

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT OF

**Product Name:** Bluetooth V4.0 Dual-Mode Dongle  
**Brand Name:** Targus  
**Model No.:** ACB75A  
**Model Difference:** N/A  
**FCC ID:** OXM000080  
**Report No.:** ER/2017/60150  
**Issue Date:** Jul. 18, 2017  
**FCC Rule Part:** §15.247, Cat: DTS  
**Applicant:** Targus International LLC  
1211 North Miller Street, Anaheim, CA 92806 USA  
**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
No.134, Wu Kung Road, New Taipei Industrial  
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24803  
**Date of test:** Jul. 04, 2017 ~ Jul. 06, 2017  
**Date of EUT  
Received:** Jun. 29, 2017



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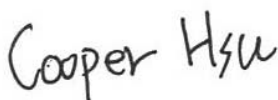
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## 1 REVISION HISTORY

Report Number	Revision	Description	Issue Date
ER/2017/60150	Rev.00	Initial creation of document	Jul. 18, 2017

Test By:



Date

Jul. 18, 2017

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Cooper Hsu / Engineer

Prepared By:



Date

Jul. 18, 2017

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Allen Tsai / Engineer

Approved By:



Date

Jul. 18, 2017

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Jim Chang / Asst. Manager

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## 2 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§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

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## 4 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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## 5 GENERAL INFORMATION

### 5.1 Product Description

General:

Product Name:	Bluetooth V4.0 Dual-Mode Dongle
Brand Name:	Targus
Model No.:	ACB75A
Model Difference:	N/A
Power Supply:	5Vdc from USB Port

Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V4.0 single mode
Channel number:	40 channels
Modulation type:	GFSK
Antenna Type:	PIFA
Antenna Gain:	PCB Antenna, Peak Gain:-4.10dBi

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## 5.2 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		

### Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest Channel (CH0)	2402 MHz
The Middle Channel (CH19)	2440 MHz
The Highest Channel (CH 39)	2480 MHz

## 5.3 Test Environment

Operating Environment:	
Temperature:	25°C
Humidity:	55% RH

## 5.4 Description of Support Units

The EUT has been tested independently.

## 5.5 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

## 5.6 Deviation from standards

None

## 5.7 Abnormalities from Standard Conditions

None

## 5.8 Other Information Requested by the Customer

None

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## 5.9 Equipment List

Conduction 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	02/07/2016	02/06/2017
LISN	Schwarzbeck	NSLK 8127	8127-648	03/11/2016	03/10/2017
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL 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

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Radiated Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2016	09/19/2017
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017
Pre-Amplifier	Agilent	8447D	2944A07676	01/05/2017	01/04/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/05/2017	01/04/2018
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

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## 6 TEST RESULT AND MEASUREMENT DATA

### 6.1 Antenna Requirement

Applicable Standard:	47 CFR Part 15C Section 15.203 /247(c)
<b>15.203 requirement:</b> An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
<b>15.247(b) (4) requirement:</b> The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -4.10dBi.	

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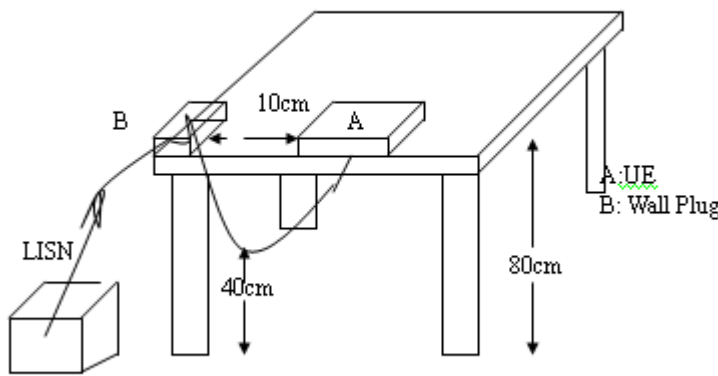
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## 6.2 Conducted emission test

Test Requirement:	47 CFR Part 15C Section 15.207														
Test Method	ANSI C63.10: 2013														
Test Frequency Range:	150kHz to 30MHz														
Limit	<table><thead><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limits dB(uV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr></thead><tbody><tr><td>0.15 to 0.50</td><td>66 to 56</td><td>56 to 46</td></tr><tr><td>0.50 to 5</td><td>56</td><td>46</td></tr><tr><td>5 to 30</td><td>60</td><td>50</td></tr></tbody></table> <p><b>Note</b> 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.</p>	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
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													
Test Procedure:	<p>1. The EUT was placed on a table which is 0.8m above ground plan.</p> <p>2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.</p> <p>3. Repeat above procedures until all phases of power being supplied by given UE are completed</p>														
Test Setup:	<p>1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.</p> <p>2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.</p> <p>3. The LISN was connected with 120Vac/60Hz power source</p>  <p>A: UE B: Wall Plug</p>														
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. Transmitting mode.														

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Final Test Mode:	Through Pre-scan, find the GFSK modulation at the lowest channel is the worst case. Transmitting mode Only the worst case is recorded in the report.
Instrument Used:	Refer to section 5.9 for details
Test Results:	Pass

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Site ConductionRoom

Limit: FCC Class B Conduction(QP)

Mode: Operationmode

Note:

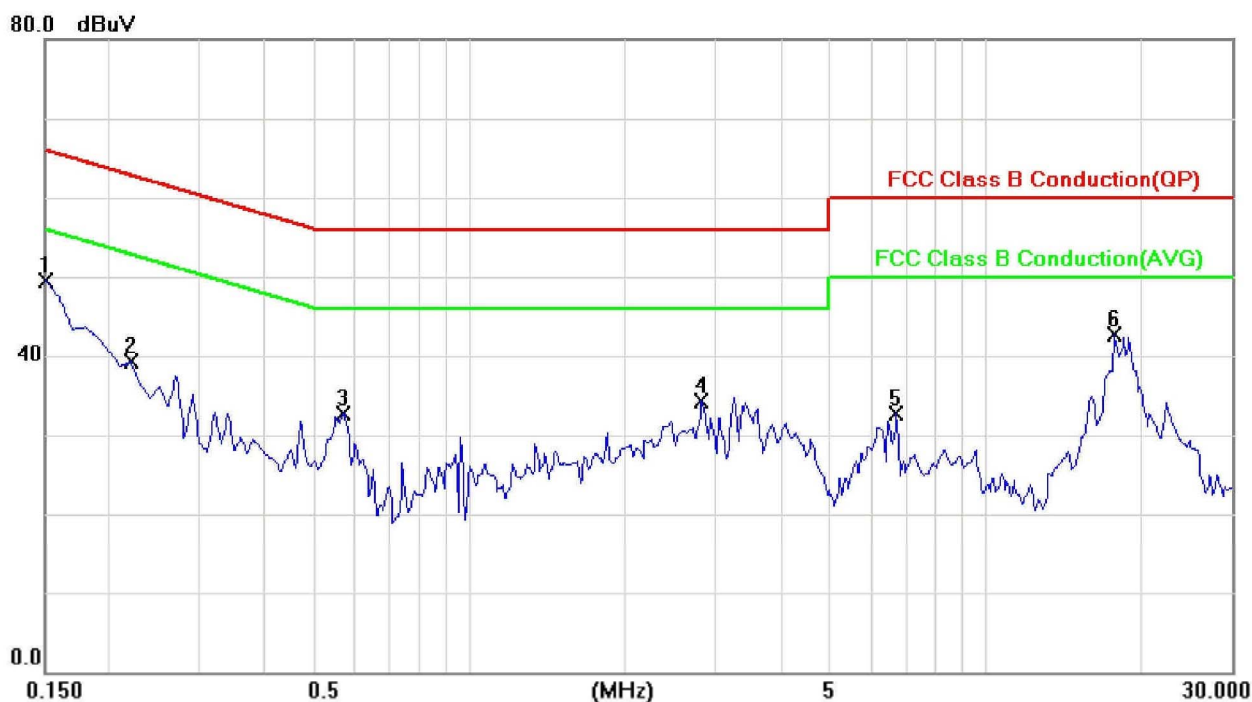
Phase: L1

Power: AC 120V/60Hz

Temperature: 26 °C

Humidity: 60%

## ConductedEmission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1500	49.44	0.16	49.60	66.00	-16.40	peak	
2		0.2200	39.09	0.16	39.25	62.82	-23.57	peak	
3		0.5700	32.62	0.17	32.79	56.00	-23.21	peak	
4		2.8200	34.01	0.23	34.24	56.00	-21.76	peak	
5		6.7200	32.30	0.31	32.61	60.00	-27.39	peak	
6		17.6800	42.32	0.42	42.74	60.00	-17.26	peak	

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Site ConductionRoom

Limit: FCC Class B Conduction(QP)

Mode: Operationmode

Note:

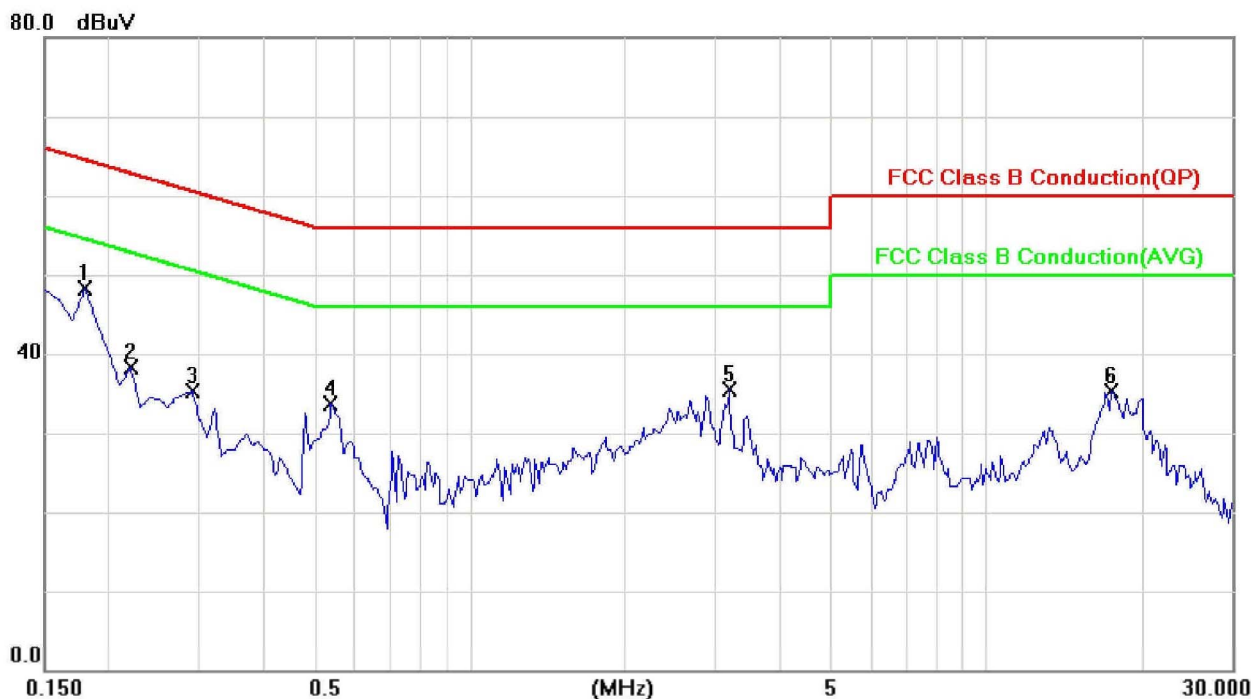
Phase: N

Power: AC 120V/60Hz

Temperature: 26 °C

Humidity: 60%

## ConductedEmission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1800	48.07	0.19	48.26	64.49	-16.23	peak	
2		0.2200	38.05	0.19	38.24	62.82	-24.58	peak	
3		0.2900	35.07	0.20	35.27	60.52	-25.25	peak	
4		0.5400	33.57	0.19	33.76	56.00	-22.24	peak	
5		3.1800	35.13	0.28	35.41	56.00	-20.59	peak	
6		17.5200	34.68	0.53	35.21	60.00	-24.79	peak	

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

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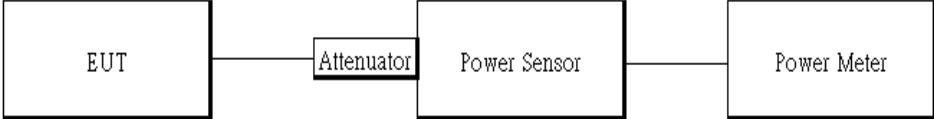
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### 6.3 Peak output power measurement

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method	ANSI C63.10: 2013 FCC KDB 558074 D01 DTS Meas. Guidance.
Test Setup:	 <p>Remark: Offset the cable loss 0.5dB in the Power Meter.</p>
Limit	30 dBm
Test Procedure:	<ol style="list-style-type: none"> <li>1. Place the EUT on the table and set it in transmitting mode.</li> <li>2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.</li> <li>3. Record the max. Reading as observed from Power Meter.</li> <li>4. Repeat above procedures until all test default channel measured was complete.</li> </ol>
Test Mode	Transmitting with GFSK modulation
Instruments used:	Refer to section 5.9 for details
Test Results:	Pass

### Measurement Data

#### Formula:

Duty Cycle =  $T_{on} / (T_{on} + T_{off})$

#### Duty Factor:

	Duty Cycle (%)	Duty Factor (dB)
BLE	62.56	2.04

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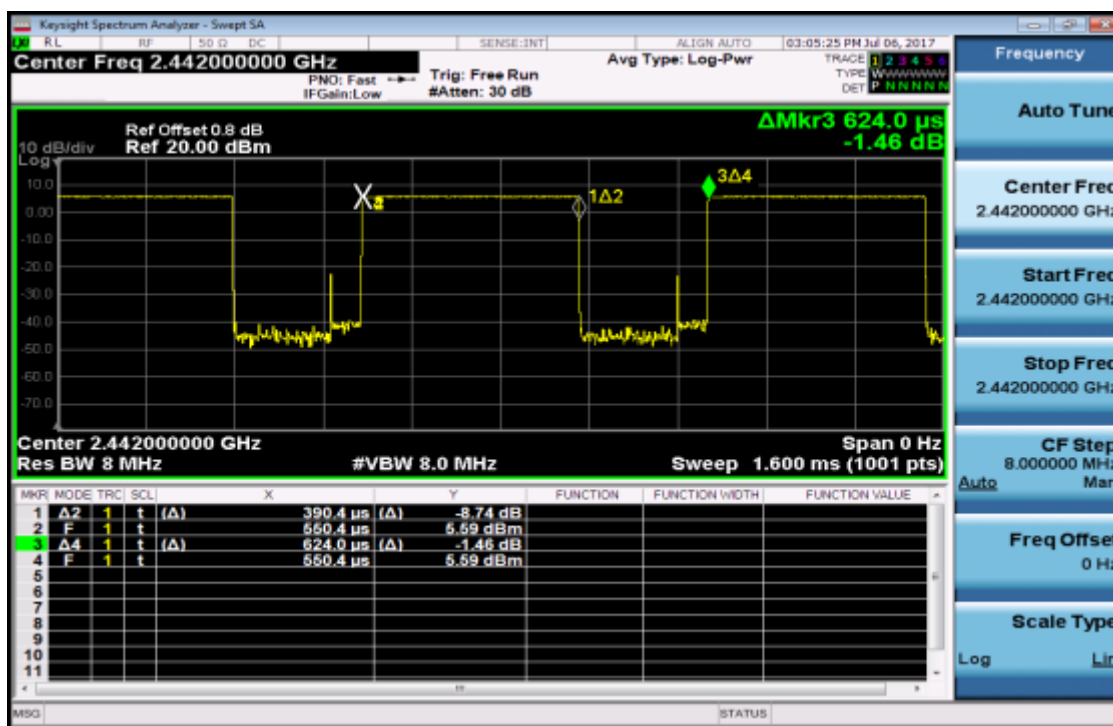
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Duty Cycle Factor:  $10 \cdot \log(1/62.56/100) = 2.04$

## BLE mode:

CH	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
0	2402	5.87	1 Watt = 30 dBm
20	2442	6.17	1 Watt = 30 dBm
39	2480	6.26	1 Watt = 30 dBm

## BLE mode:

CH	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
0	2402	3.51	1 Watt = 30 dBm
20	2442	3.82	1 Watt = 30 dBm
39	2480	3.91	1 Watt = 30 dBm

\*Note: Measured by power meter, cable loss as 0.8 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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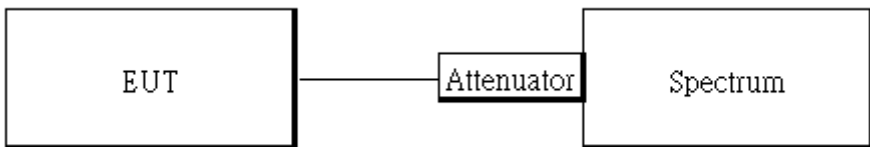
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## 6.4 6dB Bandwidth measurement

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method	ANSI C63.10: 2013 FCC KDB 558074 D01 DTS Meas. Guidance.
Test Setup:	
Limit	≥ 500 kHz
Test Procedure:	<ol style="list-style-type: none"> <li>1. Place the EUT on the table and set it in transmitting mode.</li> <li>2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.</li> <li>3. For 6dB Bandwidth:</li> <li>4. Set the spectrum analyzer as RBW=100 kHz, VBW= 3*RBW, Span = 5MHz, Detector=Peak, Sweep=auto.</li> <li>5. Mark the peak frequency and -6dB (upper and lower) frequency.</li> <li>6. For 99% Bandwidth:</li> <li>7. Set the spectrum analyzer as RBW=1%, VBW=3*RBW, Span = 2MHz, Detector=Sample, Sweep=auto.</li> <li>8. Turn on the 99% bandwidth function, max reading.</li> <li>9. Repeat above procedures until all test default channel is completed</li> </ol>
Test Mode	Transmitting with GFSK modulation
Instruments used:	Refer to section 5.9 for details
Test Results:	Pass

### Measurement Data:

*Note: Refer to next page for plots.*

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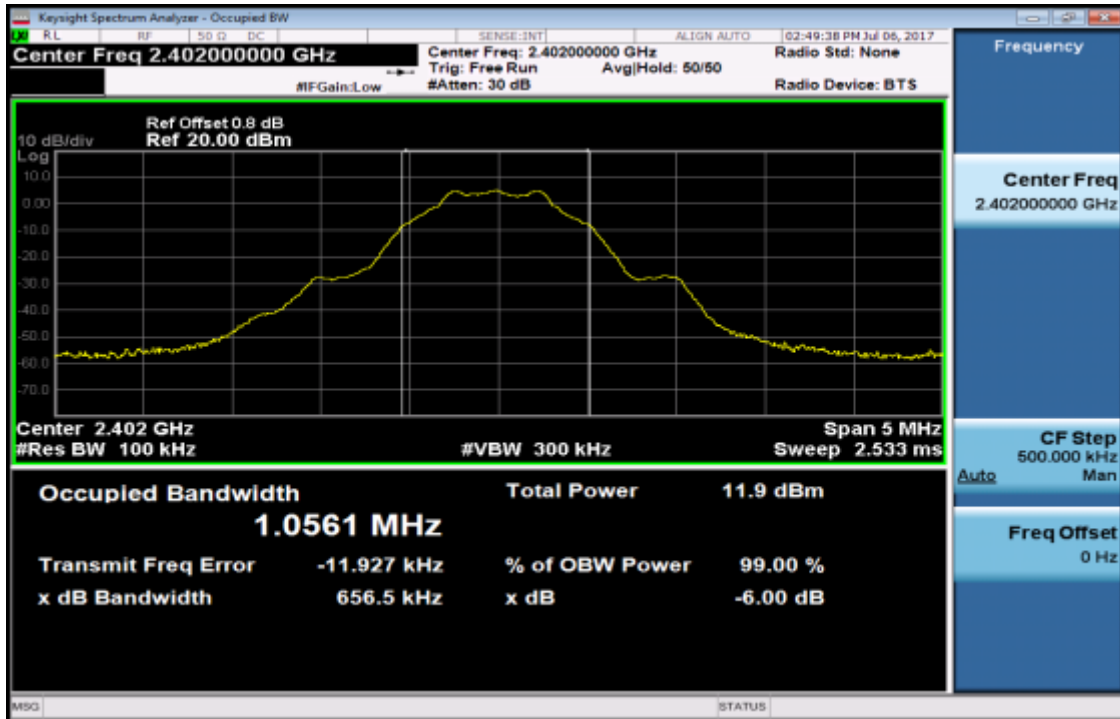
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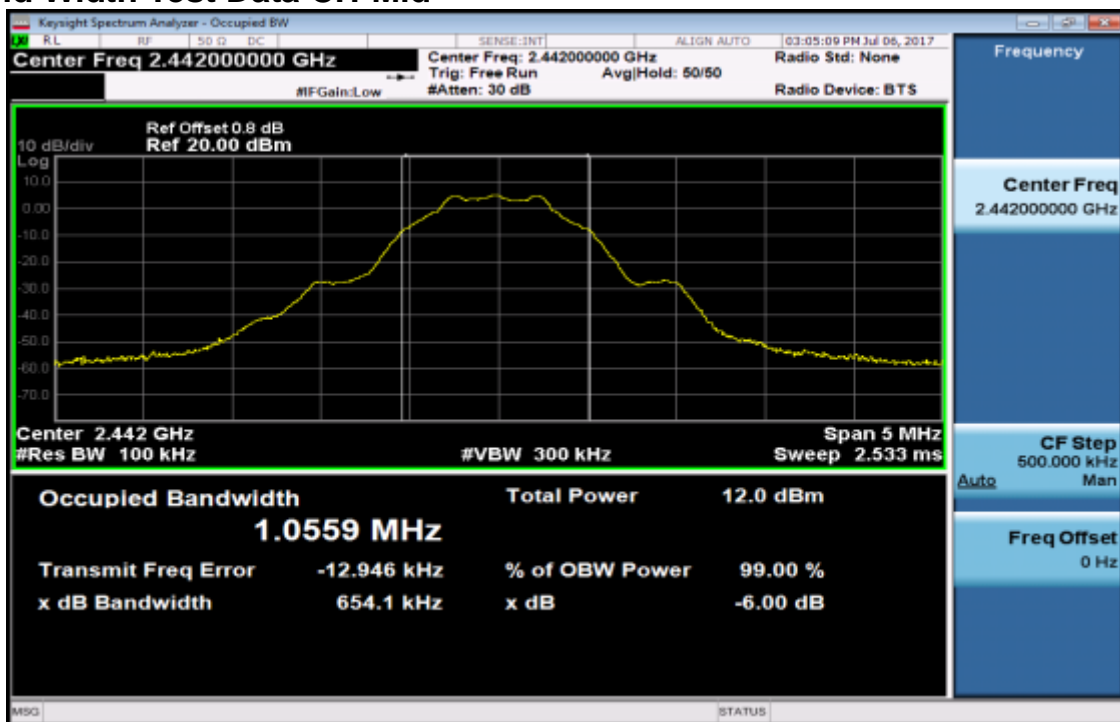
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## 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid



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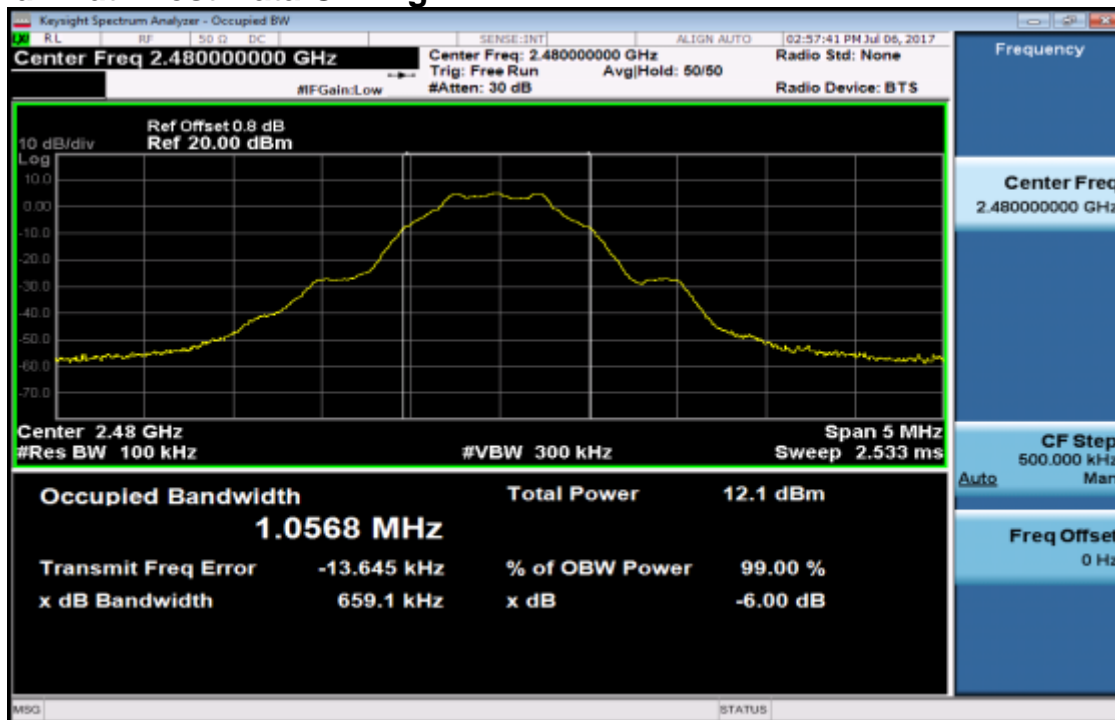
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## 6dB Band Width Test Data CH-High



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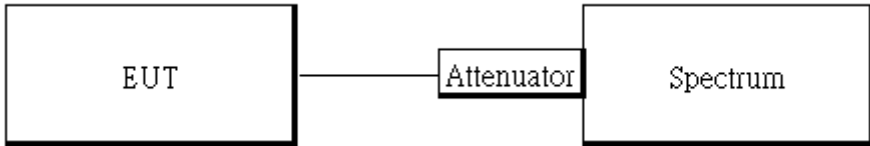
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## 6.5 Peak power spectral density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 :2013 Section 11.10.2 FCC KDB 558074 D01 DTS Meas. Guidance
Test Setup:	
Test Procedure:	<ol style="list-style-type: none"> <li>1. Set analyzer center frequency to DTS channel center frequency.</li> <li>2. Set the span to 1.5 times the DTS channel bandwidth.</li> <li>3. Set the RBW = 3 kHz. &amp; the VBW = 10 kHz</li> <li>4. For defining Restricted Band Edge Limit: Set the RBW = 100kHz &amp; VBW = 300 kHz.</li> <li>5. Detector = peak.</li> <li>6. Sweep time = auto couple.</li> <li>7. Trace mode = max hold.</li> <li>8. Allow trace to fully stabilize.</li> <li>9. Use the peak marker function to determine the maximum amplitude level.</li> </ol>
Limit:	≤8.00dBm/3kHz
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.9 for details.
Test Results:	Pass

### 6.5.1 Measurement Data

#### BLE mode

##### BLE mode

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-8.64	8	PASS
2442	-8.52	8	PASS
2480	-8.54	8	PASS

*NOTE: cable loss as 0.8dB that offsets in the spectrum*

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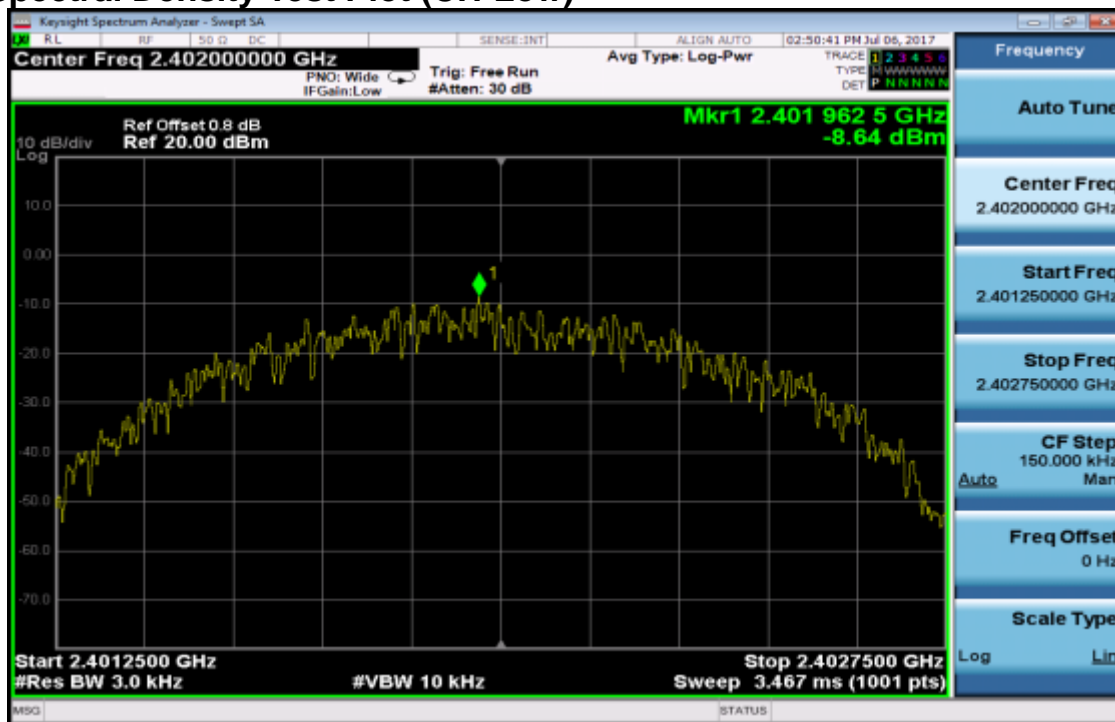
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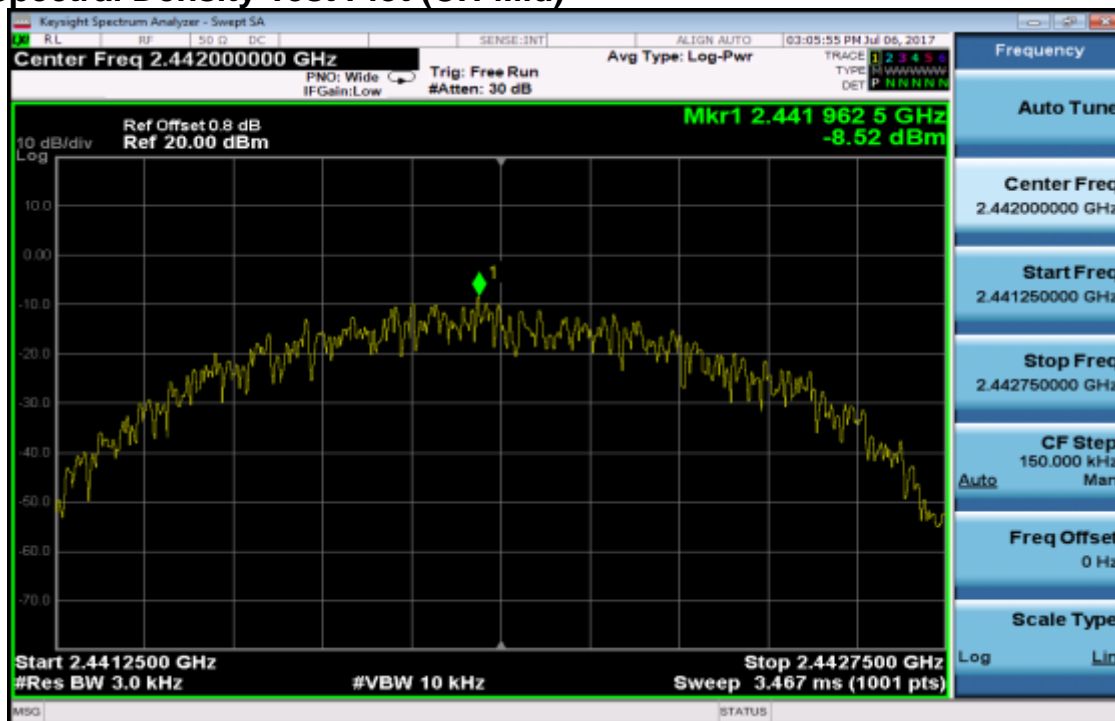
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## BLE mode

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



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



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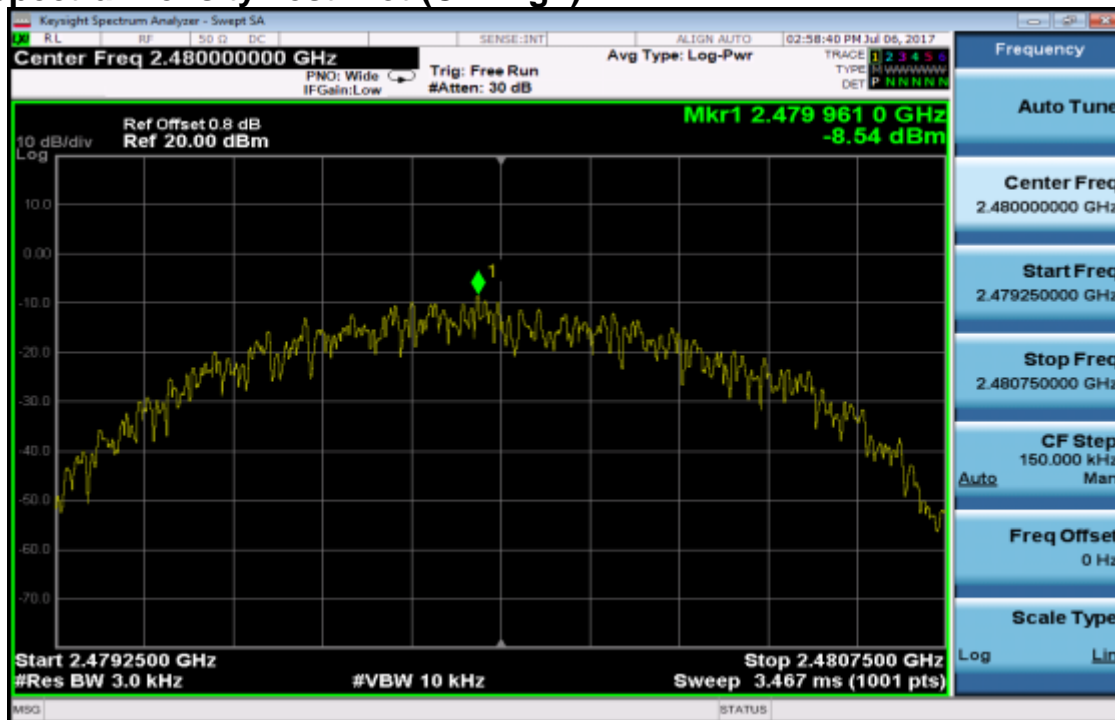
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## Power Spectral Density Test Plot (CH-High)



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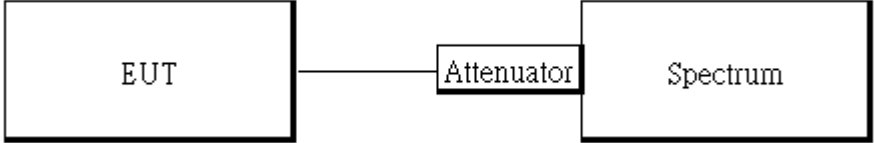
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## 6.6 Conducted band edges and spurious emission measurement

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13 FCC KDB 558074 D01 DTS Meas. Guidance
Test Setup:	
Band Edge Limit Calculation Test Procedure:	<ol style="list-style-type: none"> <li>1. Set analyzer center frequency to DTS channel center frequency.</li> <li>2. Set the span to 1.5 times the DTS channel bandwidth.</li> <li>3. Set the RBW = 100kHz &amp; VBW = 300 kHz.</li> <li>4. Detector = peak.</li> <li>5. Sweep time = auto couple.</li> <li>6. Trace mode = max hold.</li> <li>7. Allow trace to fully stabilize.</li> <li>8. Use the peak marker function to determine the maximum amplitude level.</li> </ol>
Conducted Band Edge Test Procedure:	<ol style="list-style-type: none"> <li>1. To connect Antenna Port of EUT to Spectrum.</li> <li>2. Set RBW = 100 kHz &amp; VBW=300 kHz, Detector =Peak, Sweep = Auto</li> <li>3. Allow trace to fully stabilize.</li> <li>4. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.</li> <li>5. Repeat above procedures until all default test channel measured were complete.</li> </ol>

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Conducted Spurious Emission Test Procedure:	<ol style="list-style-type: none"> <li>1. To connect Antenna Port of EUT to Spectrum.</li> <li>2. Set RBW = 100 kHz &amp; VBW=300 kHz, Detector =Peak, Sweep = Auto</li> <li>3. Allow trace to fully stabilize.</li> <li>4. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.</li> <li>5. Repeat above procedures until all default test channel measured were complete.</li> </ol>
Limit:	<p>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).</p>
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.9 for details.
Test Results:	Pass

### 6.6.1 Band Edge Limit Calculation Measurement Data

#### Band Edge Limit

Frequency (MHz)	RF Power Density (dBm)	Bandedge Limit = PSD - 20dB (dBm)
2402	4.90	-15.10
2480	5.04	-14.96

NOTE: cable loss as dB that offsets in the spectrum

NOTE: Refer to next page for plots.

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## Power Spectral Density for Bandedge Limit (CH-Low)



## Power Spectral Density for Bandedge Limit (CH-High)



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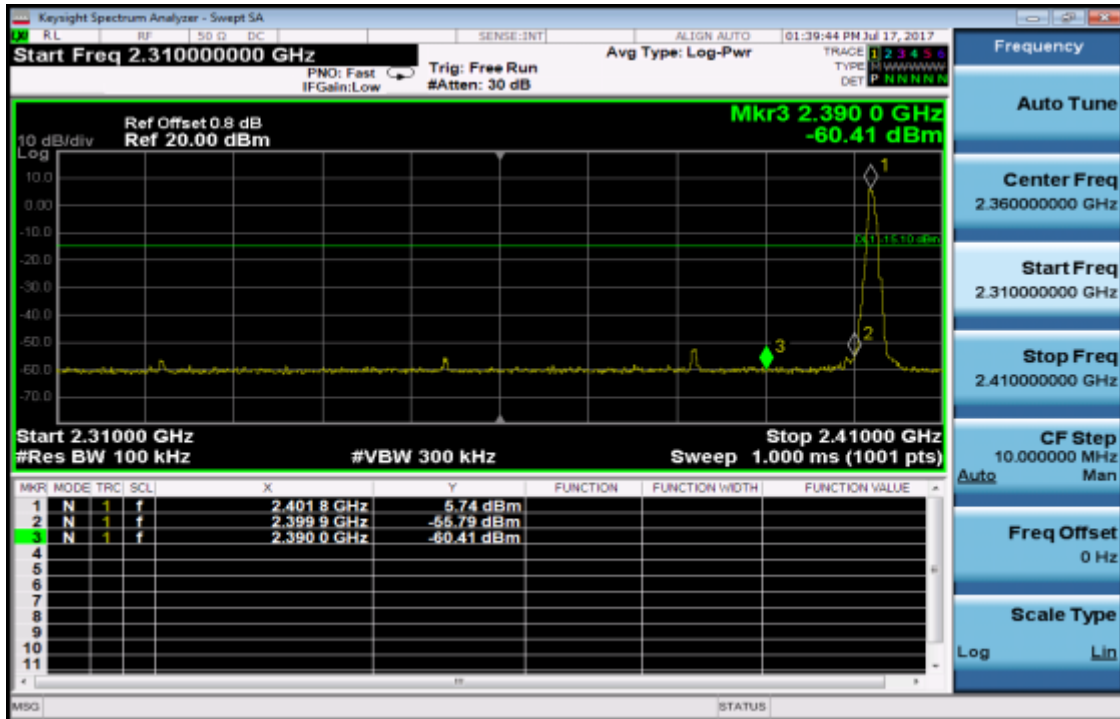
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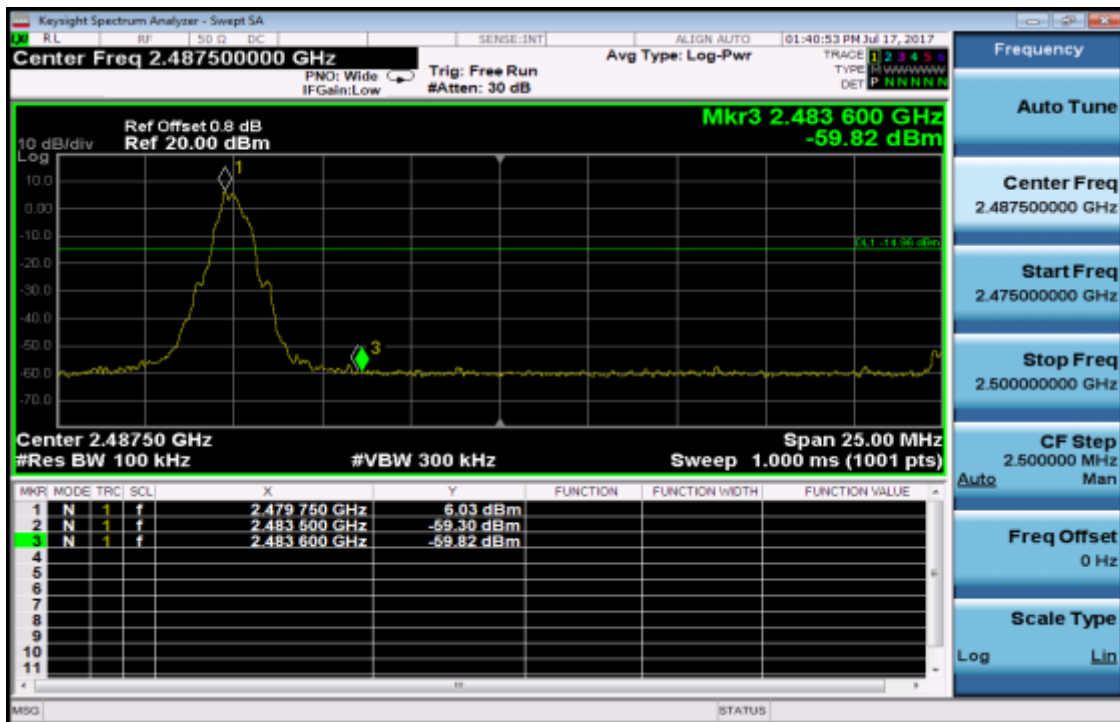
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## 6.6.2 Band Edges Test Data CH-Low



## CH-High



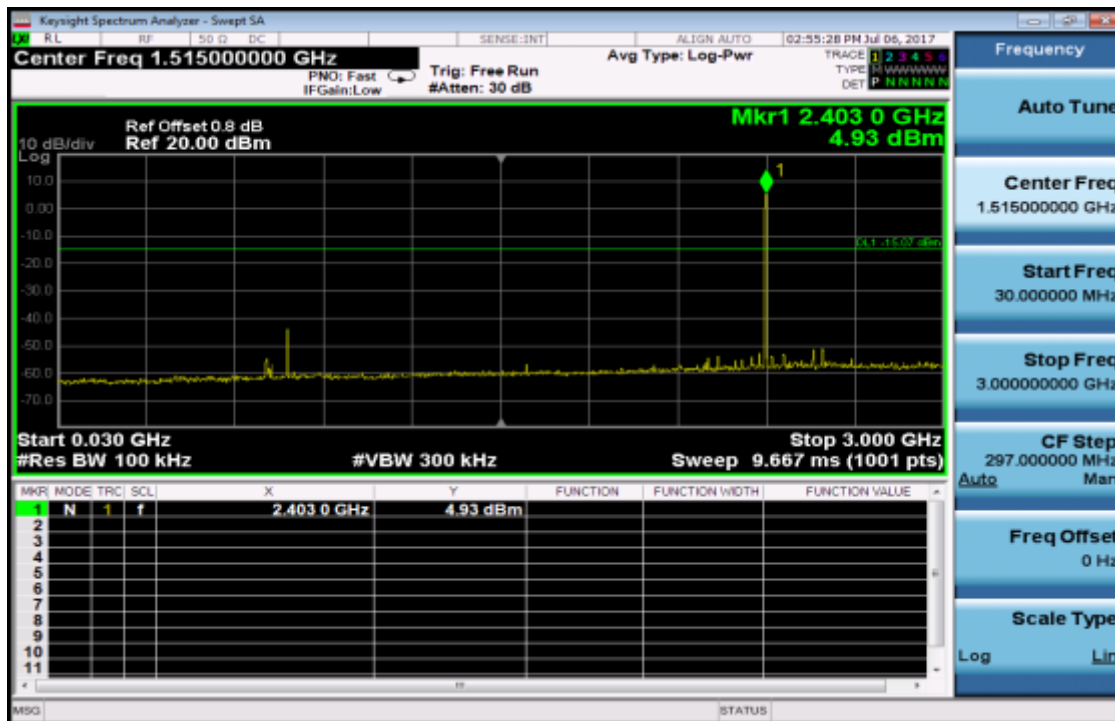
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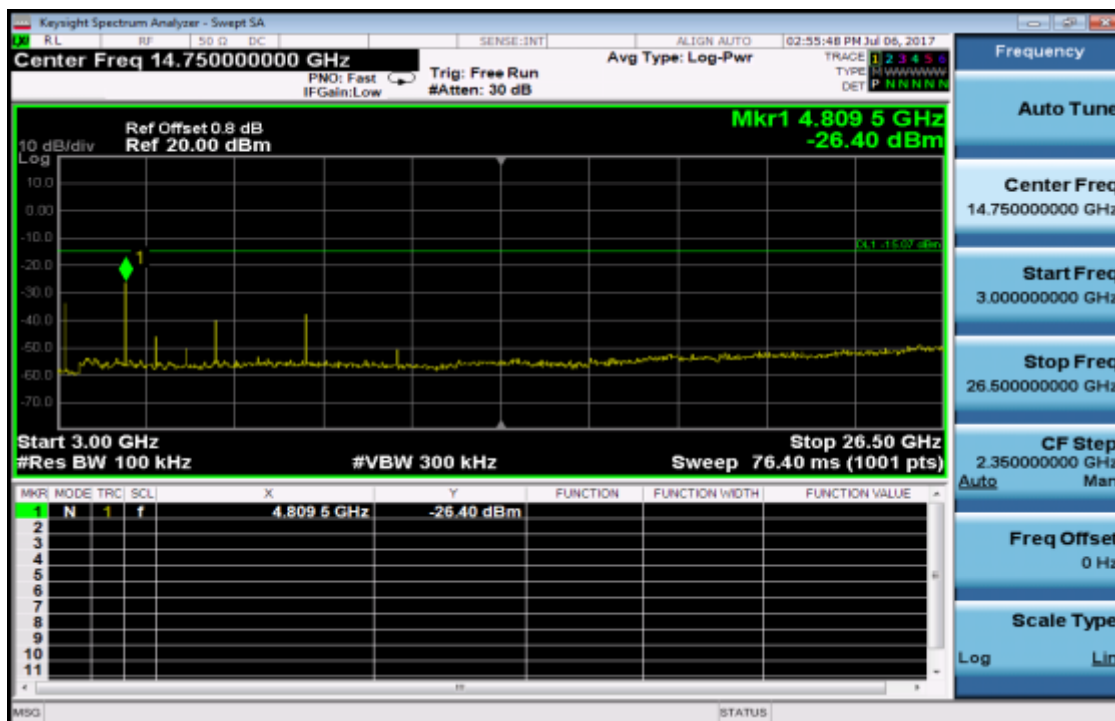
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### 6.6.3 Conducted Spurious Emission Measurement Result

#### CH-Low 30MHz – 3GHz



#### CH-Low 3GHz – 26.5GHz



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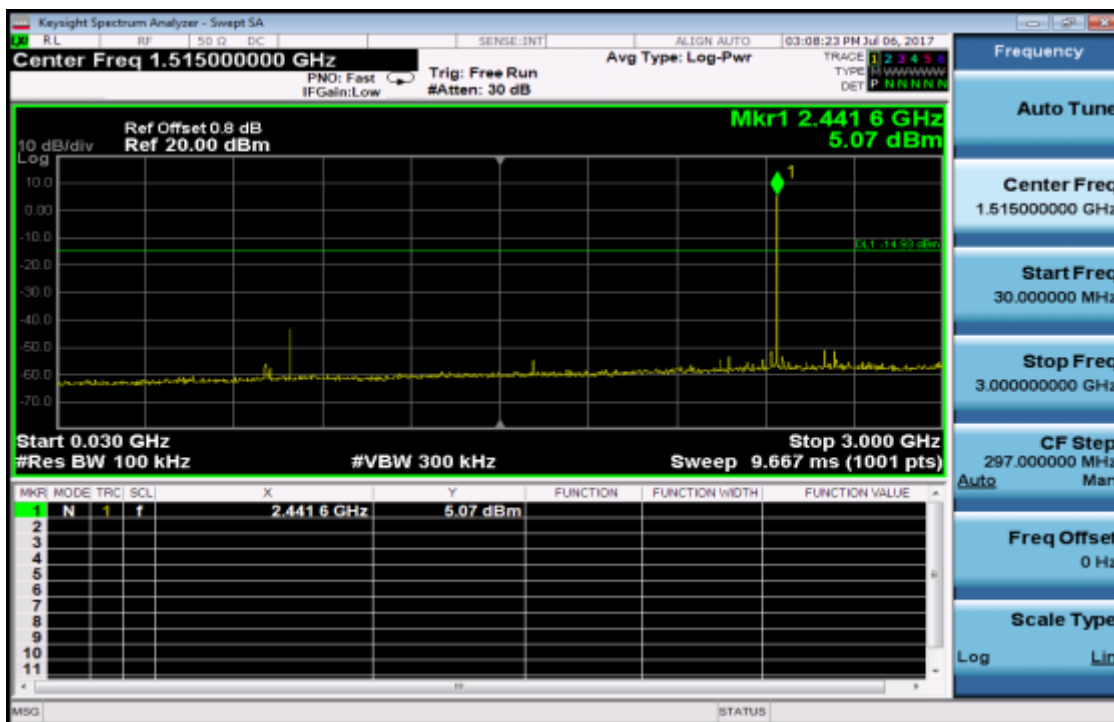
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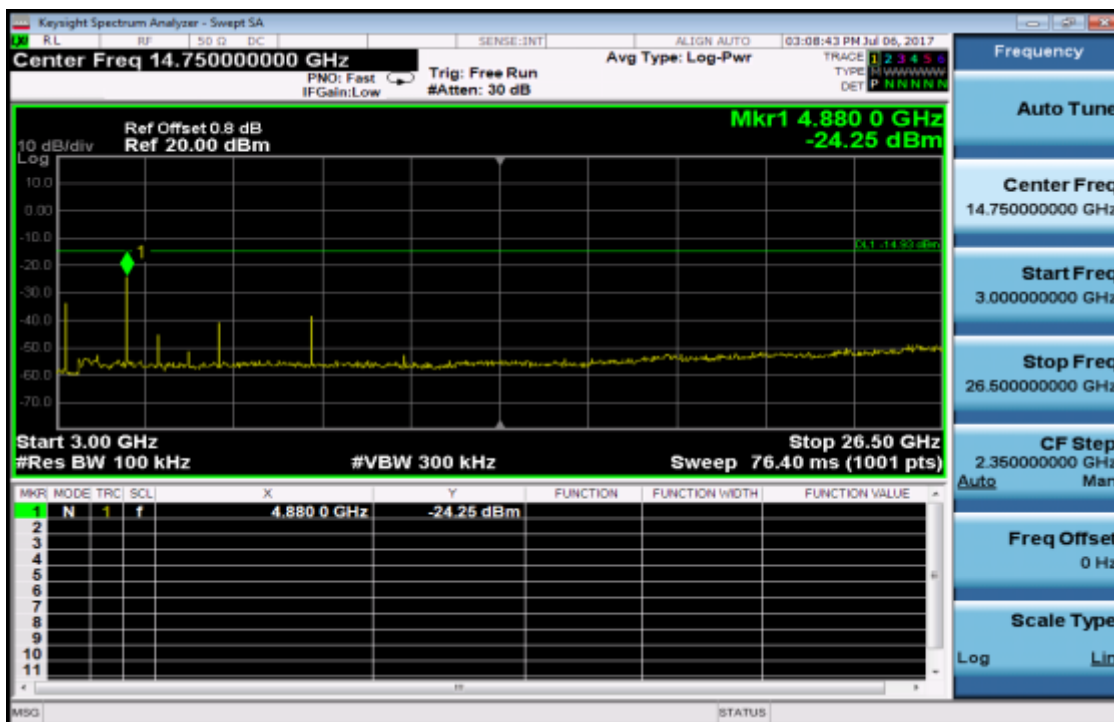
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## CH-Mid 30MHz – 3GHz



## CH-Mid 3GHz – 26.5GHz



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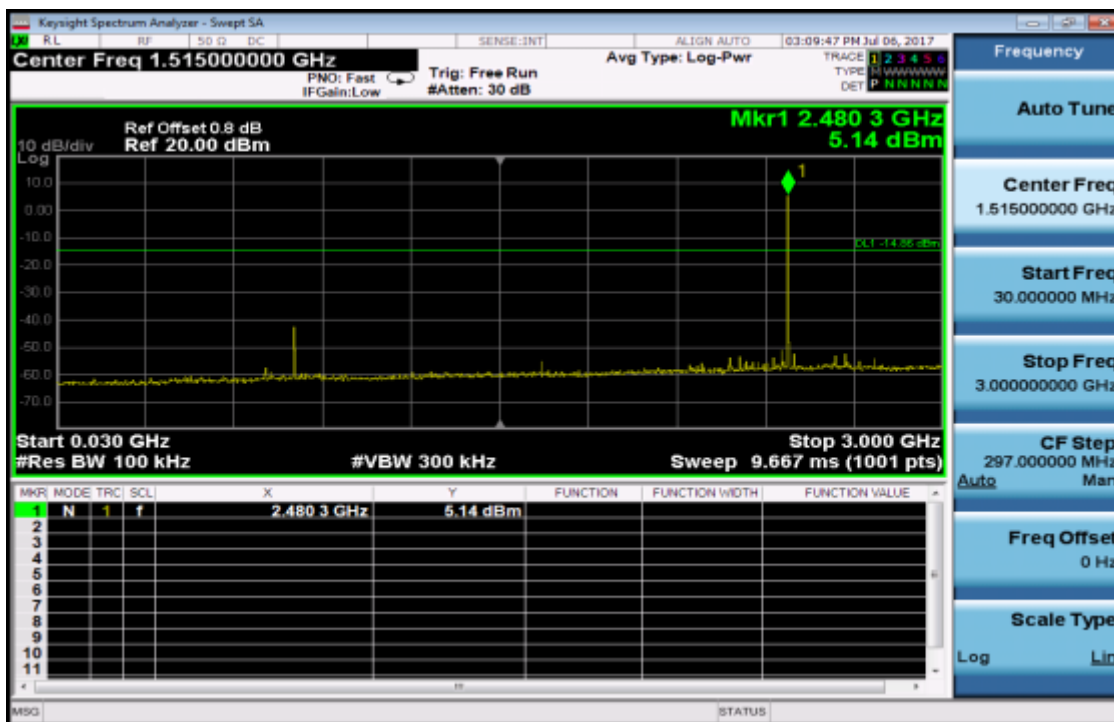
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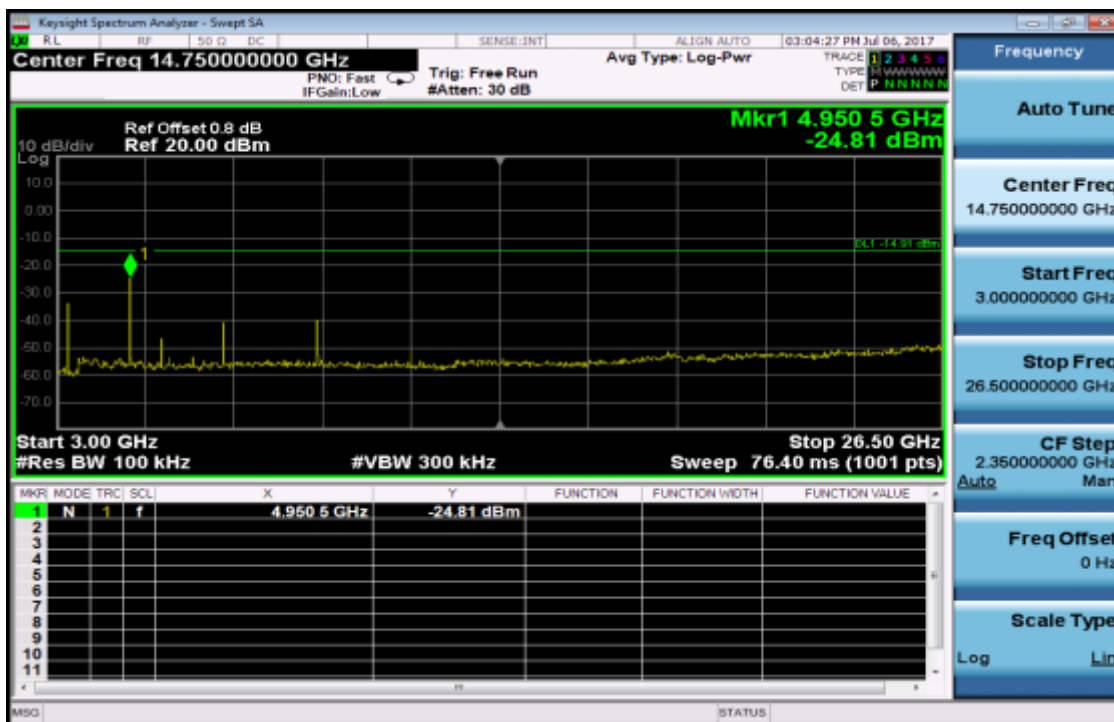
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## CH-High 30MHz – 3GHz



## CH- High 3GHz – 26.5GHz



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## 6.7 Radiated bandedge and spurious emission measurement

Test Requirement:	47 CFR Part 15C Section 15.247(d)																										
Test Method:	ANSI C63.10 :2013 Section 11.12 FCC KDB 558074 D01 DTS Meas. Guidance																										
Limit:	<table><tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Distance (meters)</td></tr><tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr><tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr><tr><td>1.705-30</td><td>30</td><td>30</td></tr><tr><td>30-88</td><td>100</td><td>3</td></tr><tr><td>88-216</td><td>150</td><td>3</td></tr><tr><td>216-960</td><td>200</td><td>3</td></tr><tr><td>Above 960</td><td>500</td><td>3</td></tr></table> <p>The lower limit shall apply at the transition frequencies. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)</p> <p>Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.</p>			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
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																									
Test Procedure:	<ol style="list-style-type: none"><li>1. The EUT was placed on a turn table with 0.8m for frequency&lt; 1GHz and 1.5m for frequency&gt; 1GHz above ground plan.</li><li>2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.</li><li>3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.</li><li>4. 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.</li><li>5. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.</li><li>6. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle &gt; 98%) or VBW ≥ 1/T (Duty cycle &lt; 98%) for Average Detector at frequency above 1 GHz.</li><li>7. 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</li></ol>																										

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	<p>for maximum response.” is still within the 3dB illumination BW of the measurement antenna.</p> <p>8. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.</p> <p>9. 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.</p> <p>10. Repeat above procedures until all default test channel measured were complete.</p> <p>11. Repeat above procedures until all default test channel measured were complete.</p>								
Test Mode:	<p>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 was reported.</p>								
Test Site Factor:	<p>Field Strength Calculation</p> <p>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:</p> $FS = RA + AF + CL - AG$ <table border="1"> <tr> <td>Where</td><td></td></tr> <tr> <td>FS = Field Strength</td><td>CL = Cable Attenuation Factor (Cable Loss)</td></tr> <tr> <td>RA = Reading Amplitude</td><td>AG = Amplifier Gain</td></tr> <tr> <td>AF = Antenna Factor</td><td></td></tr> </table> <p>Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)  Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)</p> <p><b>Note :</b></p> <p>“F” : denotes Fundamental Frequency. ;</p> <p>“H” : denotes Harmonic Frequency.</p> <p>“E” : denotes Band Edge Frequency. ;</p> <p>“S” : denotes Spurious Frequency.</p>	Where		FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)	RA = Reading Amplitude	AG = Amplifier Gain	AF = Antenna Factor	
Where									
FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)								
RA = Reading Amplitude	AG = Amplifier Gain								
AF = Antenna Factor									
Instruments Used:	Refer to section 5.9 for details.								
Test Results:	Pass								

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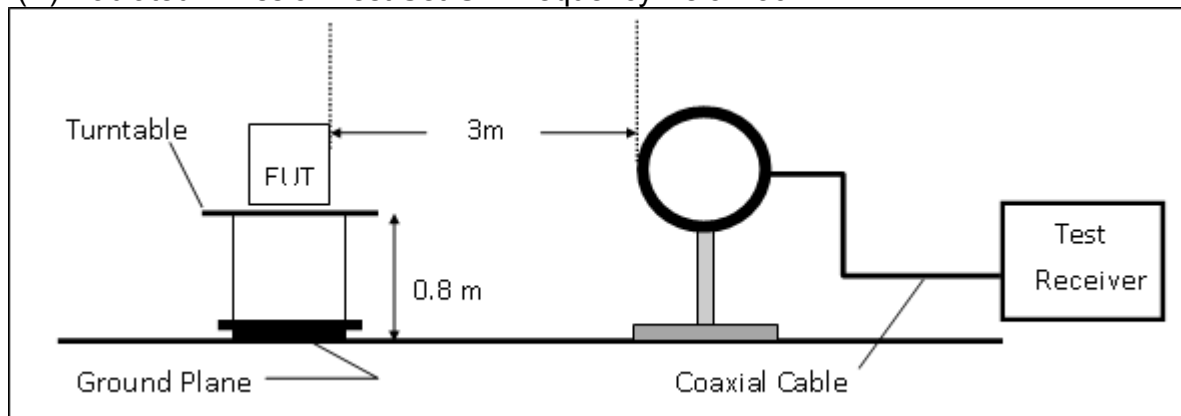
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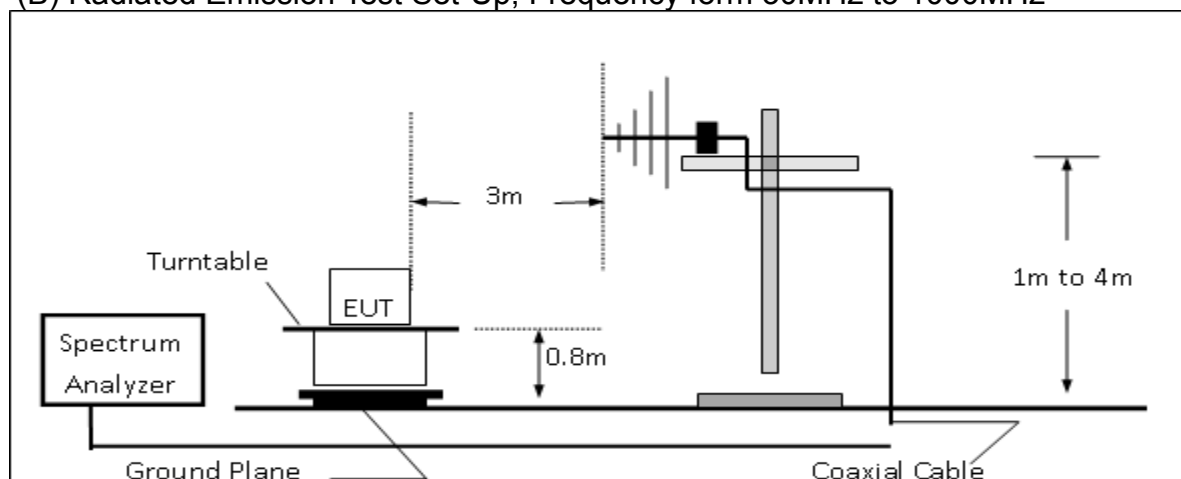
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## Test Set-up:

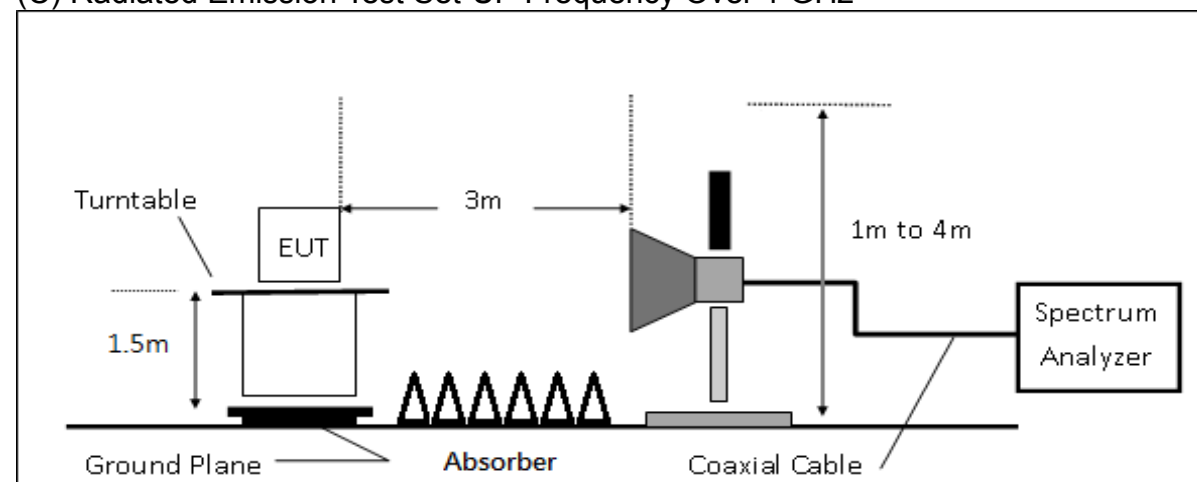
## (A) Radiated Emission Test Set-UP Frequency Below 30MHz.



## (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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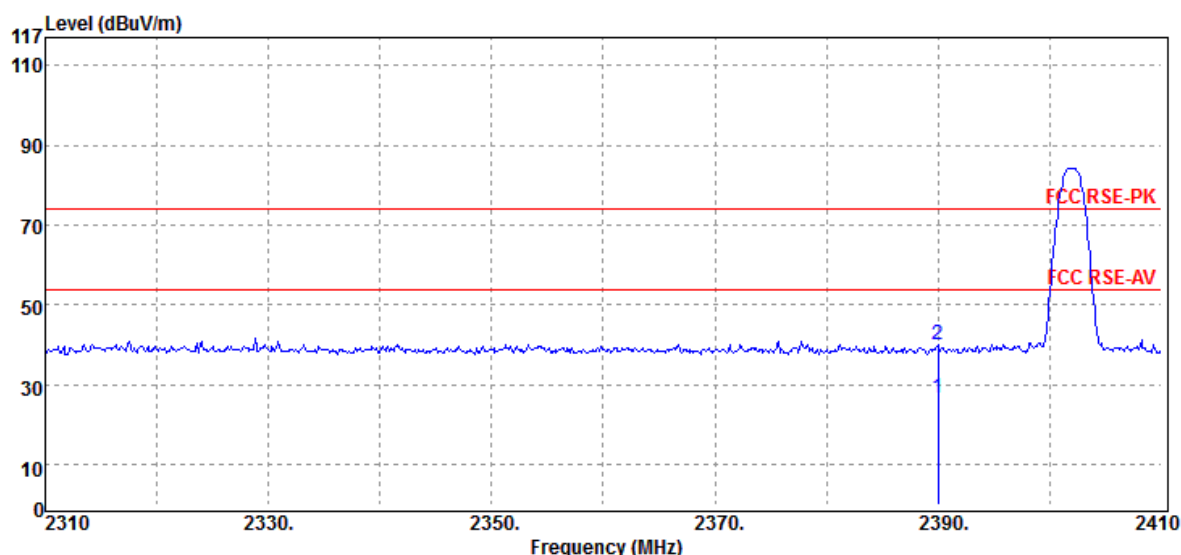


### 6.7.1 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

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.

### 6.7.2 Radiated Band Edge Measurement Result

Operation Band	:BLE	Test Date	:2017-07-04
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
2390.00	E	Average	28.49	-1.74	26.75	54.00	-27.25
2390.00	E	Peak	41.68	-1.74	39.94	74.00	-34.06

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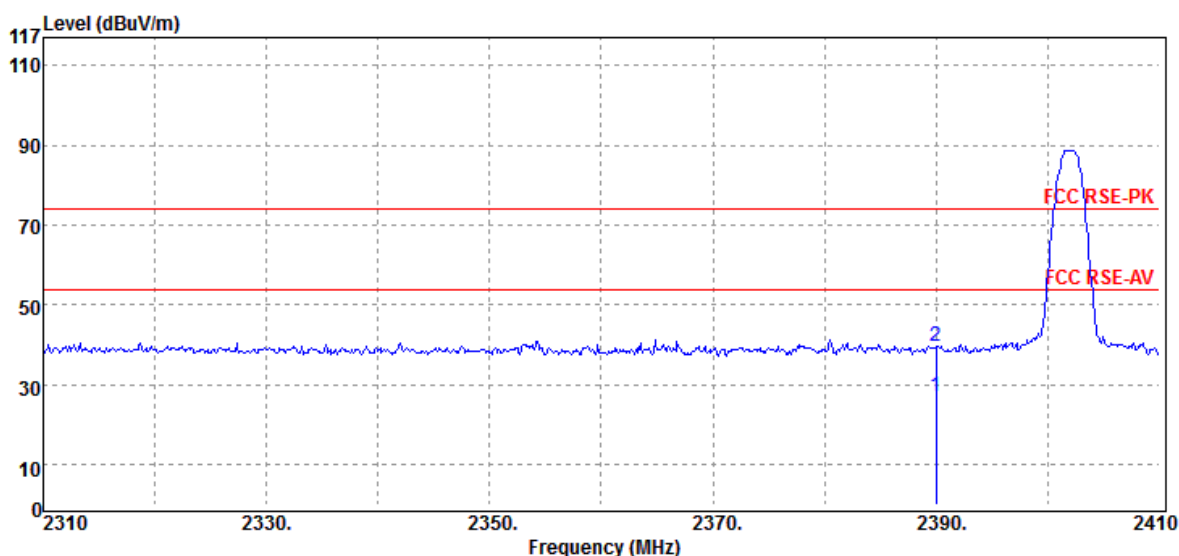
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Operation Band :BLE  
Fundamental Frequency :2402 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :E2 Plane

Test Date :2017-07-04  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
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	Average	28.81	-1.74	27.07	54.00	-26.93
2390.00	E	Peak	41.35	-1.74	39.61	74.00	-34.39

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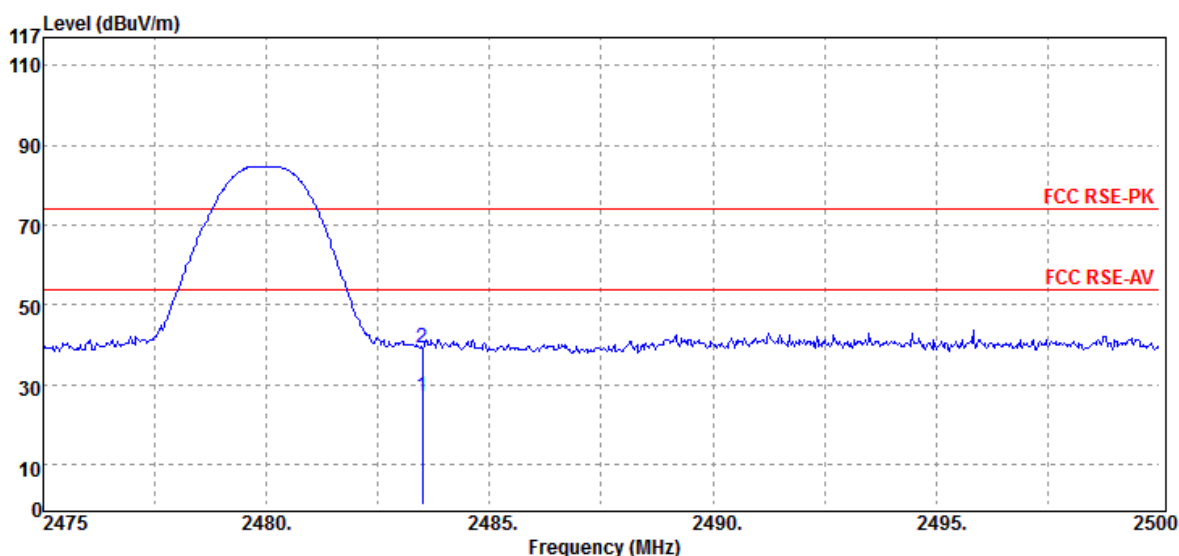
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Operation Band :BLE  
Fundamental Frequency :2480 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2017-07-04  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
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
2483.50	E	Average	28.85	-1.62	27.23	54.00	-26.77
2483.50	E	Peak	40.98	-1.62	39.36	74.00	-34.64

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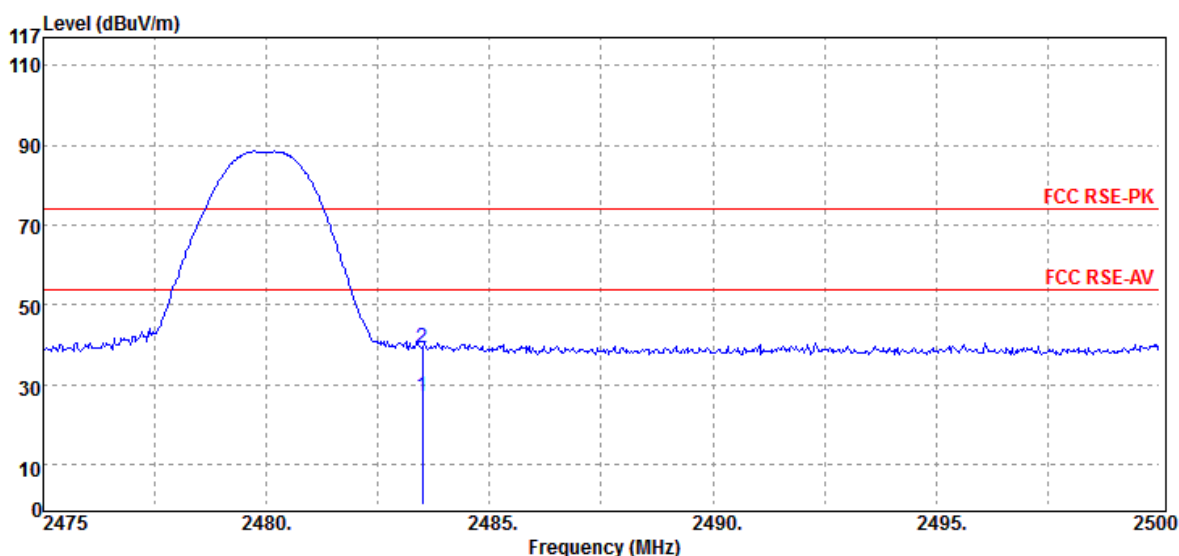
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Operation Band :BLE  
Fundamental Frequency :2480 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2017-07-04  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
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
2483.50	E	Average	28.71	-1.62	27.09	54.00	-26.91
2483.50	E	Peak	41.04	-1.62	39.42	74.00	-34.58

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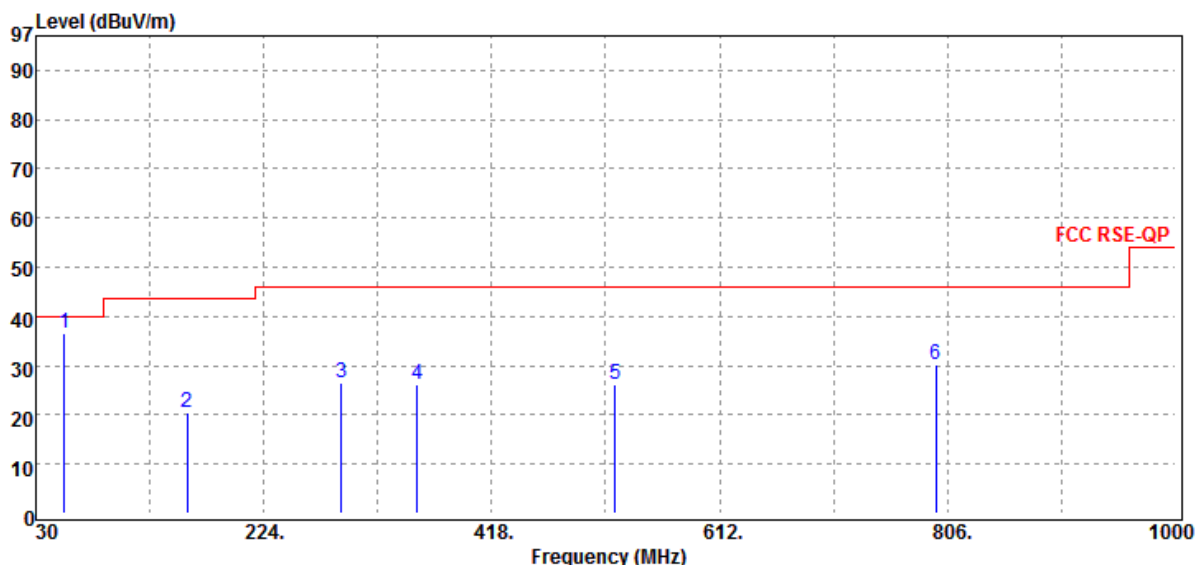
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### 6.7.3 Radiated Spurious Emission Measurement Result For Frequency form 30MHz to 1000MHz

Operation Band	:BLE	Test Date	:2017-07-05
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
54.25	S	Peak	44.27	-7.82	36.45	40.00	-3.55
159.01	S	Peak	27.75	-7.38	20.37	43.50	-23.13
289.96	S	Peak	32.48	-6.07	26.41	46.00	-19.59
354.95	S	Peak	30.99	-4.75	26.24	46.00	-19.76
522.76	S	Peak	27.98	-1.66	26.32	46.00	-19.68
796.30	S	Peak	27.13	3.01	30.14	46.00	-15.86

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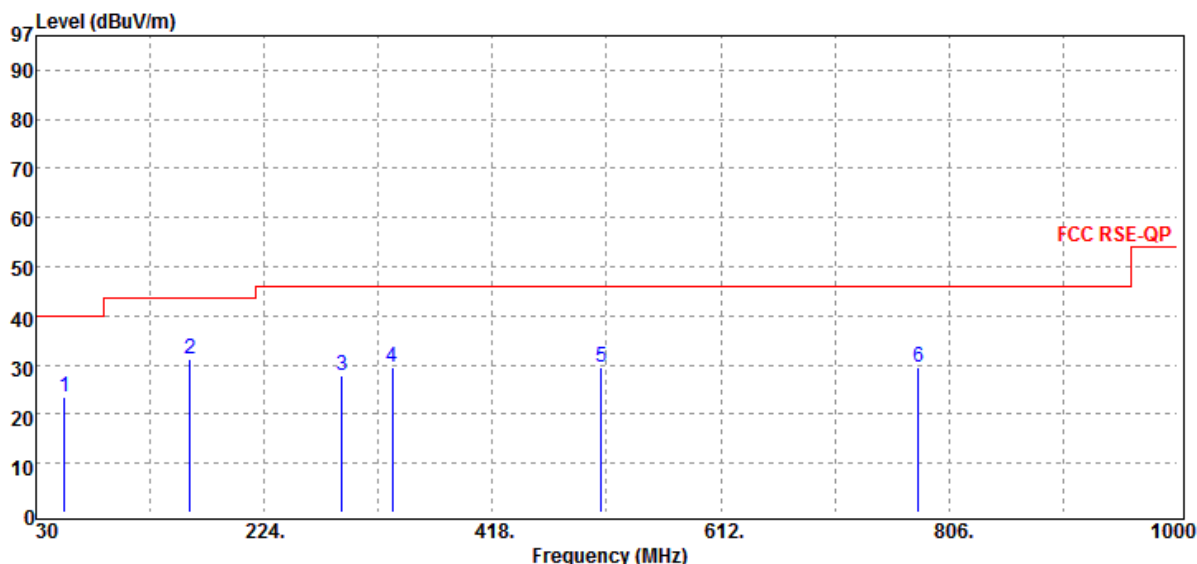
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Operation Band :BLE  
Fundamental Frequency :2402 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :E2 Plane

Test Date :2017-07-05  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
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
54.25	S	Peak	31.44	-7.82	23.62	40.00	-16.38
160.95	S	Peak	38.60	-7.43	31.17	43.50	-12.33
289.96	S	Peak	34.09	-6.07	28.02	46.00	-17.98
332.64	S	Peak	34.94	-5.30	29.64	46.00	-16.36
510.15	S	Peak	31.77	-2.19	29.58	46.00	-16.42
779.81	S	Peak	26.90	2.58	29.48	46.00	-16.52

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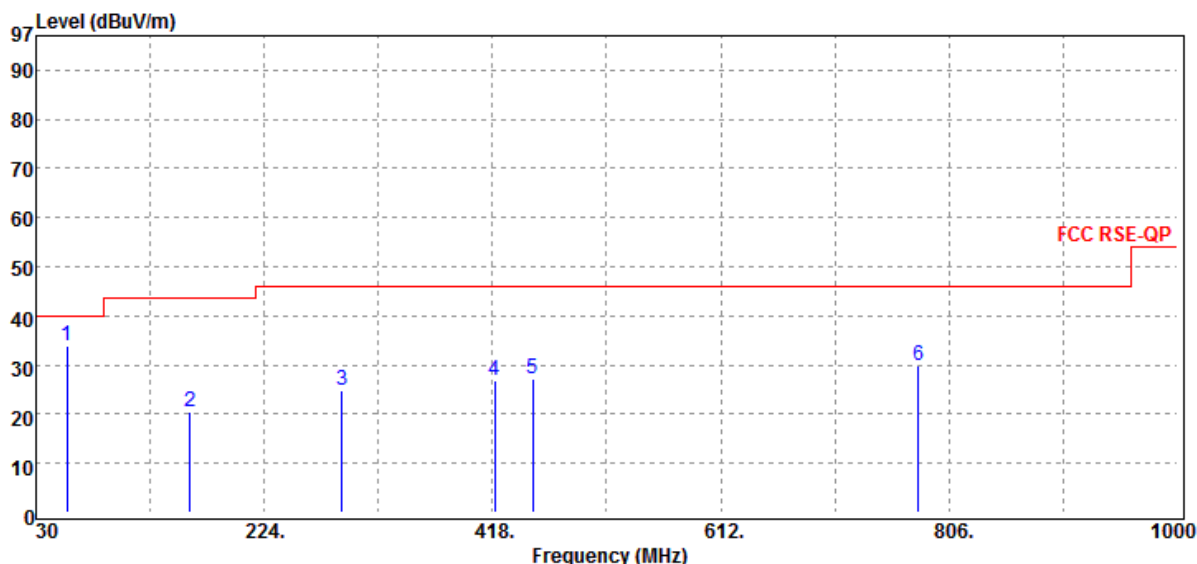
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Operation Band :BLE  
Fundamental Frequency :2442 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2017-07-05  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
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
56.19	S	Peak	41.72	-7.91	33.81	40.00	-6.19
160.95	S	Peak	27.75	-7.43	20.32	43.50	-23.18
289.96	S	Peak	31.00	-6.07	24.93	46.00	-21.07
419.94	S	Peak	30.08	-3.39	26.69	46.00	-19.31
451.95	S	Peak	29.91	-2.84	27.07	46.00	-18.93
779.81	S	Peak	27.17	2.58	29.75	46.00	-16.25

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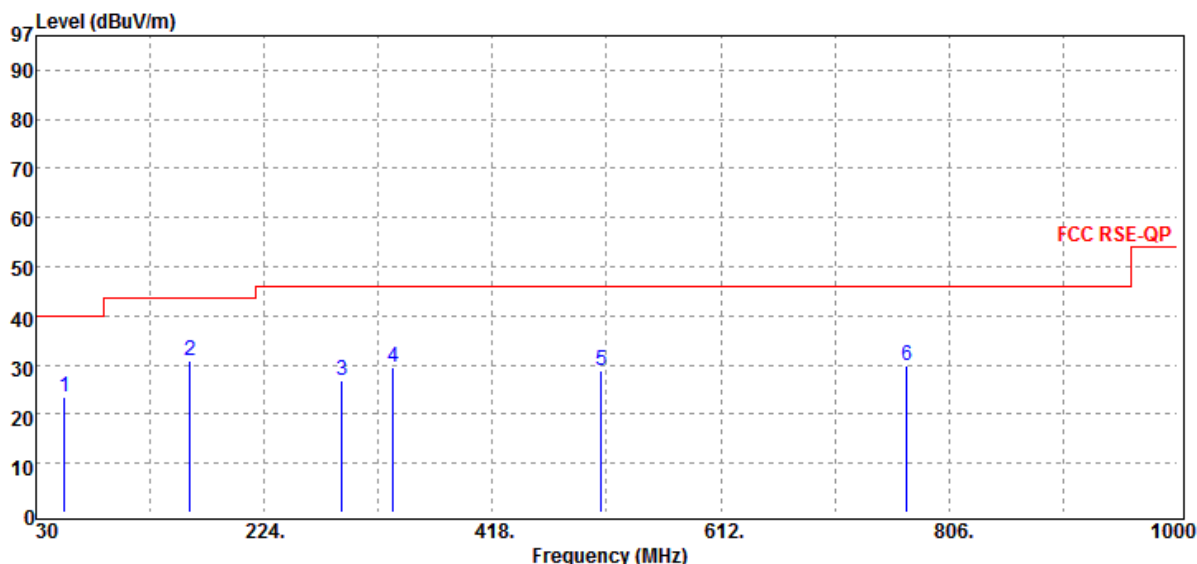
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Operation Band :BLE  
Fundamental Frequency :2442 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2017-07-05  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
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
54.25	S	Peak	31.43	-7.82	23.61	40.00	-16.39
160.95	S	Peak	38.18	-7.43	30.75	43.50	-12.75
289.96	S	Peak	32.98	-6.07	26.91	46.00	-19.09
333.61	S	Peak	34.66	-5.29	29.37	46.00	-16.63
510.15	S	Peak	31.14	-2.19	28.95	46.00	-17.05
770.11	S	Peak	27.18	2.68	29.86	46.00	-16.14

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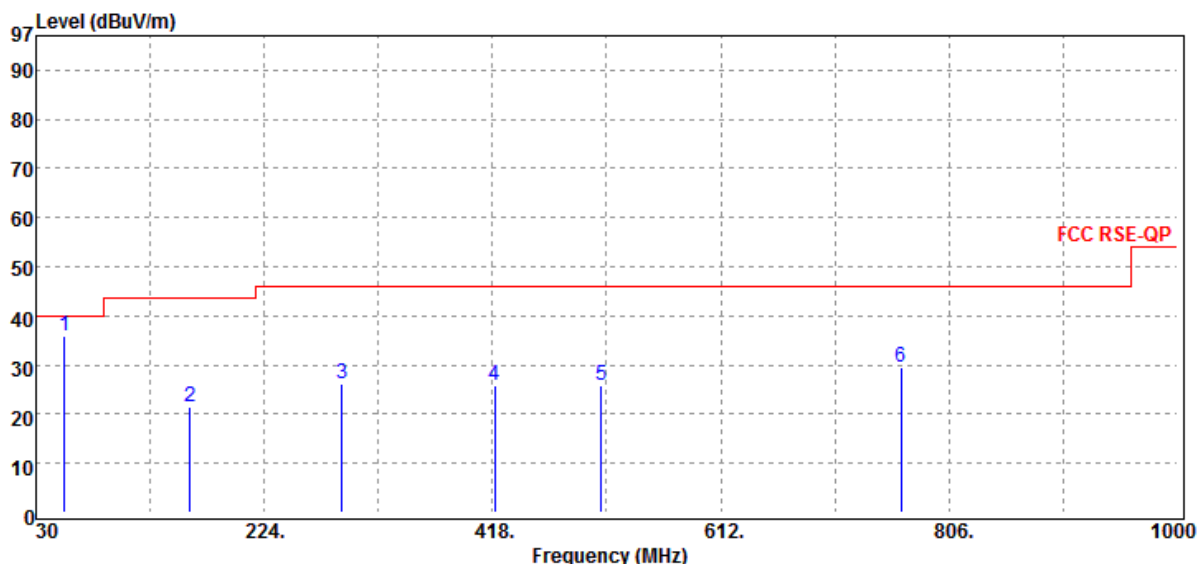
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Operation Band	:BLE	Test Date	:2017-07-05
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



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
54.25	S	Peak	43.62	-7.82	35.80	40.00	-4.20
160.95	S	Peak	28.87	-7.43	21.44	43.50	-22.06
289.96	S	Peak	32.18	-6.07	26.11	46.00	-19.89
419.94	S	Peak	29.08	-3.39	25.69	46.00	-20.31
510.15	S	Peak	27.99	-2.19	25.80	46.00	-20.20
765.26	S	Peak	26.42	3.11	29.53	46.00	-16.47

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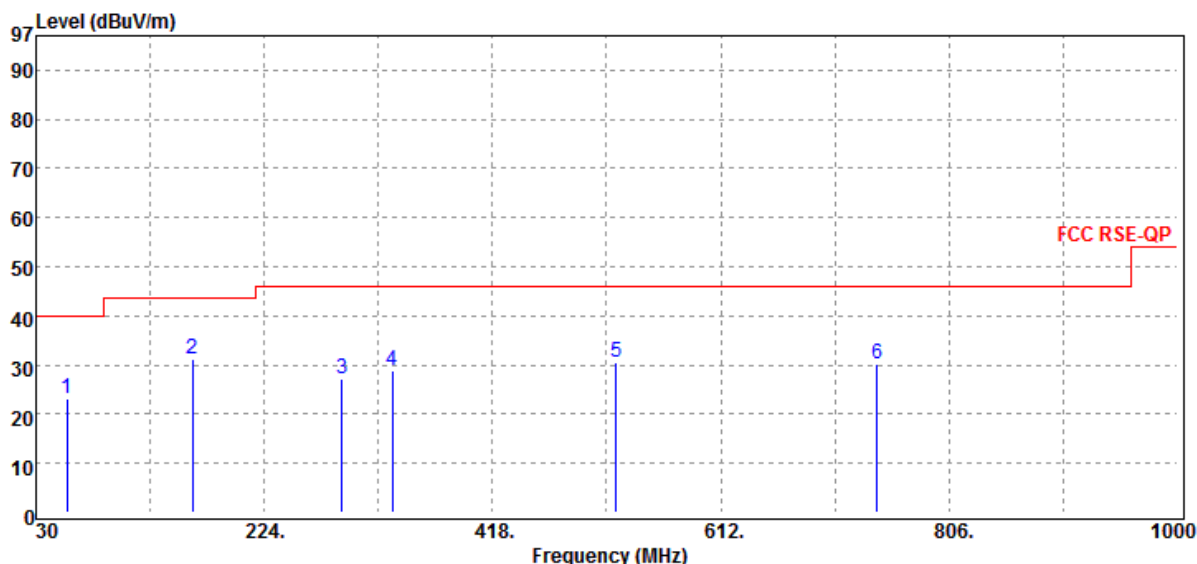
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Operation Band	:BLE	Test Date	:2017-07-05
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
56.19	S	Peak	31.17	-7.91	23.26	40.00	-16.74
162.89	S	Peak	38.59	-7.48	31.11	43.50	-12.39
289.96	S	Peak	33.18	-6.07	27.11	46.00	-18.89
332.64	S	Peak	34.05	-5.30	28.75	46.00	-17.25
522.76	S	Peak	32.32	-1.66	30.66	46.00	-15.34
744.89	S	Peak	27.85	2.25	30.10	46.00	-15.90

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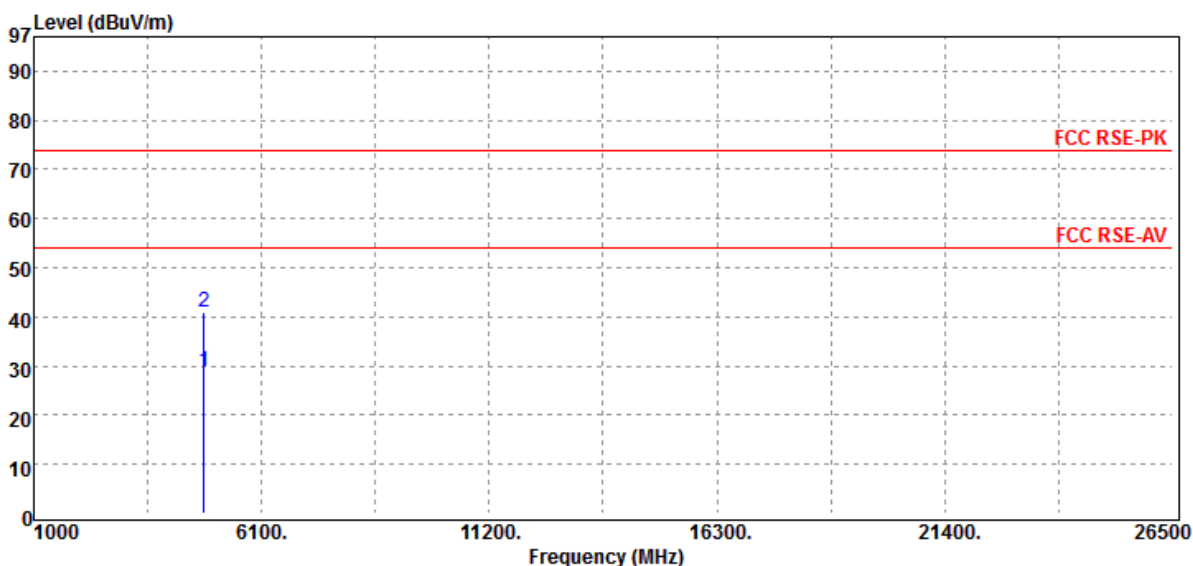
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#### 6.7.4 Radiated Spurious Emission Measurement Result For Frequency above 1GHz

Operation Band	:BLE	Test Date	:2017-07-04
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Tin
EUT Pol.	:E2 Plane	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	Safe Margin dB
4804.00	H	Average	23.79	4.92	28.71	54.00	-25.29
4804.00	H	Peak	36.19	4.92	41.11	74.00	-32.89

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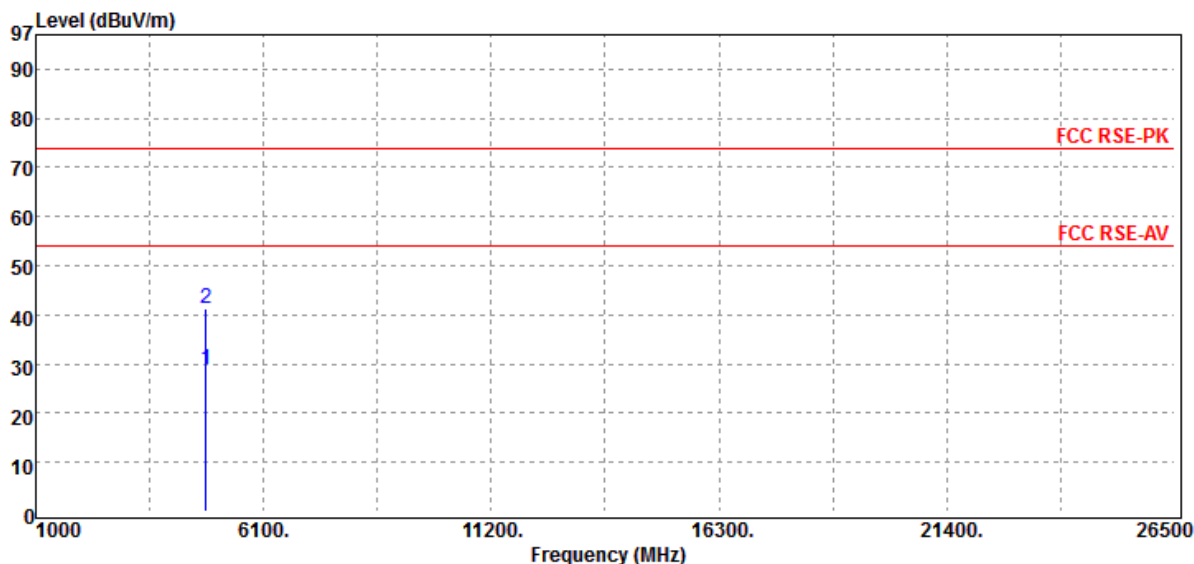
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Operation Band :BLE  
Fundamental Frequency :2402 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :E2 Plane

Test Date :2017-07-04  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
4804.00	H	Average	23.84	4.92	28.76	54.00	-25.24
4804.00	H	Peak	36.40	4.92	41.32	74.00	-32.68

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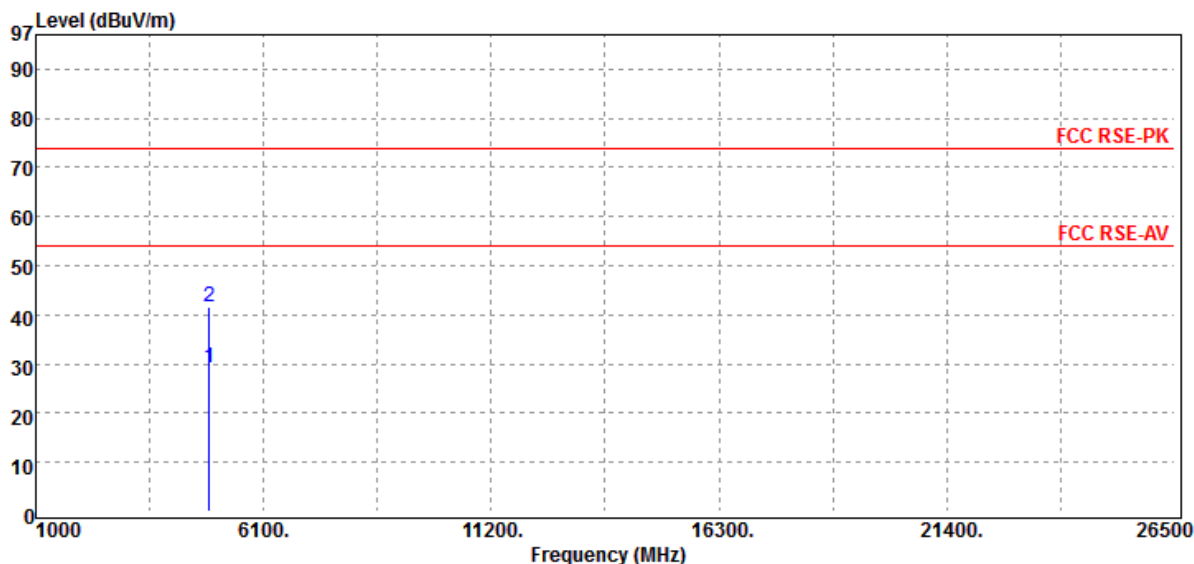
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Operation Band :BLE  
Fundamental Frequency :2442 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2017-07-05  
Temp./Humi. :21 deg\_C / 61 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
4884.00	H	Average	23.87	5.20	29.07	54.00	-24.93
4884.00	H	Peak	36.41	5.20	41.61	74.00	-32.39

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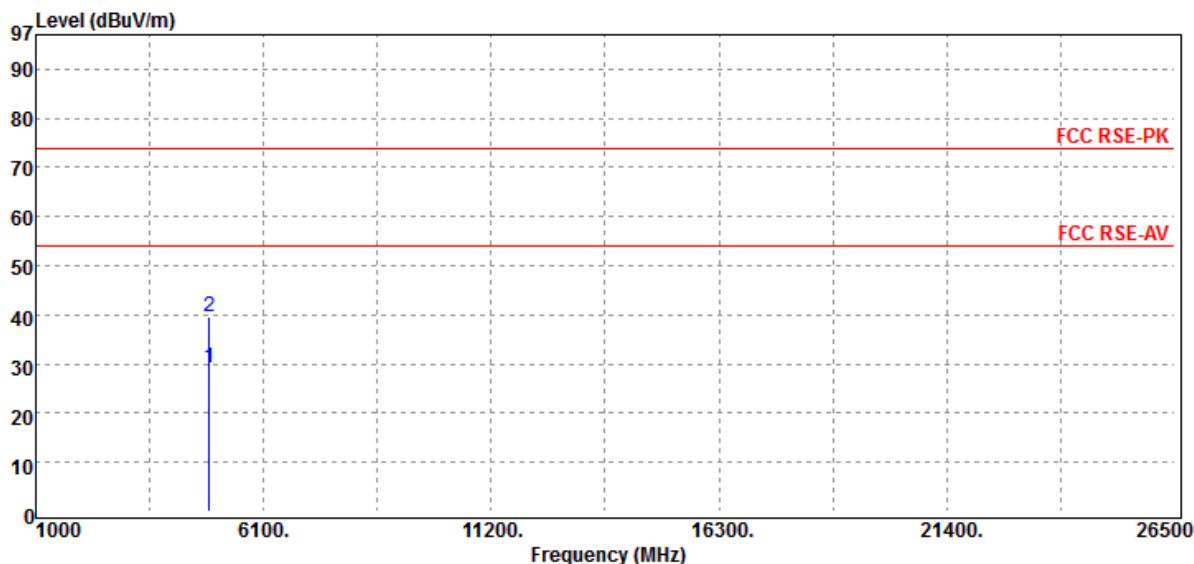
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Operation Band :BLE  
Fundamental Frequency :2442 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2017-07-05  
Temp./Humi. :21 deg\_C / 61 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
4884.00	H	Average	23.92	5.20	29.12	54.00	-24.88
4884.00	H	Peak	34.35	5.20	39.55	74.00	-34.45

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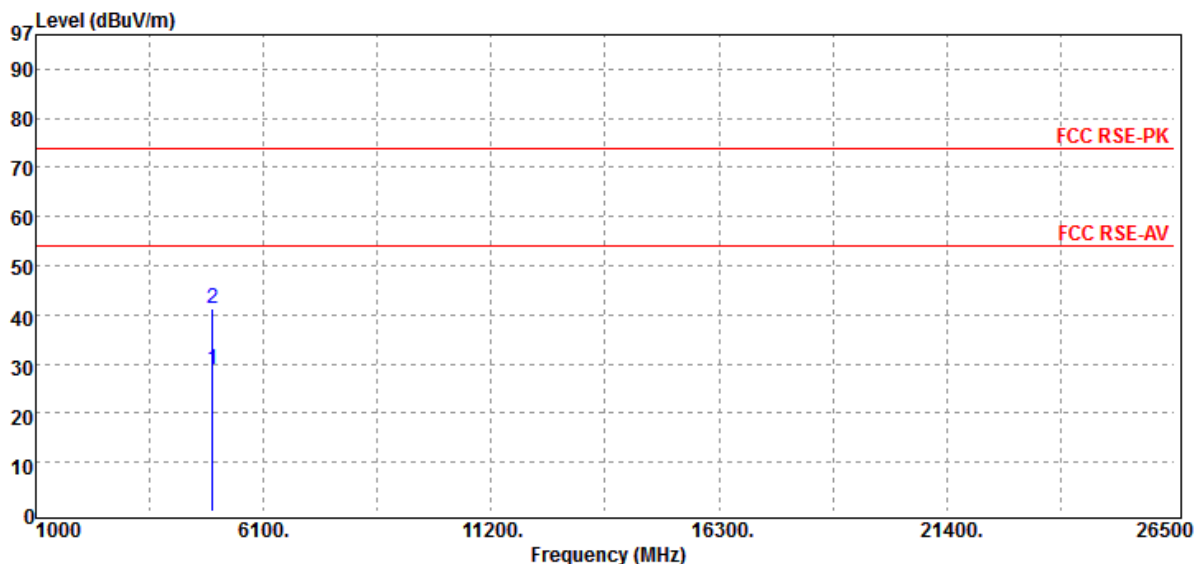
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Operation Band	:BLE	Test Date	:2017-07-05
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
4960.00	H	Average	23.49	5.29	28.78	54.00	-25.22
4960.00	H	Peak	35.95	5.29	41.24	74.00	-32.76

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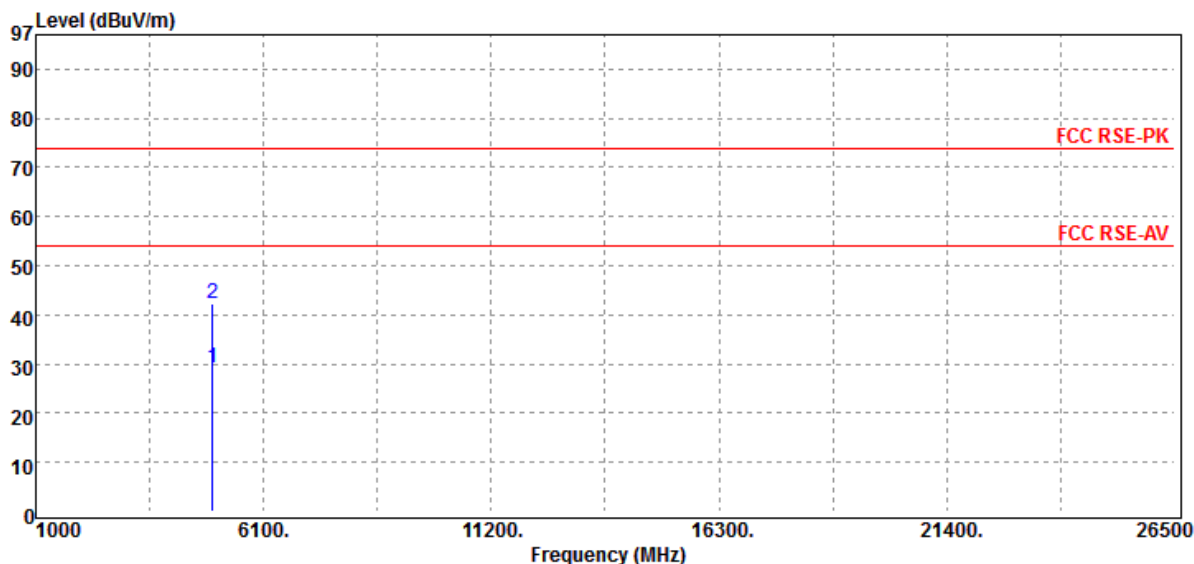
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Operation Band	:BLE	Test Date	:2017-07-05
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
4960.00	H	Average	23.81	5.29	29.10	54.00	-24.90
4960.00	H	Peak	37.05	5.29	42.34	74.00	-31.66

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## 7 RF EXPOSURE

### 7.1 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*

### 7.2 Measurement Result:

This is a portable device and the max. output power including tune-up tolerance is 2.46 (mW), lower than the threshold given and derived as formula given above, where

$$= 2.46(\text{mW})/5(\text{mm}) \cdot \sqrt{2.462 \text{ (GHz)}} = 0.772 < 3.0$$

Frequency (MHz)	Max. output power including tune-up tolerance(dBm)	Max. output power including tune-up tolerance(mW)	Distance (mm)	Result
2462	3.91	2.460	5	0.772

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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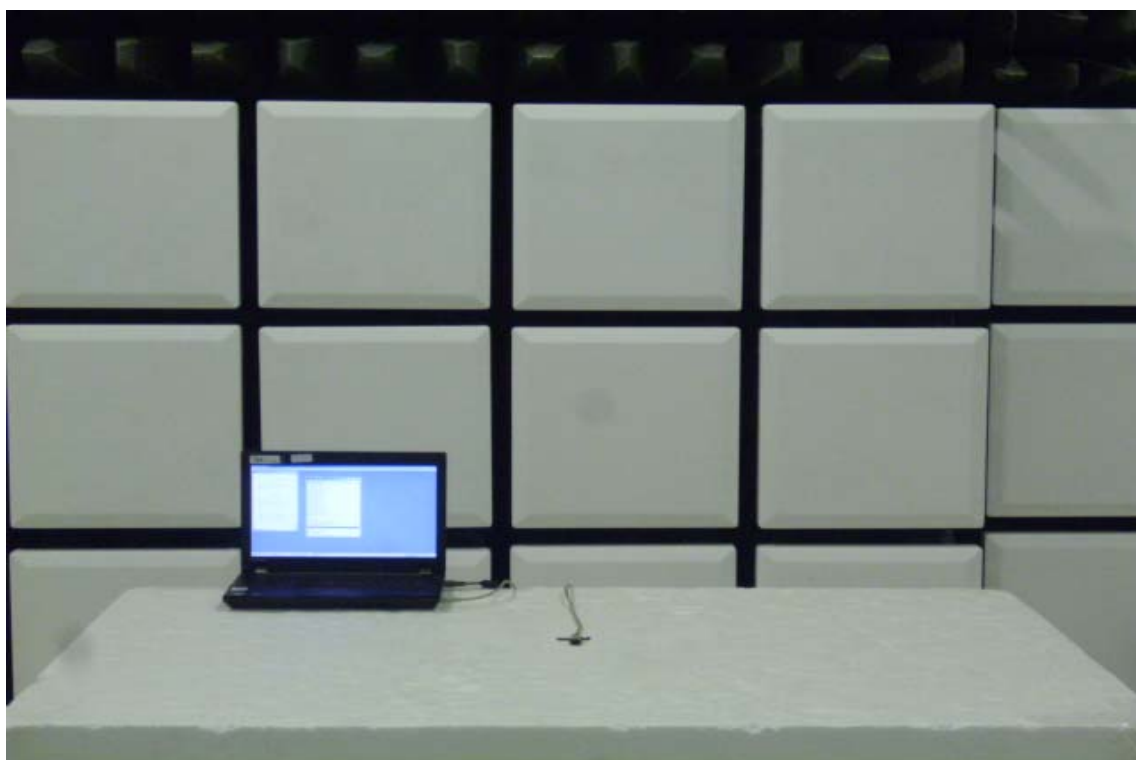
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## PHOTOGRAPHS OF SET UP

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



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



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### Conducted Setup Photo (AC Power Line)



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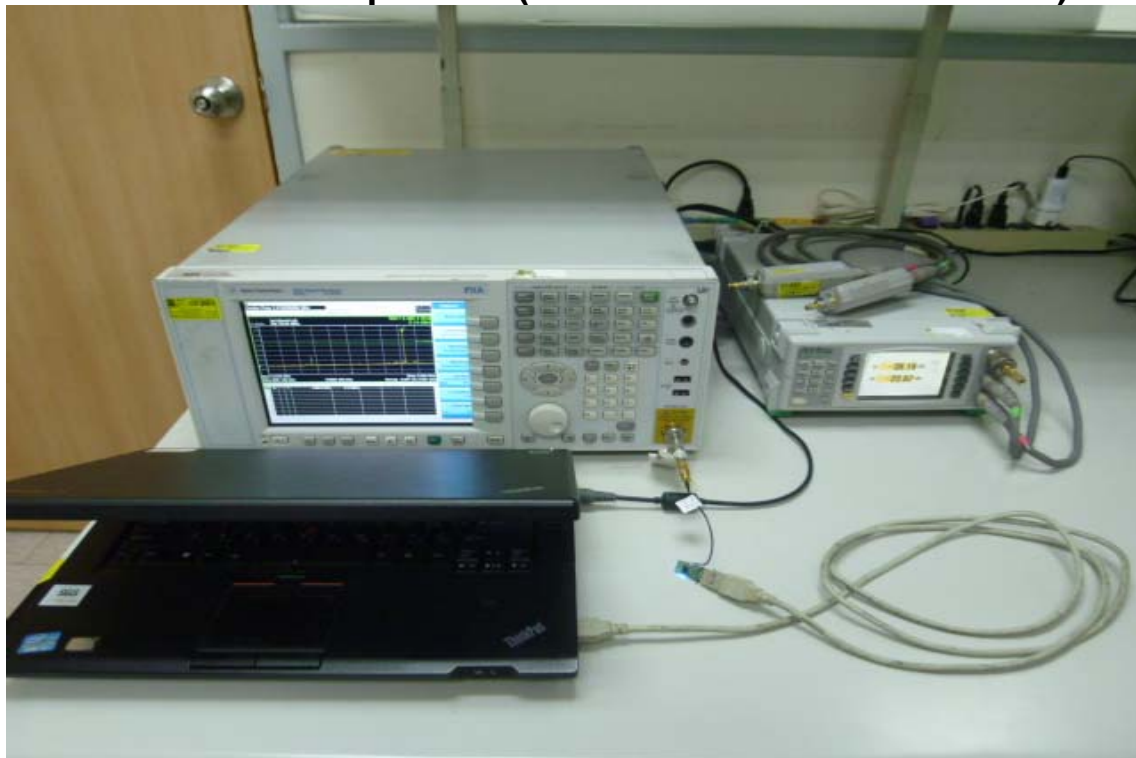
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### Conducted Setup Photo (Measurement at Antenna Port)



### PHOTOGRAPHS OF EUT

Please refer to the attached file(EUT Photo)

~ End of Report ~

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