

# FCC PART 15C TEST REPORT FOR CERTIFICATION

## On Behalf of

Soundlab Technology Company Limited

Soundbar

Model Number: Klipsch Cinema 800 Sound bar

FCC ID: 2ATKO-BAR800

|               |                                                                     |
|---------------|---------------------------------------------------------------------|
| Prepared for: | Soundlab Technology Company Limited                                 |
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|               |                                                                     |
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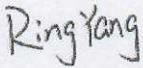
|                 |                       |
|-----------------|-----------------------|
| Report Number:  | ESTE-R2008096         |
| Date of Test:   | Jul. 14~Aug. 18, 2020 |
| Date of Report: | Aug. 19, 2020         |

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## EST Technology Co., Ltd.

|                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Applicant:</b>                                                                                                                                                                                        | Soundlab Technology Company Limited                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                       |                       |
| <b>Address:</b>                                                                                                                                                                                          | No.101,202,Building 1, Microlab Industrial Park, No.2 Baozi South Road, Kengzi, Pingshan District, ShenZhen, China                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                       |                       |
| <b>Manufacturer:</b>                                                                                                                                                                                     | Klipsch Group Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                       |                       |
| <b>Address:</b>                                                                                                                                                                                          | 3502 Woodview Trace, Indianapolis, IN 46268                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                       |                       |
| <b>E.U.T:</b>                                                                                                                                                                                            | Soundbar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                       |                       |
| <b>Model Number:</b>                                                                                                                                                                                     | Klipsch Cinema 800 Sound bar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |                       |
| <b>Power Supply:</b>                                                                                                                                                                                     | AC 100~240V, 50/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |                       |
| <b>Trade Name:</b>                                                                                                                                                                                       | Klipsch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Serial No.:</b>                                                                                                    | -----                 |
| <b>Date of Receipt:</b>                                                                                                                                                                                  | Jul. 14, 2020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Date of Test:</b>                                                                                                  | Jul. 14~Aug. 18, 2020 |
| <b>Test Specification:</b>                                                                                                                                                                               | FCC Part 15 Subpart C (15.247)<br>ANSI C63.10:2013<br>FCC KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |                       |
| <b>Test Result:</b>                                                                                                                                                                                      | <p>The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements.</p> <p>This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.</p> |                                                                                                                       |                       |
| <b>Prepared by:</b>                                                                                                                                                                                      | <b>Reviewed by:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Date:</b> Aug. 19, 2020                                                                                            |                       |
| <br>_____<br>Ring Yang / Assistant                                                                                    | <br>_____<br>Seven Wang / Engineer                                                                                                                                                                                                                                                                                                                                                                                                                         | <br>_____<br>Iceman Hu / Manager |                       |
| <b>Other Aspects:</b><br>None.                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                       |
| <i>Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested</i>                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                       |
| <i>This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                       |



## 1. GENERAL INFORMATION

### 1.1. Description of Device (EUT)

|                         |   |                                                                               |
|-------------------------|---|-------------------------------------------------------------------------------|
| Product Name            | : | Soundbar                                                                      |
| Model Number            | : | Klipsch Cinema 800 Sound bar                                                  |
| Software Version        | : | V28                                                                           |
| Hardware Version        | : | V1.0.                                                                         |
| Operation frequency     | : | 2402MHz~2480MHz                                                               |
| Number of channel       | : | 79                                                                            |
| Max Output Power (PEAK) | : | 6.59dBm                                                                       |
| Modulation Type         | : | BT BDR(1Mbps): GFSK<br>BT EDR(2Mbps): $\pi/4$ -DQPSK<br>BT EDR(3Mbps): 8-DPSK |
| Sample Type             | : | Prototype production                                                          |

Note:

For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

### 1.2. Antenna Information

| Ant No.                                                                                 | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|-----------------------------------------------------------------------------------------|-------|------------|--------------|-----------|------------|
| 1                                                                                       | N/A   | N/A        | Internal     | N/A       | 2.34       |
| 2                                                                                       | N/A   | N/A        | Internal     | N/A       | 2.34       |
| Only one antenna transmission is supported, Simultaneous transmission is not supported. |       |            |              |           |            |

## 2. SUMMARY OF TEST

### 2.1. Summary of test result

| Report Section | Description of Test Item                  | FCC Standard Section          | Results |
|----------------|-------------------------------------------|-------------------------------|---------|
| 3              | Maximum Peak Output Power                 | 15.247(a)(1)                  | PASS    |
| 4              | 20dB Bandwidth                            | 15.247(a)(1)                  | PASS    |
| 5              | Carrier Frequency Separation              | 15.247(a)(1)                  | PASS    |
| 6              | Number Of Hopping Channel                 | 15.247(a)(1)(iii)             | PASS    |
| 7              | Dwell Time                                | 15.247(a)(1)(iii)             | PASS    |
| 8              | Conducted Band Edge                       | 15.247(d)                     | PASS    |
| 9              | Conducted Spurious Emissions              | 15.247(d)                     | PASS    |
| 10             | Radiated Spurious Emissions and Band Edge | 15.205<br>15.209<br>15.247(d) | PASS    |
| 11             | AC Power Line Conducted Emissions         | 15.207                        | PASS    |
| 12             | Antenna Requirement                       | 15.203                        | PASS    |

Note:

(1) "N/A" denotes test is not applicable in this test report

## 2.2. Test Facilities

EMC Lab : Certificated by CNAS, CHINA  
Registration No.: L5288  
This Certificate is valid until: November 12, 2023

Certificated by FCC, USA  
Designation Number: CN1215  
This Certificate is valid until: January 31, 2022

Certificated by A2LA, USA  
Registration No.: 4366.01  
This Certificate is valid until: January 31, 2022

Certificated by Industry Canada  
CAB identifier No.: CN0035  
This Certificate is valid until: January 31, 2022

Certificated by VCCI, Japan  
Registration No.: C-14103; T-20073; R-13663;  
R-20103; G-20097  
Date of registration: Apr. 20, 2020  
This Certificate is valid until: Apr. 19, 2023

Certificated by TUV Rheinland, Germany  
Registration No.: UA 50413872 0001  
Date of registration: July 31, 2018

Certificated by Intertek  
Registration No.: 2011-RTL-L2-64  
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

### 2.3. Measurement uncertainty

| Test Item                                                  | Uncertainty                       |
|------------------------------------------------------------|-----------------------------------|
| Uncertainty for Conduction emission test                   | $\pm 3.48\text{dB}$               |
| Uncertainty for spurious emissions test<br>(30MHz-1GHz)    | $\pm 4.60\text{ dB(Polarize: H)}$ |
|                                                            | $\pm 4.68\text{ dB(Polarize: V)}$ |
| Uncertainty for spurious emissions test<br>(1GHz to 25GHz) | $\pm 4.96\text{dB}$               |
| Uncertainty for radio frequency                            | $7 \times 10^{-8}$                |
| Uncertainty for conducted RF Power                         | 0.20dB                            |
| Uncertainty for Power density test                         | 0.26dB                            |

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

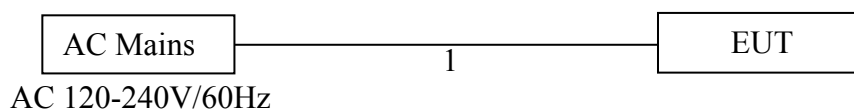
### 2.4. Assistant equipment used for test

| Item | Equipment | Brand | Model Name/Type No. | FCC ID | Series No. |
|------|-----------|-------|---------------------|--------|------------|
| -    | -         | -     | -                   | -      | -          |

| Item | Shielded Type | Ferrite Core | Length | Note     |
|------|---------------|--------------|--------|----------|
| 1    | NO            | NO           | 1.5m   | AC Cable |

### 2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into Bluetooth test mode by software before test.



(EUT: Soundbar)



## 2.6. Test mode

Combining all the rates, modulations, and packet types, the Pre-scans had been carried out. The worst case test mode was selected for the final test as listed below.

| Test Item                               | Modulation Type | Operating Mode | Packet Type | Test Channel                   |
|-----------------------------------------|-----------------|----------------|-------------|--------------------------------|
| Maximum Peak Output Power               | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/Middle/High                |
| 20dB Bandwidth                          | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/Middle/High                |
| Carrier Frequency Separation            | GFSK&8-DPSK     | Hopping        | DH5         | Low/Middle/High                |
| Number Of Hopping Channel               | GFSK&8-DPSK     | Hopping        | DH5         | All Channel Hopping            |
| Dwell Time                              | GFSK&8-DPSK     | Hopping        | DH1/DH3/DH5 | Middle( All Channel Hopping)   |
| Conducted Band Edge                     | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/ High& All Channel Hopping |
| Conducted Spurious Emissions            | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/Middle/High                |
| Radiated Spurious Emissions(Below 1GHz) | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/Middle/High                |
| Radiated Spurious Emissions(Above 1GHz) | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/Middle/High                |
| Radiated Band Edge                      | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/High                       |
| AC Power Line Conducted Emissions       | GFSK&8-DPSK     | Non Hopping    | DH5         | Low/Middle/High                |

Note:

1. In radiated measurement, the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane**.

## 2.7. Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| 0           | 2402            | 1           | 2403            | 2           | 2404            | 3           | 2405            |
| 4           | 2406            | 5           | 2407            | 6           | 2408            | 7           | 2409            |
| 8           | 2410            | 9           | 2411            | 10          | 2412            | 11          | 2413            |
| 12          | 2414            | 13          | 2415            | 14          | 2416            | 15          | 2417            |
| 16          | 2418            | 17          | 2419            | 18          | 2420            | 19          | 2421            |
| 20          | 2422            | 21          | 2423            | 22          | 2424            | 23          | 2425            |
| 24          | 2426            | 25          | 2427            | 26          | 2428            | 27          | 2429            |
| 28          | 2430            | 29          | 2431            | 30          | 2432            | 31          | 2433            |
| 32          | 2434            | 33          | 2435            | 34          | 2436            | 35          | 2437            |
| 36          | 2438            | 37          | 2439            | 38          | 2440            | 39          | 2441            |
| 40          | 2442            | 41          | 2443            | 42          | 2444            | 43          | 2445            |
| 44          | 2446            | 45          | 2447            | 46          | 2448            | 47          | 2449            |
| 48          | 2450            | 49          | 2451            | 50          | 2452            | 51          | 2453            |
| 52          | 2454            | 53          | 2455            | 54          | 2456            | 55          | 2457            |
| 56          | 2458            | 57          | 2459            | 58          | 2460            | 59          | 2461            |
| 60          | 2462            | 61          | 2463            | 62          | 2464            | 63          | 2465            |
| 64          | 2466            | 65          | 2467            | 66          | 2468            | 67          | 2469            |
| 68          | 2470            | 69          | 2471            | 70          | 2472            | 71          | 2473            |
| 72          | 2474            | 73          | 2475            | 74          | 2476            | 75          | 2477            |
| 76          | 2478            | 77          | 2479            | 78          | 2480            | -           | -               |

## 2.8. Power Setting of Test Software

| Software Name         | SecureCRT 5.50 |         |         |
|-----------------------|----------------|---------|---------|
| Frequency(MHz)        | 2402           | 2441    | 2480    |
| GFSK(1Mbps) Setting   | Default        | Default | Default |
| 8-DPSK(3Mbps) Setting | Default        | Default | Default |

## 2.9. Test Equipmen

| For conducted emission test |                 |              |            |                  |            |           |
|-----------------------------|-----------------|--------------|------------|------------------|------------|-----------|
| Equipment                   | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
| EMI Test Receiver           | Rohde & Schwarz | ESHS30       | EST-E001   | LISAI            | June 13,20 | 1 Year    |
| Artificial Mains Network    | Rohde & Schwarz | ENV216       | EST-E002   | LISAI            | June 13,20 | 1 Year    |
| Pulse Limiter               | Rohde & Schwarz | ESH3-Z2      | EST-E078   | LISAI            | June 13,20 | 1 Year    |
| Test Software               | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |

| For radiated emission test(9 kHz-30MHz) |                 |              |            |                  |            |           |
|-----------------------------------------|-----------------|--------------|------------|------------------|------------|-----------|
| Equipment                               | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
| EMI Test Receiver                       | Rohde & Schwarz | ESR7         | EST-E047   | LISAI            | June 13,20 | 1 Year    |
| Active Loop Antenna                     | SCHWARZB ECK    | FMZB 1519B   | EST-E054   | LISAI            | June 13,20 | 1 Year    |
| Test Software                           | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |
| 9kHz-30MHz Cable                        | N/A             | EST-001      | N/A        | N/A              | N/A        | N/A       |

| For radiated emissions test (30-1000MHz) |                 |              |            |                  |            |           |
|------------------------------------------|-----------------|--------------|------------|------------------|------------|-----------|
| Equipment                                | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
| EMI Test Receiver                        | Rohde & Schwarz | ESR7         | EST-E047   | LISAI            | June 13,20 | 1 Year    |
| Bilog Antenna                            | Teseq           | CBL 6111D    | EST-E034   | LISAI            | June 13,20 | 1 Year    |
| Test Software                            | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |
| 30-1000MHz Cable                         | N/A             | EST-002      | N/A        | N/A              | N/A        | N/A       |

| For radiated emission test(Above 1000MHz) |                 |              |            |                  |            |           |
|-------------------------------------------|-----------------|--------------|------------|------------------|------------|-----------|
| Equipment                                 | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
| Horn Antenna                              | SCHWARZB ECK    | BBHA9120D    | EST-E031   | LISAI            | June 13,20 | 1 Year    |
| Signal Amplifier                          | SCHWARZB ECK    | BBV9718      | EST-E032   | LISAI            | June 13,20 | 1 Year    |
| Spectrum Analyzer                         | Rohde & Schwarz | FSV40        | EST-E069   | LISAI            | June 13,20 | 1 Year    |
| Test Software                             | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |
| Above 1GHz Cable                          | N/A             | EST-003      | N/A        | N/A              | N/A        | N/A       |

| For connect EUT antenna terminal test |                 |           |            |                  |            |           |
|---------------------------------------|-----------------|-----------|------------|------------------|------------|-----------|
| Equipment                             | Manufacturer    | Model No. | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
| Spectrum Analyzer                     | Rohde & Schwarz | FSV40     | EST-E069   | LISAI            | June 13,20 | 1 Year    |

### 3. MAXIMUM PEAK OUTPUT POWER

#### 3.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping 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.

#### 3.2. Test Setup



#### 3.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting  |
|---------------------|----------|
| RBW                 | 3MHz     |
| VBW                 | 3MHz     |
| Span                | 7.5MHz   |
| Sweep Time          | Auto     |
| Detector            | Peak     |
| Trace Mode          | Max Hold |

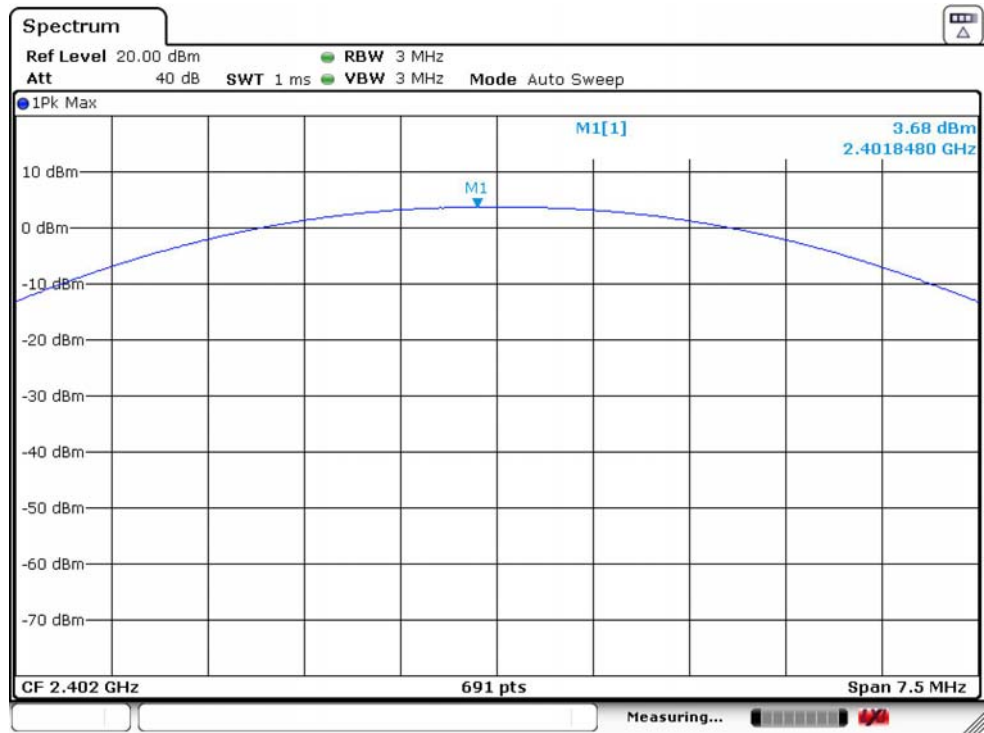
#### 3.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

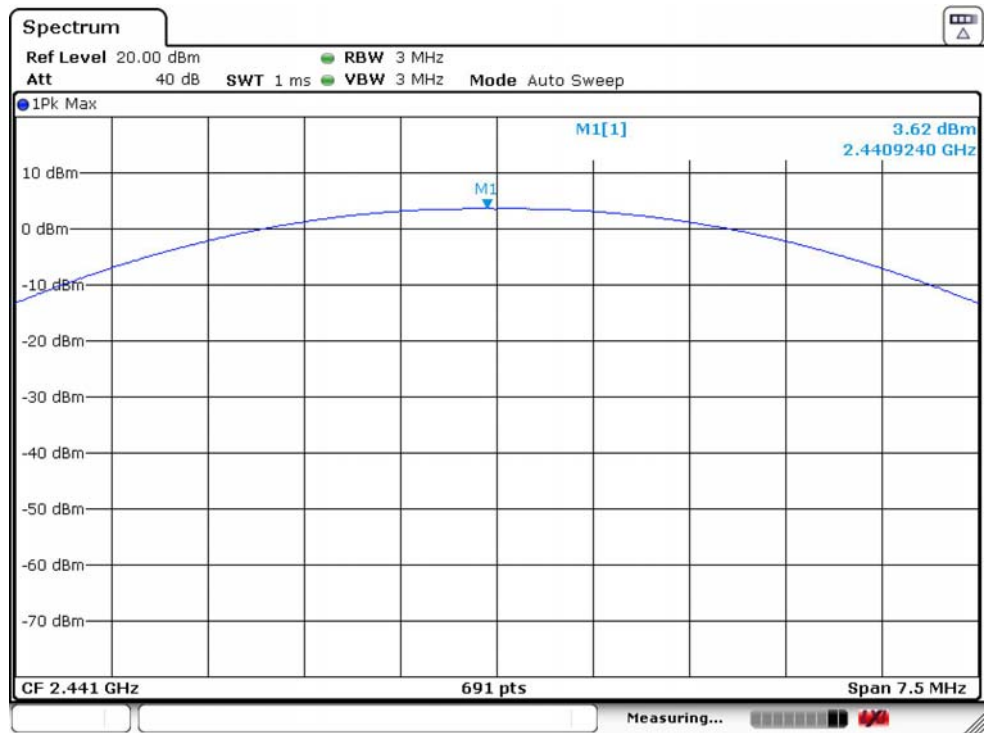
## 3.5. Test Result

| Temperature |        | 23.5℃      | Relative Humidity | 49%    | Test Voltage |        | 120V/60Hz |
|-------------|--------|------------|-------------------|--------|--------------|--------|-----------|
| Antenna     | Mode   | Freq (MHz) | Peak Output Power |        | Limit        |        | Result    |
|             |        |            | dBm               | W      | dBm          | W      |           |
| ANT 1       | GFSK   | 2402       | 3.68              | 0.0023 | 20.97        | 0.1250 | PASS      |
|             |        | 2441       | 3.62              | 0.0023 | 20.97        | 0.1250 | PASS      |
|             |        | 2480       | 3.44              | 0.0022 | 20.97        | 0.1250 | PASS      |
|             | 8-DPSK | 2402       | 6.49              | 0.0045 | 20.97        | 0.1250 | PASS      |
|             |        | 2441       | 6.38              | 0.0043 | 20.97        | 0.1250 | PASS      |
|             |        | 2480       | 6.20              | 0.0042 | 20.97        | 0.1250 | PASS      |
| ANT 2       | GFSK   | 2402       | 3.79              | 0.0024 | 20.97        | 0.1250 | PASS      |
|             |        | 2441       | 3.65              | 0.0023 | 20.97        | 0.1250 | PASS      |
|             |        | 2480       | 3.44              | 0.0022 | 20.97        | 0.1250 | PASS      |
|             | 8-DPSK | 2402       | 6.59              | 0.0046 | 20.97        | 0.1250 | PASS      |
|             |        | 2441       | 6.39              | 0.0044 | 20.97        | 0.1250 | PASS      |
|             |        | 2480       | 6.18              | 0.0041 | 20.97        | 0.1250 | PASS      |

GFSK 2402 MHz AN 1

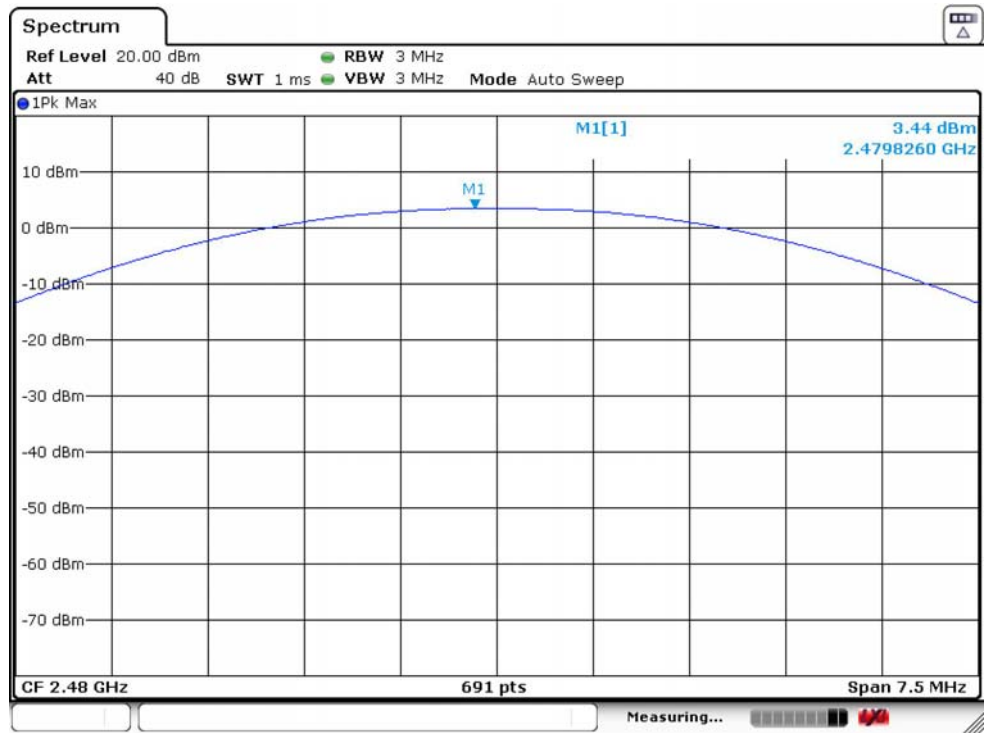


GFSK 2441 MHz ANT 1

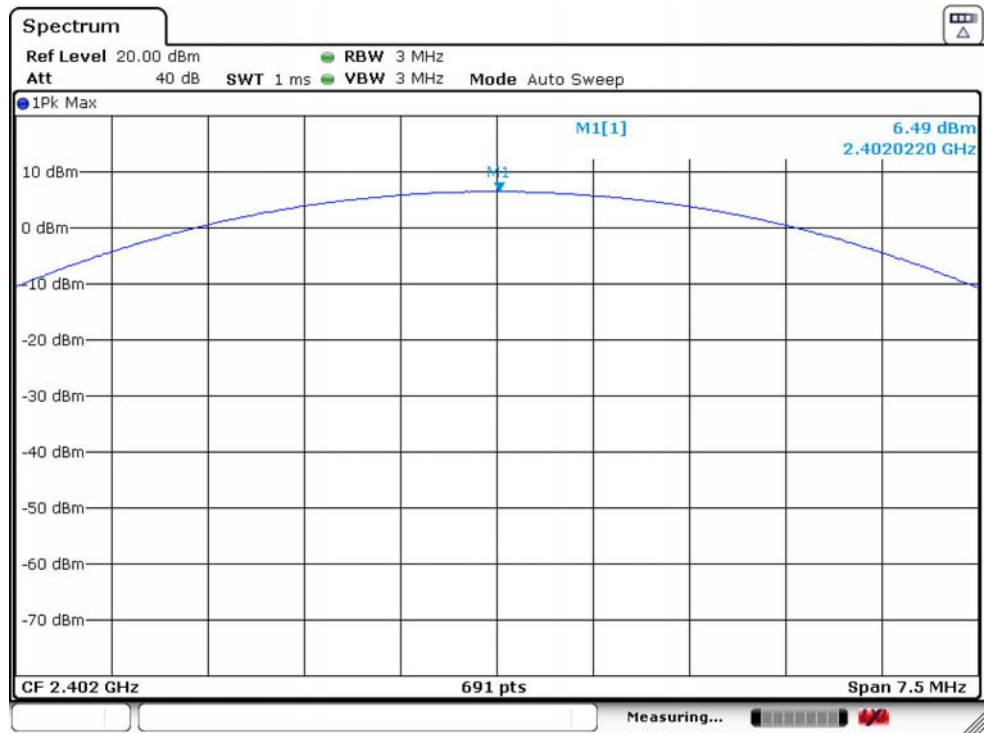




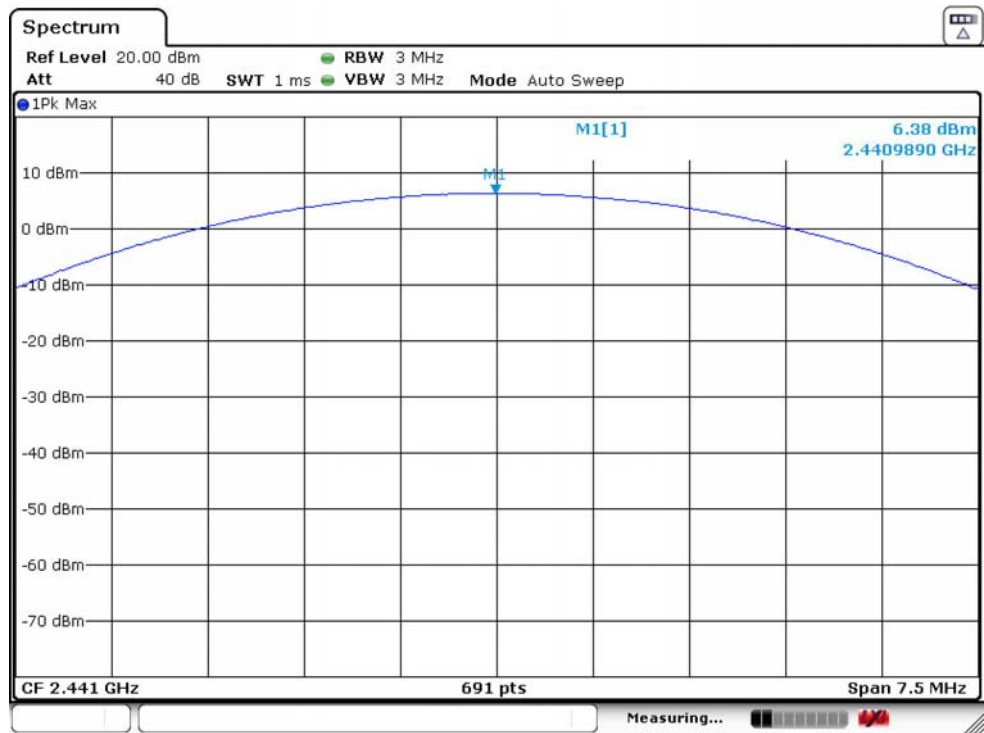
GFSK 2480 MHz ANT 1



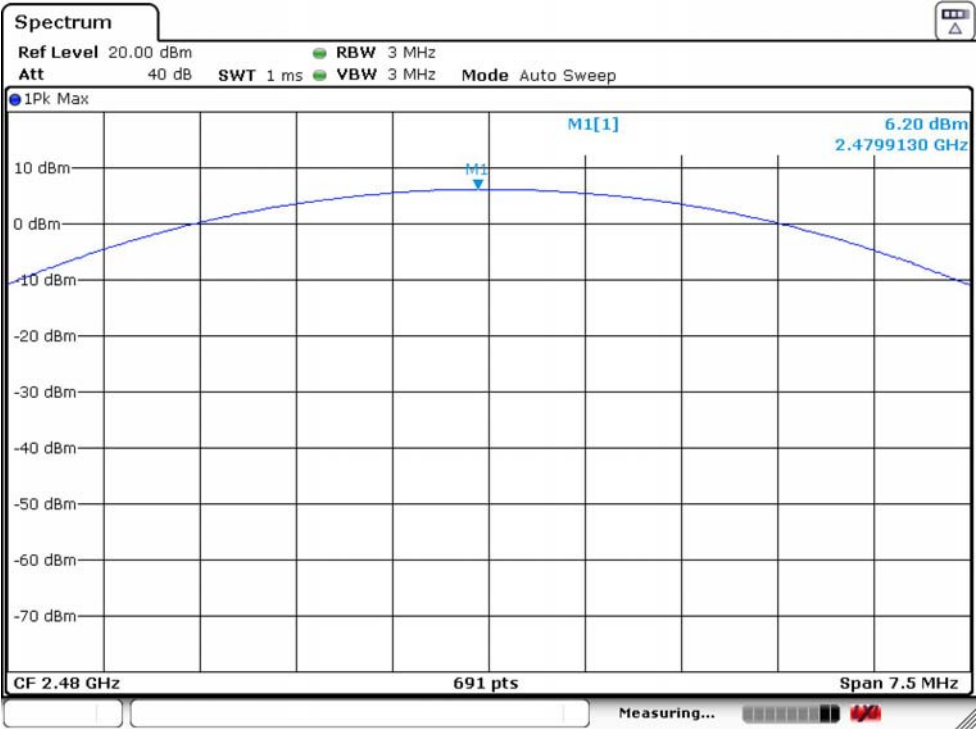
8-DPSK 2402 MHz ANT 1



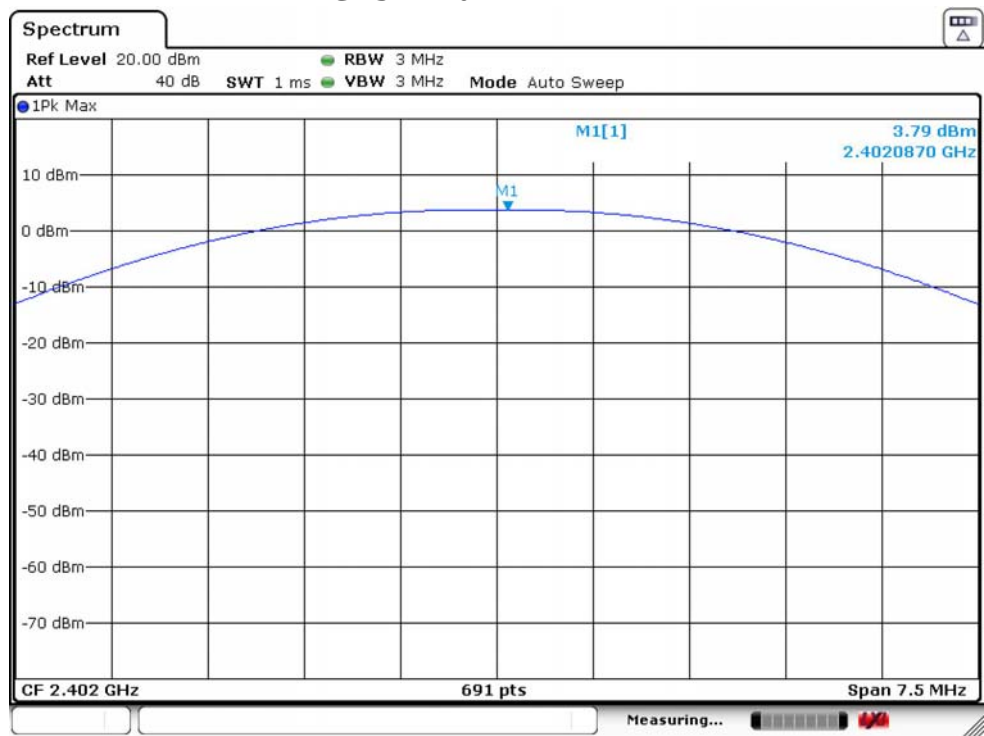
8-DPSK 2441 MHz ANT 1



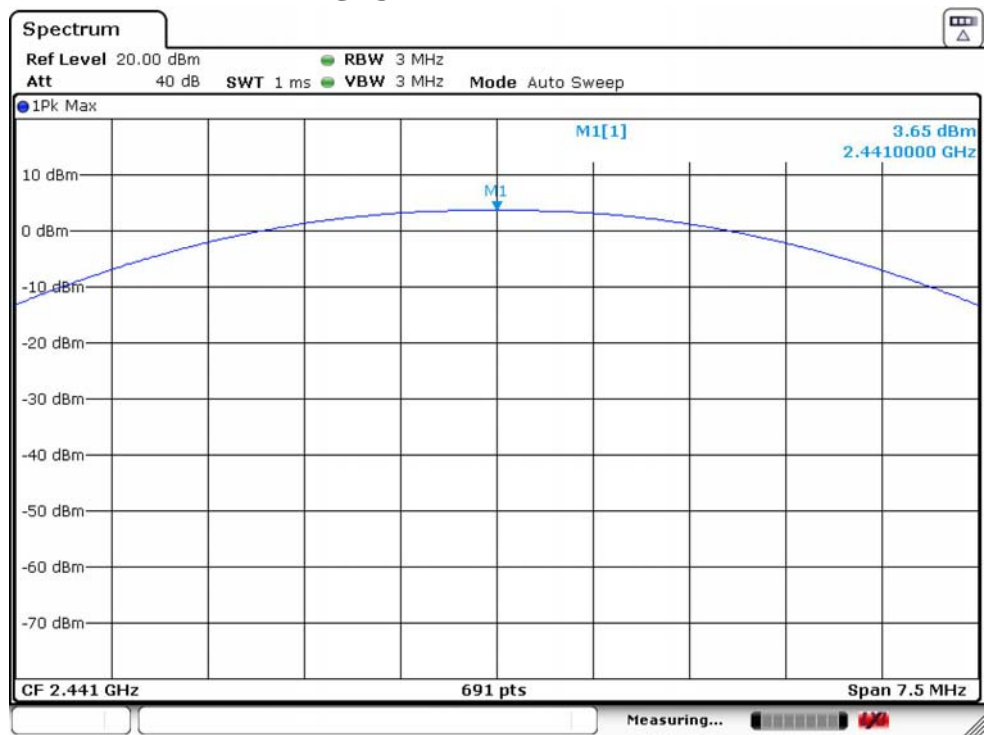
8-DPSK 2480 MHz ANT 1



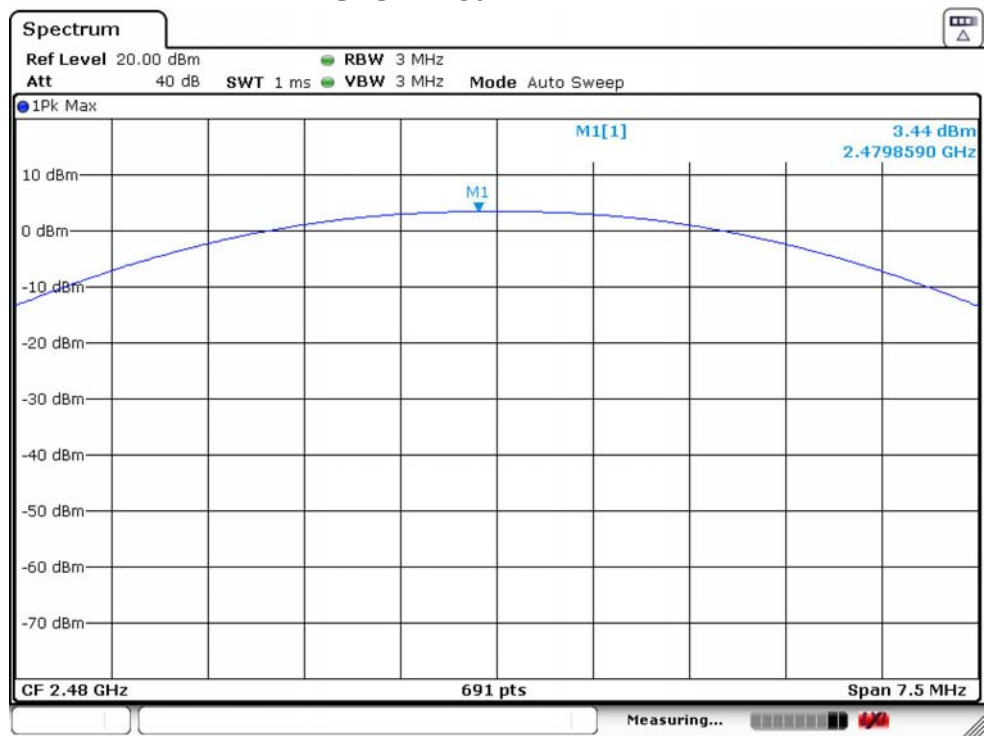
GFSK 2402 MHz ANT 2



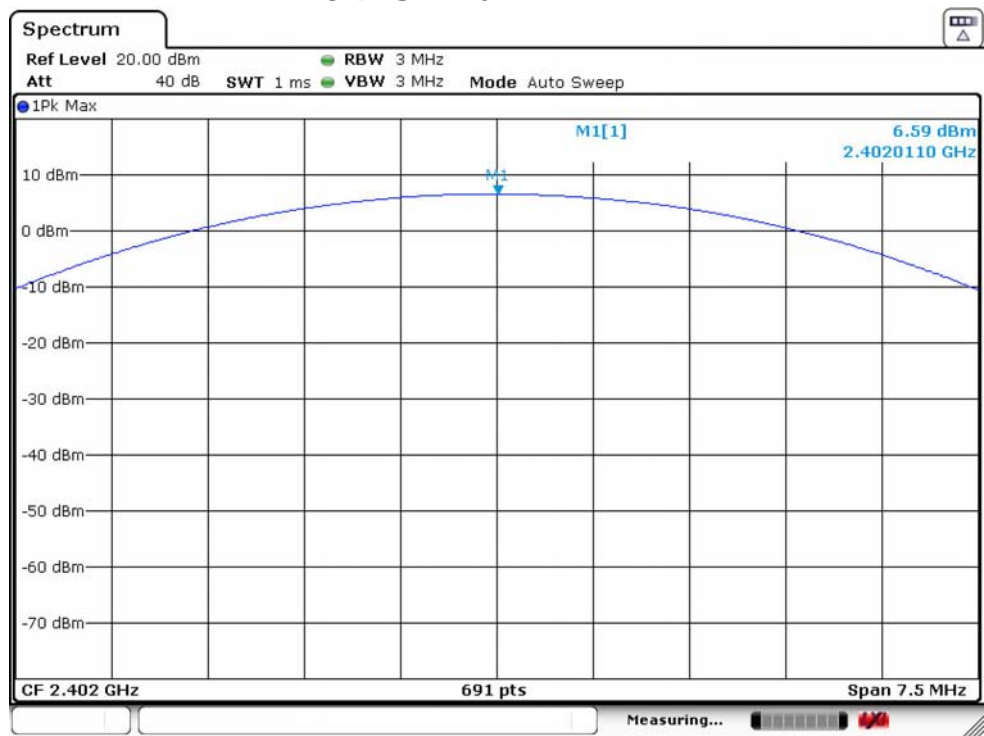
GFSK 2441 MHz ANT 2



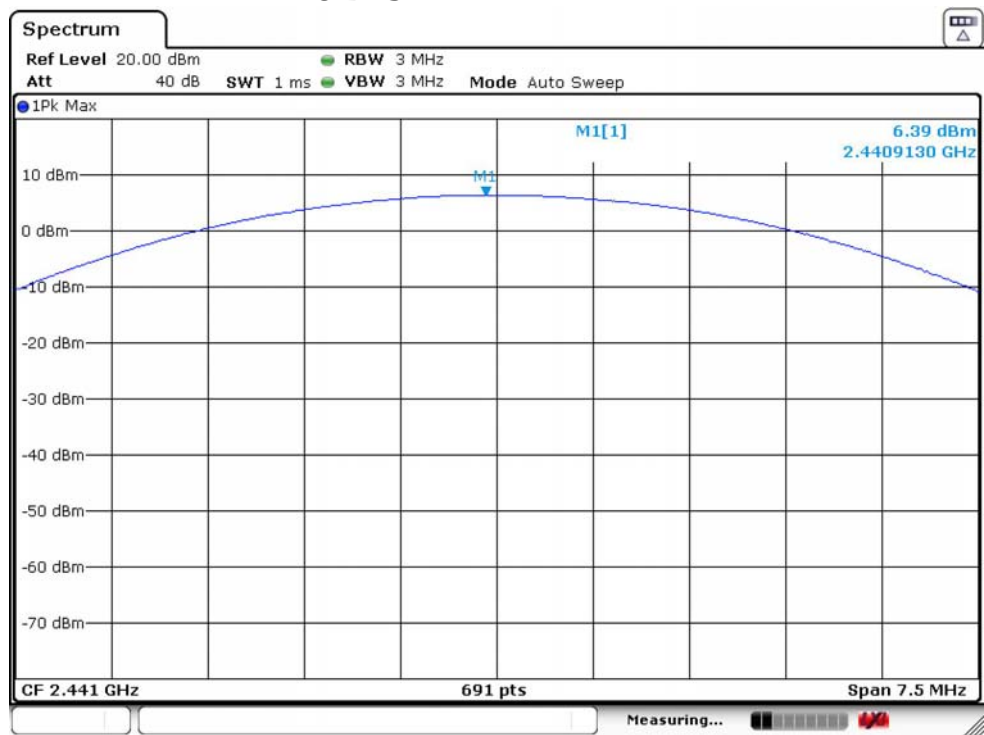
GFSK 2480 MHz ANT 2



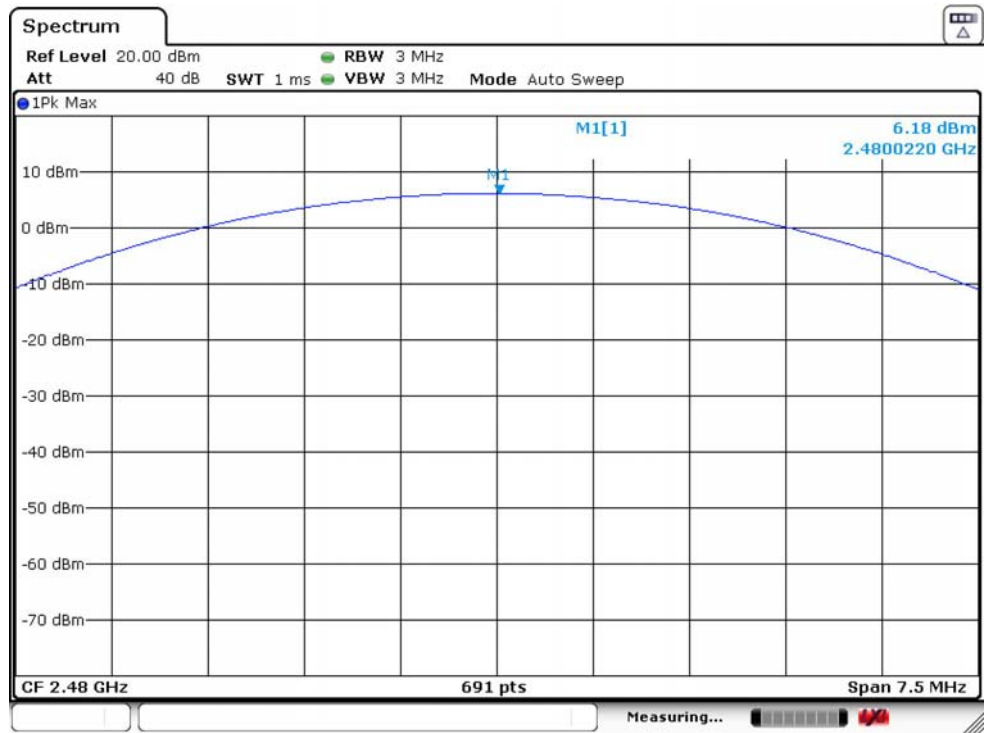
8-DPSK 2402 MHz ANT 2



8-DPSK 2441 MHz ANT 2



8-DPSK 2480 MHz ANT 2



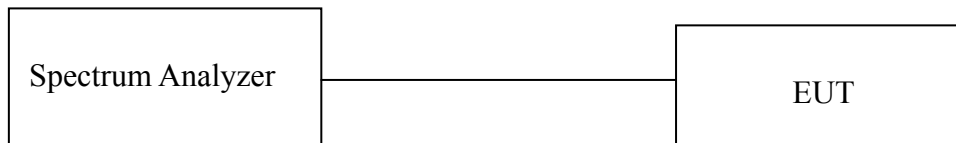


## 4. 20 DB BANDWIDTH

### 4.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping 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.

### 4.2. Test Setup



### 4.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting  |
|---------------------|----------|
| RBW                 | 30KHz    |
| VBW                 | 100KHz   |
| Span                | 3MHz     |
| Sweep Time          | Auto     |
| Detector            | Peak     |
| Trace Mode          | Max Hold |

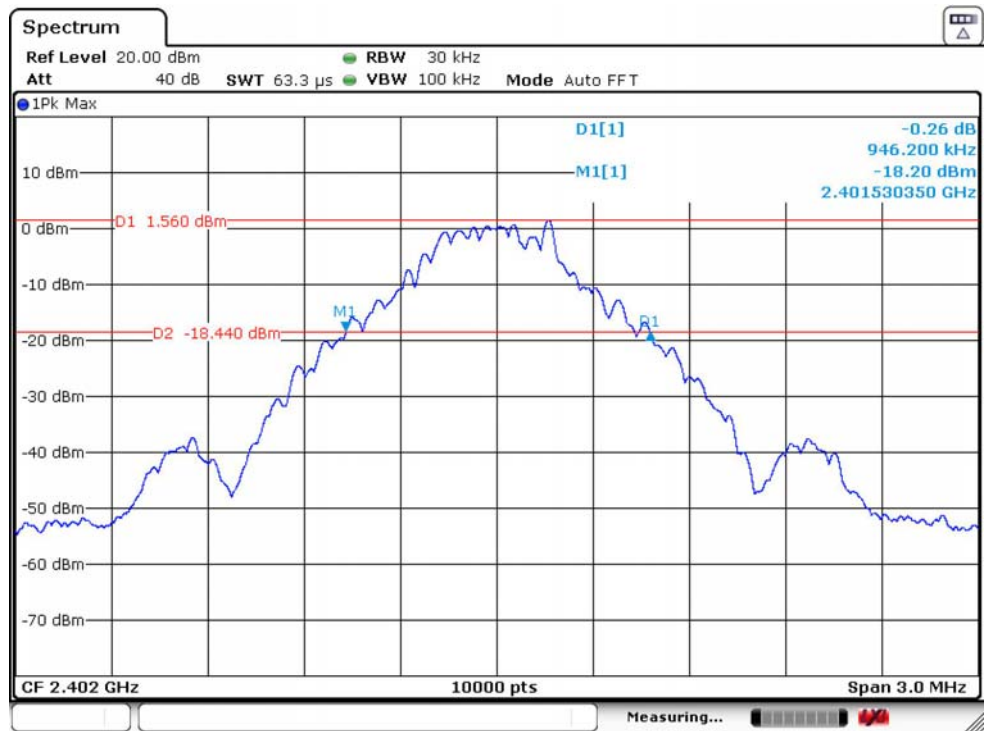
### 4.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 4.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the ndB down function to measure 20dB Bandwidth.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

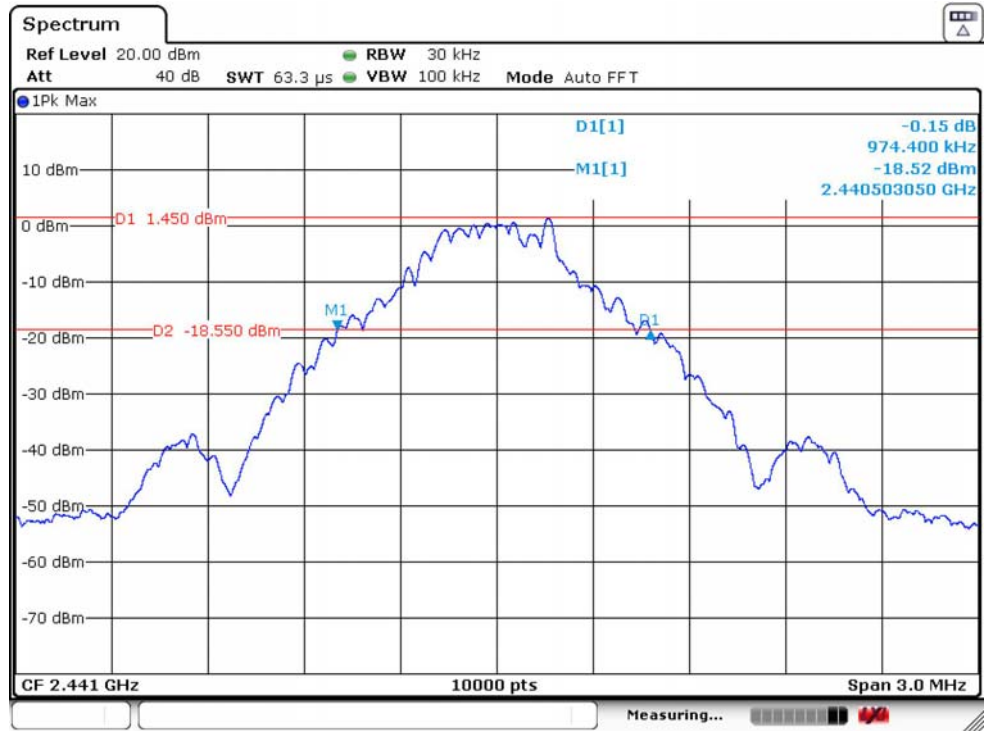
## 4.5. Test Result

|              |             |            |                      |             |        |
|--------------|-------------|------------|----------------------|-------------|--------|
| Temperature  |             | 23.5℃      | Relative Humidity    | 49%         |        |
| Test Voltage |             | 120V/60Hz  |                      |             |        |
| Antenna      | Mode        | Freq (MHz) | 20dB Bandwidth (MHz) | Limit (MHz) | Result |
| ANT 1        | GFSK(DH5)   | 2402       | 0.9462               | /           | PASS   |
|              |             | 2441       | 0.9744               | /           | PASS   |
|              |             | 2480       | 0.9483               | /           | PASS   |
|              | 8-DPSK(DH5) | 2402       | 1.2843               | /           | PASS   |
|              |             | 2441       | 1.2870               | /           | PASS   |
|              |             | 2480       | 1.2840               | /           | PASS   |
| ANT 2        | GFSK(DH5)   | 2402       | 0.9477               | /           | PASS   |
|              |             | 2441       | 0.9477               | /           | PASS   |
|              |             | 2480       | 0.9471               | /           | PASS   |
|              | 8-DPSK(DH5) | 2402       | 1.2849               | /           | PASS   |
|              |             | 2441       | 1.2849               | /           | PASS   |
|              |             | 2480       | 1.2846               | /           | PASS   |

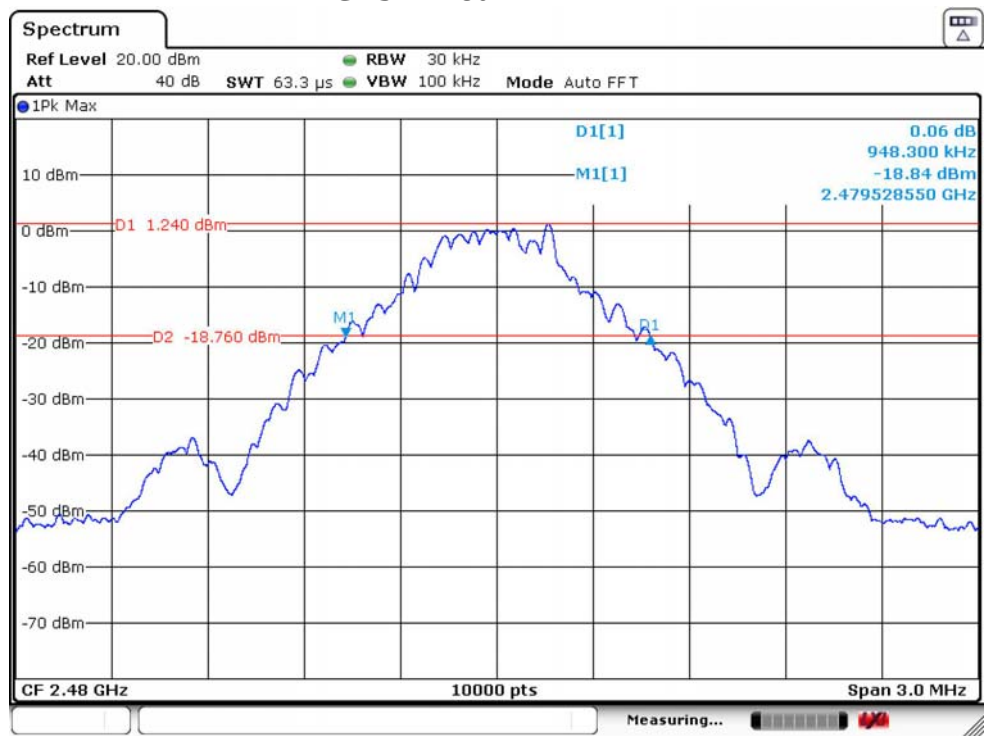
GFSK 2402MHz ANT 1



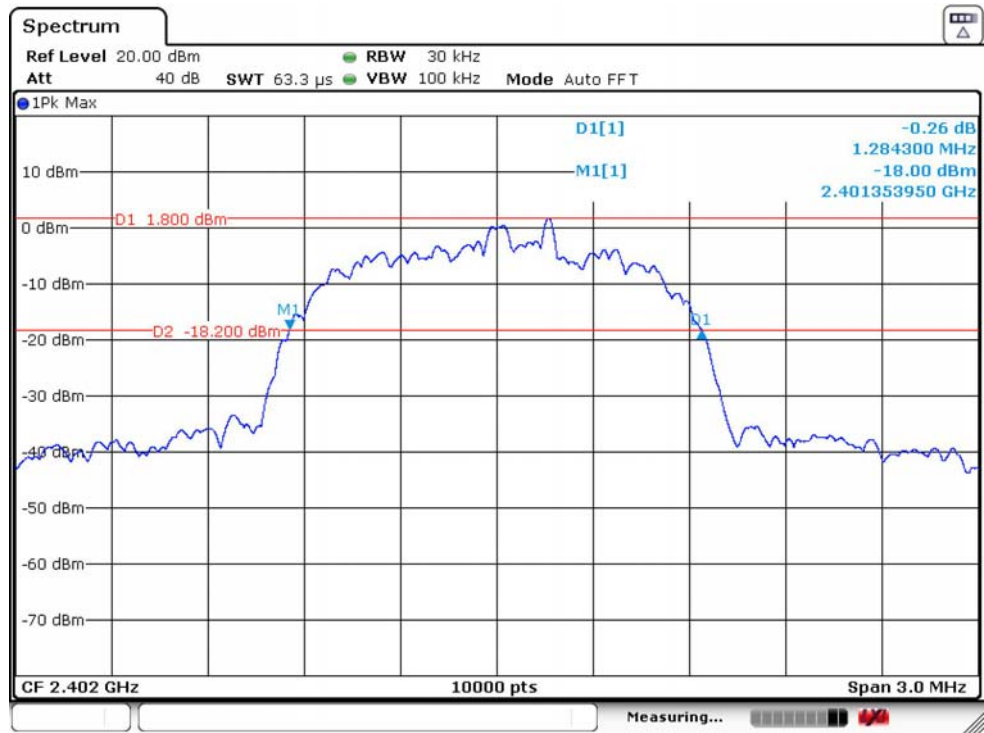
GFSK 2441MHz ANT 1



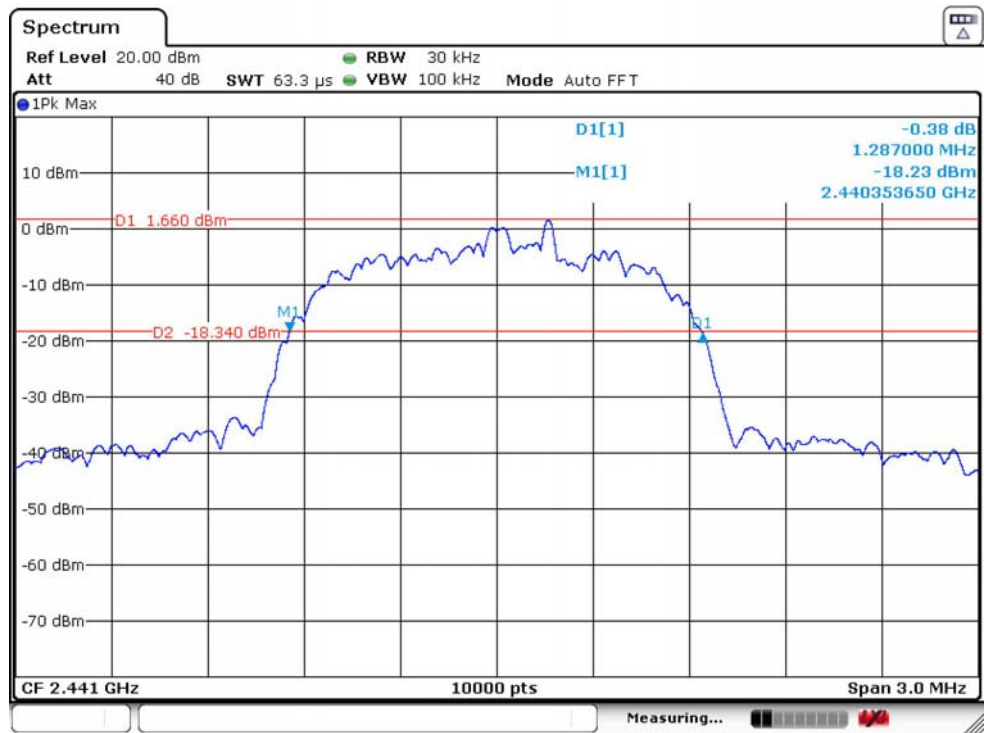
GFSK 2480MHz ANT 1



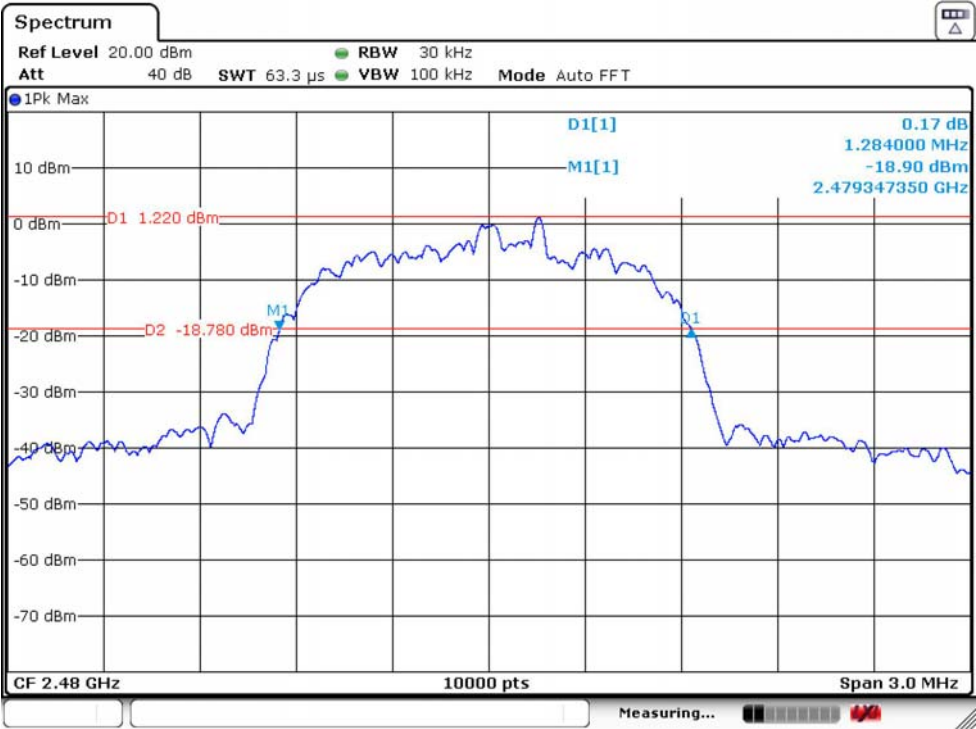
8-DPSK 2402MHz ANT 1



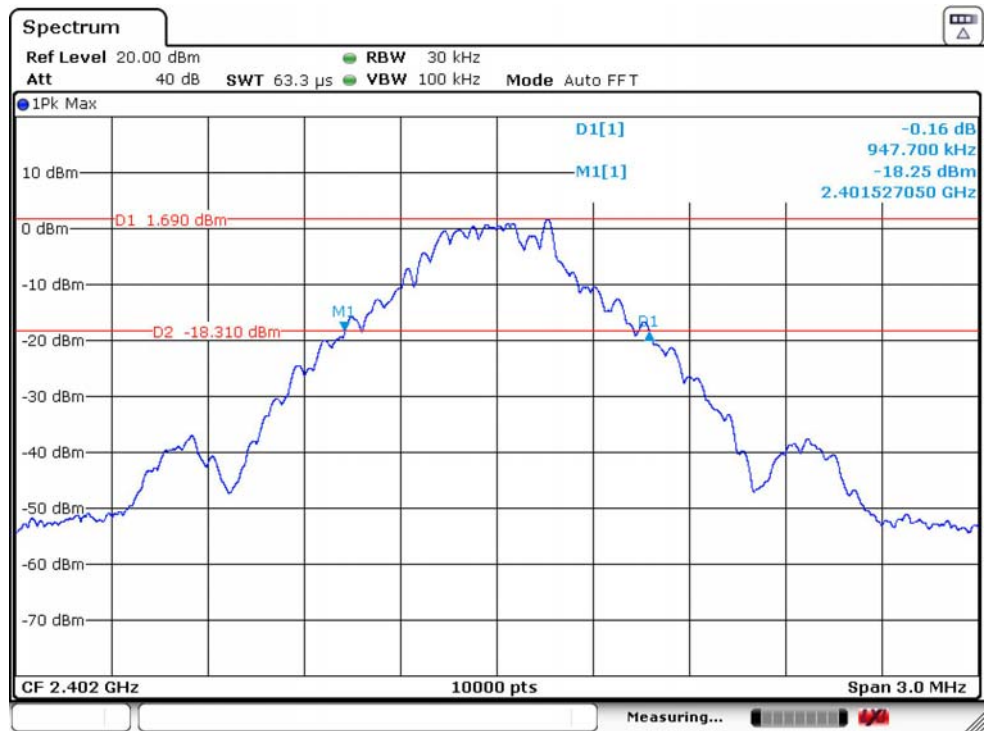
8-DPSK 2441MHz ANT 1



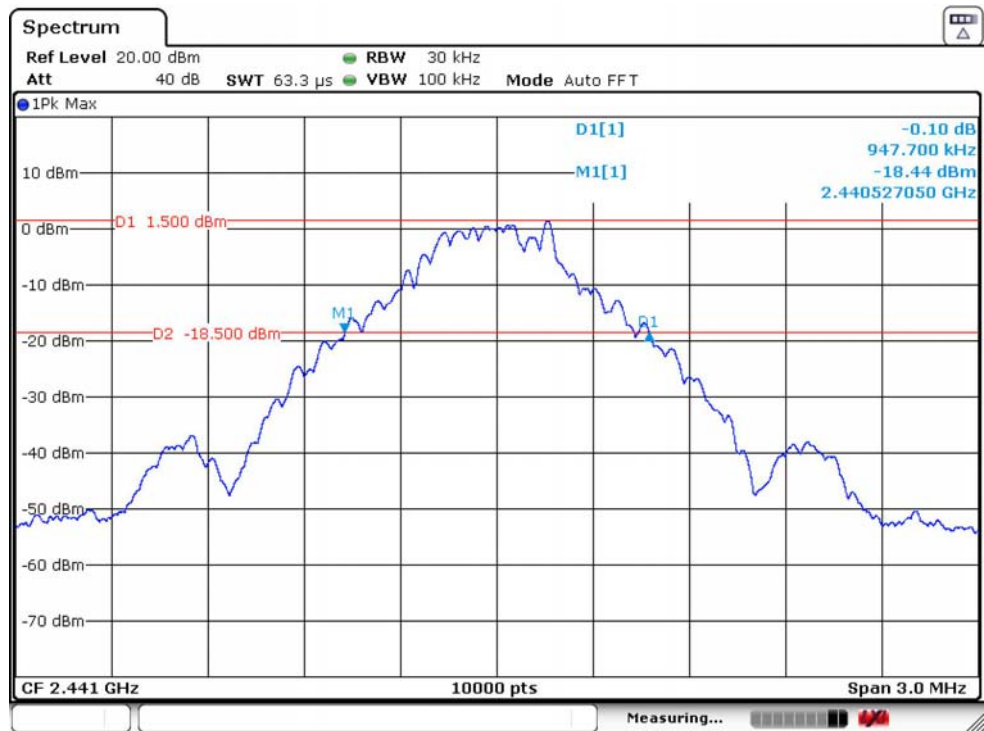
8-DPSK 2480MHz ANT 1



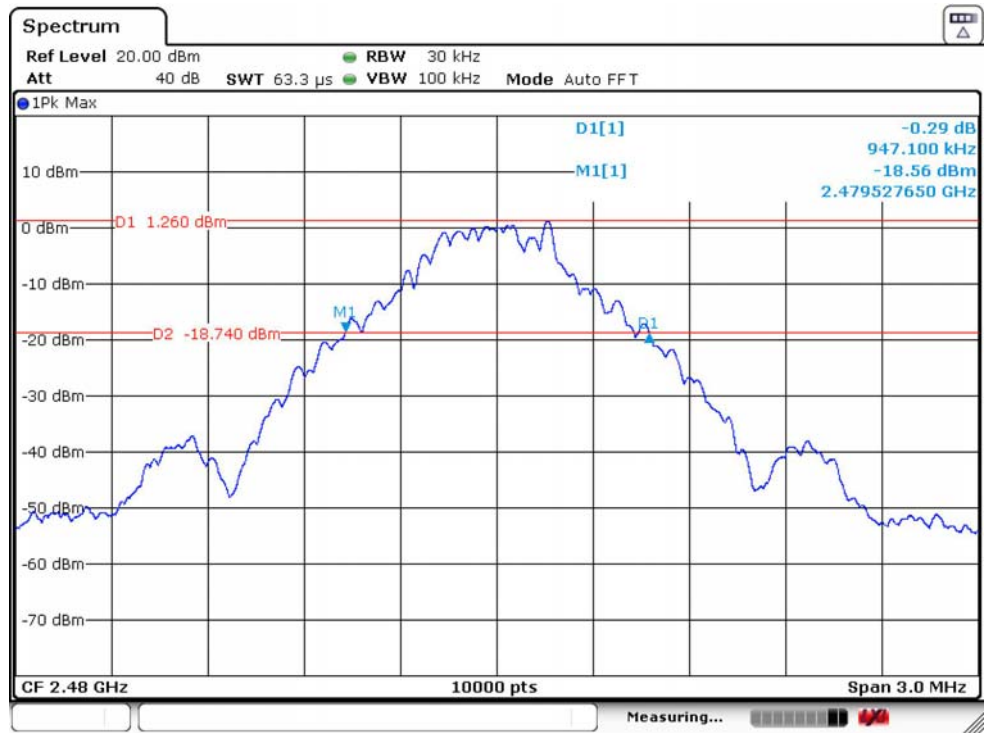
GFSK 2402MHz ANT 2



GFSK 2441MHz ANT 2

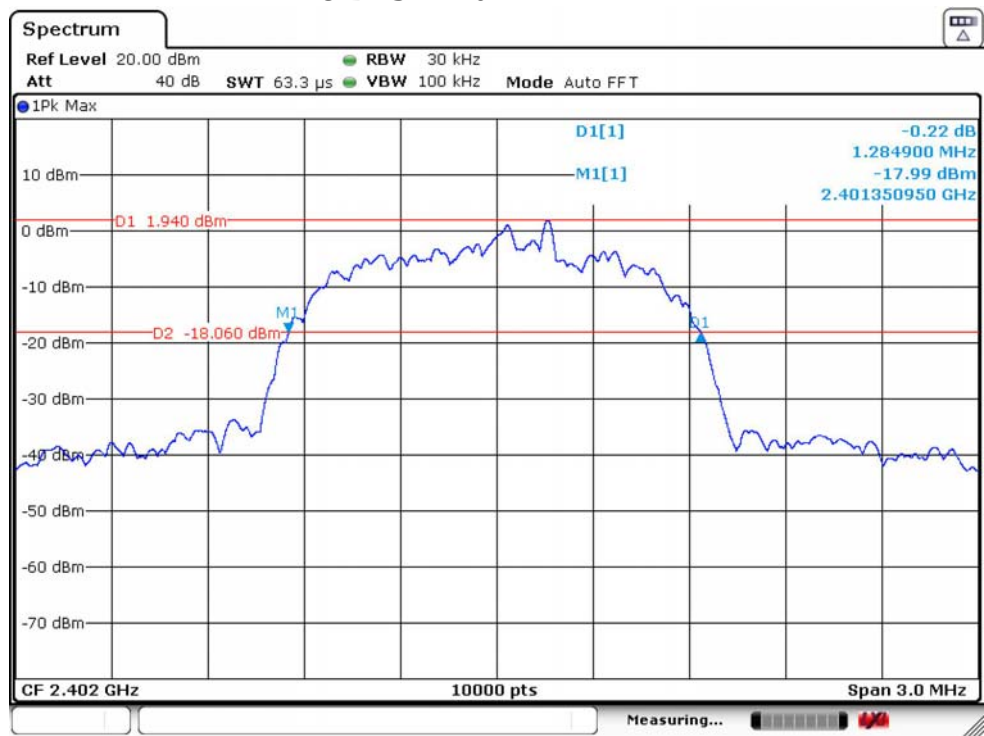


GFSK 2480MHz ANT 2

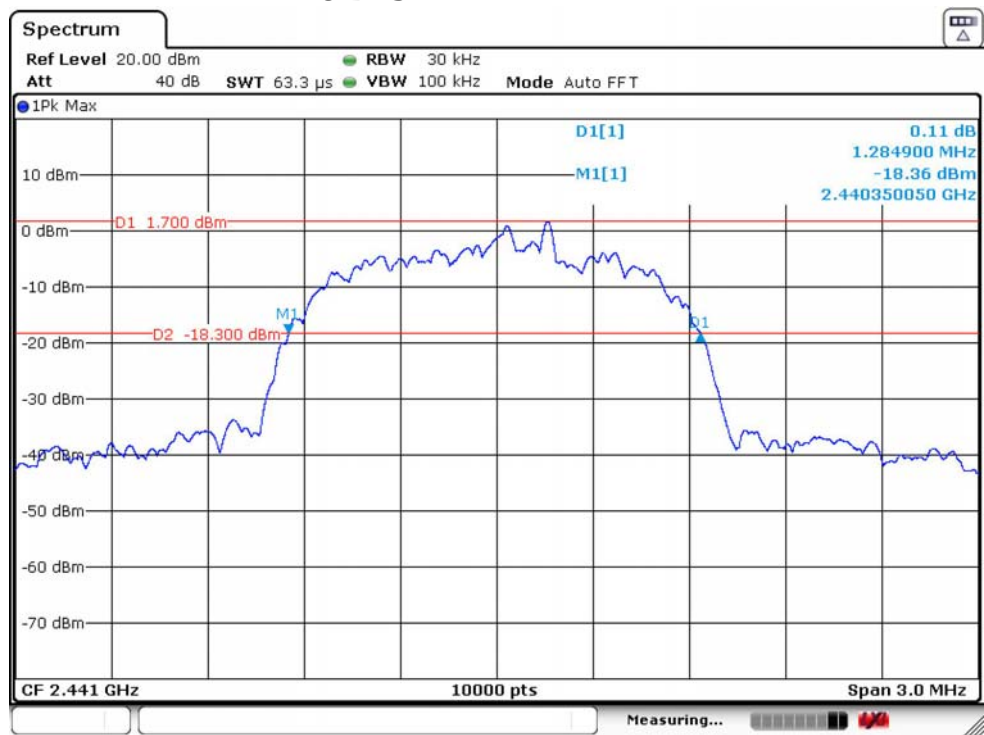




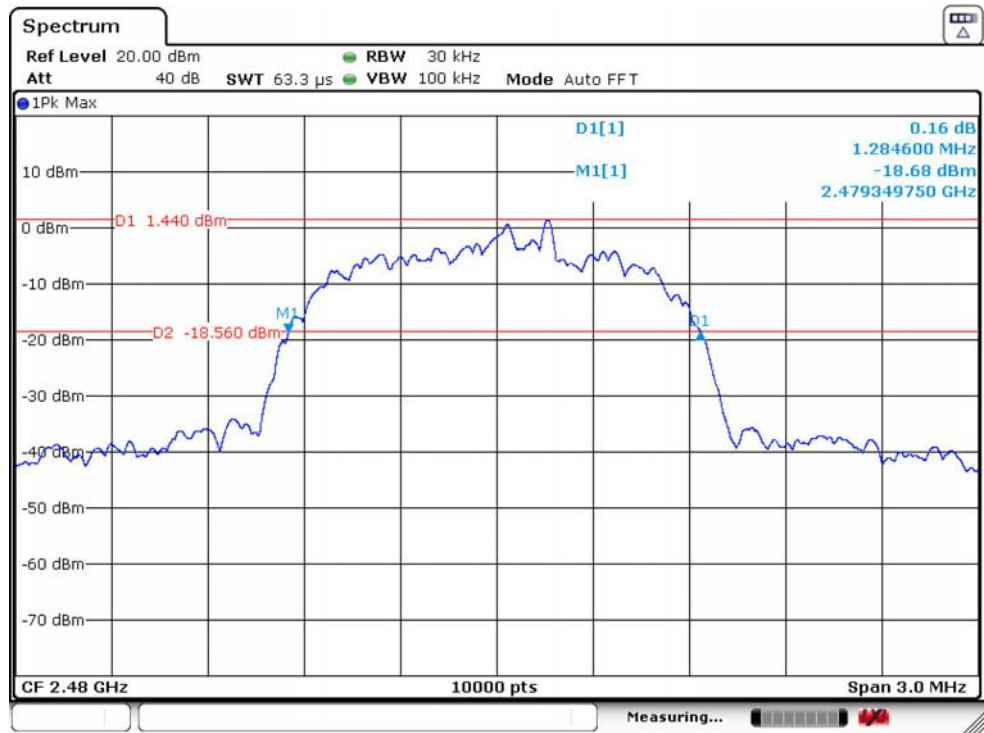
8-DPSK 2402MHz ANT 2



8-DPSK 2441MHz ANT 2



8-DPSK 2480MHz ANT 2



## 5. CARRIER FREQUENCY SEPARATION

### 5.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping 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.

### 5.2. Test Setup



### 5.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting  |
|---------------------|----------|
| RBW                 | 30KHz    |
| VBW                 | 100KHz   |
| Span                | 3MHz     |
| Sweep Time          | Auto     |
| Detector            | Peak     |
| Trace Mode          | Max Hold |

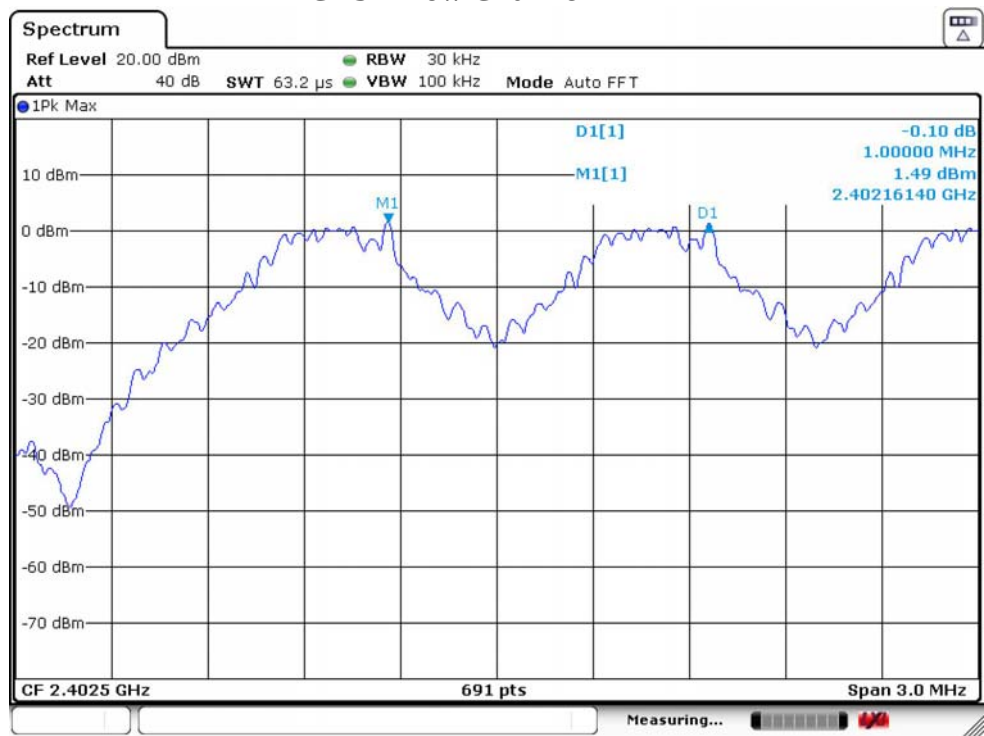
### 5.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 5.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-delta function to measure channel separation between two adjacent channels.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

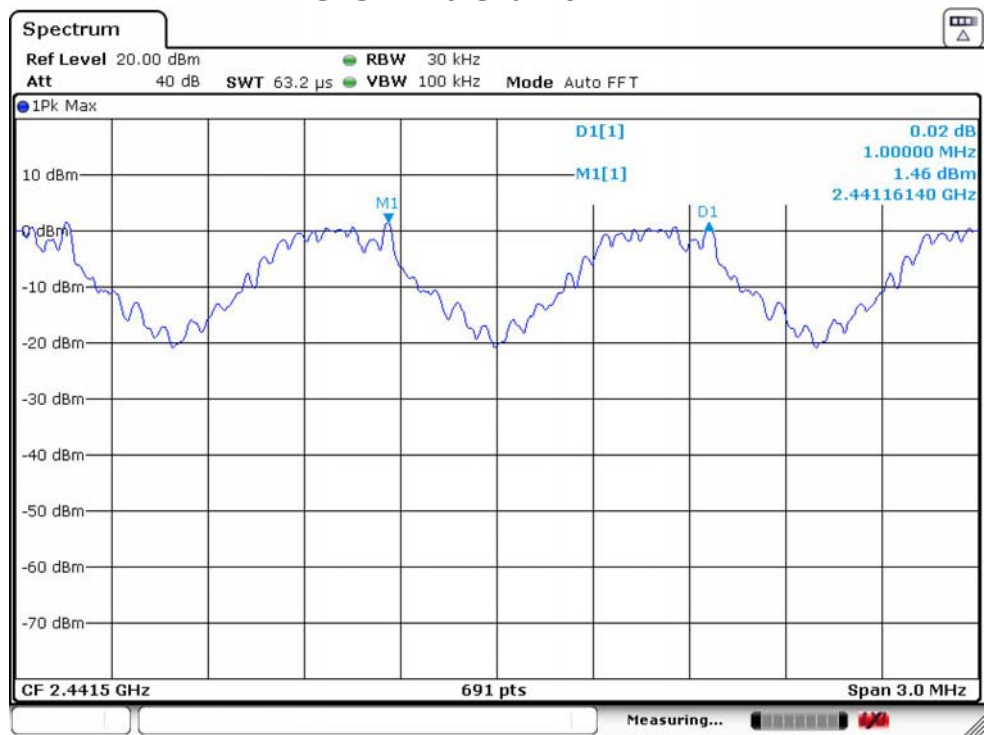
## 5.5. Test Result

| Temperature |             | 23.5℃   | Relative Humidity        |  | 49%                               | Test Voltage |        | 120V/60Hz |
|-------------|-------------|---------|--------------------------|--|-----------------------------------|--------------|--------|-----------|
| Antenna     | Mode        | Channel | Channel Separation (MHz) |  | 2/3 of 20dB Bandwidth Limit (MHz) |              | Result |           |
| ANT 1       | GFSK(DH5)   | Low CH  | 1.0000                   |  | 0.6308                            |              | PASS   |           |
|             |             | Mid CH  | 1.0000                   |  | 0.6496                            |              | PASS   |           |
|             |             | High CH | 1.0000                   |  | 0.6322                            |              | PASS   |           |
|             | 8-DPSK(DH5) | Low CH  | 1.0000                   |  | 0.8562                            |              | PASS   |           |
|             |             | Mid CH  | 1.0000                   |  | 0.8580                            |              | PASS   |           |
|             |             | High CH | 1.0000                   |  | 0.8560                            |              | PASS   |           |
| ANT 2       | GFSK(DH5)   | Low CH  | 1.0000                   |  | 0.6318                            |              | PASS   |           |
|             |             | Mid CH  | 1.0000                   |  | 0.6318                            |              | PASS   |           |
|             |             | High CH | 1.0000                   |  | 0.6314                            |              | PASS   |           |
|             | 8-DPSK(DH5) | Low CH  | 1.0000                   |  | 0.8566                            |              | PASS   |           |
|             |             | Mid CH  | 1.0000                   |  | 0.8566                            |              | PASS   |           |
|             |             | High CH | 1.0000                   |  | 0.8564                            |              | PASS   |           |

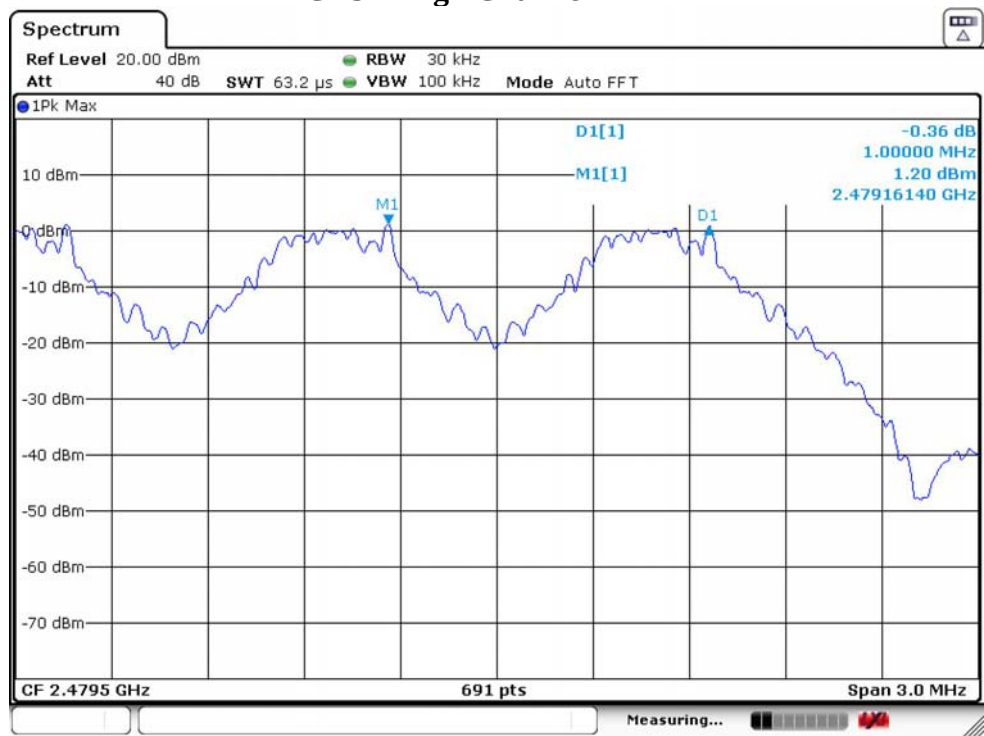
GFSK Low Channel ANT 1



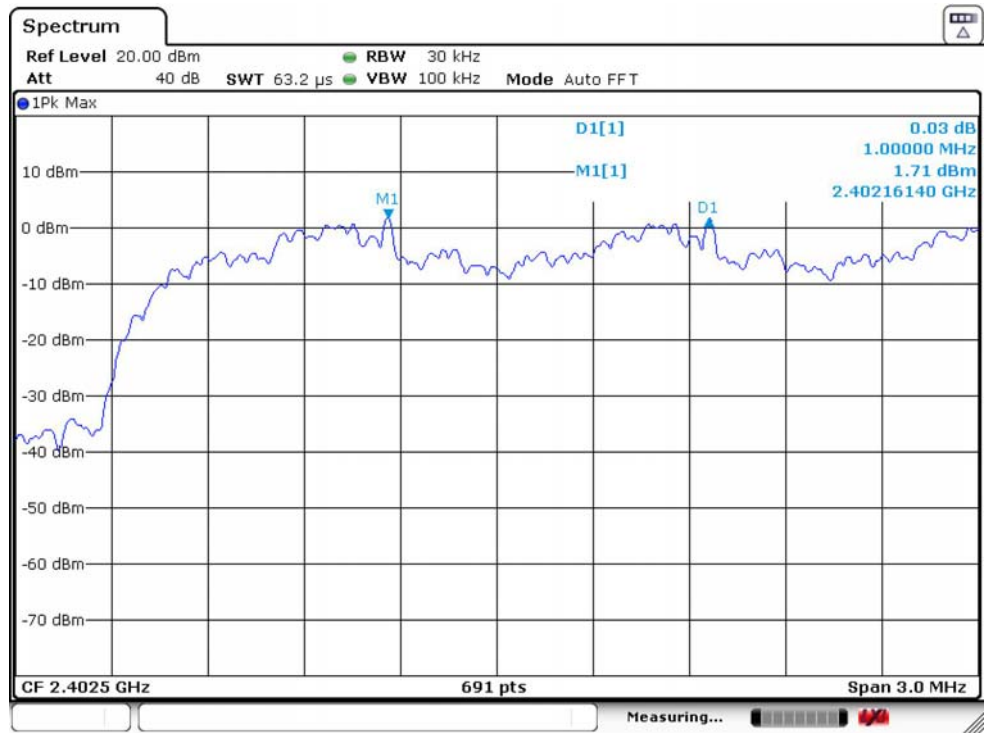
GFSK Mid Channel ANT 1



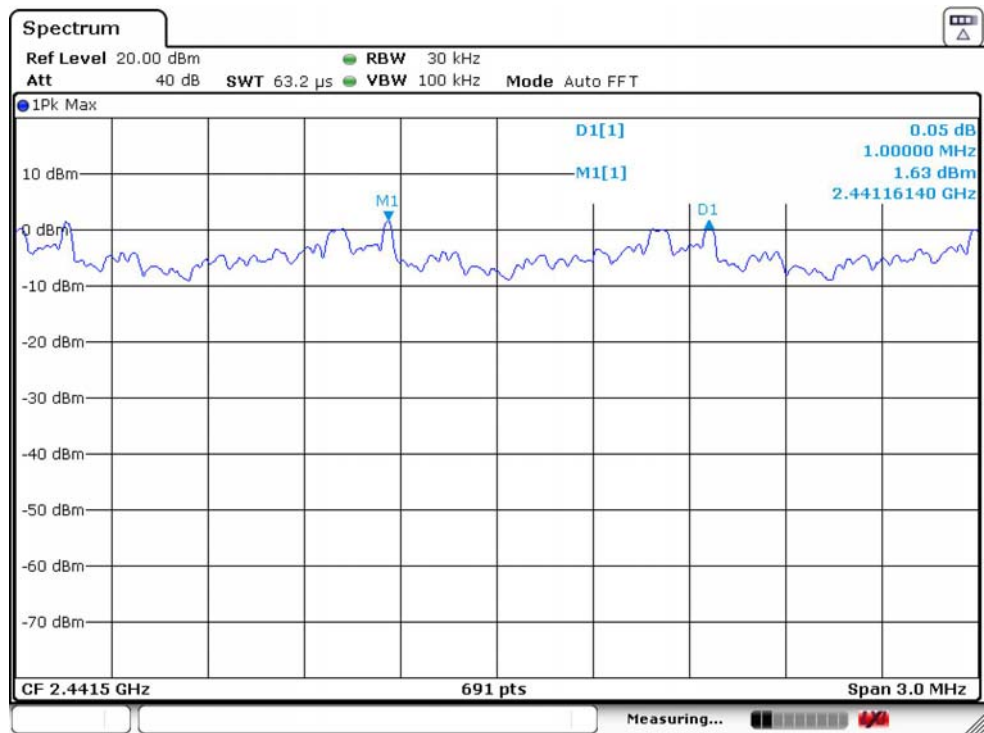
GFSK High Channel ANT 1



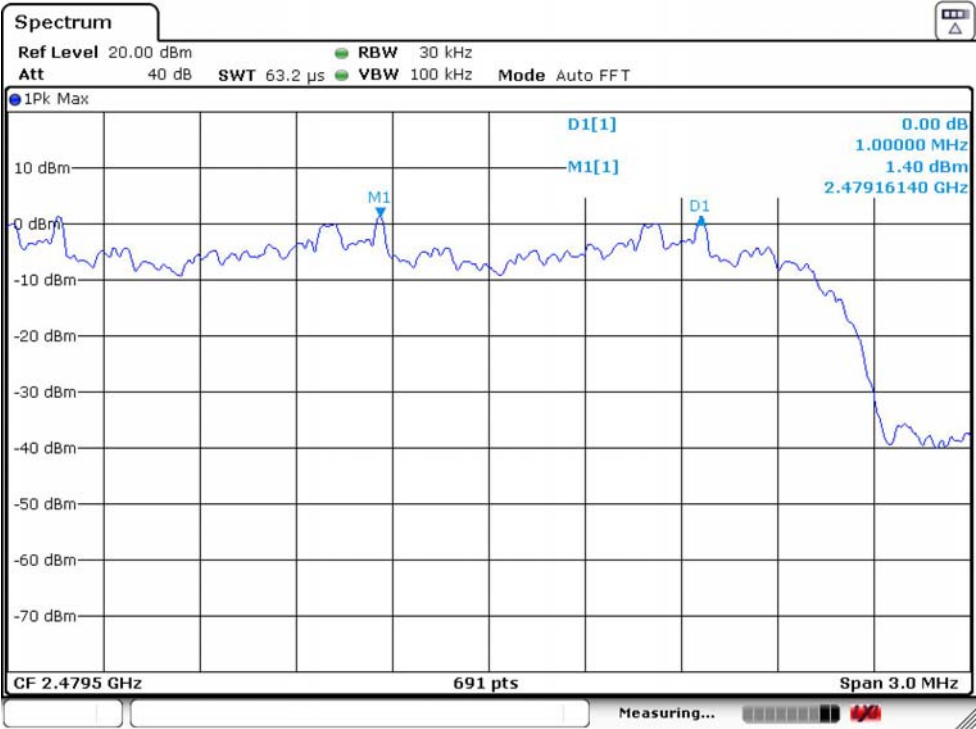
8-DPSK Low Channel ANT 1



8-DPSK Mid Channel ANT 1

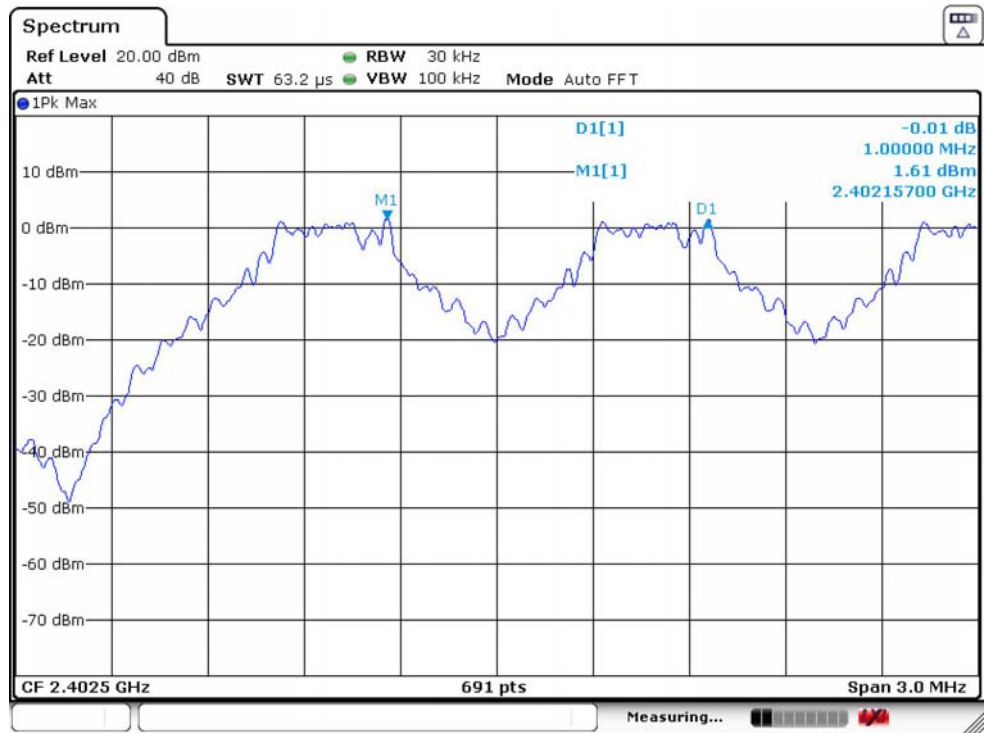


8-DPSK High Channel ANT 1

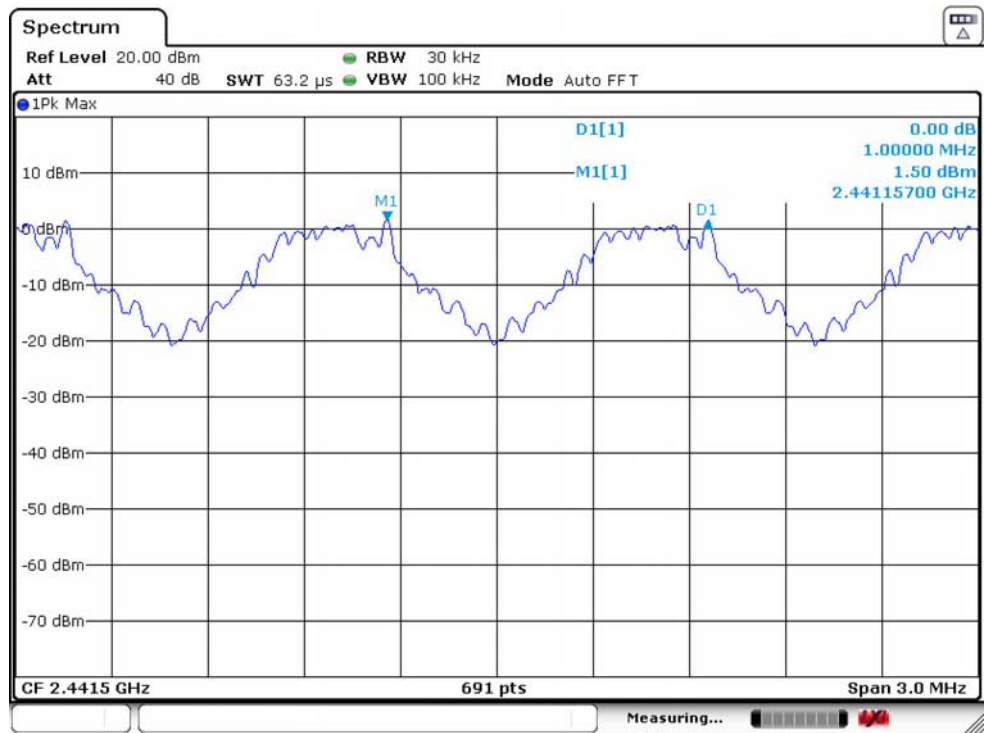




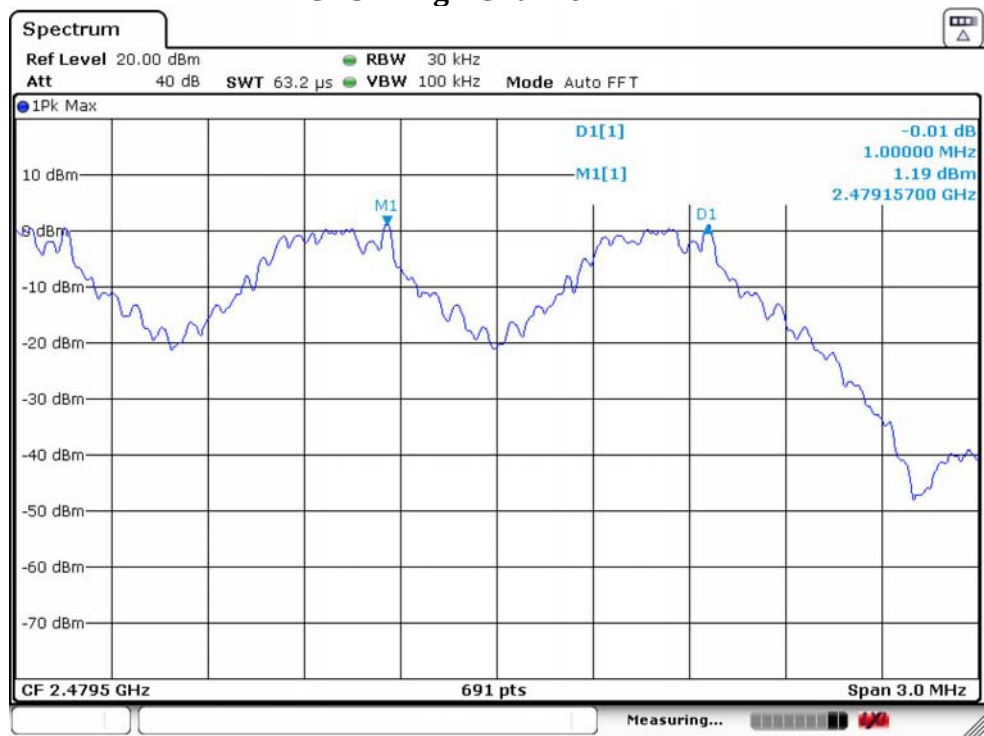
GFSK Low Channel ANT 2



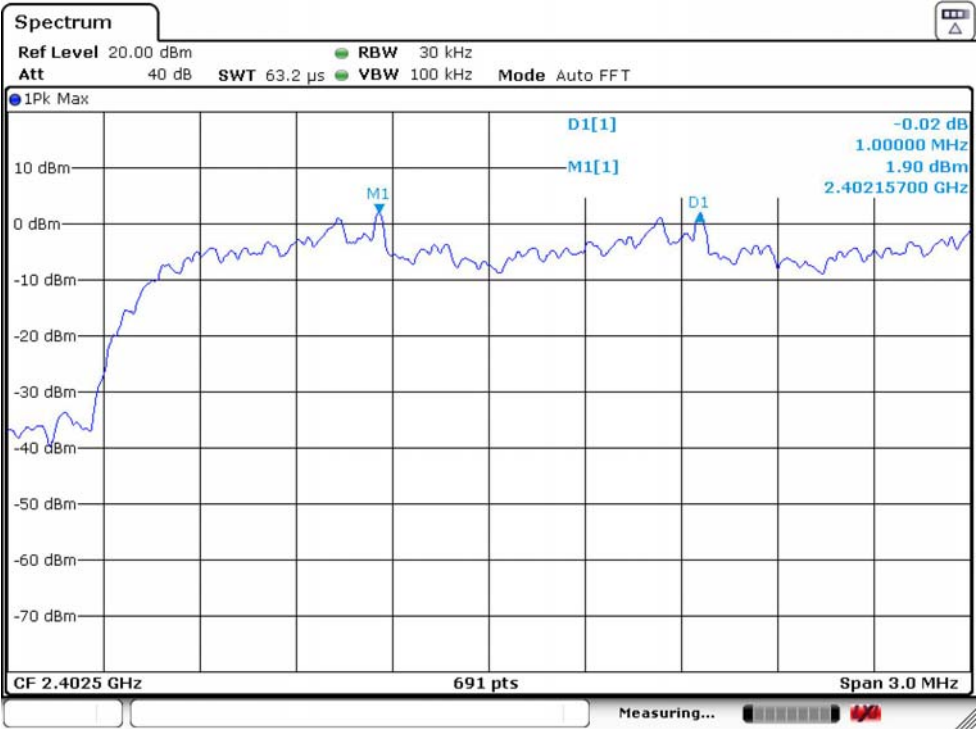
GFSK Mid Channel ANT 2



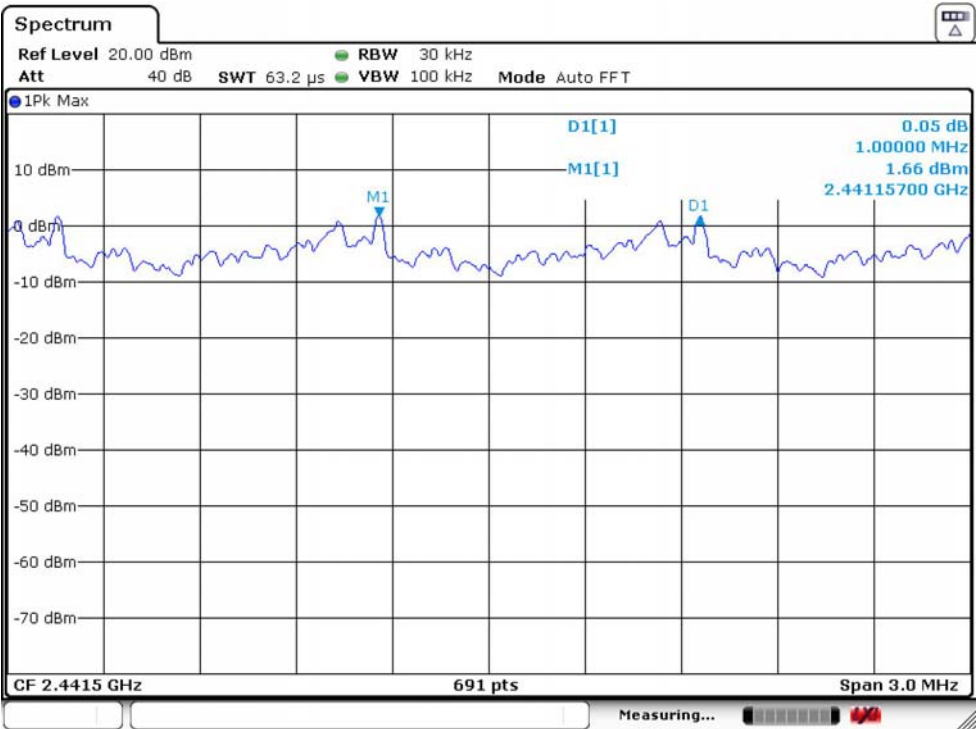
GFSK High Channel ANT 2



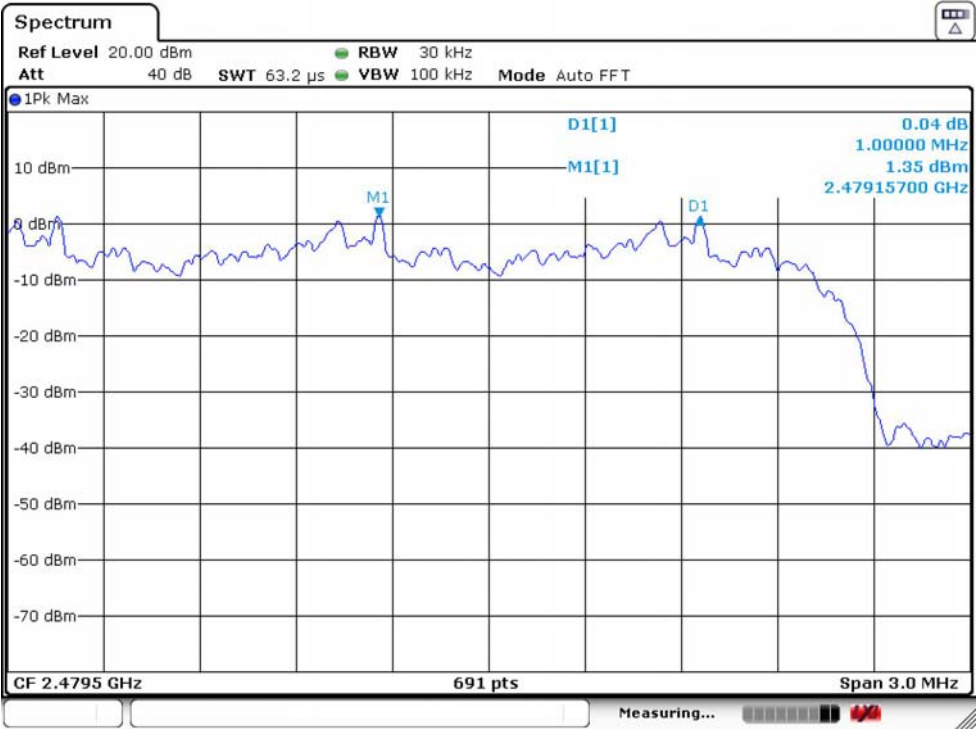
8-DPSK Low Channel ANT 2



8-DPSK Mid Channel ANT 2



8-DPSK High Channel ANT 2

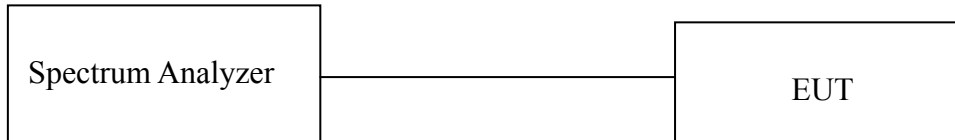


## 6. NUMBER OF HOPPING CHANNEL

### 6.1. Limit

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

### 6.2. Test Setup



### 6.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting   |
|---------------------|-----------|
| RBW                 | 300KHz    |
| VBW                 | 300KHz    |
| Start frequency     | 2400MHz   |
| Stop frequency      | 2483.5MHz |
| Sweep Time          | Auto      |
| Detector            | Peak      |
| Trace Mode          | Max Hold  |

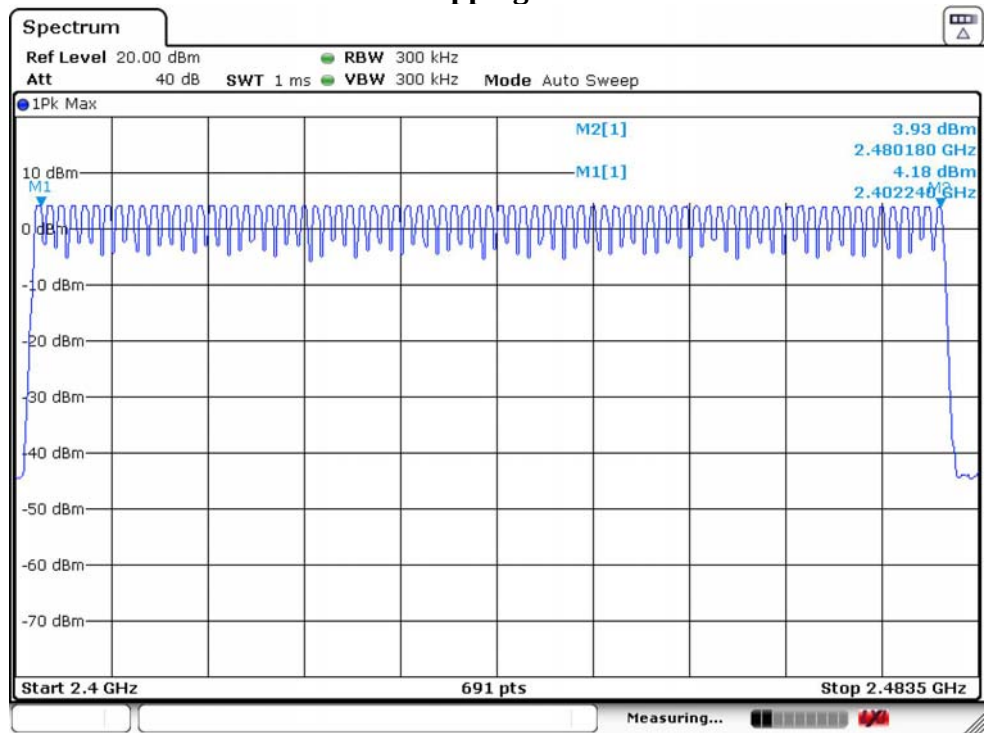
### 6.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 6.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-peak function to mark the first and last frequency hopping channel.
- Repeat above procedures until all test modes were measured.
- Record the results in the test report.

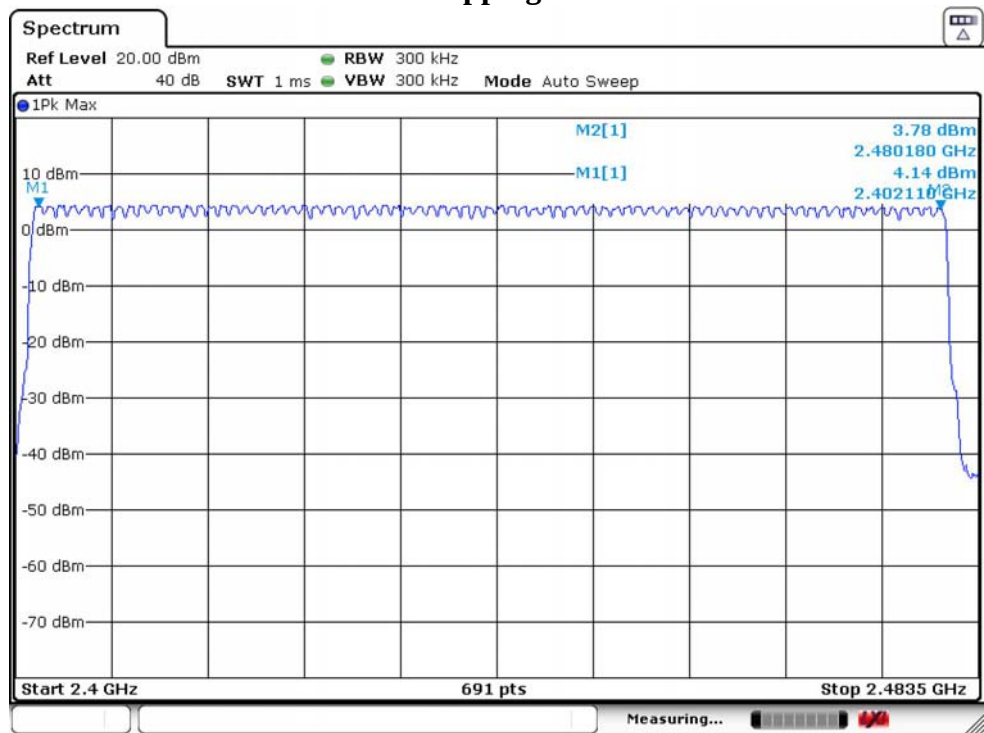
## 6.5. Test Result

|             |             |                           |                   |     |              |           |
|-------------|-------------|---------------------------|-------------------|-----|--------------|-----------|
| Temperature |             | 23.5℃                     | Relative Humidity | 49% | Test Voltage | 120V/60Hz |
| Antenna     | Mode        | Number of Hopping Channel |                   |     | Limit        | Result    |
| ANT 1       | GFSK(DH5)   | 79                        |                   |     | $\geq 15$    | PASS      |
|             | 8-DPSK(DH5) | 79                        |                   |     | $\geq 15$    | PASS      |
| ANT 2       | GFSK(DH5)   | 79                        |                   |     | $\geq 15$    | PASS      |
|             | 8-DPSK(DH5) | 79                        |                   |     | $\geq 15$    | PASS      |

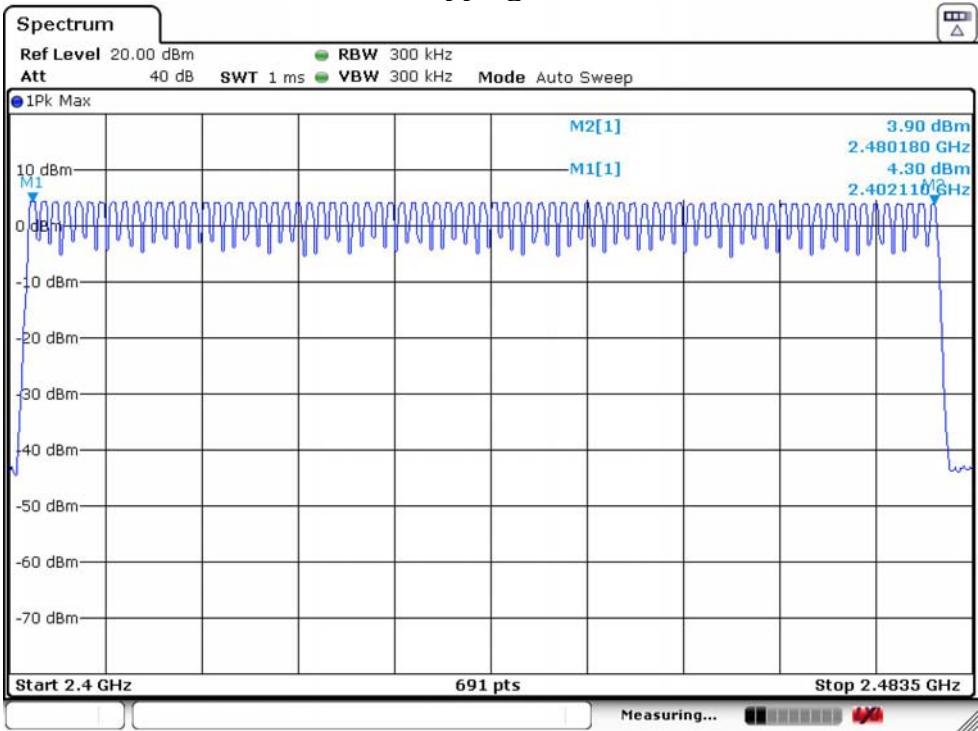
GFSK Hopping On ANT 1



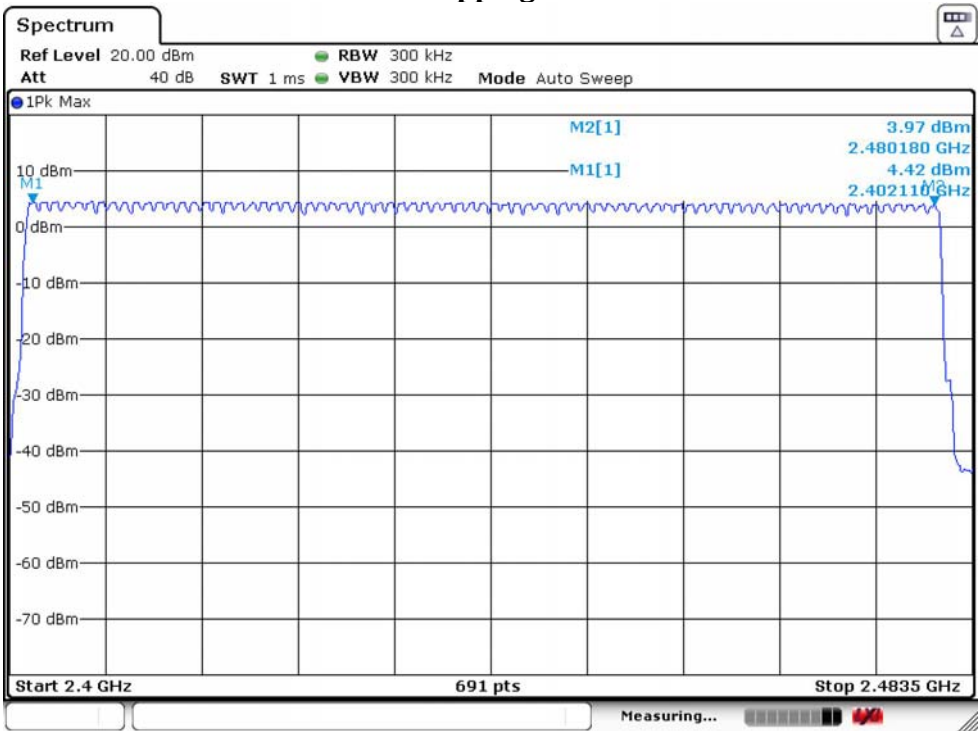
8-DPSK Hopping On ANT 1



GFSK Hopping On ANT 2



8-DPSK Hopping On ANT 2





## 7. DWELL TIME

### 7.1. 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.

### 7.2. Test Setup



### 7.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting                        |
|---------------------|--------------------------------|
| RBW                 | 1MHz                           |
| VBW                 | 1MHz                           |
| Span                | Zero                           |
| Detector            | Peak                           |
| Sweep Time          | 2.5ms(DH1)/10ms(DH3)/20ms(DH5) |
| Sweep Mode          | Single Sweep                   |

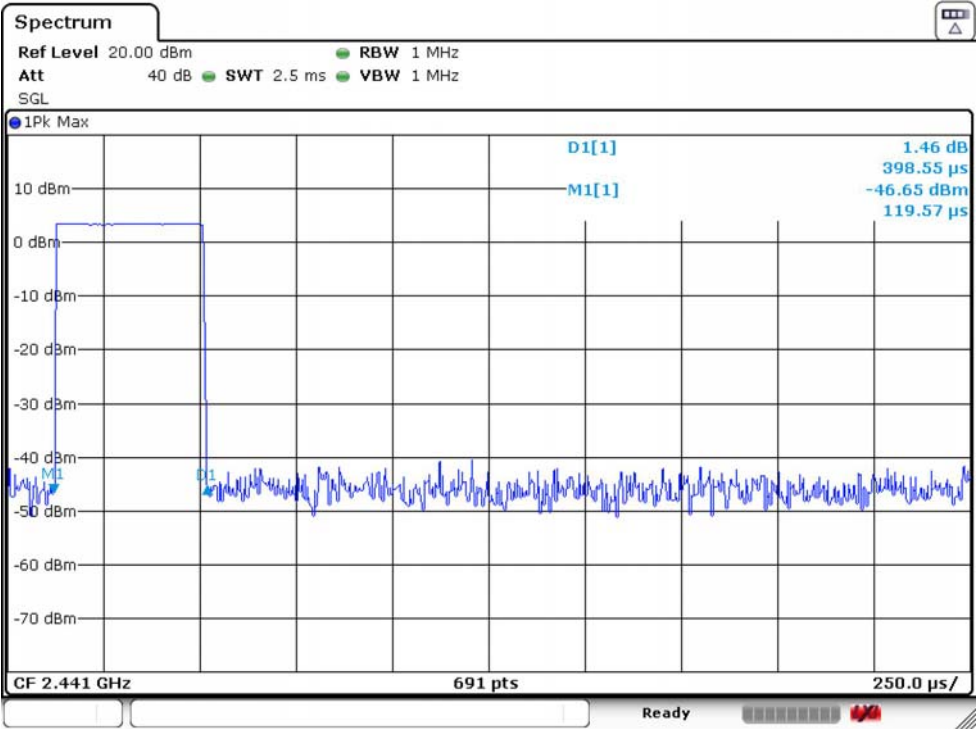
### 7.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 7.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-delta function to measure single pulse duration.
- Repeat above procedures until all test modes were measured.
- Record the results in the test report.

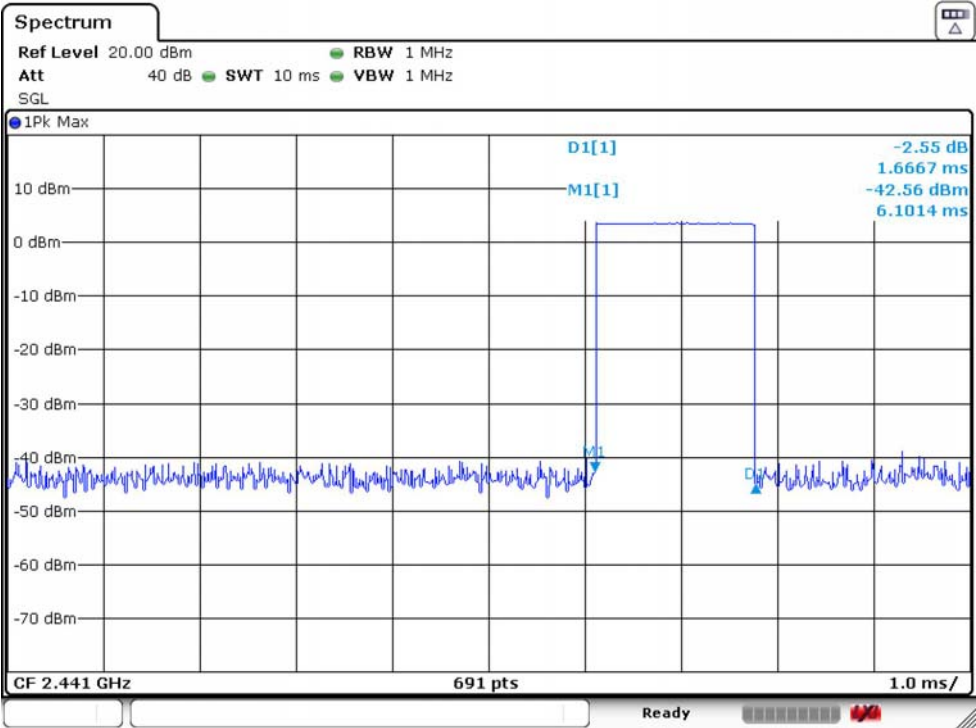
## 7.5. Test Result

| Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             | 23.5℃      | Relative Humidity                |                     | 49%             | Test Voltage | 120V/60Hz |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|----------------------------------|---------------------|-----------------|--------------|-----------|
| Antenna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Mode        | Freq (MHz) | Hops in Observation Period(hops) | Pulse Duration (ms) | Dwell time (ms) | Limit        | Result    |
| ANT 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GFSK DH1    | 2441       | 320                              | 0.3986              | 127.54          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GFSK DH3    | 2441       | 160                              | 1.6667              | 266.67          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GFSK DH5    | 2441       | 106.67                           | 2.9566              | 315.37          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-DPSK 3DH1 | 2441       | 320                              | 0.3986              | 127.54          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-DPSK 3DH3 | 2441       | 160                              | 1.6957              | 271.31          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-DPSK 3DH5 | 2441       | 106.67                           | 2.9565              | 315.36          | <400ms       | PASS      |
| ANT 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GFSK DH1    | 2441       | 320                              | 0.4022              | 128.69          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GFSK DH3    | 2441       | 160                              | 1.6812              | 268.99          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GFSK DH5    | 2441       | 106.67                           | 2.9565              | 315.36          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-DPSK 3DH1 | 2441       | 320                              | 0.3986              | 127.54          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-DPSK 3DH3 | 2441       | 160                              | 1.6812              | 268.99          | <400ms       | PASS      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-DPSK 3DH5 | 2441       | 106.67                           | 2.9565              | 315.36          | <400ms       | PASS      |
| <p>1. DH1 Packet permit maximum 1600 hops/s with 2 timeslot in 79 channels (1 timeslot TX, 1 timeslot RX), So the hops in Observation Period(<math>0.4s \times 79 \text{ channel}</math>)=<math>(1600/79/2)\text{hops/s} \times 0.4s \times 79=320 \text{ hops}</math>.</p> <p>2. DH3 Packet permit maximum 1600 hops/s with 4 timeslot in 79 channels (3 timeslot TX, 1 timeslot RX), So the hops in Observation Period(<math>0.4s \times 79 \text{ channel}</math>)=<math>(1600/79/4)\text{hops/s} \times 0.4s \times 79=160 \text{ hops}</math>.</p> <p>3. DH5 Packet permit maximum 1600 hops/s with 6 timeslot in 79 channels (5 timeslot TX, 1 timeslot RX), So the hops in Observation Period(<math>0.4s \times 79 \text{ channel}</math>)=<math>(1600/79/5)\text{hops/s} \times 0.4s \times 79=106.67 \text{ hops}</math>.</p> <p>4. Dwell Time= Hops in Observation Period <math>\times</math> Pulse Duration.</p> |             |            |                                  |                     |                 |              |           |

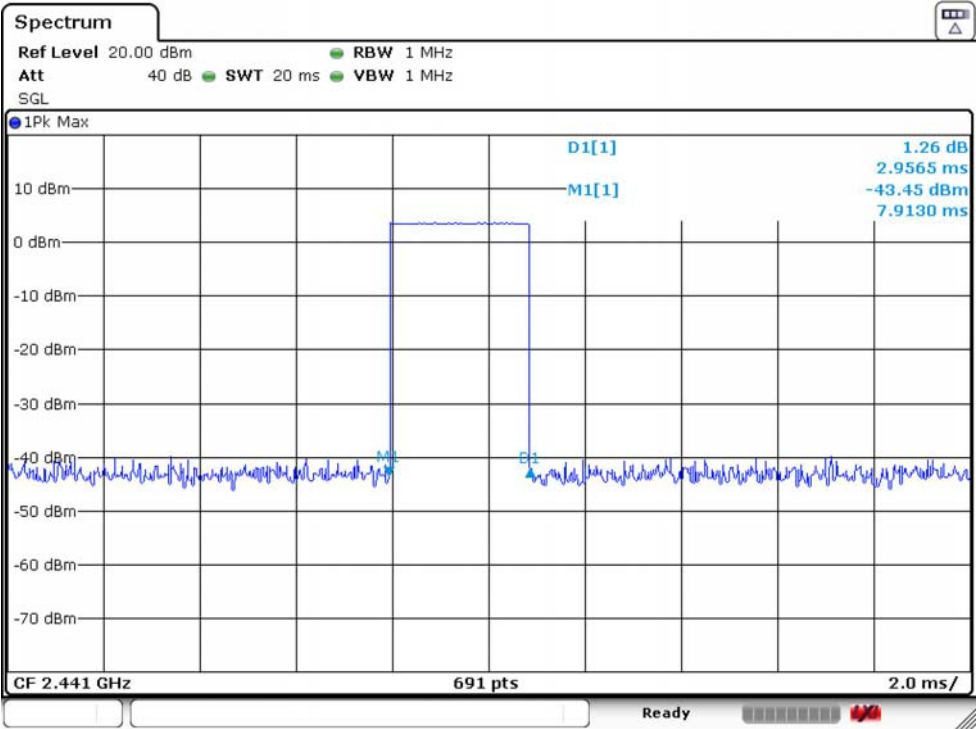
GFSK DH1 ANT 1



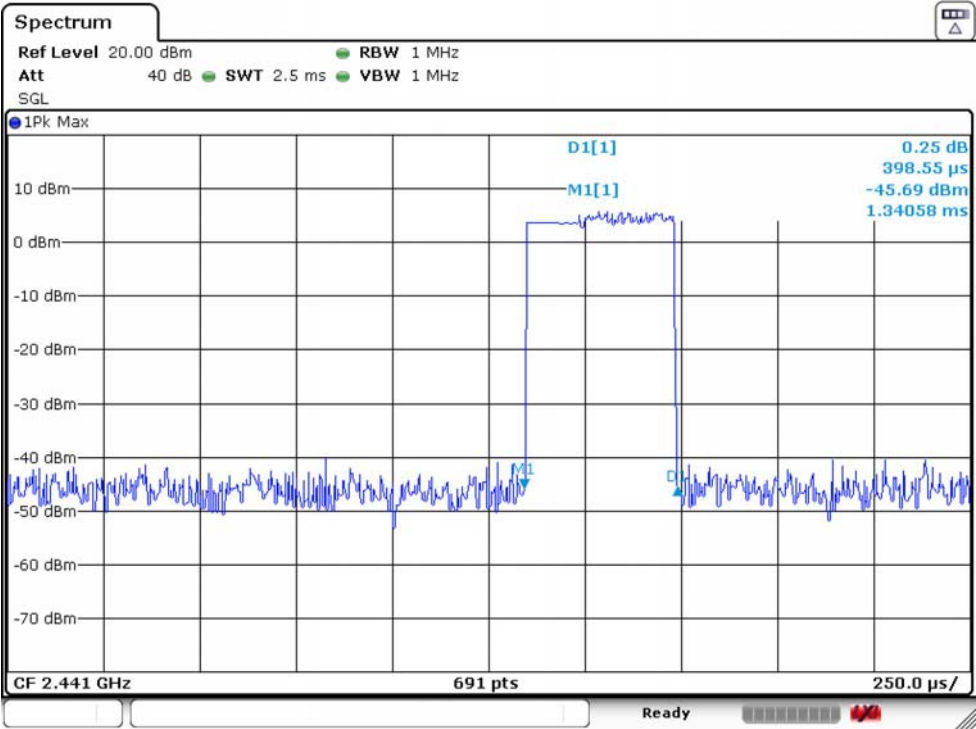
GFSK DH3 ANT 1



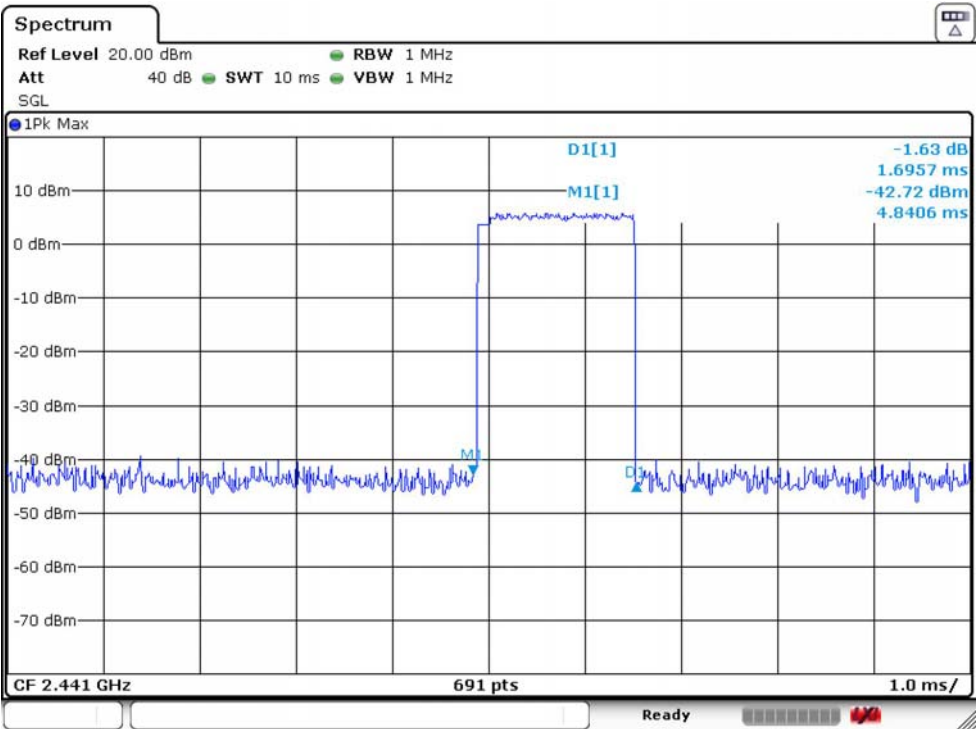
GFSK DH5 ANT 1



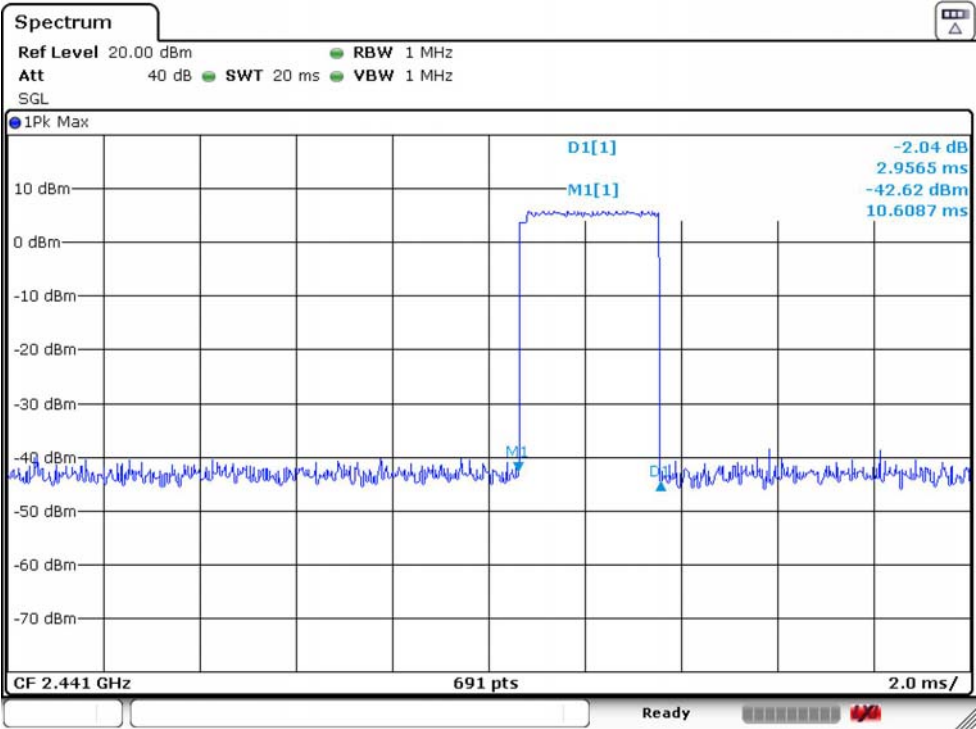
8-DPSK 3DH1 ANT 1



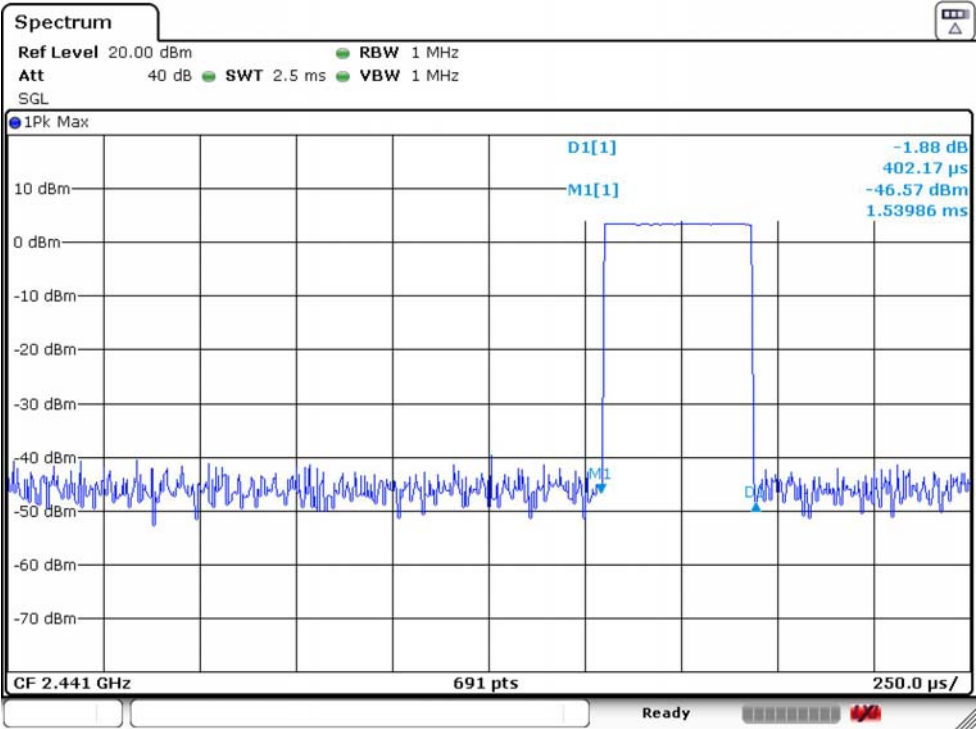
8-DPSK 3DH3 ANT 1



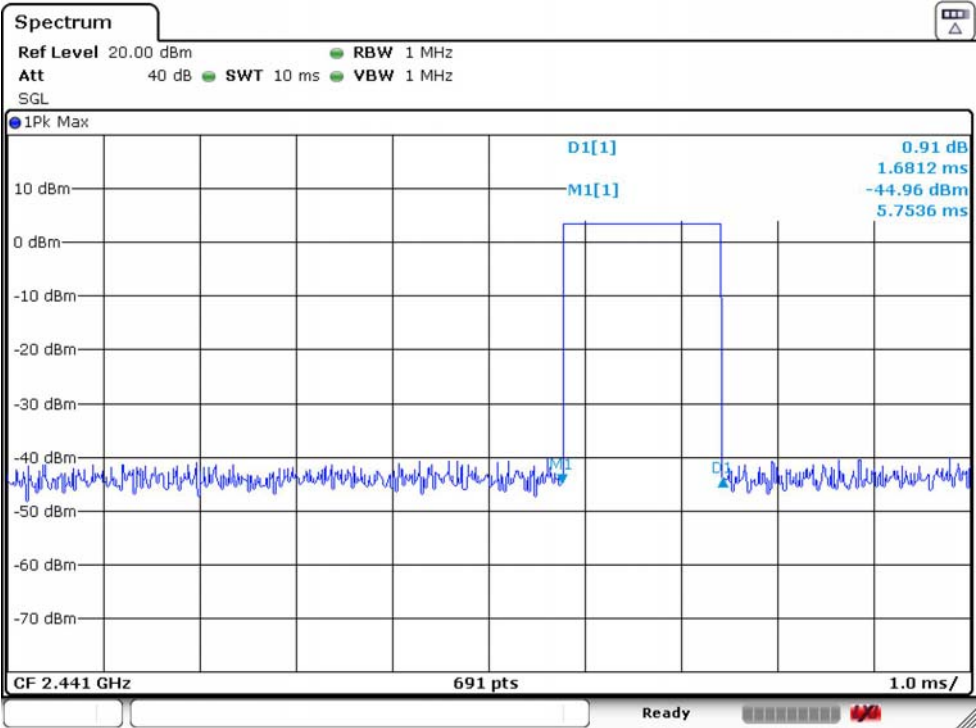
8-DPSK 3DH5 ANT 1



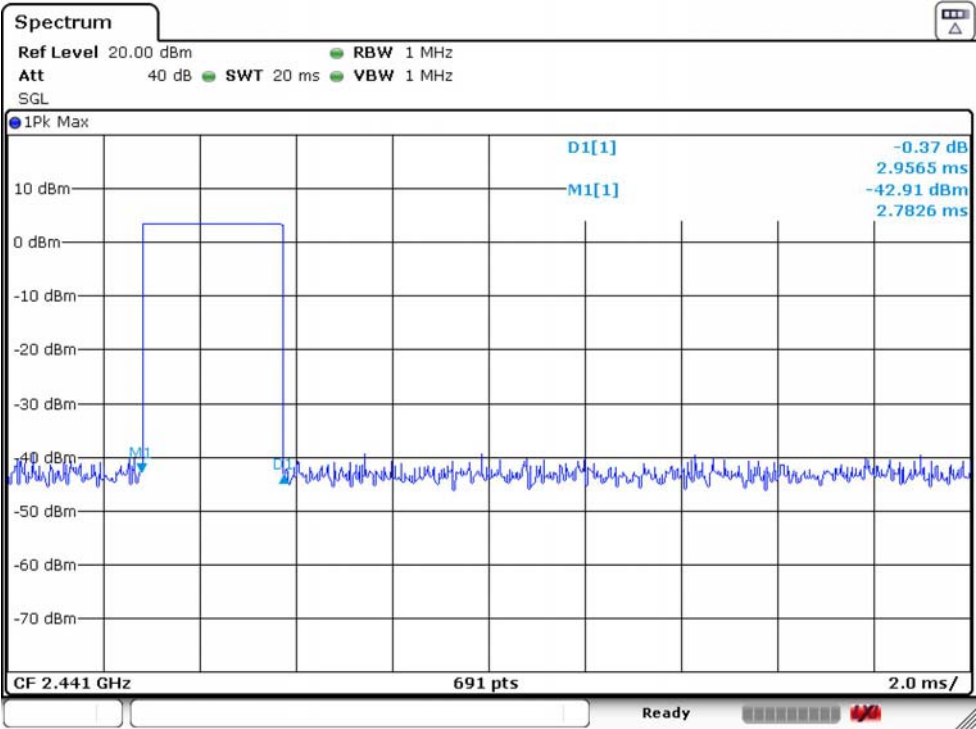
GFSK DH1 ANT 2



GFSK DH3 ANT 2

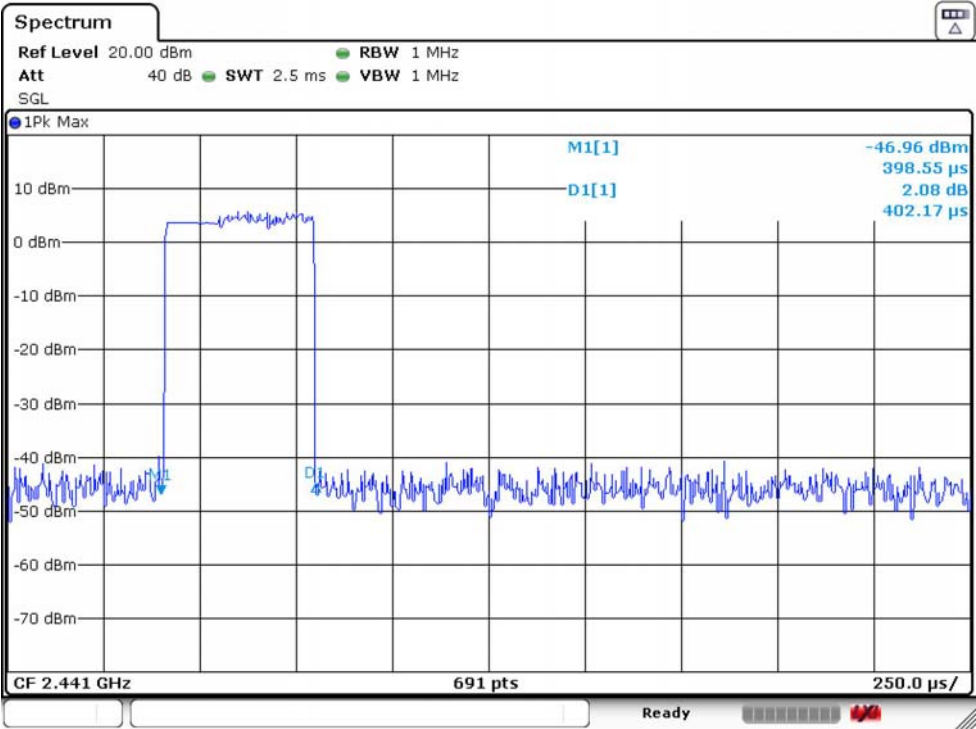


GFSK DH5 ANT 2

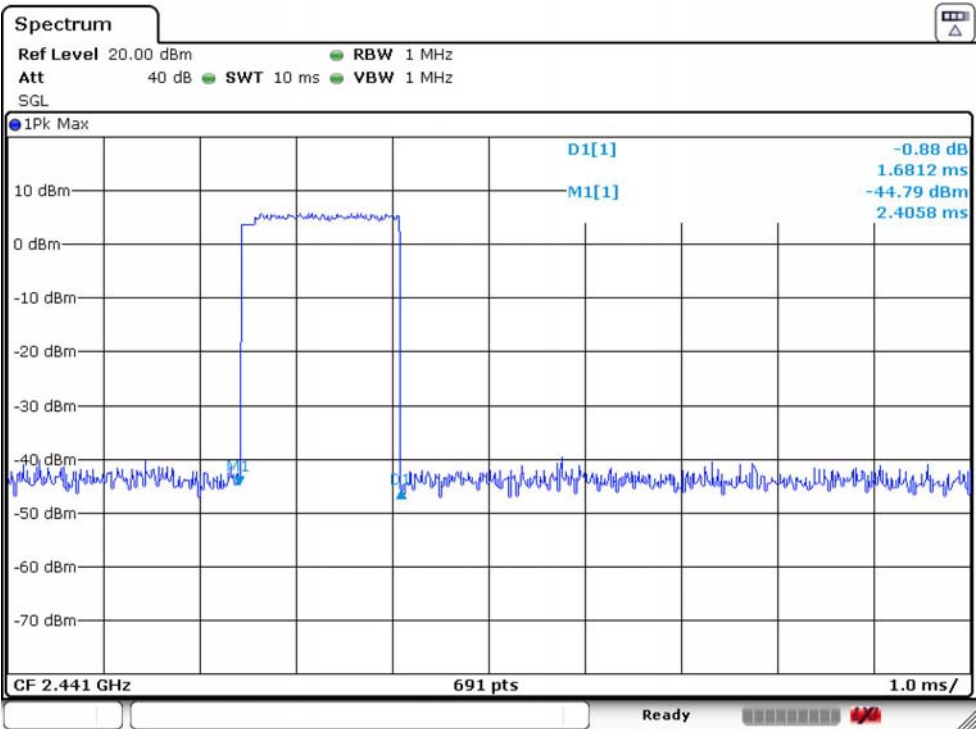




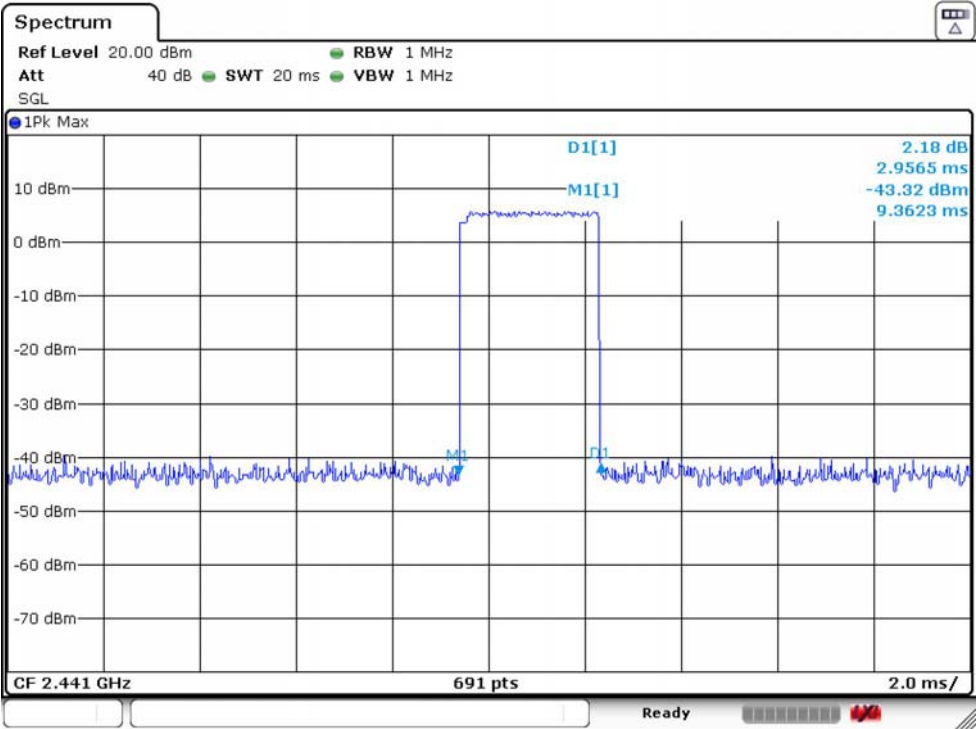
8-DPSK 3DH1 ANT 2



8-DPSK 3DH3 ANT 2



8-DPSK 3DH5 ANT 2

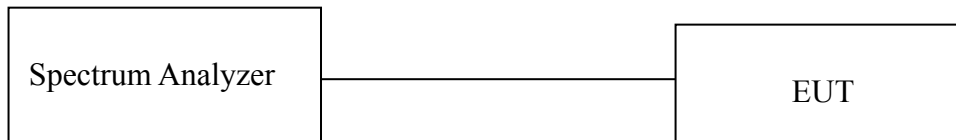


## 8. CONDUCTED BAND EDGE

### 8.1. 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. 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) (see §15.205(c)).

### 8.2. Test Setup



### 8.3. Spectrum Analyzer Setting

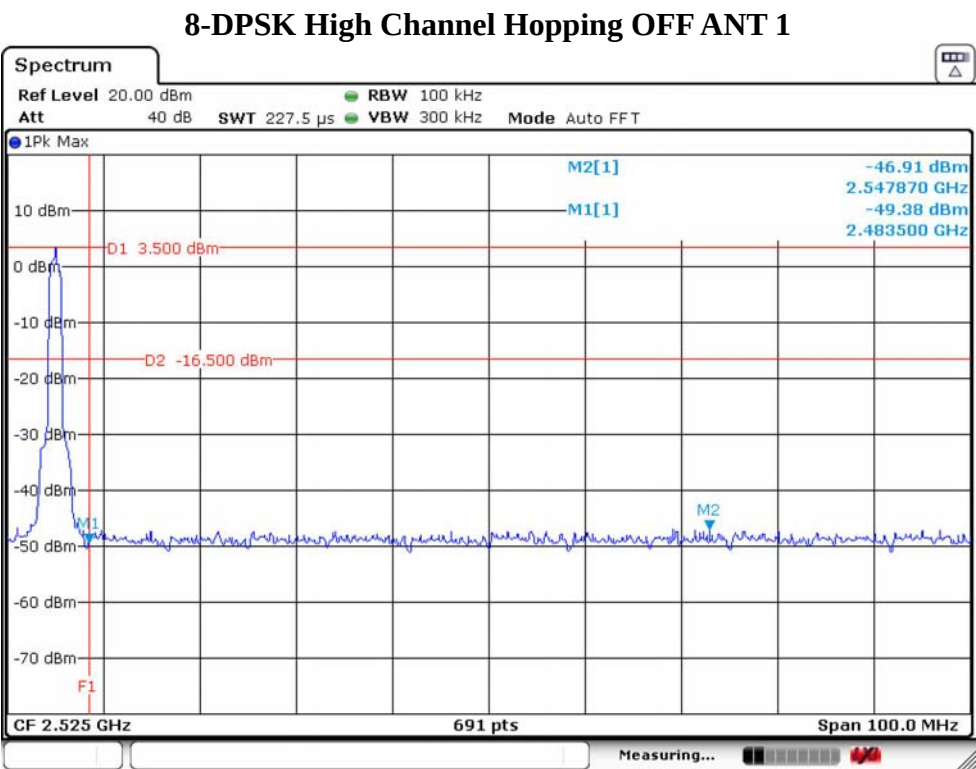
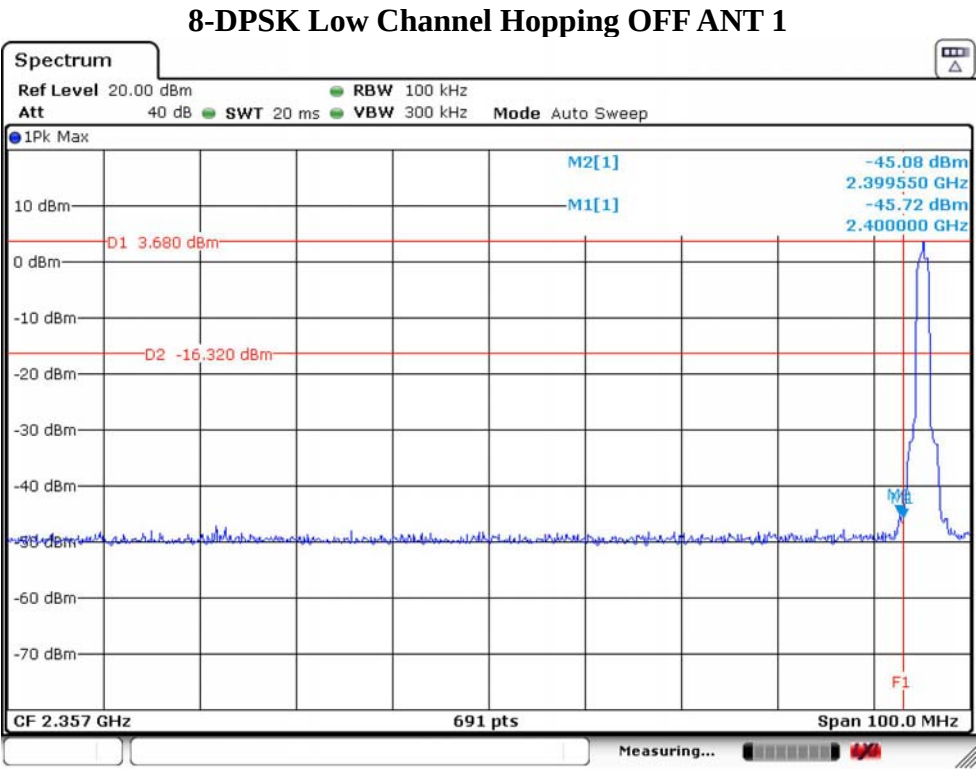
| Spectrum Parameters | Setting  |
|---------------------|----------|
| RBW                 | 100KHz   |
| VBW                 | 300KHz   |
| Span                | 100MHz   |
| Sweep Time          | Auto     |
| Detector            | Peak     |
| Trace Mode          | Max Hold |

### 8.4. Test Procedure

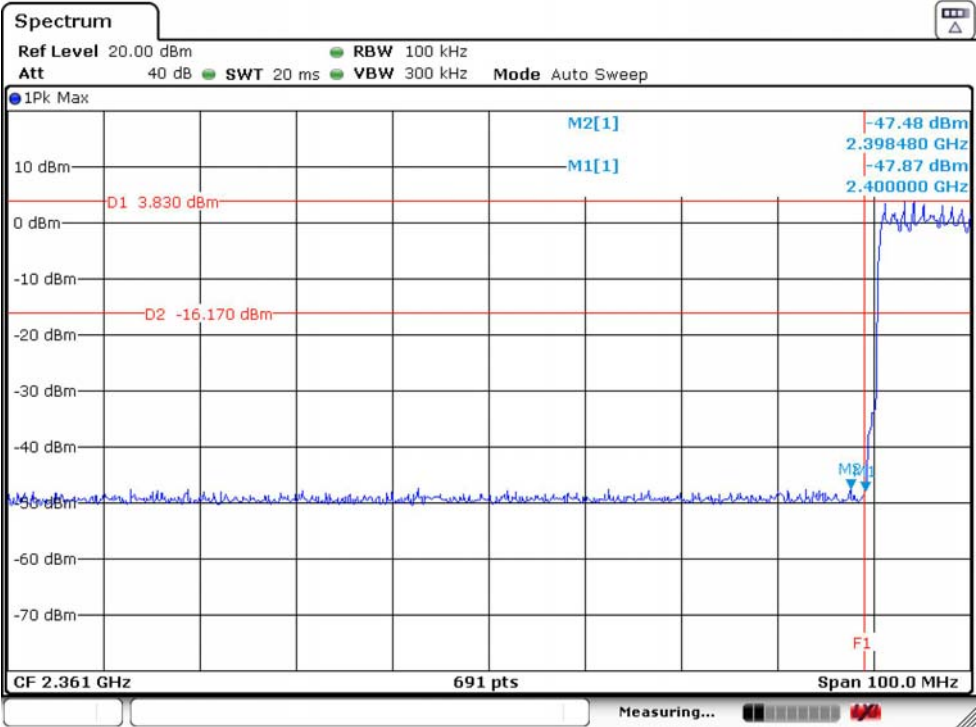
- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 8.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels and test modes were measured(including frequency hopping off and frequency hopping on).
- Record the results in the test report.

8.5. Test Result

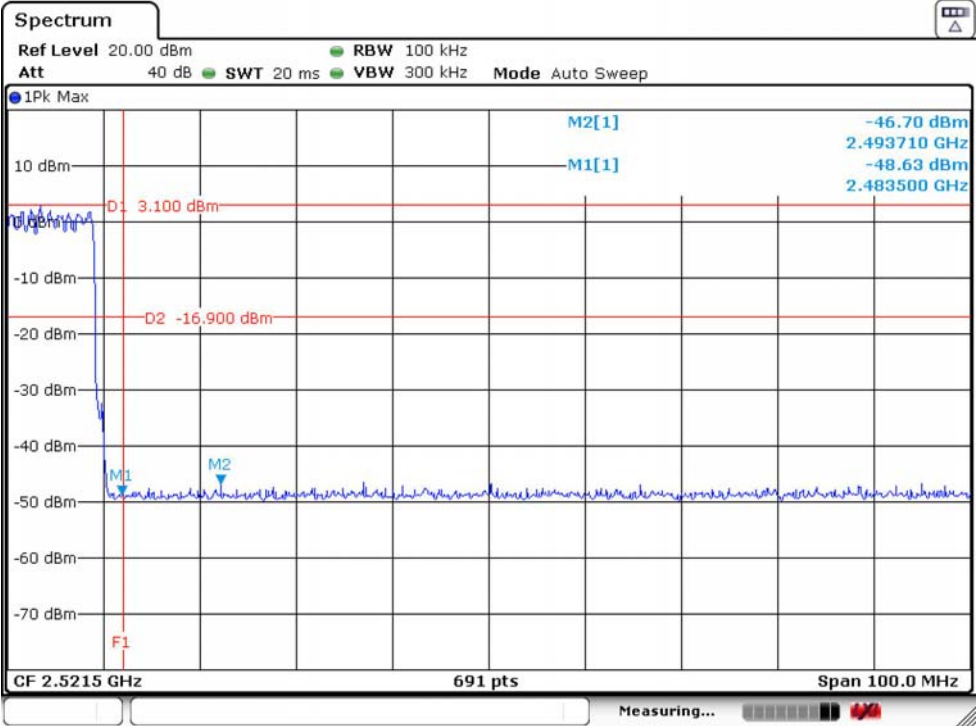
|             |       |                   |     |              |           |
|-------------|-------|-------------------|-----|--------------|-----------|
| Temperature | 23.5℃ | Relative Humidity | 49% | Test Voltage | 120V/60Hz |
| Result      | PASS  |                   |     |              |           |



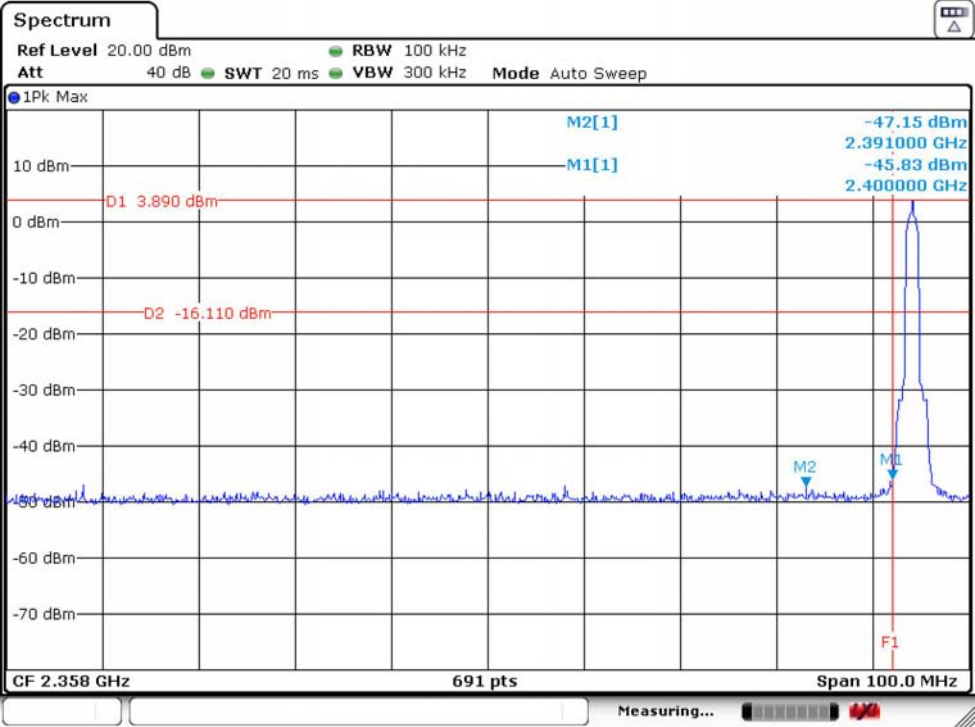
8-DPSK Low Channel Hopping ON ANT 1



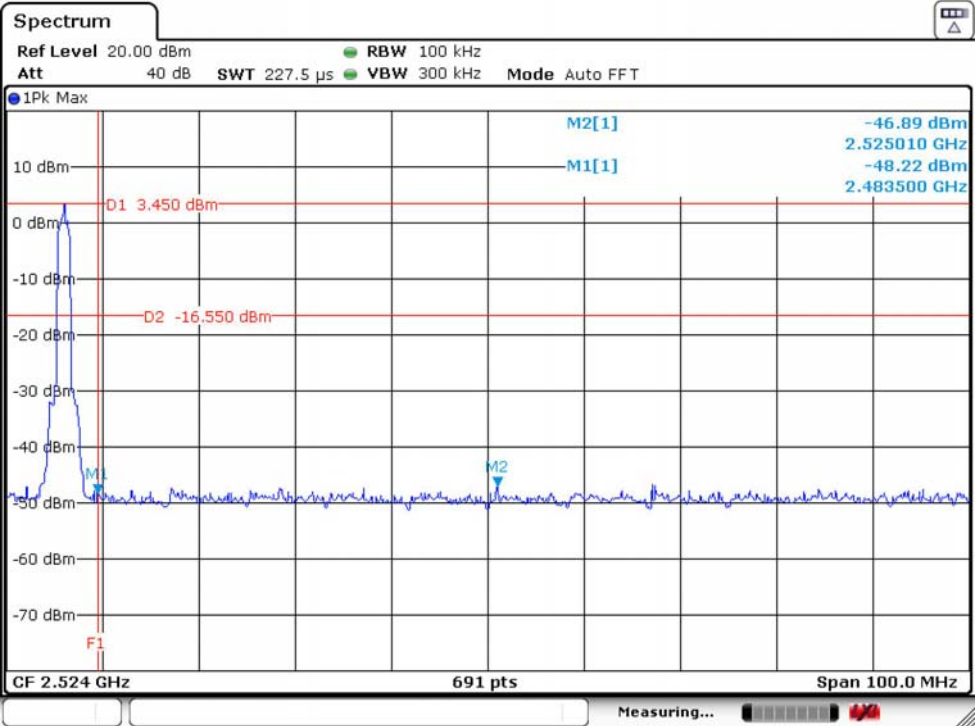
8-DPSK High Channel Hopping ON ANT 1



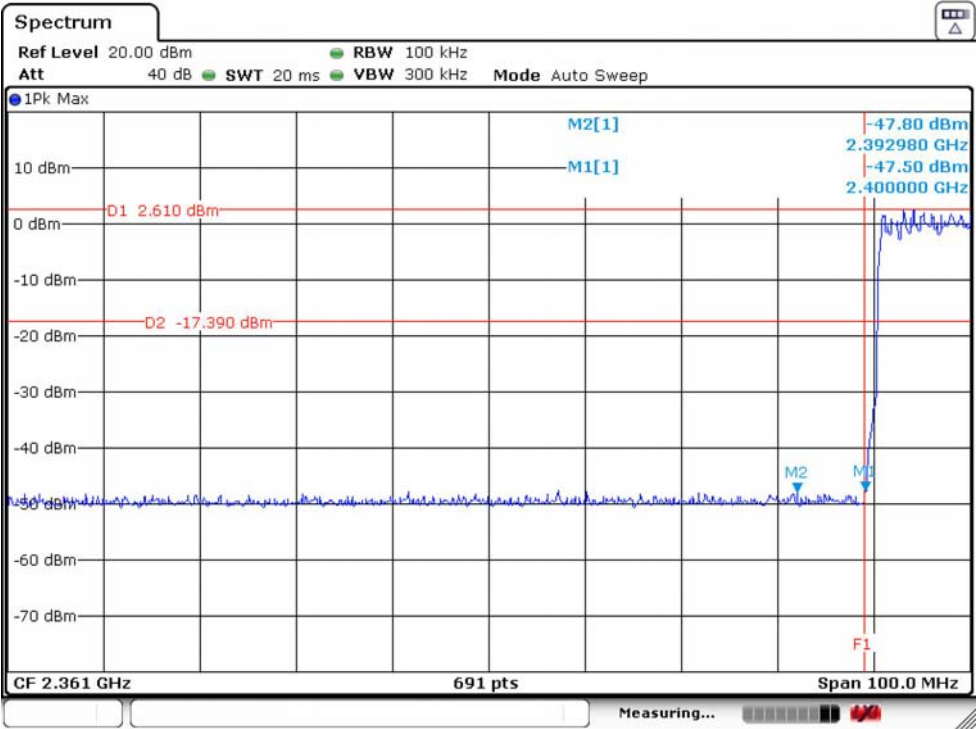
8-DPSK Low Channel Hopping OFF ANT 2



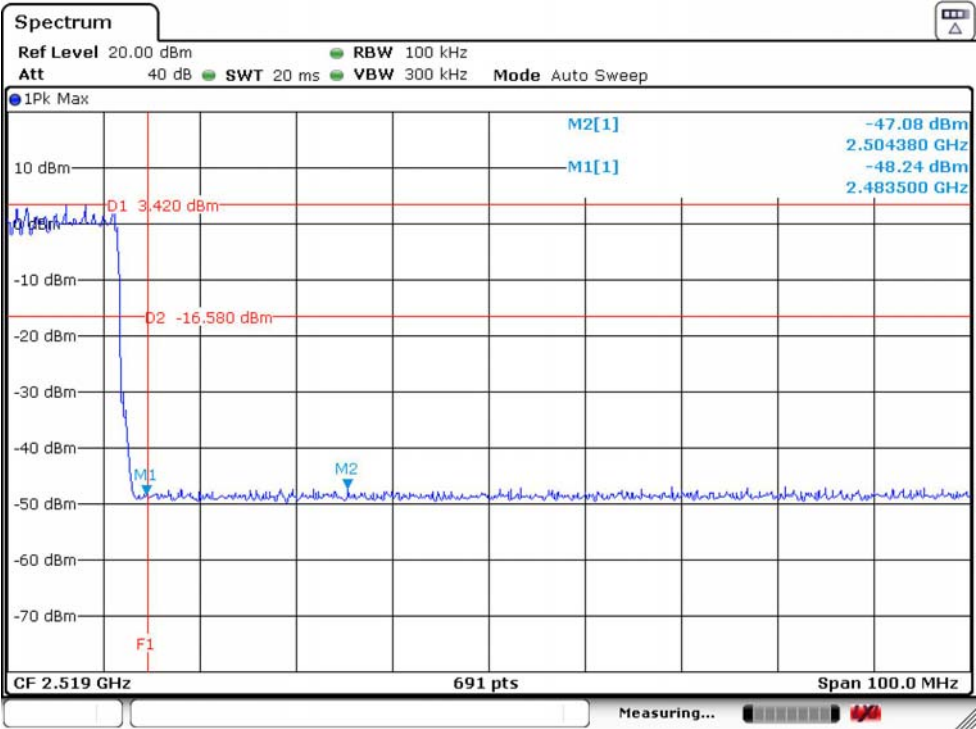
8-DPSK High Channel Hopping OFF ANT 2



8-DPSK Low Channel Hopping ON ANT 2



8-DPSK High Channel Hopping ON ANT 2



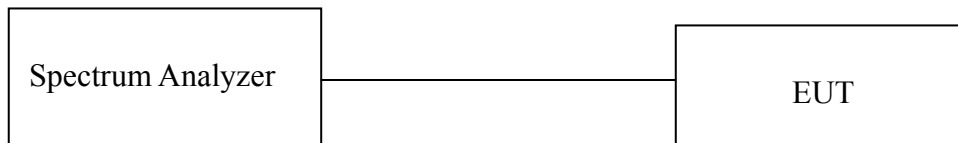
All modulations are all tested ,only worse case is reported

## 9. CONDUCTED SPURIOUS EMISSIONS

### 9.1. 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. 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) (see §15.205(c)).

### 9.2. Test Setup



### 9.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting  |
|---------------------|----------|
| RBW                 | 100KHz   |
| VBW                 | 300KHz   |
| Start frequency     | 30MHz    |
| Stop frequency      | 25GHz    |
| Sweep Time          | Auto     |
| Detector            | Peak     |
| Trace Mode          | Max Hold |

### 9.4. Test Procedure

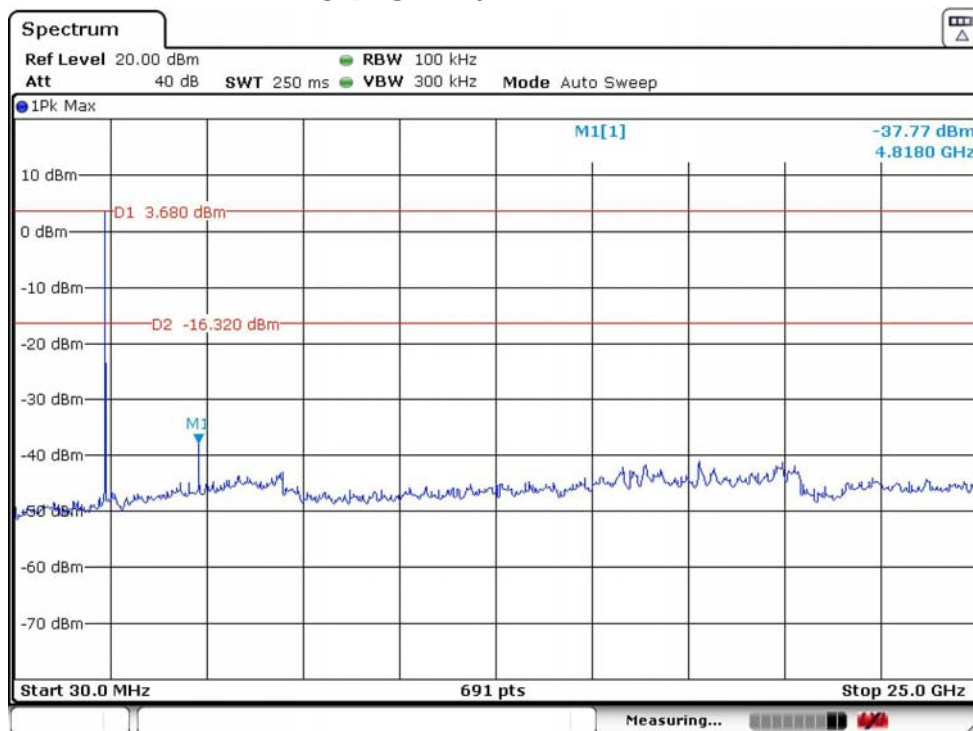
- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 9.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.



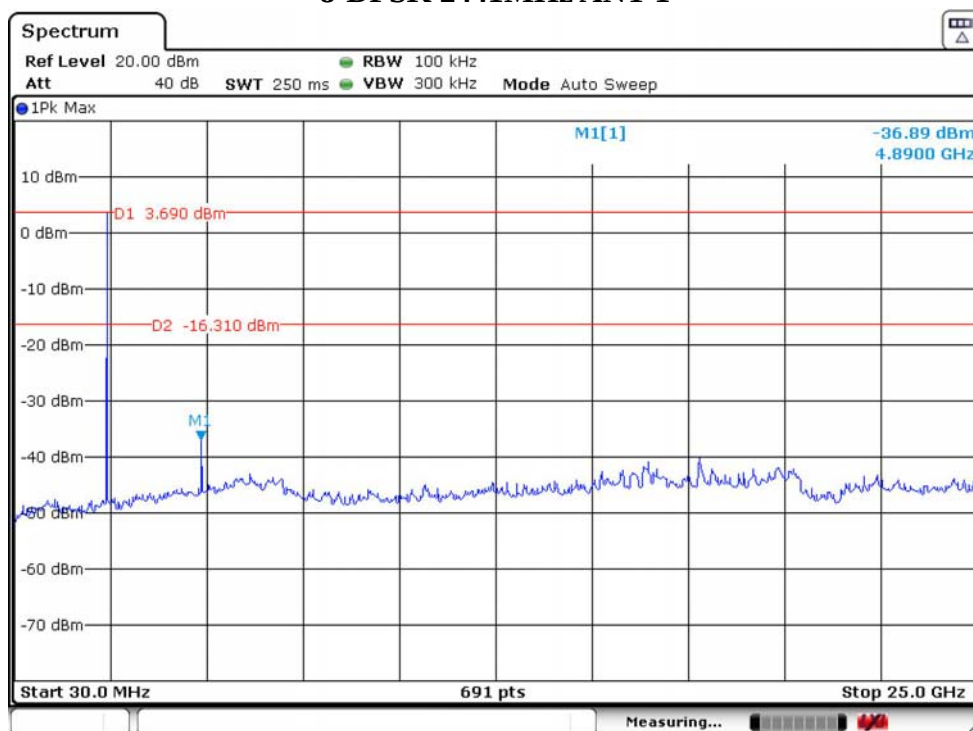
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|             |       |                   |     |              |           |
|-------------|-------|-------------------|-----|--------------|-----------|
| Temperature | 23.5℃ | Relative Humidity | 49% | Test Voltage | 120V/60Hz |
| Result      | PASS  |                   |     |              |           |

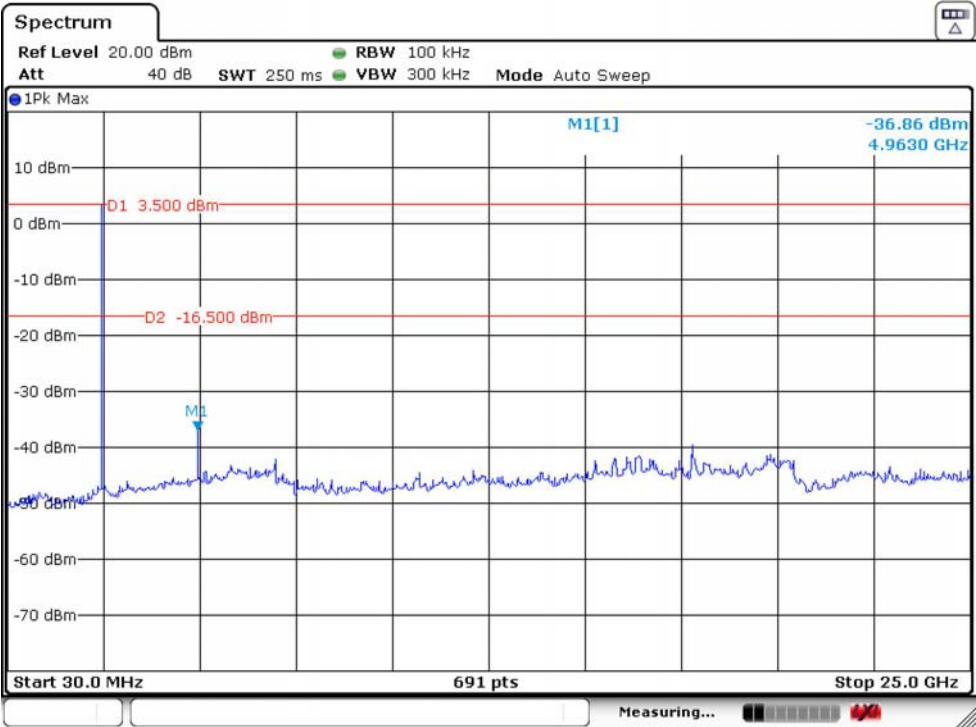
## 8-DPSK 2402MHz ANT 1



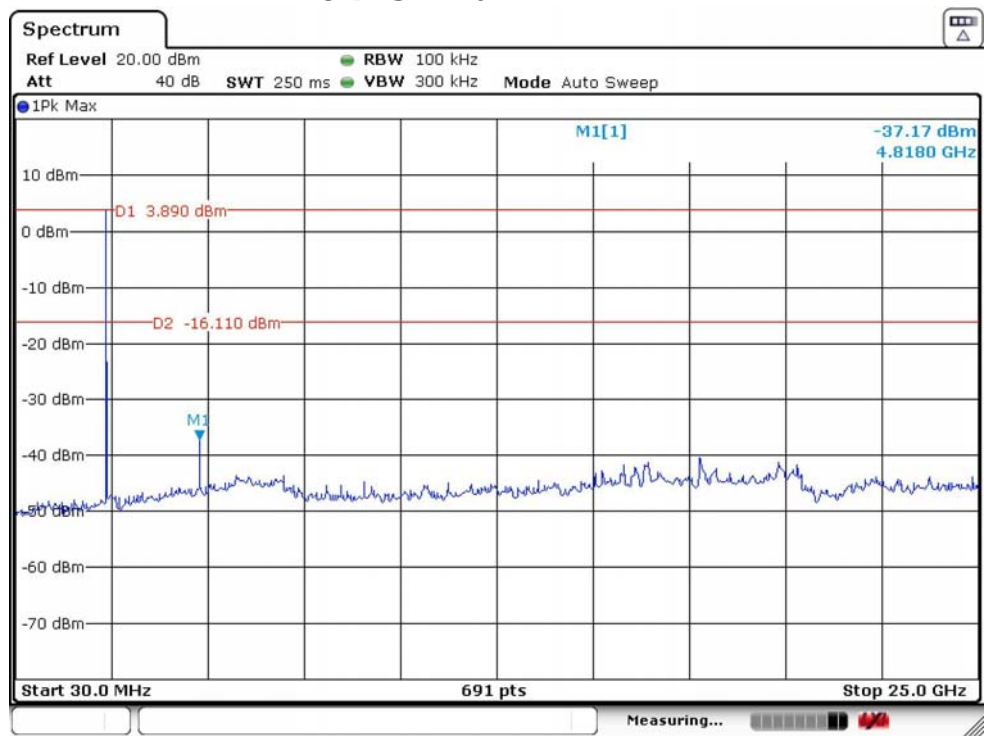
## 8-DPSK 2441MHz ANT 1



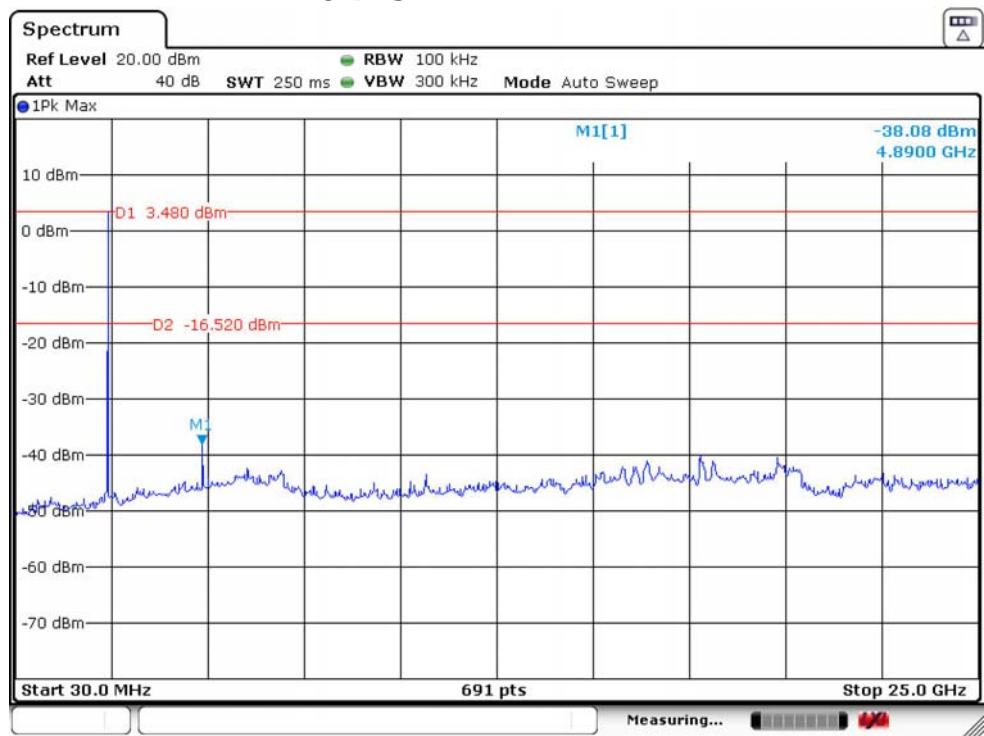
8-DPSK 2480MHz ANT 1



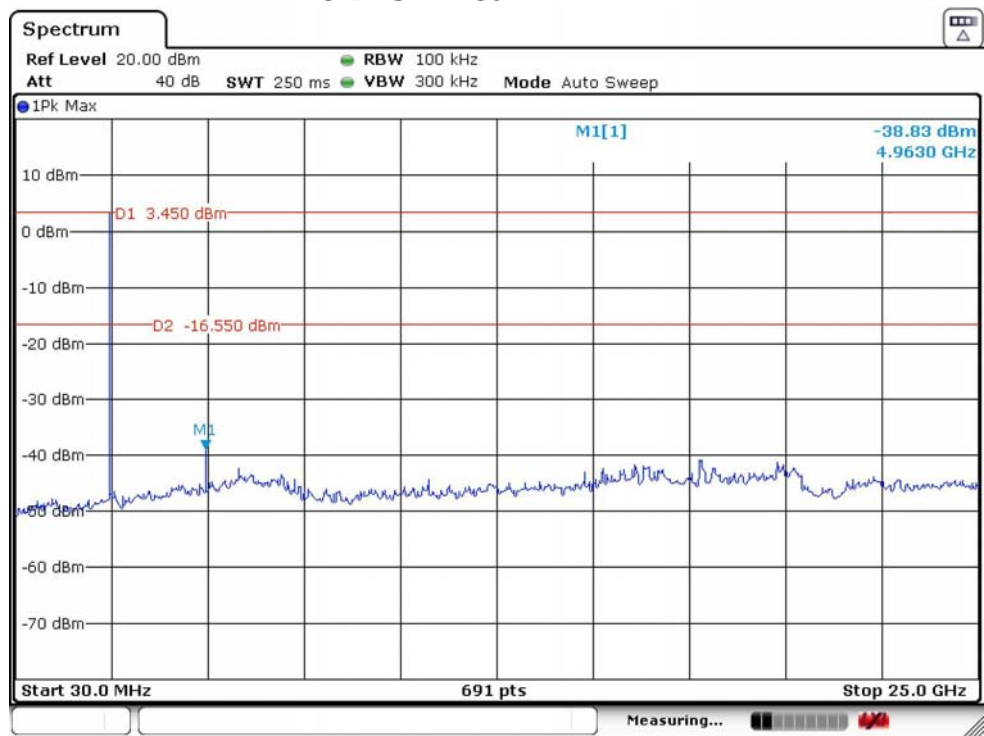
8-DPSK 2402MHz ANT 2



8-DPSK 2441MHz ANT 2



8-DPSK 2480MHz ANT 2



All modulations are all tested ,only worse case is reported