



# RF TEST REPORT

**Report No.:** SET2019-16008

**Product Name:** THE HAYMAKER headphones

**FCC ID:** 2AD8P- HM100

**IC:** 12709A-HM100

**Model No.:** HM100

**Applicant:** Dongguan Laccess Electronic Technology Co.,Ltd.

**Address:** No. 2 Xiangyang Road, Tian Xin Huaxing Industrial Area, Qiaotou town, Dongguan , China.

**Dates of Testing:** 12/01/2019 —12/05/2019

**Issued by:** CCIC Southern Testing Co., Ltd

**Lab Location:** Electronic Testing Building, No. 43 Shahe Road Xili Street, Nanshan District, Shenzhen, Guangdong 518055, China

**Tel:** 86 755 26627338    **Fax:** 86 755 26627238

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## Test Report

**Product Name** ..... THE HAYMAKER headphones

**Brand Name** ..... HAYMAKER

**Trade Name** ..... HAYMAKER

**Applicant** ..... Dongguan Laccess Electronic Technology Co.,Ltd.

**Applicant Address** ..... No. 2 Xiangyang Road, Tian Xin Huaxing Industrial Area,  
Qiaotou town, Dongguan , China

**Manufacturer** ..... Dongguan Laccess Electronic Technology Co.,Ltd..

**Manufacturer Address** ..... No. 2 Xiangyang Road, Tian Xin Huaxing Industrial Area,  
Qiaotou town, Dongguan , China

**Test Standards** ..... 47 CFR Part 15 Subpart C:  
IC RSS-Gen (Issue 5, March 2019)  
IC RSS-247 (Issue 2, Feb. 2017)

**Test Result** ..... PASS

**Tested by** ..... *Vincent*

2019.12.10

\_\_\_\_\_  
Vincent, Test Engineer

**Reviewed by** .....

*Chris You*

2019.12.10

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Chris You, Senior Engineer

**Approved by** .....

*Shuangwen Zhang*

2019.12.10

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Shuangwen Zhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2019.12.10	First edition

## 1. General Information

### 1.1. EUT Description

EUT Type	THE HAYMAKER headphones	
Frequency Range	Bluetooth EDR	2402MHz~2480MHz
Channel Number	Bluetooth EDR	79
Bit Rate of Transmitter	Bluetooth EDR	1/2/3Mbps
Modulation Type	Bluetooth EDR	GFSK,PI/4DQPSK,8DPSK
HW	V1.1	
SW	V2.30	
Antenna Type	Internal	
Antenna Gain	4dBi	

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 2: a. When power on, the EUT will scan the whole frequency until a Connection command from the other BT devices.

b. When receiving the signal from the other BT devices, The EUT transmit are sponse signal.

c. The other devices receive the response signal and recognize it, then send a connection command to establish the connection.

d. After the connection establish successfully, the data transmission is beginning. At the same time, the both devices will shift frequencies in synchronization per asame pseudo randomly ordered list of hopping frequencies, the hopping rate is 1600 times per second.

e. The bandwidth of the receiver, which is set to a fixed width by the software.

Note 3: Bluetooth signal has 9 packages 1DH1, 1DH3, 1DH5, 2DH1, 2DH3, 2DH5, 3DH1, 3DH3, 3DH5, DH5 package is largest, we are testing DH5 in the document.

## 1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2017	Radio Frequency Devices
2	ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices
3	IC RSS-Gen (Issue 5, March 2019)	General Requirements for Compliance Of Radio Apparatus
4	RSS-247 (Issue 2, Feb. 2017)	Digital Transmission System(DTSs) Frequency Hopping System(FHSs) and Licence-Exempt Local Area Network (LE-LAN) Device

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	IC Rule	Description	Result
1	15.203	RSS-Gen, 6.8	Antenna Requirement	PASS
2	15.247(a)	RSS-247, 5.1(d)	Number of Hopping Frequency	PASS
3	15.247(b)	RSS-247, 5.4(b)	Peak Output Power	PASS
4	15.247(a)	RSS-247, 5.1(b) RSS-GEN, 6.7	20dB and 99% Bandwidth	PASS
5	15.247(a)	RSS-247, 5.1(b)	Carrier Frequency Separation	PASS
6	15.247(a)	RSS-247, 5.1(d)	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	RSS-247, 5.5	Conducted Spurious Emission	PASS
8	15.247(d)	RSS-247, 5.5	Conducted Band Edge	PASS
9	15.207	RSS-Gen, 8.8	Conducted Emission	PASS
10	15.209 15.247(c) 15.205	RSS-247, 5.5	Radiated Band Edges and Spurious Emission	PASS

Note: The test were performed according to the method of measurements prescribed in ANSI C63.10 2013.

## 1.3. Frequency Hopping System Requirements

### 1.3.1. 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.

### 1.3.2. 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.

This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for KDB558074 D01 v05r02 and FCC Part 15.247 rule.

Carrier Frequency and channel List:

Channel	Frequency(MHz)
0	2402
1	2403
...	...
39	2441
40	2442
...	...
77	2479
78	2480

Note:  $F(\text{MHz})=2402+1*n$  ( $0 \leq n \leq 78$ )



## 1.4. Facilities and Accreditations

### 1.4.1. Facilities

#### **CNAS-Lab Code: L1659**

CCIC-SET is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

#### **FCC-Registration No.: CN5031**

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. DesignationNumber: CN5031, valid time is until December 31, 2020.

#### **ISED Registration: 11185A**

#### **CAB identifier: CN0064**

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Dec. 31, 2020.

#### **NVLAP Lab Code: 201008-0**

CCIC-SET is a third party testing organization accredited by NVLAP according to ISO/IEC 17025. The accreditation certificate number is 201008-0.

### 1.4.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa

## 2. Test Requirements

### 2.1. Antenna requirement

#### 2.1.1. Applicable Standard

According to FCC 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. 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.

And according to FCC 47 CFR Section 15.247(c), 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.

According to IC RSS Gen 6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

#### 2.1.2. Antenna Information

**Antenna Category:** Internal antenna

An Internal antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

#### Antenna General Information:

No.	EUT	Ant. Type	Gain(dBi)
1	THE HAYMAKER headphones	Internal	4

#### 2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

## 2.2. Number of Hopping Frequency

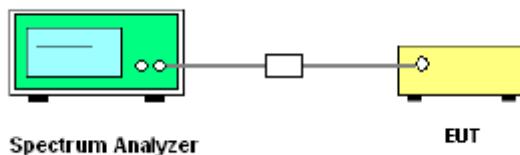
### 2.2.1. Limit of Number of Hopping Frequency

Frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

### 2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.2.3. Test Setup



### 2.2.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.3
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation;  
Set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth,  
Whichever is smaller.  $\text{VBW} \geq \text{RBW}$ , Trace = max hold, Sweep=auto, Detector function=peak.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.



### **2.2.5. Test Results of Number of Hopping Frequency**

Please refer to Appendix A for detail

## 2.3. Peak Output Power

### 2.3.1. Limit of Peak Output Power

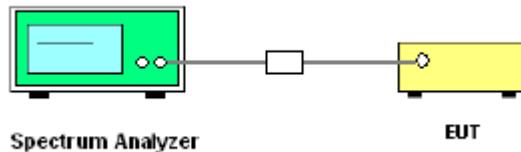
Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

RSS 247 5.4(b): For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels.

### 2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.3.3. Test Setup



### 2.3.4. Test Procedures

1. The testing follows ANSI C63.10-2013 Clause 7.8.5
2. The RF output of EUT was connected to Spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.



### 2.3.5. Test Result of Output Power

Please refer to Appendix A for detail

## 2.4. 20dB and 99% Occupied Bandwidth

### 2.4.1. Definition

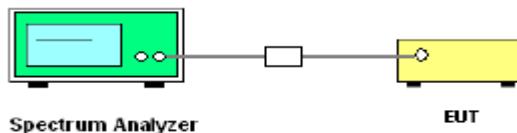
According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth ( $10 \times \log 1\% = 20\text{dB}$ ) taking the total RF output power.

According to RSS Gen, The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSS

### 2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.4.3. Test Setup



### 2.4.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 6.9.2
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.  
Span = approximately 2 to 5 times the OBW, centered on a hopping channel;  
 $\text{RBW} \geq 1\%$  to 5% of the OBW; VBW shall be approximately three times RBW;  
Sweep = auto; Detector function = peak; Trace = max hold. For %99 Occupy bandwidth  
measurement, Make the measurement with the spectrum analyzer's resolution bandwidth (RBW)  
= 30 kHz. Set the Video bandwidth (VBW) = 100 kHz
5. Measure and record the results in the test report.



#### **2.4.5. Test Results of 20dB Bandwidth**

Please refer to Appendix A for detail

## 2.5. Carried Frequency Separation

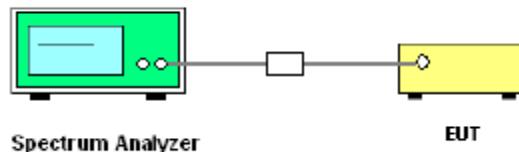
### 2.5.1. Limit of Carried Frequency Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.5.3. Test Setup



### 2.5.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.2.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:  
  
Span = wide enough to capture the peaks of two adjacent channels; RBW: Start with the RBW set to approximately 30% of the channel spacing;
6. Measure and record the results in the test report.



### **2.5.5. Test Results of Carried Frequency Separation**

Please refer to Appendix A for detail

## 2.6. Dwell time

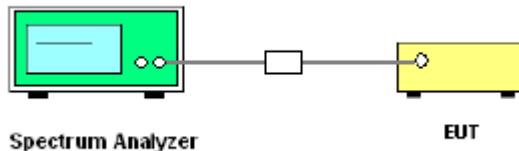
### 2.6.1. Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 2.6.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.6.3. Test Setup



### 2.6.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.4.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be  $\leq$  channel spacing and where possible RBW should be set  $\gg 1 / T$ , where T is the expected dwell time per channel; VBW  $\geq$  RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.



## 2.6.5. Test Results of Dwell Time

Please refer to Appendix A for detail

## 2.7. Conducted Spurious Emissions

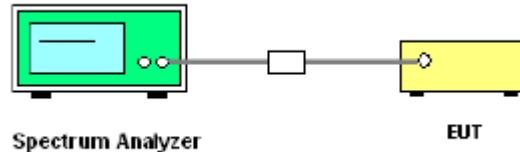
### 2.7.1. Limit of Spurious Emission

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

### 2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.7.3. Test Setup



### 2.7.4. Test Procedure

1. The testing follows the guidelines in Spurious RF Conducted Emissions of ANSI C63.10 2013 Clause 7.8.8.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.



### **2.7.5. Test Results of Conducted Spurious Emissions**

Please refer to Appendix A for detail

## 2.8. Conducted Band Edge

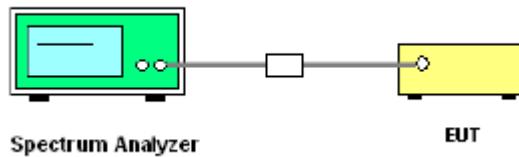
### 2.8.1. Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

### 2.8.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.8.3. Test Setup



### 2.8.1. Test Procedure

1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of ANSI C63.10 2013 Clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz ( $\geq 1\%$  span=10MHz), VBW = 300kHz ( $\geq$ RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.



### **2.8.2. Test Results of Conducted Band Edge**

Please refer to Appendix A for detail

## 2.9. Conducted Emission

### 2.9.1. Limit of Conducted Emission

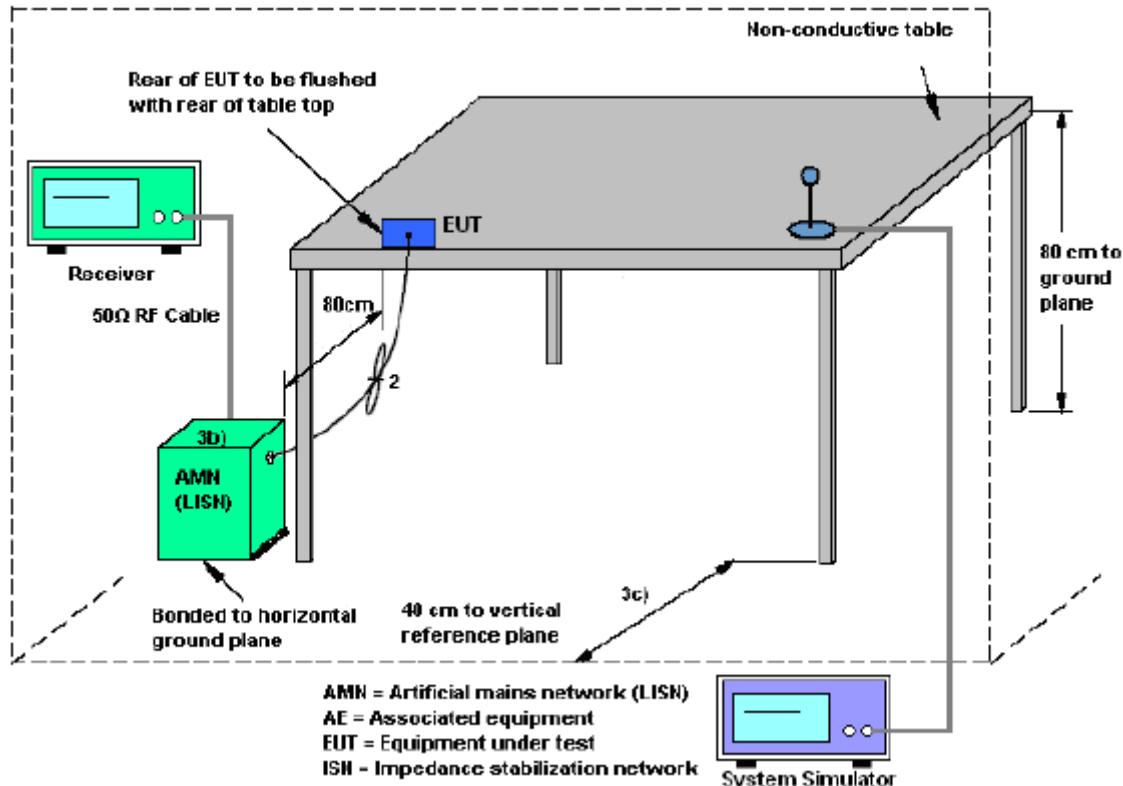
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

### 2.9.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.9.3. Test Setup

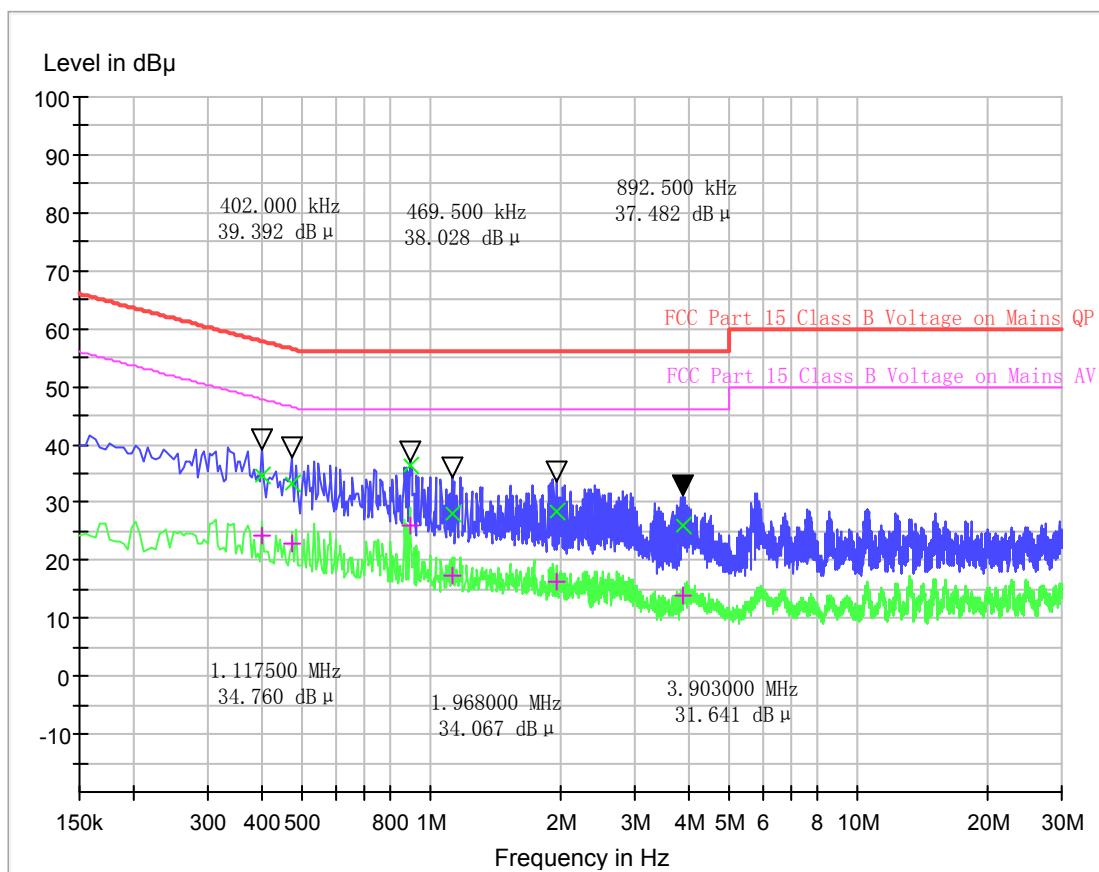


#### 2.9.4. Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

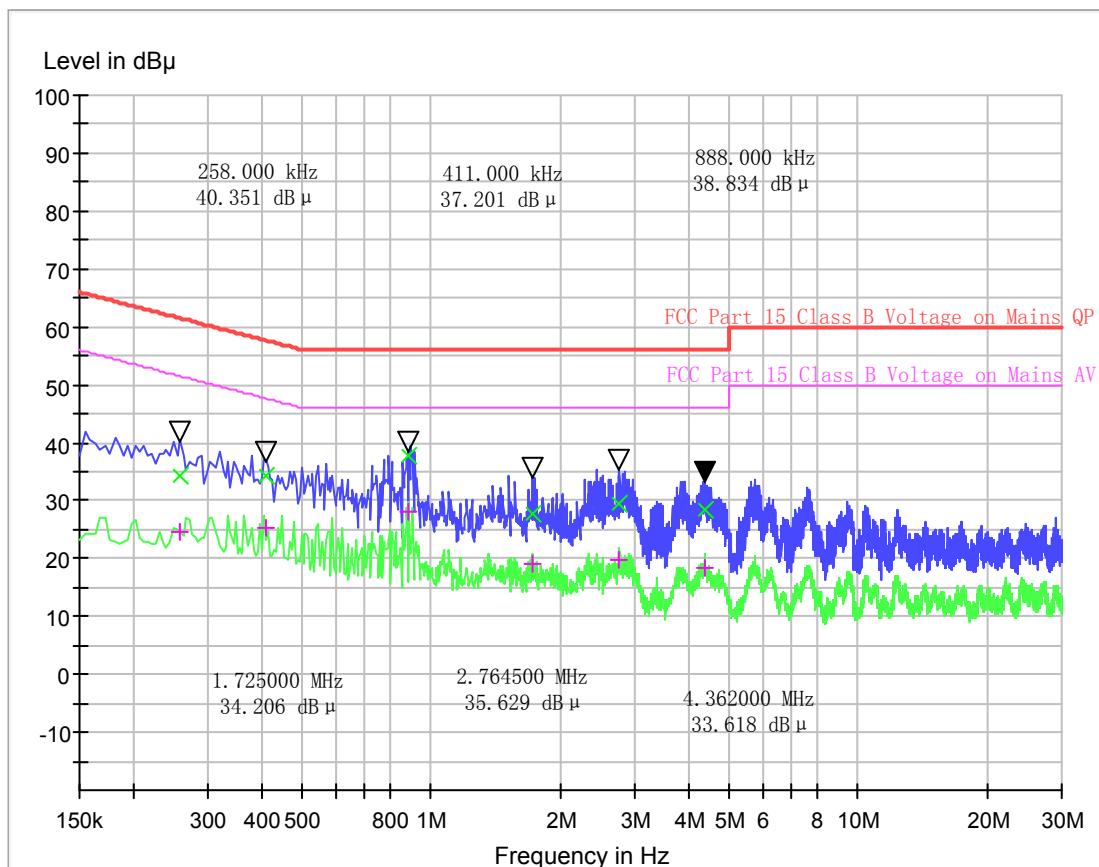
#### 2.9.3. Test Results of Conducted Emission

The EUT configuration of the emission tests is Bluetooth Link + USB Cable (Charging from Adapter)



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	CAverage (dB $\mu$ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB $\mu$ V)
0.402000	34.59	24.29	0.1	10.1	23.22	57.8	23.52	47.8
0.469500	33.24	22.92	0.1	10.1	23.28	56.5	23.60	46.5
0.892500	36.51	25.83	0.6	10.6	19.49	56.0	20.17	46.0
1.117500	28.18	17.22	0.6	10.6	27.82	56.0	28.78	46.0
1.968000	28.52	16.34	0.6	10.6	27.48	56.0	29.66	46.0
3.903000	25.92	14.03	0.7	10.7	30.08	56.0	31.97	46.0



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	CAverage (dB $\mu$ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB $\mu$ V)
0.258000	34.26	24.59	0.1	10.1	27.24	61.5	26.91	51.5
0.411000	34.25	25.39	0.1	10.1	23.38	57.6	22.24	47.6
0.888000	37.75	28.10	0.1	10.1	18.25	56.0	17.90	46.0
1.725000	27.82	19.08	0.1	10.1	28.18	56.0	26.92	46.0
2.764500	29.52	19.92	0.2	10.2	26.48	56.0	26.08	46.0
4.362000	28.43	18.52	0.2	10.2	27.57	56.0	27.48	46.0

**Test Result: PASS**

**Note: Correction factor=Cabel loss+ attenuation factor  
attenuation factor=10dB**

and the test results also compliance with RSS GEN requirement.

## 2.10. Radiated Band Edges and Spurious Emission

### 2.10.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

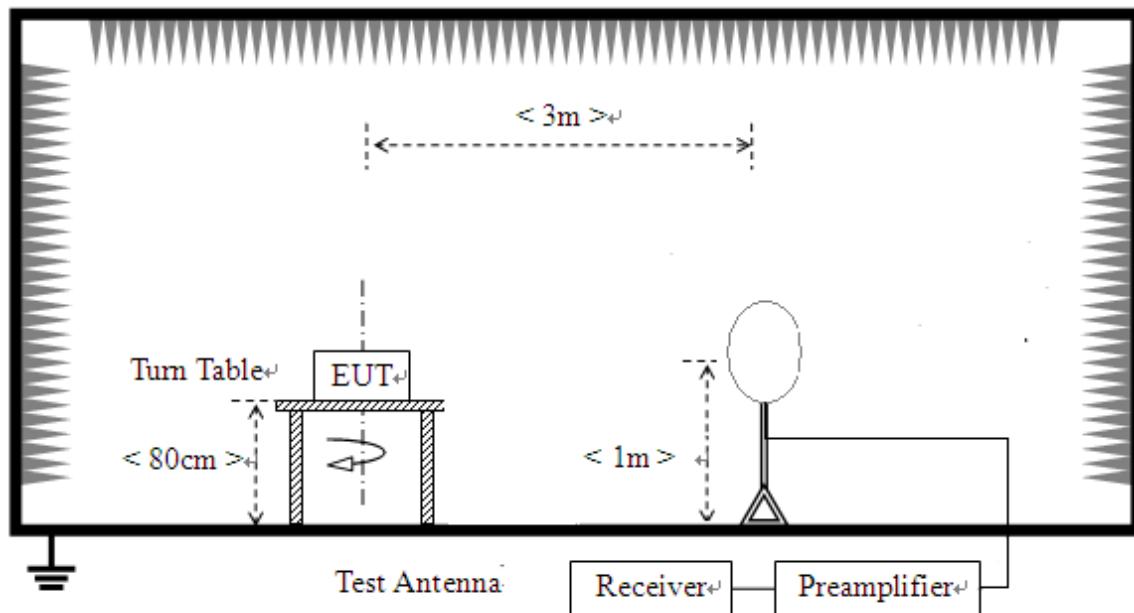
Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 2.10.2. Measuring Instruments

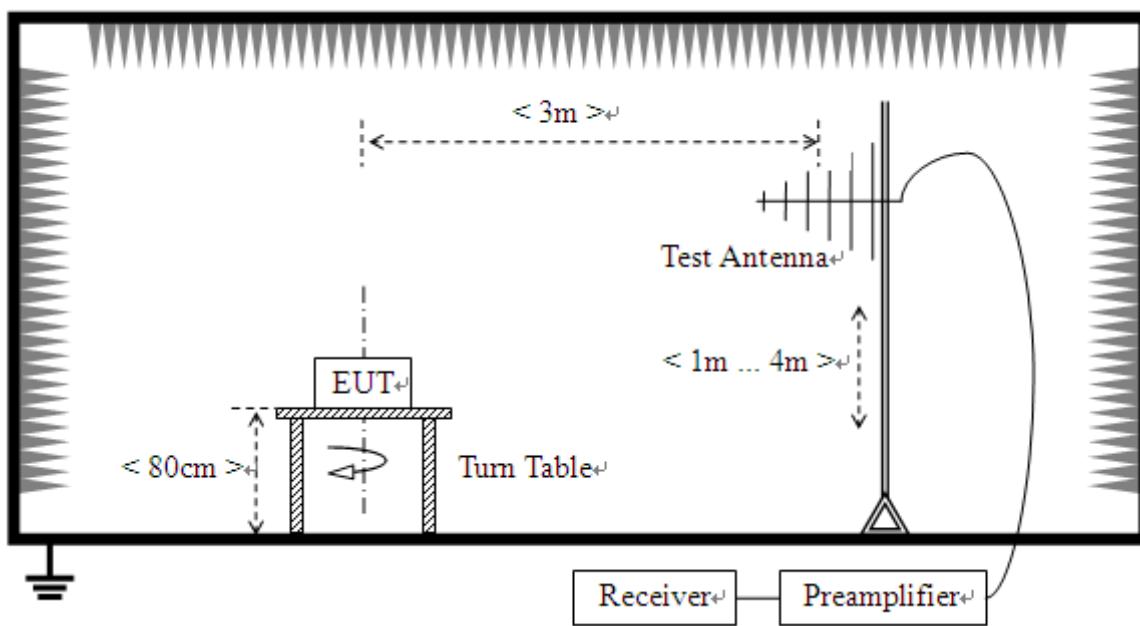
The measuring equipment is listed in the section 3 of this test report.

### 2.10.3. Test Setup

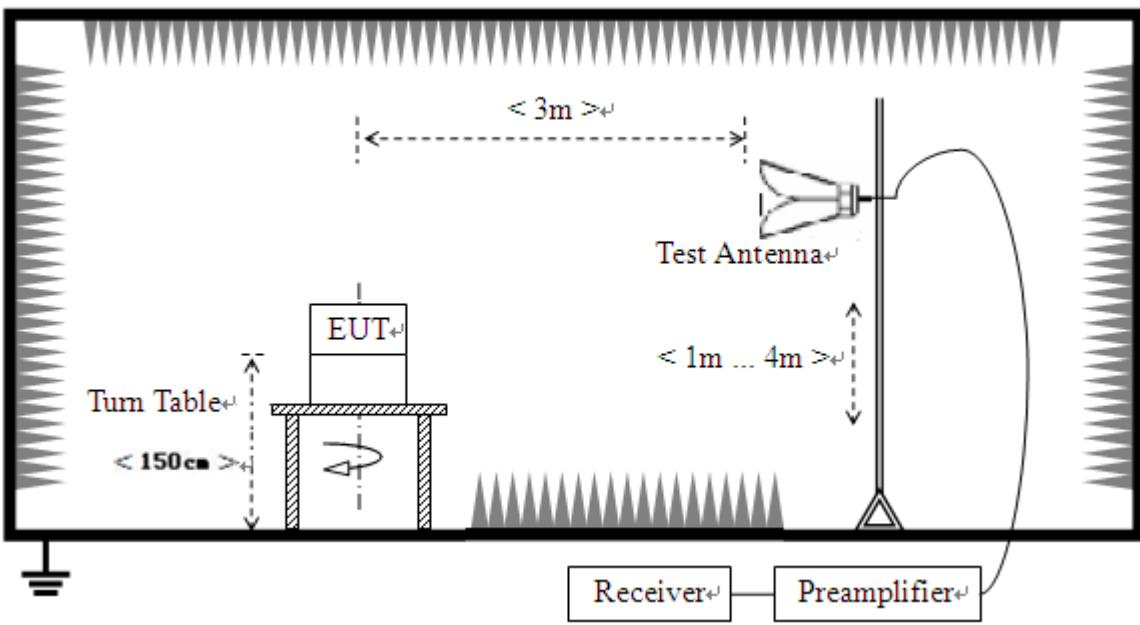
- 1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



#### 2.10.4. Test Procedure

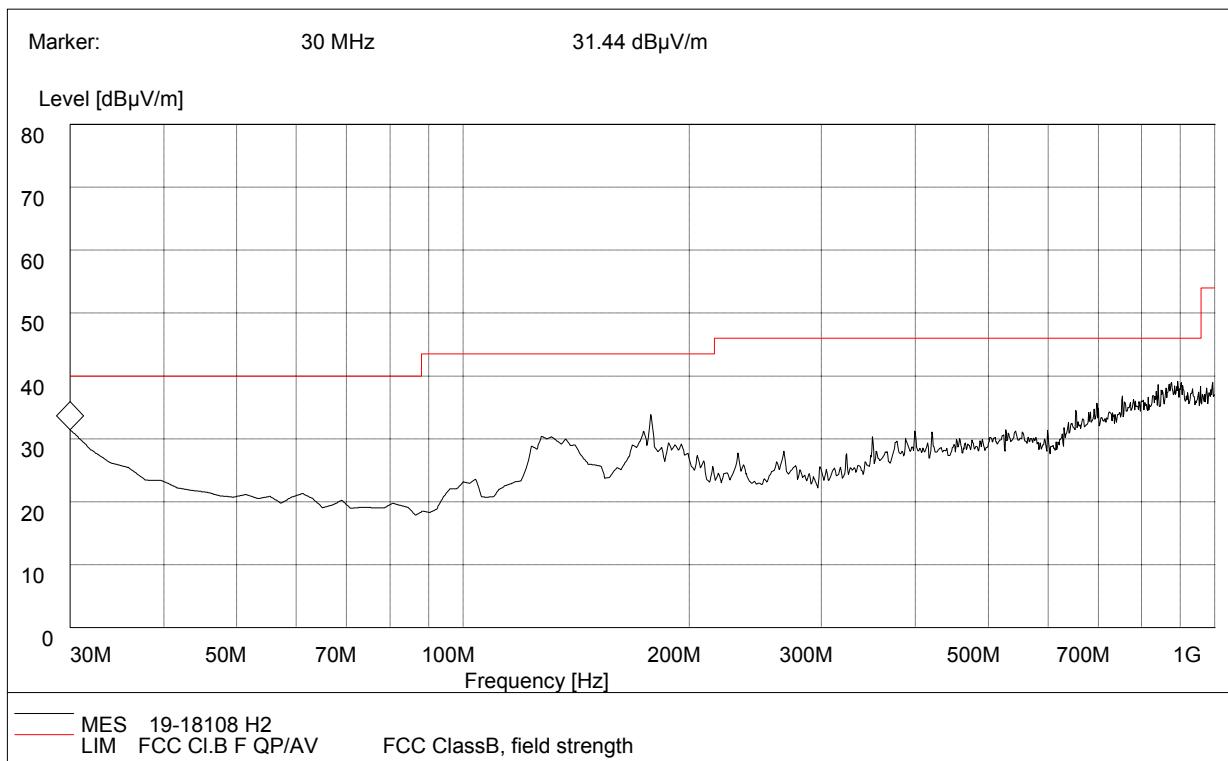
1. The EUT was placed on a turntable 0.8m below 1GHz and 1.5m above 1GHz above ground.
  2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
  3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
  4. Set to the maximum power setting and enable the EUT transmit continuously.
  5. Use the following spectrum analyzer settings:
    - (1) Span shall wide enough to fully capture the emission being measured;
    - (2) Set RBW=100 kHz for  $f < 1$  GHz, RBW=1MHz for  $f > 1$  GHz ;  $VBW \geq RBW$ ; Sweep = auto; Detector function = peak; Trace = max hold for peak
    - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
- Duty cycle = On time/100 milliseconds
- On time =  $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$
- Where  $N_1$  is number of type 1 pulses,  $L_1$  is length of type 1 pulses, etc.
- Average Emission Level = Peak Emission Level +  $20 \cdot \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

## 2.10.5. Test Results of Radiated Band Edge and Spurious Emission

### For 9 KHz to 30MHz

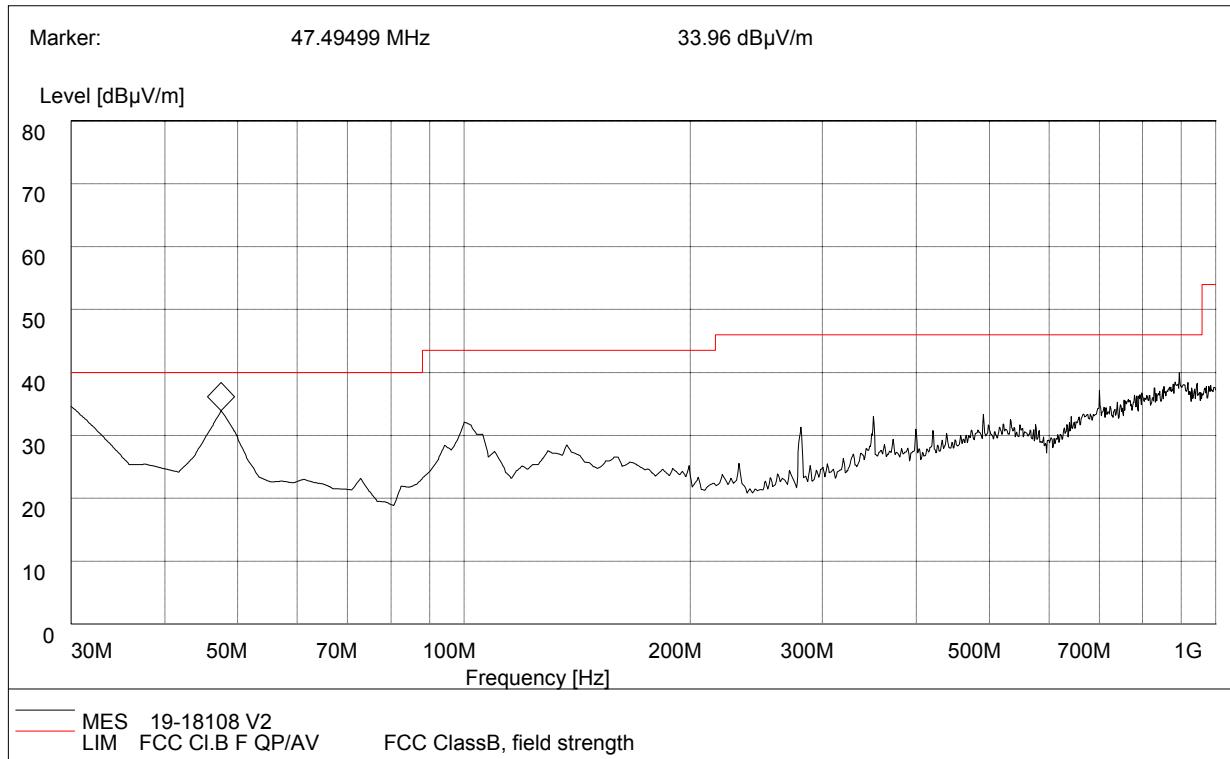
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

### For 30MHz to 1000MHz



Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB $\mu$ V/m)	Margin (dB)	Antenna	Verdict
30	31.44	120	120	46.0	14.56	Horizontal	Pass
138.95	30.21	120	120	43.5	13.29	Horizontal	Pass
174.58	32.54	120	120	43.5	10.96	Horizontal	Pass
269.47	27.57	120	120	46.0	18.43	Horizontal	Pass
351.57	31.08	120	120	46.0	14.92	Horizontal	Pass
901.74	38.17	120	120	46.0	7.83	Horizontal	Pass

(Plot A: 30MHz to 1GHz, Antenna Horizontal)



Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB $\mu$ V/m)	Margin (dB)	Antenna	Verdict
30	34.26	120	120	46.0	11.74	Vertical	Pass
47.49	33.96	120	120	43.5	9.54	Vertical	Pass
100.85	32.13	120	120	43.5	11.37	Vertical	Pass
282.35	31.87	120	120	46.0	14.13	Vertical	Pass
351.62	34.09	120	120	46.0	11.91	Vertical	Pass
899.87	39.89	120	120	46.0	6.11	Vertical	Pass

(Plot B: 30MHz to 1GHz, Antenna Vertical)

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. Margin value = Limit value - Emission Level

**For 1GHz to 25GHz****ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (GFSK\_2402MHz)**

No.	Fre. (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	48.36	PK	74.00	-25.64	1.50	300.00	47.06	5.20	28.60	32.50	1.30
2	2390.00	36.62	AV	54.00	-17.38	1.50	300.00	35.32	5.20	28.60	32.50	1.30
3	4804.00	50.32	PK	74.00	-23.68	1.50	300.00	43.92	7.40	30.40	31.40	6.40
4	4804.00	38.21	AV	54.00	-15.79	1.50	300.00	31.81	7.40	30.40	31.40	6.40
5	7206.00	51.18	PK	74.00	-22.82	1.50	300.00	41.88	9.90	31.50	32.10	9.30
6	7206.00	39.29	AV	54.00	-14.71	1.50	300.00	29.99	9.90	31.50	32.10	9.30

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (GFSK\_2402MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	47.95	PK	74.00	-26.05	1.60	220.00	46.65	5.20	28.60	32.50	1.30
2	2390.00	37.63	AV	54.00	-16.37	1.60	220.00	36.33	5.20	28.60	32.50	1.30
3	4804.00	50.97	PK	74.00	-23.03	1.60	220.00	44.57	7.40	30.40	31.40	6.40
4	4804.00	40.85	AV	54.00	-13.15	1.60	220.00	34.45	7.40	30.40	31.40	6.40
5	7206.00	51.84	PK	74.00	-22.16	1.60	220.00	42.54	9.90	31.50	32.10	9.30
6	7206.00	40.80	AV	54.00	-13.20	1.60	220.00	31.50	9.90	31.50	32.10	9.30

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (GFSK\_2441MHz)**

No.	Fre. (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	49.87	PK	74.00	-24.13	1.50	300.00	43.47	6.70	31.20	31.50	6.40
2	4882.00	39.55	AV	54.00	-14.45	1.50	300.00	33.15	6.70	31.20	31.50	6.40
3	7323.00	51.64	PK	74.00	-22.36	1.50	300.00	42.24	10.10	31.50	32.30	9.40
4	7323.00	41.50	AV	54.00	-12.50	1.50	300.00	32.10	10.10	31.50	32.30	9.40

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (GFSK\_2441MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	48.88	PK	74.00	-25.12	1.60	220.00	42.48	6.70	31.20	31.50	6.40
2	4882.00	37.64	AV	54.00	-16.36	1.60	220.00	31.24	6.70	31.20	31.50	6.40
3	7323.00	50.97	PK	74.00	-23.03	1.60	220.00	41.57	10.10	31.50	32.30	9.40
4	7323.00	39.17	AV	54.00	-14.83	1.60	220.00	29.77	10.10	31.50	32.30	9.40

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (GFSK\_2480MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	46.95	PK	74.00	-27.05	1.50	200.00	44.35	5.70	28.70	31.80	2.60
2	2483.50	36.84	AV	54.00	-17.16	1.50	200.00	34.24	5.70	28.70	31.80	2.60
3	4960.00	51.01	PK	74.00	-22.99	1.50	200.00	44.31	7.00	31.20	31.50	6.70
4	4960.00	39.88	AV	54.00	-14.12	1.50	200.00	33.18	7.00	31.20	31.50	6.70
5	7440.00	51.88	PK	74.00	-22.12	1.50	200.00	42.38	10.20	31.60	32.40	9.50
6	7440.00	39.90	AV	54.00	-14.10	1.50	200.00	30.40	10.20	31.60	32.40	9.50

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (GFSK\_2480MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	51.47	PK	74.00	-22.53	1.60	290.00	48.87	5.70	28.70	31.80	2.60
2	2483.50	40.45	AV	54.00	-13.55	1.60	290.00	37.85	5.70	28.70	31.80	2.60
3	4960.00	52.31	PK	74.00	-21.69	1.60	290.00	45.61	7.00	31.20	31.50	6.70
4	4960.00	42.21	AV	54.00	-11.79	1.60	290.00	35.51	7.00	31.20	31.50	6.70
5	7440.00	52.11	PK	74.00	-21.89	1.60	290.00	42.61	10.20	31.60	32.40	9.50
6	7440.00	41.05	AV	54.00	-12.95	1.60	290.00	31.55	10.20	31.60	32.40	9.50

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (pi/4DQPSK\_2402MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	50.97	PK	74.00	-23.03	1.50	210.00	49.67	5.20	28.60	32.50	1.30
2	2390.00	37.02	AV	54.00	-16.98	1.50	210.00	35.72	5.20	28.60	32.50	1.30
3	4804.00	53.33	PK	74.00	-20.67	1.50	210.00	46.93	6.70	31.20	31.50	6.40
4	4804.00	42.23	AV	54.00	-11.77	1.50	210.00	35.83	6.70	31.20	31.50	6.40
5	7206.00	54.13	PK	74.00	-19.87	1.50	210.00	39.23	16.00	30.90	32.00	14.90
6	7206.00	43.09	AV	54.00	-10.91	1.50	210.00	28.19	16.00	30.90	32.00	14.90

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (pi/4DQPSK\_2402MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	49.65	PK	74.00	-24.35	1.60	180.00	48.35	5.20	28.60	32.50	1.30
2	2390.00	36.51	AV	54.00	-17.49	1.60	180.00	35.21	5.20	28.60	32.50	1.30
3	4804.00	51.87	PK	74.00	-22.13	1.60	180.00	45.47	6.70	31.20	31.50	6.40
4	4804.00	39.89	AV	54.00	-14.11	1.60	180.00	33.49	6.70	31.20	31.50	6.40
5	7206.00	52.94	PK	74.00	-21.06	1.60	180.00	38.04	16.00	30.90	32.00	14.90
6	7206.00	41.89	AV	54.00	-12.11	1.60	180.00	26.99	16.00	30.90	32.00	14.90

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (pi/4DQPSK\_2441MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	50.65	PK	74.00	-23.35	1.50	300.00	44.25	6.70	31.20	31.50	6.40
2	4882.00	38.91	AV	54.00	-15.09	1.50	300.00	32.51	6.70	31.20	31.50	6.40
3	7323.00	53.26	PK	74.00	-20.74	1.50	300.00	43.86	10.10	31.50	32.30	9.40
4	7323.00	42.11	AV	54.00	-11.89	1.50	300.00	32.71	10.10	31.50	32.30	9.40

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (pi/4DQPSK\_2441MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	51.25	PK	74.00	-22.75	1.60	260.00	44.85	6.70	31.20	31.50	6.40
2	4882.00	40.19	AV	54.00	-13.81	1.60	260.00	33.79	6.70	31.20	31.50	6.40
3	7323.00	52.97	PK	74.00	-21.03	1.60	260.00	43.57	10.10	31.50	32.30	9.40
4	7323.00	41.93	AV	54.00	-12.07	1.60	260.00	32.53	10.10	31.50	32.30	9.40

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (pi/4DQPSK\_2480MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	50.65	PK	74.00	-23.35	1.50	180.00	48.05	5.70	28.70	31.80	2.60
2	2483.50	40.18	AV	54.00	-13.82	1.50	180.00	37.58	5.70	28.70	31.80	2.60
3	4960.00	51.18	PK	74.00	-22.82	1.50	180.00	44.48	7.00	31.20	31.50	6.70
4	4960.00	39.82	AV	54.00	-14.18	1.50	180.00	33.12	7.00	31.20	31.50	6.70
5	7440.00	52.78	PK	74.00	-21.22	1.50	180.00	43.28	10.20	31.60	32.40	9.50
6	7440.00	41.63	AV	54.00	-12.37	1.50	180.00	32.13	10.20	31.60	32.40	9.50

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (pi/4DQPSK\_2480MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	52.64	PK	74.00	-21.36	1.70	290.00	50.04	5.70	28.70	31.80	2.60
2	2483.50	42.31	AV	54.00	-11.69	1.70	290.00	39.71	5.70	28.70	31.80	2.60
3	4960.00	52.88	PK	74.00	-21.12	1.70	290.00	46.18	7.00	31.20	31.50	6.70
4	4960.00	42.92	AV	54.00	-11.08	1.70	290.00	36.22	7.00	31.20	31.50	6.70
5	7440.00	53.16	PK	74.00	-20.84	1.70	290.00	43.66	10.20	31.60	32.40	9.50
6	7440.00	42.00	AV	54.00	-12.00	1.70	290.00	32.50	10.20	31.60	32.40	9.50

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (8DPSK\_2402MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	49.87	PK	74.00	-24.13	1.70	300.00	48.57	5.20	28.60	32.50	1.30
2	2390.00	36.23	AV	54.00	-17.77	1.70	300.00	34.93	5.20	28.60	32.50	1.30
3	4804.00	53.64	PK	74.00	-20.36	1.70	300.00	47.24	7.40	30.40	31.40	6.40
4	4804.00	41.79	AV	54.00	-12.21	1.70	300.00	35.39	7.40	30.40	31.40	6.40
5	7206.00	52.97	PK	74.00	-21.03	1.70	300.00	43.67	9.90	31.50	32.10	9.30
6	7206.00	40.99	AV	54.00	-13.01	1.70	300.00	31.69	9.90	31.50	32.10	9.30

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (8DPSK\_2402MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	50.34	PK	74.00	-23.66	1.80	310.00	49.04	5.20	28.60	32.50	1.30
2	2390.00	37.00	AV	54.00	-17.00	1.80	310.00	35.70	5.20	28.60	32.50	1.30
3	4804.00	51.29	PK	74.00	-22.71	1.80	310.00	44.89	7.40	30.40	31.40	6.40
4	4804.00	39.64	AV	54.00	-14.36	1.80	310.00	33.24	7.40	30.40	31.40	6.40
5	7206.00	52.67	PK	74.00	-21.33	1.80	310.00	43.37	9.90	31.50	32.10	9.30
6	7206.00	40.88	AV	54.00	-13.12	1.80	310.00	31.58	9.90	31.50	32.10	9.30

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (8DPSK\_2441MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	51.68	PK	74.00	-22.32	1.70	210.00	45.28	6.70	31.20	31.50	6.40
2	4882.00	40.65	AV	54.00	-13.35	1.70	210.00	34.25	6.70	31.20	31.50	6.40
3	7323.00	52.97	PK	74.00	-21.03	1.70	210.00	43.57	10.10	31.50	32.30	9.40
4	7323.00	41.80	AV	54.00	-12.20	1.70	210.00	32.40	10.10	31.50	32.30	9.40

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (8DPSK\_2441MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	53.64	PK	74.00	-20.36	1.70	220.00	47.24	6.70	31.20	31.50	6.40
2	4882.00	42.37	AV	54.00	-11.63	1.70	220.00	35.97	6.70	31.20	31.50	6.40
3	7323.00	52.78	PK	74.00	-21.22	1.70	220.00	43.38	10.10	31.50	32.30	9.40
4	7323.00	41.58	AV	54.00	-12.42	1.70	220.00	32.18	10.10	31.50	32.30	9.40

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M (8DPSK\_2480MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	52.16	PK	74.00	-21.84	1.50	330.00	49.56	5.70	28.70	31.80	2.60
2	2483.50	41.01	AV	54.00	-12.99	1.50	330.00	38.41	5.70	28.70	31.80	2.60
3	4960.00	53.21	PK	74.00	-20.79	1.50	330.00	46.81	6.70	31.20	31.50	6.40
4	4960.00	41.98	AV	54.00	-12.02	1.50	330.00	35.58	6.70	31.20	31.50	6.40
5	7440.00	53.33	PK	74.00	-20.67	1.50	330.00	38.43	16.00	30.90	32.00	14.90
6	7440.00	42.18	AV	54.00	-11.82	1.50	330.00	27.28	16.00	30.90	32.00	14.90

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M (8DPSK\_2480MHz)**

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	51.78	PK	74.00	-22.22	1.50	190.00	49.18	5.70	28.70	31.80	2.60
2	2483.50	40.73	AV	54.00	-13.27	1.50	190.00	38.13	5.70	28.70	31.80	2.60
3	4960.00	52.64	PK	74.00	-21.36	1.50	190.00	46.24	6.70	31.20	31.50	6.40
4	4960.00	41.17	AV	54.00	-12.83	1.50	190.00	34.77	6.70	31.20	31.50	6.40
5	7440.00	53.06	PK	74.00	-20.94	1.50	190.00	38.16	16.00	30.90	32.00	14.90
6	7440.00	41.11	AV	54.00	-12.89	1.50	190.00	26.21	16.00	30.90	32.00	14.90

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
  - Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level - Limit value

### 3. List of measuring equipment

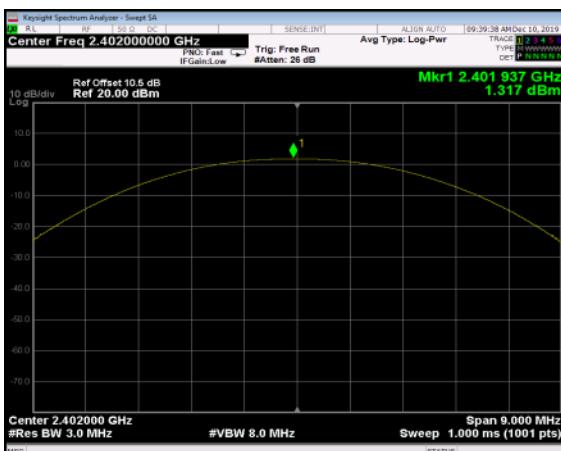
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI TEST RECEIVER	R&S	ESIB7	A0501375	2019.07.30	2020.07.29
2	Power Meter	R&S	NRP-Z31	102872	2019.5.5	2020.05.04
3	TURNTABLE	ETS	2088	2149	N/A	N/A
4	ANTENNA MAST	ETS	2075	2346	N/A	N/A
5	EMI TEST Software	R&S	ESK1	N/A	N/A	N/A
6	Horn antenna (18GHz~26.5GHz)	AR	AT4002A	305753	2017.11.10	2020.11.09
7	Amplifier	MILMEGA	80RF1000-25 0	A140901925	2017.10.09	2020.10.08
8	JS amplifier	AR	25S1G4AM1	A0304248	2017.10.09	2020.10.08
9	High pass filter	Compliance Direction systems	BSU-6	34202	2019.11.10	2020.11.09
13	Horn Antenna	AR	AT4002A	305753	2017.07.12	2020.07.11
14	Horn Antenna	AR	AT4510	325306	2018.07.14	2020.07.13
15	ULTRA-BROADBA ND ANTENNA	R&S	HL562	A0304224	2017.07.14	2020.07.13
16	Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25
17	Temperature chamber	Dongguan gaoda instrument CO.LTD	GD-7005-100	130130101	2019.04.22	2020.04.21
18	Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2019.06.05	2020.06.04
19	Power Supply	R&S	NGMO1	101037	2019.08.03	2020.08.02
20	EMI TEST RECEIVER	KEYSIGHT	ESIB26	A0304218	2019.05.20	2020.05.19
21	LISN	ROHDE&SCHWA RZ	ENV216	A140701847	2018.12.10	2019.12.10
22	Cable	MATCHING PAD	W7	/	2019.01.02	2020.01.01

## Appendix A

### RF Output Power Test Result and Data

BT Maximum Output Power					
Mode	Test Frequency	Packet Type	Power(dBm)	Limit(dBm)	Result
GFSK	2402	DH5	1.31	21	Pass
GFSK	2441	DH5	1.77	21	Pass
GFSK	2480	DH5	1.33	21	Pass
pi/4DQPSK	2402	2DH5	0.90	21	Pass
pi/4DQPSK	2441	2DH5	1.84	21	Pass
pi/4DQPSK	2480	2DH5	1.82	21	Pass
8DPSK	2402	3DH5	1.01	21	Pass
8DPSK	2441	3DH5	1.84	21	Pass
8DPSK	2480	3DH5	1.82	21	Pass

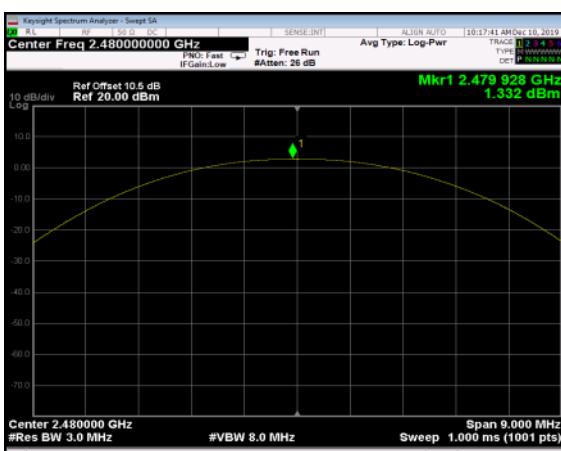
## Output Power: GFSK,2402MHz,DH5



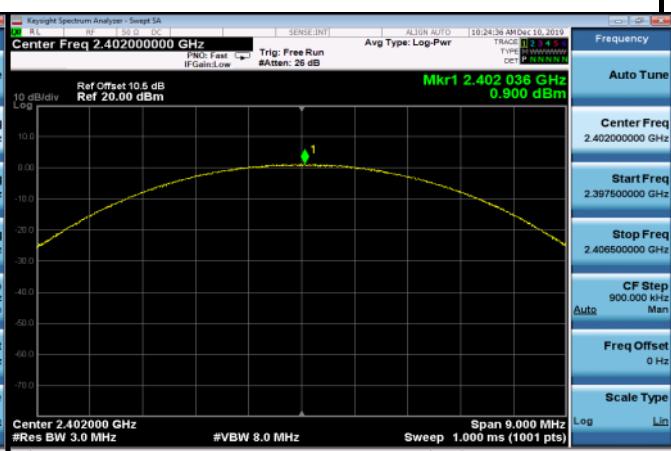
## Output Power: GFSK,2441MHz,DH5



## Output Power: GFSK,2480MHz,DH5



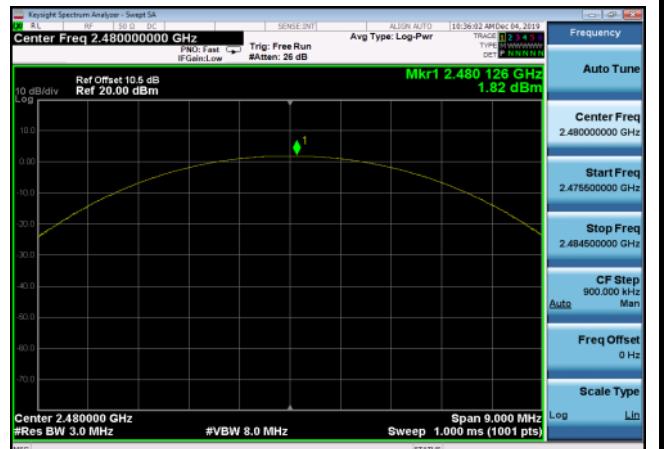
## Output Power: DQPSK,2402MHz,2DH5



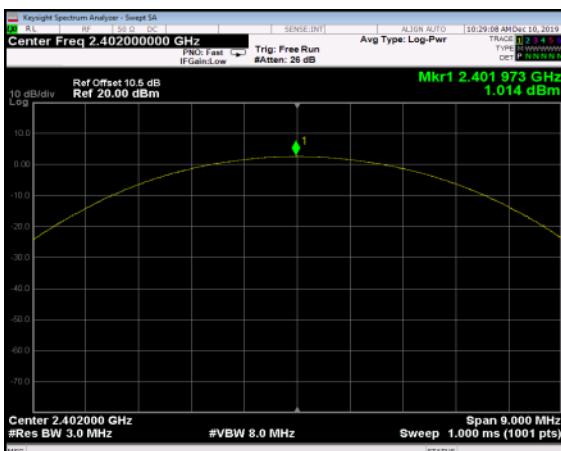
## Output Power: DQPSK,2441MHz,2DH5



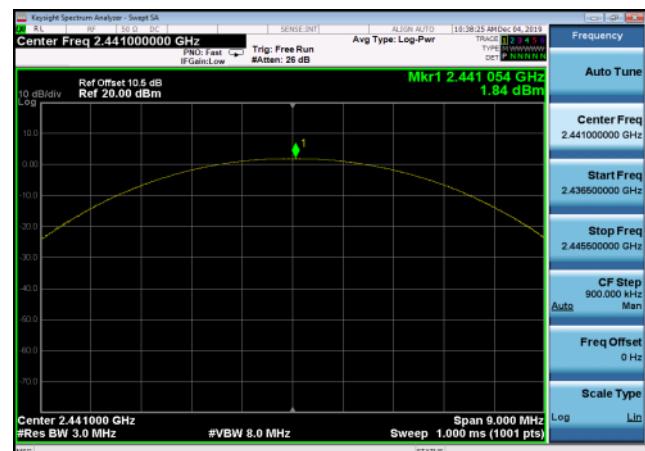
## Output Power: DQPSK,2480MHz,2DH5



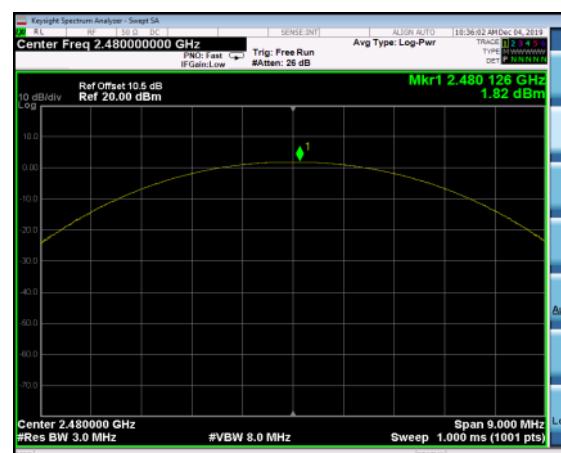
Output Power: 8DPSK,2402MHz,3DH5



Output Power: 8DPSK,2441MHz,3DH5



Output Power: 8DPSK,2480MHz,3DH5



**20dB and 99% Occupied Bandwidth****Test Result and Data**

BT Occupied 20dB and 99% Bandwidth					
Mode	Test Frequency	Packet Type	-20dB Occupy Bandwidth(KHz)	99% Occupy Bandwidth(KHz)	Result
GFSK	2402	DH5	942.906	866.704	Pass
GFSK	2441	DH5	970.3	882.865	Pass
GFSK	2480	DH5	961.183	880.789	Pass
pi/4DQPSK	2402	2DH5	1338.249	1189.822	Pass
pi/4DQPSK	2441	2DH5	1338.892	1189.984	Pass
pi/4DQPSK	2480	2DH5	1338.815	1190.906	Pass
8DPSK	2402	3DH5	1331.105	1189.462	Pass
8DPSK	2441	3DH5	1331.95	1191.386	Pass
8DPSK	2480	3DH5	1332.899	1191.213	Pass

## 20dB Bandwidth: GFSK,2402MHz,DH5



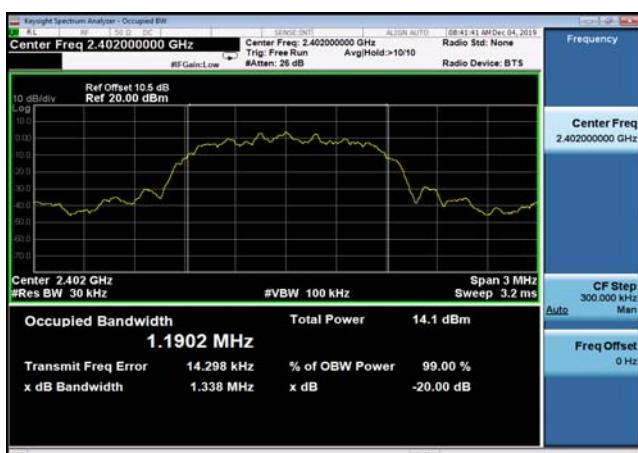
## 20dB Bandwidth: GFSK,2441MHz,DH5



## 20dB Bandwidth: GFSK,2480MHz,DH5



## 20dB Bandwidth: DQPSK,2402MHz,2DH5

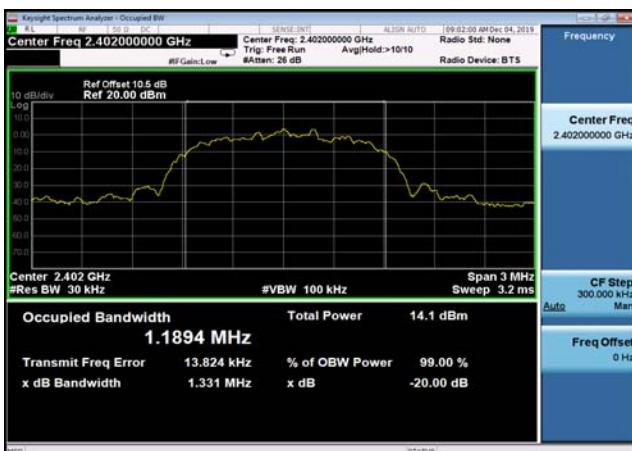


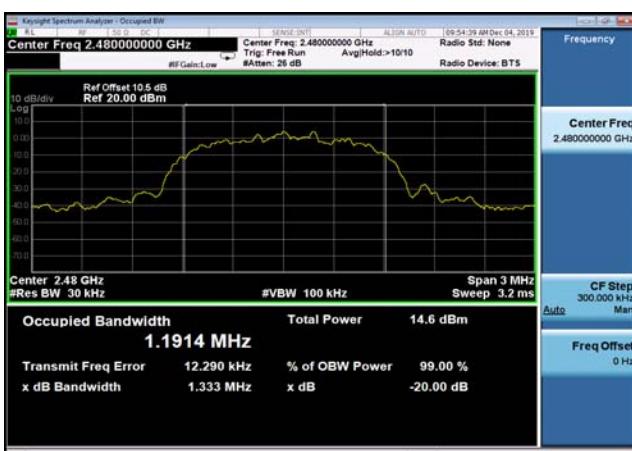
## 20dB Bandwidth: DQPSK,2441MHz,2DH5



## 20dB Bandwidth: DQPSK,2480MHz,2DH5



**20dB Bandwidth: 8DPSK,2402MHz,3DH5**

**20dB Bandwidth: 8DPSK,2441MHz,3DH5**

**20dB Bandwidth: 8DPSK,2480MHz,3DH5**

**99% Bandwidth: GFSK,2402MHz,DH5**

**99% Bandwidth: GFSK,2441MHz,DH5**


## 99% Bandwidth: GFSK,2480MHz,DH5



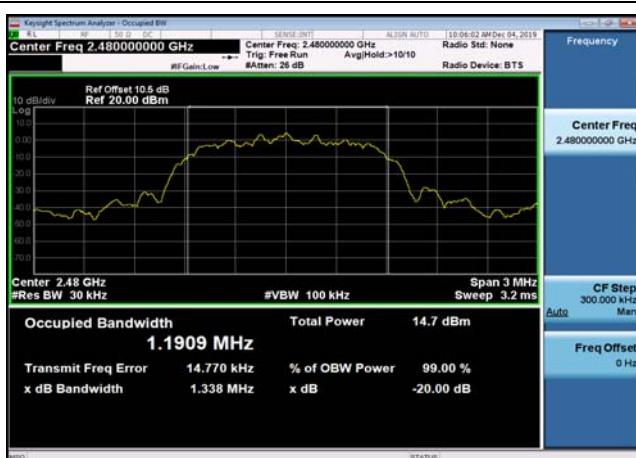
## 99% Bandwidth: DQPSK,2402MHz,2DH5



## 99% Bandwidth: DQPSK,2441MHz,2DH5



## 99% Bandwidth: DQPSK,2480MHz,2DH5



## 99% Bandwidth: 8DPSK,2402MHz,3DH5



## 99% Bandwidth: 8DPSK,2441MHz,3DH5

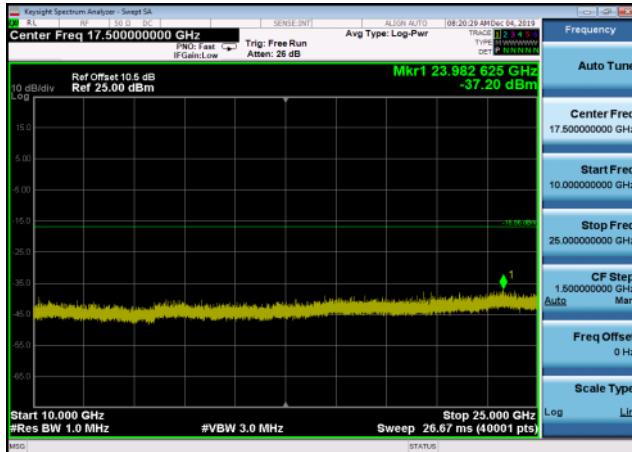


## 99% Bandwidth: 8DPSK,2480MHz,3DH5

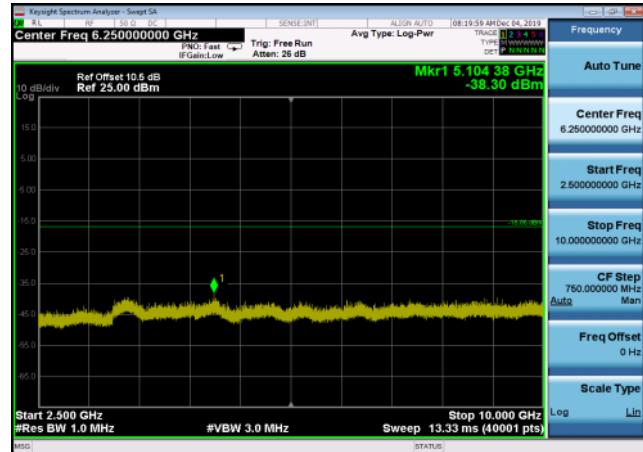


## Transmitter Spurious Emission and Bandedge Test Result and Data

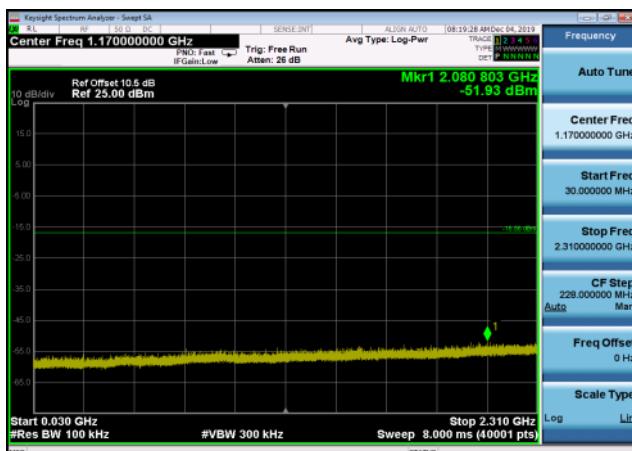
Conducted Emission: GFSK,2402,DH5  
,10000MHz~25000MHz



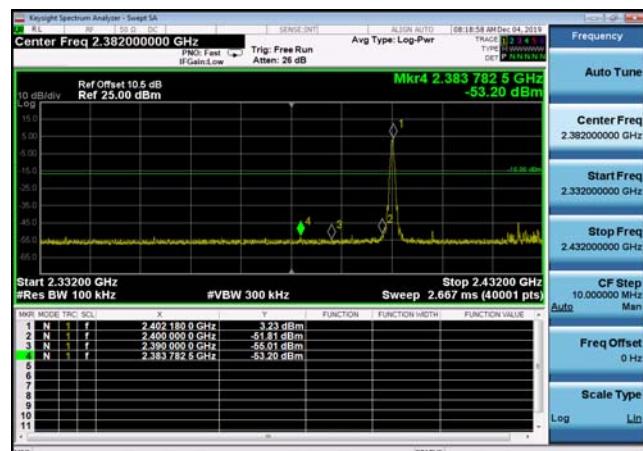
Conducted Emission: GFSK,2402,DH5  
,2500MHz~10000MHz



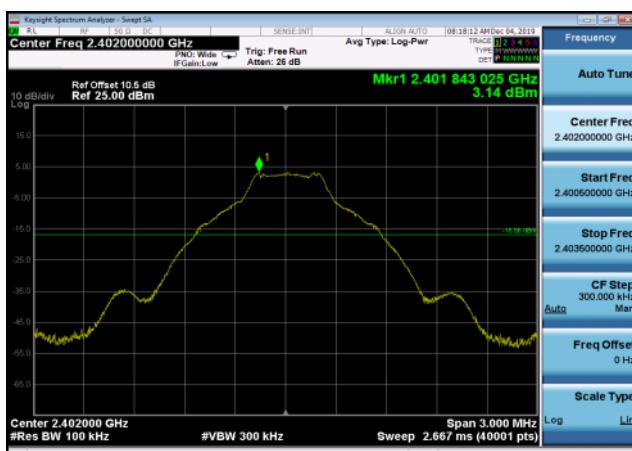
Conducted Emission: GFSK,2402,DH5  
,30MHz~2310MHz



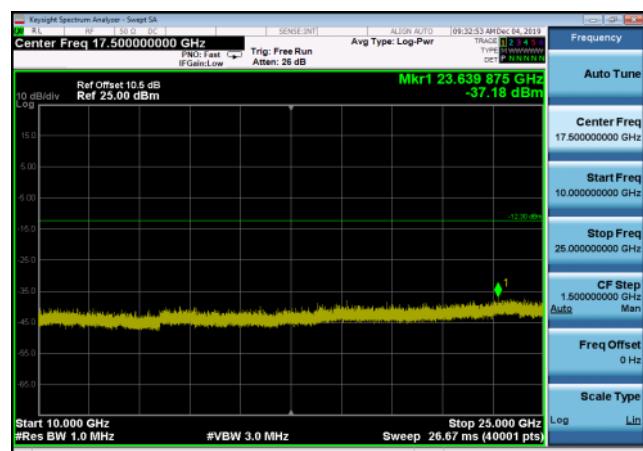
Conducted Emission: GFSK,2402,DH5  
,Band Edge HoppingOFF



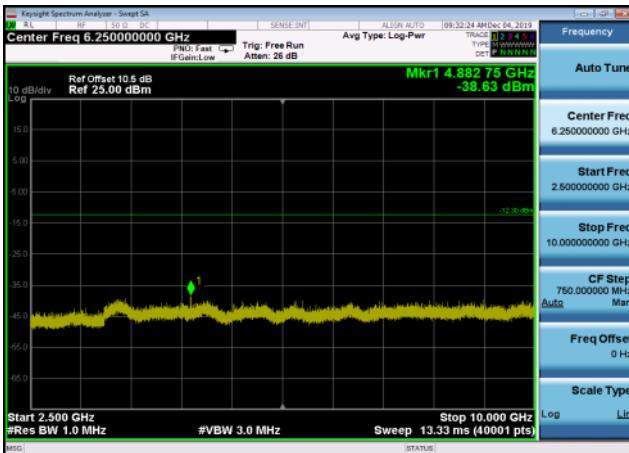
Conducted Emission: GFSK,2402,DH5  
,Reference Level



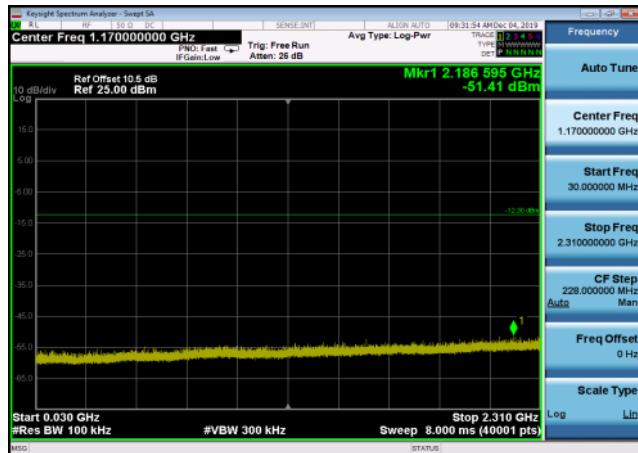
Conducted Emission: GFSK,2441,DH5  
,10000MHz~25000MHz



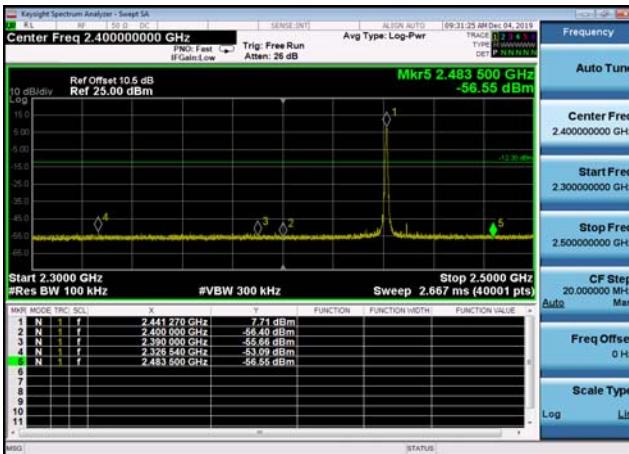
Conducted Emission: GFSK,2441,DH5  
,2500MHz~10000MHz



Conducted Emission: GFSK,2441,DH5  
,30MHz~2310MHz



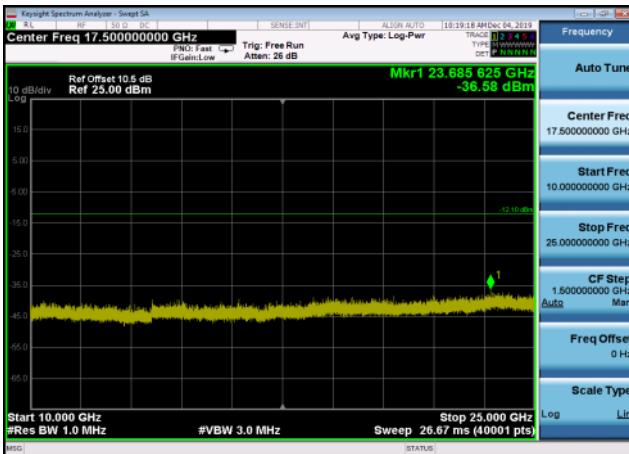
Conducted Emission: GFSK,2441,DH5  
,Band Edge HoppingOFF



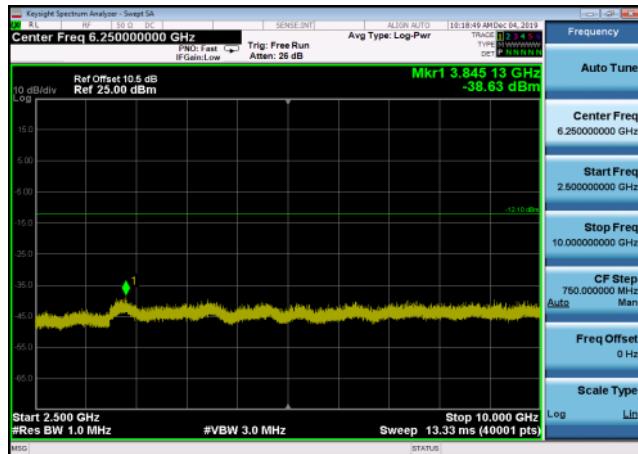
Conducted Emission: GFSK,2441,DH5  
,Reference Level



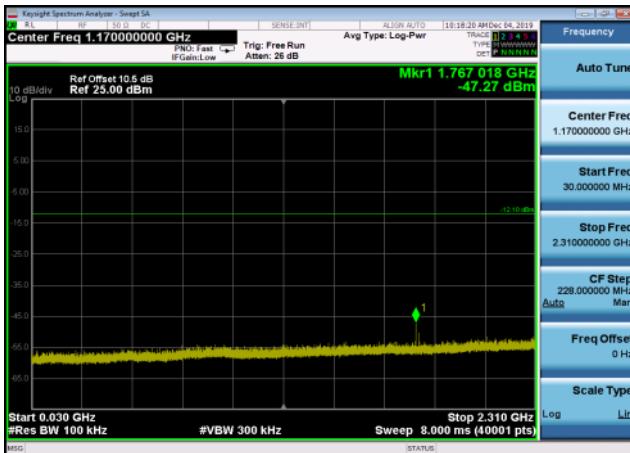
Conducted Emission: GFSK,2480,DH5  
,10000MHz~25000MHz



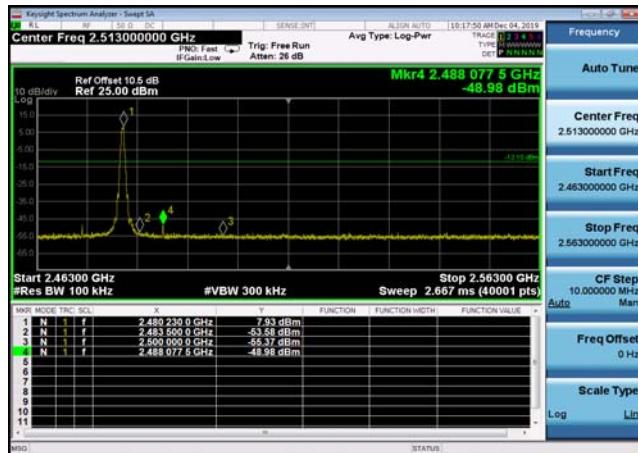
Conducted Emission: GFSK,2480,DH5  
,2500MHz~10000MHz



Conducted Emission: GFSK,2480,DH5  
,30MHz~2310MHz



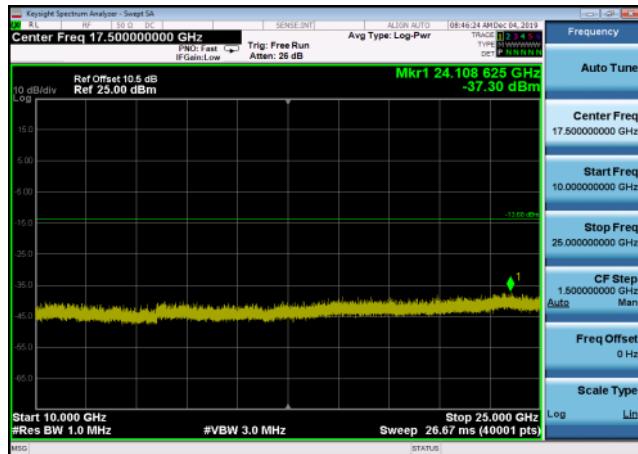
Conducted Emission: GFSK,2480,DH5  
,Band Edge HoppingOFF



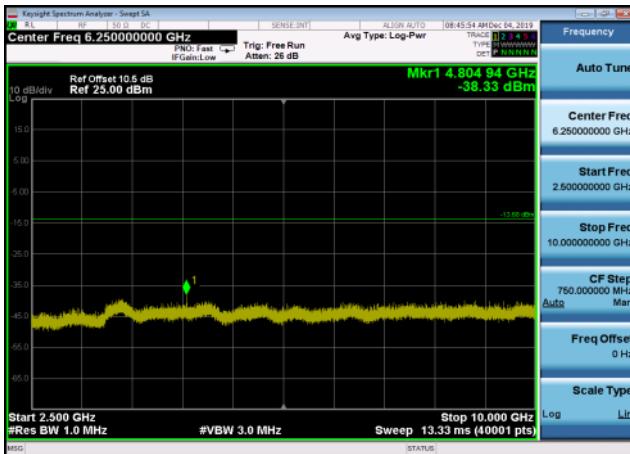
Conducted Emission: GFSK,2480,DH5  
,Reference Level



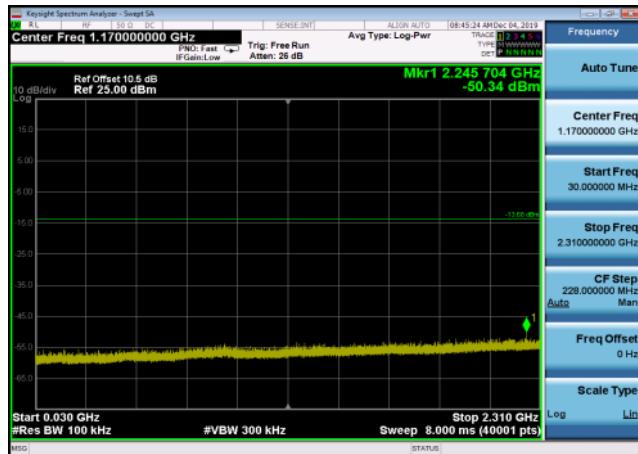
Conducted Emission: DQPSK,2402,2DH5  
,10000MHz~25000MHz



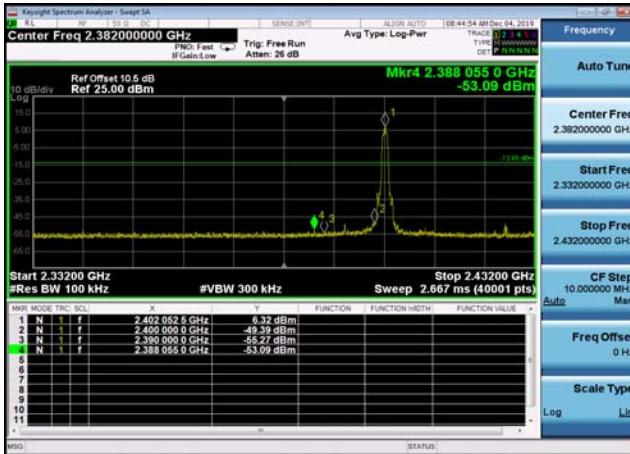
Conducted Emission: DQPSK,2402,2DH5  
,2500MHz~10000MHz



Conducted Emission: DQPSK,2402,2DH5  
,30MHz~2310MHz



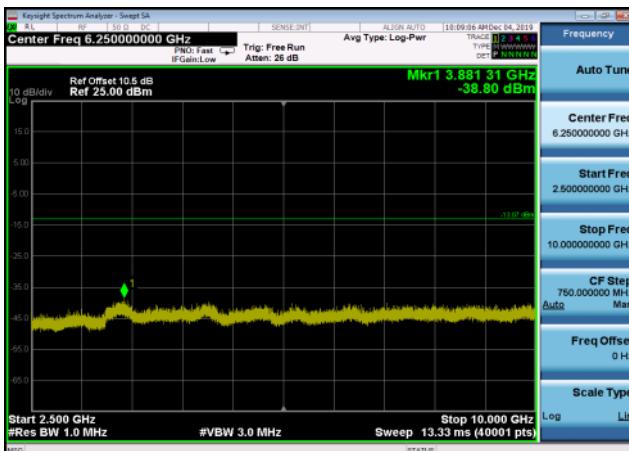
Conducted Emission: DQPSK,2402,2DH5  
,Band Edge HoppingOFF



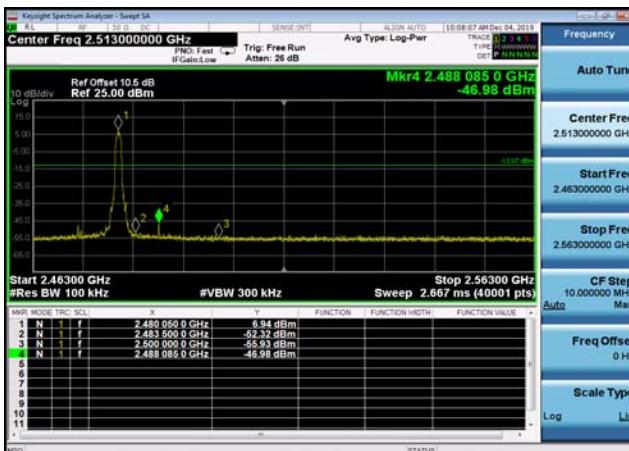
Conducted Emission: DQPSK,2441,2DH5  
,Reference Level



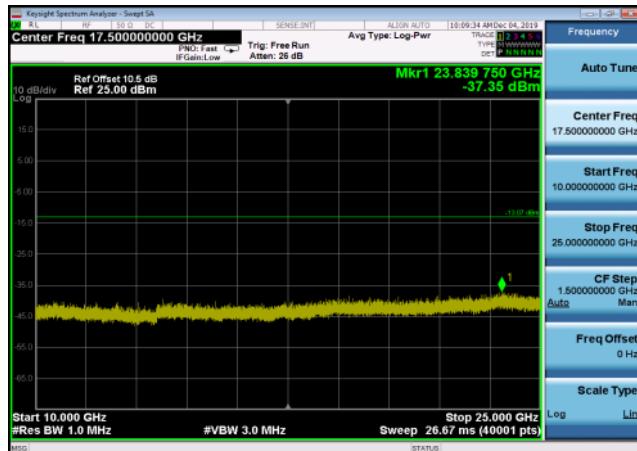
Conducted Emission: DQPSK,2480,2DH5  
,2500MHz~10000MHz



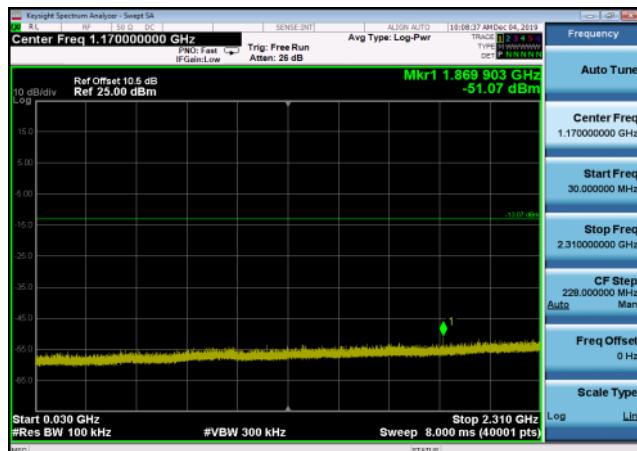
Conducted Emission: DQPSK,2480,2DH5  
,Band Edge HoppingOFF



Conducted Emission: DQPSK,2480,2DH5  
,10000MHz~25000MHz



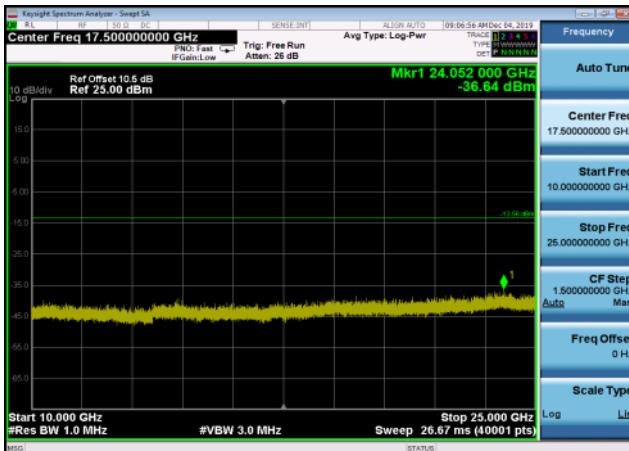
Conducted Emission: DQPSK,2480,2DH5  
,30MHz~2310MHz



Conducted Emission: DQPSK,2480,2DH5  
,Reference Level



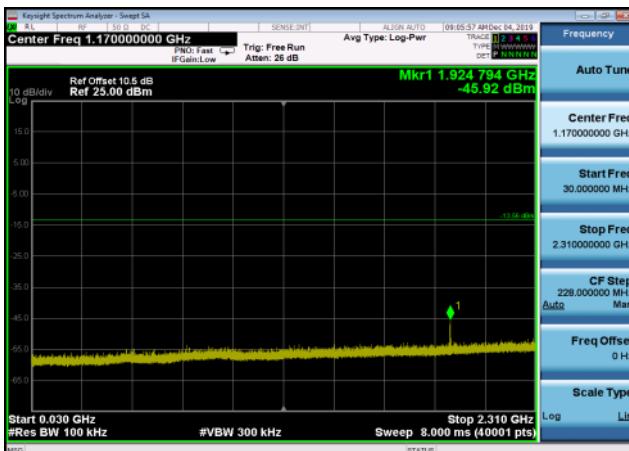
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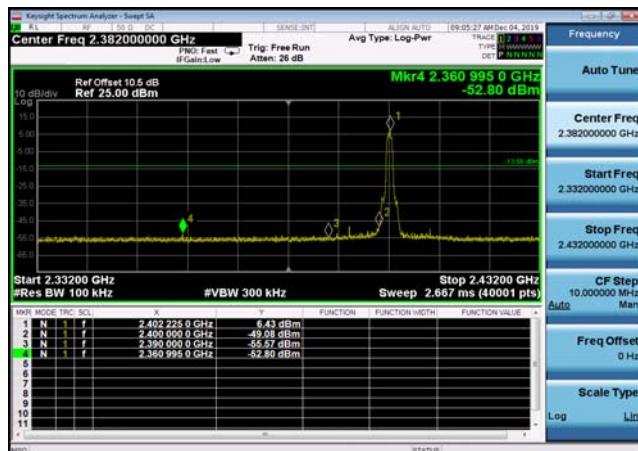
Conducted Emission: 8DPSK,2402,3DH5  
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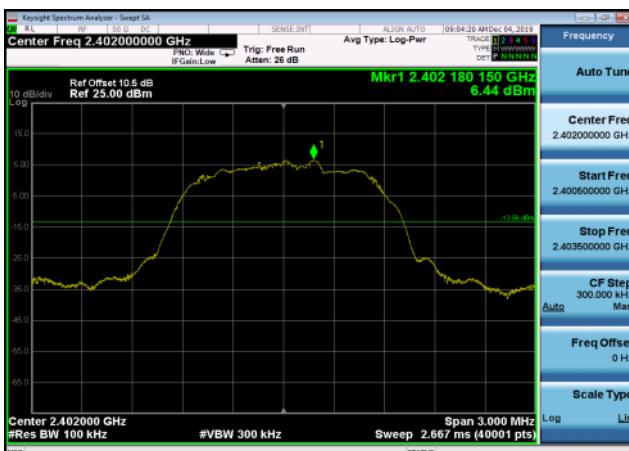
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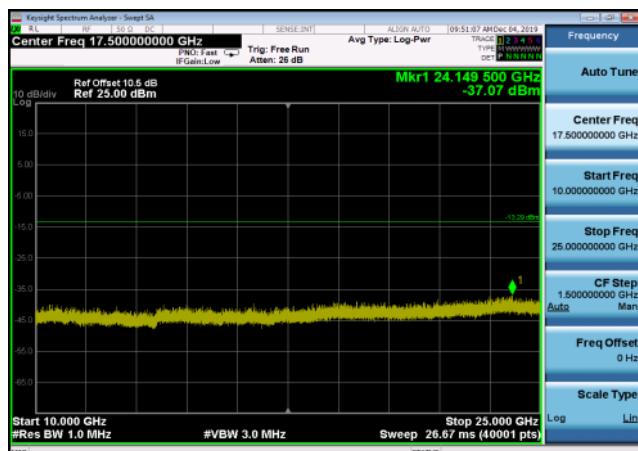
Conducted Emission: 8DPSK,2402,3DH5  
,Band Edge Hopping OFF



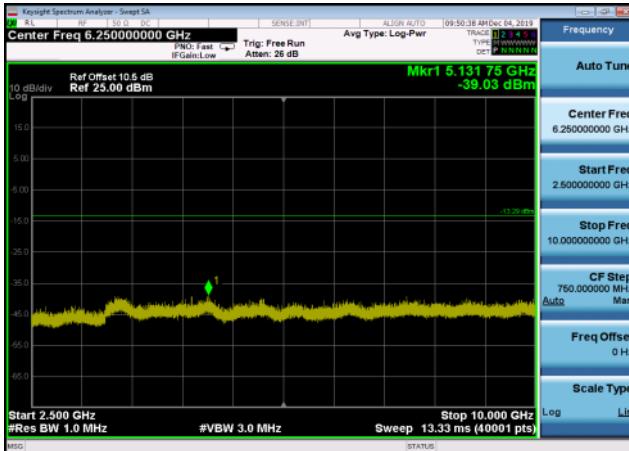
Conducted Emission: 8DPSK,2402,3DH5  
,Reference Level



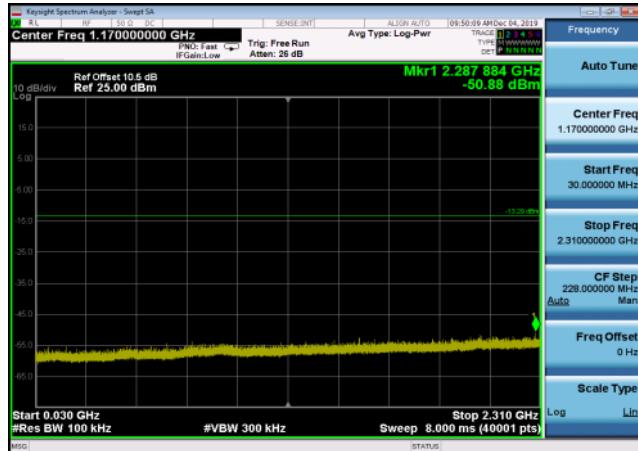
Conducted Emission: 8DPSK,2441,3DH5  
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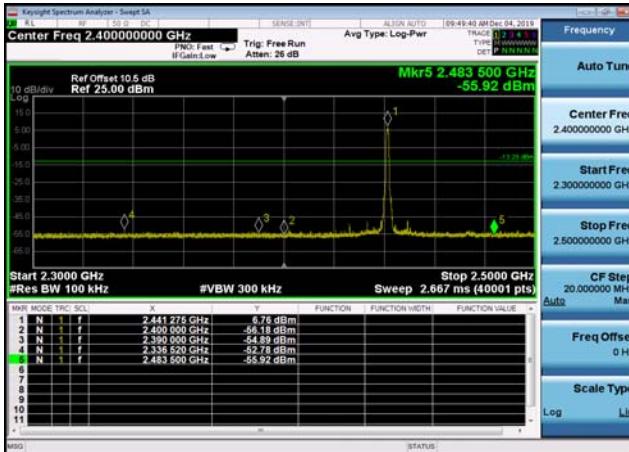
Conducted Emission: 8DPSK,2441,3DH5  
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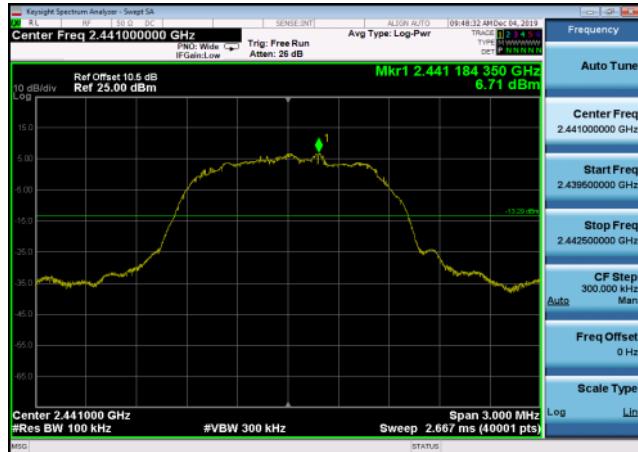
Conducted Emission: 8DPSK,2441,3DH5  
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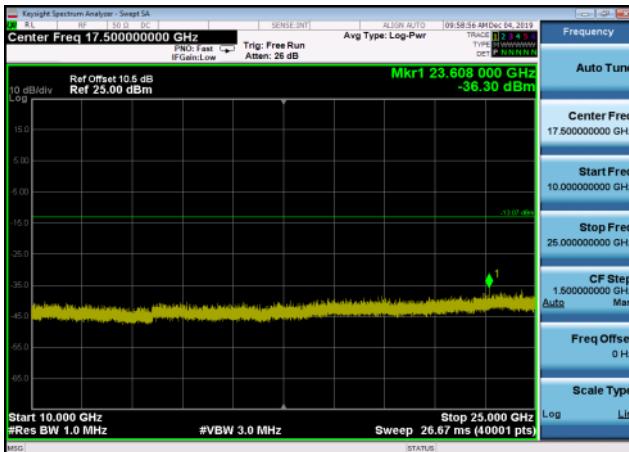
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,Band Edge HoppingOFF



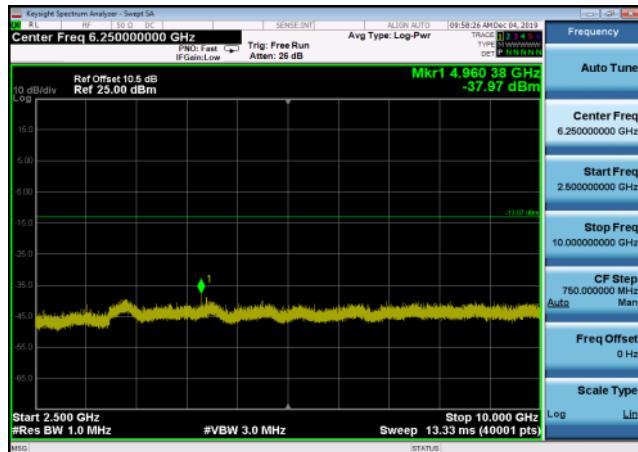
Conducted Emission: 8DPSK,2441,3DH5  
,Reference Level



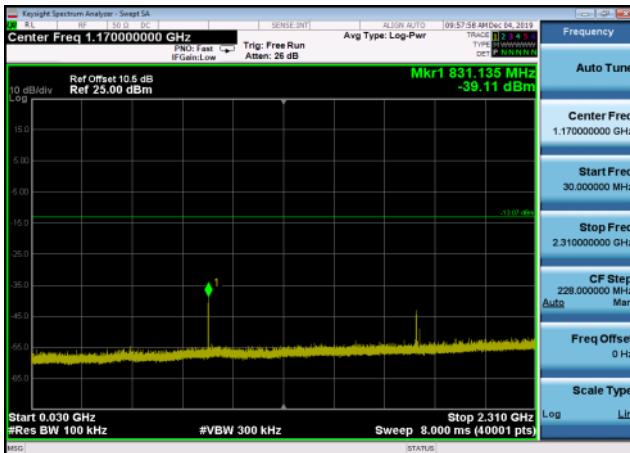
Conducted Emission: 8DPSK,2480,3DH5  
,10000MHz~25000MHz



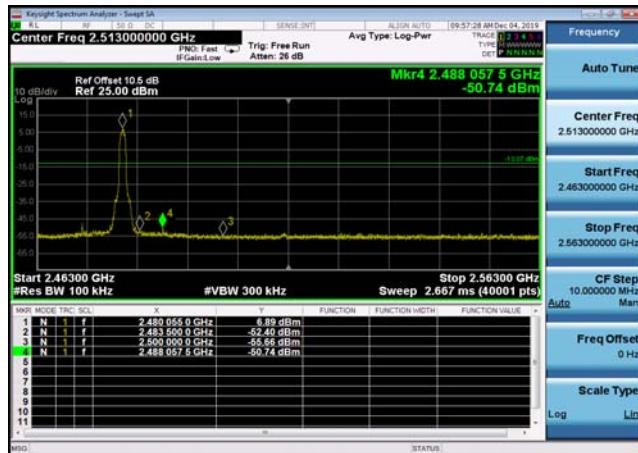
Conducted Emission: 8DPSK,2480,3DH5  
,2500MHz~10000MHz



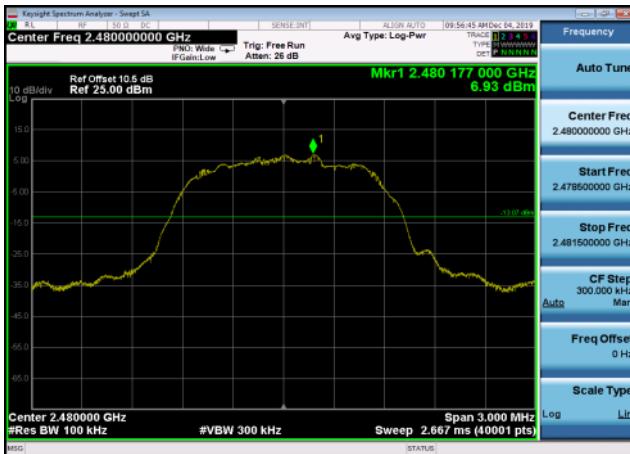
Conducted Emission: 8DPSK,2480,3DH5  
,30MHz~2310MHz



Conducted Emission: 8DPSK,2480,3DH5  
,Band Edge HoppingOFF



Conducted Emission: 8DPSK,2480,3DH5  
,Reference Level

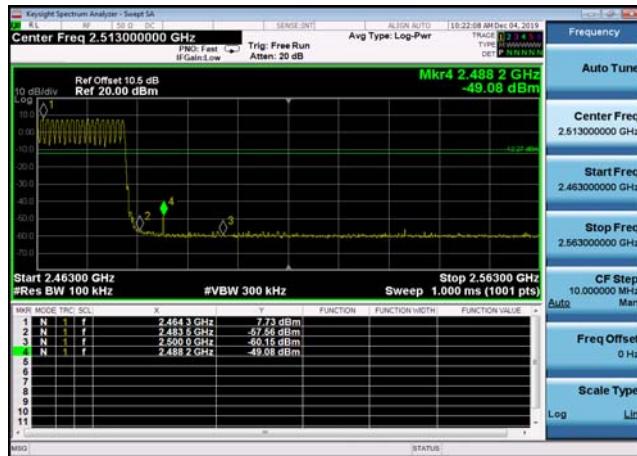


## Hopping On Mode

Conducted Emission: GFSK,2402,DH5  
,Band Edge



Conducted Emission: GFSK,2480,DH5  
,Band Edge



Conducted Emission: DQPSK,2402,2DH5  
,Band Edge



Conducted Emission: DQPSK,2480,2DH5  
,Band Edge



Conducted Emission: 8DPSK,2402,3DH5  
,Band Edge



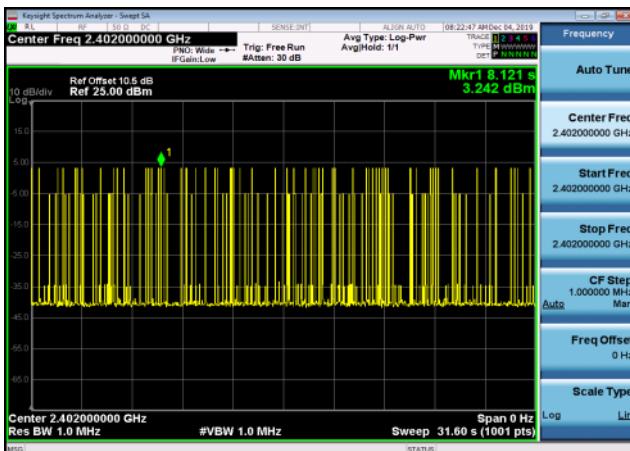
Conducted Emission: 8DPSK,2480,3DH5  
,Band Edge



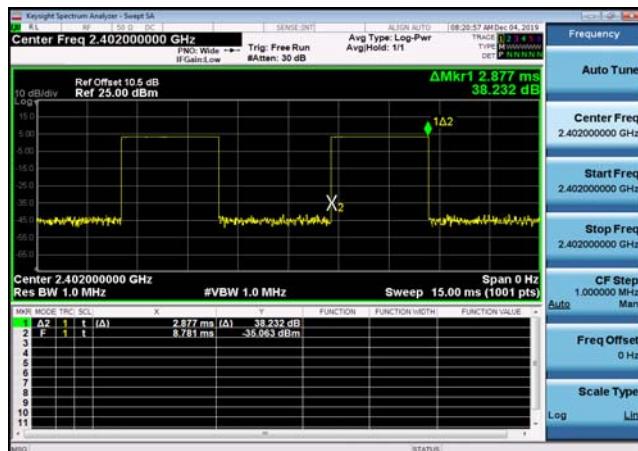
## Dwell Time Test Result and Data

BT Dwell Time						
Mode	Test Frequency	Packet Type	Transmission Time(ms)	Number	Dwell Time(ms)	Result
GFSK	2402	DH5	2.88	63	181.26	Pass
GFSK	2441	DH5	2.89	99	286.32	Pass
GFSK	2480	DH5	2.89	99	286.32	Pass
pi/4DQPSK	2402	2DH5	2.89	95	274.75	Pass
pi/4DQPSK	2441	2DH5	2.89	93	268.97	Pass
pi/4DQPSK	2480	2DH5	2.89	101	292.1	Pass
8DPSK	2402	3DH5	2.91	94	273.27	Pass
8DPSK	2441	3DH5	2.89	89	257.4	Pass
8DPSK	2480	3DH5	2.89	100	289.21	Pass

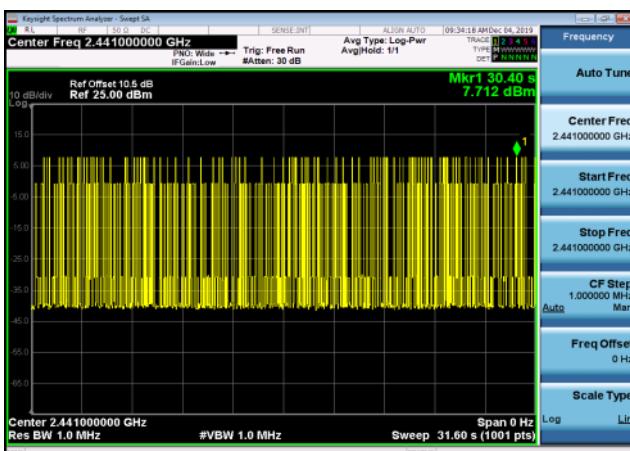
### GFSK,2402,DH5,Transmission Number



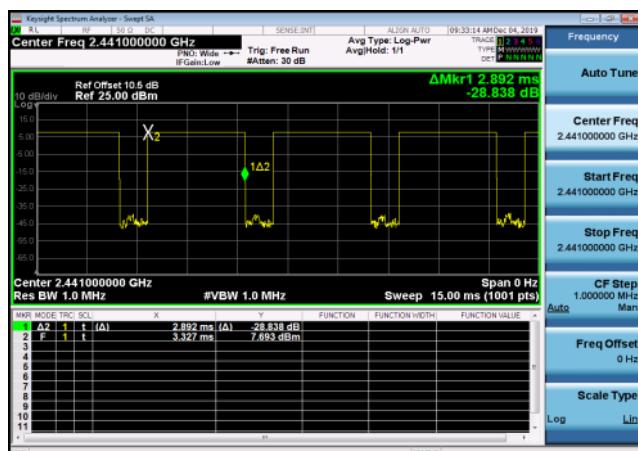
### GFSK,2402,DH5,Transmission Time



### GFSK,2441,DH5,Transmission Number



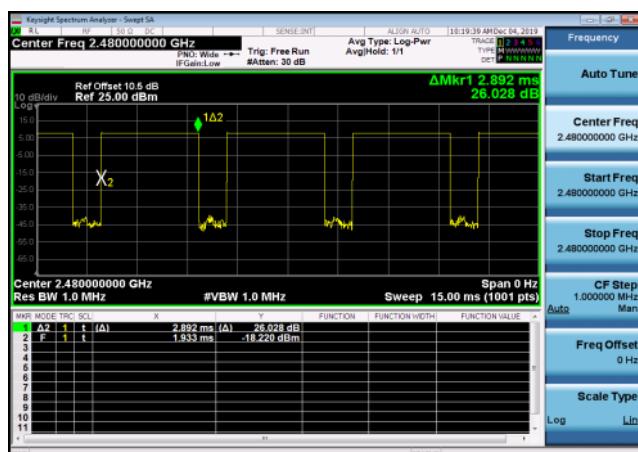
### GFSK,2441,DH5,Transmission Time



### GFSK,2480,DH5,Transmission Number



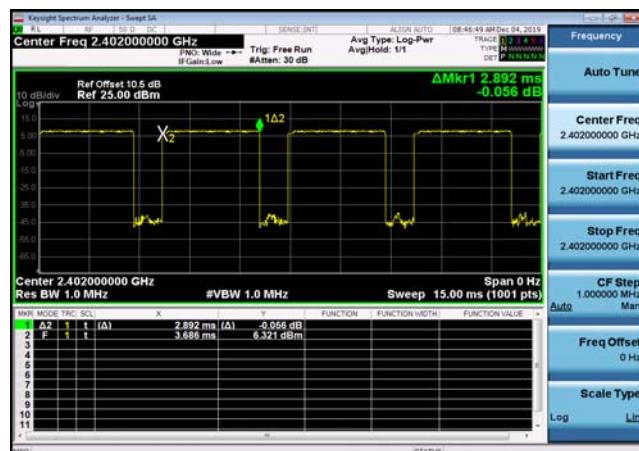
### GFSK,2480,DH5,Transmission Time



## DQPSK,2402,2DH5,Transmission Number



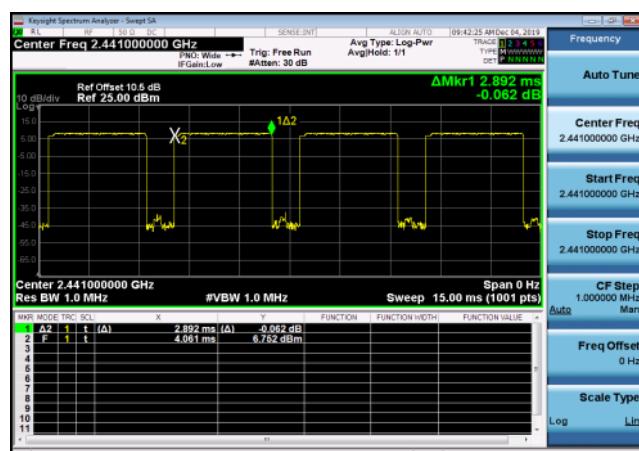
## DQPSK,2402,2DH5,Transmission Time



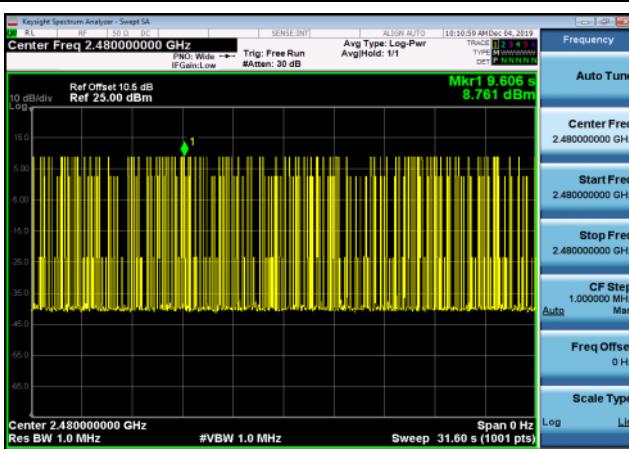
## DQPSK,2441,2DH5,Transmission Number



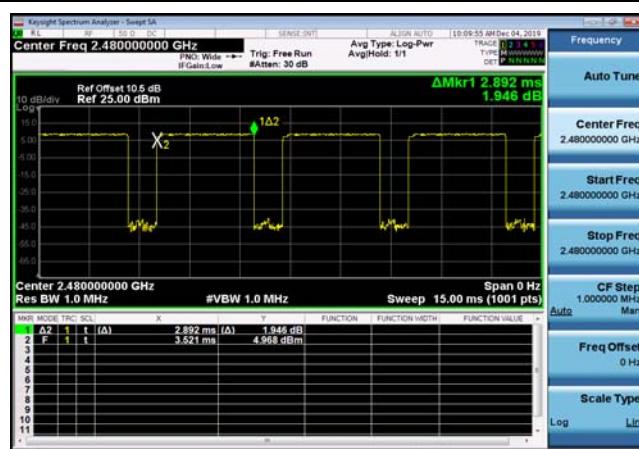
## DQPSK,2441,2DH5,Transmission Time



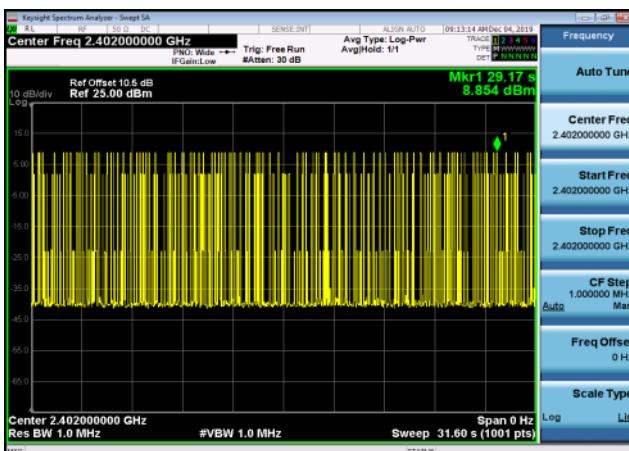
## DQPSK,2480,2DH5,Transmission Number



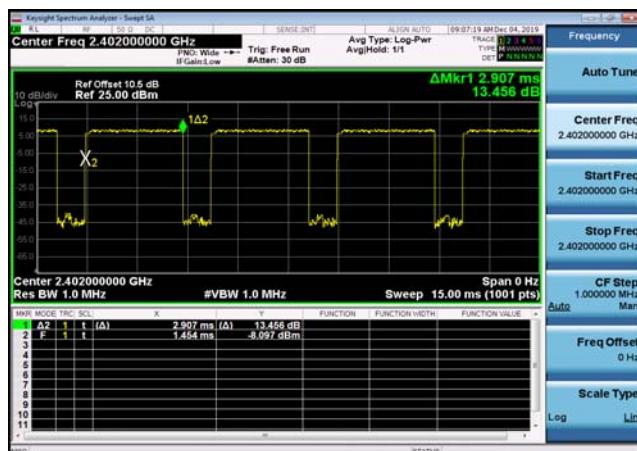
## DQPSK,2480,2DH5,Transmission Time



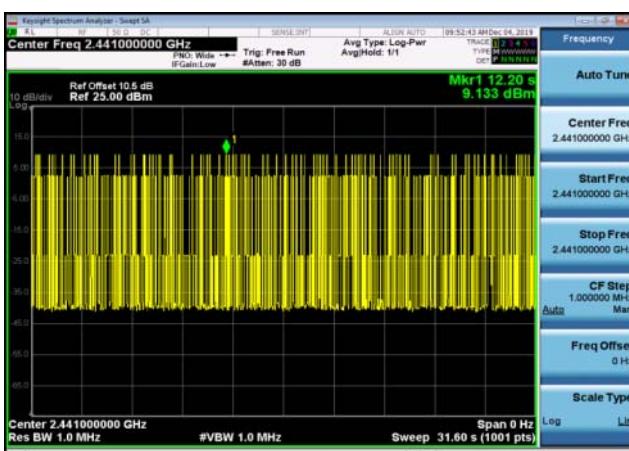
### 8DPSK,2402,3DH5,Transmission Number



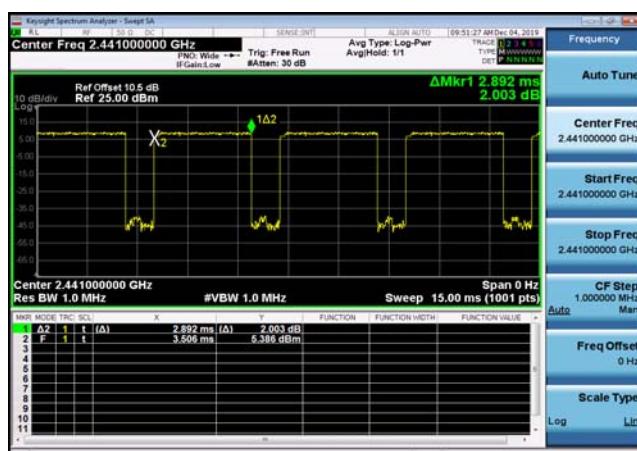
### 8DPSK,2402,3DH5,Transmission Time



### 8DPSK,2441,3DH5,Transmission Number



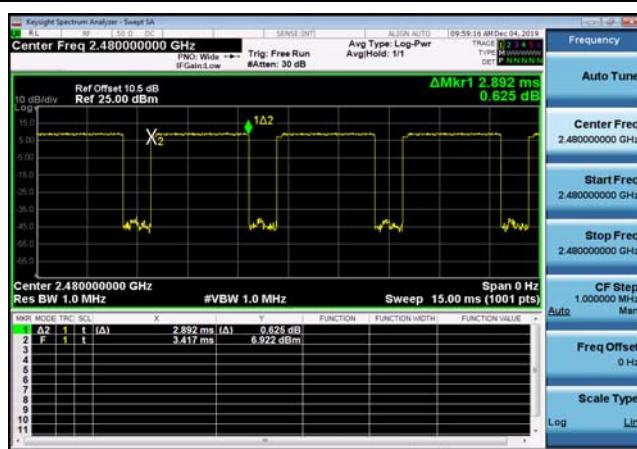
### 8DPSK,2441,3DH5,Transmission Time



### 8DPSK,2480,3DH5,Transmission Number



### 8DPSK,2480,3DH5,Transmission Time



## Carrier Frequency Separation Test Result and Data

BT Carrier Frequency Separation						
Mode	Test Frequency	Packet Type	Range (MHz~MHz)	Separation (KHz)	(Min Limit) (KHz)	Result
GFSK	Hopping	DH5	2401.5MHz~2403.5MHz	999	≥628.60	Pass
GFSK	Hopping	DH5	2440.5MHz~2442.5MHz	1108.89	≥646.87	Pass
GFSK	Hopping	DH5	2478.5MHz~2480.5MHz	999	≥640.79	Pass
pi/4DQPSK	Hopping	2DH5	2401.5MHz~2403.5MHz	999	≥892.17	Pass
pi/4DQPSK	Hopping	2DH5	2440.5MHz~2442.5MHz	999	≥892.59	Pass
pi/4DQPSK	Hopping	2DH5	2478.5MHz~2480.5MHz	999	≥892.54	Pass
8DPSK	Hopping	3DH5	2401.5MHz~2403.5MHz	1176.82	≥887.40	Pass
8DPSK	Hopping	3DH5	2440.5MHz~2442.5MHz	1001	≥887.97	Pass
8DPSK	Hopping	3DH5	2478.5MHz~2480.5MHz	1001	≥888.60	Pass

Note:The limit is 2/3 of 20dB Bandwidth

## GFSK,HoppingDH5,2401.5~2403.5



## GFSK,HoppingDH5,2440.5~2442.5



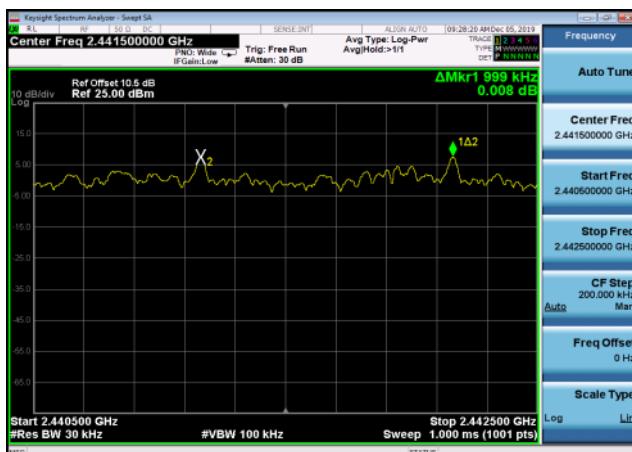
## GFSK,HoppingDH5,2478.5~2480.5



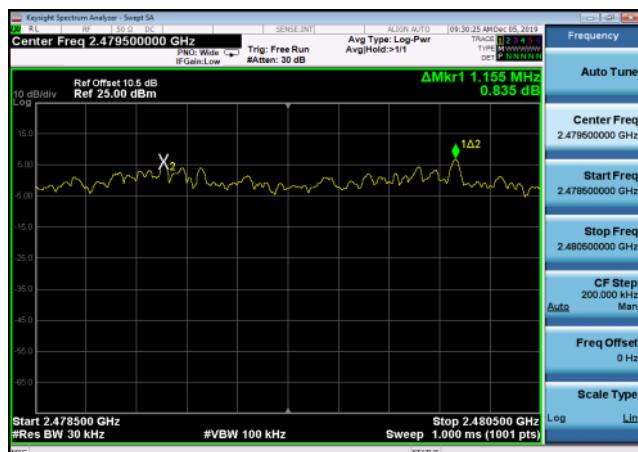
## DQPSK,Hopping2DH5,2401.5~2403.5



## DQPSK,Hopping2DH5,2440.5~2442.5



## DQPSK,Hopping2DH5,2478.5~2480.5



## 8DPSK,Hopping3DH5,2401.5~2403.5



## 8DPSK,Hopping3DH5,2440.5~2442.5



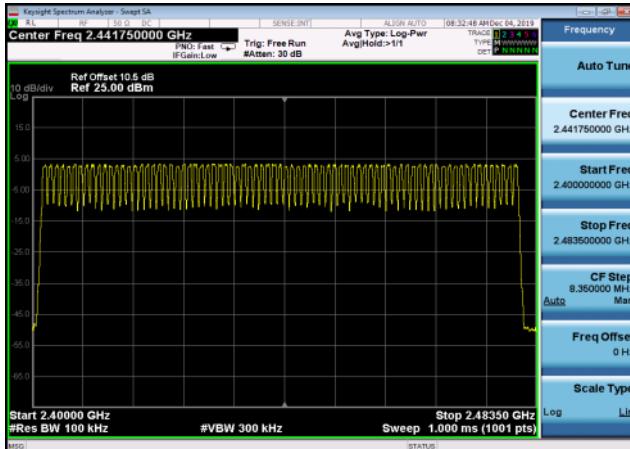
## 8DPSK,Hopping3DH5,2478.5~2480.5



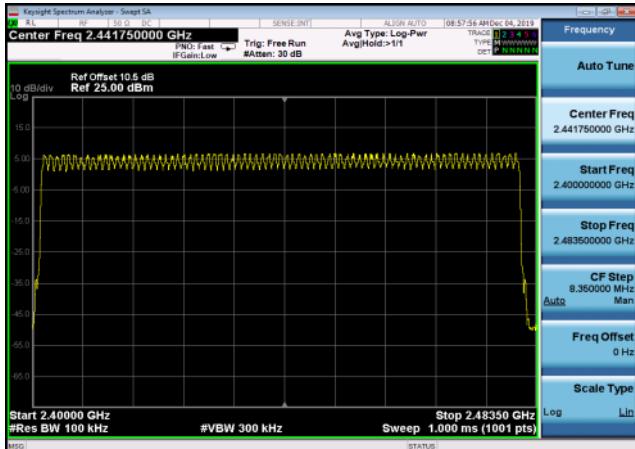
## Hopping Channel Numbers Test Result and Data

BT Number Of Hopping Channels					
Mode	Test Frequency	Packet Type	Test Range(MHz~MHz)	Limit	Result
GFSK	Hopping	DH5	2400~2483.5	≥15	Pass
pi/4DQPSK	Hopping	2DH5	2400~2483.5	≥15	Pass
8DPSK	Hopping	3DH5	2400~2483.5	≥15	Pass

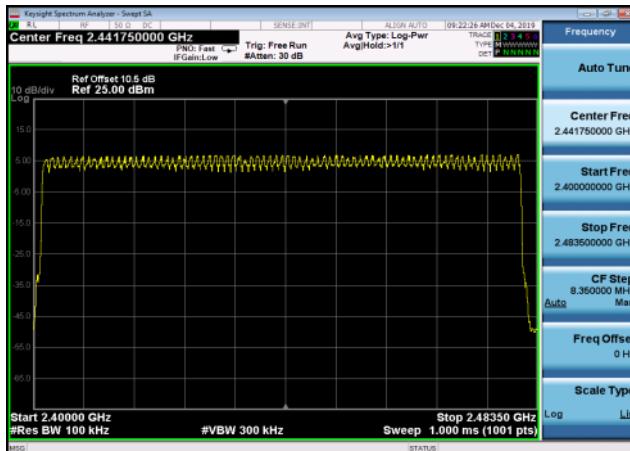
Number Of Hopping Channels: GFSK  
,HoppingMhz,DH5\_2400~2483.5



Number Of Hopping Channels: DQPSK  
,HoppingMhz,2DH5\_2400~2483.5



Number Of Hopping Channels: 8DPSK  
,HoppingMhz,3DH5\_2400~2483.5



\*\* END OF REPORT \*\*