

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT CLASS II PERMISSIVE CHANGE REPORT

OF

**Product Name:** BLE Module  
**Brand Name:** Raytac  
**Model No.:** MDBT42Q, MDBT42Q-P  
**Model Difference:** MDBT42Q with Chip antenna,  
MDBT42Q-P with PCB antenna  
**FCC ID:** SH6MDBT42Q  
**Report No.:** ER/2016/70009-02  
**Issue Date:** Dec. 05, 2017  
**FCC Rule Part:** §15.247, Cat: DTS  
**Prepared for:** Raytac Corporation  
5F, No.3, Jiankang Rd., Zhonghe Dist., New  
Taipei City, 23586, Taiwan  
**Prepared by:** SGS Taiwan Ltd.  
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No.134, Wu Kung Road, New Taipei Indus-  
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## VERIFICATION OF COMPLIANCE

**Applicant:** Raytac Corporation  
5F, No.3, Jiankang Rd., Zhonghe Dist., New Taipei City, 23586,  
Taiwan

**Product Name:** BLE Module

**Brand Name:** Raytac

**Model No.:** MDBT42Q, MDBT42Q-P

**Model Difference:** MDBT42Q with Chip antenna, MDBT42Q-P with PCB antenna

**FCC ID:** SH6MDBT42Q

**Report Number:** ER/2016/70009-02

**Date of test:** Nov. 09, 2017 ~ Nov. 28, 2017

**Date of EUT Received:** Nov. 09, 2017

**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:**

Cooper Hsu

**Date**

Dec. 05, 2017

Cooper Hsu / Engineer

**Prepared By:**

Yuri Tsai

**Date**

Dec. 05, 2017

Yuri Tsai / Clerk

**Approved By:**

Jim Chang

**Date**

Dec. 05, 2017

Jim Chang / Asst. Manager

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## Revision History

Report Number	Revision	Description	Issue Date
ER/2016/70009-02	Rev.00	Initial creation of document	Dec. 05, 2017

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## Table of Contents

1	GENERAL INFORMATION.....	5
2	SYSTEM TEST CONFIGURATION .....	8
3	SUMMARY OF TEST RESULTS .....	10
4	DESCRIPTION OF TEST MODES.....	10
5	MEASUREMENT UNCERTAINTY.....	12
6	PEAK OUTPUT POWER MEASUREMENT .....	13
7	6dB BANDWIDTH MEASUREMENT .....	16
8	CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT .....	20
9	RADIATED BANEDGE AND SPURIOUS EMISSION MEASUREMENT .....	26
10	PEAK POWER SPECTRAL DENSITY .....	63
11	ANTENNA REQUIREMENT .....	68
12	RF Exposure .....	69
	PHOTOGRAPHS OF SET UP .....	71
	PHOTOGRAPHS OF EUT .....	76

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# 1 GENERAL INFORMATION

## 1.1 Product Description

General:

Product Name:	BLE Module
Brand Name:	Raytac
Model No.:	MDBT42Q, MDBT42Q-P
Model Difference:	MDBT42Q with Chip antenna, MDBT42Q-P with PCB antenna
Class II permissive change	1. Add BT 5.0 by software enabling mechanism. 2. There is no change in hardware or in existing RF relevant portion. 3. Changed Product Name from BT 4.2 Module to BLE Module.
Software version:	1
Hardware version:	1
Power Supply:	3Vdc

Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	Bluetooth V4.2 & 5.0 LE mode
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	3.56 dBm
Antenna Designation:	Chip Antenna, Gain:-1.6dBi Model No.: MDBT42Q, Supplier: Raytac PCB Antenna, Gain:-1.61dBi Model No.: MDBT42Q-P, Supplier: Raytac

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## 1.2 Product Feature of Equipment Under Test

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

Product Feature	
Product Name:	BLE Module
Brand Name:	Raytac
Model No.:	MDBT42Q, MDBT42Q-P
Model Difference:	MDBT42Q with Chip antenna, MDBT42Q-P with PCB antenna
FCC ID:	SH6MDBT42Q
Bluetooth Version	Bluetooth V4.2 & 5.0 LE mode

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

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### 1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance

ANSI C63.10:2013

Note:

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

### 1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Numbers are: 509634

IC Registration Numbers are: 4260A-5

### 1.5 Special Accessories

There are no special accessories used while test was conducted.

### 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

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

### 2.2 EUT Exercise

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

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground 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/ 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 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 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 1dB.

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## 2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Configuration

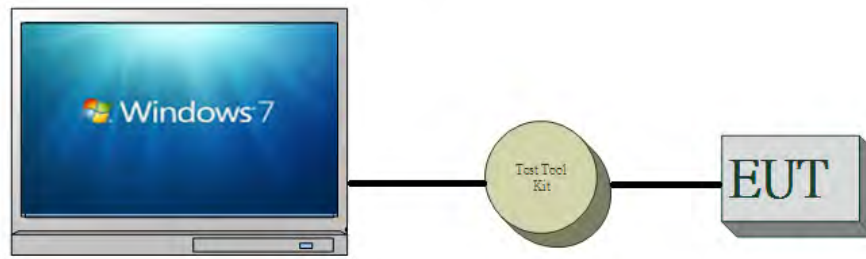


Fig. 2-2 Conduction



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	LR-7HXZA	Shielded	Un-Shielded
3.	Testing Kit	N/A	N/A	N/A	N/A	N/A

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

### 4 DESCRIPTION OF TEST MODES

#### 4.1 Operated in 2400 ~ 2483.5MHz Band

40 channels are provided for Bluetooth LE

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
0	2402 MHz	14	2430 MHz	28	2458 MHz
1	2404 MHz	15	2432 MHz	29	2460 MHz
2	2406 MHz	16	2434 MHz	30	2462 MHz
3	2408 MHz	17	2436 MHz	31	2464 MHz
4	2410 MHz	18	2438 MHz	32	2466 MHz
5	2412 MHz	19	2440 MHz	33	2468 MHz
6	2414 MHz	20	2442 MHz	34	2470 MHz
7	2416MHz	21	2444 MHz	35	2472 MHz
8	2418 MHz	22	2446 MHz	36	2474 MHz
9	2420 MHz	23	2448 MHz	37	2476 MHz
10	2422 MHz	24	2450 MHz	38	2478 MHz
11	2424 MHz	25	2452 MHz	39	2480 MHz
12	2426 MHz	26	2454 MHz		
13	2428 MHz	27	2456 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.

##### RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	0,20,39	GFSK	2
RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	0,20,39	GFSK	2

**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 Transmitter for channel Low, Mid and High, the worst case E2 position and 2 types antenna measurement data was reported.

##### ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	0,20,39	GFSK	2

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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 : <b>Vertical</b> )	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 : <b>Horizontal</b> )	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 PEAK OUTPUT POWER MEASUREMENT

### 6.1 Standard Applicable:

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

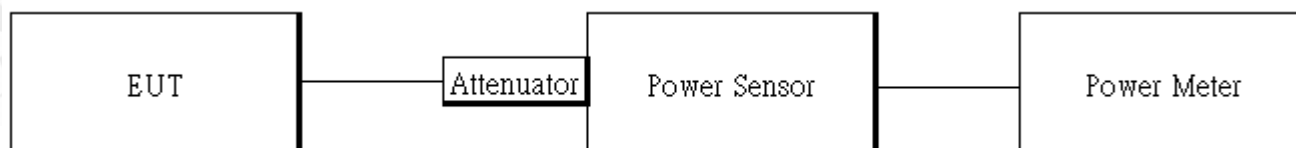
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

### 6.2 Measurement Equipment Used:

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

### 6.3 Test Set-up:



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#### 6.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

##### Power Meter:

It is used as the auxiliary test equipment to conduct the output power measurement.

4. Record the max. Reading as observed from Power Meter.
5. Repeat above procedures until all test default channel measured was complete.

##### Duty Factor:

	Duty Cycle (%)	Duty Factor (dB)
BLE	33.00	4.81

Duty Cycle Factor:  $10 \cdot \log(1/(33/100)) = 4.81$

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## 6.5 Measurement Result:

### BT5.0 mode:

#### BLE mode:

CH	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
0	2402	3.43	1 Watt = 30 dBm
20	2442	<b>3.56</b>	1 Watt = 30 dBm
39	2480	3.47	1 Watt = 30 dBm

BLE mode:			
CH	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
0	2402	3.08	1 Watt = 30 dBm
20	2442	3.43	1 Watt = 30 dBm
39	2480	3.34	1 Watt = 30 dBm

\*Note: Measured by power meter, cable loss as 1 dB that offsets on the power meter in Peak

\*Note: Measured by power meter, **as cable loss+ Duty cycle factor** that offsets on the power meter

\*Note: Max. Output include tune up tolerance Power is average power

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## 7 6dB BANDWIDTH MEASUREMENT

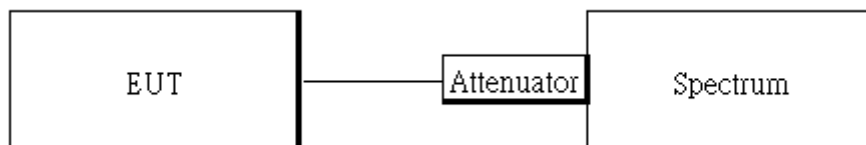
### 7.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz .

### 7.2 Measurement Equipment Used

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SÜHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

### 7.3 Test Set-up:



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#### 7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. For 6dB Bandwidth:  
Set the spectrum analyzer as RBW=100 kHz, VBW= 3\*RBW, Span = 5MHz, Detector=Peak, Sweep=auto.
5. Mark the peak frequency and -6dB (upper and lower) frequency.
6. For 99% Bandwidth:  
Set the spectrum analyzer as RBW=1%, VBW=3\*RBW, Span = 2MHz, Detector=Sample, Sweep=auto.
7. Turn on the 99% bandwidth function, max reading.
8. Repeat above procedures until all test default channel is completed

#### 7.5 Measurement Result:

##### BLE mode

Frequency (MHz)	6dB BW (MHz)	BW (MHz)	Result
2402	1.1754	> 0.5	PASS
2442	1.1841	> 0.5	PASS
2480	0.9858	> 0.5	PASS

*Note: Refer to next page for plots.*

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## BT5.0 mode 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid



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## 6dB Band Width Test Data CH-High



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## 8 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

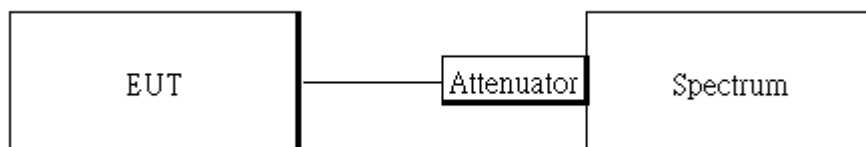
### 8.1 Standard Applicable

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).

### 8.2 Measurement Equipment Used:

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

### 8.3 Test SET-UP:



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## 8.4 Measurement Procedure

### Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
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 start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker 1 – 20dBm
8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

### Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
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.

## 8.5 Measurement Result

### Note:

1. Refer to next page spectrum analyzer data chart and tabular data sheets.
2. For restricted Band Edge Limit, please refer to section 11.5 of this report for measurement result.

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## BT5.0 mode Band Edges Test Data CH-Low



## Band Edges Test Data CH-High



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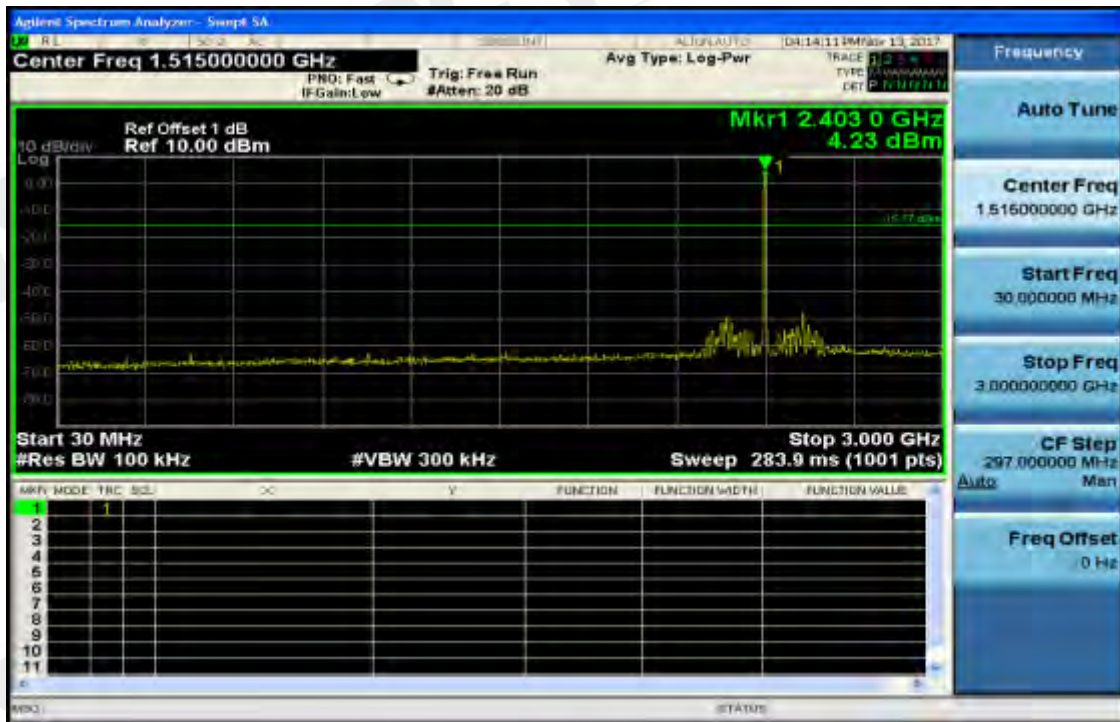
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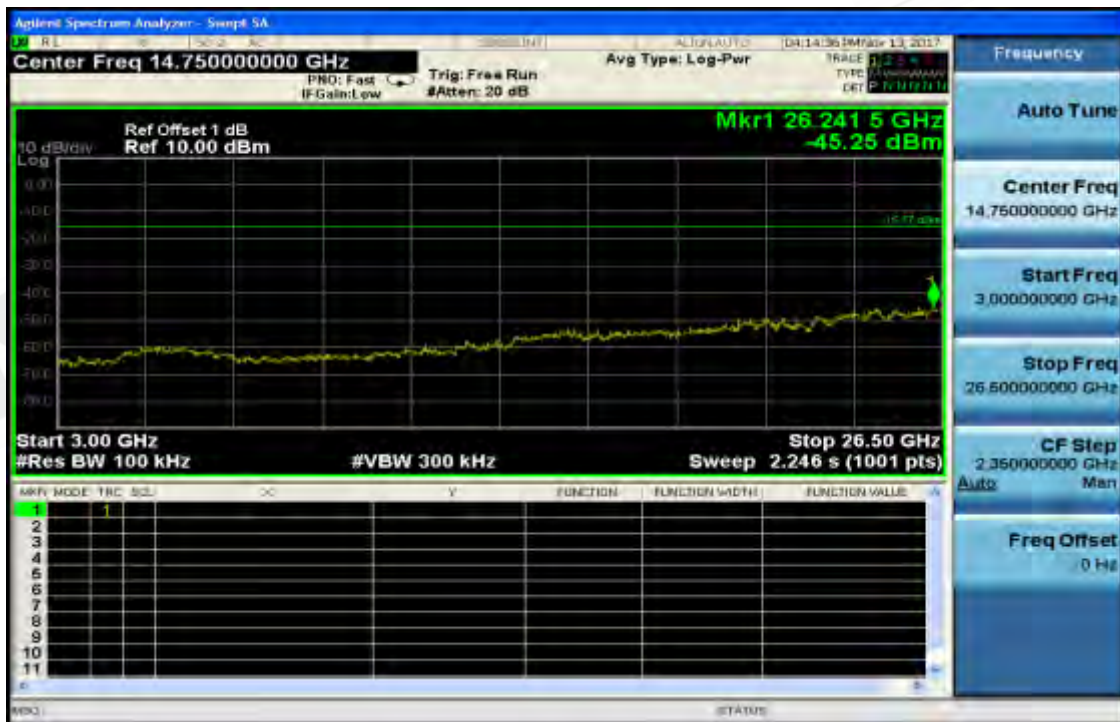
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## Conducted Spurious Emission Measurement Result CH-Low 30MHz – 3GHz



## CH-Low 3GHz – 26.5GHz



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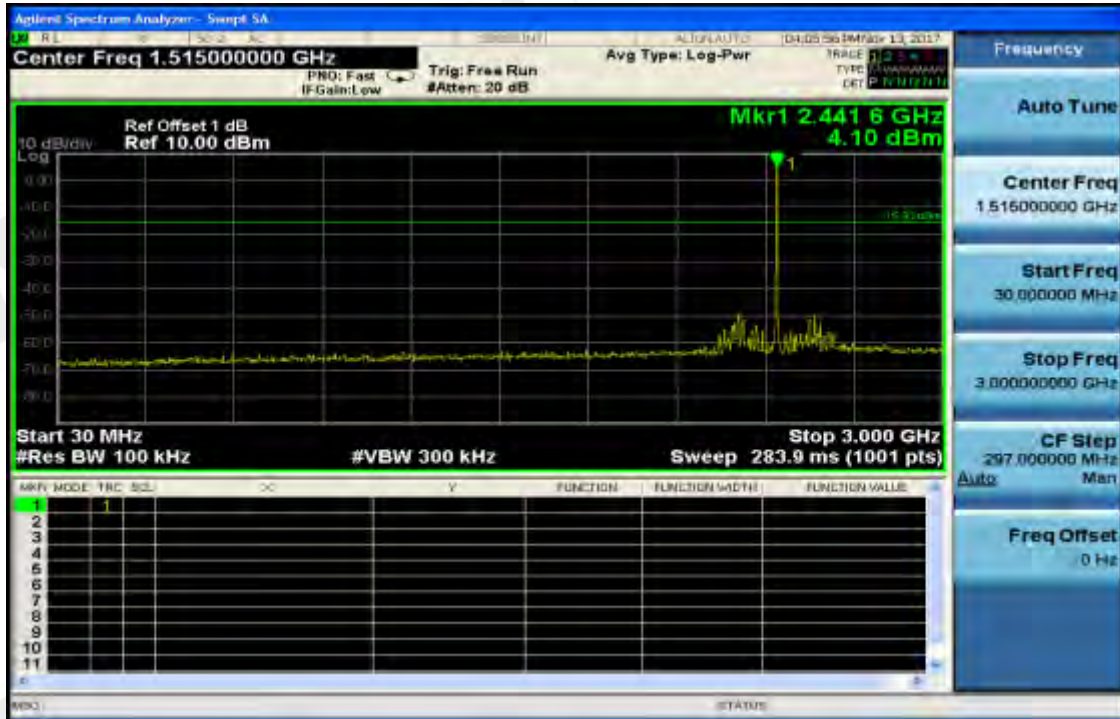
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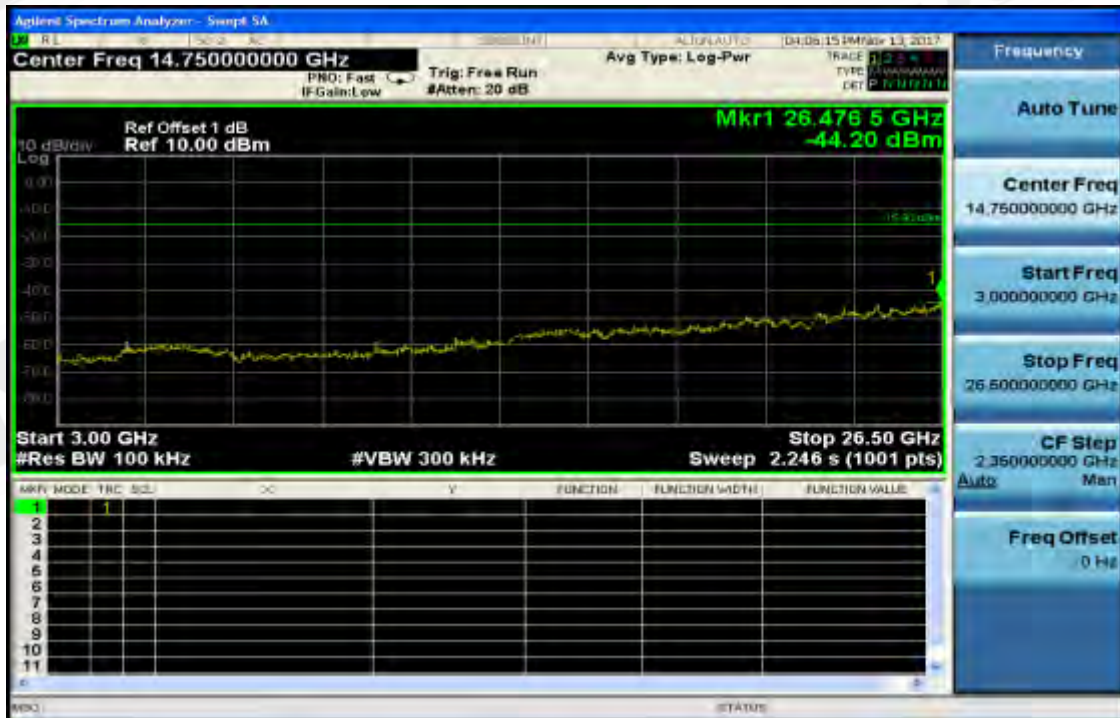
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## CH-Mid 30MHz – 3GHz



## CH-Mid 3GHz – 26.5GHz



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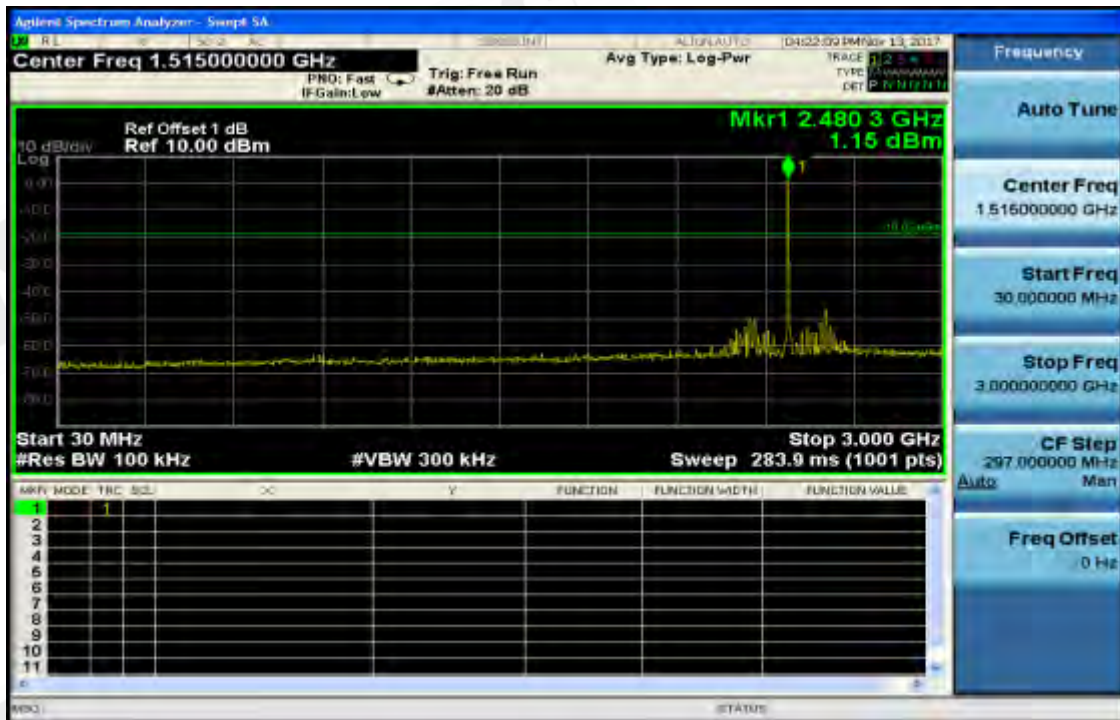
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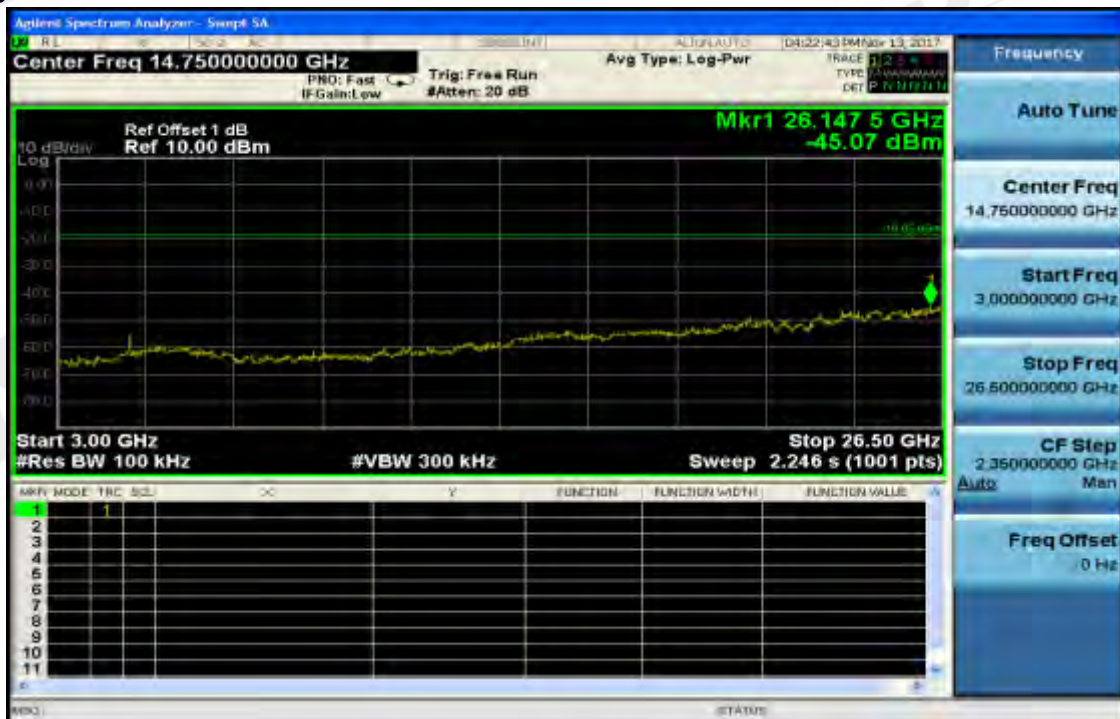
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## CH-High 30MHz – 3GHz



## CH- High 3GHz – 26.5GHz



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## 9 RADIATED BANDEDGE 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 must also comply with the §15.209 limit as below.

And according to §15.33(a) (1), 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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## 9.2 Measurement Equipment Used

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

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

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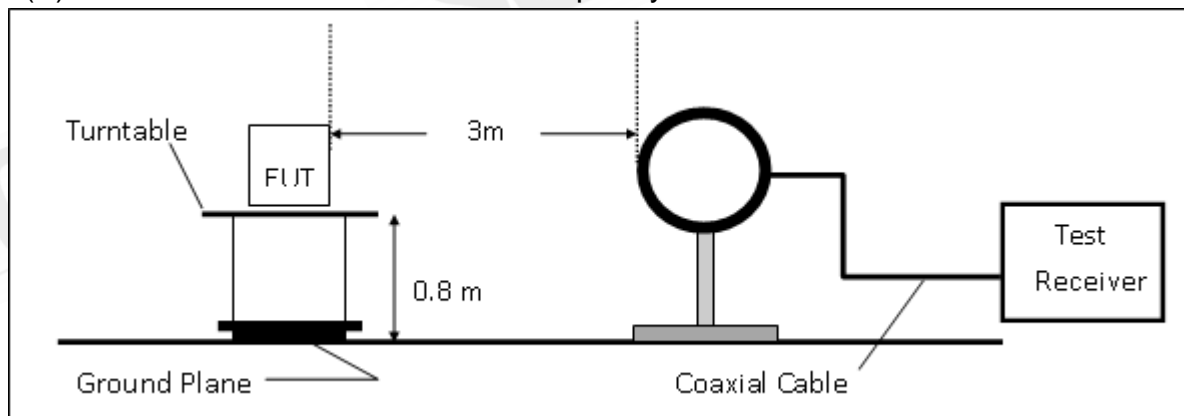
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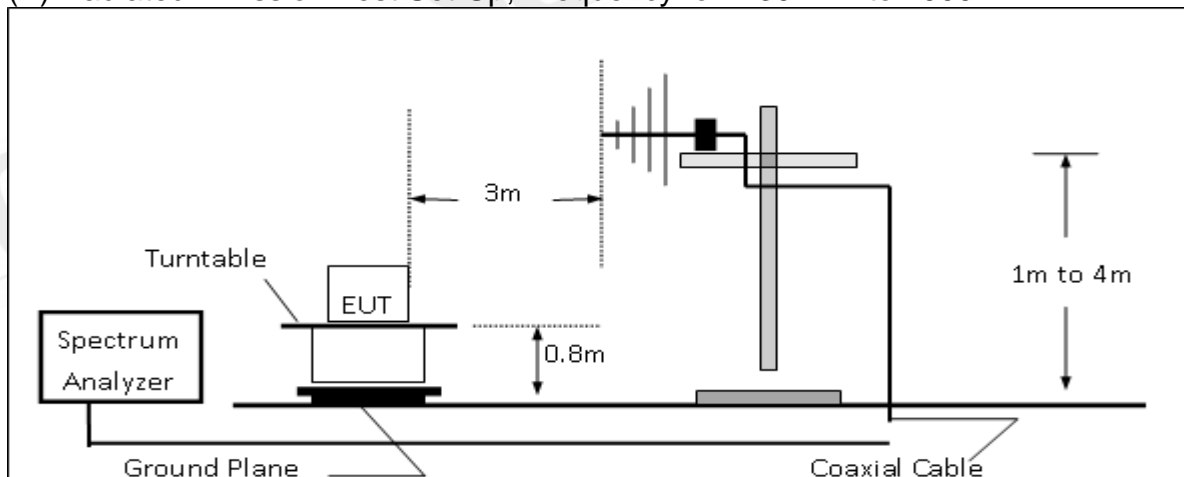
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### 9.3 Test SET-UP

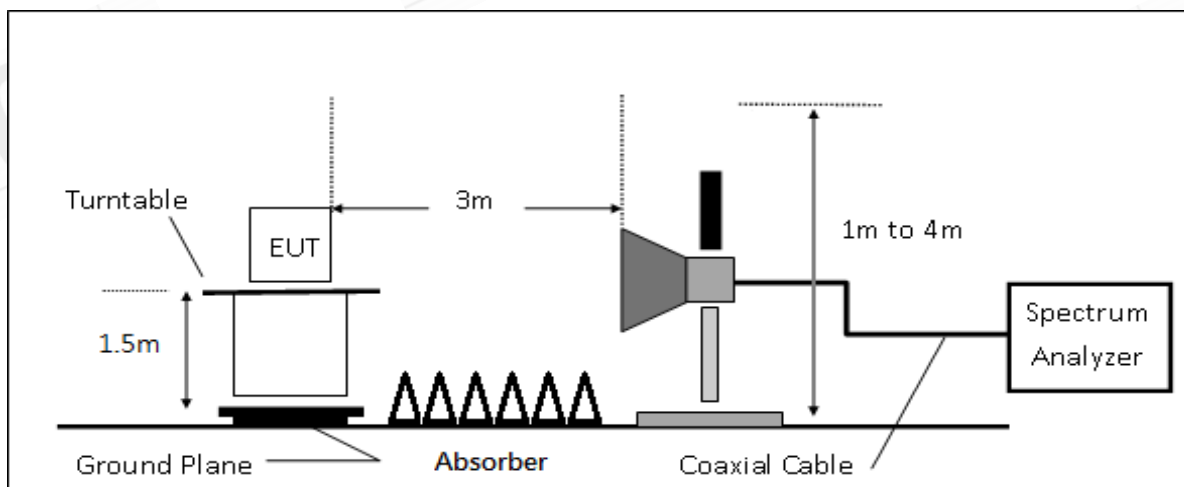
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(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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#### 9.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 0.8m 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. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
8. 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.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

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### 9.5 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	

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.

### 9.6 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.

### 9.7 Measurement Result:

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

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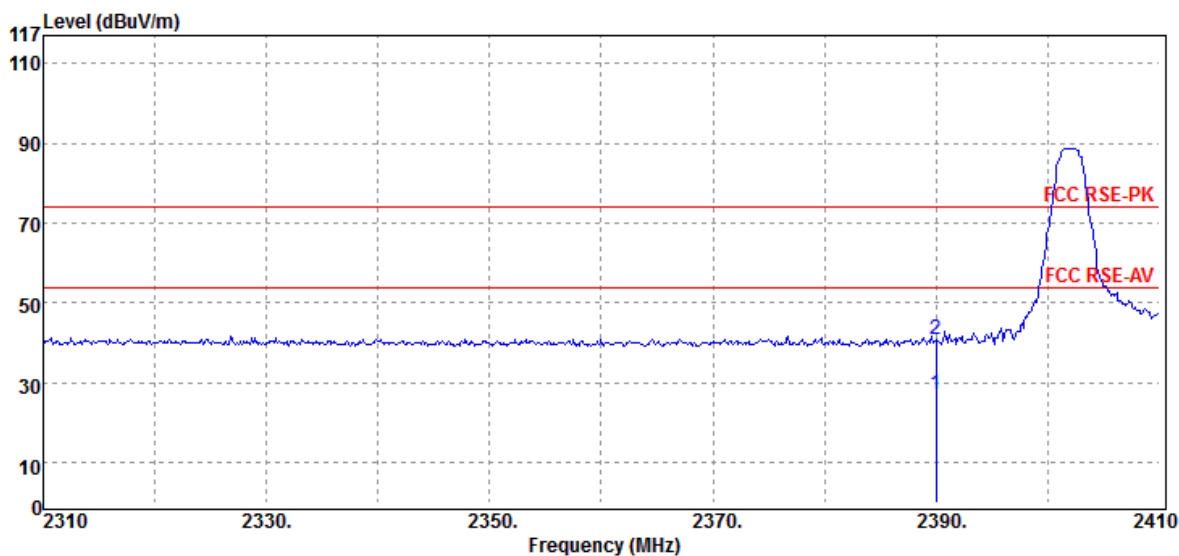
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## Radiated Band Edge Measurement Result (BT5.0 mode)

## Chip antenna

Operation Band :BT5.0  
 Fundamental Frequency :2402 MHz  
 Operation Mode :Bandedge CH LOW  
 EUT Pol. :E2 Plane

Test Date :2017-11-14  
 Temp./Humi. :21 deg\_C / 61 RH  
 Engineer :Kane  
 Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
2390.00	E	Average	28.80	-1.74	27.06	54.00	-26.94
2390.00	E	Peak	42.57	-1.74	40.83	74.00	-33.17

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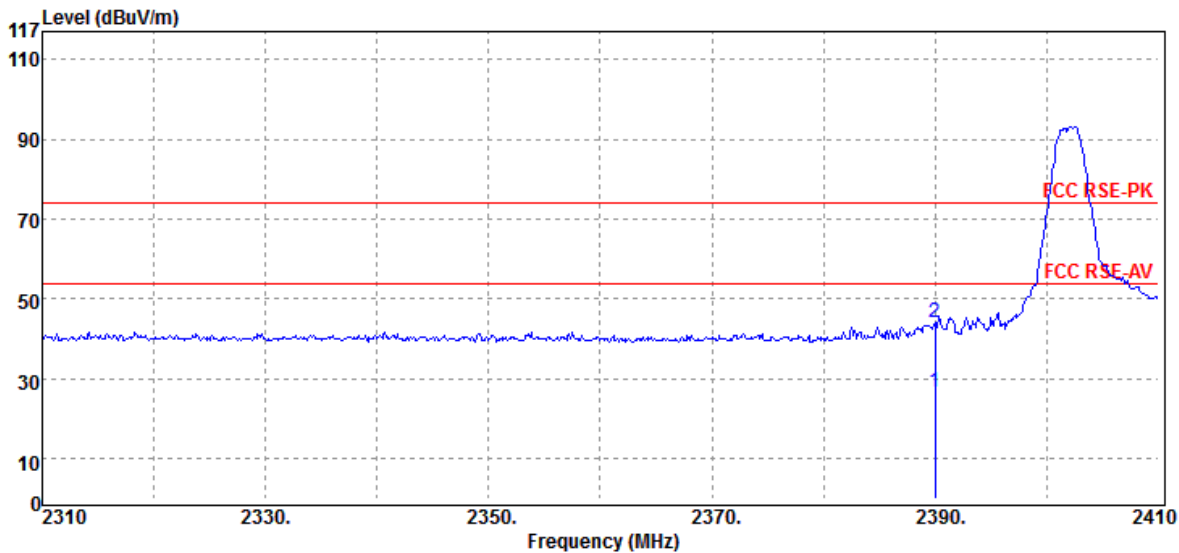
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Operation Band :BT5.0  
Fundamental Frequency :2402 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :E2 Plane

Test Date :2017-11-14  
Temp./Humi. :21 deg\_C / 61 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode			Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	28.45	-1.74	26.71	54.00	-27.29
2390.00	E	Peak	45.73	-1.74	43.99	74.00	-30.01

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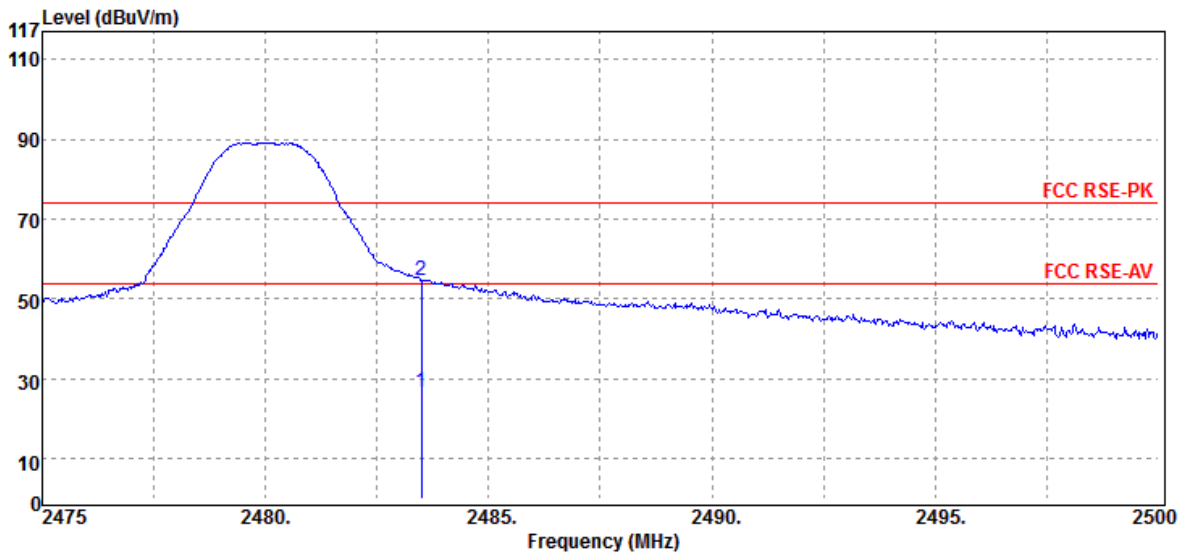
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode			Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	28.44	-1.62	26.82	54.00	-27.18
2483.50	E	Peak	56.31	-1.62	54.69	74.00	-19.31

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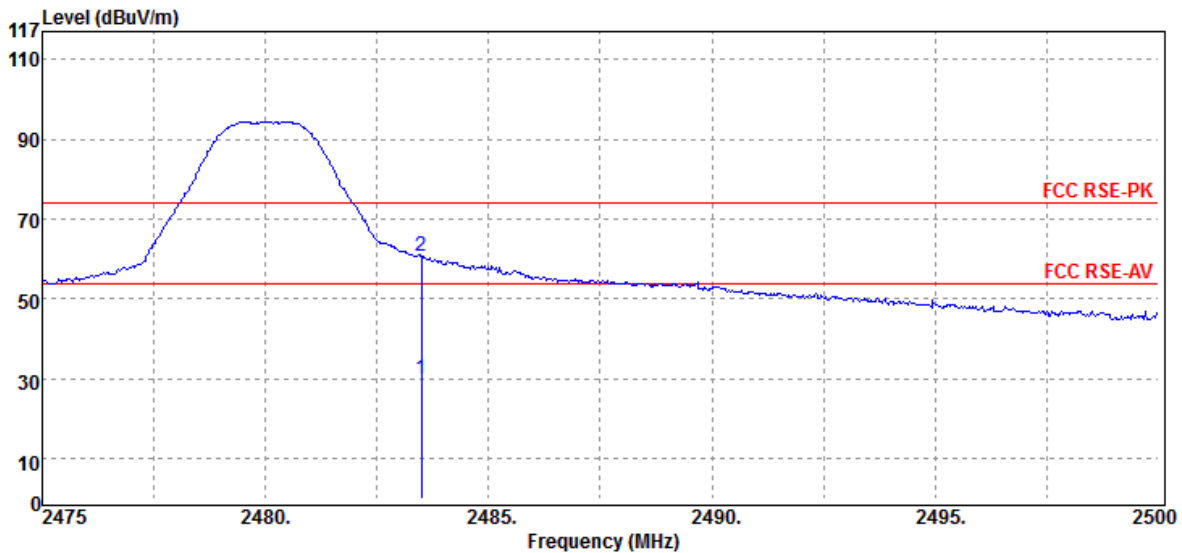
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	31.65	-1.62	30.03	54.00	-23.97
2483.50	E	Peak	62.27	-1.62	60.65	74.00	-13.35

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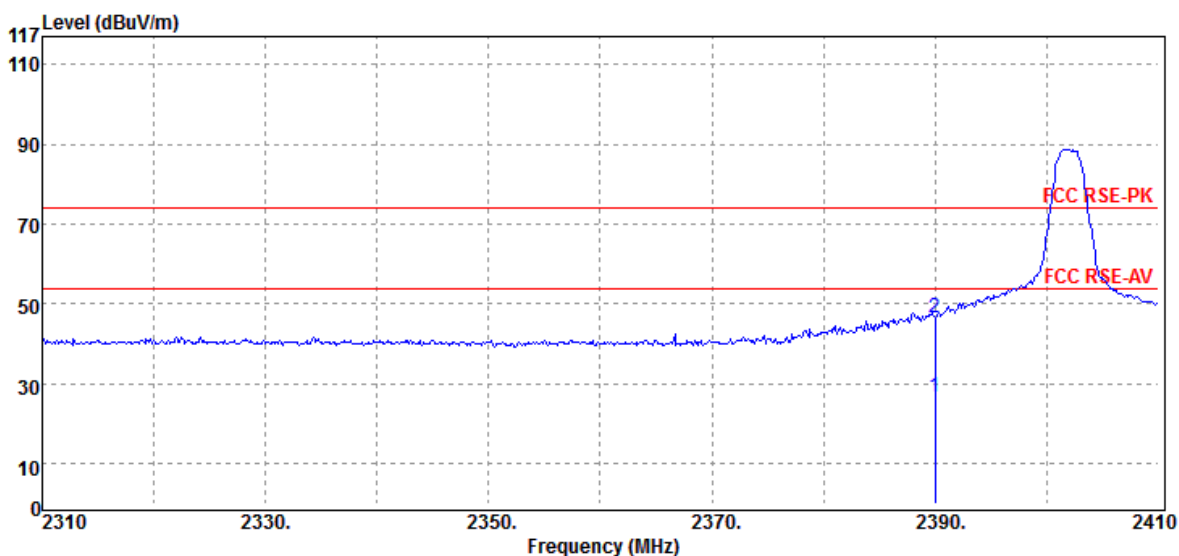
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## PCB Antenna

Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	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	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
2390.00	E	Average	28.47	-1.74	26.73	54.00	-27.27
2390.00	E	Peak	48.30	-1.74	46.56	74.00	-27.44

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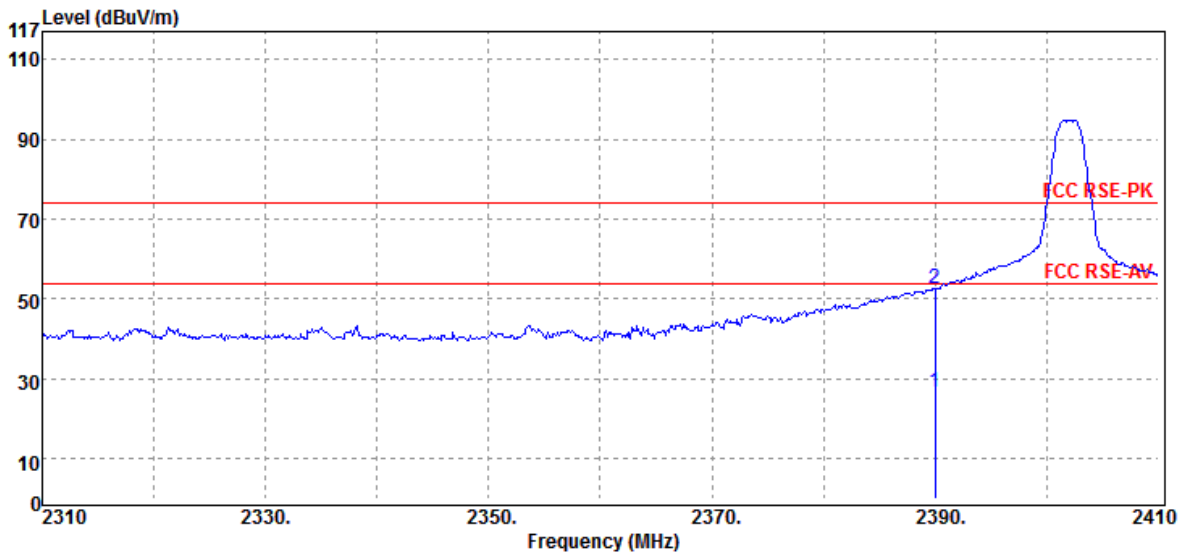
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2390.00	E	Average	28.46	-1.74	26.72	54.00	-27.28
2390.00	E	Peak	54.33	-1.74	52.59	74.00	-21.41

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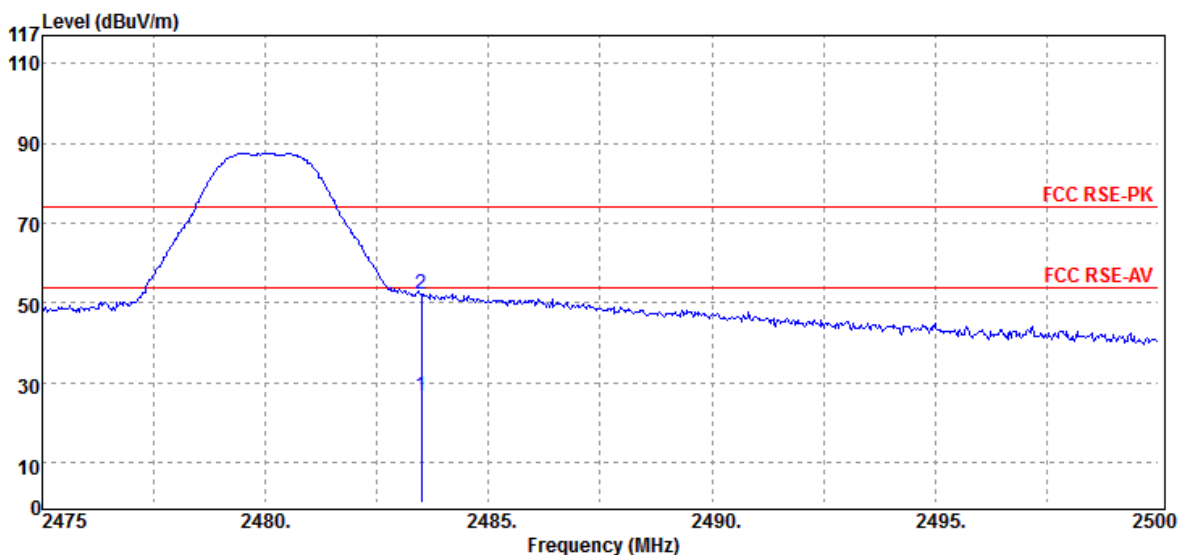
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode			Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	28.40	-1.62	26.78	54.00	-27.22
2483.50	E	Peak	53.74	-1.62	52.12	74.00	-21.88

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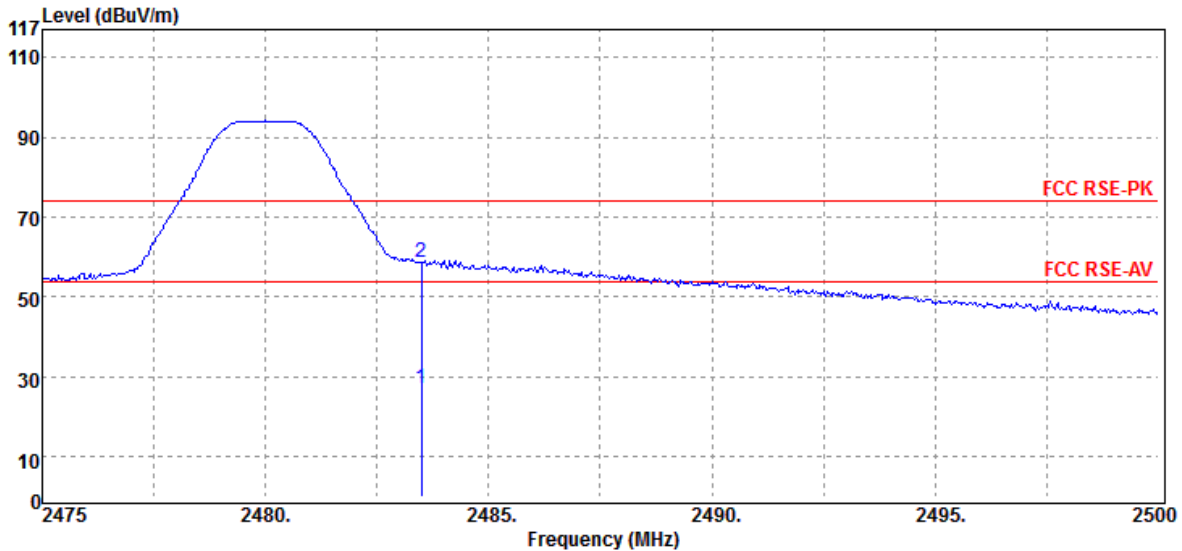
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	28.65	-1.62	27.03	54.00	-26.97
2483.50	E	Peak	60.41	-1.62	58.79	74.00	-15.21

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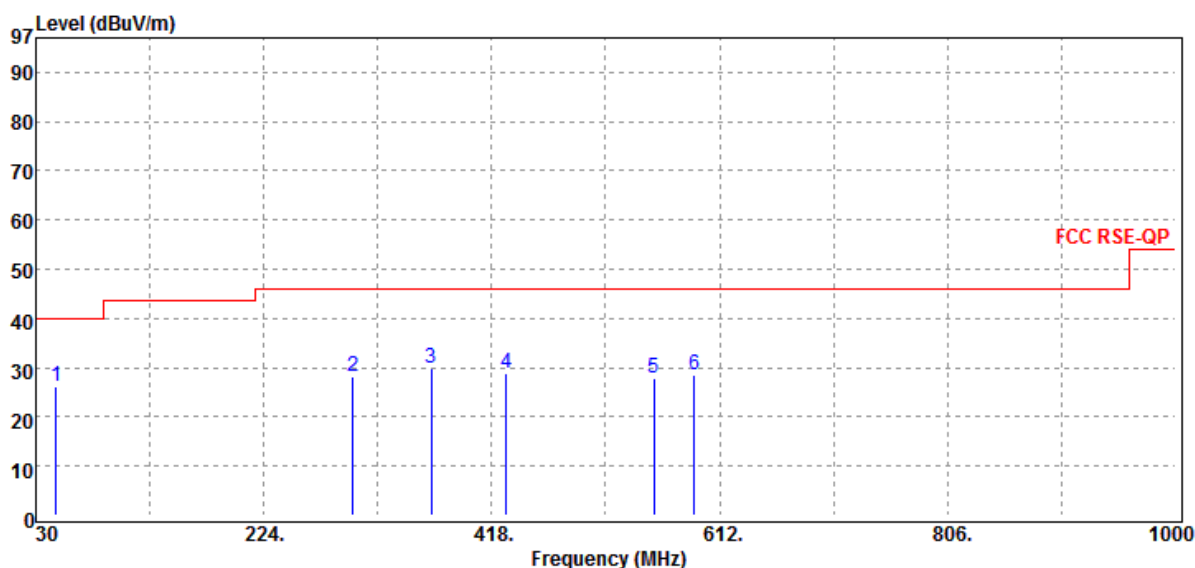
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# Radiated Spurious Emission Measurement Result (BT5.0 mode) For Frequency form 30MHz to 1000MHz

## Chip Antenna

Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
47.46	S	Peak	34.04	-7.85	26.19	40.00	-13.81
299.66	S	Peak	34.11	-5.93	28.18	46.00	-17.82
366.59	S	Peak	34.57	-4.72	29.85	46.00	-16.15
430.61	S	Peak	32.07	-3.33	28.74	46.00	-17.26
555.74	S	Peak	29.31	-1.30	28.01	46.00	-17.99
590.66	S	Peak	28.84	-0.19	28.65	46.00	-17.35

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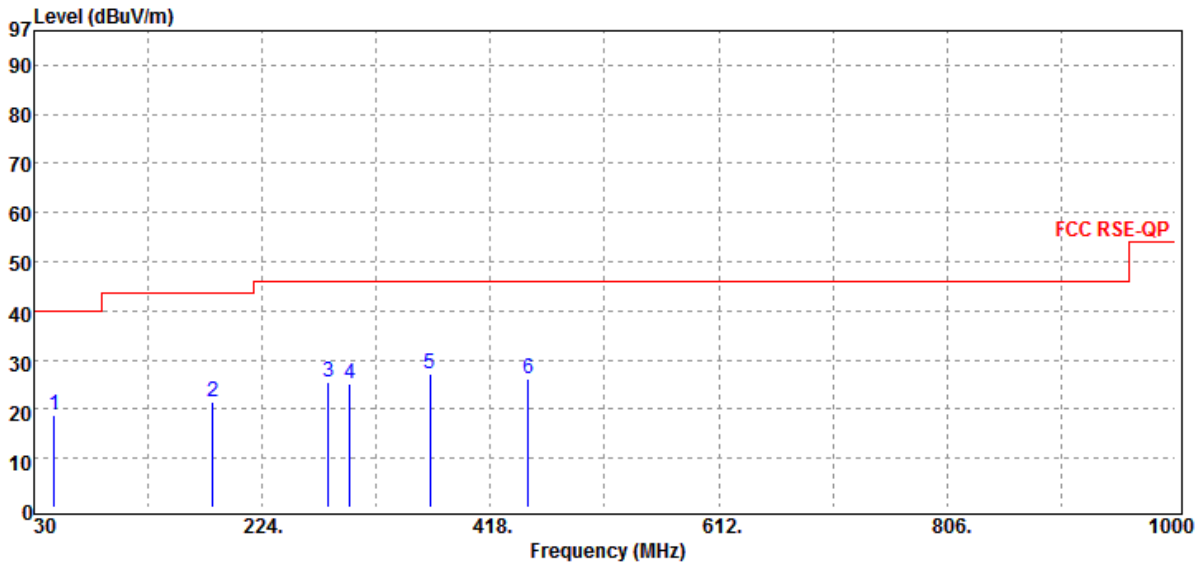
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
47.46	S	Peak	26.64	-7.85	18.79	40.00	-21.21
182.29	S	Peak	30.25	-8.82	21.43	43.50	-22.07
280.26	S	Peak	31.90	-6.35	25.55	46.00	-20.45
298.69	S	Peak	31.03	-5.95	25.08	46.00	-20.92
366.59	S	Peak	32.03	-4.72	27.31	46.00	-18.69
450.01	S	Peak	28.97	-2.92	26.05	46.00	-19.95

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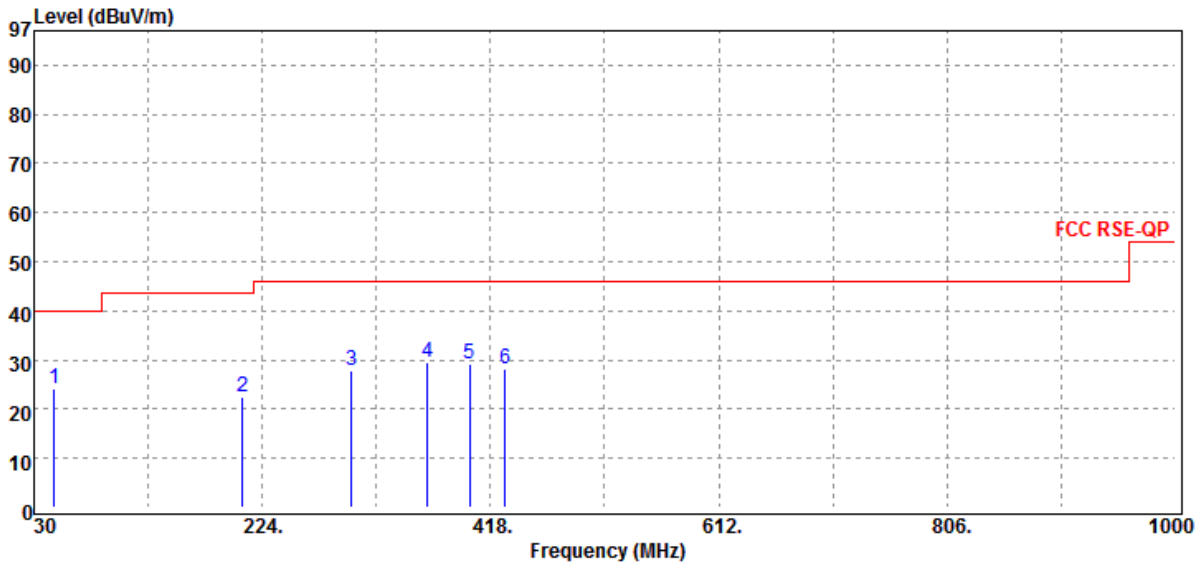
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



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	
47.46	S	Peak	32.13	-7.85	24.28	40.00	-15.72
207.51	S	Peak	32.13	-9.73	22.40	43.50	-21.10
299.66	S	Peak	33.84	-5.93	27.91	46.00	-18.09
364.65	S	Peak	34.33	-4.69	29.64	46.00	-16.36
400.54	S	Peak	33.21	-3.94	29.27	46.00	-16.73
430.61	S	Peak	31.54	-3.33	28.21	46.00	-17.79

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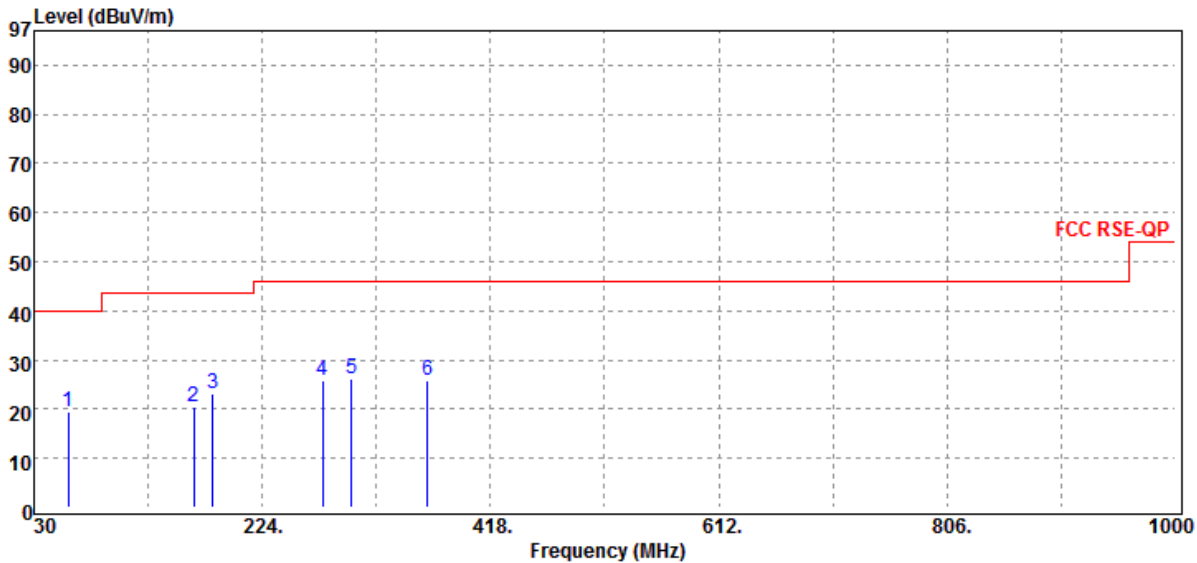
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
59.10	S	Peak	27.57	-8.03	19.54	40.00	-20.46
165.80	S	Peak	27.95	-7.40	20.55	43.50	-22.95
182.29	S	Peak	32.05	-8.82	23.23	43.50	-20.27
275.41	S	Peak	32.36	-6.63	25.73	46.00	-20.27
299.66	S	Peak	32.07	-5.93	26.14	46.00	-19.86
364.65	S	Peak	30.37	-4.69	25.68	46.00	-20.32

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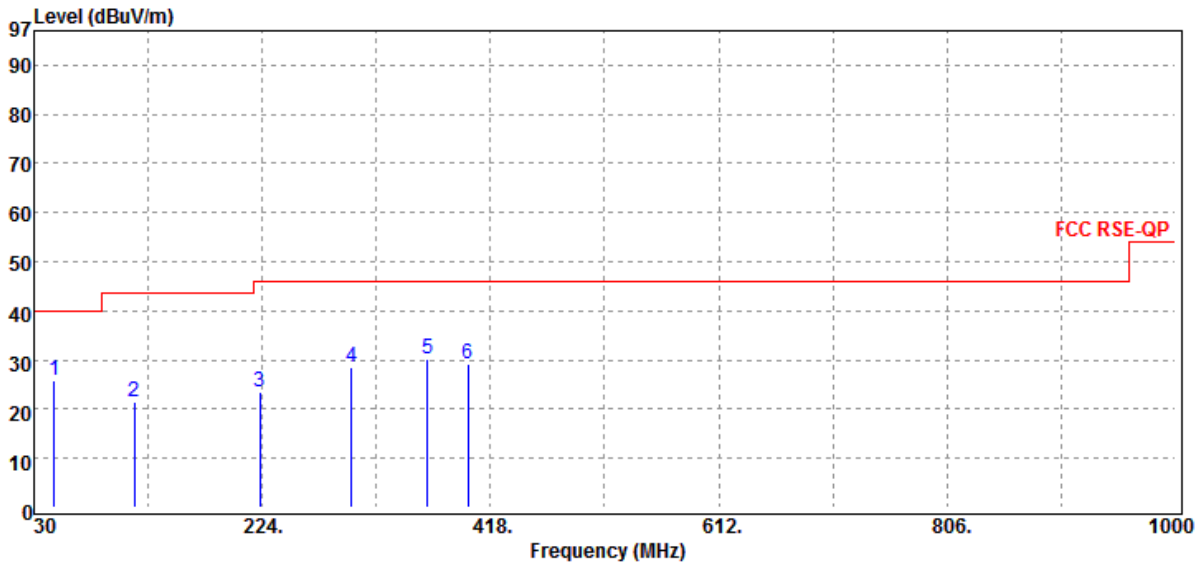
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
47.46	S	Peak	33.77	-7.85	25.92	40.00	-14.08
115.36	S	Peak	32.16	-10.79	21.37	43.50	-22.13
222.06	S	Peak	32.70	-9.22	23.48	46.00	-22.52
299.66	S	Peak	34.44	-5.93	28.51	46.00	-17.49
364.65	S	Peak	34.78	-4.69	30.09	46.00	-15.91
398.60	S	Peak	33.21	-3.97	29.24	46.00	-16.76

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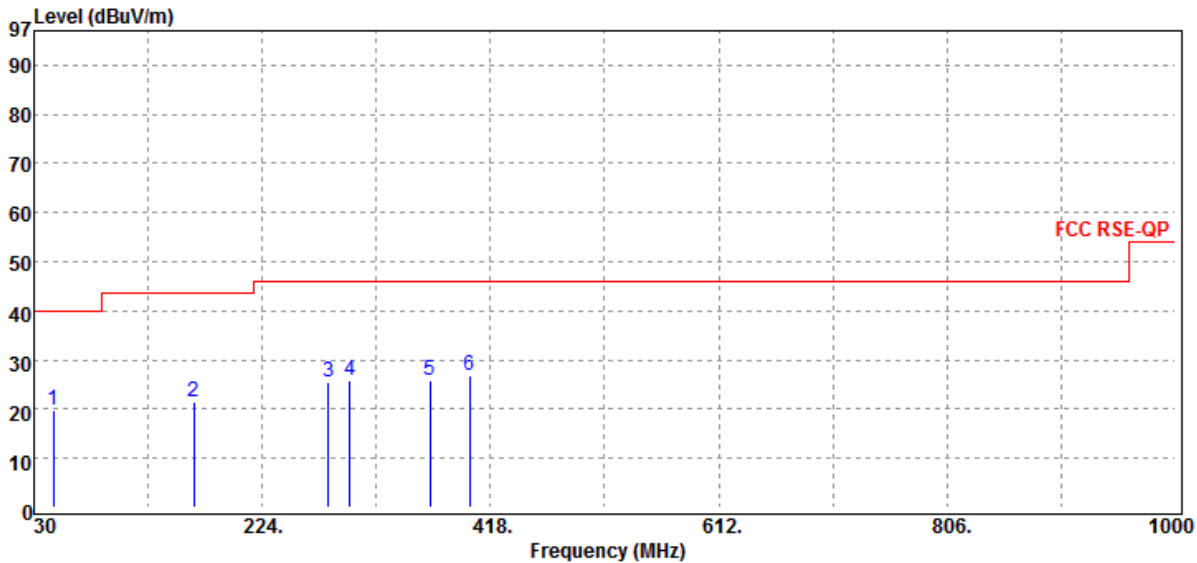
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
46.49	S	Peak	27.70	-7.91	19.79	40.00	-20.21
165.80	S	Peak	28.83	-7.40	21.43	43.50	-22.07
280.26	S	Peak	31.94	-6.35	25.59	46.00	-20.41
298.69	S	Peak	31.77	-5.95	25.82	46.00	-20.18
366.59	S	Peak	30.58	-4.72	25.86	46.00	-20.14
400.54	S	Peak	30.76	-3.94	26.82	46.00	-19.18

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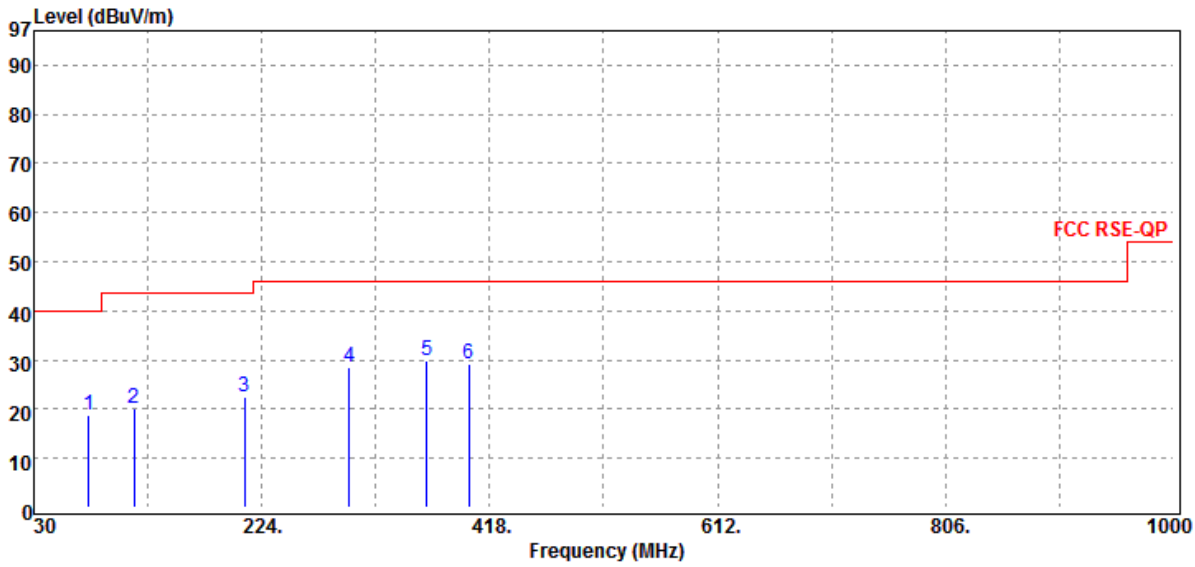
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**PCB Antenna**

Operation Band :BT5.0  
 Fundamental Frequency :2402 MHz  
 Operation Mode :Tx CH LOW  
 EUT Pol. :E2 Plane

Test Date :2017-11-14  
 Temp./Humi. :21 deg\_C / 61 RH  
 Engineer :Kane  
 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
76.56	S	Peak	30.51	-11.64	18.87	40.00	-21.13
115.36	S	Peak	30.83	-10.79	20.04	43.50	-23.46
209.45	S	Peak	32.30	-9.77	22.53	43.50	-20.97
298.69	S	Peak	34.32	-5.95	28.37	46.00	-17.63
364.65	S	Peak	34.54	-4.69	29.85	46.00	-16.15
400.54	S	Peak	33.30	-3.94	29.36	46.00	-16.64

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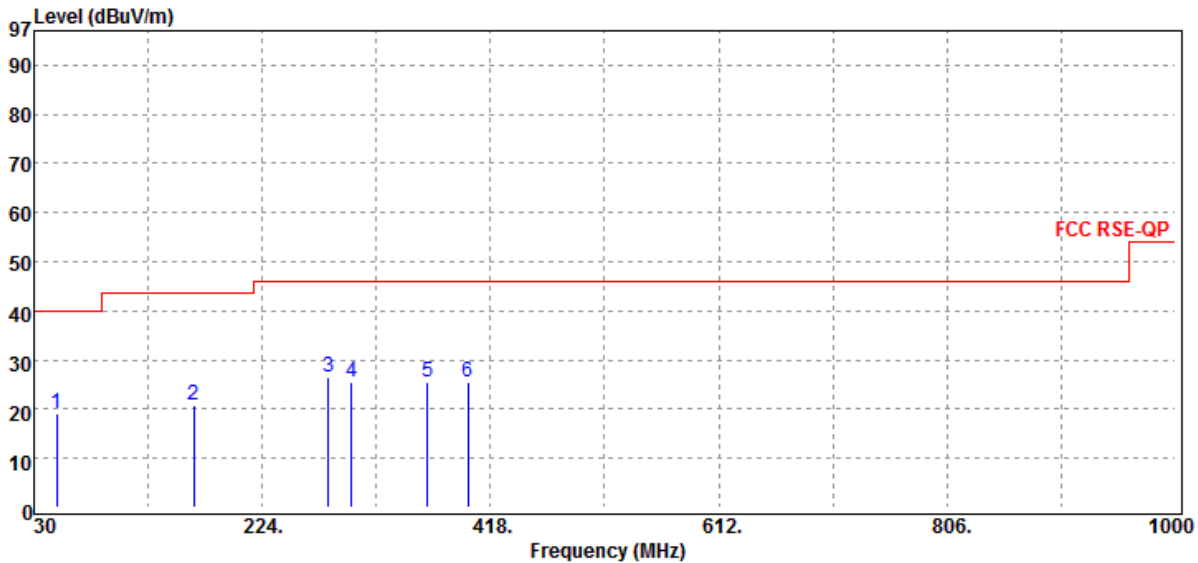
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
49.40	S	Peak	27.03	-7.74	19.29	40.00	-20.71
165.80	S	Peak	28.35	-7.40	20.95	43.50	-22.55
280.26	S	Peak	32.94	-6.35	26.59	46.00	-19.41
299.66	S	Peak	31.46	-5.93	25.53	46.00	-20.47
364.65	S	Peak	30.05	-4.69	25.36	46.00	-20.64
398.60	S	Peak	29.53	-3.97	25.56	46.00	-20.44

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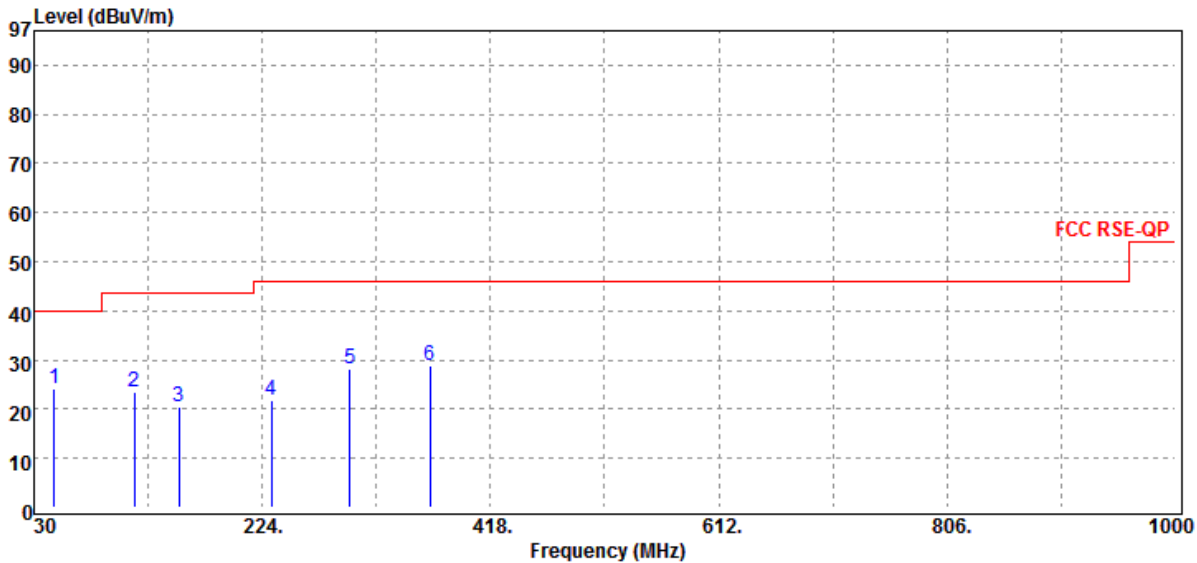
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dB $\mu$ V		dB $\mu$ V/m	dB $\mu$ V/m	
47.46	S	Peak	32.15	-7.85	24.30	40.00	-15.70
115.36	S	Peak	34.33	-10.79	23.54	43.50	-19.96
153.19	S	Peak	28.26	-7.71	20.55	43.50	-22.95
231.76	S	Peak	30.67	-8.85	21.82	46.00	-24.18
298.69	S	Peak	34.29	-5.95	28.34	46.00	-17.66
366.59	S	Peak	33.45	-4.72	28.73	46.00	-17.27

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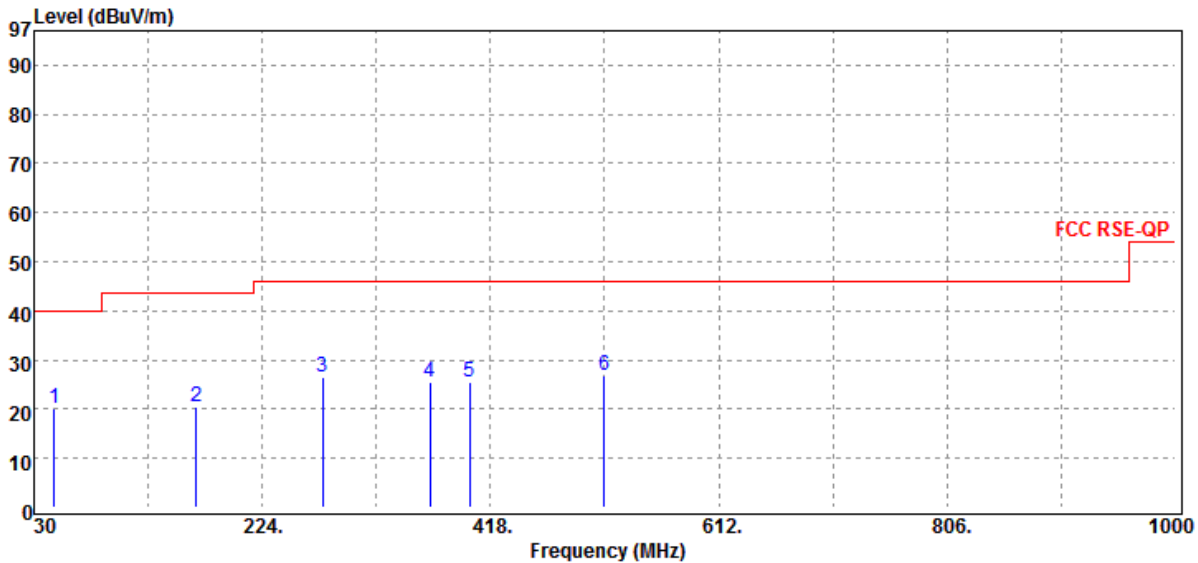
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
47.46	S	Peak	27.95	-7.85	20.10	40.00	-19.90
167.74	S	Peak	27.98	-7.46	20.52	43.50	-22.98
275.41	S	Peak	33.05	-6.63	26.42	46.00	-19.58
366.59	S	Peak	30.27	-4.72	25.55	46.00	-20.45
400.54	S	Peak	29.32	-3.94	25.38	46.00	-20.62
515.00	S	Peak	28.70	-1.94	26.76	46.00	-19.24

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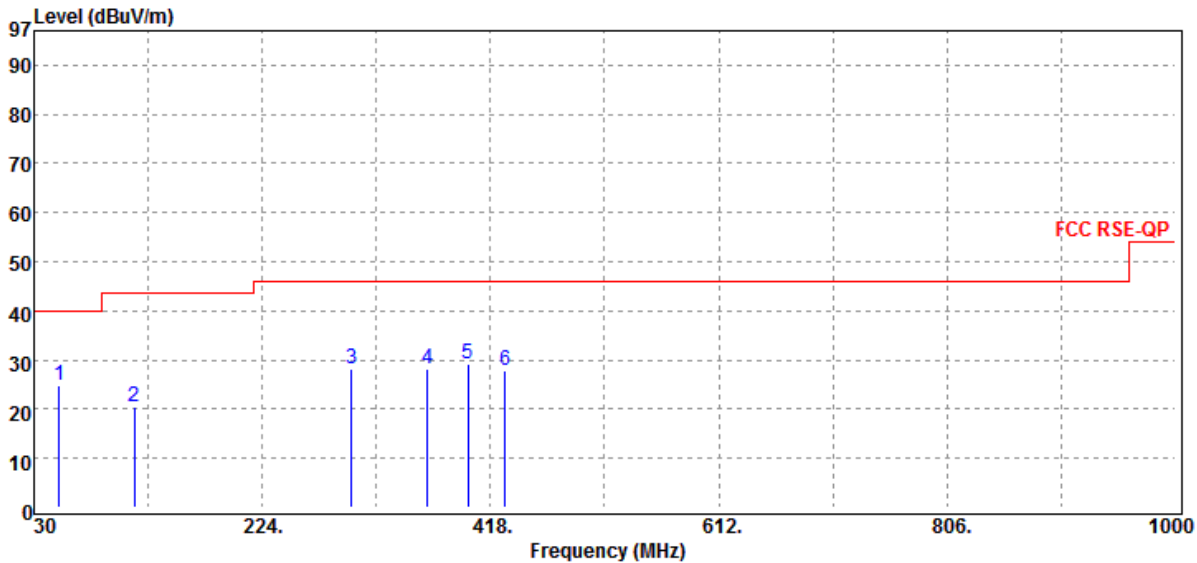
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dB $\mu$ V		dB $\mu$ V/m	dB $\mu$ V/m	
51.34	S	Peak	32.42	-7.75	24.67	40.00	-15.33
115.36	S	Peak	31.33	-10.79	20.54	43.50	-22.96
299.66	S	Peak	34.26	-5.93	28.33	46.00	-17.67
364.65	S	Peak	32.90	-4.69	28.21	46.00	-17.79
398.60	S	Peak	33.22	-3.97	29.25	46.00	-16.75
430.61	S	Peak	31.16	-3.33	27.83	46.00	-18.17

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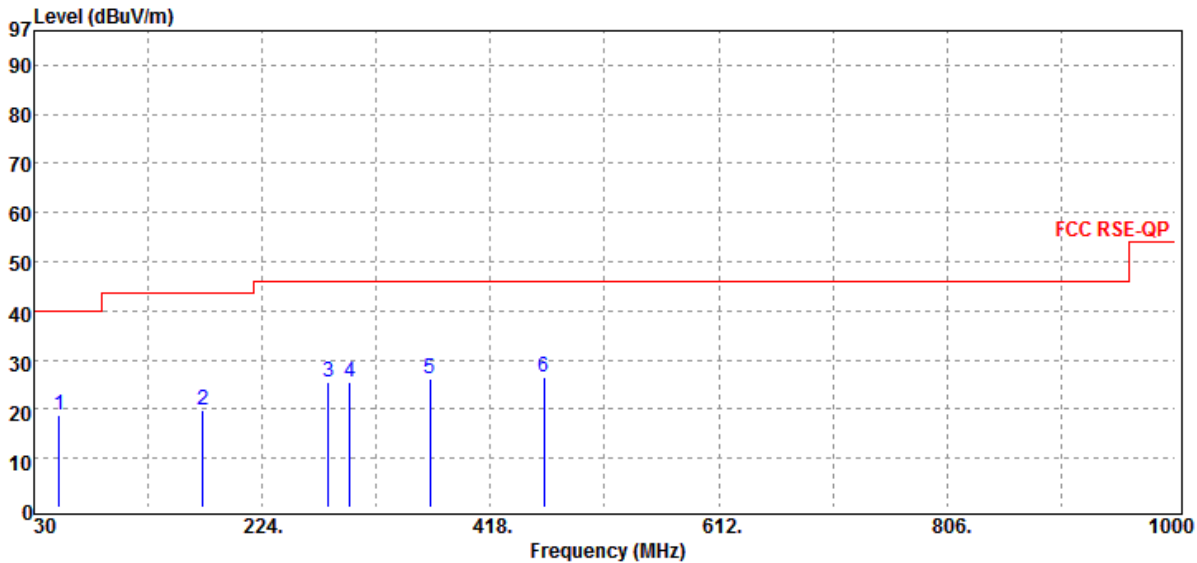
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
51.34	S	Peak	26.51	-7.75	18.76	40.00	-21.24
173.56	S	Peak	27.88	-7.96	19.92	43.50	-23.58
280.26	S	Peak	32.01	-6.35	25.66	46.00	-20.34
298.69	S	Peak	31.49	-5.95	25.54	46.00	-20.46
366.59	S	Peak	30.80	-4.72	26.08	46.00	-19.92
463.59	S	Peak	29.21	-2.55	26.66	46.00	-19.34

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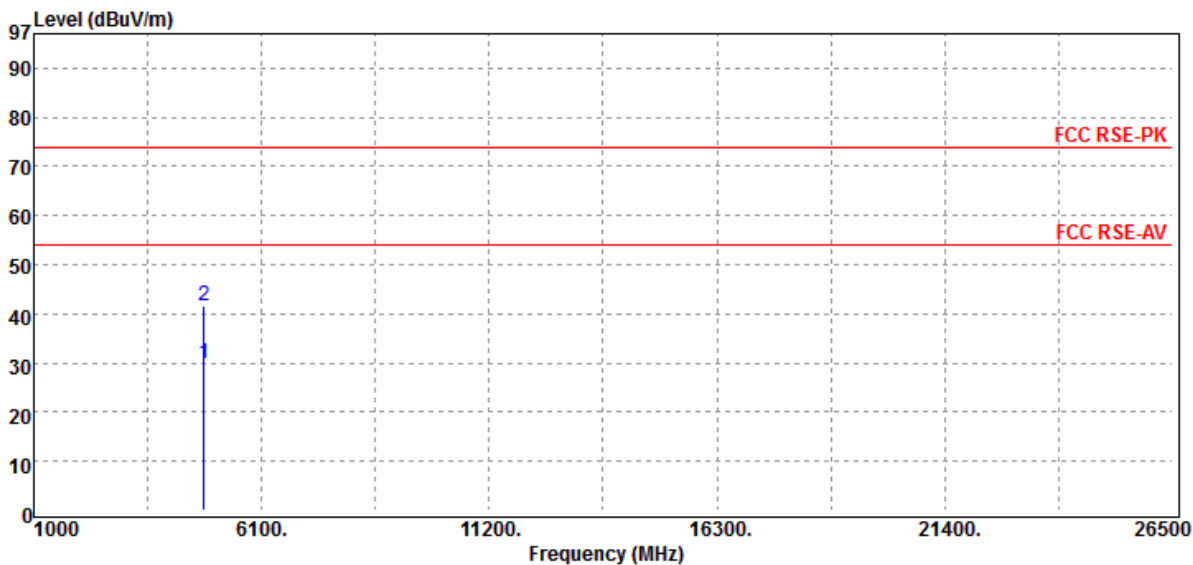
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## Radiated Spurious Emission Measurement Result (BT5.0 mode)

## For Frequency above 1GHz

## Chip Antenna

Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	Margin
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4804.00	H	Average	24.86	4.92	29.78	54.00	-24.22
4804.00	H	Peak	36.78	4.92	41.70	74.00	-32.30

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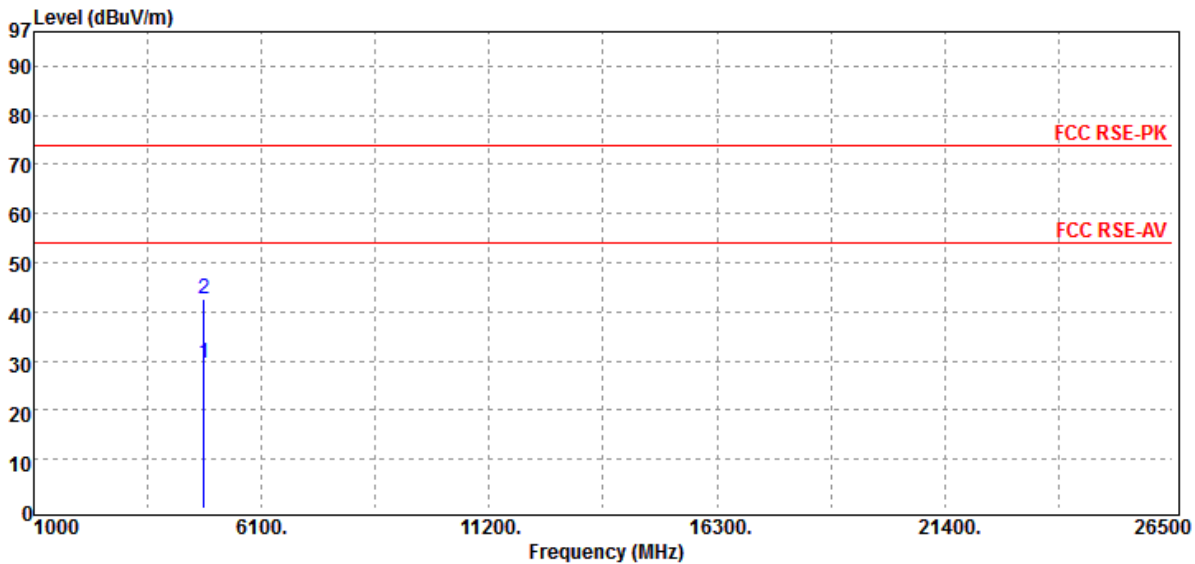
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4804.00	H	Average	24.78	4.92	29.70	54.00	-24.30
4804.00	H	Peak	37.84	4.92	42.76	74.00	-31.24

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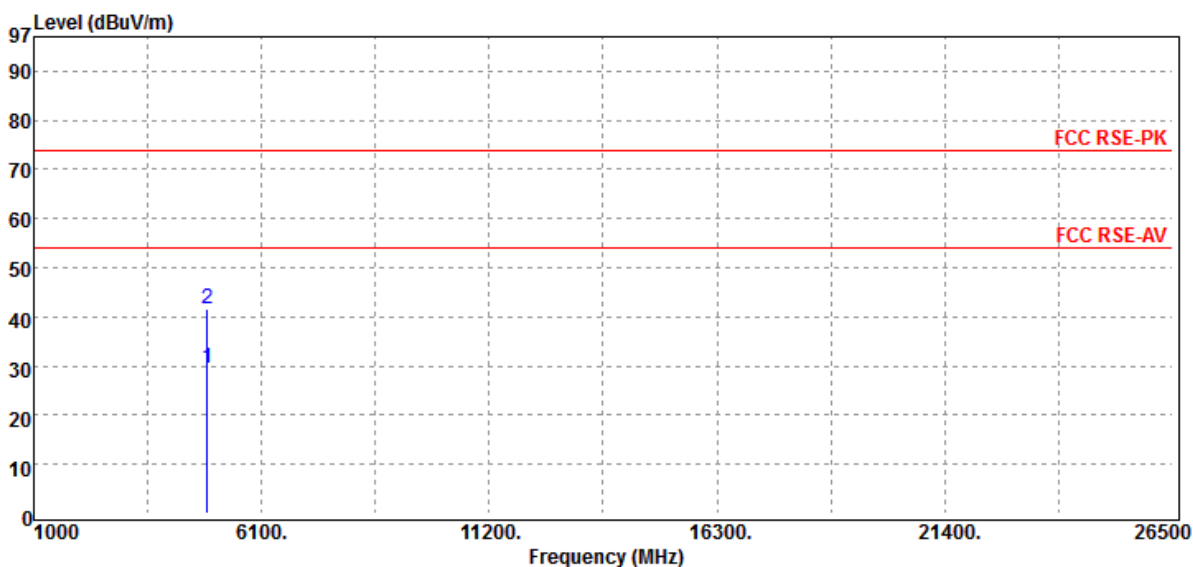
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	H	Average	24.41	5.20	29.61	54.00	-24.39
4884.00	H	Peak	36.58	5.20	41.78	74.00	-32.22

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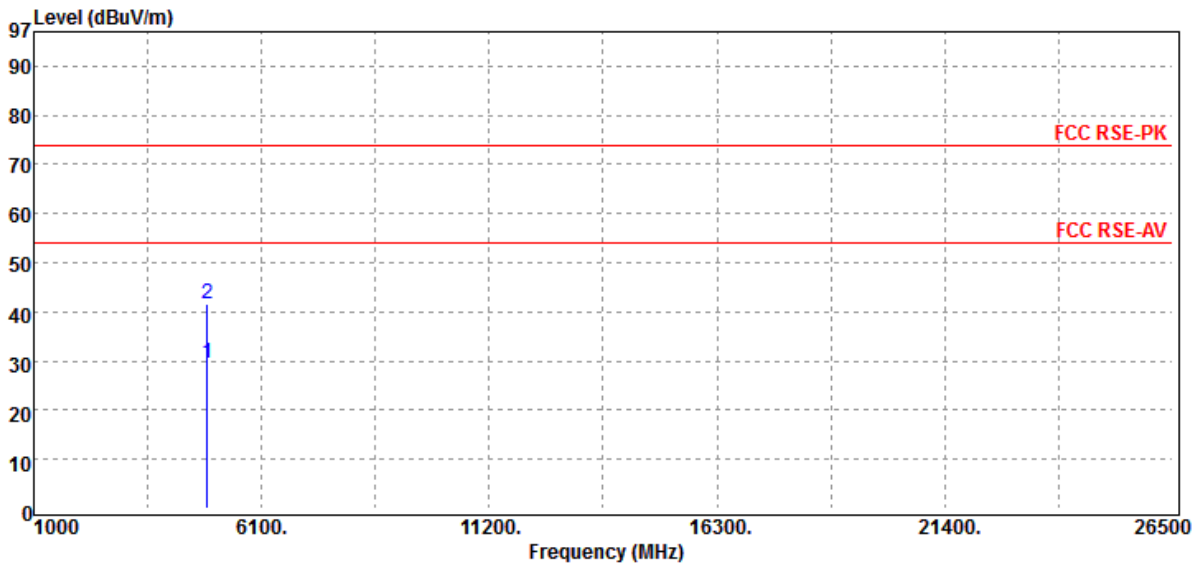
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	H	Average	24.44	5.20	29.64	54.00	-24.36
4884.00	H	Peak	36.39	5.20	41.59	74.00	-32.41

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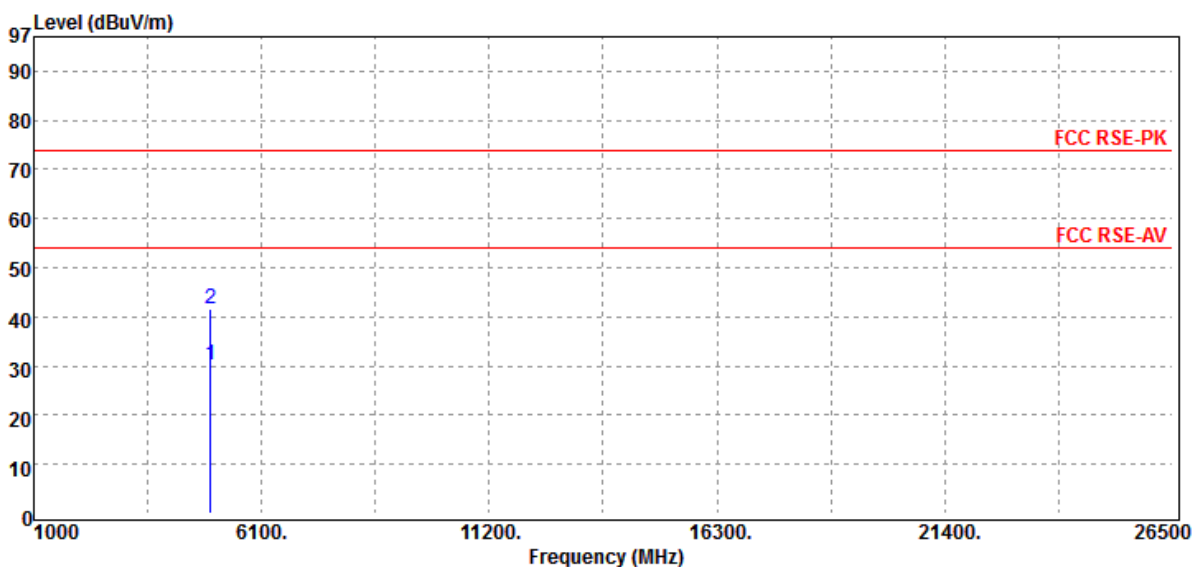
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	25.06	5.29	30.35	54.00	-23.65
4960.00	H	Peak	36.48	5.29	41.77	74.00	-32.23

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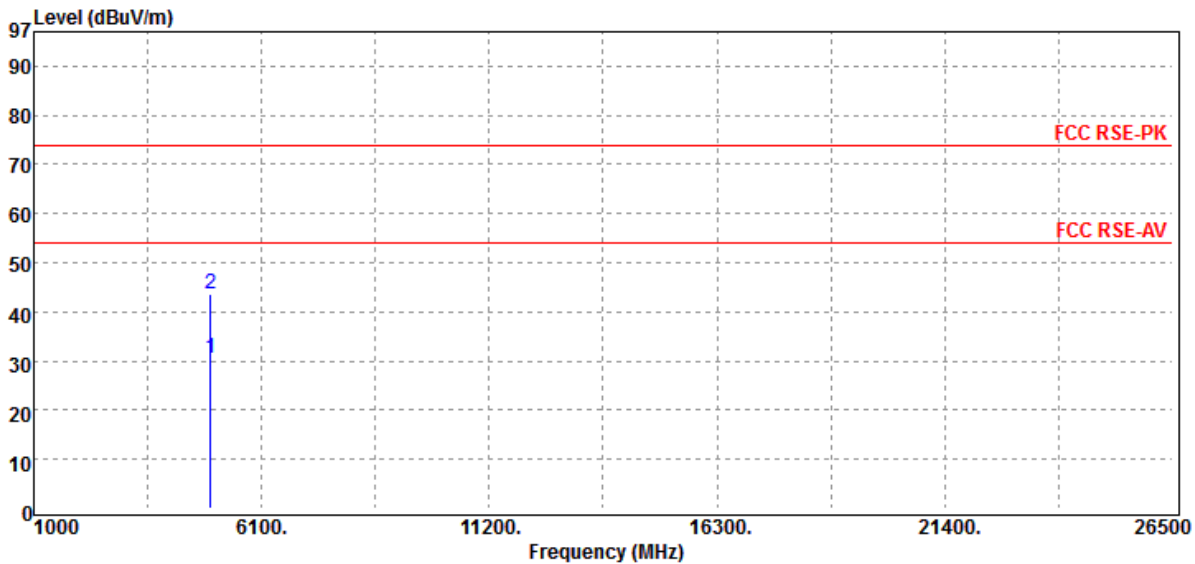
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	25.12	5.29	30.41	54.00	-23.59
4960.00	H	Peak	38.27	5.29	43.56	74.00	-30.44

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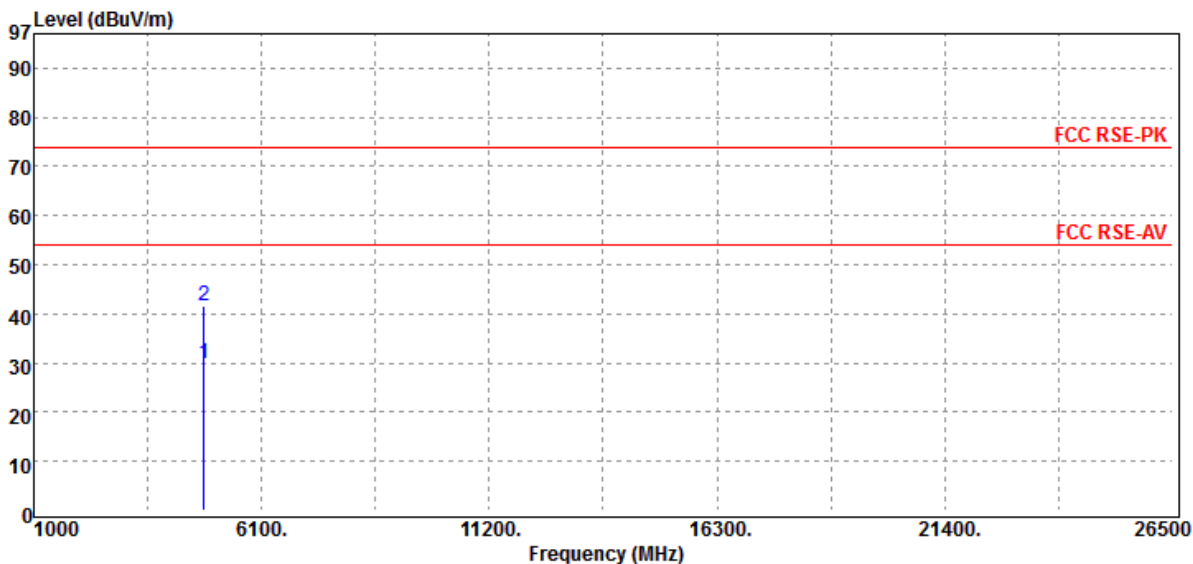
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**PCB Antenna**

Operation Band :BT5.0  
 Fundamental Frequency :2402 MHz  
 Operation Mode :Tx CH LOW  
 EUT Pol. :E2 Plane

Test Date :2017-11-14  
 Temp./Humi. :21 deg\_C / 61 RH  
 Engineer :Kane  
 Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4804.00	H	Average	25.11	4.92	30.03	54.00	-23.97
4804.00	H	Peak	36.85	4.92	41.77	74.00	-32.23

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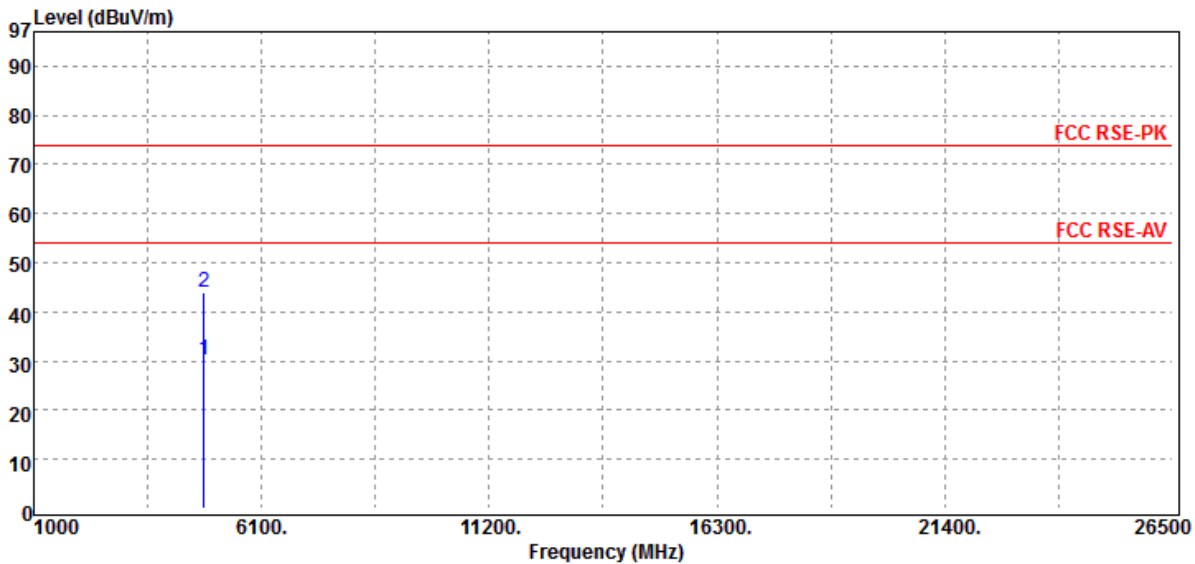
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4804.00	H	Average	25.33	4.92	30.25	54.00	-23.75
4804.00	H	Peak	39.03	4.92	43.95	74.00	-30.05

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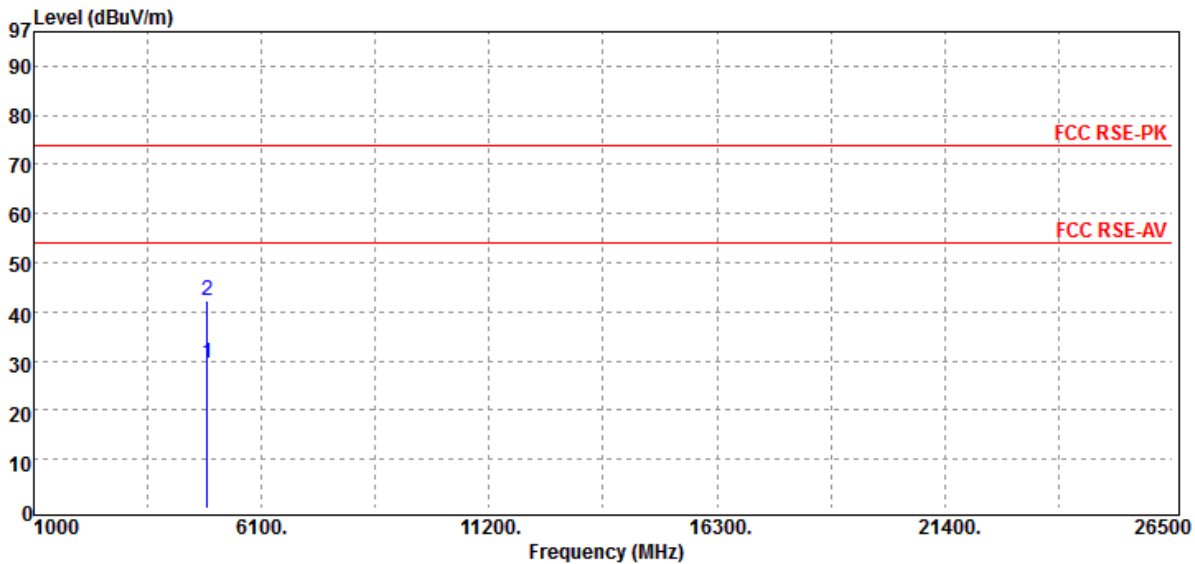
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	H	Average	24.41	5.20	29.61	54.00	-24.39
4884.00	H	Peak	37.04	5.20	42.24	74.00	-31.76

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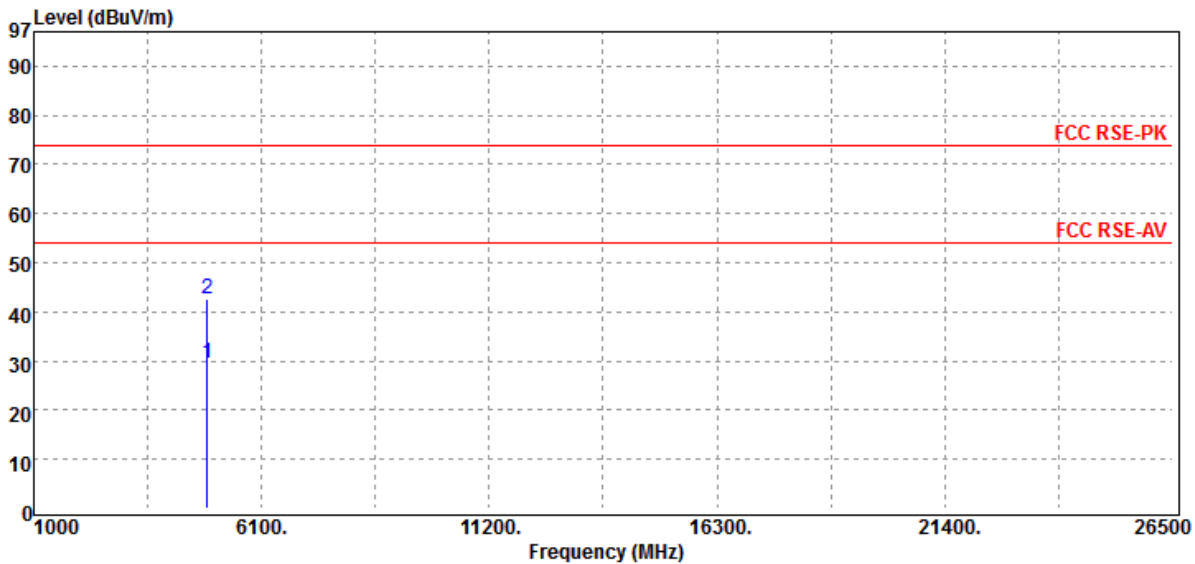
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2442 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	H	Average	24.37	5.20	29.57	54.00	-24.43
4884.00	H	Peak	37.51	5.20	42.71	74.00	-31.29

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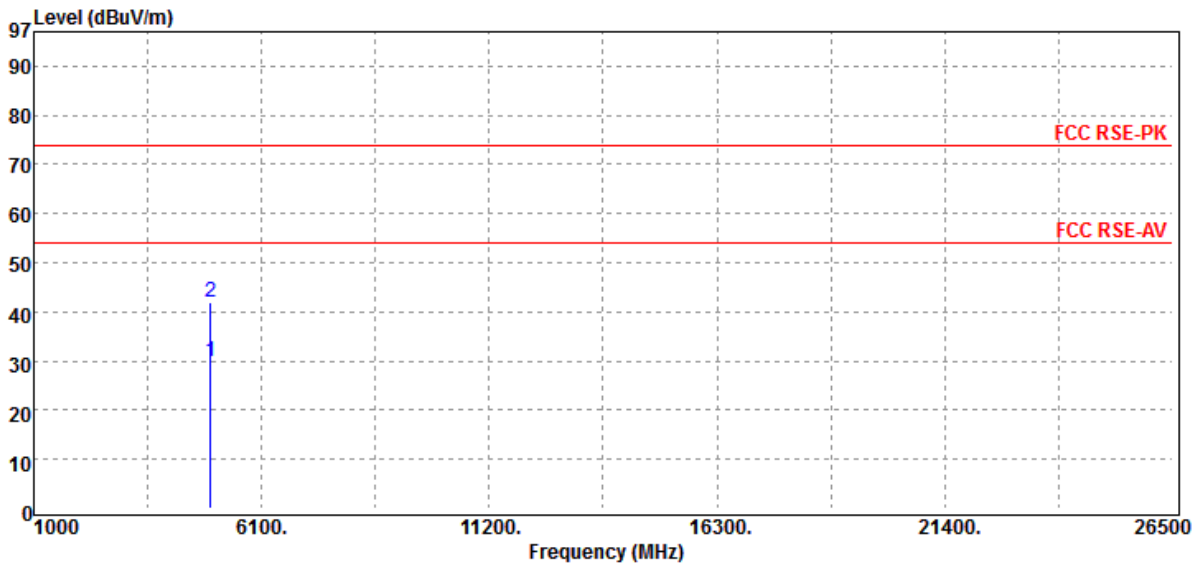
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	24.62	5.29	29.91	54.00	-24.09
4960.00	H	Peak	36.73	5.29	42.02	74.00	-31.98

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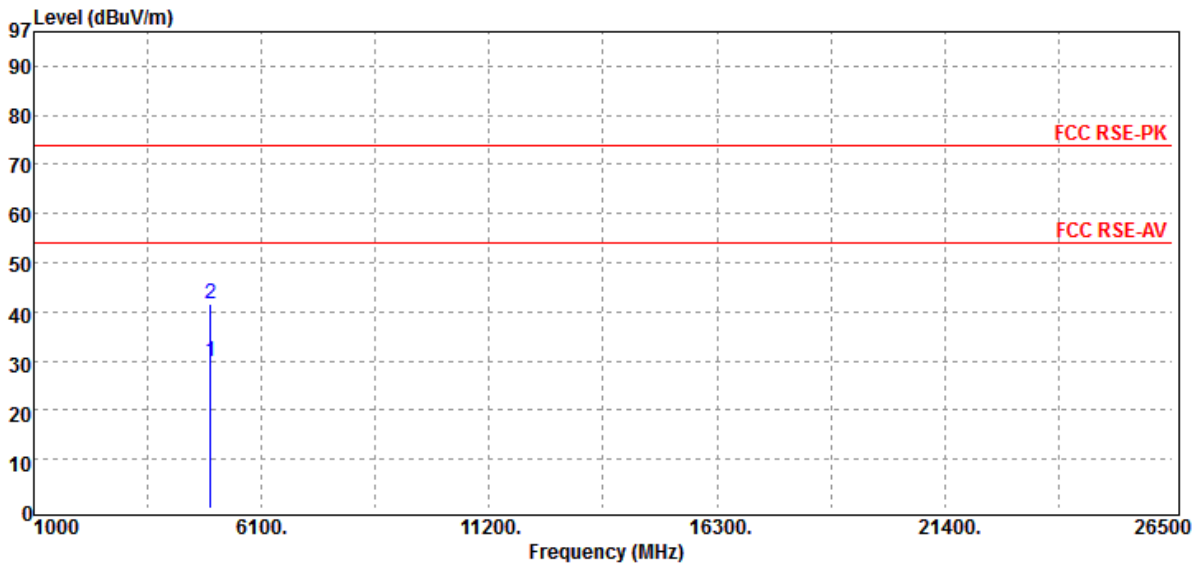
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Operation Band	:BT5.0	Test Date	:2017-11-14
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	24.56	5.29	29.85	54.00	-24.15
4960.00	H	Peak	36.38	5.29	41.67	74.00	-32.33

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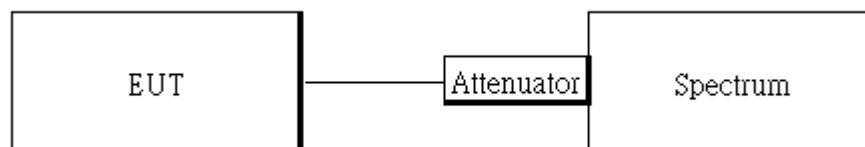
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**10 PEAK POWER SPECTRAL DENSITY****10.1 Standard Applicable:**

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

**10.2 Measurement Equipment Used:**

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

**10.3 Test Set-up:****10.4 Measurement Procedure:**

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz.
5. Set the VBW = 10 kHz.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.

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**10.5 Measurement Result:****BT5.0 mode****BLE mode**

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-13.70	8	PASS
2442	-14.13	8	PASS
2480	-13.40	8	PASS

**NOTE: cable loss as 1dB that offsets in the spectrum****Band Edge Limit**

Frequency (MHz)	RF Power Density (dBm)	Bandedge Limit = PSD - 20dB (dBm)
2402	4.26	-15.74
2480	4.32	-15.68

**NOTE: cable loss as dB that offsets in the spectrum****NOTE: Refer to next page for plots.**

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**BT5.0 mode  
Power Spectral Density Test Plot (CH-Low)****Power Spectral Density Test Plot (CH-Mid)**

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## Power Spectral Density Test Plot (CH-High)



## Power Spectral Density for Band edge Limit (CH-Low)



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## Power Spectral Density for Band edge Limit (CH-High)



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## 11 ANTENNA REQUIREMENT

### 11.1 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.

### 11.2 Antenna Connected Construction:

An embedded-in antenna design is used.

The antenna is designed as permanently attached and has 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.

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## 12 RF Exposure

### 12.1 Standard Applicable:

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

This is a Portable device with its physical nature to be used nearby, the distance between radiating structure and human is less than 20cm.

As per KDB 447498 D01 4.3.1, The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$$\left[ \frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \right] \cdot \sqrt{f(\text{GHz})} \leq 3.0 \text{ for 1-g Head \& Body SAR and } \leq 7.5 \text{ for 10-g extremity Hand SAR, where}$$

*f (GHz) is the RF channel transmit frequency in GHz*

*Power and distance are rounded to the nearest mW and mm before calculation*

### (A) Measurement Result:

#### Step 1:

This is a portable device and the max. output power including tune-up tolerance is 2.203 (mW), lower than the threshold given and derived as formula given above, where

$$= 2.203(\text{mW}) / 5(\text{mm}) \cdot \sqrt{2.442 \text{ (GHz)}} = 0.689 < 7.5$$

Frequency (MHz)	Avg. output power (dBm)	Avg. output power (mW)	Distance (mm)	Result
2442	3.43	2.203	5	0.689

As the result of calculation result indicates, the RF exposure generating from given transmitter (transmitter employed digital modulation) can be excluded from SAR measurement, and is deemed compliant with RF exposure as per FCC.

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## The table of quick reference in terms of power threshold

### SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and $\leq 50$ mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

*Note that the table present above is the table of quick reference, indexing the level of power threshold with respect to the corresponding frequency. The value of the index may be deviated, and therefore, the derivation of exemption based on KDB447498 D01 is used in this test report, relevantly.*

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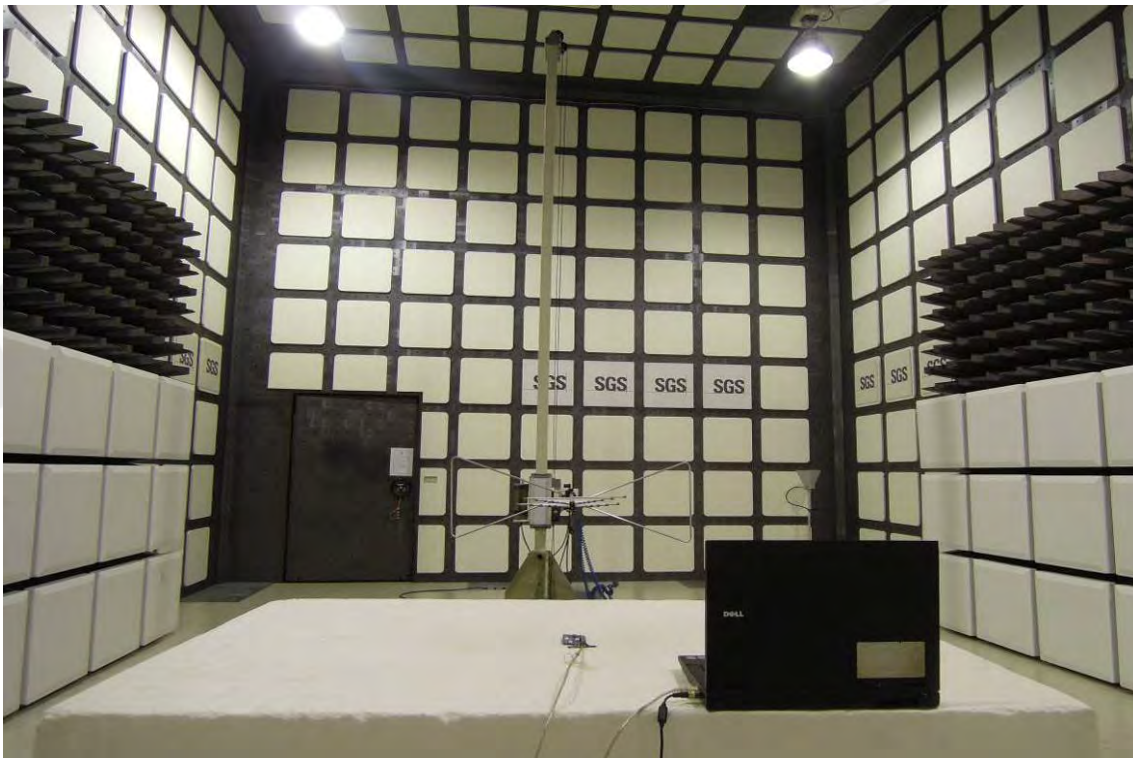
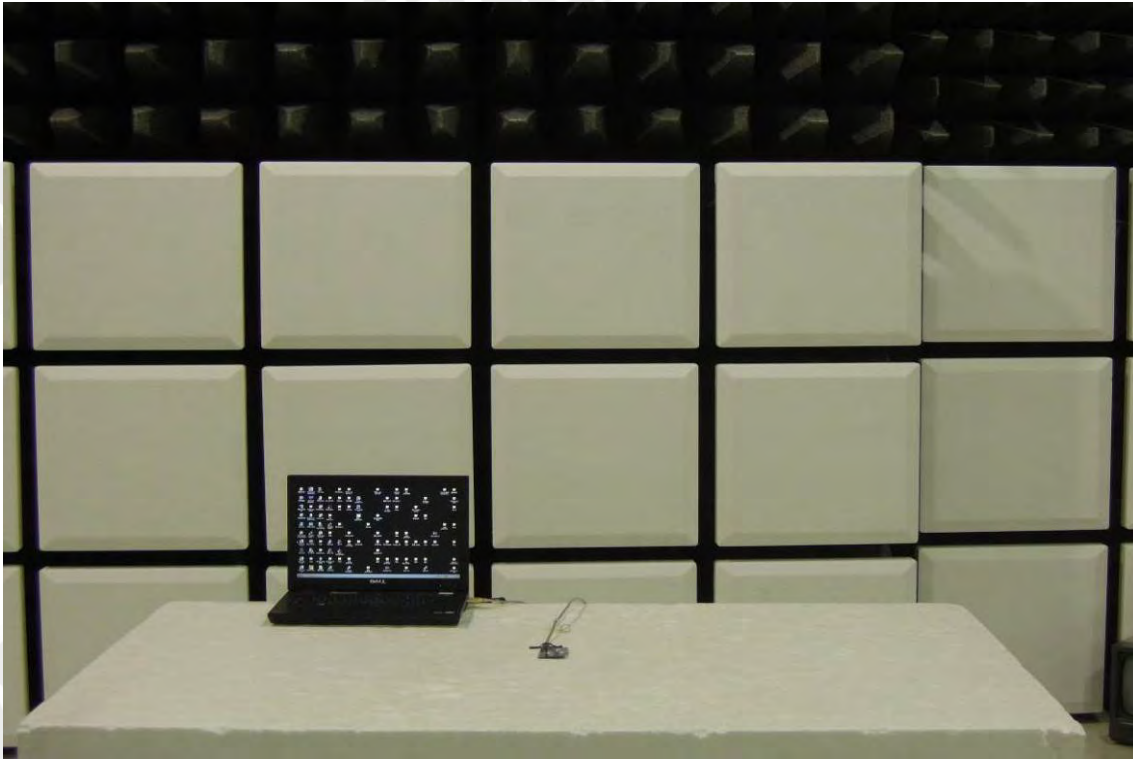
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## PHOTOGRAPHS OF SET UP

### Radiated Emission Set up Photos (Below 1GHz) (Chip Antenna)



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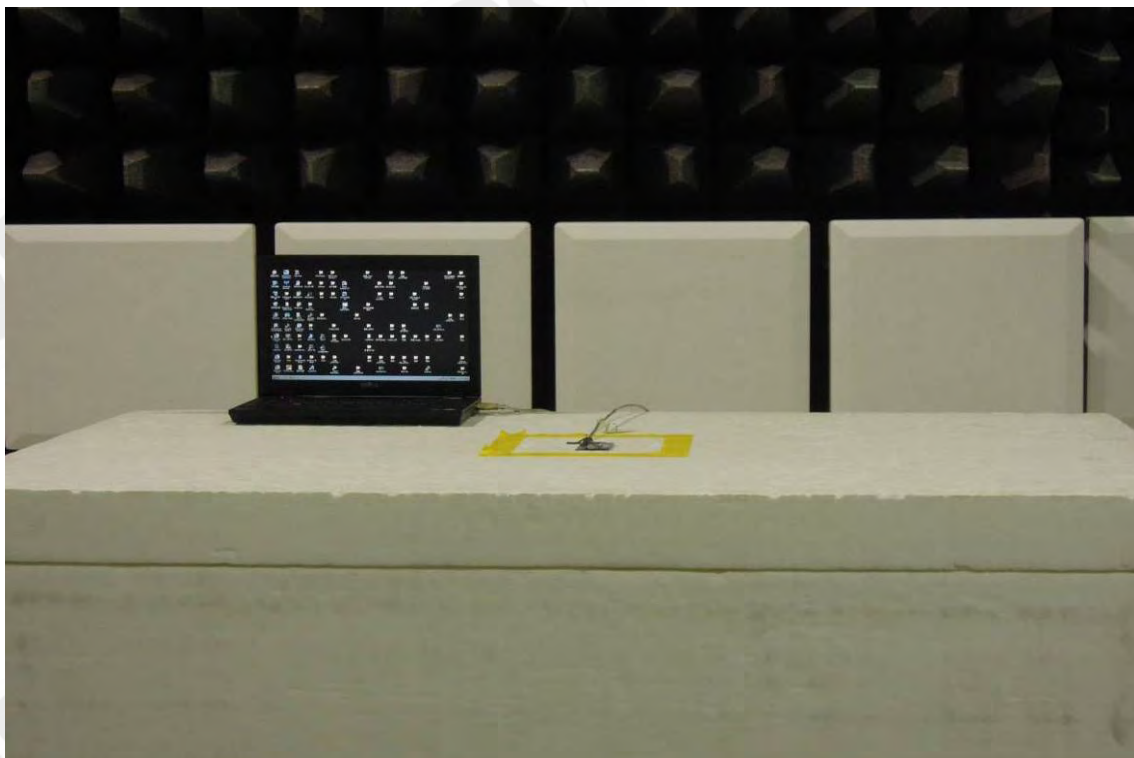
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## Radiated Emission Set up Photos (Above 1GHz)



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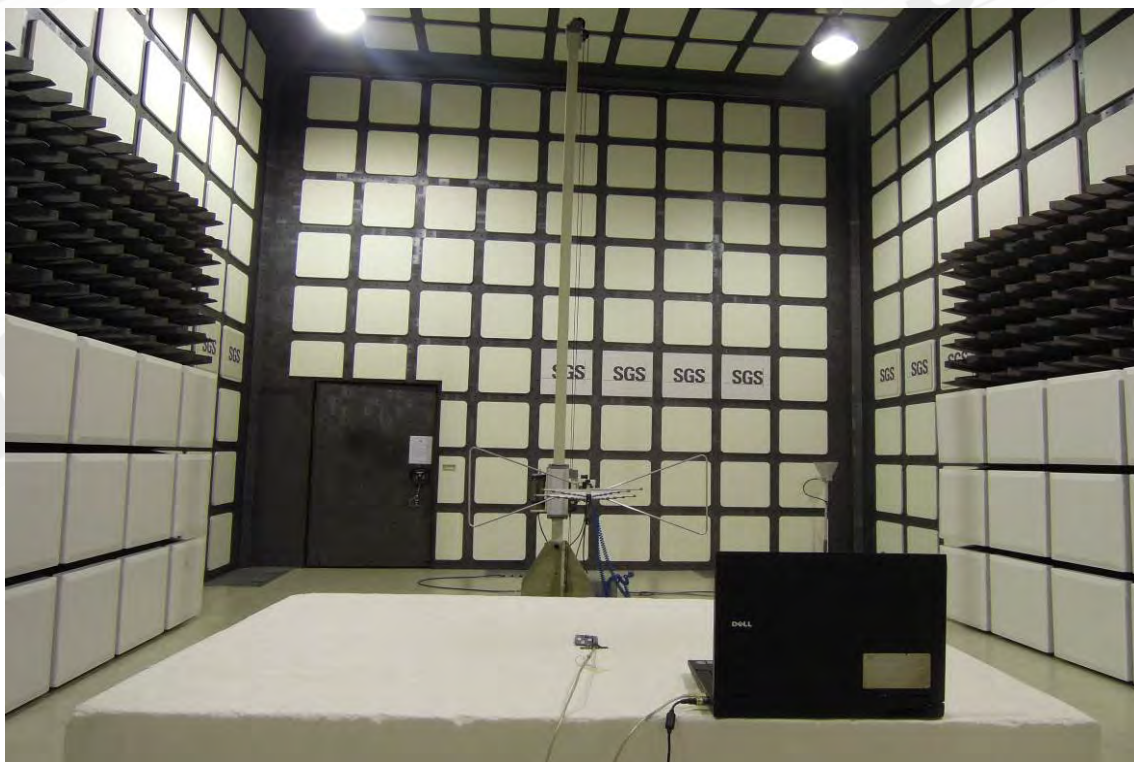
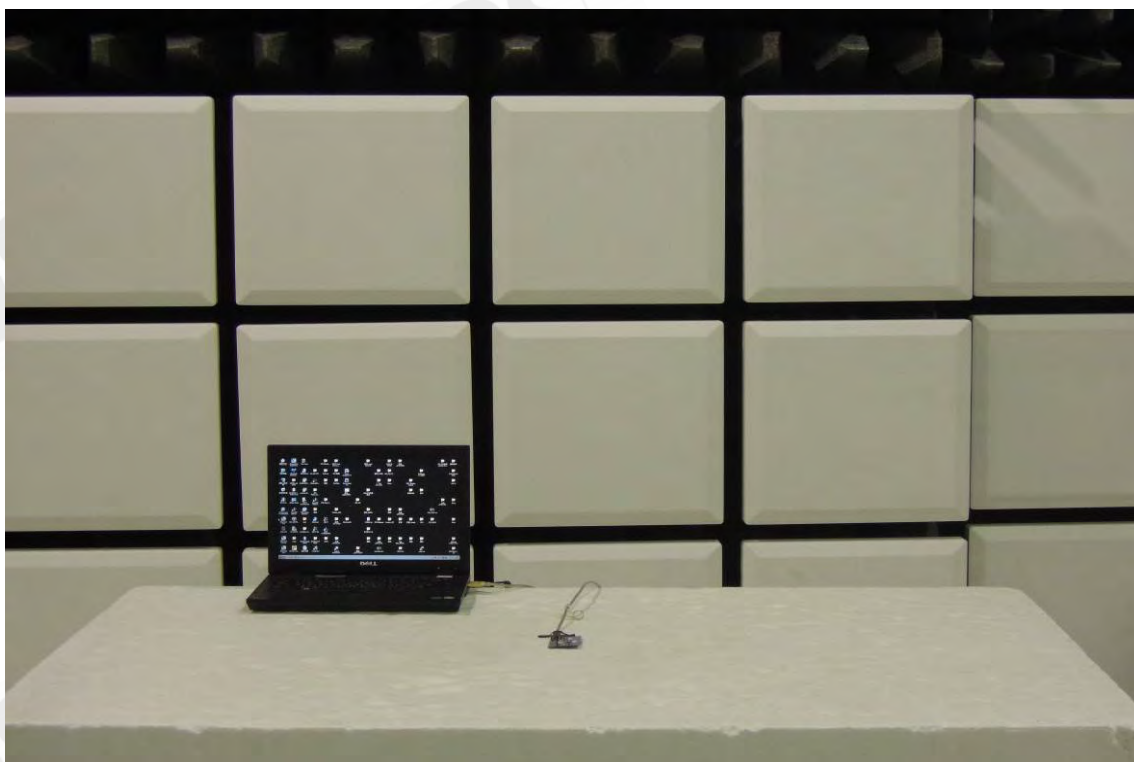
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## Radiated Emission Set up Photos (Below 1GHz) (PCB Antenna)



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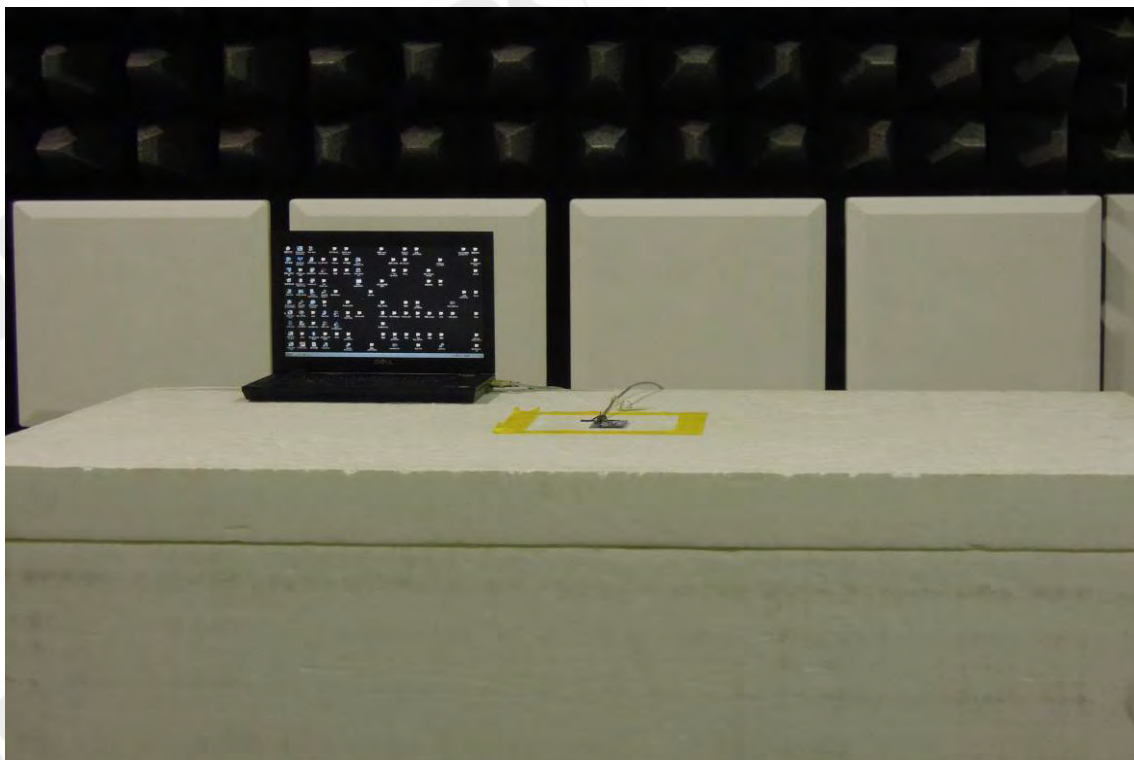
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## Radiated Emission Set up Photos (Above 1GHz)



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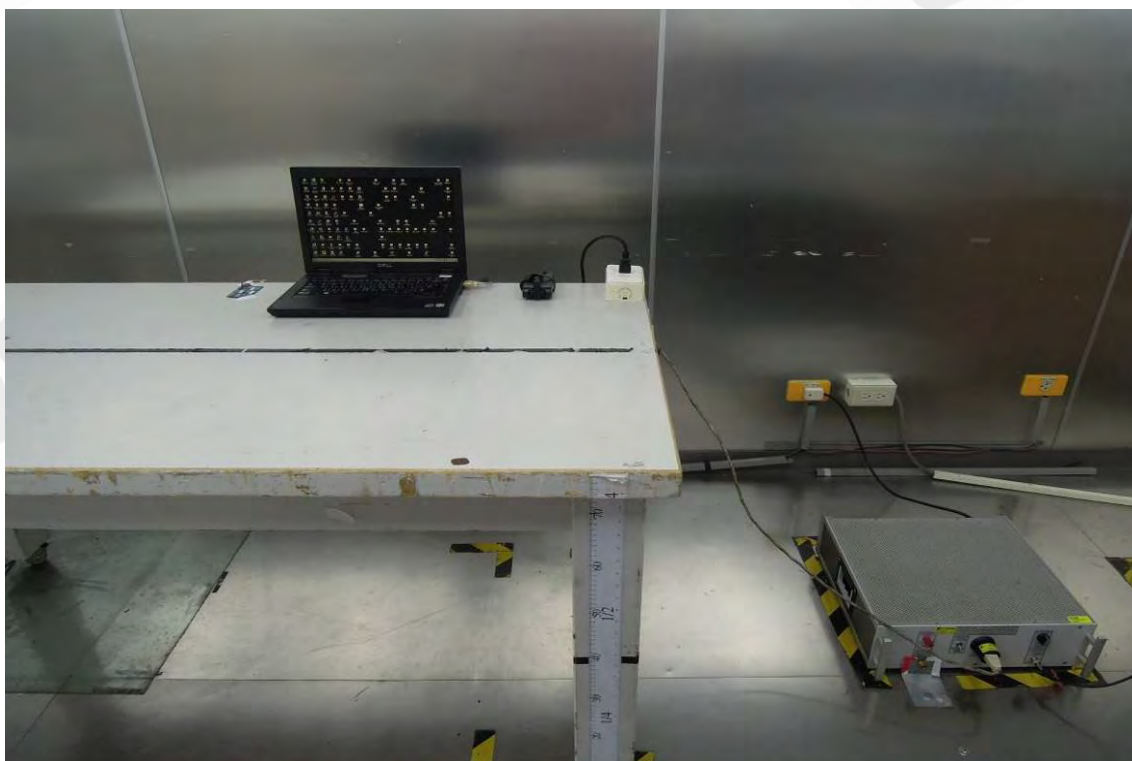
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## AC Power-line Conducted Emission Set up Photo



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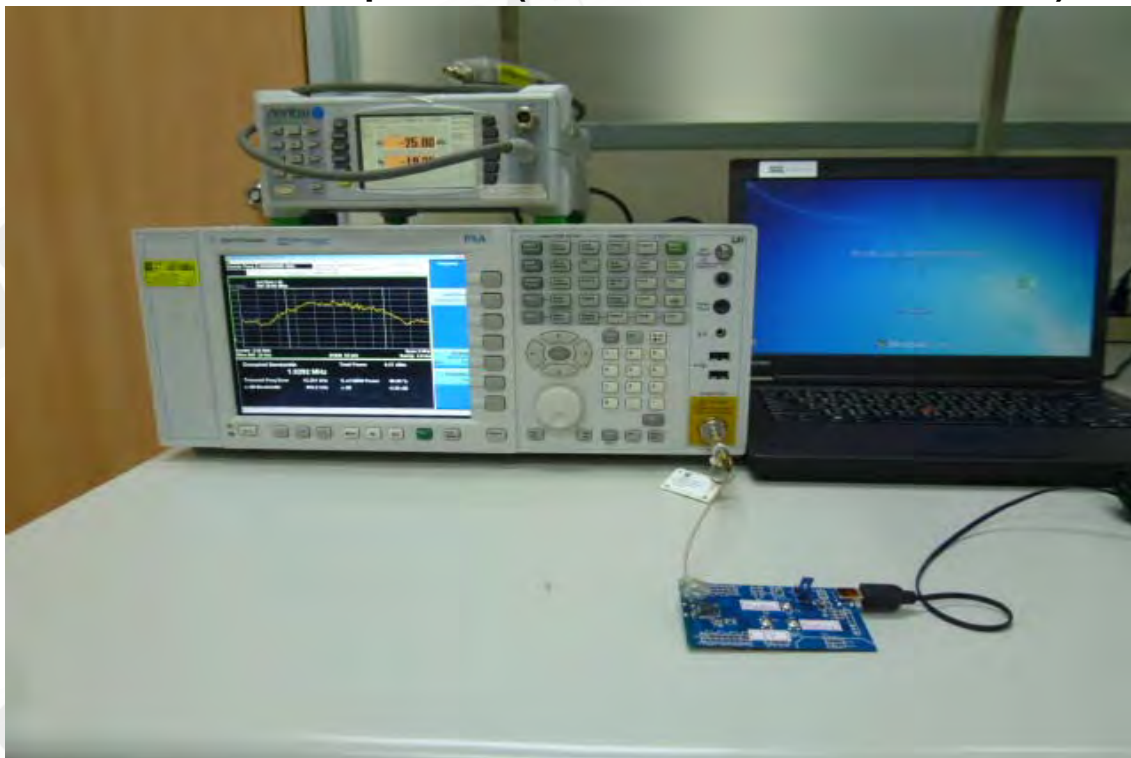
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**Conducted Setup Photo (Measurement at Antenna Port)****PHOTOGRAPHS OF EUT**

**Please refer to the attached file(EUT Photo)**

*~ End of Report ~*

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