

FCC  
RF  
TEST REPORT

ISSUED BY  
Shenzhen BALUN Technology Co., Ltd.



FOR  
**CD JUKEBOX BLUETOOTH SPEAKER**

ISSUED TO  
Tonika Electronics Technology (Shenzhen) CO., Ltd.

3rd floor, D Building, Haikexing Industrial Park No.16, Baoshan Road,  
Jinlong Avenue, Pingshan New District, Shenzhen, China



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*Jul. 20, 2015*

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Date

*Jul. 20, 2015*

Report No.: BL-SZ1550175-601

EUT Type: CD JUKEBOX BLUETOOTH SPEAKER

Model Name: TA-359, CHT955

Brand Name: Tonika, Craig

Test Standard: 47 CFR Part 15 Subpart C

FCC ID: SDNTA-359-01

Test conclusion: Pass

Test Date: May. 25, 2015 ~ Jul. 17, 2015

Date of Issue: Jul. 20, 2015

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**Revision History**

| <u>Version</u> | <u>Issue Date</u>    | <u>Revisions</u>     |
|----------------|----------------------|----------------------|
| <u>Rev. 01</u> | <u>Jul. 20, 2015</u> | <u>Initial Issue</u> |
| <u> </u>       | <u> </u>             | <u> </u>             |

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## 1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

### 1.1 Identification of the Testing Laboratory

|              |                                                                                                                                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------|
| Company Name | Shenzhen BALUN Technology Co., Ltd.                                                                                             |
| Address      | Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Phone Number | +86 755 6683 3402                                                                                                               |
| Fax Number   | +86 755 6182 4271                                                                                                               |

### 1.2 Identification of the Responsible Testing Location

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Location             | Shenzhen BALUN Technology Co., Ltd.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Address                   | Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Accreditation Certificate | <p>The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1.</p> <p>The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625.</p> <p>The laboratory has met the requirements of the IAS Accreditation Criteria for Testing Laboratories (AC89), has demonstrated compliance with ISO/IEC Standard 17025:2005. The accreditation certificate number is TL-588.</p> <p>The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.</p> |
| Description               | All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 1.3 Announce

- (1) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (2) The test report is invalid if there is any evidence and/or falsification.
- (3) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (4) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

## 2 PRODUCT INFORMATION

### 2.1 Applicant

|           |                                                                                                                              |
|-----------|------------------------------------------------------------------------------------------------------------------------------|
| Applicant | Tonika Electronics Technology (Shenzhen) CO., Ltd.                                                                           |
| Address   | 3rd floor, D Building, Haikexing Industrial Park No.16, Baoshan Road, Jinlong Avenue, Pingshan New District, Shenzhen, China |

### 2.2 Manufacturer

|              |                                                                                                                              |
|--------------|------------------------------------------------------------------------------------------------------------------------------|
| Manufacturer | Tonika Electronics Technology (Shenzhen) CO., Ltd.                                                                           |
| Address      | 3rd floor, D Building, Haikexing Industrial Park No.16, Baoshan Road, Jinlong Avenue, Pingshan New District, Shenzhen, China |

### 2.3 General Description for Equipment under Test (EUT)

|                                           |                                                                                                                                                                       |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Type                                  | CD JUKEBOX BLUETOOTH SPEAKER                                                                                                                                          |
| The Under Test Model Name                 | TA-359                                                                                                                                                                |
| Series Model Name                         | TA-359, CHT955                                                                                                                                                        |
| Description of Model name differentiation | The equipment model TA-359 and CHT955 are the EUT model name, the electrical parameters and internal structure of circuit are same, only the model name is different. |
| Hardware Version                          | N/A                                                                                                                                                                   |
| Software Version                          | N/A                                                                                                                                                                   |
| Network and Wireless connectivity         | Bluetooth 2.1+EDR                                                                                                                                                     |
| About the Product                         | The equipment is Bluetooth Speaker, it contains Bluetooth 2.1+EDR operating at 2.4 GHz ISM band, and it was tested in this report.                                    |

### 2.4 Technical Information

|                       |                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------|
| Modulation Technology | FHSS                                                                                               |
| Modulation Type       | GFSK, $\pi/4$ -DQPSK, 8-DPSK                                                                       |
| Transfer Rate         | 1 Mbps, 2 Mbps, 3 Mbps                                                                             |
| Frequency Range       | The frequency range used is 2402 MHz – 2480 MHz;<br>The frequency block is 2400 MHz to 2483.5 MHz. |
| Number of channel     | 79 (at intervals of 1 MHz)                                                                         |
| Tested Channel        | 0 (2402 MHz), 39 (2441 MHz), 78 (2480 MHz).                                                        |
| Antenna Type          | PCB Antenna                                                                                        |
| Antenna Gain          | 0 dBi (All involve the antenna gain test item, has been included in the final results)             |

Note: The above EUT information in section 2.3 and 2.4 was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

## 2.5 Ancillary Equipment

|                       |                |                              |
|-----------------------|----------------|------------------------------|
| Ancillary Equipment 1 | Charger        |                              |
|                       | Brand Name     | N/A                          |
|                       | Model No       | DZ010LL050200U               |
|                       | Serial No      | N/A                          |
|                       | Rated Input    | ~ 100-240 V, 0.3 A, 50/60 Hz |
|                       | Rated Output   | = 5 V, 2 A                   |
| Ancillary Equipment 2 | Remote Control |                              |

### 3 SUMMARY OF TEST RESULTS

#### 3.1 Test Standards

| No. | Identity                                             | Document Title                                                                                                                                                                   |
|-----|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | 47 CFR Part 15,<br>Subpart C<br>(10-1-14 Edition)    | Miscellaneous Wireless Communications Services                                                                                                                                   |
| 2   | FCC PUBLIC<br>NOTICE<br>DA 00-705<br>(Mar. 30, 2000) | Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems                                                                                                 |
| 3   | ANSI C63.4-2009                                      | American National Standard for Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| 4   | ANSI C63.10-2009                                     | American National Standard for Testing Unlicensed Wireless Devices                                                                                                               |

#### 3.2 Verdict

| No. | Description                    | FCC Part No.        | Test Result | Verdict                |
|-----|--------------------------------|---------------------|-------------|------------------------|
| 1   | Antenna Requirement            | 15.203              | --          | Pass <sup>Note 1</sup> |
| 2   | Number of Hopping Frequency    | 15.247(a)           | ANNEX A.1   | Pass                   |
| 3   | Peak Output Power              | 15.247(b)           | ANNEX A.2   | Pass                   |
| 4   | Occupied Bandwidth             | 15.247(a)           | ANNEX A.3   | Pass                   |
| 5   | Carrier Frequency Separation   | 15.247(a)           | ANNEX A.4   | Pass                   |
| 6   | Time of Occupancy (Dwell time) | 15.247(a)           | ANNEX A.5   | Pass                   |
| 7   | Conducted Spurious Emission    | 15.247(d)           | ANNEX A.6   | Pass                   |
| 8   | Conducted Emission             | 15.207              | ANNEX A.7   | Pass                   |
| 9   | Radiated Spurious Emission     | 15.209<br>15.247(d) | ANNEX A.8   | Pass                   |
| 10  | Band Edge                      | 15.209<br>15.247(d) | ANNEX A.9   | Pass                   |

Note 1: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

## 4 GENERAL TEST CONFIGURATIONS

### 4.1 Test Environments

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

|                            |                         |                |
|----------------------------|-------------------------|----------------|
| Relative Humidity          | 45% - 55%               |                |
| Atmospheric Pressure       | 100 kPa - 102 kPa       |                |
| Temperature                | NT (Normal Temperature) | +22°C to +25°C |
| Working Voltage of the EUT | NV (Normal Voltage)     | 3.7 V          |

### 4.2 Test Equipment List

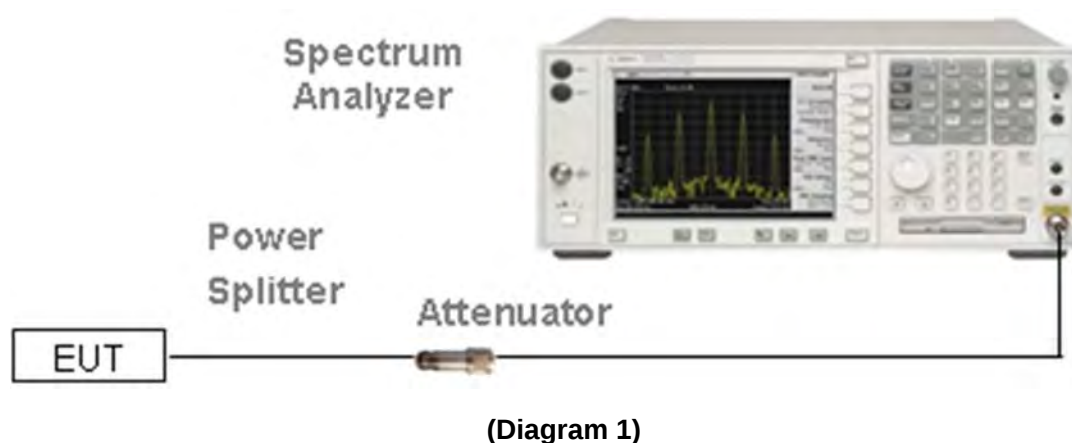
| Description                       | Manufacturer         | Model      | Serial No. | Cal. Date  | Cal. Due   |
|-----------------------------------|----------------------|------------|------------|------------|------------|
| Spectrum Analyzer                 | ROHDE&SCHWARZ        | FSV-30     | 103118     | 2015.07.01 | 2016.06.30 |
| Vector Signal Generator           | ROHDE&SCHWARZ        | SMBV100A   | 177746     | 2015.07.01 | 2016.06.30 |
| Signal Generator                  | ROHDE&SCHWARZ        | SMB100A    | 260592     | 2015.07.01 | 2016.06.30 |
| Switch Unit with OSP-B157         | ROHDE&SCHWARZ        | OSP120     | 101270     | 2015.07.01 | 2016.06.30 |
| Spectrum Analyzer                 | AGILENT              | E4440A     | MY45304434 | 2015.07.01 | 2016.06.30 |
| EMI Receiver                      | ROHDE&SCHWARZ        | ESRP       | 101036     | 2015.07.01 | 2016.06.30 |
| LISN                              | SCHWARZBECK          | NSLK 8127  | 8127-687   | 2015.07.01 | 2016.06.30 |
| Bluetooth Tester                  | ROHDE&SCHWARZ        | CBT        | 101005     | 2015.07.01 | 2016.06.30 |
| Power Splitter                    | KMW                  | DCPD-LDC   | 1305003215 | 2015.07.01 | 2016.06.30 |
| Power Sensor                      | ROHDE&SCHWARZ        | NRP-Z21    | 103971     | 2015.07.01 | 2016.06.30 |
| Attenuator (20 dB)                | KMW                  | ZA-S1-201  | 110617091  | --         | --         |
| Attenuator (6 dB)                 | KMW                  | ZA-S1-61   | 1305003189 | --         | --         |
| DC Power Supply                   | ROHDE&SCHWARZ        | HMP2020    | 018141664  | 2015.07.01 | 2016.06.30 |
| Temperature Chamber               | ANGELANTIONI SCIENCE | NTH64-40A  | 1310       | 2015.07.01 | 2016.06.30 |
| Test Antenna-Loop(9 kHz-30 MHz)   | SCHWARZBECK          | FMZB 1519  | 1519-037   | 2015.07.01 | 2017.06.30 |
| Test Antenna-Bi-Log(30 MHz-3 GHz) | SCHWARZBECK          | VULB 9163  | 9163-624   | 2015.07.01 | 2017.06.30 |
| Test Antenna-Horn(1-18 GHz)       | SCHWARZBECK          | BBHA 9120D | 9120D-1148 | 2015.07.01 | 2017.06.30 |
| Test Antenna-Horn(15-26.5 GHz)    | SCHWARZBECK          | BBHA 9170  | 9170-305   | 2015.07.01 | 2017.06.30 |
| Anechoic Chamber                  | RAINFORD             | 9m*6m*6m   | N/A        | 2015.02.28 | 2016.02.27 |
| Shielded Enclosure                | ChangNing            | CN-130701  | 130703     | --         | --         |

### 4.3 Test Configurations

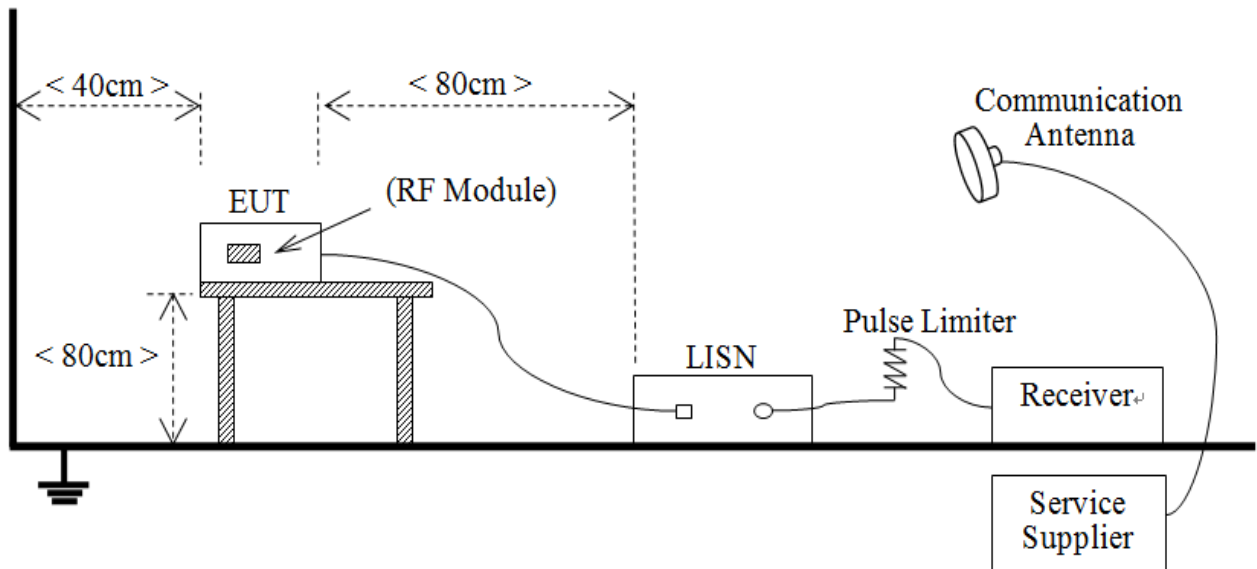
| Test Configurations (TC) NO. | Description                                              |                     |
|------------------------------|----------------------------------------------------------|---------------------|
|                              | Signal Description                                       | Operating Frequency |
| Transmitter                  |                                                          |                     |
| TC01                         | GFSK modulation, package type DH5, hopping on            | --                  |
| TC02                         | GFSK modulation, package type DH5, hopping off           | Ch No. 0/ 2402 MHz  |
| TC03                         | GFSK modulation, package type DH5, hopping off           | Ch No. 39/ 2441 MHz |
| TC04                         | GFSK modulation, package type DH5, hopping off           | Ch No. 78/ 2480 MHz |
| TC05                         | $\pi/4$ -DQPSK modulation, package type DH5, hopping on  | --                  |
| TC06                         | $\pi/4$ -DQPSK modulation, package type DH5, hopping off | Ch No. 0/ 2402 MHz  |
| TC07                         | $\pi/4$ -DQPSK modulation, package type DH5, hopping off | Ch No. 39/ 2441 MHz |
| TC08                         | $\pi/4$ -DQPSK modulation, package type DH5, hopping off | Ch No. 78/ 2480 MHz |
| TC09                         | 8DPSK modulation, package type DH5, hopping on           | --                  |
| TC10                         | 8DPSK modulation, package type DH5, hopping off          | Ch No. 0/ 2402 MHz  |
| TC11                         | 8DPSK modulation, package type DH5, hopping off          | Ch No. 39/ 2441 MHz |
| TC12                         | 8DPSK modulation, package type DH5, hopping off          | Ch No. 78/ 2480 MHz |

### 4.4 Description of Test Setup

#### 4.4.1 For Antenna Port Test

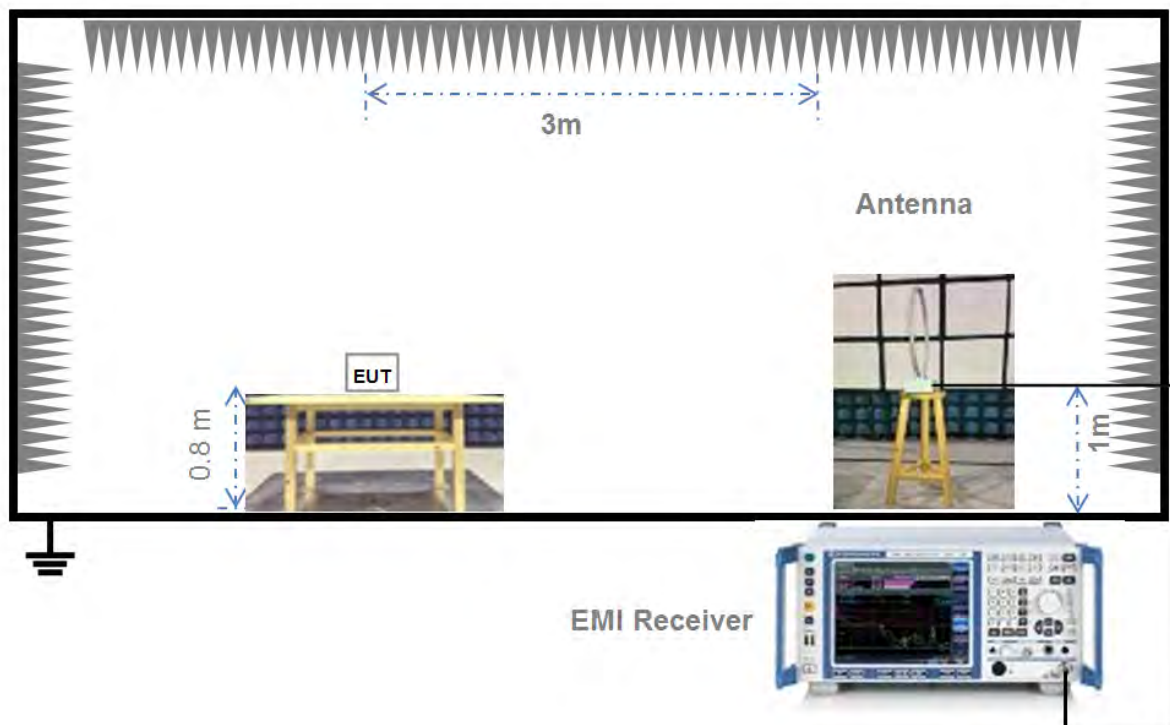


#### 4.4.2 For AC Power Supply Port Test



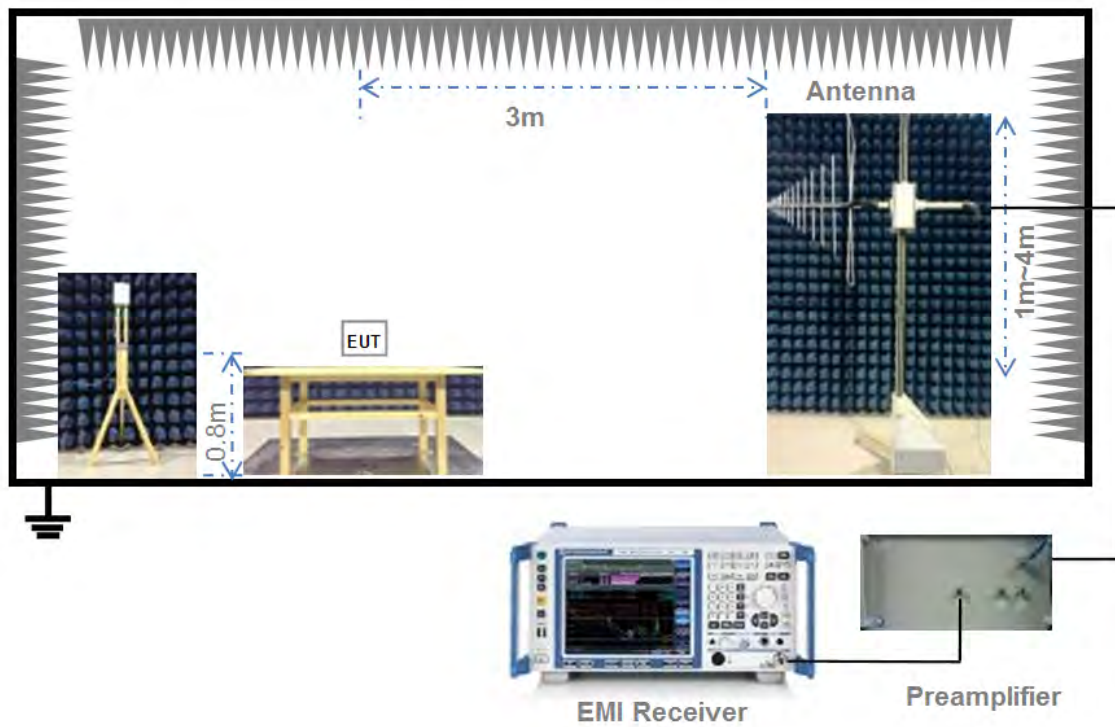
(Diagram 2)

#### 4.4.3 For Radiated Test (Below 30 MHz)



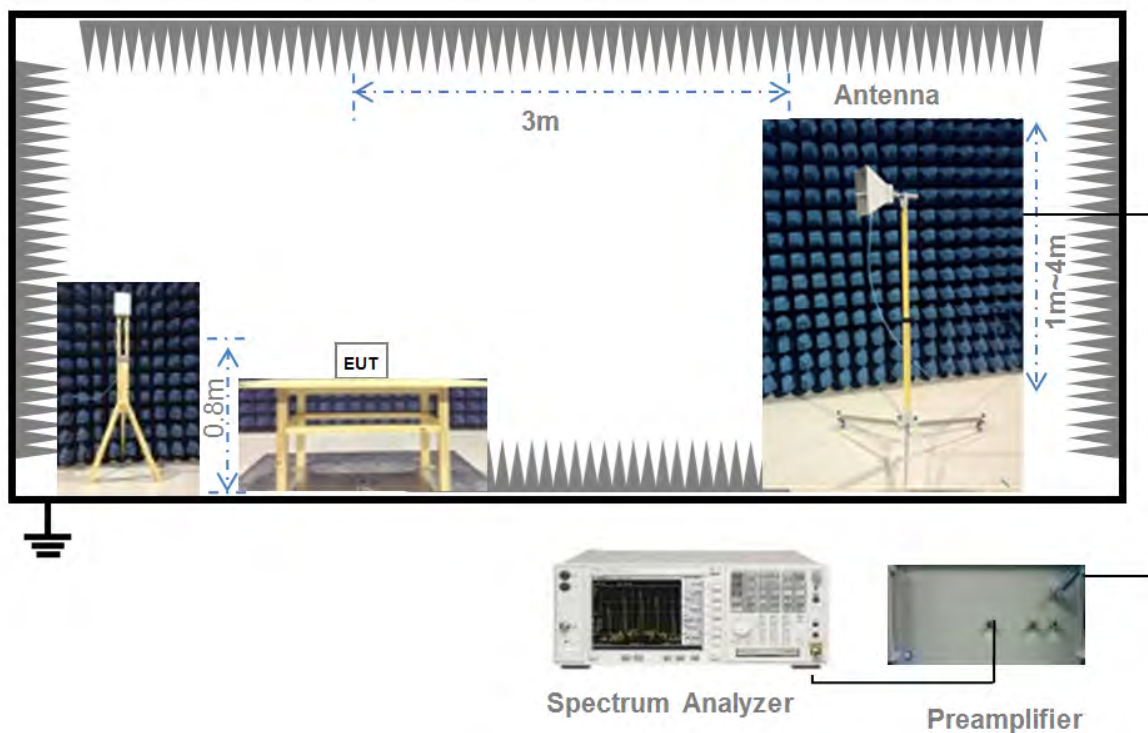
(Diagram 3)

#### 4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

#### 4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

## 4.5 Test Conditions

| Test Case                                                                                                                         | Test Conditions |                                              |                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------------------|------------------------------------------------------------------------|
|                                                                                                                                   | Test Env.       | Test Setup <sup>Note 1</sup>                 | Test Configuration <sup>Note 2</sup>                                   |
| Number of Hopping Frequency                                                                                                       | NTNV            | Test Setup 1                                 | TC01, TC05, TC09                                                       |
| Peak Output Power                                                                                                                 | NTNV            | Test Setup 1                                 | TC02, TC03, TC04, TC06, TC07, TC08, TC10, TC11, TC12                   |
| Occupied Bandwidth                                                                                                                | NTNV            | Test Setup 1                                 | TC02, TC03, TC04, TC06, TC07, TC08, TC10, TC11, TC12                   |
| Carrier Frequency Separation                                                                                                      | NTNV            | Test Setup 1                                 | TC01, TC05, TC09                                                       |
| Time of Occupancy (Dwell time)                                                                                                    | NTNV            | Test Setup 1                                 | TC01, TC05, TC09                                                       |
| Conducted Spurious Emission                                                                                                       | NTNV            | Test Setup 1                                 | TC02, TC03, TC04, TC06, TC07, TC08, TC10, TC11, TC12                   |
| Conducted Emission                                                                                                                | NTNV            | Test Setup 2                                 | TC01, TC02, TC03, TC04, TC05, TC06, TC07, TC08, TC09, TC10, TC11, TC12 |
| Radiated Emission                                                                                                                 | NTNV            | Test Setup 3<br>Test Setup 4<br>Test Setup 5 | TC01, TC02, TC03, TC04, TC05, TC06, TC07, TC08, TC09, TC10, TC11, TC12 |
| Band Edge                                                                                                                         | NTNV            | Test Setup 5                                 | TC01, TC02, TC04, TC05, TC06, TC08, TC09, TC10, TC12                   |
| Note:<br>1. Please refer to section 4.4 for test setup details.<br>2. Please refer to section 4.3 for test configuration details. |                 |                                              |                                                                        |

## 4.6 Measurement Results Explanation Example

### 4.6.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

### 4.6.2 For radiated band edges and spurious emission test:

Per part 15.35(c), the EUT Bluetooth average emission level could be determined by the peak emission level applying duty cycle correction factor, to represent averaging over the whole pulse train.

The average level is derived from the peak level corrected with "Duty cycle correction factor".

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + Duty cycle correction factor (dB)

Duty cycle correction factor (dB) =  $20 * \log (\text{Duty cycle})$ .

Duty cycle = on time / 100 milliseconds

On time = dwell time \* hopping number in 100 ms

For example: bluetooth with dwell time 2.9 ms and 3 hops in 100 ms, then

Duty cycle correction factor (dB) =  $20 * \log ((2.9 * 3) / 100) = -21.21 \text{ dB}$

Following shows an average computation example with duty cycle correction factor = -21.21 dB, and the peak emission level is 45.61 dBuV/m.

Example:

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + duty cycle correction factor (dB)  
=  $45.61 + (-21.21) = 24.4 \text{ (dBuV/m)}$

## 5 TEST ITEMS

### 5.1 Antenna Requirements

#### 5.1.1 Standard Applicable

FCC §15.203 & 15.247(b)

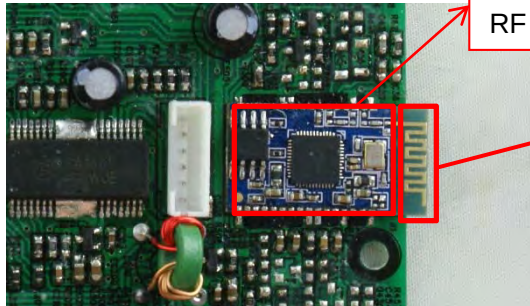
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply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

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

#### 5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

| Protected Method              | Description                                                               |
|-------------------------------|---------------------------------------------------------------------------|
| The antenna is An embedded-in | The antenna is welded on the mainboard, can't be replaced by the consumer |

| Reference Documents | Item                                                                                 |
|---------------------|--------------------------------------------------------------------------------------|
| Photo               |  |

#### 5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

## 5.2 Number of Hopping Frequency

### 5.2.1 Limit

FCC §15.247(a) (1) (iii)

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

### 5.2.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.2.3 Test Procedure

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

Span = the frequency band of operation

RBW  $\geq$  1% of the span

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 5.2.4 Test Result

Please refer to ANNEX A.1.

## 5.3 Peak Output Power

### 5.3.1 Test Limit

FCC § 15.247(b)

For frequency hopping systems that operates in the 2400 MHz to 2483.5 MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1 Watt.

### 5.3.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.3.3 Test Procedure

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

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  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

### 5.3.4 Test Result

Please refer to ANNEX A.2.

## 5.4 Occupied Bandwidth

### 5.4.1 Limit

FCC §15.247(a)

The 20 dB bandwidth is known as the 99% emission bandwidth, or 20 dB bandwidth ( $10 \cdot \log 1\% = 20$  dB) taking the total RF output power.

### 5.4.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.4.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW  $\geq$  1% of the 20 dB bandwidth

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

### 5.4.4 Test Result

Please refer to ANNEX A.3.

## 5.5 Carrier Frequency Separation

### 5.5.1 Limit

FCC §15.247(a)

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

### 5.5.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.5.3 Test Procedure

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

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW)  $\geq 1\%$  of the span

Video (or Average) Bandwidth (VBW)  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

### 5.5.4 Test Result

Please refer to ANNEX A.4.

## 5.6 Time of Occupancy (Dwell time)

### 5.6.1 Limit

FCC §15.247(a)

Frequency hopping systems in the 2400 MHz - 2483.5 MHz band shall use at least 15 non-overlapping channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 5.6.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.6.3 Test Procedure

The average time of occupancy on any channel within the Period can be calculated with formulas:

For DH1 package type

$$\{\text{Total of Dwell}\} = \{\text{Pulse Time}\} * (1600 / 2) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\}$$

$$\{\text{Period}\} = 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}$$

For DH3 package type

$$\{\text{Total of Dwell}\} = \{\text{Pulse Time}\} * (1600 / 4) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\}$$

$$\{\text{Period}\} = 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}$$

For DH5 package type

$$\{\text{Total of Dwell}\} = \{\text{Pulse Time}\} * (1600 / 6) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\}$$

$$\{\text{Period}\} = 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}$$

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

### 5.6.4 Test Result

Please refer to ANNEX A.5.

## 5.7 Conducted Spurious Emission

### 5.7.1 Limit

FCC §15.247(d)

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.

### 5.7.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.7.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 5.7.4 Test Result

Please refer to ANNEX A.6.

## 5.8 Conducted Emission

### 5.8.1 Limit

FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

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

### 5.8.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.8.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

### 5.8.4 Test Result

Please refer to ANNEX A.7.

## 5.9 Radiated Spurious Emission

### 5.9.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

Note:

1. Field Strength ( $\text{dB}\mu\text{V/m}$ ) =  $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$ .
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics:  $54\text{dB}\mu\text{V/m}@3\text{m (AV)}$  and  $74\text{dB}\mu\text{V/m}@3\text{m (PK)}$ .

### 5.9.2 Test Setup

The section 4.4.1 (Diagram 3-5) test setup description was used for this test.

### 5.9.3 Test Procedure

The measurement frequency range is from 30 MHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from  $0^\circ$  to  $360^\circ$ , and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

#### 5.9.4 Test Result

Please refer to ANNEX A.8.

## 5.10 Band Edge

### 5.10.1 Limit

FCC §15.209&15.247(d)

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.

### 5.10.2 Test Setup

The section 4.4.1 (Diagram 1) test setup description was used for this test.

### 5.10.3 Test Procedure

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

RBW  $\geq$  1% of the span

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak /AV

Trace = max hold

Allow the trace to stabilize.

$E \text{ [dB}\mu\text{V/m]} = UR + AT + A\text{Factor [dB]}; AT = LCable \text{ loss [dB]} - G\text{preamp [dB]}$

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

### 5.10.4 Test Result

Please refer to ANNEX A.9.

## ANNEX A TEST RESULT

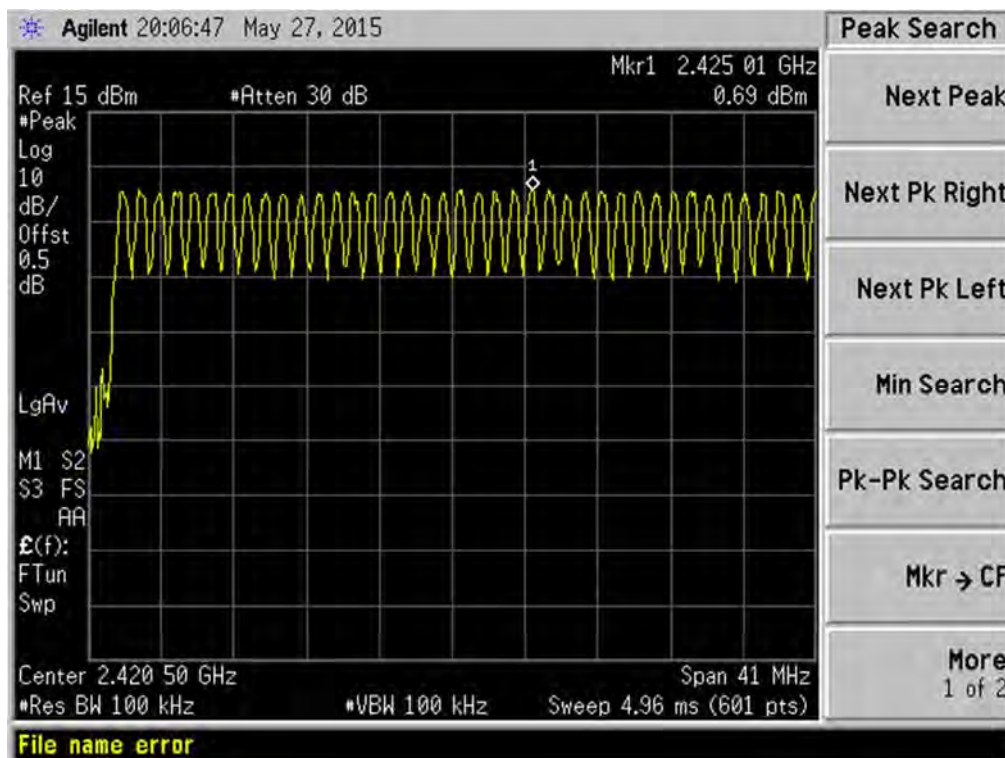
### A.1 Number of Hopping Frequency

#### Test Data

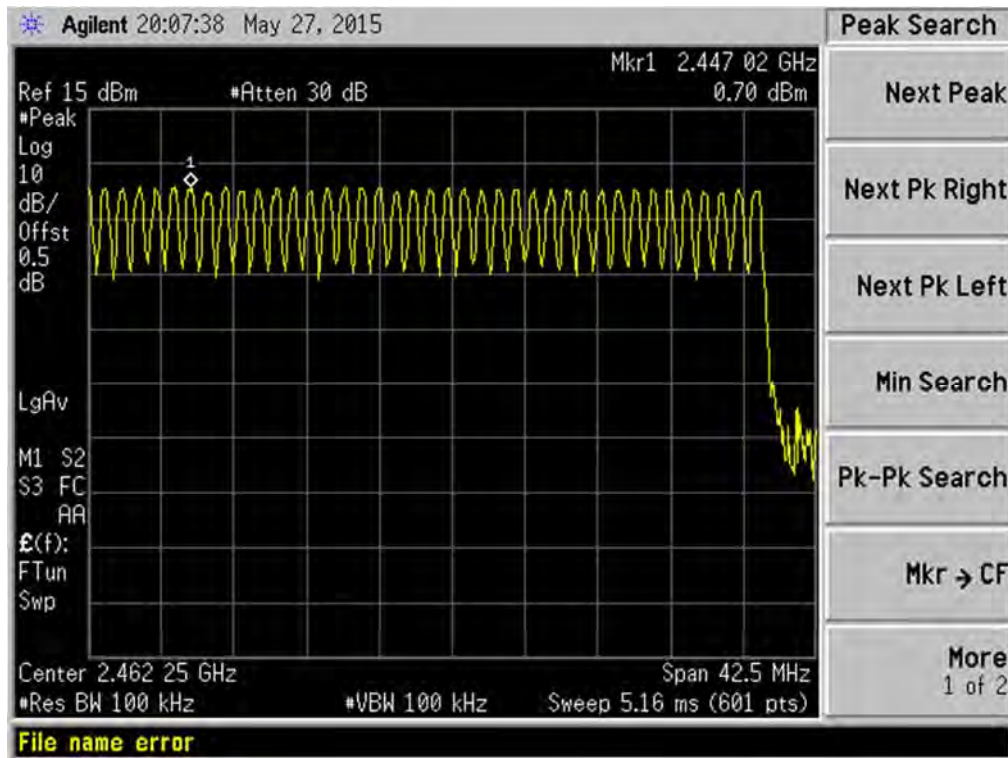
| Test Mode | Frequency Block (MHz) | Measured Channel Numbers | Min. Limit | Verdict |
|-----------|-----------------------|--------------------------|------------|---------|
| GFSK      | 2400 - 2483.5         | 79                       | 15         | Pass    |
| π/4-DQPSK | 2400 - 2483.5         | 79                       | 15         | Pass    |
| 8-DPSK    | 2400 - 2483.5         | 79                       | 15         | Pass    |

#### Test plots

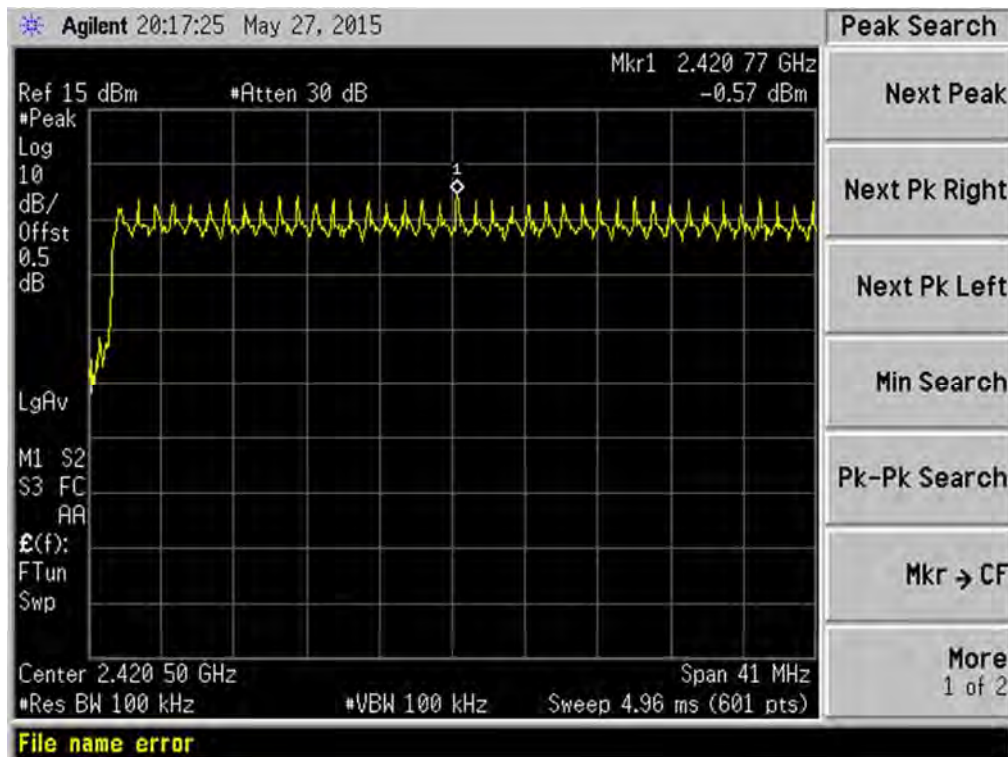
GFSK 2.4 GHz ~ 2.4415 GHz



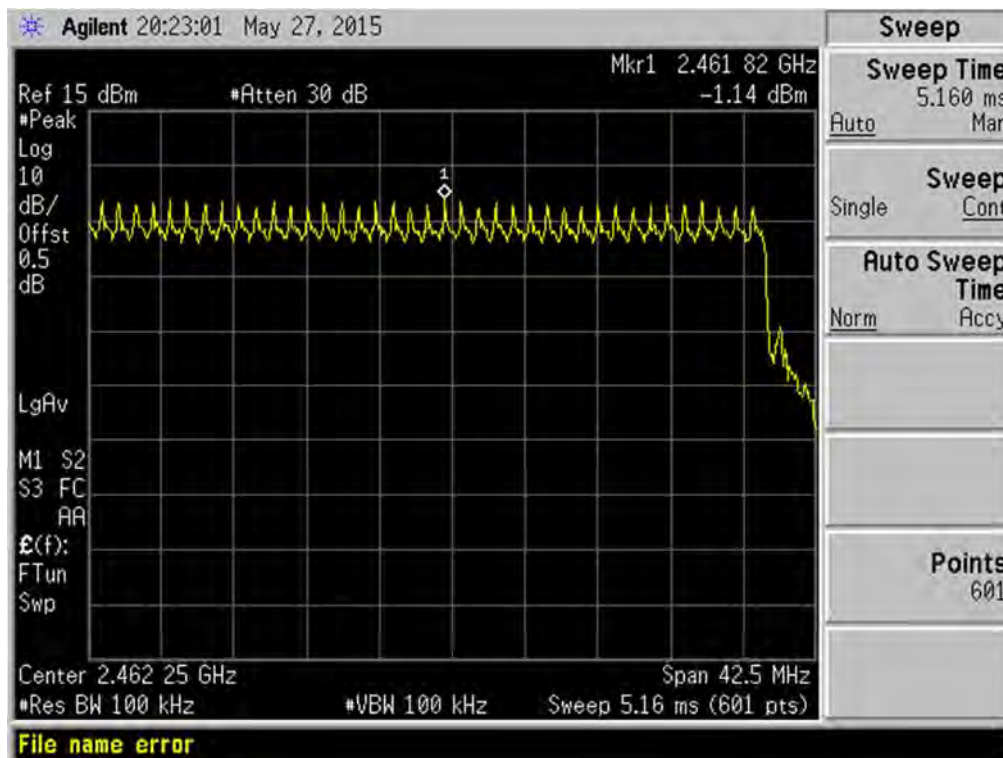
## GFSK 2.4415 GHz ~ 2.4835 GHz



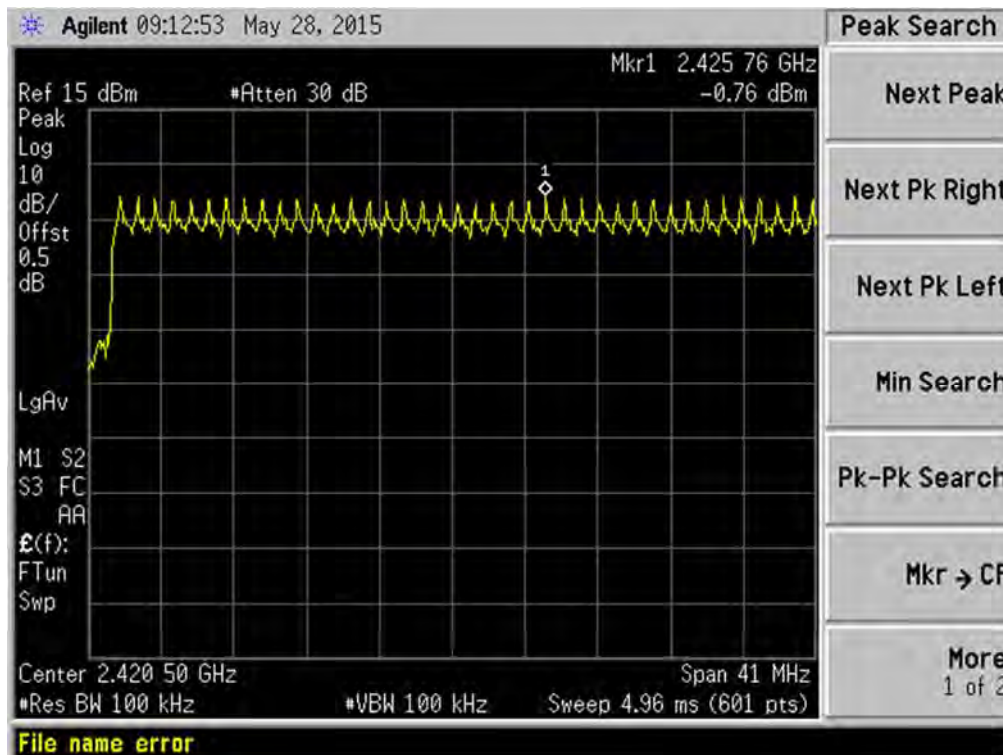
## π/4-DQPSK 2.4 GHz ~ 2.4415 GHz



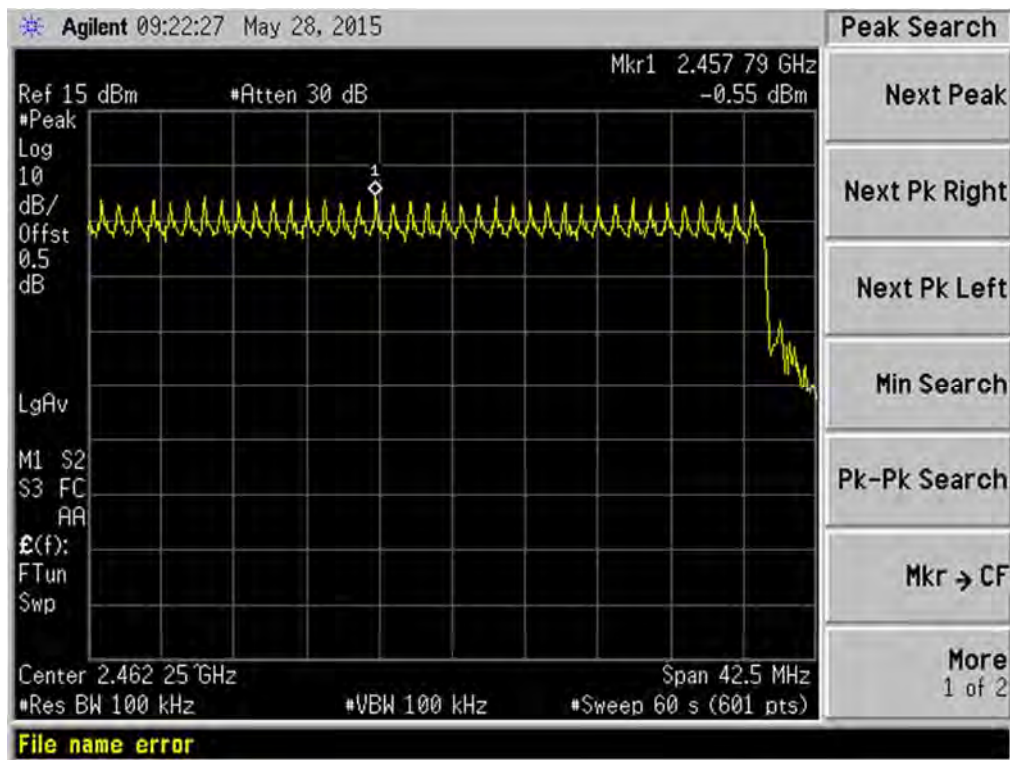
### □/4-DQPSK 2.4415 GHz ~ 2.4835 GHz



### 8-DPSK 2.4 GHz ~ 2.4415 GHz



## 8-DPSK 2.4415 GHz ~ 2.4835 GHz



## A.2 Peak Output Power

### Test Data

GFSK Mode:

| Channel | Measured Output Peak Power |      | Limit |      | Verdict |
|---------|----------------------------|------|-------|------|---------|
|         | dBm                        | mW   | dBm   | mW   |         |
| Low     | -1.70                      | 0.68 | 30    | 1000 | Pass    |
| Middle  | -2.12                      | 0.61 |       |      | Pass    |
| High    | -2.43                      | 0.57 |       |      | Pass    |

π/4-DQPSK Mode:

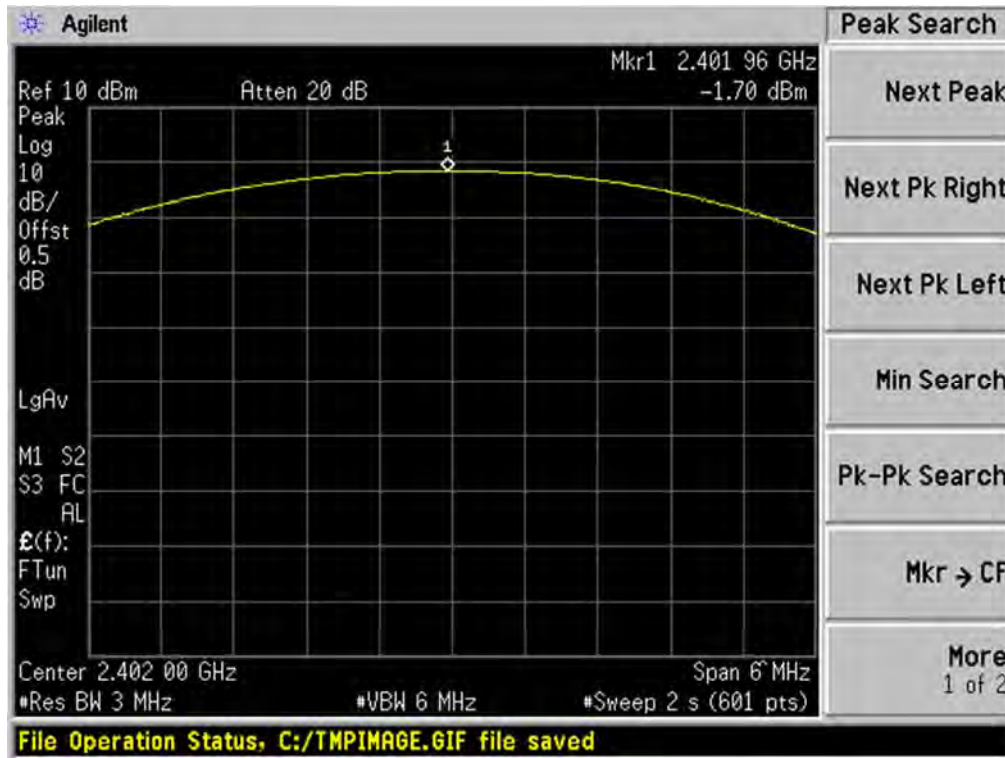
| Channel | Measured Output Peak Power |      | Limit |      | Verdict |
|---------|----------------------------|------|-------|------|---------|
|         | dBm                        | mW   | dBm   | mW   |         |
| Low     | -1.71                      | 0.67 | 30    | 1000 | Pass    |
| Middle  | -2.13                      | 0.61 |       |      | Pass    |
| High    | -2.42                      | 0.57 |       |      | Pass    |

8-DPSK Mode:

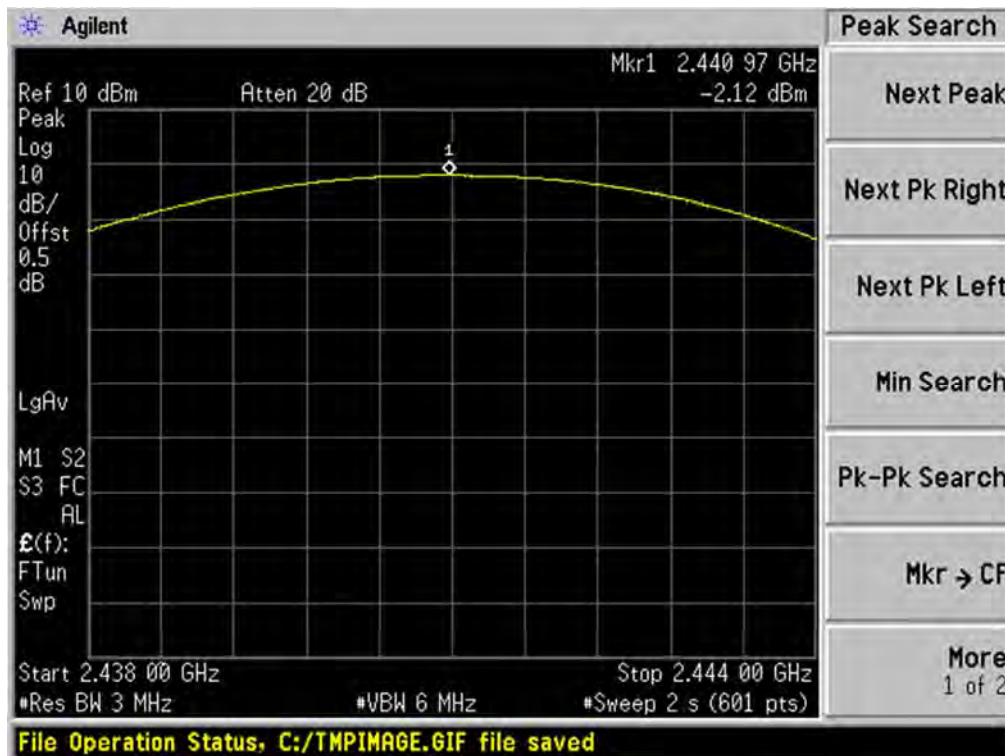
| Channel | Measured Output Peak Power |      | Limit |      | Verdict |
|---------|----------------------------|------|-------|------|---------|
|         | dBm                        | mW   | dBm   | mW   |         |
| Low     | -1.70                      | 0.68 | 30    | 1000 | Pass    |
| Middle  | -2.12                      | 0.61 |       |      | Pass    |
| High    | -2.42                      | 0.57 |       |      | Pass    |

## Test plots

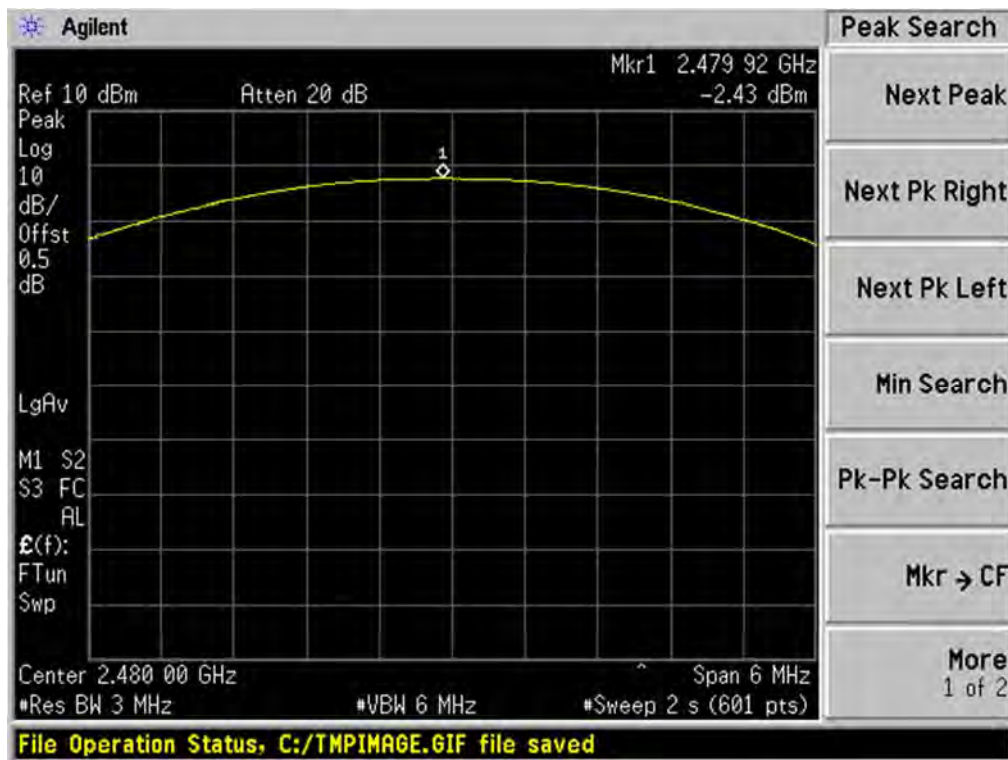
### GFSK LOW CHANNEL



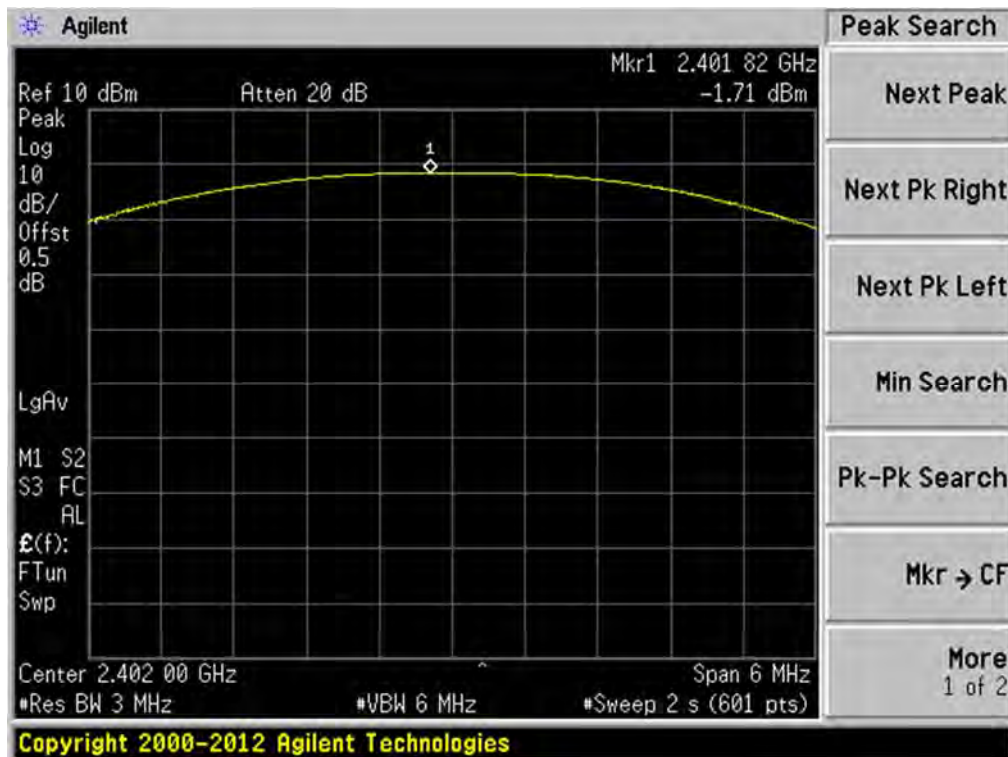
### GFSK MIDDLE CHANNEL



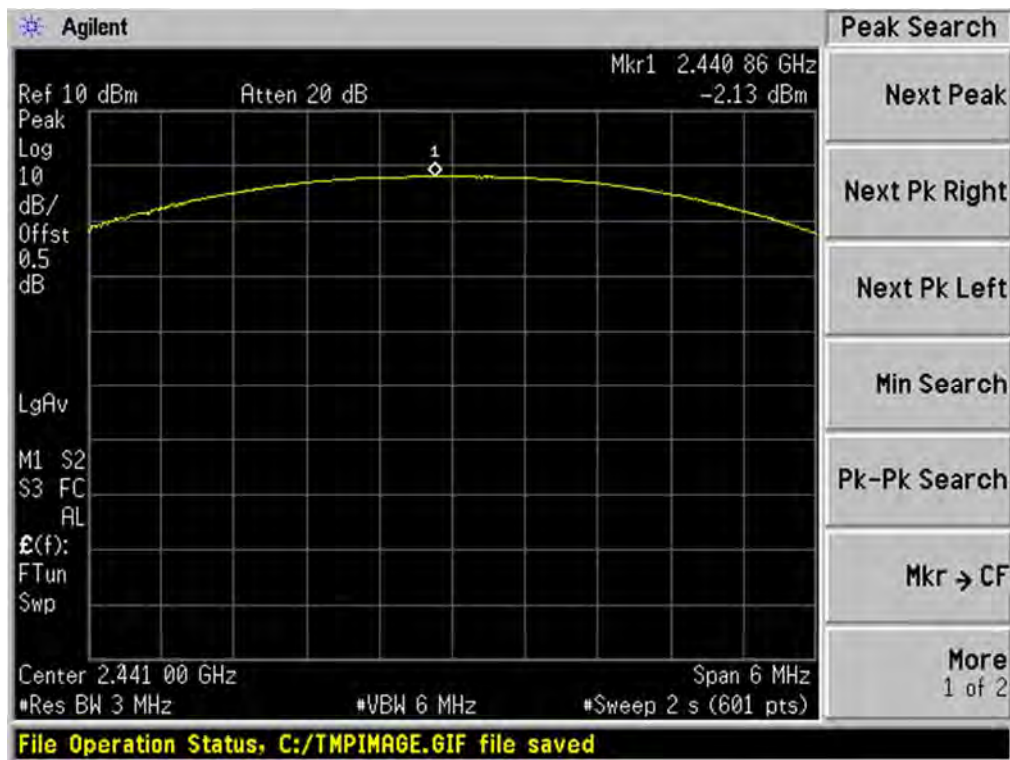
### GFSK HIGH CHANNEL



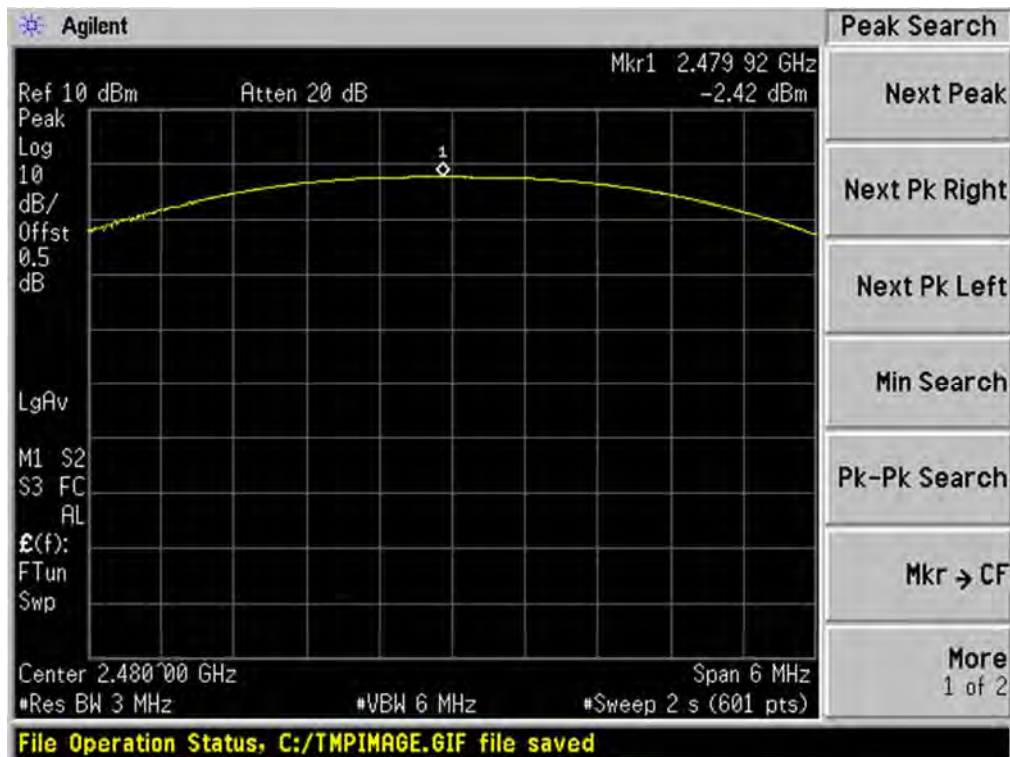
### π/4-DQPSK LOW CHANNEL



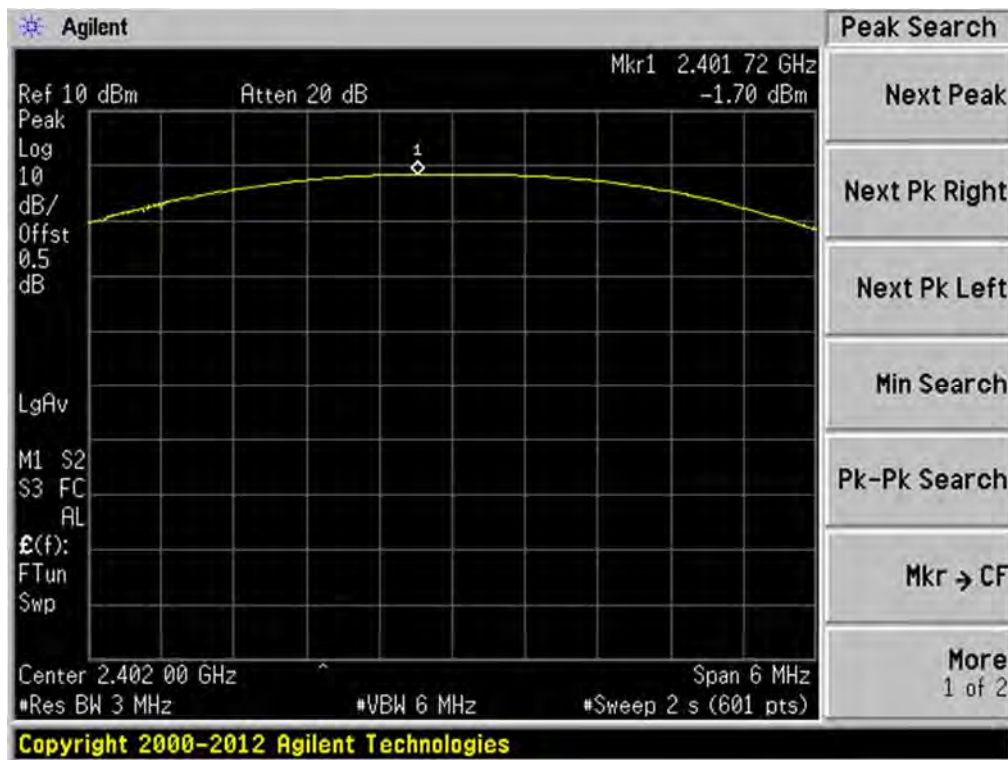
### □/4-DQPSK MIDDLE CHANNEL



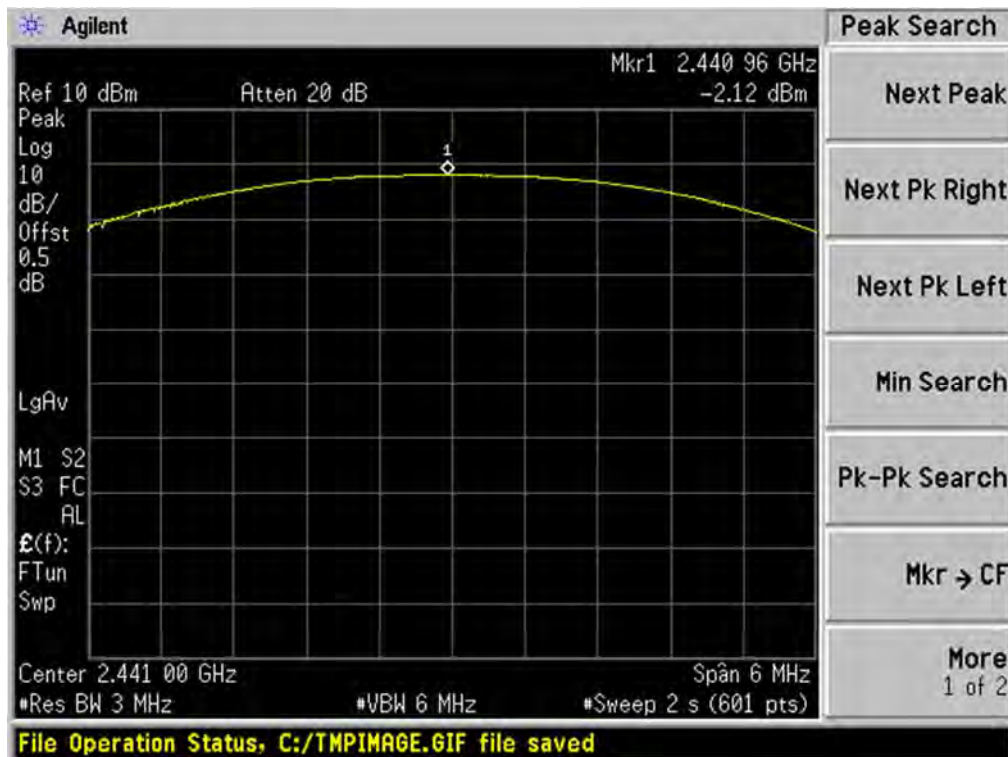
### □/4-DQPSK HIGH CHANNEL



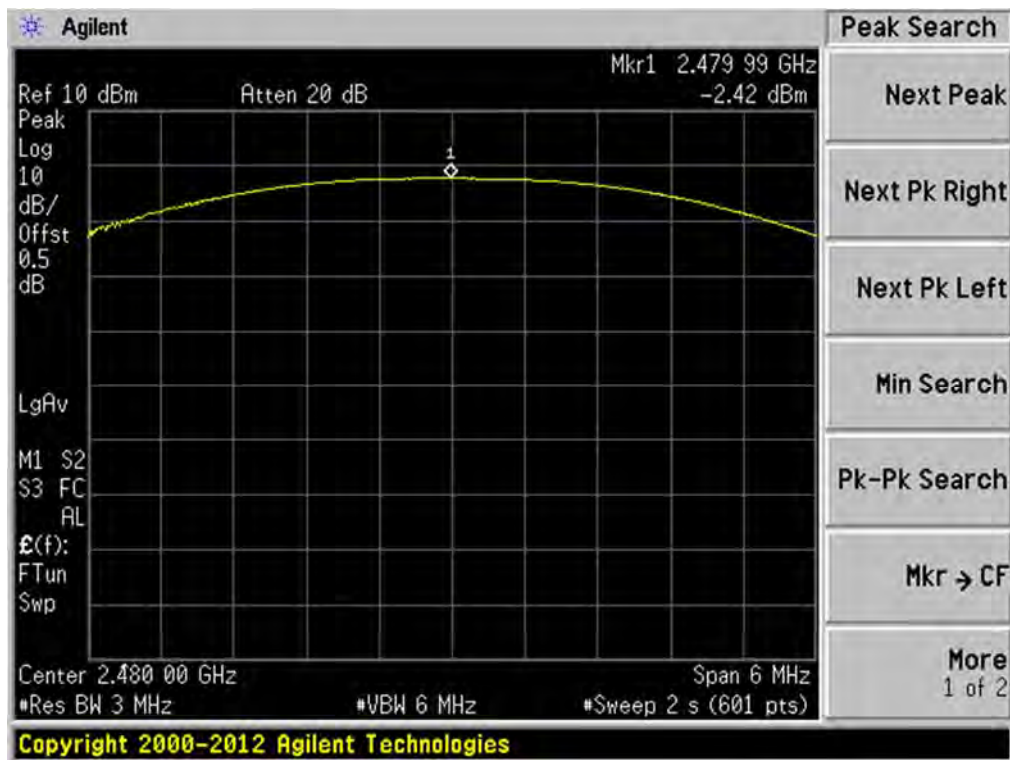
### 8-DPSK LOW CHANNEL



### 8-DPSK MIDDLE CHANNEL



## 8-DPSK HIGH CHANNEL



### A.3 20dB and 99% bandwidth

#### Test Data

GFSK Mode:

| Channel | 20 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(kHz) |
|---------|--------------------------|------------------------|
| Low     | 1.168                    | 1.0578                 |
| Middle  | 1.190                    | 1.0694                 |
| High    | 1.193                    | 1.0740                 |

π/4-DQPSK Mode:

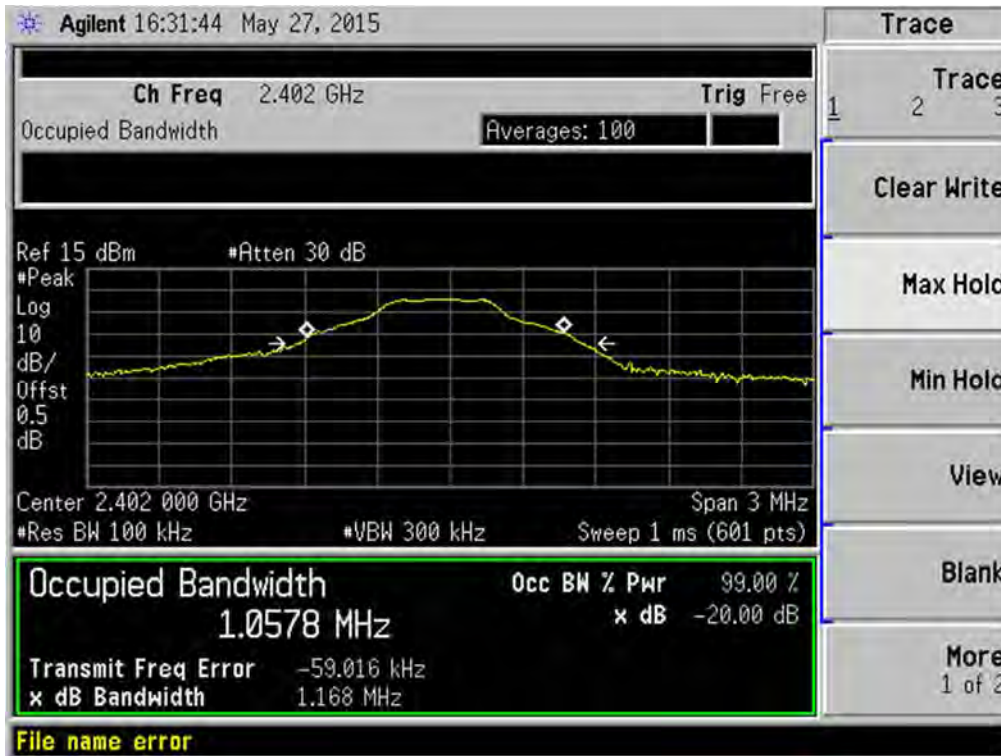
| Channel | 20 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------------|------------------------|
| Low     | 1.374                    | 1.8007                 |
| Middle  | 1.399                    | 1.7871                 |
| High    | 1.377                    | 1.7365                 |

8-DPSK Mode:

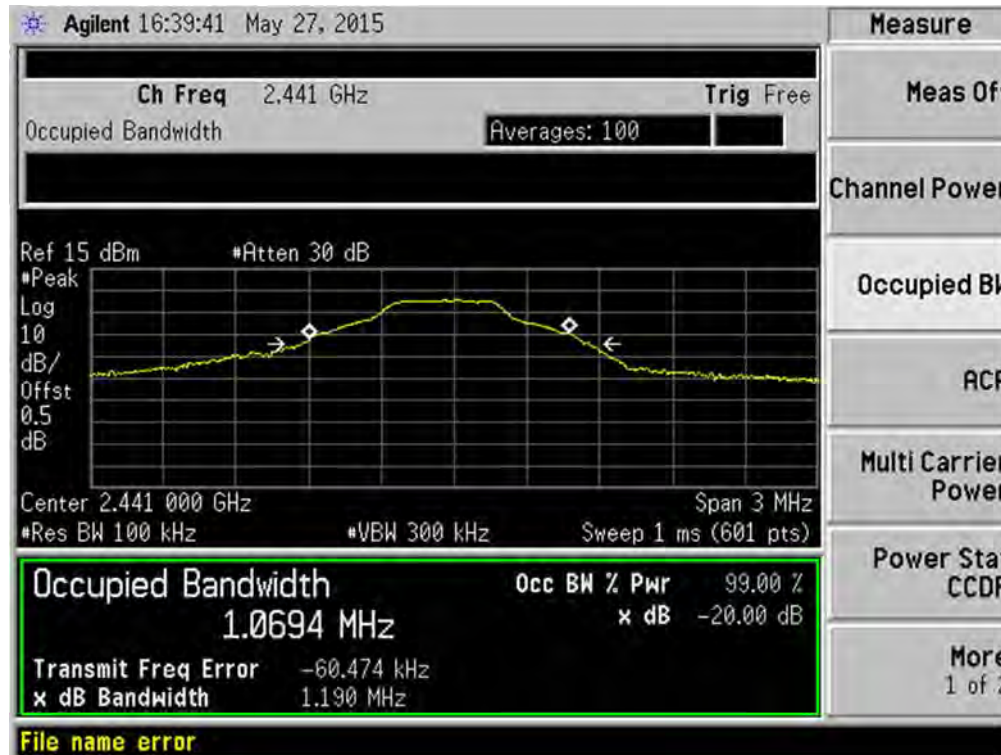
| Channel | 20 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------------|------------------------|
| Low     | 1.398                    | 1.7846                 |
| Middle  | 1.387                    | 1.7017                 |
| High    | 1.388                    | 1.7359                 |

# Test plots

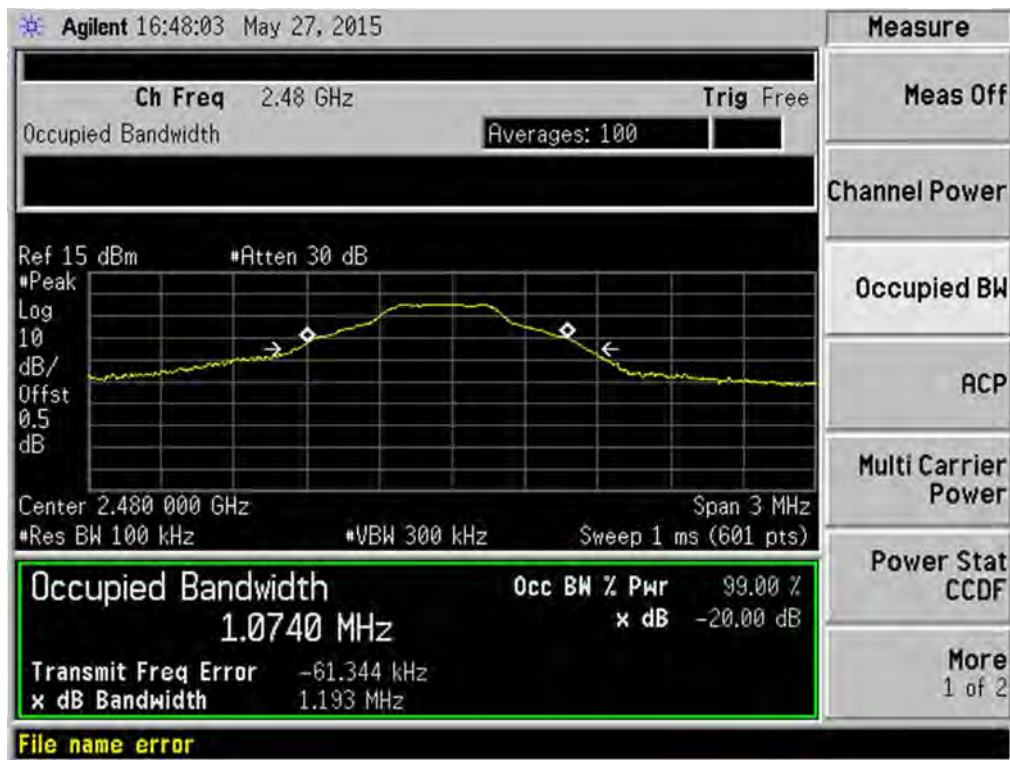
## GFSK LOW CHANNEL



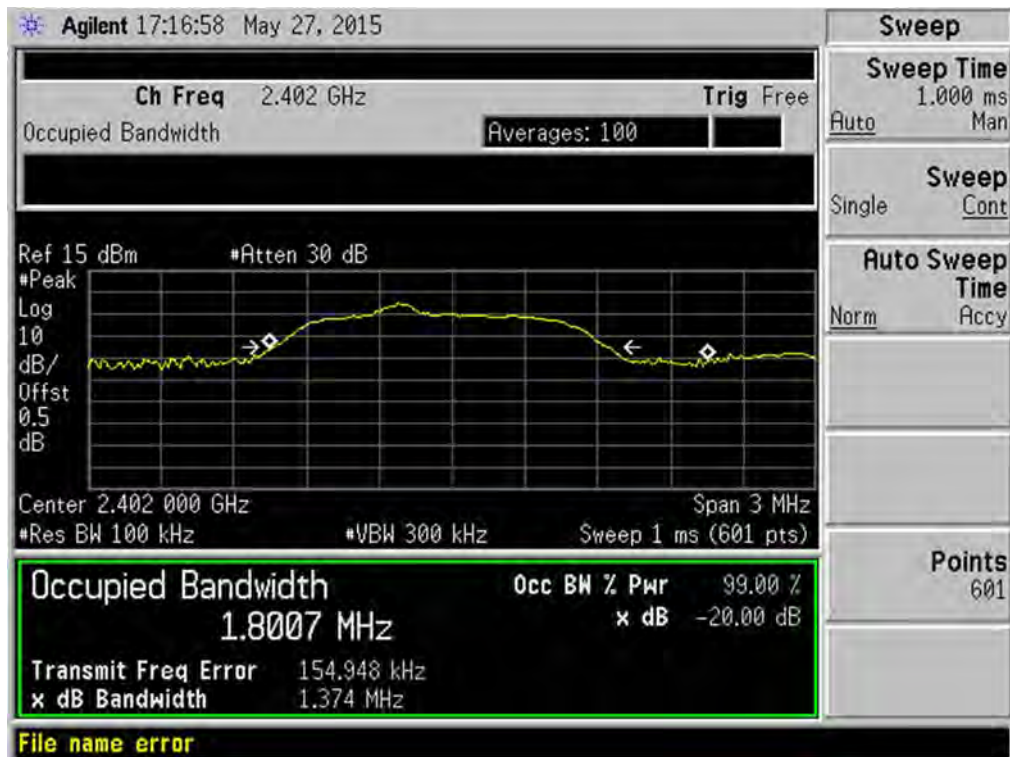
## GFSK MIDDLE CHANNEL



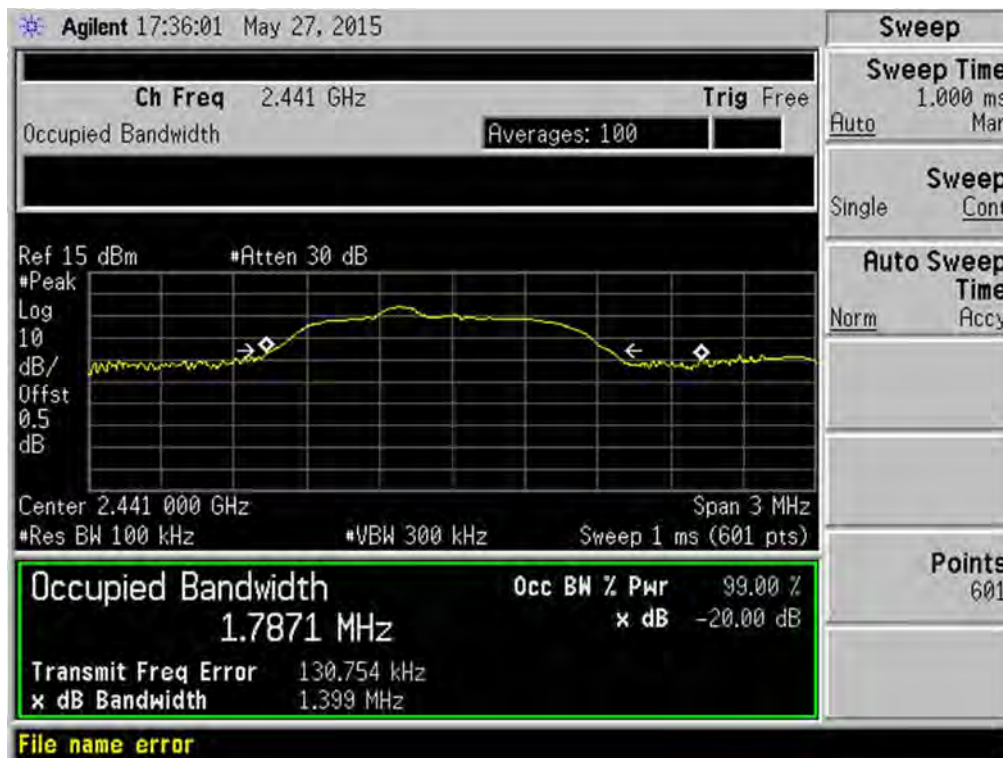
### GFSK HIGH CHANNEL



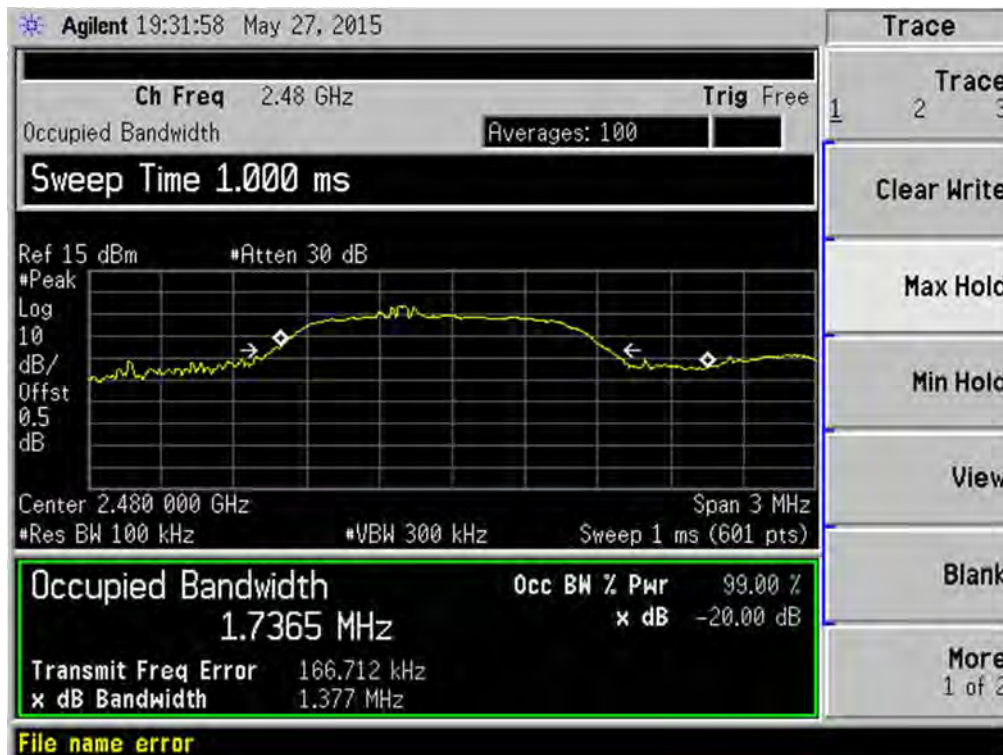
### π/4-DQPSK LOW CHANNEL



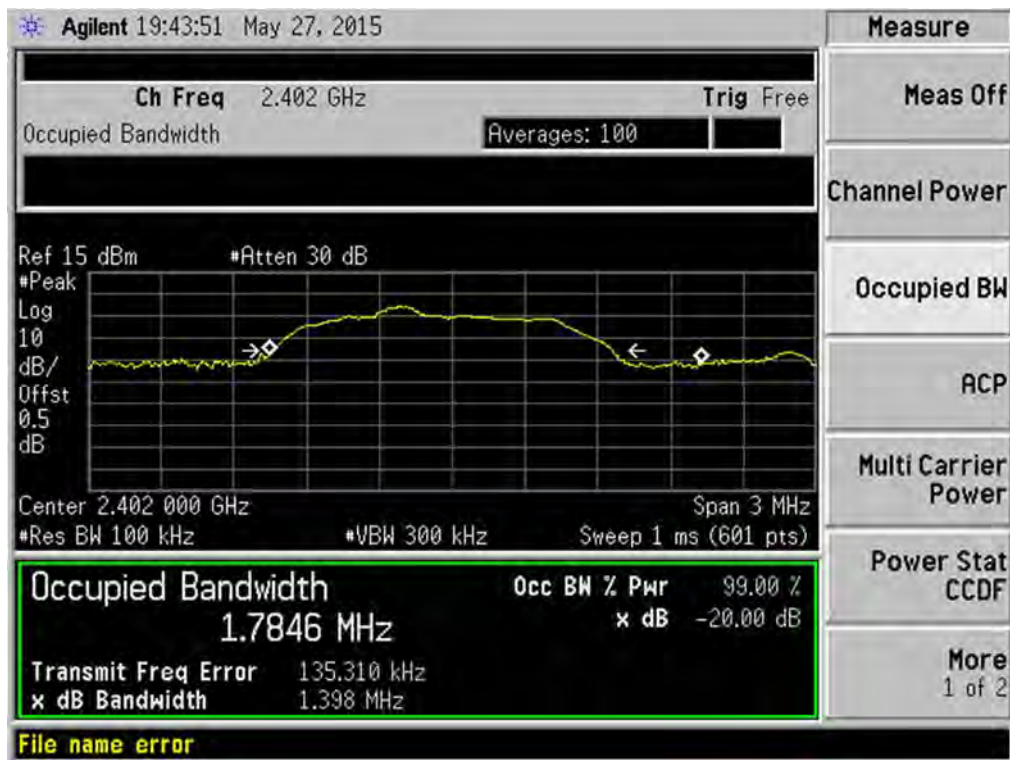
# □/4-DQPSK MIDDLE CHANNEL



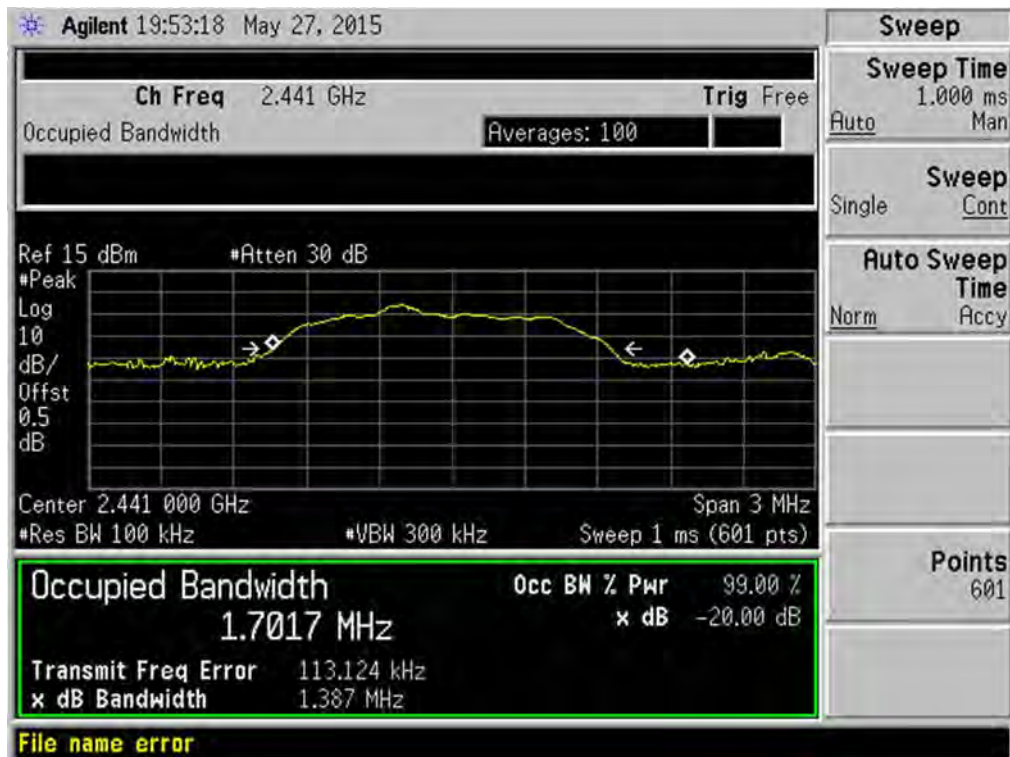
# □/4-DQPSK HIGH CHANNEL



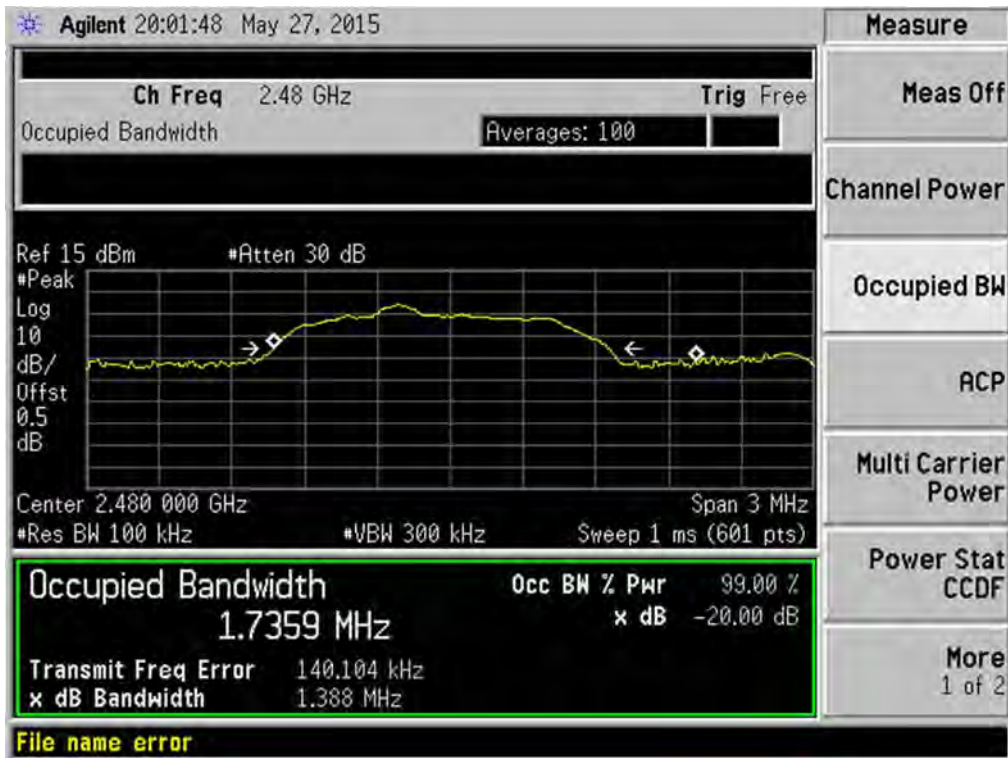
### 8-DPSK LOW CHANNEL



### 8-DPSK MIDDLE CHANNEL



## 8-DPSK HIGH CHANNEL



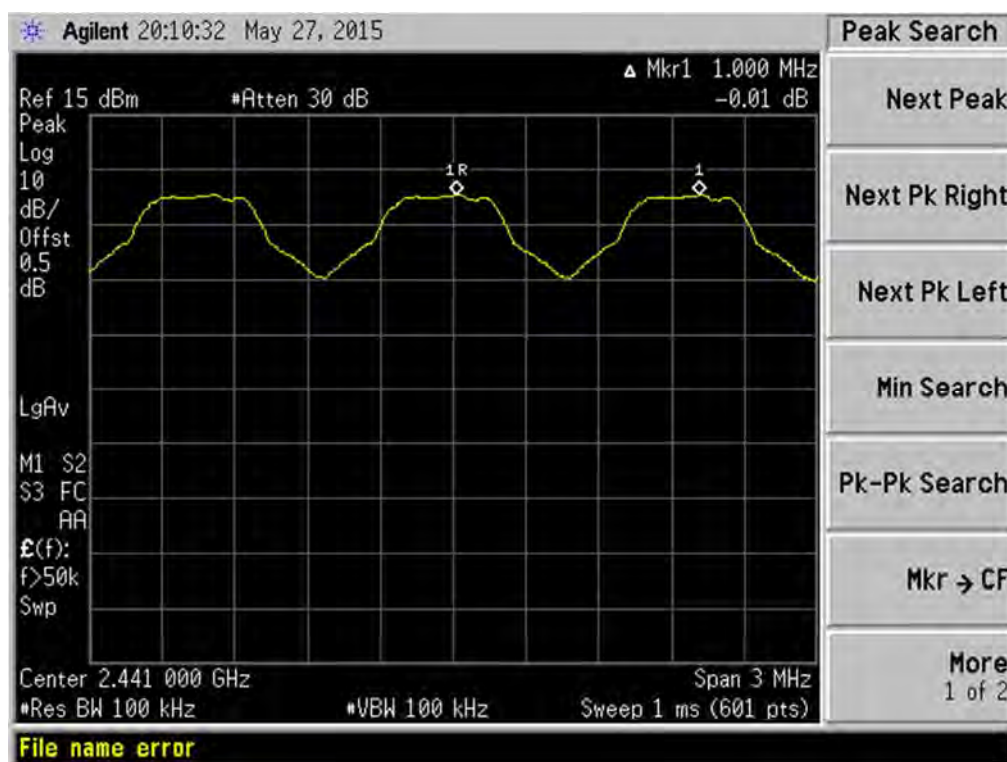
## A.4 Hopping Frequency Separation

### Test Data

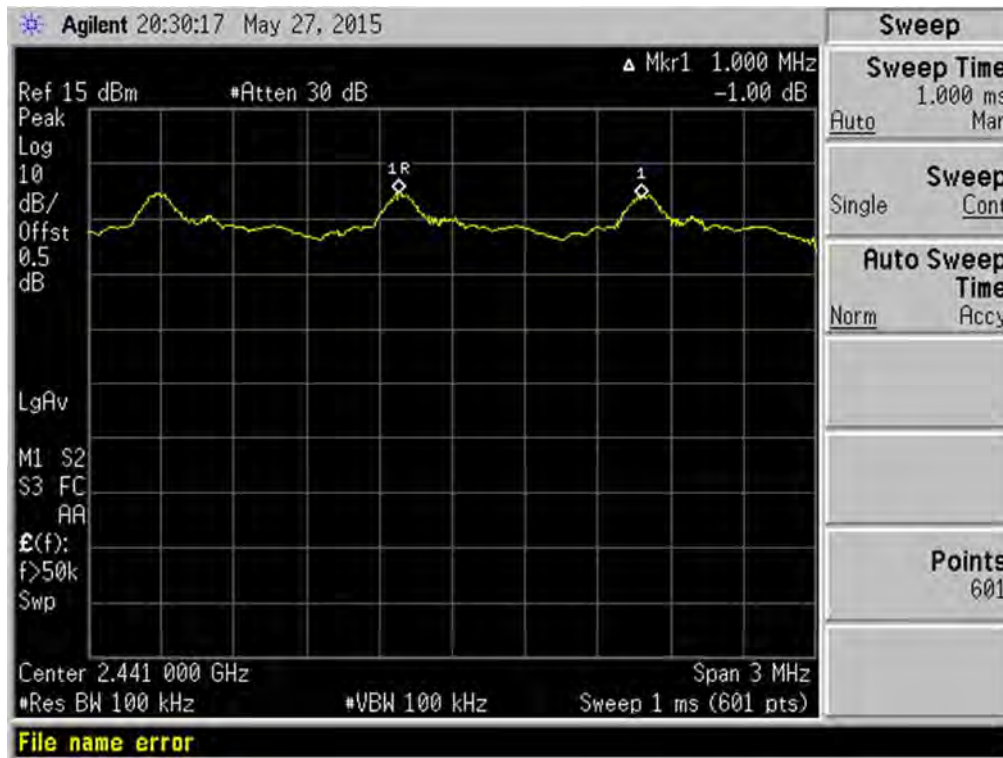
| Mode           | Frequency separation (MHz) | Max 20 dB Bandwidth (MHz) | Two-thirds of the 20 dB bandwidth (MHz) | Verdict |
|----------------|----------------------------|---------------------------|-----------------------------------------|---------|
| GFSK           | 1.000                      | 1.193                     | 0.795                                   | Pass    |
| $\Pi/4$ -DQPSK | 1.000                      | 1.399                     | 0.933                                   | Pass    |
| 8-DPSK         | 1.000                      | 1.398                     | 0.932                                   | Pass    |

### Test plots

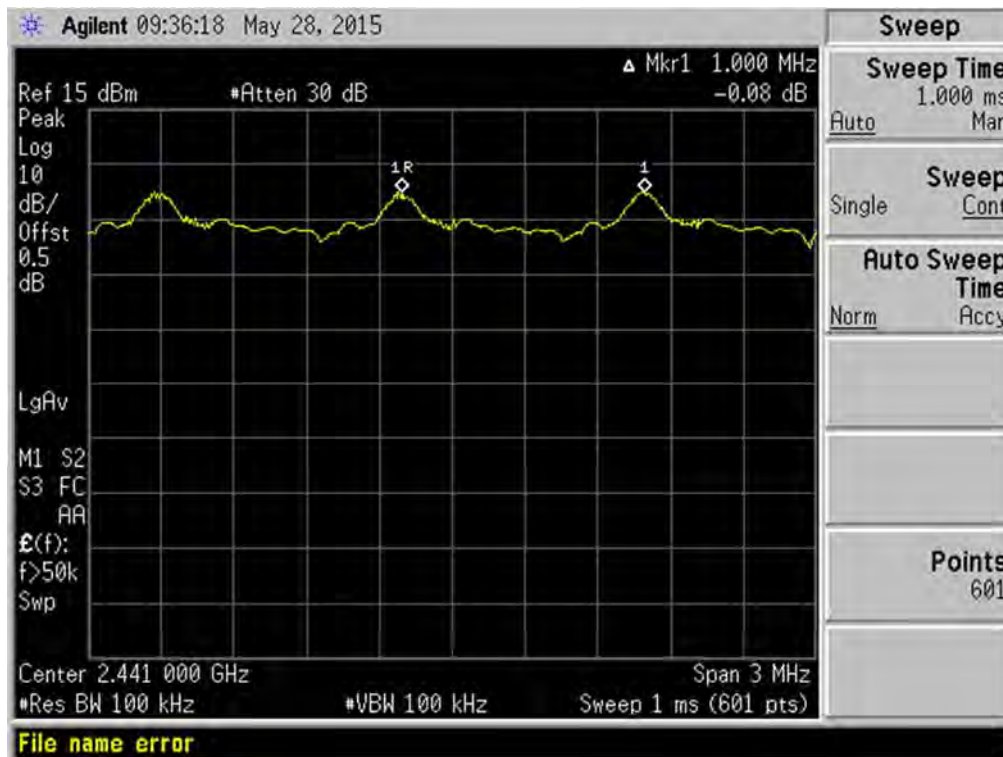
#### GFSK



### □/4-DQPSK



### 8-DPSK



## A.5 Average Time of Occupancy

### Test Data

GFSK Mode:

| DH Packet | Pulse Width (ms) | Total of Dwell (ms) | Limit (sec) | Verdict |
|-----------|------------------|---------------------|-------------|---------|
| DH 1      | 0.520            | 166.405             | 0.4         | Pass    |
| DH 3      | 1.653            | 264.488             | 0.4         | Pass    |
| DH 5      | 2.800            | 298.676             | 0.4         | Pass    |

π/4-DQPSK Mode:

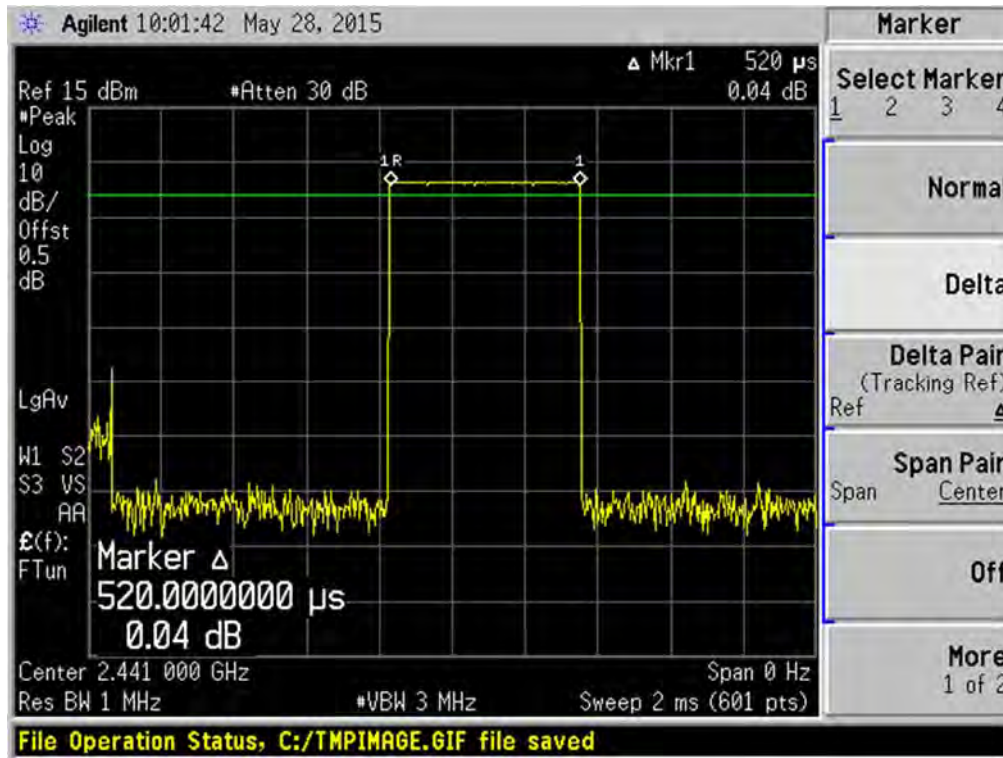
| DH Packet | Pulse Width (ms) | Total of Dwell (ms) | Limit (sec) | Verdict |
|-----------|------------------|---------------------|-------------|---------|
| DH 1      | 0.563            | 180.166             | 0.4         | Pass    |
| DH 3      | 1.653            | 264.488             | 0.4         | Pass    |
| DH 5      | 2.773            | 295.796             | 0.4         | Pass    |

8-DPSK Mode:

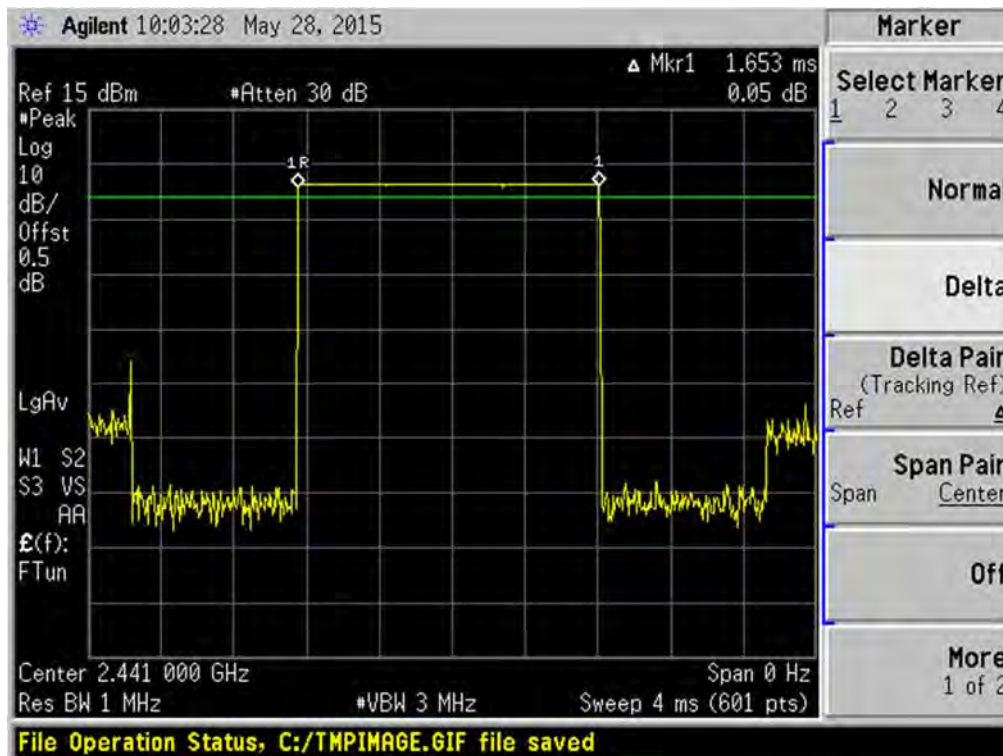
| DH Packet | Pulse Width (ms) | Total of Dwell (ms) | Limit (sec) | Verdict |
|-----------|------------------|---------------------|-------------|---------|
| DH 1      | 0.517            | 165.125             | 0.4         | Pass    |
| DH 3      | 1.673            | 267.688             | 0.4         | Pass    |
| DH 5      | 2.967            | 316.490             | 0.4         | Pass    |

# Test Plots

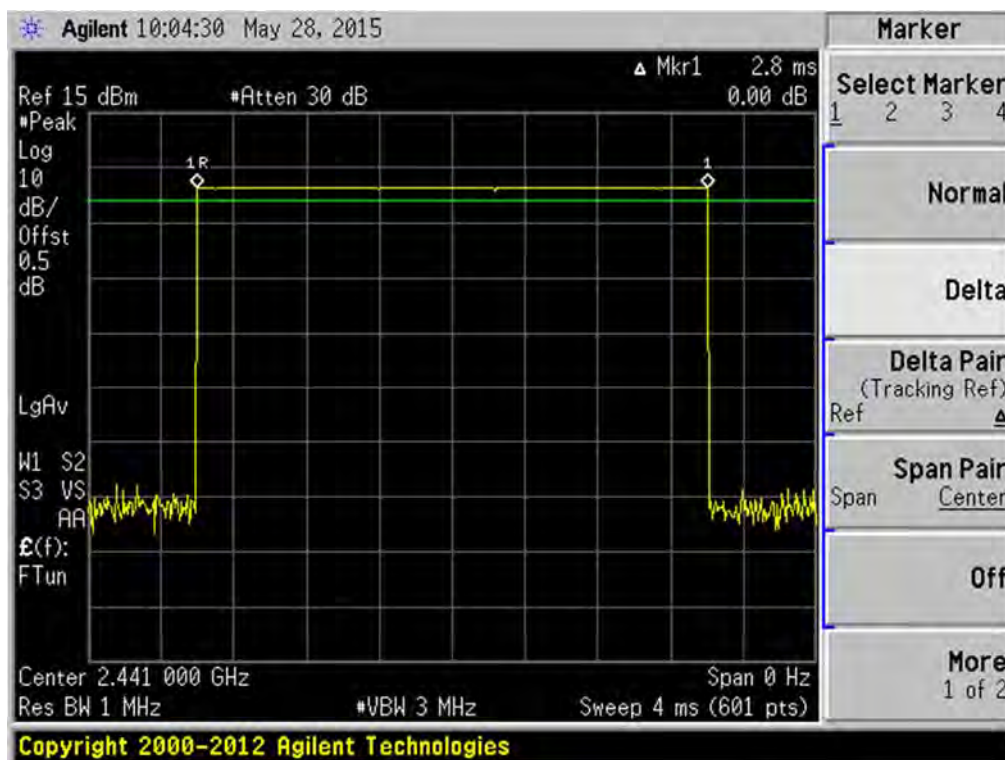
## GFSK DH1



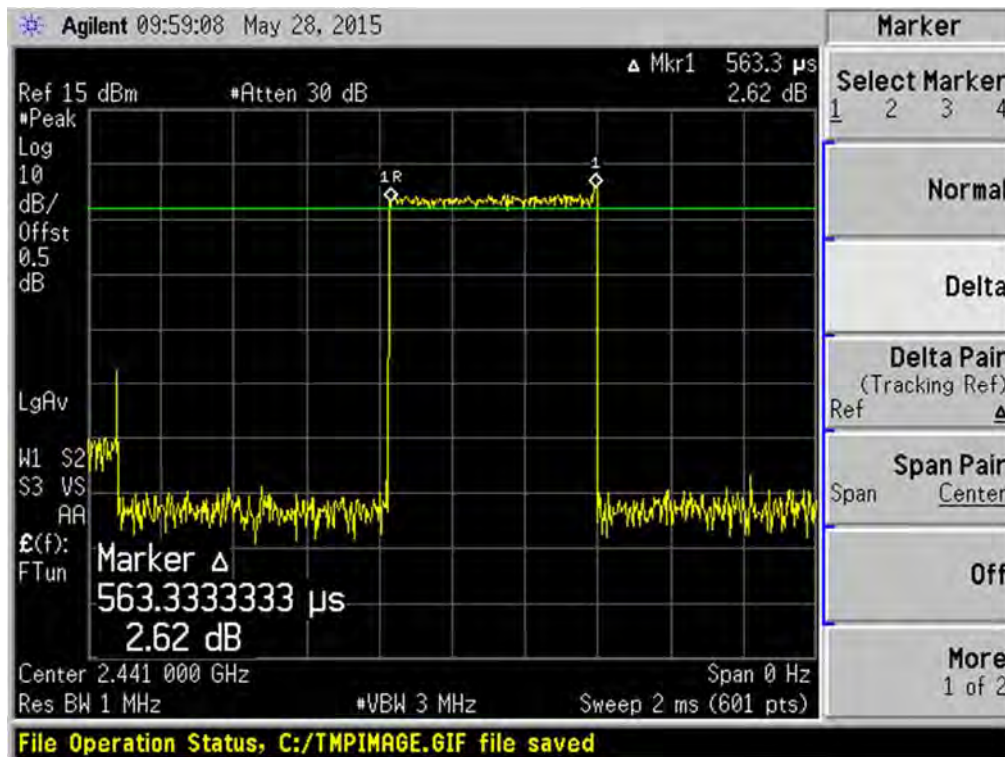
## GFSK DH3



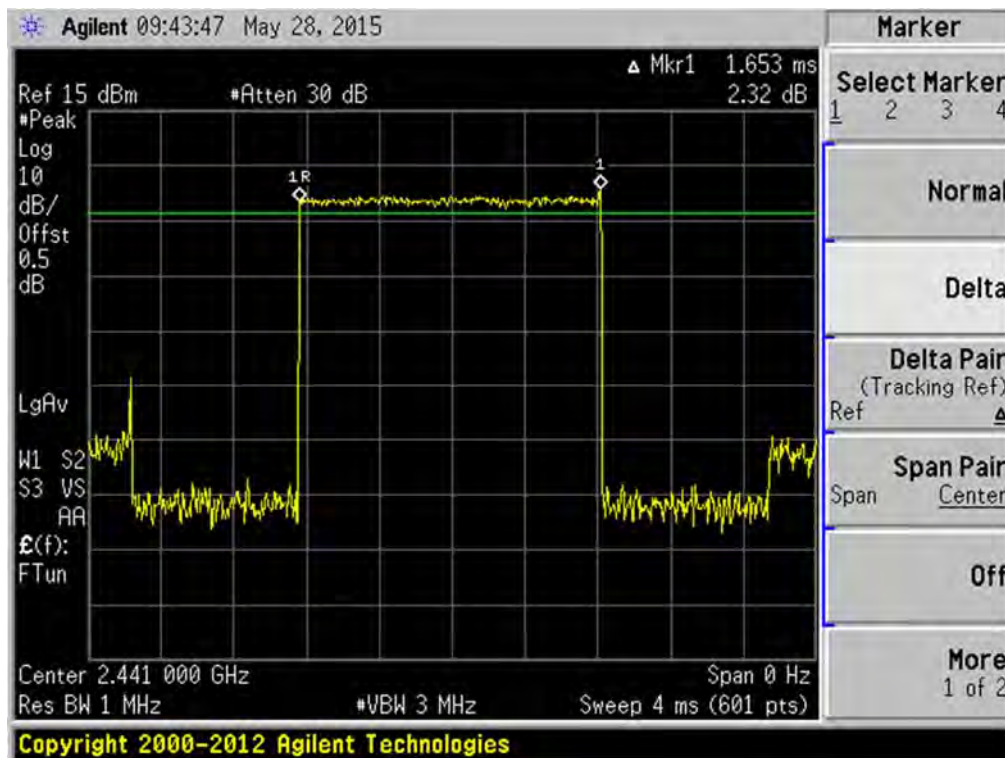
### GFSK DH5



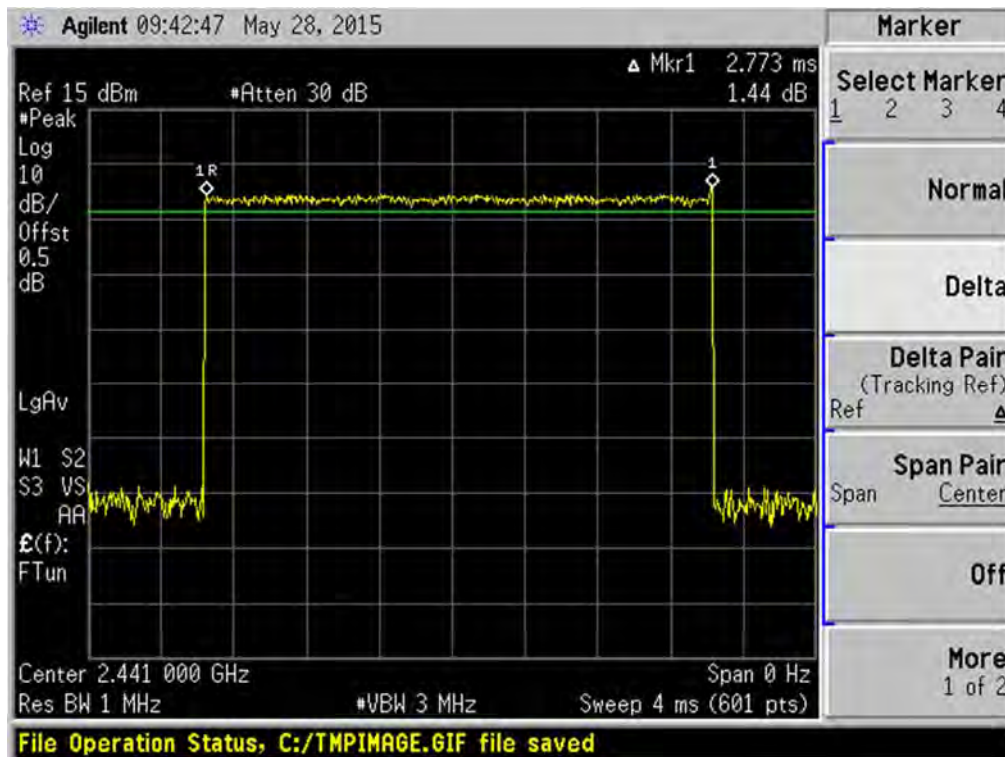
### π/4-DQPSK DH1



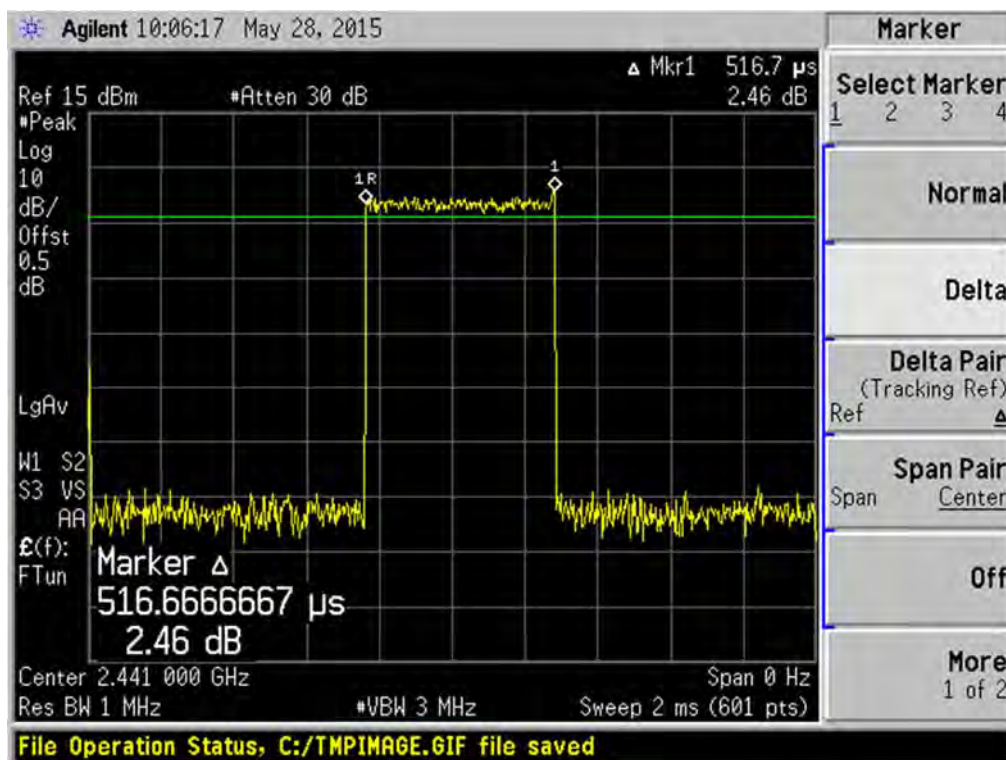
### □/4-DQPSK DH3



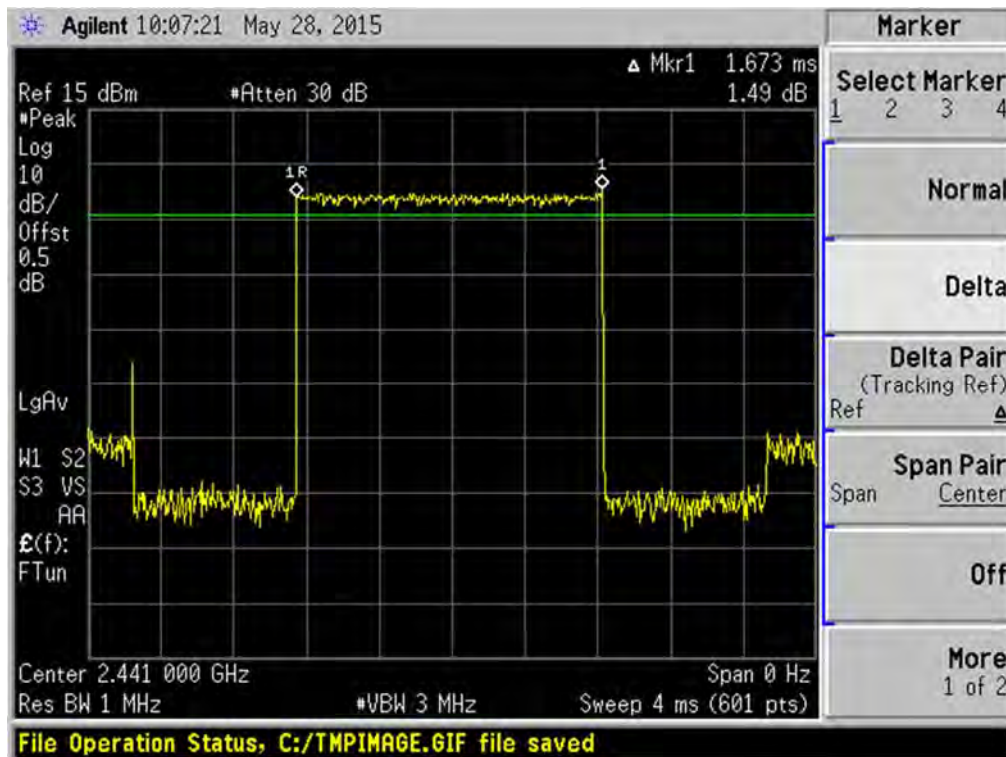
### □/4-DQPSK DH5



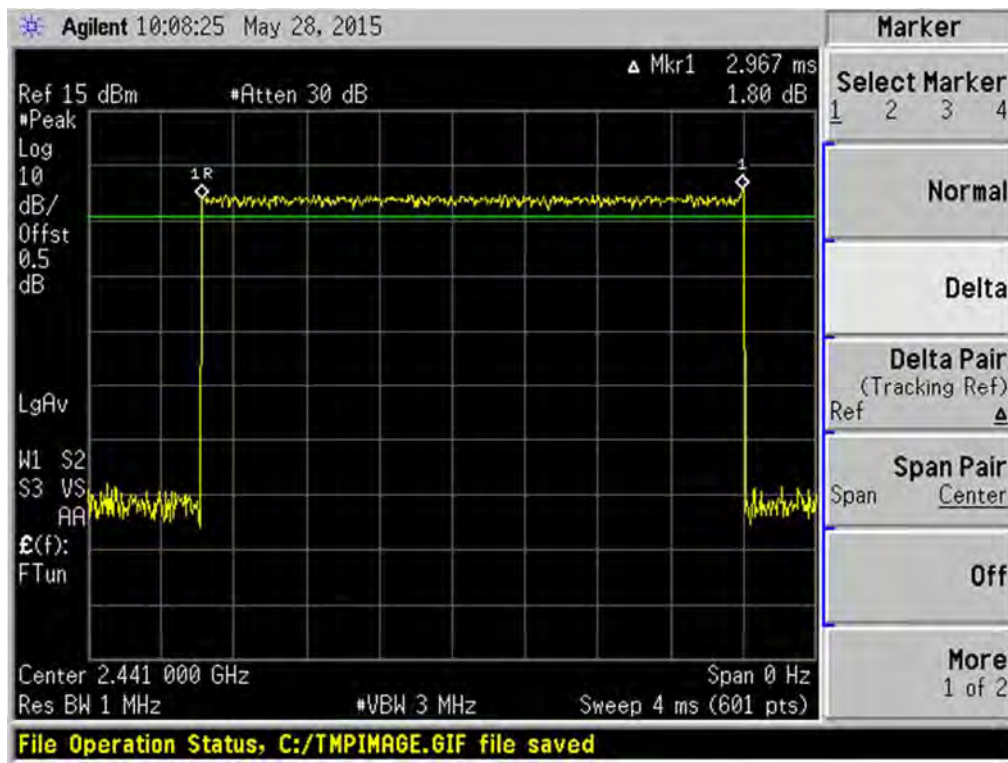
### 8-DPSK DH1



### 8-DPSK DH3



## 8-DPSK DH5



## A.6 Conducted Spurious Emissions

### Test Data

GFSK Mode:

| Channel | Measured Max. Out of Band Emission (dBm) | Limit (dBm)   |                         | Verdict |
|---------|------------------------------------------|---------------|-------------------------|---------|
|         |                                          | Carrier Level | Calculated 20 dBc Limit |         |
| Low     | -35.34                                   | 1.03          | -19.0                   | Pass    |
| Middle  | -38.13                                   | 0.19          | -19.8                   | Pass    |
| High    | -36.81                                   | -0.01         | -20.0                   | Pass    |

π/4-DQPSK Mode:

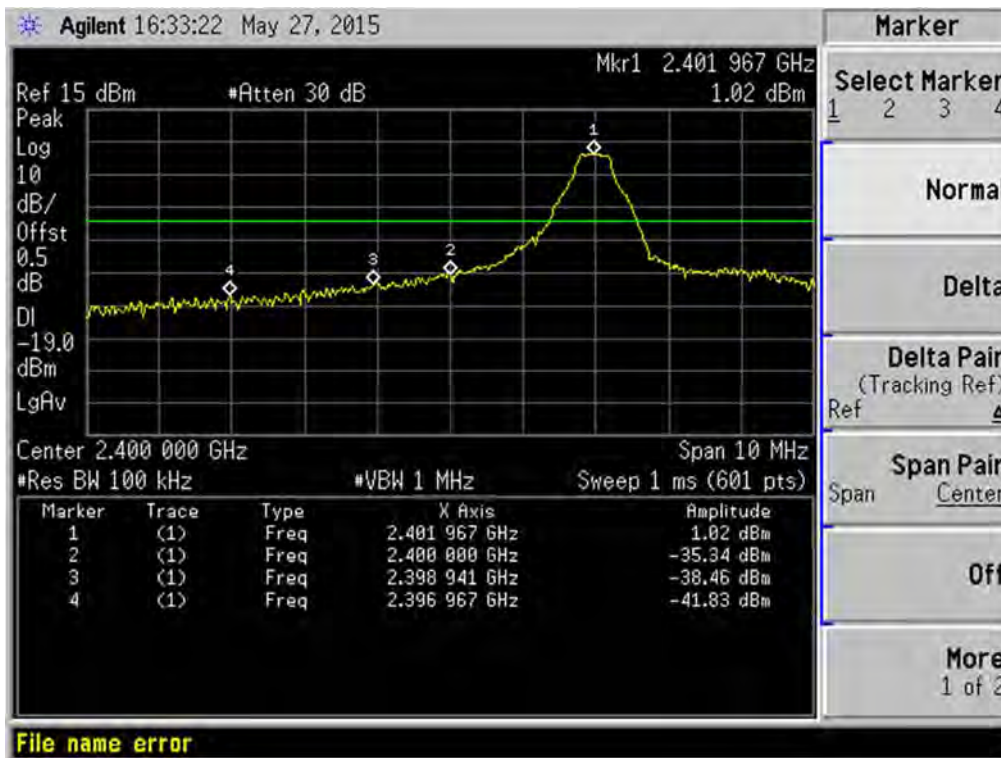
| Channel | Measured Max. Out of Band Emission (dBm) | Limit (dBm)   |                         | Verdict |
|---------|------------------------------------------|---------------|-------------------------|---------|
|         |                                          | Carrier Level | Calculated 20 dBc Limit |         |
| Low     | -26.34                                   | -5.57         | -25.6                   | Pass    |
| Middle  | -47.21                                   | -6.19         | -26.2                   | Pass    |
| High    | -34.58                                   | -5.68         | -25.7                   | Pass    |

8-DPSK Mode:

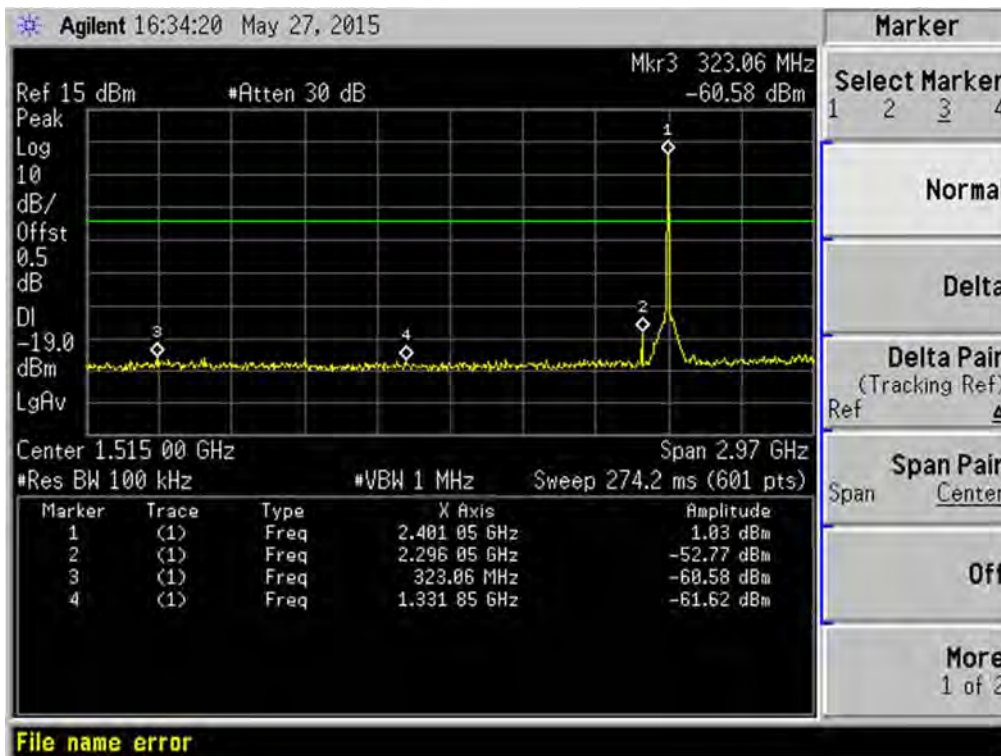
| Channel | Measured Max. Out of Band Emission (dBm) | Limit (dBm)   |                         | Verdict |
|---------|------------------------------------------|---------------|-------------------------|---------|
|         |                                          | Carrier Level | Calculated 20 dBc Limit |         |
| Low     | -26.58                                   | -4.82         | -24.8                   | Pass    |
| Middle  | -48.40                                   | -5.24         | -25.4                   | Pass    |
| High    | -34.80                                   | -5.48         | -25.5                   | Pass    |

# Test Plots

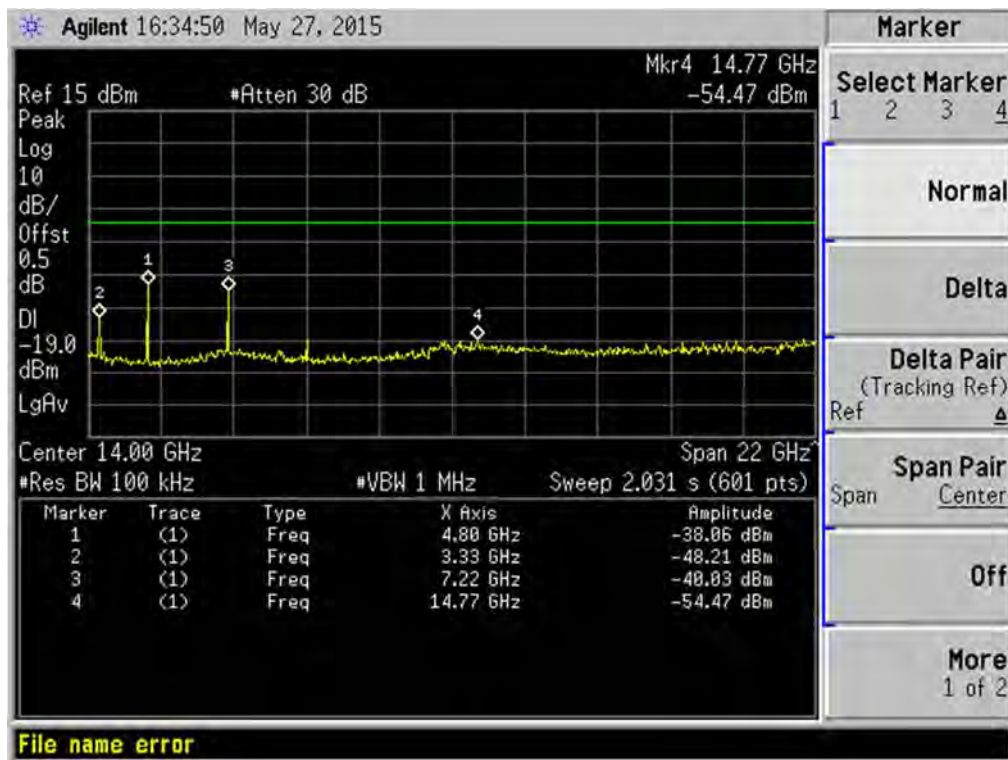
## GFSK LOW CHANNEL , BAND EDGE



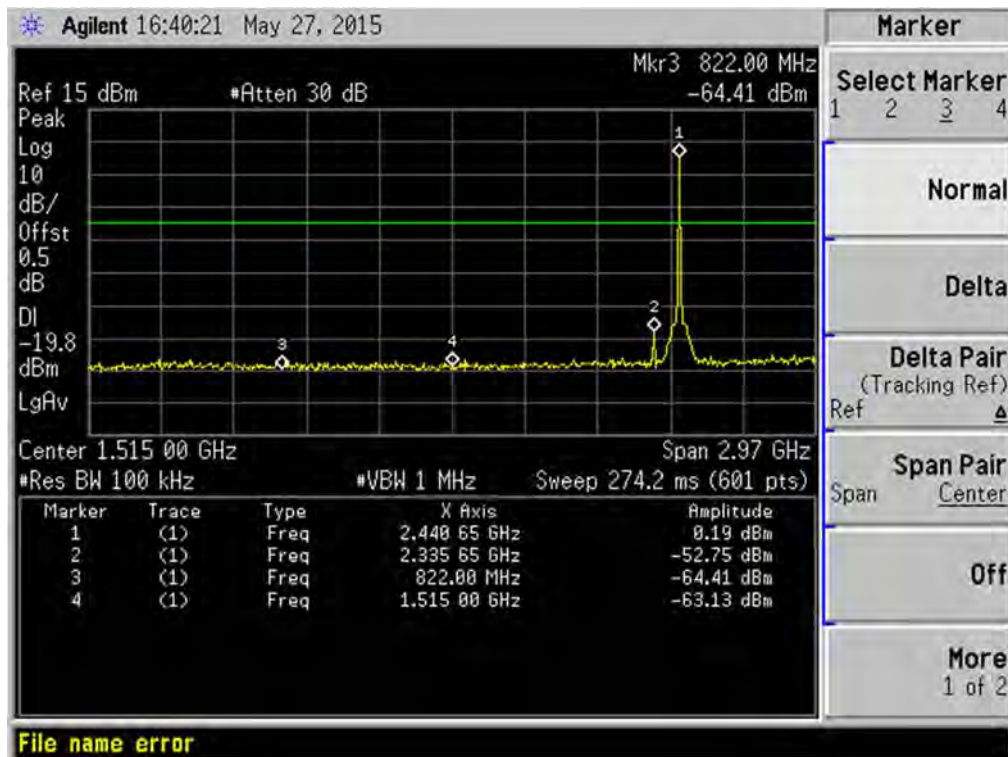
## GFSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



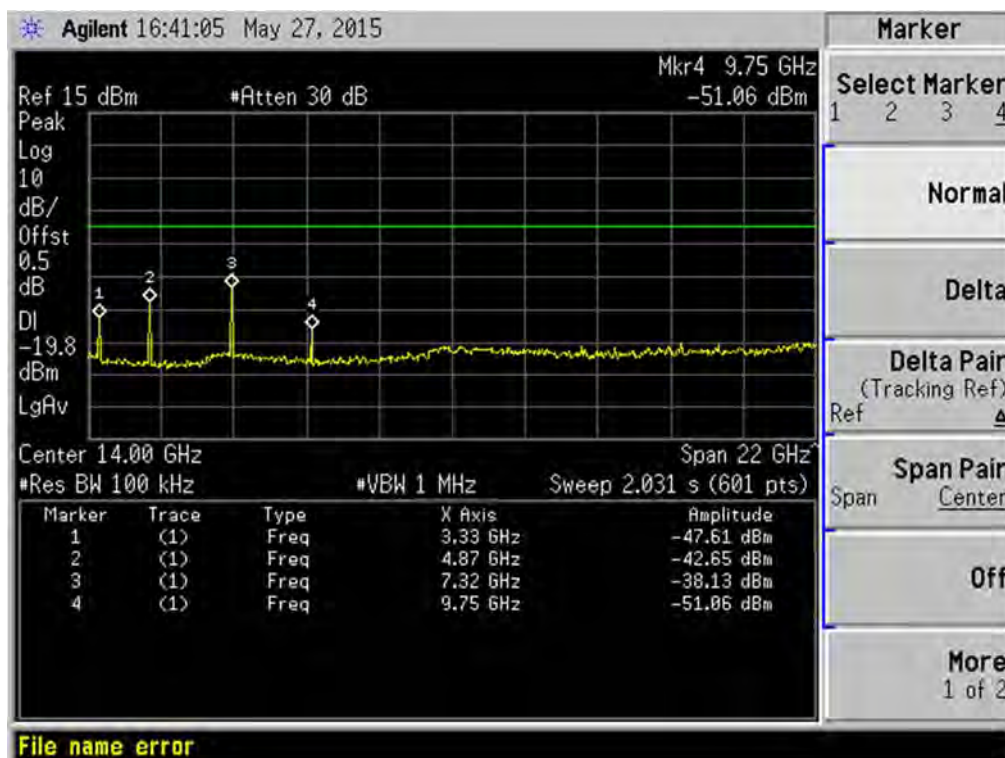
## GFSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



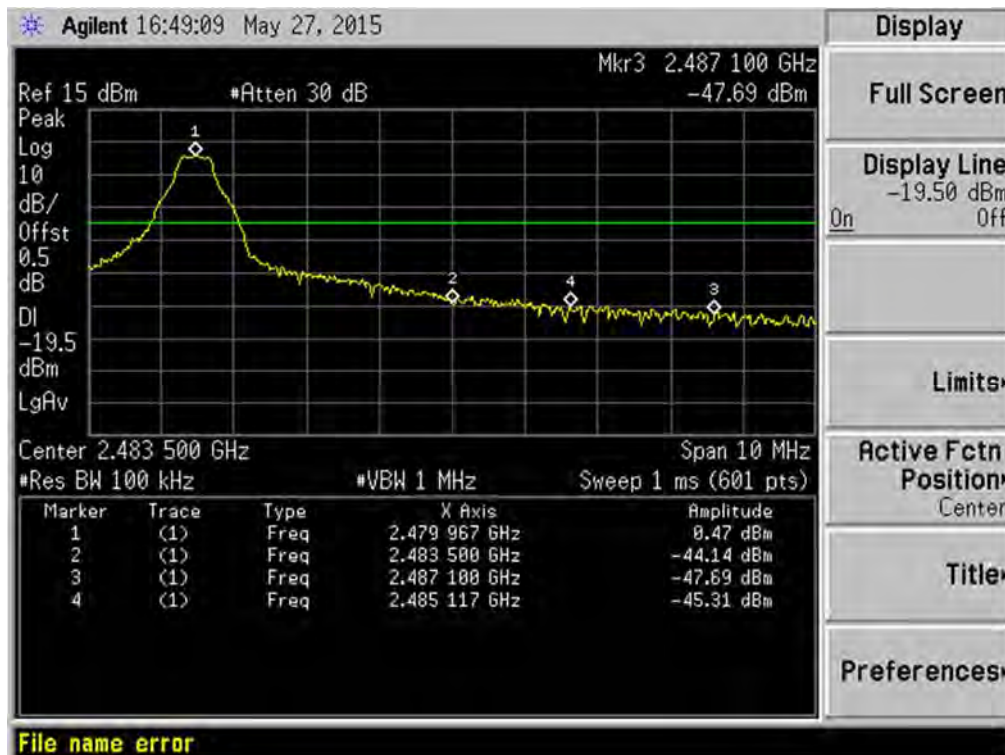
## GFSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3GHz



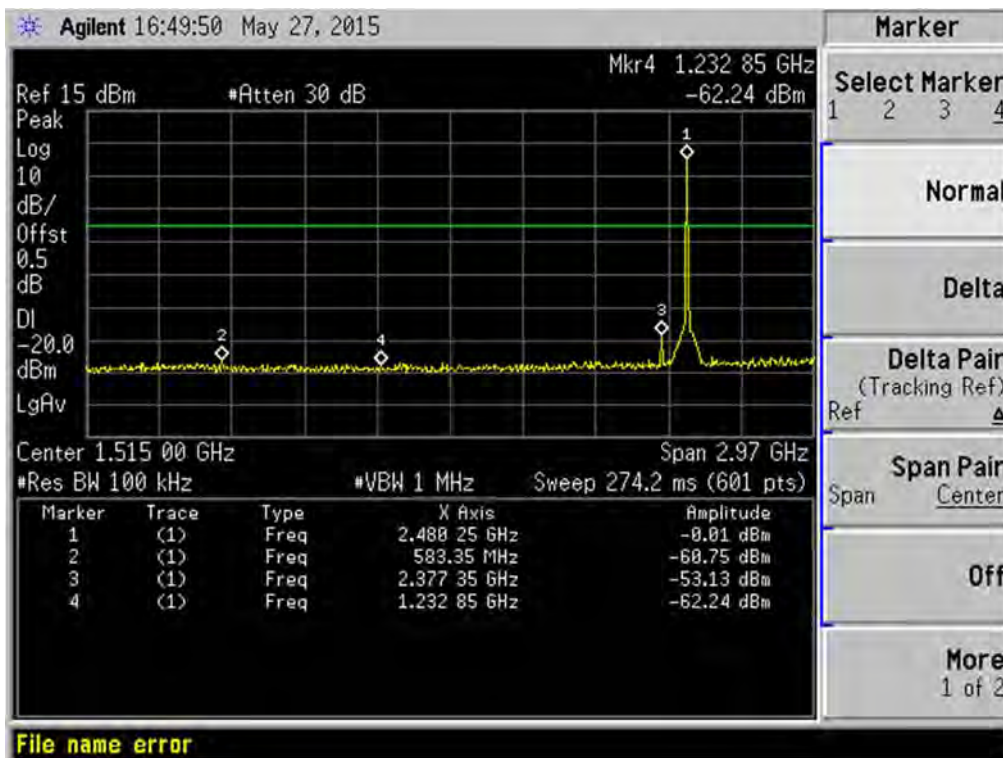
## GFSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



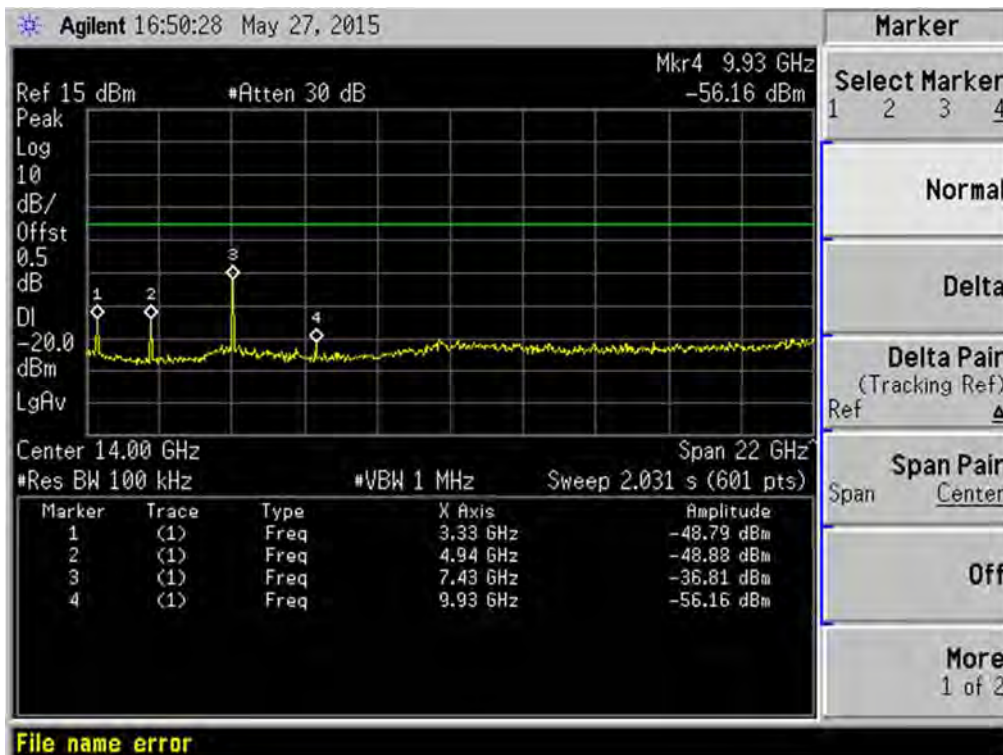
## GFSK HIGH CHANNEL , BAND EDGE



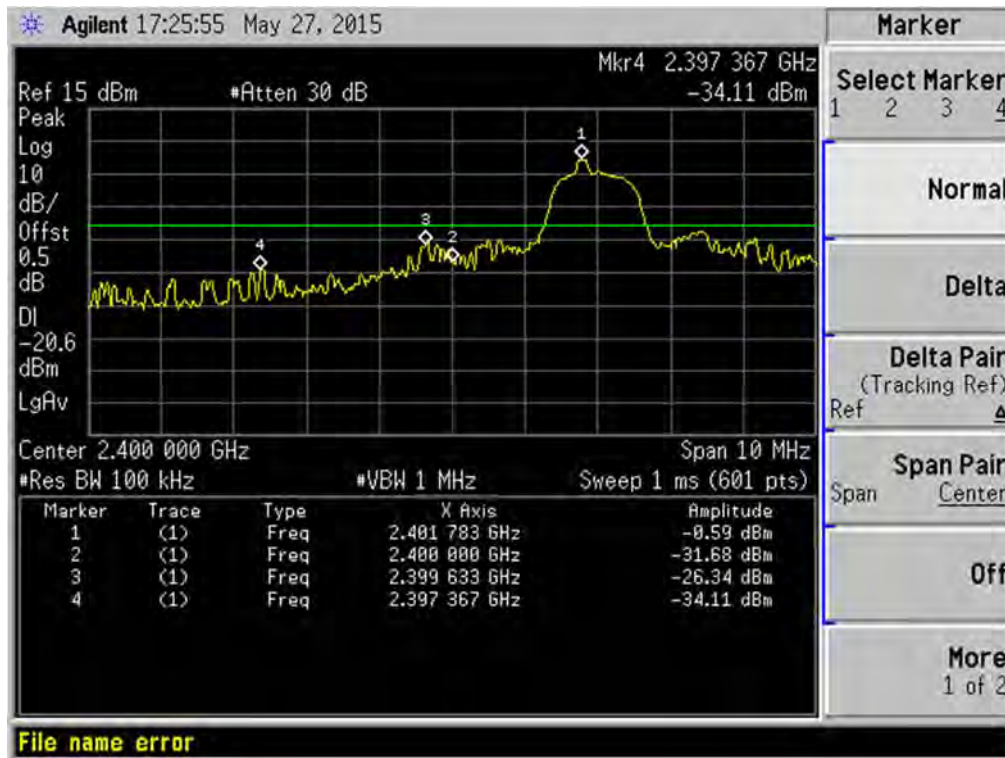
### GFSK HIGH CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



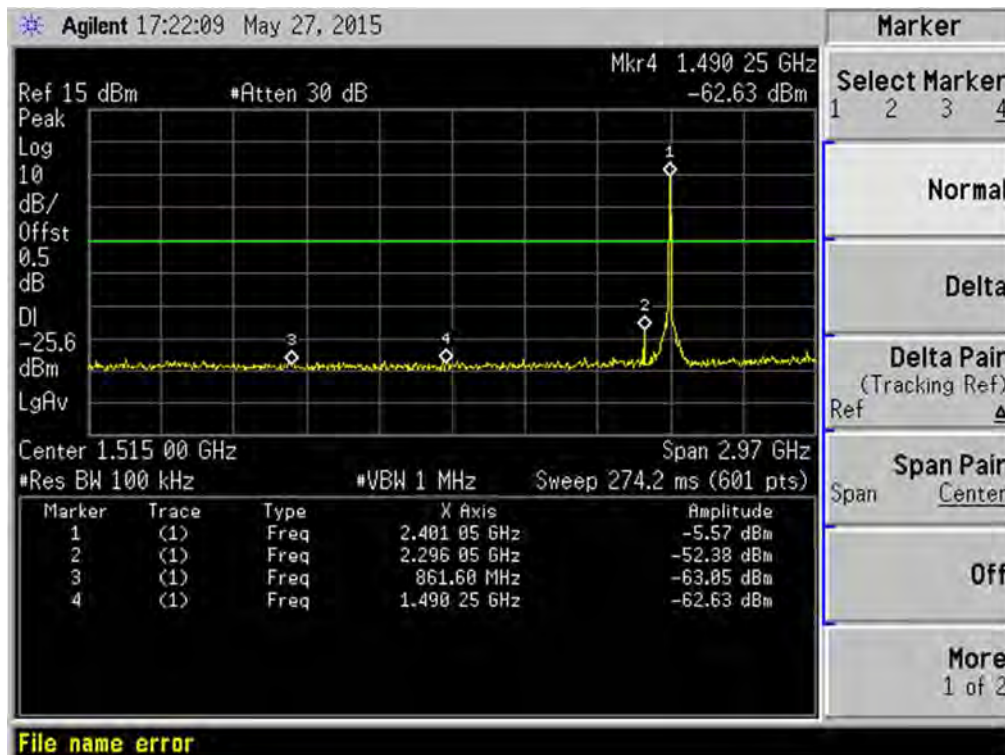
### GFSK HIGH CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



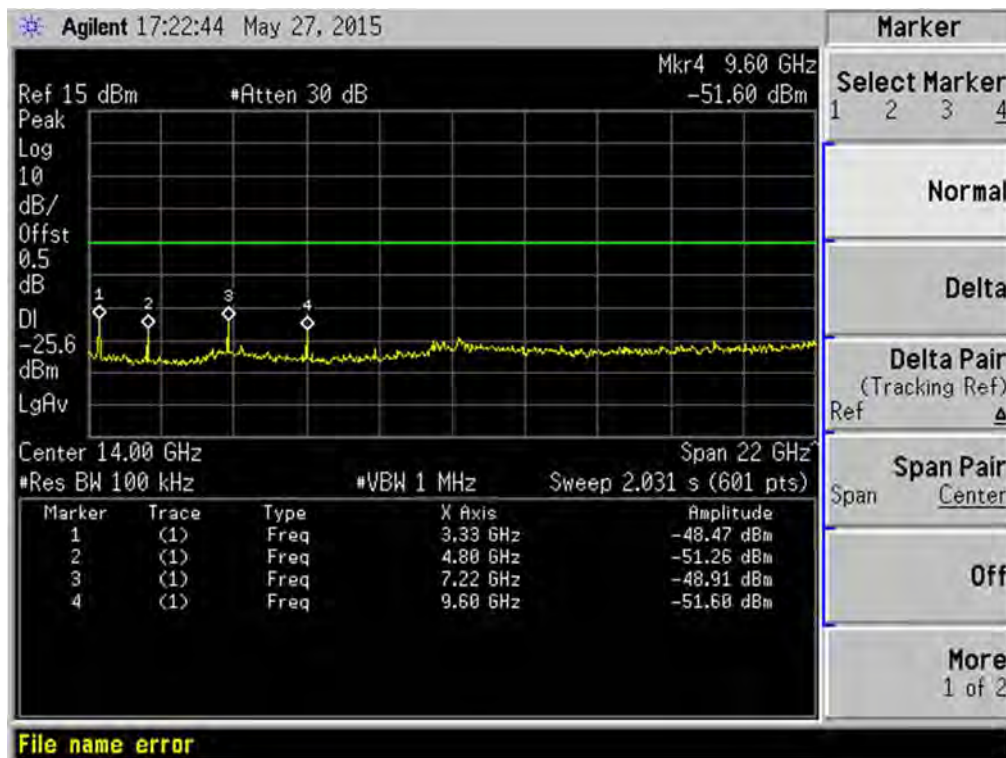
# □/4-DQPSK LOW CHANNEL , BAND EDGE



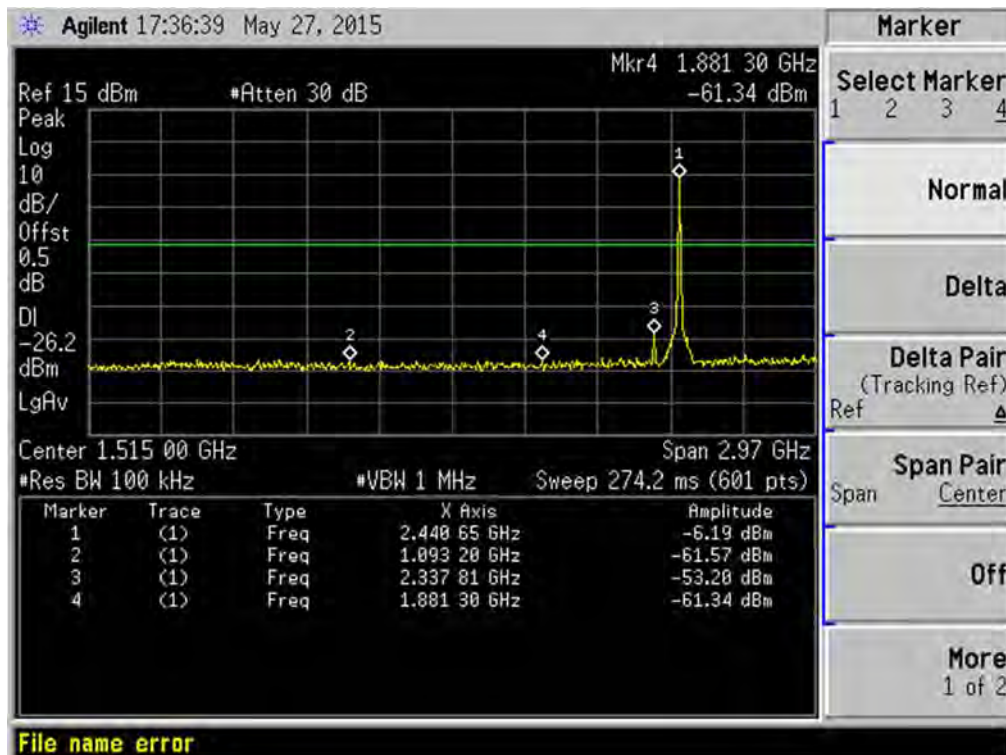
# □/4-DQPSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



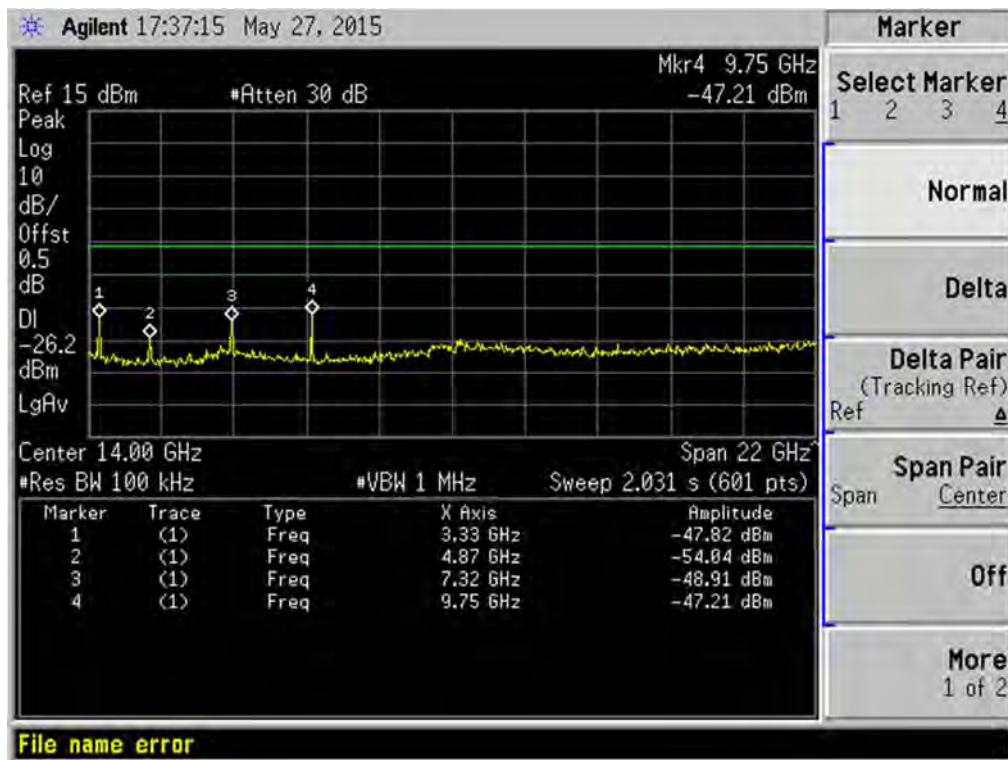
# □/4-DQPSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



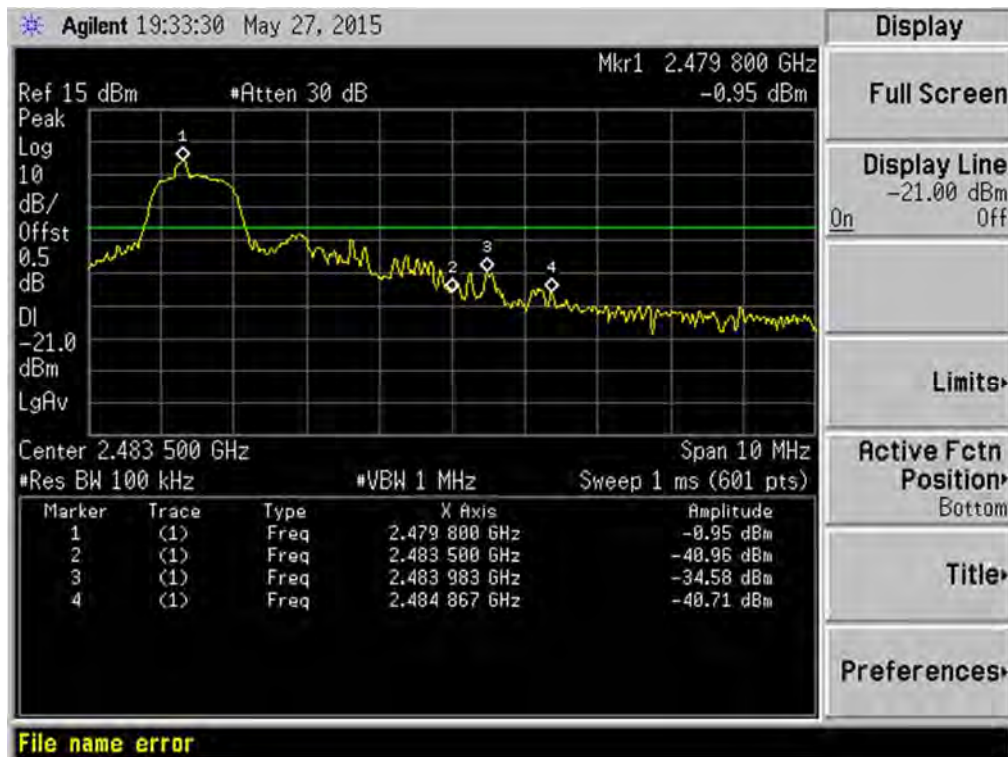
# □/4-DQPSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



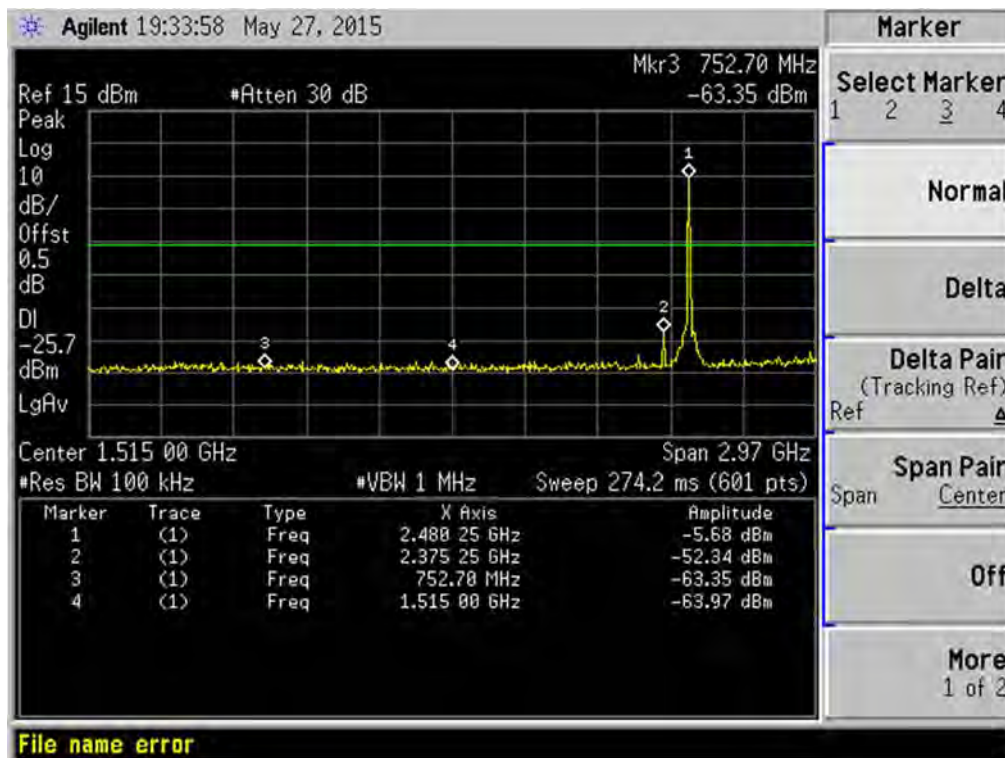
### □/4-DQPSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



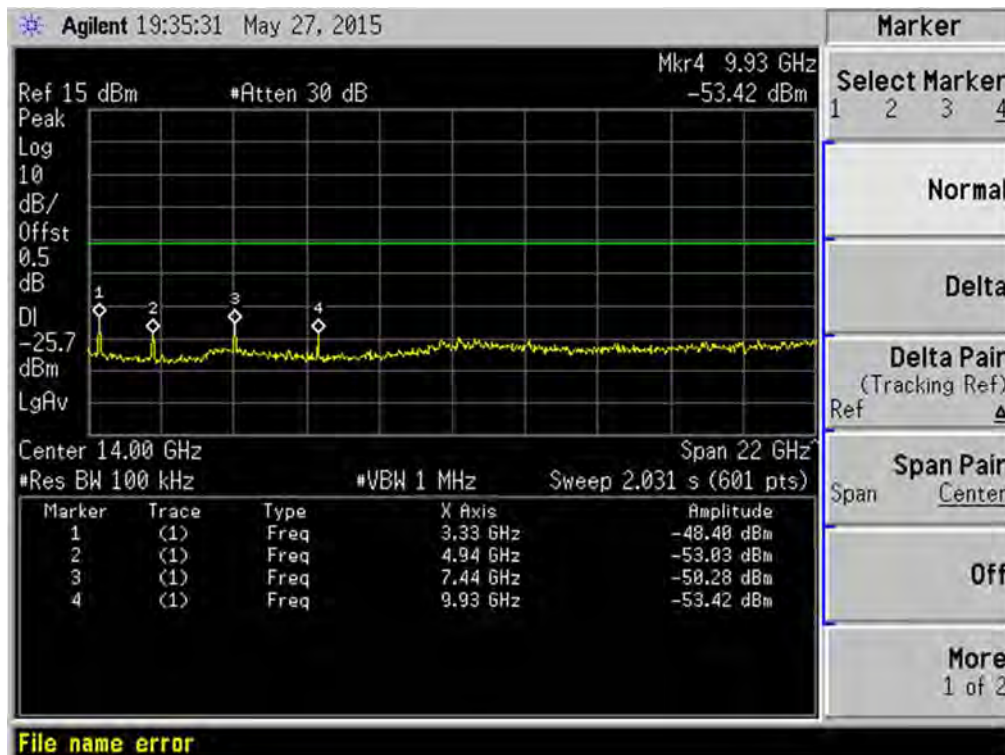
### □/4-DQPSK HIGH CHANNEL , BAND EDGE



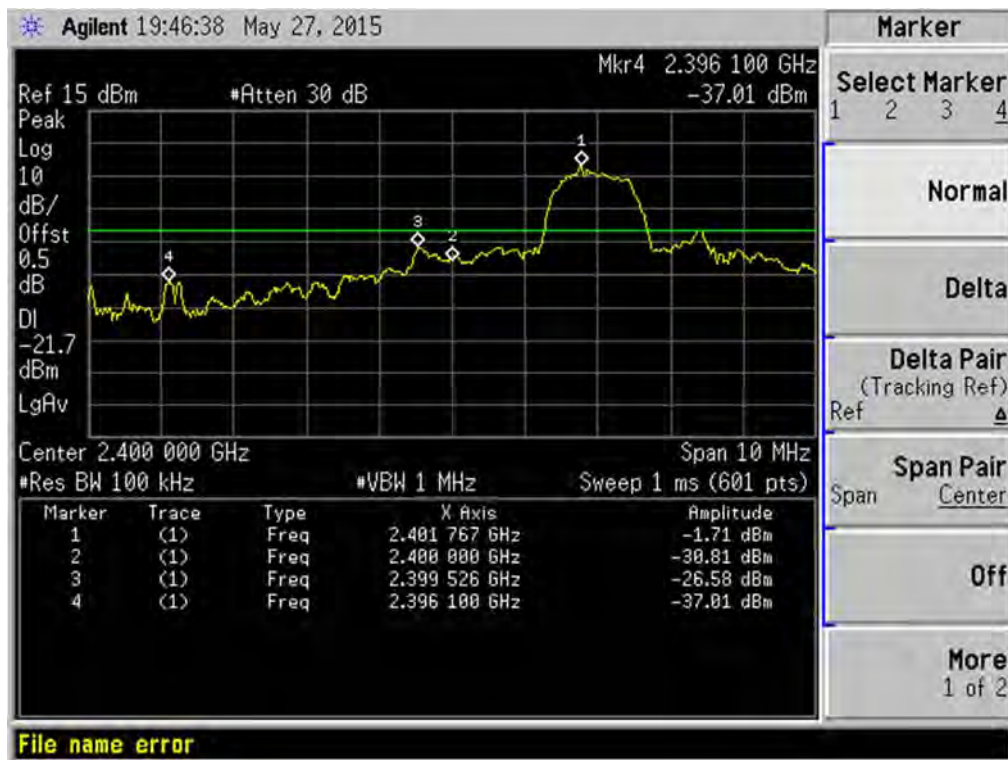
# □/4-DQPSK HIGH CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



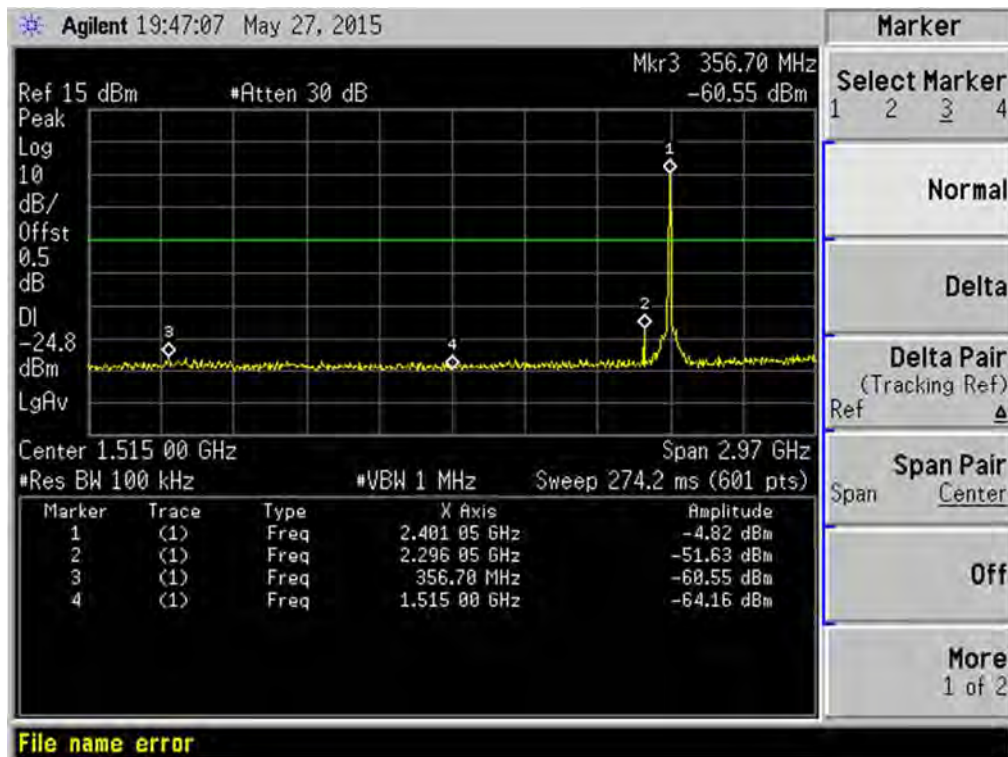
# □/4-DQPSK HIGH CHANNEL , SPURIOUS 3 GHz ~ 25GHz



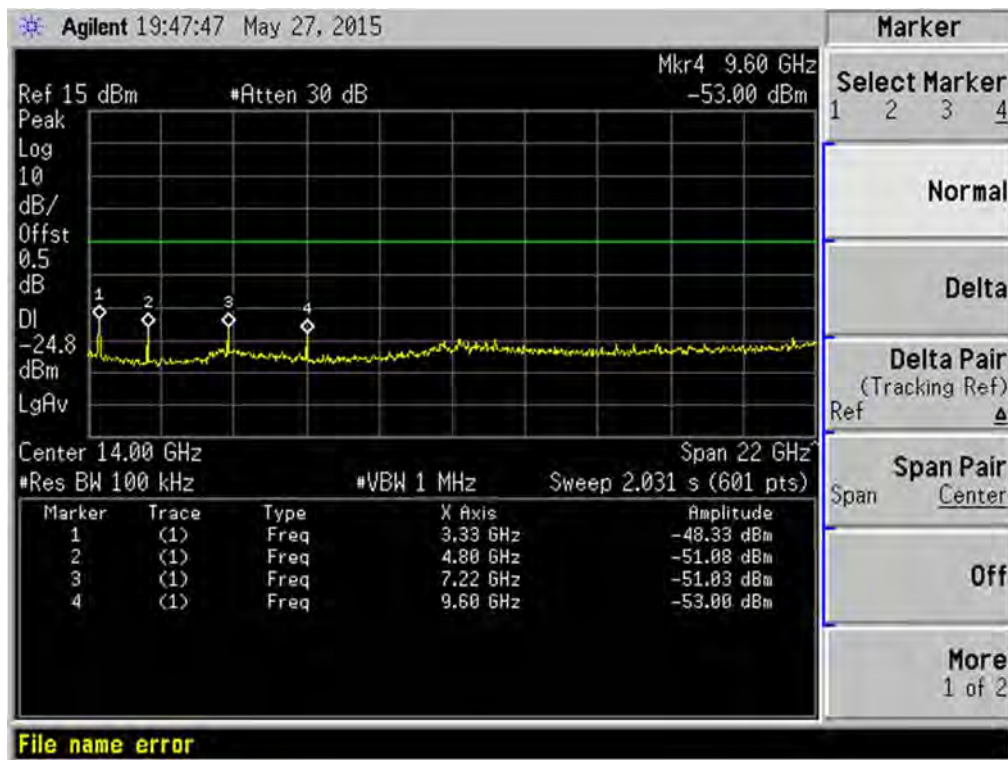
## 8-DPSK LOW CHANNEL , BAND EDGE



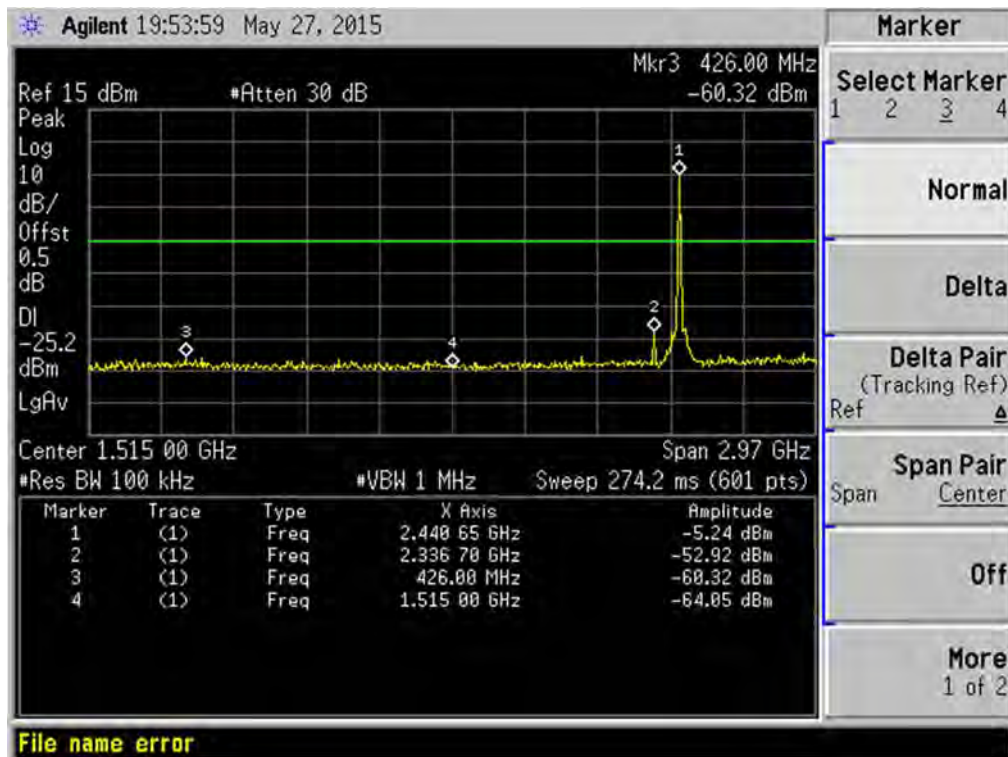
## 8-DPSK LOW CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



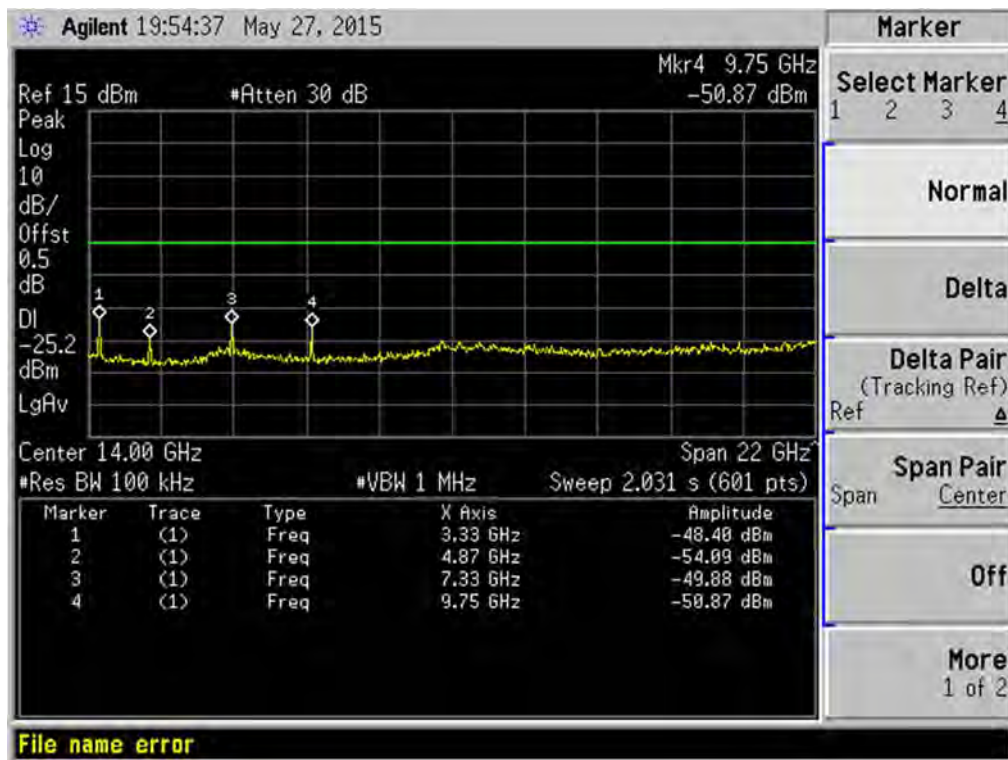
## 8-DPSK LOW CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



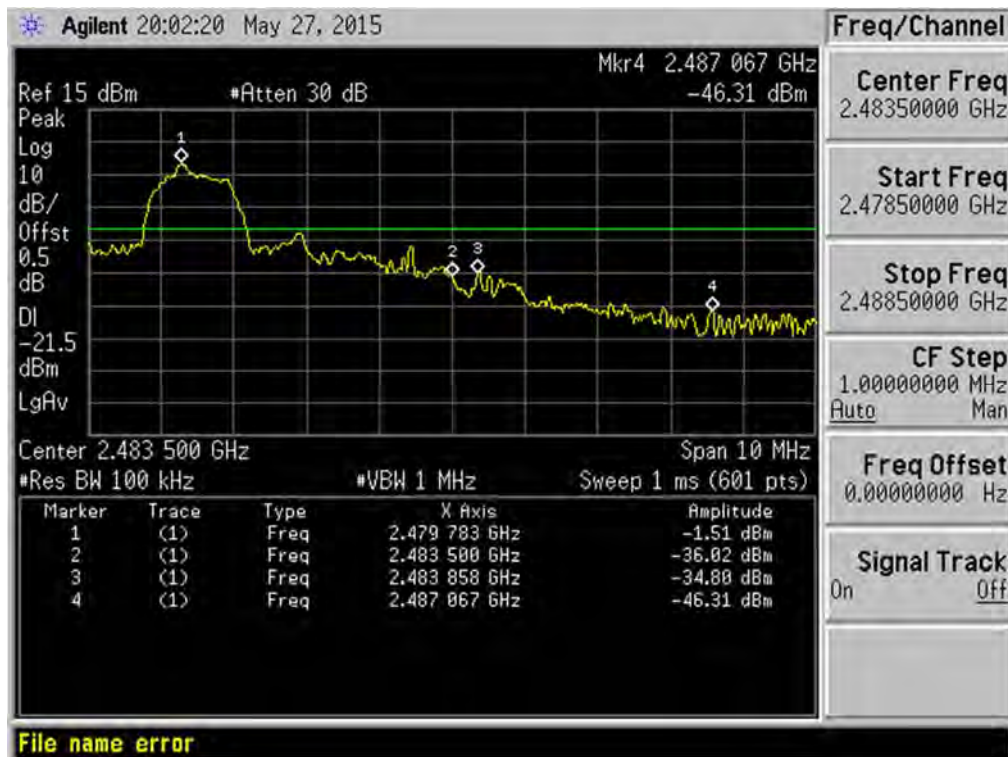
## 8-DPSK MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



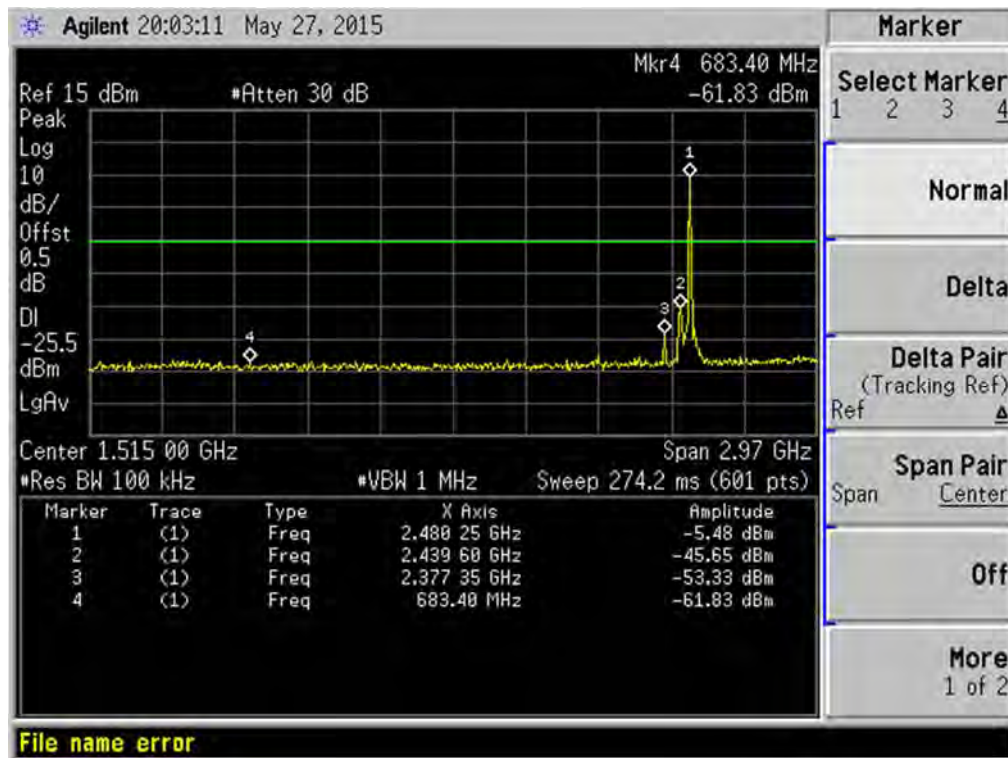
## 8-DPSK MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



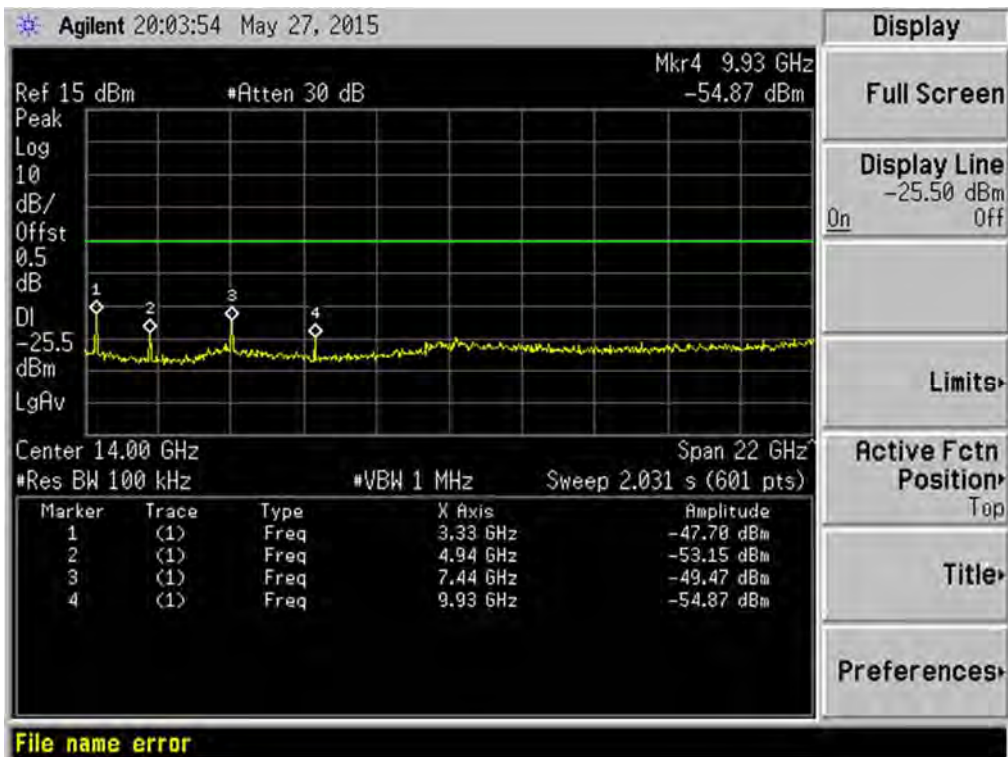
## 8-DPSK HIGH CHANNEL , BAND EDGE



## 8-DPSK HIGH CHANNEL , SPURIOUS 30 MHz ~3 GHz



## 8-DPSK HIGH CHANNEL , SPURIOUS 3 GHz ~ 25 GHz

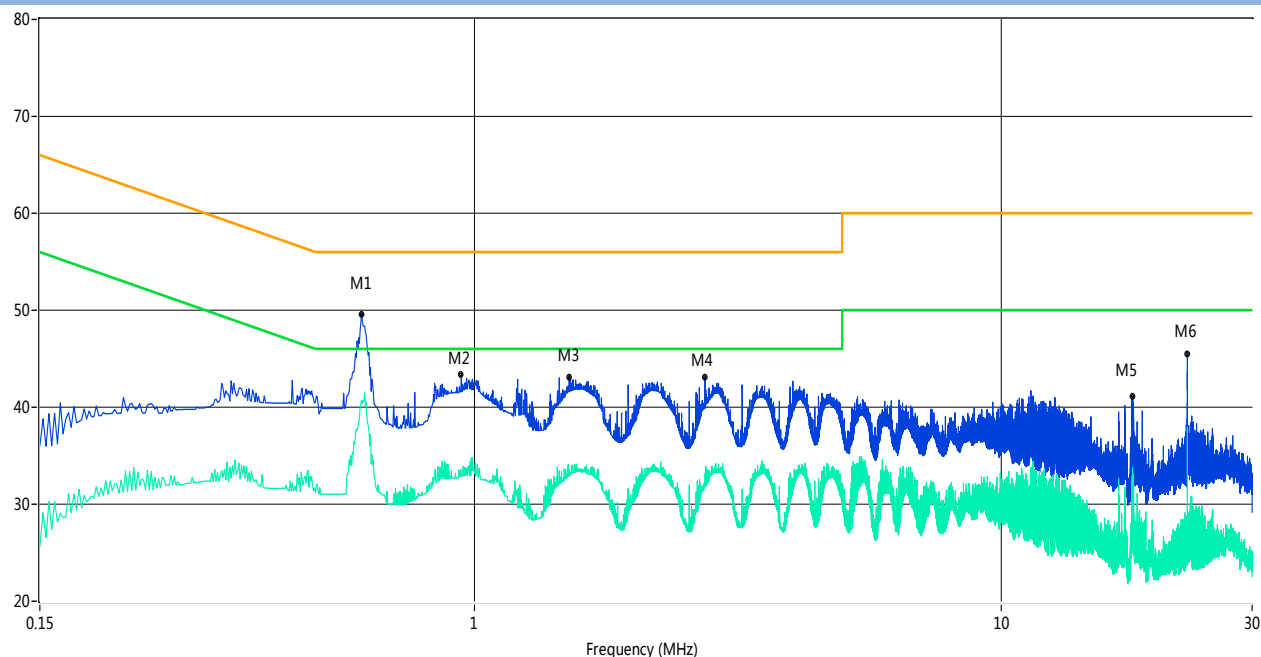


## A.7 Conducted Emissions

Note: All configurations have been tested, only the worst configuration (GFSK High Channel) shown here.

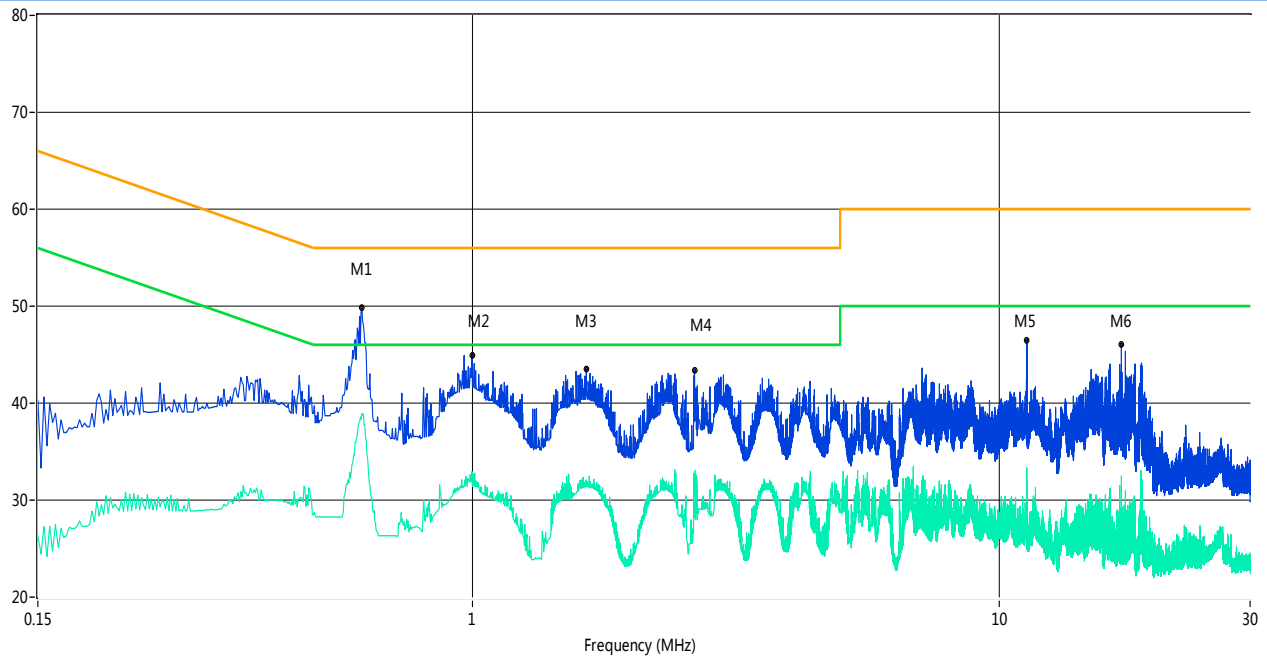
### Test Data and Plots

#### PHASE L



| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Margin (dB) | Detector | Line   | Verdict |
|-----|-----------------|----------------|-------------|--------------|-------------|----------|--------|---------|
| 1   | 0.61            | 49.6           | 13.00       | 56.0         | 6.40        | Peak     | L Line | Pass    |
| 1** | 0.61            | 40.7           | 13.00       | 46.0         | 5.30        | AV       | L Line | Pass    |
| 2   | 0.95            | 43.4           | 13.00       | 56.0         | 12.60       | Peak     | L Line | Pass    |
| 2** | 0.95            | 32.7           | 13.00       | 46.0         | 13.30       | AV       | L Line | Pass    |
| 3   | 1.52            | 43.2           | 13.00       | 56.0         | 12.80       | Peak     | L Line | Pass    |
| 3** | 1.52            | 33.0           | 13.00       | 46.0         | 13.00       | AV       | L Line | Pass    |
| 4   | 2.75            | 43.1           | 13.00       | 56.0         | 12.90       | Peak     | L Line | Pass    |
| 4** | 2.75            | 33.1           | 13.00       | 46.0         | 12.90       | AV       | L Line | Pass    |
| 5   | 17.76           | 41.1           | 13.00       | 60.0         | 18.90       | Peak     | L Line | Pass    |
| 5** | 17.76           | 32.8           | 13.00       | 50.0         | 17.20       | AV       | L Line | Pass    |
| 6   | 22.61           | 45.5           | 13.00       | 60.0         | 14.50       | Peak     | L Line | Pass    |
| 6** | 22.61           | 34.4           | 13.00       | 50.0         | 15.60       | AV       | L Line | Pass    |

# PHASE N

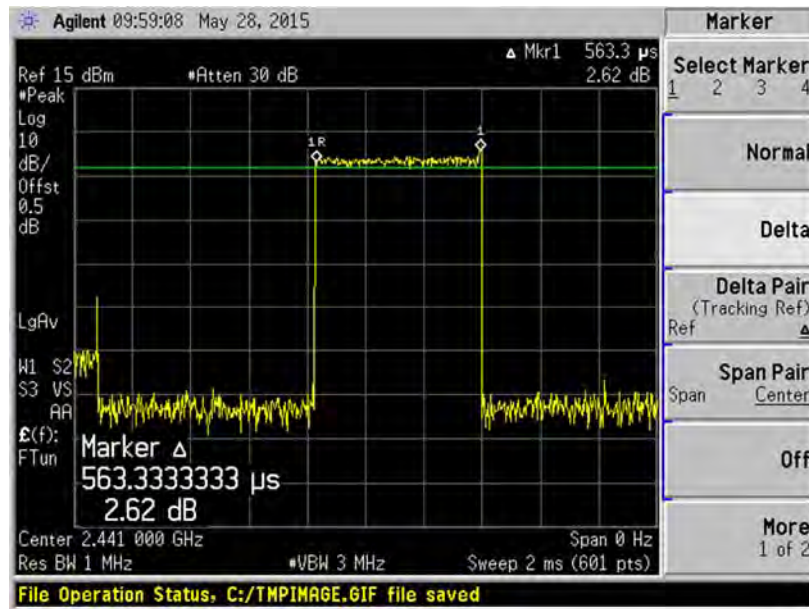


| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Margin (dB) | Detector | Line   | Verdict |
|-----|-----------------|----------------|-------------|--------------|-------------|----------|--------|---------|
| 1   | 0.62            | 49.8           | 13.00       | 56.0         | 6.20        | Peak     | N Line | Pass    |
| 1** | 0.62            | 38.9           | 13.00       | 46.0         | 7.10        | AV       | N Line | Pass    |
| 2   | 1.00            | 44.9           | 13.00       | 56.0         | 11.10       | Peak     | N Line | Pass    |
| 2** | 1.00            | 32.9           | 13.00       | 46.0         | 13.10       | AV       | N Line | Pass    |
| 3   | 1.65            | 43.5           | 13.00       | 56.0         | 12.50       | Peak     | N Line | Pass    |
| 3** | 1.65            | 32.1           | 13.00       | 46.0         | 13.90       | AV       | N Line | Pass    |
| 4   | 2.65            | 43.3           | 13.00       | 56.0         | 12.70       | Peak     | N Line | Pass    |
| 4** | 2.65            | 31.1           | 13.00       | 46.0         | 14.90       | AV       | N Line | Pass    |
| 5   | 11.30           | 46.4           | 13.00       | 60.0         | 13.60       | Peak     | N Line | Pass    |
| 5** | 11.30           | 31.9           | 13.00       | 50.0         | 18.10       | AV       | N Line | Pass    |
| 6   | 17.09           | 46.1           | 13.00       | 60.0         | 13.90       | Peak     | N Line | Pass    |
| 6** | 17.09           | 32.5           | 13.00       | 50.0         | 17.50       | AV       | N Line | Pass    |

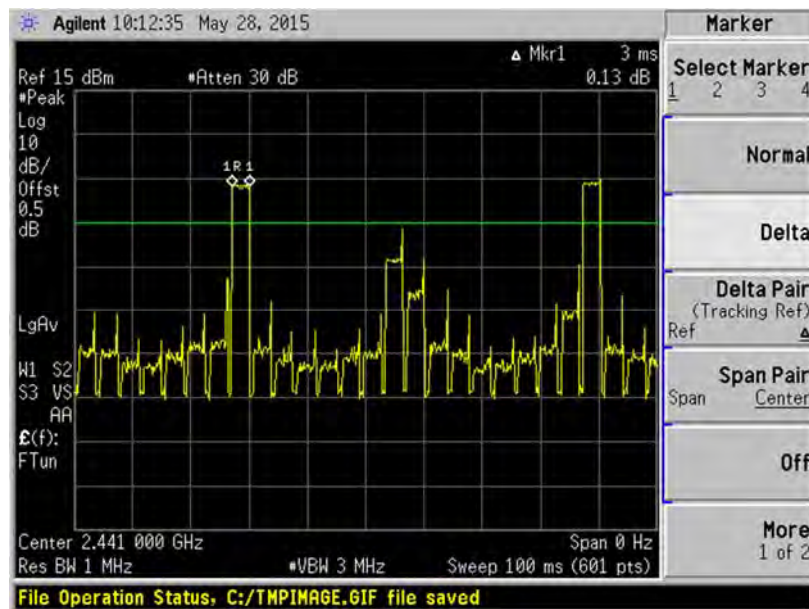
## A.8 Radiated Emission

Duty cycle correction factor for average measurement.

DH5 on time/100 ms(One Pulse) Plot on Channel 39



DH5 on time/100 ms(Count Pulses) Plot on Channel 39



### Note:

1. Duty cycle = on time/100 milliseconds =  $4 * 2.62 / 100 = 10.48 \%$
2. Duty cycle correction factor =  $20 * \log(\text{Duty cycle}) = -19.59 \text{ dB}$
3. DH5 has the highest duty cycle and is reported.

Note 1: The symbol of "--" in the table which means not application.

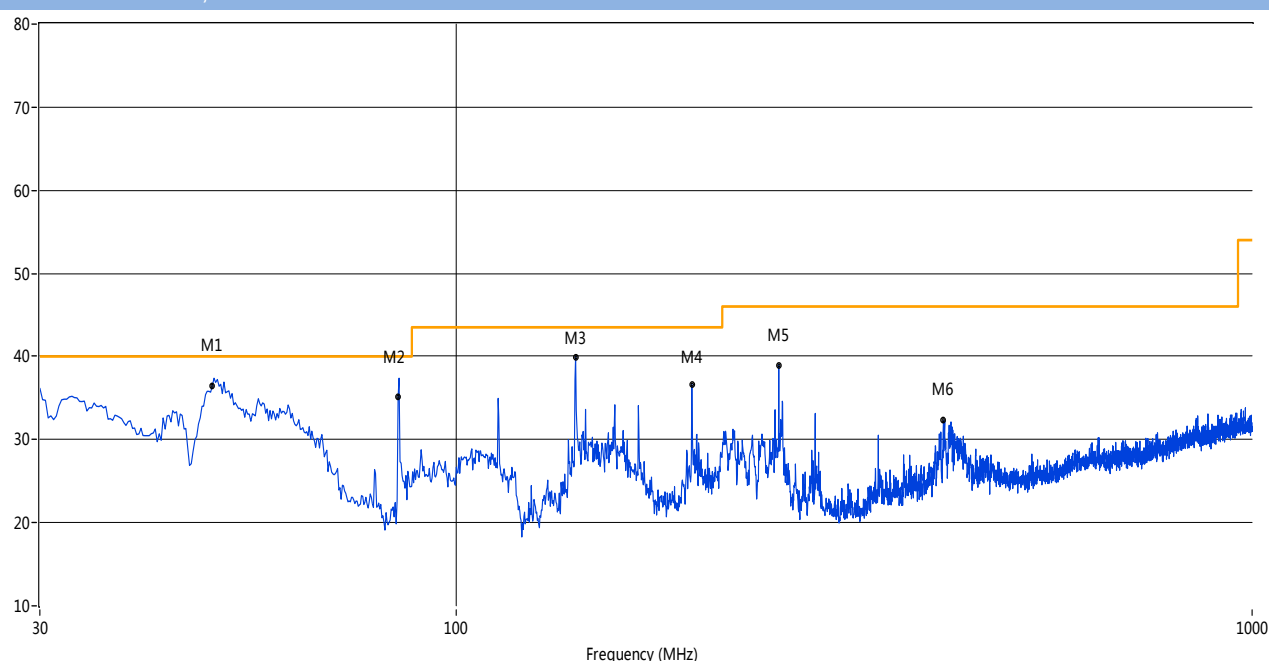
Note 2: For the test data above 1 GHz, According the ANSI C63.4-2009, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note 3: All configurations have been tested, only the worst configuration (GFSK High Channel) shown here.

### Test Data and Plots

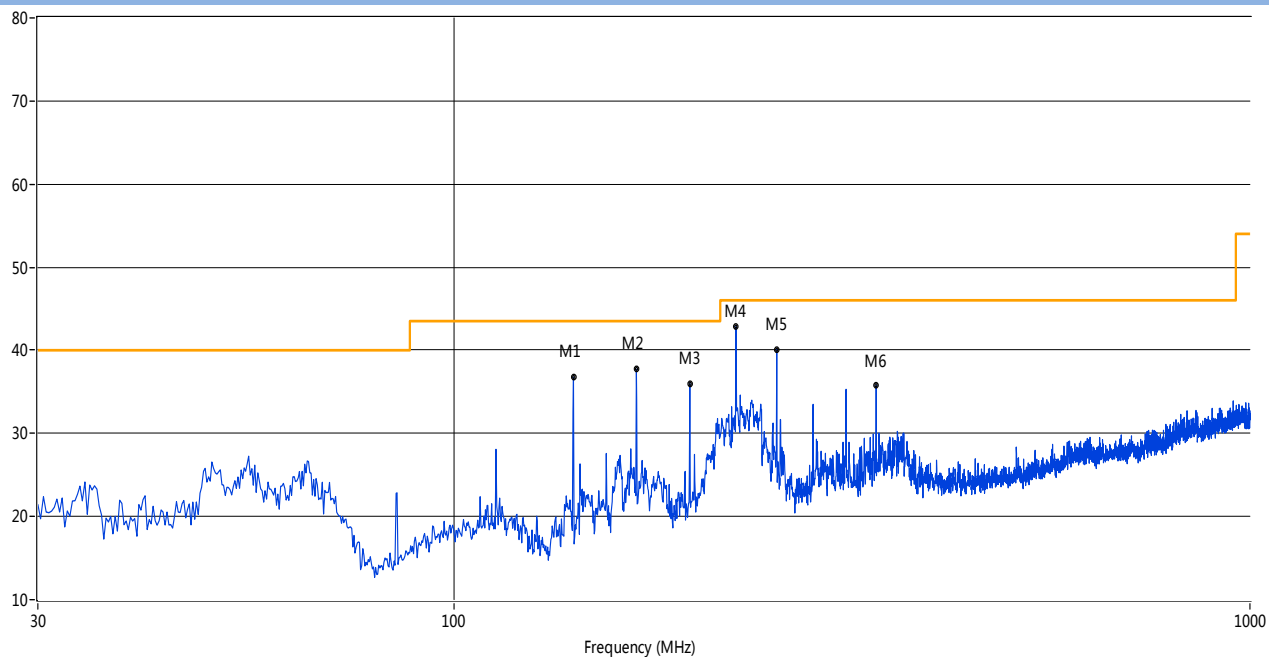
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

30 MHz to 1 GHz, ANT V



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 49.80           | 36.51            | -18.72      | 40.0           | 3.49        | Peak     | 265.60    | 106.60      | Vertical | Pass    |
| 1*  | 49.80           | 33.27            | -18.72      | 40.0           | 6.73        | QP       | 265.60    | 106.60      | Vertical | Pass    |
| 2   | 84.75           | 35.08            | -23.44      | 40.0           | 4.92        | Peak     | 343.50    | 128.80      | Vertical | Pass    |
| 2*  | 84.75           | 32.47            | -23.44      | 40.0           | 7.53        | QP       | 343.50    | 128.80      | Vertical | Pass    |
| 3   | 141.28          | 39.97            | -23.63      | 43.5           | 3.53        | Peak     | 337.90    | 100         | Vertical | Pass    |
| 4   | 197.77          | 36.61            | -20.37      | 43.5           | 6.89        | Peak     | 115.10    | 100         | Vertical | Pass    |
| 5   | 254.26          | 37.79            | -18.79      | 46.0           | 8.21        | Peak     | 353.00    | 100         | Vertical | Pass    |
| 6   | 409.42          | 32.30            | -14.85      | 46.0           | 13.70       | Peak     | 26.20     | 100         | Vertical | Pass    |

## 30 MHz to 1 GHz, ANT H



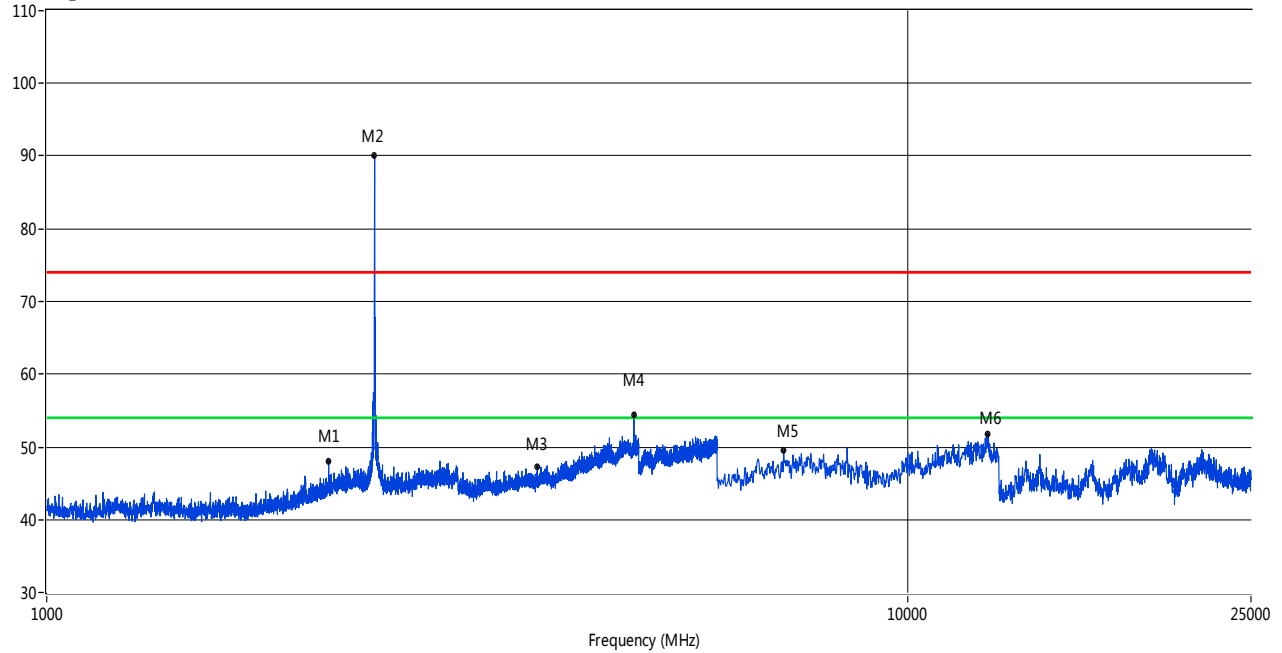
| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 141.28          | 36.75            | -23.63      | 43.5           | 6.75        | Peak     | 149.80    | 100         | Horizontal | Pass    |
| 2   | 169.40          | 37.51            | -22.67      | 43.5           | 5.99        | Peak     | 356.10    | 100         | Horizontal | Pass    |
| 3   | 197.77          | 35.96            | -20.37      | 43.5           | 7.54        | Peak     | 38.10     | 100         | Horizontal | Pass    |
| 4   | 225.89          | 42.84            | -19.87      | 46.0           | 3.16        | Peak     | 38.10     | 100         | Horizontal | Pass    |
| 5   | 254.26          | 40.07            | -18.79      | 46.0           | 5.93        | Peak     | 54.80     | 100         | Horizontal | Pass    |
| 6   | 339.11          | 35.77            | -16.29      | 46.0           | 10.23       | Peak     | 338.90    | 100         | Horizontal | Pass    |

Note: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

### Test Data and Plots (1 GHz ~ 10th Harmonic)

#### GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT V

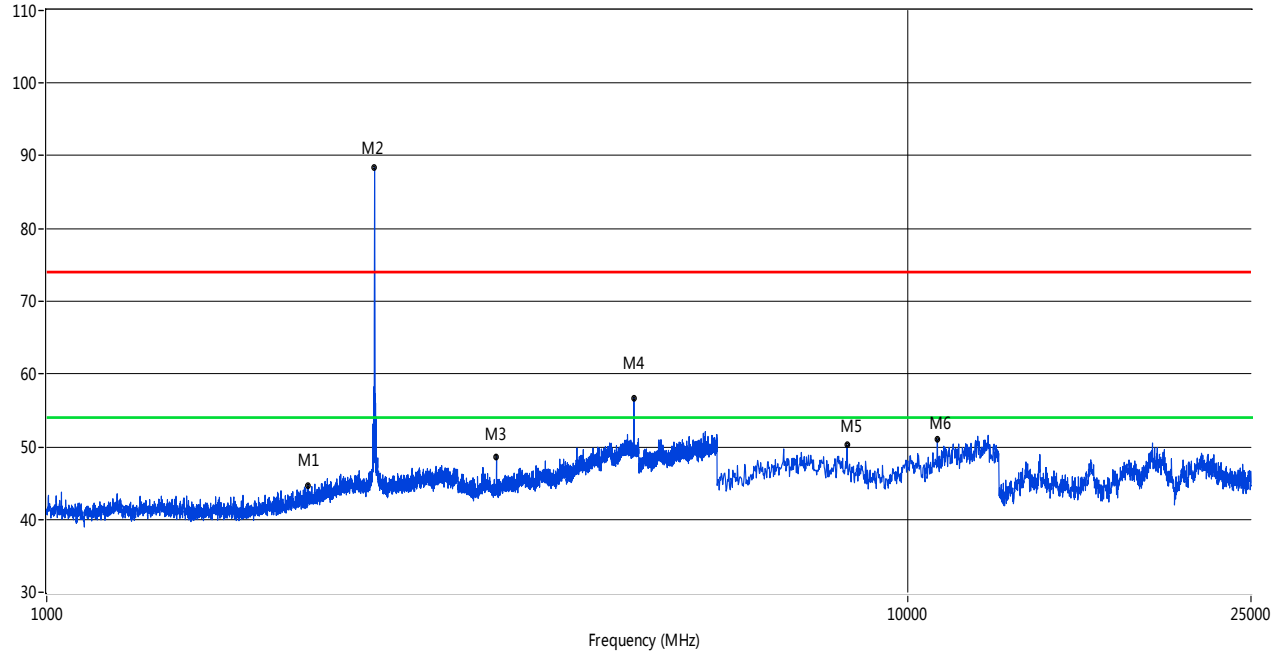
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 2124.22         | 48.10            | -1.06       | 74.0           | 25.90       | Peak     | 153.00    | 100         | Vertical | Pass    |
| 2   | 2401.65         | 90.02            | -0.27       | 74.0           | -16.02      | Peak     | 184.90    | 100         | Vertical | N/A     |
| 3   | 3710.82         | 47.34            | 10.44       | 74.0           | 26.66       | Peak     | 327.90    | 100         | Vertical | Pass    |
| 4** | 4804.05         | 34.88            | 13.74       | 54.0           | 19.1        | AV       | 359.30    | 100         | Vertical | Pass    |
| 4   | 4804.05         | 54.47            | 13.74       | 74.0           | 19.53       | Peak     | 359.30    | 100         | Vertical | Pass    |
| 5   | 7168.05         | 49.47            | 17.52       | 74.0           | 24.53       | Peak     | 0.00      | 100         | Vertical | Pass    |
| 6   | 12345.67        | 51.82            | 20.64       | 74.0           | 22.18       | Peak     | 171.60    | 100         | Vertical | Pass    |

## GFSK LOW CHANNEL 1 GHz to 25 GHz, ANT H

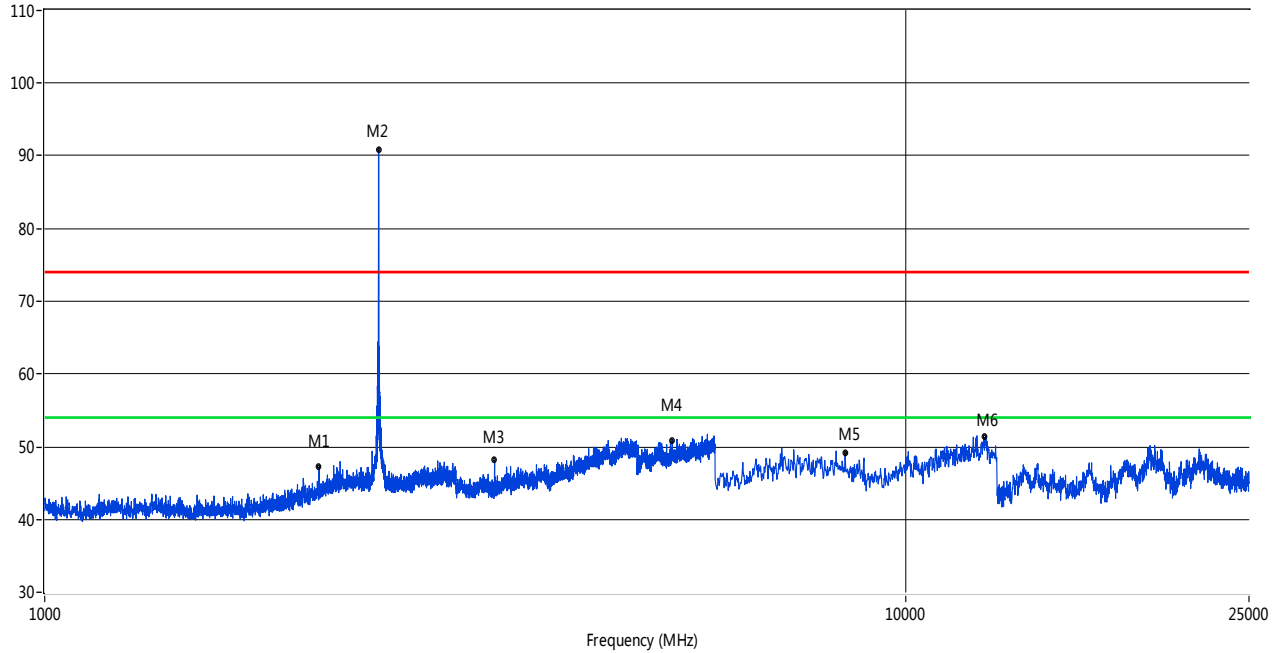
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 2010.25         | 44.72            | -2.18       | 74.0           | 29.28       | Peak     | 252.30    | 100         | Horizontal | Pass    |
| 2   | 2401.65         | 88.33            | -0.27       | 74.0           | -14.33      | Peak     | 187.90    | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.66            | 8.95        | 74.0           | 25.34       | Peak     | 306.30    | 100         | Horizontal | Pass    |
| 4** | 4804.05         | 37.15            | 13.74       | 54.0           | 16.9        | AV       | 359.30    | 100         | Horizontal | Pass    |
| 4   | 4804.05         | 56.74            | 13.74       | 74.0           | 17.26       | Peak     | 359.30    | 100         | Horizontal | Pass    |
| 5   | 8493.34         | 50.22            | 17.82       | 74.0           | 23.78       | Peak     | 232.70    | 100         | Horizontal | Pass    |
| 6   | 10806.99        | 50.95            | 19.73       | 74.0           | 23.05       | Peak     | 12.10     | 100         | Horizontal | Pass    |

## GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V

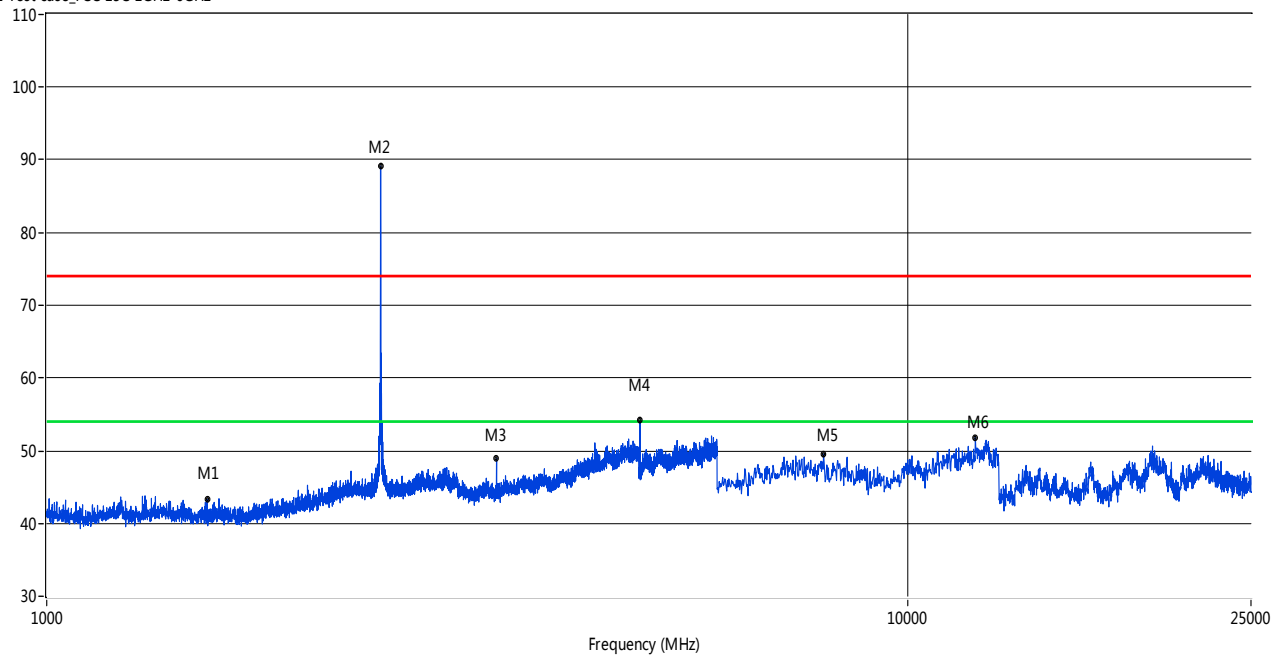
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 2080.73         | 47.22            | -1.66       | 74.0           | 26.78       | Peak     | 149.30    | 100         | Vertical | Pass    |
| 2   | 2440.64         | 90.86            | -0.41       | 74.0           | -16.86      | Peak     | 276.20    | 100         | Vertical | N/A     |
| 3   | 3328.42         | 48.17            | 8.96        | 74.0           | 25.83       | Peak     | 289.60    | 100         | Vertical | Pass    |
| 4   | 5350.66         | 50.84            | 14.82       | 74.0           | 23.16       | Peak     | 28.80     | 100         | Vertical | Pass    |
| 5   | 8493.34         | 49.17            | 17.82       | 74.0           | 24.83       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 12311.98        | 51.32            | 20.64       | 74.0           | 22.68       | Peak     | 353.30    | 100         | Vertical | Pass    |

## GFSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H

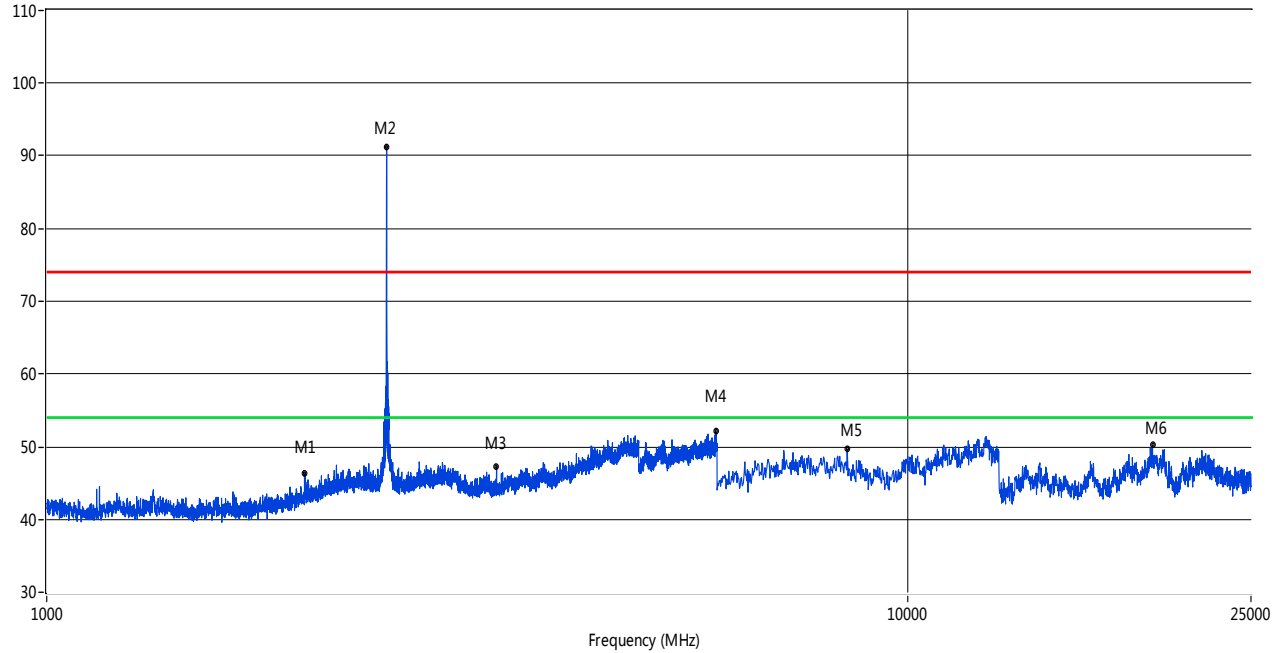
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1534.87         | 43.32            | -4.28       | 74.0           | 30.68       | Peak     | 165.40    | 100         | Horizontal | Pass    |
| 2   | 2440.64         | 89.11            | -0.41       | 74.0           | -15.11      | Peak     | 189.10    | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.97            | 8.95        | 74.0           | 25.03       | Peak     | 1.70      | 100         | Horizontal | Pass    |
| 4** | 4882.03         | 34.55            | 13.60       | 54.0           | 19.5        | AV       | 349.70    | 100         | Horizontal | Pass    |
| 4   | 4882.03         | 54.14            | 13.60       | 74.0           | 19.86       | Peak     | 349.70    | 100         | Horizontal | Pass    |
| 5   | 7976.70         | 49.49            | 17.96       | 74.0           | 24.51       | Peak     | 171.60    | 100         | Horizontal | Pass    |
| 6   | 11963.81        | 51.86            | 20.71       | 74.0           | 22.14       | Peak     | 190.50    | 100         | Horizontal | Pass    |

## GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V

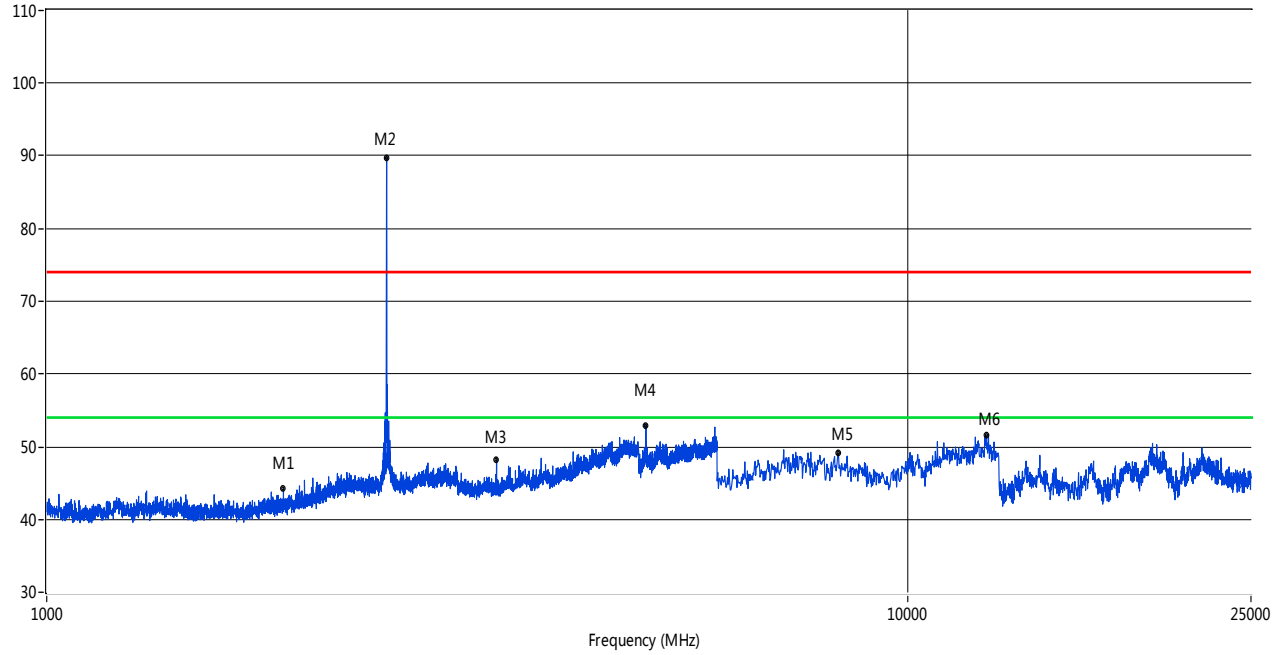
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1991.75         | 46.33            | -2.53       | 74.0           | 27.67       | Peak     | 283.60    | 100         | Vertical | Pass    |
| 2   | 2479.63         | 91.15            | -0.63       | 74.0           | -17.15      | Peak     | 324.30    | 100         | Vertical | N/A     |
| 3   | 3327.67         | 47.36            | 8.95        | 74.0           | 26.64       | Peak     | 140.00    | 100         | Vertical | Pass    |
| 4   | 5976.76         | 52.08            | 15.67       | 74.0           | 21.92       | Peak     | 357.70    | 100         | Vertical | Pass    |
| 5   | 8493.34         | 49.70            | 17.82       | 74.0           | 24.30       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 19209.65        | 50.22            | 14.06       | 74.0           | 23.78       | Peak     | 301.20    | 100         | Vertical | Pass    |

## GFSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H

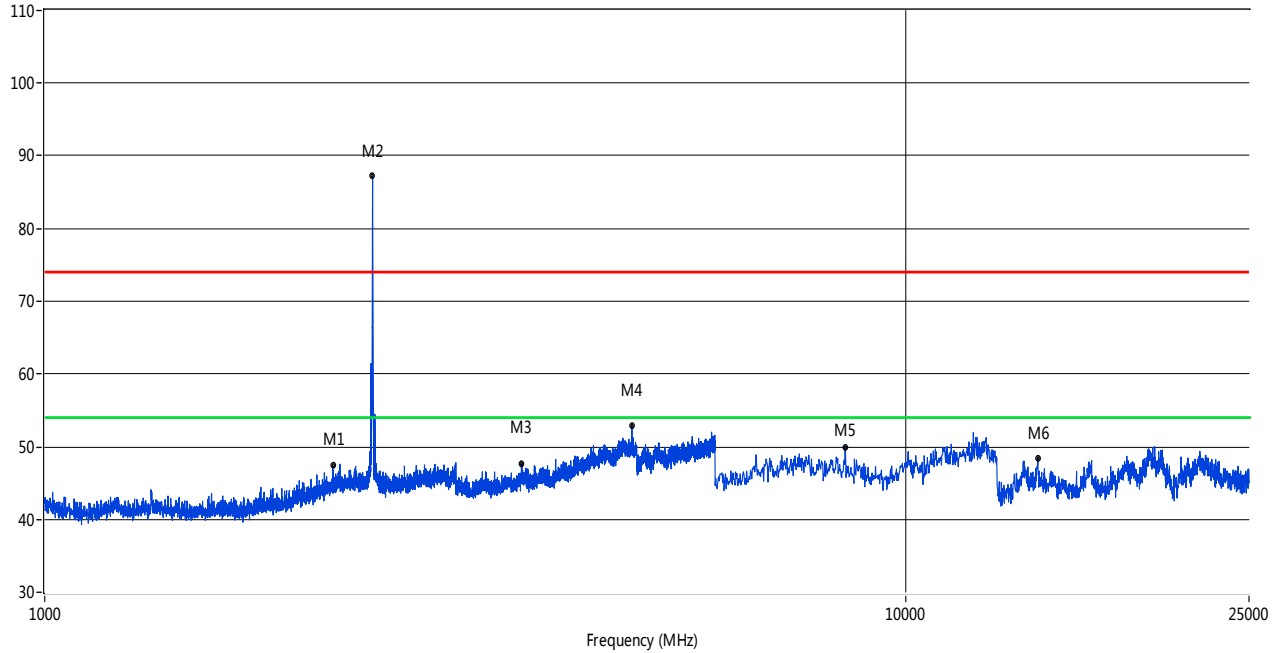
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1882.28         | 44.34            | -3.07       | 74.0           | 29.66       | Peak     | 220.10    | 100         | Horizontal | Pass    |
| 2   | 2479.63         | 89.66            | -0.63       | 74.0           | -15.66      | Peak     | 52.20     | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.23            | 8.95        | 74.0           | 25.77       | Peak     | 302.10    | 100         | Horizontal | Pass    |
| 4   | 4959.26         | 52.88            | 14.19       | 74.0           | 21.12       | Peak     | 292.50    | 100         | Horizontal | Pass    |
| 5   | 8291.18         | 49.12            | 19.23       | 74.0           | 24.88       | Peak     | 312.70    | 100         | Horizontal | Pass    |
| 6   | 12311.98        | 51.57            | 20.64       | 74.0           | 22.43       | Peak     | 353.30    | 100         | Horizontal | Pass    |

# Π/4-DQPSK LOW CHANNEL 1 GHz to 25 GHz, ANT V

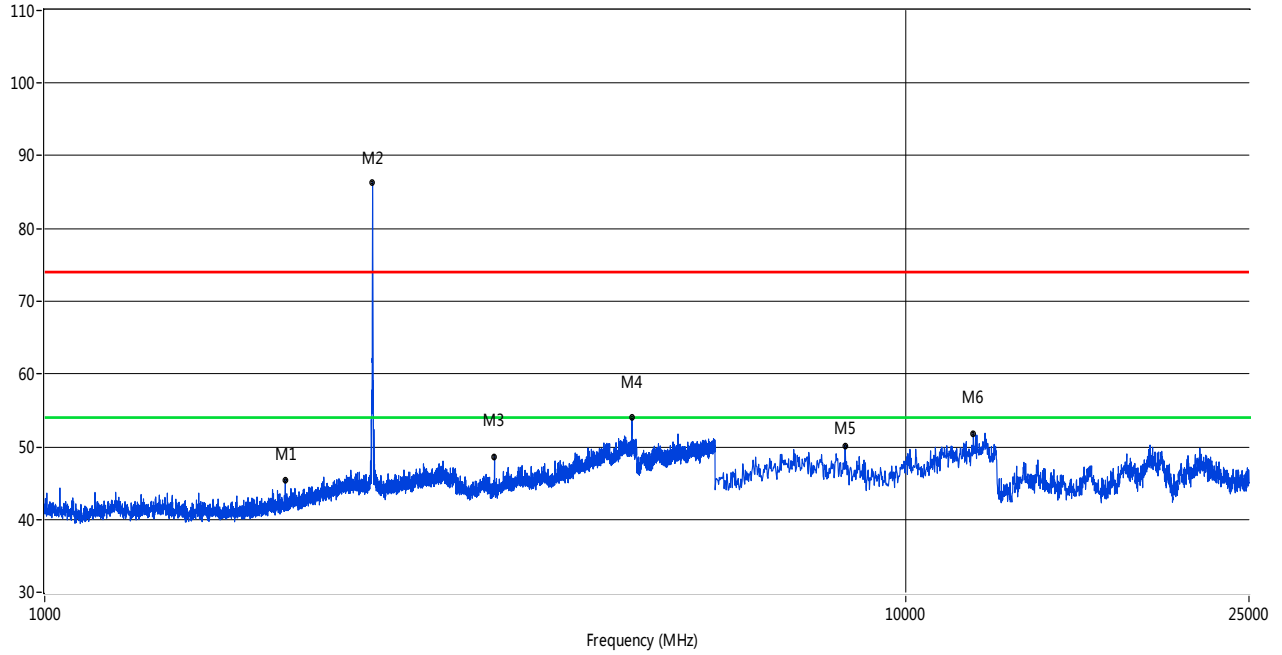
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 2159.21         | 47.39            | -0.98       | 74.0           | 26.61       | Peak     | 141.20    | 100         | Vertical | Pass    |
| 2   | 2401.65         | 87.20            | -0.27       | 74.0           | -13.20      | Peak     | 77.60     | 100         | Vertical | N/A     |
| 3   | 3575.86         | 47.61            | 9.86        | 74.0           | 26.39       | Peak     | 153.60    | 100         | Vertical | Pass    |
| 4   | 4804.05         | 52.91            | 13.74       | 74.0           | 21.09       | Peak     | 143.90    | 100         | Vertical | Pass    |
| 5   | 8493.34         | 49.98            | 17.82       | 74.0           | 24.02       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 14216.31        | 48.48            | 9.61        | 74.0           | 25.52       | Peak     | 323.60    | 100         | Vertical | Pass    |

# Π/4-DQPSK LOW CHANNEL 1 GHz to 25 GHz, ANT H

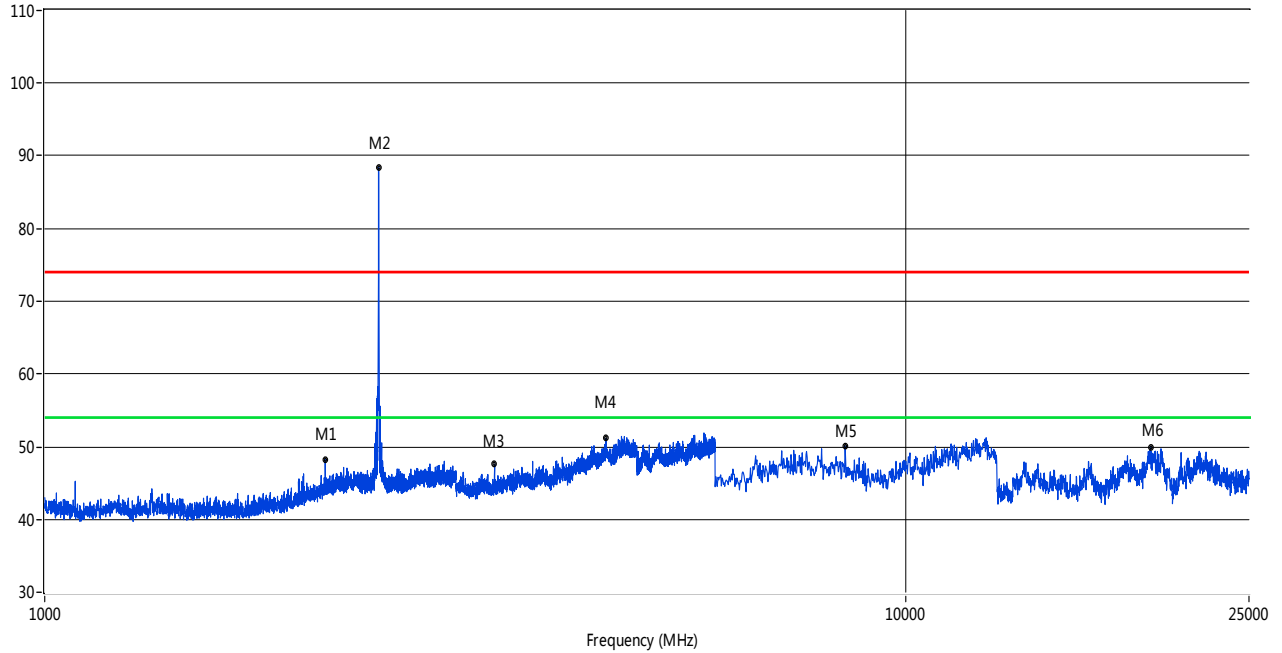
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1901.78         | 45.46            | -2.87       | 74.0           | 28.54       | Peak     | 228.10    | 100         | Horizontal | Pass    |
| 2   | 2401.65         | 86.29            | -0.27       | 74.0           | -12.29      | Peak     | 188.20    | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.67            | 8.95        | 74.0           | 25.33       | Peak     | 295.50    | 100         | Horizontal | Pass    |
| 4   | 4804.05         | 53.99            | 13.74       | 74.0           | 20.01       | Peak     | 310.00    | 100         | Horizontal | Pass    |
| 5   | 8493.34         | 50.17            | 17.82       | 74.0           | 23.83       | Peak     | 232.70    | 100         | Horizontal | Pass    |
| 6   | 11963.81        | 51.83            | 20.71       | 74.0           | 22.17       | Peak     | 190.50    | 100         | Horizontal | Pass    |

# Π/4-DQPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V

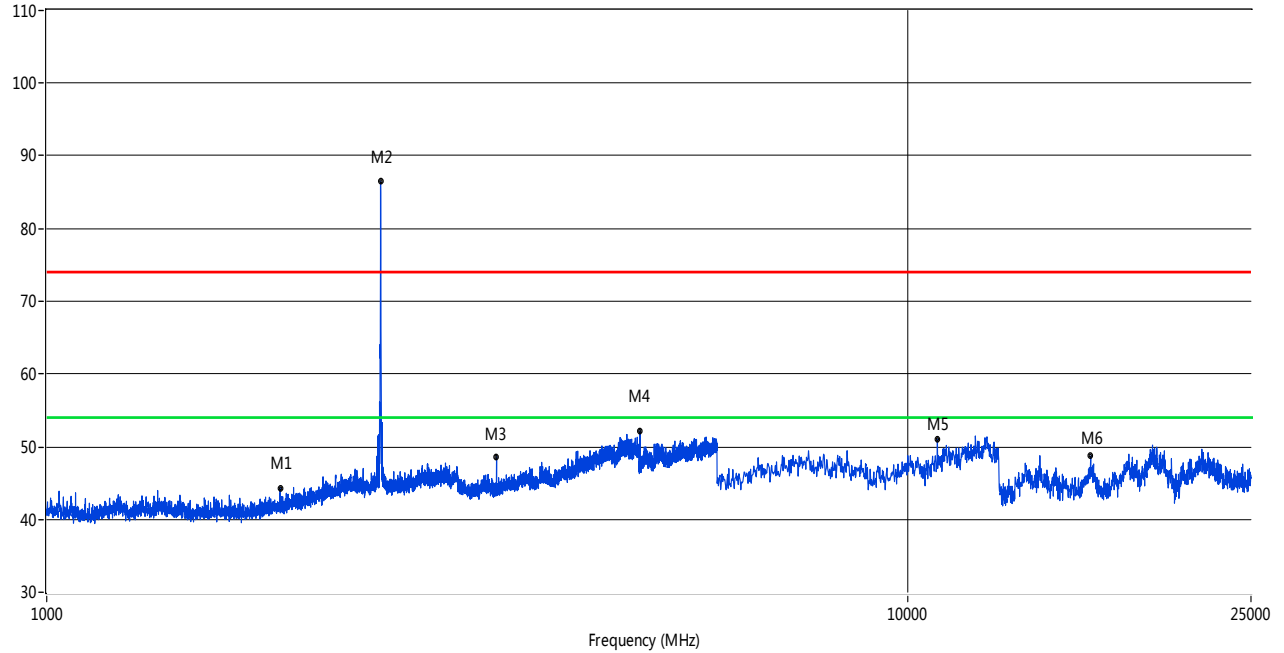
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 2116.22         | 48.23            | -1.30       | 74.0           | 25.77       | Peak     | 147.70    | 100         | Vertical | Pass    |
| 2   | 2440.64         | 88.41            | -0.41       | 74.0           | -14.41      | Peak     | 283.40    | 100         | Vertical | N/A     |
| 3   | 3328.42         | 47.58            | 8.96        | 74.0           | 26.42       | Peak     | 131.50    | 100         | Vertical | Pass    |
| 4   | 4482.38         | 51.15            | 12.70       | 74.0           | 22.85       | Peak     | 338.20    | 100         | Vertical | Pass    |
| 5   | 8493.34         | 50.12            | 17.82       | 74.0           | 23.88       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 19209.65        | 49.98            | 14.06       | 74.0           | 24.02       | Peak     | 301.20    | 100         | Vertical | Pass    |

# $\pi/4$ -DQPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H

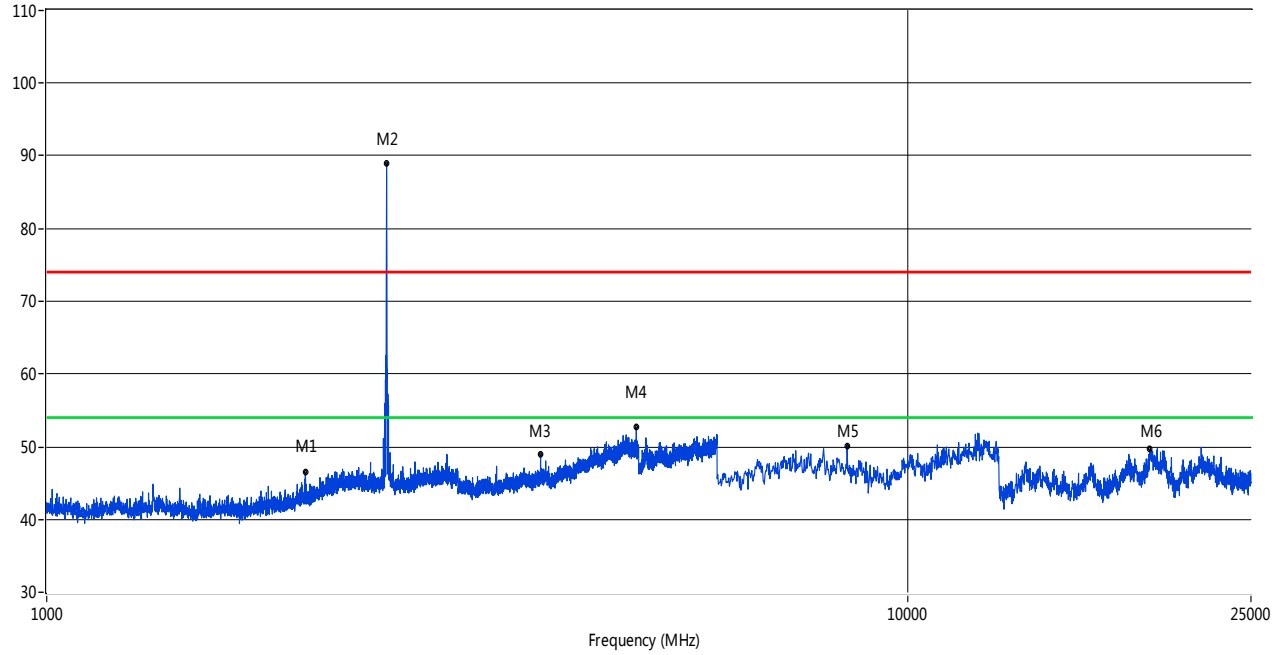
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1865.78         | 44.28            | -3.11       | 74.0           | 29.72       | Peak     | 28.40     | 100         | Horizontal | Pass    |
| 2   | 2440.64         | 86.47            | -0.41       | 74.0           | -12.47      | Peak     | 323.80    | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.62            | 8.95        | 74.0           | 25.38       | Peak     | 359.10    | 100         | Horizontal | Pass    |
| 4   | 4880.53         | 52.09            | 13.62       | 74.0           | 21.91       | Peak     | 348.70    | 100         | Horizontal | Pass    |
| 5   | 10806.99        | 51.03            | 19.73       | 74.0           | 22.97       | Peak     | 12.10     | 100         | Horizontal | Pass    |
| 6   | 16285.77        | 48.72            | 11.59       | 74.0           | 25.28       | Peak     | 153.80    | 100         | Horizontal | Pass    |

# $\pi/4$ -DQPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V

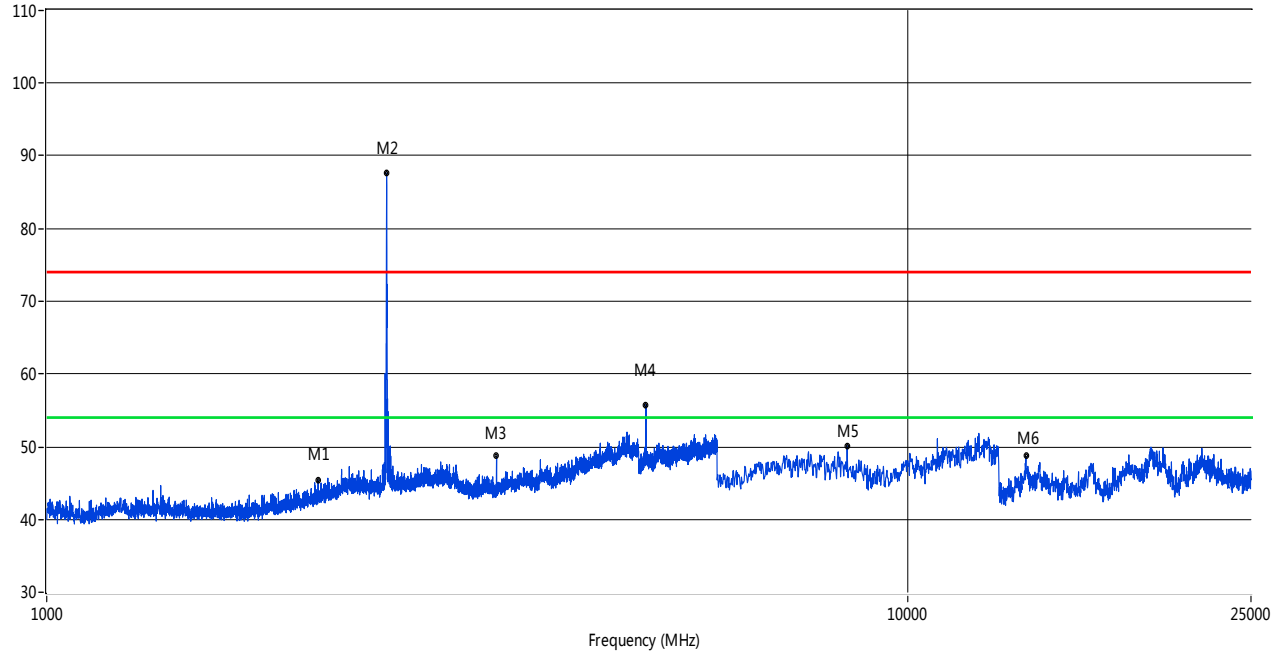
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1995.75         | 46.44            | -2.51       | 74.0           | 27.56       | Peak     | 283.90    | 100         | Vertical | Pass    |
| 2   | 2479.63         | 88.91            | -0.63       | 74.0           | -14.91      | Peak     | 92.90     | 100         | Vertical | N/A     |
| 3   | 3743.06         | 48.91            | 10.74       | 74.0           | 25.09       | Peak     | 13.70     | 100         | Vertical | Pass    |
| 4   | 4834.79         | 52.64            | 13.67       | 74.0           | 21.36       | Peak     | 86.70     | 100         | Vertical | Pass    |
| 5   | 8493.34         | 50.17            | 17.82       | 74.0           | 23.83       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 19069.88        | 49.66            | 13.64       | 74.0           | 24.34       | Peak     | 131.70    | 100         | Vertical | Pass    |

# Π/4-DQPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H

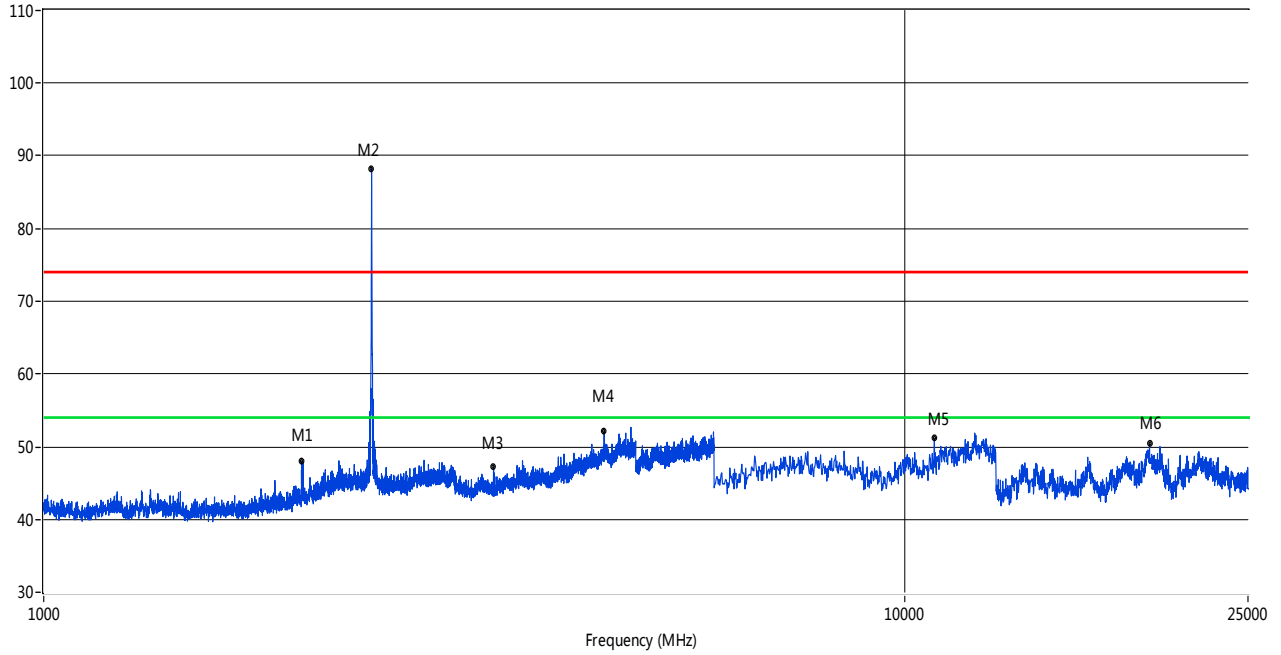
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 2065.23         | 45.44            | -1.87       | 74.0           | 28.56       | Peak     | 236.00    | 100         | Horizontal | Pass    |
| 2   | 2480.13         | 87.61            | -0.60       | 74.0           | -13.61      | Peak     | 60.80     | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.73            | 8.95        | 74.0           | 25.27       | Peak     | 0.50      | 100         | Horizontal | Pass    |
| 4** | 4960.76         | 36.19            | 14.26       | 54.0           | 17.8        | AV       | 325.50    | 100         | Horizontal | Pass    |
| 4   | 4960.76         | 55.78            | 14.26       | 74.0           | 18.22       | Peak     | 325.50    | 100         | Horizontal | Pass    |
| 5   | 8493.34         | 50.13            | 17.82       | 74.0           | 23.87       | Peak     | 232.70    | 100         | Horizontal | Pass    |
| 6   | 13696.34        | 48.69            | 9.65        | 74.0           | 25.31       | Peak     | 59.30     | 100         | Horizontal | Pass    |

## 8-DPSK LOW CHANNEL 1 GHz to 25 GHz, ANT V

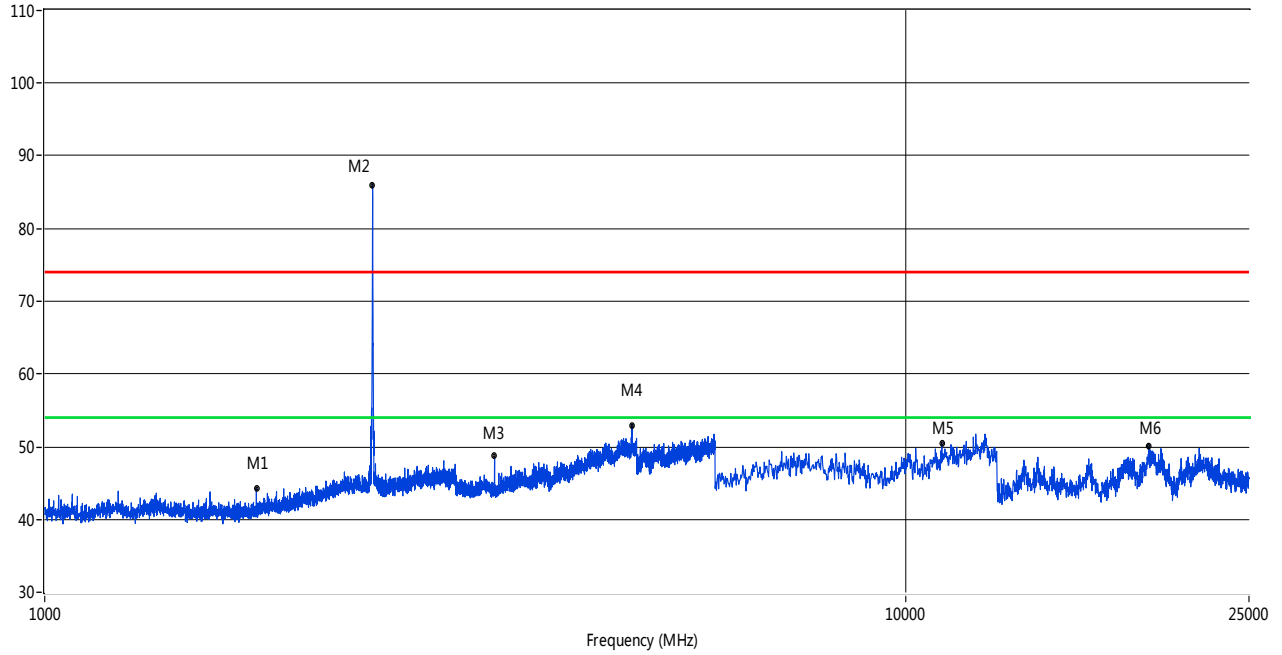
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1992.75         | 47.96            | -2.55       | 74.0           | 26.04       | Peak     | 268.30    | 100         | Vertical | Pass    |
| 2   | 2401.65         | 88.27            | -0.27       | 74.0           | -14.27      | Peak     | 164.30    | 100         | Vertical | N/A     |
| 3   | 3327.67         | 47.37            | 8.95        | 74.0           | 26.63       | Peak     | 183.90    | 100         | Vertical | Pass    |
| 4   | 4471.88         | 52.09            | 12.54       | 74.0           | 21.91       | Peak     | 71.80     | 100         | Vertical | Pass    |
| 5   | 10806.99        | 51.13            | 19.73       | 74.0           | 22.87       | Peak     | 12.10     | 100         | Vertical | Pass    |
| 6   | 19209.65        | 50.51            | 14.06       | 74.0           | 23.49       | Peak     | 301.20    | 100         | Vertical | Pass    |

# 8-DPSK LOW CHANNEL 1 GHz to 25 GHz, ANT H

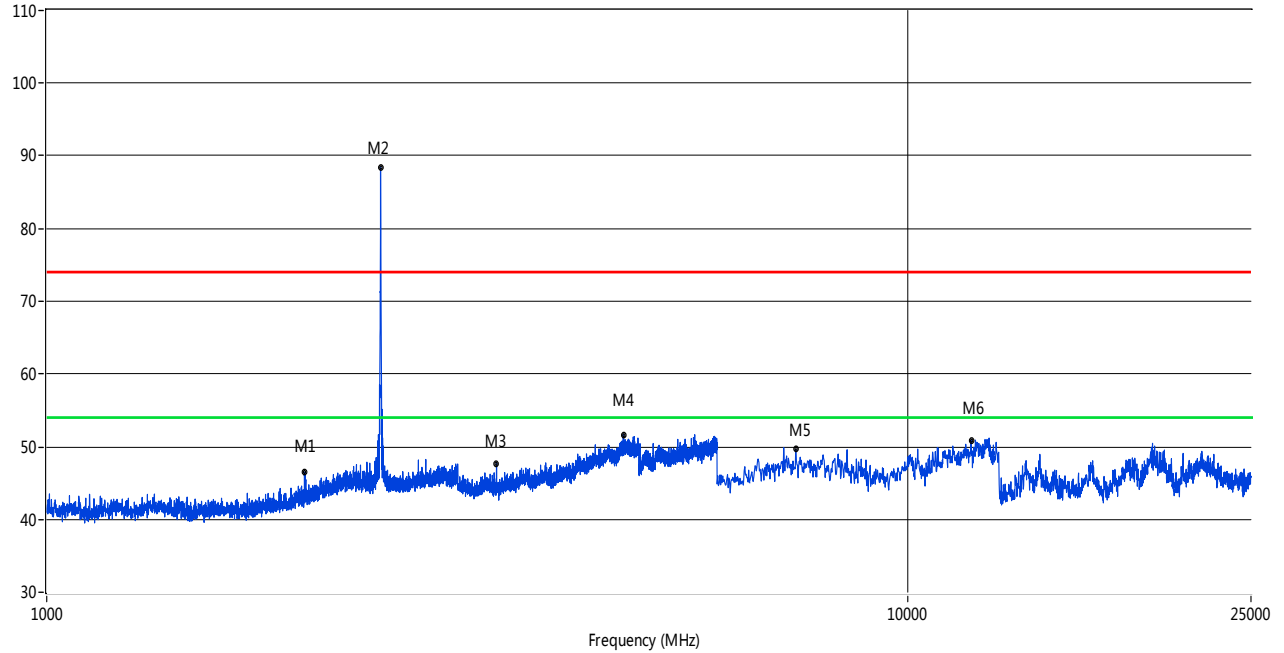
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1760.81         | 44.29            | -3.75       | 74.0           | 29.71       | Peak     | 125.90    | 100         | Horizontal | Pass    |
| 2   | 2401.65         | 86.04            | -0.27       | 74.0           | -12.04      | Peak     | 181.20    | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.73            | 8.95        | 74.0           | 25.27       | Peak     | 301.40    | 100         | Horizontal | Pass    |
| 4   | 4803.30         | 52.95            | 13.74       | 74.0           | 21.05       | Peak     | 340.30    | 100         | Horizontal | Pass    |
| 5   | 10997.92        | 50.45            | 20.11       | 74.0           | 23.55       | Peak     | 357.10    | 100         | Horizontal | Pass    |
| 6   | 19129.78        | 50.12            | 13.86       | 74.0           | 23.88       | Peak     | 23.20     | 100         | Horizontal | Pass    |

## 8-DPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT V

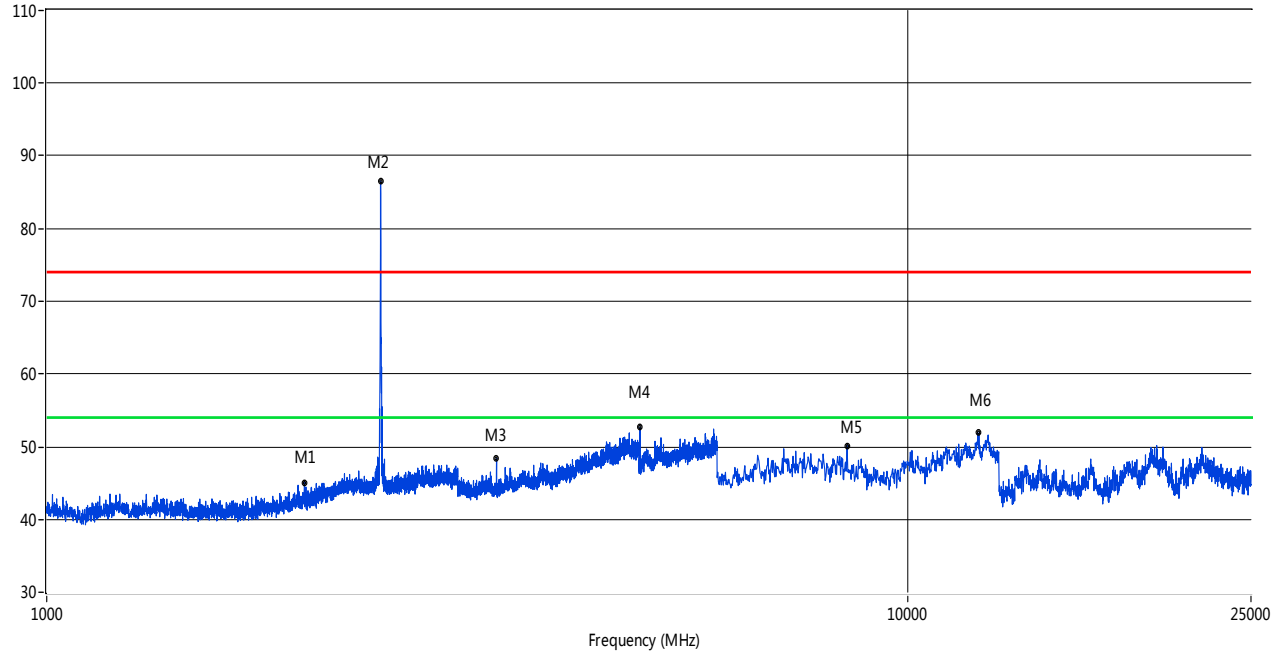
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1990.75         | 46.49            | -2.61       | 74.0           | 27.51       | Peak     | 276.50    | 100         | Vertical | Pass    |
| 2   | 2440.64         | 88.43            | -0.41       | 74.0           | -14.43      | Peak     | 284.30    | 100         | Vertical | N/A     |
| 3   | 3327.67         | 47.73            | 8.95        | 74.0           | 26.27       | Peak     | 335.10    | 100         | Vertical | Pass    |
| 4   | 4669.83         | 51.62            | 13.15       | 74.0           | 22.38       | Peak     | 286.10    | 100         | Vertical | Pass    |
| 5   | 7403.91         | 49.64            | 17.02       | 74.0           | 24.36       | Peak     | 275.30    | 100         | Vertical | Pass    |
| 6   | 11829.03        | 50.88            | 20.39       | 74.0           | 23.12       | Peak     | 326.70    | 100         | Vertical | Pass    |

## 8-DPSK MIDDLE CHANNEL 1 GHz to 25 GHz, ANT H

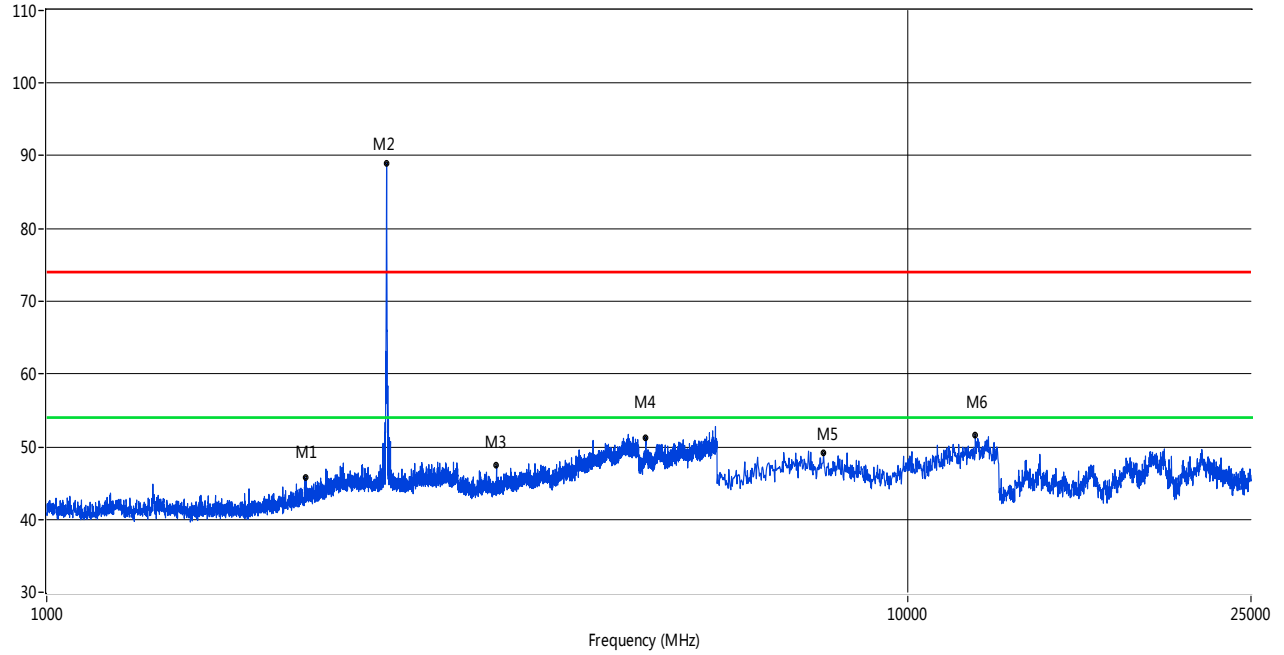
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1991.25         | 45.04            | -2.58       | 74.0           | 28.96       | Peak     | 236.60    | 100         | Horizontal | Pass    |
| 2   | 2441.14         | 86.50            | -0.38       | 74.0           | -12.50      | Peak     | 180.80    | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.42            | 8.95        | 74.0           | 25.58       | Peak     | 291.20    | 100         | Horizontal | Pass    |
| 4   | 4882.78         | 52.65            | 13.61       | 74.0           | 21.35       | Peak     | 310.50    | 100         | Horizontal | Pass    |
| 5   | 8493.34         | 50.14            | 17.82       | 74.0           | 23.86       | Peak     | 232.70    | 100         | Horizontal | Pass    |
| 6   | 12076.12        | 51.91            | 20.80       | 74.0           | 22.09       | Peak     | 317.50    | 100         | Horizontal | Pass    |

## 8-DPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT V

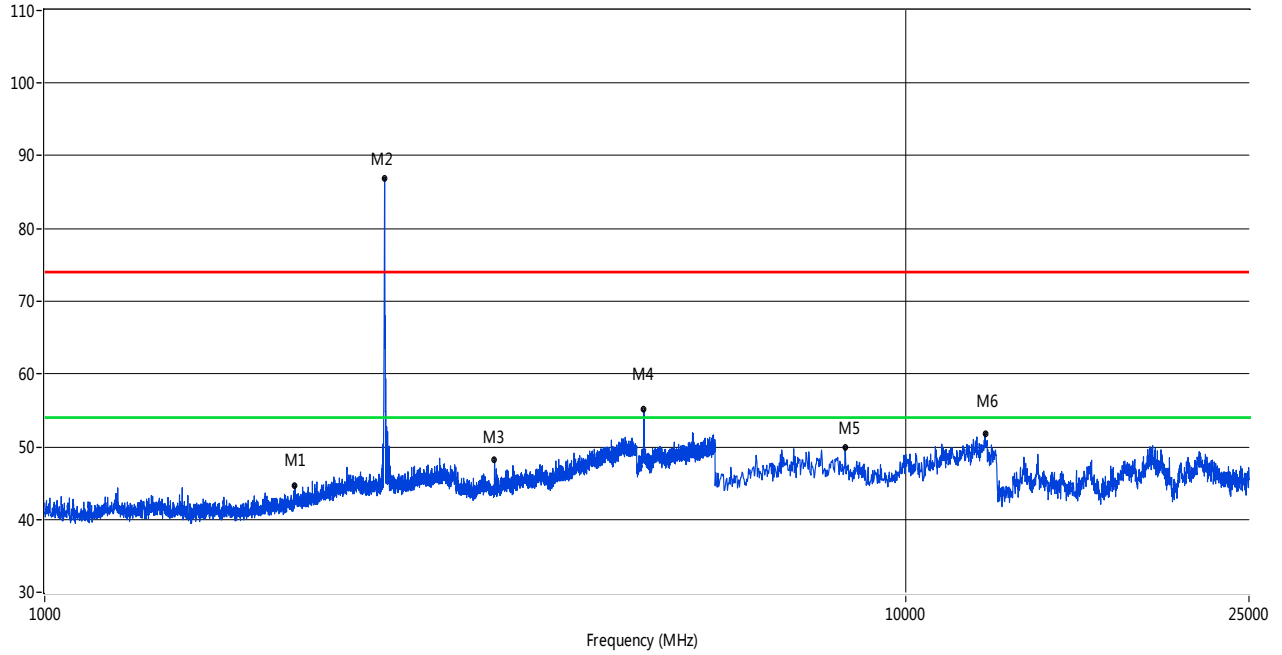
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1995.75         | 45.73            | -2.51       | 74.0           | 28.27       | Peak     | 276.40    | 100         | Vertical | Pass    |
| 2   | 2480.13         | 88.98            | -0.60       | 74.0           | -14.98      | Peak     | 324.10    | 100         | Vertical | N/A     |
| 3   | 3328.42         | 47.42            | 8.96        | 74.0           | 26.58       | Peak     | 294.60    | 100         | Vertical | Pass    |
| 4   | 4959.26         | 51.26            | 14.19       | 74.0           | 22.74       | Peak     | 0.10      | 100         | Vertical | Pass    |
| 5   | 7976.70         | 49.08            | 17.96       | 74.0           | 24.92       | Peak     | 171.60    | 100         | Vertical | Pass    |
| 6   | 11963.81        | 51.65            | 20.71       | 74.0           | 22.35       | Peak     | 190.50    | 100         | Vertical | Pass    |

## 8-DPSK HIGH CHANNEL 1 GHz to 25 GHz, ANT H

RE Test case\_FCC 15C 1GHz-6GHz

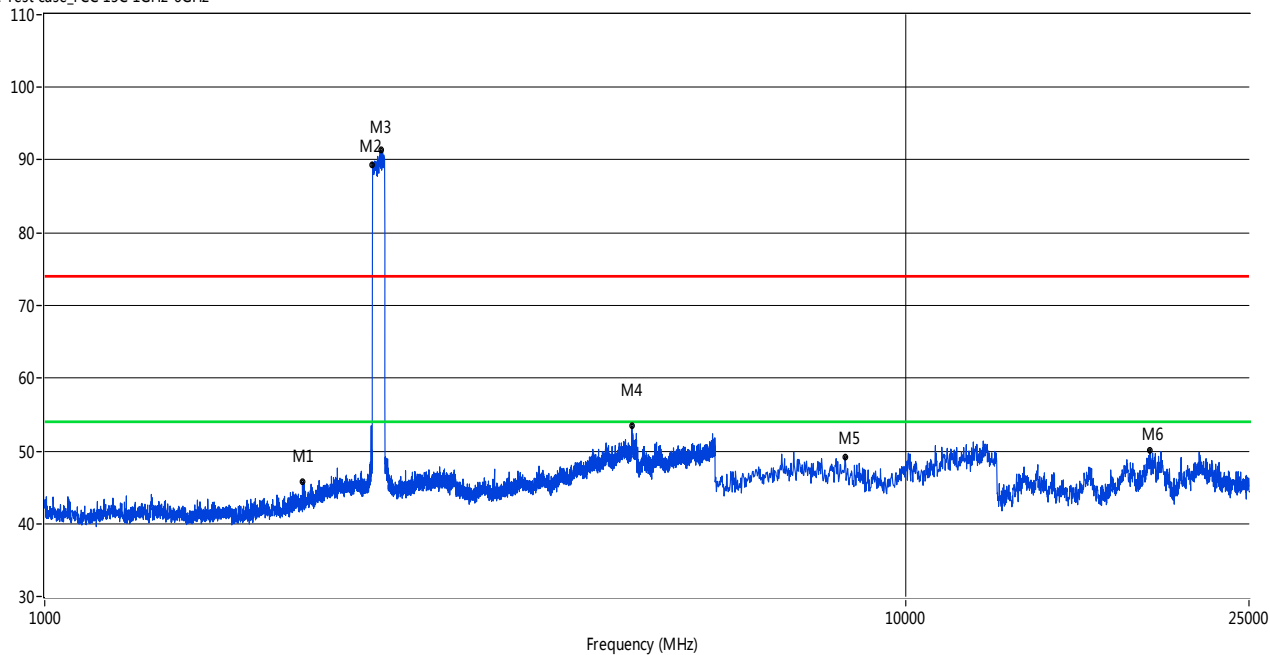


| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1952.26         | 44.74            | -2.39       | 74.0           | 29.26       | Peak     | 244.40    | 100         | Horizontal | Pass    |
| 2   | 2480.13         | 86.86            | -0.60       | 74.0           | -12.86      | Peak     | 53.70     | 100         | Horizontal | N/A     |
| 3   | 3327.67         | 48.24            | 8.95        | 74.0           | 25.76       | Peak     | 301.00    | 100         | Horizontal | Pass    |
| 4** | 4960.76         | 35.5             | 14.26       | 54.0           | 18.5        | AV       | 344.80    | 100         | Horizontal | Pass    |
| 4   | 4960.76         | 55.09            | 14.26       | 74.0           | 18.91       | Peak     | 344.80    | 100         | Horizontal | Pass    |
| 5   | 8493.34         | 49.96            | 17.82       | 74.0           | 24.04       | Peak     | 232.70    | 100         | Horizontal | Pass    |
| 6   | 12345.67        | 51.85            | 20.64       | 74.0           | 22.15       | Peak     | 171.60    | 100         | Horizontal | Pass    |

### Hopping Mode:

#### GFSK MODE 1 GHz to 25 GHz, ANT V

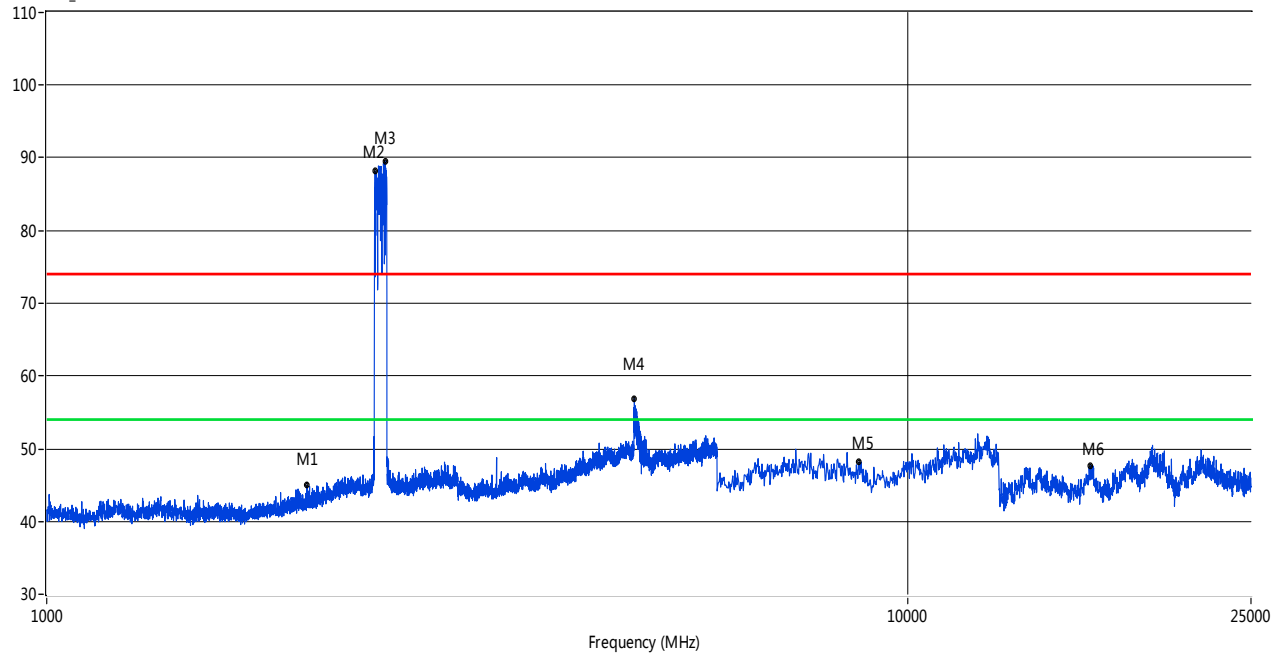
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1993.25         | 45.71            | -2.54       | 74.0           | 28.29       | Peak     | 276.50    | 100         | Vertical | Pass    |
| 2   | 2401.65         | 89.29            | -0.27       | 74.0           | -15.29      | Peak     | 76.20     | 100         | Vertical | N/A     |
| 3   | 2456.64         | 91.32            | -0.51       | 74.0           | -17.32      | Peak     | 284.30    | 100         | Vertical | N/A     |
| 4   | 4804.05         | 53.42            | 13.74       | 74.0           | 20.58       | Peak     | 353.50    | 100         | Vertical | Pass    |
| 5   | 8493.34         | 49.15            | 17.82       | 74.0           | 24.85       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 19189.68        | 50.10            | 14.08       | 74.0           | 23.90       | Peak     | 51.70     | 100         | Vertical | Pass    |

## GFSK MODE 1 GHz to 25 GHz, ANT H

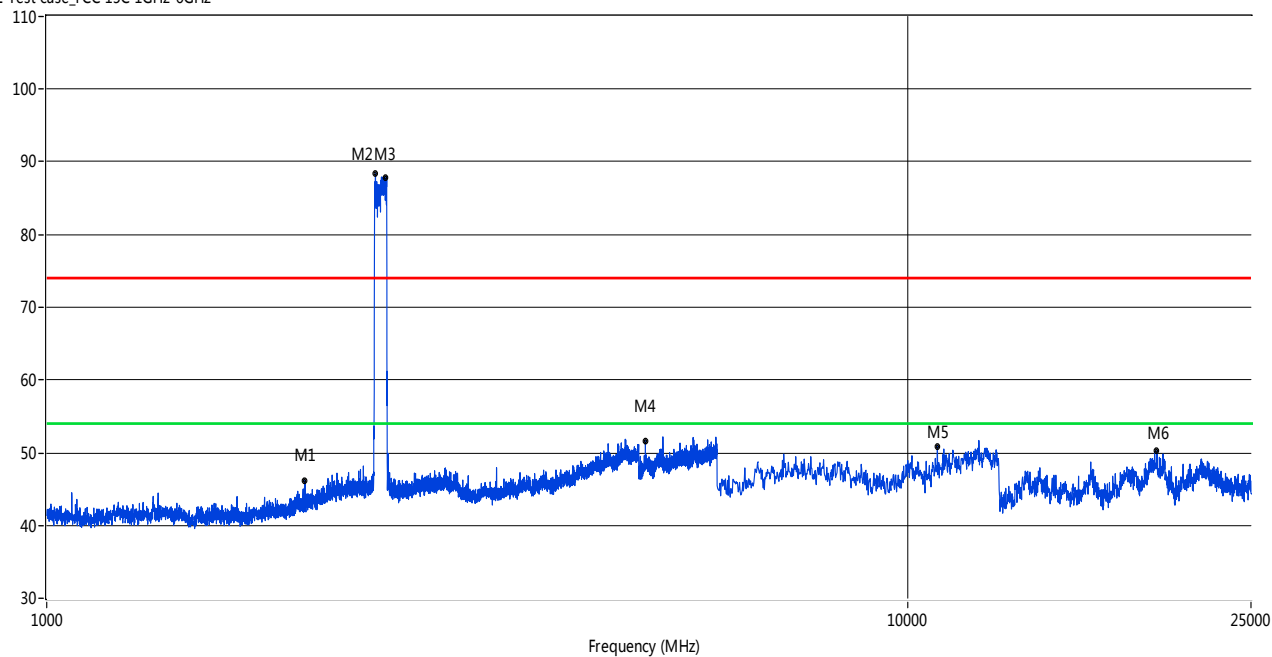
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 2004.75         | 44.98            | -2.28       | 74.0           | 29.02       | Peak     | 219.80    | 100         | Horizontal | Pass    |
| 2   | 2405.15         | 88.21            | -0.24       | 74.0           | -14.21      | Peak     | 179.50    | 100         | Horizontal | N/A     |
| 3   | 2470.13         | 89.59            | -0.51       | 74.0           | -15.59      | Peak     | 187.60    | 100         | Horizontal | N/A     |
| 4** | 4809.30         | 37.35            | 13.85       | 54.0           | 16.7        | AV       | 349.60    | 100         | Horizontal | Pass    |
| 4   | 4809.30         | 56.94            | 13.85       | 74.0           | 17.06       | Peak     | 349.60    | 100         | Horizontal | Pass    |
| 5   | 8751.66         | 48.14            | 17.55       | 74.0           | 25.86       | Peak     | 180.90    | 100         | Horizontal | Pass    |
| 6   | 16285.77        | 47.73            | 11.59       | 74.0           | 26.27       | Peak     | 153.80    | 100         | Horizontal | Pass    |

# Π/4-DQPSK MODE 1 GHz to 25 GHz, ANT V

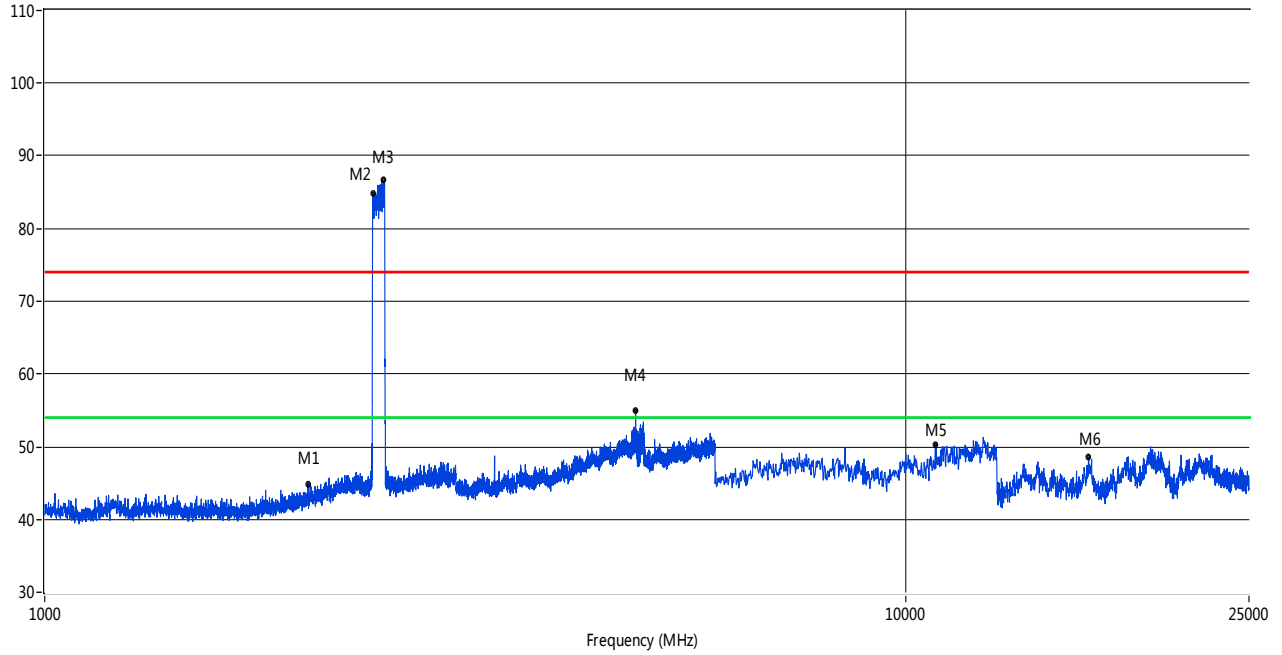
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1992.25         | 46.24            | -2.53       | 74.0           | 27.76       | Peak     | 276.10    | 100         | Vertical | Pass    |
| 2   | 2407.65         | 88.37            | -0.18       | 74.0           | -14.37      | Peak     | 180.60    | 100         | Vertical | N/A     |
| 3   | 2469.13         | 87.88            | -0.51       | 74.0           | -13.88      | Peak     | 276.10    | 100         | Vertical | N/A     |
| 4   | 4954.01         | 51.59            | 14.09       | 74.0           | 22.41       | Peak     | 207.10    | 100         | Vertical | Pass    |
| 5   | 10806.99        | 50.92            | 19.73       | 74.0           | 23.08       | Peak     | 12.10     | 100         | Vertical | Pass    |
| 6   | 19429.28        | 50.25            | 12.84       | 74.0           | 23.75       | Peak     | 343.40    | 100         | Vertical | Pass    |

# Π/4-DQPSK MODE 1 GHz to 25 GHz, ANT H

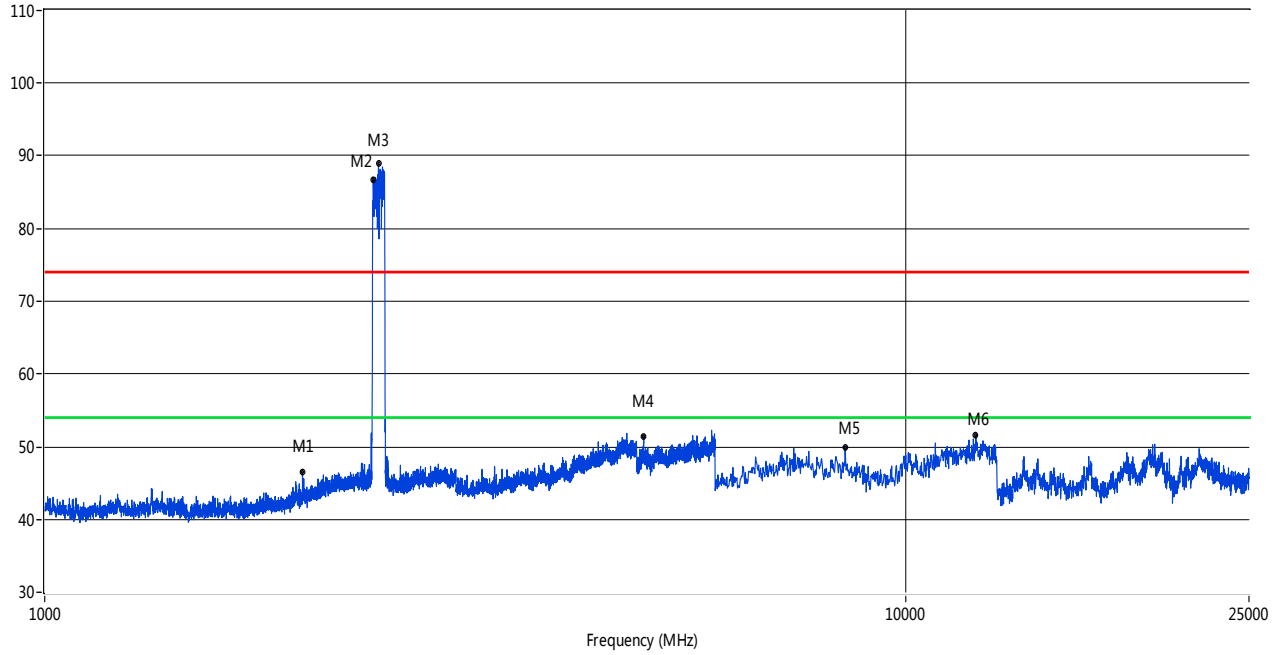
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 2021.24         | 44.80            | -2.22       | 74.0           | 29.20       | Peak     | 115.80    | 100         | Horizontal | Pass    |
| 2   | 2405.15         | 84.78            | -0.24       | 74.0           | -10.78      | Peak     | 179.80    | 100         | Horizontal | N/A     |
| 3   | 2476.13         | 86.68            | -0.55       | 74.0           | -12.68      | Peak     | 52.10     | 100         | Horizontal | N/A     |
| 4** | 4851.29         | 35.45            | 13.60       | 54.0           | 18.6        | AV       | 353.90    | 100         | Horizontal | Pass    |
| 4   | 4851.29         | 55.04            | 13.60       | 74.0           | 18.96       | Peak     | 353.90    | 100         | Horizontal | Pass    |
| 5   | 10806.99        | 50.30            | 19.73       | 74.0           | 23.70       | Peak     | 12.10     | 100         | Horizontal | Pass    |
| 6   | 16285.77        | 48.53            | 11.59       | 74.0           | 25.47       | Peak     | 153.80    | 100         | Horizontal | Pass    |

## 8-DPSK MODE 1 GHz to 25 GHz, ANT V

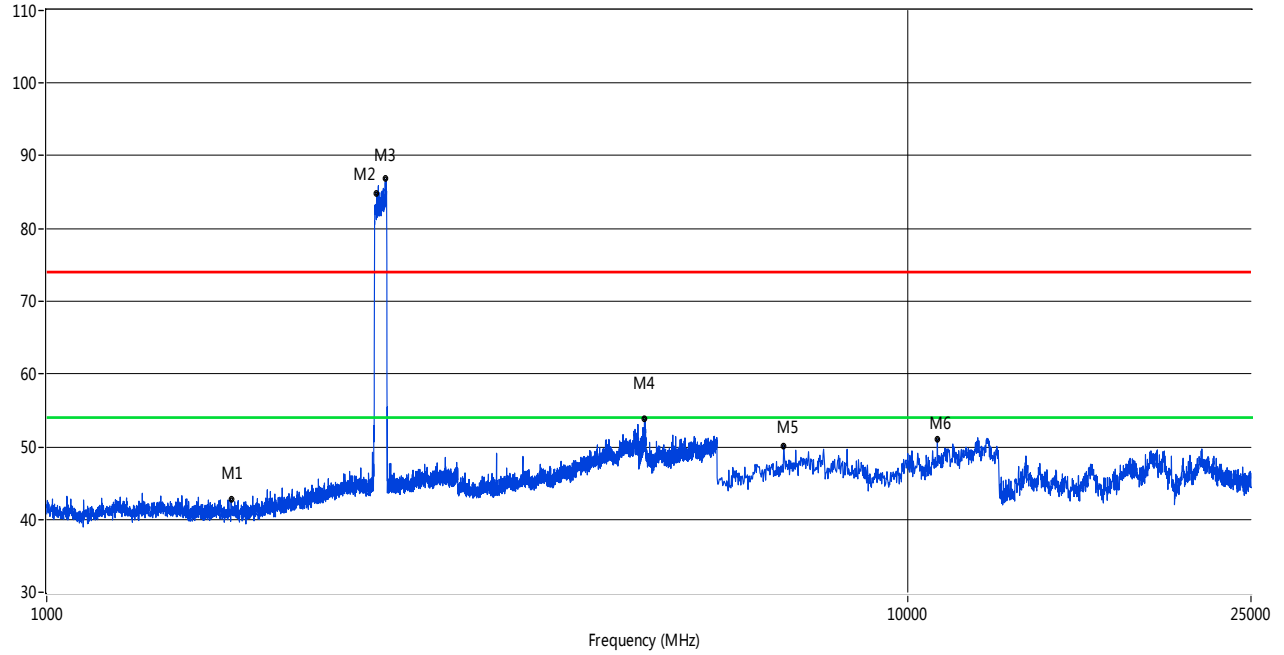
RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1991.75         | 46.52            | -2.53       | 74.0           | 27.48       | Peak     | 260.10    | 100         | Vertical | Pass    |
| 2   | 2405.65         | 86.73            | -0.17       | 74.0           | -12.73      | Peak     | 76.50     | 100         | Vertical | N/A     |
| 3   | 2439.64         | 88.90            | -0.46       | 74.0           | -14.90      | Peak     | 76.50     | 100         | Vertical | N/A     |
| 4   | 4957.01         | 51.39            | 14.13       | 74.0           | 22.61       | Peak     | 360.00    | 100         | Vertical | Pass    |
| 5   | 8493.34         | 49.89            | 17.82       | 74.0           | 24.11       | Peak     | 232.70    | 100         | Vertical | Pass    |
| 6   | 12042.43        | 51.62            | 20.83       | 74.0           | 22.38       | Peak     | 115.40    | 100         | Vertical | Pass    |

## 8-DPSK MODE 1 GHz to 25 GHz, ANT H

RE Test case\_FCC 15C 1GHz-6GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1636.84         | 42.68            | -4.21       | 74.0           | 31.32       | Peak     | 92.90     | 100         | Horizontal | Pass    |
| 2   | 2414.65         | 84.93            | -0.04       | 74.0           | -10.93      | Peak     | 188.30    | 100         | Horizontal | N/A     |
| 3   | 2474.13         | 86.81            | -0.49       | 74.0           | -12.81      | Peak     | 52.90     | 100         | Horizontal | N/A     |
| 4   | 4943.51         | 53.83            | 14.12       | 74.0           | 20.17       | Peak     | 300.30    | 100         | Horizontal | Pass    |
| 5   | 7168.05         | 50.14            | 17.52       | 74.0           | 23.86       | Peak     | 0.00      | 100         | Horizontal | Pass    |
| 6   | 10806.99        | 50.95            | 19.73       | 74.0           | 23.05       | Peak     | 12.10     | 100         | Horizontal | Pass    |

## A.9 Band Edge

### Test Data

Note 1: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

Note 2: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have show the worst case.

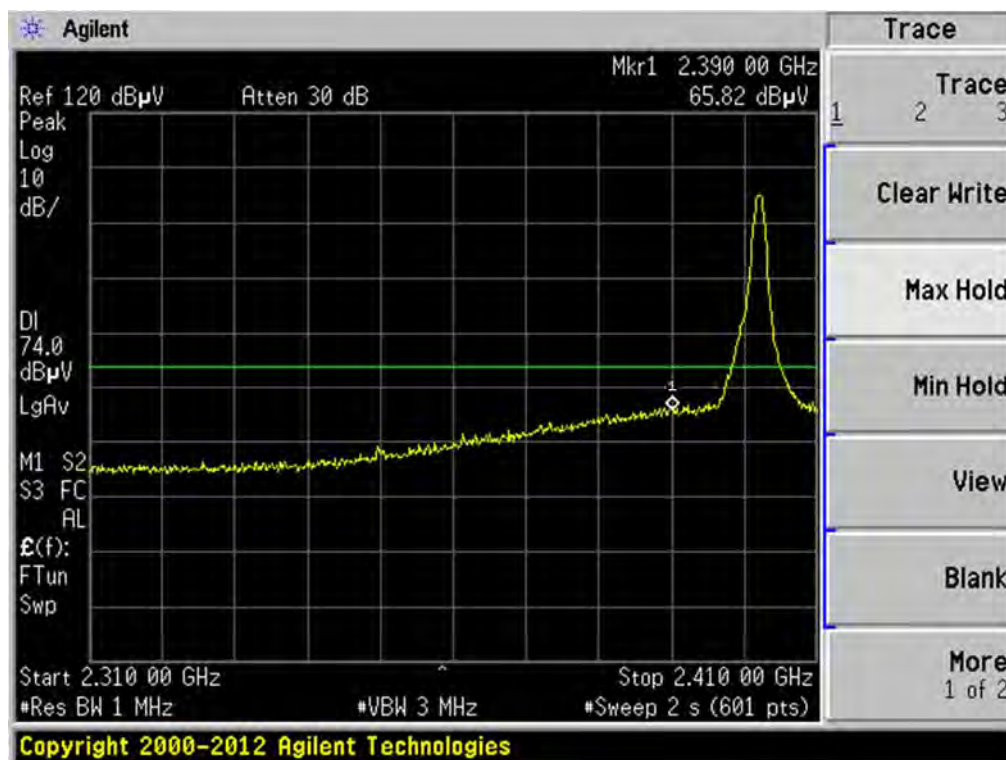
Note 3: The average levels were calculated from the peak level corrected with duty cycle correction factor (15.59 dB) derived from  $20\log(\text{dwell time}/100 \text{ ms})$ .

For example: Average level = 65.82 dBuV/m – 19.59 (dB) = 46.23 dBuV/m.

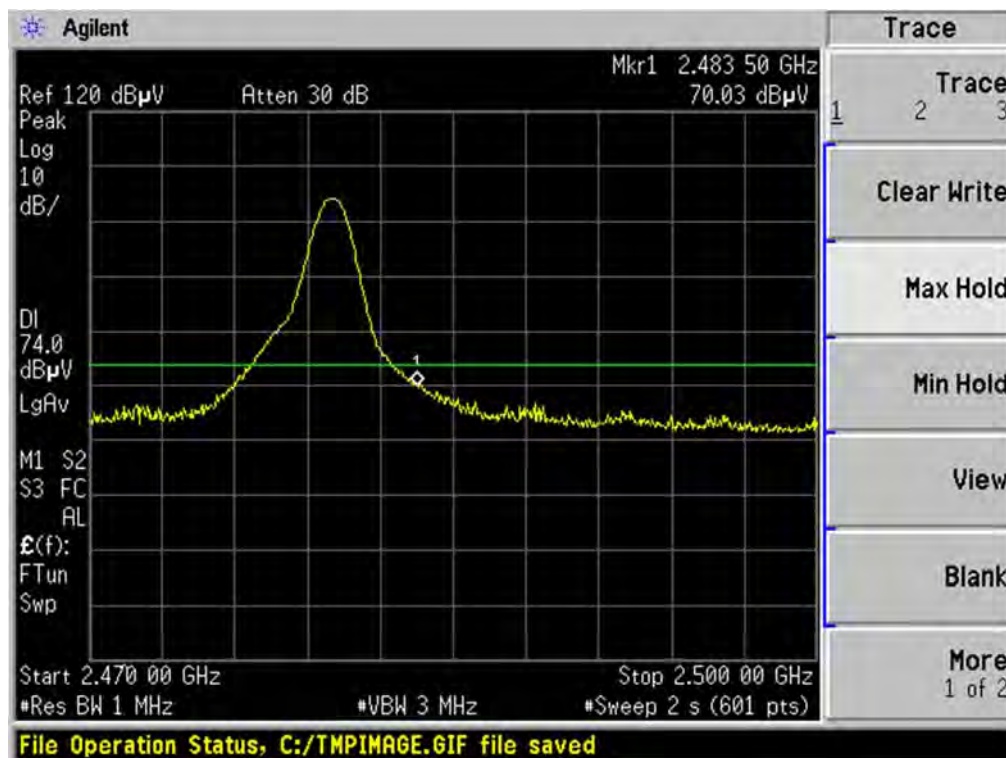
| Test Mode          | Test Channel | Frequency (MHz) | Level (dBuV/m) | Limit Line (dBuV/m) | Margin (dB) | Remark  | Verdict |
|--------------------|--------------|-----------------|----------------|---------------------|-------------|---------|---------|
| GFSK               | Low          | 2390.00         | 65.82          | 74                  | 8.18        | PEAK    | Pass    |
|                    |              | 2390.00         | 46.23          | 54                  | 7.77        | AVERAGE | Pass    |
| GFSK               | HIGH         | 2483.50         | 70.03          | 74                  | 3.97        | PEAK    | Pass    |
|                    |              | 2483.50         | 50.44          | 54                  | 3.56        | AVERAGE | Pass    |
| Π/4DQPSK           | Low          | 2390.00         | 65.69          | 74                  | 8.31        | PEAK    | Pass    |
|                    |              | 2390.00         | 46.1           | 54                  | 7.9         | AVERAGE | Pass    |
| Π/4DQPSK           | HIGH         | 2483.50         | 70.89          | 74                  | 3.11        | PEAK    | Pass    |
|                    |              | 2483.50         | 51.3           | 54                  | 2.7         | AVERAGE | Pass    |
| 8-DPSK             | Low          | 2390.00         | 66.28          | 74                  | 7.72        | PEAK    | Pass    |
|                    |              | 2390.00         | 46.69          | 54                  | 7.31        | AVERAGE | Pass    |
| 8-DPSK             | HIGH         | 2483.50         | 70.06          | 74                  | 3.94        | PEAK    | Pass    |
|                    |              | 2483.50         | 50.47          | 54                  | 3.53        | AVERAGE | Pass    |
| GFSK(Hopping)      | Low          | 2390.00         | 65.47          | 74                  | 8.53        | PEAK    | Pass    |
|                    |              | 2390.00         | 45.88          | 54                  | 8.12        | AVERAGE | Pass    |
| GFSK(Hopping)      | HIGH         | 2483.50         | 70.23          | 74                  | 3.77        | PEAK    | Pass    |
|                    |              | 2483.50         | 50.64          | 54                  | 3.36        | AVERAGE | Pass    |
| Π/4DQPSK (Hopping) | Low          | 2390.00         | 65.69          | 74                  | 8.31        | PEAK    | Pass    |
|                    |              | 2390.00         | 46.1           | 54                  | 7.9         | AVERAGE | Pass    |
| Π/4DQPSK (Hopping) | HIGH         | 2483.50         | 70.89          | 74                  | 3.11        | PEAK    | Pass    |
|                    |              | 2483.50         | 51.3           | 54                  | 2.7         | AVERAGE | Pass    |
| 8-DPSK (Hopping)   | Low          | 2390.00         | 65.15          | 74                  | 8.85        | PEAK    | Pass    |
|                    |              | 2390.00         | 45.56          | 54                  | 8.44        | AVERAGE | Pass    |
| 8-DPSK (Hopping)   | HIGH         | 2483.50         | 70.06          | 74                  | 3.94        | PEAK    | Pass    |
|                    |              | 2483.50         | 50.47          | 54                  | 3.53        | AVERAGE | Pass    |

# Test Plots

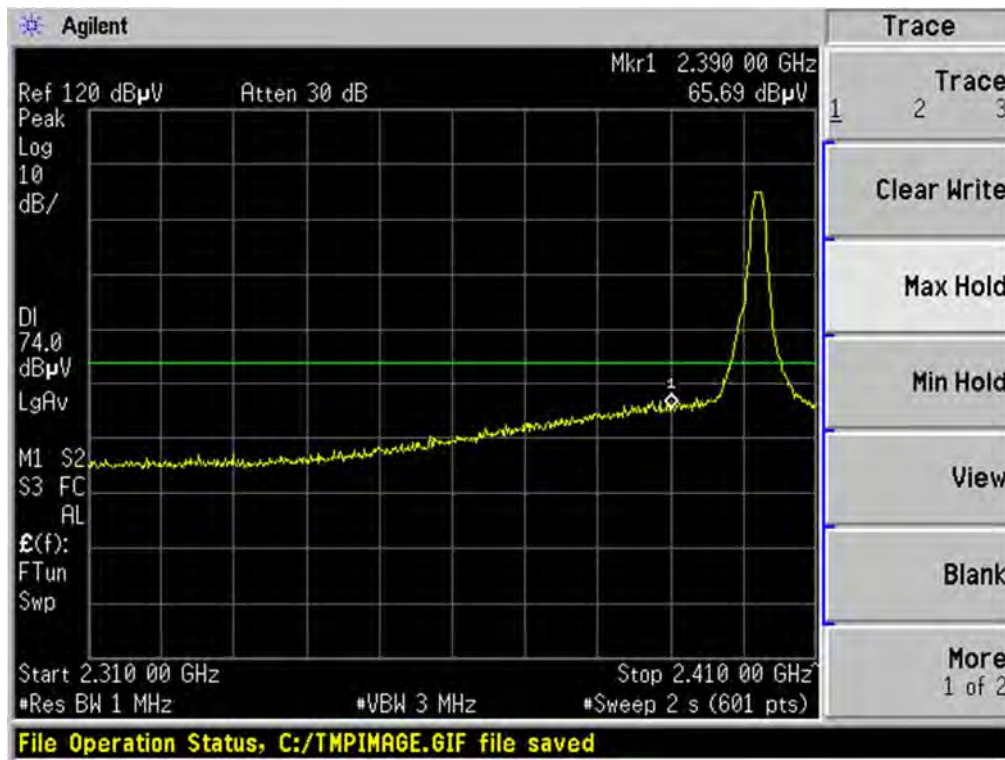
## GFSK LOW CHANNEL , PEAK



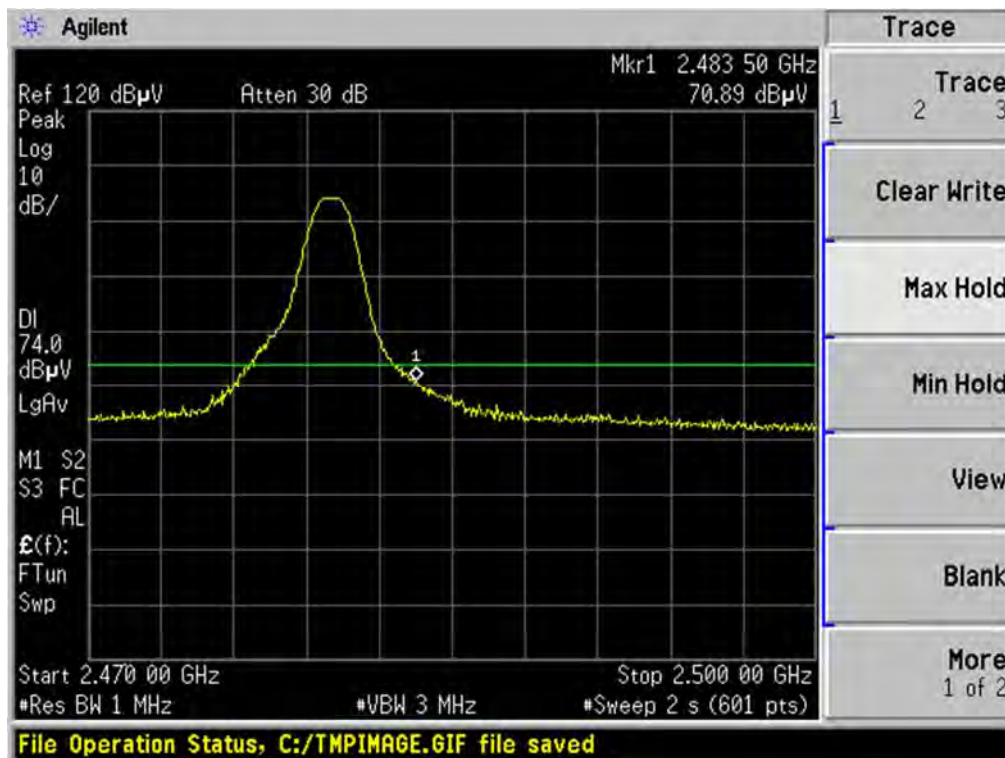
## GFSK HIGH CHANNEL , PEAK



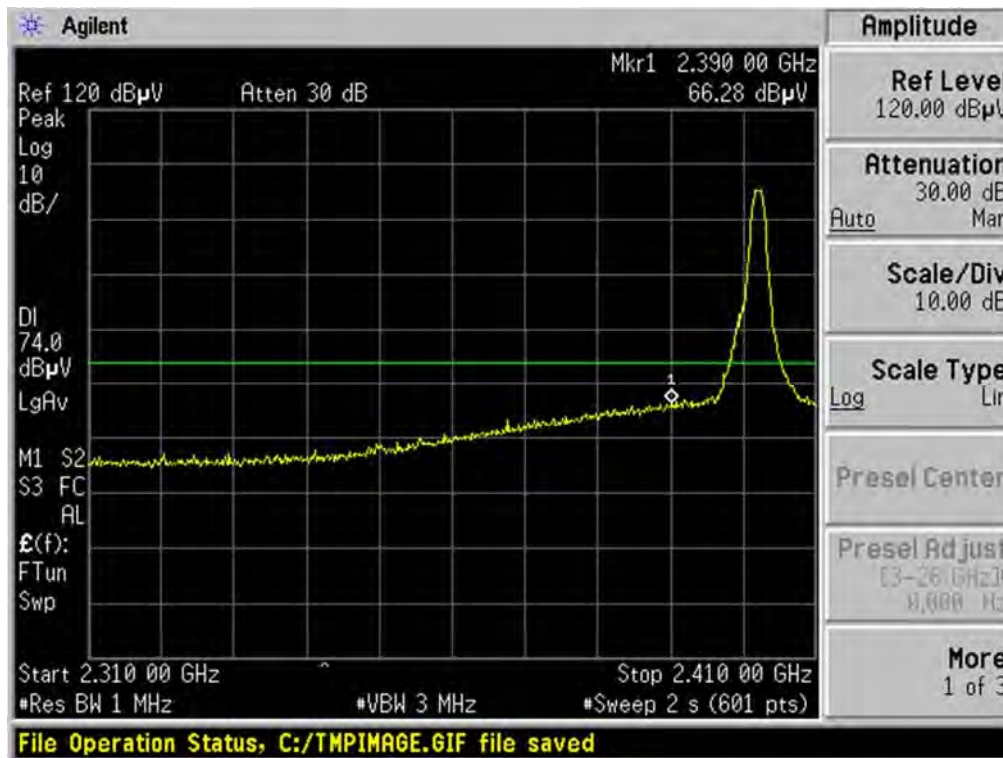
### □/4-DQPSK LOW CHANNEL , PEAK



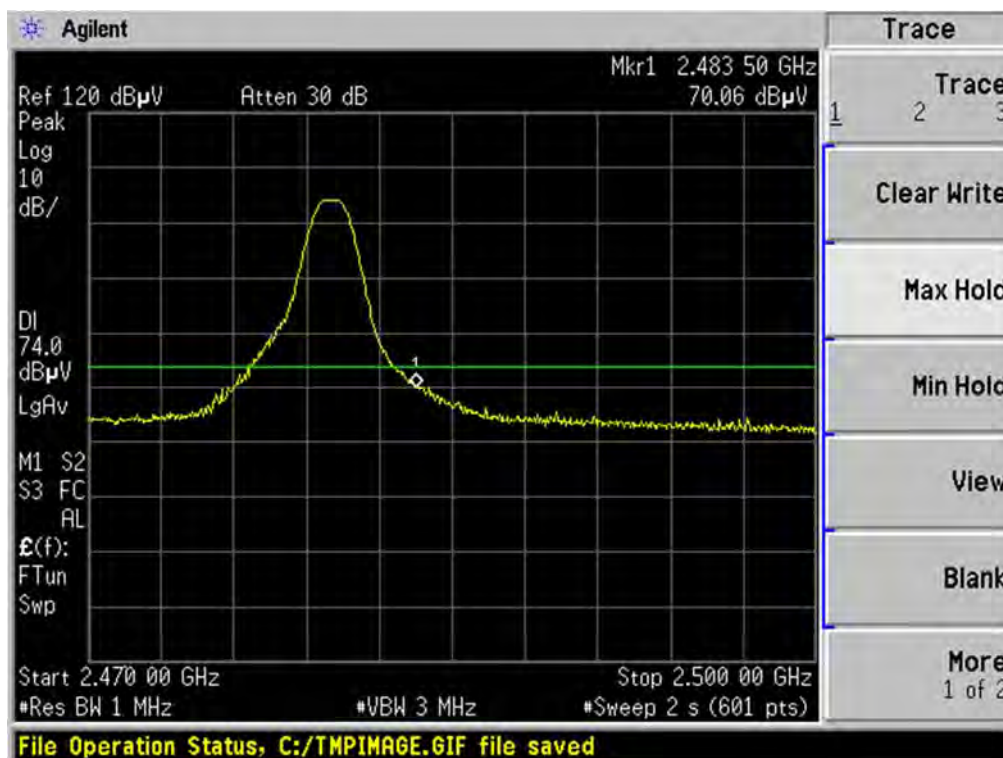
### □/4-DQPSK HIGH CHANNEL , PEAK



### 8-DPSK LOW CHANNEL , PEAK

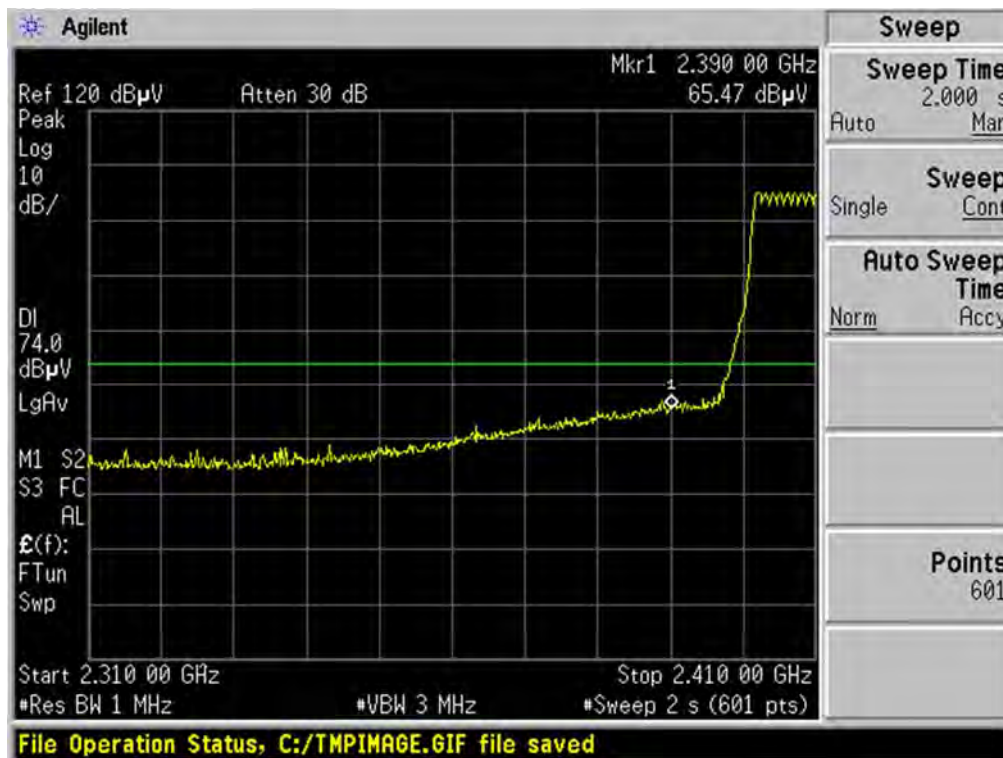


### 8-DPSK HIGH CHANNEL , PEAK

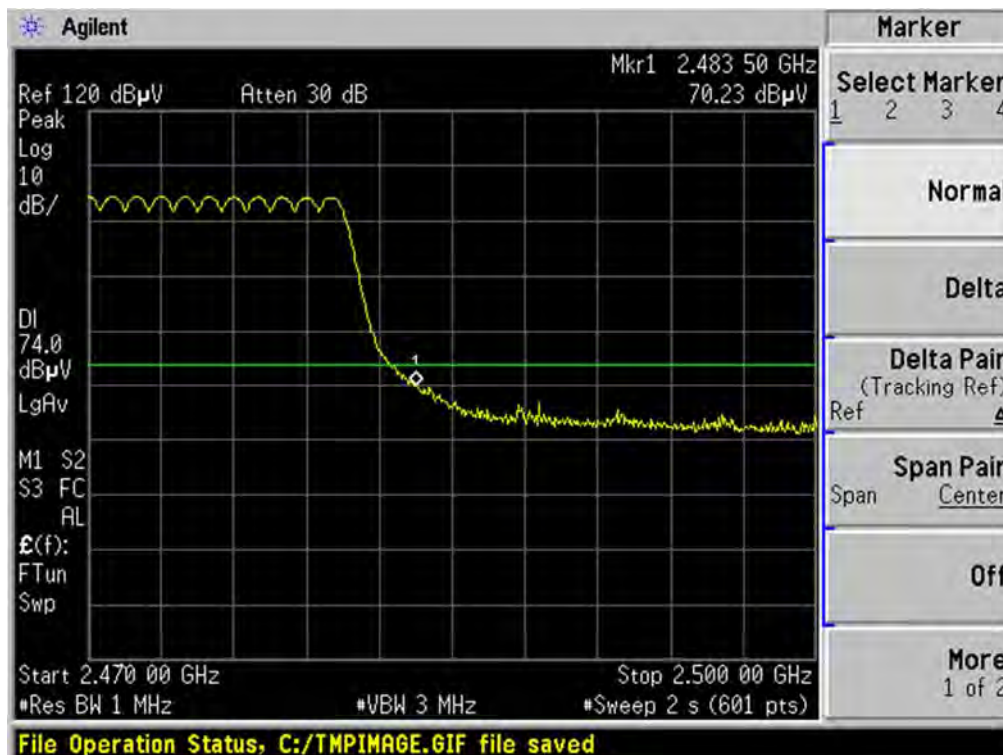


Hopping Mode:

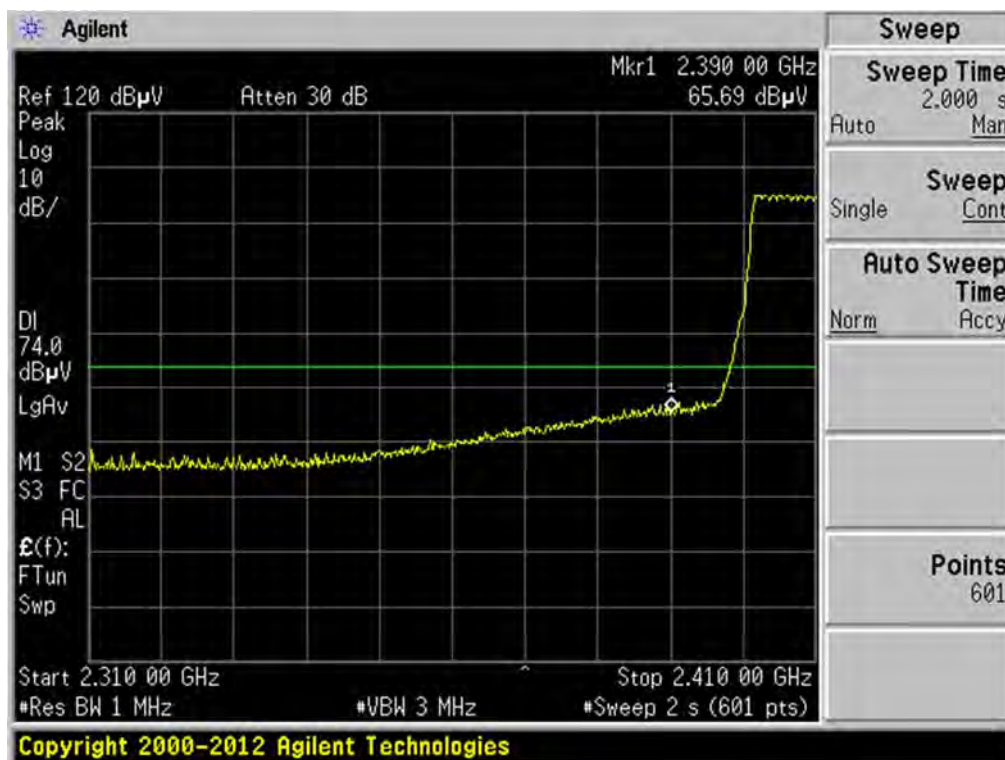
### GFSK LOW FREQUENCY BAND, PEAK



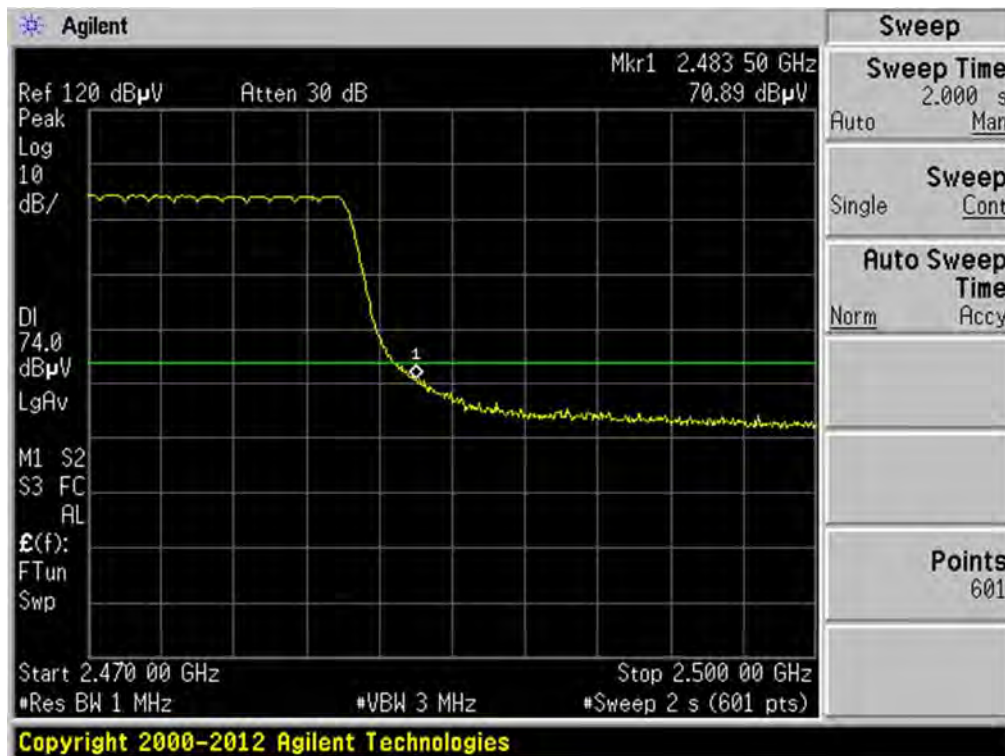
### GFSK HIGH FREQUENCY BAND, PEAK



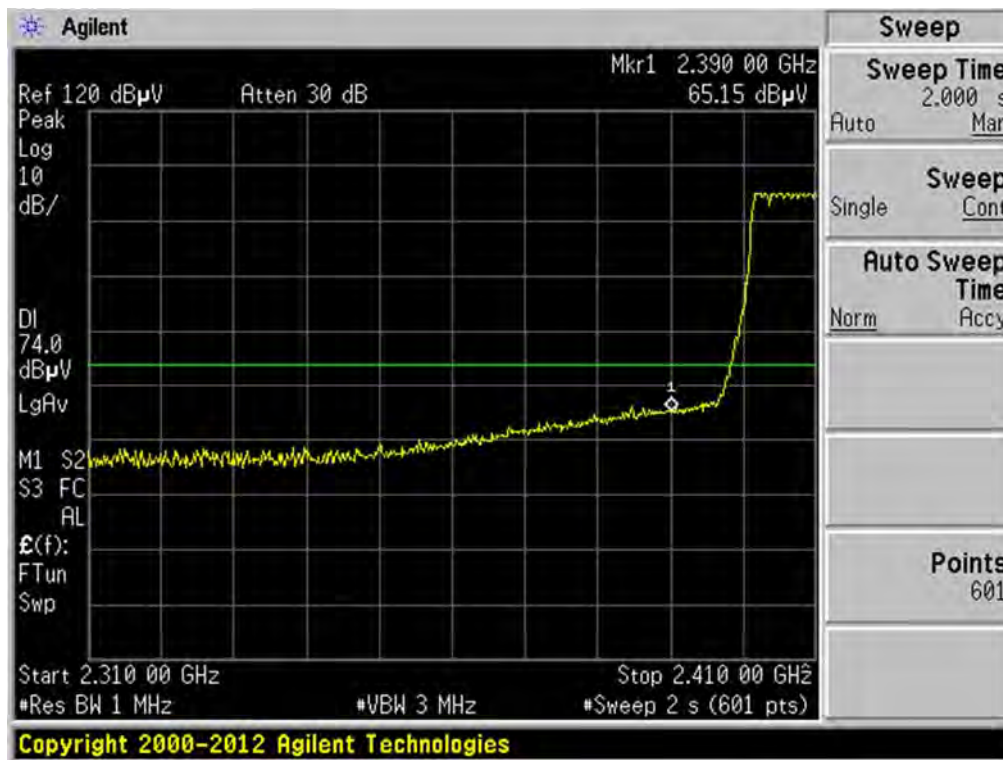
# $\pi/4$ -DQPSK LOW FREQUENCY BAND, PEAK



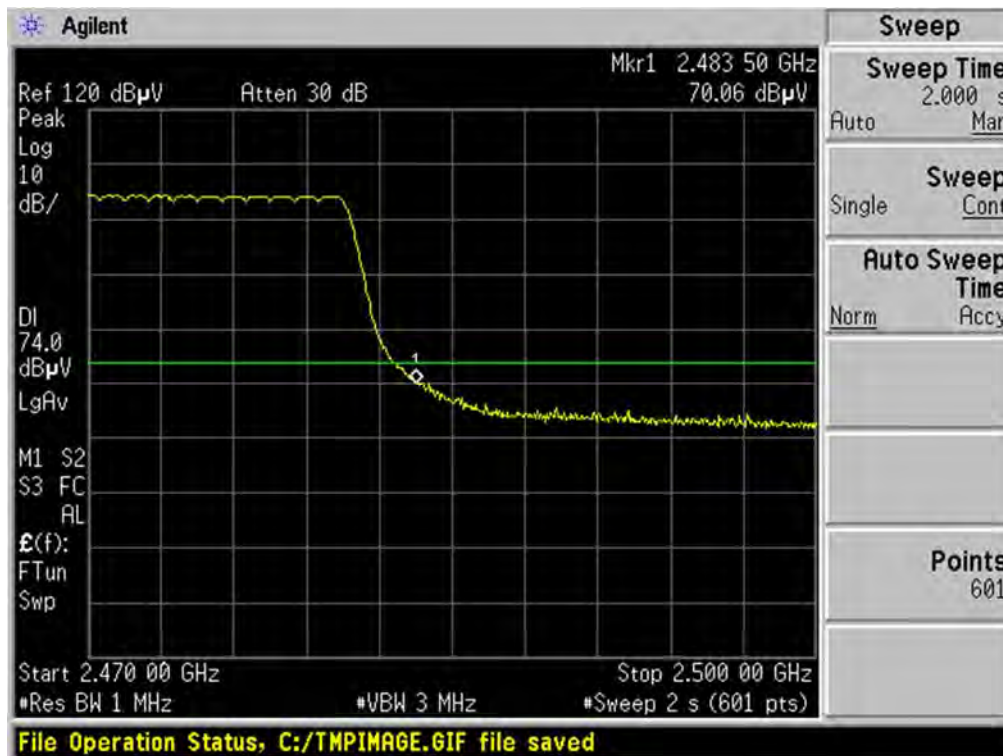
# $\pi/4$ -DQPSK HIGH FREQUENCY BAND, PEAK



### 8-DPSK LOW FREQUENCY BAND, PEAK



### 8-DPSK HIGH FREQUENCY BAND, PEAK



## **ANNEX B TEST SETUP PHOTOS**

Please refer the document “Annex B TEST SETUP PHOTOS”.

## **ANNEX C EUT PHOTOS**

### **C.1 Appearance of the EUT**

Please refer the document “C.1 Appearance of the EUT”.

### **C.2 Inside of the EUT**

Please refer the document “C.2 Inside of the EUT”.

--END OF REPORT--