

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: MRB1
Brand Name: Multiroom System
Marketing Name: MRB1z
Model No.: MRB1
Model Difference: N/A
FCC ID: 2AE5MMRB1
Report No.: E2/2015/60036
Issue Date: Aug. 11, 2015
FCC Rule Part: §15.249
Prepared for: SFB2 MEPZ1, 6015 Lapu-Lapu City,
Philippines
Prepared by: SGS Taiwan Ltd.
Electronics & Communication Laboratory
No.2, Keji 1st Rd., Guishan District, Taoyuan
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VERIFICATION OF COMPLIANCE

Applicant: EuroCB (Phils.) Inc.
SFB2 MEPZ1, 6015 Lapu-Lapu City, Philippines

Product Name: MRB1

Brand Name: N/A

Marketing Name: MRB1

FCC ID 2AE5MMRB1

Model No.: MRB1

Model Difference: N/A

File Number: E2/2015/60036

Date of test: Jun. 17, 2015 ~ Jul. 15, 2015

Date of EUT Received: Jun. 17, 2015

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Test By:

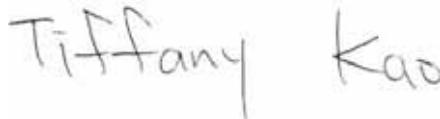


Date:

Aug. 14, 2015

Aken Huang / Engineer

Prepared By:

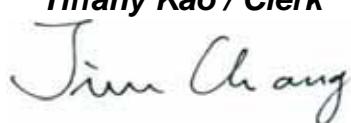


Date:

Aug. 14, 2015

Tiffany Kao / Clerk

Approved By:



Date:

Aug. 14, 2015

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
E2/2015/60036	Rev.00	Initial creation of document	Aug. 11, 2015

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1. GENERAL INFORMATION

1.1. Product Description

Product Name:	MRB1
Brand Name:	Multiroom System
Marketing Name:	MRB1
Model No.:	MRB1
Model difference:	N/A
Hardware Version:	V1
Software Version:	R1
Operation Frequency:	2406 ~ 2474MHz
Channel Number:	18 channels
Channel Spacing:	4MHz
Modulation Type:	8DPSK
Audio Cable:	Model No.: N/A, Supplier: N/A
Power Supply:	20Vdc from AC/DC Adapter
	Adapter: Model No.: 3A-401WP20, Supplier: ENG
Antenna Designation:	Whip Antenna, Antenna Gain: 2.5dBi

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1.2. Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is supporting, 2.4GHz and Bluetooth features, and below is details of information:

Product Feature	
Product Name:	MRB1
Brand Name:	Multiroom System
Marketing Name:	MRB1
Model No.:	MRB1
Model Difference:	N/A
FCC ID:	2AE5MMRB1
Bluetooth Version	V4.0 dual mode
2.4GHz Operation Frequency:	2406 ~ 2474MHz

Note: The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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1.3. Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.249

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under the DoC procedure.

1.4. Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan. (TAF code 0513)

FCC Registration Numbers are: 628985

1.5. Special Accessories

There are no special accessories used while test was conducted.

1.6. Equipment Modifications

There was no modification incorporated into the EUT.

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2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme..

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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2.4. Limitation

(1) Conducted Emission

According to section 15.207(a) Conducted Emission Limits is as following.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 – 0.5	66 - 56	56 - 46
0.5 – 5	56	46
5 - 30	60	50

(2) Radiated Emission 15.249(a)

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following.

Frequency (MHz)	Field strength of Fundamental	Field strength of Harmonics	Distance (m)
902 - 928	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
2400 – 2483.5	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
5725 – 5875	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3

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(3) Radiated Emission 15.249 (d)

Emission Radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209 and RSS-210 issue 8,§A2.9(a) as below, whichever is the lesser attenuation.

Frequency (MHz)	Field strength μ V/m	Distance (m)	Field strength at 3m $\text{dB}\mu$ V/m
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

(4) Radiated Emission 15.249(e)

For frequencies above 1000MHz, the above field strength limits are based on average limits. The peak filed strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

Remark 1. Emission level in $\text{dB}\mu$ V/m = $20 \log (\mu\text{V}/\text{m})$

: 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205

4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of § 15.205, then the general radiated emission limits in § 15.209 apply.

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2.5. Configuration of Tested System

Fig. 2-1 Radiated Emission & AC Power Line Conducted Configuration

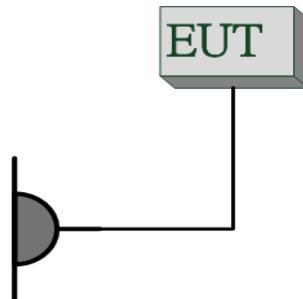


Fig. 2-2 Conducted (Antenna Port) Configuration

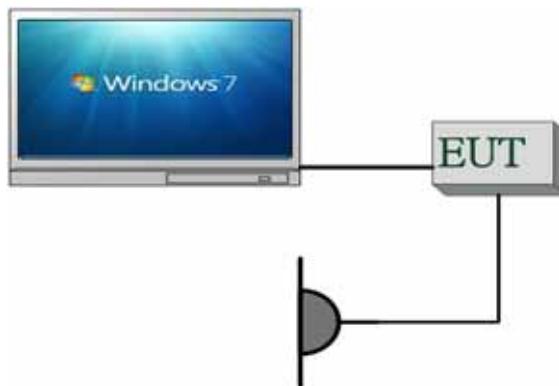


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	2.4GHz wireless Test Software	PurePath Wireless Commander	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L412	LR-027LM	Shielded	Unshielded

Note: All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

Grounding: Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207/	Conducted Emission	N/A
§15.249(a)(d)(e)	Field Strength Measurement	Compliant
§15.215(c)	20dB band width Measurement	Compliant

4. DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

18 channels are provided.

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2406MHz	7	2430MHz	13	2454MHz
2	2410MHz	8	2434MHz	14	2458MHz
3	2414MHz	9	2438MHz	15	2462MHz
4	2418MHz	10	2442MHz	16	2466MHz
5	2422MHz	11	2446MHz	17	2470MHz
6	2426MHz	12	2450MHz	18	2474MHz

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4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE	ANTENNA PORT
2.4G	1 to 18	1,10,18	8-DPSK	3DH5	MAIN

RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE	ANTENNA PORT
2.4G	1 to 18	1,10,18	8-DPSK	3DH5	MAIN

Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth LE 4.1 Transmitter for channel Low, Mid and High, the worst case H position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE	ANTENNA PORT
2.4G	1 to 18	1,10,18	8-DPSK	3DH5	MAIN

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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
20dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

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6. CONDUCTED EMISSIONS TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

1. The lower limit shall apply at the transition frequencies

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2014	12/11/2015
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	01/06/2015	01/07/2016
LISN	Schwarzbeck	NSLK 8127	8127-648	06/09/2015	06/08/2016
LISN	Rolf-Heine	NNB-2/16Z	99012	03/04/2015	03/03/2016
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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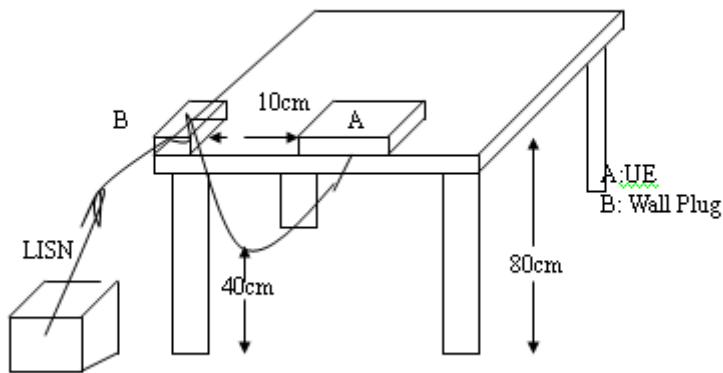
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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6 Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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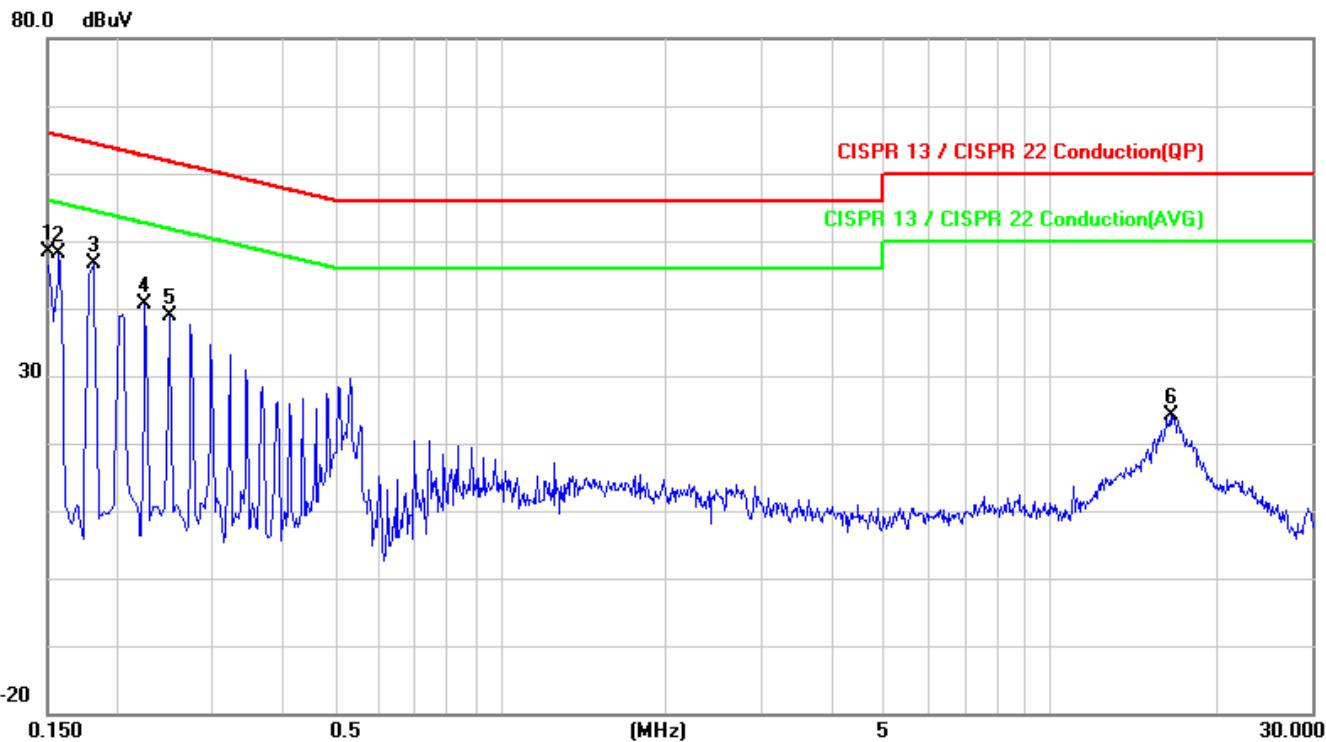
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Aug. 14, 2015
Temperature:	26	Humidity:	60 %	Test By:	Vito
Model No.:	MRB1			Phase:	L1 / N

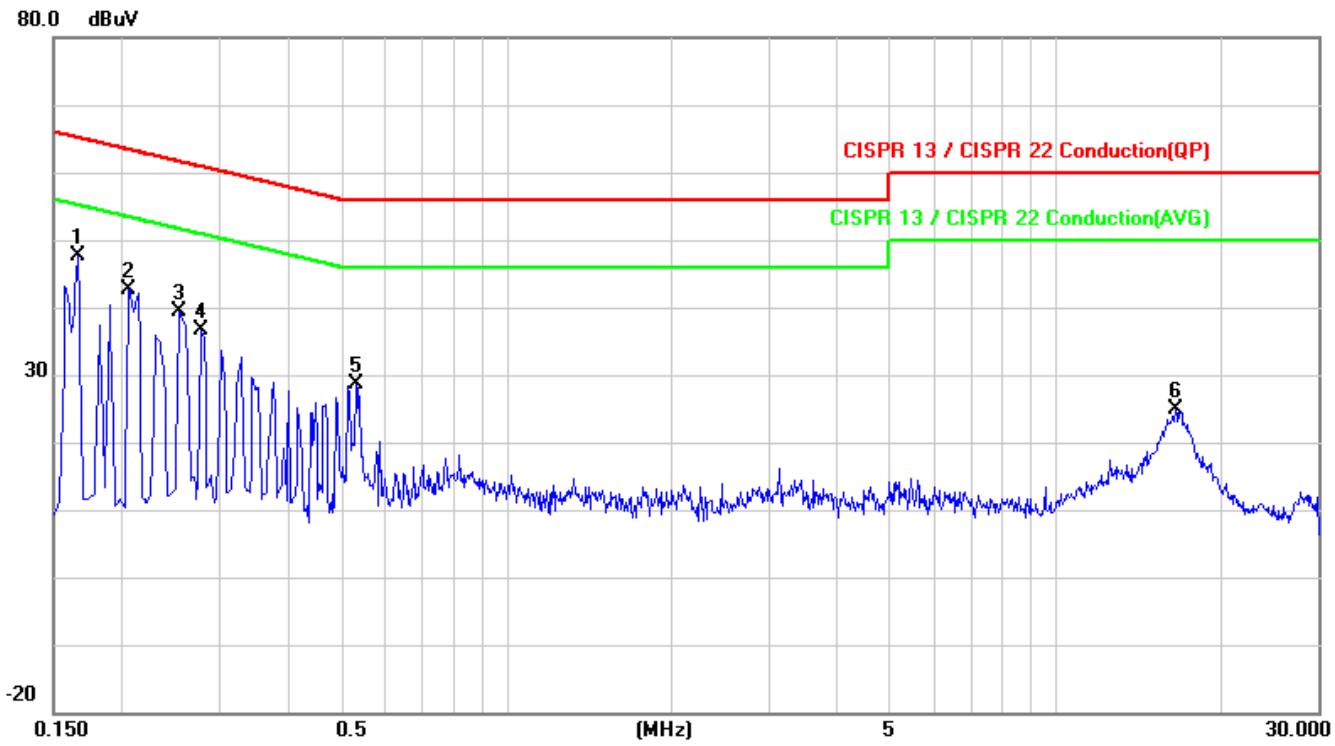


No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)		
1	*	0.1500	48.39	0.08	48.47	66.00	-17.53	peak	
2	*	0.1580	48.14	0.08	48.22	65.57	-17.35	peak	
3	*	0.1820	46.45	0.08	46.53	64.39	-17.86	peak	
4	*	0.2260	40.64	0.08	40.72	62.60	-21.88	peak	
5	*	0.2500	38.89	0.09	38.98	61.76	-22.78	peak	
6	*	16.6500	23.57	0.60	24.17	60.00	-35.83	peak	

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No.	Mk.	Freq. (MHz)	Reading dBuV	Factor	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1	*	0.1660	47.44	0.14	47.58	65.16	-17.58	peak	
2		0.2060	42.56	0.13	42.69	63.37	-20.68	peak	
3		0.2540	39.35	0.15	39.50	61.63	-22.13	peak	
4		0.2780	36.55	0.16	36.71	60.88	-24.17	peak	
5		0.5340	28.34	0.28	28.62	56.00	-27.38	peak	
6		16.5300	24.21	0.63	24.84	60.00	-35.16	peak	

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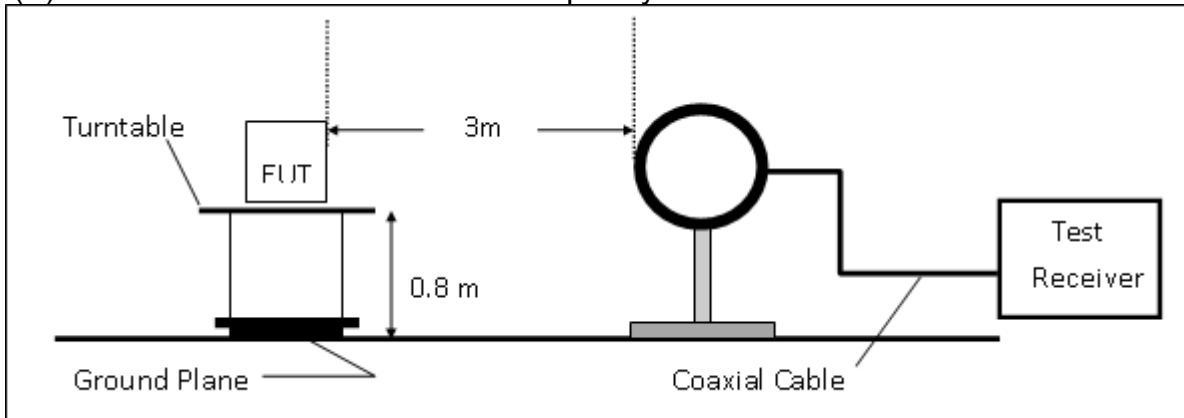
7. RADIATED EMISSION TEST

7.1 Measurement Procedure

1. The EUT was placed on a turntable that is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

7.2 Test SET-UP (Block Diagram of Configuration)

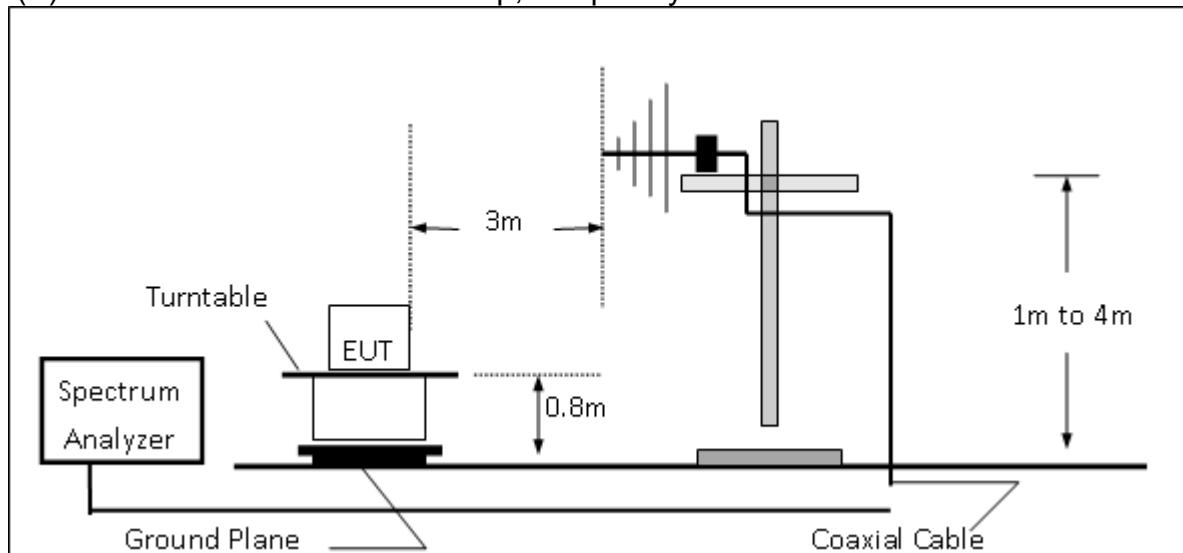
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



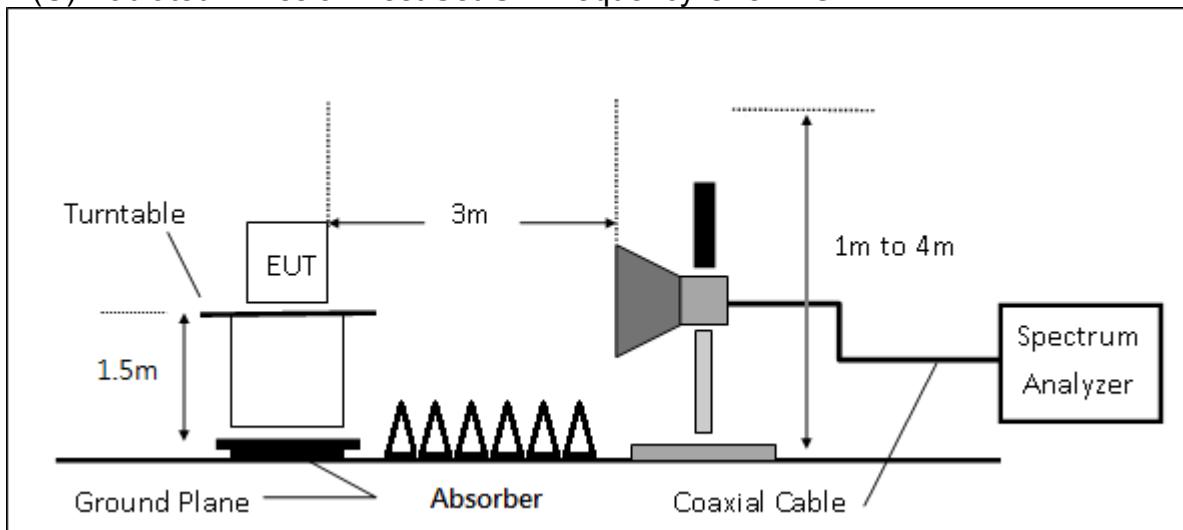
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(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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7.3 Measurement Equipment Used:

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/09/2015	04/08/2016
Loop Antenna	ETS-Lindgren	6502	00143303	12/09/2014	12/08/2015
Broadband Antenna	TESEQ	CBL 6112D	35240	12/05/2014	12/04/2015
Horn Antenna	ETS-Lindgren	3117	00143272	12/08/2014	12/07/2015
Horn Antenna	ETS-Lindgren	3160-09	00117911	11/13/2014	11/12/2015
Horn Antenna	ETS-Lindgren	3160-10	00117783	11/13/2014	11/12/2015
Pre Amplifier	EMC Instruments	EMC330	980096	12/19/2014	12/18/2015
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-18	10204	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-26	100780	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF27	12/19/2014	12/18/2015
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2015	05/03/2016
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.

Note: N.C.R refers to Not Calibrated Required

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7.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/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.

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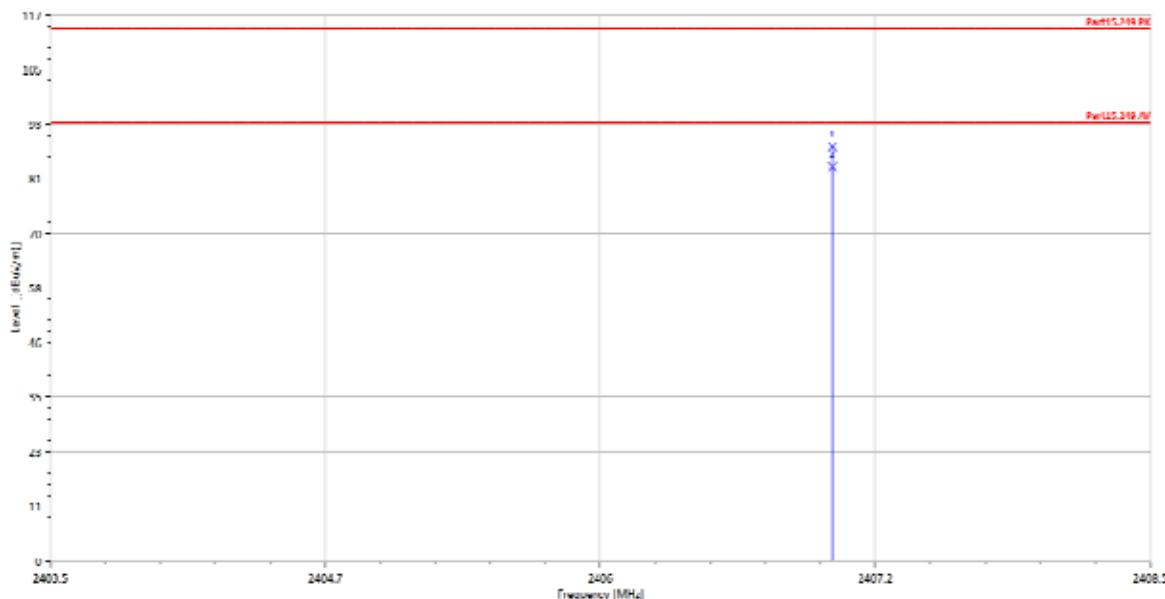
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7.5 Measurement Result

Radiated Spurious Emission Measurement Result (MAIN)

Operation Band	:2.4G	Test Date	:2015-07-16
Fundamental Frequency	:2406 MHz	Temp./Humi.	:24.6deg_C/47RH
Operation Mode	:MAIN LOW	Engineer	:Vito
EUT Pol.	:H Plan	Measurement Antenna Pol.	:VERTICAL



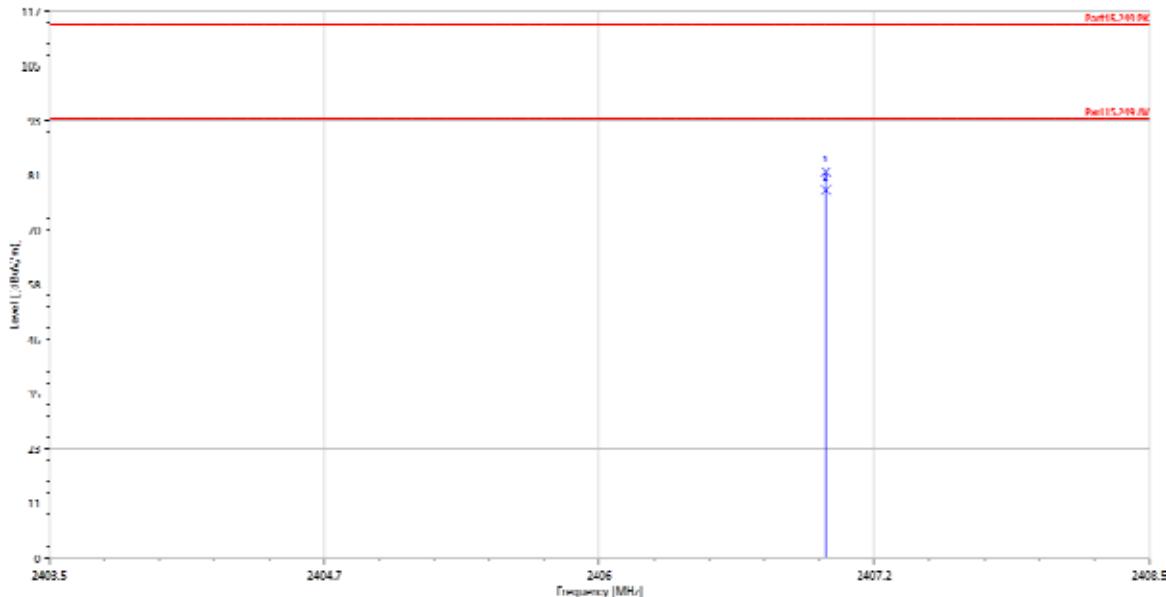
Freq. MHz	Detector Mode PK/QP/AV	Note F/H/E/S	Spectrum Reading Level dBµV/m	Factor dB	Actual	Limit @3m dBµV/m	Safe Margin dB
					Factor FS	Limit @3m dBµV/m	Safe Margin dB
					Actual dBµV/m	Limit @3m dBµV/m	Safe Margin dB
2407.06	Peak	F	82.10	6.66	88.76	114.00	-25.24
2407.06	Average	F	77.81	6.66	84.47	94.00	-9.53

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Operation Band :2.4G
Fundamental Frequency :2406 MHz
Operation Mode :MAIN LOW
EUT Pol. :H Plan
Test Date :2015-07-16
Temp./Humi. :24.6deg_C/47RH
Engineer :Vito
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode	Note F/H/E/S	Spectrum Reading Level dB μ V/m	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
						dB μ V/m	dB
2407.03	Peak	F	76.02	6.66	82.68	114.00	-31.32
2407.03	Average	F	72.09	6.66	78.75	94.00	-15.25

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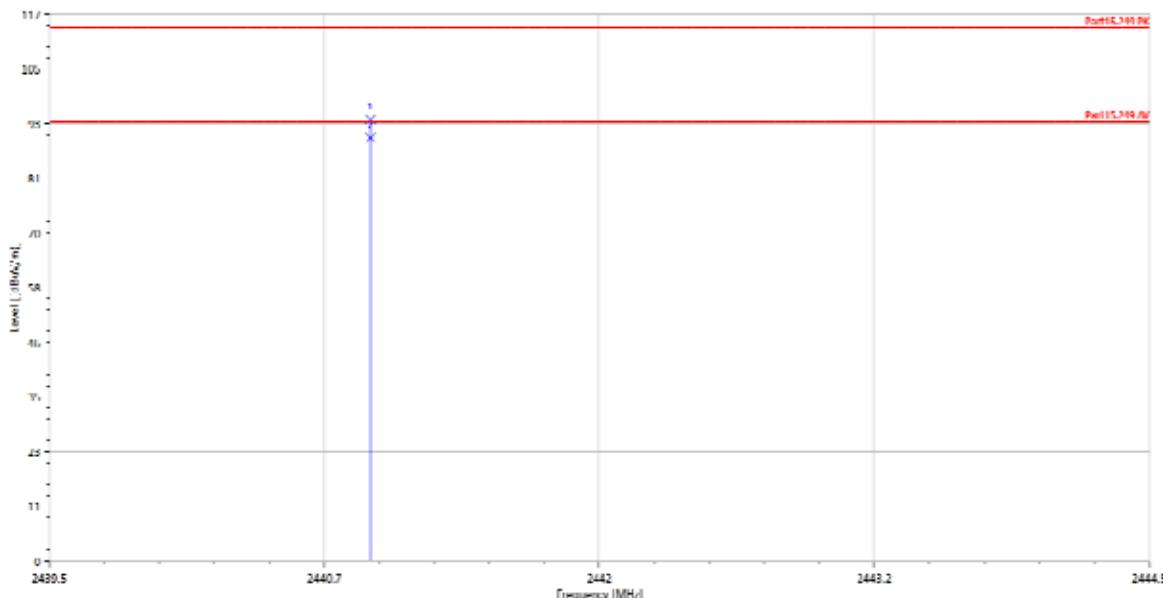
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Operation Band :2.4G
Fundamental Frequency :2442 MHz
Operation Mode :MAIN MID
EUT Pol. :H Plan
Test Date :2015-07-16
Temp./Humi. :24.6deg_C/47RH
Engineer :Vito
Measurement Antenna Pol. :VERTICAL



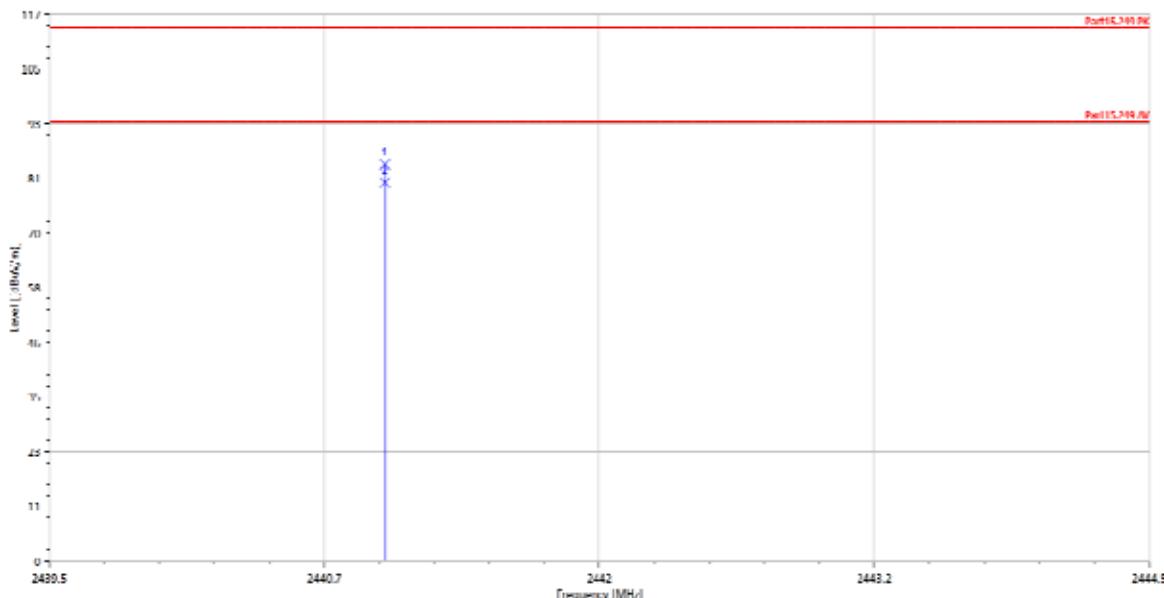
Freq. MHz	Detector Mode	Note F/H/E/S	Spectrum Reading Level dBµV/m	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Safe Margin dB
2440.96	Peak	F	87.65	6.83	94.48	114.00	-19.52
2440.96	Average	F	83.72	6.83	90.55	94.00	-3.45

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Operation Band :2.4G
Fundamental Frequency :2442 MHz
Operation Mode :MAIN MID
EUT Pol. :H Plan
Test Date :2015-07-16
Temp./Humi. :24.6deg_C/47RH
Engineer :Vito
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode	Note F/H/E/S	Spectrum Reading Level dB μ V/m	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
						dB μ V/m	dB
2441.03	Peak	F	78.05	6.83	84.88	114.00	-29.12
2441.03	Average	F	74.12	6.83	80.95	94.00	-13.05

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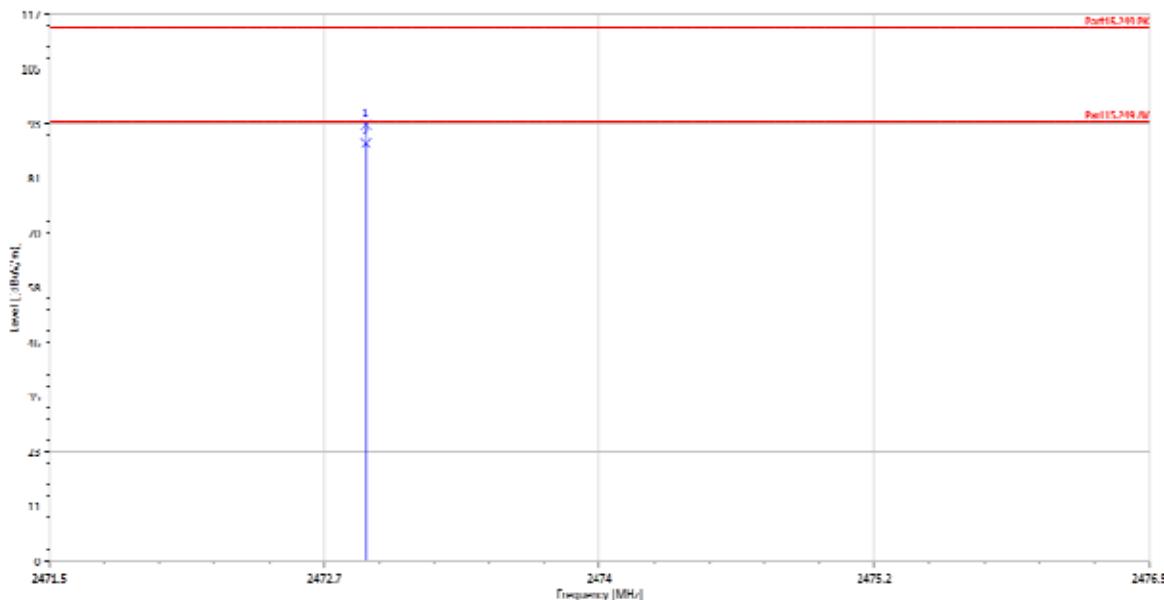
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Operation Band :2.4G Test Date :2015-07-16
Fundamental Frequency :2474 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :MAIN HIGH Engineer :Vito
EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode	Note F/H/E/S	Spectrum Reading Level		Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Safe Margin dB
			PK/QP/AV	dBµV				
2472.94	Peak	F	86.36		6.93	93.30	114.00	-20.70
2472.94	Average	F	82.38		6.93	89.31	94.00	-4.69

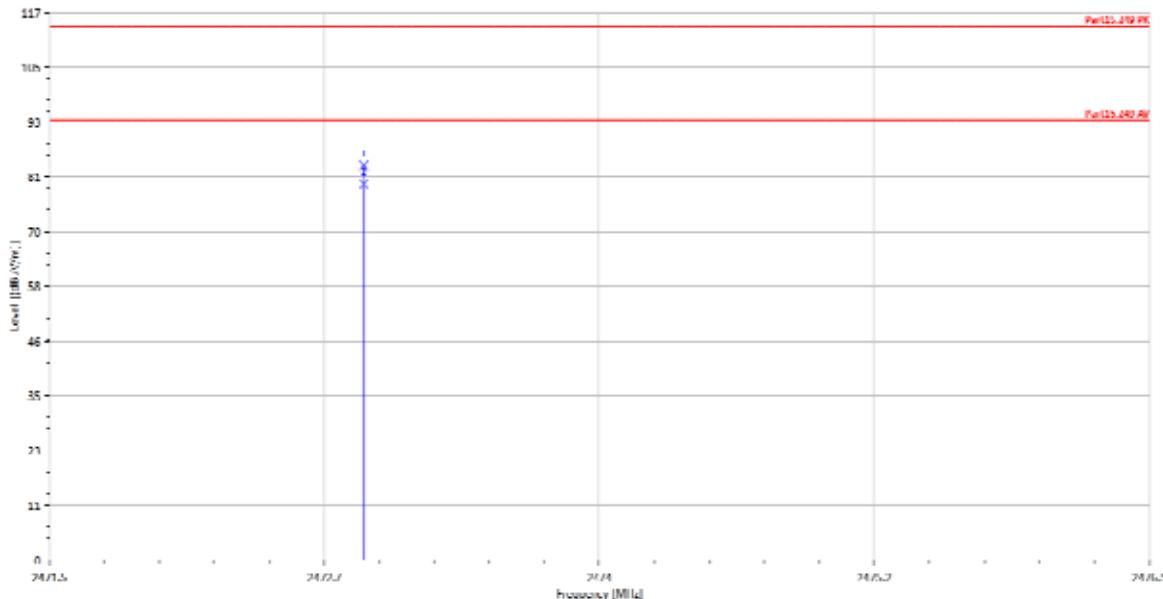
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Operation Band :2.4G
 Fundamental Frequency :2474 MHz
 Operation Mode :MAIN HIGH
 EUT Pol. :H Plan

Test Date :2015-07-16
 Temp./Humi. :24.6deg_C/47RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode	Note F/H/E/S	Spectrum Reading	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Safe Margin dB
						dBµV/m	dB
2472.93	Peak	F	77.33	6.93	84.27	114.00	-29.73
2472.93	Average	F	73.37	6.93	80.30	94.00	-13.70

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Radiated Spurious Emission Measurement Result

Operation Band :2.4G Test Date :2014-07-16
Fundamental Frequency :2406 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :BANDEDGE LOW Engineer :Ashton
EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual	Limit	Margin
					FS dB μ V/m	@3m dB μ V/m	dB
2390.00	E	Peak	45.39	6.62	52.01	74	-21.99
2390.00	E	Average	33.45	6.62	40.07	54	-13.93

Operation Band :2.4G Test Date :2014-07-16
Fundamental Frequency :2406 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :BANDEDGE LOW Engineer :Ashton
EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual	Limit	Margin
					FS dB μ V/m	@3m dB μ V/m	dB
2390.00	E	Peak	45.30	6.62	51.92	74	-22.08
2390.00	E	Average	33.31	6.62	39.93	54	-14.07

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Operation Band :2.4G Test Date :2014-07-16
Fundamental Frequency :2474 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :BANDEDGE HIGH Engineer :Ashton
EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
2483.50	E	Peak	46.13	6.96	53.09	74	-20.91	
2483.50	E	Average	33.71	6.96	40.67	54	-13.33	

Operation Band :2.4G Test Date :2014-07-16
Fundamental Frequency :2474 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :BANDEDGE HIGH Engineer :Ashton
EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
2483.50	E	Peak	45.53	6.96	52.49	74	-21.51	
2483.50	E	Average	33.63	6.96	40.59	54	-13.41	

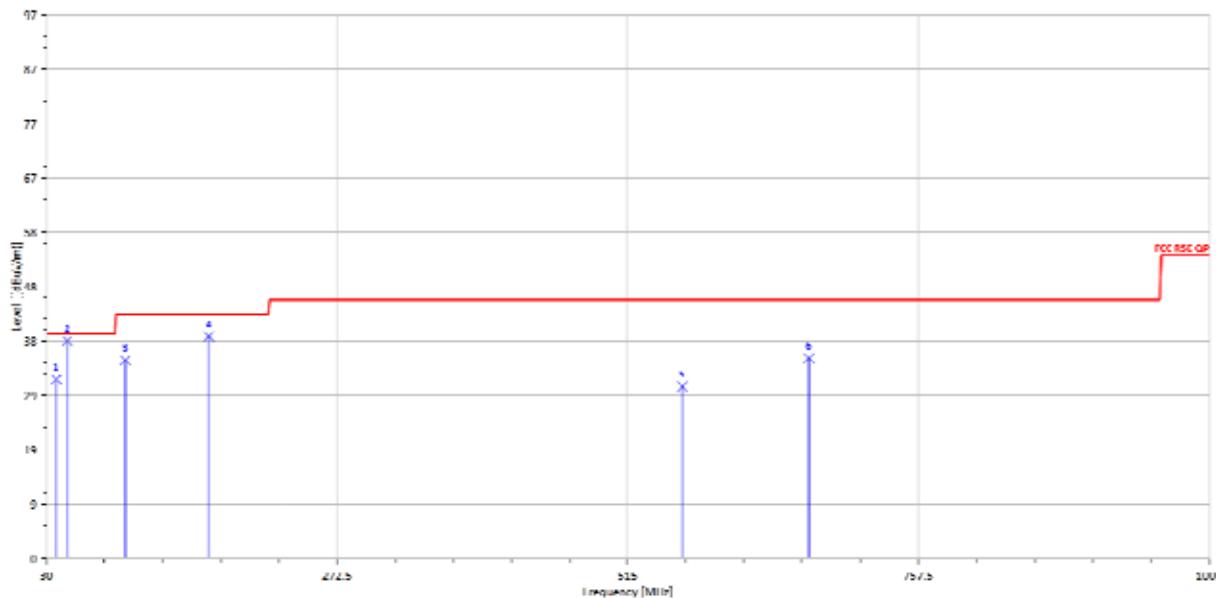
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Radiated Spurious Emission Measurement Result

Operation Band	:2.4G	Test Date	:2014-07-16
Fundamental Frequency	:2406 MHz	Temp./Humi.	:24.6deg_C/47RH
Operation Mode	:TX LOW	Engineer	:Ashton
EUT Pol.	:H Plan	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level dB μ V	Factor dB	Actual	Limit @3m	Margin
					FS dB μ V/m	dB μ V/m	dB
38.59	S	QP	50.02	-18.10	31.92	40	-8.08
47.46	S	QP	62.70	-23.95	38.75	40	-1.25
95.96	S	Peak	59.87	-24.54	35.33	43.5	-8.17
165.80	S	Peak	63.15	-23.56	39.59	43.5	-3.91
560.59	S	Peak	43.46	-12.86	30.60	46	-15.40
666.32	S	Peak	47.34	-11.65	35.69	46	-10.31

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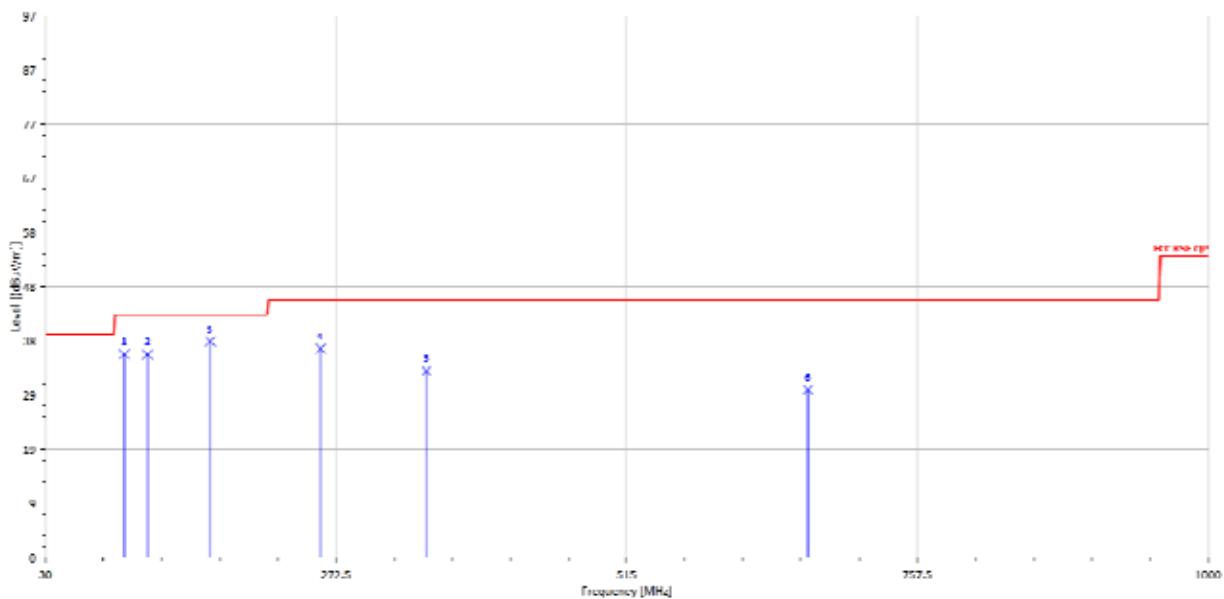
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Operation Band : 2.4G
 Fundamental Frequency : 2406 MHz
 Operation Mode : TX LOW
 EUT Pol. : H Plan

Test Date : 2014-07-16
 Temp./Humi. : 24.6deg_C/47RH
 Engineer : Ashton
 Measurement Antenna Pol. : HORIZONTAL



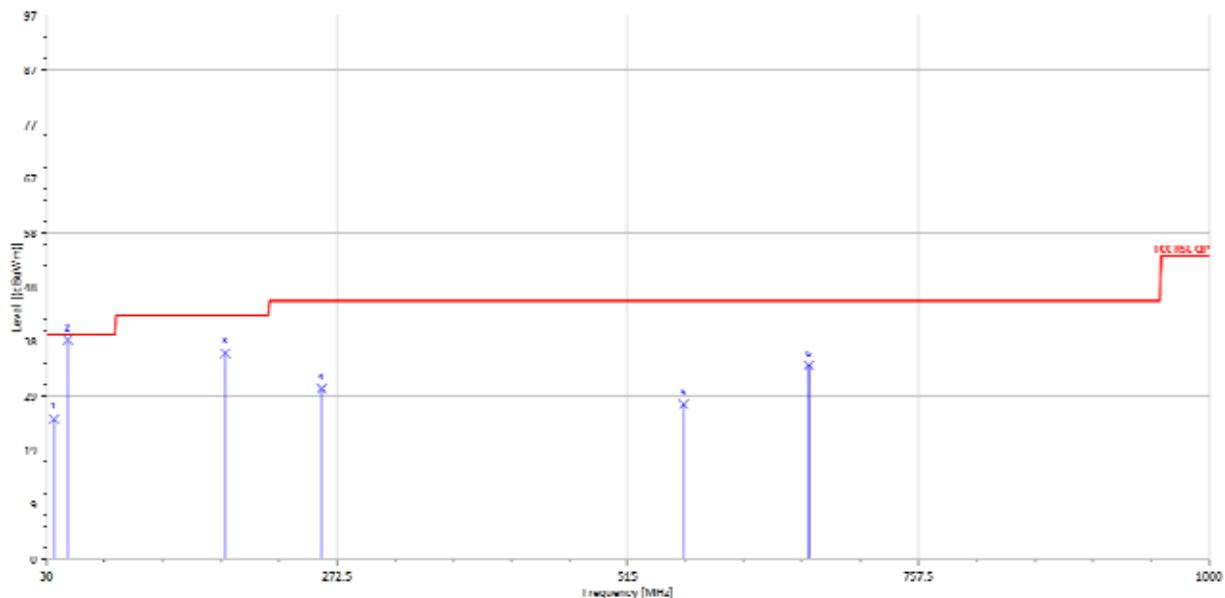
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
			Mode	Reading Level				
95.96	S	Peak	60.95	-24.54	36.41	43.5	-7.09	
115.36	S	Peak	58.22	-21.86	36.36	43.5	-7.14	
167.74	S	Peak	62.34	-23.65	38.69	43.5	-4.81	
259.89	S	Peak	56.75	-19.33	37.42	46	-8.58	
348.16	S	Peak	50.84	-17.43	33.41	46	-12.59	
666.32	S	Peak	41.69	-11.65	30.04	46	-15.97	

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Operation Band :2.4G
 Fundamental Frequency :2442 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2014-07-16
 Temp./Humi. :24.6deg_C/47RH
 Engineer :Ashton
 Measurement Antenna Pol. :VERTICAL



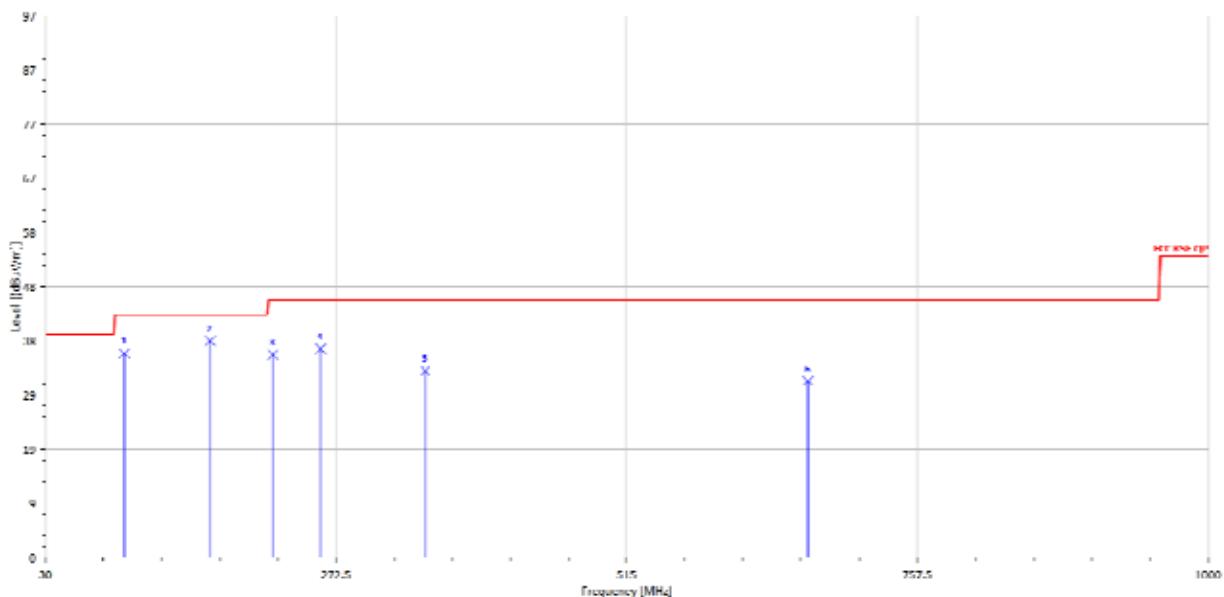
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
36.79	S	QP		41.93	-16.96	24.97	40	-15.03
48.00	S	QP		63.34	-24.28	39.05	40	-0.95
179.38	S	Peak		61.09	-24.35	36.74	43.5	-6.76
259.89	S	Peak		49.69	-19.33	30.36	46	-15.64
561.56	S	Peak		40.34	-12.80	27.54	46	-18.46
666.32	S	Peak		46.20	-11.65	34.55	46	-11.45

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Operation Band : 2.4G
 Fundamental Frequency : 2442 MHz
 Operation Mode : TX MID
 EUT Pol. : H Plan

Test Date : 2014-07-16
 Temp./Humi. : 24.6deg_C/47RH
 Engineer : Ashton
 Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum		Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
			Reading	Level				
95.96	S	Peak	61.10	-24.54	36.57	43.5	-6.94	
167.74	S	Peak	62.41	-23.65	38.76	43.5	-4.74	
220.12	S	Peak	59.30	-22.96	36.34	46	-9.66	
259.89	S	Peak	56.71	-19.33	37.37	46	-8.63	
347.19	S	Peak	50.89	-17.46	33.43	46	-12.57	
666.32	S	Peak	43.23	-11.65	31.57	46	-14.43	

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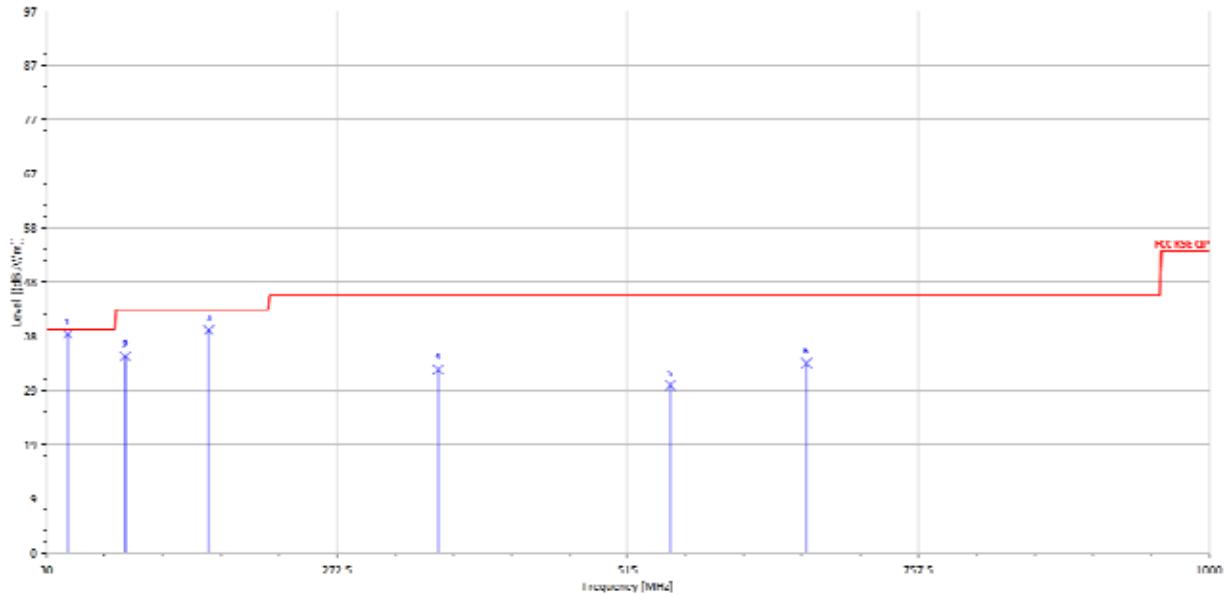
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Operation Band :2.4G
Fundamental Frequency :2474 MHz
Operation Mode :TX HIGH
EUT Pol. :H Plan
Test Date :2014-07-16
Temp./Humi. :24.6deg_C/47RH
Engineer :Ashton
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
						FS dB μ V/m	Margin dB
48.00	S	QP	63.38	-24.28	39.10	40	-0.90
95.96	S	Peak	59.65	-24.54	35.11	43.5	-8.39
165.80	S	Peak	63.39	-23.56	39.83	43.5	-3.67
356.89	S	Peak	50.09	-17.28	32.81	46	-13.20
550.89	S	Peak	43.22	-13.24	29.98	46	-16.02
664.38	S	Peak	45.56	-11.66	33.90	46	-12.10

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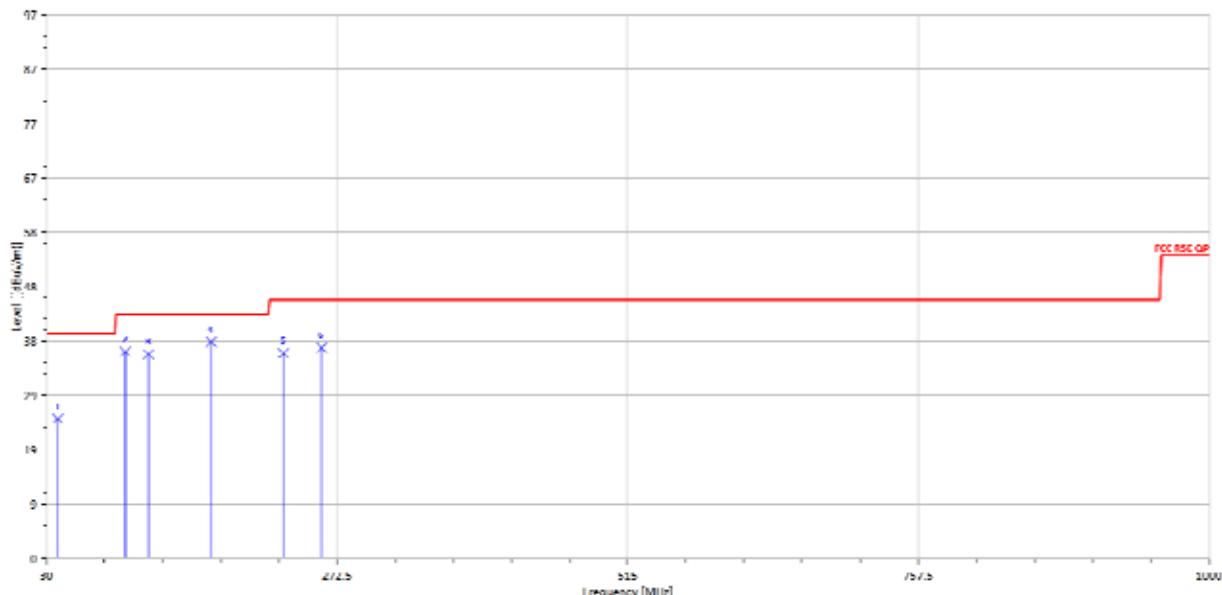
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Operation Band :2.4G
 Fundamental Frequency :2474 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2014-07-16
 Temp./Humi. :24.6deg_C/47RH
 Engineer :Ashton
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
			PK/QP/AV	Reading Level dBµV				
			Peak	43.69				
39.70	S	Peak	43.69	-18.79	24.89	40	-15.11	
95.96	S	Peak	61.41	-24.54	36.87	43.5	-6.63	
115.36	S	Peak	58.29	-21.86	36.42	43.5	-7.08	
167.74	S	Peak	62.25	-23.65	38.59	43.5	-4.91	
227.88	S	Peak	59.04	-22.45	36.59	46	-9.41	
259.89	S	Peak	56.90	-19.33	37.57	46	-8.43	

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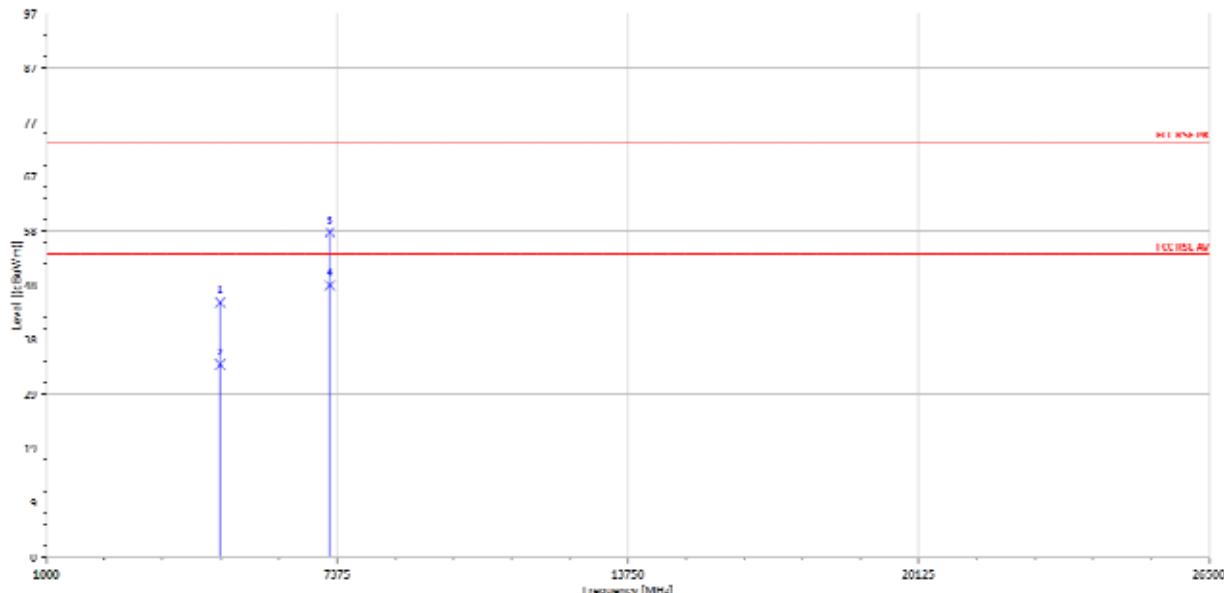
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Operation Band :2.4G
Fundamental Frequency :2406 MHz
Operation Mode :TX LOW
EUT Pol. :H Plan
Test Date :2014-07-16
Temp./Humi. :24.6deg_C/47RH
Engineer :Ashton
Measurement Antenna Pol. :VERTICAL



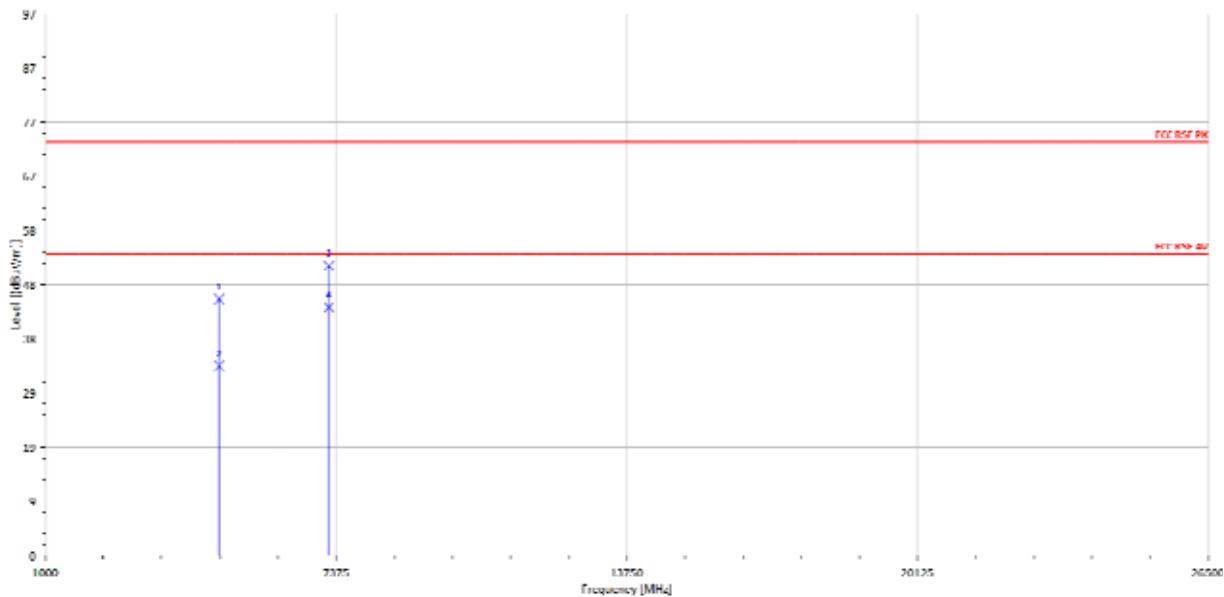
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
						dB μ V/m	dB
4812.00	H	Peak	34.41	10.99	45.40	74	-28.60
4812.00	H	Average	23.38	10.99	34.37	54	-19.63
7218.00	H	Peak	42.79	15.13	57.92	74	-16.08
7218.00	H	Average	33.37	15.13	48.50	54	-5.50

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Operation Band :2.4G Test Date :2014-07-16
Fundamental Frequency :2406 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :TX LOW Engineer :Ashton
EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL



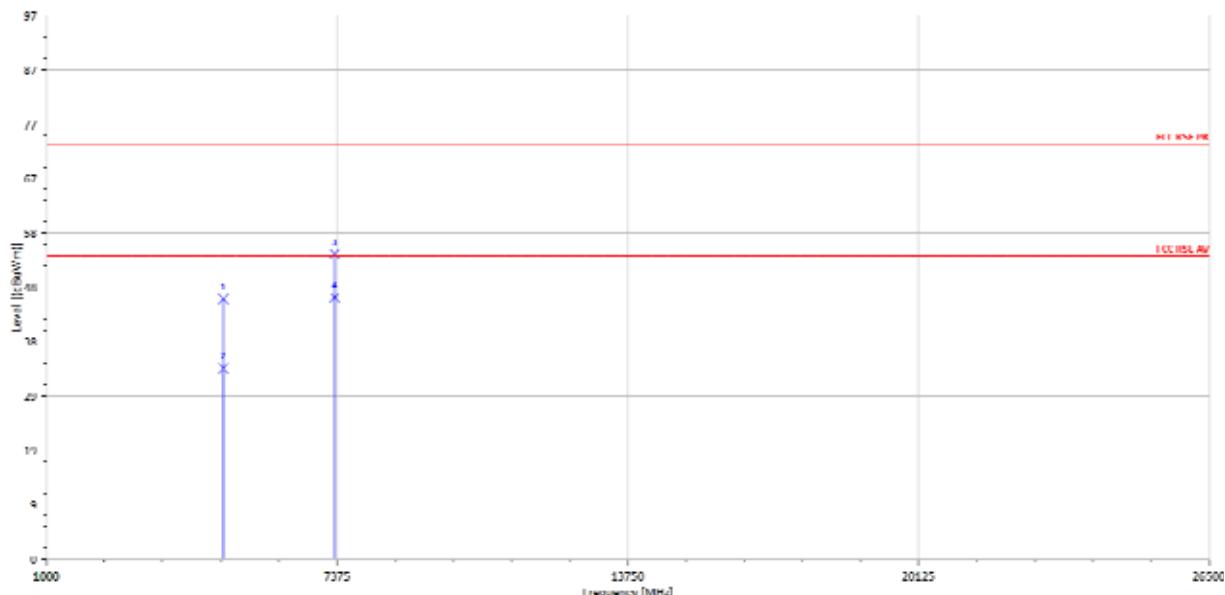
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum		Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
			Reading	Level dBμV				
4812.00	H	Peak	34.92	10.99	45.90	74	-28.10	
4812.00	H	Average	23.00	10.99	33.99	54	-20.01	
7218.00	H	Peak	36.73	15.13	51.86	74	-22.14	
7218.00	H	Average	29.34	15.13	44.47	54	-9.53	

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Operation Band :2.4G
Fundamental Frequency :2442 MHz
Operation Mode :TX MID
EUT Pol. :H Plan

Test Date :2014-07-16
Temp./Humi. :24.6deg_C/47RH
Engineer :Ashton
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading			dB μ V/m	dB
		PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4884.00	H	Peak	35.45	10.92	46.37	74	-27.63
4884.00	H	Average	23.08	10.92	34.00	54	-20.00
7326.00	H	Peak	39.00	15.39	54.40	74	-19.60
7326.00	H	Average	31.25	15.39	46.64	54	-7.36

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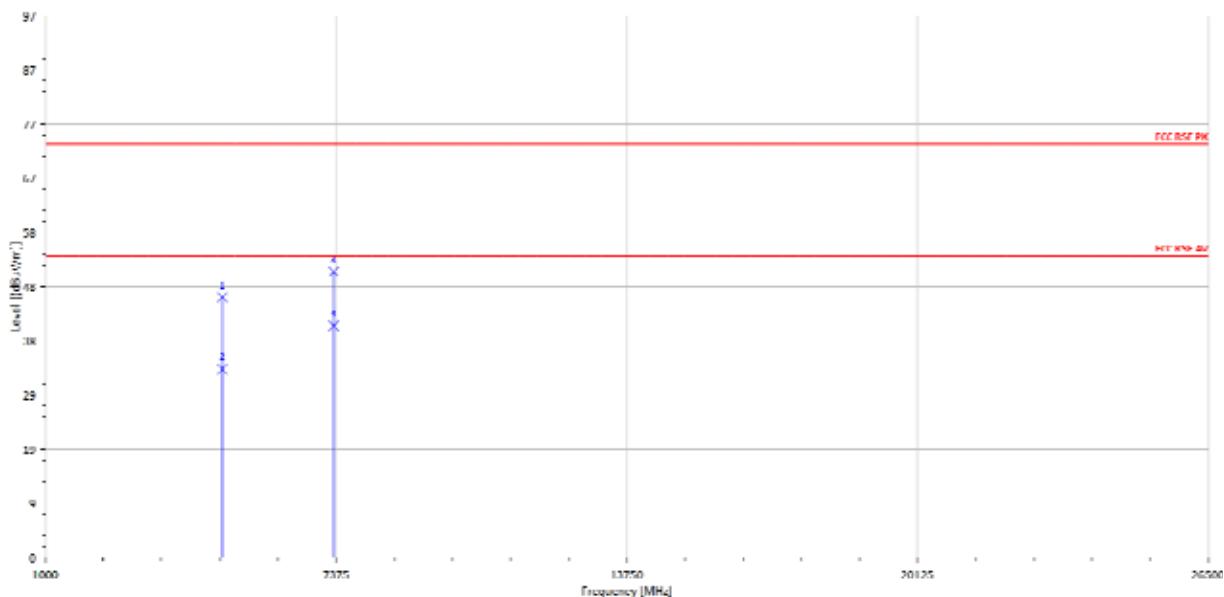
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Operation Band :2.4G Test Date :2014-07-16
Fundamental Frequency :2442 MHz Temp./Humi. :24.6deg_C/47RH
Operation Mode :TX MID Engineer :Ashton
EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
						Limit @3m dB μ V/m	Margin dB
4884.00	H	Peak	35.64	10.92	46.56	74	-27.44
4884.00	H	Average	22.80	10.92	33.72	54	-20.28
7326.00	H	Peak	35.77	15.39	51.16	74	-22.84
7326.00	H	Average	26.09	15.39	41.48	54	-12.52

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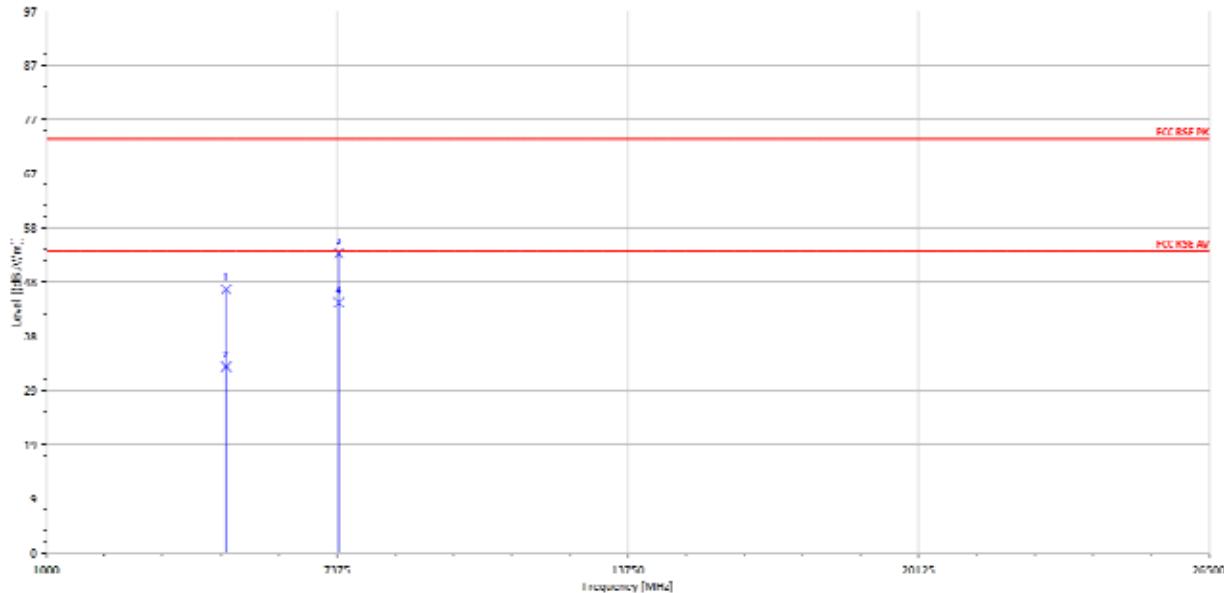
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Operation Band :2.4G
 Fundamental Frequency :2474 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2014-07-16
 Temp./Humi. :24.6deg_C/47RH
 Engineer :Ashton
 Measurement Antenna Pol. :VERTICAL

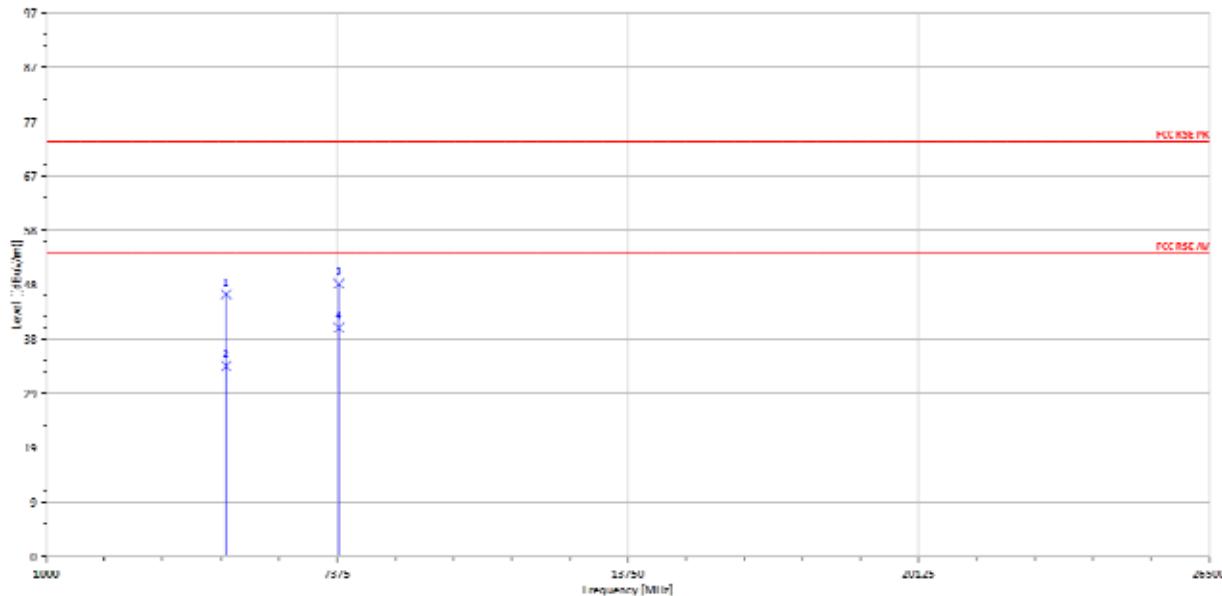


Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual FS dBµV	Limit @3m dBµV/m	Margin dB
						dBµV/m	
4948.00	H	Peak	36.16	10.96	47.12	74	-26.88
4948.00	H	Average	22.39	10.96	33.35	54	-20.65
7422.00	H	Peak	38.09	15.52	53.61	74	-20.39
7422.00	H	Average	29.28	15.52	44.80	54	-9.20

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Operation Band :2.4G
 Fundamental Frequency :2474 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan
 Test Date :2014-07-16
 Temp./Humi. :24.6deg_C/47RH
 Engineer :Ashton
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
						@3m	
		PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4948.00	H	Peak	35.75	10.96	46.70	74	-27.30
4948.00	H	Average	22.98	10.96	33.94	54	-20.06
7422.00	H	Peak	33.11	15.52	48.62	74	-25.38
7422.00	H	Average	25.26	15.52	40.78	54	-13.22

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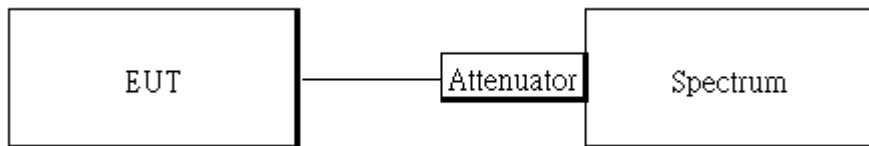
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8. 20 dB BAND WIDTH MEASUREMENT

8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set ETU normal operating mode.
3. Set SPA Center Frequency = fundamental frequency, RBW = 100kHz, VBW = 300kHz, Span =5MHz.
4. Set SPA Max hold. Mark peak, -20dB.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

Conducted Emission Test Site					
Name of Equipment	Name of Equipment	Name of Equipment	Name of Equipment	Name of Equipment	Name of Equipment
Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer
Power Meter	Power Meter	Power Meter	Power Meter	Power Meter	Power Meter
Power Sensor	Power Sensor	Power Sensor	Power Sensor	Power Sensor	Power Sensor
Power Sensor	Power Sensor	Power Sensor	Power Sensor	Power Sensor	Power Sensor
Coaxial Cable 30cm	Coaxial Cable 30cm	Coaxial Cable 30cm	Coaxial Cable 30cm	Coaxial Cable 30cm	Coaxial Cable 30cm
DC Block	DC Block	DC Block	DC Block	DC Block	DC Block
Splitter	Splitter	Splitter	Splitter	Splitter	Splitter
Attenuator	Attenuator	Attenuator	Attenuator	Attenuator	Attenuator
DC Power Supply	DC Power Supply	DC Power Supply	DC Power Supply	DC Power Supply	DC Power Supply

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8.4 Measurement Results:

Frequency MHz	20dB Bandwidth (MHz)
2406	4.345
2442	4.343
2474	4.334

Please refer to next page data chart.

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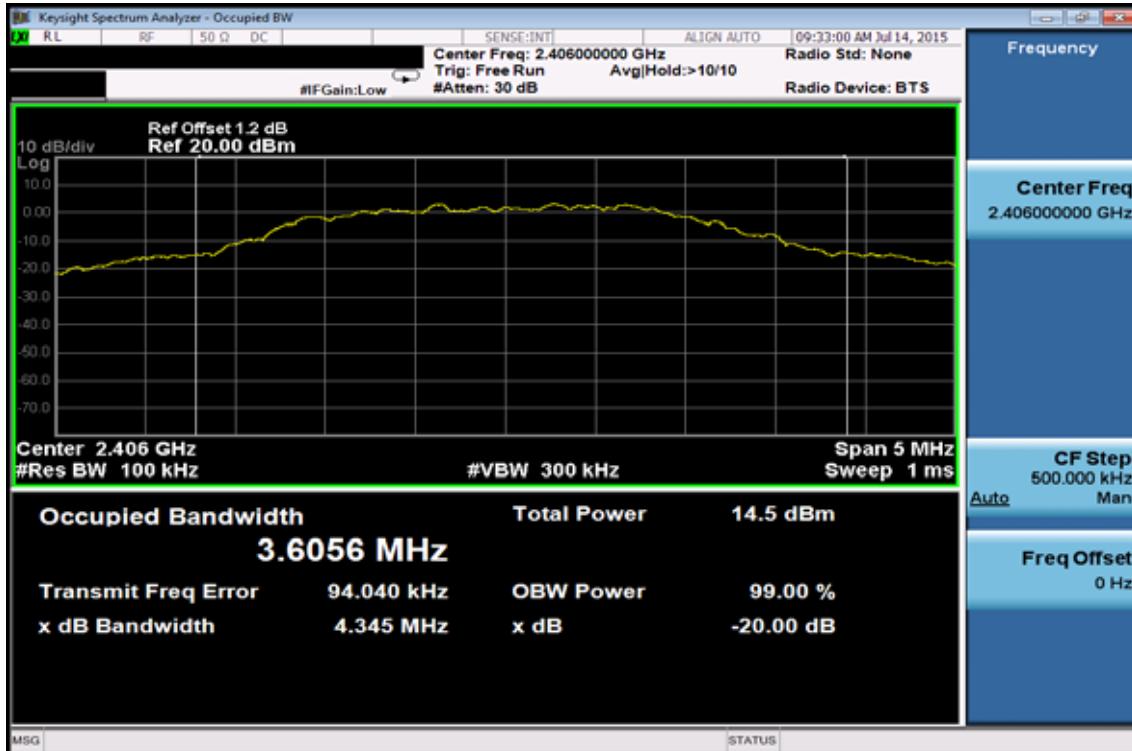
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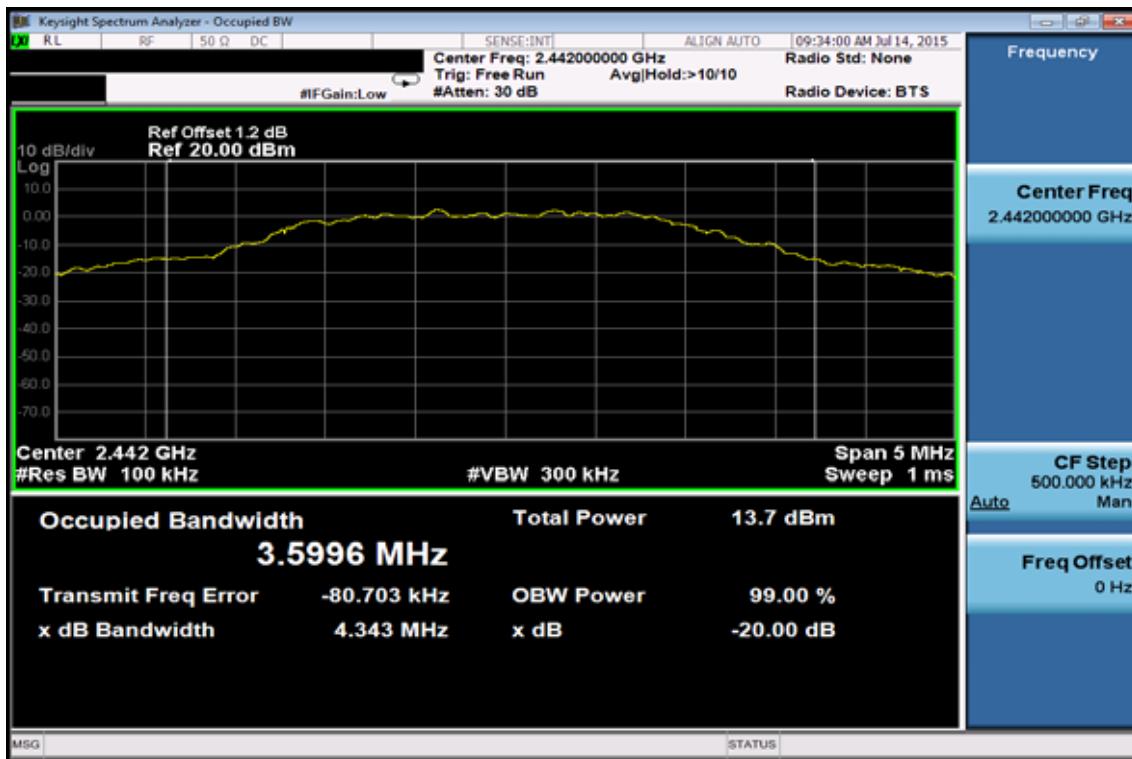
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20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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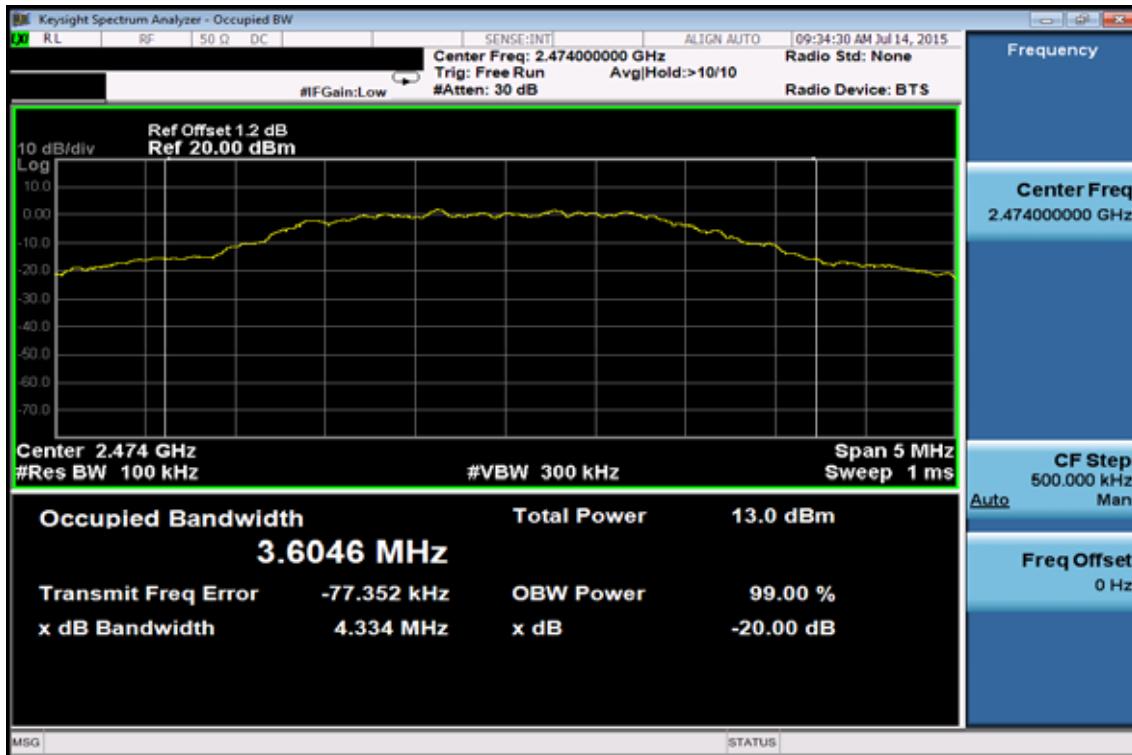
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20dB Bandwidth Test Data CH-High



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9. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

9.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

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9.2 Maximum Permissible Exposure (MPE) Evaluation

According to section 7.5 Where the highest Field Strength at 3 meters is 83.72 dB μ V/m = -11.51 EIRP (dBm) at 2442MHz.

MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input	-11.51	(dBm)
Maximum peak output power at antenna input	0.0706318	(mW)
Duty cycle:	100	(%)
Maximum Pav :	0.0706318	(mW)
Antenna gain (linear):	1.1220185	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2442	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0000141	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.000041 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2442MHz.

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