

**FCC 47 CFR PART 15 SUBPART C**  
**CERTIFICATION TEST REPORT for BT**

*For*

**BLUETOOTH PORTABLE CD RADIO BOOMBOX**

**MODEL No.: MET112, AR4000CDBK, AR4000XXXX**  
**(X can be numbers, letters or spaces)**

**FCC ID: 2AB4KMETYH112**

**Trade Mark: MET, ART+SOUND**

**REPORT NO: ES161202006E**

**ISSUE DATE: April 05, 2017**

*Prepared for*

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*Prepared by*

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## 1 TEST RESULT CERTIFICATION

Applicant:	MET INDUSTRIAL LTD ROOM D, 26/F, KINGS TOWER, 111 KING LAM STREET, LAI CHI KOK, HONG KONG
Manufacture:	DONG GUAN YING HUI Electronics Factory Chijiao Section, Town Center Road, Wangniudun Town, Dongguan City, Guangdong Province, China
Product Description:	BLUETOOTH PORTABLE CD RADIO BOOMBOX
Model Number:	MET112, AR4000CDBK, AR4000XXXX (X can be numbers, letters or spaces) (Note: all the model numbers are identical in circuitry and electrical, mechanical and physical construction; the only differences are the appearance and colour and model no. , for trading purpose. We take MET112 to test.)
Trade Mark:	MET, ART+SOUND
File Number:	ES161202006E
Date of Test:	December 03, 2016 to April 04, 2017

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2 2016, Subpart J	PASS
FCC 47 CFR Part 15 2016, Subpart C	

The above equipment was tested by EMTEK(SHENZHEN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 2016 and Part 15.247 2016

The test results of this report relate only to the tested sample identified in this report.

Date of Test :

December 03, 2016 to April 04, 2017

Prepared by :

Doris Su/Editor

Reviewer:

Yaping Shen

Yaping Shen/Supervisor

Approve & Authorized Signer :

Lisa Wang

Lisa Wang/Manager

## 2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
<b>Data Rate</b>	1Mbps for GFSK modulation 2Mbps for pi/4-DQPSK modulation
<b>Modulation</b>	GFSK modulation (1Mbps) pi/4-DQPSK modulation (2Mbps)
<b>Operating Frequency Range</b>	2402-2480MHz
<b>Number of Channels</b>	79 channels
<b>Transmit Power Max</b>	0.329 dBm
<b>Antenna Type</b>	PCB antenna
<b>Antenna Gain</b>	2.3 dBi
<b>Power supply</b>	<input checked="" type="checkbox"/> DC supply: DC 9V(1.5V×6pcs) by dry battery or DC 9V by adapter <input checked="" type="checkbox"/> Adapter supply: Manufacturer: SHENZHEN FU JIA APPLIANCE CO., LTD. Model: FJ-SW1260901000DU Input: AC 100-240V~, 50/60Hz, 0.4A Max Output: DC 9V,1A
<b>Temperature Range</b>	-10°C ~ +55°C

**Note:** for more details, please refer to the User's manual of the EUT.

### 3 SUMMARY OF TEST RESULT

FCC PartClause	Test Parameter	Verdict	Remark
15.247(a)(1)	20 dB Bandwidth	PASS	
15.247(a)(1)	Carrier Frequency Separation	PASS	
15.247(a)(1)	Number of Hopping Frequencies	PASS	
15.247(a)(1)	Average Time of Occupancy (Dwell Time)	PASS	
15.247(b)(1)	Maximum Peak Conducted Output Power	PASS	
15.247(c)	Conducted Spurious Emissions, Bandedge	PASS	
15.247(d) 15.209	Radiated Spurious Emissions	PASS	
15.207	Conducted Emission	PASS	
15.203	Antenna Application	PASS	
	NOTE1:N/A (Not Applicable)		

#### RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2AB4KMETYH112 filing to comply with Section 15.247 of the FCC Part 15, Subpart C.

## 4 TEST METHODOLOGY

### 4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:  
 FCC 47 CFR Part 2, Subpart J  
 FCC 47 CFR Part 15, Subpart C  
 DA 00-705

### 4.2 MEASUREMENT EQUIPMENT USED

#### 4.2.1 Conducted Emission Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LASTCAL.	DUE CAL.
Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/28/2016	05/28/2017
L.I.S.N.	Schwarzbeck	NNLK8129	8129203	05/28/2016	05/28/2017
50Ω Coaxial Switch	Anritsu	MP59B	M20531	N/A	N/A
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100006	05/28/2016	05/28/2017
Voltage Probe	Rohde & Schwarz	TK9416	N/A	05/28/2016	05/28/2017
I.S.N	Rohde & Schwarz	ENY22	1109.9508.02	05/28/2016	05/28/2017

#### 4.2.2 Radiated Emission Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	DUE CAL.
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/28/2016	05/28/2017
Pre-Amplifier	HP	8447D	2944A07999	05/28/2016	05/28/2017
Bilog Antenna	Schwarzbeck	VULB9163	142	05/28/2016	05/28/2017
Loop Antenna	ARA	PLA-1030/B	1029	05/28/2016	05/28/2017
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	05/28/2016	05/28/2017
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/28/2016	05/28/2017
Cable	Schwarzbeck	AK9513	ACRX1	05/28/2016	05/28/2017
Cable	Rosenberger	N/A	FP2RX2	05/28/2016	05/28/2017
Cable	Schwarzbeck	AK9513	CRPX1	05/28/2016	05/28/2017
Cable	Schwarzbeck	AK9513	CRRX2	05/28/2016	05/28/2017

#### 4.2.3 Radio Frequency Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LASTCAL.	DUE CAL.
Spectrum Analyzer	Agilent	E4407B	88156318	05/28/2016	05/28/2017
Signal Analyzer	Agilent	N9010A	My53470879	05/28/2016	05/28/2017
Power meter	Anritsu	ML2495A	0824006	05/28/2016	05/28/2017
Power sensor	Anritsu	MA2411B	0738172	05/28/2016	05/28/2017

**Remark:** Each piece of equipment is scheduled for calibration once a year.

#### 4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

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

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (1Mbps for Bluetooth V2.1+ BR GFSK modulation; 2Mbps for Bluetooth V2.1+EDR pi/4-DQPSK modulation) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for BluetoothV2.1+EDR:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	...	...
1	2403	40	2442	76	2478
2	2404	41	2443	77	2479
...	...	...	...	78	2480

Note:  $fc = 2402\text{MHz} + (k-1) \times 1\text{MHz}$  k=1 to 79

Test Frequency and channel for Bluetooth V2.1+EDR:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	78	2480

## 5 FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at  
Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China  
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

### 5.2 LABORATORY ACCREDITATIONS AND LISTINGS

#### Site Description

- EMC Lab. : Accredited by CNAS, 2016.10.24  
The certificate is valid until 2022.10.28  
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01: 2006(identical to ISO/IEC17025: 2005)  
The Certificate Registration Number is L2291
- : Accredited by TUV Rheinland Shenzhen, 2010.5.25  
The Laboratory has been assessed according to the requirements ISO/IEC 17025.
- : FEDERAL COMMUNICATIONS COMMISSION  
Laboratory Division 7435 Oakland Mills Road Columbia, MD 21046

July 13, 2016

Registration Number: 406365

- : Accredited by Industry Canada, November 24, 2015  
The Certificate Registration Number is 4480A-2

## 6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

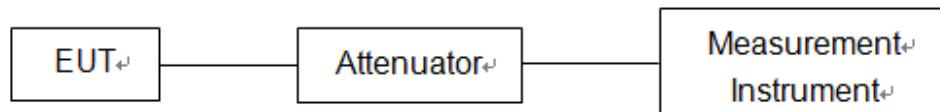
Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0 \text{dB}$
Conducted Emissions Test	$\pm 2.0 \text{dB}$
Radiated Emission Test	$\pm 2.0 \text{dB}$
Occupied Bandwidth Test	$\pm 1.0 \text{dB}$
Band Edge Test	$\pm 3 \text{dB}$
All emission, radiated	$\pm 3 \text{dB}$
Antenna Port Emission	$\pm 3 \text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

Measurement Uncertainty for a level of Confidence of 95%

## 7 SETUP OF EQUIPMENT UNDER TEST

### 7.1 RADIO FREQUENCY TEST SETUP 1

The Bluetooth V2.1+EDR component's antenna port(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



### 7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

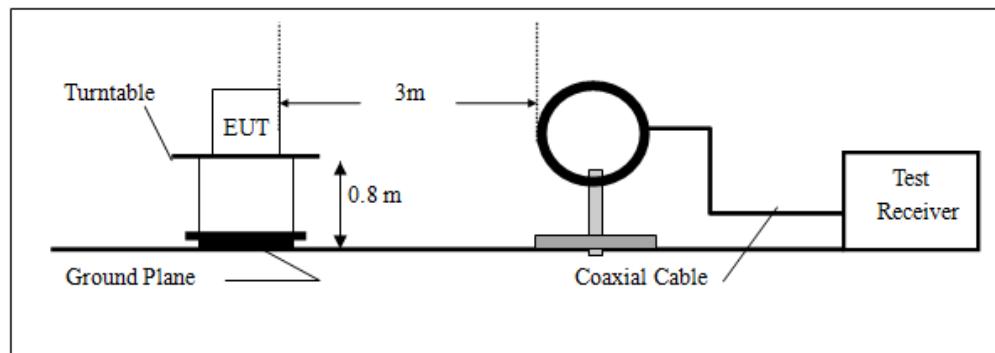
30MHz-1GHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

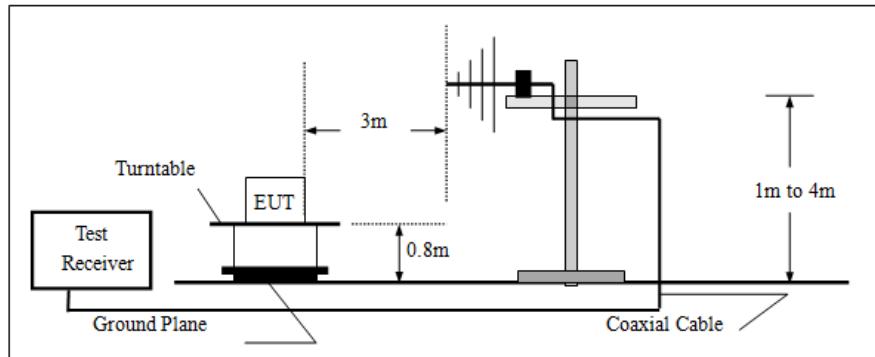
Above 1GHz:

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

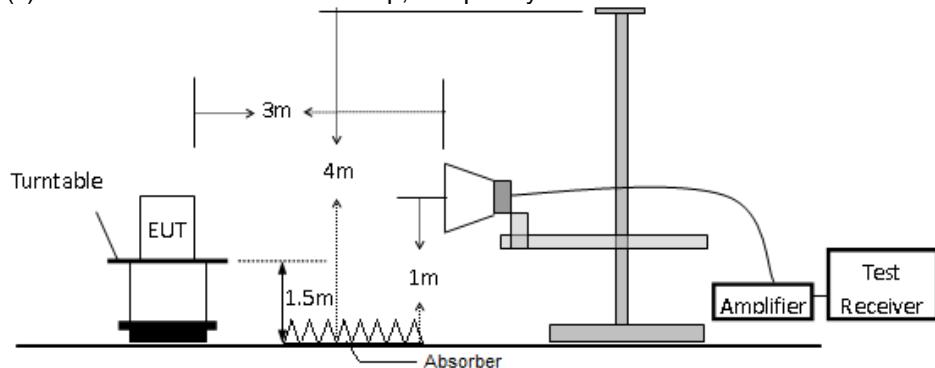
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

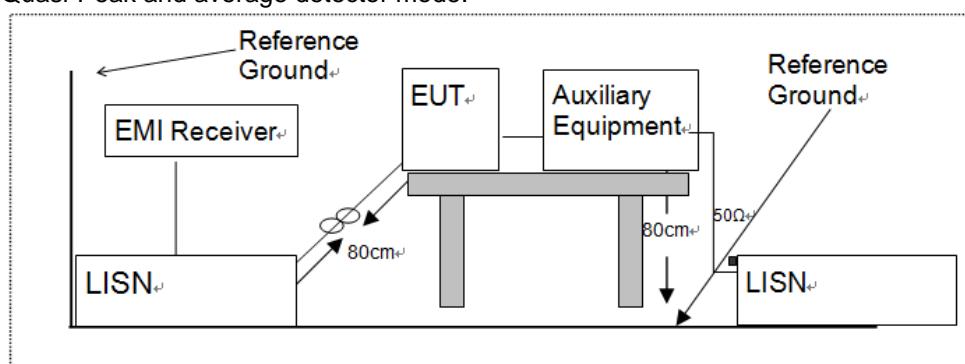


### 7.3 CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT (Game fitness board) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



#### 7.4 SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Note
1.	iPhone	Apple	iPhone 5C/A1526	N/A	N/A

**Notes:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 8 FREQUENCY HOPPING SYSTEM REQUIREMENTS

### 8.1 Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

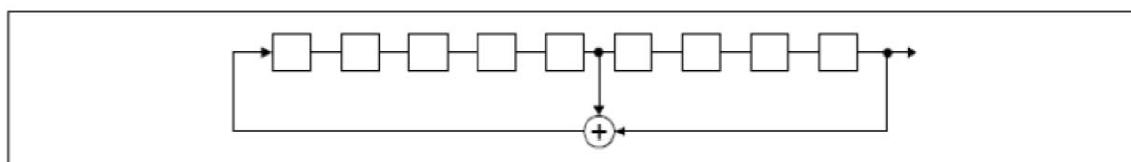
### 8.2 EUT Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The normal hop is 1 600 hops/s.

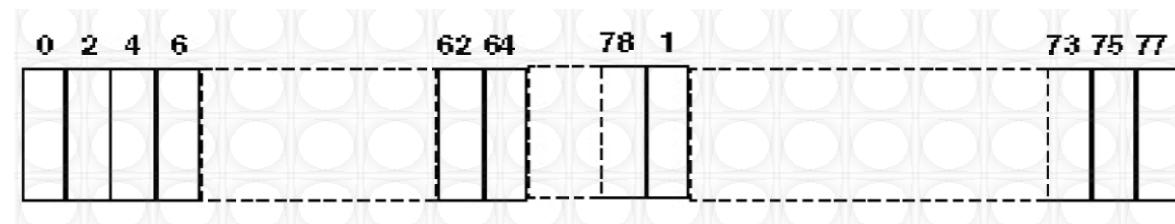
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones. Number of shift register stages: 9

Length of pseudo-random sequence:  $2^9 - 1 = 524$  bits

Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*



Each frequency used equally on the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

### **8.3 Equal Hopping Frequency Use**

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

Example of a 79 hopping sequence in data mode:

35, 27, 6, 44, 14, 61, 74, 32, 1, 11, 23, 2, 55, 65, 29, 3, 9, 52, 78, 58, 40, 25, 0, 7, 18, 26, 76, 60, 47, 50, 2, 5, 16, 37, 70, 63, 66, 54, 20, 13, 4, 8, 15, 21, 26, 10, 73, 77, 67, 69, 43, 24, 57, 39, 46, 72, 48, 33, 17, 31, 75, 19,

41, 62, 68, 28, 51, 66, 30, 56, 34, 59, 71, 22, 49, 64, 38, 45, 36, 42, 53

Each Frequency used equally on the average by each transmitter

### **8.4 Frequency Hopping System**

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH- enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

## 9 TEST REQUIREMENTS

### 9.1 20DB BANDWIDTH

#### 9.1.1 Applicable Standard

According to FCC Part 15.247(a)(1) and DA 00-705

#### 9.1.2 Conformance Limit

No limit requirement.

#### 9.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### 9.1.4 Test Procedure

The EUT was operating in Bluetooth V2.1+EDR mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 30 kHz.

Set the video bandwidth (VBW) =100kHz.

Set Span= approximately 2 to 3 times the 20 dB bandwidth

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use themarker-delta function to measure 20 dB down one side of the emission. Reset the markerdeltafunction, and move the marker to the other side of the emission, until it is (asclose as possible to) even with the reference marker level. The marker-delta reading atthis point is the 20 dB bandwidth of the emission.

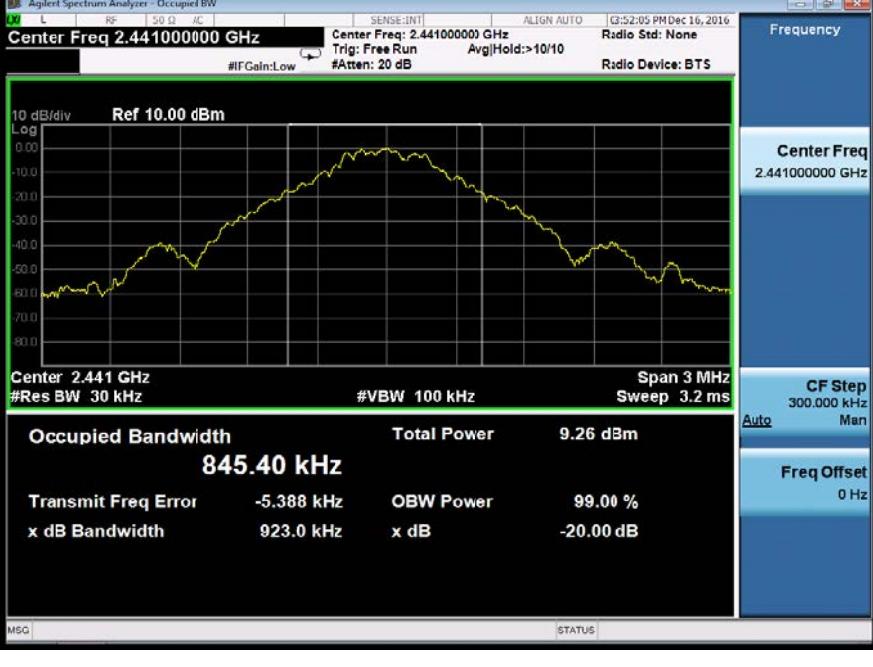
If this value varies with differentmodes of operation (e.g., data rate, modulation format, etc.), repeat this test for eachvariation.

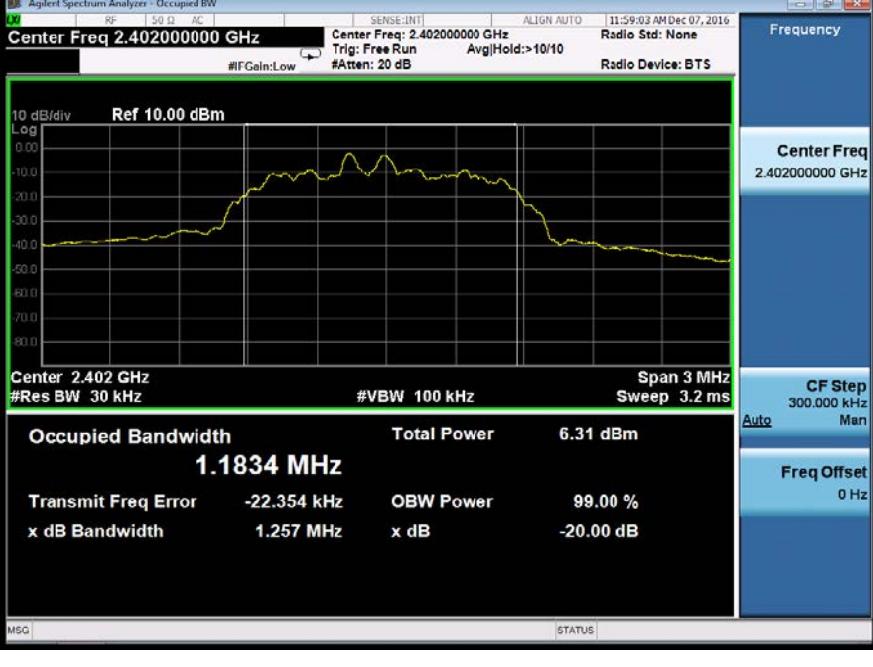
Measure and record the results in the test report.

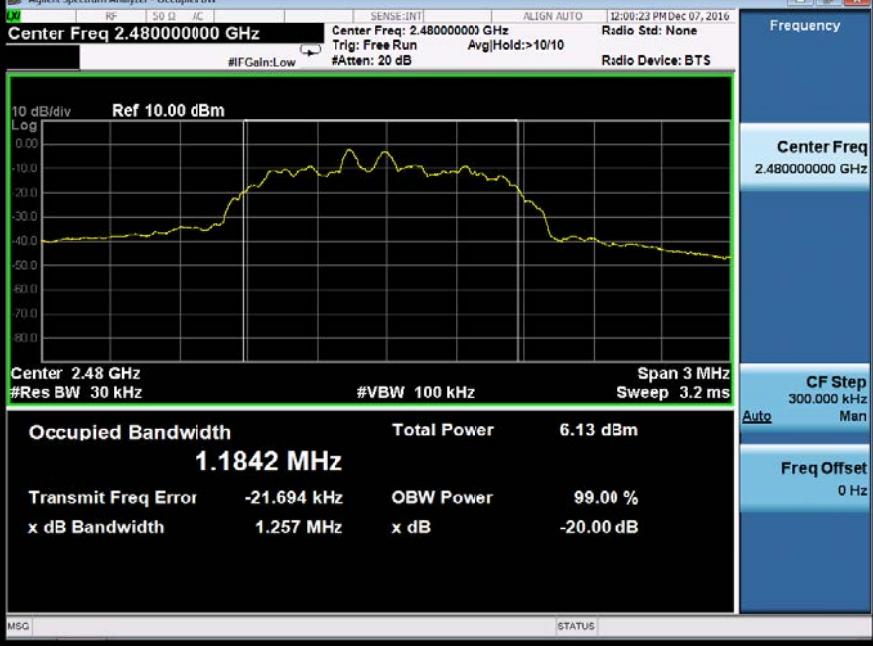
### Test Results

Temperature:	24°C	Test Date:	December 16, 2016
Humidity:	53 %	Test By:	KK

Modulation Mode	Channel Number	Channel Frequency (MHz)	20dB Bandwidth (kHz)
GFSK	00	2402	910.10
	39	2441	923.00
	78	2480	928.60
pi/4-DQPSK	00	2402	1257.00
	39	2441	1256.00
	78	2480	1257.00

Test Model	20dB Bandwidth			
	Bluetooth V2.1+EDR		GFSKModulation	
	Channel 0: 2402MHz			
	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40200000 GHz</p> <p>Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>Center 2.402 GHz #Res BW 30 kHz #VBW 100 kHz Span 3 MHz Sweep 3.2 ms</p> <p>Occupied Bandwidth 839.55 kHz Total Power 9.12 dBm</p> <p>Transmit Freq Error -5.503 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 910.1 kHz x dB -20.00 dB</p> <p>CF Step 300.000 kHz Auto</p> <p>Freq Offset 0 Hz</p>			
Test Model	20dB Bandwidth			
	Bluetooth V2.1+EDR		GFSKModulation	
	Channel 39: 2441MHz			
	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.44100000 GHz</p> <p>Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>Center 2.441 GHz #Res BW 30 kHz #VBW 100 kHz Span 3 MHz Sweep 3.2 ms</p> <p>Occupied Bandwidth 845.40 kHz Total Power 9.26 dBm</p> <p>Transmit Freq Error -5.388 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 923.0 kHz x dB -20.00 dB</p> <p>CF Step 300.000 kHz Auto</p> <p>Freq Offset 0 Hz</p>			

Test Model	20dB Bandwidth				
	Bluetooth V2.1+EDR				
	Channel 78: 2480MHz	GFSKModulation			
 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.48000000 GHz</p> <p>Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>Center 2.48 GHz #Res BW 30 kHz #VBW 100 kHz Span 3 MHz Sweep 3.2 ms</p> <p>Occupied Bandwidth 842.32 kHz Total Power 10.8 dBm</p> <p>Transmit Freq Error -6.977 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 928.6 kHz x dB -20.00 dB</p> <p>MSG STATUS</p>					
 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40200000 GHz</p> <p>Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>Center 2.402 GHz #Res BW 30 kHz #VBW 100 kHz Span 3 MHz Sweep 3.2 ms</p> <p>Occupied Bandwidth 1.1834 MHz Total Power 6.31 dBm</p> <p>Transmit Freq Error -22.354 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 1.257 MHz x dB -20.00 dB</p> <p>MSG STATUS</p>					

Test Model	20dB Bandwidth		
	Bluetooth V2.1+EDR		
	Channel 39: 2441MHz	pi/4-DQPSKModulation	
 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>1.1852 MHz</p> <p>Occupied Bandwidth Total Power 6.23 dBm</p> <p>Transmit Freq Error -22.025 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 1.256 MHz x dB -20.00 dB</p> <p>Span 3 MHz Sweep 3.2 ms</p> <p>CF Step 300.000 kHz Man</p> <p>Freq Offset 0 Hz</p>			
20dB Bandwidth			
Bluetooth V2.1+EDR			
Channel 78: 2480MHz		pi/4-DQPSKModulation	
 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>1.1842 MHz</p> <p>Occupied Bandwidth Total Power 6.13 dBm</p> <p>Transmit Freq Error -21.694 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 1.257 MHz x dB -20.00 dB</p> <p>Span 3 MHz Sweep 3.2 ms</p> <p>CF Step 300.000 kHz Man</p> <p>Freq Offset 0 Hz</p>			

## 9.2 CARRIER FREQUENCY SEPARATION

### 9.2.1 Applicable Standard

According to FCC Part 15.247(a)(1) and DA 00-705

### 9.2.2 Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

In case of an output power less than 125mW, the frequency hopping system may have channels separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 9.2.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 9.2.4 Test Procedure

- According to FCC Part 15.247(a)(1)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Set the RBW = 100kHz. Set VBW = 300kHz.

Set the span = wide enough to capture the peaks of two adjacent channels

Set Sweep time = auto couple.

Set Detector = peak. Set Trace mode = max hold.

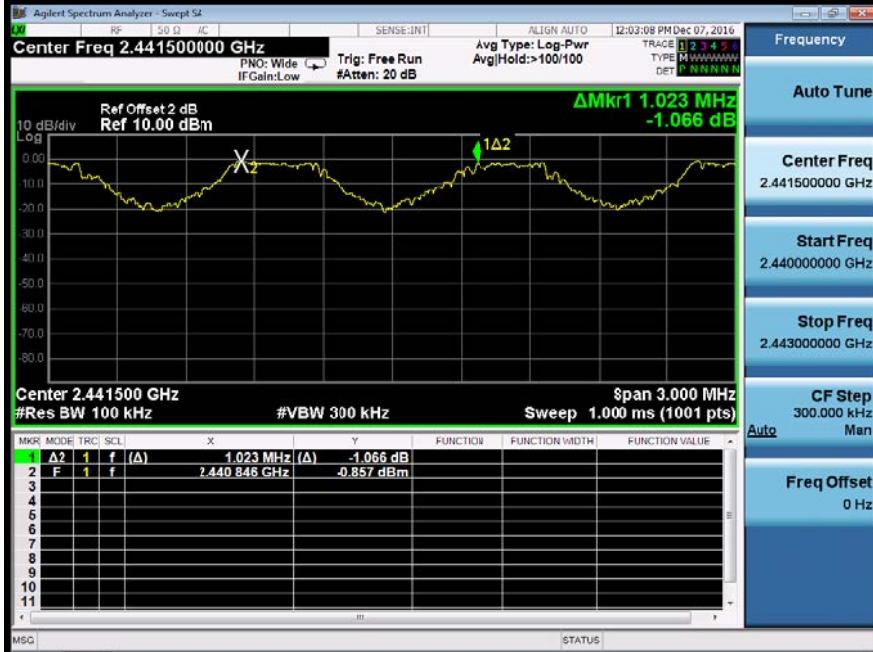
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

### Test Results

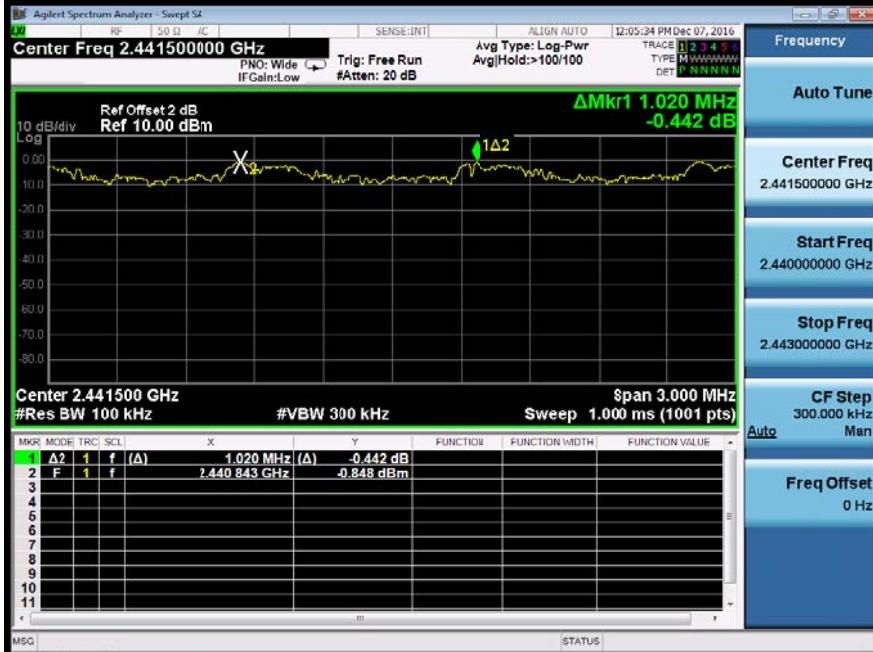
Temperature:	24°C	Test Date:	December 07, 2016
Humidity:	53 %	Test By:	KK

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (kHz)	Limit (kHz)	Verdict
GFSK	0	2402	948	>910.1	PASS
	39	2441	1023	>923.0	PASS
	78	2480	1008	>928.6	PASS
pi/4-DQPSK	0	2402	1002	>838.0	PASS
	39	2441	1020	>837.3	PASS
	78	2480	999	>838.0	PASS

Note: Limit = 20dB bandwidth for GFSK modulation, Limit = 20dB bandwidth \* 2/3 for pi/4-DQPSK modulation, if it is greater than 25kHz and the output power is less than 125mW (21dBm).

Test Model	Carrier Frequency Separation																																																																	
	Bluetooth V2.1+EDR																																																																	
	Channel 0: 2402MHz	GFSKModulation																																																																
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.402500000 GHz</p> <p>PNO: Wide IFGain:Low</p> <p>Trig: Free Run #Atten: 20 dB</p> <p>Avg Type: Log-Pwr Avg Hold:&gt;100/100</p> <p>TRACE 1 2 3 4 5 TYPE MWWWW DET PNNNN</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.40250000 GHz</p> <p>Start Freq 2.401000000 GHz</p> <p>Stop Freq 2.404000000 GHz</p> <p>CF Step 300.000 kHz Man</p> <p>Freq Offset 0 Hz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>Log</p> <p>10 dB/div</p> <p>0.00 10.00 -20.00 -30.00 -40.00 -50.00 -60.00 -70.00 -80.00</p> <p>ΔMkr1 -948 kHz -0.773 dB</p> <p>Center 2.402500 GHz #VBW 300 kHz Sweep 1.000 ms (1001 pts)</p> <p>MKR MODE: TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE</p> <table border="1"> <tr> <td>1</td> <td>Δ2</td> <td>1</td> <td>f (Δ)</td> <td>-948 kHz (Δ)</td> <td>-0.773 dB</td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>f</td> <td>2.402 851 GHz</td> <td>-0.842 dBm</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>MSG STATUS</p>	1	Δ2	1	f (Δ)	-948 kHz (Δ)	-0.773 dB	2	F	1	f	2.402 851 GHz	-0.842 dBm	3						4						5						6						7						8						9						10						11					
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### 9.3 NUMBER OF HOPPING FREQUENCIES

#### 9.3.1 Applicable Standard

According to FCC Part 15.247(a)(1) (iii)and DA 00-705

#### 9.3.2 Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall use at least 15 channels.

#### 9.3.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### 9.3.4 Test Procedure

- According to FCC Part15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW = 100kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

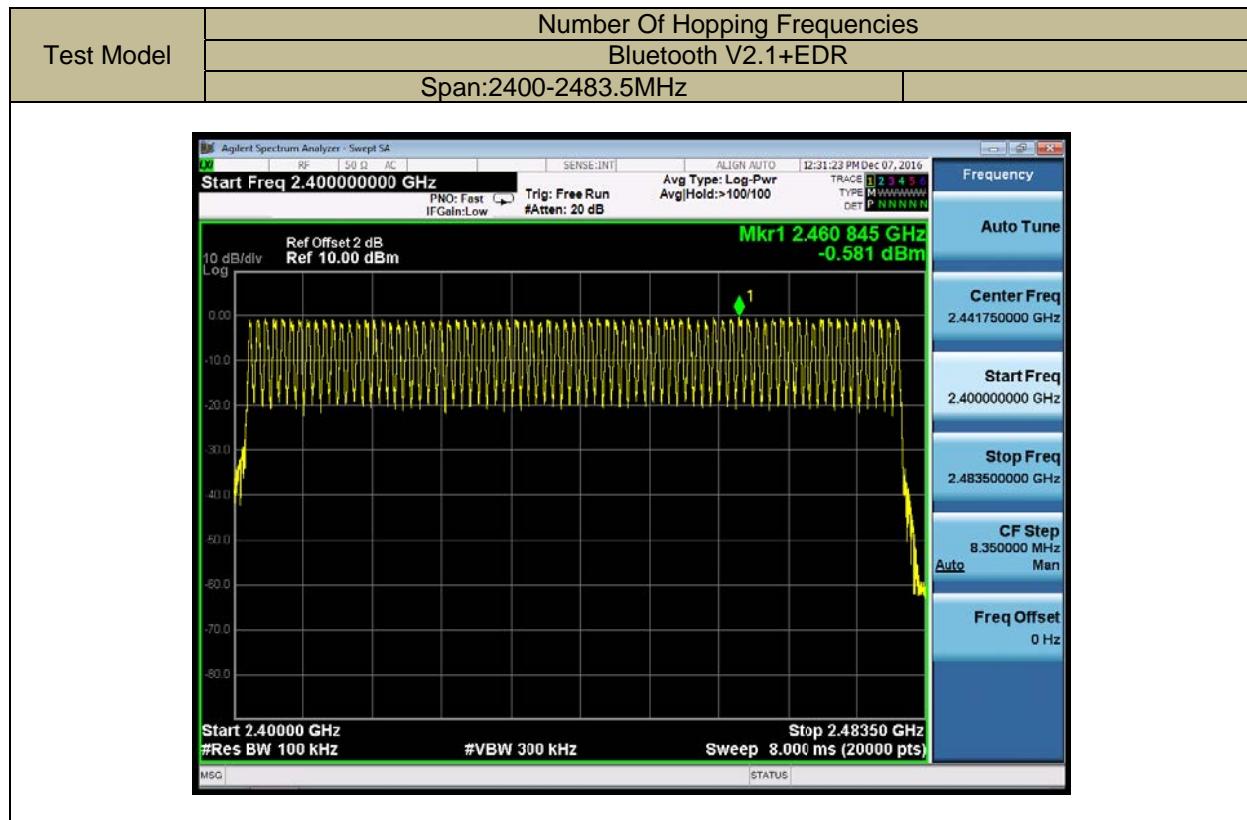
Trace = max hold

Allow the trace to stabilize. It may prove necessary to break the span up to sections, inorder to clearly show all of the hopping frequencies.

#### Test Results

Temperature: 24°C      Test Date: December 07, 2016  
Humidity: 53 %      Test By: KK

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel limit
2402-2480	79	>15



## 9.4 AVERAGE TIME OF OCCUPANCY (DWELL TIME)

### 9.4.1 Applicable Standard

According to FCC Part 15.247(a)(1)(iii) and DA 00-705

### 9.4.2 Conformance Limit

For frequency hopping systems operating in the 2400-2483.5MHz band, the averagetime of occupancy on any channel shall not be greater than 0.4s within a period of 0.4smultiplied by the number of hopping channels employed.

### 9.4.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 9.4.4 Test Procedure

- According to FCC Part15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzersettings:

Span = zero span, centered on a hopping channel

RBW = 1 MHz

VBW  $\geq$  RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value

varies with different modes of operation (e.g., data rate, modulation format, etc.),

repeat this test for each variation. The limit is specified in one of the subparagraphsof this Section.

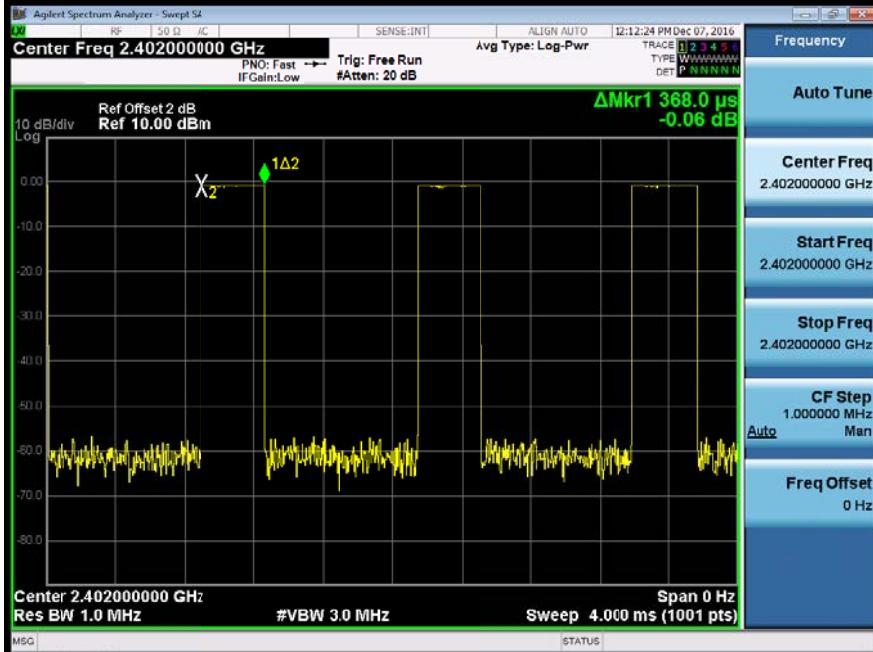
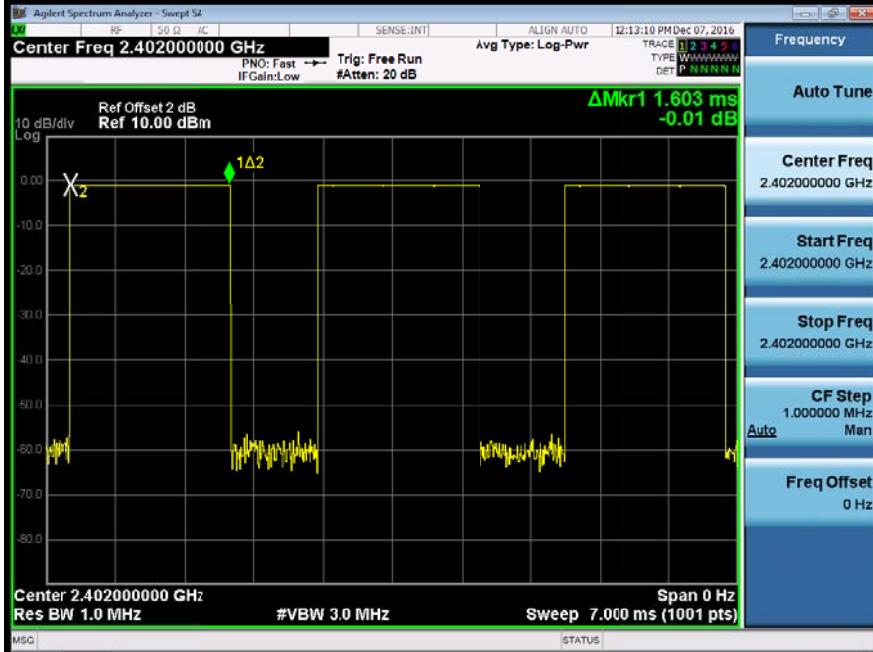
### 9.4.5 Test Results

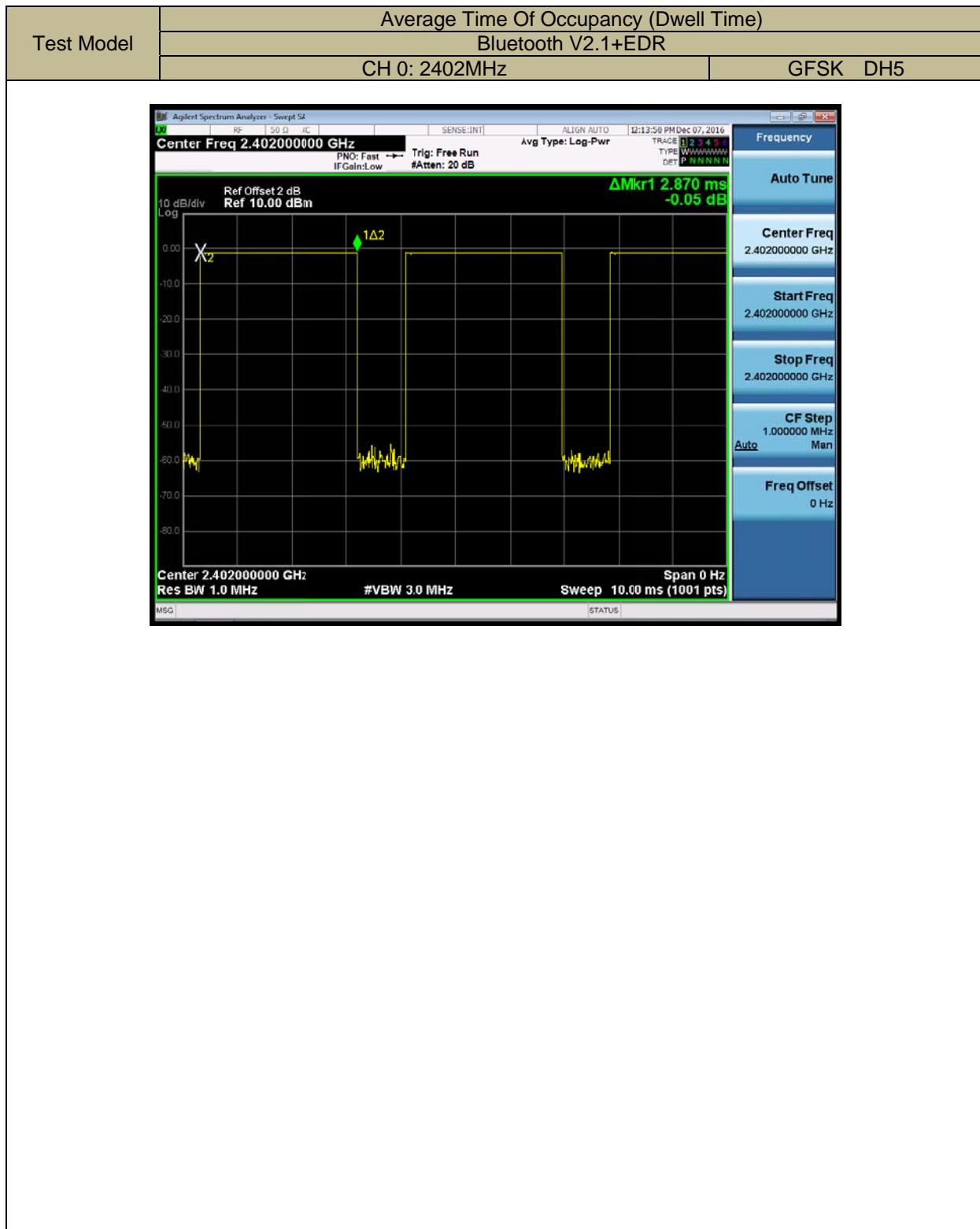
Temperature:	24°C	Test Date:	December 07, 2016
Humidity:	53 %	Test By:	KK

Modulation Mode	Channel Number	Packet type	Pluse width (ms)	DwellTime (ms)	Limit (ms)	Verdict
GFSK	0	DH1	0.368	117.76	<400	PASS
	0	DH3	1.603	256.48	<400	PASS
	0	DH5	2.870	306.13	<400	PASS

Note1: DwellTime(DH1)=PW\*(1600/2/79)\*31.6  
DwellTime(DH3)=PW\*(1600/4/79)\*31.6  
DwellTime(DH5)=PW\*(1600/6/79)\*31.6

Note2: Bluetooth (GFSK, pi/4-DQPSK) mode have been tested, and the worst results has been recorded on the follow page.

Test Model	Average Time Of Occupancy (Dwell Time)		
	Bluetooth V2.1+EDR		
	CH 0: 2402MHz	GFSK	DH1
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>ΔMkr1 368.0 μs -0.06 dB</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.402000000 GHz</p> <p>Start Freq 2.402000000 GHz</p> <p>Stop Freq 2.402000000 GHz</p> <p>CF Step 1.000000 MHz Man</p> <p>Freq Offset 0 Hz</p> <p>1Δ2</p> <p>Center 2.402000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 4.000 ms (1001 pts)</p>			
Test Model	Average Time Of Occupancy (Dwell Time)		
	Bluetooth V2.1+EDR	GFSK	DH3
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>ΔMkr1 1.603 ms -0.01 dB</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.402000000 GHz</p> <p>Start Freq 2.402000000 GHz</p> <p>Stop Freq 2.402000000 GHz</p> <p>CF Step 1.000000 MHz Man</p> <p>Freq Offset 0 Hz</p> <p>1Δ2</p> <p>Center 2.402000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 7.000 ms (1001 pts)</p>			



## 9.5 MAXIMUM PEAK CONDUCTED OUTPUT POWER

### 9.5.1 Applicable Standard

According to FCC Part 15.247(b)(1) and DA 00-705

### 9.5.2 Conformance Limit

The max For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

### 9.5.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 9.5.4 Test Procedure

- According to FCC Part15.247(b)(1)

As an alternative to a peak power measurement, compliance with the limit can be based on a measurement of the maximum conducted output power.

Use the following spectrum analyzer settings:

Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel(about 10MHz)

Set RBW > the 20 dB bandwidth of the emission being measured(about 3MHz)

Set VBW ≥ RBW

Set Sweep = auto

Set Detector function = peak

Set Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emissionto determine the peak amplitude level.

## Test Results

Temperature:	24°C	Test Date:	December 07, 2016
Humidity:	53 %	Test By:	KK

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)	Verdict
GFSK	0	2402	-0.661	30	PASS
	39	2441	-0.776	30	PASS
	78	2480	-0.763	30	PASS
pi/4-DQPSK	0	2402	<b>0.329</b>	21	PASS
	39	2441	0.191	21	PASS
	78	2480	0.202	21	PASS

Note:N/A

Test Model	Maximum PeakConducted Output Power				
	Bluetooth V2.1+EDR				
	Channel 0: 2402MHz		GFSK		
 <p>The screenshot shows the Agilent Spectrum Analyzer interface. The main window displays a spectrum plot with a single peak at 2.40183 GHz, labeled 'Mkr1'. The y-axis ranges from -10.00 to -80.00 dBm. The x-axis shows a span of 10.00 MHz centered at 2.402000 GHz. The right side of the screen shows the instrument's configuration parameters:</p> <ul style="list-style-type: none"> <li>Frequency: 2.40200000 GHz</li> <li>Auto Tune</li> <li>Center Freq: 2.40200000 GHz</li> <li>Start Freq: 2.39700000 GHz</li> <li>Stop Freq: 2.40700000 GHz</li> <li>CF Step: 1.000000 MHz (Man)</li> <li>Freq Offset: 0 Hz</li> </ul>					
Maximum PeakConducted Output Power					
Bluetooth V2.1+EDR					
Channel 39: 2441MHz		GFSK			
 <p>The screenshot shows the Agilent Spectrum Analyzer interface. The main window displays a spectrum plot with a single peak at 2.44074 GHz, labeled 'Mkr1'. The y-axis ranges from -10.00 to -80.00 dBm. The x-axis shows a span of 10.00 MHz centered at 2.441000 GHz. The right side of the screen shows the instrument's configuration parameters:</p> <ul style="list-style-type: none"> <li>Frequency: 2.44100000 GHz</li> <li>Auto Tune</li> <li>Center Freq: 2.44100000 GHz</li> <li>Start Freq: 2.43600000 GHz</li> <li>Stop Freq: 2.44600000 GHz</li> <li>CF Step: 1.000000 MHz (Man)</li> <li>Freq Offset: 0 Hz</li> </ul>					

Test Model	Maximum PeakConducted Output Power				
	Bluetooth V2.1+EDR				
	Channel 78: 2480MHz		GFSK		
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>Mkr1 2.479 73 GHz -0.763 dBm</p> <p>10 dB/div Log</p> <p>Span 10.00 MHz</p> <p>Center 2.480000 GHz #Res BW 3.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts)</p> <p>MSO STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.480000000 GHz</p> <p>Start Freq 2.476000000 GHz</p> <p>Stop Freq 2.485000000 GHz</p> <p>CF Step 1.000000 MHz Man</p> <p>Freq Offset 0 Hz</p>					
Maximum PeakConducted Output Power					
Bluetooth V2.1+EDR					
Channel 0: 2402MHz			pi/4-DQPSK		
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>Mkr1 2.401 88 GHz 0.329 dBm</p> <p>10 dB/div Log</p> <p>Span 10.00 MHz</p> <p>Center 2.402000 GHz #Res BW 3.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts)</p> <p>MSO STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.402000000 GHz</p> <p>Start Freq 2.397000000 GHz</p> <p>Stop Freq 2.407000000 GHz</p> <p>CF Step 1.000000 MHz Man</p> <p>Freq Offset 0 Hz</p>					

Test Model	Maximum PeakConducted Output Power												
	Bluetooth V2.1+EDR												
	Channel 39: 2441MHz		pi/4-DQPSK										
 <p>The screenshot shows an Agilent Spectrum Analyzer interface. The main window displays a spectrum plot with a single peak at 2.44082 GHz, labeled 'Mkr1'. The y-axis is logarithmic, ranging from -10.00 to -80.00 dBm. The x-axis shows a 10 MHz span centered at 2.44100 GHz. The right side of the screen shows a control panel with various frequency settings: Center Freq (2.44100000 GHz), Start Freq (2.43600000 GHz), Stop Freq (2.44600000 GHz), CF Step (1.000000 MHz), and Freq Offset (0 Hz). The status bar at the bottom indicates 'Sweep 1.000 ms (1001 pts)'.</p>													
<table border="1"> <tr> <td rowspan="3">Test Model</td> <td colspan="3">Maximum PeakConducted Output Power</td></tr> <tr> <td colspan="2">Bluetooth V2.1+EDR</td><td></td></tr> <tr> <td colspan="2">Channel 78: 2480MHz</td><td>pi/4-DQPSK</td></tr> </table>  <p>The screenshot shows an Agilent Spectrum Analyzer interface. The main window displays a spectrum plot with a single peak at 2.47981 GHz, labeled 'Mkr1'. The y-axis is logarithmic, ranging from -10.00 to -80.00 dBm. The x-axis shows a 10 MHz span centered at 2.48000 GHz. The right side of the screen shows a control panel with various frequency settings: Center Freq (2.48000000 GHz), Start Freq (2.47500000 GHz), Stop Freq (2.48500000 GHz), CF Step (1.000000 MHz), and Freq Offset (0 Hz). The status bar at the bottom indicates 'Sweep 1.000 ms (1001 pts)'.</p>				Test Model	Maximum PeakConducted Output Power			Bluetooth V2.1+EDR			Channel 78: 2480MHz		pi/4-DQPSK
Test Model	Maximum PeakConducted Output Power												
	Bluetooth V2.1+EDR												
	Channel 78: 2480MHz		pi/4-DQPSK										

## 9.6 CONDUCTED SUPRIOS EMISSION, BANDEDGE

### 9.6.1 Applicable Standard

According to FCC Part 15.247(d) and DA 00-705

### 9.6.2 Conformance Limit

According to FCC Part 15.247(d):

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, provided the transmitter demonstrates compliance with the peak conducted power limits.

### 9.6.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 9.6.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

#### ■ Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DSS channel center frequency.

Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.

Set the RBW = 100 kHz. Set the VBW  $\geq 3 \times$  RBW.

Set Detector = peak. Set Sweep time = auto couple.

Set Trace mode = max hold. Allow trace to fully stabilize.

Use the peak marker function to determine the maximum Maximumconductedlevel.

Note that the channel found to contain the maximum conducted level can be used to establish the reference level.

#### ■ Band-edge Compliance of RF Conducted Emissions

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation

Set RBW  $\geq 1\%$  of the span=100kHzSet VBW  $\geq$  RBW

Set Sweep = autoSet Detector function = peakSet Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission.

The marker-delta value now displayed must comply with the limit specified in this Section.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

#### ■ ConductedSpurious RF Conducted Emission

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.(30MHz to 25GHz).Set RBW = 100 kHzSet VBW  $\geq$  RBW

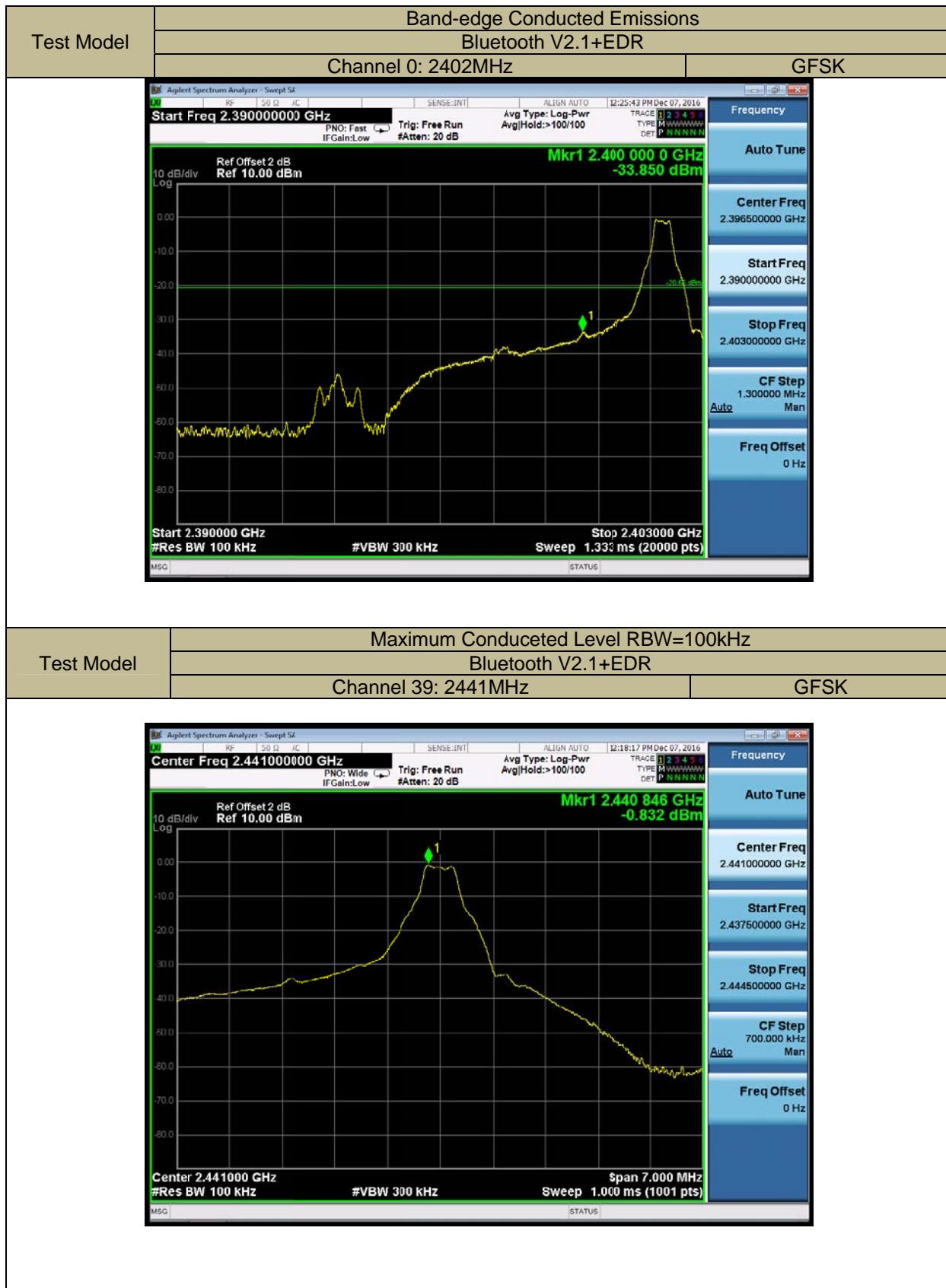
Set Sweep = autoSet Detector function = peakSet Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

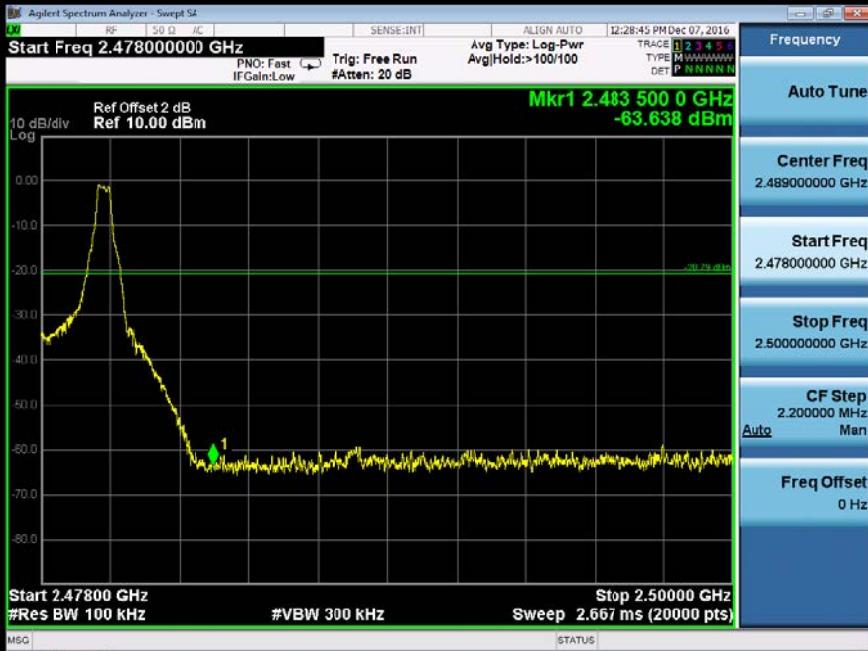
### 9.6.5 Test Results

Bluetooth (GFSK, pi/4-DQPSK, Hopping) mode have been tested, and all results were report as below:

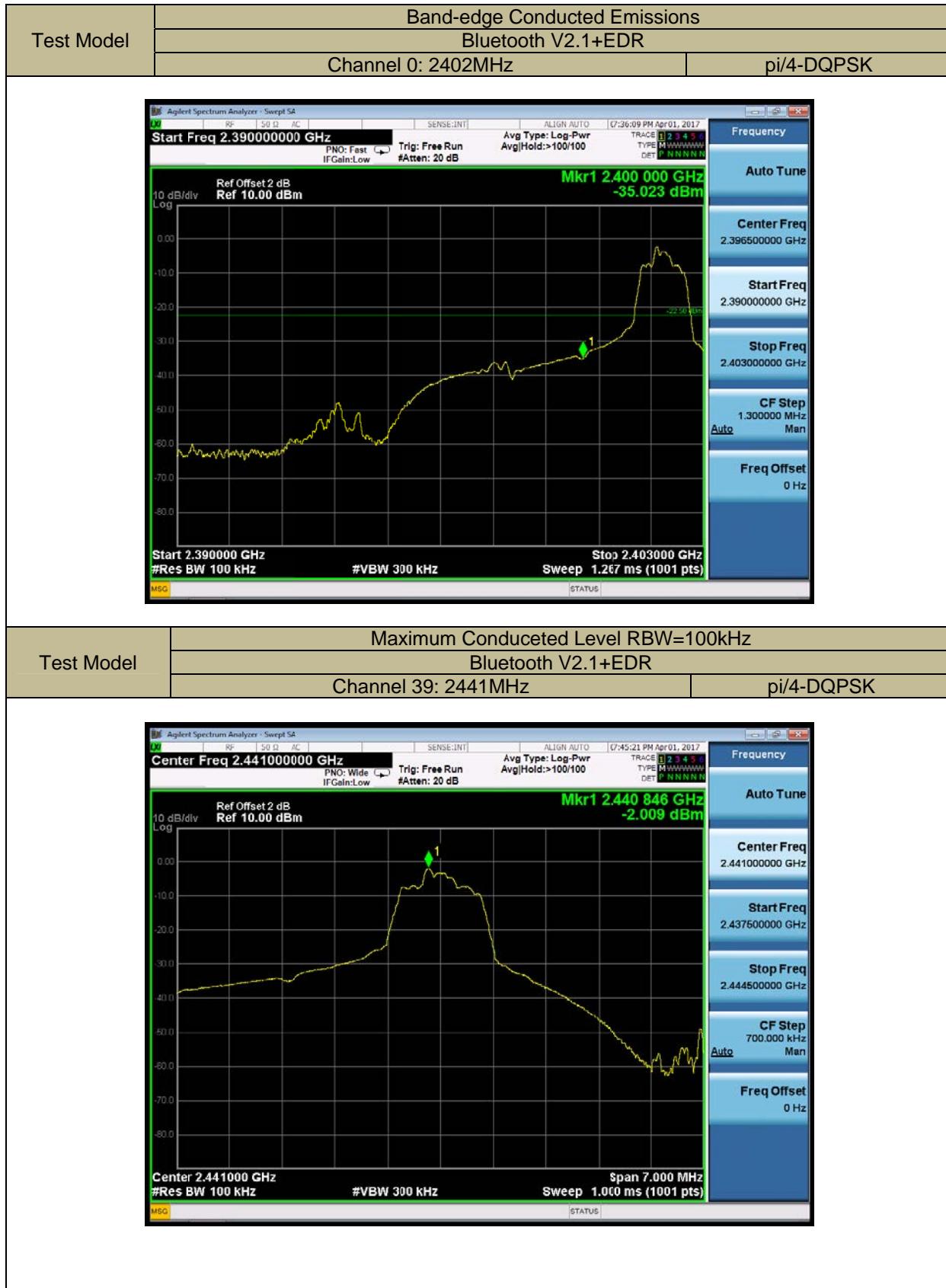
Test Model	Maximum Conduced Level RBW=100kHz		
	Bluetooth V2.1+EDR		
	Channel 0: 2402MHz		GFSK
 <p>The screenshot shows a spectrum analysis plot with a yellow trace. The center frequency is set to 2.402000000 GHz. The measurement parameters are: PNO: Wide, Trig: Free Run, #Atten: 20 dB. The average type is Log-Pwr, and the hold time is &gt;100/100. The marker Mkr1 shows a peak at 2.401846 GHz with a power of -0.656 dBm. The x-axis spans from 2.398500000 GHz to 2.405600000 GHz with a center at 2.402000000 GHz and a span of 7.000 MHz. The y-axis ranges from -80.0 to 10.0 dB. The sweep time is 1.000 ms (1001 pts). The right panel displays the following parameters:</p> <ul style="list-style-type: none"> <li>Frequency: 2.402000000 GHz</li> <li>Start Freq: 2.398500000 GHz</li> <li>Stop Freq: 2.405600000 GHz</li> <li>CF Step: 700.000 kHz</li> <li>Freq Offset: 0 Hz</li> </ul>			
Test Model	ConductedSpurious RF Conducted Emission		
	Bluetooth V2.1+EDR		
	Channel 0: 2402MHz		GFSK
 <p>The screenshot shows a spectrum analysis plot with a yellow trace. The start frequency is set to 30.000000 MHz. The measurement parameters are: PNO: Fast, Trig: Free Run, #Atten: 20 dB. The average type is Log-Pwr, and the hold time is 7/100. The marker Mkr1 shows a peak at 24.8527 GHz with a power of -47.586 dBm. The x-axis spans from 30.000000 MHz to 25.000000000 GHz with a center at 24.8527 GHz and a span of 25.00 GHz. The y-axis ranges from -80.0 to 10.0 dB. The sweep time is 2.387 s (20000 pts). The right panel displays the following parameters:</p> <ul style="list-style-type: none"> <li>Frequency: 24.8527 GHz</li> <li>Start Freq: 30.000000 MHz</li> <li>Stop Freq: 25.000000000 GHz</li> <li>CF Step: 2.497000000 GHz</li> <li>Freq Offset: 0 Hz</li> </ul>			



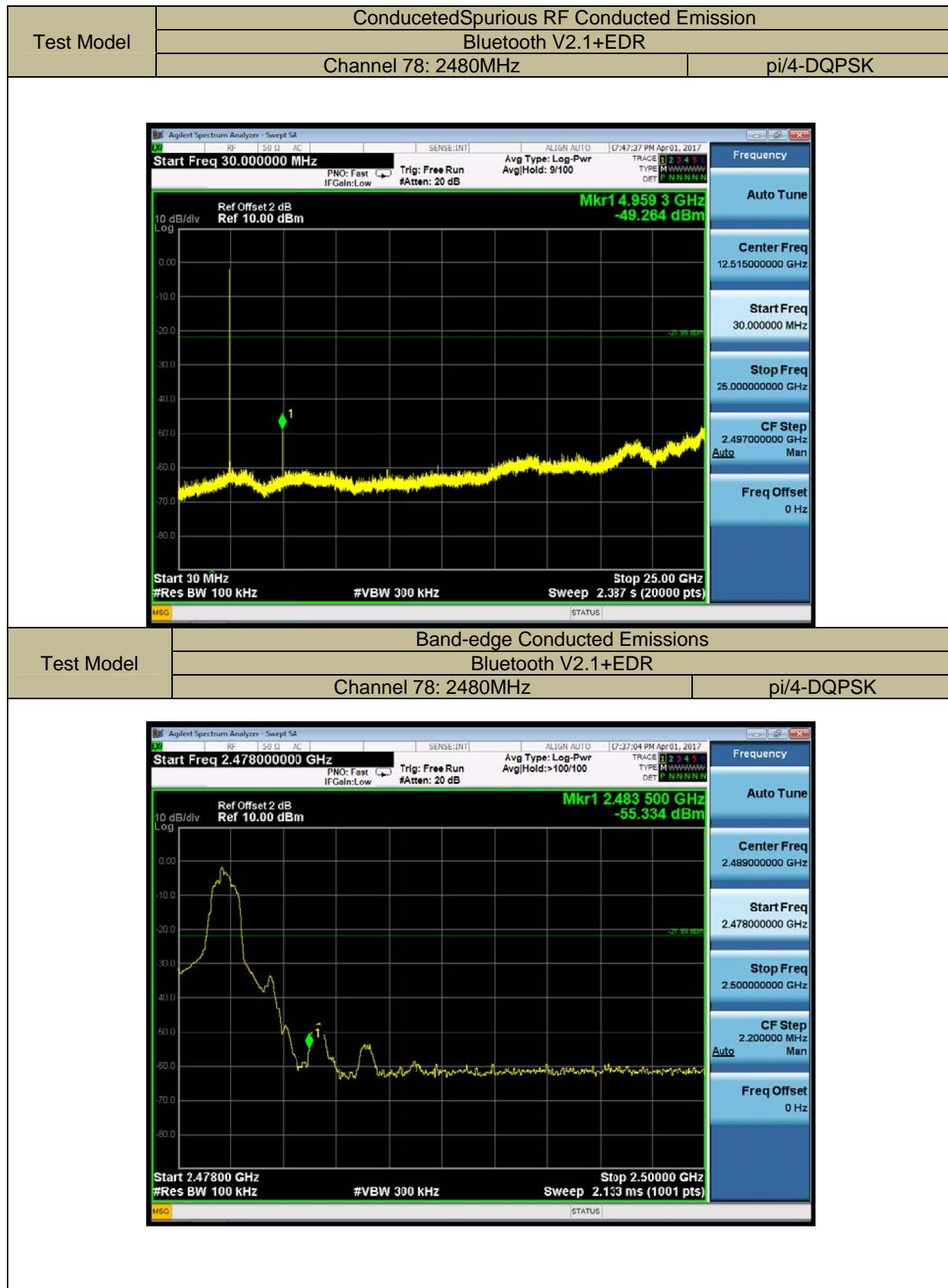
Test Model	Conducted Spurious RF Conducted Emission	
	Bluetooth V2.1+EDR	
	Channel 39: 2441MHz	GFSK
 <p>The screenshot shows an Agilent Spectrum Analyzer interface. The main display shows a spectrum from 30 MHz to 25.00 GHz. A sharp peak is labeled 'Mkr1' at 4.881 GHz with a power level of -47.040 dBm. The left panel displays various measurement parameters: Start Freq 30.000000 MHz, Ref Offset 2 dB, Ref 10.00 dBm, PNO: Fast, Trig: Free Run, #Atten: 20 dB, Avg Type: Log-Pwr, Avg Hold: 10/100, and SENSE: INT. The right panel shows configuration settings: Frequency (12.515000000 GHz), Auto Tune, Center Freq (12.515000000 GHz), Start Freq (30.000000 MHz), Stop Freq (25.000000000 GHz), CF Step (2.497000000 GHz, Auto), and Freq Offset (0 Hz). The bottom status bar indicates: Start 30 MHz, #Res BW 100 KHz, #VBW 300 KHz, Stop 25.00 GHz, Sweep 2.387 s (20000 pts), and STATUS.</p>		
 <p>The screenshot shows an Agilent Spectrum Analyzer interface. The main display shows a spectrum from 2.4765 GHz to 2.4835 GHz. A single peak is labeled 'Mkr1' at 2.479 846 GHz with a power level of -0.793 dBm. The left panel displays parameters: Center Freq 2.480000000 GHz, PNO: Wide, Trig: Free Run, #Atten: 20 dB, Avg Type: Log-Pwr, Avg Hold: &gt;100/100, and SENSE: INT. The right panel shows configuration settings: Frequency (2.479 846 GHz), Auto Tune, Center Freq (2.480000000 GHz), Start Freq (2.476500000 GHz), Stop Freq (2.483500000 GHz), CF Step (700.000 kHz, Auto), and Freq Offset (0 Hz). The bottom status bar indicates: Center 2.480000 GHz, #Res BW 100 KHz, #VBW 300 KHz, Span 7.000 MHz, Sweep 1.000 ms (1001 pts), and STATUS.</p>		

Test Model	Conducted Spurious RF Conducted Emission		
	Bluetooth V2.1+EDR		GFSK
	Channel 78: 2480MHz		
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Start Freq 30.000000 MHz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 4.959 3 GHz -42.895 dBm</p> <p>Start 30 MHz #Res BW 100 kHz #VBW 300 KHz Stop 25.00 GHz Sweep 2.387 s (20000 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 12.515000000 GHz</p> <p>Start Freq 30.000000 MHz</p> <p>Stop Freq 25.000000000 GHz</p> <p>CF Step 2.497000000 GHz Man</p> <p>Freq Offset 0 Hz</p>			
Band-edge Conducted Emissions			GFSK
Test Model	Bluetooth V2.1+EDR		GFSK
 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Start Freq 2.478000000 GHz</p> <p>Ref Offset 2 dB Ref 10.00 dBm</p> <p>10 dB/div Log</p> <p>Mkr1 2.483 500 0 GHz -63.638 dBm</p> <p>Start 2.47800 GHz #Res BW 100 kHz #VBW 300 KHz Stop 2.50000 GHz Sweep 2.667 ms (20000 pts)</p> <p>MSG STATUS</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.489000000 GHz</p> <p>Start Freq 2.478000000 GHz</p> <p>Stop Freq 2.500000000 GHz</p> <p>CF Step 2.200000 MHz Man</p> <p>Freq Offset 0 Hz</p>			

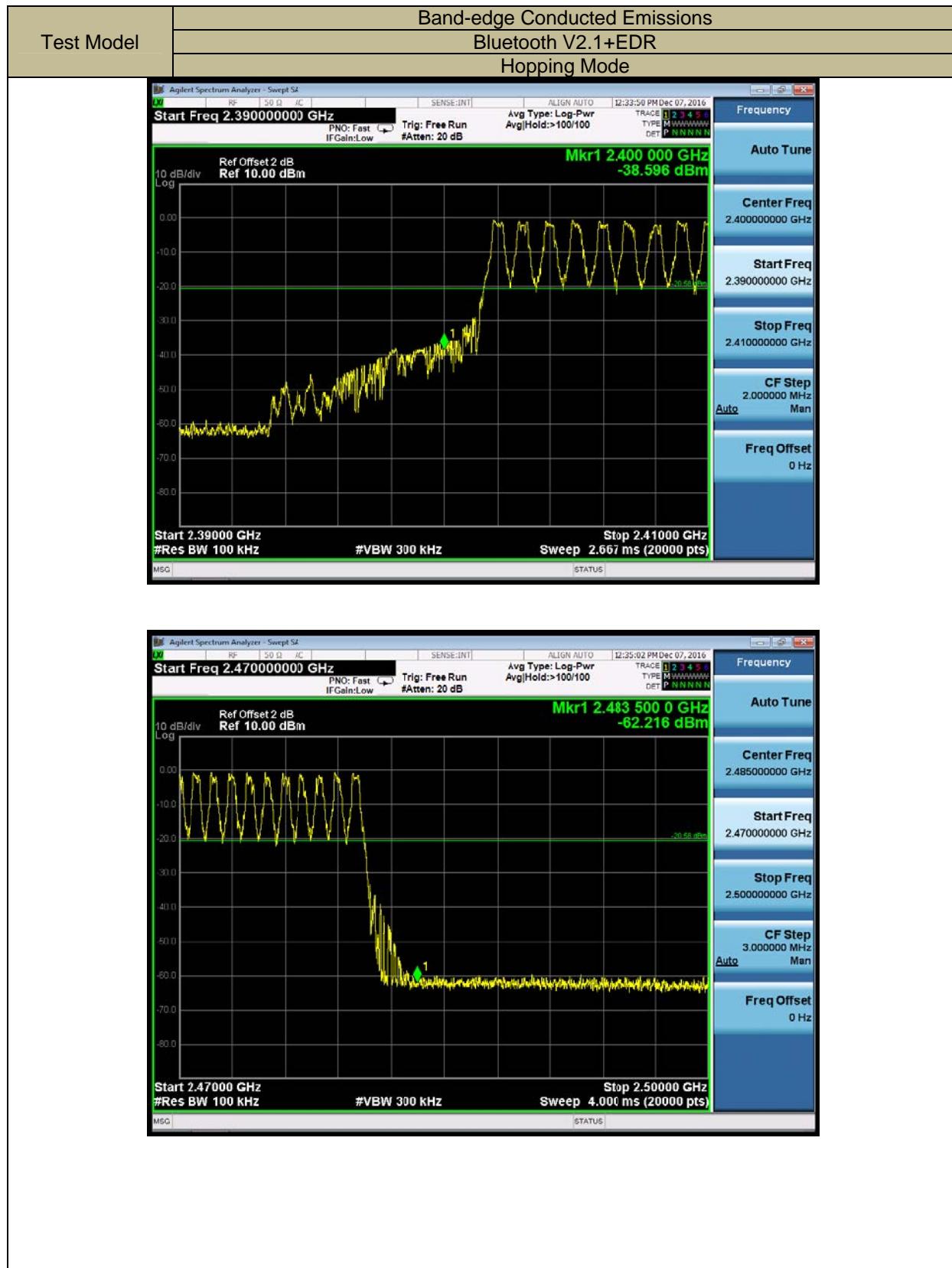
Test Model	Maximum Conducted Level RBW=100kHz		
	Bluetooth V2.1+EDR		
	Channel 0: 2402MHz	pi/4-DQPSK	
 <p>The screenshot shows an Agilent Spectrum Analyzer interface. The main window displays a spectrum plot with a single peak labeled 'Mkr1' at 2.401853 GHz with a power level of -2.498 dBm. The plot has a logarithmic scale from -80.0 to 0.0 dB. The center frequency is set to 2.402000000 GHz, and the span is 7.000 MHz. The configuration panel on the right shows the following parameters:</p> <ul style="list-style-type: none"> <li>Frequency: Auto Tune</li> <li>Center Freq: 2.402000000 GHz</li> <li>Start Freq: 2.398600000 GHz</li> <li>Stop Freq: 2.405500000 GHz</li> <li>CF Step: 700.000 kHz</li> <li>Freq Offset: 0 Hz</li> </ul>			
Test Model	Conducted Spurious RF Conducted Emission	Bluetooth V2.1+EDR	
	Channel 0: 2402MHz	pi/4-DQPSK	
 <p>The screenshot shows an Agilent Spectrum Analyzer interface. The main window displays a spectrum plot with a peak labeled 'Mkr1' at 4.8033 GHz with a power level of -46.200 dBm. The plot has a logarithmic scale from -80.0 to 0.0 dB. The center frequency is set to 12.515000000 GHz, and the span is 25.000 GHz. The configuration panel on the right shows the following parameters:</p> <ul style="list-style-type: none"> <li>Frequency: Auto Tune</li> <li>Center Freq: 12.515000000 GHz</li> <li>Start Freq: 30.0000000 MHz</li> <li>Stop Freq: 25.000000000 GHz</li> <li>CF Step: 2.497000000 GHz</li> <li>Freq Offset: 0 Hz</li> </ul>			







Test Model	Maximum Conducted Level RBW=100kHz			
	Bluetooth V2.1+EDR			
	Hopping Mode			
 <p>The screenshot shows a spectrum analysis plot with the following parameters:</p> <ul style="list-style-type: none"> <li><b>Start Freq:</b> 2.40000000 GHz</li> <li><b>Stop Freq:</b> 2.48350000 GHz</li> <li><b>CF Step:</b> 8.350000 MHz</li> <li><b>Freq Offset:</b> 0 Hz</li> <li><b>VBW:</b> 300 kHz</li> <li><b>Sweep Time:</b> 8.000 ms (20000 pts)</li> <li><b>Marker 1:</b> Mkr1 2.460 845 GHz, -0.581 dBm</li> </ul>				
<p>Conducted Spurious RF Conducted Emission</p> <p>Bluetooth V2.1+EDR</p> <p>Hopping Mode</p>				
 <p>The screenshot shows a spectrum analysis plot with the following parameters:</p> <ul style="list-style-type: none"> <li><b>Start Freq:</b> 30.000000 MHz</li> <li><b>Stop Freq:</b> 25.000000000 GHz</li> <li><b>CF Step:</b> 2.49700000 GHz</li> <li><b>Freq Offset:</b> 0 Hz</li> <li><b>VBW:</b> 300 kHz</li> <li><b>Sweep Time:</b> 2.387 s (20000 pts)</li> <li><b>Marker 1:</b> Mkr1 4.933 1 GHz, -45.934 dBm</li> </ul>				



## 9.7 RADIATED SPURIOUS EMISSION

### 9.7.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and DA 00-705

### 9.7.2 Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).  
 According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.205,the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength ( $\mu$ V/m)	Field Strength (dB $\mu$ V/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log ( $\mu$ V/m)	300
0.490-1.705	2400/F(KHz)	20 log ( $\mu$ V/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

### 9.7.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

### 9.7.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz(1GHz to 25GHz), 100 kHz for  $f < 1$  GHz(30MHz to 1GHz)

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.10-2013 respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from  $20\log(\text{dwell time}/100 \text{ ms})$ , in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

### 9.7.5 Test Results

#### ■ Spurious Emission below 30MHz(9KHz to 30MHz)

Temperature:	24°C	Test Date:	December 08, 2016
Humidity:	53 %	Test By:	KK
Test mode:	TX Mode		

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

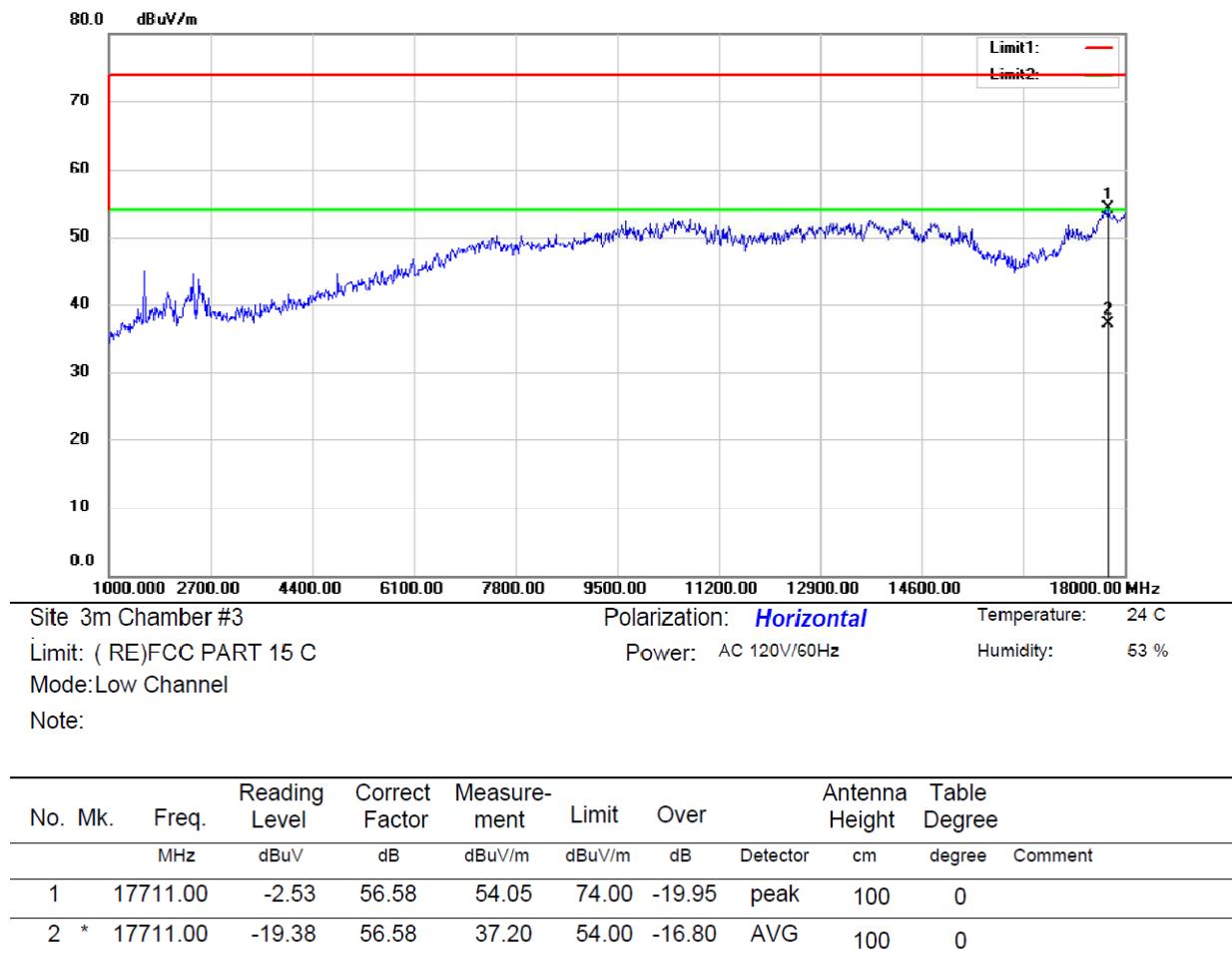
Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor = $40\log(\text{Specific distance}/\text{test distance})(\text{ dB})$ ;

Limit line=Specific limits(dBuV) + distance extrapolation factor

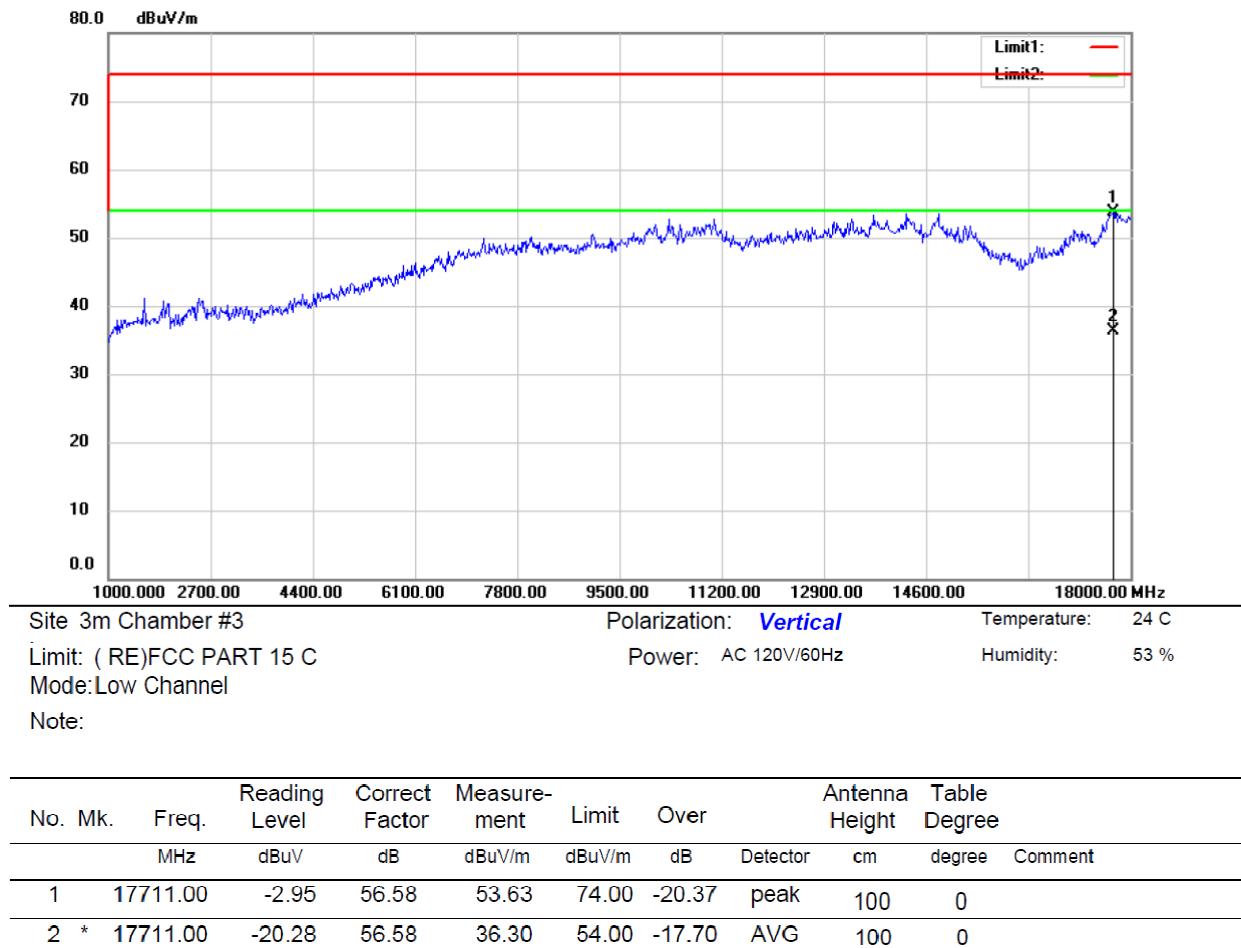
#### ■ Spurious Emission Above 1GHz(1GHz to 25GHz)

Bluetooth (GFSK, pi/4-DQPSK) mode have been tested, and the worst result(GFSK)was report as below:



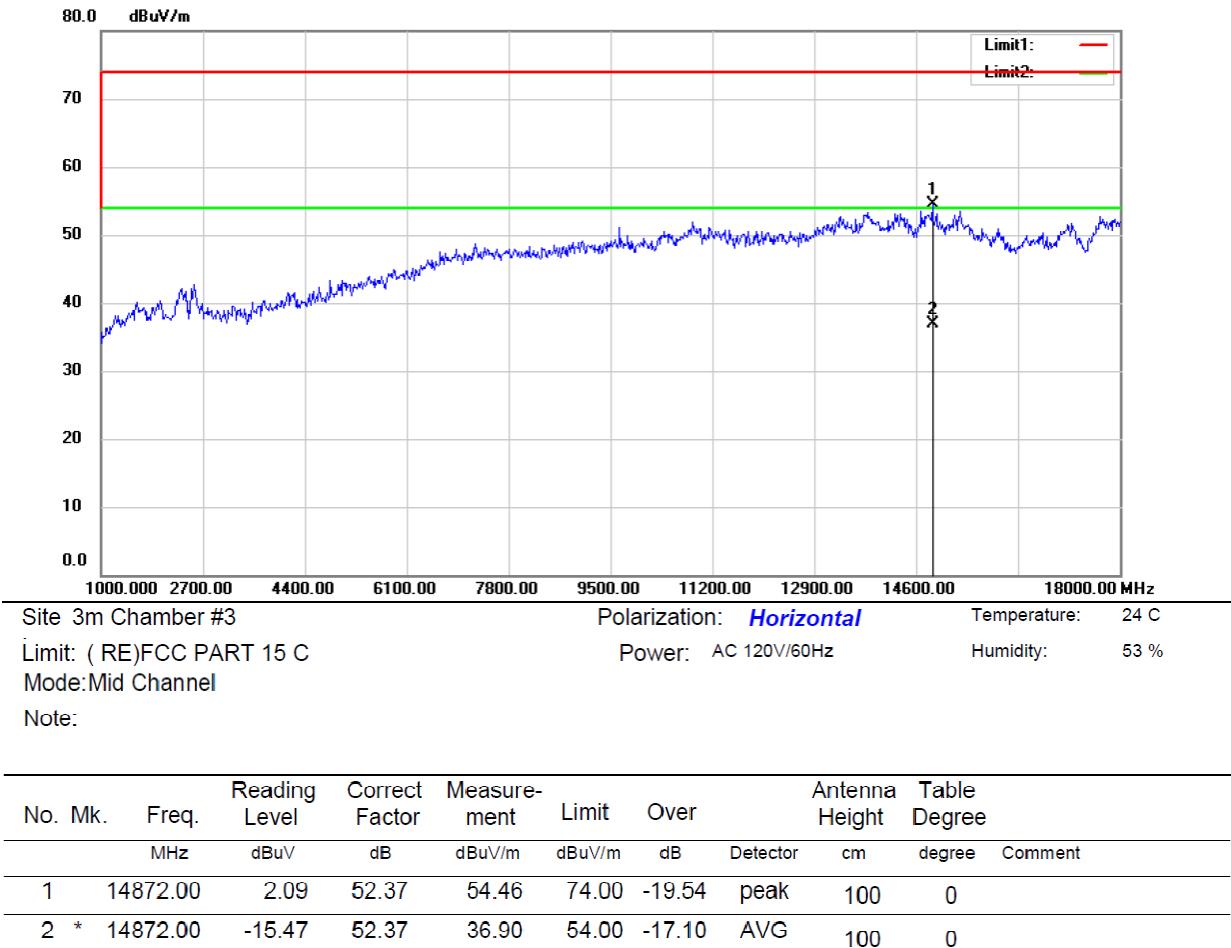
\*:Maximum data    x:Over limit    !:over margin

Operator: CSL



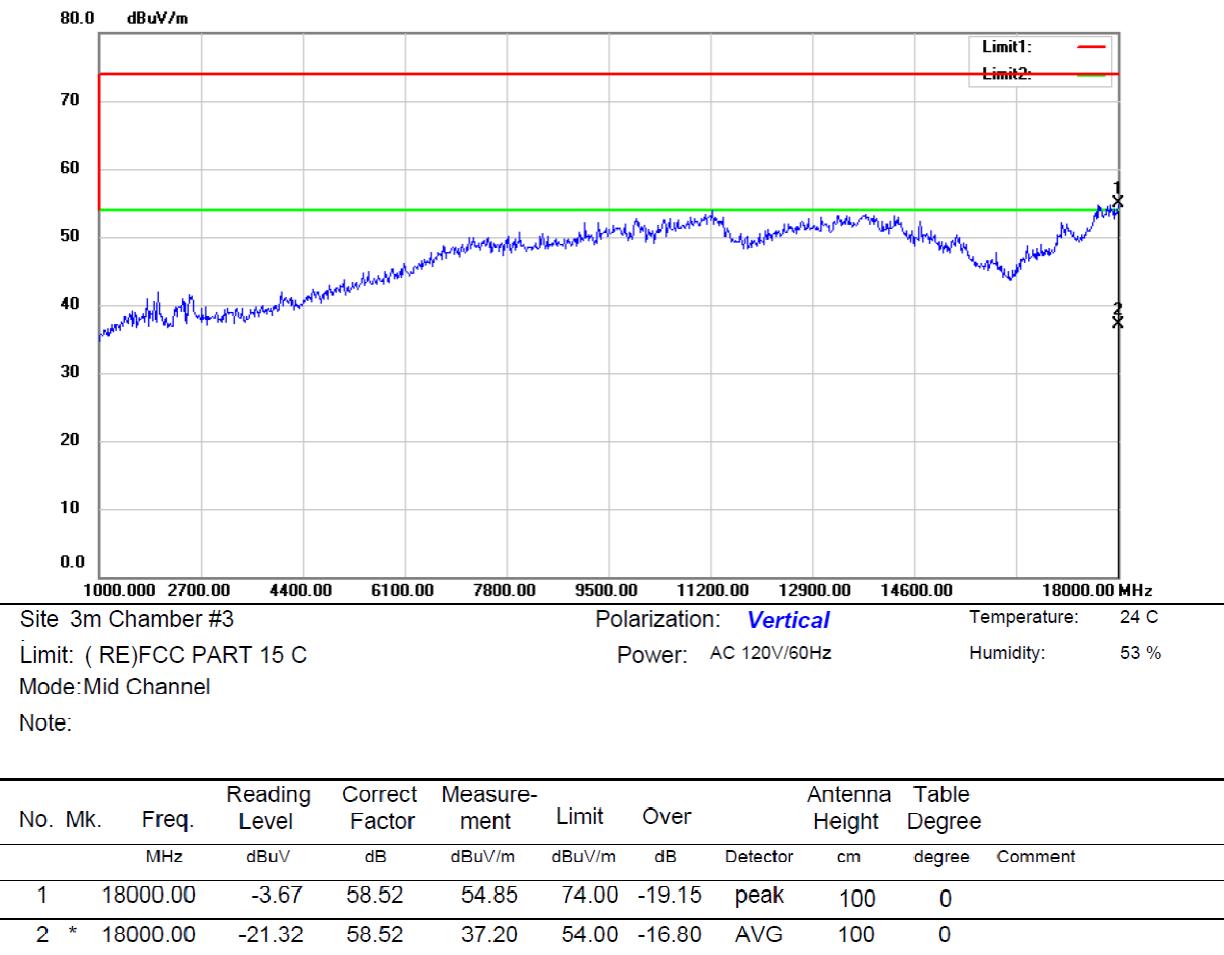
\*:Maximum data    x:Over limit    !:over margin

Operator: CSL



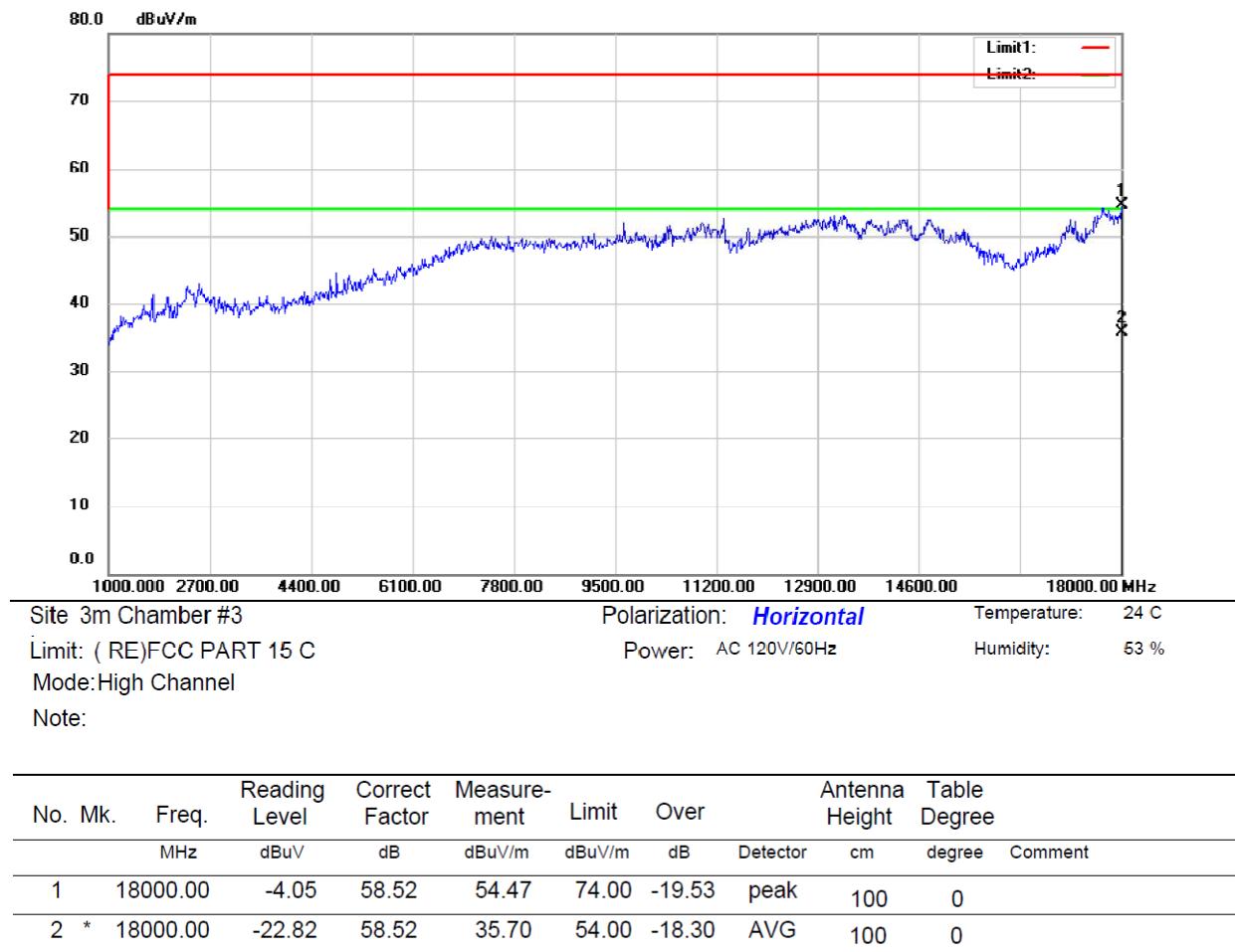
\*:Maximum data    x:Over limit    !:over margin

Operator: CSL



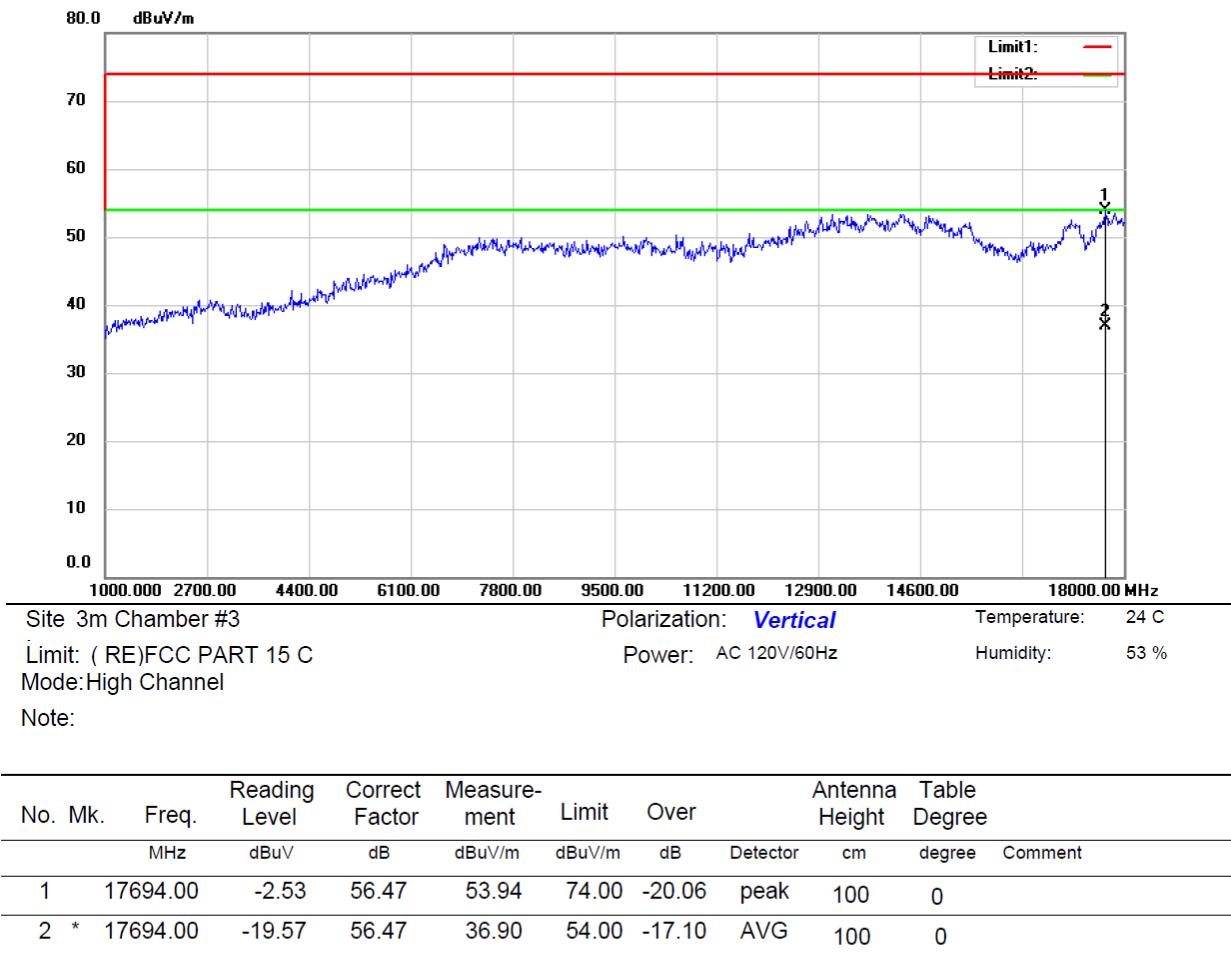
\*:Maximum data    x:Over limit    !:over margin

Operator: CSL



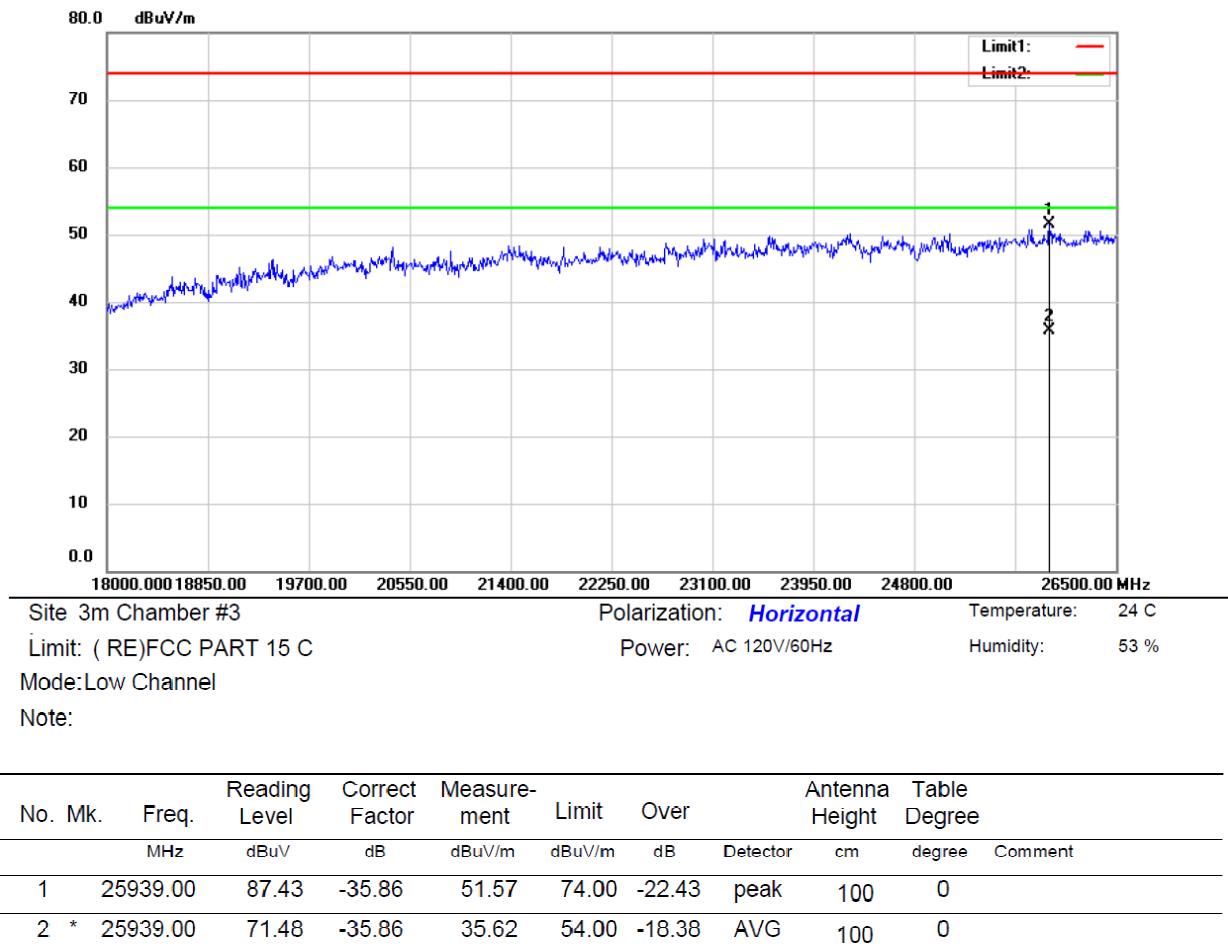
\*:Maximum data    x:Over limit    !:over margin

Operator: CSL



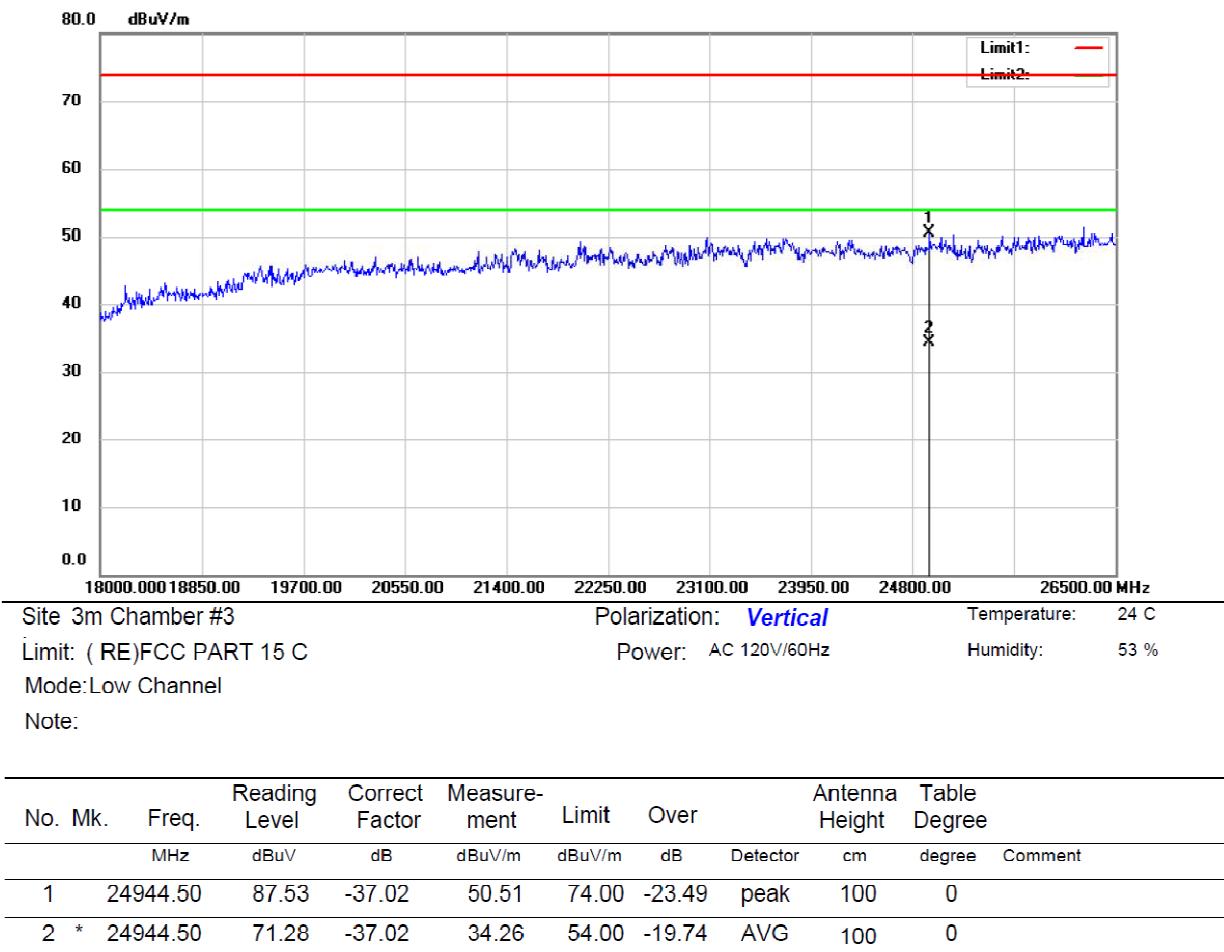
\*:Maximum data    x:Over limit    !:over margin

Operator: CSL



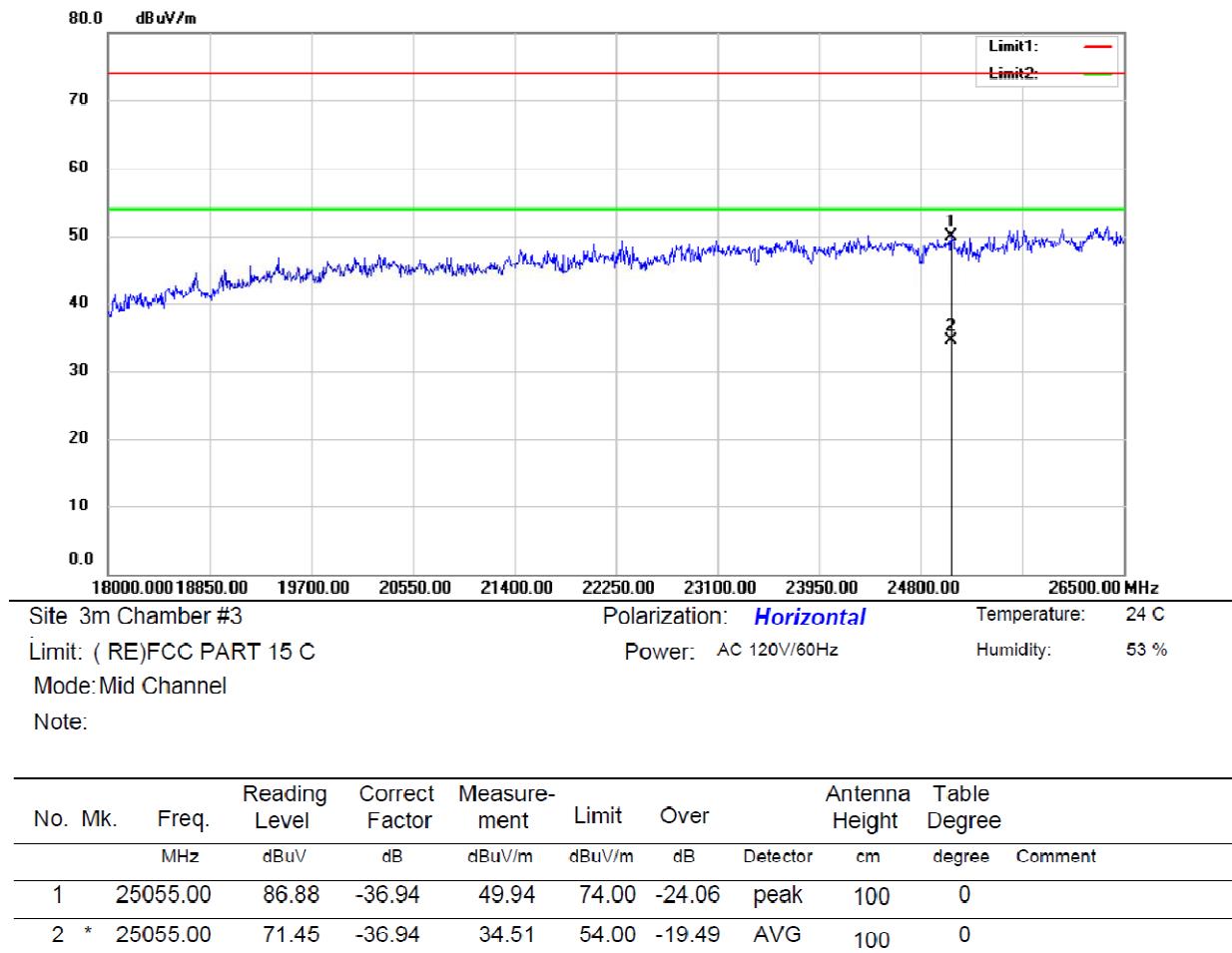
\*:Maximum data    x:Over limit    !:over margin

Operator: KK



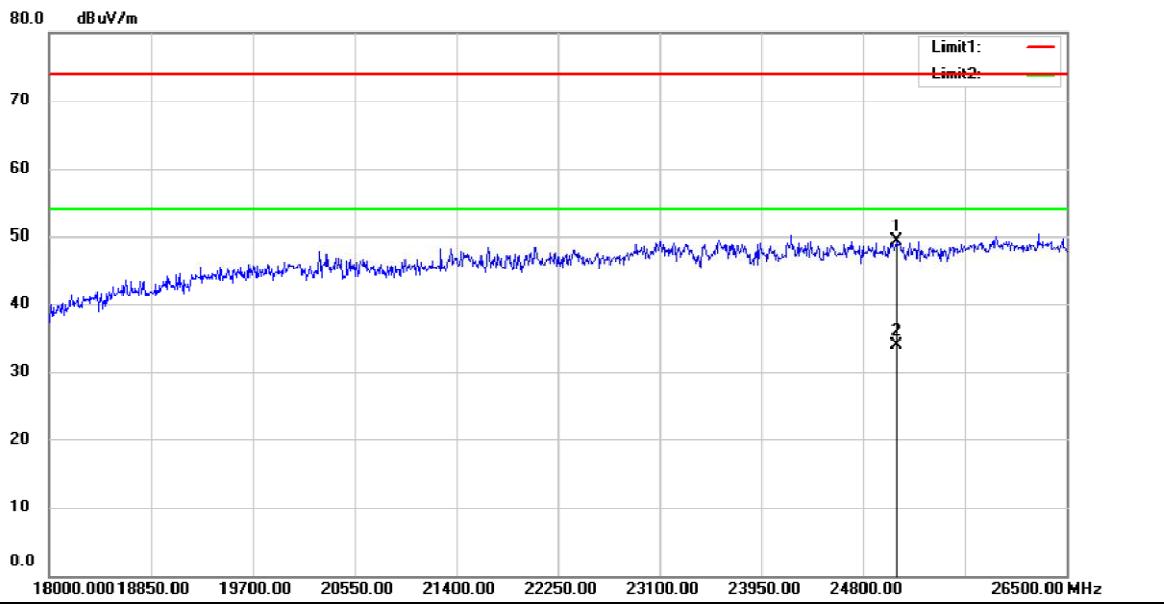
\*:Maximum data    x:Over limit    !:over margin

Operator: KK



\*:Maximum data    x:Over limit    !:over margin

Operator: KK



Site 3m Chamber #3

Polarization: **Vertical**

Temperature: 24 C

Limit: ( RE)FCC PART 15 C

Power: AC 120V/60Hz

Humidity: 53 %

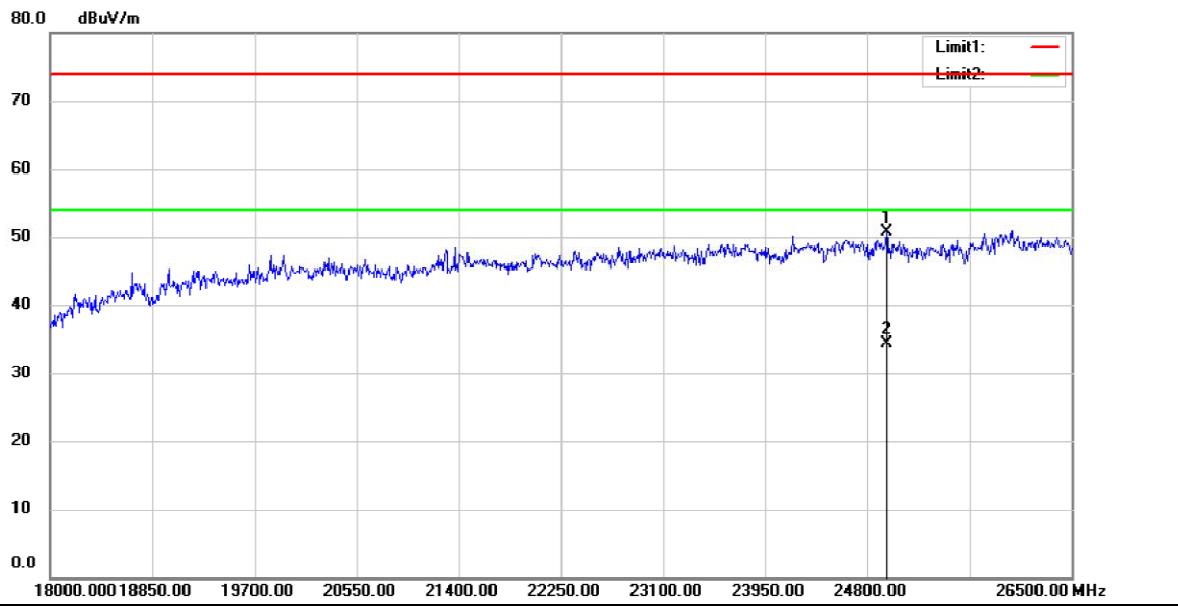
Mode: Mid Channel

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB	Over Detector	Antenna Height cm	Table Degree	Comment
1		25072.00	86.32	-36.92	49.40	74.00	-24.60	peak	100	0
2	*	25072.00	70.87	-36.92	33.95	54.00	-20.05	AVG	100	0

\*:Maximum data    x:Over limit    !:over margin

Operator: KK



Site 3m Chamber #3

Polarization: **Horizontal**

Temperature: 24 C

Limit: ( RE)FCC PART 15 C

Power: AC 120V/60Hz

Humidity: 53 %

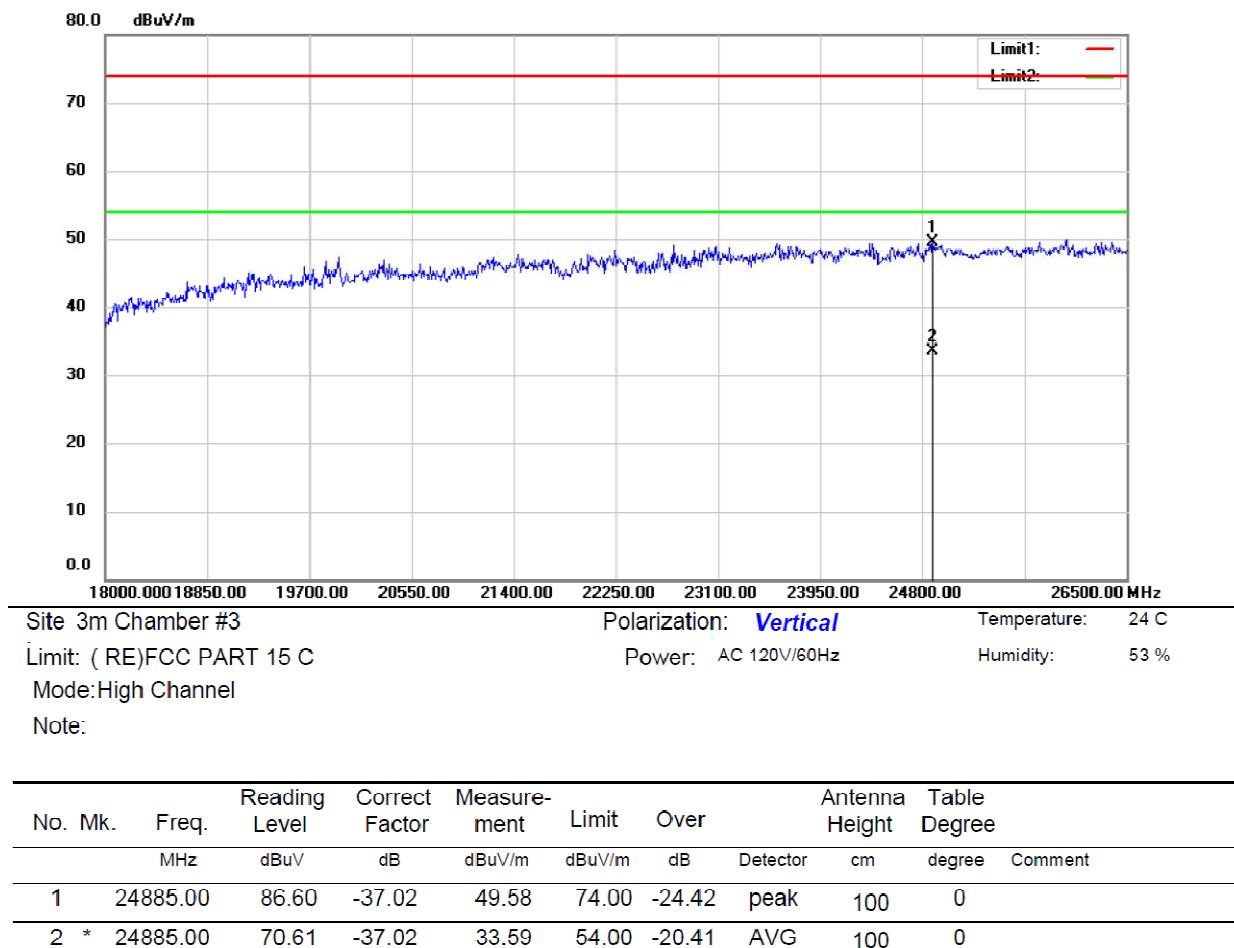
Mode: High Channel

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB	Over Detector	Antenna Height cm	Table Degree	Comment
1		24961.50	87.66	-37.01	50.65	74.00	-23.35	peak	100	0
2	*	24961.50	71.27	-37.01	34.26	54.00	-19.74	AVG	100	0

\*:Maximum data    x:Over limit    !:over margin

Operator: KK



\*:Maximum data    x:Over limit    !:over margin

Operator: KK

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

Bluetooth (GFSK, pi/4-DQPSK, Hopping) mode have been tested, and the worst result(GFSK, Hopping) was report as below:

Temperature:	24°C	Test Date:	December 08, 2016
Humidity:	53 %	Test By:	KK
Test mode:	GFSK	Frequency:	Channel 0: 2402MHz

Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)
2352.960	H	38.56	74	-35.44	27.50	54	-26.50
2352.000	V	38.48	74	-35.52	26.40	54	-27.60

Temperature:	24°C	Test Date:	December 08, 2016
Humidity:	53 %	Test By:	KK
Test mode:	GFSK	Frequency:	Channel 78: 2480MHz

Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)
2494.010	H	39.07	74	-34.93	28.10	54	-25.90
2494.209	V	38.29	74	-35.71	27.60	54	-26.40

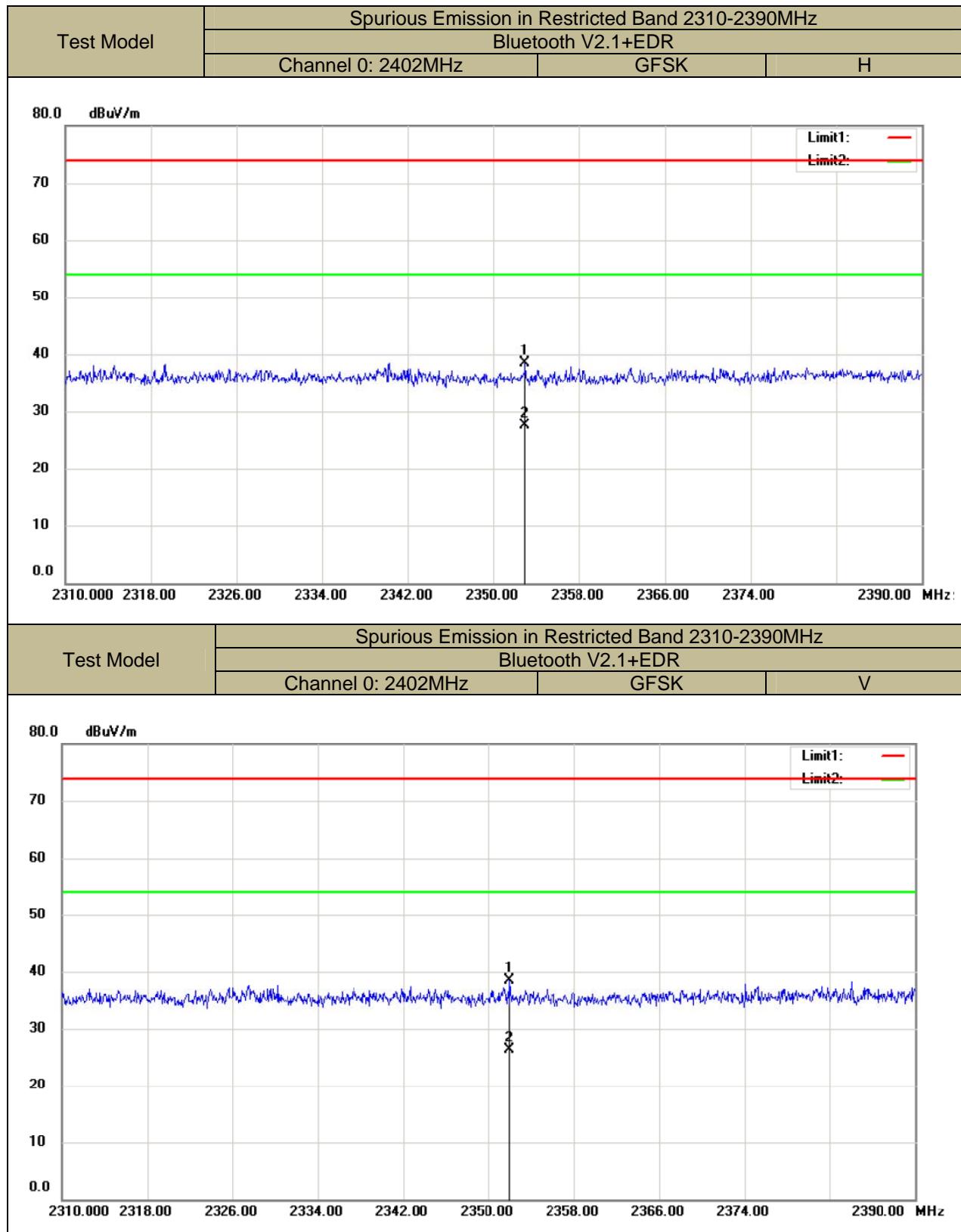
Temperature:	24°C	Test Date:	December 08, 2016
Humidity:	53 %	Test By:	KK
Test mode:	GFSK	Frequency:	Hopping

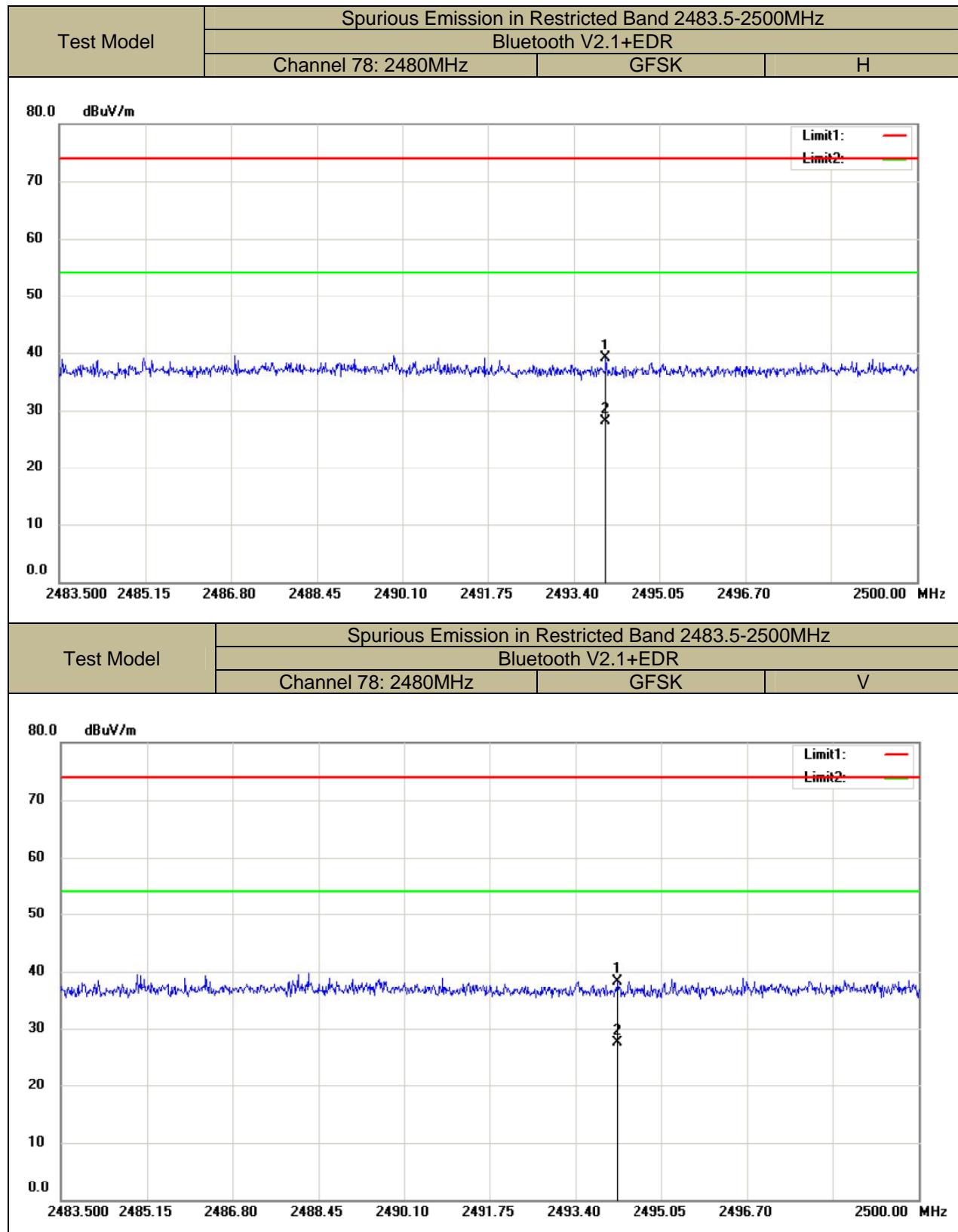
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)
2400.00	H	51.18	74	-22.82	34.60	54	-19.40
2483.50	H	44.25	74	-29.75	30.30	54	-23.70
2400.00	V	57.01	74	-16.99	41.50	54	-12.50
2483.50	V	42.15	74	-31.85	27.10	54	-26.90

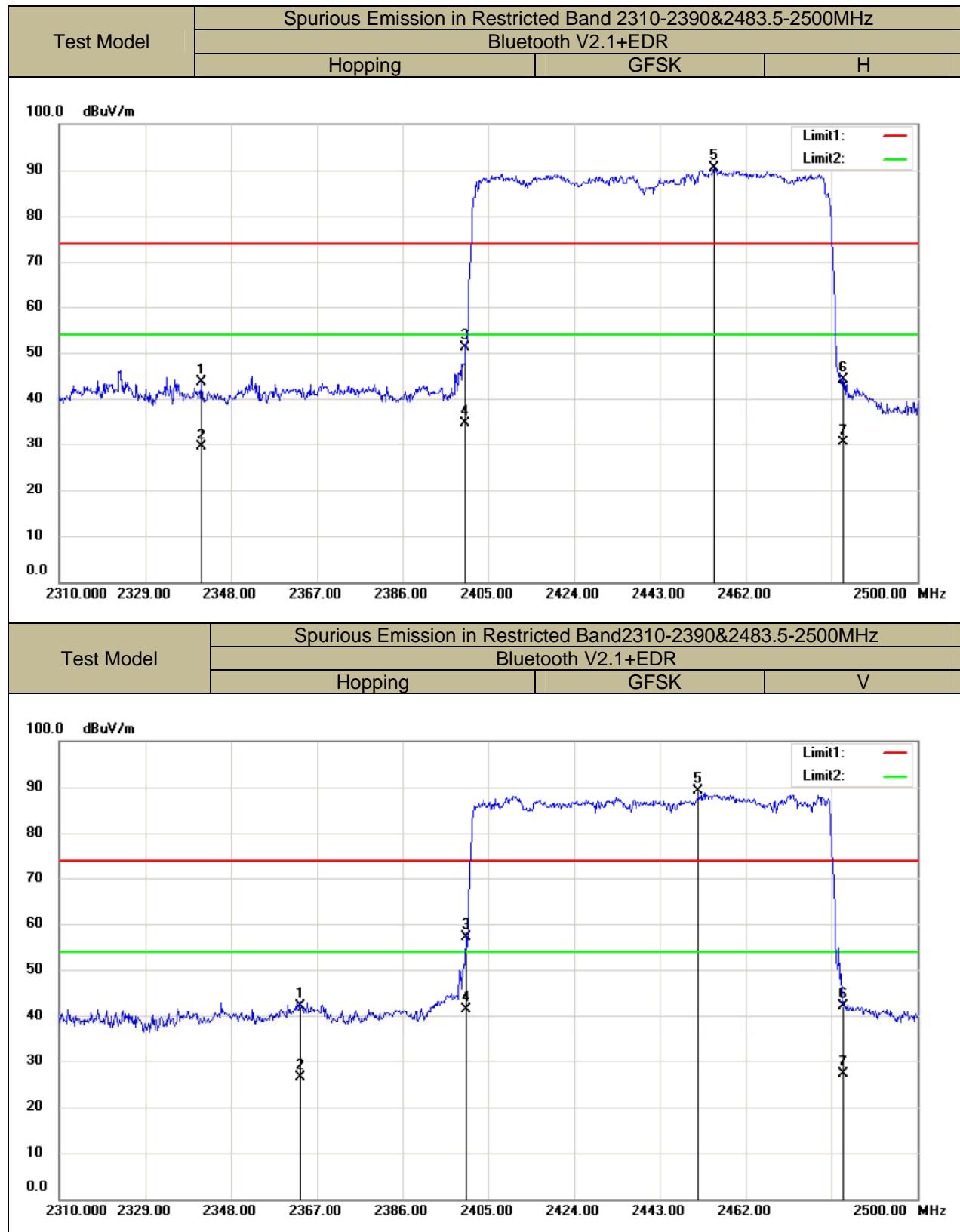
**Note:** (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).

(2) Emission Level= Reading Level+Probe Factor +Cable Loss.

(3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

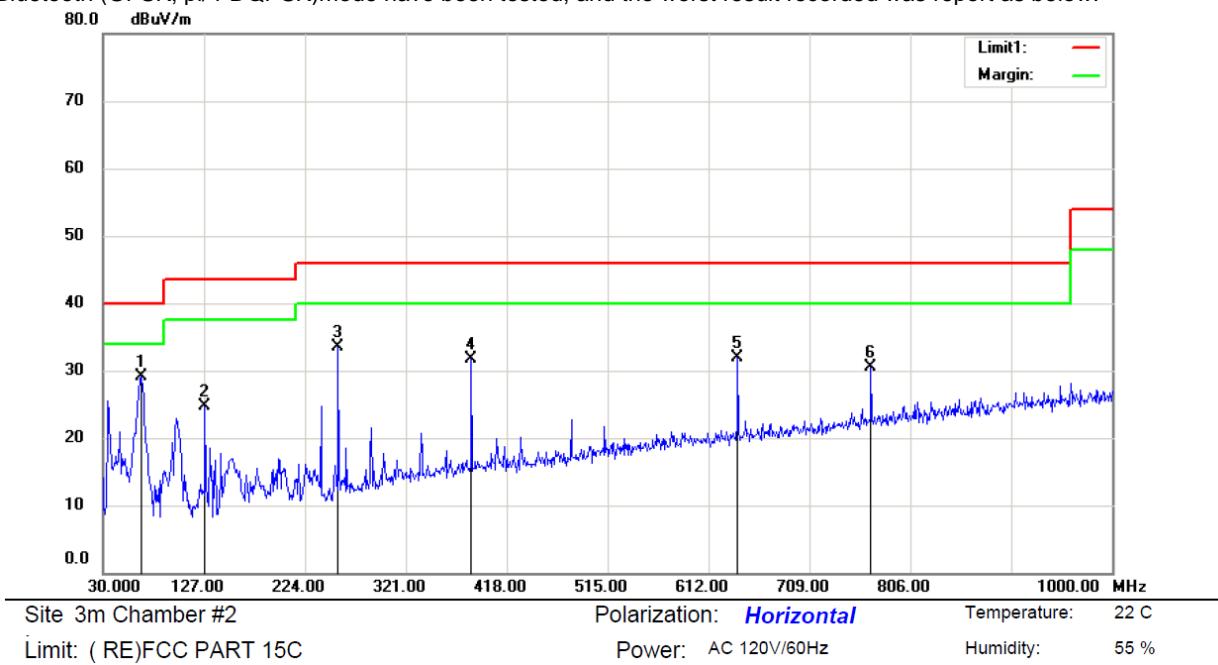






■ Spurious Emission below 1GHz(30MHz to 1GHz)

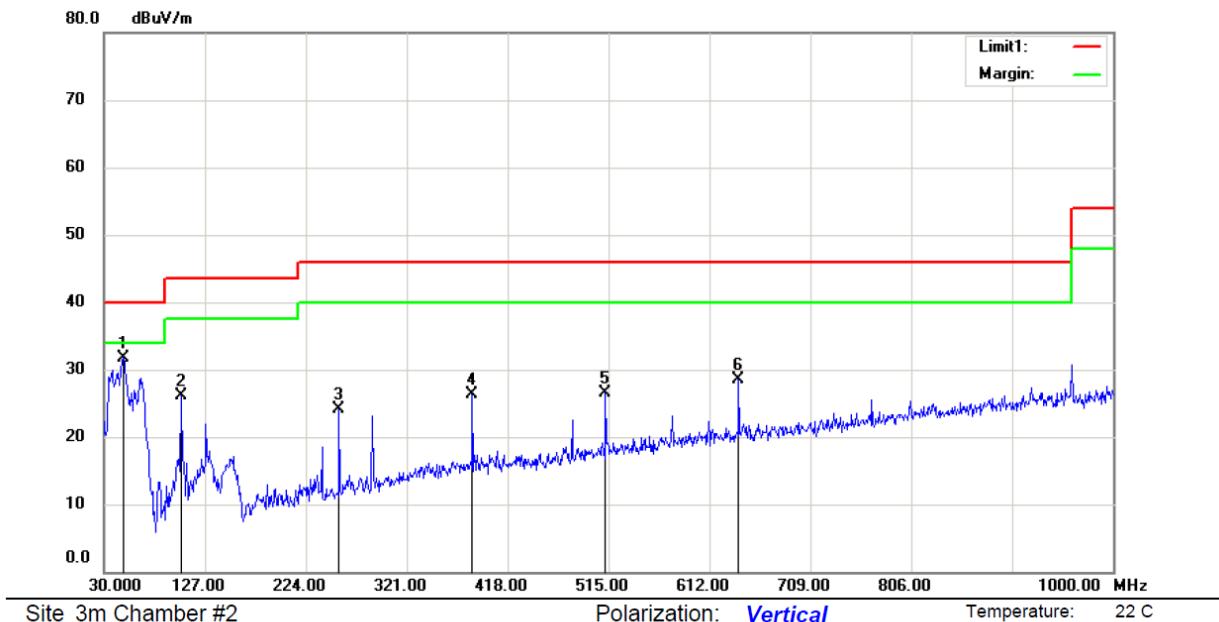
Bluetooth (GFSK, pi/4-DQPSK) mode have been tested, and the worst result recorded was report as below:



No.	Mk.	Freq. MHz	Reading	Correct	Measure-	Limit	Over	Antenna Height cm	Table Degree
			Level dBuV	Factor dB	ment dBuV/m				
1	*	66.8600	45.61	-16.60	29.01	40.00	-10.99	QP	
2		127.9700	42.80	-18.16	24.64	43.50	-18.86	QP	
3		256.0100	46.84	-13.34	33.50	46.00	-12.50	QP	
4		384.0500	41.21	-9.44	31.77	46.00	-14.23	QP	
5		640.1300	36.48	-4.64	31.84	46.00	-14.16	QP	
6		768.1700	32.93	-2.52	30.41	46.00	-15.59	QP	

\*:Maximum data    x:Over limit    !:over margin

Operator:



Site 3m Chamber #2

Polarization: *Vertical*

Temperature: 22 C

Limit: ( RE)FCC PART 15C

Power: AC 120V/60Hz

Humidity: 55 %

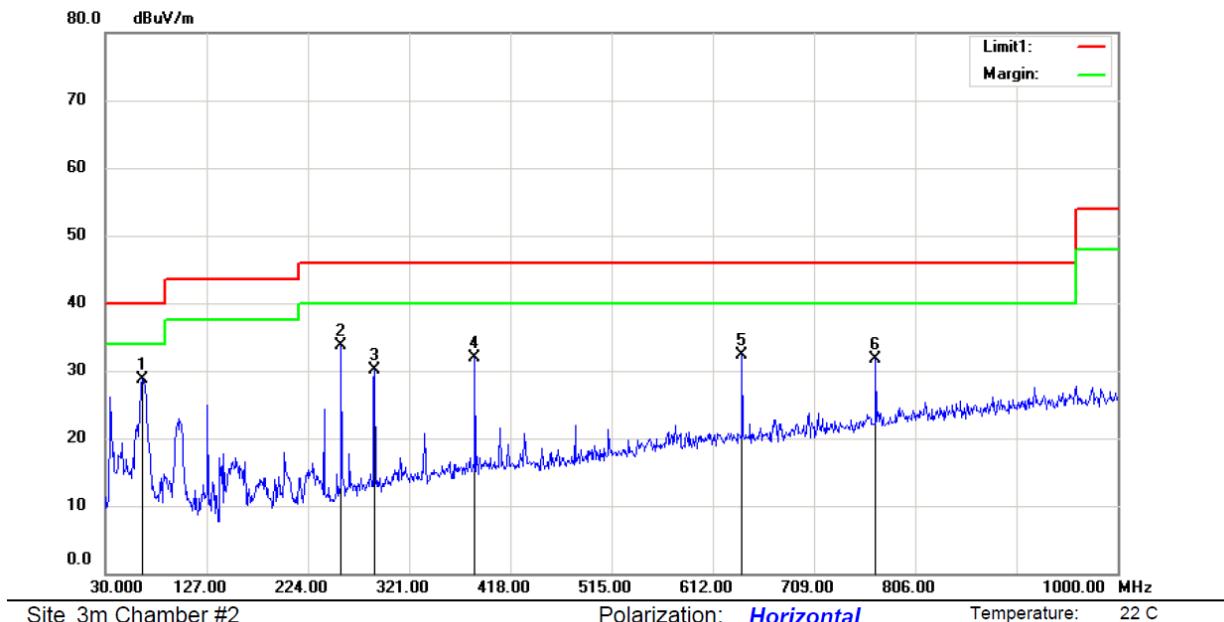
Mode:TX(LOW CHANNEL)

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table		
			Level	Factor	ment				Height	Degree	
			MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1	*	48.4300	45.14	-13.44	31.70	40.00	-8.30	QP			
2		103.7200	41.31	-15.15	26.16	43.50	-17.34	QP			
3		256.0100	37.47	-13.34	24.13	46.00	-21.87	QP			
4		384.0500	35.65	-9.44	26.21	46.00	-19.79	QP			
5		512.0900	33.75	-7.22	26.53	46.00	-19.47	QP			
6		640.1300	33.16	-4.64	28.52	46.00	-17.48	QP			

\*:Maximum data    x:Over limit    !:over margin

Operator:



Site 3m Chamber #2

Polarization: **Horizontal**

Temperature: 22 C

Limit: ( RE)FCC PART 15C

Power: AC 120V/60Hz

Humidity: 55 %

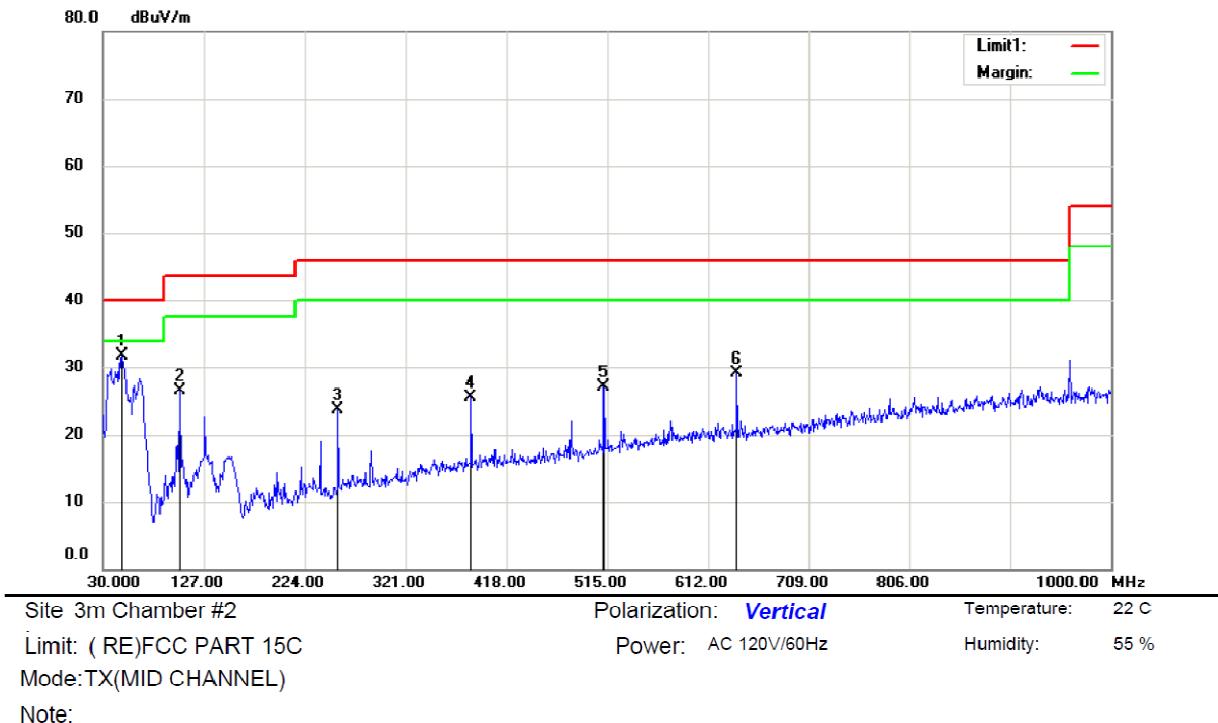
Mode:TX(MID CHANNEL)

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm		Table Degree
								Detector	Comment	
1	*	65.8900	44.92	-16.28	28.64	40.00	-11.36	QP		
2		256.0100	47.01	-13.34	33.67	46.00	-12.33	QP		
3		288.0200	42.31	-12.22	30.09	46.00	-15.91	QP		
4		384.0500	41.37	-9.44	31.93	46.00	-14.07	QP		
5		640.1300	37.00	-4.64	32.36	46.00	-13.64	QP		
6		768.1700	34.27	-2.52	31.75	46.00	-14.25	QP		

\*:Maximum data    x:Over limit    !:over margin

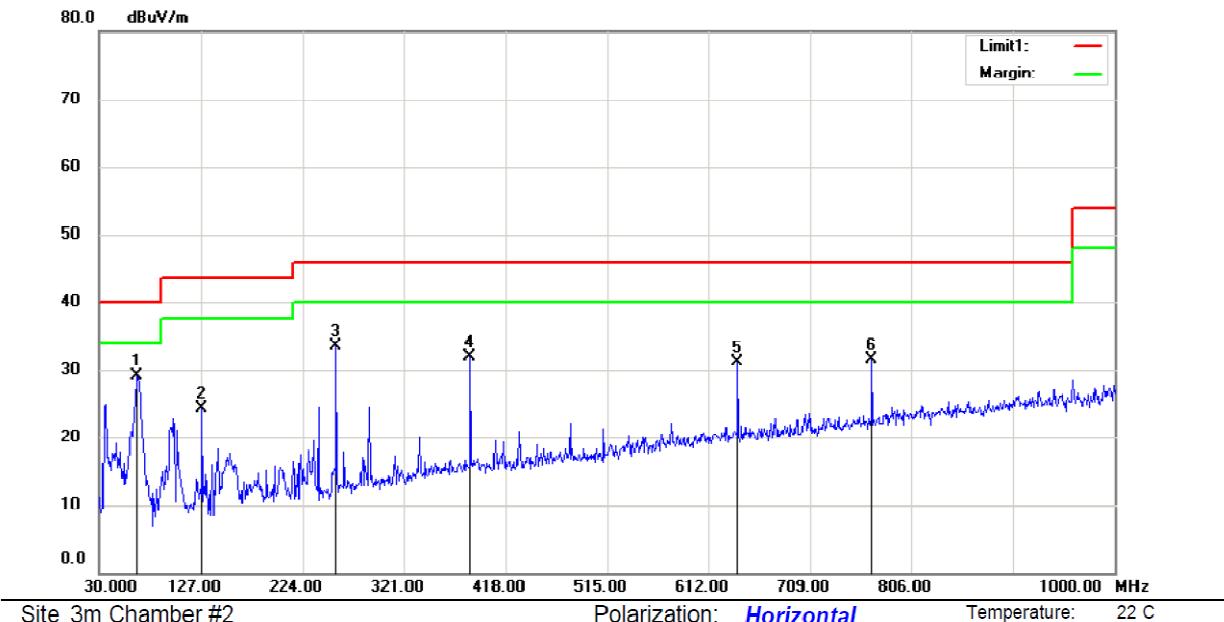
Operator:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1	*	48.4300	45.10	-13.44	31.66	40.00	-8.34	QP		
2		103.7200	41.59	-15.15	26.44	43.50	-17.06	QP		
3		256.0100	36.97	-13.34	23.63	46.00	-22.37	QP		
4		384.0500	34.97	-9.44	25.53	46.00	-20.47	QP		
5		512.0900	34.39	-7.22	27.17	46.00	-18.83	QP		
6		640.1300	33.70	-4.64	29.06	46.00	-16.94	QP		

\*:Maximum data    x:Over limit    !:over margin

Operator:



Site 3m Chamber #2

Polarization: **Horizontal**

Temperature: 22 C

Limit: (RE)FCC PART 15C

Power: AC 120V/60Hz

Humidity: 55 %

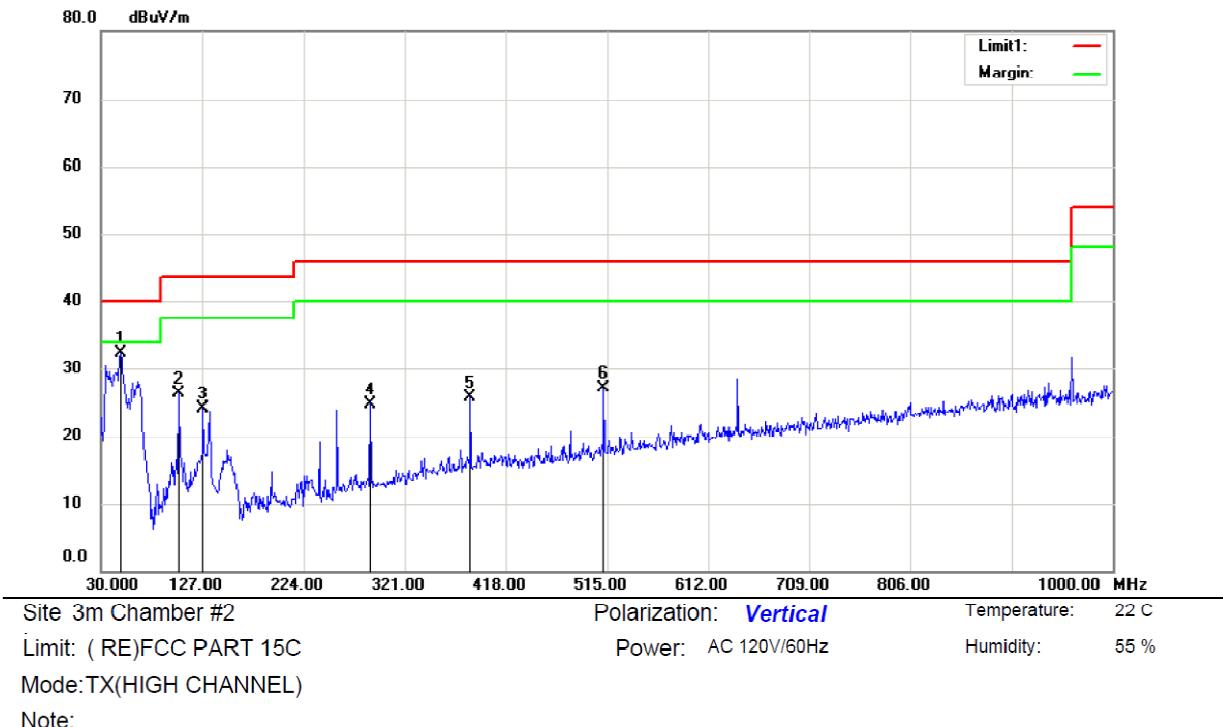
Mode:TX(HIGH CHANNEL)

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1	*	65.8900	45.48	-16.28	29.20	40.00	-10.80	QP			
2		127.9700	42.43	-18.16	24.27	43.50	-19.23	QP			
3		256.0100	46.83	-13.34	33.49	46.00	-12.51	QP			
4		384.0500	41.36	-9.44	31.92	46.00	-14.08	QP			
5		640.1300	35.82	-4.64	31.18	46.00	-14.82	QP			
6		768.1700	34.02	-2.52	31.50	46.00	-14.50	QP			

\*:Maximum data    x:Over limit    !:over margin

Operator:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1	*	48.4300	45.75	-13.44	32.31	40.00	-7.69	QP			
2		103.7200	41.47	-15.15	26.32	43.50	-17.18	QP			
3		127.9700	42.31	-18.16	24.15	43.50	-19.35	QP			
4		288.0200	37.02	-12.22	24.80	46.00	-21.20	QP			
5		384.0500	35.05	-9.44	25.61	46.00	-20.39	QP			
6		512.0900	34.27	-7.22	27.05	46.00	-18.95	QP			

\*:Maximum data    x:Over limit    !:over margin

Operator:

## 9.8 CONDUCTED EMISSION TEST

### 9.8.1 Applicable Standard

According to FCC Part 15.207(a)

### 9.8.2 Conformance Limit

Conducted Emission Limit		
Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies  
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 9.8.3 Test Configuration

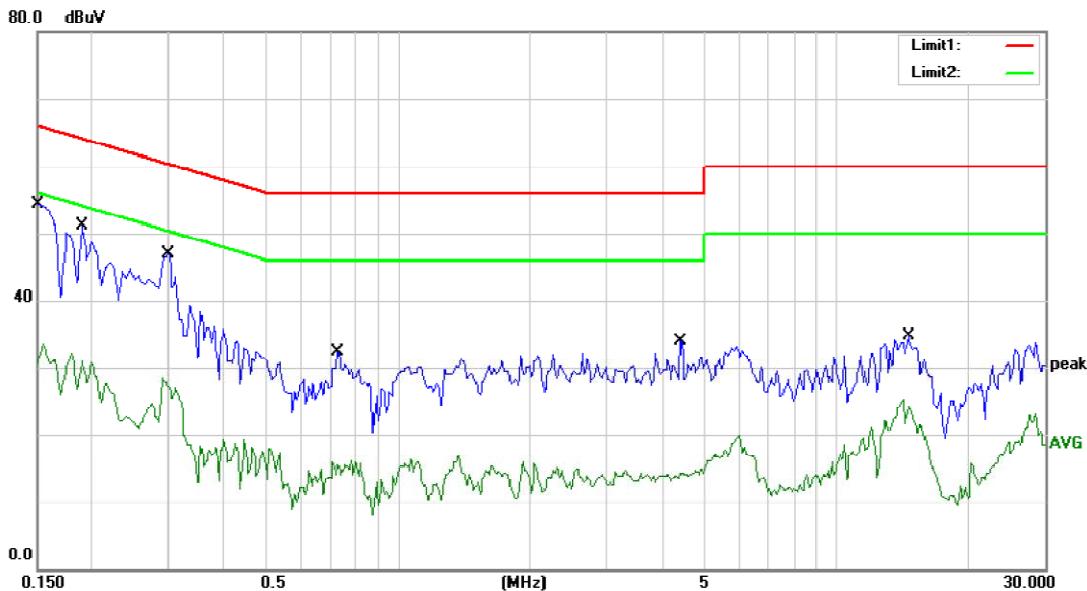
Test according to clause 7.3 conducted emission test setup

### 9.8.4 Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.  
Maximum procedure was performed on the highest emissions to ensure EUT compliance.  
Repeat above procedures until all frequency measured were complete.

### 9.8.5 Test Results

The 120V & 240V voltage have been tested, and the worst result recorded was report as below:



Site Conduction #1

Phase: **L1**

Temperature: 22

Limit: (CE)FCC PART 15C

Power: AC 120V/60Hz

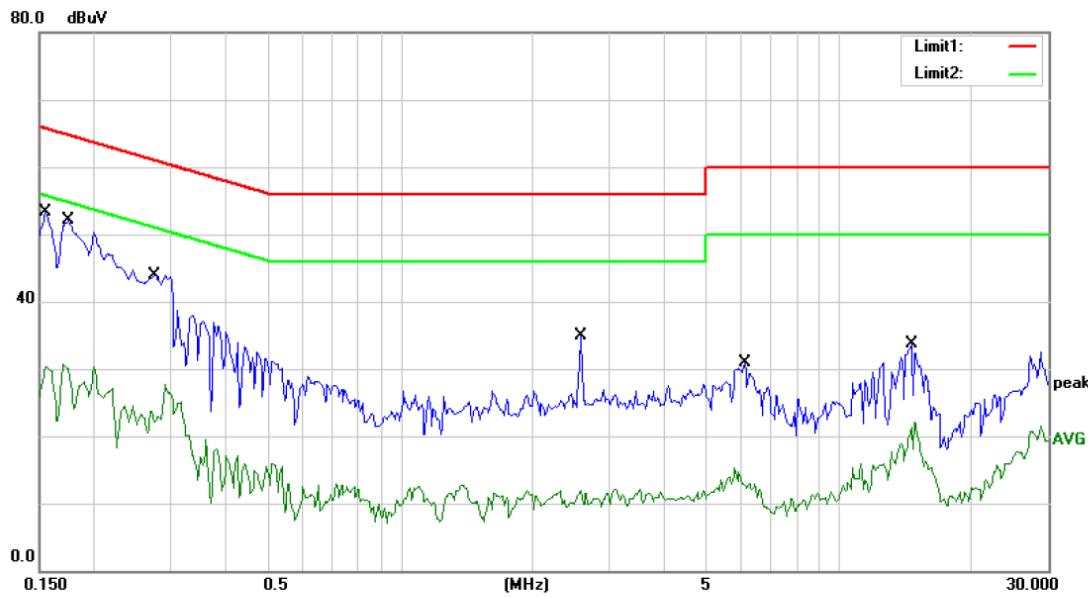
Humidity: 55 %

Mode: BT

Note:

No.	Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit	Over	Detector	Comment
			dBuV	dB	dBuV	dB			
1	*	0.1500	54.38	0.00	54.38	66.00	-11.62	QP	
2		0.1500	33.44	0.00	33.44	56.00	-22.56	AVG	
3		0.1900	51.12	0.00	51.12	64.04	-12.92	QP	
4		0.1900	32.13	0.00	32.13	54.04	-21.91	AVG	
5		0.3000	46.89	0.00	46.89	60.24	-13.35	QP	
6		0.3000	28.43	0.00	28.43	50.24	-21.81	AVG	
7		0.7300	32.33	0.00	32.33	56.00	-23.67	QP	
8		0.7300	15.86	0.00	15.86	46.00	-30.14	AVG	
9		4.4300	33.89	0.00	33.89	56.00	-22.11	QP	
10		4.4300	14.91	0.00	14.91	46.00	-31.09	AVG	
11		14.6500	34.79	0.00	34.79	60.00	-25.21	QP	
12		14.6500	25.30	0.00	25.30	50.00	-24.70	AVG	

\*:Maximum data    x:Over limit    !:over margin      Comment: Factor build in receiver.      Operator: WQG



Site Conduction #1

Phase: **N**

Temperature: 22

Limit: (CE)FCC PART 15C

Power: AC 120V/60Hz

Humidity: 55 %

Mode: BT

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dB			
1	*	0.1550	53.32	0.00	53.32	65.73	-12.41	QP	
2		0.1550	30.40	0.00	30.40	55.73	-25.33	AVG	
3		0.1750	52.01	0.00	52.01	64.72	-12.71	QP	
4		0.1750	30.65	0.00	30.65	54.72	-24.07	AVG	
5		0.2750	43.99	0.00	43.99	60.97	-16.98	QP	
6		0.2750	27.76	0.00	27.76	50.97	-23.21	AVG	
7		2.5750	34.83	0.00	34.83	56.00	-21.17	QP	
8		2.5750	11.98	0.00	11.98	46.00	-34.02	AVG	
9		6.0900	30.82	0.00	30.82	60.00	-29.18	QP	
10		6.0900	15.28	0.00	15.28	50.00	-34.72	AVG	
11		14.5171	33.18	0.00	33.18	60.00	-26.82	QP	
12		14.5171	22.05	0.00	22.05	50.00	-27.95	AVG	

\*:Maximum data

x:Over limit

!:over margin

Comment: Factor build in receiver.

Operator: WQG

## 9.9 ANTENNA APPLICATION

### 9.9.1 Antenna Requirement

Standard	Requirement
FCC CRF Part15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 9.9.2 Result

The EUT'S antenna is PCB antenna. The antenna's gain is 2.3dBi, and the antenna can't be replaced by the userwhich in accordance to section 15.203, please refer to the photos.