

**FCC - TEST REPORT**

Report Number : 68.760.16.750.01 Date of Issue: October 18, 2016

Model : AR102A4BKA, AR102A4AGA, 317857, 320538

Product Type : CAT EAR HEADPHONE V1.2

Applicant : Brookstone Purchasing, Inc.

Address : One Innovation Way, Merrimack, NH 03054, USA

Production Facility : CCA Electronic Factory

Address : Building 120-121th, Pinghuan Industrial City, Pingshan, Town,  
Pingshan District, 518118 Shenzhen City, PEOPLE'S REPUBLIC  
OF CHINATest Result : ☒ Positive ☐ NegativeTotal pages including  
Appendices : 48

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## 2 Details about the Test Laboratory

### Details about the Test Laboratory

#### Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch  
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint  
Road 2, Nanshan District  
Shenzhen 518052  
P.R. China

Telephone: 86 755 8828 6998  
Fax: 86 755 828 5299

FCC Registration No.: 502708

#### Test Site 2

Company name: Waltek Services (Shenzhen) Co., Ltd.  
1/F., Fukangtai Building, West Baima Road, Songgang  
Street, Baoan District, Shenzhen 518105, Guangdong, China

Telephone: 86 7558 355 1033  
Fax: 86 7558 355 2400

FCC Registration No.: 880581

### 3 Description of the Equipment Under Test

|                               |                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------|
| Product:                      | CAT EAR HEADPHONE V1.2                                                                |
| Model no.:                    | AR102A4BKA, AR102A4AGA, 317857, 320538                                                |
| FCC ID:                       | 2AFVN-317857                                                                          |
| Options and accessories:      | NIL                                                                                   |
| Rating:                       | DC3.7V Supplied by Li-ion Rechargeable Battery<br>DC5.0V Charged by the mini-USB port |
| RF Transmission<br>Frequency: | 2402MHz-2480MHz                                                                       |
| No. of Operated Channel:      | 79                                                                                    |
| Modulation:                   | GFSK, $\pi/4$ -DQPSK, 8-DPSK                                                          |
| Antenna Type:                 | Integrated antenna                                                                    |
| Antenna Gain:                 | 2.55dBi                                                                               |
| Description of the EUT:       | The Equipment Under Test (EUT) is a Bluetooth headset operated at 2.4GHz              |

## 4 Summary of Test Standards

| Test Standards                             |                                                                        |
|--------------------------------------------|------------------------------------------------------------------------|
| FCC Part 15 Subpart C<br>10-1-2015 Edition | PART 15 - RADIO FREQUENCY DEVICES<br>Subpart C - Intentional Radiators |

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and ANSI C63.10-2013.

## 5 Summary of Test Results

| Technical Requirements                                |                                             |            |             |           |
|-------------------------------------------------------|---------------------------------------------|------------|-------------|-----------|
| FCC Part 15 Subpart C/RSS-247 Issue 1/RSS-Gen Issue 4 |                                             |            |             |           |
| Test Condition                                        |                                             | Pages      | Test Result | Test Site |
| §15.207                                               | Conducted emission AC power port            | 10         | Pass        | Site 2    |
| §15.247(b)(1)                                         | Conducted peak output power                 | 13         | Pass        | Site 2    |
| §15.247(e)                                            | Power spectral density*                     | --         | N/A         | --        |
| §15.247(a)(2)                                         | 6dB bandwidth                               | --         | N/A         | --        |
| §15.247(a)(1)                                         | 20dB bandwidth and 99% Occupied Bandwidth   | 20         | Pass        | Site 2    |
| §15.247(a)(1)                                         | Carrier frequency separation                | 27         | Pass        | Site 2    |
| §15.247(a)(1)(iii)                                    | Number of hopping frequencies               | 30         | Pass        | Site 2    |
| §15.247(a)(1)(iii)                                    | Dwell Time                                  | 32         | Pass        | Site 2    |
| §15.247(d)                                            | Spurious RF conducted emissions             | 35         | Pass        | Site 2    |
| §15.247(d)                                            | Band edge                                   | 38         | Pass        | Site 2    |
| §15.247(d) & §15.209 &                                | Spurious radiated emissions for transmitter | 43         | Pass        | Site 2    |
| §15.203                                               | Antenna requirement                         | See note 1 | Pass        | --        |

Note 1: N/A=Not Applicable.

Note 2: The EUT uses an Integrated antenna, which gain is 2.55dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

## 6 General Remarks

### Remarks

This submittal(s) (test report) is intended for FCC ID: 2AFVN-317857, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C.

All the models are same except for model name difference for the marketing requirement. So all the tests were applied on AR102A4BKA, other models are deemed to fulfil the test without further testing.

### SUMMARY:

All tests according to the regulations cited on page 5 were

☒ - Performed

☐ - **Not** Performed

The Equipment Under Test

☒ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date: September 6, 2016

Testing Start Date: September 6, 2016

Testing End Date: September 23, 2016

Tested By  
EMC Test Engineer  
(Waltek Services (Shenzhen) Co., Ltd.)

2016-10-18

Date

Jack Wen

Name

*Jack Wen*

Signature

Prepared By  
EMC Project Engineer  
(TÜV SÜD Certification and Testing  
(China) Co., Ltd. Shenzhen Branch)

2016-10-18

Date

Mark Chen

Name

*Mark Chen*

Signature

Approved by  
EMC Project Manager  
(TÜV SÜD Certification and Testing (China)  
Co., Ltd. Shenzhen Branch)

2016-10-18

Date

Cookies Bu

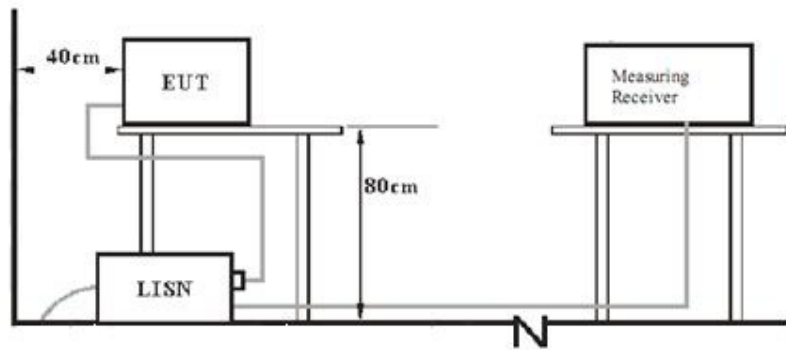
Name

*Cookies Bu*

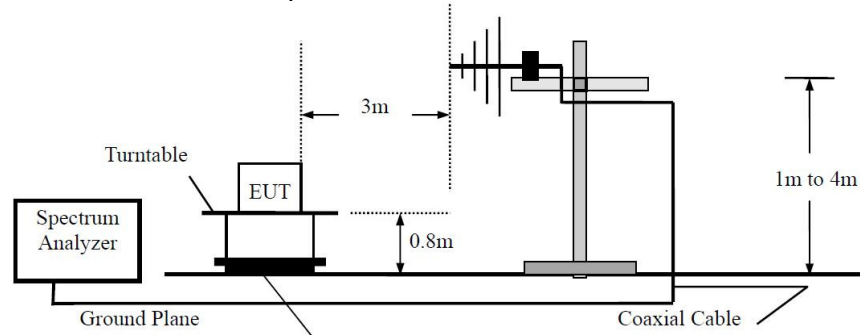
Signature

## 7 Test Setups

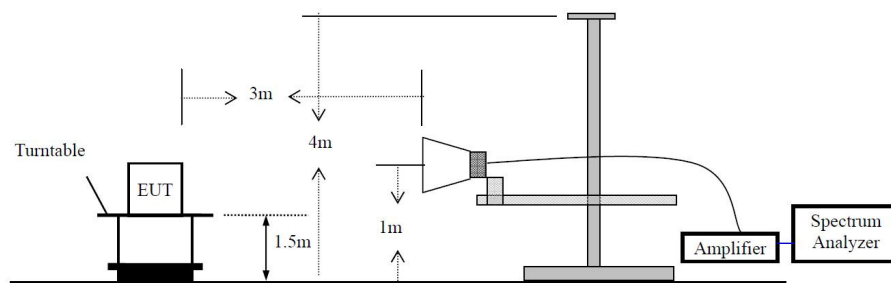
### 7.1 AC Power Line Conducted Emission test setups



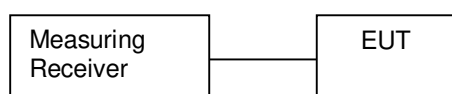
### 7.2 Radiated test setups Below 1GHz



### Above 1GHz



### 7.3 Conducted RF test setups



## 8 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO. | S/N |
|-------------|--------------|-----------|-----|
| PC          | LENOVO       | ---       | --- |

Test software: CSR Blue Test 3, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

## 9 Technical Requirement

### 9.1 Conducted Emission

#### Test Method

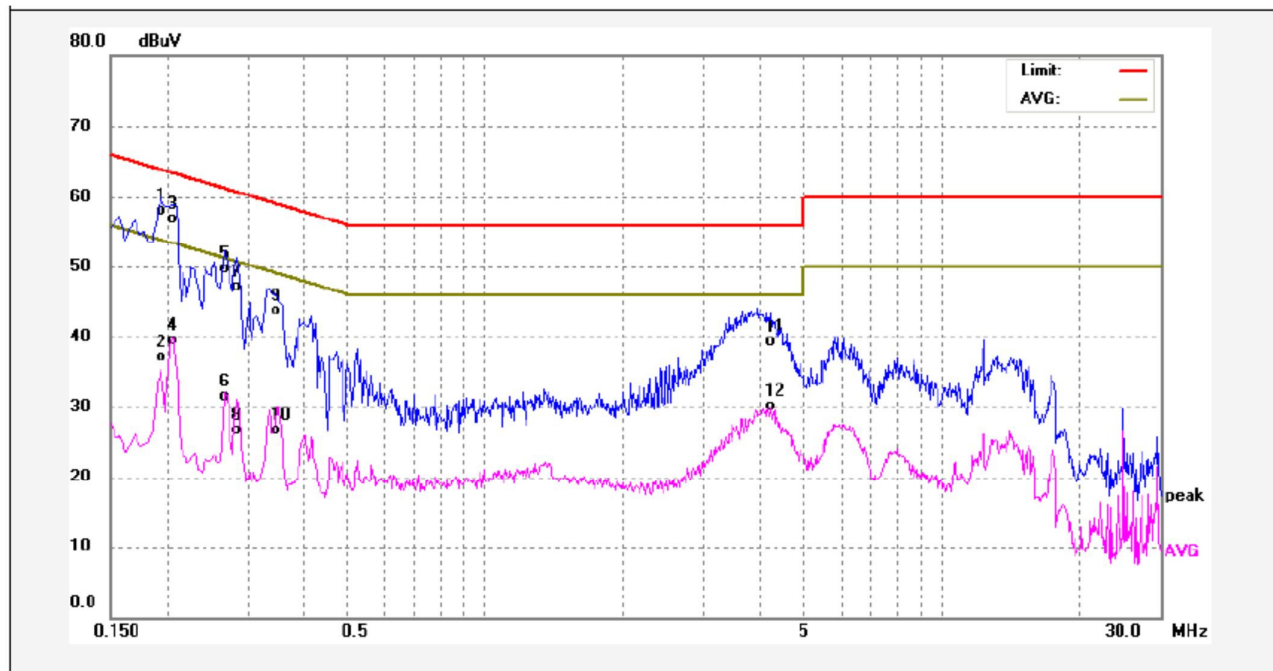
1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

#### Limit

| Frequency<br>MHz | QP Limit<br>dB $\mu$ V | AV Limit<br>dB $\mu$ V |
|------------------|------------------------|------------------------|
| 0.150-0.500      | 66-56*                 | 56-46*                 |
| 0.500-5          | 56                     | 46                     |
| 5-30             | 60                     | 50                     |

## Conducted Emission

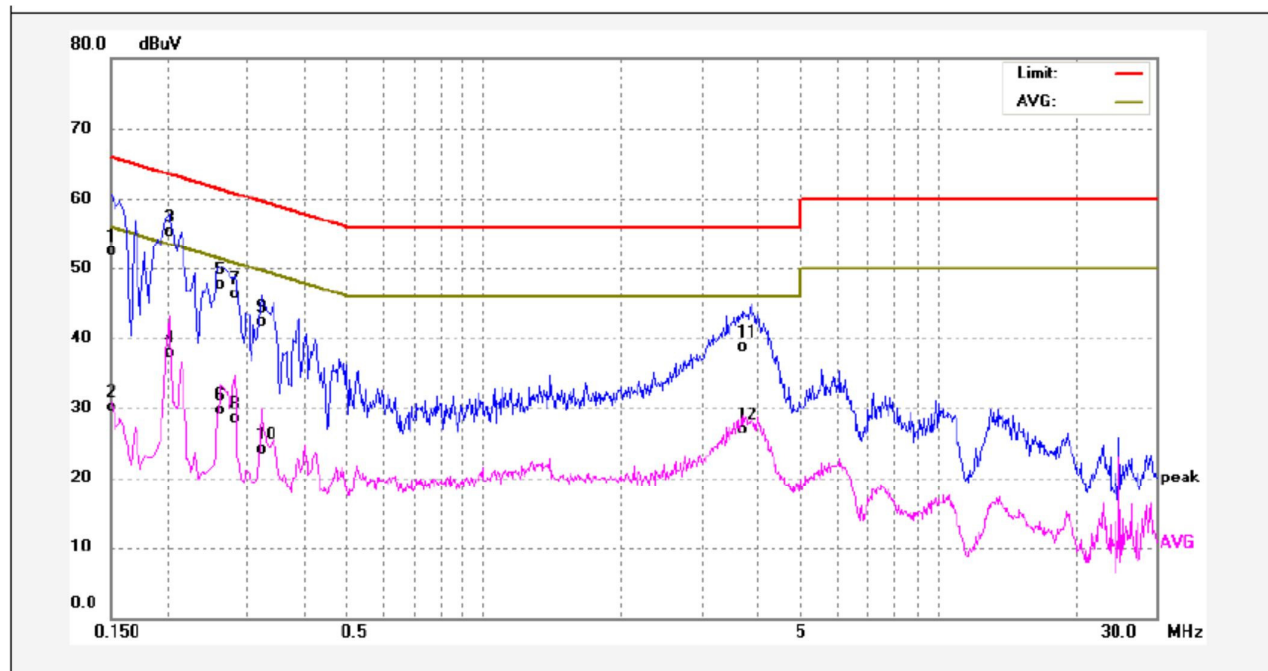
Product Type : CAT EAR HEADPHONE V1.2  
 M/N : AR102A4BKA  
 Operating Condition : BT Link  
 Test Specification : Live  
 Comment : AC 120V/60Hz



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1940      | 47.84          | 10.26       | 58.10         | 63.86      | -5.76       | QP       |        |
| 2   | 0.1940      | 26.85          | 10.26       | 37.11         | 53.86      | -16.75      | AVG      |        |
| 3   | 0.2060      | 46.70          | 10.26       | 56.96         | 63.36      | -6.40       | QP       |        |
| 4   | 0.2060      | 29.29          | 10.26       | 39.55         | 53.36      | -13.81      | AVG      |        |
| 5   | 0.2660      | 39.39          | 10.27       | 49.66         | 61.24      | -11.58      | QP       |        |
| 6   | 0.2660      | 21.22          | 10.27       | 31.49         | 51.24      | -19.75      | AVG      |        |
| 7   | 0.2860      | 36.84          | 10.27       | 47.11         | 60.64      | -13.53      | QP       |        |
| 8   | 0.2860      | 16.52          | 10.27       | 26.79         | 50.64      | -23.85      | AVG      |        |
| 9   | 0.3500      | 33.39          | 10.29       | 43.68         | 58.96      | -15.28      | QP       |        |
| 10  | 0.3500      | 16.37          | 10.29       | 26.66         | 48.96      | -22.30      | AVG      |        |
| 11  | 4.2020      | 28.86          | 10.51       | 39.37         | 56.00      | -16.63      | QP       |        |
| 12  | 4.2020      | 19.65          | 10.51       | 30.16         | 46.00      | -15.84      | AVG      |        |

## Conducted Emission

Product Type : CAT EAR HEADPHONE V1.2  
 M/N : AR102A4BKA  
 Operating Condition : BT Link  
 Test Specification : Neutral  
 Comment : AC 120V/60Hz



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1500      | 42.28          | 10.29       | 52.57         | 65.99      | -13.42      | QP       |        |
| 2   | 0.1500      | 19.72          | 10.29       | 30.01         | 55.99      | -25.98      | AVG      |        |
| 3   | 0.2020      | 45.05          | 10.26       | 55.31         | 63.52      | -8.21       | QP       |        |
| 4   | 0.2020      | 27.66          | 10.26       | 37.92         | 53.52      | -15.60      | AVG      |        |
| 5   | 0.2620      | 37.38          | 10.26       | 47.64         | 61.36      | -13.72      | QP       |        |
| 6   | 0.2620      | 19.48          | 10.26       | 29.74         | 51.36      | -21.62      | AVG      |        |
| 7   | 0.2819      | 36.03          | 10.27       | 46.30         | 60.76      | -14.46      | QP       |        |
| 8   | 0.2819      | 18.27          | 10.27       | 28.54         | 50.76      | -22.22      | AVG      |        |
| 9   | 0.3220      | 31.95          | 10.28       | 42.23         | 59.65      | -17.42      | QP       |        |
| 10  | 0.3220      | 13.73          | 10.28       | 24.01         | 49.65      | -25.64      | AVG      |        |
| 11  | 3.6860      | 28.19          | 10.51       | 38.70         | 56.00      | -17.30      | QP       |        |
| 12  | 3.6860      | 16.43          | 10.51       | 26.94         | 46.00      | -19.06      | AVG      |        |

## 9.2 Conducted peak output power

### Test Method

1. Use the following spectrum analyzer settings:  
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel  
RBW > the 20 dB bandwidth of the emission being measured, VBW ≥ RBW,  
Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

### Limits

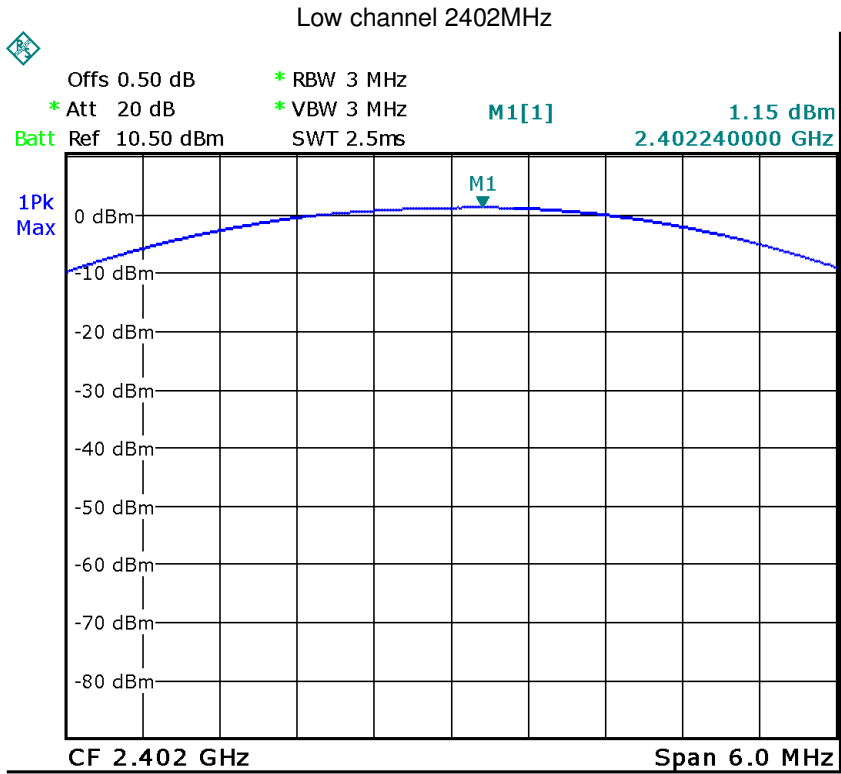
| Frequency Range<br>MHz | Limit<br>W | Limit<br>dBm |
|------------------------|------------|--------------|
| 2400-2483.5            | ≤1         | ≤30          |

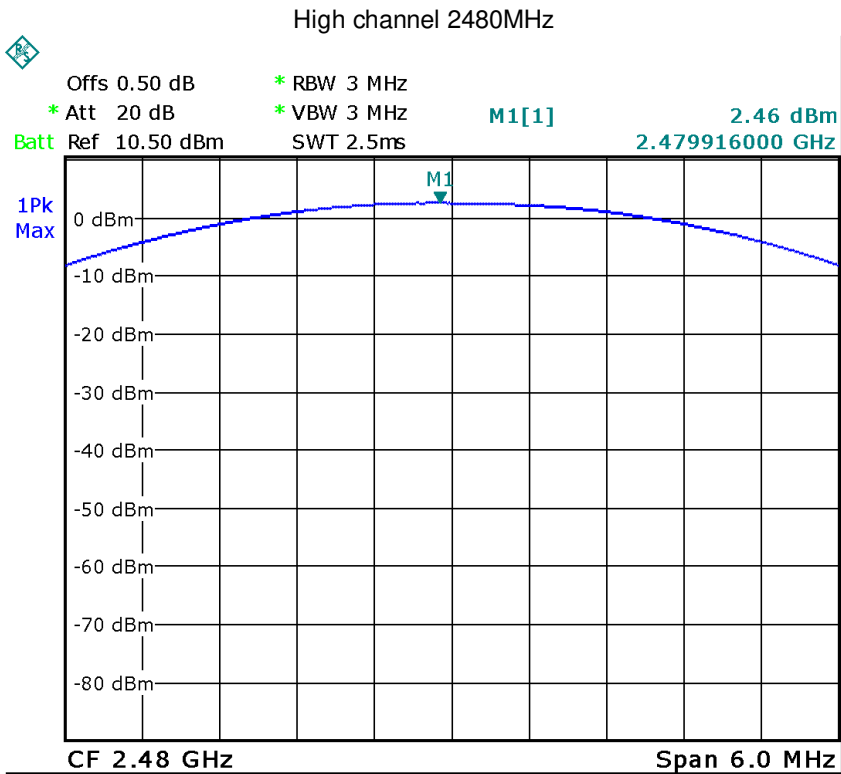
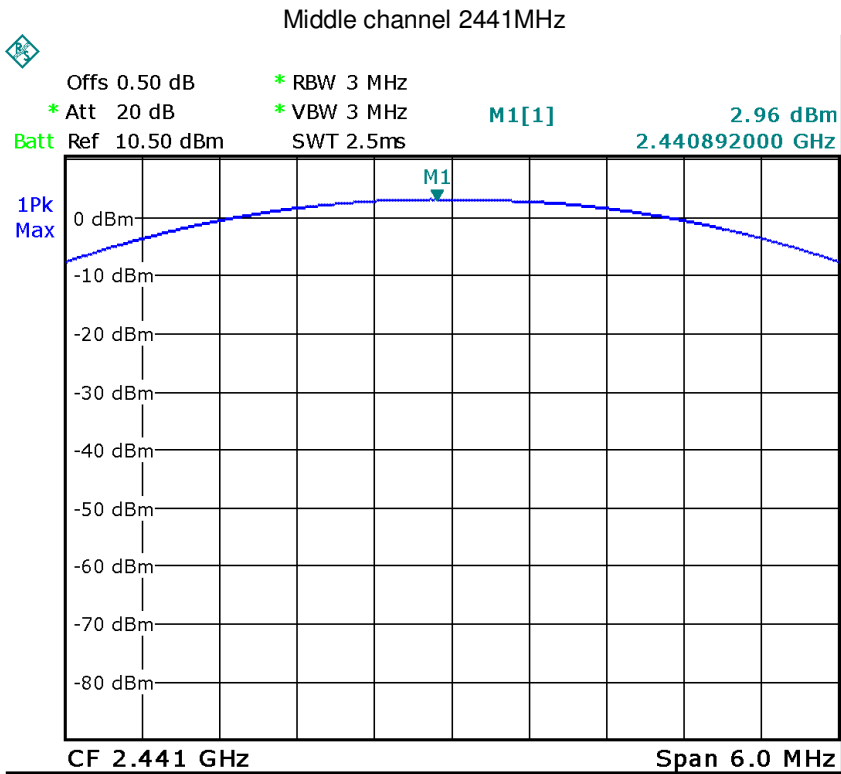


Conducted peak output power

Bluetooth Mode GFSK modulation Test Result

| Frequency<br>MHz       | Conducted Peak<br>Output Power<br>dBm | Result |
|------------------------|---------------------------------------|--------|
| Low channel 2402MHz    | 1.15                                  | Pass   |
| Middle channel 2441MHz | 2.96                                  | Pass   |
| High channel 2480MHz   | 2.46                                  | Pass   |

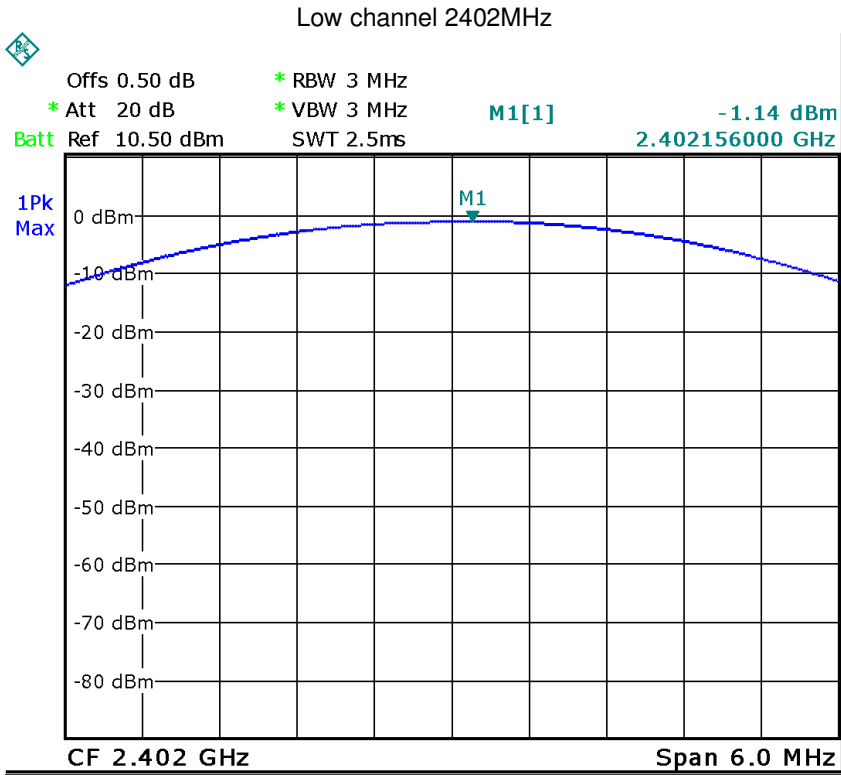


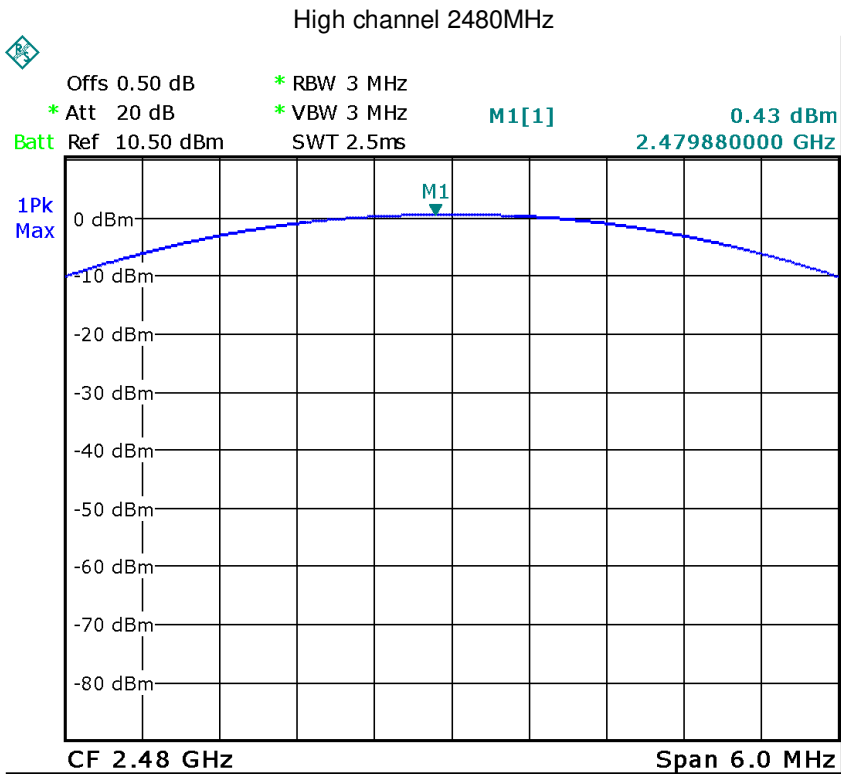
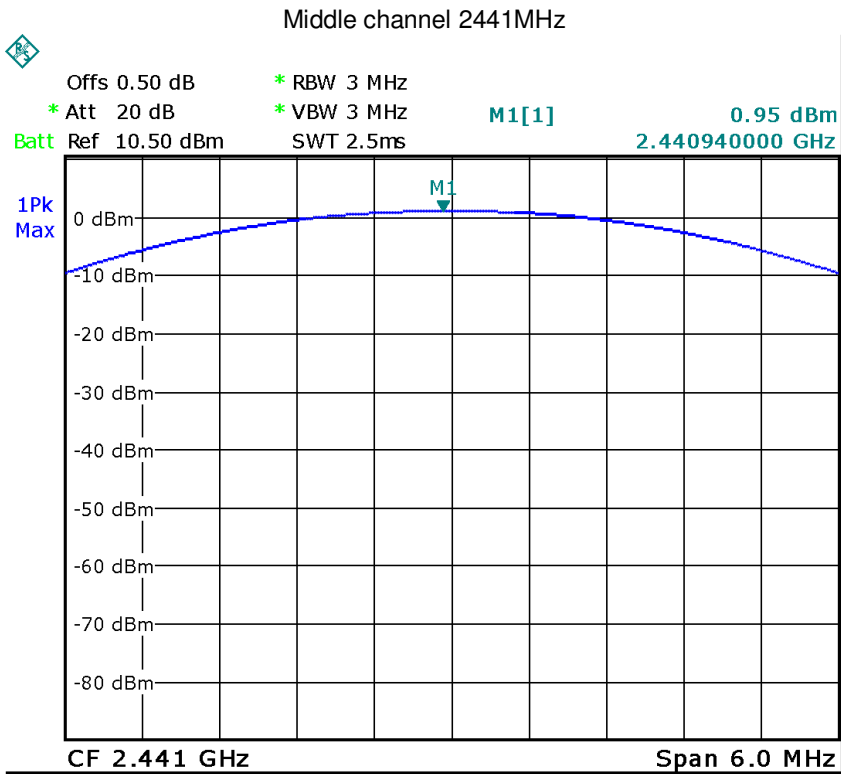




Bluetooth Mode  $\pi/4$ -DQPSK modulation Test Result

| Frequency<br>MHz       | Conducted Peak<br>Output Power<br>dBm | Result |
|------------------------|---------------------------------------|--------|
| Low channel 2402MHz    | -1.14                                 | Pass   |
| Middle channel 2441MHz | 0.95                                  | Pass   |
| High channel 2480MHz   | 0.43                                  | Pass   |

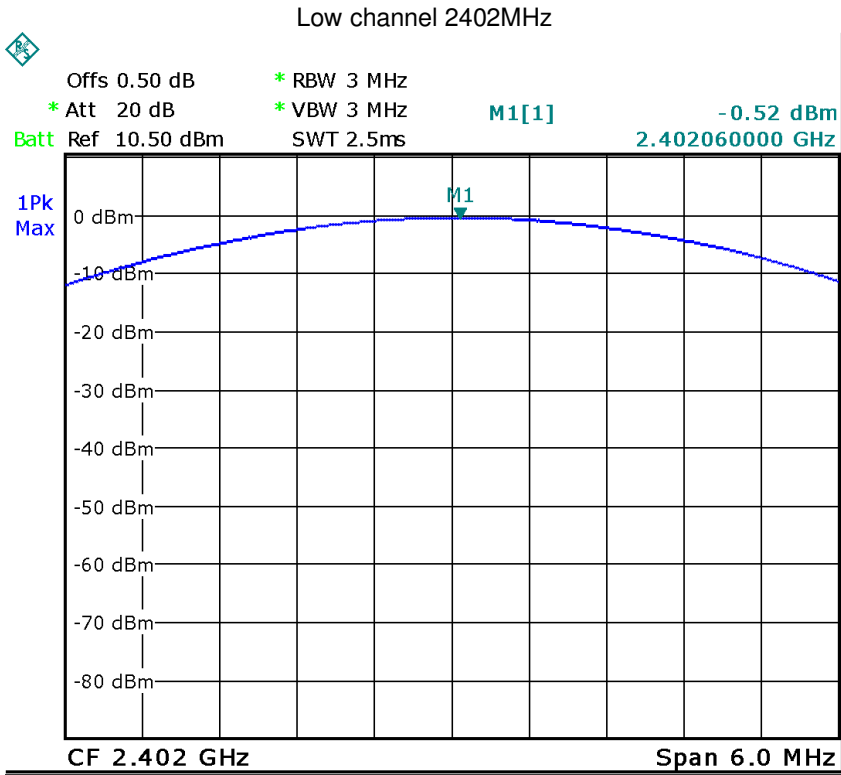


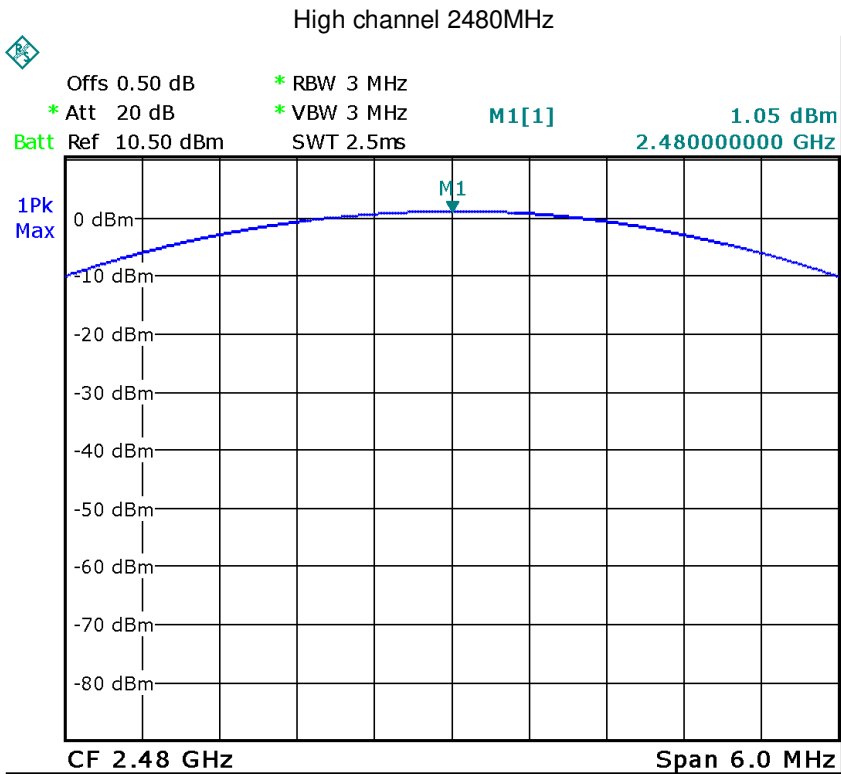
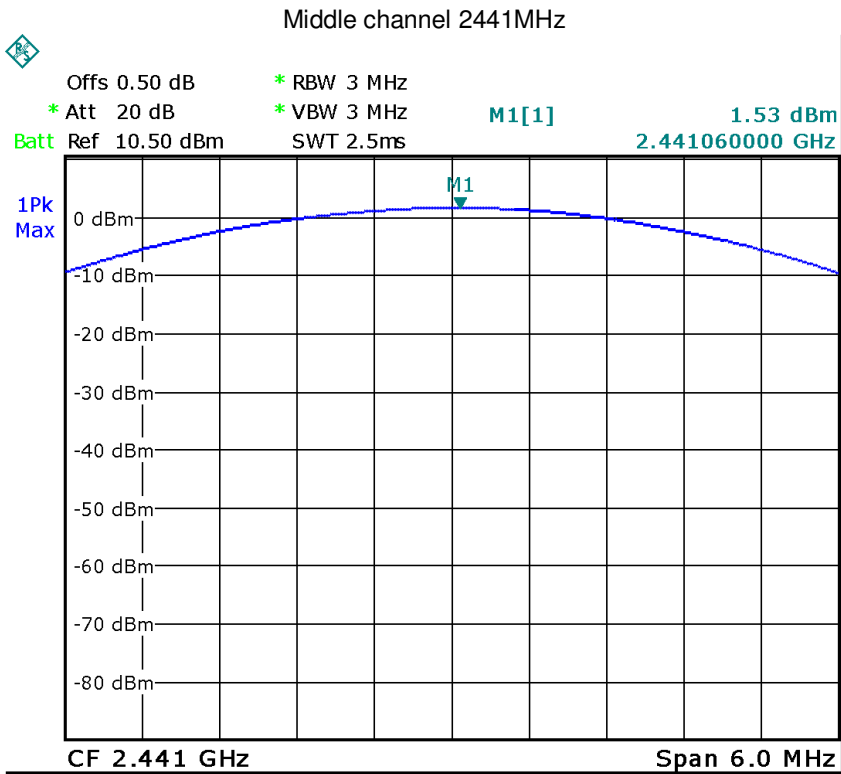




Bluetooth Mode 8DPSK modulation Test Result

| Frequency<br>MHz       | Conducted Peak<br>Output Power<br>dBm | Result |
|------------------------|---------------------------------------|--------|
| Low channel 2402MHz    | -0.52                                 | Pass   |
| Middle channel 2441MHz | 1.53                                  | Pass   |
| High channel 2480MHz   | 1.05                                  | Pass   |





### 9.3 20 dB bandwidth and 99% Occupied Bandwidth

#### Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

#### Limit

Limit [kHz]

---

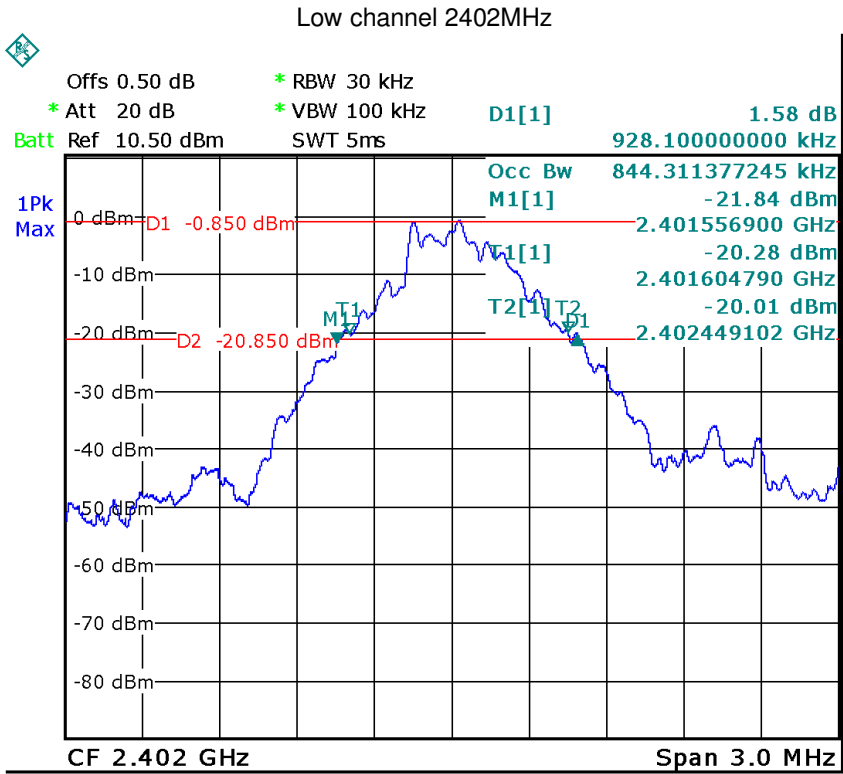
N/A

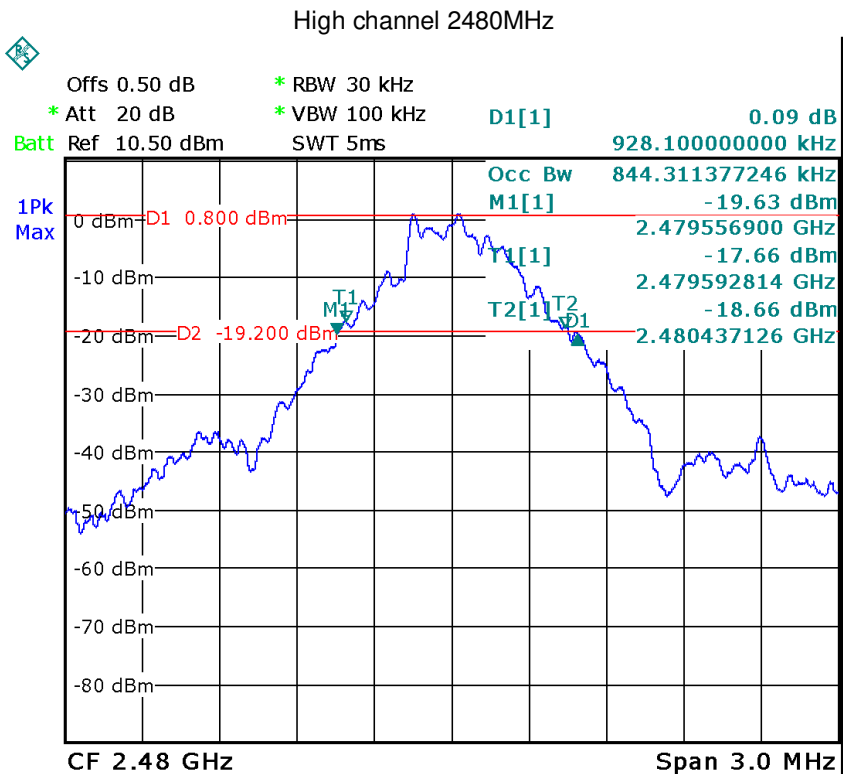
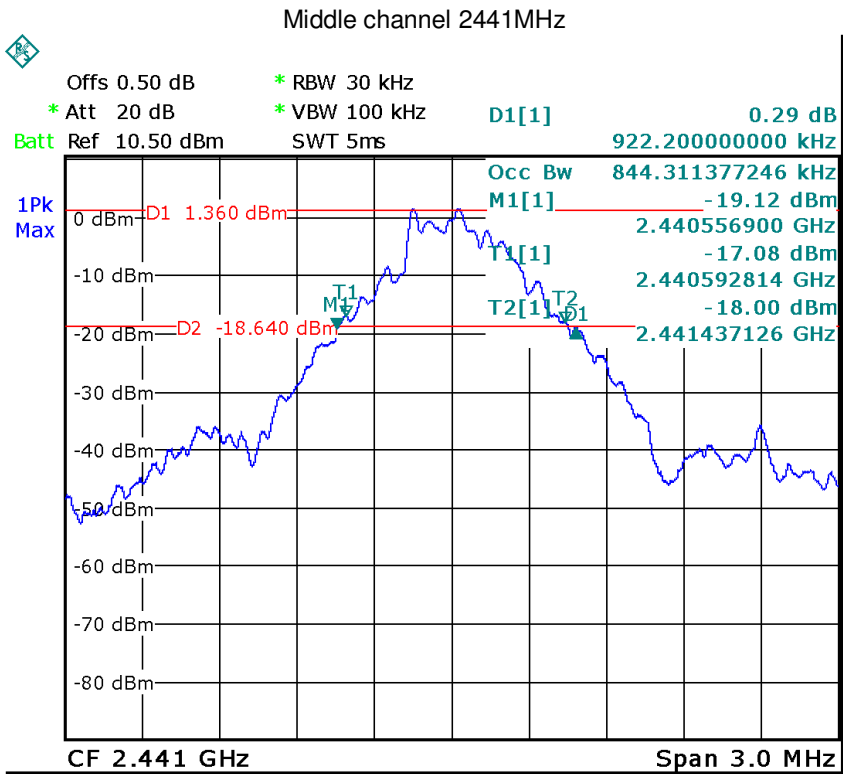


20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

| Frequency | 20 dB Bandwidth | 99% Bandwidth | Limit | Result |
|-----------|-----------------|---------------|-------|--------|
| MHz       | kHz             | kHz           | kHz   |        |
| 2402      | 928.1           | 844.311       | --    | Pass   |
| 2441      | 922.2           | 844.311       | --    | Pass   |
| 2480      | 928.1           | 844.311       | --    | Pass   |



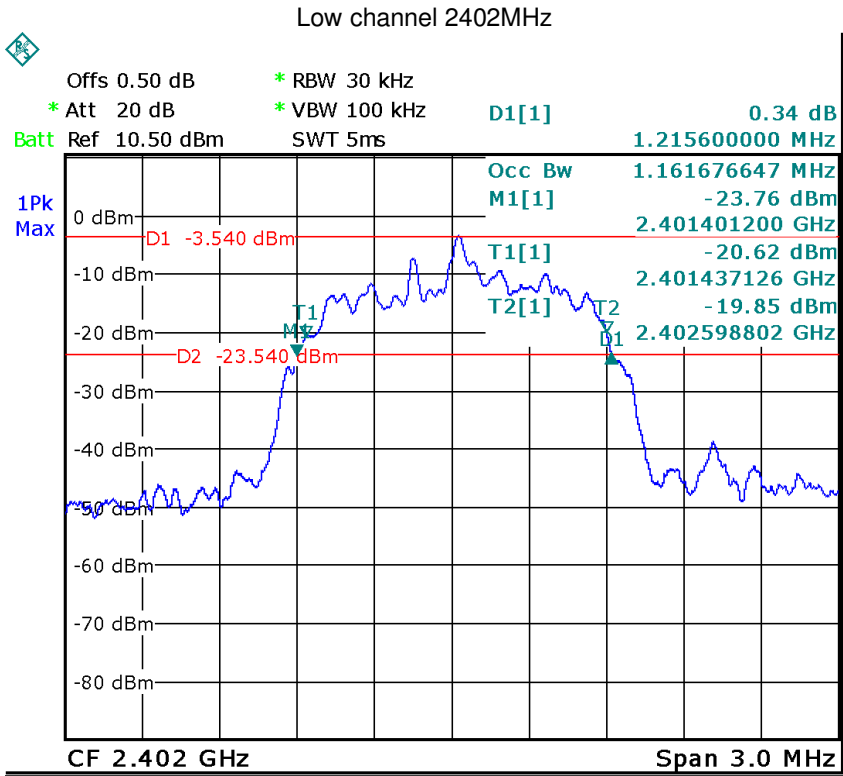


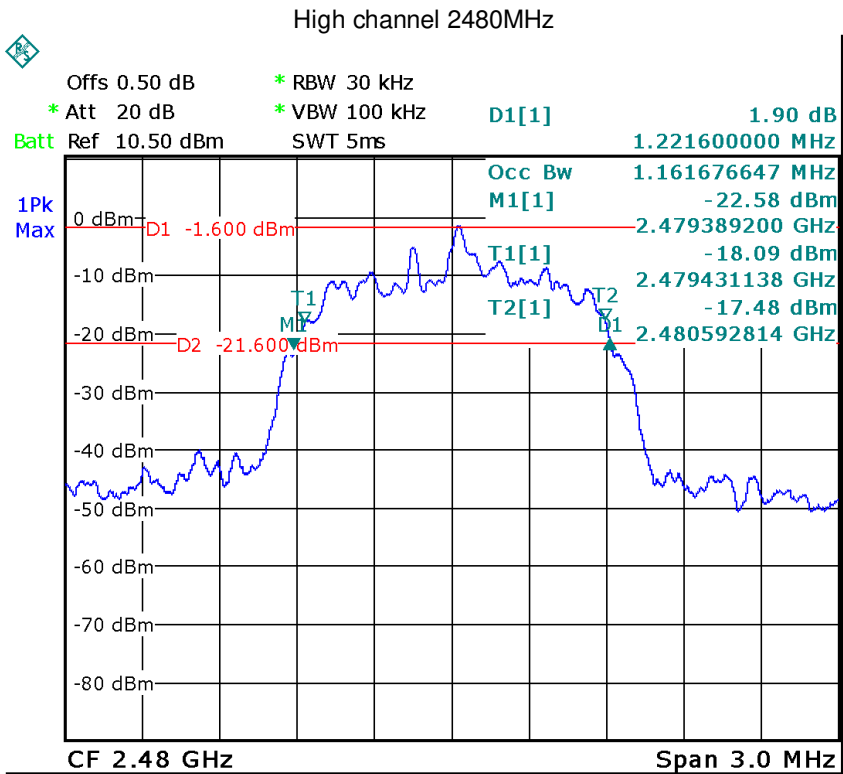
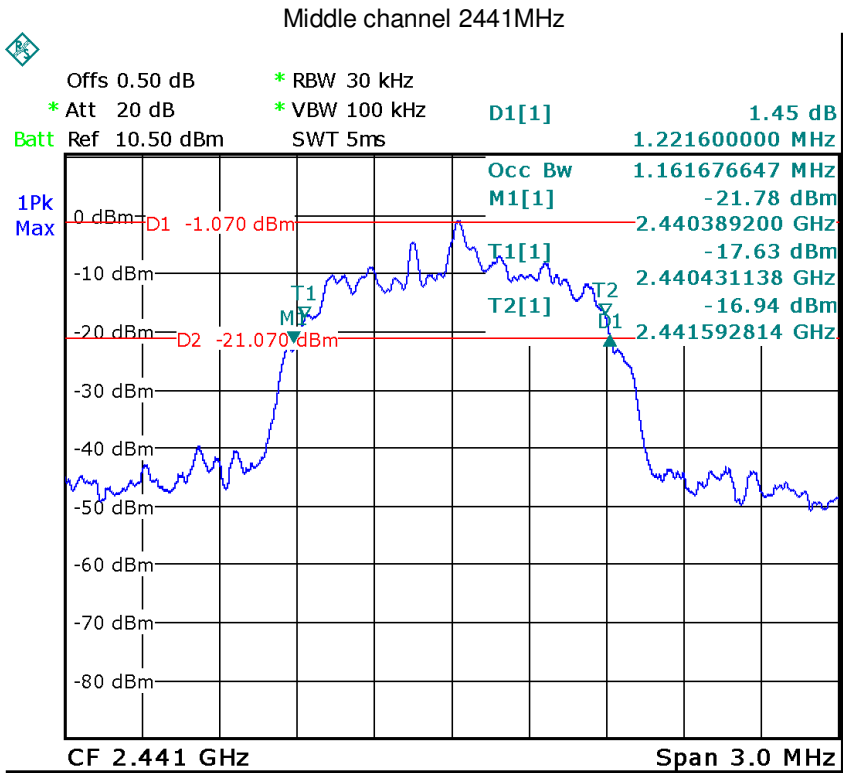


20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode  $\pi/4$ -DQPSK Modulation test result

| Frequency | 20 dB Bandwidth | 99% Bandwidth | Limit | Result |
|-----------|-----------------|---------------|-------|--------|
| MHz       | kHz             | kHz           | kHz   |        |
| 2402      | 1215.6          | 1161.68       | --    | Pass   |
| 2441      | 1221.6          | 1161.68       | --    | Pass   |
| 2480      | 1221.6          | 1161.68       | --    | Pass   |



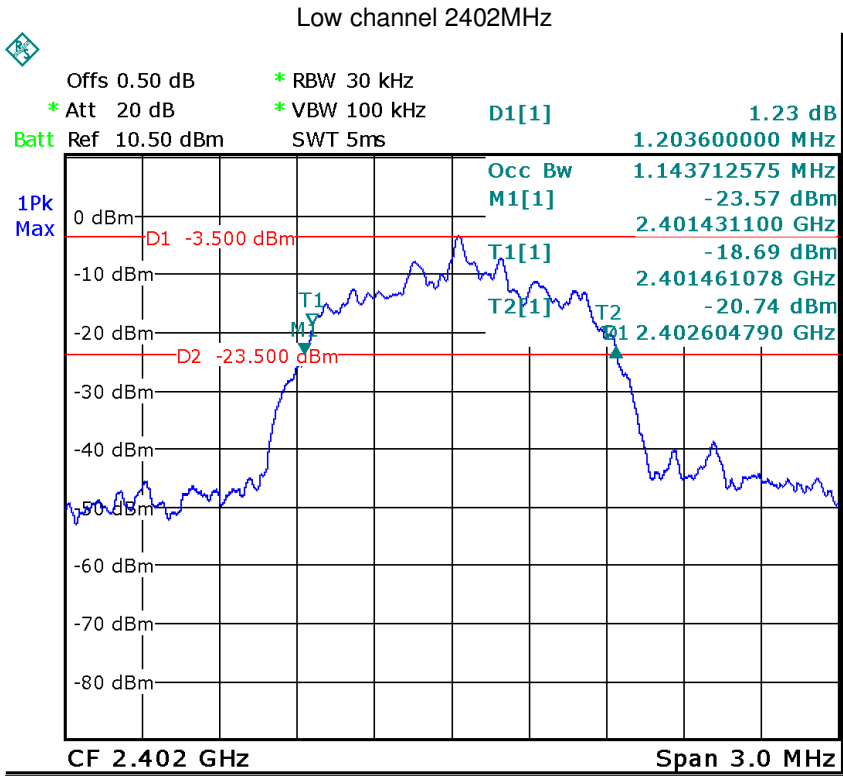


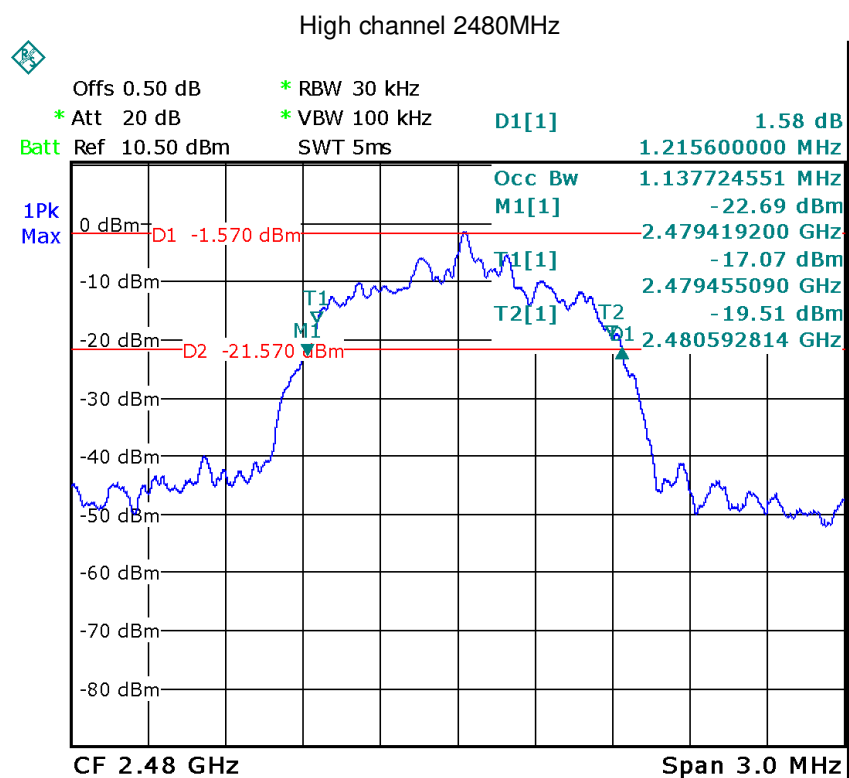
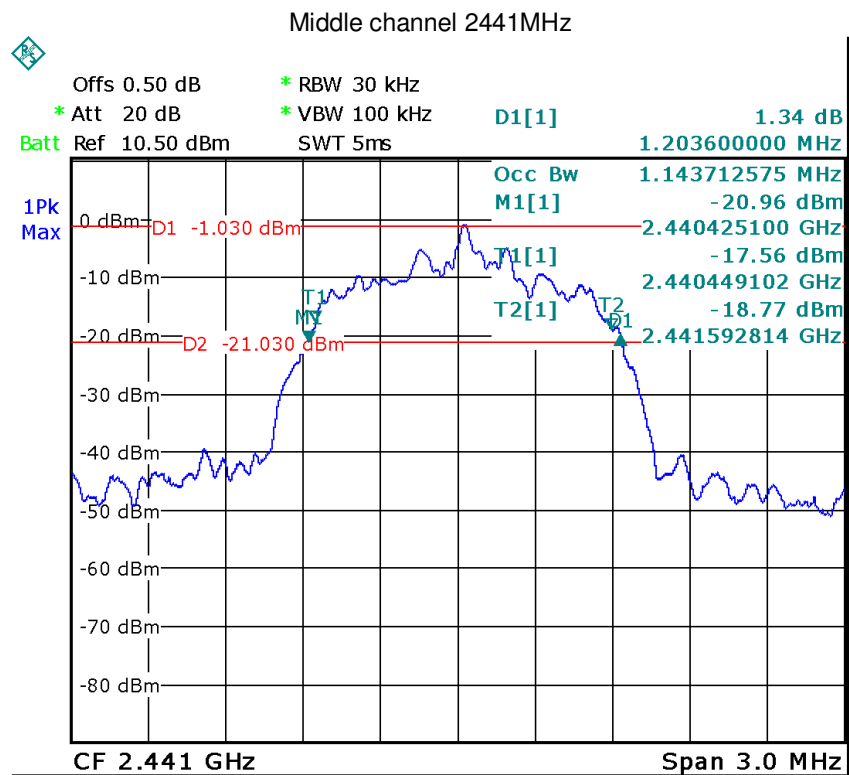


20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode 8DPSK Modulation test result

| Frequency<br>MHz | 20 dB Bandwidth<br>kHz | 99% Bandwidth<br>kHz | Limit<br>kHz | Result |
|------------------|------------------------|----------------------|--------------|--------|
| 2402             | 1203.6                 | 1143.71              | --           | Pass   |
| 2441             | 1203.6                 | 1143.71              | --           | Pass   |
| 2480             | 1215.6                 | 1137.72              | --           | Pass   |





## 9.4 Carrier Frequency Separation

### Test Method

1. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peaks of two adjacent channels, RBW  $\geq$  1% of the span, VBW  $\geq$  RBW, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

### Limit

| Limit<br>kHz                                                         |
|----------------------------------------------------------------------|
| $\geq 25\text{kHz}$ or $2/3$ of the 20 dB bandwidth which is greater |

### GFSK Modulation Limit

| Frequency<br>MHz | 2/3 of 20 dB Bandwidth<br>kHz |
|------------------|-------------------------------|
| 2402             | 618.73                        |
| 2441             | 614.8                         |
| 2480             | 618.73                        |

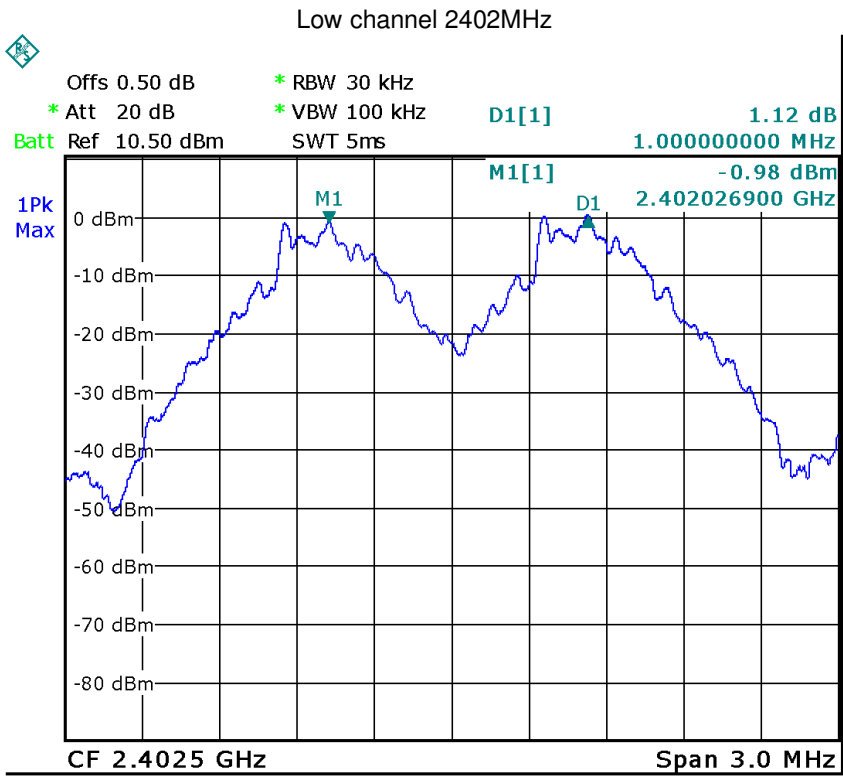


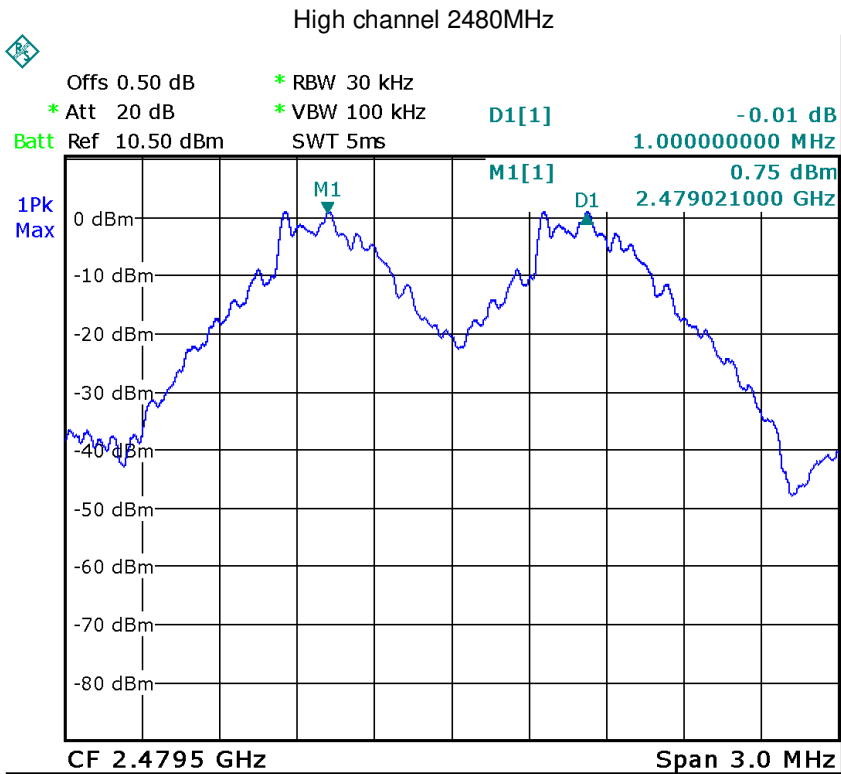
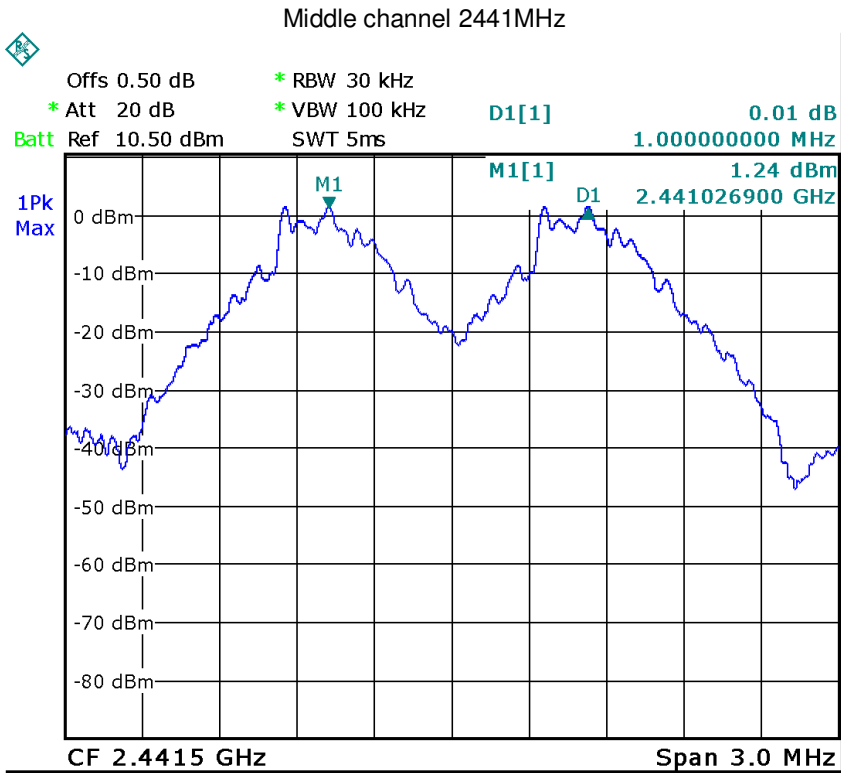
Carrier Frequency Separation

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

GFSK Modulation test result

| Frequency<br>MHz | Carrier Frequency Separation<br>kHz | Result |
|------------------|-------------------------------------|--------|
| 2402             | 1000                                | Pass   |
| 2441             | 1000                                | Pass   |
| 2480             | 1000                                | Pass   |





## 9.5 Number of hopping frequencies

### Test Method

1. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peaks of two adjacent channels, RBW  $\geq$  1% of the span, VBW  $\geq$  RBW, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

### Limit

**Limit  
number**

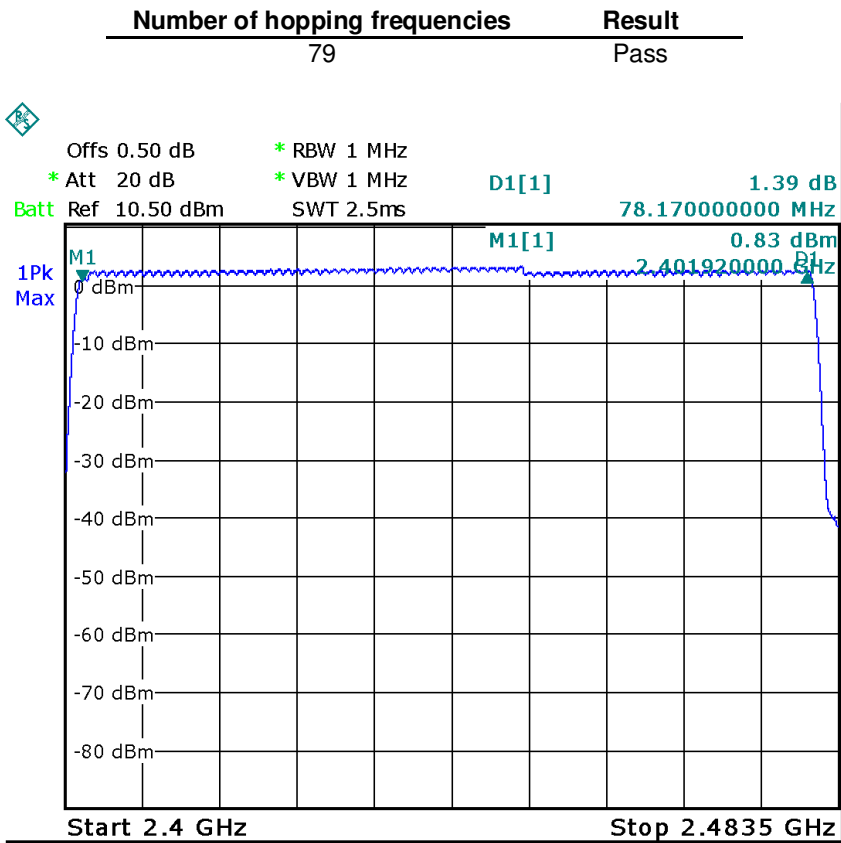
---

$\geq 15$



Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.



## 9.6 Dwell Time

### Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.  
Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

### Limit

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

## Dwell Time

### Dwell time

The maximum dwell time shall be 0.4 s.

According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows:

The duration for dwell time calculation:  $0.4 \text{ [s]} * \text{hopping number} = 0.4 \text{ [s]} * 79 \text{ [ch]} = 31.6 \text{ [s*ch]}$ ;

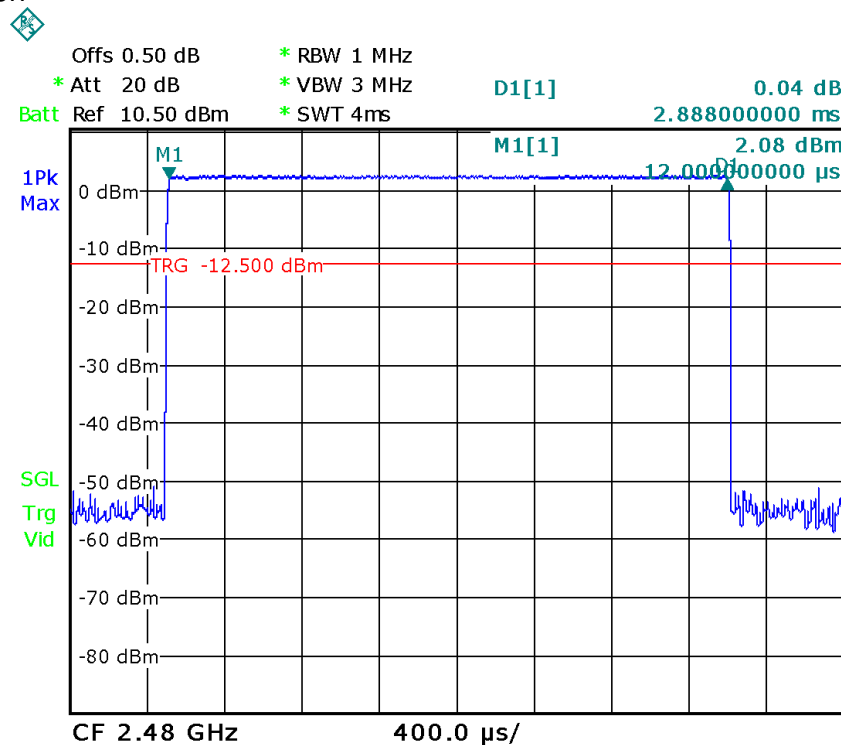
The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5 =  $1600 / 6 / 79 * 31.6 = 106.67$

### Test Result

| Modulation     | Mode | Reading (us) | Total Hops | Test Result (ms) | Limit (ms) | Result |
|----------------|------|--------------|------------|------------------|------------|--------|
| GFSK           | DH5  | 2888         | 106.67     | 308.053          | < 400      | Pass   |
| $\pi/4$ -DQPSK | 2DH5 | 2888         | 106.67     | 308.053          | < 400      | Pass   |
| 8-DPSK         | 3DH5 | 2896         | 106.67     | 308.907          | < 400      | Pass   |

### GFSK Modulation



DH5



## 9.7 Spurious RF conducted emissions

### Test Method

1. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span.  
RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

### Limit

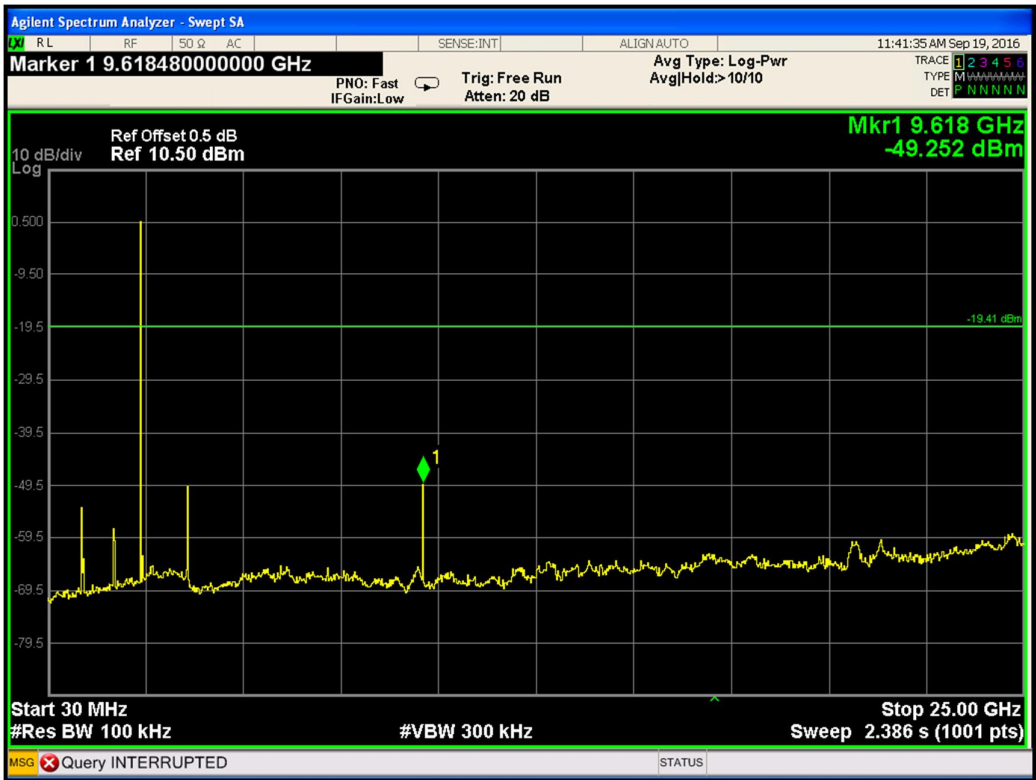
| Frequency Range<br>MHz | Limit (dBc) |
|------------------------|-------------|
| 30-25000               | -20         |



Spurious RF conducted emissions

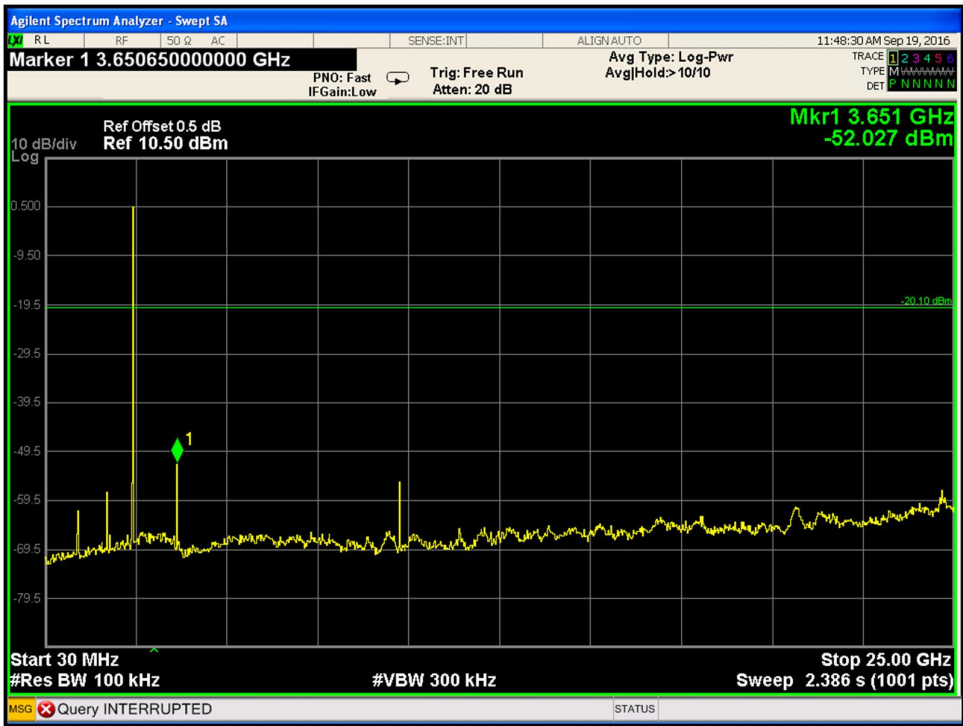
Only the worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.  
BT3.0 GFSK Modulation:

Low channel 2402MHz

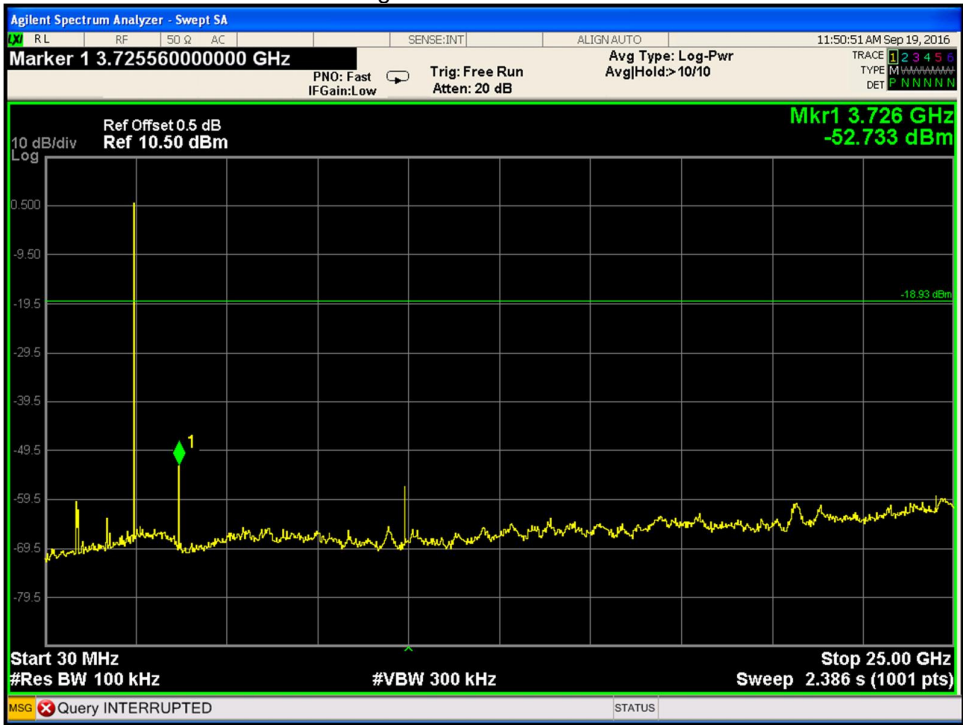




Middle channel 2441MHz



High channel 2480MHz



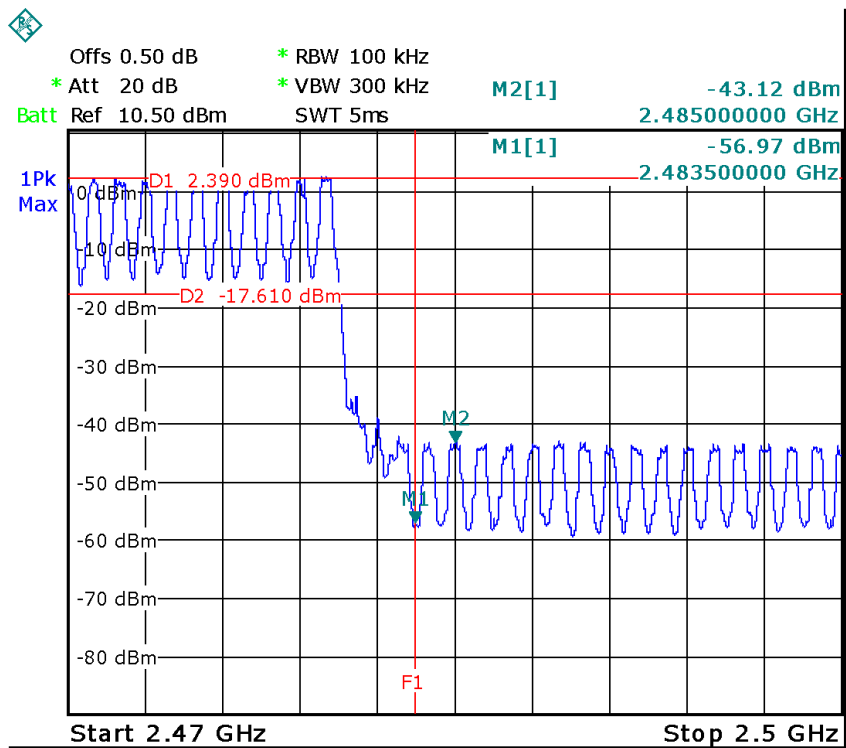
## 9.8 Band edge testing

### Test Method

- 1 Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 kHz, VBW  $\geq$  RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

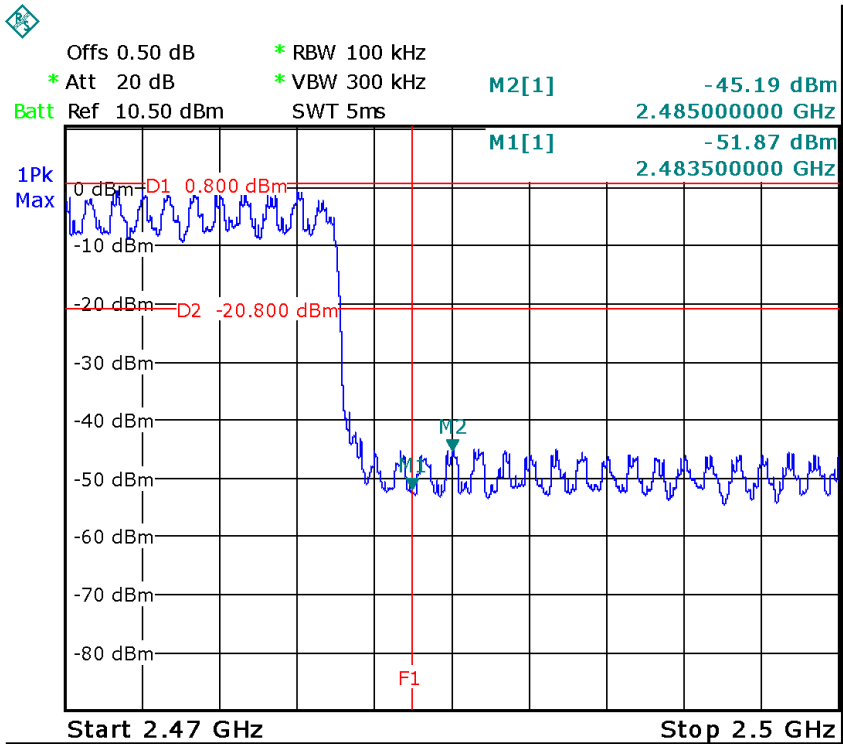
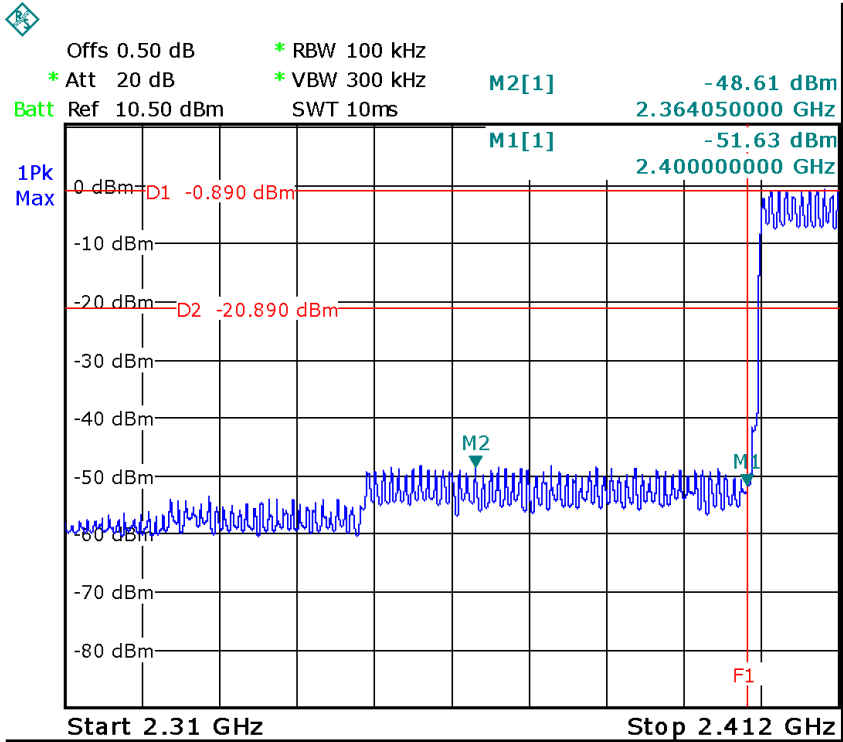
### Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.



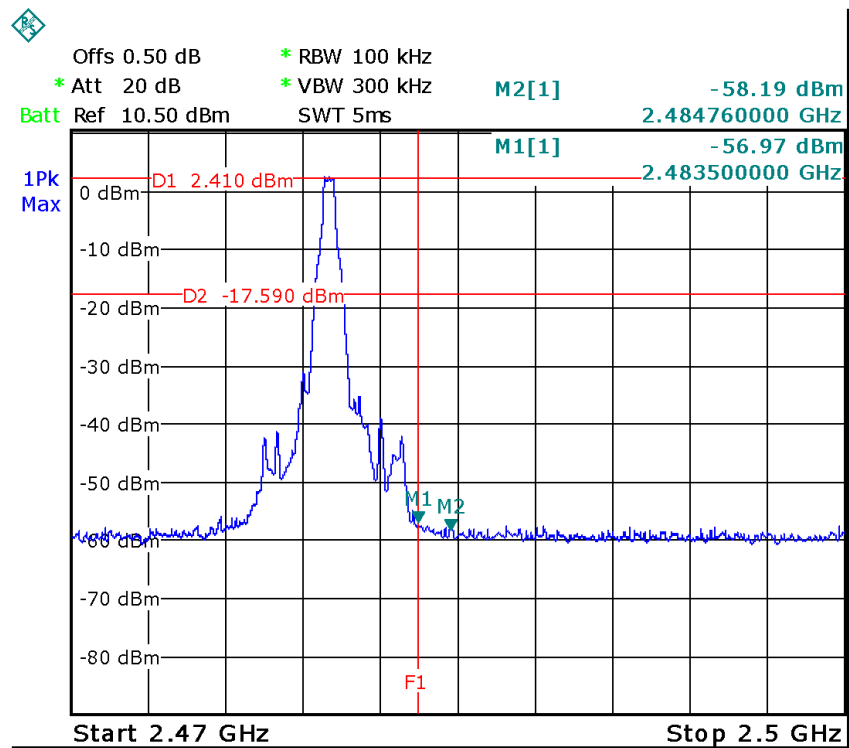
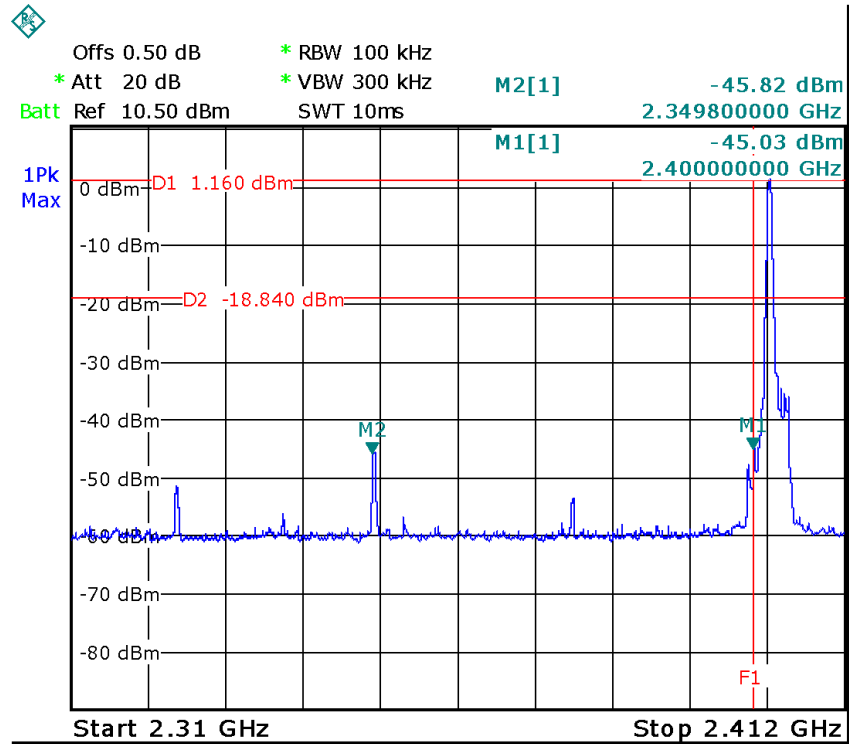


8DPSK Hopping on mode:



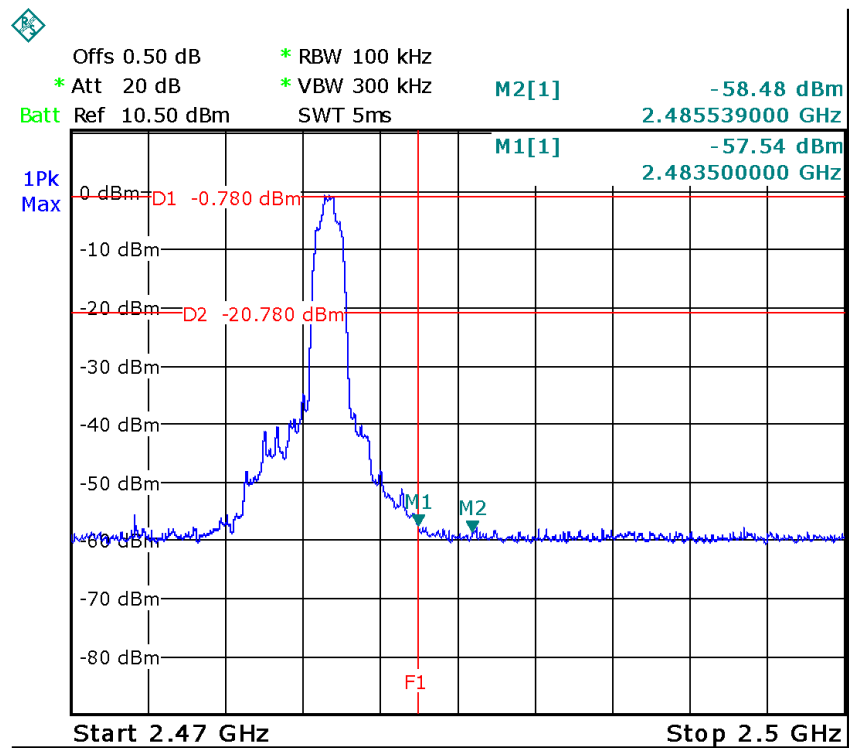
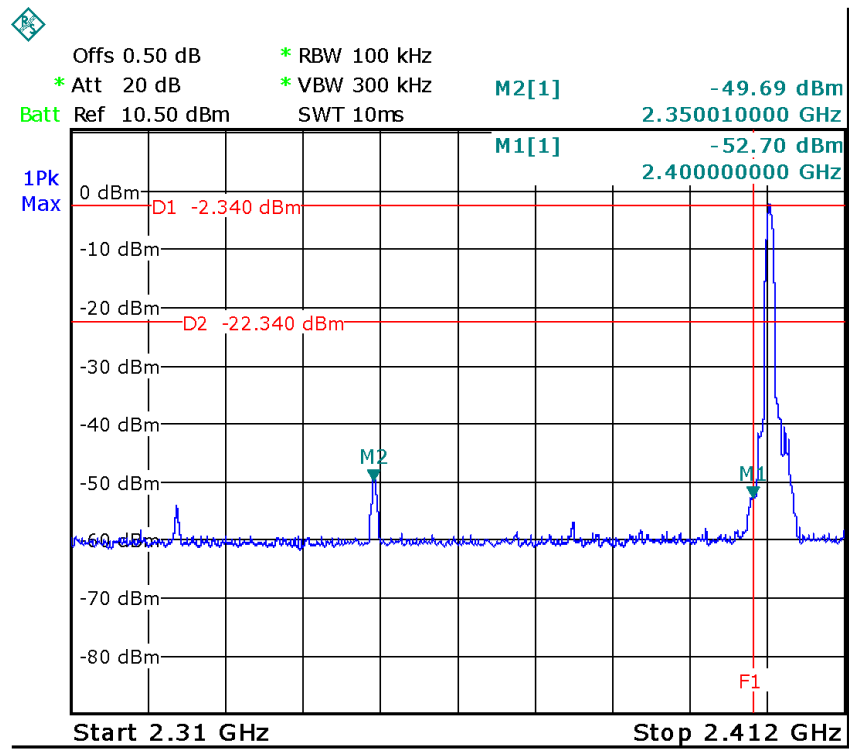


GFSK Hopping off mode:





8DPSK Hopping off mode:



## 9.9 Spurious radiated emissions for transmitter

### Test Method

- 1: The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

#### For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 1MHz, VBW  $\geq$  RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

#### For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 KHz, VBW  $\geq$  RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

### Note:

- 1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
- 3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ( $20\log(1/\text{duty cycle})$ ).
- 4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

## Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

| Frequency<br>MHz | Field Strength<br>uV/m | Field Strength<br>dBμV/m | Detector |
|------------------|------------------------|--------------------------|----------|
| 30-88            | 100                    | 40                       | QP       |
| 88-216           | 150                    | 43.5                     | QP       |
| 216-960          | 200                    | 46                       | QP       |
| 960-1000         | 500                    | 54                       | QP       |
| Above 1000       | 500                    | 54                       | AV       |
| Above 1000       | 5000                   | 74                       | PK       |

## Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

### Transmitting spurious emission test result as below:

#### BT3.0 GFSK Modulation 2402MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit  | Detector | Margin | Result |
|----------------|-----------|----------------|--------------|--------|----------|--------|--------|
|                | MHz       | dBuV/m         |              | dBuV/m |          | dBuV/m |        |
| 26-1000MHz     | 26.9973   | 34             | H            | 69.54  | QP       | 35.54  | Pass   |
|                | 116.9493* | 18.17          | H            | 43.5   | QP       | 25.33  | Pass   |
|                | 26.896    | 33.77          | V            | 69.54  | QP       | 35.77  | Pass   |
|                | 116.9492* | 22.61          | V            | 43.5   | QP       | 20.89  | Pass   |
| 1000-24800MHz  | 4805*     | 57.55          | H            | 74     | PK       | 16.45  | Pass   |
|                | 4805*     | 47.89          | H            | 54     | AV       | 6.11   | Pass   |
|                | 4805*     | 55.89          | V            | 74     | PK       | 18.11  | Pass   |
|                | 4805*     | 47.66          | V            | 54     | AV       | 6.34   | Pass   |
|                | --        | --             | --           | --     | --       | --     | Pass   |

#### BT3.0 GFSK Modulation 2441MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit  | Detector | Margin | Result |
|----------------|-----------|----------------|--------------|--------|----------|--------|--------|
|                | MHz       | dBuV/m         |              | dBuV/m |          | dBuV/m |        |
| 26-1000MHz     | 27.98     | 34.78          | H            | 69.54  | QP       | 34.76  | Pass   |
|                | 177.5091  | 20.39          | H            | 43.5   | QP       | 23.11  | Pass   |
|                | 26.56     | 34.96          | V            | 69.54  | QP       | 34.58  | Pass   |
|                | 385.2803  | 22.70          | V            | 46     | QP       | 23.30  | Pass   |
| 1000-24800MHz  | 4885*     | 63.88          | H            | 74     | PK       | 10.62  | Pass   |
|                | 4885*     | 51.22          | H            | 54     | AV       | 2.78   | Pass   |
|                | 4885*     | 53.16          | V            | 74     | PK       | 20.84  | Pass   |
|                | --        | --             | --           | --     | --       | --     | Pass   |

## BT3.0 GFSK Modulation 2480MHz Test Result

| Frequency Band       | Frequency<br>MHz | Emission Level<br>dBuV/m | Polarization | Limit<br>dBuV/m | Detector | Margin<br>dBuV/m | Result |
|----------------------|------------------|--------------------------|--------------|-----------------|----------|------------------|--------|
| <b>26-1000MHz</b>    | 26.61            | 34.15                    | H            | 69.54           | QP       | 35.39            | Pass   |
|                      | 177.5091         | 20.39                    | H            | 43.5            | QP       | 23.11            | Pass   |
|                      | 26.35            | 34.37                    | V            | 69.54           | QP       | 35.17            | Pass   |
|                      | 93.1131          | 17.23                    | V            | 43.5            | QP       | 26.27            | Pass   |
| <b>1000-24800MHz</b> | 4960*            | 67                       | H            | 74              | PK       | 7.00             | Pass   |
|                      | 4960*            | 52.22                    | H            | 54              | AV       | 1.78             | Pass   |
|                      | 4960*            | 55.79                    | V            | 74              | PK       | 18.21            | Pass   |
|                      | 4960*            | 47.66                    | V            | 54              | AV       | 6.34             | Pass   |
|                      | --               | --                       | --           | --              | --       | --               | Pass   |

## Remark:

- (1) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.

## 10 Test Equipment List

### Site 2:

| Conducted Emissions Test Site 2#                              |                              |                      |             |                 |                       |                      |
|---------------------------------------------------------------|------------------------------|----------------------|-------------|-----------------|-----------------------|----------------------|
| Item                                                          | Equipment                    | Manufacturer         | Model No.   | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1                                                             | EMI Test Receiver            | R&S                  | ESCI        | 101155          | Sep.12, 2016          | Sep.11, 2017         |
| 2                                                             | LISN                         | SCHWARZBECK          | NSLK 8128   | 8128-289        | Sep.12, 2016          | Sep.11, 2017         |
| 3                                                             | Limiter                      | York                 | MTS-IMP-136 | 261115-001-0024 | Sep.12, 2016          | Sep.11, 2017         |
| 4                                                             | Cable                        | Laplace              | RF300       | -               | Sep.12, 2016          | Sep.11, 2017         |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 1# |                              |                      |             |                 |                       |                      |
| Item                                                          | Equipment                    | Manufacturer         | Model No.   | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1                                                             | EMC Analyzer                 | Agilent              | E7405A      | MY45114943      | Oct.17,2015           | Oct.16,2016          |
| 2                                                             | Active Loop Antenna          | Beijing Dazhi        | ZN30900A    | -               | Oct.17,2015           | Oct.16,2016          |
| 3                                                             | Trilog Broadband Antenna     | SCHWARZBECK          | VULB9163    | 336             | Apr.19,2016           | Apr.18,2017          |
| 4                                                             | Coaxial Cable (below 1GHz)   | Top                  | TYPE16(13M) | -               | Sep.12, 2016          | Sep.11, 2017         |
| 5                                                             | Broad-band Horn Antenna      | SCHWARZBECK          | BBHA 9120 D | 667             | Apr.19,2016           | Apr.18,2017          |
| 6                                                             | Broad-band Horn Antenna      | SCHWARZBECK          | BBHA 9170   | 335             | Apr.19,2016           | Apr.18,2017          |
| 7                                                             | Broadband Preamplifier       | COMPLIANCE DIRECTION | PAP-1G18    | 2004            | Mar.17,2016           | Mar.16,2017          |
| 8                                                             | Coaxial Cable (above 1GHz)   | Top                  | 1GHz-25GHz  | EW02014-7       | Apr.10,2016           | Apr.09,2017          |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 2# |                              |                      |             |                 |                       |                      |
| Item                                                          | Equipment                    | Manufacturer         | Model No.   | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1                                                             | Test Receiver                | R&S                  | ESCI        | 101296          | Apr.10,2016           | Apr.09,2017          |
| 2                                                             | Trilog Broadband Antenna     | SCHWARZBECK          | VULB9160    | 9160-3325       | Apr.10,2016           | Apr.09,2017          |
| 3                                                             | Amplifier                    | ANRITSU              | MH648A      | M43381          | Apr.10,2016           | Apr.09,2017          |
| 4                                                             | Cable                        | HUBER+SUHNER         | CBL2        | 525178          | Apr.10,2016           | Apr.09,2017          |
| RF Conducted Testing                                          |                              |                      |             |                 |                       |                      |
| Item                                                          | Equipment                    | Manufacturer         | Model No.   | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1.                                                            | EMC Analyzer (9k~26.5GHz)    | Agilent              | E7405A      | MY45114943      | Sep.12, 2016          | Sep.11, 2017         |
| 2.                                                            | Spectrum Analyzer (9k-6GHz)  | R&S                  | FSL6        | 100959          | Sep.12, 2016          | Sep.11, 2017         |
| 3.                                                            | Signal Analyzer (9k~26.5GHz) | Agilent              | N9010A      | MY50520207      | Sep.12, 2016          | Sep.11, 2017         |

#### RF Conducted Testing:

- Conducted peak output power
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Spurious RF conducted emissions
- Band edge

## 11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

| Parameter                         | Uncertainty                                 |
|-----------------------------------|---------------------------------------------|
| Radio Frequency                   | $\pm 1 \times 10^{-6}$                      |
| RF Power                          | $\pm 1.0$ dB                                |
| RF Power Density                  | $\pm 2.2$ dB                                |
| Radiated Spurious Emissions test  | $\pm 5.03$ dB (Bilog antenna 30M~1000MHz)   |
|                                   | $\pm 4.74$ dB (Horn antenna 1000M~25000MHz) |
| Conducted Spurious Emissions test | $\pm 3.64$ dB (AC mains 150KHz~30MHz)       |

**Test setup photos section: Refer to the annex A.**

**EUT photo section: Refer to the annex B.**