

# FCC Test Report

Product Name	BT Dongle
Model No.	TUF Dongle
FCC ID.	MSQ-TUFDONGLE

Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan

Date of Receipt	May 25, 2017
Issued Date	June 27, 2017
Report No.	1750644R-RFUSP01V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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# Test Report

Issued Date: June 27, 2017

Report No.: 1750644R-RFUSP01V00



Product Name	BT Dongle
Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan
Manufacturer	ASUSTeK COMPUTER INC.
Model No.	TUF Dongle
FCC ID.	MSQ-TUFDONGLE
EUT Rated Voltage	DC 5V by USB
EUT Test Voltage	AC 120V/60Hz
Trade Name	ASUS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v04
Test Result	Complied

Documented By :



( Senior Adm. Specialist / Genie Chang )

Tested By :



( Engineer / Nova Chu )

Approved By :



( Director / Vincent Lin )

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## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	BT Dongle
Trade Name	ASUS
Model No.	TUF Dongle
FCC ID.	MSQ-TUFDONGLE
Frequency Range	2402 – 2480MHz
Channel Number	V4.0: 40CH
Type of Modulation	V4.0: GFSK(1Mbps)
Antenna Type	Chip Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”

#### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	PSA	RFANT3216120A3T	Chip Antenna	0.07dBi for 2.4 GHz

Note: The antenna of EUT is conforming to FCC 15.203.

#### Center Frequency of Each Channel: (For V4.0)

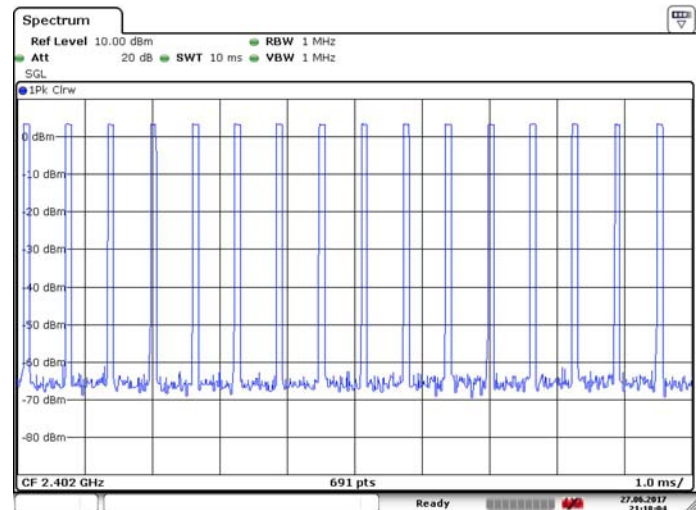
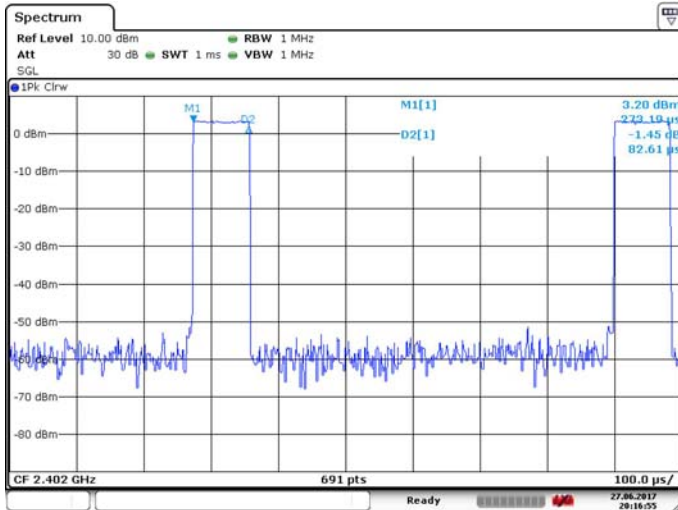
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 01:	2404 MHz	Channel 02:	2406 MHz	Channel 03:	2408 MHz
Channel 04:	2410 MHz	Channel 05:	2412 MHz	Channel 06:	2414 MHz	Channel 07:	2416 MHz
Channel 08:	2418 MHz	Channel 09:	2420 MHz	Channel 10:	2422 MHz	Channel 11:	2424 MHz
Channel 12:	2426 MHz	Channel 13:	2428 MHz	Channel 14:	2430 MHz	Channel 15:	2432 MHz
Channel 16:	2434 MHz	Channel 17:	2436 MHz	Channel 18:	2438 MHz	Channel 19:	2440 MHz
Channel 20:	2442 MHz	Channel 21:	2444 MHz	Channel 22:	2446 MHz	Channel 23:	2448 MHz
Channel 24:	2450 MHz	Channel 25:	2452 MHz	Channel 26:	2454 MHz	Channel 27:	2456 MHz
Channel 28:	2458 MHz	Channel 29:	2460 MHz	Channel 30:	2462 MHz	Channel 31:	2464 MHz
Channel 32:	2466 MHz	Channel 33:	2468 MHz	Channel 34:	2470 MHz	Channel 35:	2472 MHz
Channel 36:	2474 MHz	Channel 37:	2476 MHz	Channel 38:	2478 MHz	Channel 39:	2480 MHz

**Duty Cycle:**

Formula:

$$\text{Duty cycle} = \text{Ton} / (\text{Ton} + \text{Toff})$$

$$\text{Duty cycle} = 82.61\mu\text{s} * 16 / 10\text{ms} = 0.1321$$



Note:

1. The EUT is a BT Dongle with a built-in Bluetooth Low Energy transceiver.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit - BLE
-----------	------------------------

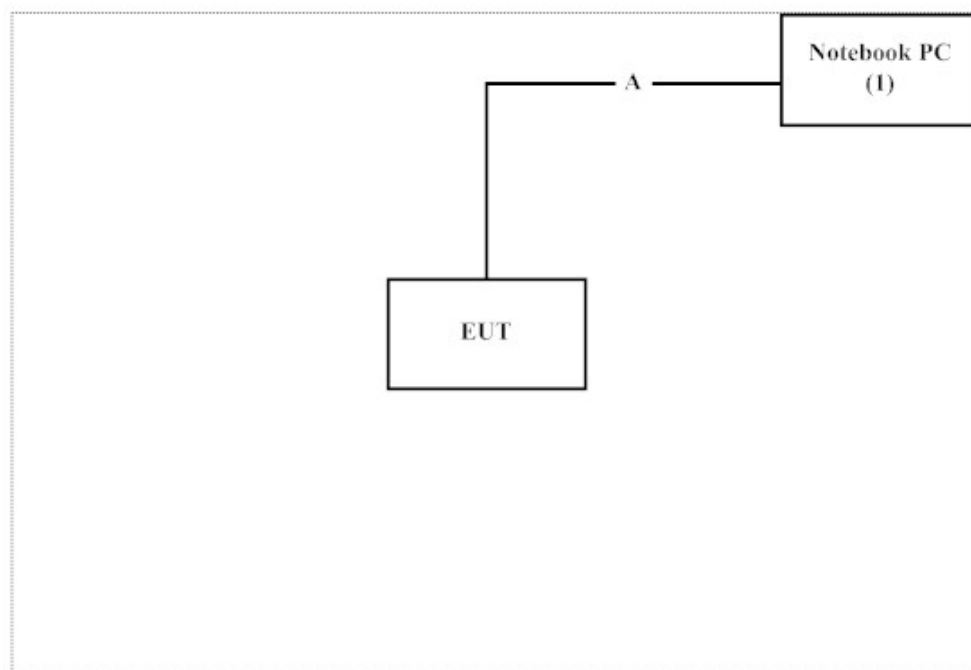
### 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	DELL	P62G	416FJC2	N/A

	Signal Cable Type	Signal cable Description
A	USB Cable	Non-Shielded, 1.8m

### 1.4. Configuration of Tested System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4.
- (2) Execute software "BTool-V1.40.15" on the EUT
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Press "OK" to start the continuous Transmit.
- (5) Verify that the EUT works properly.

## 1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

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FCC Accreditation Number: TW1014

## 1.7. List of Test Equipment

### For Conduction measurements /ASR1

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	EMI Test Receiver	R&S	ESR7	161601	2017.01.06	2018.01.05
X	Two-Line V-Network	R&S	ENV216	101306	2017.02.16	2018.02.15
X	Two-Line V-Network	R&S	ENV216	101307	2017.03.17	2018.03.16
X	Coaxial Cable	Quietek	RG400_BNC	RF001	2017.05.24	2018.05.23

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

### For Conducted measurements /ASR4

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSV30	103464	2017.01.09	2018.01.08
X	Power Meter	Anritsu	ML2496A	1548003	2016.12.15	2017.12.14
X	Power Sensor	Anritsu	MA2411B	1531024	2016.12.15	2017.12.14
X	Power Sensor	Anritsu	MA2411B	1531025	2016.12.15	2017.12.14
	Bluetooth Tester	R&S	CBT	101238	2017.01.03	2018.01.02

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek Conduction Test System V8.0.110

### For Radiated measurements /ACB1

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Loop Antenna	A.H.	SAS-562B	272	2016.07.21	2017.07.20
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	2017.02.09	2018.02.08
X	Horn Antenna	ETS-Lindgren	3117	00203800	2016.10.13	2017.10.12
X	Horn Antenna	Com-Power	AH-840	101087	2017.05.24	2018.05.23
X	Pre-Amplifier	EMCI	EMC001330	980316	2017.05.14	2018.05.15
X	Pre-Amplifier	EMCI	EMC051835SE	980311	2017.05.15	2018.05.16
X	Pre-Amplifier	EMCI	EMC05820SE	980310	2017.05.15	2018.05.16
X	Pre-Amplifier	EMCI	EMC184045SE	980314	2017.05.17	2018.05.18
X	Filter	MICRO TRONICS	BRM50702	G251	2016.08.11	2017.08.10
	Filter	MICRO TRONICS	BRM50716	G188	2016.08.11	2017.08.10
X	EMI Test Receiver	R&S	ESR7	101602	2016.12.15	2017.12.14
X	Spectrum Analyzer	R&S	FSV40	101149	2017.01.24	2018.01.23
X	Coaxial Cable	SUHNER	SUCOFLEX 106	RF002	2017.05.25	2018.05.24
X	Mircoflex Cable	HUBER SUHNER	SUCOFLEX 102	MY3381/2	2016.08.11	2017.08.10

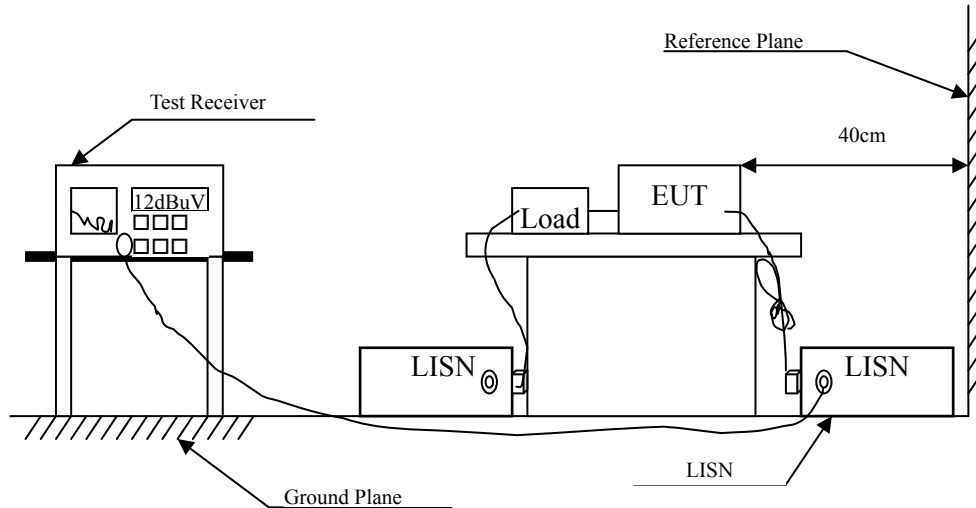
Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113



## 2. Conducted Emission

### 2.1. Test Setup



### 2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

### **2.3. Test Procedure**

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

### **2.4. Uncertainty**

±2.35dB

## 2.5. Test Result of Conducted Emission

Product : BT Dongle  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/06/03

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.152	9.707	46.098	55.805	-10.138	65.943
0.496	9.736	32.028	41.765	-14.349	56.114
1.187	9.756	12.900	22.656	-33.344	56.000
3.604	9.853	26.336	36.189	-19.811	56.000
9.998	9.996	25.138	35.135	-24.865	60.000
24.576	10.172	27.991	38.163	-21.837	60.000
<b>Average</b>					
0.152	9.707	31.544	41.251	-14.692	55.943
0.496	9.736	18.363	28.100	-18.014	46.114
1.187	9.756	4.388	14.144	-31.856	46.000
3.604	9.853	15.194	25.047	-20.953	46.000
9.998	9.996	19.390	29.386	-20.614	50.000
24.576	10.172	26.697	36.869	-13.131	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : BT Dongle  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/06/03

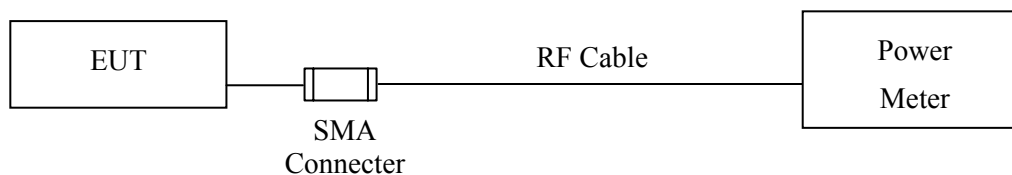
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.150	9.698	46.012	55.710	-10.290	66.000
0.274	9.696	19.865	29.561	-32.896	62.457
0.490	9.727	30.911	40.637	-15.649	56.286
3.554	9.847	25.589	35.437	-20.563	56.000
9.883	9.995	25.112	35.107	-24.893	60.000
24.576	10.212	27.943	38.155	-21.845	60.000
<b>Average</b>					
0.150	9.698	31.839	41.537	-14.463	56.000
0.274	9.696	2.456	12.152	-40.305	52.457
0.490	9.727	18.490	28.217	-18.069	46.286
3.554	9.847	14.684	24.532	-21.468	46.000
9.883	9.995	19.329	29.324	-20.676	50.000
24.576	10.212	27.024	37.236	-12.764	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

### 3. Peak Power Output

#### 3.1. Test Setup



#### 3.2. Limit

The maximum peak power shall be less 1Watt.

#### 3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.3 PKPM1 Peak power meter method.

#### 3.4. Uncertainty

$\pm 0.86$  dB

### 3.5. Test Result of Peak Power Output

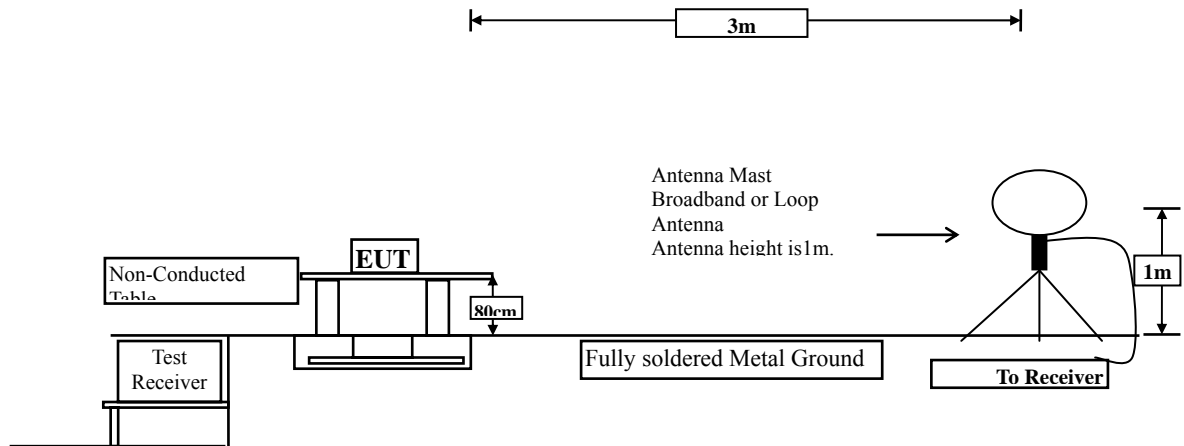
Product : BT Dongle  
Test Item : Peak Power Output  
Test Mode : Mode 1: Transmit - BLE  
Test Date : 2017/06/08

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	3.62	1 Watt= 30 dBm	Pass
Channel 19	2440.00	3.24	1 Watt= 30 dBm	Pass
Channel 39	2480.00	2.82	1 Watt= 30 dBm	Pass

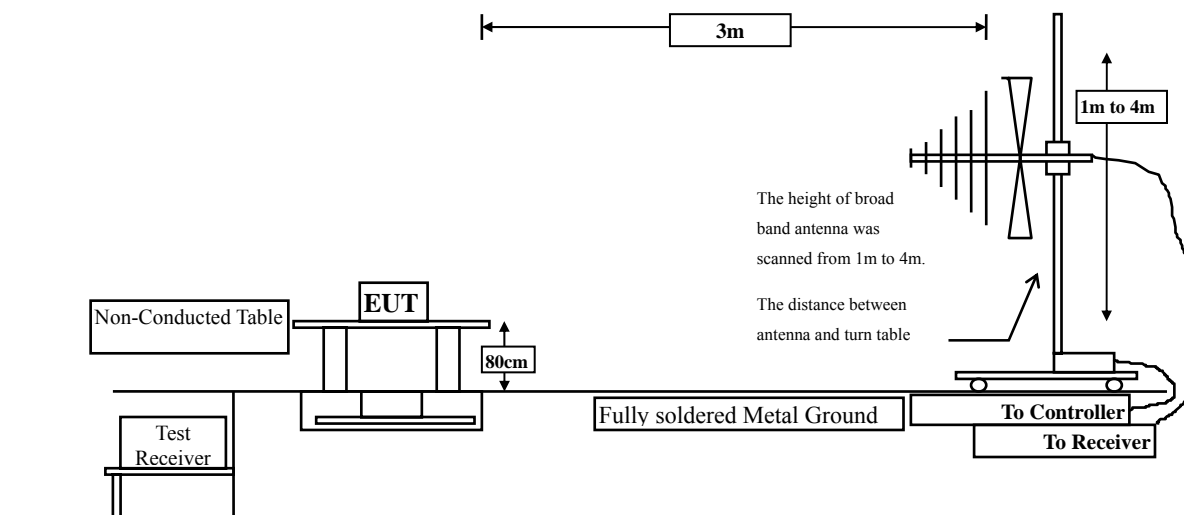
## 4. Radiated Emission

### 4.1. Test Setup

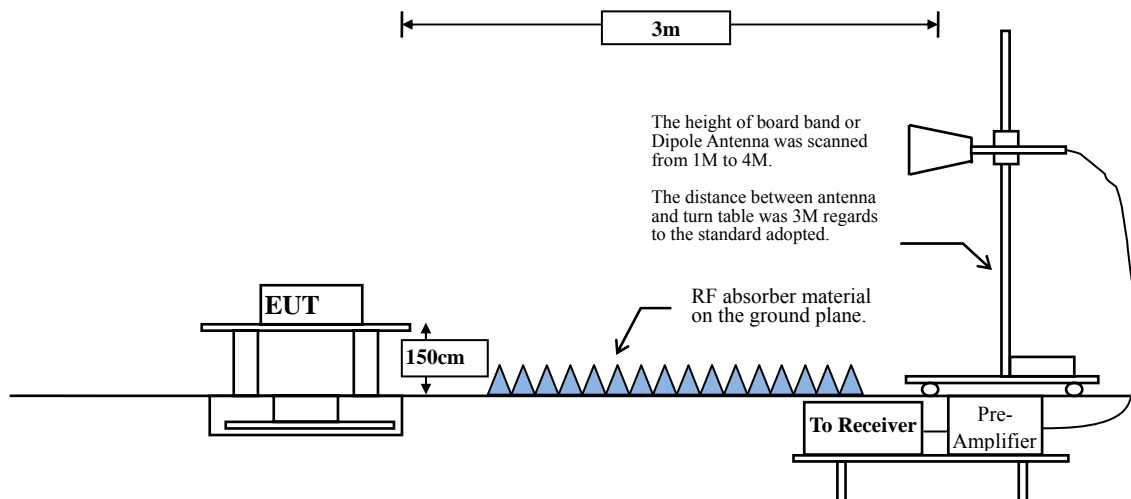
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



## 4.2. Limits

### ➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
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

- Remarks:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
  2. In the Above Table, the tighter limit applies at the band edges.
  3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.



### 4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

The average measurement tested according to KDB 558074 section 12.2.5.3. Reduced VBW averaging across on- and off-times of the EUT transmissions with max hold.

VBW  $\geq 1/T$ :

Duty Cycle	T	1/T	VBW Setting
0.1321	82.61 us	12.105 KHz	20 KHz

### 4.4. Uncertainty

Horizontal polarization :

30-300MHz:  $\pm 4.08\text{dB}$  ; 300M-1GHz:  $\pm 3.86\text{dB}$  ; 1-18GHz:  $\pm 3.77\text{dB}$  ; 18-40GHz:  $\pm 3.98\text{dB}$

Vertical polarization :

30-300MHz:  $\pm 4.81\text{dB}$  ; 300M-1GHz:  $\pm 3.87\text{dB}$  ; 1-18GHz:  $\pm 3.83\text{dB}$  ; 18-40GHz:  $\pm 3.98\text{dB}$

#### 4.5. Test Result of Radiated Emission

Product : BT Dongle  
 Test Item : Harmonic Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE(2402MHz)  
 Test Date : 2017/06/02

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4804.000	-3.773	47.920	44.147	-29.853	74.000
7206.000	-0.784	48.780	47.995	-26.005	74.000
9608.000	1.052	43.690	44.743	-29.257	74.000
<b>Average</b>					
<b>Detector:</b>					
--					54.000
<b>Vertical</b>					
<b>Peak Detector:</b>					
4804.000	-3.773	50.640	46.867	-27.133	74.000
7206.000	-0.784	45.350	44.565	-29.435	74.000
9608.000	1.052	44.070	45.123	-28.877	74.000
<b>Average</b>					
<b>Detector:</b>					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : BT Dongle  
 Test Item : Harmonic Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/06/02

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4880.000	-3.770	47.180	43.410	-30.590	74.000
7320.000	-0.715	50.880	50.165	-23.835	74.000
9760.000	1.381	43.140	44.521	-29.479	74.000
<b>Average</b>					
<b>Detector:</b>					
--					54.000
<b>Vertical</b>					
<b>Peak Detector:</b>					
4880.000	-3.770	50.820	47.050	-26.950	74.000
7320.000	-0.715	44.210	43.495	-30.505	74.000
9760.000	1.381	44.880	46.261	-27.739	74.000
<b>Average</b>					
<b>Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : BT Dongle  
 Test Item : Harmonic Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE (2480MHz)  
 Test Date : 2017/06/02

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4960.000	-3.732	48.600	44.868	-29.132	74.000
7440.000	-0.646	54.130	53.483	-20.517	74.000
9920.000	1.687	42.750	44.437	-29.563	74.000
<b>Average</b>					
<b>Detector:</b>					
--					54.000
<b>Vertical</b>					
<b>Peak Detector:</b>					
4960.000	-3.732	54.010	50.278	-23.722	74.000
7440.000	-0.646	46.050	45.403	-28.597	74.000
9920.000	1.687	42.790	44.477	-29.523	74.000
<b>Average</b>					
<b>Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : BT Dongle  
 Test Item : General Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/06/02

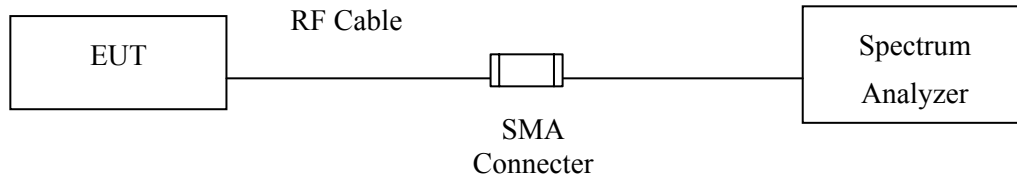
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
113.420	-13.808	39.220	25.413	-18.087	43.500
308.418	-9.892	41.270	31.378	-14.622	46.000
396.500	-7.680	35.380	27.701	-18.299	46.000
630.540	-3.089	32.380	29.290	-16.710	46.000
780.690	-0.886	30.680	29.795	-16.205	46.000
992.420	1.721	29.590	31.312	-22.688	54.000
<b>Vertical</b>					
70.850	-13.713	34.750	21.038	-18.962	40.000
265.700	-11.272	33.310	22.038	-23.962	46.000
400.250	-7.578	30.460	22.882	-23.118	46.000
596.180	-3.416	22.260	18.844	-27.156	46.000
800.160	-0.662	30.680	30.018	-15.982	46.000
960.170	1.234	19.880	21.113	-32.887	54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

## 5. RF Antenna Conducted Test

### 5.1. Test Setup



### 5.2. Limits

According to FCC Section 15.247(d). 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 measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

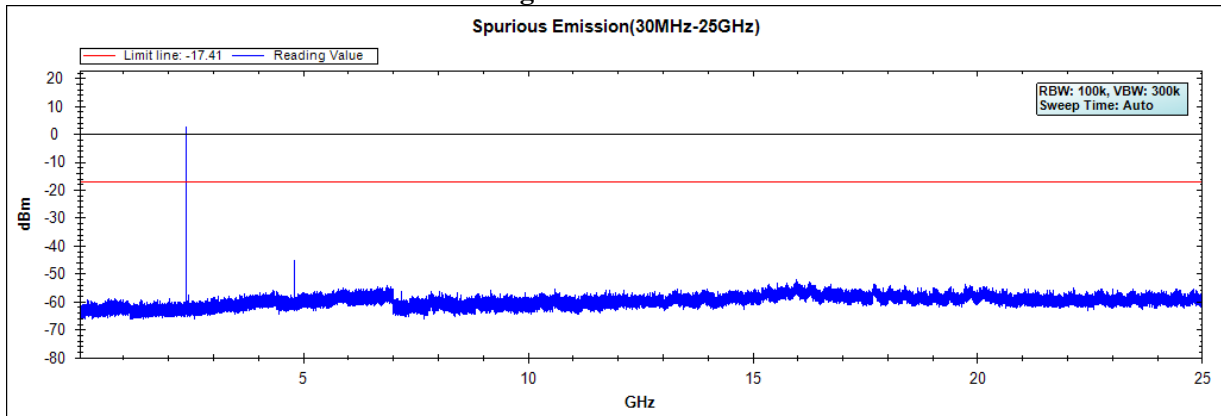
### 5.4. Uncertainty

±1.23dB

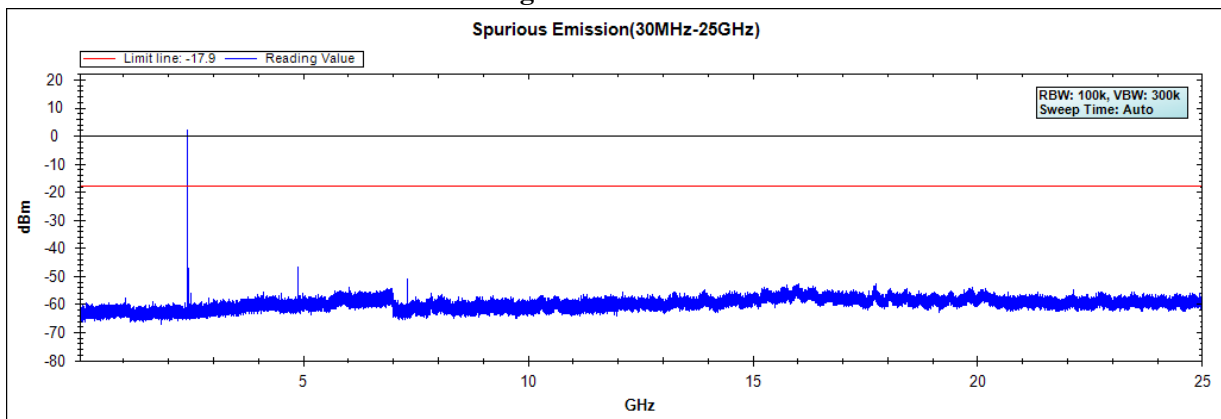
## 5.5. Test Result of RF Antenna Conducted Test

Product : BT Dongle  
Test Item : RF Antenna Conducted Test  
Test Mode : Mode 1: Transmit - BLE  
Test Date : 2017/06/02

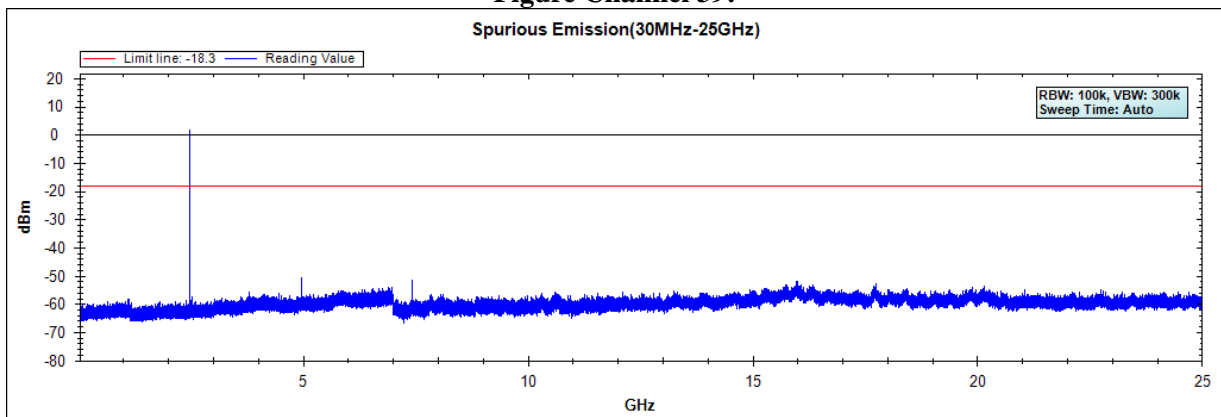
**Figure Channel 00:**



**Figure Channel 19:**



**Figure Channel 39:**

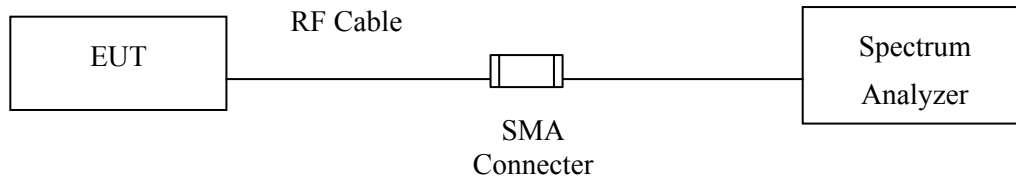


Note: The above test pattern is synthesized by multiple of the frequency range.

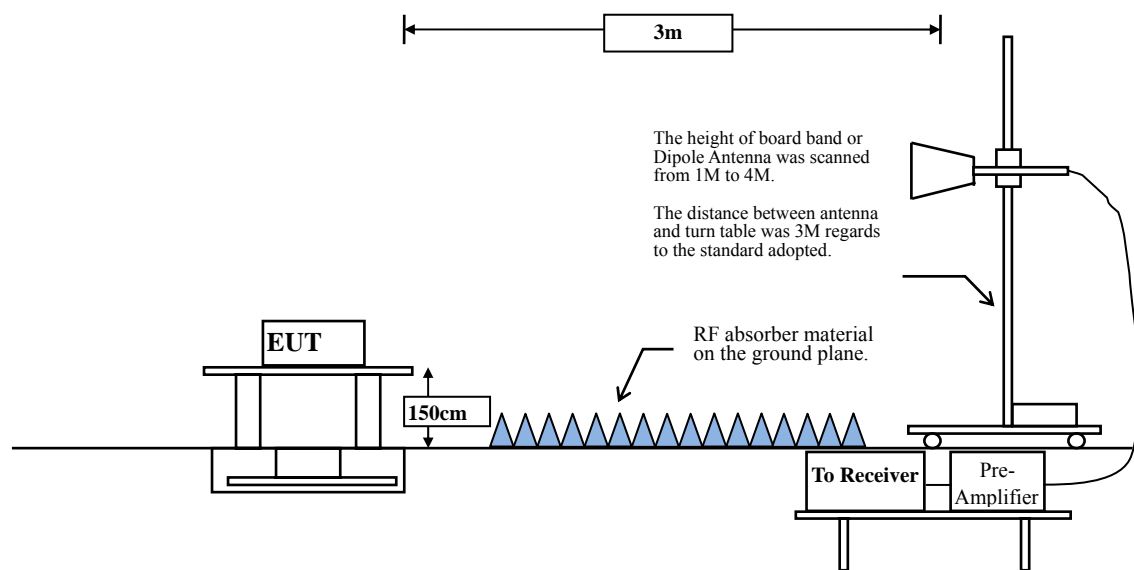
## 6. Band Edge

### 6.1. Test Setup

#### RF Conducted Measurement



#### RF Radiated Measurement:





## 6.2. Limit

According to FCC Section 15.247(d). 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 measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

The average measurement tested according to KDB 558074 section 12.2.5.3. Reduced VBW averaging across on- and off-times of the EUT transmissions with max hold.

VBW  $\geq 1/T$ :

Duty Cycle	T	1/T	VBW Setting
0.1321	82.61 us	12.105 KHz	20 KHz

## 6.4. Uncertainty

Conducted:  $\pm 1.23$ dB

Radiated:

Horizontal polarization : 1-18GHz:  $\pm 3.77$ dB

Vertical polarization : 1-18GHz :  $\pm 3.83$ dB

## 6.5. Test Result of Band Edge

Product : BT Dongle  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/06/02

### RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
00 (Peak)	2370.000	11.494	30.972	42.466	74.00	54.00	Pass
00 (Peak)	2390.000	11.556	28.625	40.181	74.00	54.00	Pass
00 (Peak)	2400.000	11.579	58.259	69.838	--	--	--
00 (Peak)	2402.319	11.584	87.124	98.708	--	--	--
00 (Average)	2369.855	11.494	23.278	34.772	74.00	54.00	Pass
00 (Average)	2390.000	11.556	20.350	31.906	74.00	54.00	Pass
00 (Average)	2400.000	11.579	52.634	64.213	--	--	--
00 (Average)	2402.029	11.584	86.693	98.277	--	--	--

Figure Channel 00:

Horizontal (Peak)

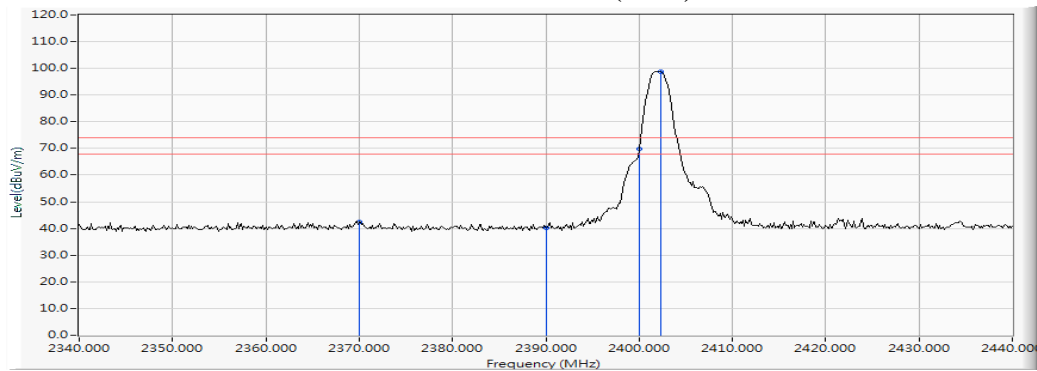
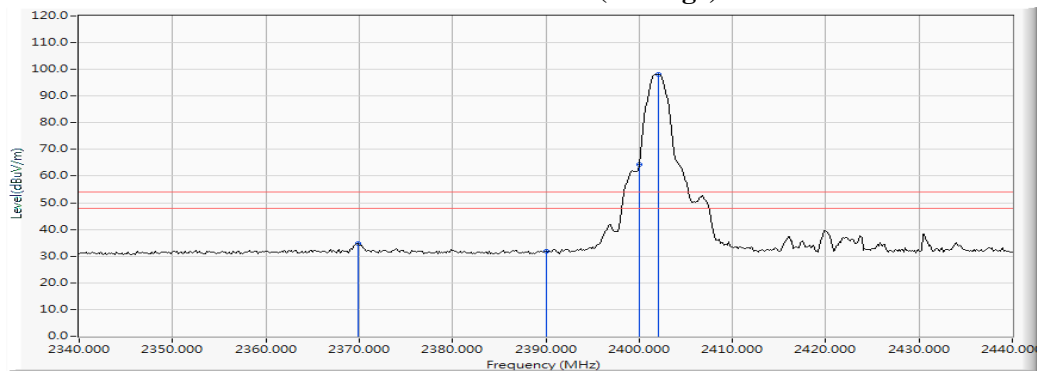


Figure Channel 00:

Horizontal (Average)



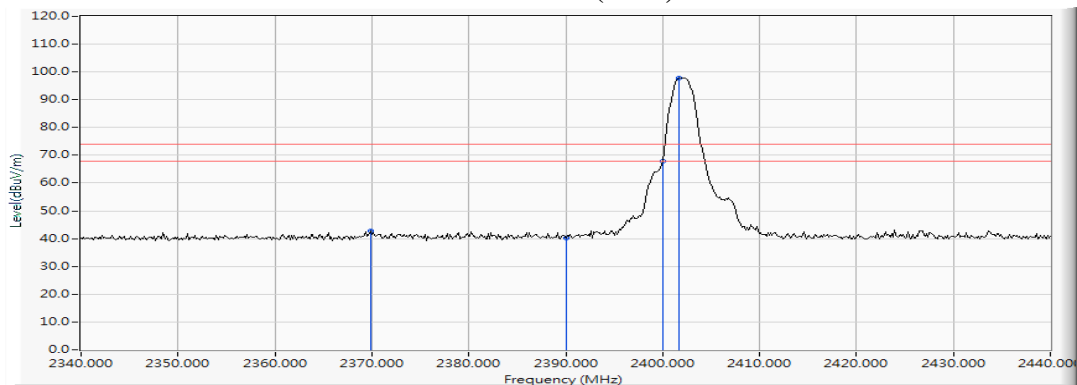
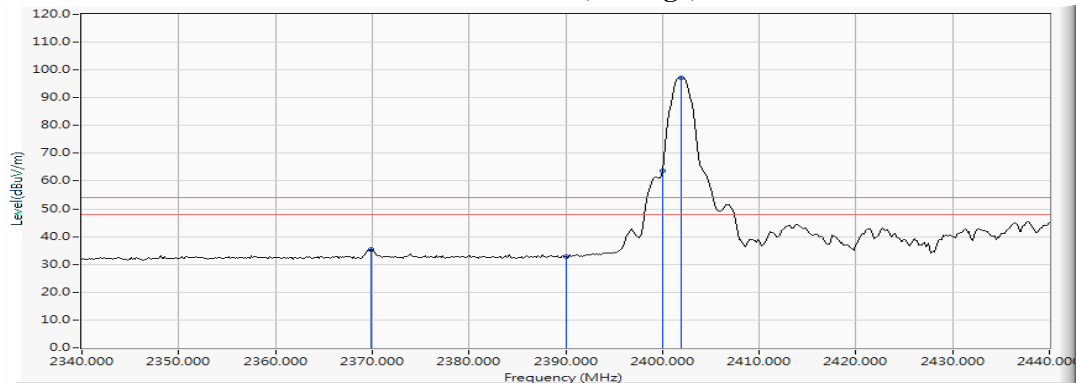
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : BT Dongle  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/06/02

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
00 (Peak)	2369.855	11.494	31.369	42.863	74.00	54.00	Pass
00 (Peak)	2390.000	11.556	28.547	40.103	74.00	54.00	Pass
00 (Peak)	2400.000	11.579	56.308	67.887	--	--	--
00 (Peak)	2401.739	11.582	86.149	97.732	--	--	--
00 (Average)	2369.855	11.494	23.748	35.242	74.00	54.00	Pass
00 (Average)	2390.000	11.556	21.335	32.891	74.00	54.00	Pass
00 (Average)	2400.000	11.579	52.068	63.647	--	--	--
00 (Average)	2401.884	11.584	85.735	97.318	--	--	--

**Figure Channel 00: Vertical (Peak)****Figure Channel 00: Vertical (Average)**

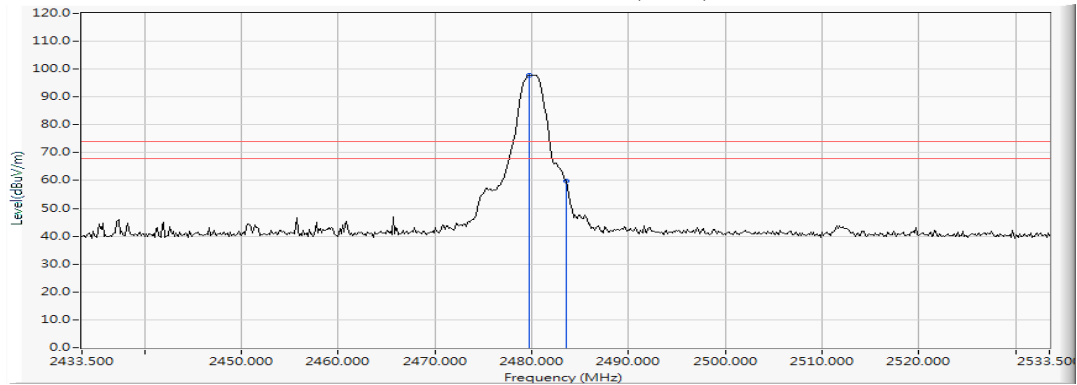
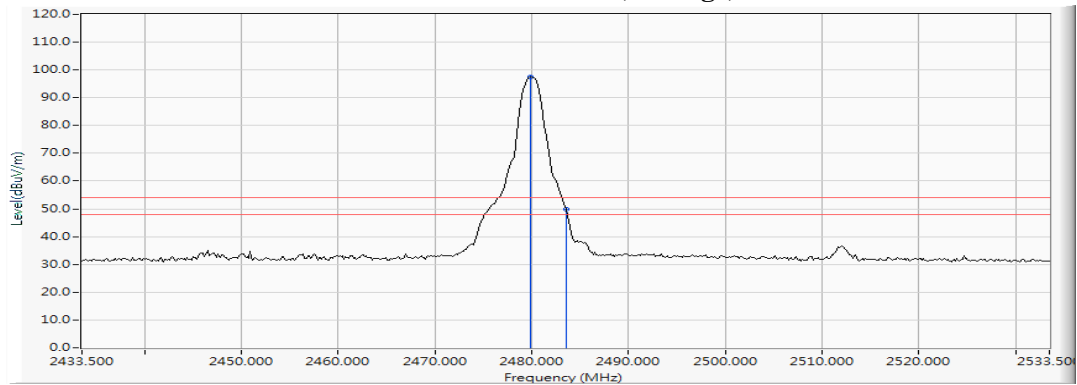
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : BT Dongle  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/06/02

**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
39 (Peak)	2479.732	11.791	86.067	97.858	--	--	--
39 (Peak)	2483.500	11.800	47.894	59.694	74.00	54.00	Pass
39 (Average)	2479.877	11.791	85.539	97.330	--	--	--
39 (Average)	2483.500	11.800	38.087	49.887	74.00	54.00	Pass

**Figure Channel 39:****Horizontal (Peak)****Figure Channel 39:****Horizontal (Average)**

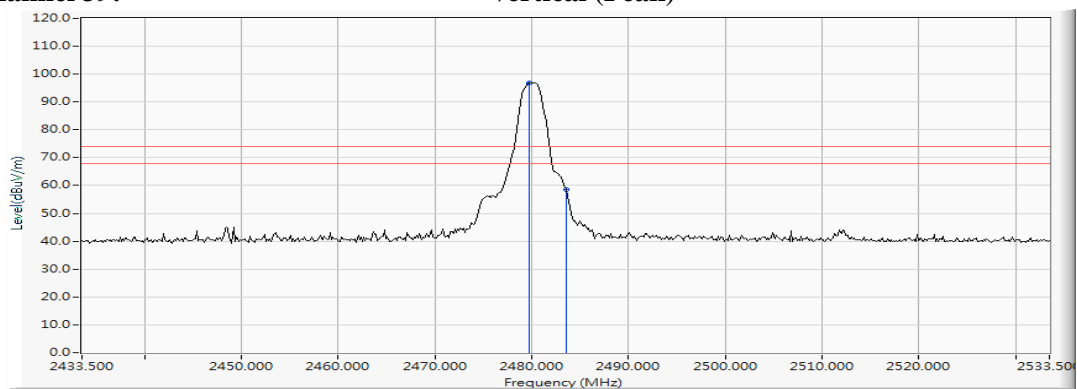
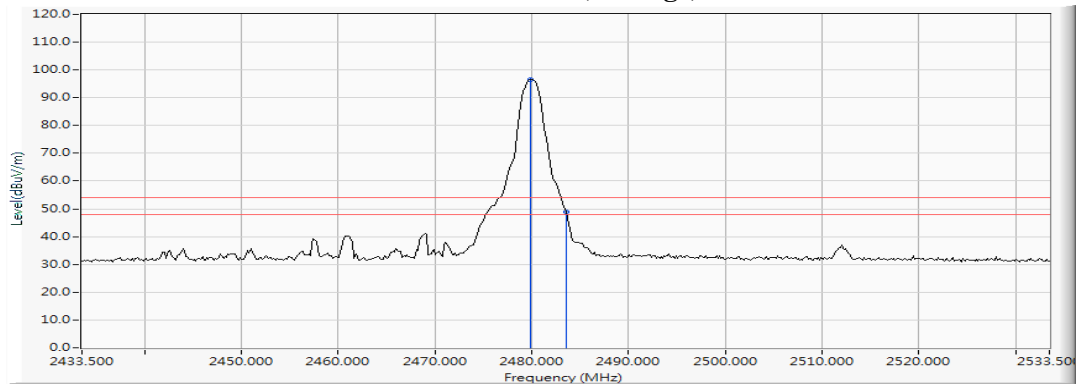
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : BT Dongle  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/06/02

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
39 (Peak)	2479.732	11.791	85.178	96.969	--	--	--
39 (Peak)	2483.500	11.800	46.651	58.451	74.00	54.00	Pass
39 (Average)	2479.877	11.791	84.714	96.505	--	--	--
39 (Average)	2483.500	11.800	37.141	48.941	74.00	54.00	Pass

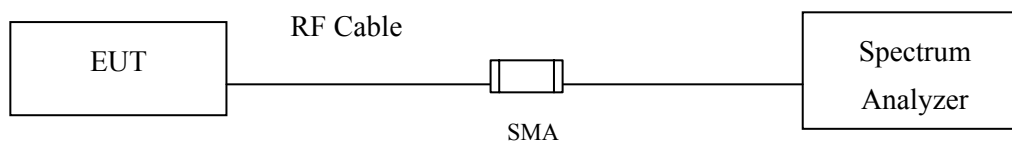
**Figure Channel 39: Vertical (Peak)****Figure Channel 39: Vertical (Average)**

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 20KHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

## 7. 6dB Bandwidth

### 7.1. Test Setup



### 7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

### 7.3. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth,  $VBW \geq 3 * RBW$

### 7.4. Uncertainty

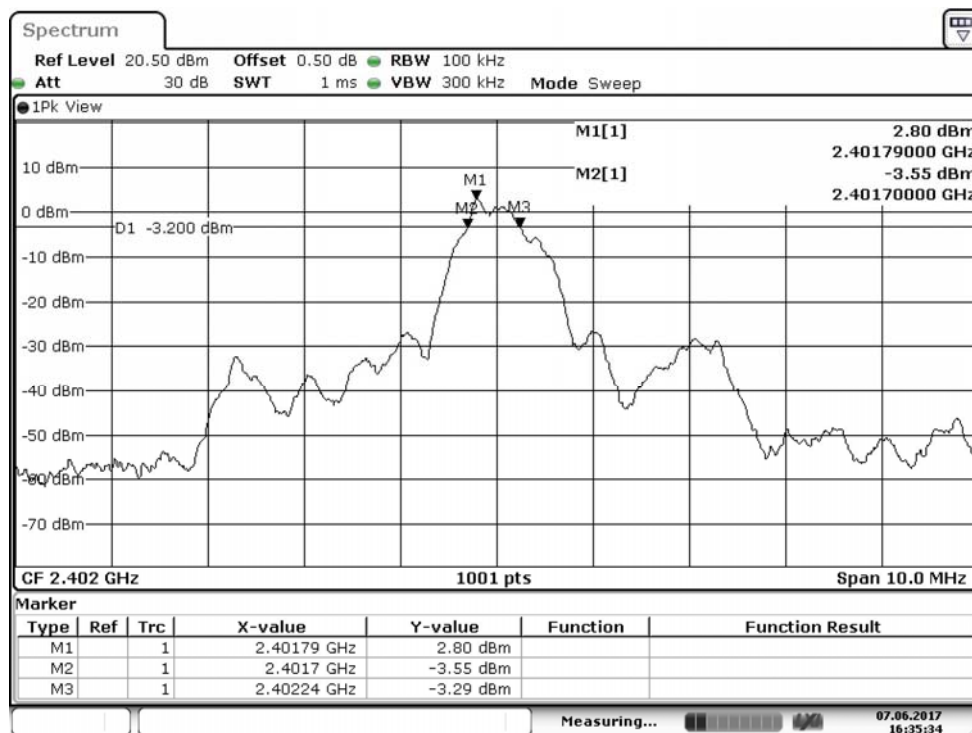
$\pm 279.2 \text{ Hz}$

## 7.5. Test Result of 6dB Bandwidth

Product : BT Dongle  
 Test Item : 6dB Bandwidth Data  
 Test Mode : Mode 1: Transmit - BLE (2402MHz)  
 Test Date : 2017/06/08

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	540	>500	Pass

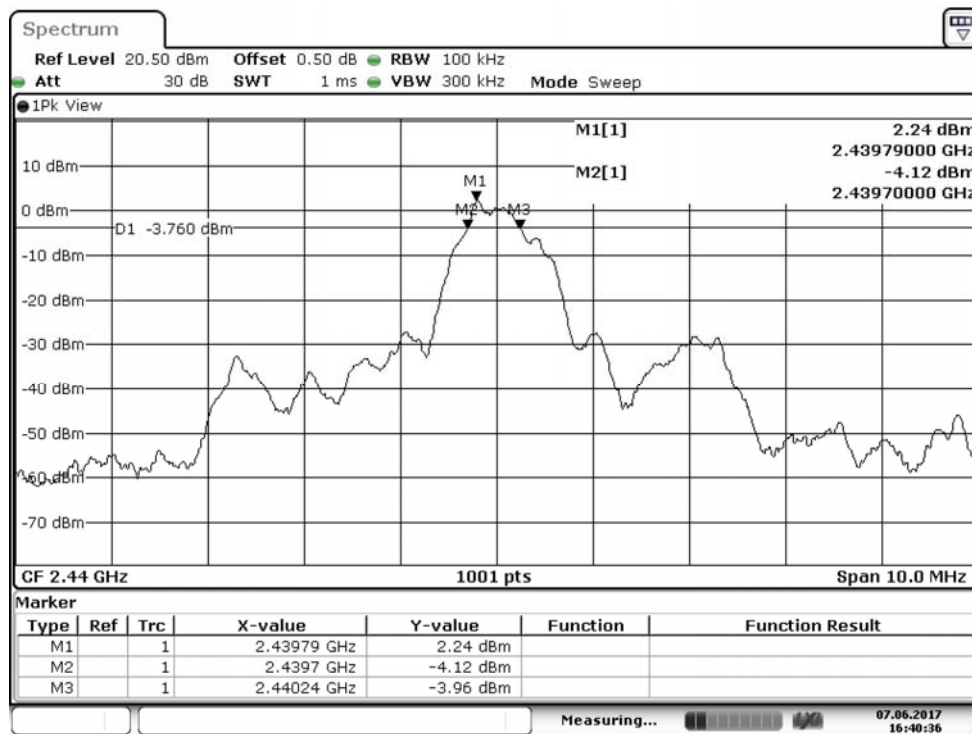
Figure Channel 00:



Product : BT Dongle  
 Test Item : 6dB Bandwidth Data  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/06/08

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	540	>500	Pass

Figure Channel 19:

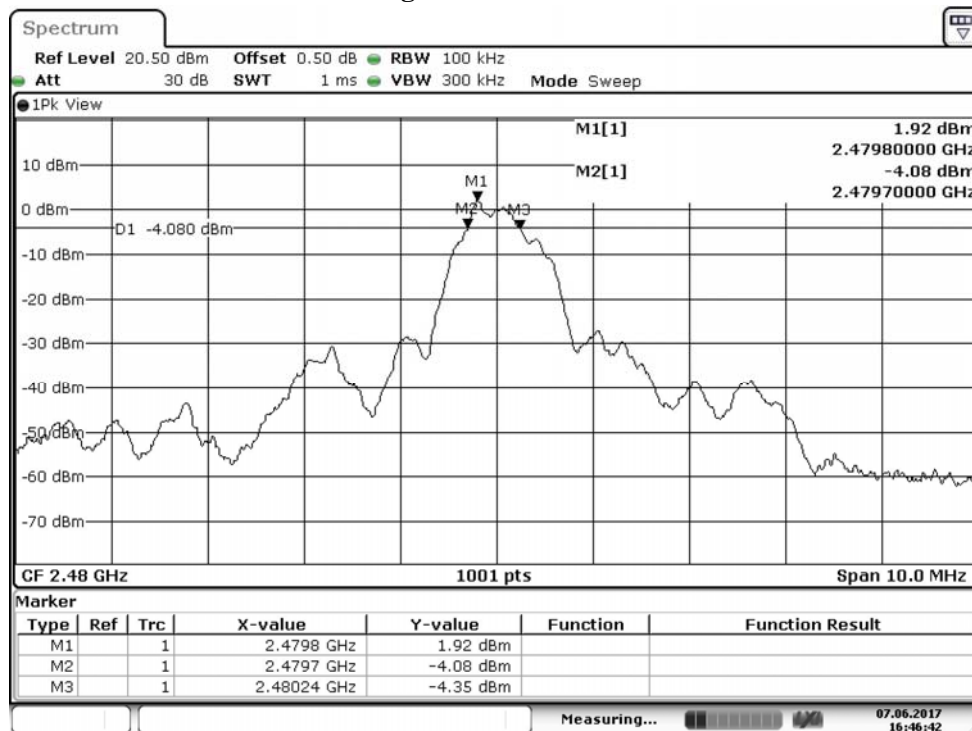




Product : BT Dongle  
 Test Item : 6dB Bandwidth Data  
 Test Mode : Mode 1: Transmit - BLE (2480MHz)  
 Test Date : 2017/06/08

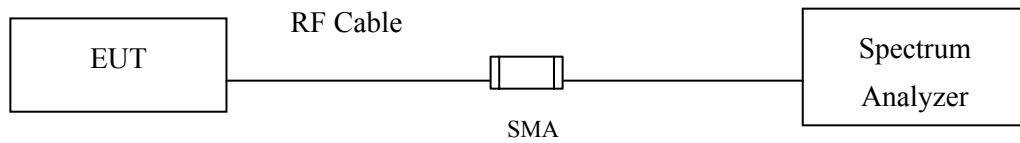
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	540	>500	Pass

Figure Channel 39:



## 8. Power Density

### 8.1. Test Setup



### 8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

### 8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

### 8.4. Uncertainty

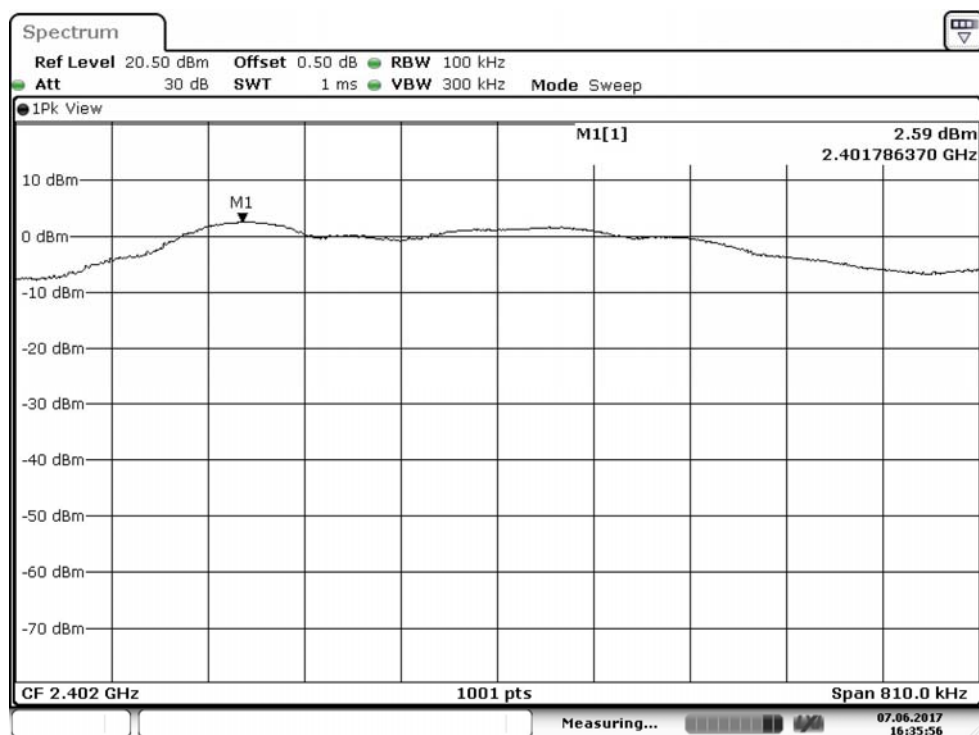
$\pm 1.23\text{dB}$

### 8.5. Test Result of Power Density

Product : BT Dongle  
 Test Item : Power Density Data  
 Test Mode : Mode 1: Transmit - BLE (2402MHz)  
 Test Date : 2017/06/08

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	2.59	$\leq 8\text{dBm}$	Pass

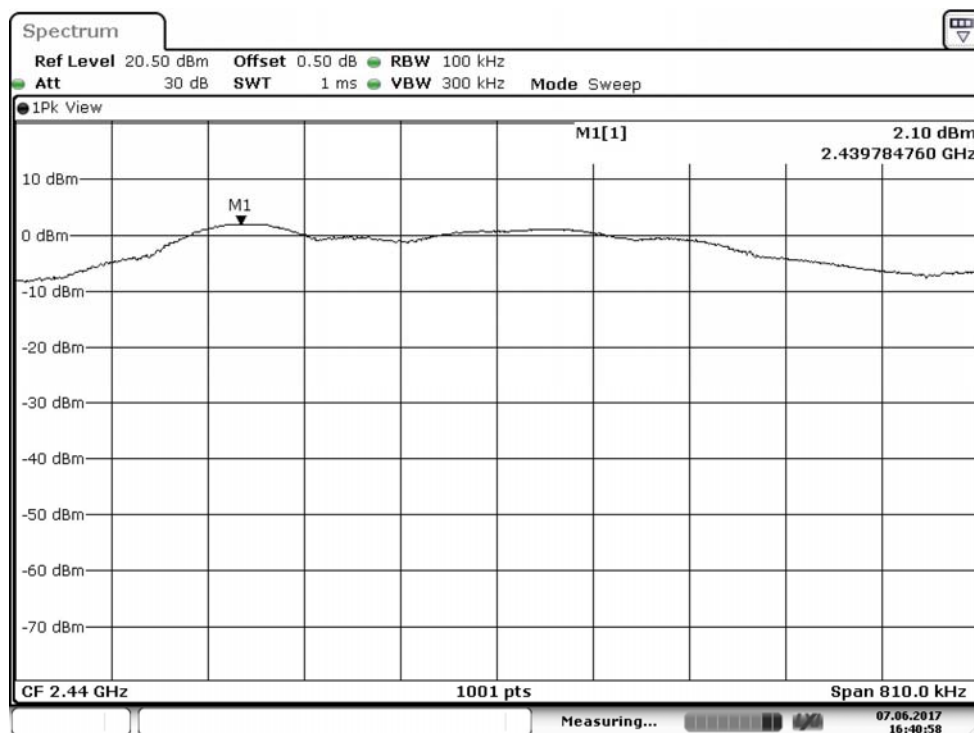
Figure Channel 00:



Product : BT Dongle  
 Test Item : Power Density Data  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/06/08

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
19	2440	2.1	$\leq 8\text{dBm}$	Pass

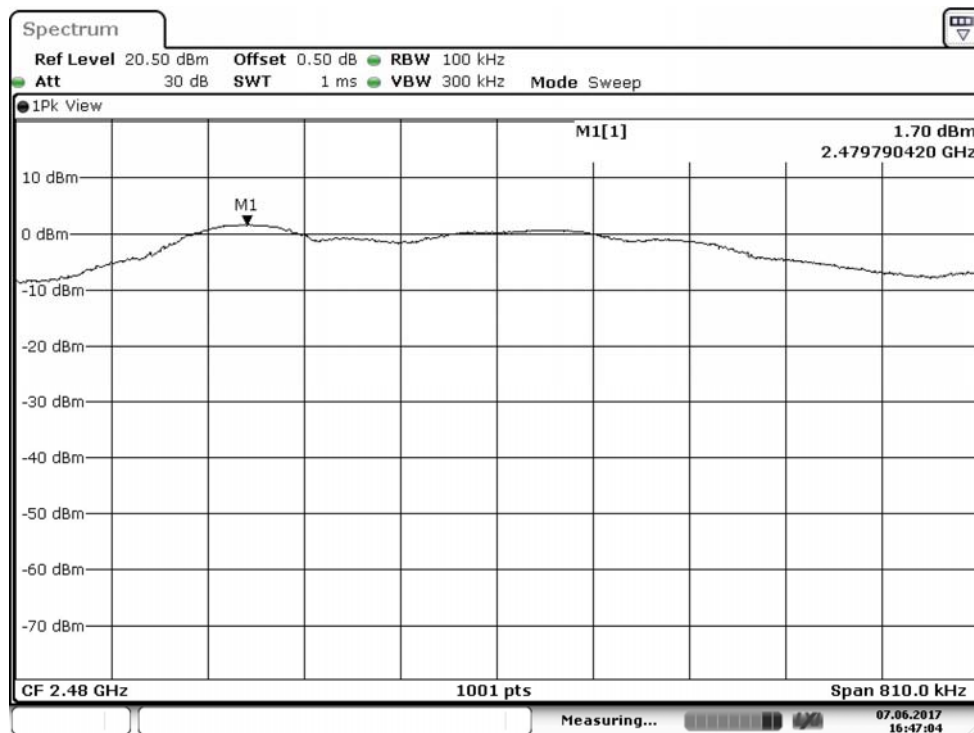
Figure Channel 19:



Product : BT Dongle  
 Test Item : Power Density Data  
 Test Mode : Mode 1: Transmit - BLE (2480MHz)  
 Test Date : 2017/06/08

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2480	1.7	$\leq 8\text{dBm}$	Pass

Figure Channel 39:



## **9. EMI Reduction Method During Compliance Testing**

No modification was made during testing.

## Attachment 1: EUT Test Photographs

## Attachment 2: EUT Detailed Photographs