

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND RSS 247 REQUIREMENT

OF

Applicant: ECOFIT NETWORKS INC.
3375 Whittier Avenue Victoria, BC V8Z 3R1

Product Name: GATEWAY

Brand Name: ECOFIT Networks Inc.

Model No.: GTY110

Model Difference: N/A

FCC ID: 2ADCN-GTY110

IC: 12408A-GTY110

Report Number: E2/2016/90035

FCC Rule Part: §15.247, Cat: DSS

IC Rule Part: RSS-247 issue 2 Feb 2017

Issue Date: Nov. 22, 2017

Date of Test: Nov. 10, 2017 ~ Nov. 21, 2017

Date of EUT Received: Sep. 10, 2016

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.

Prepared By:

Karen Huang

Karen Huang / Clerk

Approved By:

Jim Chang

Jim Chang / Asst. Manager



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Revision History

Report Number	Revision	Description	Issue Date
E2/2016/90035	Rev.00	Initial creation of document	Nov. 22, 2017

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	GATEWAY	
Brand Name:	ECOFIT Networks Inc.	
Model No.:	GTY110	
Model Difference:	N/A	
Product SW/HW version:	N/A / N/A	
Radio SW/HW version:	N/A / N/A	
Test SW Version:	N/A	
RF power setting in TEST SW:	N/A	
Mounting Panel:	Model No.: N/A, Supplier: N/A	
Power Supply:	12Vdc from AC/DC Adapter	
	Adapter:	Model No.: FSP040-RHAN2, Supplier: FSP GROUP INC.

2.4GHz:

Frequency Range:	2419 – 2457MHz
Channel number:	20 channels
Channel space:	2MHz
Modulation type:	GFSK
Transmit Power:	17.79 dBm
Antenna Designation:	Omni-directional Antenna, Gain: 2dBi

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1.2 Test Methodology of Applied Standards

Canada RSS-247 issue 2 Feb. 2017

RSS-Gen issue 4 Nov. 2014

FCC Part 15, Subpart C §15.247

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,
Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Numbers are: 735305 / TW0002

Canada Registration Number: 4620A-5

1.4 Special Accessories

There is no special accessory 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 plan. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50 uH 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 0.8 m above the reference ground plan. 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 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 10.4dB.

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2.5 Configuration of Tested System

Fig. 2-1 Configuration of Radiated & Conduction Tested System

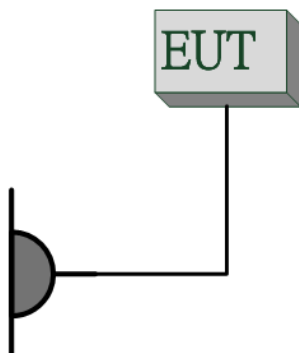


Fig.2-2 Configuration of Conducted Tested System

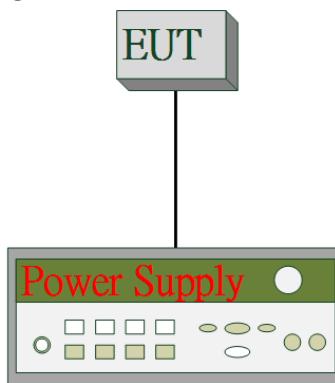


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	2.4GHz Test Software	N/A	N/A	N/A	N/A	N/A
2	DC Power Supply	Agilent	E3640A	MY53140006	N/A	Unshielded

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	RSS-247 §5.4 (2)	Peak Output Power	Compliant
§15.247(a)(1)	RSS-247 §5.1 (1) RSS-Gen §6.6	20dB & 99% Bandwidth	Compliant
§15.247(d)	RSS-247 §5.5	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	RSS-247 §5.5	Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	RSS-247 §5.1 (2)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 (4)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 (4)	Time of Occupancy	Compliant
§15.203 §15.247(b)	-	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

20 channels are provided for 2.4GHz

CH	FREQUENCY	CH	FREQUENCY
19	2419 MHz	39	2439 MHz
21	2421 MHz	41	2441 MHz
23	2423 MHz	43	2443 MHz
25	2425 MHz	45	2445 MHz
27	2427 MHz	47	2447 MHz
29	2429 MHz	49	2449 MHz
31	2431 MHz	51	2451 MHz
33	2433 MHz	53	2453 MHz
35	2435 MHz	55	2455 MHz
37	2437 MHz	57	2457 MHz

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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 Investigation has been done on all the possible configurations for searching the worst case.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
2.4GHz	19 to 57	19,41,57	GFSK	-
RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
2.4GHz	19 to 57	19,41,57	GFSK	-

Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 2.4GHz Transmitter for channel Low, Mid and High, the worst case H position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST				
Peak Output Power, 20dB Band Width				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
2.4GHz	19 to 57	19,41,57	GFSK	-
Band Edge				
2.4GHz	19 to 57	19,57	GFSK	-
Frequency Separation				
2.4GHz	19 to 57	0,1,2	GFSK	-
Number of hopping frequency				
2.4GHz	19 to 57	19,57	GFSK	-
Time of Occupancy (Dwell time)				
2.4GHz	19 to 57	41	GFSK	-

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
20dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 51.33 Hz
Number of hopping frequency	+/- 51.33 Hz
Time of Occupancy	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz – 30MHz: +/- 2.87 dB
	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)	9kHz – 30MHz: +/- 2.87 dB
	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 within 150 kHz 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	12/12/2016	12/11/2017
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	08/30/2017	08/29/2018
LISN	Schwarzbeck	NSLK 8127	8127-648	06/18/2017	06/17/2018
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
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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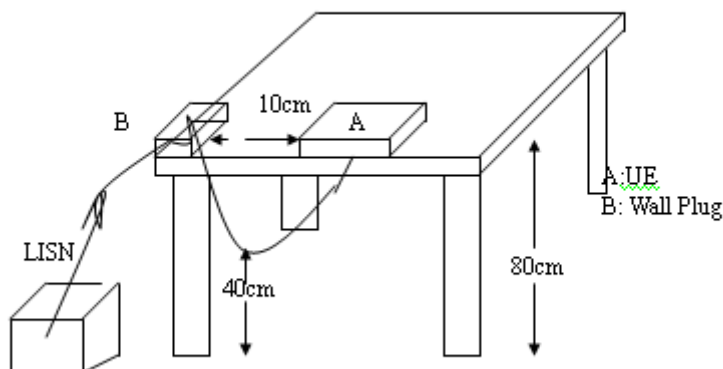
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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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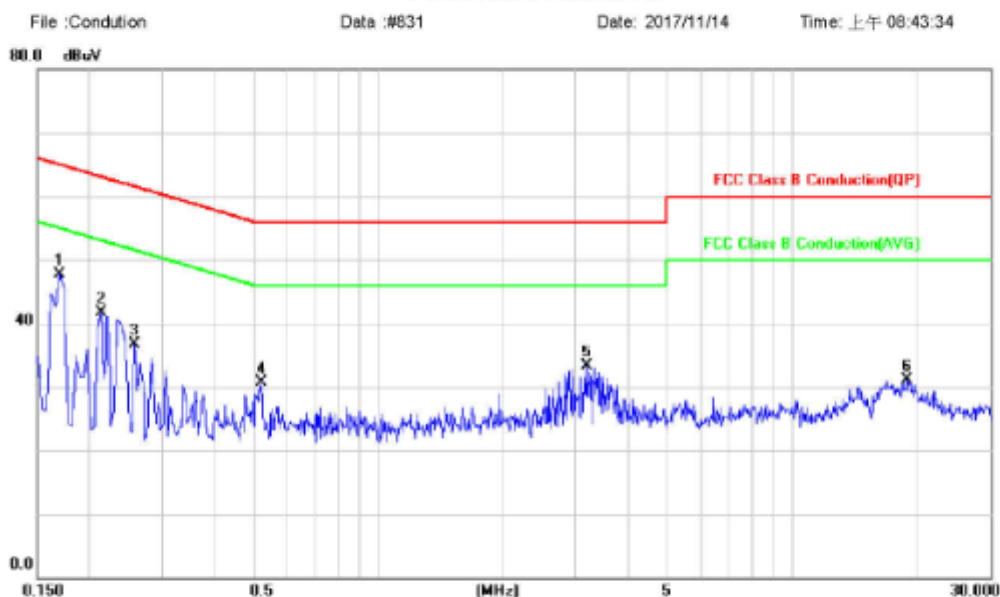
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6.6 Measurement Result

Site : Conduction Room	Phase: L1	Temperature: 23 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 70 %
Mode:		
Note:		

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1700	28.08	19.65	47.73	64.96	-17.23	peak	
2		0.2140	22.06	19.66	41.72	63.05	-21.33	peak	
3		0.2580	17.06	19.74	36.80	61.50	-24.70	peak	
4		0.5220	10.60	20.12	30.72	56.00	-25.28	peak	
5		3.1980	12.85	20.37	33.22	56.00	-22.78	peak	
6		18.9260	10.82	20.20	31.02	60.00	-28.98	peak	

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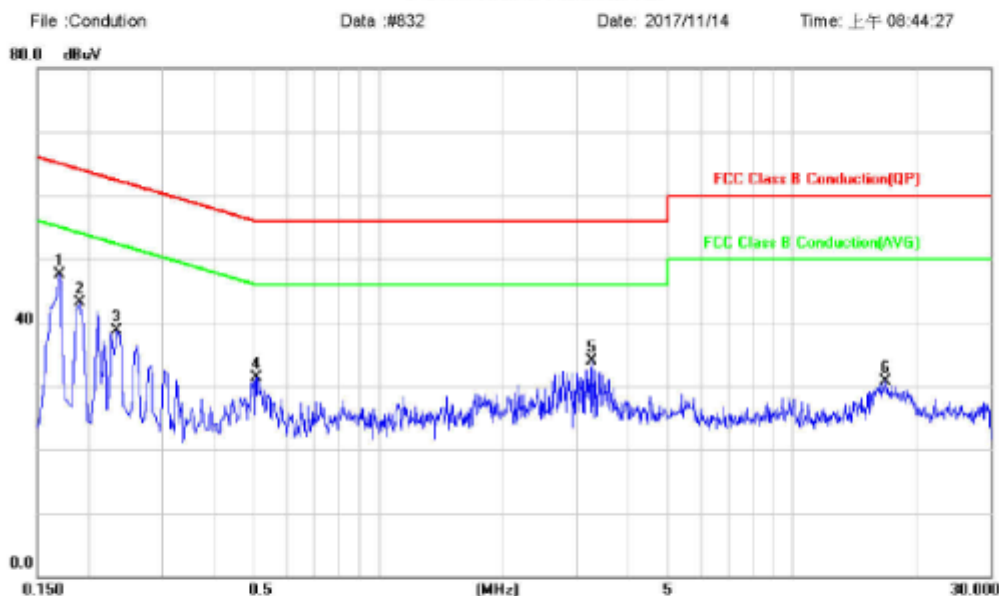
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Site : Conduction Room Phase: **N** Temperature: 23 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 70 %
 Mode:
 Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1700	28.01	19.50	47.51	64.96	-17.45	peak	
2		0.1900	23.69	19.49	43.18	64.04	-20.86	peak	
3		0.2340	19.23	19.55	38.78	62.31	-23.53	peak	
4		0.5100	11.40	19.98	31.38	56.00	-24.62	peak	
5		3.2780	13.75	20.21	33.96	56.00	-22.04	peak	
6		16.8380	10.60	20.02	30.62	60.00	-29.38	peak	

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7 PEAK OUTPUT POWER MEASUREMENT

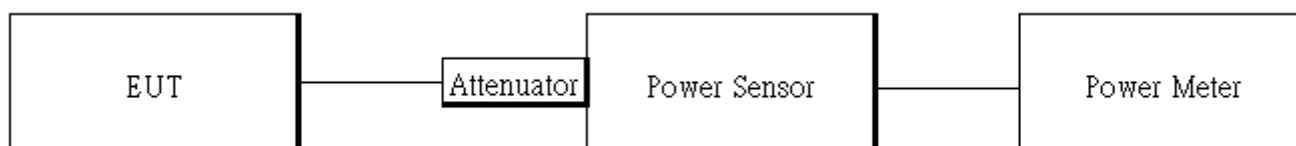
7.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels.

7.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Power Meter	Anritsu	ML2496A	1326001	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315048	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315049	06/23/2017	06/22/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195 C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Splitter	RF-LAMBDA	RFLT2W1G18G	RF35	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

7.3 Test Set-up:



7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW $\geq$ 20dB bandwidth)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

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7.5 Measurement Result

2.4GHz mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
19	2419	17.02	50.350	125
41	2441	16.93	49.317	125
57	2457	17.79	60.117	125

2.4GHz mode (Average):

CH	Freq. (MHz)	Max. Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
19	2419	16.95	49.545	125
41	2441	16.86	48.529	125
57	2457	17.72	59.156	125

***Note: Max. Output include tune up tolerance Power measured by using average detector.**

2.4GHz mode EIRP

Channel	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
19	2419	16.95	2.00	78.524	4000
41	2441	16.86	2.00	76.913	4000
57	2457	17.72	2.00	93.756	4000

*** Note:** EIRP = Average Power + Gain

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8 20dB & 99% BANDWIDTH MEASUREMENT

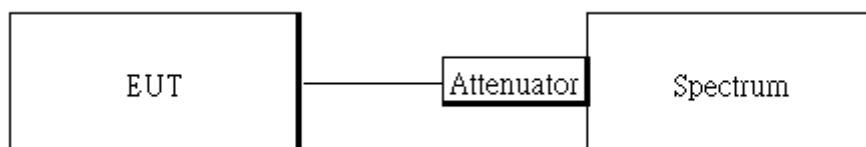
8.1 Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

8.3 Test Set-up



8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
5. Mark the peak frequency and -20dB (upper and lower) frequency
6. Turn on the 99% bandwidth function, max reading.
7. Repeat above procedures until all test default channel is completed

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8.5 Measurement Result

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.917	0.61
Mid	0.798	0.53
High	0.796	0.53

CH	99% Bandwidth (MHz)
Low	2.0699
Mid	1.7026
High	1.4784

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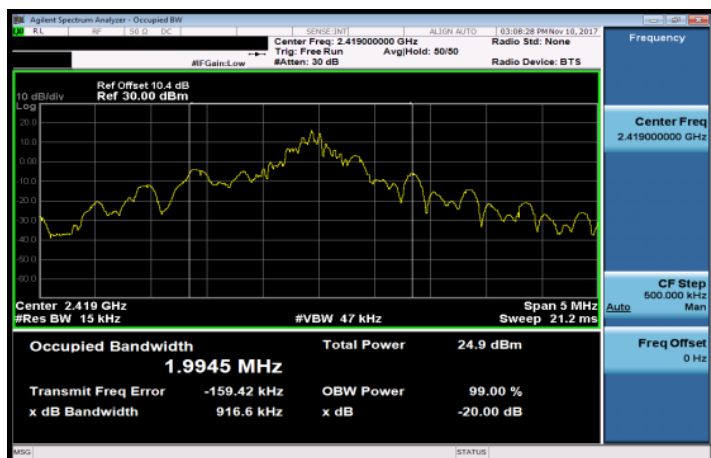
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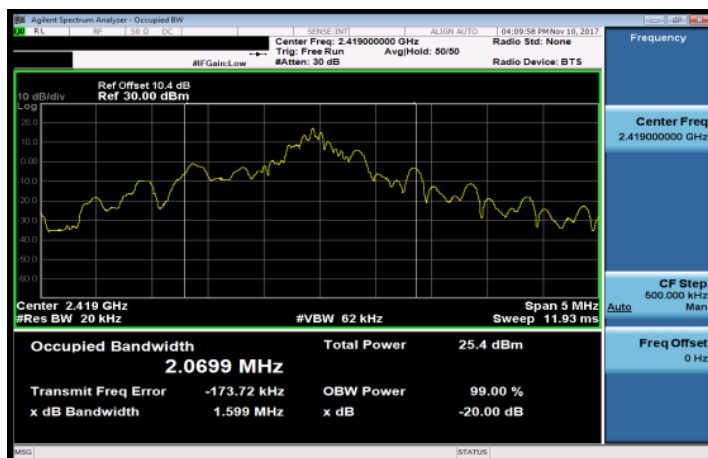
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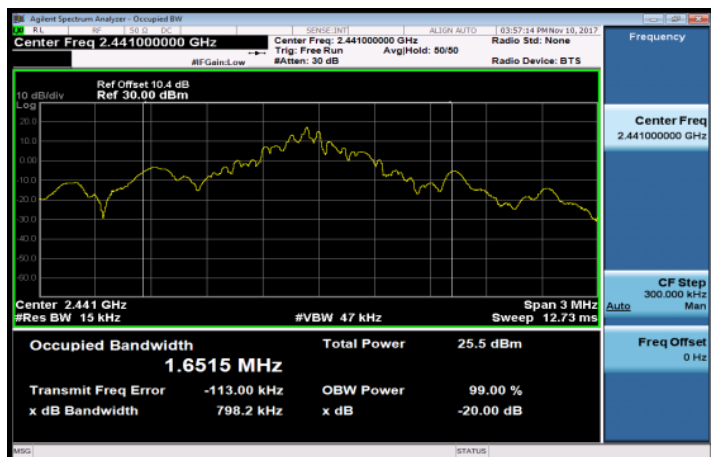
20dB Bandwidth BW CH-Low (GFSK mode)



99% Bandwidth BW CH-Low (GFSK mode)



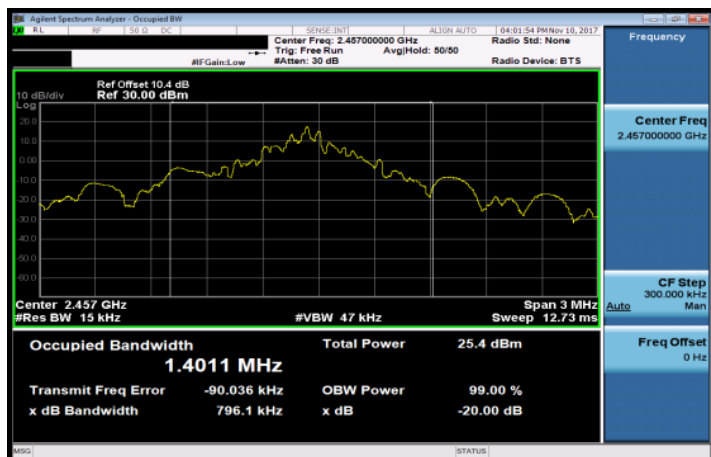
CH-Mid (GFSK mode)



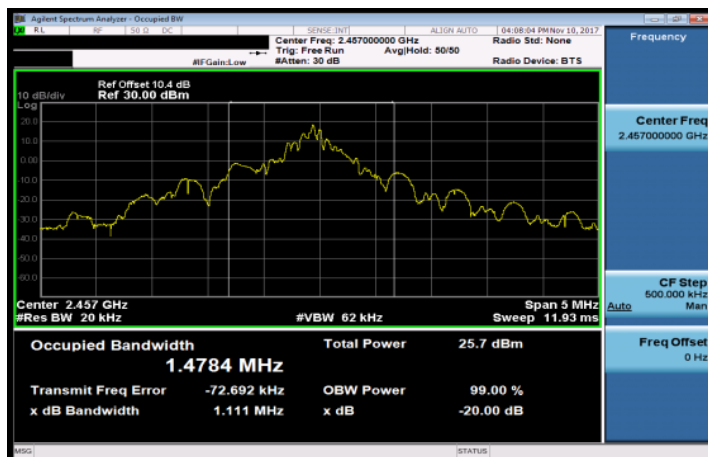
CH-Mid (GFSK mode)



CH-High (GFSK mode)



CH-High (GFSK mode)



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9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

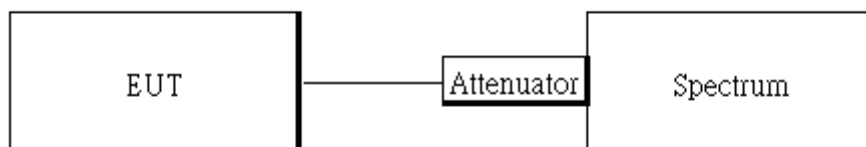
9.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9 limit.

9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

9.3 Test SET-UP



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9.4 Measurement Procedure

Conducted Band Edge:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
7. Repeat above procedures until all frequency measured were complete.

Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Set RBW = 100 kHz & VBW = 300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

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	

9.5 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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Hopping mode Band Edge CH-Low



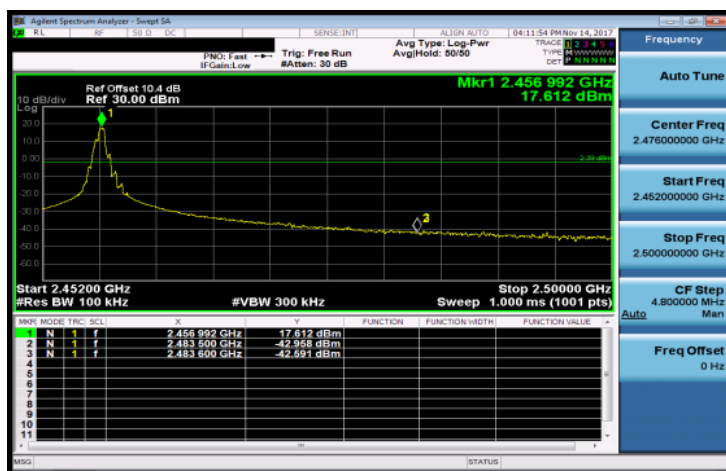
Non-Hopping Band Edge CH-Low



Band Edge CH-High



Band Edge CH-High



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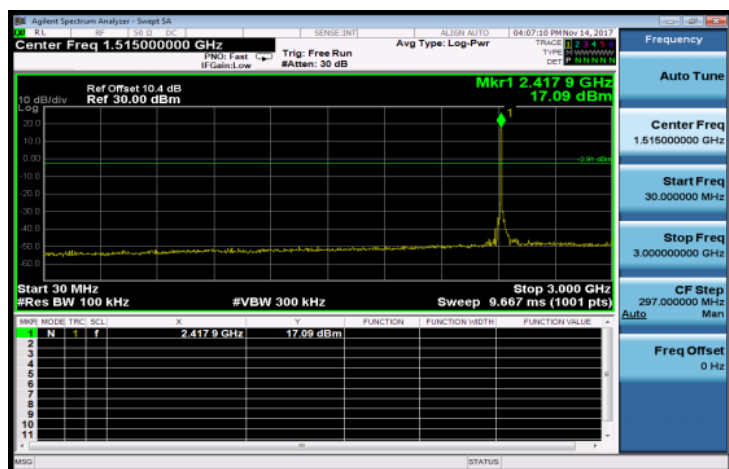
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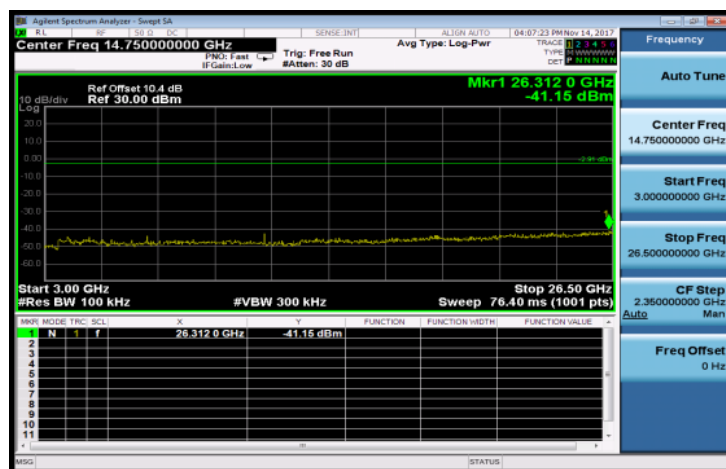
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Conducted Spurious Emission Measurement Result

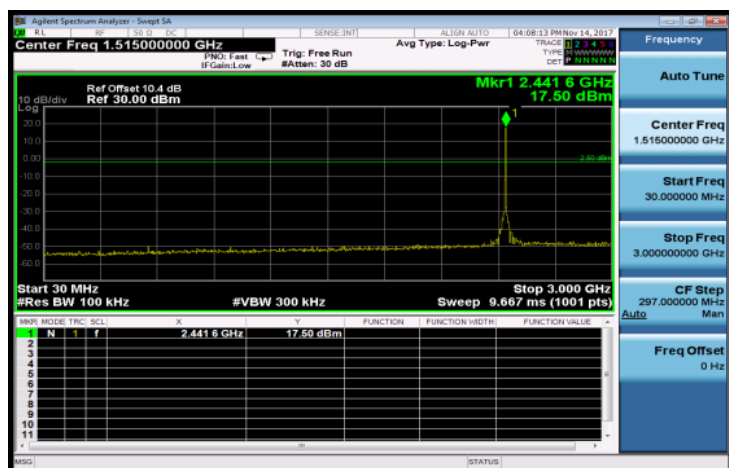
Ch Low 30MHz – 3GHz



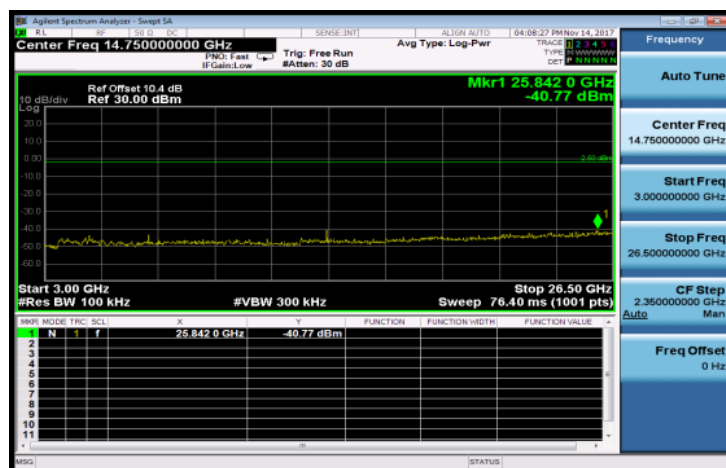
Ch Low 3GHz – 26.5GHz



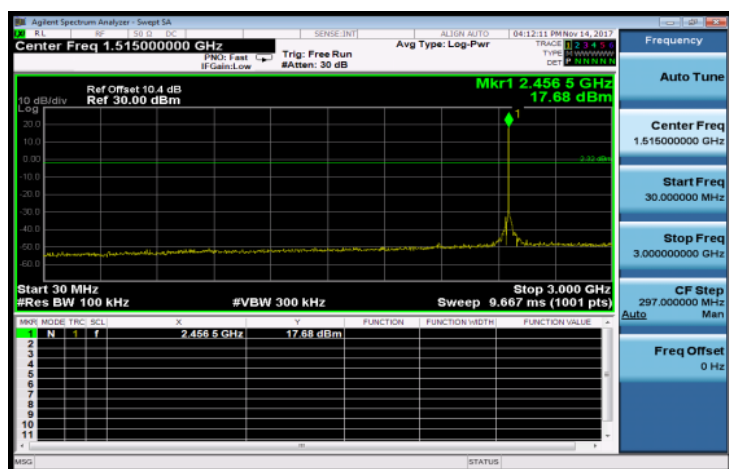
Ch Mid 30MHz – 3GHz



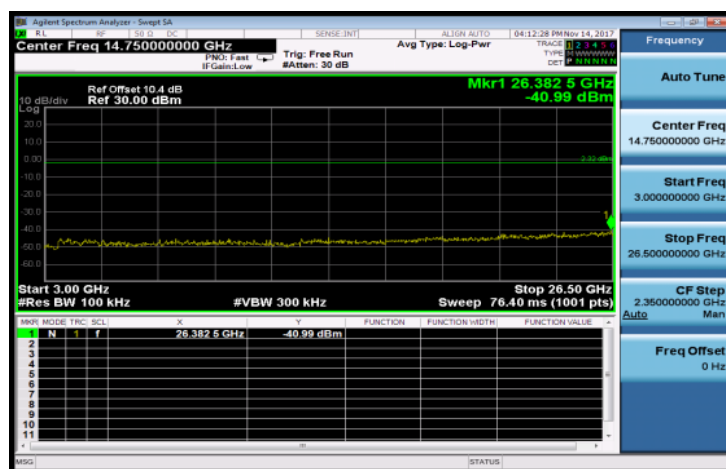
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, must also comply with the §15.209 & RSS-Gen §8.10 Table 6 limit.

And according to §15.33(a) (1) & RSS-Gen §8.9 Table 4 & 5, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

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10.2 Measurement Equipment Used

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESU 40	100363	04/18/2017	04/17/2018
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2016	12/22/2017
Broadband Antenna	TESEQ	CBL 6112D	35240	11/03/2017	11/02/2018
Horn Antenna	ETS-Lindgren	3117	00143272	12/15/2016	12/16/2017
Horn Antenna	Schwarzbeck	BBHA9170	185	08/01/2017	07/31/2018
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2016	12/11/2017
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-18	10204	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-26	100780	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF27	12/12/2016	12/11/2017
Site NSA	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
Site VSWR	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2017	05/03/2018
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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

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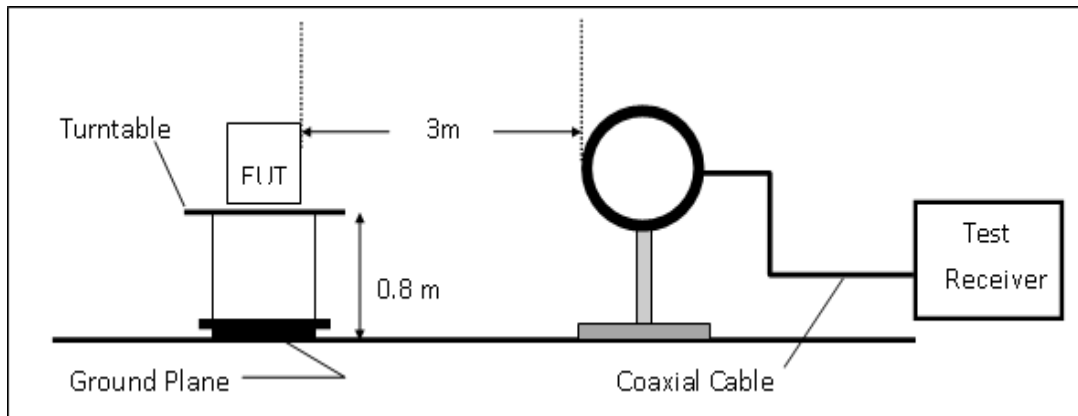
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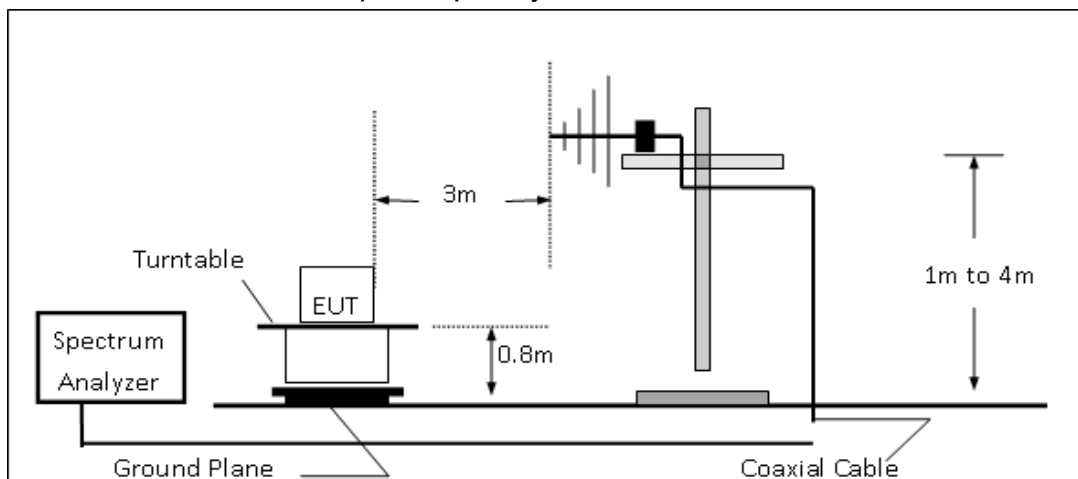
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10.3 Test SET-UP

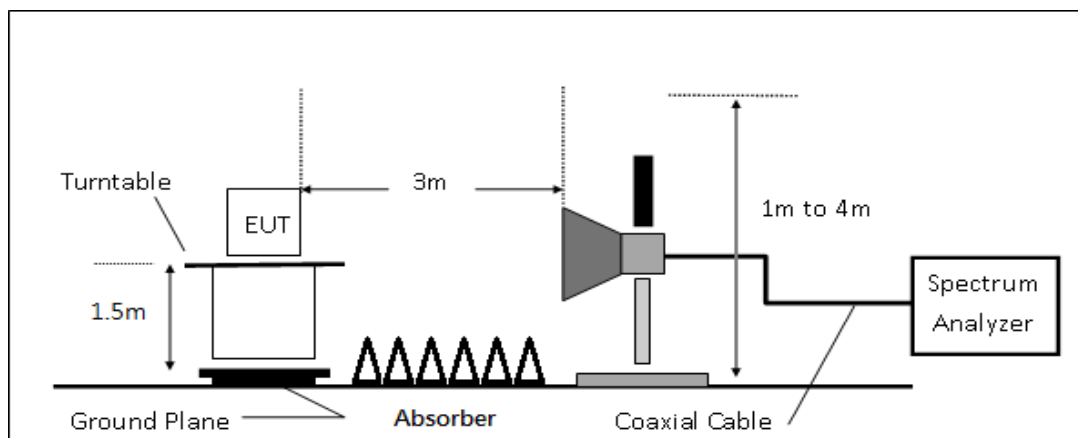
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(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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10.4 Measurement Procedure

Radiated Emission

1. The testing follows ANSI C63.10 Measurement Guidelines.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Use the follow spectrum analyzer setting:
 - (1) Span = wide enough to fully capture the emission being measured
 - (2) RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, VBW $\geq$ RBW, Sweep = auto, Detector function = peak, Trace = max hold
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c)
 Duty Cycle = On time/100 milliseconds

$$\text{On time} = N1 * L1 = N2 * L2 + \dots + N(n-1) * L(n-1) + N(n) * L(n)$$
 Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
 Average Emission Level = Peak Emission Level + $20 * \log(\text{duty Cycle})$
6. When 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.
7. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
8. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
9. Repeat above procedures until all frequency of the interest measured were complete.

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10.5 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	

The limit of the emission level is expressed in dBuV/m, which converts $20 \cdot \log(\mu\text{V/m})$

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

Factor(dB) = Antenna Factor(dBuV/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.

10.6 Test Results of Radiated Spurious Emissions form 9 KHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

10.7 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Note: There is a comparison data of both open-field test site and semi-Anechoic, and test result came out very similar.

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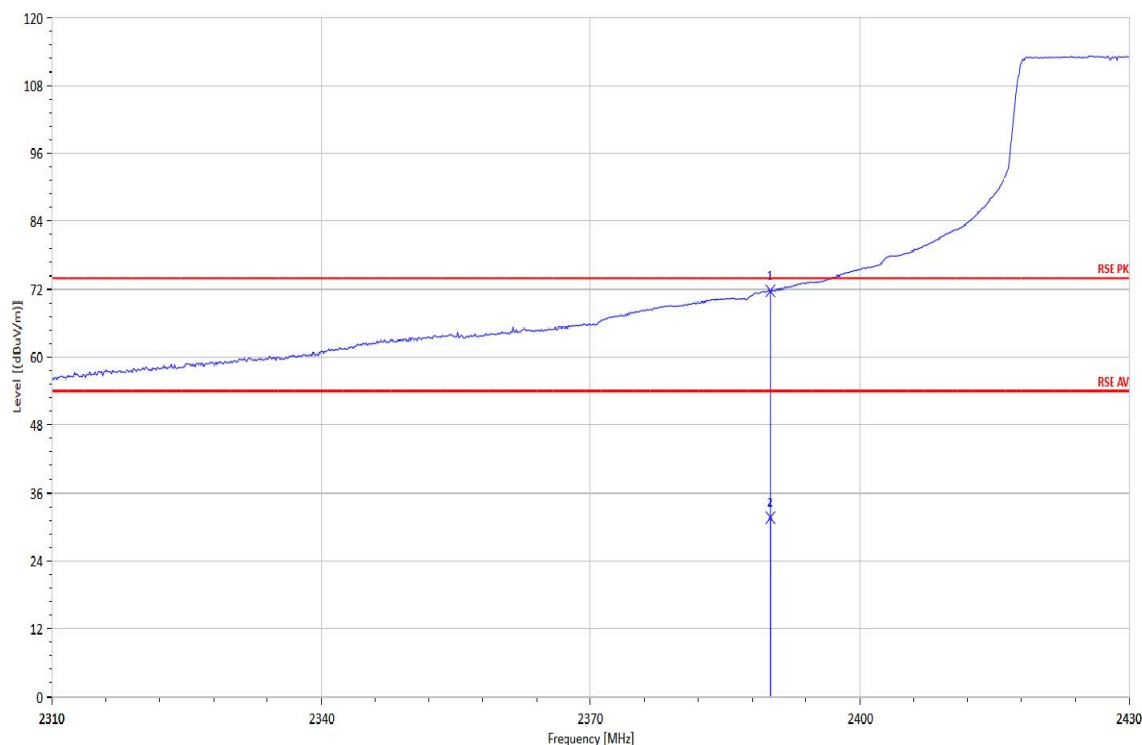
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Radiated Band Edge Measurement Result: (Hopping Mode)

Operation Mode :	2.4G Hopping	Test Date :	2017/11/14
Fundamental Frequency :	2419 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	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	dB	dBμV/m	dBμV/m	dB
2390.00	E	Peak	70.74	0.92	71.66	74	-2.34
2390.00	E	Average	30.72	0.92	31.64	54	-22.36

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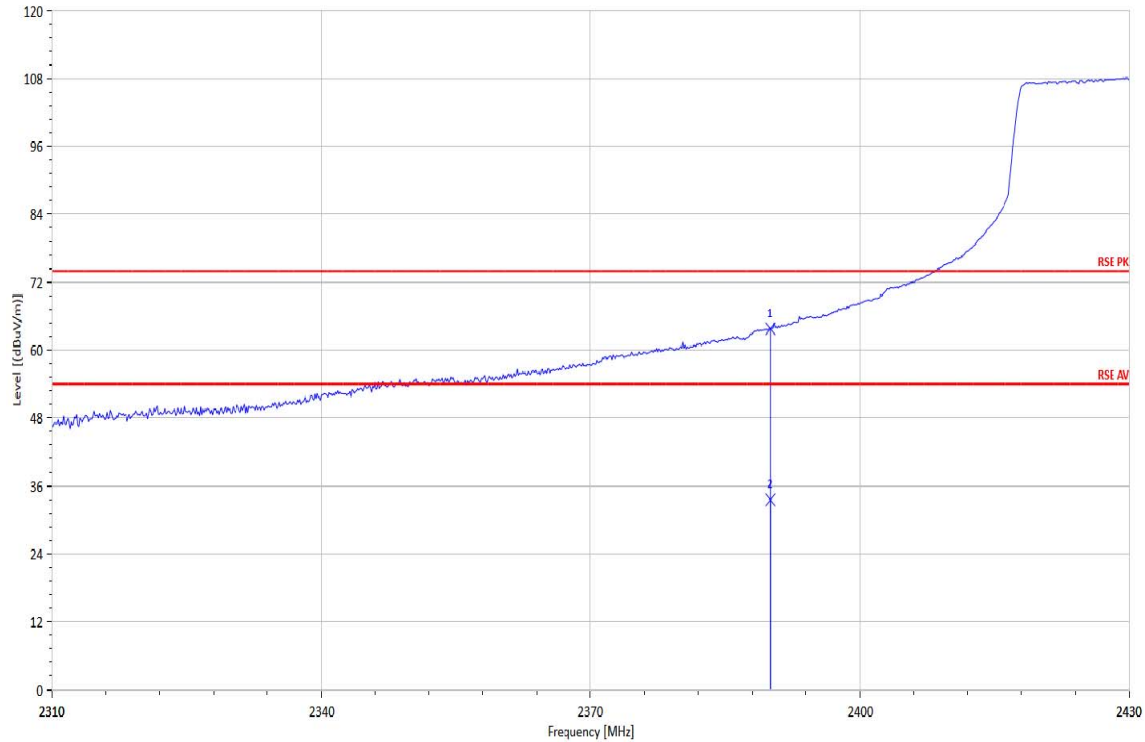
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Operation Mode :	2.4G Hopping	Test Date :	2017/11/14
Fundamental Frequency :	2419 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Peak	62.85	0.92	63.78	74	-10.22
2390.00	E	Average	32.62	0.92	33.54	54	-20.46

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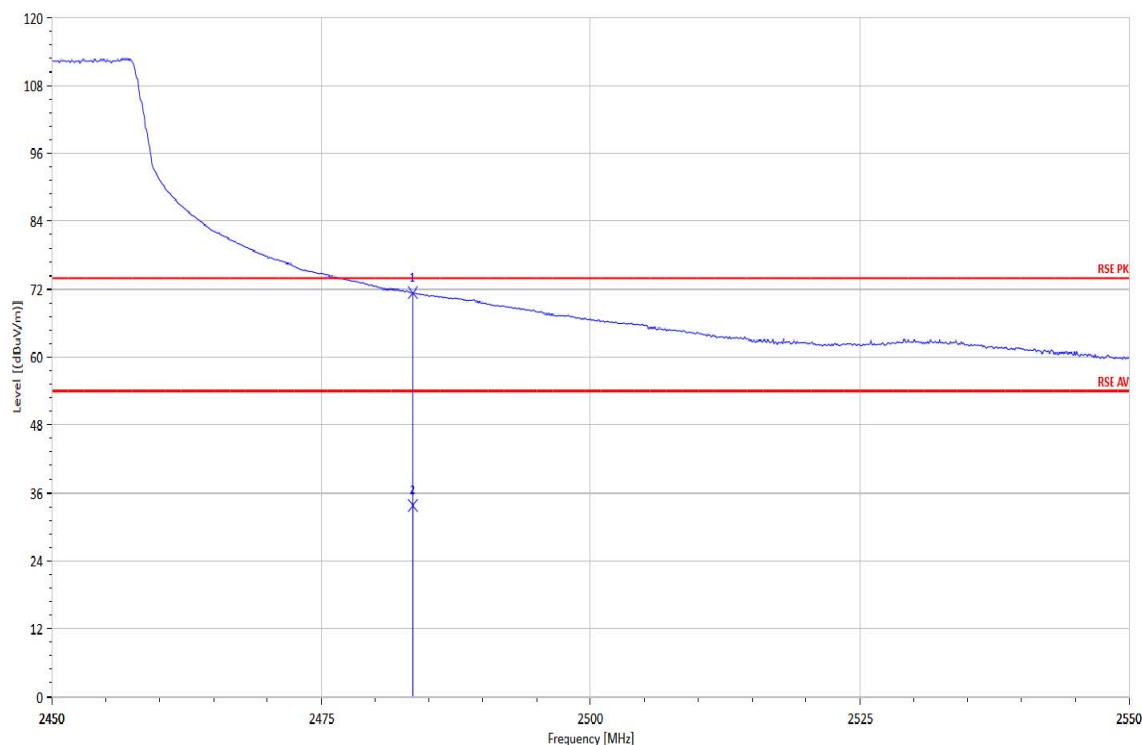
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Operation Mode : 2.4G Hopping Test Date : 2017/11/14
 Fundamental Frequency : 2457 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH HIGH Test Engineer : Enzo
 EUT Pol. : H Measurement Antenna Pol. : Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Peak	70.18	1.16	71.34	74	-2.66
2483.50	E	Average	32.63	1.16	33.79	54	-20.21

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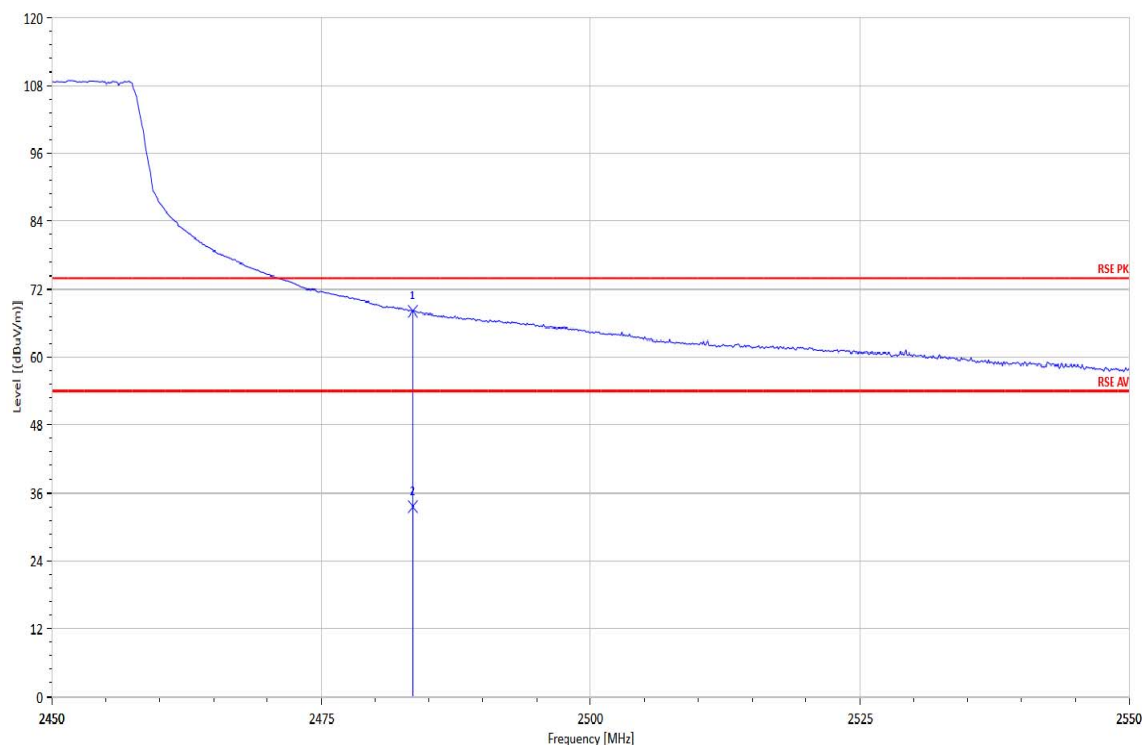
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Operation Mode : 2.4G Hopping Test Date : 2017/11/14
 Fundamental Frequency : 2457 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH HIGH Test Engineer : Enzo
 EUT Pol. : H Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Peak	66.96	1.16	68.12	74	-5.88
2483.50	E	Average	32.41	1.16	33.57	54	-20.43

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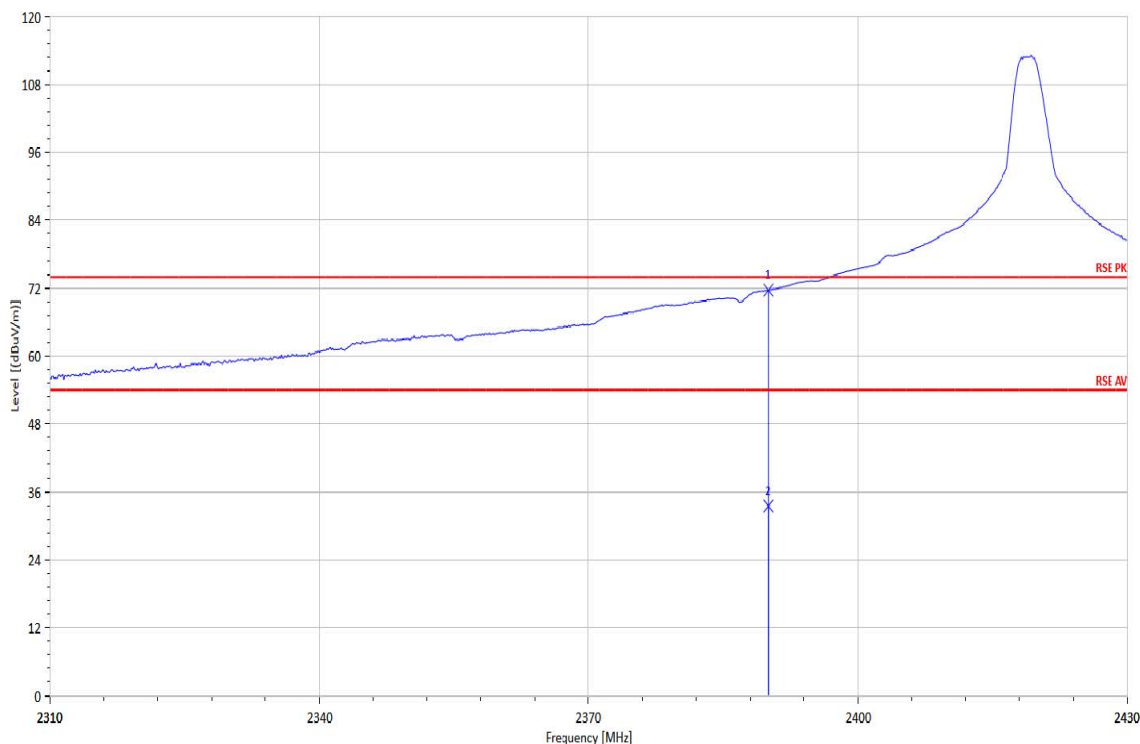
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Radiated Emission – Band Edge (Non-Hopping Mode):

Operation Mode :	2.4G	Test Date :	2017/11/14
Fundamental Frequency :	2419 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.00	E	Peak	70.69	0.92	71.61	74	-2.39
2390.00	E	Average	32.58	0.92	33.50	54	-20.50

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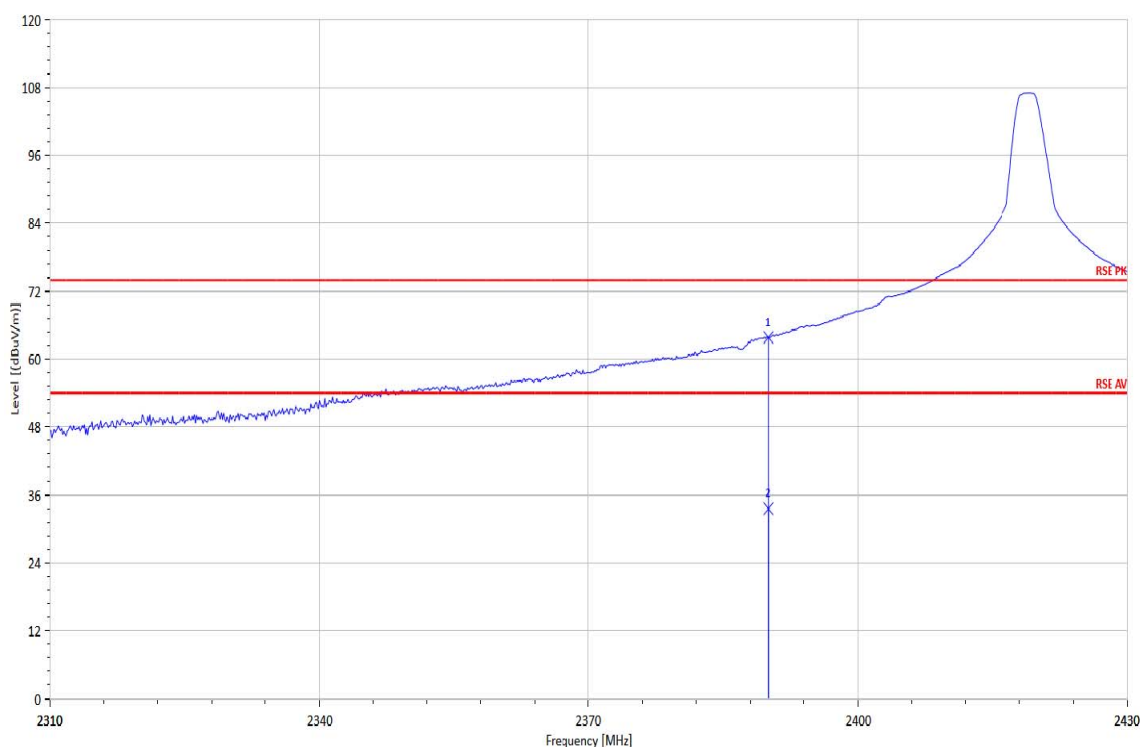
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Operation Mode :	2.4G	Test Date :	2017/11/14
Fundamental Frequency :	2419 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH LOW	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2390.00	E	Peak	62.92	0.92	63.84	74	-10.16
2390.00	E	Average	32.64	0.92	33.56	54	-20.44

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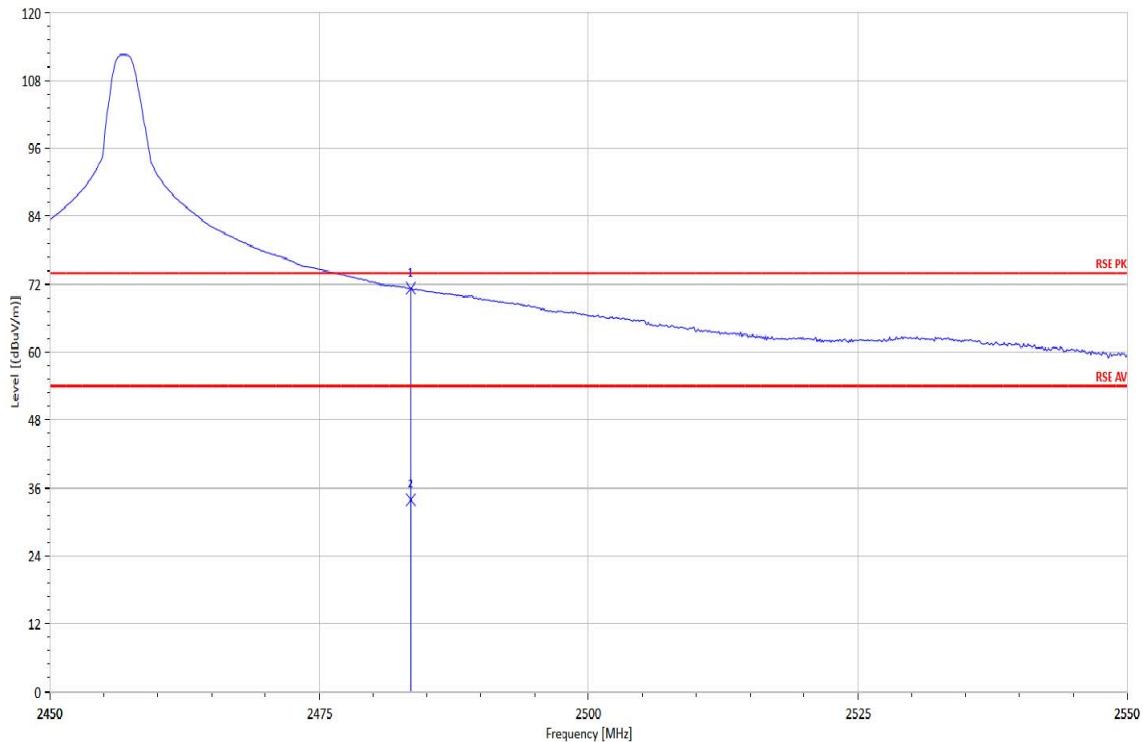
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Operation Mode :	2.4G	Test Date :	2017/11/14
Fundamental Frequency :	2457 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH HIGH	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



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
2483.50	E	Peak	70.09	1.16	71.25	74	-2.75
2483.50	E	Average	32.75	1.16	33.91	54	-20.09

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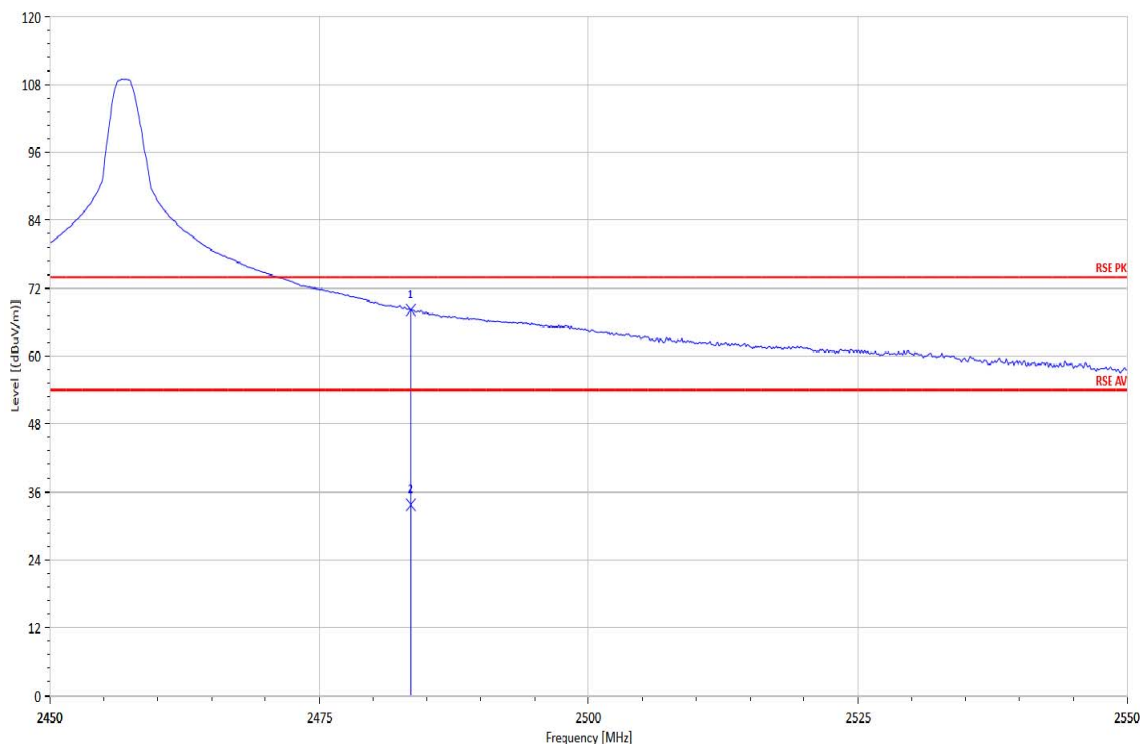
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Operation Mode :	2.4G	Test Date :	2017/11/14
Fundamental Frequency :	2457 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	BE CH HIGH	Test Engineer :	Enzo
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



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
2483.50	E	Peak	67.01	1.16	68.17	74	-5.83
2483.50	E	Average	32.58	1.16	33.74	54	-20.26

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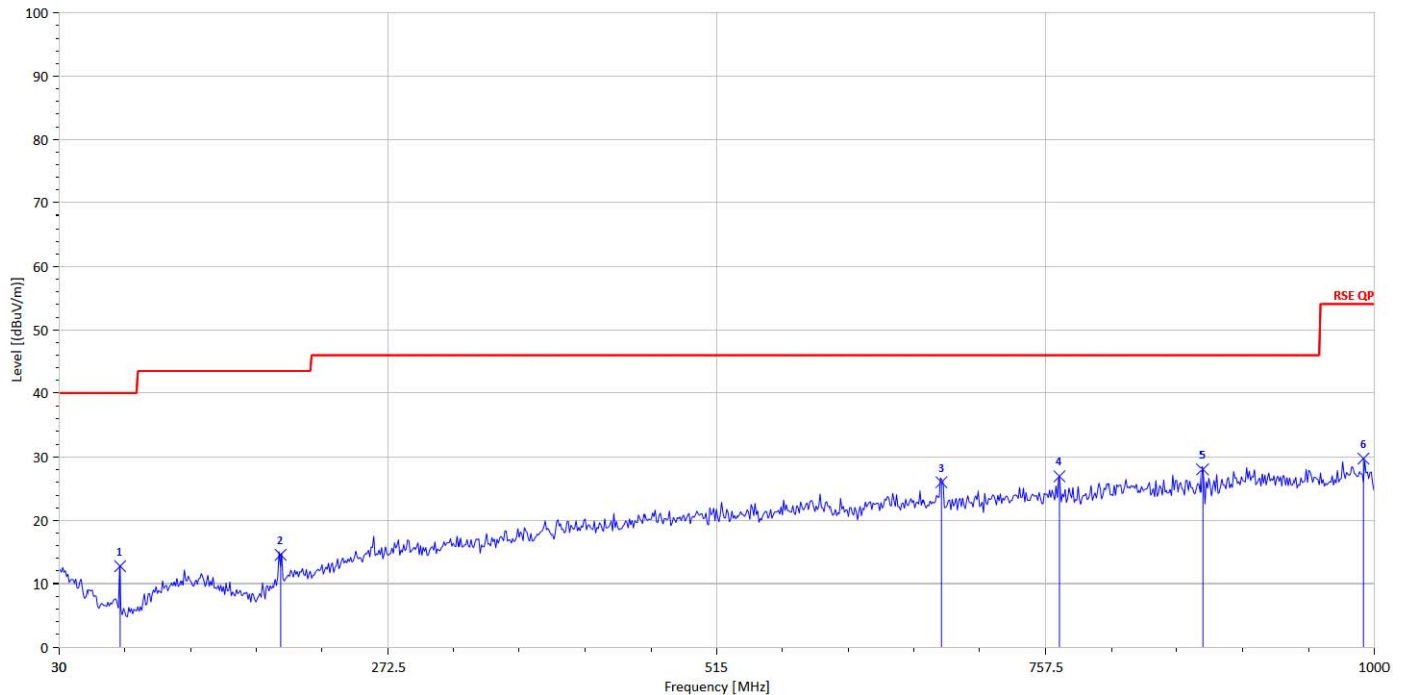
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Radiated Spurious Emission Measurement Result:

For Frequency form 30MHz to 1000MHz

Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2419 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
75.02	S	Peak	34.14	-21.41	12.73	40	-27.27
193.19	S	Peak	32.56	-18.02	14.54	43.5	-28.96
680.65	S	Peak	31.47	-5.53	25.94	46	-20.06
767.88	S	Peak	31.18	-4.29	26.89	46	-19.11
873.39	S	Peak	30.69	-2.70	27.99	46	-18.01
992.26	S	Peak	30.45	-0.75	29.71	54	-24.29

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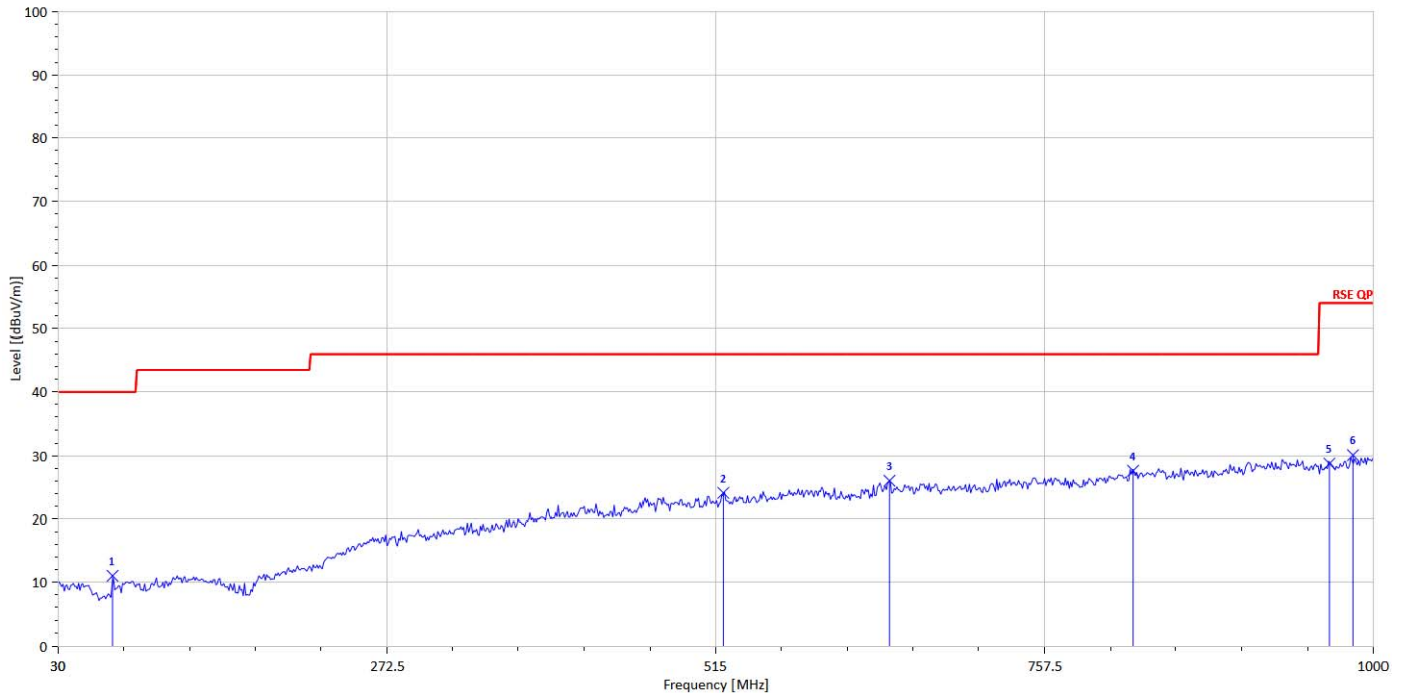
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Operation Mode : 2.4G Test Date : 2017/11/10
 Fundamental Frequency : 2419 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Low Test Engineer : Ashton
 EUT Pol. : H Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
70.09	S	Peak	32.78	-21.75	11.03	40	-28.97
520.98	S	Peak	31.43	-7.34	24.10	46	-21.90
643.37	S	Peak	31.11	-5.10	26.01	46	-19.99
822.74	S	Peak	30.23	-2.63	27.60	46	-18.40
967.64	S	Peak	30.24	-1.50	28.74	54	-25.26
985.23	S	Peak	30.83	-0.74	30.09	54	-23.91

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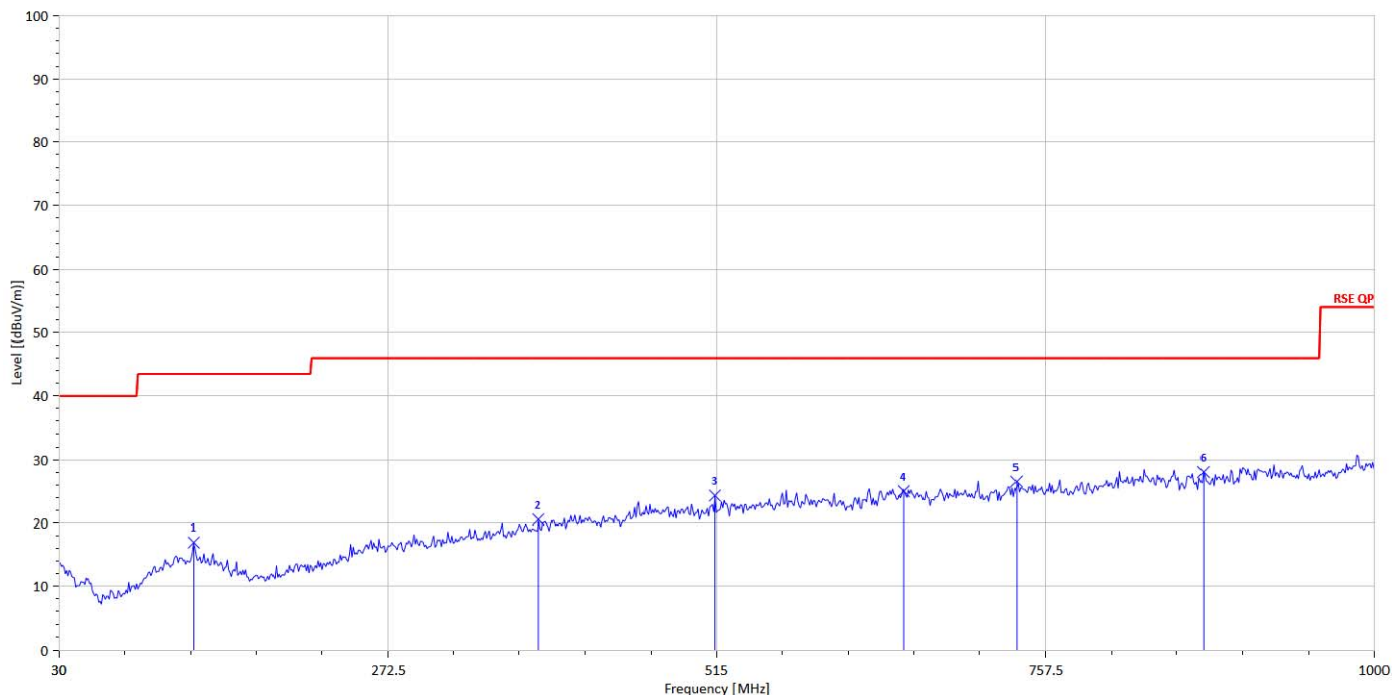
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Operation Mode : 2.4G Test Date : 2017/11/10
 Fundamental Frequency : 2441 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Mid Test Engineer : Ashton
 EUT Pol. : H Measurement Antenna Pol. : Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
129.18	S	Peak	32.58	-15.63	16.94	43.5	-26.56
383.81	S	Peak	30.82	-10.28	20.53	46	-25.47
513.94	S	Peak	31.98	-7.67	24.31	46	-21.69
653.22	S	Peak	30.25	-5.25	25.00	46	-21.00
736.22	S	Peak	30.96	-4.44	26.52	46	-19.48
874.09	S	Peak	30.77	-2.73	28.04	46	-17.96

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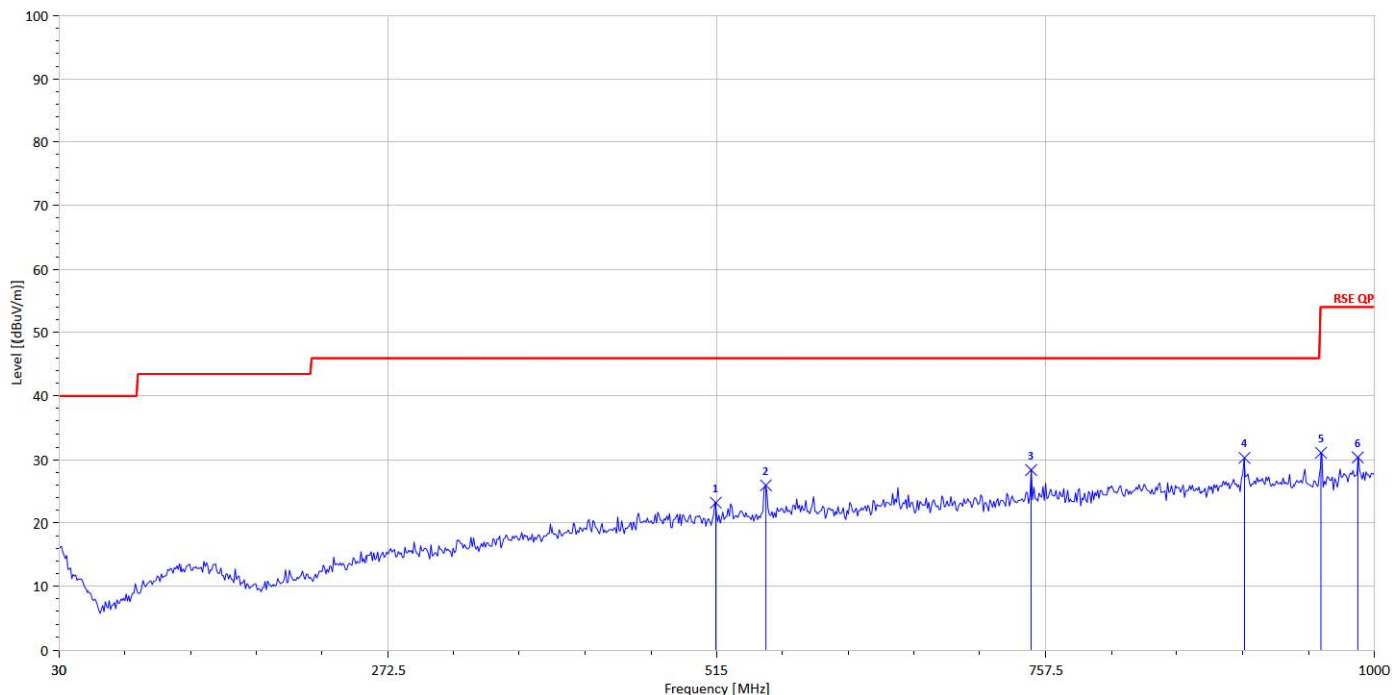
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f (886-2) 2298-0488

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Operation Mode : 2.4G Test Date : 2017/11/10
 Fundamental Frequency : 2441 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Mid Test Engineer : Ashton
 EUT Pol. : H Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
514.65	S	Peak	30.78	-7.62	23.16	46	-22.84
551.23	S	Peak	32.65	-6.73	25.92	46	-20.08
746.77	S	Peak	32.60	-4.24	28.36	46	-17.64
904.34	S	Peak	32.04	-1.75	30.29	46	-15.71
960.61	S	Peak	33.34	-2.24	31.10	54	-22.90
988.04	S	Peak	30.95	-0.57	30.38	54	-23.62

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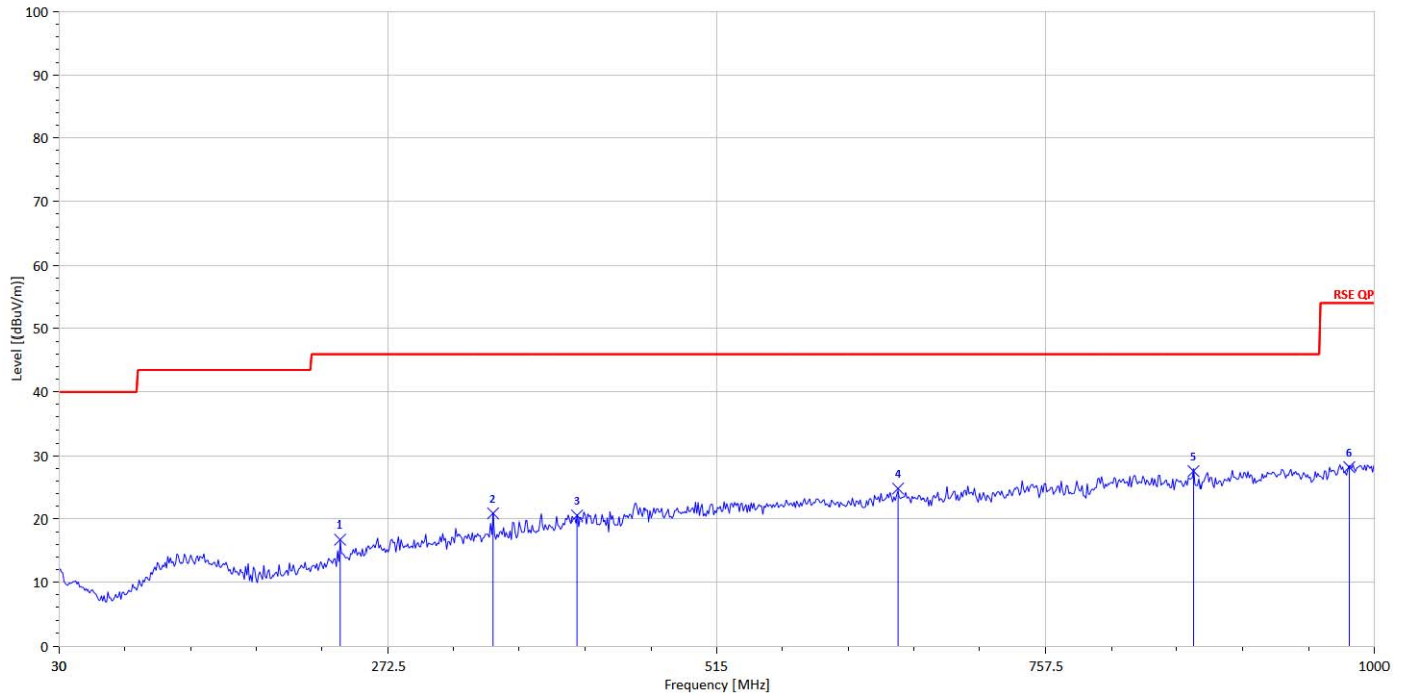
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Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2457 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
237.51	S	Peak	32.32	-15.54	16.78	46	-29.22
350.05	S	Peak	32.38	-11.55	20.83	46	-25.17
411.95	S	Peak	29.81	-9.33	20.48	46	-25.52
649.00	S	Peak	29.86	-5.09	24.77	46	-21.23
867.06	S	Peak	30.57	-3.02	27.55	46	-18.45
981.71	S	Peak	29.11	-0.93	28.17	54	-25.83

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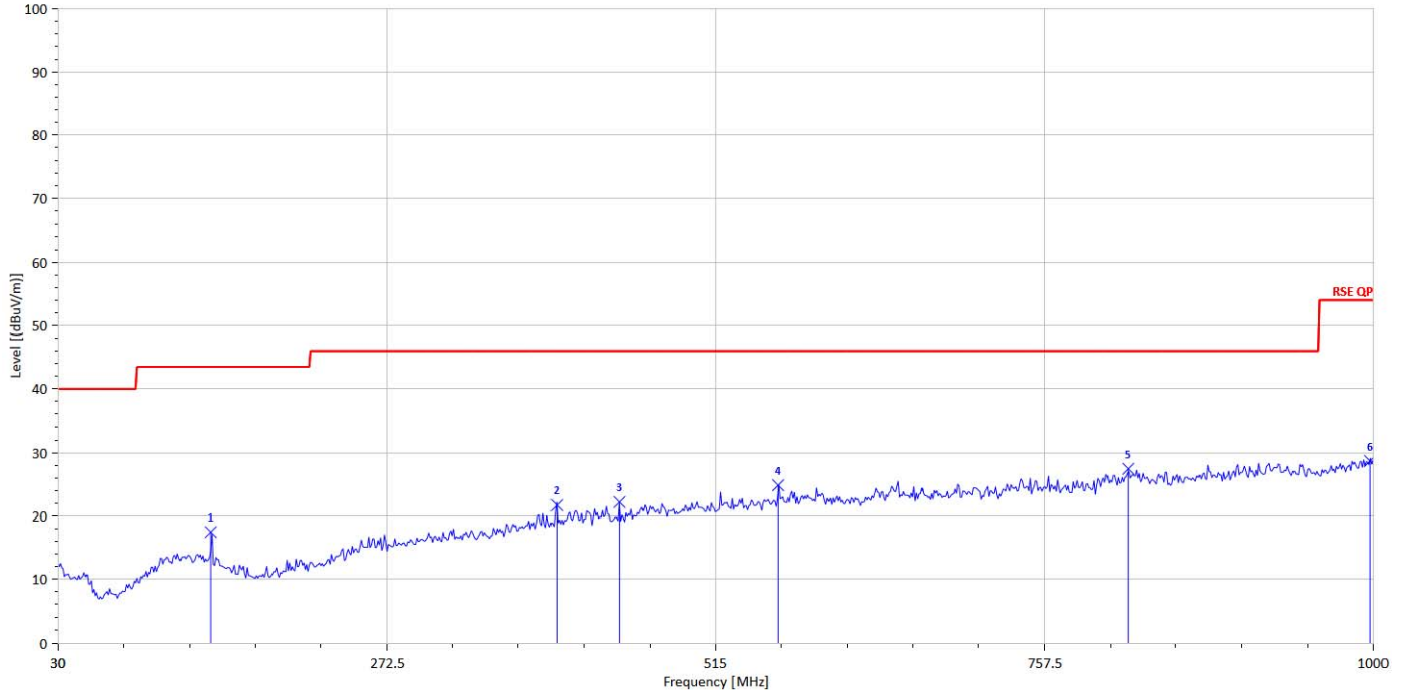
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Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2457 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
142.55	S	Peak	33.74	-16.26	17.48	43.5	-26.02
397.88	S	Peak	31.42	-9.74	21.69	46	-24.31
444.31	S	Peak	31.49	-9.32	22.17	46	-23.83
561.07	S	Peak	31.37	-6.53	24.84	46	-21.16
819.22	S	Peak	30.44	-2.99	27.45	46	-18.55
997.89	S	Peak	29.36	-0.67	28.69	54	-25.31

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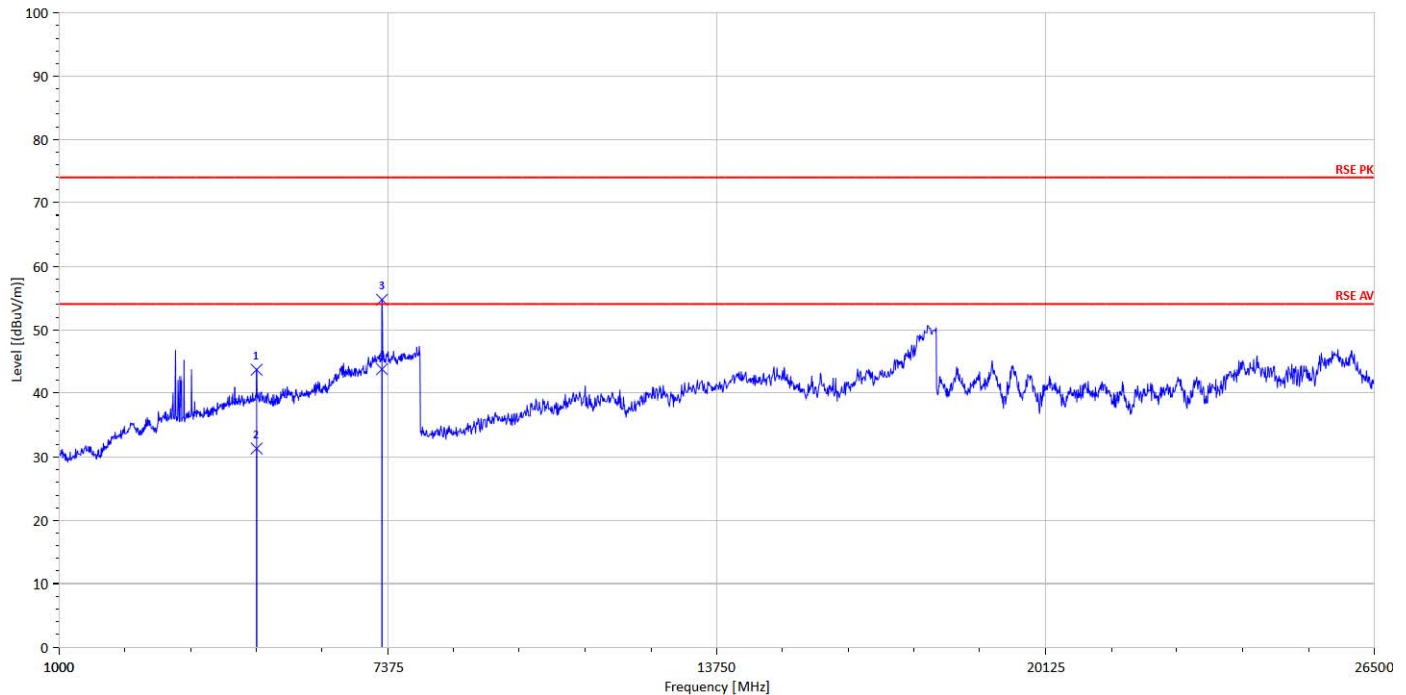
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Radiated Spurious Emission Measurement Result:

For Frequency above 1 GHz

Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2419 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4838.00	H	Peak	35.35	7.54	42.89	74	-31.11
4838.00	H	Average	22.95	7.54	30.49	54	-23.51
7257.00	H	Peak	38.59	15.25	53.84	74	-20.16
7257.00	H	Average	27.68	15.25	42.93	54	-11.07

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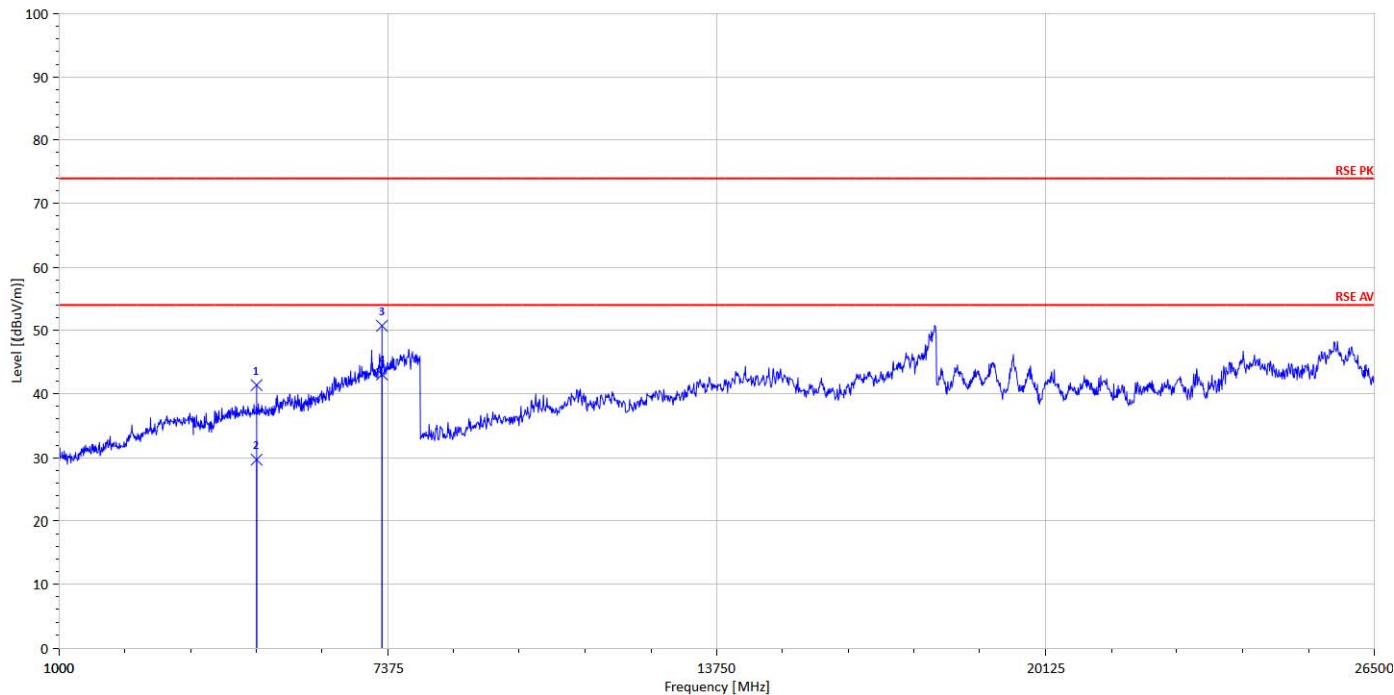
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f (886-2) 2298-0488

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Operation Mode : 2.4G Test Date : 2017/11/10
 Fundamental Frequency : 2419 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Low Test Engineer : Ashton
 EUT Pol. : H Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4838.00	H	Peak	33.86	7.54	41.40	74	-32.60
4838.00	H	Average	22.15	7.54	29.69	54	-24.31
7257.00	H	Peak	35.45	15.25	50.70	74	-23.30
7257.00	H	Average	27.86	15.25	43.11	54	-10.89

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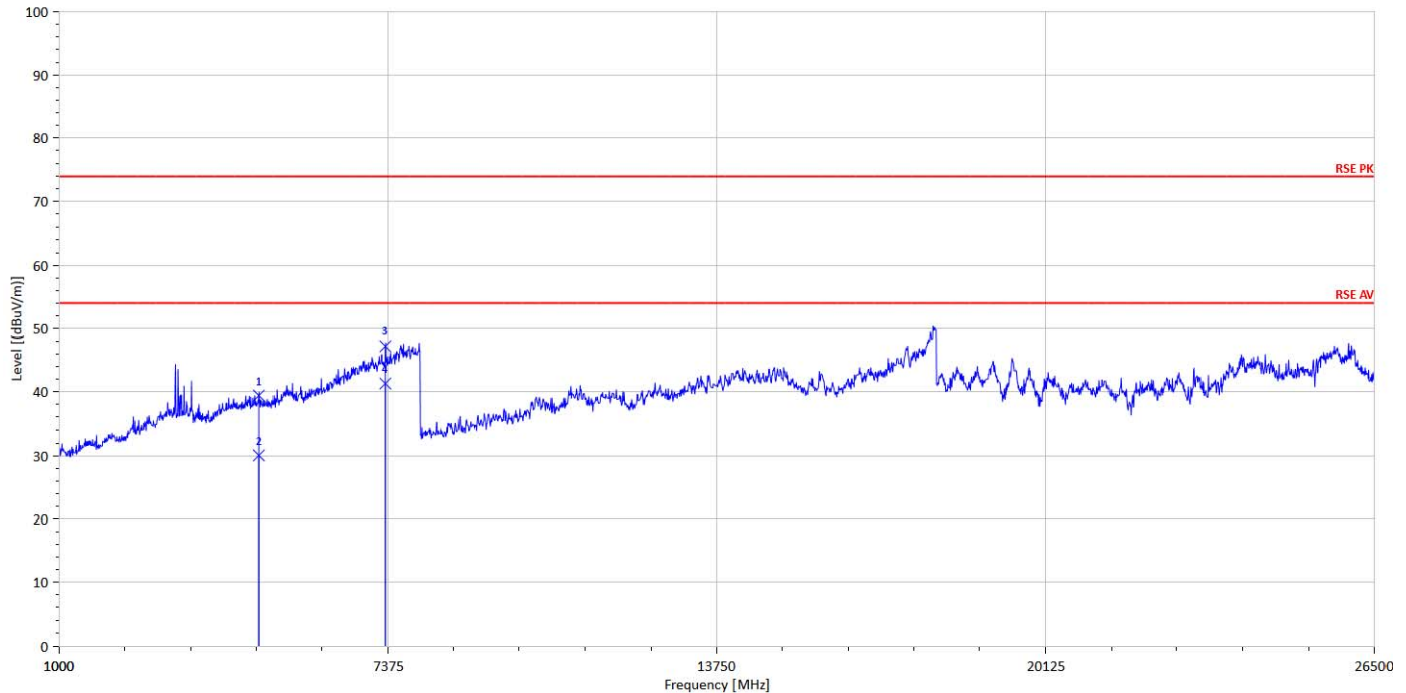
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Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2441 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4882.00	H	Peak	31.74	7.70	39.43	74	-34.57
4882.00	H	Average	22.35	7.70	30.05	54	-23.95
7323.00	H	Peak	32.46	14.79	47.25	74	-26.75
7323.00	H	Average	26.54	14.79	41.33	54	-12.67

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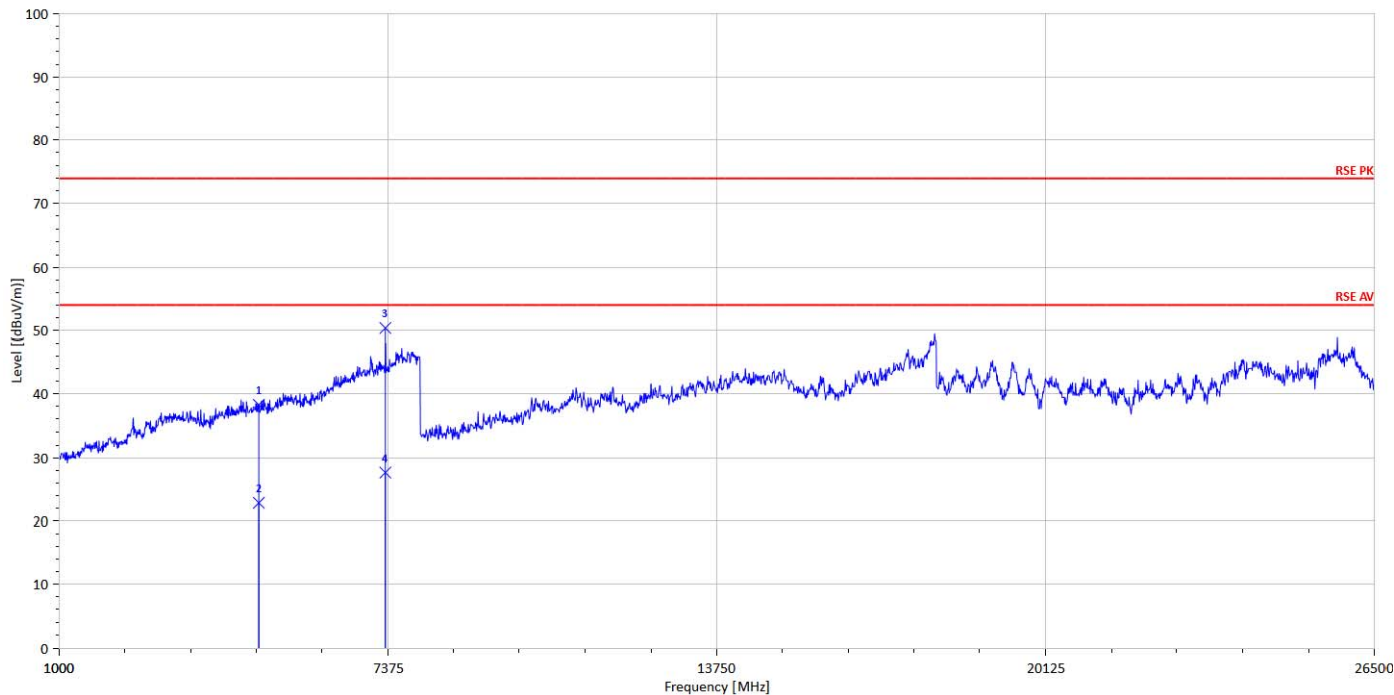
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Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2441 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4882.00	H	Peak	30.56	7.70	38.26	74	-35.74
4882.00	H	Average	22.82	7.70	30.52	54	-23.48
7323.00	H	Peak	35.57	14.79	50.36	74	-23.64
7323.00	H	Average	27.64	14.79	42.43	54	-11.57

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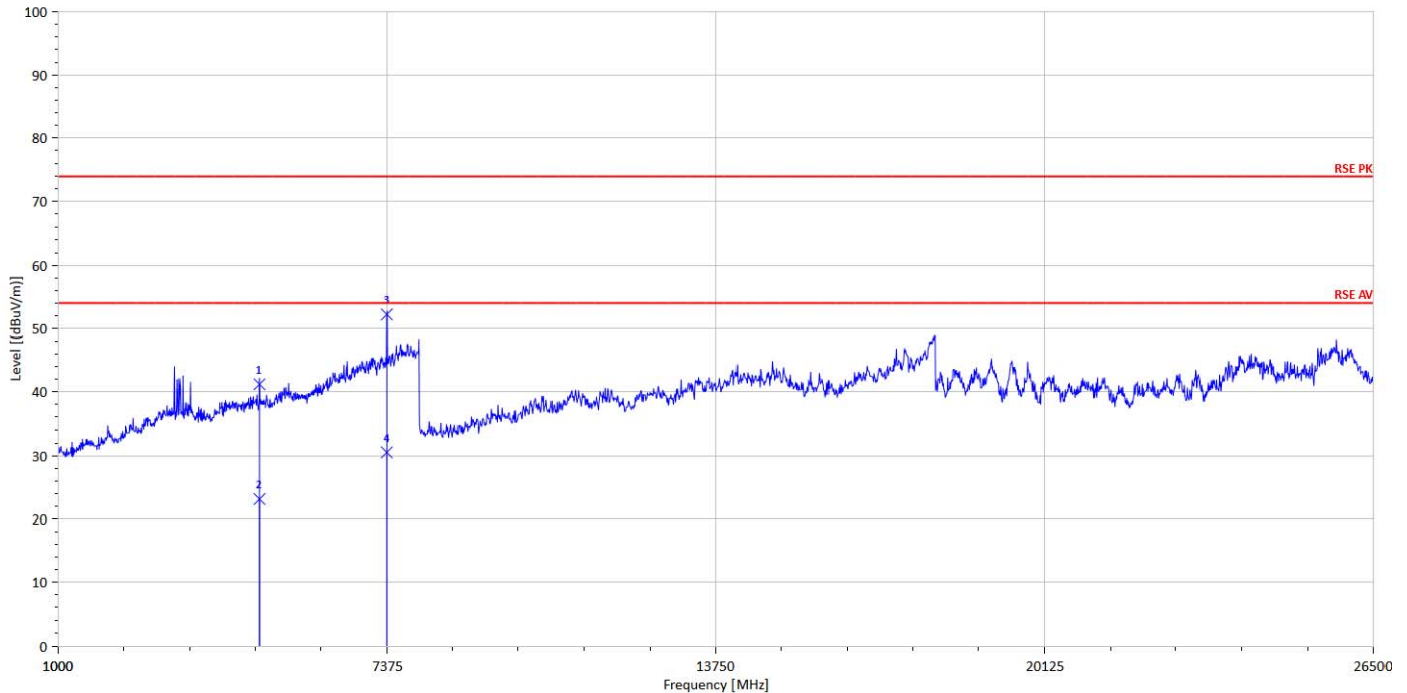
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Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2457 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4914.00	H	Peak	33.57	7.65	41.22	74	-32.78
4914.00	H	Average	23.12	7.65	30.77	54	-23.23
7371.00	H	Peak	37.19	15.01	52.20	74	-21.80
7371.00	H	Average	30.54	15.01	45.55	54	-8.45

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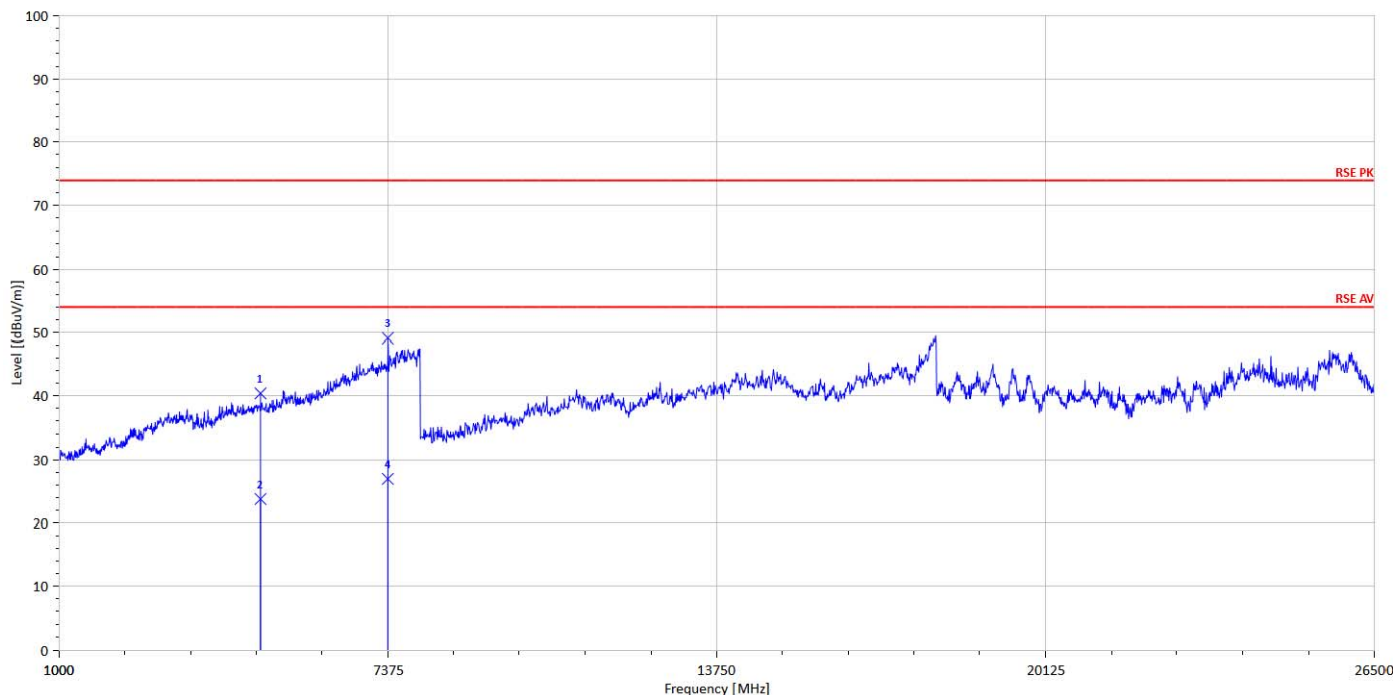
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Operation Mode :	2.4G	Test Date :	2017/11/10
Fundamental Frequency :	2457 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	H	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4914.00	H	Peak	32.76	7.65	40.41	74	-33.59
4914.00	H	Average	23.75	7.65	31.40	54	-22.60
7371.00	H	Peak	34.09	15.01	49.10	74	-24.90
7371.00	H	Average	26.95	15.01	41.96	54	-12.04

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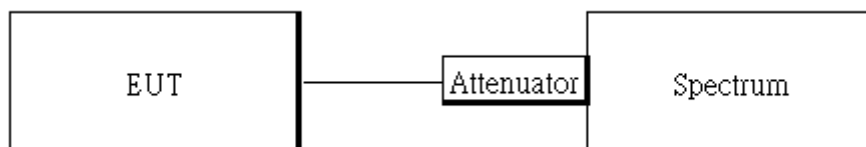
11.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

11.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A19 5C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

11.3 Test Set-up



11.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = middle of hopping channel.
5. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
6. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

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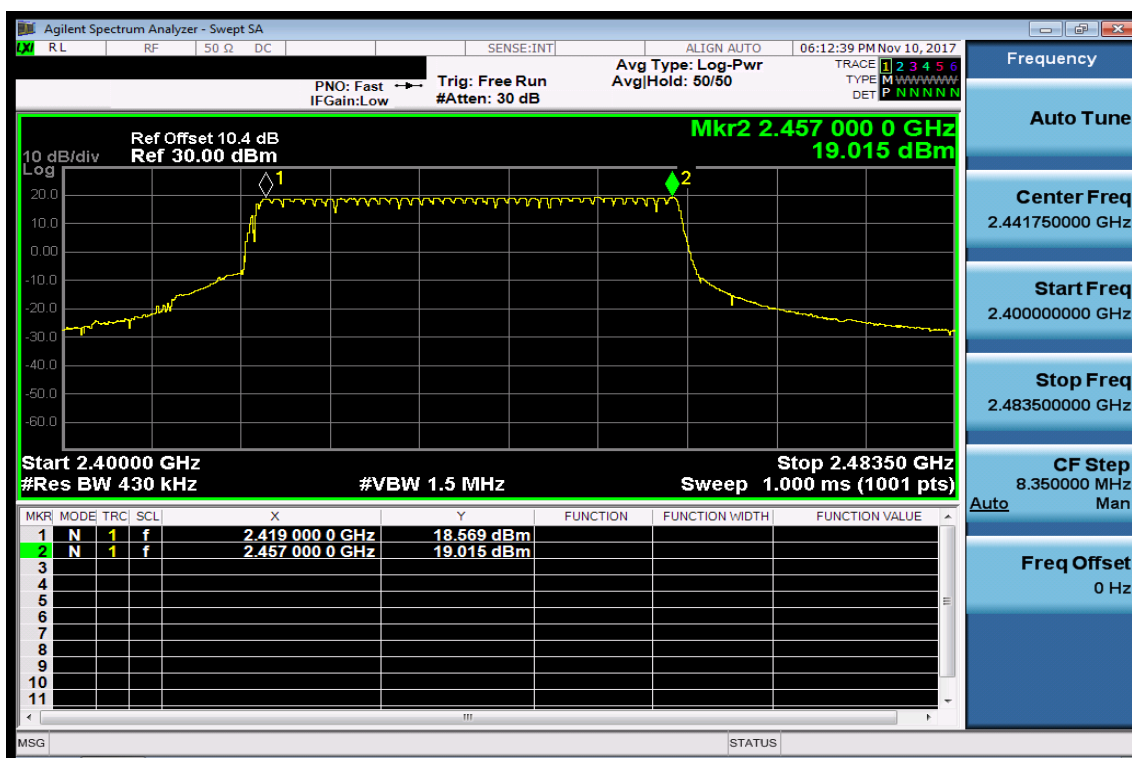
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11.5 Measurement Result

Channel separation (MHz)	Limit	Result
1	≥ 25 kHz or 2/3 times 20dB bandwidth	PASS

Frequency Separation Test Data



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12 NUMBER OF HOPPING FREQUENCY

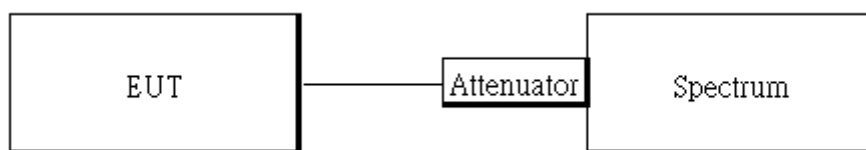
12.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

12.3 Test Set-up



12.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
5. Set the spectrum analyzer as RBW=430 kHz, VBW=1.5MHz., Detector = Peak
6. Max hold, view and count how many channel in the band.

12.5 Measurement Result

Tabular Data of Total Channel Number

	Channel Number	Limit
2.419 GHz – 2.457GHz	39	>15

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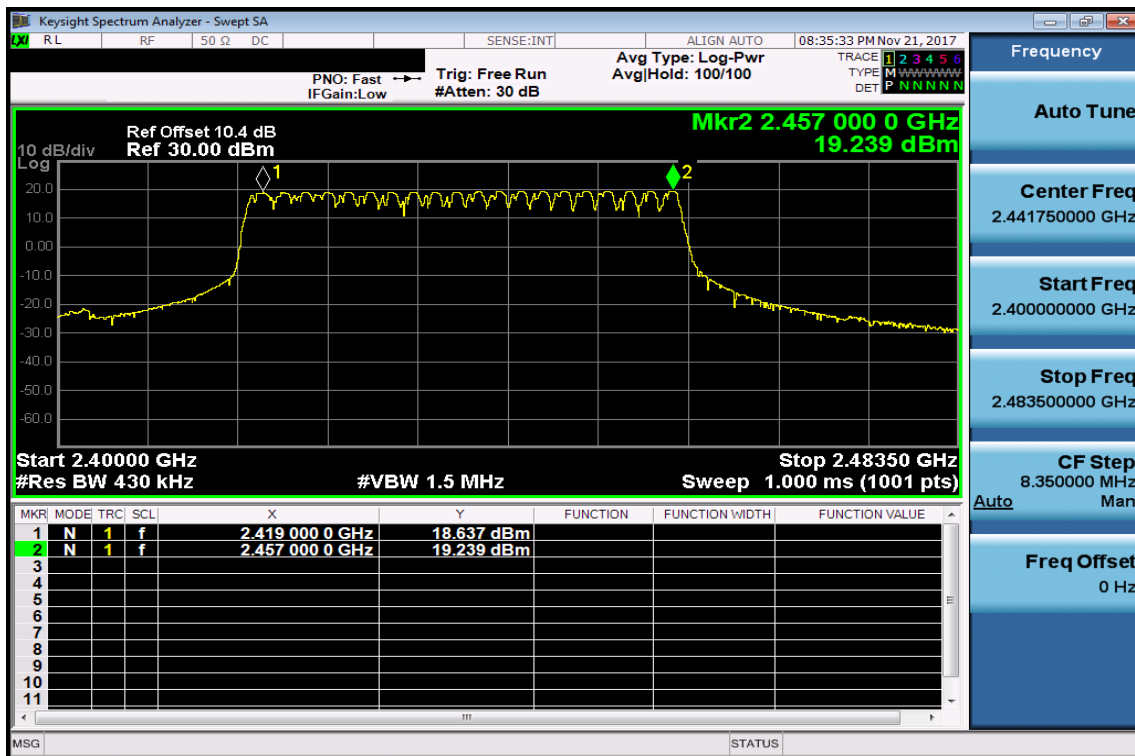
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Channel Number

2.419 GHz – 2.457GHz



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13 TIME OF OCCUPANCY (DWELL TIME)

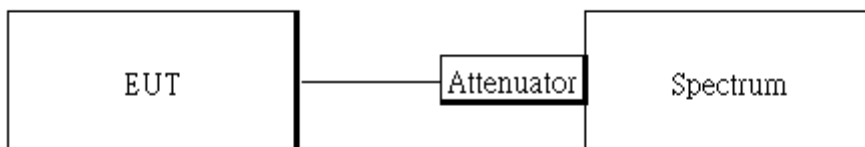
13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

13.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

13.3 Test Set-up



13.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep = 2~8ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

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DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

In AFH mode, hopping rate is 800 hop/s with 6 slots in 20 hopping channels with channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 * 20) (S), Hop Over Occupancy Time comes to (800 / 6 / 20)*(0.4 *20) =53.33

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

13.5 Tabular Result of the Measurement

Channel	PACKET TYPE	Measurement Result (ms)	Dwell Time (ms)	Offset	Limit (ms)
2441	-	34.67	0.325	10.4	400ms

$$\text{time slot} = 0.325 * (1600/6/20) * 8 = 34.67 \text{ (ms)}$$

Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	-	17.33	400ms

$$\text{time slot} = 0.325 \text{ (ms)} * (800/6/20) * 8 = 17.33 \text{ (ms)}$$

13.6 Measurement Result

Note: Refer to next page for plots.

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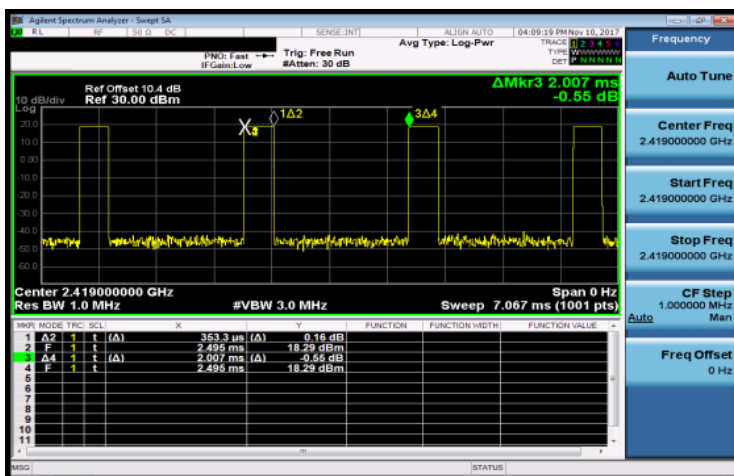
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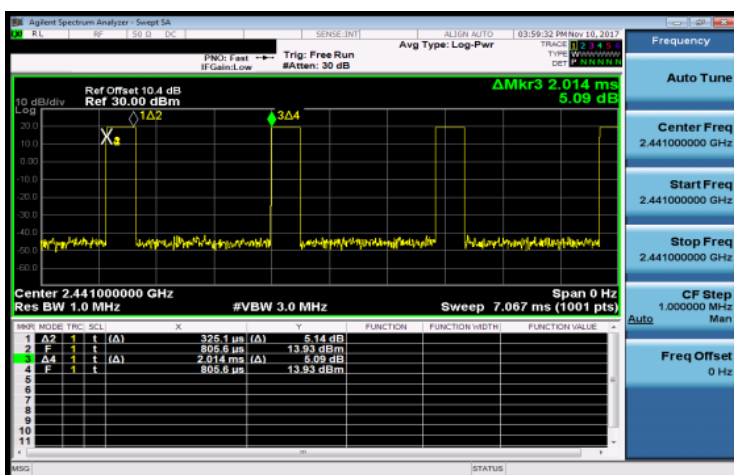
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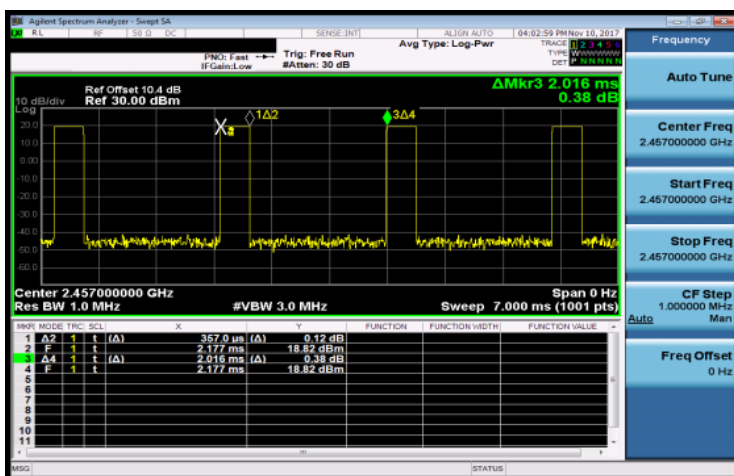
CH-Low



CH-Mid



CH-High



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14 ANTENNA REQUIREMENT

14.1 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.

14.2 Antenna Connected Construction

Omni-directional design are used.

The antenna design is no consideration of re-placement. Please see EUT photo and antenna spec. for details.

~ End of Report ~

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