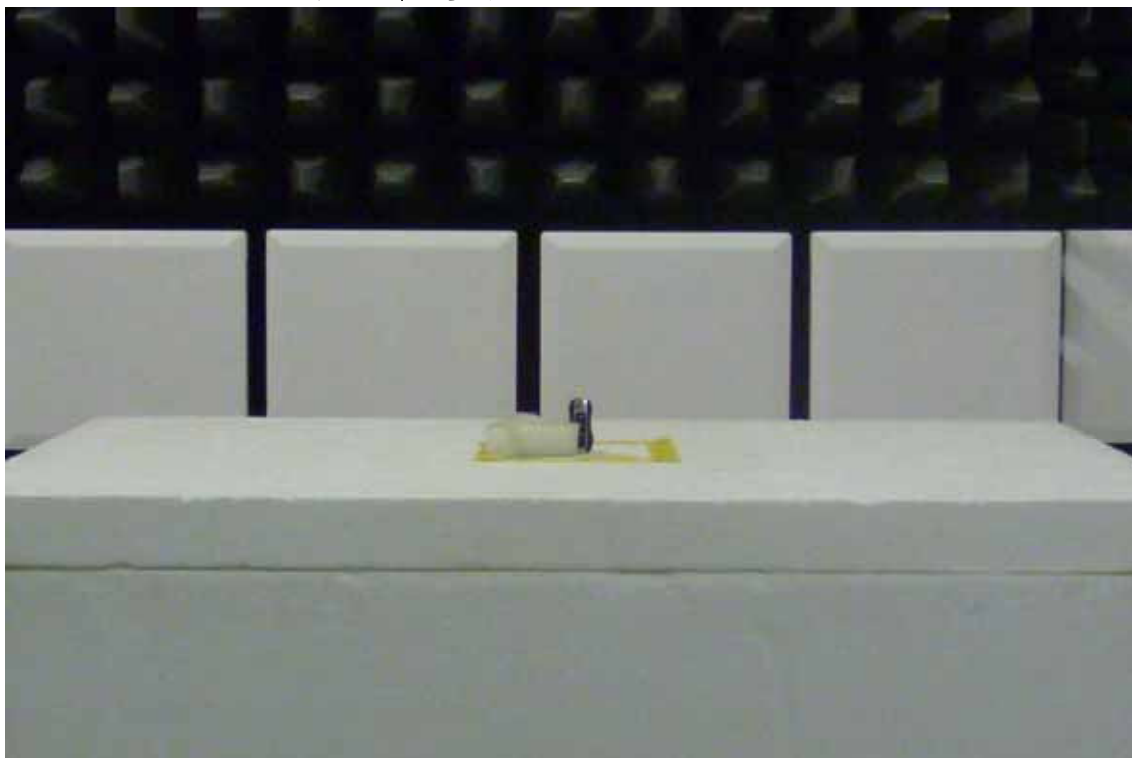
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產品照片

Please refer to the attached file(EUT Photo)

~ End of Report ~

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