

# FCC TEST REPORT

FOR

Shenzhen Hiper Song Electronic Technology Co., Ltd.

## Bluetooth speaker

Test Model: HS-BT188

Additional No.: N/A

Prepared for : **Shenzhen Hiper Song Electronic Technology Co., Ltd.**  
Address : 2F 77th building, Ci tian Pu the forth industrial district, Gongming street, Guang Ming new district, shenzhen China

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.  
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Date of receipt of test sample : Oct. 19, 2017

Number of tested samples : 1

Serial number : Prototype

Date of Test : Oct. 20, 2017–Nov. 07, 2017

Date of Report : Nov. 08, 2017

**FCC TEST REPORT****FCC CFR 47 PART 15 C(15.247): 2017****Report Reference No. .... : LCS170831044AE5**

Date of Issue ..... : Nov. 08, 2017

**Testing Laboratory Name..... : Shenzhen LCS Compliance Testing Laboratory Ltd.**Address ..... : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,  
Bao'an District, Shenzhen, Guangdong, ChinaTesting Location/ Procedure ..... : Full application of Harmonised standards ■  
Partial application of Harmonised standards □  
Other standard testing method □**Applicant's Name..... : Shenzhen Hiper Song Electronic Technology Co., Ltd.**Address ..... : 2F 77th building, Ci tian Pu the forth industrial district, Gongming  
street, Guang Ming new district, shenzhen China**Test Specification**

Standard ..... : FCC CFR 47 PART 15 C(15.247): 2017

Test Report Form No. .... : LCSEMC-1.0

TRF Originator ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF ..... : Dated 2011-03

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**Test Item Description. .... : Bluetooth speaker**

Trade Mark ..... : N/A

Test Model ..... : HS-BT188

Ratings ..... : DC 3.7V

**Result ..... : Positive****Compiled by:**

Ada Liang/ File administrators

**Supervised by:**

Glin Lu/ Technique principal

**Approved by:**

Gavin Liang/ Manager

## FCC -- TEST REPORT

|  |                                    |
|--|------------------------------------|
| Test Report No. : <b>LCS170831044AE5</b> | <u>2017-11-08</u><br>Date of issue |
|--|------------------------------------|

|                          |  |
|--------------------------|--|
| Test Model.....          | : HS-BT188   |
| EUT.....                 | : Bluetooth speaker  |
| <b>Applicant.....</b>    | <b>: Shenzhen Hiper Song Electronic Technology Co., Ltd.</b>   |
| Address.....             | : 2F 77th building, Ci tian Pu the forth industrial district, Gongming street, Guang Ming new district, shenzhen China |
| Telephone.....           | : /  |
| Fax.....                 | : /  |
| <b>Manufacturer.....</b> | <b>: Shenzhen Hiper Song Electronic Technology Co., Ltd.</b>   |
| Address.....             | : 2F 77th building, Ci tian Pu the forth industrial district, Gongming street, Guang Ming new district, shenzhen China |
| Telephone.....           | : /  |
| Fax.....                 | : /  |
| <b>Factory.....</b>      | <b>: Shenzhen Hiper Song Electronic Technology Co., Ltd.</b>   |
| Address.....             | : 2F 77th building, Ci tian Pu the forth industrial district, Gongming street, Guang Ming new district, shenzhen China |
| Telephone.....           | : /  |
| Fax.....                 | : /  |

|                    |                 |
|--------------------|-----------------|
| <b>Test Result</b> | <b>Positive</b> |
|--------------------|-----------------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

**Revision History**

| Revision | Issue Date    | Revisions     | Revised By  |
|----------|---------------|---------------|-------------|
| 00       | Nov. 08, 2017 | Initial Issue | Gavin Liang |
|          |               |               |             |
|          |               |               |             |

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# 1. SUMMARY

## 1.1. TEST STANDARDS

The tests were performed according to following standards:

**FCC Rules Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

**ANSI C63.10: 2013:** American National Standard for Testing Unlicensed Wireless Devices

**ANSI C63.4: 2014:** –American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz  
Range of 9 kHz to 40GHz

**KDB558074 D01 V03r05:** Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

## 1.2. Test Description

| FCC PART 15.247            |  |      |
|----------------------------|--|------|
| FCC Part 15.207            | AC Power Conducted Emission                    | PASS |
| FCC Part 15.247(a)(1)(i)   | 20dB Bandwidth                                 | PASS |
| FCC Part 15.247(d)         | Spurious RF Conducted Emission                 | PASS |
| FCC Part 15.247(b)         | Maximum Peak Output Power                      | PASS |
| FCC Part 15.247(b)         | Pseudorandom Frequency Hopping Sequence        | PASS |
| FCC Part 15.247(a)(1)(iii) | Number of hopping frequency& Time of Occupancy | PASS |
| FCC Part 15.247(a)(1)      | Frequency Separation                           | PASS |
| FCC Part 15.205/15.209     | Radiated Emissions                             | PASS |
| FCC Part 15.247(d)         | Band Edge Compliance of RF Emission            | PASS |
| FCC Part 15.203/15.247 (b) | Antenna Requirement                            | PASS |

### 1.3. Test Facility

#### 1.3.1 Address of the test laboratory

Shenzhen LCS Compliance Testing Laboratory Ltd.

1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China

There is one 3m semi-anechoic chamber fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

#### 1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS Registration Number. is L4595.

FCC Registration Number. is 254912.

Industry Canada Registration Number. is 9642A-1.

ESMD Registration Number. is ARCB0108.

UL Registration Number. is 100571-492.

TUV SUD Registration Number. is SCN1081.

TUV RH Registration Number. is UA 50296516-001

### 1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

| Test Item              |   | Frequency Range | Uncertainty | Note |
|------------------------|---|-----------------|-------------|------|
| Radiation Uncertainty  | : | 9KHz~30MHz      | 3.10dB      | (1)  |
|                        |   | 30MHz~200MHz    | 2.96dB      | (1)  |
|                        |   | 200MHz~1000MHz  | 3.10dB      | (1)  |
|                        |   | 1GHz~26.5GHz    | 3.80dB      | (1)  |
|                        |   | 26.5GHz~40GHz   | 3.90dB      | (1)  |
| Conduction Uncertainty | : | 150kHz~30MHz    | 1.63dB      | (1)  |
| Power disturbance      | : | 30MHz~300MHz    | 1.60dB      | (1)  |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 2. GENERAL INFORMATION

### 2.1. Environmental conditions

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

|                     |         |
|---------------------|---------|
| Normal Temperature: | 25°C    |
| Relative Humidity:  | 55 %    |
| Air Pressure:       | 101 kPa |

### 2.2. General Description of EUT

|                       |                            |
|-----------------------|----------------------------|
| Product Name:         | Bluetooth speaker          |
| Model/Type reference: | HS-BT188                   |
| Power supply:         | DC 3.7V from battery       |
| <b>Bluetooth :</b>    |                            |
| Version:              | Supported BT4.2            |
| Modulation:           | GFSK, $\pi/4$ DQPSK, 8DPSK |
| Operation frequency:  | 2402MHz~2480MHz            |
| Channel number:       | 79                         |
| Channel separation:   | 1MHz                       |
| Antenna type:         | PCB antenna                |
| Antenna gain:         | 0dBi                       |

Note: For more details, please refer to the user's manual of the EUT.

### 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT and Channel 00/39/78 were selected to test.

#### Operation Frequency :

| Channel | Frequency (MHz) |
|---------|-----------------|
| 00      | 2402            |
| 01      | 2403            |
| :       | :               |
| 38      | 2440            |
| 39      | 2441            |
| 40      | 2442            |
| :       | :               |
| 77      | 2479            |
| 78      | 2480            |



Preliminary tests were performed in each mode and packet length of BT, and found worst case as below, finally test were conducted at those mode and recorded in this report.

| Test Items                       | Worst case   |
|----------------------------------|--|
| Conducted Emissions              | DH5 Middle channel   |
| Radiated Emissions and Band Edge | 3DH5   |
| Maximum Conducted Output Power   | DH5/2DH5/3DH5  |
| 20dB Bandwidth                   | DH5/2DH5/3DH5  |
| Frequency Separation             | DH5/2DH5/3DH5 Middle channel   |
| Number of hopping frequency      | DH5/2DH5/3DH5  |
| Time of Occupancy (Dwell Time)   | DH1/DH3/DH5 Middle channel<br>2DH1/2DH3/2DH5 Middle channel<br>3DH1/3DH3/3DH5 Middle channel |
| Out-of-band Emissions            | DH5/2DH5/3DH5  |

## 2.4. Equipments Used during the Test

| Item | Equipment                | Manufacturer   | Model No.                        | Serial No.  | Last Cal.  | Next Cal.  |
|------|--------------------------|----------------|----------------------------------|-------------|------------|------------|
| 1    | EMC Receiver             | R&S            | ESCS 30                          | 100174      | 2017-06-18 | 2018-06-17 |
| 2    | Signal analyzer          | Agilent        | E4448A(External mixers to 40GHz) | US44300469  | 2017-07-16 | 2018-06-17 |
| 3    | Spectrum Analyzer        | Agilent        | N9020A                           | MY50510140  | 2017-10-27 | 2018-10-26 |
| 4    | LISN                     | MESS Tec       | NNB-2/16Z                        | 99079       | 2017-06-18 | 2018-06-17 |
| 5    | LISN                     | EMCO           | 3819/2NM                         | 9703-1839   | 2017-06-18 | 2018-06-17 |
| 6    | RF Cable-CON             | UTIFLEX        | 3102-26886-4                     | CB049       | 2017-06-18 | 2018-06-17 |
| 7    | ISN                      | SCHAFFNER      | ISN ST08                         | 21653       | 2017-06-18 | 2018-06-17 |
| 8    | 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M                           | 03CH03-HY   | 2017-06-18 | 2018-06-17 |
| 9    | Amplifier                | SCHAFFNER      | COA9231A                         | 18667       | 2017-06-18 | 2018-06-17 |
| 10   | Amplifier                | Agilent        | 8449B                            | 3008A02120  | 2017-06-16 | 2018-06-15 |
| 11   | Amplifier                | MITEQ          | AMF-6F-260400                    | 9121372     | 2017-06-16 | 2018-06-15 |
| 12   | Loop Antenna             | R&S            | HFH2-Z2                          | 860004/001  | 2017-06-18 | 2018-06-17 |
| 13   | By-log Antenna           | SCHWARZBECK    | VULB9163                         | 9163-470    | 2017-06-10 | 2018-06-09 |
| 14   | Horn Antenna             | EMCO           | 3115                             | 6741        | 2017-06-10 | 2018-06-09 |
| 15   | Horn Antenna             | SCHWARZBECK    | BBHA9170                         | BBHA9170154 | 2017-06-10 | 2018-06-09 |
| 16   | RF Cable-R03m            | Jye Bao        | RG142                            | CB021       | 2017-06-18 | 2018-06-17 |
| 17   | RF Cable-HIGH            | SUHNER         | SUCOFLEX 106                     | 03CH03-HY   | 2017-06-18 | 2018-06-17 |
| 18   | Power Sensor             | R&S            | NRV-Z81                          | 100458      | 2017-06-18 | 2018-06-17 |
| 19   | Power Sensor             | R&S            | NRV-Z32                          | 10057       | 2017-06-18 | 2018-06-17 |
| 20   | Power Meter              | R&S            | NRVS                             | 100444      | 2017-06-18 | 2018-06-17 |

The calibration interval was one year

## 2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## **2.6. Modifications**

No modifications were implemented to meet testing criteria.

### 3. TEST CONDITIONS AND RESULTS

#### 3.1. Conducted Emissions Test

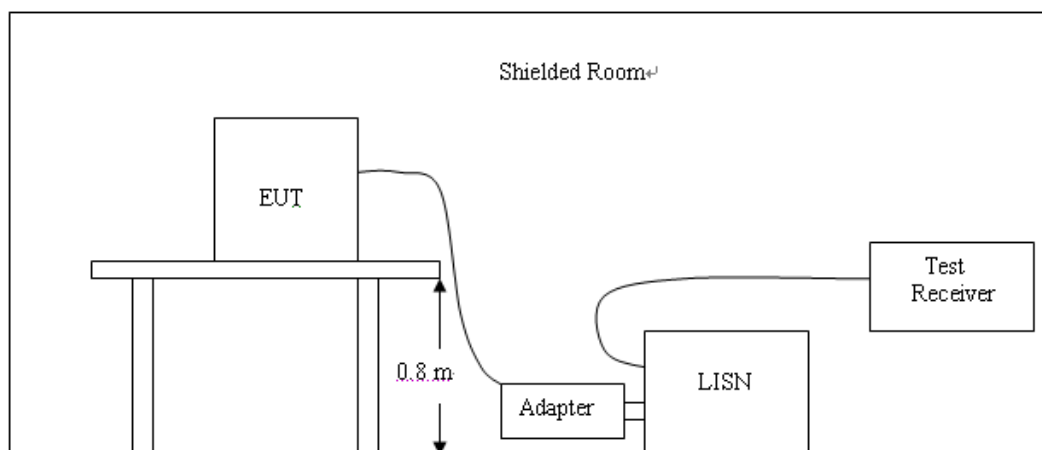
##### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

| Frequency range (MHz) | Limit (dBuV) |           |
|-----------------------|--------------|-----------|
|                       | Quasi-peak   | Average   |
| 0.15-0.5              | 66 to 56*    | 56 to 46* |
| 0.5-5                 | 56           | 46        |
| 5-30                  | 60           | 50        |

\* Decreases with the logarithm of the frequency.

##### TEST CONFIGURATION



##### TEST PROCEDURE

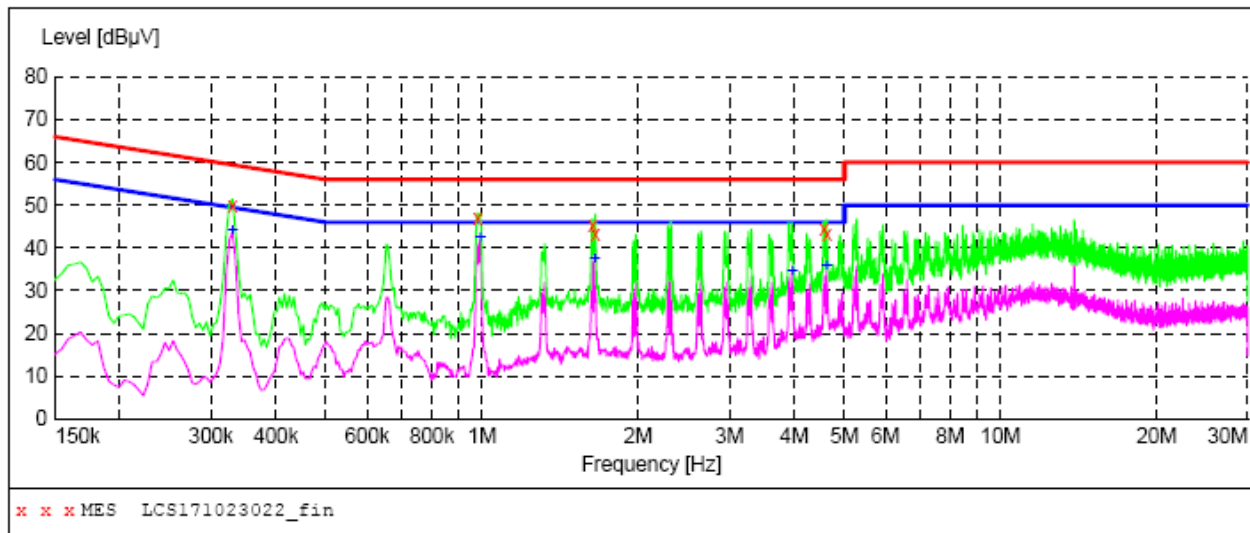
1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

**TEST RESULTS**

Remark: All modes of GFSK,  $\pi/4$ DQPSK, and 8DPSK were test at Low, Middle, and High channel; only the worst result of GFSK Middle Channel was reported as below:

**SCAN TABLE: "Voltage (9K-30M) FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "LCS171023022\_fin"**

23/10/2017 11:55

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.330000         | 49.90         | 10.2         | 60            | 9.6          | QP       | L1   | GND |
| 0.980000         | 46.80         | 10.3         | 56            | 9.2          | QP       | L1   | GND |
| 1.634000         | 45.30         | 10.3         | 56            | 10.7         | QP       | L1   | GND |
| 1.652000         | 43.20         | 10.3         | 56            | 12.8         | QP       | L1   | GND |
| 4.562000         | 44.40         | 10.4         | 56            | 11.6         | QP       | L1   | GND |
| 4.628000         | 43.10         | 10.4         | 56            | 12.9         | QP       | L1   | GND |

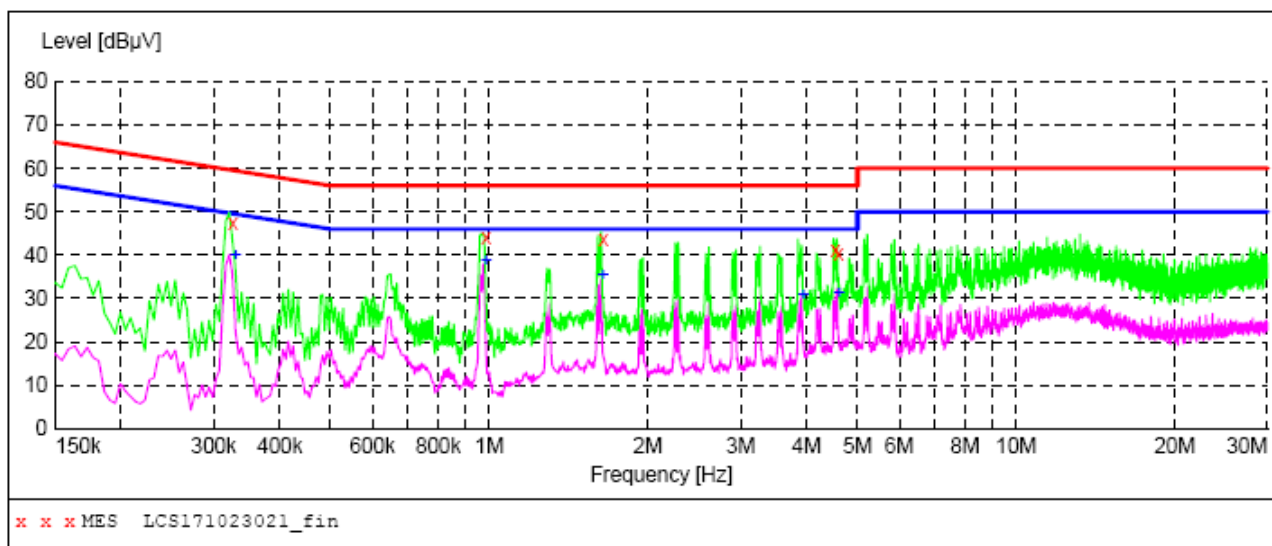
**MEASUREMENT RESULT: "LCS171023022\_fin2"**

23/10/2017 11:55

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.330000         | 44.10         | 10.2         | 50            | 5.4          | AV       | L1   | GND |
| 0.992000         | 42.40         | 10.3         | 46            | 3.6          | AV       | L1   | GND |
| 1.652000         | 37.50         | 10.3         | 46            | 8.5          | AV       | L1   | GND |
| 3.974000         | 34.60         | 10.4         | 46            | 11.4         | AV       | L1   | GND |
| 4.628000         | 35.60         | 10.4         | 46            | 10.4         | AV       | L1   | GND |

**SCAN TABLE: "Voltage (9K-30M) FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "LCS171023021\_fin"**

23/10/2017 11:51

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.326000         | 47.30         | 10.2         | 60            | 12.3         | QP       | N    | GND |
| 0.986000         | 43.90         | 10.3         | 56            | 12.1         | QP       | N    | GND |
| 1.646000         | 43.70         | 10.3         | 56            | 12.3         | QP       | N    | GND |
| 4.538000         | 41.30         | 10.4         | 56            | 14.7         | QP       | N    | GND |
| 4.598000         | 40.50         | 10.4         | 56            | 15.5         | QP       | N    | GND |

**MEASUREMENT RESULT: "LCS171023021\_fin2"**

23/10/2017 11:51

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.330000         | 39.80         | 10.2         | 50            | 9.7          | AV       | N    | GND |
| 0.986000         | 38.60         | 10.3         | 46            | 7.4          | AV       | N    | GND |
| 1.646000         | 35.50         | 10.3         | 46            | 10.5         | AV       | N    | GND |
| 3.944000         | 30.70         | 10.4         | 46            | 15.3         | AV       | N    | GND |
| 4.610000         | 31.30         | 10.4         | 46            | 14.7         | AV       | N    | GND |

## 3.2. Radiated Emissions and Band Edge

### Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

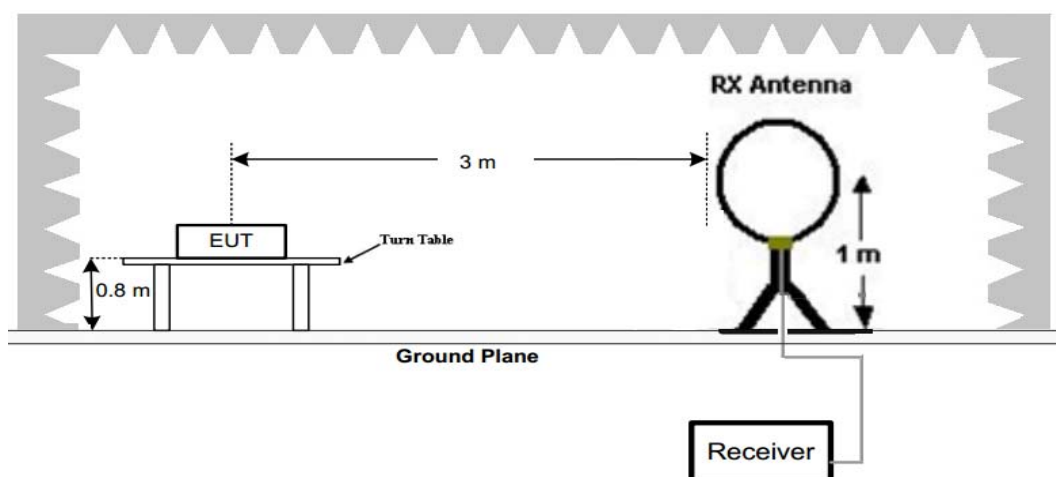
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

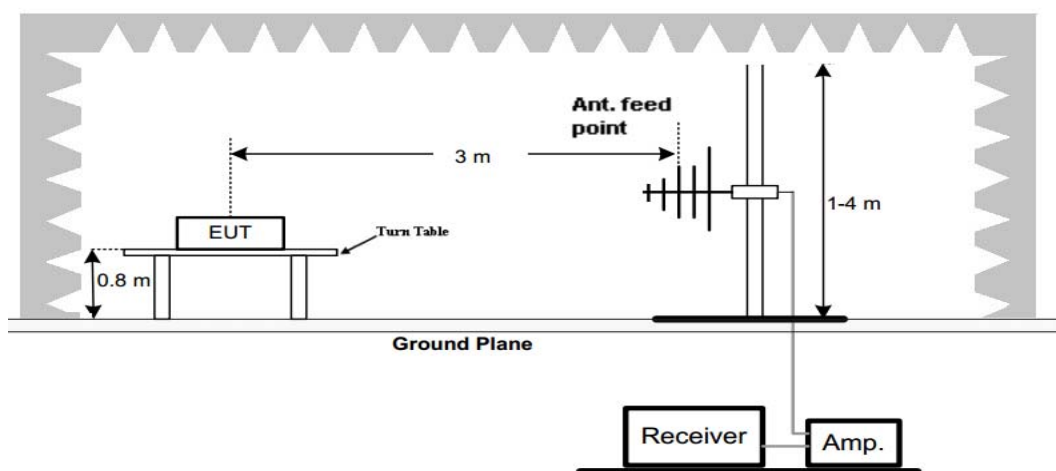
| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m)                          | Radiated (μV/m)       |
|-----------------|-------------------|--|-----------------------|
| 0.009-0.49      | 3                 | $20\log(2400/F(\text{KHz}))+40\log(300/3)$ | $2400/F(\text{KHz})$  |
| 0.49-1.705      | 3                 | $20\log(24000/F(\text{KHz}))+40\log(30/3)$ | $24000/F(\text{KHz})$ |
| 1.705-30        | 3                 | $20\log(30)+40\log(30/3)$                  | 30                    |
| 30-88           | 3                 | 40.0                                       | 100                   |
| 88-216          | 3                 | 43.5                                       | 150                   |
| 216-960         | 3                 | 46.0                                       | 200                   |
| Above 960       | 3                 | 54.0                                       | 500                   |

### TEST CONFIGURATION

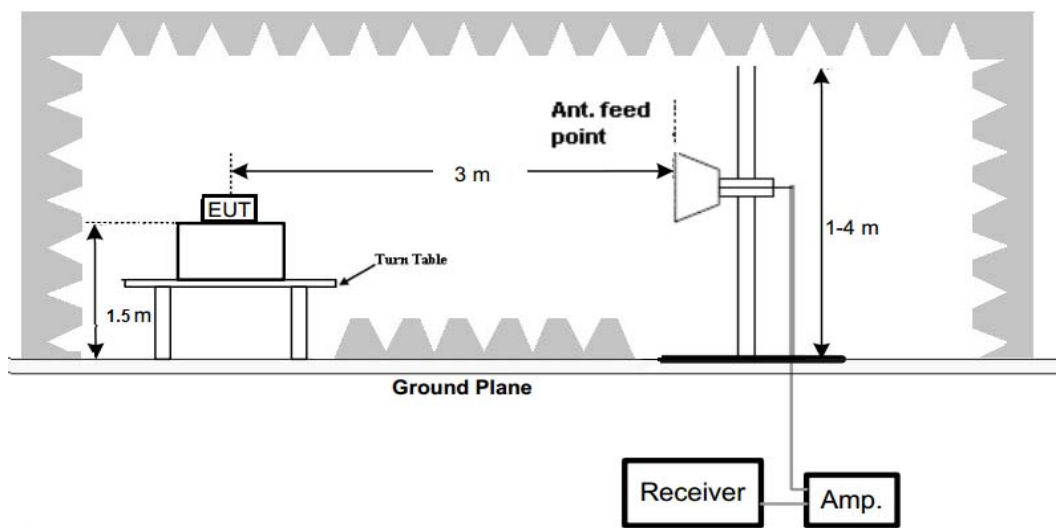
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



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



### Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

### TEST RESULTS

Remark:

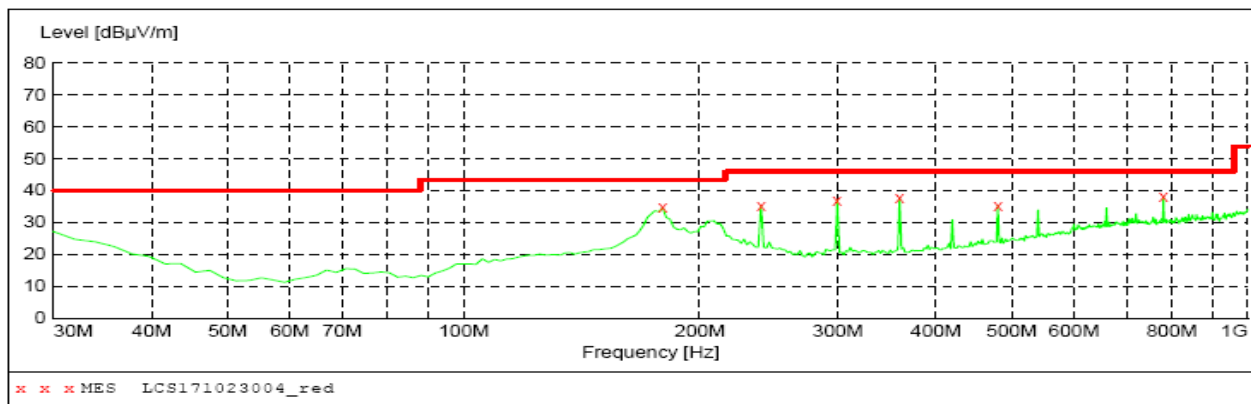
1. We measured Radiated Emission at GFSK,  $\pi/4$  DQPSK and 8DPSK mode from 9 KHz to 25GHz and recorded worst case at 8DPSK 3DH5 mode.
2. For below 1GHz testing recorded worst at 8DPSK 3DH5 low channel.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

## For 30MHz-1GHz

## Horizontal

**SWEEP TABLE: "test (30M-1G)"**

| Short Description: |                   | Field Strength |            |           |            |
|--------------------|-------------------|----------------|------------|-----------|------------|
| Start              | Stop              | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency 30.0 MHz | Frequency 1.0 GHz | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |

**MEASUREMENT RESULT: "LCS171023004\_red"**

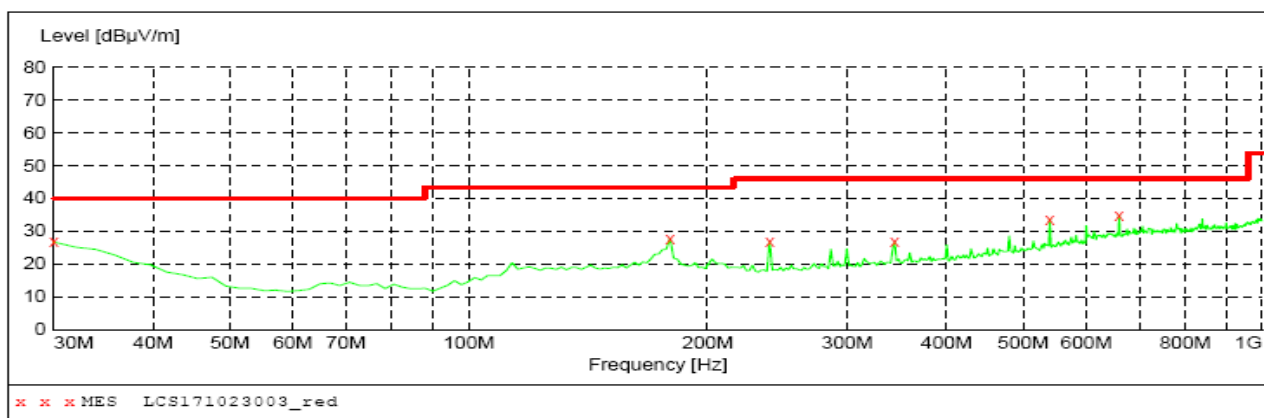
10/23/2017 9:01AM

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---------------|--------------|-----------|--------------|-----------|------|-----------|-------------|--------------|
| 179.380000    | 34.60        | 14.6      | 43.5         | 8.9       | ---  | 0.0       | 0.00        | HORIZONTAL   |
| 239.520000    | 35.20        | 14.1      | 46.0         | 10.8      | ---  | 0.0       | 0.00        | HORIZONTAL   |
| 299.660000    | 36.90        | 16.1      | 46.0         | 9.1       | ---  | 0.0       | 0.00        | HORIZONTAL   |
| 359.800000    | 37.70        | 17.5      | 46.0         | 8.3       | ---  | 0.0       | 0.00        | HORIZONTAL   |
| 480.080000    | 35.30        | 20.1      | 46.0         | 10.7      | ---  | 0.0       | 0.00        | HORIZONTAL   |
| 780.780000    | 38.10        | 25.3      | 46.0         | 7.9       | ---  | 0.0       | 0.00        | HORIZONTAL   |

## Vertical

**SWEEP TABLE: "test (30M-1G)"**

| Short Description: |                   | Field Strength |            |           |            |
|--------------------|-------------------|----------------|------------|-----------|------------|
| Start              | Stop              | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency 30.0 MHz | Frequency 1.0 GHz | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |

**MEASUREMENT RESULT: "LCS171023003\_red"**

10/23/2017 8:59AM

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---------------|--------------|-----------|--------------|-----------|------|-----------|-------------|--------------|
| 30.000000     | 26.70        | 22.1      | 40.0         | 13.3      | ---  | 0.0       | 0.00        | VERTICAL     |
| 179.380000    | 27.80        | 14.6      | 43.5         | 15.7      | ---  | 0.0       | 0.00        | VERTICAL     |
| 239.520000    | 26.80        | 14.1      | 46.0         | 19.2      | ---  | 0.0       | 0.00        | VERTICAL     |
| 344.280000    | 26.60        | 17.1      | 46.0         | 19.4      | ---  | 0.0       | 0.00        | VERTICAL     |
| 540.220000    | 33.70        | 21.6      | 46.0         | 12.3      | ---  | 0.0       | 0.00        | VERTICAL     |
| 660.500000    | 34.90        | 23.8      | 46.0         | 11.1      | ---  | 0.0       | 0.00        | VERTICAL     |



**For 1GHz to 25GHz**Note: GFSK,  $\pi/4$  DQPSK and 8DPSK all have been tested, only worse case 8DPSK is reported.**8DPSK (above 1GHz)**

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4804.00         | 57.34                   | PK | 74             | 16.66       | 52.83            | 33.49                 | 6.91              | 35.89              | 4.51                     |
| 4804.00         | 48.29                   | AV | 54             | 5.71        | 43.78            | 33.49                 | 6.91              | 35.89              | 4.51                     |
| 4997.15         | 45.61                   | PK | 74             | 28.39       | 38.84            | 33.97                 | 7.03              | 34.23              | 6.77                     |
| 4997.15         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 7206.00         | 48.72                   | PK | 74             | 25.28       | 37.61            | 36.95                 | 9.18              | 35.03              | 11.11                    |
| 7206.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4804.00         | 55.93                   | PK | 74             | 18.07       | 51.42            | 33.49                 | 6.91              | 35.89              | 4.51                     |
| 4804.00         | 46.45                   | AV | 54             | 7.55        | 41.94            | 33.49                 | 6.91              | 35.89              | 4.51                     |
| 5886.30         | 46.66                   | PK | 74             | 27.34       | 38.87            | 34.82                 | 7.52              | 34.55              | 7.79                     |
| 5886.30         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 7206.00         | 47.07                   | PK | 74             | 26.93       | 35.96            | 36.95                 | 9.18              | 35.03              | 11.11                    |
| 7206.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2441           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4882.00         | 55.57                   | PK | 74             | 18.43       | 50.92            | 33.60                 | 6.95              | 35.90              | 4.65                     |
| 4882.00         | 46.02                   | AV | 54             | 7.98        | 41.37            | 33.60                 | 6.95              | 35.90              | 4.65                     |
| 6295.38         | 44.10                   | PK | 74             | 29.90       | 35.60            | 35.19                 | 8.04              | 34.73              | 8.50                     |
| 6295.38         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 7323.00         | 47.48                   | PK | 74             | 26.52       | 35.78            | 37.46                 | 9.23              | 35.00              | 11.70                    |
| 7323.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2441           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4882.00         | 54.24                   | PK | 74             | 19.76       | 49.59            | 33.60                 | 6.95              | 35.90              | 4.65                     |
| 4882.00         | 44.68                   | AV | 54             | 9.32        | 40.03            | 33.60                 | 6.95              | 35.90              | 4.65                     |
| 6012.96         | 45.51                   | PK | 74             | 28.49       | 37.37            | 35.13                 | 7.61              | 34.60              | 8.14                     |
| 6012.96         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

|         |       |    |    |       |       |       |      |       |       |
|---------|-------|----|----|-------|-------|-------|------|-------|-------|
| 7323.00 | 46.73 | PK | 74 | 27.27 | 35.03 | 37.46 | 9.23 | 35.00 | 11.70 |
| 7323.00 | --    | AV | 54 | --    | --    | --    | --   | --    | --    |

| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4960.00         | 57.09                   | PK | 74             | 16.91       | 52.17            | 33.84                 | 7.00              | 35.92              | 4.92                     |
| 4960.00         | 48.10                   | AV | 54             | 5.90        | 43.18            | 33.84                 | 7.00              | 35.92              | 4.92                     |
| 6317.81         | 46.36                   | PK | 74             | 27.64       | 37.84            | 35.19                 | 8.08              | 34.75              | 8.52                     |
| 6317.81         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 7440.00         | 48.42                   | PK | 74             | 25.58       | 36.47            | 37.64                 | 9.28              | 34.97              | 11.95                    |
| 7440.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4960.00         | 55.05                   | PK | 74             | 18.95       | 50.13            | 33.84                 | 7.00              | 35.92              | 4.92                     |
| 4960.00         | 46.44                   | AV | 54             | 7.56        | 41.52            | 33.84                 | 7.00              | 35.92              | 4.92                     |
| 7010.62         | 45.97                   | PK | 74             | 28.03       | 35.68            | 36.26                 | 9.10              | 35.08              | 10.29                    |
| 7010.62         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 7440.00         | 47.30                   | PK | 74             | 26.70       | 35.35            | 37.64                 | 9.28              | 34.97              | 11.95                    |
| 7440.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

## 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
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

**Results of Band Edges Test (Radiated)**

Note: GFSK,  $\pi/4$  DQPSK and 8DPSK all have been tested, only worse case 8DPSK is reported.

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2402.00         | 94.06                   | PK | --             | --          | 60.66            | 28.78                 | 4.61              | 0.00               | 33.40                    |
| 2402.00         | 85.45                   | AV | --             | --          | 52.05            | 28.78                 | 4.61              | 0.00               | 33.40                    |
| 2338.05         | 46.39                   | PK | 74             | 27.61       | 13.45            | 28.40                 | 4.54              | 0.00               | 32.94                    |
| 2338.05         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2390.00         | 44.17                   | PK | 74             | 29.83       | 10.85            | 28.72                 | 4.60              | 0.00               | 33.32                    |
| 2390.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2400.00         | 47.60                   | PK | 74             | 26.40       | 14.21            | 28.78                 | 4.61              | 0.00               | 33.39                    |
| 2400.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2402.00         | 91.98                   | PK | --             | --          | 58.58            | 28.78                 | 4.61              | 0.00               | 33.40                    |
| 2402.00         | 83.42                   | AV | --             | --          | 50.02            | 28.78                 | 4.61              | 0.00               | 33.40                    |
| 2338.05         | 45.50                   | PK | 74             | 28.50       | 12.56            | 28.40                 | 4.54              | 0.00               | 32.94                    |
| 2338.05         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2390.00         | 43.86                   | PK | 74             | 30.14       | 10.54            | 28.72                 | 4.60              | 0.00               | 33.32                    |
| 2390.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2400.00         | 46.73                   | PK | 74             | 27.27       | 13.34            | 28.78                 | 4.61              | 0.00               | 33.39                    |
| 2400.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2480.00         | 93.30                   | PK | --             | --          | 59.68            | 28.92                 | 4.70              | 0.00               | 33.62                    |
| 2480.00         | 84.11                   | AV | --             | --          | 50.49            | 28.92                 | 4.70              | 0.00               | 33.62                    |
| 2483.50         | 46.69                   | PK | 74             | 27.31       | 13.06            | 28.93                 | 4.70              | 0.00               | 33.63                    |
| 2483.50         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2485.02         | 43.17                   | PK | 74             | 30.83       | 9.53             | 28.93                 | 4.70              | 0.00               | 33.64                    |
| 2485.02         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2500.00         | 40.54                   | PK | 74             | 33.46       | 6.86             | 28.96                 | 4.72              | 0.00               | 33.68                    |
| 2500.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2480.00         | 90.91                   | PK | --             | --          | 57.29            | 28.92                 | 4.70              | 0.00               | 33.62                    |
| 2480.00         | 82.52                   | AV | --             | --          | 48.90            | 28.92                 | 4.70              | 0.00               | 33.62                    |
| 2483.50         | 45.28                   | PK | 74             | 28.72       | 11.65            | 28.93                 | 4.70              | 0.00               | 33.63                    |
| 2483.50         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2485.02         | 42.50                   | PK | 74             | 31.50       | 8.86             | 28.93                 | 4.70              | 0.00               | 33.64                    |
| 2485.02         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |
| 2500.00         | 40.27                   | PK | 74             | 33.73       | 6.59             | 28.96                 | 4.72              | 0.00               | 33.68                    |
| 2500.00         | --                      | AV | 54             | --          | --               | --                    | --                | --                 | --                       |

## 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
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

### 3.3. Maximum Peak Output Power

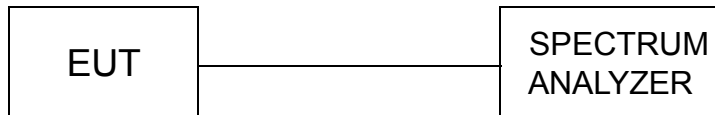
#### Limit

The Maximum Peak Output Power Measurement is 125mW(20.97).

#### Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum.

#### Test Configuration



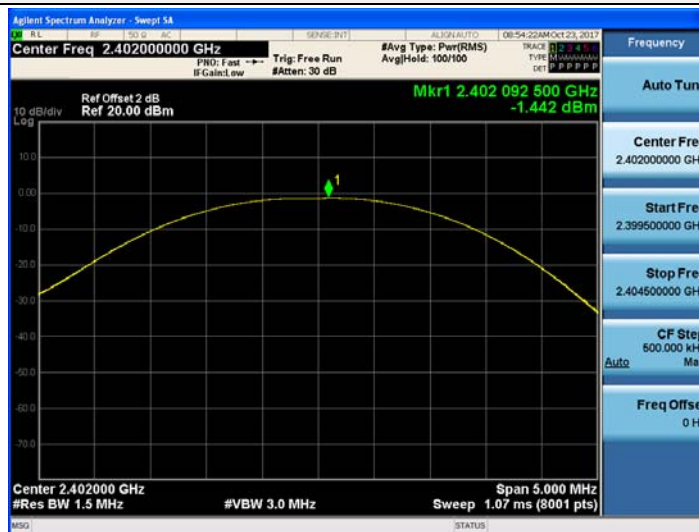
#### Test Results

| Type     | Channel | Output power (dBm) | Limit (dBm) | Result |
|----------|---------|--------------------|-------------|--------|
| GFSK     | 00      | -1.442             | 20.97       | Pass   |
|          | 39      | -2.488             |             |        |
|          | 78      | -1.736             |             |        |
| π/4DQPSK | 00      | -0.369             | 20.97       | Pass   |
|          | 39      | -1.388             |             |        |
|          | 78      | -0.617             |             |        |
| 8DPSK    | 00      | -0.354             | 20.97       | Pass   |
|          | 39      | -1.307             |             |        |
|          | 78      | -0.559             |             |        |

Note: 1.The test results including the cable lose.

Test plot as follows:

## GFSK Modulation



## CH00

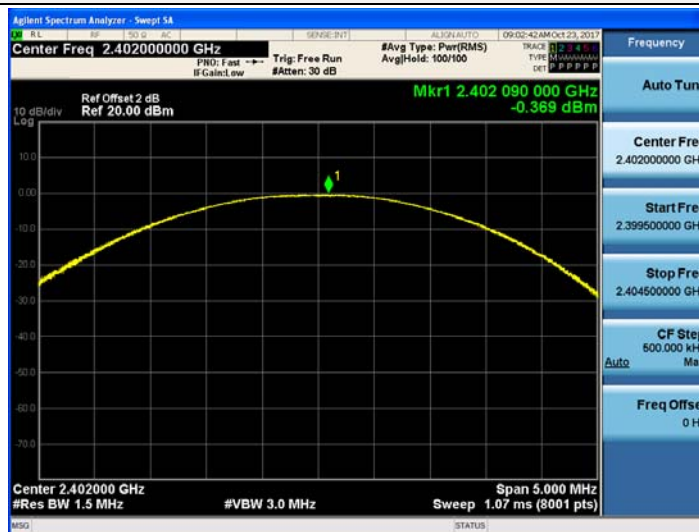


## CH39

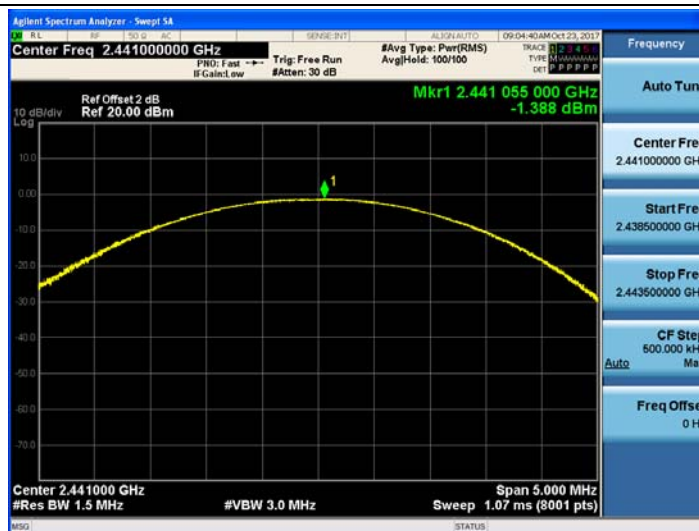


## CH78

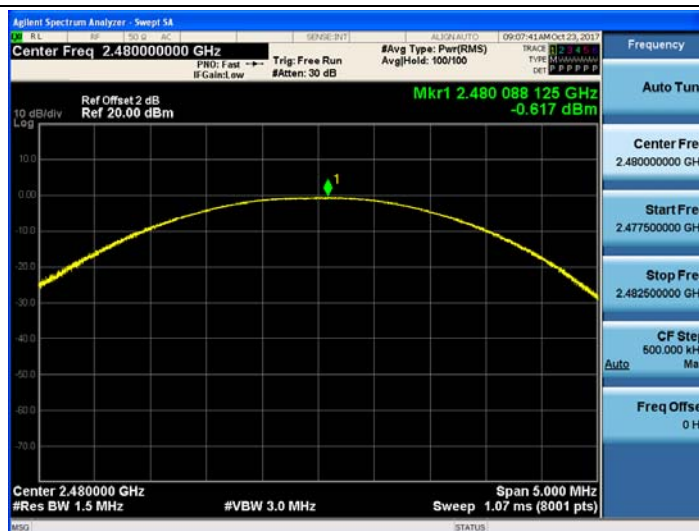
## $\pi/4$ DQPSK Modulation



## CH00

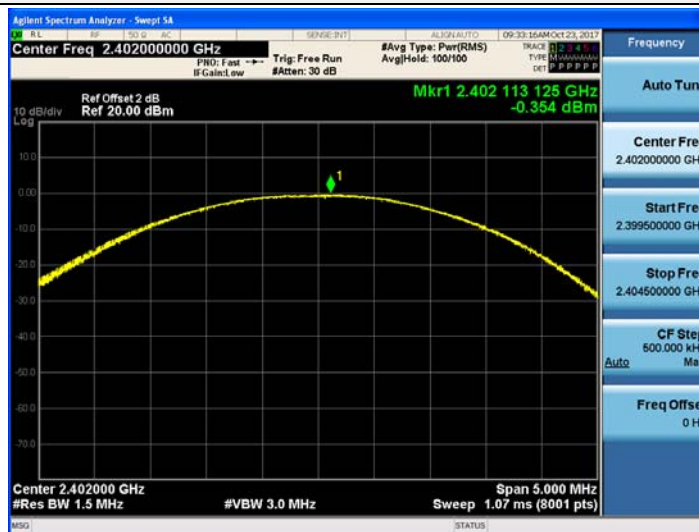


## CH39

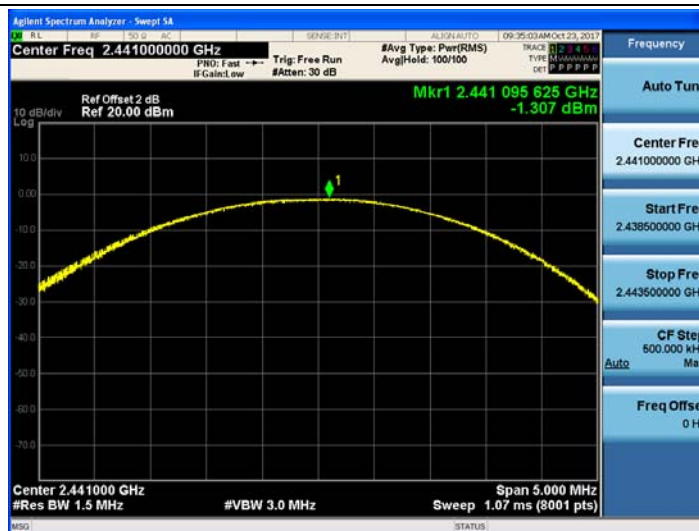


## CH78

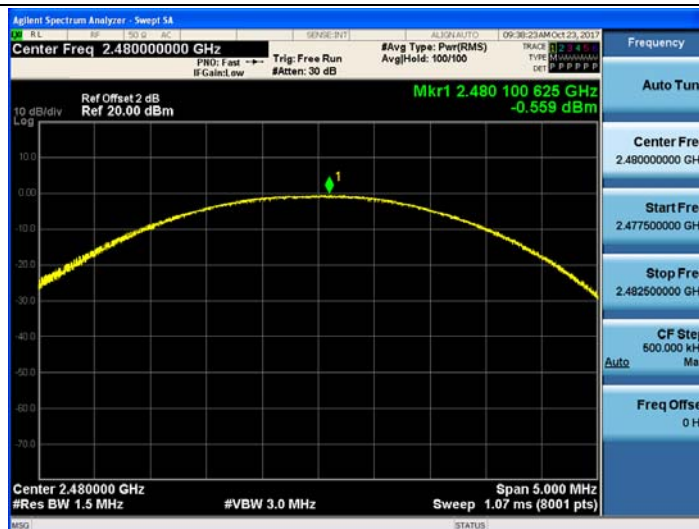
## 8DPSK Modulation



## CH00



## CH39



## CH78



### 3.4. 20dB Bandwidth

#### Limit

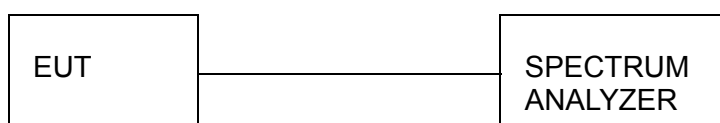
For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

#### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

#### Test Configuration

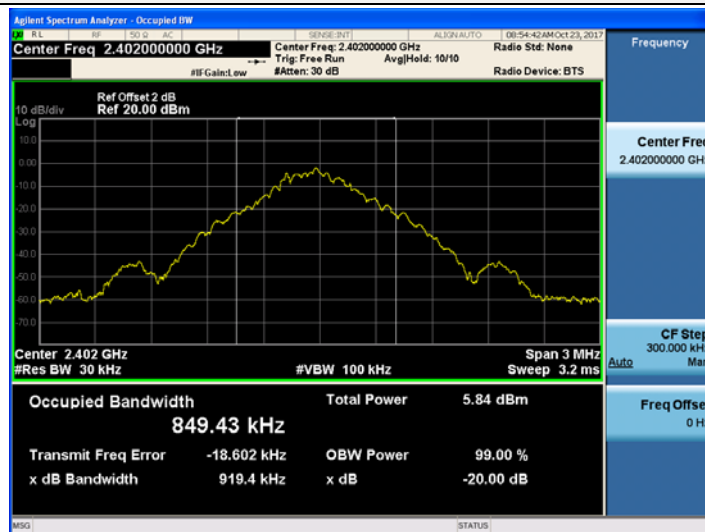


#### Test Results

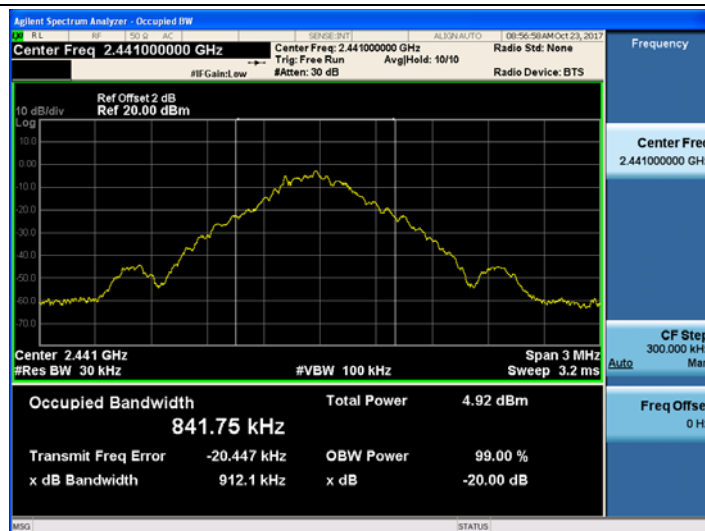
| Modulation    | Channel | 20dB bandwidth (MHz) | 99% OBW (MHz) | Result |
|---------------|---------|----------------------|---------------|--------|
| GFSK          | CH00    | 0.9194               | 0.84943       | Pass   |
|               | CH39    | 0.9121               | 0.84175       |        |
|               | CH78    | 0.8972               | 0.84406       |        |
| $\pi/4$ DQPSK | CH00    | 1.220                | 1.1649        |        |
|               | CH39    | 1.264                | 1.1719        |        |
|               | CH78    | 1.212                | 1.1668        |        |
| 8DPSK         | CH00    | 1.208                | 1.1559        |        |
|               | CH39    | 1.214                | 1.1581        |        |
|               | CH78    | 1.207                | 1.1561        |        |

Test plot as follows:

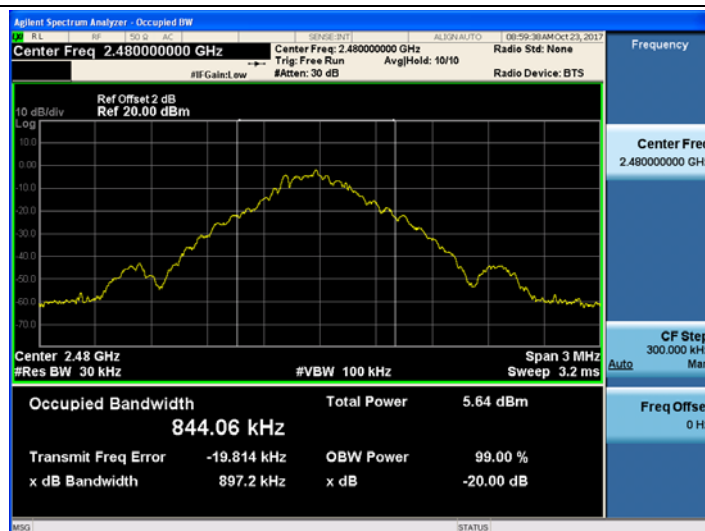
## GFSK Modulation



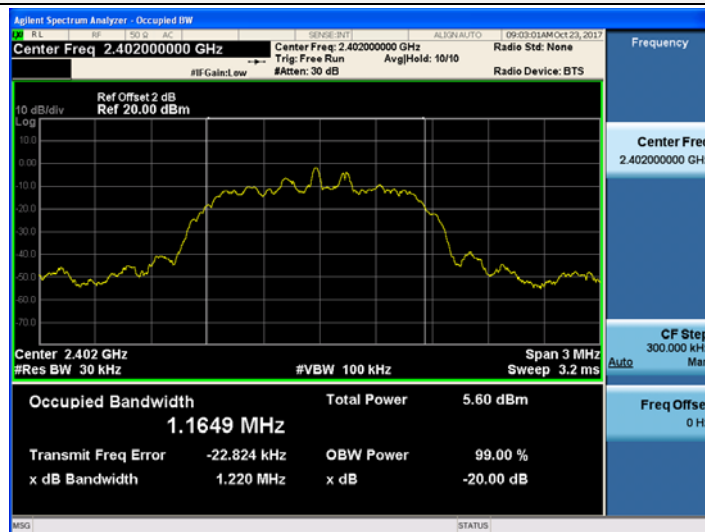
## CH00



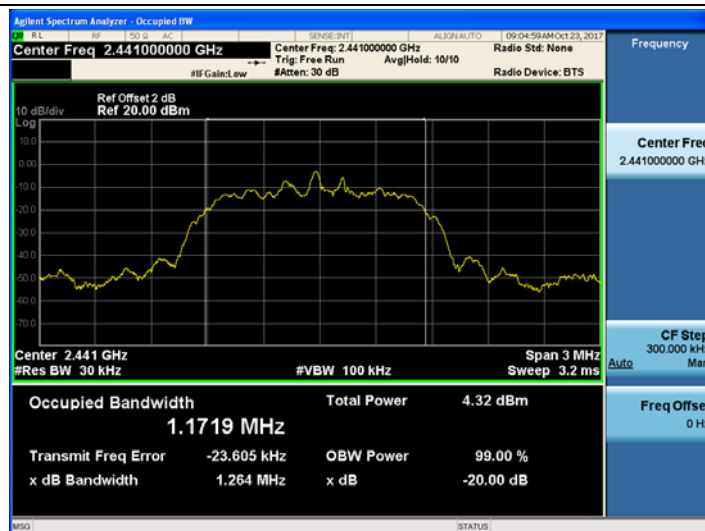
## CH39



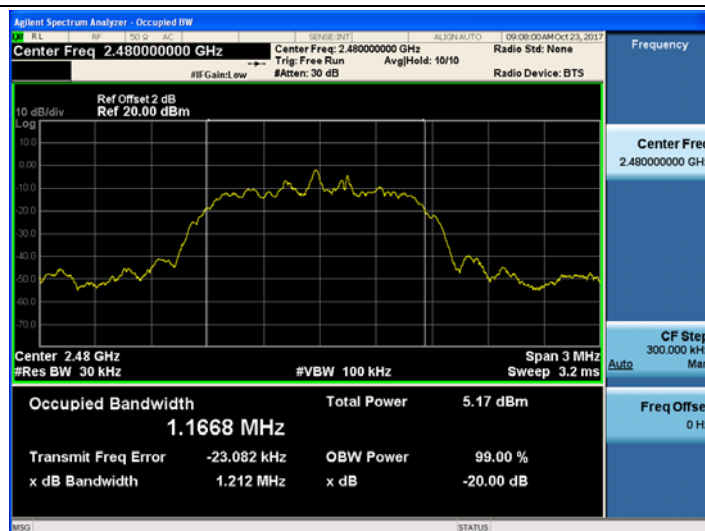
## CH78

$\pi/4$ DQPSK Modulation

## CH00

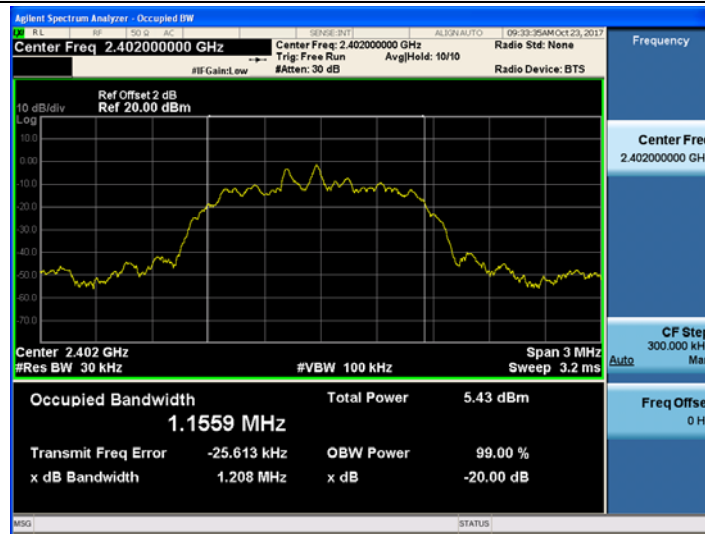


## CH39

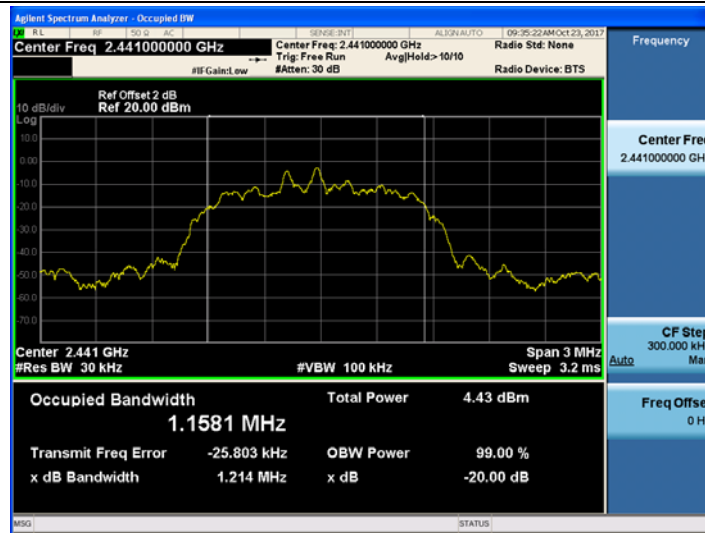


## CH78

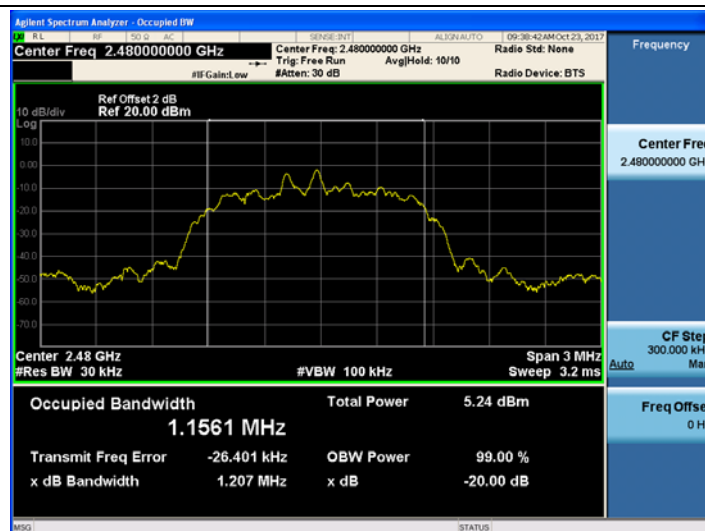
### 8DPSK Modulation



### CH00



### CH39



### CH78

### 3.5. Frequency Separation

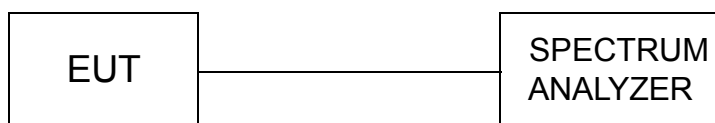
#### LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the  $2/3 \times 20\text{dB}$  bandwidth of the hopping channel, whichever is greater.

#### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW.

#### TEST CONFIGURATION



#### TEST RESULTS

| Modulation    | Channel | Channel Separation (MHz) | Limit(MHz)                                  | Result |
|---------------|---------|--------------------------|---|--------|
| GFSK          | CH39    | 1.006                    | 25KHz or $2/3 \times 20\text{dB}$ bandwidth | Pass   |
|               | CH40    |                          |   |        |
| $\pi/4$ DQPSK | CH39    | 1.000                    | 25KHz or $2/3 \times 20\text{dB}$ bandwidth | Pass   |
|               | CH40    |                          |   |        |
| 8DPSK         | CH39    | 0.999                    | 25KHz or $2/3 \times 20\text{dB}$ bandwidth | Pass   |
|               | CH40    |                          |   |        |

Note:

We have tested all mode at high, middle and low channel, and recorded worst case at middle

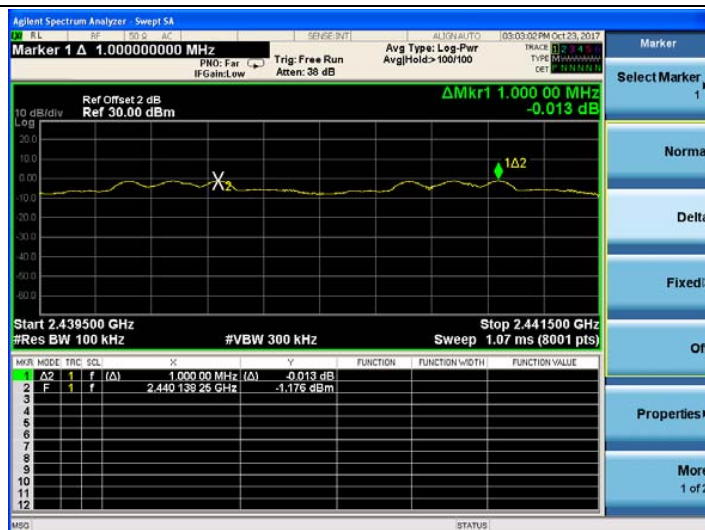
Limit :  $1264 \times 2/3 = 0.843\text{MHz}$

**Test plot as follows:**

### GFSK Modulation



### $\pi/4$ DQPSK Modulation



### 8DPSK Modulation



### 3.6. Number of hopping frequency

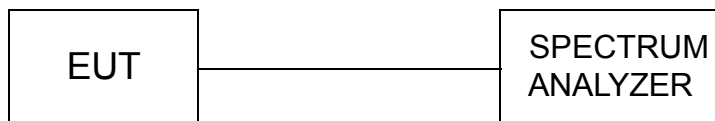
#### Limit

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

#### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

#### Test Configuration

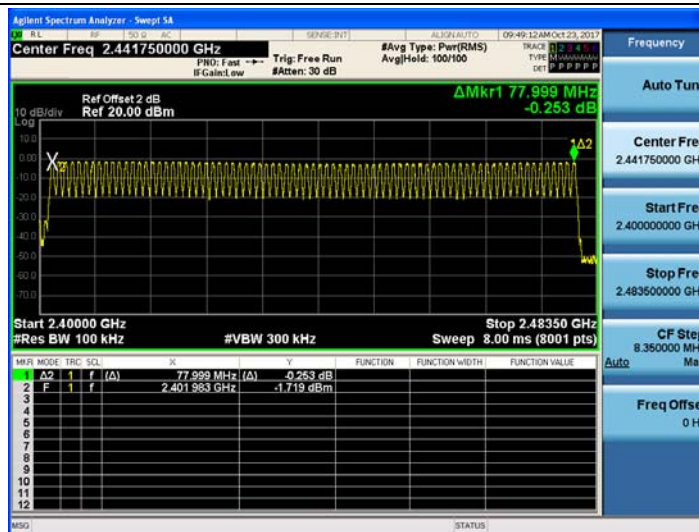


#### Test Results

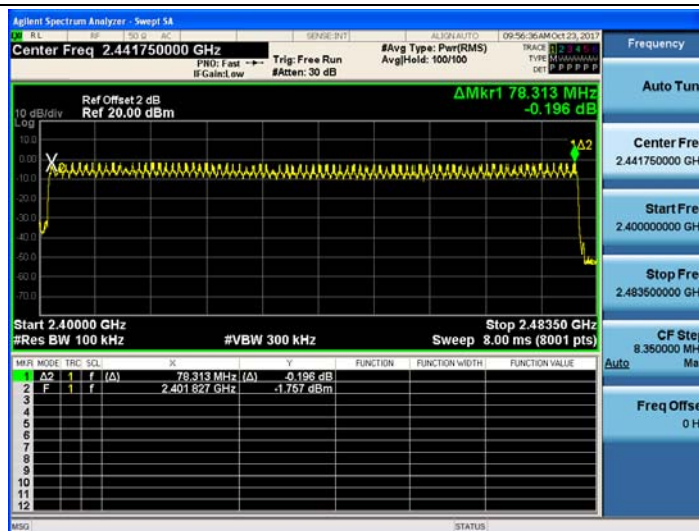
| Modulation | Number of Hopping Channel | Limit | Result |
|------------|---------------------------|-------|--------|
| GFSK       | 79                        | ≥15   | Pass   |
| π/4DQPSK   | 79                        |       |        |
| 8DPSK      | 79                        |       |        |

#### Test plot as follows:

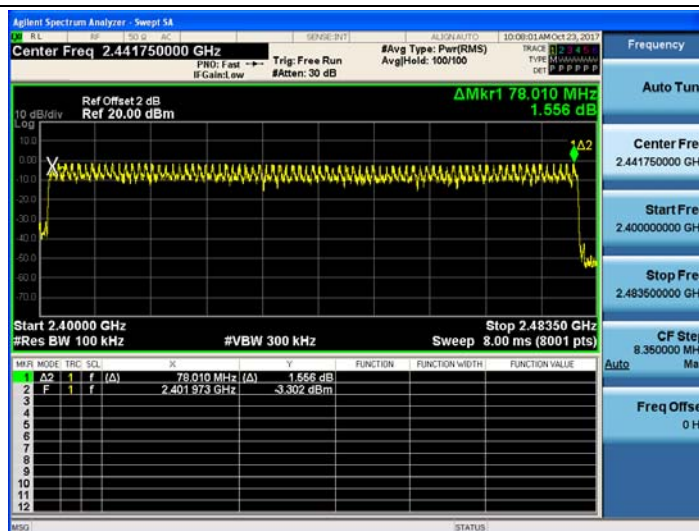
### GFSK Modulation



### $\pi/4$ DQPSK Modulation



### 8DPSK Modulation





### 3.7. Time of Occupancy (Dwell Time)

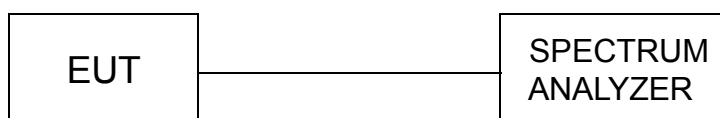
#### Limit

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.

#### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

#### Test Configuration



#### Test Results

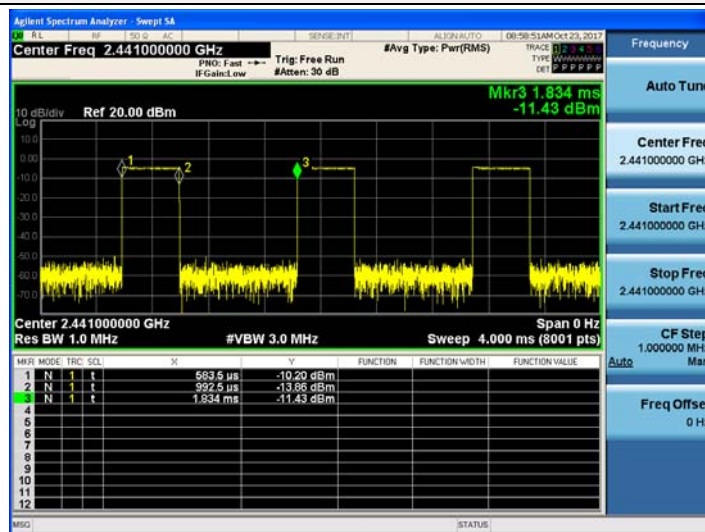
| Modulation | Packet | Pulse time (ms) | Dwell time (s) | Limit (s) | Result |
|------------|--------|-----------------|----------------|-----------|--------|
| GFSK       | DH1    | 0.409           | 0.131          | 0.40      | Pass   |
|            | DH3    | 1.664           | 0.266          |           |        |
|            | DH5    | 2.912           | 0.311          |           |        |
| π/4DQPSK   | 2-DH1  | 0.419           | 0.134          | 0.40      | Pass   |
|            | 2-DH3  | 1.671           | 0.267          |           |        |
|            | 2-DH5  | 2.917           | 0.311          |           |        |
| 8DPSK      | 3-DH1  | 0.418           | 0.134          | 0.40      | Pass   |
|            | 3-DH3  | 1.672           | 0.268          |           |        |
|            | 3-DH5  | 2.917           | 0.311          |           |        |

Note:

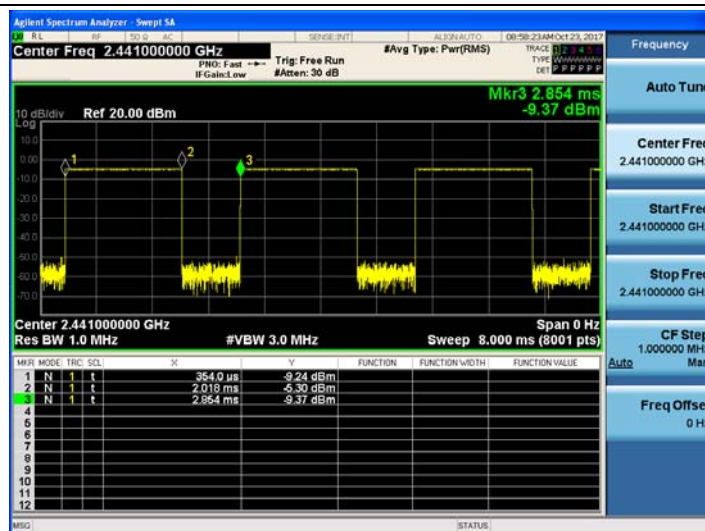
- We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.
- $\text{Dwell time} = \text{Pulse time (ms)} \times (1600 \div 2 \div 79) \times 31.6 \text{ Second}$  for DH1, 2-DH1, 3-DH1  
 $\text{Dwell time} = \text{Pulse time (ms)} \times (1600 \div 4 \div 79) \times 31.6 \text{ Second}$  for DH3, 2-DH3, 3-DH3  
 $\text{Dwell time} = \text{Pulse time (ms)} \times (1600 \div 6 \div 79) \times 31.6 \text{ Second}$  for DH5, 2-DH5, 3-DH5

#### Test plot as follows:

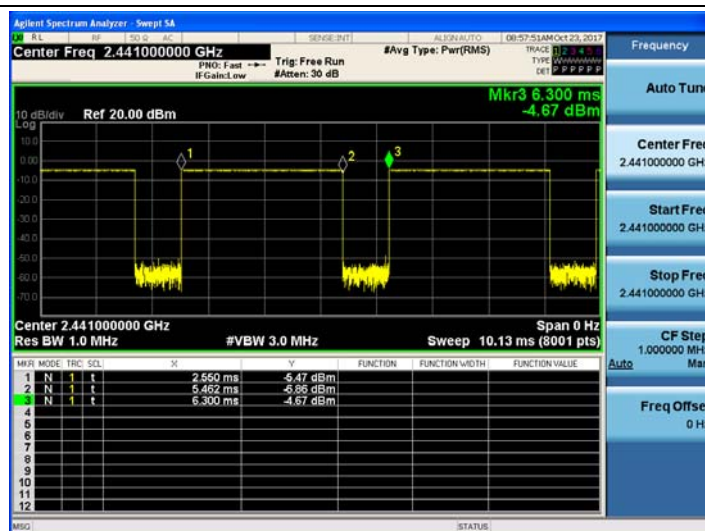
## GFSK Modulation



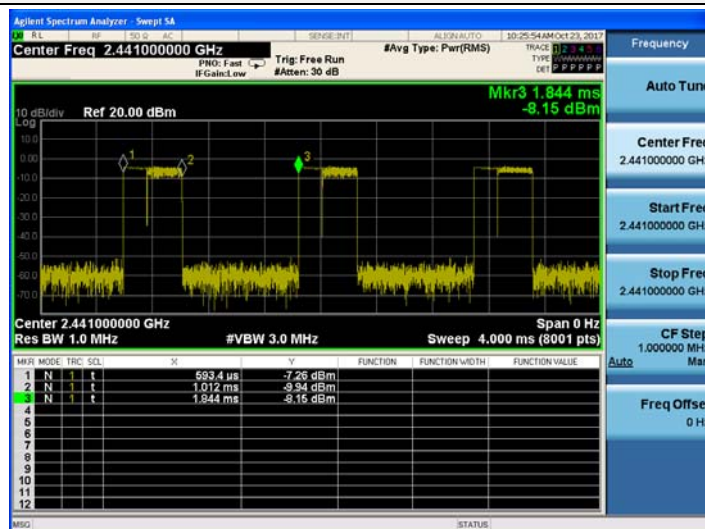
## DH1



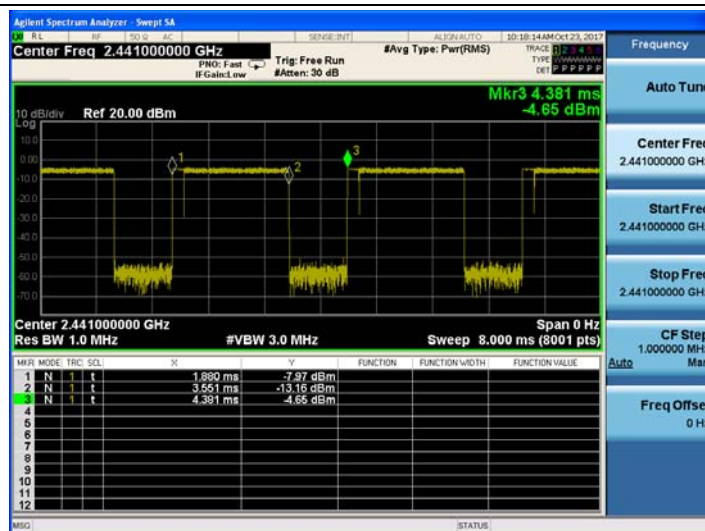
## DH3



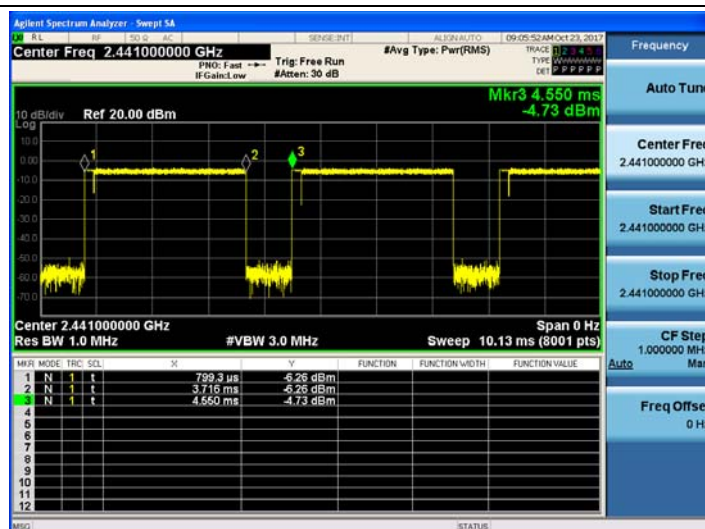
## DH5

$\pi/4$ DQPSK Modulation

## 2-DH1

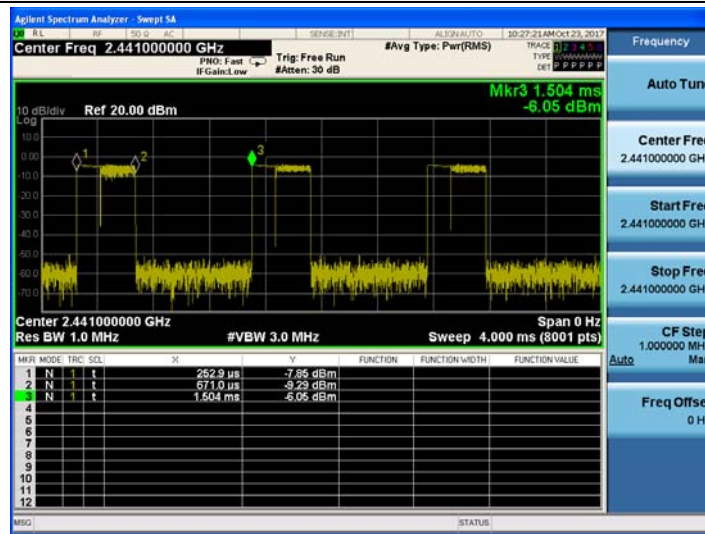


## 2-DH3

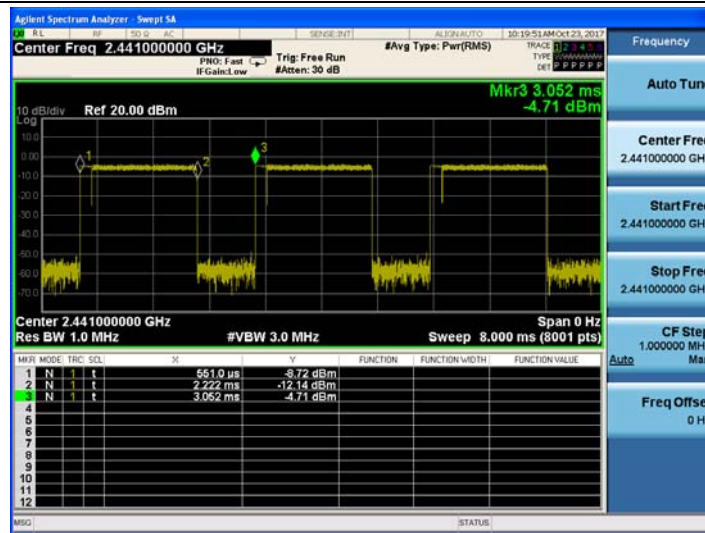


## 2-DH5

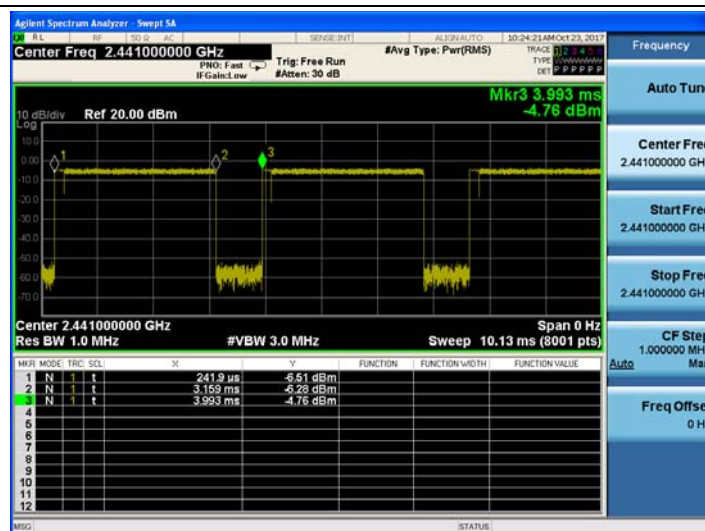
## 8DPSK Modulation



## 3-DH1



## 3-DH3



## 3-DH5

### 3.8. Out-of-band Emissions

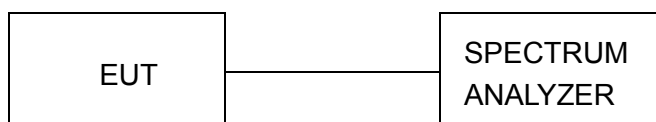
#### Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

#### Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, band edge and out-of-band emissions.

#### Test Configuration



#### Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.

We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5

Test plot as follows:



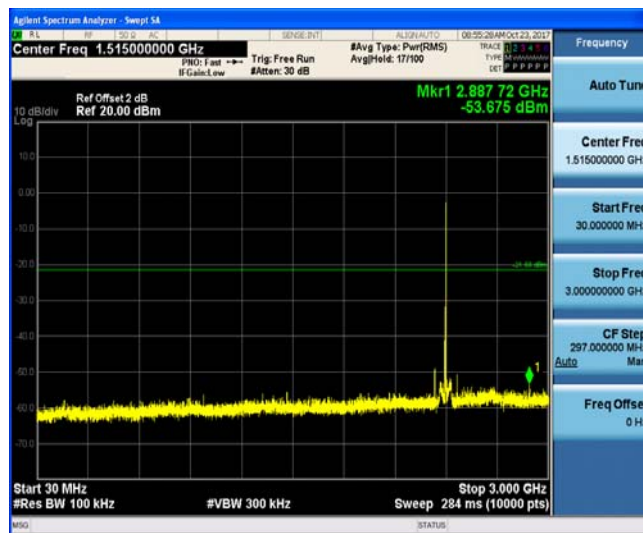
## GFSK CH00



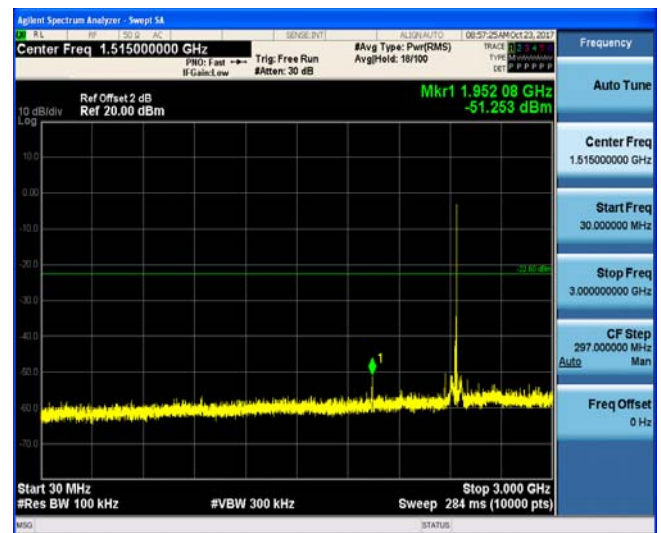
## GFSK CH39



## Reference



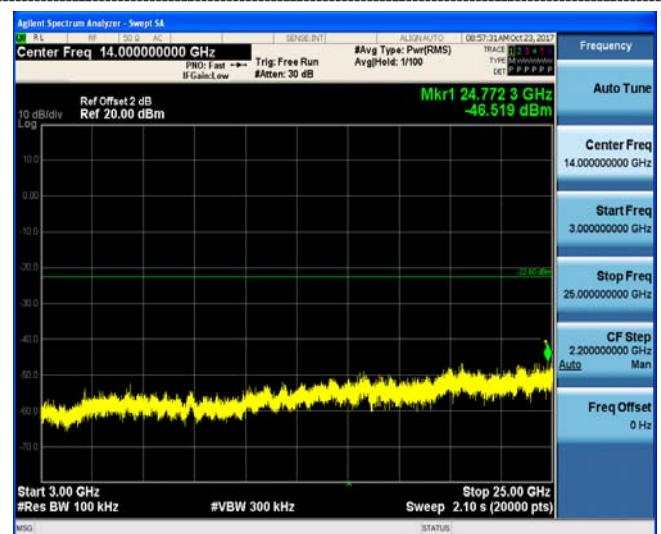
## Reference



## 30MHz-3GHz



## 30MHz-3GHz



## 3GHz-25GHz

## 3GHz-25GHz

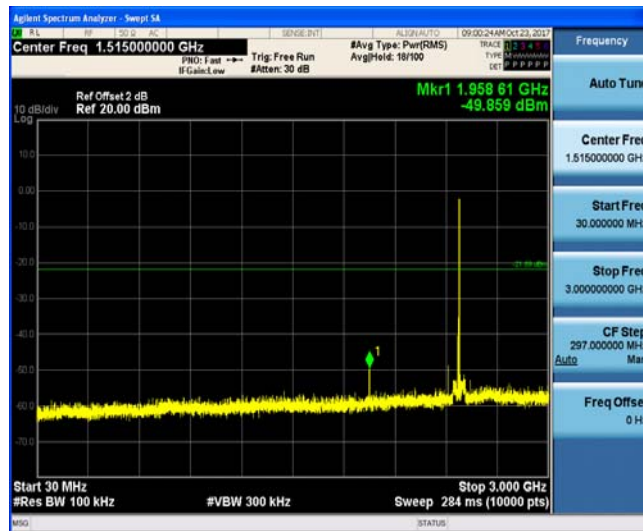
### GFSK CH78



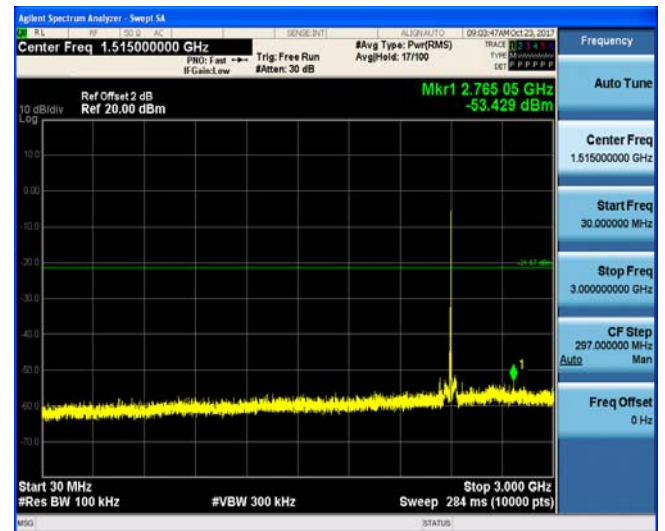
### $\pi/4$ DQPSK CH00



### Reference



### 30MHz-3GHz



### 30MHz-3GHz



### 3GHz-25GHz



### 3GHz-25GHz

$\pi/4$ DQPSK CH39

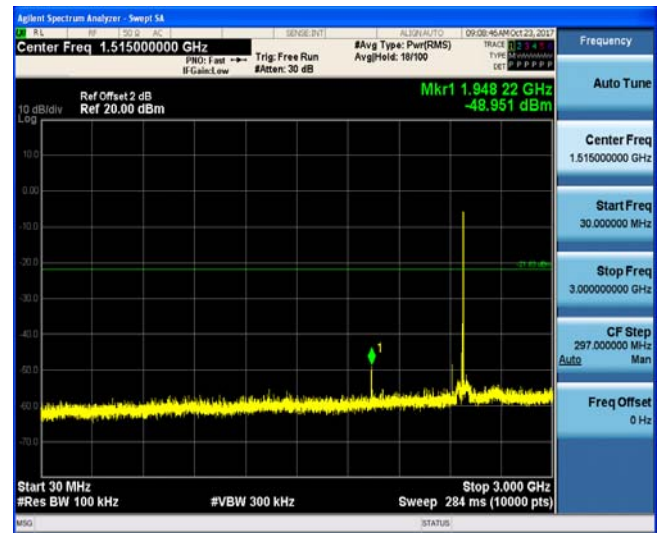
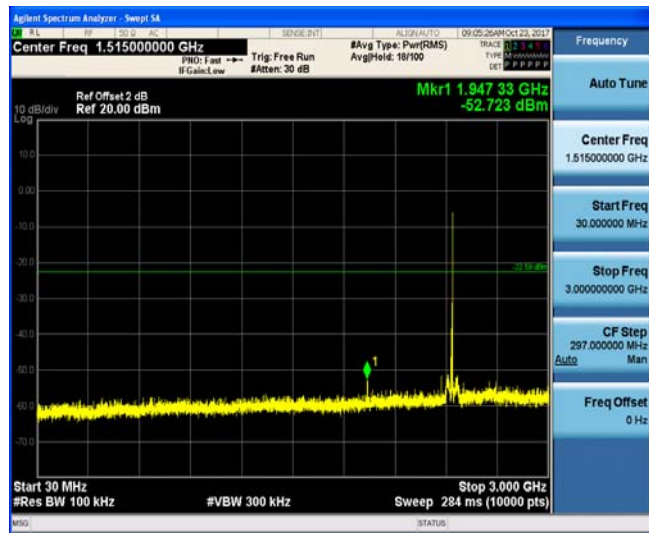


$\pi/4$ DQPSK CH78



Reference

Reference



30MHz-3GHz

30MHz-3GHz



3GHz-25GHz

3GHz-25GHz



## 8DPSK CH00

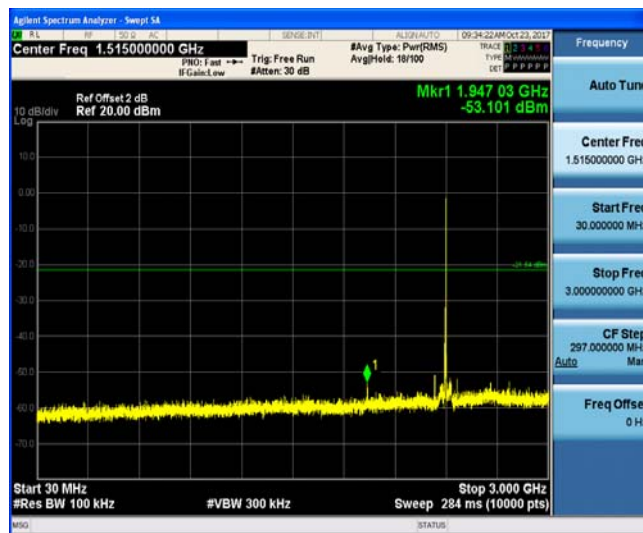


## Reference

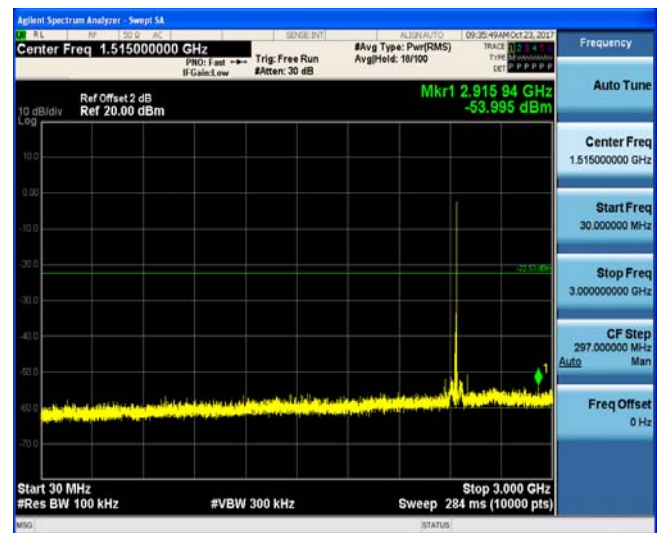
## 8DPSK CH39



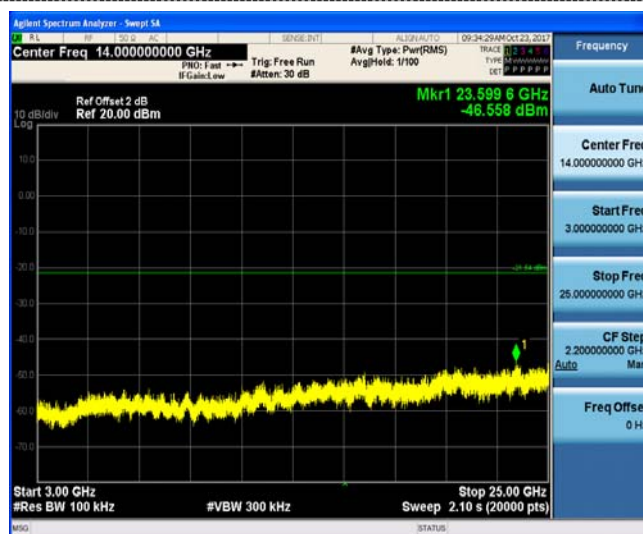
## Reference



## 30MHz-3GHz



## 30MHz-3GHz



## 3GHz-25GHz

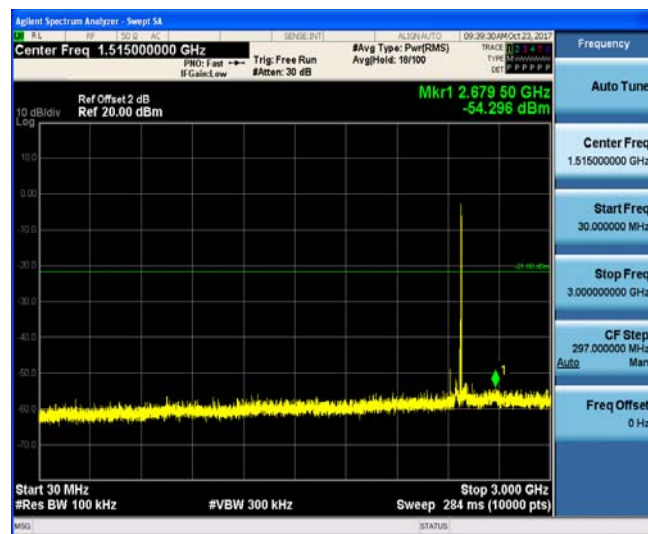


## 3GHz-25GHz

# 8DPSK CH78



Reference



30MHz-3GHz



3GHz-25GHz

# Band-edge Measurements for RF Conducted Emissions:

## GFSK



Left Band edge hopping off

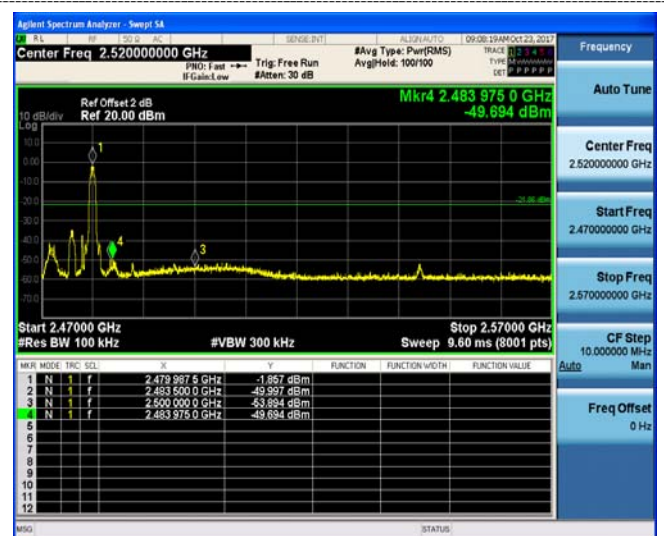
Right Band edge hopping off



Left Band edge hopping on

Right Band edge hopping on

## $\pi/4$ DQPSK



Left Band edge hopping off

Right Band edge hopping off



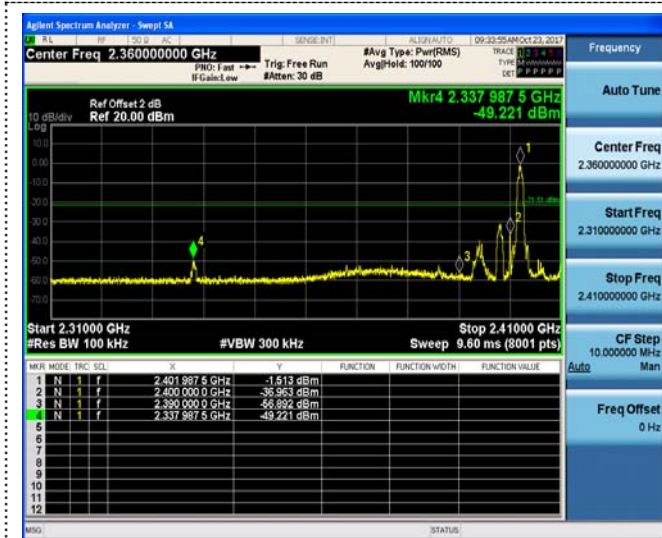


Left Band edge hopping on

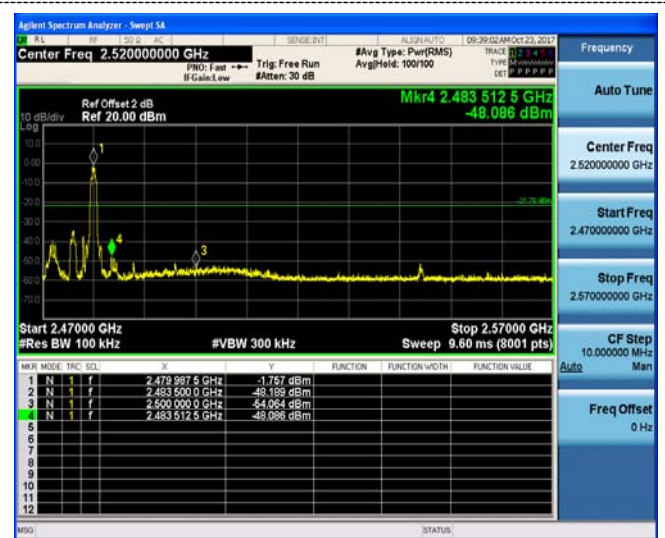


Right Band edge hopping on

## 8DPSK



Left Band edge hopping off



Right Band edge hopping off



Left Band edge hopping on



Right Band edge hopping on

### 3.9. Pseudorandom Frequency Hopping Sequence

#### **TEST APPLICABLE**

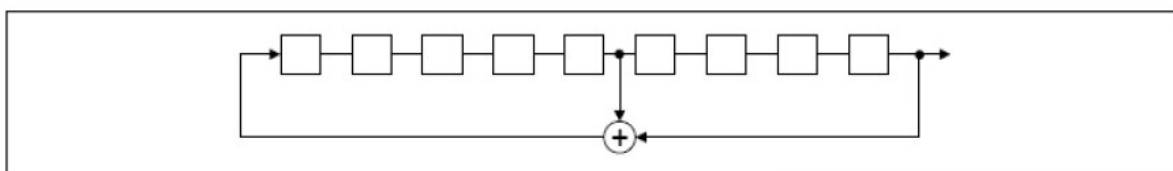
#### **For 47 CFR Part 15C section 15.247 (a) (1) requirement:**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. 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 hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

#### **EUT Pseudorandom Frequency Hopping Sequence Requirement**

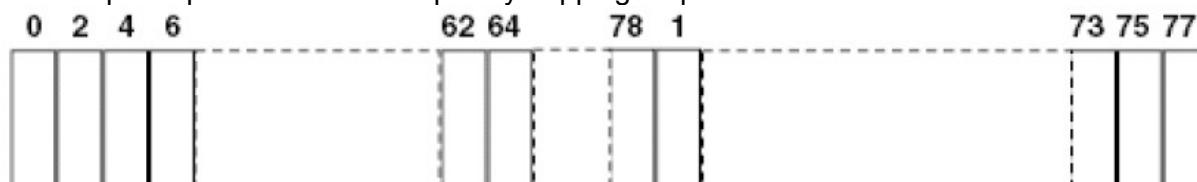
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



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

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

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

### 3.10. Antenna Requirement

#### **Standard Applicable**

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.

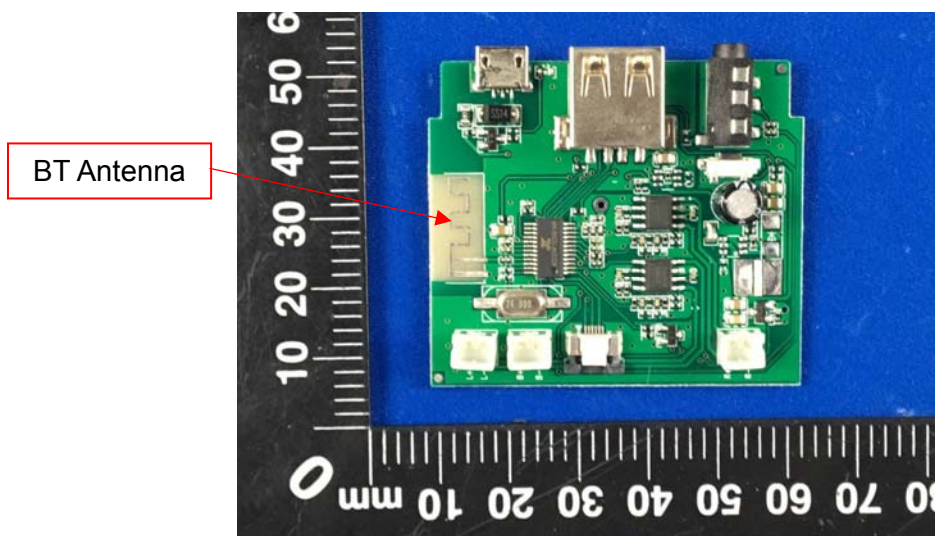
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

#### **Refer to statement below for compliance**

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

#### **Antenna Connected Construction**

The maximum gain of antenna was 0dBi.



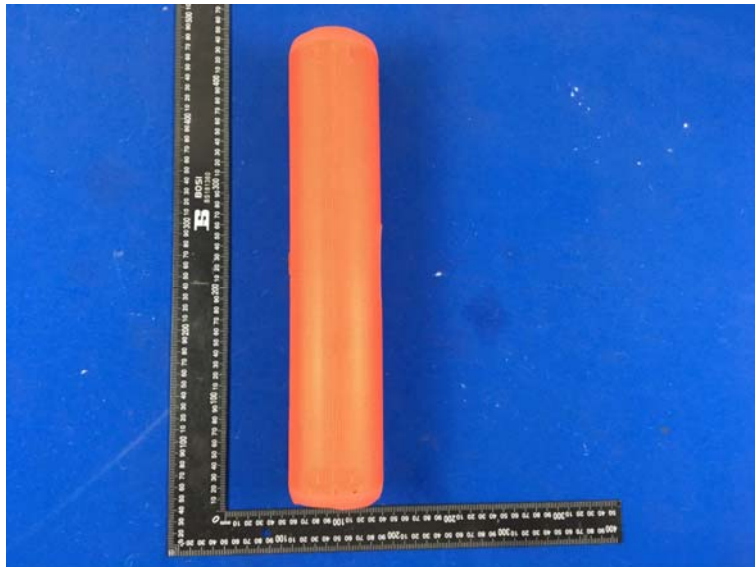
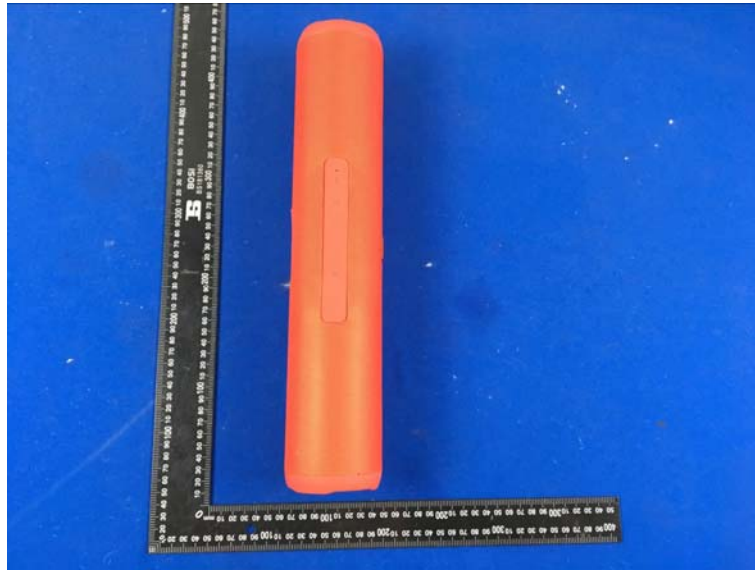
## **4. Test Setup Photos of the EUT**



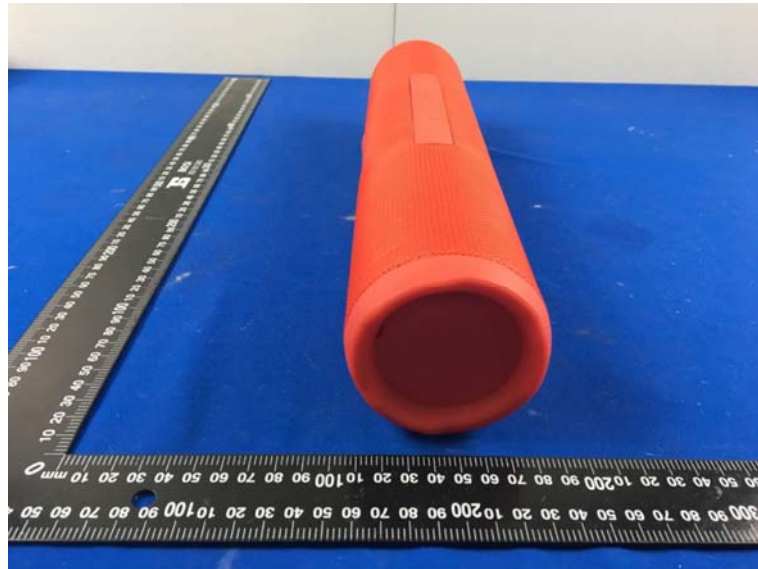


## 5. Photos of the EUT

### External Photos of EUT

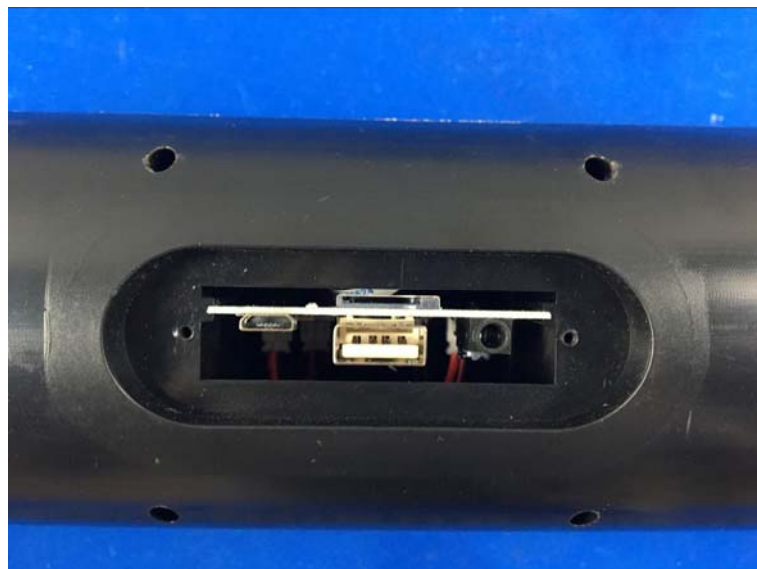
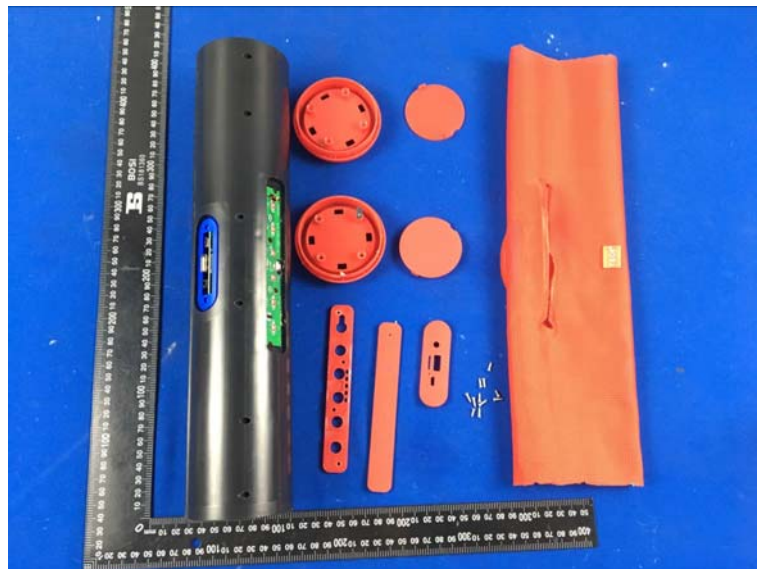




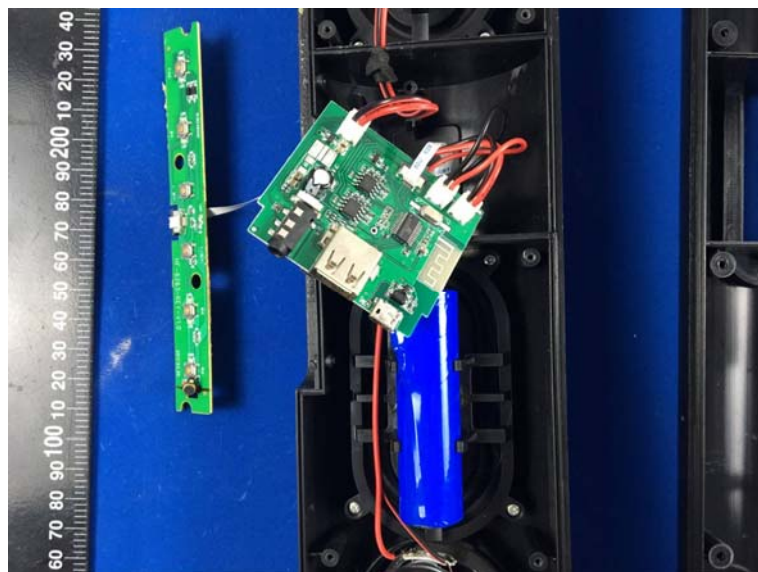
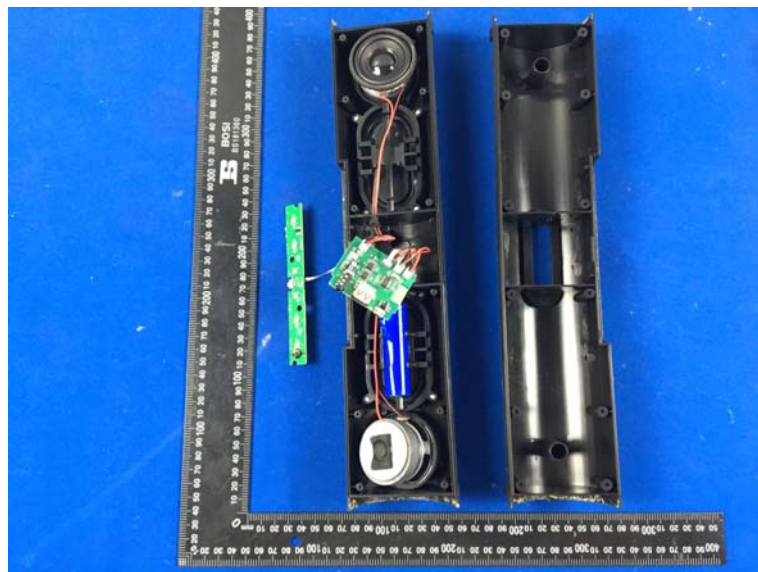
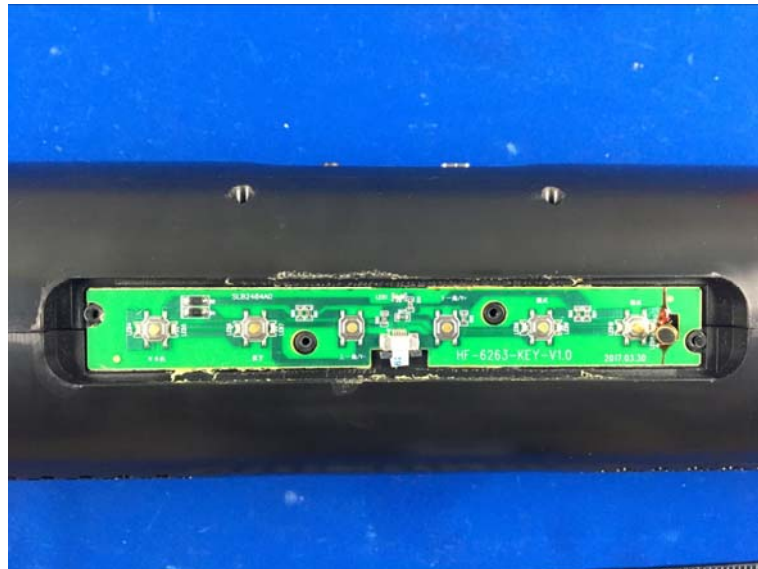




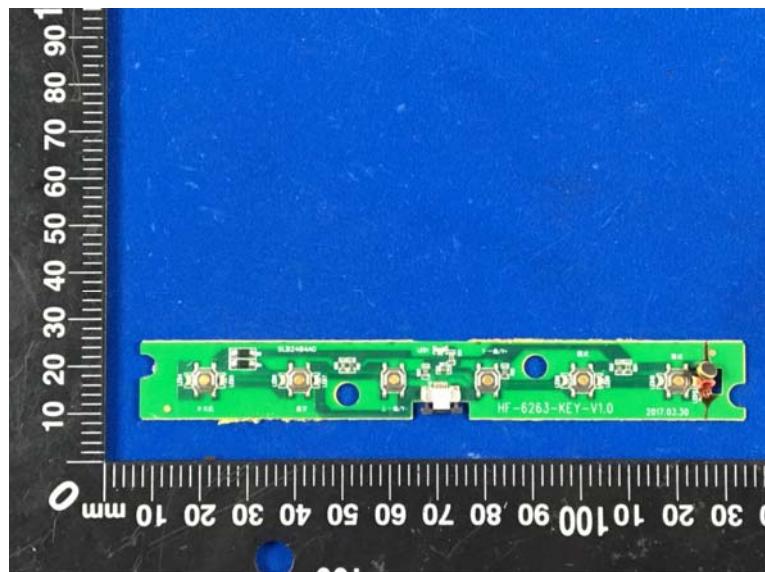
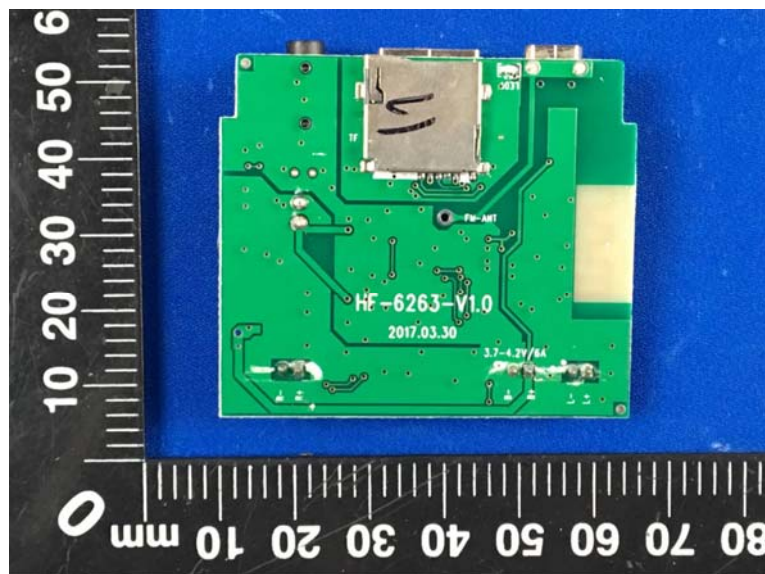
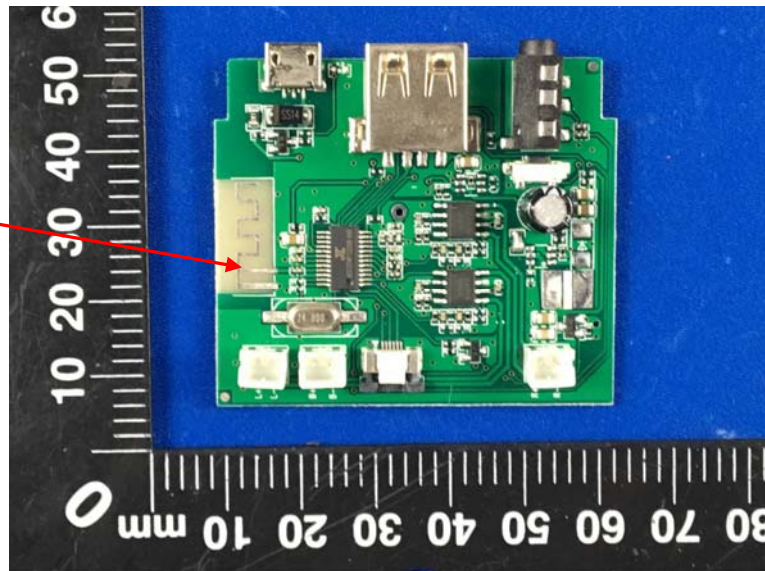
### Internal Photos of EUT

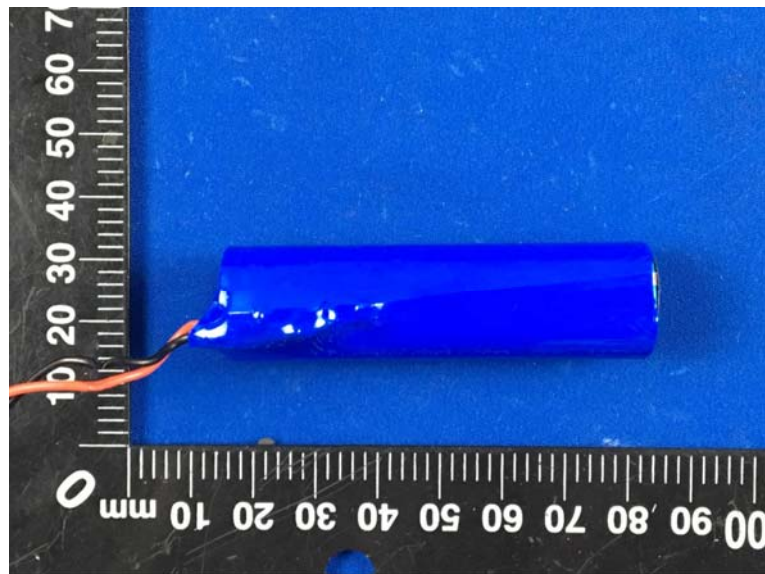
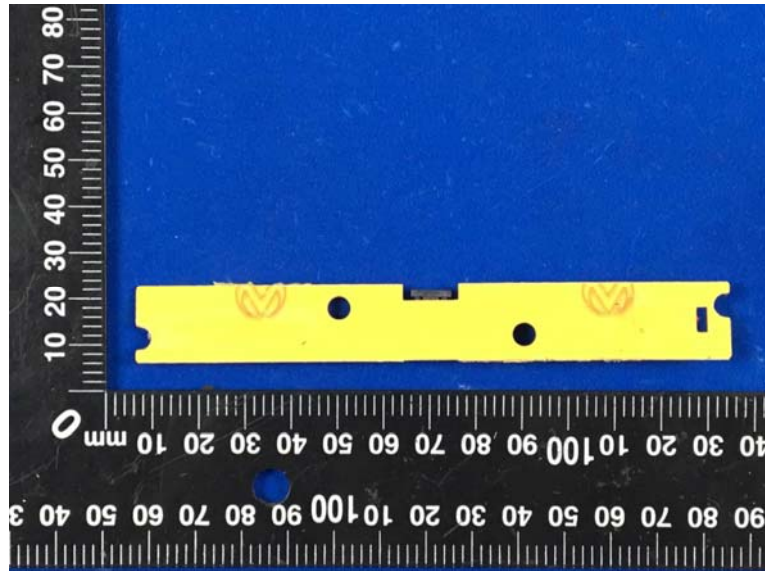






BT antenna





\*\*\*\*\* End of Report \*\*\*\*\*