

# FCC Test Report

Product Name	Intelligent Robot
Model No.	Zenbo
FCC ID.	MSQ-ZENBO

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

Date of Receipt	Aug. 15, 2016
Issued Date	Jul. 20, 2017
Report No.	1740337R-RFUSP01V00-C
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: Jul. 20, 2017

Report No.: 1740337R-RFUSP01V00-C



Product Name	Intelligent Robot
Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan
Manufacturer	ASUSTeK COMPUTER INC.
Model No.	Zenbo
FCC ID.	MSQ-ZENBO
EUT Rated Voltage	DC 14.4V (Power by Battery)
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

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( Senior Adm. Specialist / Genie Chang )

Tested By : Yulin Chen  
( Engineer / Yulin Chen )

Approved By : Vincent Lin  
( Director / Vincent Lin )

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## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	Intelligent Robot
Trade Name	ASUS
Model No.	Zenbo
FCC ID.	MSQ-ZENBO
Frequency Range	2402 – 2480MHz
Channel Number	V4.0: 40CH
Type of Modulation	V4.0: GFSK(1Mbps)
Antenna Type	PIFA Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”
Power Adapter	MFR: ASUS, M/N: ADP-45BW B Input: AC 100-240V, 50-60Hz, 1.2A Output: DC 19V, 2.37A Cable Out: Non-shielded, 2.3m

#### Antenna List

No.	Manufacturer	Part No.	ASUS Part No.	Antenna Type	Peak Gain
1	ASUS	290-70109	14008-02060000	PIFA Antenna	0.59dBi for 2.4 GHz

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

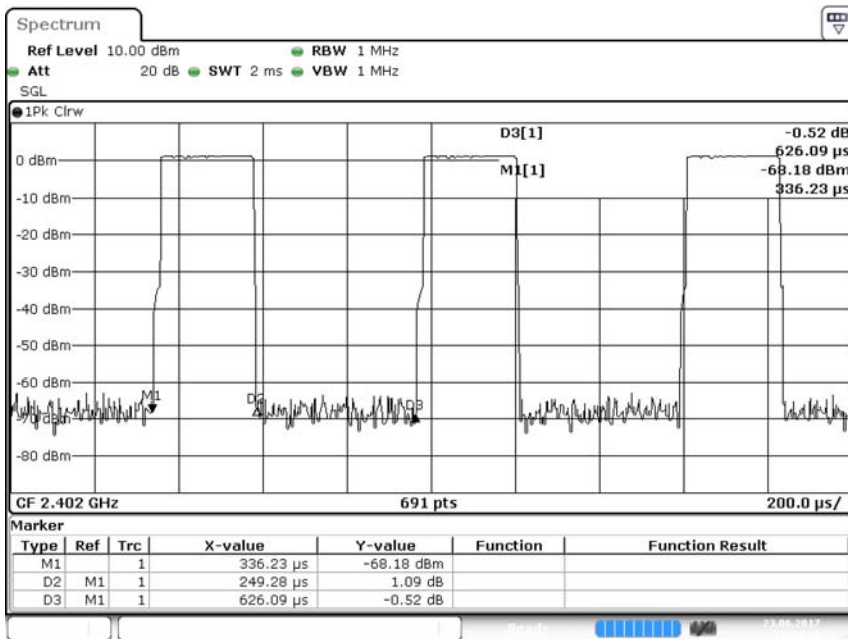
Center Frequency of Each Channel: (For V4.0)

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:

BLE	0.398
-----	-------

\*Duty cycle = Ton / (Ton + Toff)



## Note:

1. The EUT is an Intelligent Robot with a built-in WLAN 、 Bluetooth transceiver, this report for Bluetooth V4.0.
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
-----------	------------------------

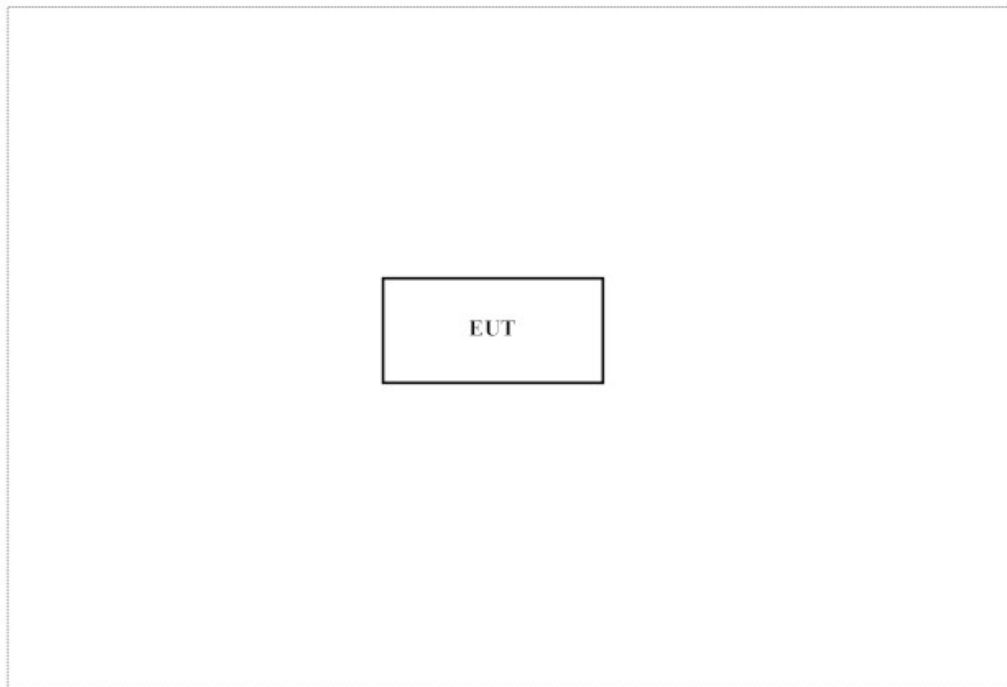
### 1.3. Tested System Details

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
N/A				

Signal Cable Type	Signal cable Description
N/A	

### 1.4. Configuration of Tested System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4.
- (2) Execute software "DRTU-v1.6.1" 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

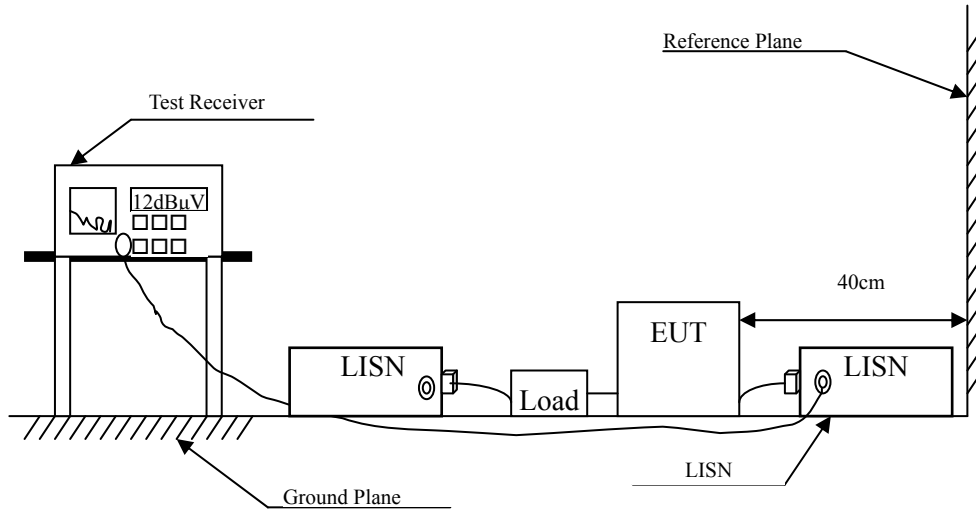
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Loop Antenna	A.H.	SAS-562B	272	2016.03.18	2018.03.17
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	2017.02.09	2018.02.08
X	Horn Antenna	ETS-Lindgren	3117	00203800	2016.10.13	2017.10.12
X	Horn Antenna	Com-Power	AH-840	101087	2017.05.24	2018.05.23
X	Pre-Amplifier	EMCI	EMC001330	980316	2017.05.14	2018.05.13
X	Pre-Amplifier	EMCI	EMC051835SE	980311	2017.05.15	2018.05.14
X	Pre-Amplifier	EMCI	EMC05820SE	980310	2017.05.15	2018.05.14
X	Pre-Amplifier	EMCI	EMC184045SE	980314	2017.05.17	2018.05.16
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 : Intelligent Robot  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit - BLE (2442MHz)  
 Test Date : 2017/07/11

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.150	9.708	41.103	50.811	-15.189	66.000
0.445	9.726	31.980	41.707	-15.864	57.571
2.958	9.827	10.176	20.003	-35.997	56.000
4.985	9.894	11.310	21.204	-34.796	56.000
13.560	10.053	14.783	24.836	-35.164	60.000
24.576	10.172	23.655	33.827	-26.173	60.000
<b>Average</b>					
0.150	9.708	22.043	31.751	-24.249	56.000
0.445	9.726	22.611	32.338	-15.233	47.571
2.958	9.827	4.469	14.297	-31.703	46.000
4.985	9.894	6.075	15.969	-30.031	46.000
13.560	10.053	5.621	15.674	-34.326	50.000
24.576	10.172	22.674	32.846	-17.154	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 : Intelligent Robot  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit - BLE (2442MHz)  
 Test Date : 2017/07/11

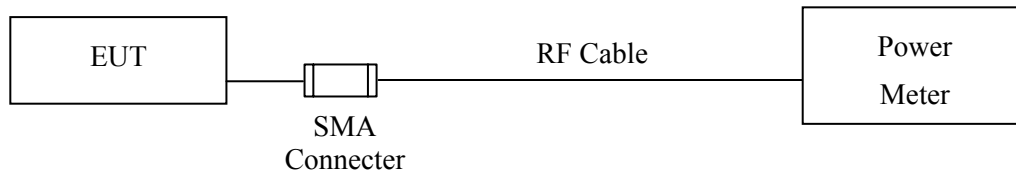
Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.152	10.800	35.162	45.962	-19.981	65.943
0.449	10.012	34.536	44.549	-12.908	57.457
3.559	9.936	14.638	24.574	-31.426	56.000
5.030	9.922	13.304	23.226	-36.774	60.000
12.581	10.088	11.227	21.315	-38.685	60.000
24.576	10.270	23.777	34.047	-25.953	60.000
<b>Average</b>					
0.152	10.800	23.882	34.682	-21.261	55.943
0.449	10.012	27.731	37.744	-9.713	47.457
3.559	9.936	8.321	18.257	-27.743	46.000
5.030	9.922	7.672	17.595	-32.405	50.000
12.581	10.088	5.318	15.407	-34.593	50.000
24.576	10.270	22.608	32.878	-17.122	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

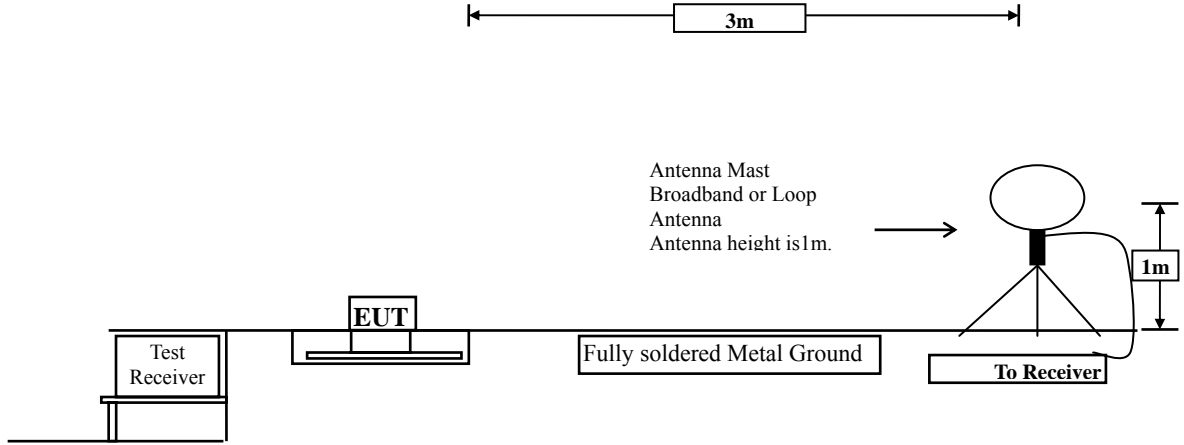
Product : Intelligent Robot  
Test Item : Peak Power Output  
Test Mode : Mode 1: Transmit - BLE  
Test Date : 2016/09/21

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	3.07	1 Watt= 30 dBm	Pass
Channel 19	2440.00	4.08	1 Watt= 30 dBm	Pass
Channel 39	2480.00	3.26	1 Watt= 30 dBm	Pass

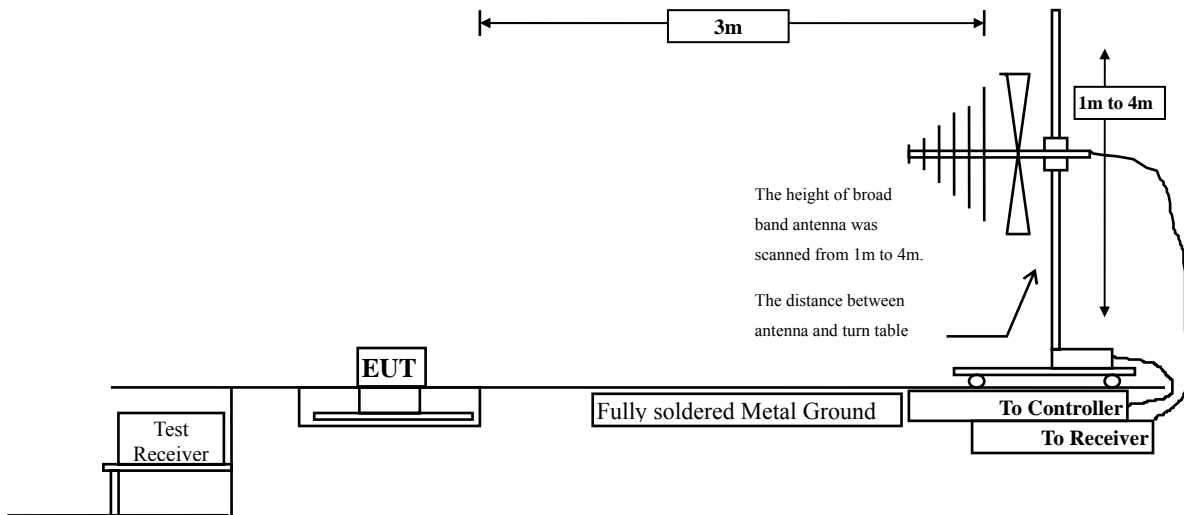
#### 4. Radiated Emission

##### 4.1. Test Setup

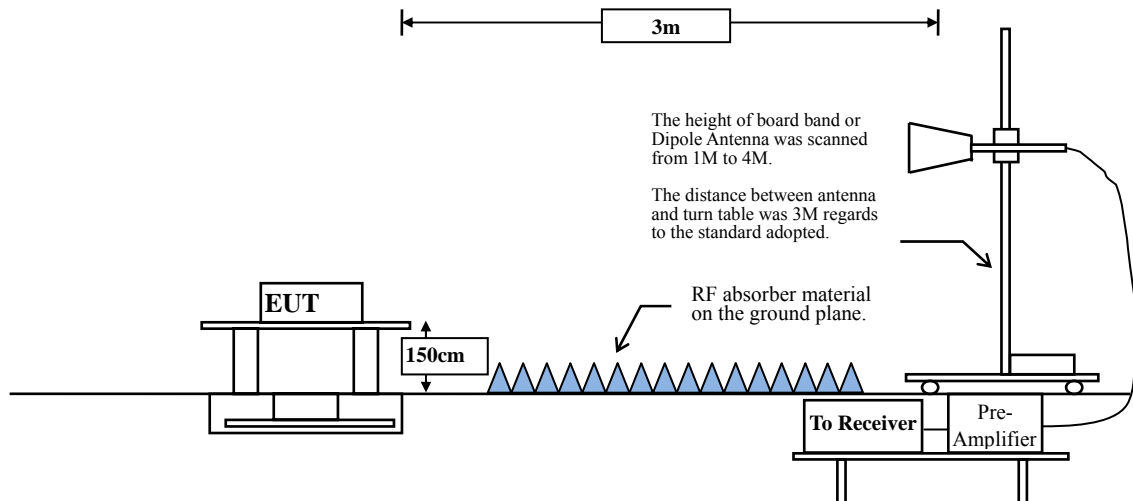
Radiated Emission Under 30MHz



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.

<b>FCC Part 15 Subpart C Paragraph 15.209 Limits</b>		
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 C63.4: 2014 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
0.398	249.28 us	4.011 KHz	5 KHz

### 4.4. Uncertainty

Horizontal polarization :

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

Vertical polarization :

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

#### 4.5. Test Result of Radiated Emission

Product : Intelligent Robot  
 Test Item : Harmonic Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE(2402MHz)  
 Test Date : 2016/09/02

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4804.000	-3.639	53.840	50.200	-23.800	74.000
7206.000	-0.634	45.170	44.536	-29.464	74.000
9608.000	1.702	43.920	45.623	-28.377	74.000
<b>Average Detector:</b>					
--					54.000
<b>Vertical</b>					
<b>Peak Detector:</b>					
4804.000	-3.639	48.950	45.310	-28.690	74.000
7206.000	-0.634	45.340	44.706	-29.294	74.000
9608.000	1.702	44.150	45.853	-28.147	74.000
<b>Average 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 = 5kHz, 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 : Intelligent Robot  
 Test Item : Harmonic Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2016/09/02

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4880.000	-3.566	52.990	49.424	-24.576	74.000
7320.000	-0.554	45.190	44.637	-29.363	74.000
9760.000	2.038	44.650	46.688	-27.312	74.000
<b>Average Detector:</b>					
--					54.000
<b>Vertical</b>					
<b>Peak Detector:</b>					
4880.000	-3.566	48.150	44.584	-29.416	74.000
7320.000	-0.554	45.560	45.007	-28.993	74.000
9760.000	2.038	44.320	46.358	-27.642	74.000
<b>Average 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 = 5kHz, 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 : Intelligent Robot  
 Test Item : Harmonic Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE (2480MHz)  
 Test Date : 2016/09/02

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4960.000	-3.472	51.020	47.549	-26.451	74.000
7440.000	-0.464	45.200	44.735	-29.265	74.000
9920.000	2.290	43.950	46.240	-27.760	74.000
<b>Average Detector:</b>					
--					54.000
<b>Vertical</b>					
<b>Peak Detector:</b>					
4960.000	-3.472	47.650	44.179	-29.821	74.000
7440.000	-0.464	44.780	44.315	-29.685	74.000
9920.000	2.290	43.590	45.880	-28.120	74.000
<b>Average 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 = 5kHz, 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 : Intelligent Robot  
 Test Item : General Radiated Emission  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2017/07/12

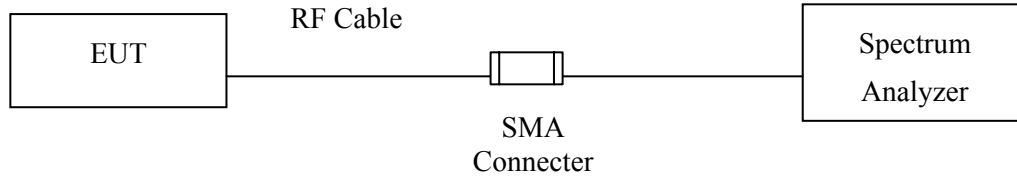
Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
164.957	-8.807	35.051	26.244	-17.256	43.500
316.783	-7.712	35.248	27.536	-18.464	46.000
418.000	-5.165	34.192	29.027	-16.973	46.000
491.101	-3.701	34.418	30.717	-15.283	46.000
583.884	-1.714	35.881	34.166	-11.834	46.000
635.899	-1.043	35.736	34.693	-11.307	46.000
<b>Vertical</b>					
160.739	-8.620	34.690	26.071	-17.429	43.500
298.507	-8.106	35.188	27.082	-18.918	46.000
413.783	-5.263	35.205	29.942	-16.058	46.000
505.159	-3.442	35.683	32.241	-13.759	46.000
640.116	-1.005	36.228	35.223	-10.777	46.000
731.493	0.508	34.392	34.900	-11.100	46.000

## 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 = 5kHz, 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.

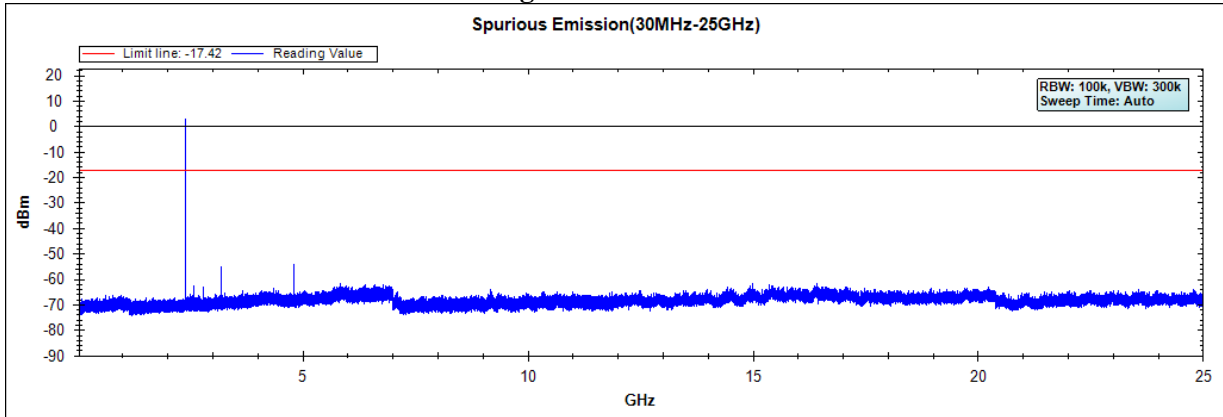
### 5.4. Uncertainty

±1.23dB

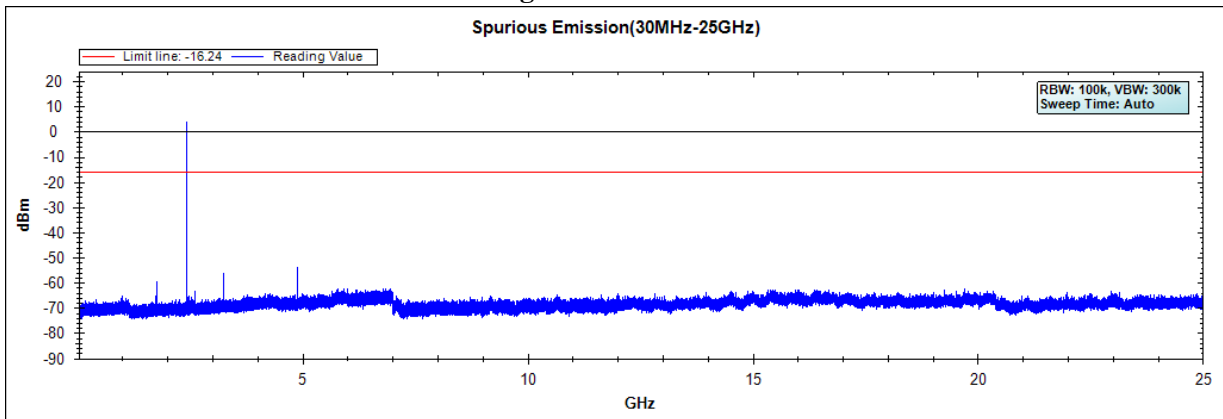
### 5.5. Test Result of RF Antenna Conducted Test

Product : Intelligent Robot  
Test Item : RF Antenna Conducted Test  
Test Mode : Mode 1: Transmit - BLE  
Test Date : 2016/09/21

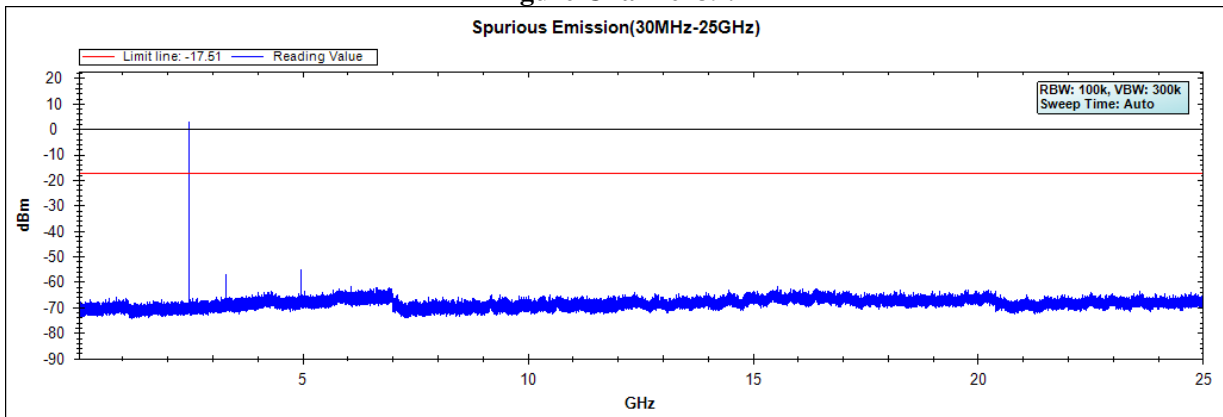
**Figure Channel 00:**



**Figure Channel 19:**



**Figure Channel 39:**



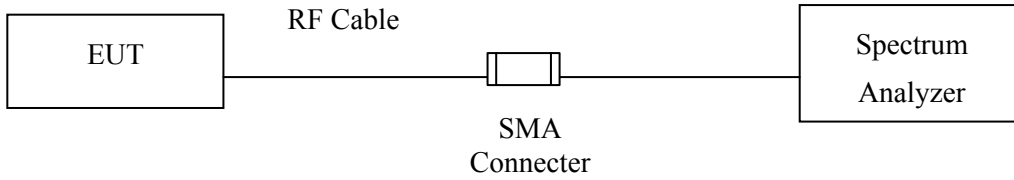
Note: The above test pattern is synthesized by multiple of the frequency range.



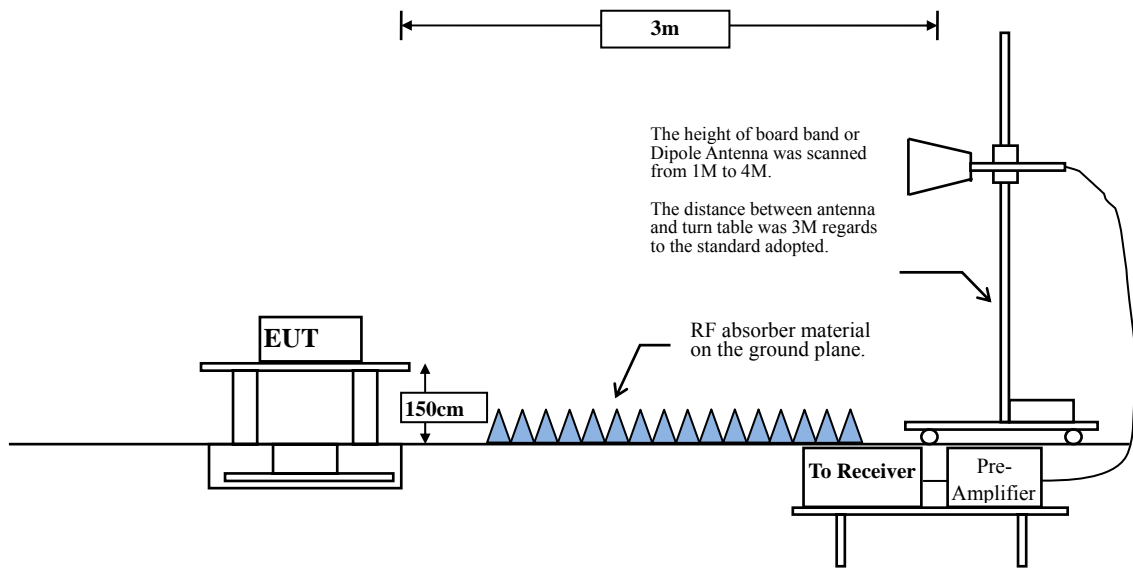
## 6. Band Edge

### 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 C63.4:2014 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
0.398	249.28 us	4.011 KHz	5 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 : Intelligent Robot  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/07/04

#### 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)	2372.899	13.504	30.372	43.876	74.00	54.00	Pass
00 (Peak)	2390.000	13.556	29.058	42.614	74.00	54.00	Pass
00 (Peak)	2400.000	13.579	59.031	72.610	--	--	--
00 (Peak)	2401.739	13.582	85.373	98.956	--	--	--
00 (Average)	2386.667	13.548	18.775	32.323	74.00	54.00	Pass
00 (Average)	2390.000	13.556	18.326	31.882	74.00	54.00	Pass
00 (Average)	2400.000	13.579	40.650	54.229	--	--	--
00 (Average)	2402.029	13.584	80.158	93.742	--	--	--

Figure Channel 00: Horizontal (Peak)

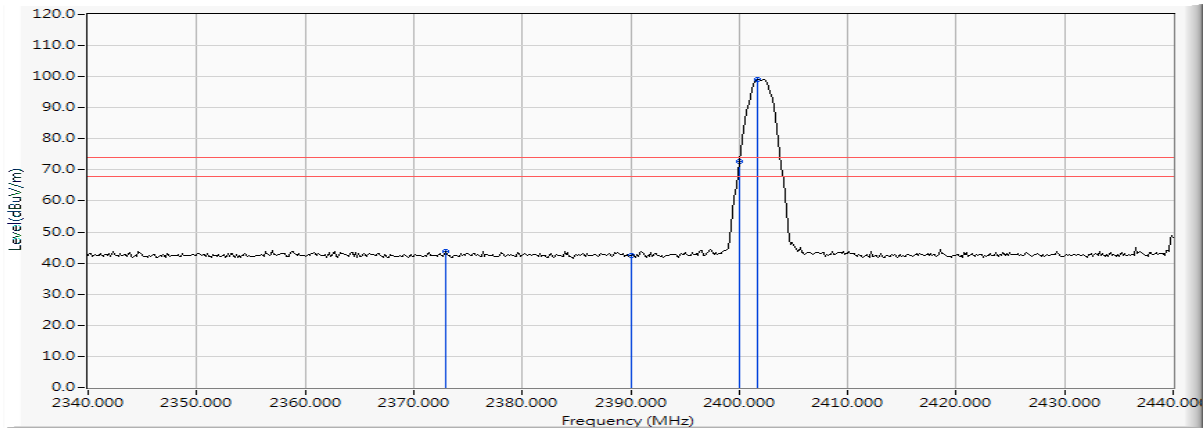
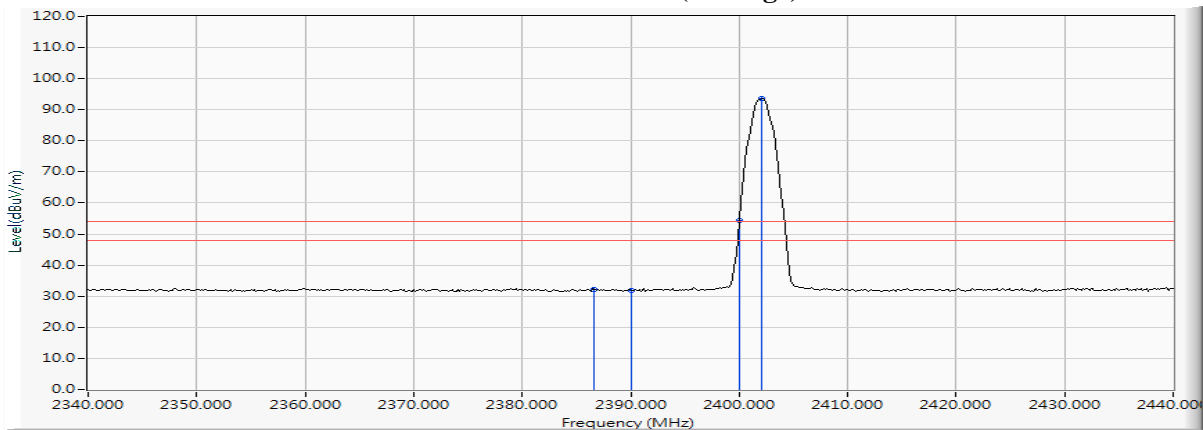


Figure Channel 00: Horizontal (Average)



Note:

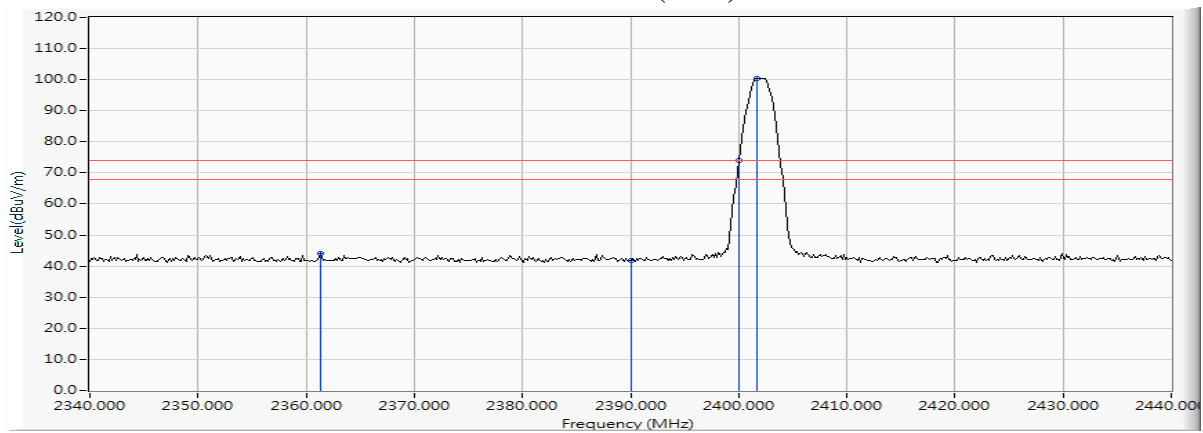
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 5kHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading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

Product : Intelligent Robot  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/07/04

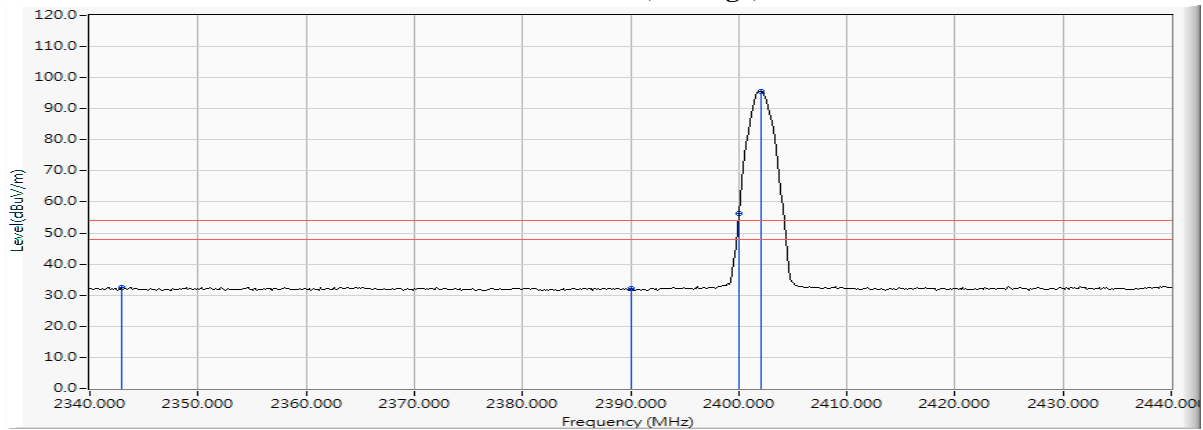
**RF Radiated Measurement (Vertical):**

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)	2361.304	13.465	30.730	44.195	74.00	54.00	Pass
00 (Peak)	2390.000	13.556	28.425	41.981	74.00	54.00	Pass
00 (Peak)	2400.000	13.579	60.444	74.023	--	--	--
00 (Peak)	2401.739	13.582	86.893	100.476	--	--	--
00 (Average)	2342.899	13.414	19.214	32.628	74.00	54.00	Pass
00 (Average)	2390.000	13.556	18.463	32.019	74.00	54.00	Pass
00 (Average)	2400.000	13.579	42.881	56.460	--	--	--
00 (Average)	2402.029	13.584	81.845	95.429	--	--	--

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



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



**Note:**

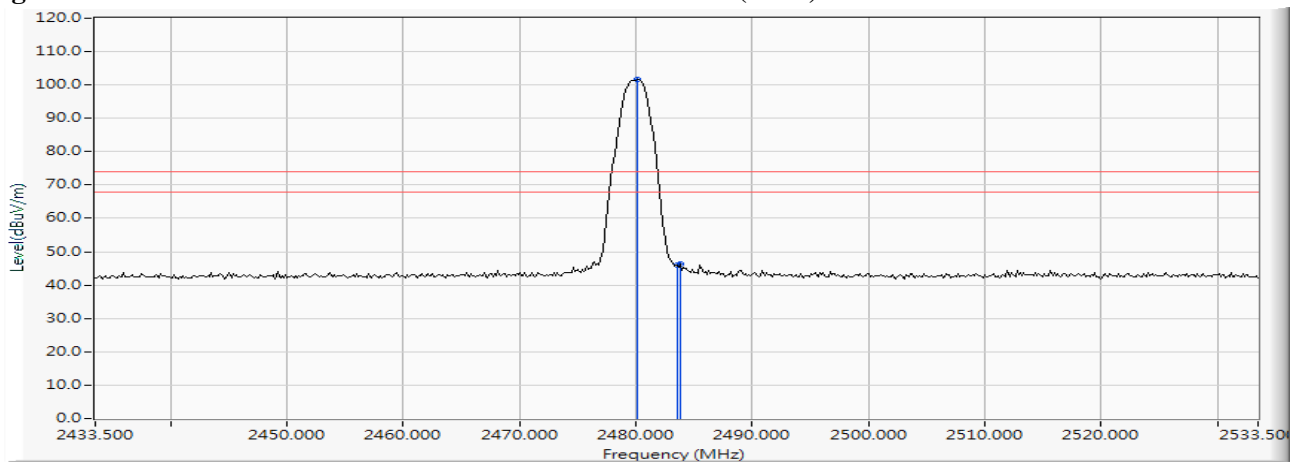
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 5kHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading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

Product : Intelligent Robot  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/07/04

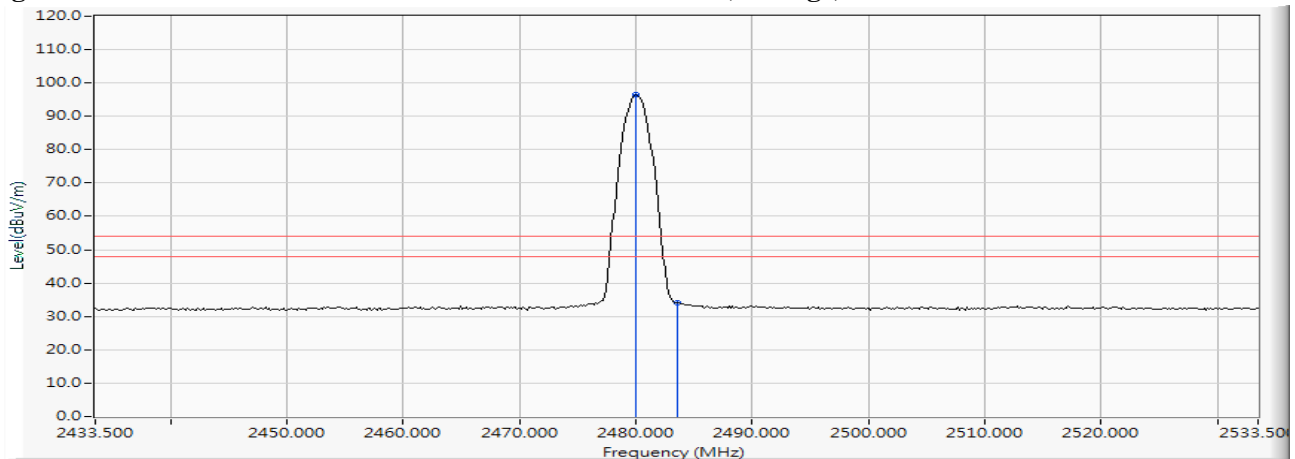
**RF Radiated Measurement (Horizontal):**

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)	2480.167	13.792	87.727	101.519	--	--	--
39 (Peak)	2483.500	13.800	32.137	45.937	74.00	54.00	Pass
39 (Peak)	2483.790	13.800	32.463	46.263	74.00	54.00	Pass
39 (Average)	2480.022	13.791	82.669	96.460	--	--	--
39 (Average)	2483.500	13.800	20.259	34.059	74.00	54.00	Pass

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



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



**Note:**

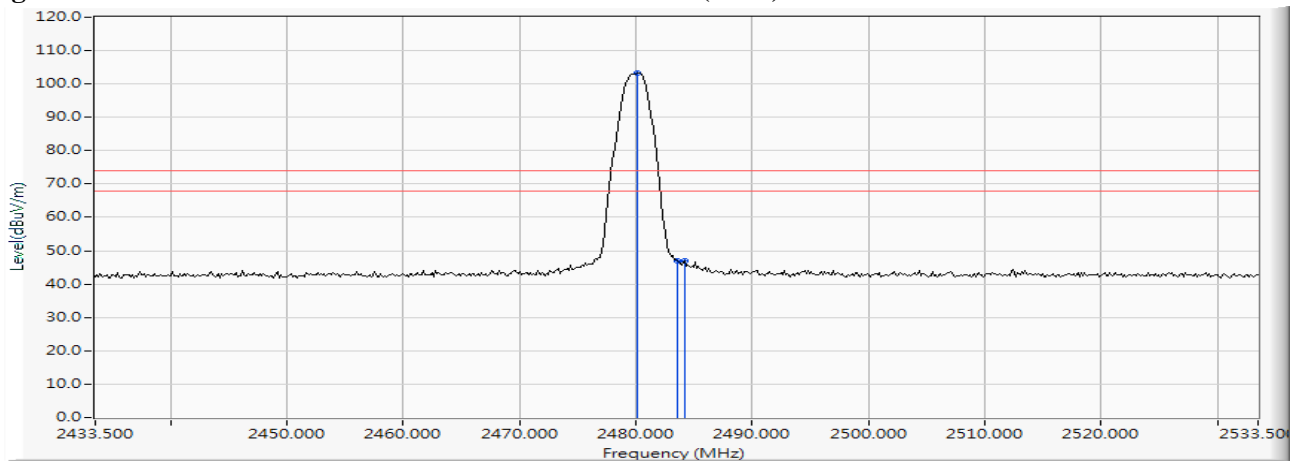
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 5kHz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading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

Product : Intelligent Robot  
 Test Item : Band Edge  
 Test Mode : Mode 1: Transmit - BLE  
 Test Date : 2017/07/04

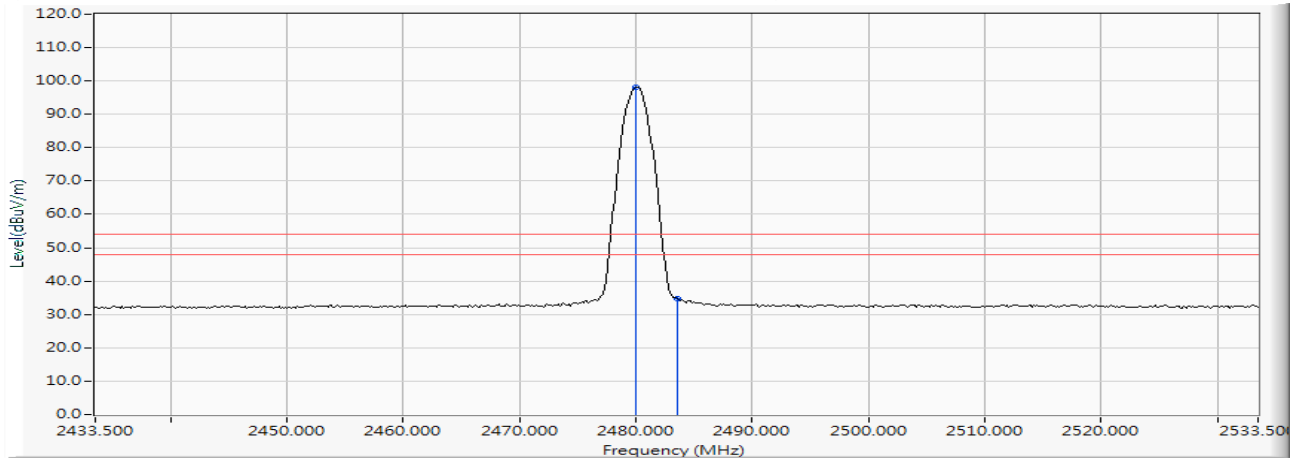
**RF Radiated Measurement (Vertical):**

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)	2480.167	13.792	89.376	103.168	--	--	--
39 (Peak)	2483.500	13.800	33.052	46.852	74.00	54.00	Pass
39 (Peak)	2484.225	13.801	33.069	46.870	74.00	54.00	Pass
39 (Average)	2480.022	13.791	84.421	98.212	--	--	--
39 (Average)	2483.500	13.800	20.914	34.714	74.00	54.00	Pass

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



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

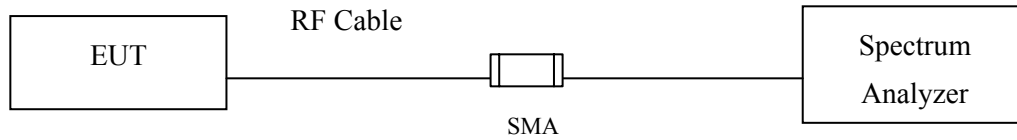


Note:

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 = 5kHz, 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

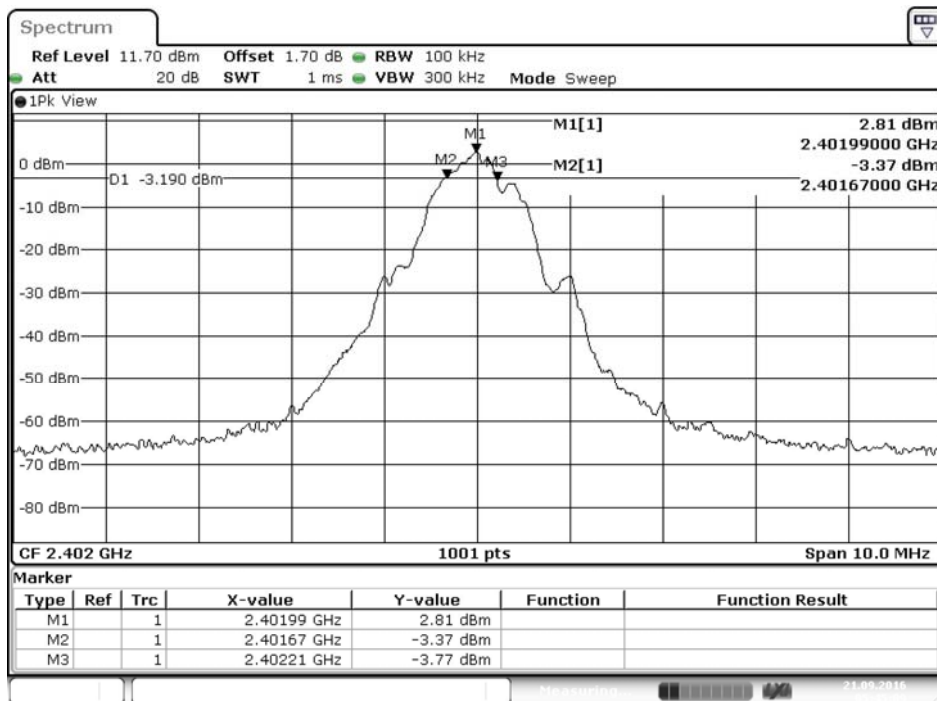
$\pm 279.2\text{Hz}$

### 7.5. Test Result of 6dB Bandwidth

Product : Intelligent Robot  
 Test Item : 6dB Bandwidth Data  
 Test Mode : Mode 1: Transmit - BLE (2402MHz)  
 Test Date : 2016/09/21

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

Figure Channel 00:



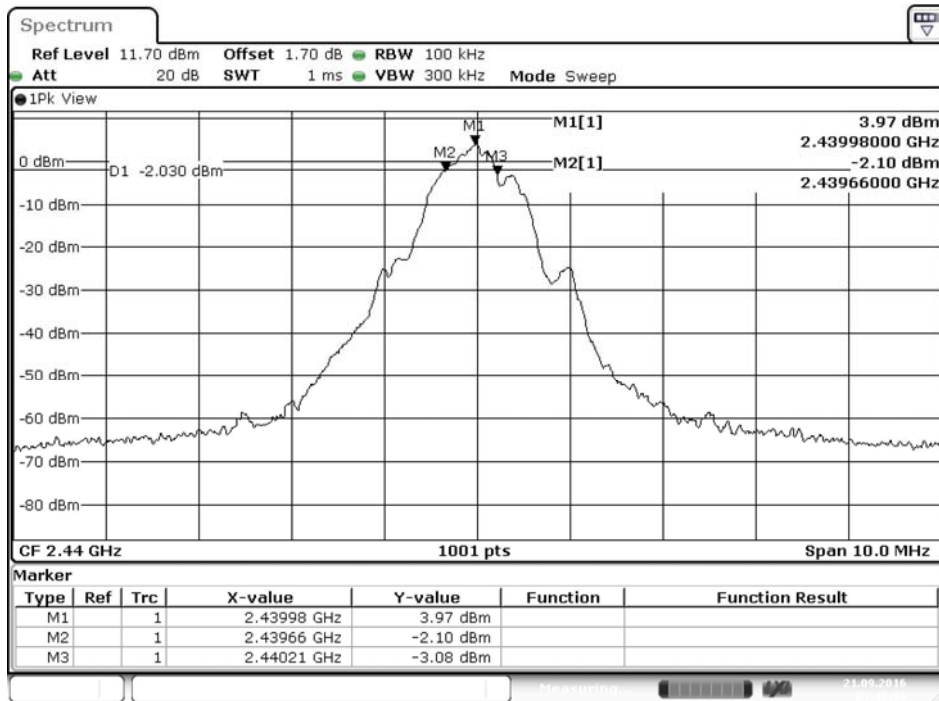
Date: 21.SEP.2016 05:45:09



Product : Intelligent Robot  
 Test Item : 6dB Bandwidth Data  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2016/09/21

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	550	>500	Pass

Figure Channel 19:

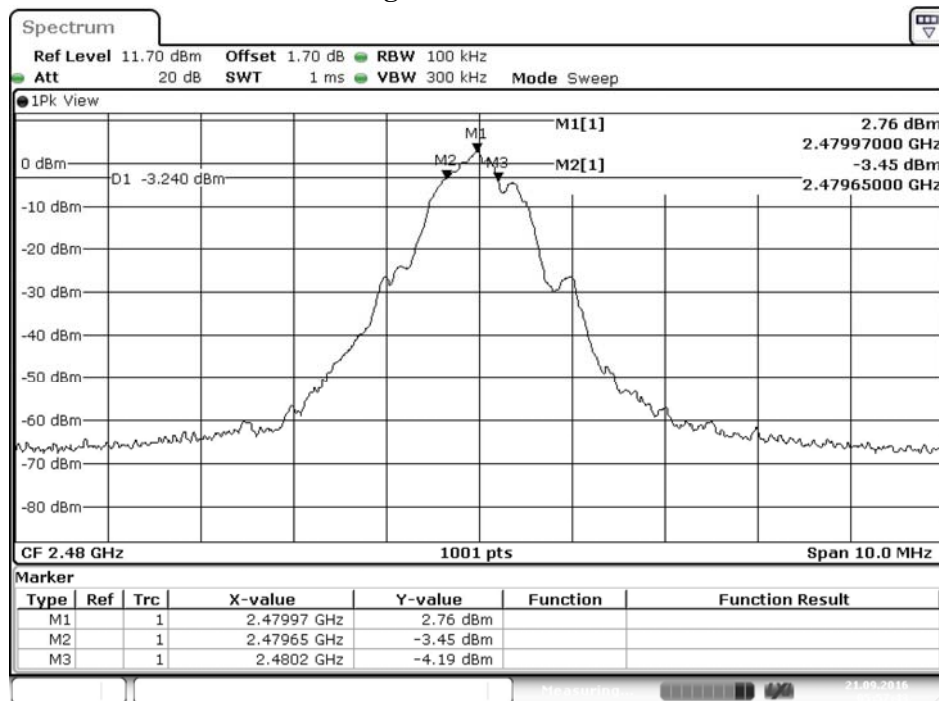


Date: 21.SEP.2016 05:49:37

Product : Intelligent Robot  
 Test Item : 6dB Bandwidth Data  
 Test Mode : Mode 1: Transmit - BLE (2480MHz)  
 Test Date : 2016/09/21

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	550	>500	Pass

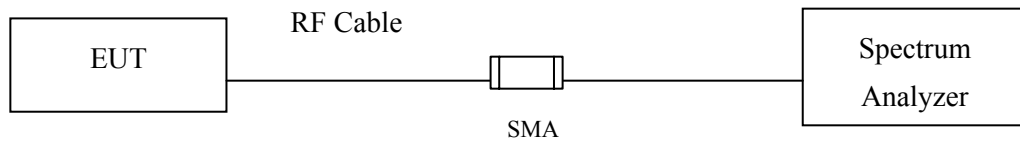
Figure Channel 39:



Date: 21.SEP.2016 05:57:43

## 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

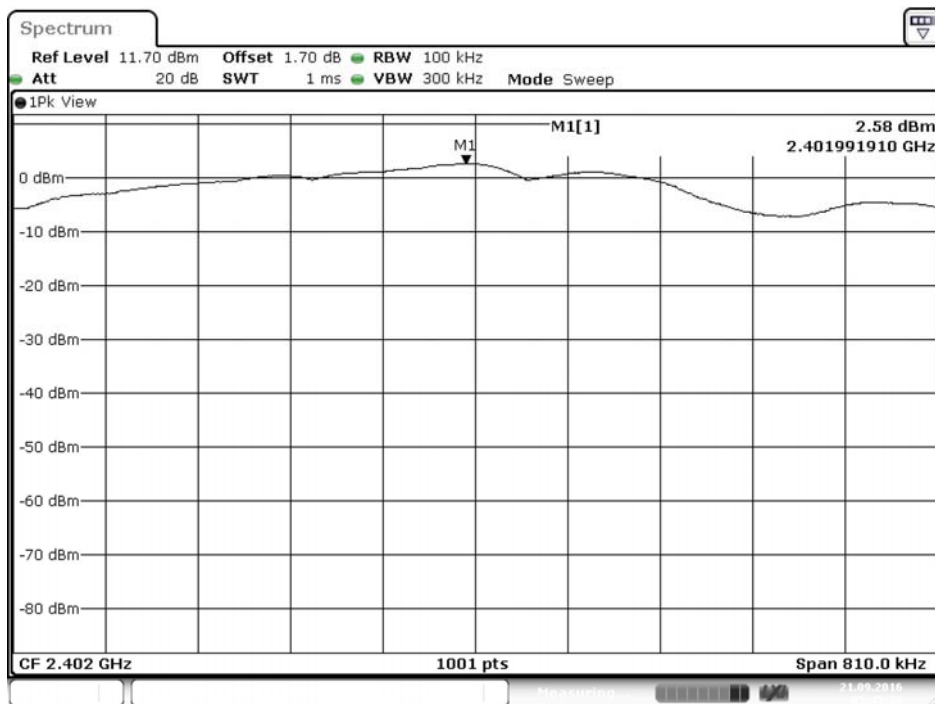
±1.23dB

### 8.5. Test Result of Power Density

Product : Intelligent Robot  
 Test Item : Power Density Data  
 Test Mode : Mode 1: Transmit - BLE (2402MHz)  
 Test Date : 2016/09/21

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	2.58	≤ 8dBm	Pass

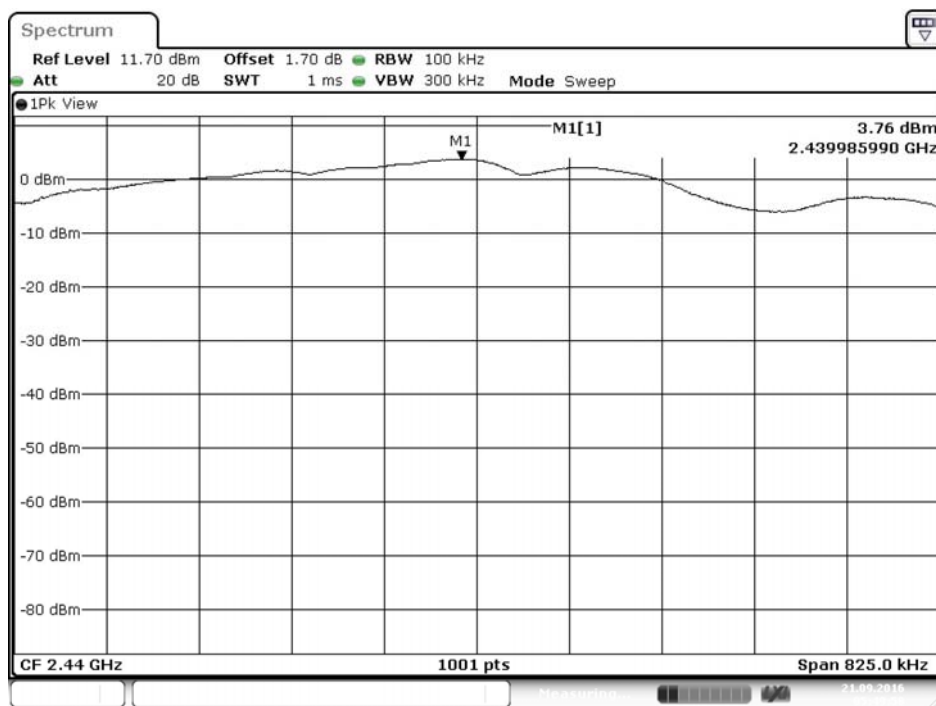
Figure Channel 00:



Product : Intelligent Robot  
 Test Item : Power Density Data  
 Test Mode : Mode 1: Transmit - BLE (2440MHz)  
 Test Date : 2016/09/21

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
19	2440	3.76	≤ 8dBm	Pass

**Figure Channel 19:**

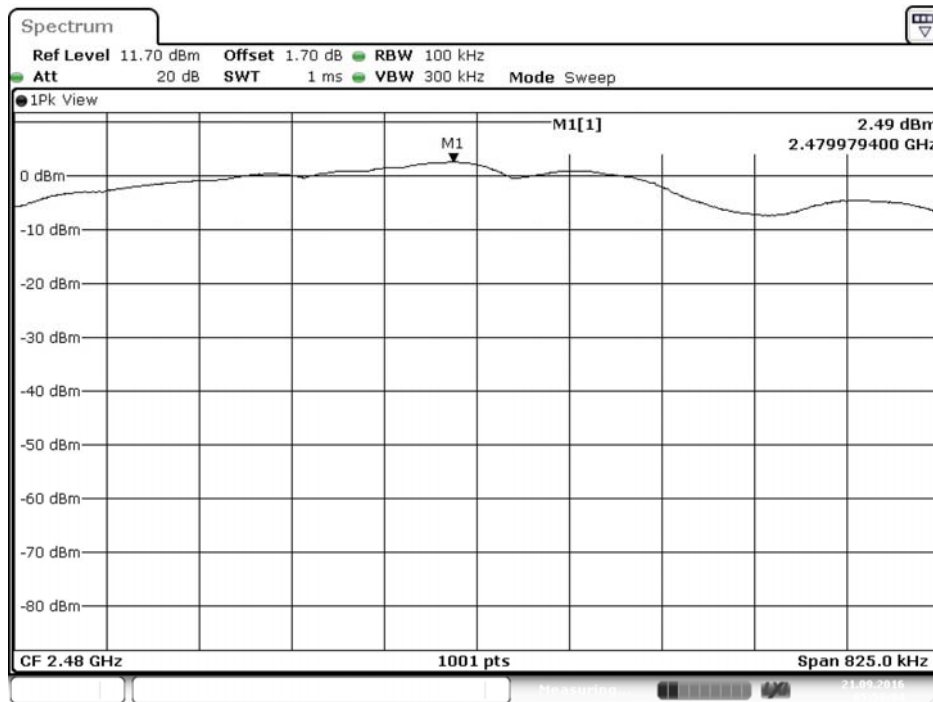


Date: 21.SEP.2016 05:49:58

Product : Intelligent Robot  
 Test Item : Power Density Data  
 Test Mode : Mode 1: Transmit - BLE (2480MHz)  
 Test Date : 2016/09/21

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2480	2.49	≤ 8dBm	Pass

**Figure Channel 39:**



Date: 21.SEP.2016 05:58:05

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

No modification was made during testing.

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## Attachment 1: EUT Test Photographs



Attachment 2: EUT Detailed Photographs