

# FCC Test Report

Product Name	Notebook
Model No.	EF20EA
FCC ID.	WL6-EF2BC40EA3

Applicant	ELITEGROUP COMPUTER SYSTEMS CO., LTD.
Address	No.239, Sec. 2, Ti Ding Blvd., Taipei, Taiwan

Date of Receipt	Sep. 01, 2015
Issued Date	Oct. 08, 2015
Report No.	1590121R-RFUSP23V00-A
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.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of QuieTek Corporation.

# Test Report

Issued Date: Oct. 08, 2015

Report No.: 1590121R-RFUSP23V00-A



Product Name	Notebook
Applicant	ELITEGROUP COMPUTER SYSTEMS CO., LTD.
Address	No.239, Sec. 2, Ti Ding Blvd., Taipei, Taiwan
Manufacturer	Elitegroup Computer Systems(SIP) CO., LTD.
Model No.	EF20EA
FCC ID.	WL6-EF2BC40EA3
EUT Rated Voltage	AC 100-240V, 50-60Hz
EUT Test Voltage	AC 120V/60Hz
Trade Name	ECS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v03r03
Test Result	Complied

Documented By :

*Leven Huang*

(Senior Adm. Specialist / Leven Huang )

Tested By :

*Nova chu*

( Engineer / Nova Chu )

Approved By :

*Vincent Lin*

( Director / Vincent Lin )

## TABLE OF CONTENTS

Description	Page
<b>1. GENERAL INFORMATION .....</b>	<b>4</b>
1.1. EUT Description.....	4
1.2. Operational Description.....	6
1.3. Tested System Details.....	7
1.4. Configuration of Tested System.....	7
1.5. EUT Exercise Software.....	7
1.6. Test Facility.....	8
<b>2. CONDUCTED EMISSION .....</b>	<b>9</b>
2.1. Test Equipment.....	9
2.2. Test Setup.....	9
2.3. Limits.....	10
2.4. Test Procedure.....	10
2.5. Uncertainty.....	10
2.6. Test Result of Conducted Emission.....	11
<b>3. PEAK POWER OUTPUT .....</b>	<b>13</b>
3.1. Test Equipment.....	13
3.2. Test Setup.....	13
3.3. Limit.....	13
3.4. Test Procedure.....	13
3.5. Uncertainty.....	13
3.6. Test Result of Peak Power Output.....	14
<b>4. RADIATED EMISSION .....</b>	<b>15</b>
4.1. Test Equipment.....	15
4.2. Test Setup.....	15
4.3. Limits.....	16
4.4. Test Procedure.....	17
4.5. Uncertainty.....	17
4.6. Test Result of Radiated Emission.....	18
<b>5. RF ANTENNA CONDUCTED TEST .....</b>	<b>22</b>
5.1. Test Equipment.....	22
5.2. Test Setup.....	22
5.3. Limits.....	22
5.4. Test Procedure.....	22
5.5. Uncertainty.....	22
5.6. Test Result of RF Antenna Conducted Test.....	23
<b>6. BAND EDGE .....</b>	<b>24</b>
6.1. Test Equipment.....	24
6.2. Test Setup.....	24
6.3. Limit.....	25
6.4. Test Procedure.....	25
6.5. Uncertainty.....	25
6.6. Test Result of Band Edge.....	26
<b>7. OCCUPIED BANDWIDTH (6DB BW).....</b>	<b>31</b>
7.1. Test Equipment.....	31
7.2. Test Setup.....	31
7.3. Limits.....	31
7.4. Test Procedure.....	31
7.5. Uncertainty.....	31
7.6. Test Result of Occupied Bandwidth.....	32
<b>8. POWER DENSITY .....</b>	<b>34</b>
8.1. Test Equipment.....	34
8.2. Test Setup.....	34
8.3. Limits.....	34
8.4. Test Procedure.....	34
8.5. Uncertainty.....	34
8.6. Test Result of Power Density.....	35
<b>9. EMI REDUCTION METHOD DURING COMPLIANCE TESTING .....</b>	<b>37</b>
Attachment 1: EUT Test Photographs	
Attachment 2: EUT Detailed Photographs	

## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	Notebook
Trade Name	ECS
Model No.	EF20EA
FCC ID.	WL6-EF2BC40EA3
Frequency Range	2402 – 2480MHz
Channel Number	V4.0: 40CH
Type of Modulation	V4.0: GFSK(1Mbps)
Antenna Type	PIFA Antenna
Antenna Gain	Refer to the table “Antenna List”
Channel Control	Auto
Power Adapter	MFR: APD, M/N: WA-24Q12FU Input: AC 100-240V, 50-60Hz, 0.7A Output: DC 12V, 2A Cable Out: Non-Shielded, 1.5m
Contain Module	AMPAK / AP6234

#### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	JEM	13B130-FW4070 (Main)	PIFA Antenna	1.39dBi For 2.4GH
2	WGT	13B130-FW4050 (Main)	PIFA Antenna	2.77dBi for 2.4 GHz

Note:

1. The antenna of EUT conforms to FCC 15.203.
2. Only the higher gain antenna was tested and recorded in this report.

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

Note:

1. The EUT is a Notebook with a built-in 2.4GHz WLAN and 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.

Test Mode	Mode 1: Transmit - BLE (GFSK)
-----------	-------------------------------

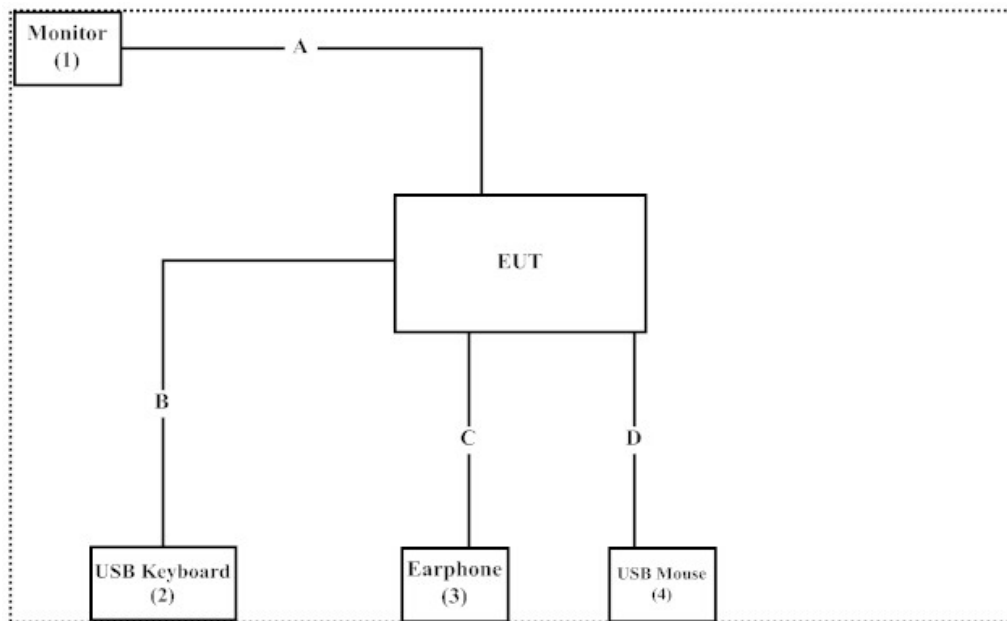
### 1.3. Tested System Details

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	Monitor	DELL	U2410f	CN-082WXD-72872-2 3E-ACDL	Non-Shielded, 1.8m
2	USB Keyboard	Logitech	Y-UR83	SY853UK	N/A
3	Earphone	Dr.AV	CD-806B	N/A	N/A
4	USB Mouse	DELL	MO56UOA	G0Y02ERZ	N/A

Signal Cable Type	Signal cable Description
A HDMI Cable	Non-Shielded, 1.8m
B Keyboard Cable	Non-Shielded, 1.8m
C Earphone Cable	Non-Shielded, 1.2m
D Mouse Cable	Non-Shielded, 1.8m

### 1.4. Configuration of Tested System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown on 1.4
- (2) Execute “WL 1.0” program on the EUT.
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Start the continuous transmission.
- (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	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from

Quietek Corporation's Web Site: <http://www.quietek.com/chinese/about/certificates.aspx?bval=5>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site:  
<http://www.quietek.com/>

Site Description: File on  
Federal Communications Commission  
FCC Engineering Laboratory  
7435 Oakland Mills Road  
Columbia, MD 21046  
Registration Number: 92195

Site Name: Quietek Corporation  
Site Address: No.5-22, Ruishukeng,  
Linkou Dist. New Taipei City 24451,  
Taiwan, R.O.C.  
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789  
E-Mail : [service@quietek.com](mailto:service@quietek.com)

FCC Accreditation Number: TW1014

## 2. Conducted Emission

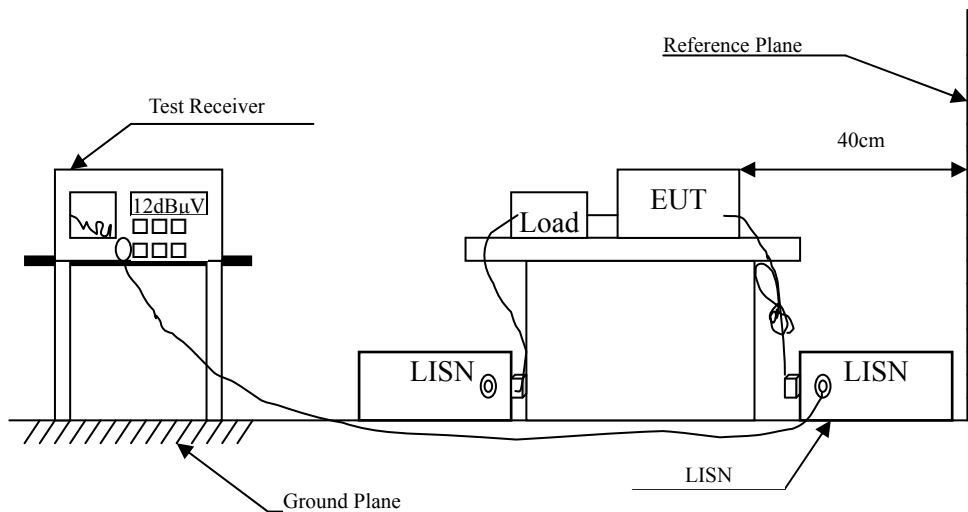
### 2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2015	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2015	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2015	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar., 2015	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2015	
	No.1 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by “X” are used to measure the final test results.

### 2.2. Test Setup





**2.3. Limits**

<b>FCC Part 15 Subpart C Paragraph 15.207 (dBμV) Limit</b>		
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.

**2.4. 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 FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

**2.5. Uncertainty**

± 2.26 dB

## 2.6. Test Result of Conducted Emission

Product : Notebook  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit - BLE (GFSK)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV	Margin dB	Limit dBμV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.154	9.763	36.960	46.723	-19.163	65.886
0.369	9.768	28.870	38.638	-21.105	59.743
0.826	9.803	19.290	29.093	-26.907	56.000
4.779	9.985	23.690	33.675	-22.325	56.000
13.744	10.127	13.050	23.177	-36.823	60.000
27.170	10.180	13.210	23.390	-36.610	60.000
<b>Average</b>					
0.154	9.763	31.380	41.143	-14.743	55.886
0.369	9.768	14.930	24.698	-25.045	49.743
0.826	9.803	13.430	23.233	-22.767	46.000
4.779	9.985	14.880	24.865	-21.135	46.000
13.744	10.127	5.510	15.637	-34.363	50.000
27.170	10.180	3.060	13.240	-36.760	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 : Notebook  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit - BLE (GFSK)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV	Margin dB	Limit dBμV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.158	9.761	37.850	47.612	-18.159	65.771
0.373	9.768	33.290	43.058	-16.571	59.629
0.810	9.802	18.060	27.862	-28.138	56.000
4.830	9.986	23.480	33.466	-22.534	56.000
14.701	10.230	13.370	23.600	-36.400	60.000
27.705	10.408	13.480	23.888	-36.112	60.000
<b>Average</b>					
0.158	9.761	31.380	41.142	-14.629	55.771
0.373	9.768	25.720	35.488	-14.141	49.629
0.810	9.802	12.050	21.852	-24.148	46.000
4.830	9.986	14.440	24.426	-21.574	46.000
14.701	10.230	6.400	16.630	-33.370	50.000
27.705	10.408	3.670	14.078	-35.922	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

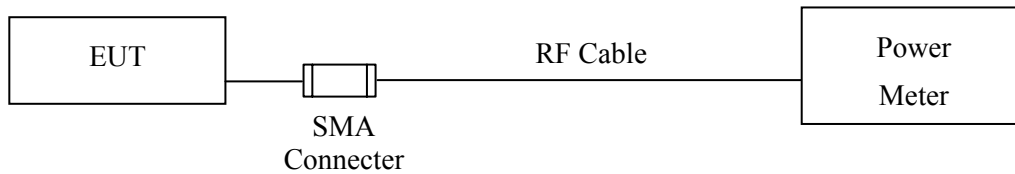
### 3. Peak Power Output

#### 3.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2015
X	Power Sensor	Anritsu	MA2411B/0738448	Jun., 2015

Note: 1. All equipments are calibrated every one year.  
2. The test instruments marked by “X” are used to measure the final test results.

#### 3.2. Test Setup



#### 3.3. Limit

The maximum peak power shall be less 1Watt.

#### 3.4. 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 9.1.2 PKPM1 Peak power meter method.

#### 3.5. Uncertainty

± 1.27 dB

### 3.6. Test Result of Peak Power Output

Product : Notebook  
Test Item : Peak Power Output  
Test Site : No.3 OATS  
Test Mode : Mode 1: Transmit - BLE (GFSK)

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	1.65	1 Watt= 30 dBm	Pass
Channel 19	2440.00	1.61	1 Watt= 30 dBm	Pass
Channel 39	2480.00	1.76	1 Watt= 30 dBm	Pass

#### 4. Radiated Emission

##### 4.1. Test Equipment

The following test equipments are used during the radiated emission test:

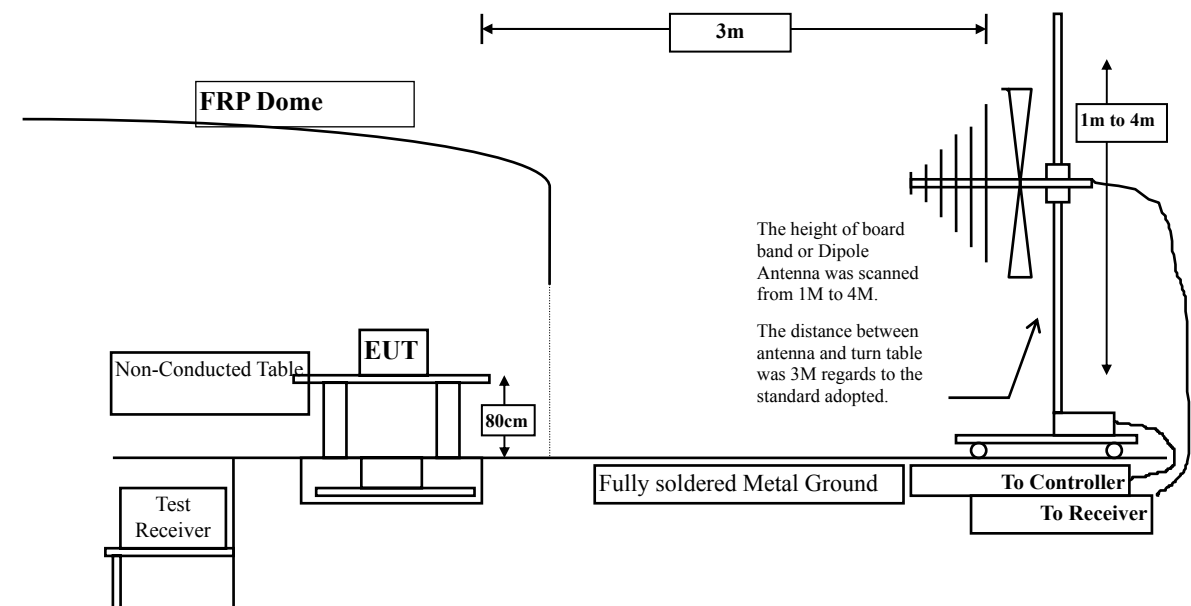
Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep, 2015
	X	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun, 2015
	X	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun, 2015
	X	Coaxial Cable	QTK(Arnist)	RG 214/ LC003-RG	Jun, 2015
	X	Coaxial signal switch	Arnist	MP59B/ 6200798682	Jun, 2015

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ CB # 8	X	Spectrum Analyzer	R&S	FSP40/ 100339	Oct, 2015
	X	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar, 2015
	X	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan, 2015
	X	Horn Antenna	TRC	AH-0801/95051	Aug, 2015
	X	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan, 2015
	X	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul, 2015
	X	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul, 2015

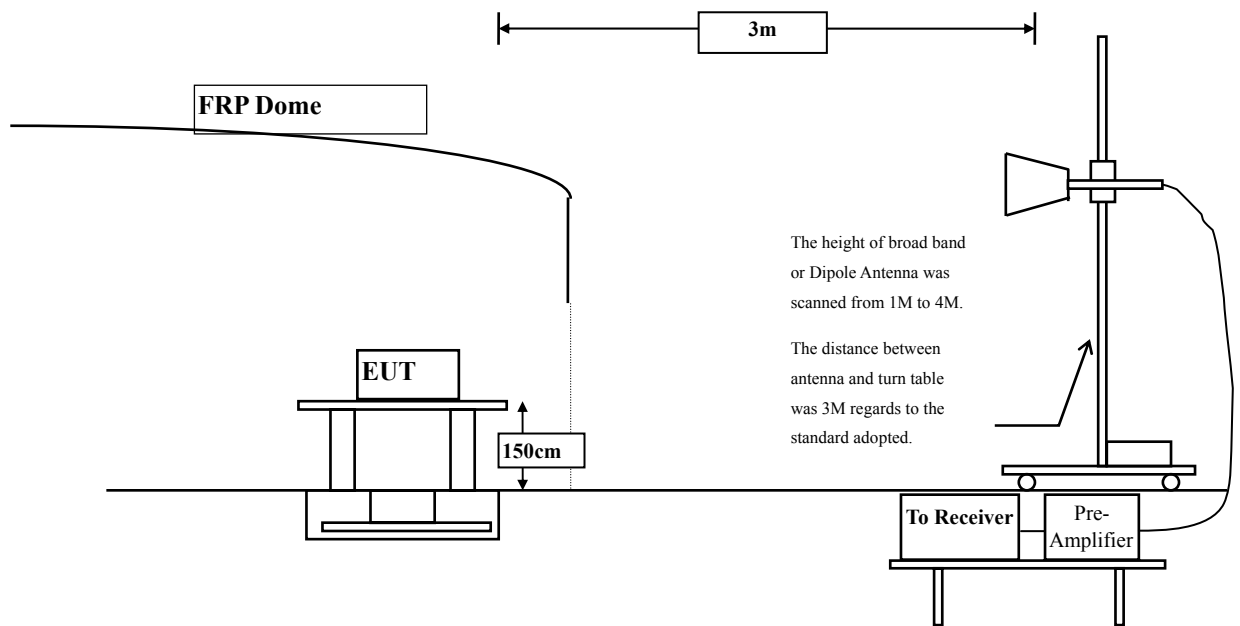
- Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.  
2. The test instruments marked with “X” are used to measure the final test results.

##### 4.2. Test Setup

Below 1GHz



Above 1GHz



### 4.3. 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 (dB $\mu$ V) = 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.

#### **4.4. 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 worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

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

#### **4.5. Uncertainty**

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz



**4.6. Test Result of Radiated Emission**

Product : Notebook  
 Test Item : Harmonic Radiated Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK)(2402MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V/m	Margin dB	Limit dB $\mu$ V/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4804.000	3.327	41.710	45.037	-28.963	74.000
7206.000	10.136	38.280	48.416	-25.584	74.000
9608.000	13.706	38.540	52.246	-21.754	74.000
<b>Average Detector:</b>					
--					
<b>Vertical</b>					
<b>Peak Detector:</b>					
4804.000	6.638	42.360	48.997	-25.003	74.000
7206.000	11.005	38.120	49.125	-24.875	74.000
9608.000	14.103	38.800	52.903	-21.097	74.000
<b>Average Detector:</b>					
--					

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 = 10 Hz, 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 : Notebook  
 Test Item : Harmonic Radiated Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V/m	Margin dB	Limit dB $\mu$ V/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4880.000	3.010	40.820	43.830	-30.170	74.000
7320.000	11.833	38.630	50.464	-23.536	74.000
9760.000	12.580	38.610	51.191	-22.809	74.000
<b>Average Detector:</b>					
--					
<b>Vertical</b>					
<b>Peak Detector:</b>					
4880.000	5.738	41.000	46.738	-27.262	74.000
7320.000	12.703	38.150	50.853	-23.147	74.000
9760.000	13.052	38.480	51.532	-22.468	74.000
<b>Average Detector:</b>					
--					

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 = 10 Hz, 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 : Notebook  
 Test Item : Harmonic Radiated Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V/m	Margin dB	Limit dB $\mu$ V/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
4960.000	2.760	41.360	44.120	-29.880	74.000
7440.000	12.567	39.190	51.756	-22.244	74.000
9920.000	13.456	39.460	52.916	-21.084	74.000
<b>Average Detector:</b>					
--					
<b>Vertical</b>					
<b>Peak Detector:</b>					
4960.000	5.557	41.080	46.637	-27.363	74.000
7440.000	13.426	39.280	52.705	-21.295	74.000
9920.000	13.958	39.160	53.118	-20.882	74.000
<b>Average Detector:</b>					
--					

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 = 10 Hz, 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 : Notebook  
 Test Item : General Radiated Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V/m	Margin dB	Limit dB $\mu$ V/m
<b>Horizontal</b>					
103.720	-8.230	36.332	28.101	-15.399	43.500
299.660	-4.751	32.715	27.964	-18.036	46.000
460.680	4.030	22.967	26.997	-19.003	46.000
604.240	4.289	23.980	28.270	-17.730	46.000
802.120	6.356	30.954	37.310	-8.690	46.000
883.600	6.601	25.489	32.090	-13.910	46.000
<b>Vertical</b>					
45.520	-10.625	39.789	29.164	-10.836	40.000
179.380	-0.824	24.129	23.305	-20.195	43.500
383.080	0.195	24.749	24.944	-21.056	46.000
538.280	1.996	23.843	25.839	-20.161	46.000
802.120	2.966	26.221	29.187	-16.813	46.000
965.080	3.832	28.400	32.232	-21.768	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 = 10 Hz, 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.

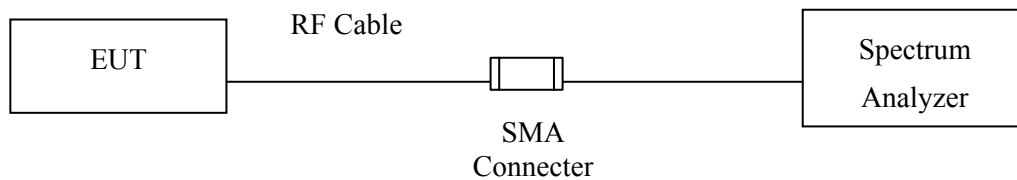
## 5. RF Antenna Conducted Test

### 5.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note: 1. All equipments are calibrated every one year.  
2. The test instruments Marked “X” are used to measure the final test results.

### 5.2. Test Setup



### 5.3. 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.

### 5.4. Test Procedure

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

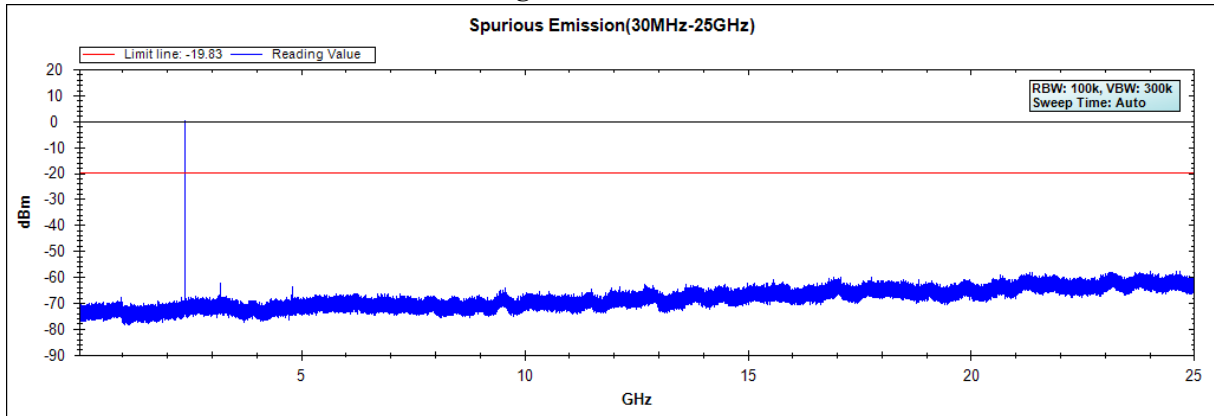
### 5.5. Uncertainty

± 150Hz

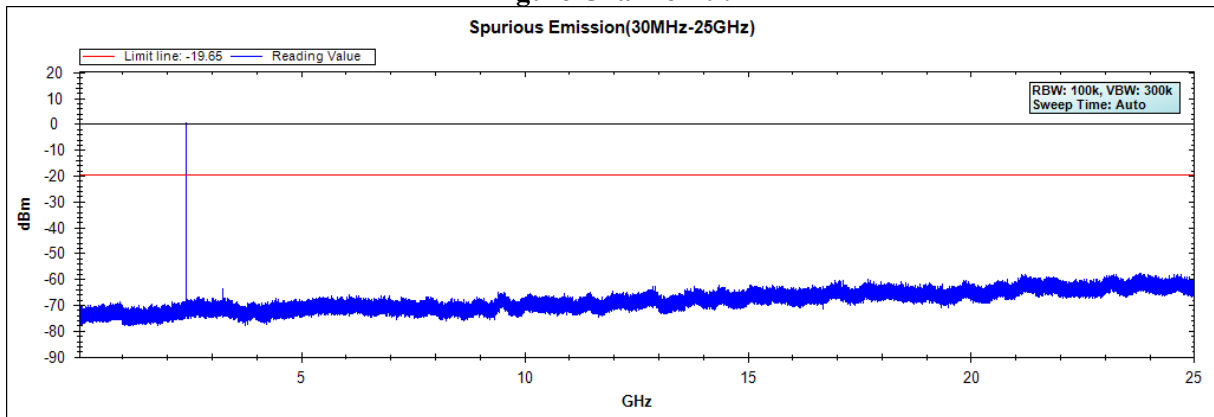
### 5.6. Test Result of RF Antenna Conducted Test

Product : Notebook  
 Test Item : RF Antenna Conducted Test  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK)

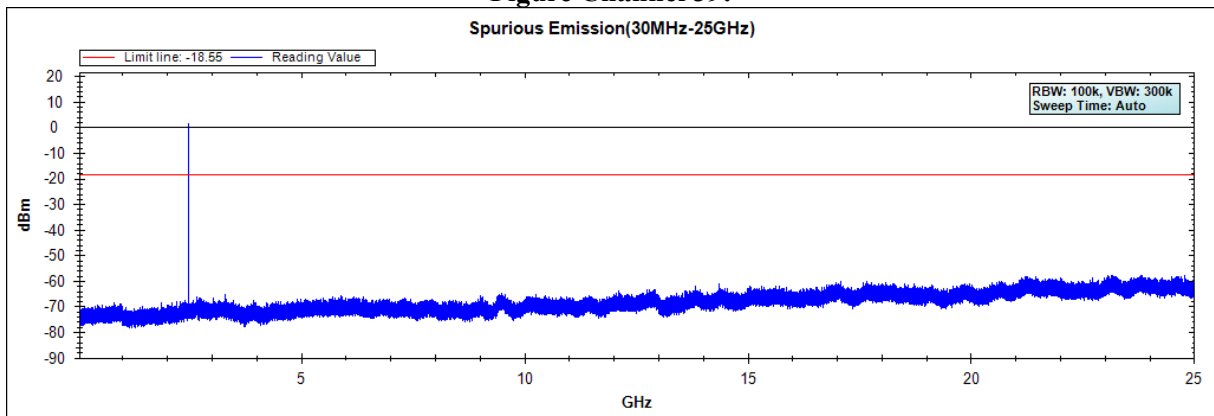
**Figure Channel 00:**



**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 Equipment

#### RF Radiated Measurement:

The following test equipments are used during the band edge tests:

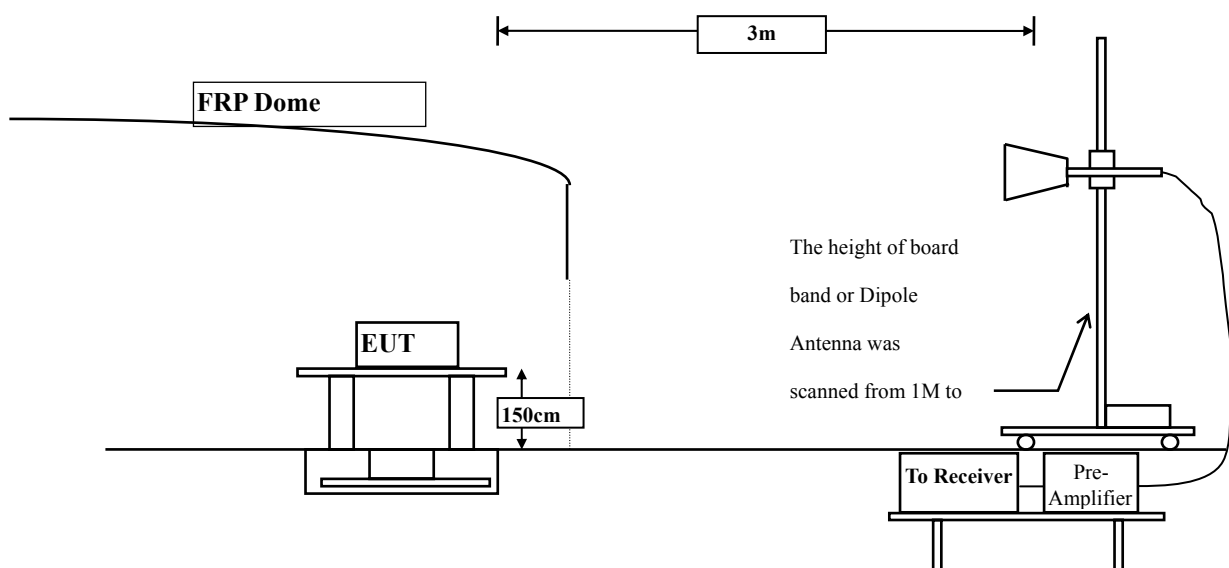
Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ CB # 8	X Spectrum Analyzer	R&S	FSP40/ 100339	Oct, 2015
	X Horn Antenna	ETS-Lindgren	3117/ 35205	Mar, 2015
	X Horn Antenna	Schwarzbeck	BBHA9170/209	Jan, 2015
	X Horn Antenna	TRC	AH-0801/95051	Aug, 2015
	X Pre-Amplifier	EMCI	EMC012630SE/980210	Jan, 2015
	X Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul, 2015
	X Pre-Amplifier	NARDA	DBL-1840N506/013	Jul, 2015

- Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.  
2. The test instruments marked with “X” are used to measure the final test results.

### 6.2. Test Setup

#### RF Radiated Measurement:

Above 1GHz



### **6.3. Limit**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. 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)).

### **6.4. 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.

### **6.5. Uncertainty**

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz



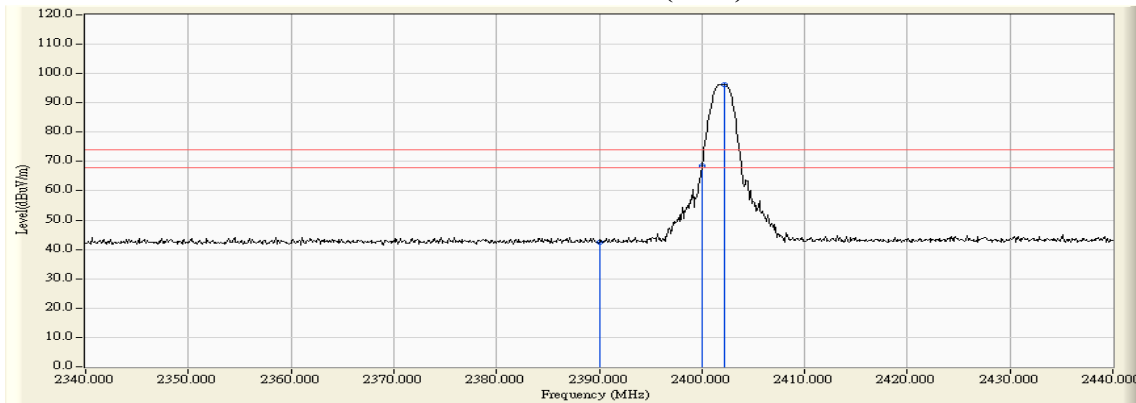
### 6.6. Test Result of Band Edge

Product : Notebook  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

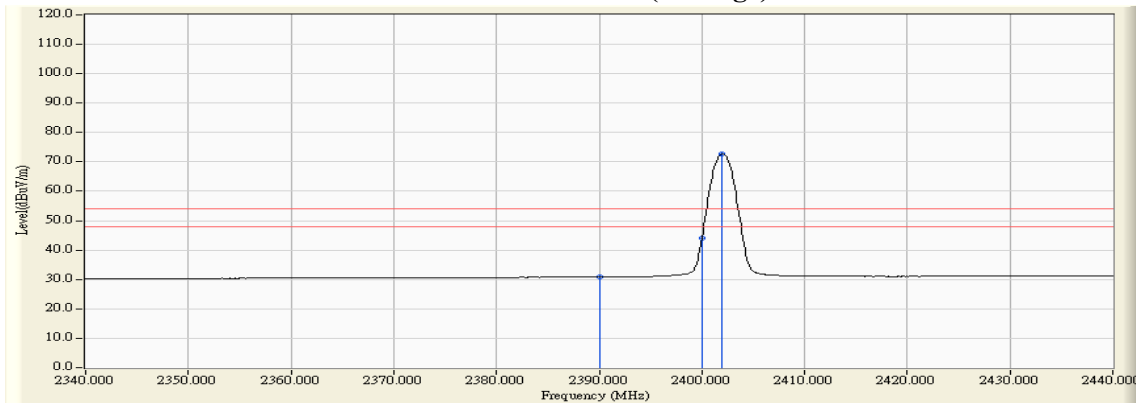
#### RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
00 (Peak)	2390.000	-1.131	43.704	42.573	74.00	54.00	Pass
00 (Peak)	2400.000	-1.084	69.564	68.481	--	--	--
00 (Peak)	2402.200	-1.072	97.404	96.333	--	--	--
00 (Average)	2390.000	-1.131	31.920	30.789	74.00	54.00	Pass
00 (Average)	2400.000	-1.084	45.181	44.098	--	--	--
00 (Average)	2402.000	-1.073	73.693	72.621	--	--	--

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



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



Note:

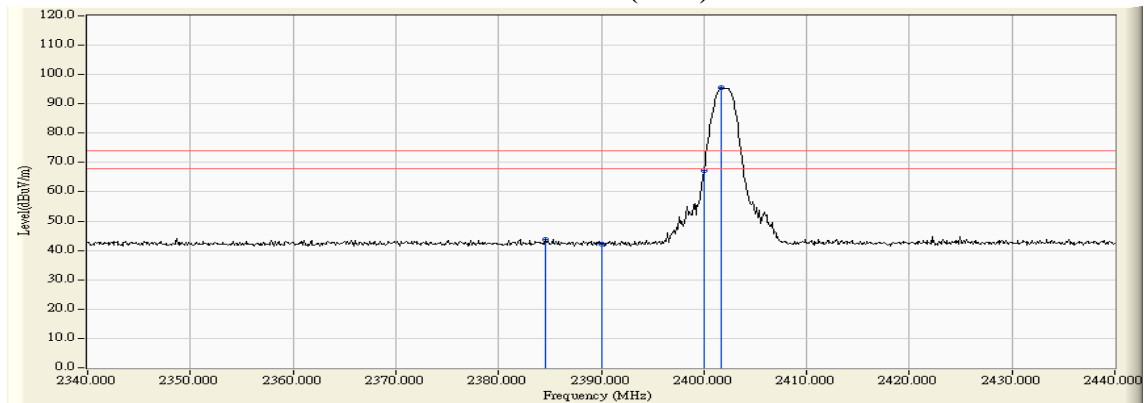
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Notebook  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

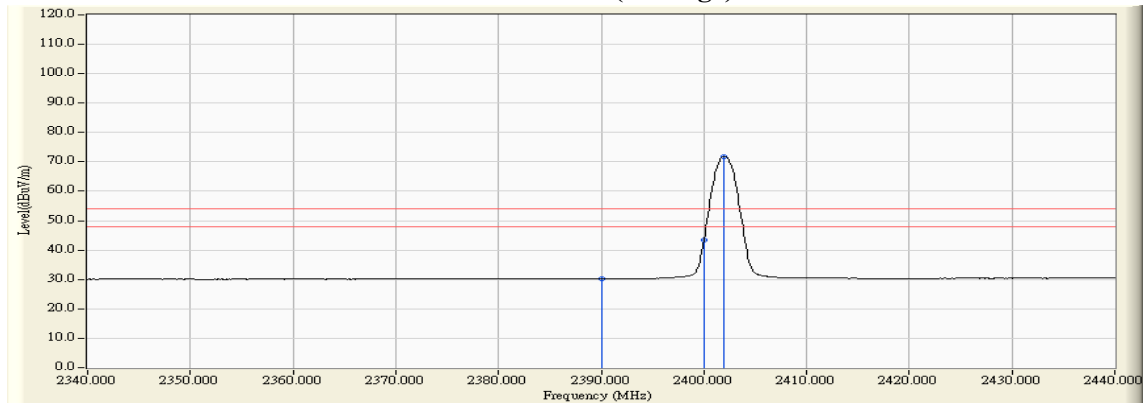
**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Result
00 (Peak)	2384.600	-1.700	45.526	43.826	74.00	54.00	Pass
00 (Peak)	2390.000	-1.725	43.961	42.236	74.00	54.00	Pass
00 (Peak)	2400.000	-1.733	69.114	67.382	--	--	--
00 (Peak)	2401.700	-1.730	97.362	95.633	--	--	--
00 (Average)	2390.000	-1.725	31.888	30.163	74.00	54.00	Pass
00 (Average)	2400.000	-1.733	45.210	43.478	--	--	--
00 (Average)	2402.000	-1.729	73.624	71.895	--	--	--

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



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



Note:

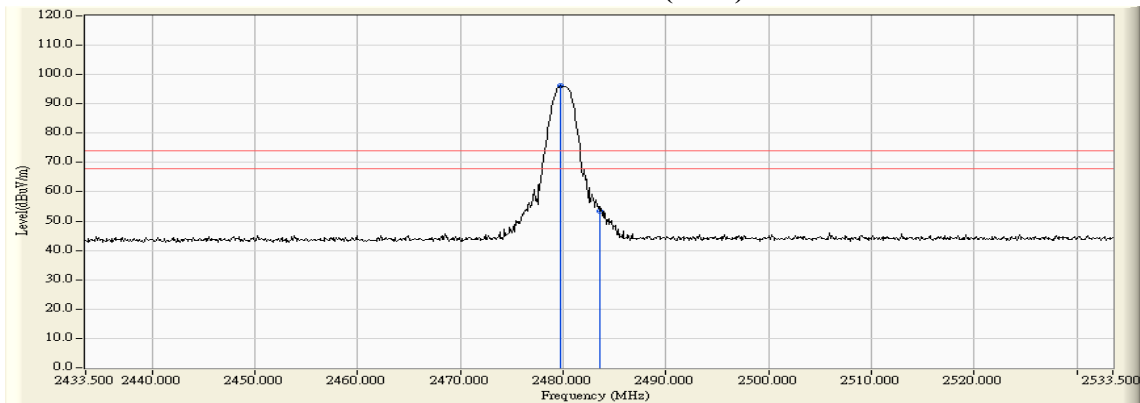
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Notebook  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

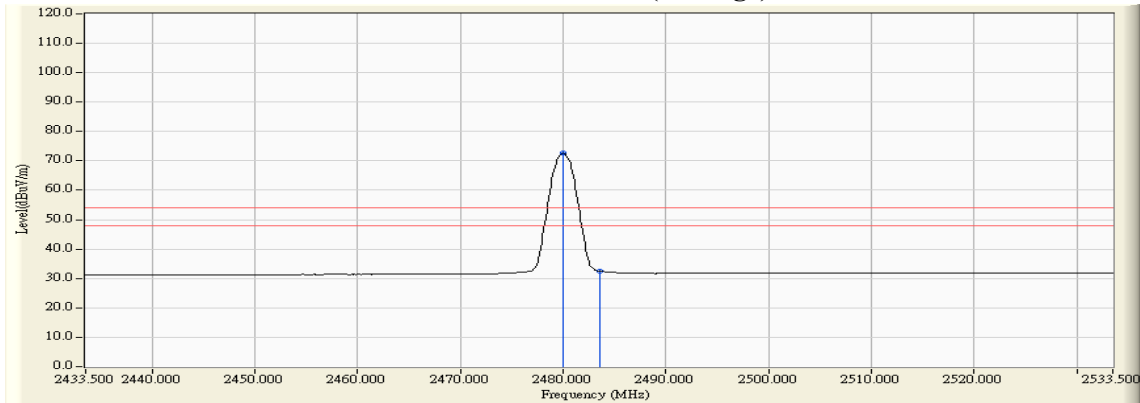
**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
39 (Peak)	2479.700	-0.581	96.655	96.073	--	--	--
39 (Peak)	2483.500	-0.558	54.044	53.486	74.00	54.00	Pass
39 (Average)	2480.000	-0.581	73.159	72.578	--	--	--
39 (Average)	2483.500	-0.558	33.050	32.492	74.00	54.00	Pass

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



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



Note:

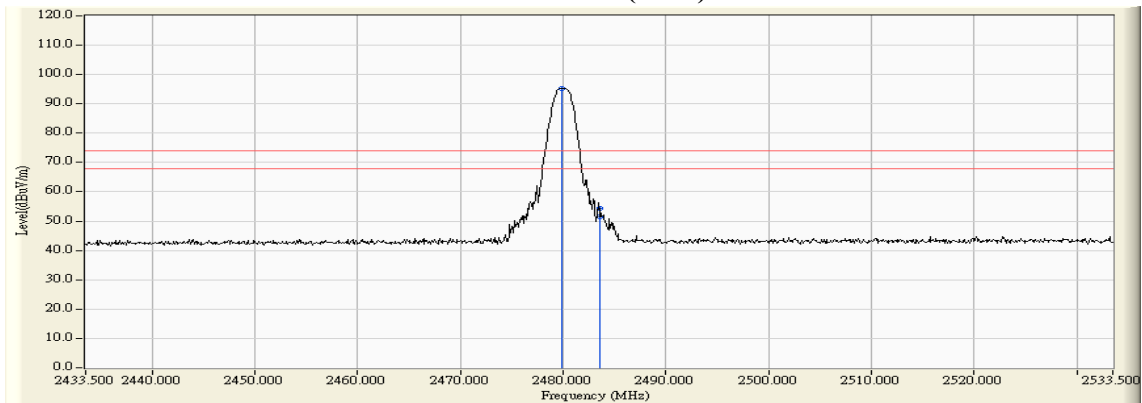
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ \* ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Notebook  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

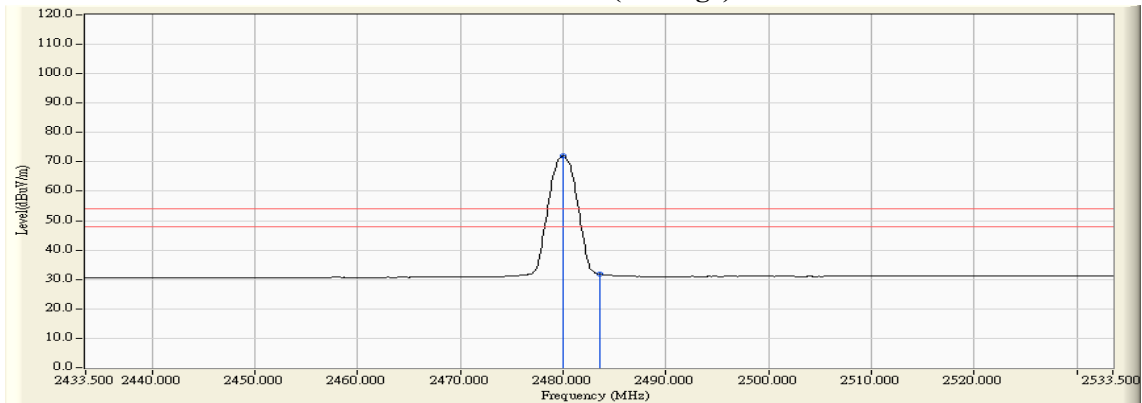
**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
39 (Peak)	2479.800	-1.325	96.606	95.281	--	--	--
39 (Peak)	2483.500	-1.305	52.669	51.364	74.00	54.00	Pass
39 (Peak)	2483.600	-1.304	55.545	54.241	74.00	54.00	Pass
39 (Average)	2480.000	-1.324	73.260	71.936	--	--	--
39 (Average)	2483.500	-1.305	33.114	31.809	74.00	54.00	Pass

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



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



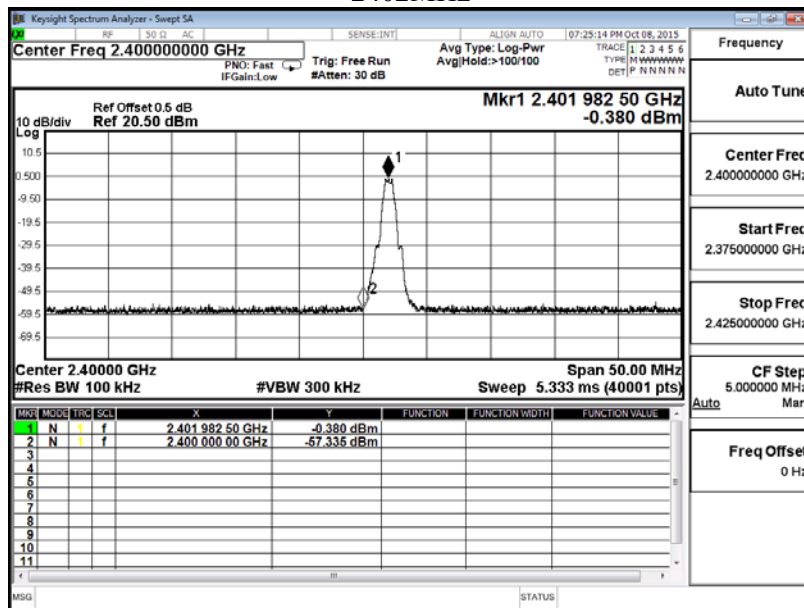
Note:

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 = 10 Hz, 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.

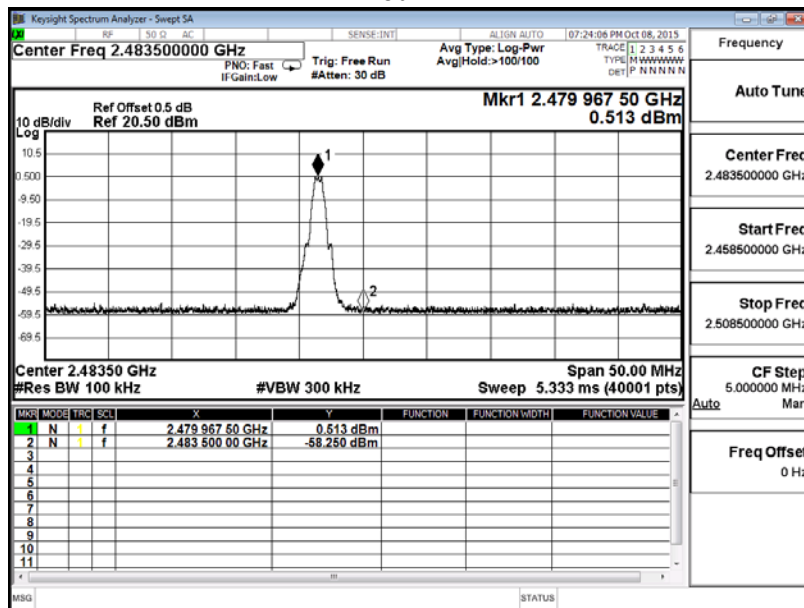
Product : Notebook  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK)

Test Frequency (MHz)	Measurement Level $\Delta$ (dB)	Limit $\Delta$ (dB)	Result
2402	56.96	>20	PASS
2480	58.76	>20	PASS

2402MHz



2480MHz



## 7. Occupied Bandwidth (6dB BW)

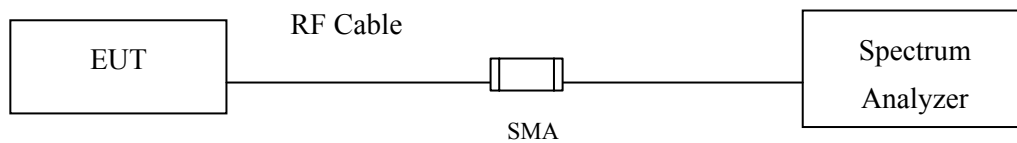
### 7.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

### 7.2. Test Setup



### 7.3. Limits

The minimum bandwidth shall be at least 500 kHz.

### 7.4. 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,  $VBW \geq 3 * RBW$

### 7.5. Uncertainty

$\pm 150\text{Hz}$

### 7.6. Test Result of Occupied Bandwidth

Product : Notebook  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	750.0	>500	Pass
19	2440	750.0	>500	Pass
39	2480	740.0	>500	Pass

**Figure Channel 00:**

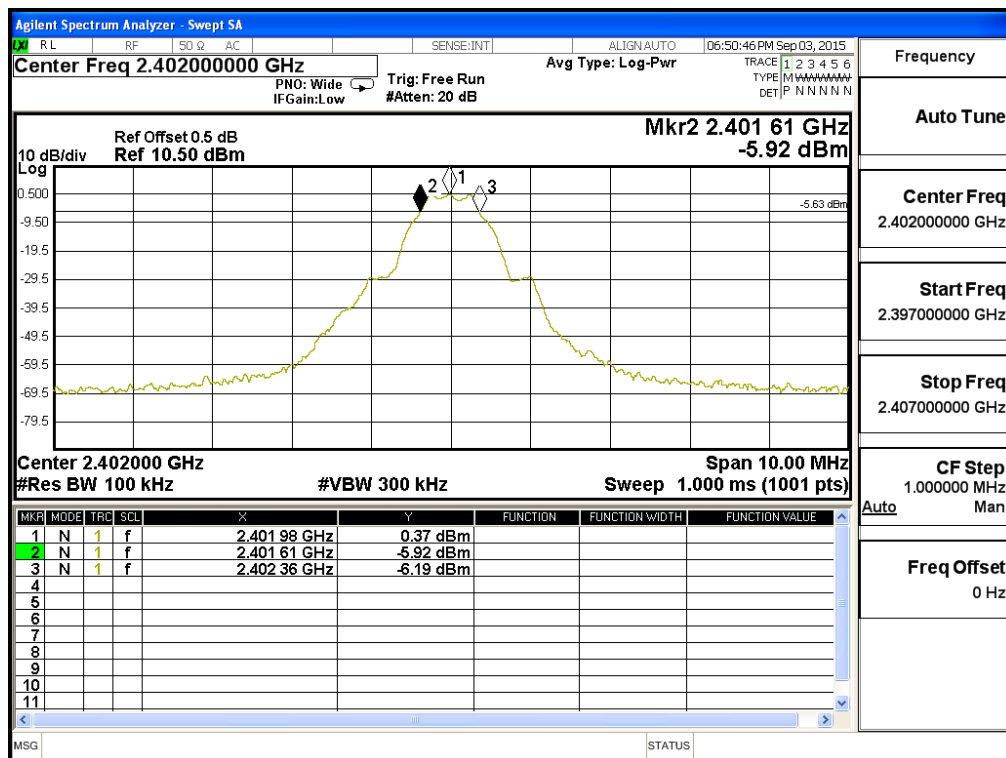


Figure Channel 19:

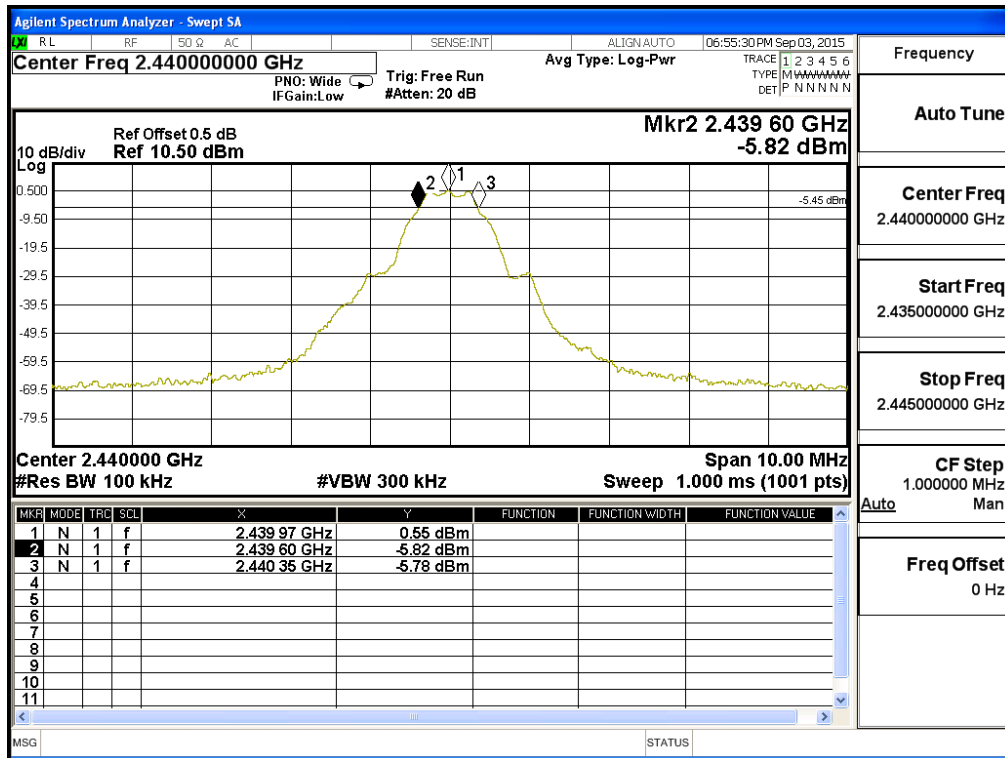
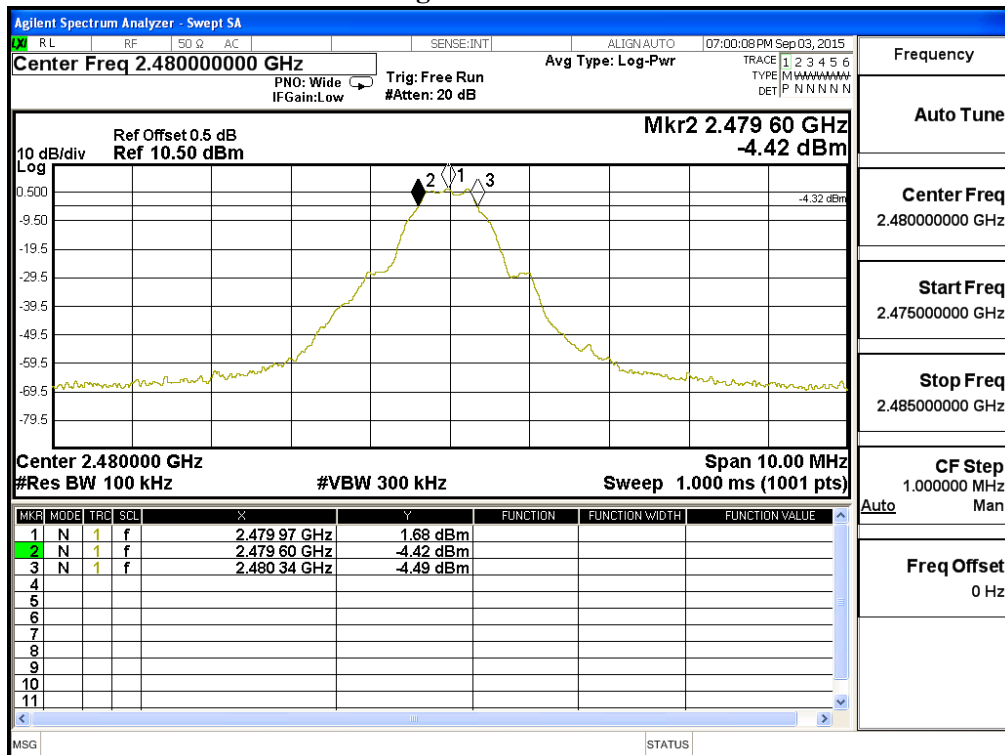


Figure Channel 39:





## 8. Power Density

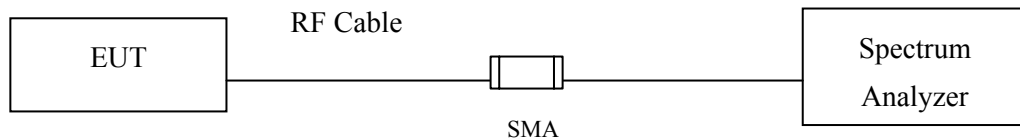
### 8.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

### 8.2. Test Setup



### 8.3. Limits

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

### 8.4. 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.

### 8.5. Uncertainty

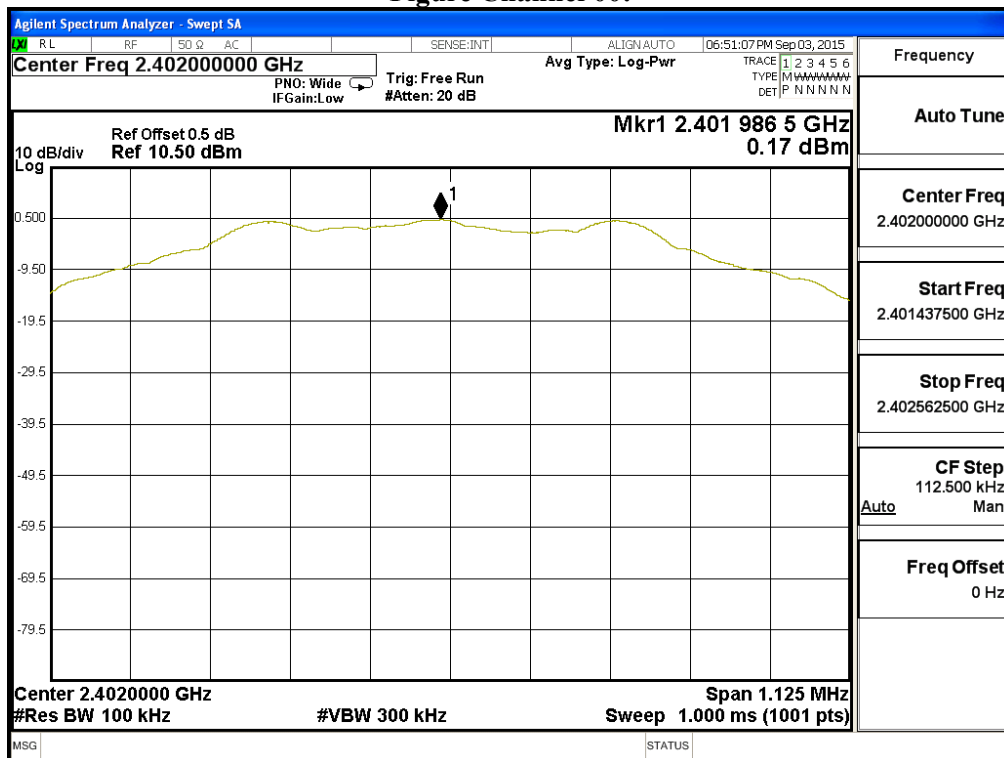
± 1.27 dB

### 8.6. Test Result of Power Density

Product : Notebook  
 Test Item : Power Density Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit - BLE (GFSK)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	0.170	< 8dBm	Pass
19	2440	0.350	< 8dBm	Pass
39	2480	1.450	< 8dBm	Pass

**Figure Channel 00:**





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

No modification was made during testing.