

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRIAL CANADA RSS-210 REQUIREMENT

OF

Product Name: Vive controller
Brand Name: HTC
Model No.: 2PR7100
Model Difference: N/A
FCC ID: NM82PR7100
IC: 4115A-2PR7100
Report No.: ER/2015/A0030
Issue Date: Nov. 13, 2015
FCC Rule Part: §15.249
IC Rule Part: RSS-210 Issue 8 , Dec. 2010
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VERIFICATION OF COMPLIANCE

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IC Applicant: HTC Corporation
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Product Name: Vive controller

Brand Name: HTC

Model No.: 2PR7100

Model Difference: N/A

FCC ID: NM82PR7100

IC: 4115A-2PR7100

File Number: ER/2015/A0030

Date of test: Oct. 07, 2015 ~ Nov. 13, 2015

Date of EUT Received: Oct. 07, 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: JJ Chen **Date** Nov. 13, 2015

JJ Chen / Engineer

Prepared By: Karen Huang **Date** Nov. 13, 2015

Karen Huang / Clerk

Approved By: Jim Chang **Date** Nov. 13, 2015

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
ER/2015/A0030	Rev.00	Initial creation of document	Nov. 13, 2015

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Contents

1	GENERAL INFORMATION.....	6
1.1	Product Description.....	6
1.2	Test Methodology of Applied Standards.....	7
1.3	Test Facility.....	7
1.4	Special Accessories.....	7
1.5	Equipment Modifications.....	7
2	SYSTEM TEST CONFIGURATION.....	8
2.1	EUT Configuration.....	8
2.2	EUT Exercise.....	8
2.3	Test Procedure.....	8
2.4	Measurement Results Explanation Example.....	8
2.5	Limitation.....	9
2.6	Configuration of Tested System.....	11
3	SUMMARY OF TEST RESULTS.....	13
4	DESCRIPTION OF TEST MODES.....	13
4.1	Operated in 2400 ~ 2483.5MHz Band.....	13
4.2	The Worst Test Modes and Channel Details.....	14
5	MEASUREMENT UNCERTAINTY.....	15
6	CONDUCTED EMISSION TEST.....	16
6.1	Standard Applicable:.....	16
6.2	Measurement Equipment Used:.....	16
6.3	EUT Setup:.....	16
6.4	Test SET-UP (Block Diagram of Configuration).....	17
6.5	Measurement Procedure:.....	17
6.6	Measurement Result:.....	17
7	Radiated Emission Test.....	20
7.1.	Measurement Procedure.....	20
7.2.	Test SET-UP (Block Diagram of Configuration).....	20
7.3.	Measurement Equipment Used:.....	22
7.4.	Field Strength Calculation.....	23
7.5.	Measurement Result.....	24

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8	20 dB & 99% Bandwidth Measurement	41
8.1	Measurement Procedure	41
8.2	Test SET-UP (Block Diagram of Configuration).....	41
8.3	Measurement Equipment Used:	41
8.4	Measurement Results:	42
9	ANTENNA REQUIREMENT	46
9.1	Standard Applicable:	46
9.2	Antenna Connected Construction:	46

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Vive controller
Brand Name:	HTC
Model No.:	2PR7100
Model Difference:	N/A
Transmit Power	101.60 dBuV/m (Peak)
Operation Frequency:	2402 ~ 2480MHz
Channel number:	79 channels
Channel space:	1MHz
Modulation Type:	FSK
Product SW / HW Version:	55E4B92B / DVT
Radio SW / HW Version:	55E4B92B / DVT
Test SW Version:	N/A
RF power setting in TEST SW:	N/A , RF power setting was not able to alter during testing
USB 2.0 Cable - Micro B (1M)	Model No.: NE 1M-UC-B, Supplier: N/A
Power Supply:	3.85Vdc from rechargeable Li-ion Polymer battery or 5Vdc from AC/DC adapter
	Battery: Model No.: B0PLH100, Supplier: N/A
	Adapter: 1. Model No.: TC NE5W-US, Supplier: N/A 2. Model No.: TC NE5W-EU Supplier: N/A 3. Model No.: TC NE5W-UK, Supplier: N/A
Antenna Designation:	PIFA Antenna, Peak Gain: 1.83dBi

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.249

RSS-Gen issue4 Nov. 2014

RSS-210 Issue 8, Dec 2010

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 certification procedure.
3. The EUT was placed 1.5m height for frequency above 1GHz in accordance with ANSI C63.10:2013.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. (TAF code 0513)

FCC Registration Numbers are: 990257

Canada Registration Number: 4620A-5.

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 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 §15.207. 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. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. 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.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor. Following shows an offset computation example with cable loss 1 dB.

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2.5 Limitation

(1) Conducted Emission

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

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
24.0 – 24.25 GHz	250 mV/m (107.95dBuV/m)	2500 uV/m (67.95dBuV/m)	3

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(3) Radiated Emission

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 as below, whichever is the lesser attenuation.

Frequency (MHz)	Field strength $\mu\text{V}/\text{m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V}/\text{m}$
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

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

- Re- mark:
1. Emission level in $\text{dB}\mu\text{V}/\text{m}=20 \log (\mu\text{V}/\text{m})$
 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 ξ 15.205 and RSS-Gen ξ 8.10
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of ξ 15.205 and RSS-Gen ξ 8.10, then the general radiated emission limits in ξ 15.209 and RSS-Gen ξ 8.9 apply.

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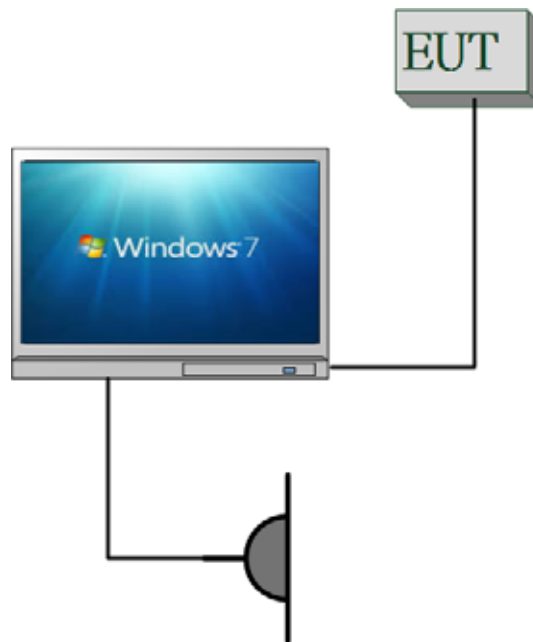
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2.6 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration



Fig. 2-2 AC Power Line Conducted Emission



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Fig. 2-3 Conducted (Antenna Port) Configuration

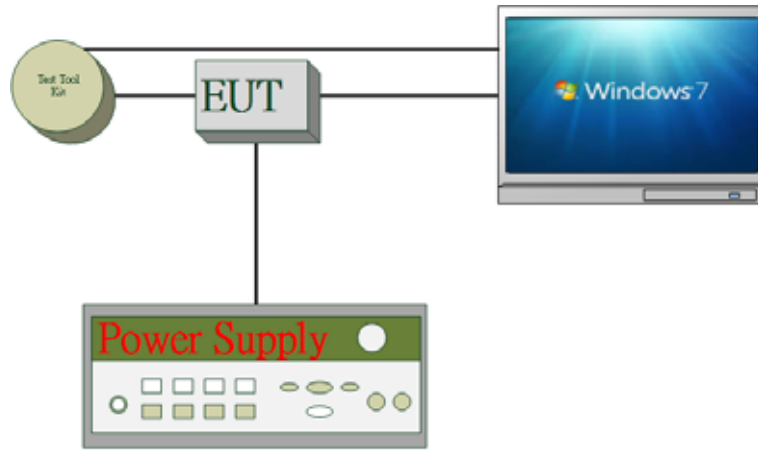


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model / Type No.	Series No.	Data Cable	Power Cord
1.	2.4GHz wireless Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L412	LR-027LM	Shielded	Unshielded
3.	DC Power Supply	HP	E3640A	KR93300208	N/A	N/A
4.	Test Tool Kit	N/A	N/A	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC / IC Rules	Description Of Test	Result
§15.207(a) / RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.249(a)(d)(e) RSS-210 §A2.9(a)(b) RSS-Gen § 8.9, RSS-Gen § 8.10	Radiated Emission	Compliant
§15.215(c) RSS-Gen §4.6.1	20dB & 99% bandwidth Measurement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided.

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	---	21	2421MHz	41	2441MHz	61	2461MHz
2	2402MHz	22	2422MHz	42	2442MHz	62	2462MHz
3	2403MHz	23	2423MHz	43	2443MHz	63	2463MHz
4	2404MHz	24	2424MHz	44	2444MHz	64	2464MHz
5	2405MHz	25	2425MHz	45	2445MHz	65	2465MHz
6	2406MHz	26	2426MHz	46	2446MHz	66	2466MHz
7	2407MHz	27	2427MHz	47	2447MHz	67	2467MHz
8	2408MHz	28	2428MHz	48	2448MHz	68	2468MHz
9	2409MHz	29	2429MHz	49	2449MHz	69	2469MHz
10	2410MHz	30	2430MHz	50	2450MHz	70	2470MHz
11	2411MHz	31	2431MHz	51	2451MHz	71	2471MHz
12	2412MHz	32	2432MHz	52	2452MHz	72	2472MHz
13	2413MHz	33	2433MHz	53	2453MHz	73	2473MHz
14	2414MHz	34	2434MHz	54	2454MHz	74	2474MHz
15	2415MHz	35	2435MHz	55	2455MHz	75	2475MHz
16	2416MHz	36	2436MHz	56	2456MHz	76	2476MHz
17	2417MHz	37	2437MHz	57	2457MHz	77	2477MHz
18	2418MHz	38	2438MHz	58	2458MHz	78	2478MHz
19	2419MHz	39	2439MHz	59	2459MHz	79	2479MHz
20	2420MHz	40	2440MHz	60	2460MHz	80	2480MHz

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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.
3. Pre-scanned was done on Whip antenna and Printed patch antenna , and Whip antenna results higher emission. Therefore, the completed set of measurement was Whip antenna to presented on this test report.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2 to 80	2,40,80	FSK	2	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2 to 80	2,40,80	FSK	2	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 E1 position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2 to 80	2,40,80	FSK	2	MAIN

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
6dB Bandwidth	+/- 51.33 Hz
100 kHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Peak Power Density	+/- 1.3 dB
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, 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 EMISSION 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	ESCI7	100760	05/04/2015	05/03/2016
LISN	SCHWARZ BECK	NSLK 8127	8127-649	05/15/2015	05/14/2016
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/13/2015	03/12/2016
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2014	11/25/2015

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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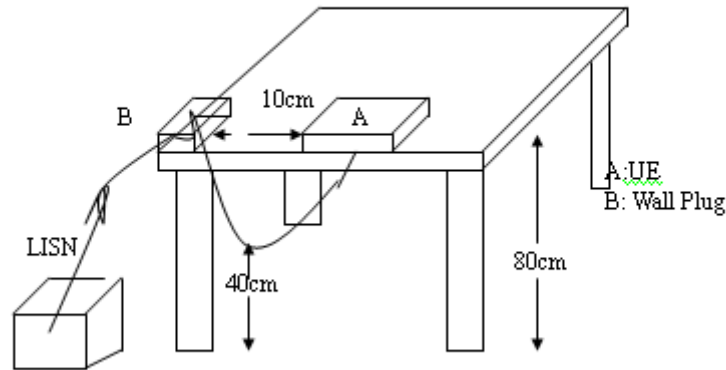
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6.4 Test SET-UP (Block Diagram of Configuration)



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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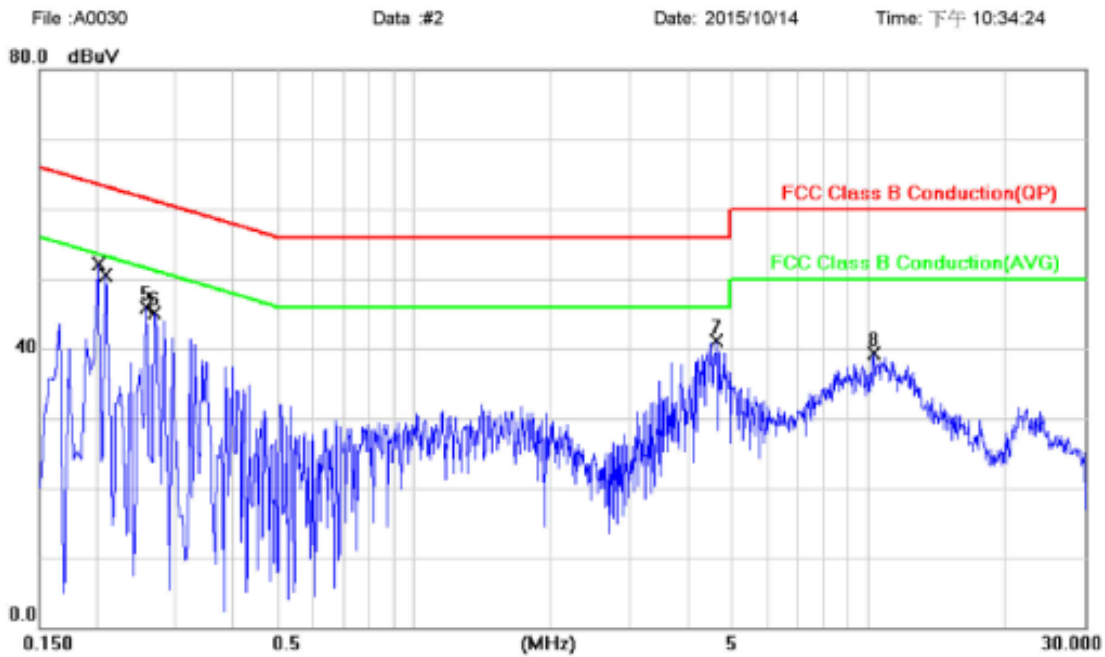
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode		Test Date:	Oct. 14, 2015	
Temperature:	25	Humidity:	70 %	Test By:	JJ
				Probe	L1

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.2020	50.10	0.04	50.14	63.53	-13.39	QP	
2		0.2020	32.30	0.04	32.34	53.53	-21.19	AVG	
3		0.2100	48.90	0.04	48.94	63.21	-14.27	QP	
4		0.2100	30.00	0.04	30.04	53.21	-23.17	AVG	
5		0.2580	45.81	0.04	45.85	61.50	-15.65	peak	
6		0.2700	45.08	0.04	45.12	61.12	-16.00	peak	
7		4.6340	40.91	0.14	41.05	56.00	-14.95	peak	
8		10.3060	39.01	0.32	39.33	60.00	-20.67	peak	

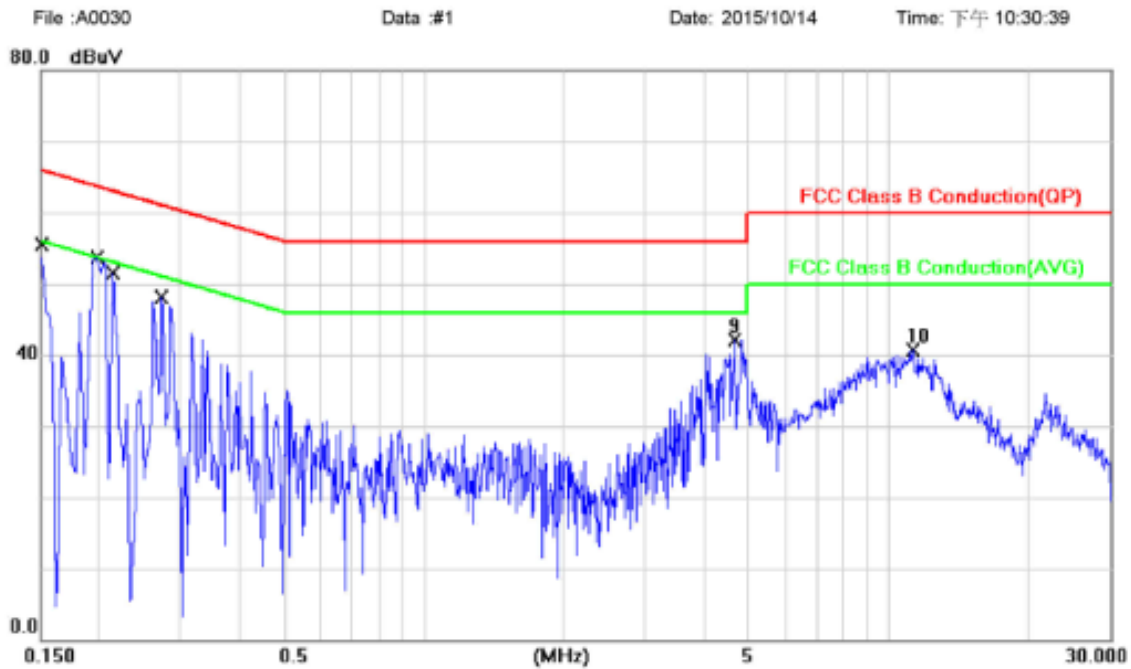
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Operation Mode:	Operation mode			Test Date:	Oct. 14, 2015
Temperature:	24	Humidity:	63 %	Test By:	JJ
				Probe	N

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1500	55.30	0.03	55.33	66.00	-10.67	QP	
2		0.1500	30.30	0.03	30.33	56.00	-25.67	AVG	
3		0.1980	51.80	0.04	51.84	63.69	-11.85	QP	
4		0.1980	34.00	0.04	34.04	53.69	-19.65	AVG	
5		0.2140	48.80	0.04	48.84	63.05	-14.21	QP	
6		0.2140	28.80	0.04	28.84	53.05	-24.21	AVG	
7		0.2740	43.60	0.04	43.64	61.00	-17.36	QP	
8		0.2740	24.10	0.04	24.14	51.00	-26.86	AVG	
9		4.6740	41.94	0.15	42.09	56.00	-13.91	peak	
10		11.2740	40.32	0.33	40.65	60.00	-19.35	peak	

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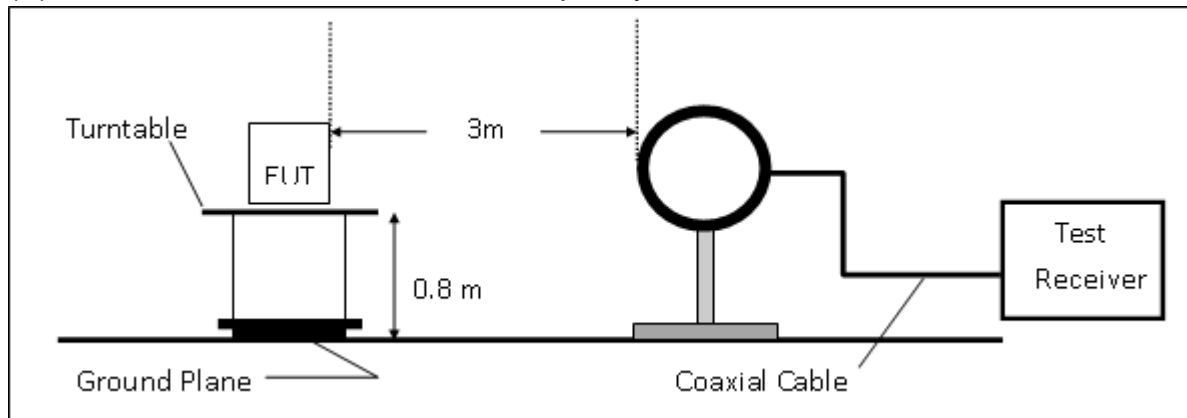
7 Radiated Emission Test

7.1. Measurement Procedure

1. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz 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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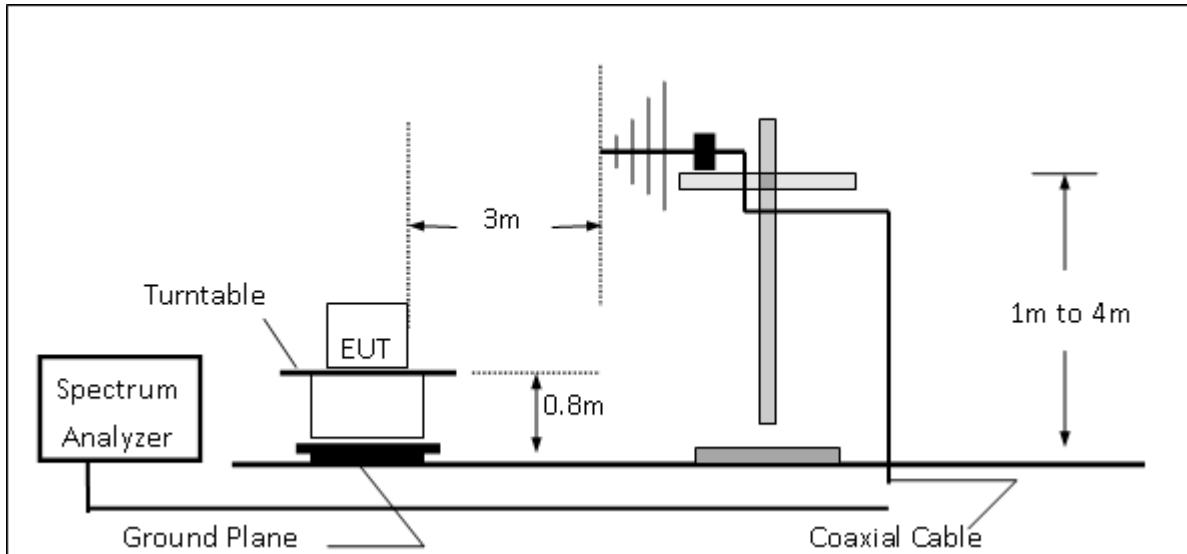
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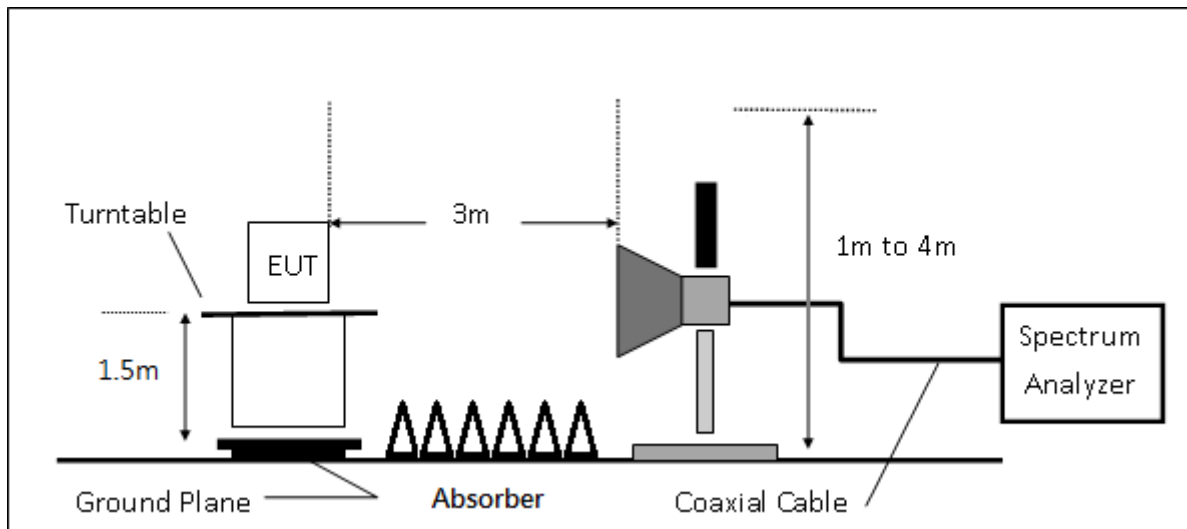
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(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



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



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7.3. Measurement Equipment Used:

SGS SAC Chamber No.C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/04/2015	05/03/2016
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	12/22/2014	12/21/2015
Spectrum Analyzer	R&S	FSV-30	101398	09/23/2015	09/22/2016
Loop Antenna	ETS.LINDGREN	6502	00143303	12/9/2014	12/08/2015
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/23/2014	12/22/2015
Horn antenna	ETS.LINDGREN	3117	123995	05/05/2015	05/04/2016
Horn Antenna	Schwarzbeck	BBHA9170	184	12/25/2014	12/24/2015
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2015	01/01/2016
Pre-Amplifier	Agilent	8449B	3008A00578	01/02/2015	01/01/2016
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/02/2015	01/01/2016
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	004	01/02/2015	01/01/2016
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	060776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/02/2015	01/01/2016
3m Site NSA	SGS	966 chamber	N/A	07/01/2015	06/30/2016

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(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.

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7.5. Measurement Result

Radiated Spurious Emission Measurement Result (MAIN)

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:MAIN LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
2402.24	F	Average	76.64	5.23	81.87	94.00	-12.13
2402.24	F	Peak	94.87	5.23	100.10	114.00	-13.90

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:MAIN LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
2401.76	F	Average	77.74	5.23	82.97	94.00	-11.03
2401.76	F	Peak	96.37	5.23	101.60	114.00	-12.40

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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:MAIN MID	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
2440.24	F	Average	75.72	5.43	81.15	94.00	-12.85
2440.24	F	Peak	93.16	5.43	98.59	114.00	-15.41

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:MAIN MID	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
2439.72	F	Average	77.44	5.43	82.87	94.00	-11.13
2439.72	F	Peak	95.55	5.43	100.98	114.00	-13.02

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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:MAIN HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2479.71	F	Average	74.01	5.95	79.96	94.00	-14.04
2479.71	F	Peak	91.68	5.95	97.63	114.00	-16.37

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:MAIN HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV/m	dB	dBµV/m	dBµV/m	dB
2480.22	F	Average	76.64	5.96	82.60	94.00	-11.40
2480.22	F	Peak	94.72	5.96	100.68	114.00	-13.32

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Radiated Spurious Emission Measurement Result

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:BANDEDGE LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
2390.00	E	Average	28.09	5.16	33.25	54.00	-20.75
2390.00	E	Peak	51.37	5.16	56.53	74.00	-17.47

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:BANDEDGE LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
2390.00	E	Average	28.05	5.16	33.21	54.00	-20.79
2390.00	E	Peak	53.59	5.16	58.75	74.00	-15.25

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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:BANDEDGE HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV/m	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	30.11	6.01	36.12	54.00	-17.88
2483.50	E	Peak	55.28	6.01	61.29	74.00	-12.71

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:BANDEDGE HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV/m	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	31.10	6.01	37.11	54.00	-16.89
2483.50	E	Peak	58.71	6.01	64.72	74.00	-9.28

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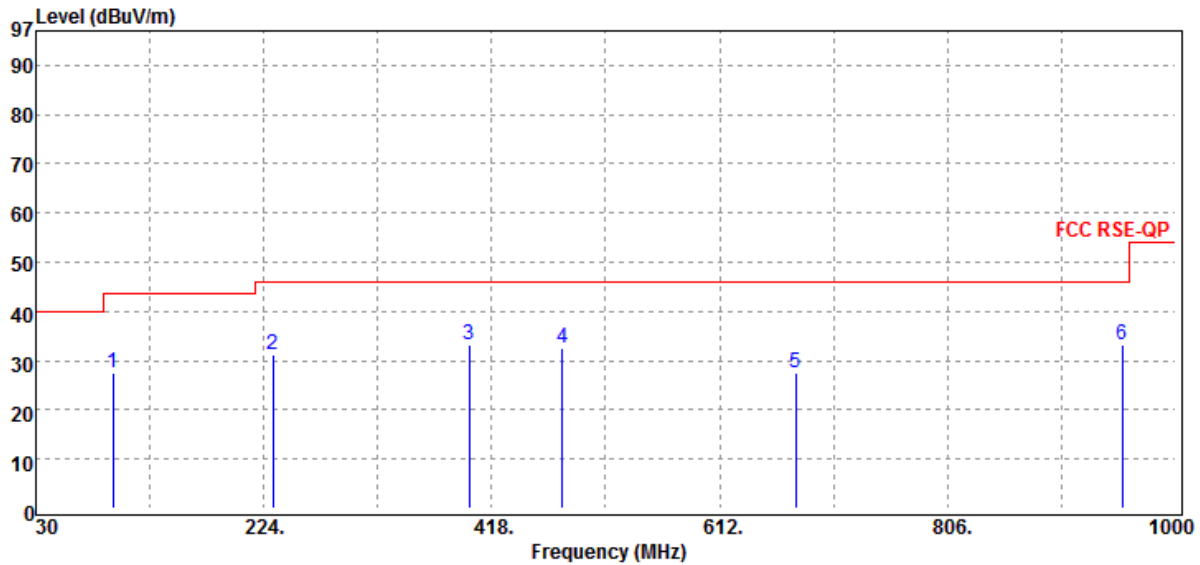
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Radiated Spurious Emission Measurement Result

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



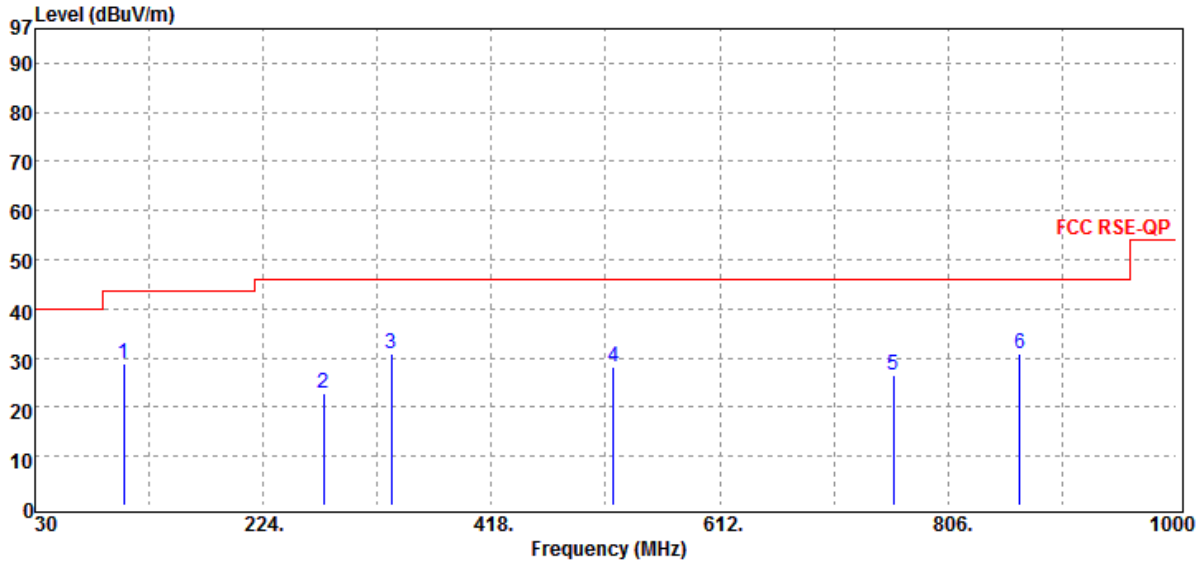
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
95.96	S	Peak	42.20	-14.78	27.42	43.50	-16.08
231.76	S	Peak	42.13	-10.83	31.30	46.00	-14.70
398.60	S	Peak	39.32	-6.03	33.29	46.00	-12.71
478.14	S	Peak	37.36	-4.68	32.68	46.00	-13.32
676.99	S	Peak	28.59	-1.11	27.48	46.00	-18.52
954.41	S	Peak	29.84	3.49	33.33	46.00	-12.67

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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
105.66	S	Peak	41.80	-13.05	28.75	43.50	-14.75
275.41	S	Peak	31.61	-8.66	22.95	46.00	-23.05
332.64	S	Peak	38.61	-7.67	30.94	46.00	-15.06
521.79	S	Peak	32.55	-4.37	28.18	46.00	-17.82
759.44	S	Peak	25.40	1.07	26.47	46.00	-19.53
867.11	S	Peak	28.53	2.49	31.02	46.00	-14.98

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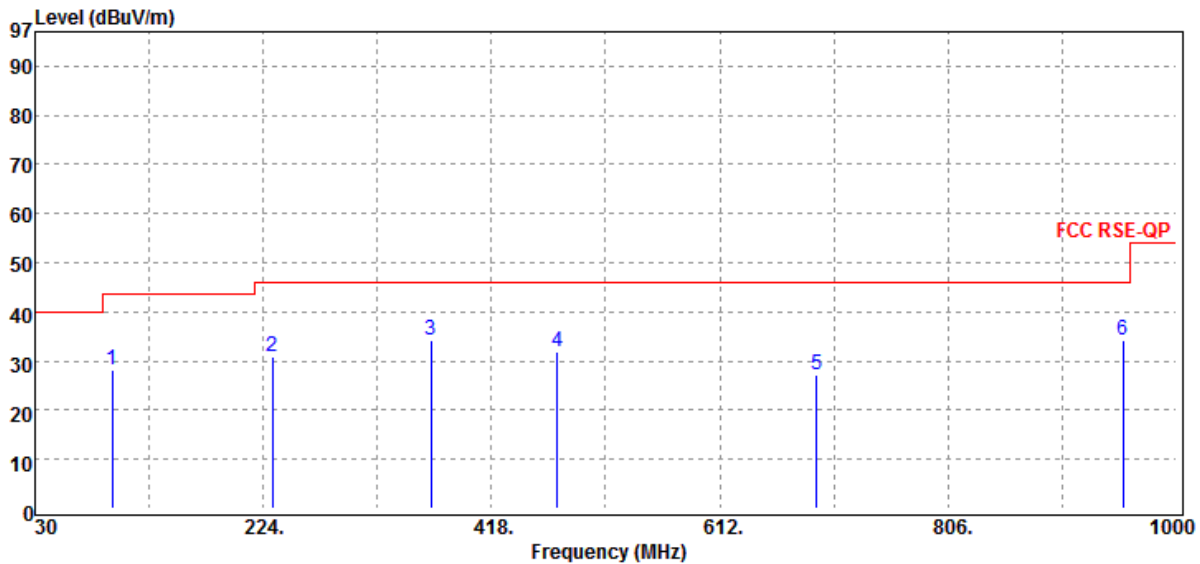
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Operation Band :2.4G
Fundamental Frequency :2440 MHz
Operation Mode :TX MID
EUT Pol. :E2 Plan

Test Date :2015-10-13
Temp./Humi. :22deg_C/61RH
Engineer :Vito
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
95.96	S	Peak	43.01	-14.78	28.23	43.50	-15.27
231.76	S	Peak	41.73	-10.83	30.90	46.00	-15.10
366.59	S	Peak	41.11	-6.92	34.19	46.00	-11.81
474.26	S	Peak	36.82	-4.88	31.94	46.00	-14.06
694.45	S	Peak	27.88	-0.85	27.03	46.00	-18.97
954.41	S	Peak	30.74	3.49	34.23	46.00	-11.77

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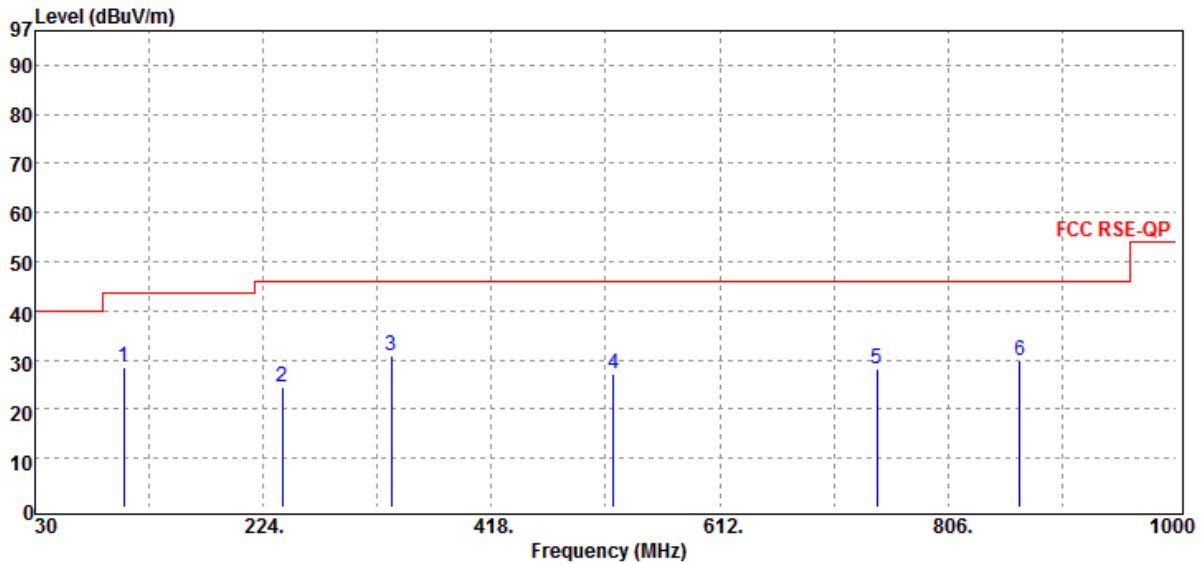
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Member of SGS Group

Operation Band :2.4G
 Fundamental Frequency :2440 MHz
 Operation Mode :TX MID
 EUT Pol. :E2 Plan

Test Date :2015-10-13
 Temp./Humi. :22deg_C/61RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
105.66	S	Peak	41.60	-13.05	28.55	43.50	-14.95
240.49	S	Peak	34.60	-10.23	24.37	46.00	-21.63
332.64	S	Peak	38.48	-7.67	30.81	46.00	-15.19
521.79	S	Peak	31.66	-4.37	27.29	46.00	-18.71
745.86	S	Peak	28.33	-0.05	28.28	46.00	-17.72
867.11	S	Peak	27.23	2.49	29.72	46.00	-16.28

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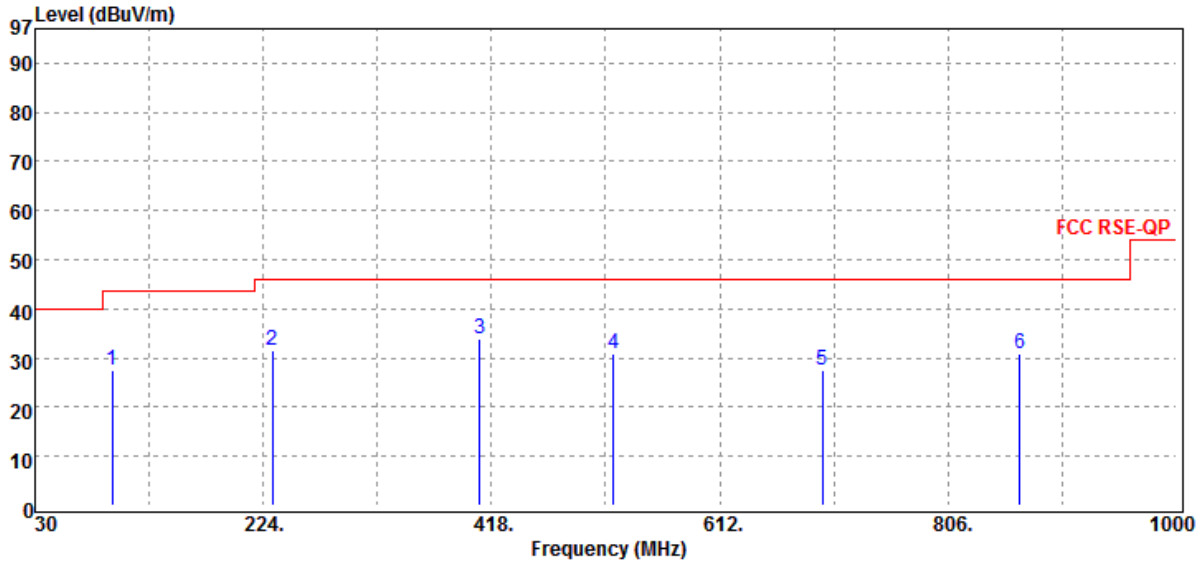
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Member of SGS Group

Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
95.96	S	Peak	42.29	-14.78	27.51	43.50	-15.99
231.76	S	Peak	42.40	-10.83	31.57	46.00	-14.43
408.30	S	Peak	39.84	-5.90	33.94	46.00	-12.06
521.79	S	Peak	35.38	-4.37	31.01	46.00	-14.99
699.30	S	Peak	28.66	-1.06	27.60	46.00	-18.40
867.11	S	Peak	28.42	2.49	30.91	46.00	-15.09

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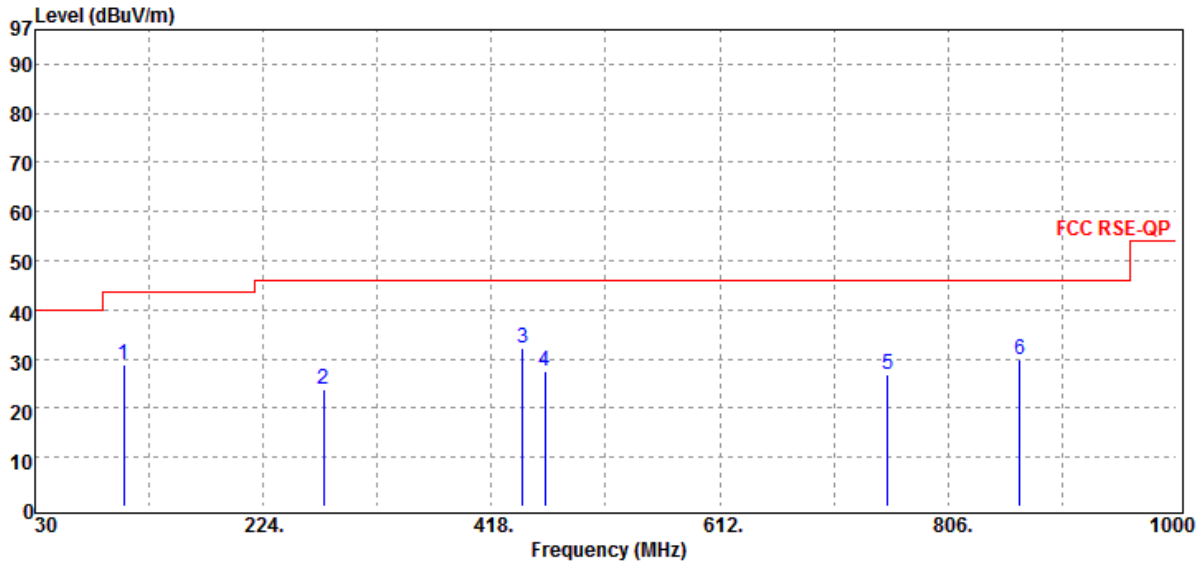
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Member of SGS Group

Operation Band :2.4G
Fundamental Frequency :2480 MHz
Operation Mode :TX HIGH
EUT Pol. :E2 Plan

Test Date :2015-10-13
Temp./Humi. :22deg_C/61RH
Engineer :Vito
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
105.66	S	Peak	41.91	-13.05	28.86	43.50	-14.64
275.41	S	Peak	32.33	-8.66	23.67	46.00	-22.33
444.19	S	Peak	38.00	-5.78	32.22	46.00	-13.78
463.59	S	Peak	32.92	-5.39	27.53	46.00	-18.47
754.59	S	Peak	26.20	0.73	26.93	46.00	-19.07
867.11	S	Peak	27.33	2.49	29.82	46.00	-16.18

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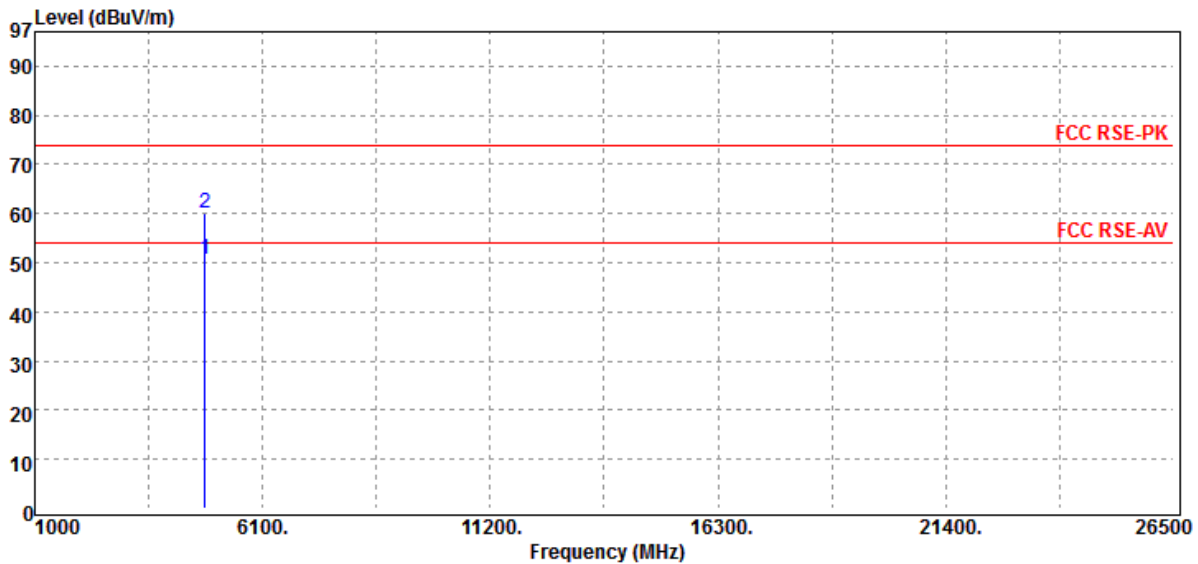
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Member of SGS Group

Operation Band :2.4G
Fundamental Frequency :2402 MHz
Operation Mode :TX LOW
EUT Pol. :E2 Plan

Test Date :2015-10-13
Temp./Humi. :22deg_C/61RH
Engineer :Vito
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V/m	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4804.00	H	Average	41.25	9.56	50.81	54.00	-3.19
4804.00	H	Peak	50.41	9.56	59.97	74.00	-14.03

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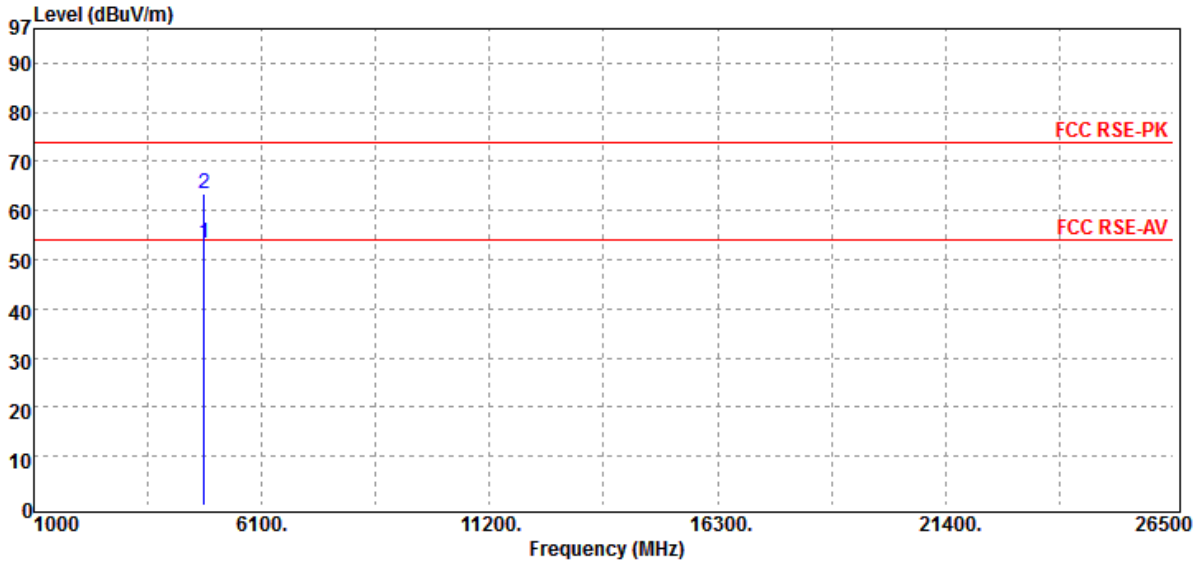
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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:TX LOW	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
4804.00	H	Average	43.71	9.56	53.27	54.00	-0.73
4804.00	H	Peak	54.02	9.56	63.58	74.00	-10.42

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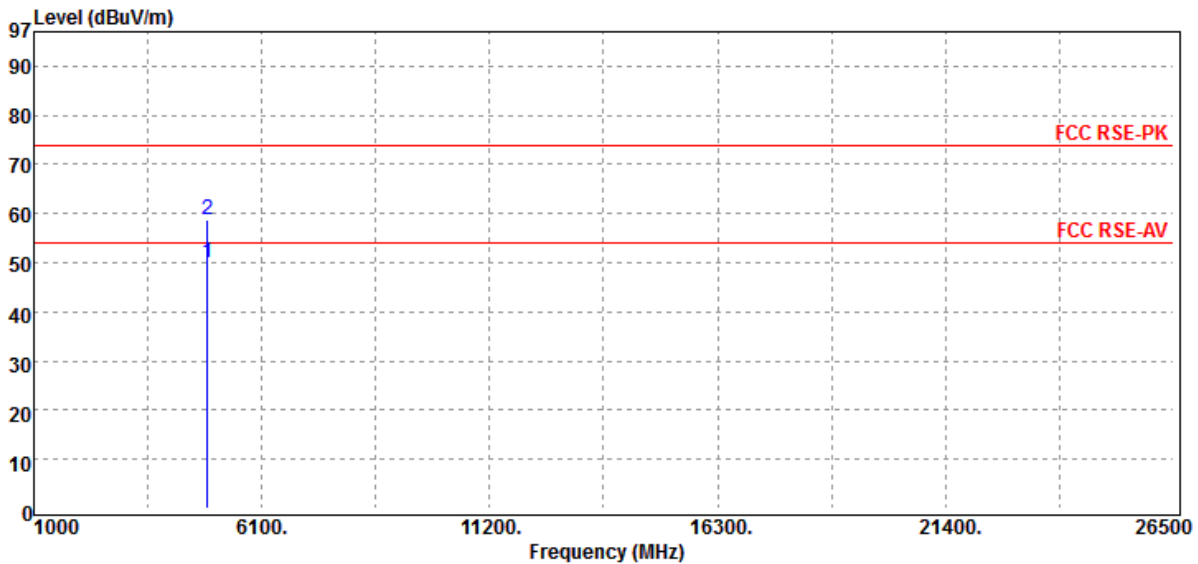
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Member of SGS Group

Operation Band :2.4G
Fundamental Frequency :2440 MHz
Operation Mode :TX MID
EUT Pol. :E2 Plan

Test Date :2015-10-13
Temp./Humi. :22deg_C/61RH
Engineer :Vito
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V/m	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4880.00	H	Average	40.30	9.85	50.15	54.00	-3.85
4880.00	H	Peak	48.82	9.85	58.67	74.00	-15.33

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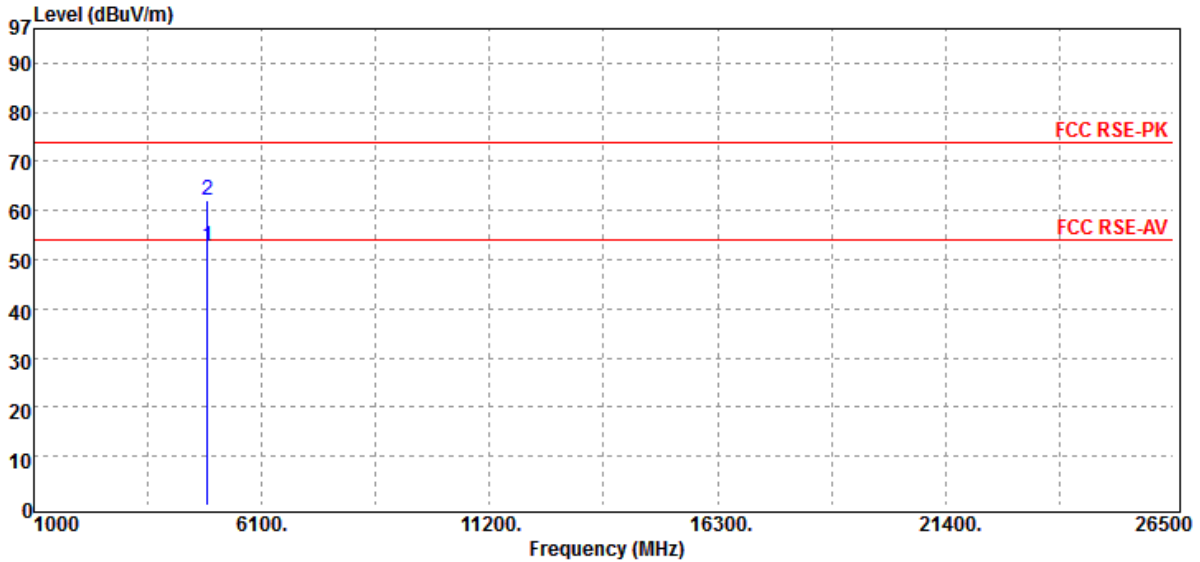
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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4880.00	H	Average	42.74	9.85	52.59	54.00	-1.41
4880.00	H	Peak	52.19	9.85	62.04	74.00	-11.96

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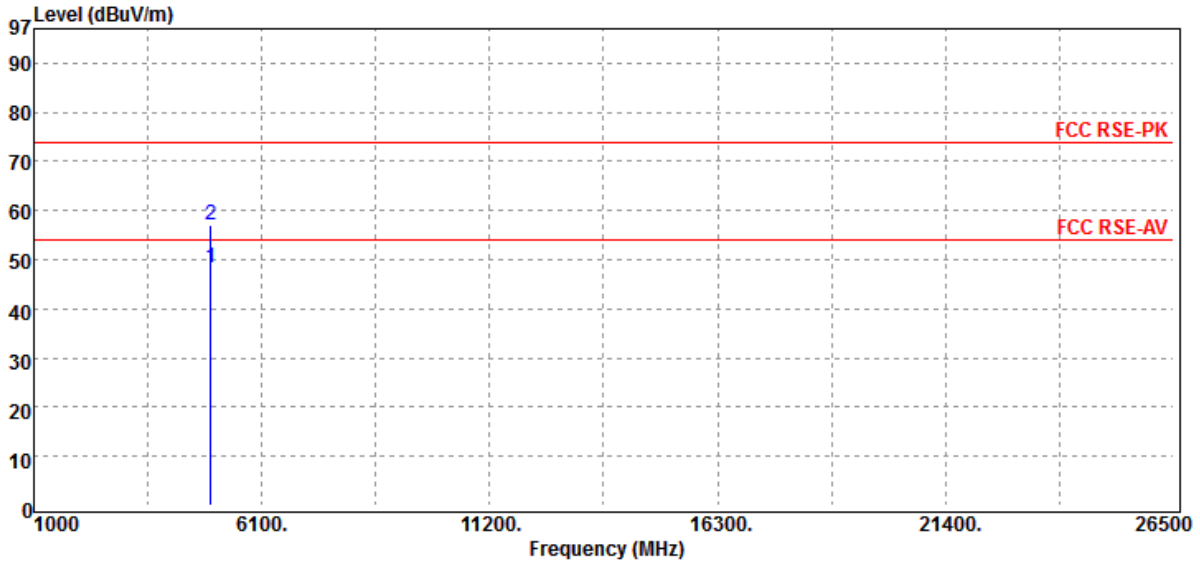
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Operation Band	:2.4G	Test Date	:2015-10-13
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22deg_C/61RH
Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	PK/QP/AV	Reading Level	dB	dB μ V/m	dB μ V/m	dB
4960.00	H	Average	38.44	9.86	48.30	54.00	-5.70
4960.00	H	Peak	47.14	9.86	57.00	74.00	-17.00

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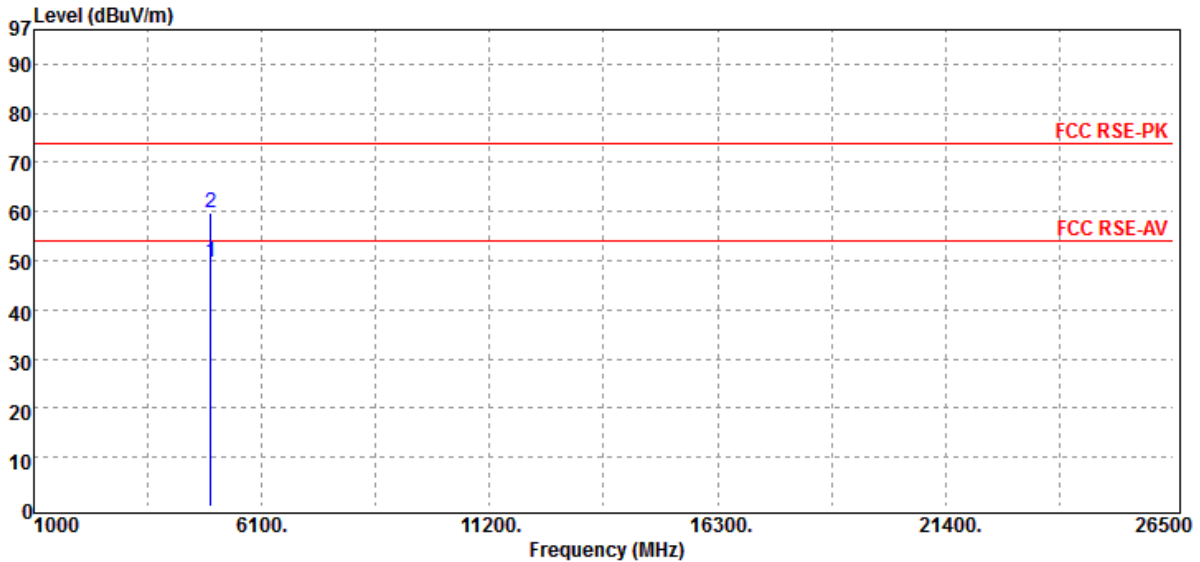
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Operation Mode	:TX HIGH	Engineer	:Vito
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV/m	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.00	H	Average	39.84	9.86	49.70	54.00	-4.30
4960.00	H	Peak	50.03	9.86	59.89	74.00	-14.11

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8 20 dB & 99% Bandwidth 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)

Refer to section 7.2 for the plot.

8.3 Measurement Equipment Used:

SGS Conducted Room(ALL)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/20/2014	12/19/2015
Power Sensor	Anritsu	MA2411B	917032	12/20/2014	12/19/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
Low Loss Cable	HUBER+SUHNE R	SUCOFLEX 104PEA	N/A	01/02/2015	01/01/2016
Spectrum Analyzer	Agilent	E4440A	MY45304525	05/05/2015	05/04/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	002	01/02/2015	01/01/2016
Splitter	Agilent	11636B	N/A	01/02/2015	01/01/2016

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8.4 Measurement Results:

20dB

2.402GHz = 1260 kHz

2.440GHz = 1228 kHz

2.480GHz = 1199 kHz

99%

2.402GHz = 1009.5 kHz

2.440GHz = 1039.6 kHz

2.480GHz = 996.61 kHz

Refer to attached data chart.

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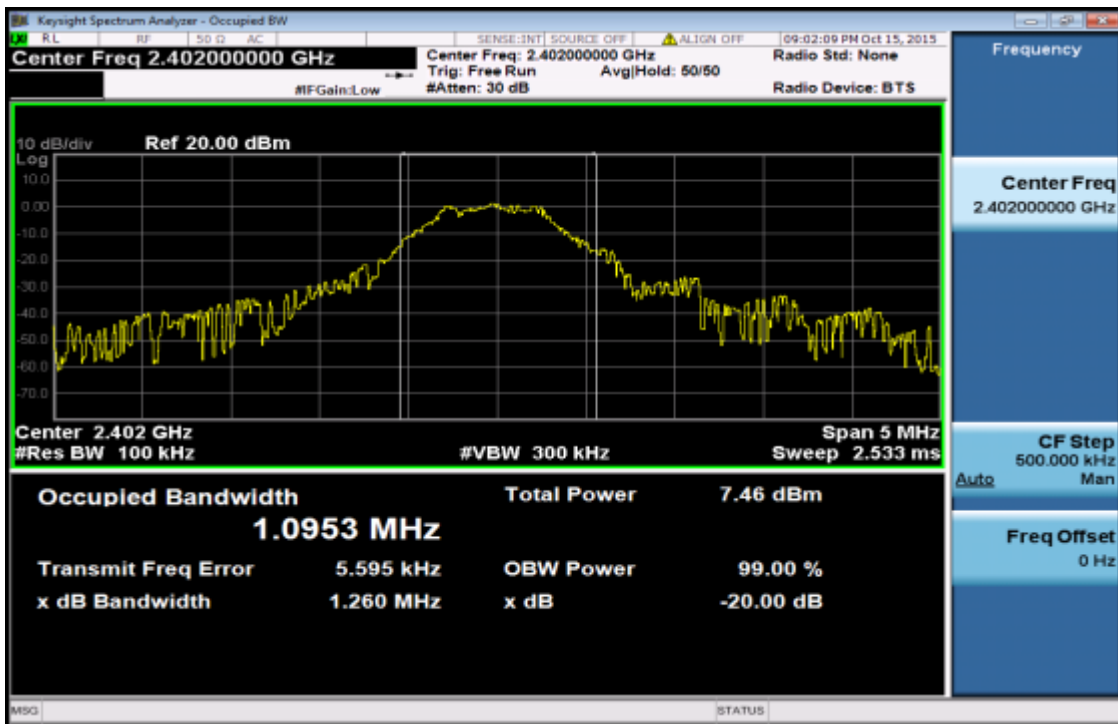
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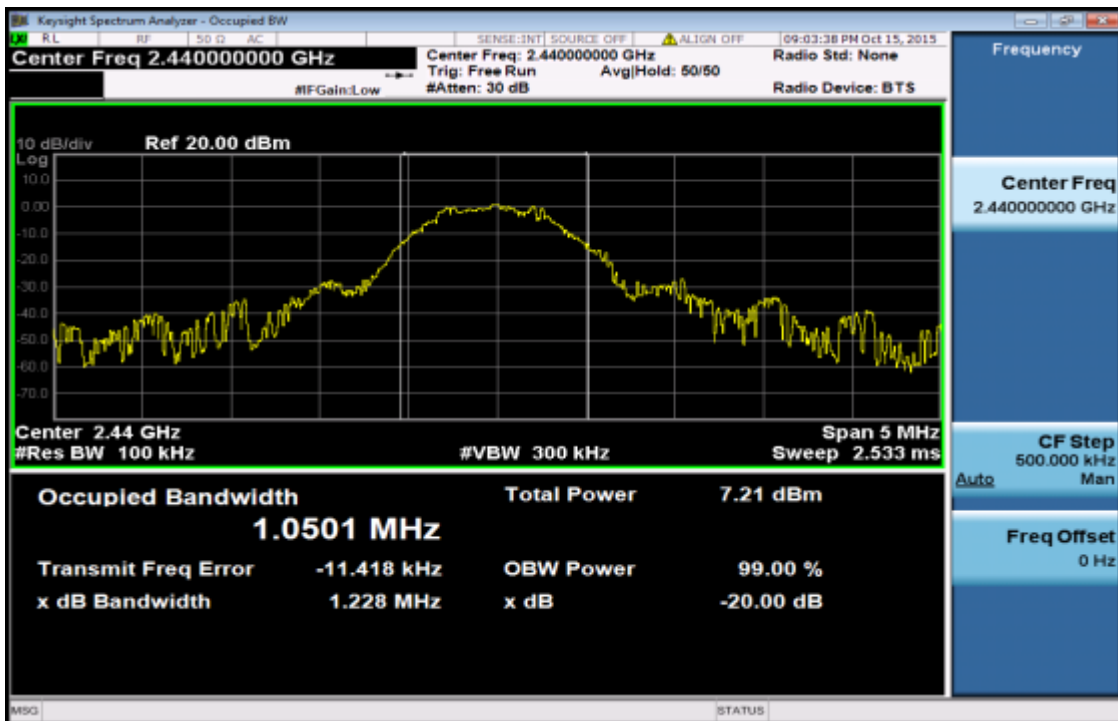
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20dB Bandwidth Test Plot (2.402GHz)



20dB Bandwidth Test Plot (2.440GHz)



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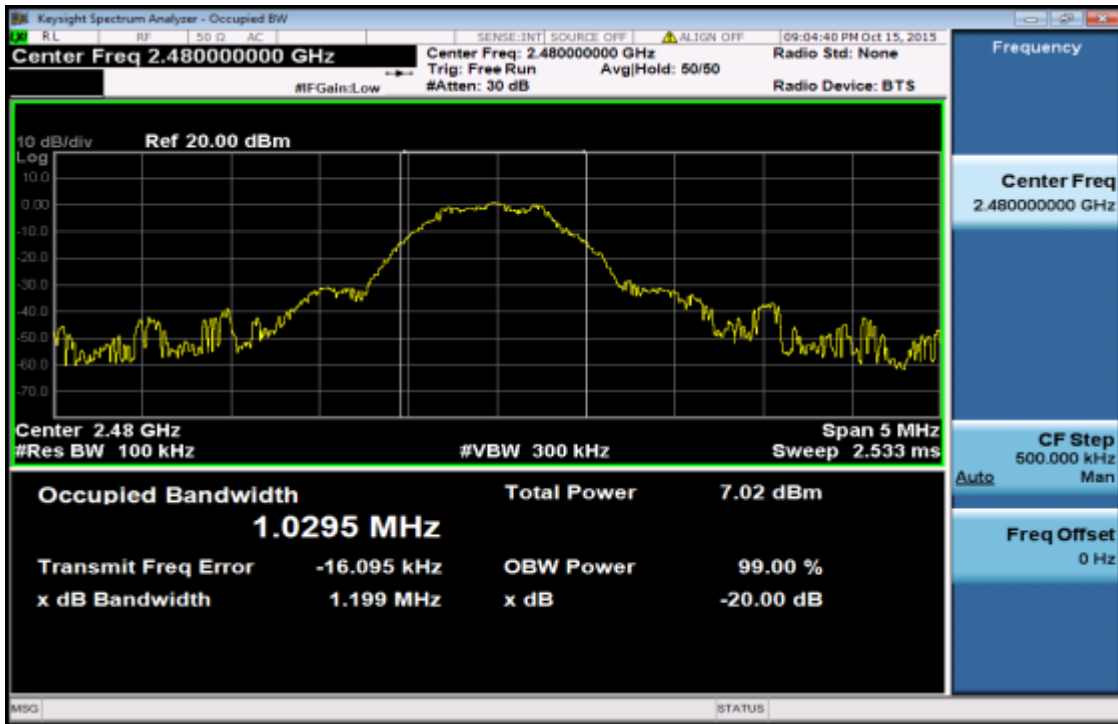
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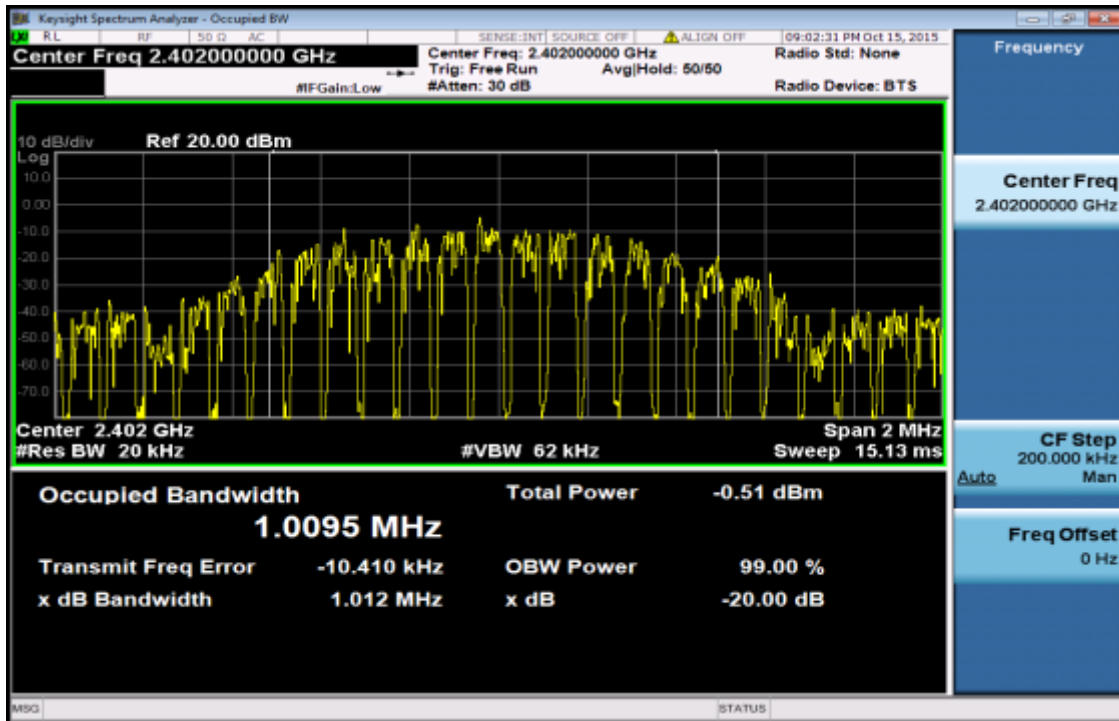
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20dB Bandwidth Test Plot (2.480GHz)



99% Bandwidth Test Plot (2.402GHz)



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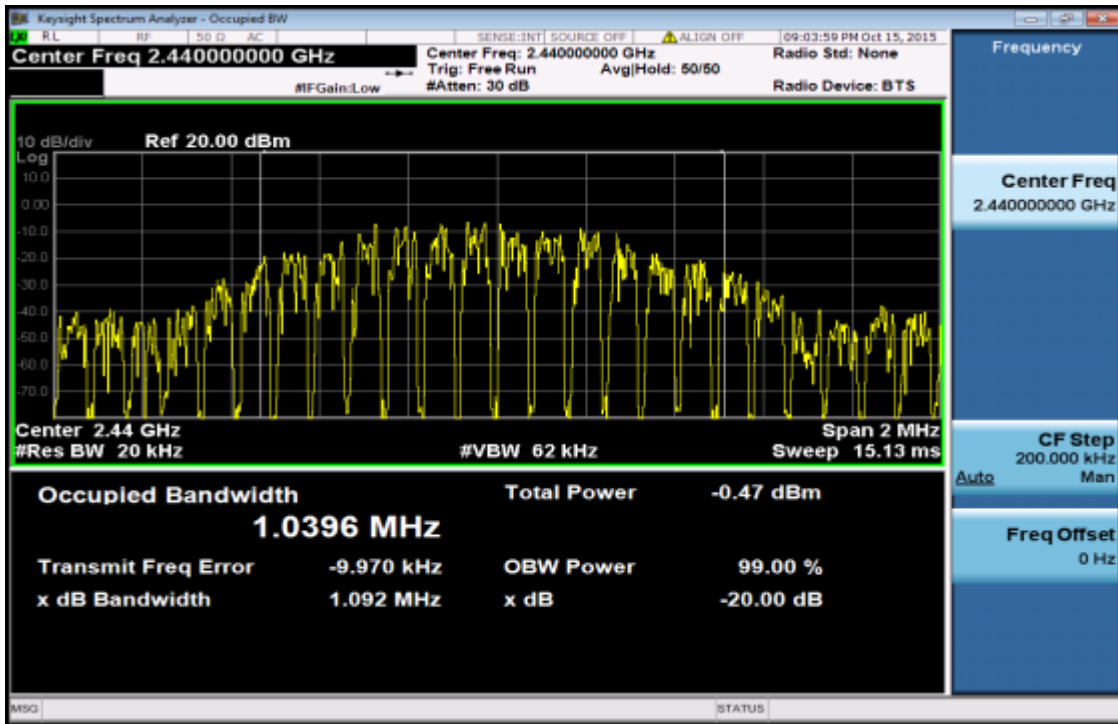
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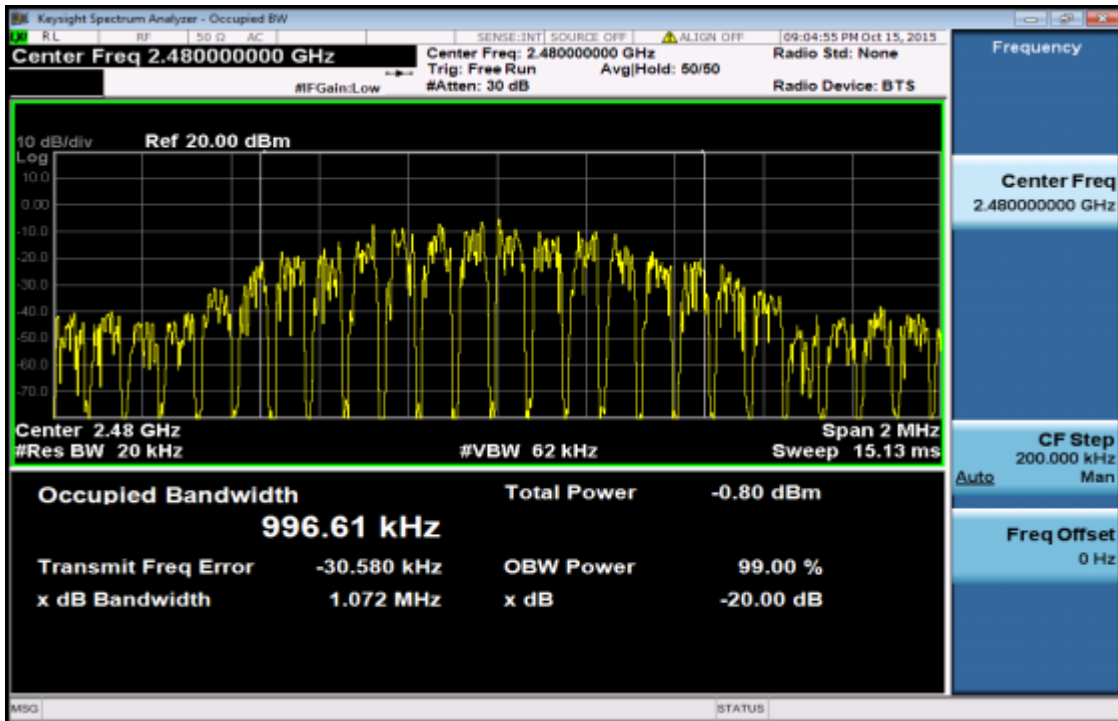
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99% Bandwidth Test Plot (2.440GHz)



99% Bandwidth Test Plot (2.480GHz)



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9 ANTENNA REQUIREMENT

9.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

In case of point-to-point operation, the power shall be reduced by the one dB for every 3 dB that the directional gain of antenna exceeds 6dBi.

9.2 Antenna Connected Construction:

An embedded-in antenna design is used.

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

The antenna gain is less than 6dBi. Therefore, it is not necessary to reduce maximum output power limit.

~ End of Report ~

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