

**FCC TEST REPORT**  
**FOR**  
**Huike Electronics(shenzhen)Co.,Ltd**  
**laptop**  
**Test Model: ELL1103T**

|                                |   |  |
|--------------------------------|---|--|
| Prepared for                   | : | Huike Electronics(shenzhen)Co.,Ltd   |
| Address                        | : | Huike industrial park,Minying industrial park,Shui tian<br>country,Shiyan,Baoan District,Shenzhen,China    |
| Prepared by                    | : | Shenzhen LCS Compliance Testing Laboratory Ltd.  |
| Address                        | : | 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,<br>Bao'an District, Shenzhen, Guangdong, China |
| Tel                            | : | (+86)755-82591330  |
| Fax                            | : | (+86)755-82591332  |
| Web                            | : | www.LCS-cert.com   |
| Mail                           | : | webmaster@LCS-cert.com   |
| Date of receipt of test sample | : | May 12, 2017   |
| Number of tested samples       | : | 1  |
| Serial number                  | : | Prototype  |
| Date of Test                   | : | May 12, 2017~June 06, 2017   |
| Date of Report                 | : | June 06, 2017  |

**FCC TEST REPORT**  
**FCC CFR 47 PART 15 C(15.247)**

**Report Reference No. .... : LCS170512042AE**

Date of Issue ..... : June 06, 2017

**Testing Laboratory Name ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.**Address ..... : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,  
Bao'an District, Shenzhen, Guangdong, ChinaTesting Location/ Procedure..... : Full application of Harmonised standards ■  
Partial application of Harmonised standards □  
Other standard testing method □**Applicant's Name ..... : Huike Electronics(shenzhen)Co.,Ltd**Address ..... : Huike industrial park,Minying industrial park,Shui tian  
country,Shiyan,Baoan District,Shenzhen,China**Test Specification**

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

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

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

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

**Shenzhen LCS Compliance Testing Laboratory Ltd. All rights reserved.**

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen LCS Compliance Testing Laboratory Ltd. is acknowledged as copyright owner and source of the material. Shenzhen LCS Compliance Testing Laboratory Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

**Test Item Description. .... : laptop**

Trade Mark..... : TEQNIO

Model/ Type reference..... : ELL1103T

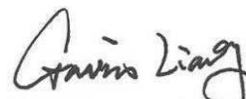
Ratings..... : DC 3.8V by battery(10000mAh)

Adapter parameters: Input: AC100-240V, 50/60Hz,  
Output: DC 5V/3A**Result ..... : Positive****Compiled by:**

Dick Su/ File administrators

**Supervised by:**

Glin Lu/ Technique principal

**Approved by:**

Gavin Liang/ Manager

**FCC -- TEST REPORT**

|   |                                       |
|---|---------------------------------------|
| <b>Test Report No. :</b> LCS170512042AE | <u>June 06, 2017</u><br>Date of issue |
|---|---------------------------------------|

|                          |   |
|--------------------------|---|
| Type / Model.....        | : ELL1103T  |
| EUT.....                 | : laptop  |
| <b>Applicant.....</b>    | <b>: Huike Electronics(shenzhen)Co.,Ltd</b>   |
| Address.....             | : Huike industrial park,Minying industrial park,Shui tian<br>country,Shiyan,Baoan District,Shenzhen,China |
| Telephone.....           | : /   |
| Fax.....                 | : /   |
| <b>Manufacturer.....</b> | <b>: Huike Electronics(shenzhen)Co.,Ltd</b>   |
| Address.....             | : Huike industrial park,Minying industrial park,Shui tian<br>country,Shiyan,Baoan District,Shenzhen,China |
| Telephone.....           | : /   |
| Fax.....                 | : /   |
| <b>Factory.....</b>      | <b>: Huike Electronics(shenzhen)Co.,Ltd</b>   |
| Address.....             | : Huike industrial park,Minying industrial park,Shui tian<br>country,Shiyan,Baoan District,Shenzhen,China |
| Telephone.....           | : /   |
| Fax.....                 | : /   |

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

The test report merely corresponds to the test sample.

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

**Revision History**

| Revision | Issue Date    | Revisions     | Revised By  |
|----------|---------------|---------------|-------------|
| 00       | June 06, 2017 | Initial Issue | Gavin Liang |
|          |               |               |             |
|          |               |               |             |

## TABLE OF CONTENTS

| Description  | Page      |
|--|-----------|
| <b>1. GENERAL INFORMATION .....</b>                        | <b>6</b>  |
| 1.1 Description of Device (EUT) .....                      | 6         |
| 1.2 Support equipment List .....                           | 6         |
| 1.3 External I/O Cable .....                               | 6         |
| 1.4 Description of Test Facility .....                     | 6         |
| 1.5 Statement of the Measurement Uncertainty .....         | 7         |
| 1.6 Measurement Uncertainty .....                          | 7         |
| 1.7 Description of Test Modes .....                        | 7         |
| <b>2. TEST METHODOLOGY .....</b>                           | <b>8</b>  |
| 2.1 EUT Configuration .....                                | 8         |
| 2.2 EUT Exercise .....                                     | 8         |
| 2.3 General Test Procedures .....                          | 8         |
| 2.4. Test Sample .....                                     | 8         |
| <b>3. SYSTEM TEST CONFIGURATION .....</b>                  | <b>9</b>  |
| 3.1 Justification .....                                    | 9         |
| 3.2 EUT Exercise Software .....                            | 9         |
| 3.3 Special Accessories .....                              | 9         |
| 3.4 Block Diagram/Schematics .....                         | 9         |
| 3.5 Equipment Modifications .....                          | 9         |
| 3.6 Test Setup .....                                       | 9         |
| <b>4. SUMMARY OF TEST RESULTS .....</b>                    | <b>10</b> |
| <b>5. SUMMARY OF TEST EQUIPMENT .....</b>                  | <b>11</b> |
| <b>6. MEASUREMENT RESULTS .....</b>                        | <b>12</b> |
| 6.1 Peak Power .....                                       | 12        |
| 6.2 Frequency Separation and 20 dB Bandwidth .....         | 13        |
| 6.3 Number of Hopping Frequency .....                      | 19        |
| 6.4 Time of Occupancy (Dwell Time) .....                   | 20        |
| 6.5 Conducted Spurious Emissions and Band Edges Test ..... | 24        |
| 6.6 Restricted Band Emission Limit .....                   | 30        |
| 6.7. AC Power line conducted emissions .....               | 40        |
| 6.8. Band-edge measurements for radiated emissions .....   | 43        |
| 6.9. Pseudorandom frequency hopping sequence .....         | 48        |
| 6.10. Antenna requirement .....                            | 49        |

## 1. GENERAL INFORMATION

### 1.1 Description of Device (EUT)

|                         |  |
|-------------------------|--|
| EUT                     | laptop   |
| Model Number            | ELL1103T   |
| Model Declaration       | /  |
| Test Model              | ELL1103T   |
| Hardware version        | /  |
| Software version        | RS1 14393  |
| Power Supply            | DC 3.8V by battery(10000mAh)   |
|                         | Adapter parameters: Input: AC100-240V, 50/60Hz,<br>Output: DC 5V/3A      |
| Bluetooth Technology    |  |
| Operation frequency     | 2402MHz-2480MHz  |
| Modulation Type         | GFSK, $\pi/4$ -DQPSK, 8-DPSK(DSS)<br>GFSK for Bluetooth 4.0(DTS)         |
| Bluetooth Version       | V4.0   |
| Channel Number          | 79 Channels for Bluetooth 3.0(DSS)<br>40 Channels for Bluetooth 4.0(DTS) |
| Channel Spacing         | 1 MHz Bluetooth 3.0(DSS);<br>2 MHz Bluetooth 4.0(DTS);                   |
| Antenna Type            | PIFA Antenna   |
| Antenna Gain            | 1.29dBi (Max.)   |
| Extreme temp. Tolerance | -10°C to +55°C   |

### 1.2 Support equipment List

| Manufacturer | Description   | Model | Serial Number | Certificate |
|--------------|---------------|-------|---------------|-------------|
| --           | AC/DC Adapter | --    | --            | DoC         |

### 1.3 External I/O Cable

| I/O Port Description | Quantity | Cable |
|----------------------|----------|-------|
| Charge Interface     | 1        | N/A   |
| AUX Port             | 1        | N/A   |
| TF Card Slot         | 1        | N/A   |
| USB Port             | 2        | N/A   |
| HDMI Port            | 1        | N/A   |

### 1.4 Description of Test Facility

CNAS Registration Number. is L4595.  
FCC Registration Number. is 899208.  
Industry Canada Registration Number. is 9642A-1.  
ESMD Registration Number. is ARCB0108.  
UL Registration Number. is 100571-492.  
TUV SUD Registration Number. is SCN1081.  
TUV RH Registration Number. is UA 50296516-001

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

## 1.5 Statement of the Measurement Uncertainty

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

## 1.6 Measurement Uncertainty

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

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

## 1.7 Description of Test Modes

Bluetooth operates in the unlicensed ISM Band at 2.4GHz. With basic data rate feature, the data rates can be up to 1 Mb/s by modulating the RF carrier using GFSK techniques. The EUT works in the X-axis, Y-axis, Z-axis. The following operating modes were applied for the related test items. All test modes were tested, only the result of the worst case was recorded in the report.

| Mode of Operations     | Frequency Range (MHz) | Data Rate (Mbps) |
|------------------------|-----------------------|------------------|
| BT                     | 2402                  | 1/2/3            |
|                        | 2441                  | 1/2/3            |
|                        | 2480                  | 1/2/3            |
| For Conducted Emission |                       |                  |
| Test Mode              | TX Mode               |                  |
| For Radiated Emission  |                       |                  |
| Test Mode              | TX Mode               |                  |

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be TX (1Mbps).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX(1Mbps-Low Channel).

AC conducted emission test performed at both voltage AC 120V/60Hz and AC 240V/60Hz.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR PART 15C 15.207, 15.209, 15.247 and DA 00-705.

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

The EUT was operated in the normal operating mode for Hopping Numbers and Dwell Time test and a continuous transmits mode for other tests.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C.

### 2.3 General Test Procedures

#### 2.3.1 Conducted Emissions

The EUT is directly placed on the ground. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

#### 2.3.2 Radiated Emissions

The EUT is placed on a turntable, which is directly placed on the ground. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

### 2.4. Test Sample

The application provides 2 samples to meet requirement;

| Sample Number | Description                           |
|---------------|---------------------------------------|
| Sample 1      | Engineer sample – continuous transmit |
| Sample 2      | Normal sample – Intermittent transmit |



### 3. SYSTEM TEST CONFIGURATION

#### 3.1 Justification

The system was configured for testing in a continuous transmits condition.

#### 3.2 EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (Smart RF Control Kit) provided by application.

#### 3.3 Special Accessories

| Manufacturer | Description   | Model | Serial Number | Certificate |
|--------------|---------------|-------|---------------|-------------|
| --.          | AC/DC Adapter | --    | --            | DoC         |

#### 3.4 Block Diagram/Schematics

Please refer to the related document.

#### 3.5 Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

#### 3.6 Test Setup

Please refer to the test setup photo.

#### 4. SUMMARY OF TEST RESULTS

| Applied Standard: FCC Part 15 Subpart C |   |             |           |
|---|---|-------------|-----------|
| FCC Rules                               | Description of Test                       | Test Sample | Result    |
| §15.247(b)(1)                           | Maximum Conducted Output Power            | Sample 1    | Compliant |
| §15.247(c)                              | Frequency Separation And 20 dB Bandwidth  | Sample 1    | Compliant |
| §15.247(a)(1)(ii)                       | Number Of Hopping Frequency               | Sample 2    | Compliant |
| §15.247(a)(1)(iii)                      | Time Of Occupancy (Dwell Time)            | Sample 2    | Compliant |
| §15.209, §15.247(d)                     | Radiated and Conducted Spurious Emissions | Sample 1    | Compliant |
| §15.205                                 | Emissions at Restricted Band              | Sample 1    | Compliant |
| §15.207(a)                              | Conducted Emissions                       | Sample 1    | Compliant |
| §15.203                                 | Antenna Requirements                      | Sample 1    | Compliant |
| §15.247(i)§2.1093                       | RF Exposure                               | N/A         | Compliant |

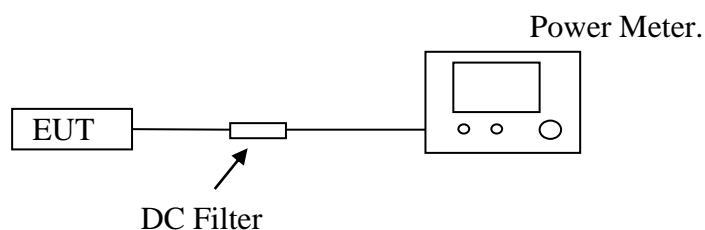
## 5. SUMMARY OF TEST EQUIPMENT

| Item | Equipment                | Manufacturer       | Model No.                        | Serial No.  | Last Cal.  | Next Cal.  |
|------|--------------------------|--------------------|----------------------------------|-------------|------------|------------|
| 1    | Power Sensor             | R&S                | NRV-Z51                          | 100458      | 2016-06-18 | 2017-06-17 |
| 2    | Power Sensor             | R&S                | NRV-Z32                          | 10057       | 2016-06-18 | 2017-06-17 |
| 3    | Power Meter              | R&S                | NRVS                             | 100444      | 2016-06-18 | 2017-06-17 |
| 4    | DC Filter                | MPE                | 23872C                           | N/A         | 2016-06-18 | 2017-06-17 |
| 5    | RF Cable                 | Harbour Industries | 1452                             | N/A         | 2016-06-18 | 2017-06-17 |
| 6    | SMA Connector            | Harbour Industries | 9625                             | N/A         | 2016-06-18 | 2017-06-17 |
| 7    | Spectrum Analyzer        | Agilent            | N9020A                           | MY50510140  | 2016-10-27 | 2017-10-26 |
| 8    | Signal analyzer          | Agilent            | E4448A(External mixers to 40GHz) | US44300469  | 2016-06-16 | 2017-06-15 |
| 9    | RF Cable                 | Hubersuhne         | Sucoflex104                      | FP2RX2      | 2016-06-18 | 2017-06-17 |
| 10   | 3m Semi Anechoic Chamber | SIDT FRANKONIA     | SAC-3M                           | 03CH03-HY   | 2016-06-18 | 2017-06-17 |
| 11   | Amplifier                | SCHAFFNER          | COA9231A                         | 18667       | 2016-06-18 | 2017-06-17 |
| 12   | Amplifier                | Agilent            | 8449B                            | 3008A02120  | 2016-06-16 | 2017-06-15 |
| 13   | Amplifier                | MITEQ              | AMF-6F-260400                    | 9121372     | 2016-06-16 | 2017-06-15 |
| 14   | Loop Antenna             | R&S                | HFH2-Z2                          | 860004/001  | 2016-06-18 | 2017-06-17 |
| 15   | By-log Antenna           | SCHWARZBECK        | VULB9163                         | 9163-470    | 2016-06-10 | 2017-06-09 |
| 16   | Horn Antenna             | EMCO               | 3115                             | 6741        | 2016-06-10 | 2017-06-09 |
| 17   | Horn Antenna             | SCHWARZBECK        | BBHA9170                         | BBHA9170154 | 2016-06-10 | 2017-06-09 |
| 18   | RF Cable-R03m            | Jye Bao            | RG142                            | CB021       | 2016-06-18 | 2017-06-17 |
| 19   | RF Cable-HIGH            | SUHNER             | SUCOFLEX 106                     | 03CH03-HY   | 2016-06-18 | 2017-06-17 |
| 20   | EMI Test Receiver        | ROHDE & SCHWARZ    | ESCI                             | 101142      | 2016-06-18 | 2017-06-17 |
| 21   | Artificial Mains         | ROHDE & SCHWARZ    | ENV216                           | 101288      | 2016-06-18 | 2017-06-17 |
| 22   | EMI Test Software        | AUDIX              | E3                               | N/A         | 2016-06-18 | 2017-06-17 |

## 6. MEASUREMENT RESULTS

### 6.1 Peak Power

#### 6.1.1 Block Diagram of Test Setup



#### 6.1.2 Limit

According to §15.247(b)(1), For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

#### 6.1.3 Test Procedure

The transmitter output is connected to the Power Meter.

#### 6.1.4 Test Results

| Test Mode | Channel | Frequency (MHz) | Measured Maximum Peak Power (dBm) | Limits (dBm) | Verdict |
|-----------|---------|-----------------|-----------------------------------|--------------|---------|
| GFSK      | 0       | 2402            | 3.83                              | 30           | PASS    |
|           | 39      | 2441            | 3.72                              |              |         |
|           | 78      | 2480            | 3.56                              |              |         |
| π/4DQPSK  | 0       | 2402            | 3.34                              | 21           | PASS    |
|           | 39      | 2441            | 3.27                              |              |         |
|           | 78      | 2480            | 3.03                              |              |         |
| 8DPSK     | 0       | 2402            | 2.37                              | 21           | PASS    |
|           | 39      | 2441            | 2.29                              |              |         |
|           | 78      | 2480            | 2.06                              |              |         |

#### Remark:

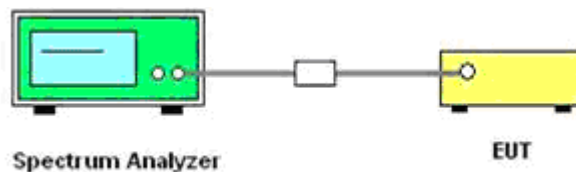
1. Test results including cable loss;

## 6.2 Frequency Separation and 20 dB Bandwidth

### 6.2.1 Limit

According to §15.247(a) (1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

### 6.2.2 Block Diagram of Test Setup



### 6.2.3 Test Procedure

Frequency separation test procedure:

- 1). Place the EUT on the table and set it in transmitting mode.
- 2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- 3). Set center frequency of Spectrum Analyzer = middle of hopping channel.
- 4). Set the Spectrum Analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.
- 5). Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

20dB bandwidth test procedure:

- 1). Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.
- 2). RBW  $\geq 1\%$  of the 20 dB bandwidth, VBW  $\geq$  RBW.
- 3). Detector function = peak.
- 4). Trace = max hold.

### 6.2.4 Test Results

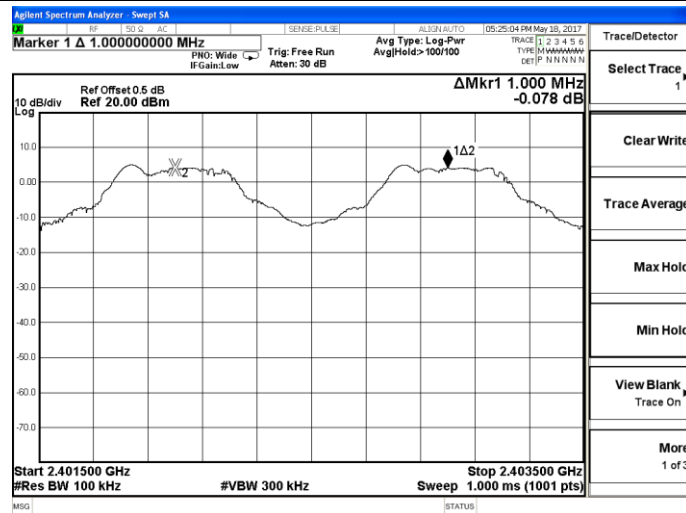
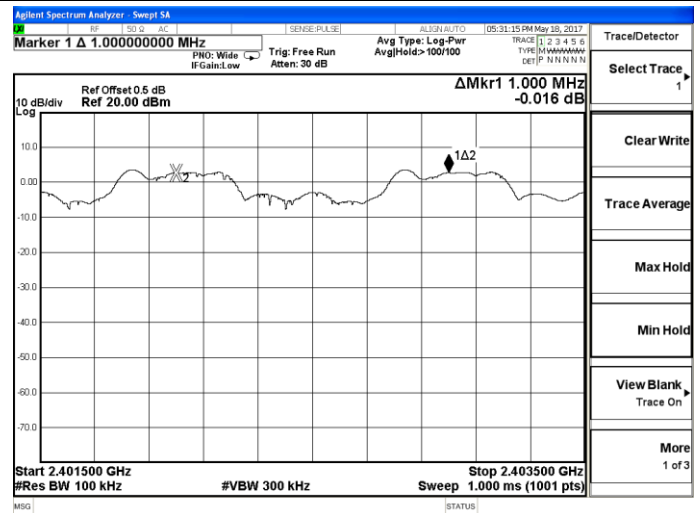
| The Measurement Result With 1Mbps For GFSK Modulation           |                      |                          |             |        |
|---|----------------------|--------------------------|-------------|--------|
| Channel   | 20dB Bandwidth (MHz) | Channel Separation (MHz) | Limit (MHz) | Result |
| Low   | 0.8294               | 1.000                    | 0.8294      | Pass   |
| Middle  | 0.8277               |                          | 0.8277      | Pass   |
| High  | 0.8334               |                          | 0.8334      | Pass   |
| The Measurement Result With 2Mbps For $\pi/4$ -DQPSK Modulation |                      |                          |             |        |
| Channel   | 20dB Bandwidth (MHz) | Channel Separation (MHz) | Limit (MHz) | Result |
| Low   | 1.119                | 1.000                    | 0.746       | Pass   |
| Middle  | 1.119                |                          | 0.746       | Pass   |
| High  | 1.118                |                          | 0.745       | Pass   |
| The Measurement Result With 3Mbps For 8-DPSK Modulation         |                      |                          |             |        |
| Channel   | 20dB Bandwidth (MHz) | Channel Separation (MHz) | Limit (MHz) | Result |
| Low   | 1.165                | 1.000                    | 0.777       | Pass   |
| Middle  | 1.165                |                          | 0.777       | Pass   |
| High  | 1.166                |                          | 0.777       | Pass   |

**Remark:**

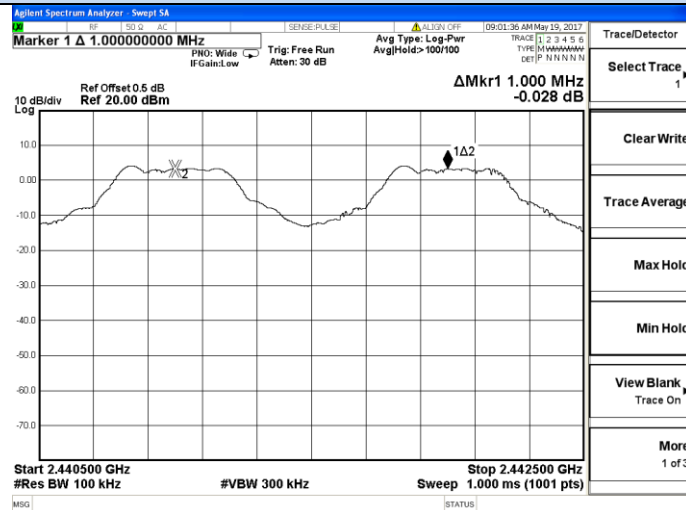
1. Test results including cable loss;
2. please refer to following plots;
3. Measured at difference Packet Type for each mode and recorded worst case for each mode.

## Frequency Separation

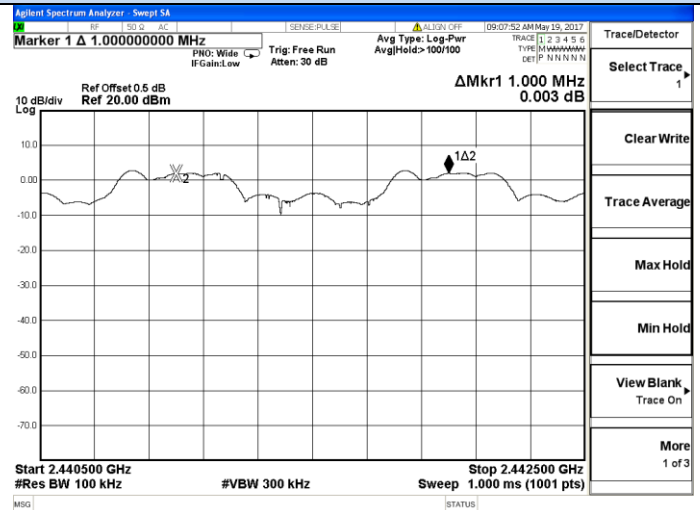
## GFSK

 $\pi/4$ -DQPSK

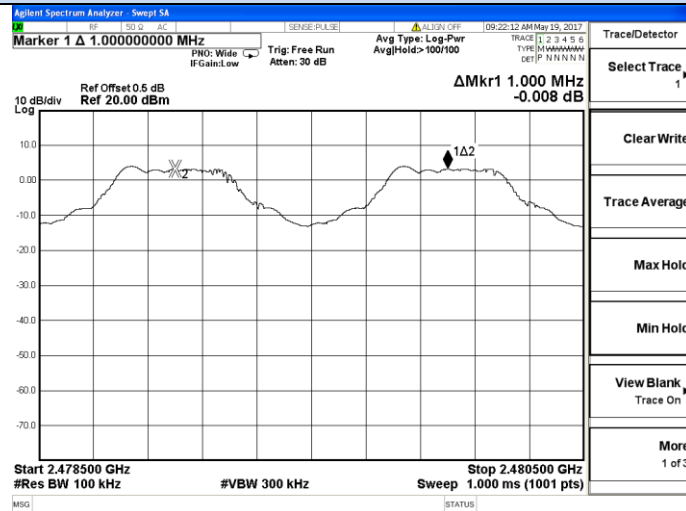
## Channel 0 / 2402 MHz



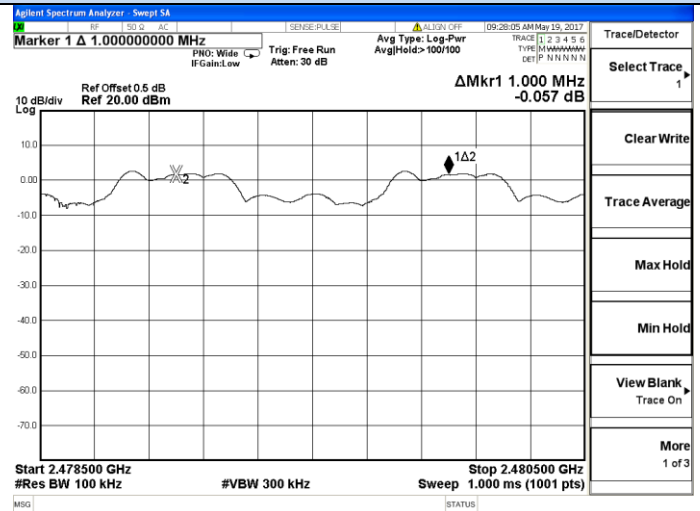
## Channel 0 / 2402 MHz



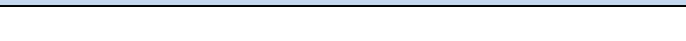
## Channel 39 / 2441 MHz



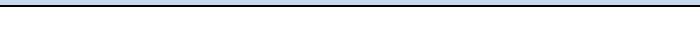
## Channel 39 / 2441 MHz

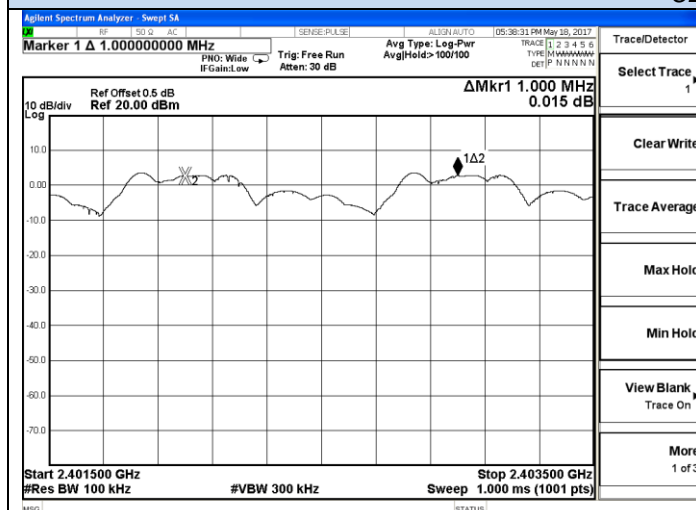


## Channel 78 / 2480 MHz

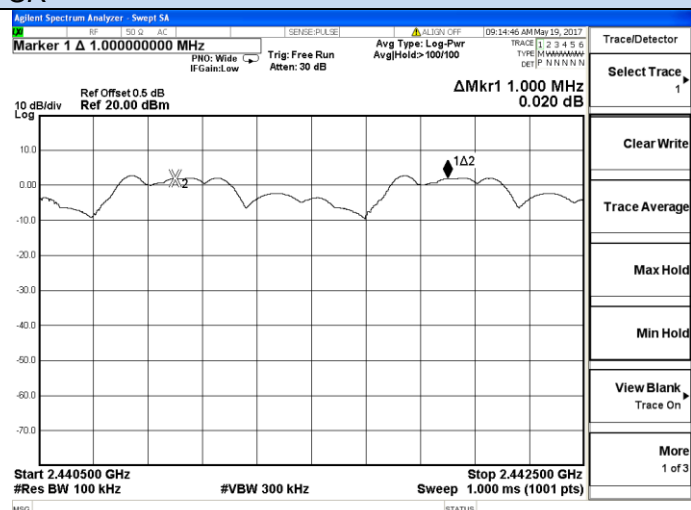


## Channel 78 / 2480 MHz

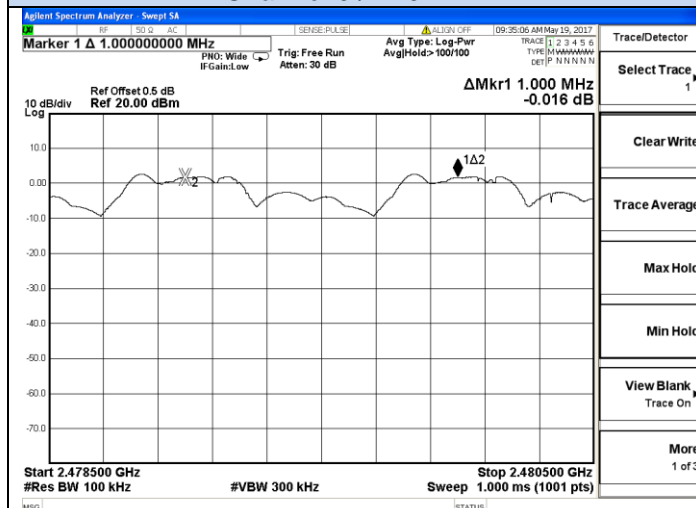


Frequency Separation  
8DPSK

Channel 0 / 2402 MHz



Channel 39 / 2441 MHz

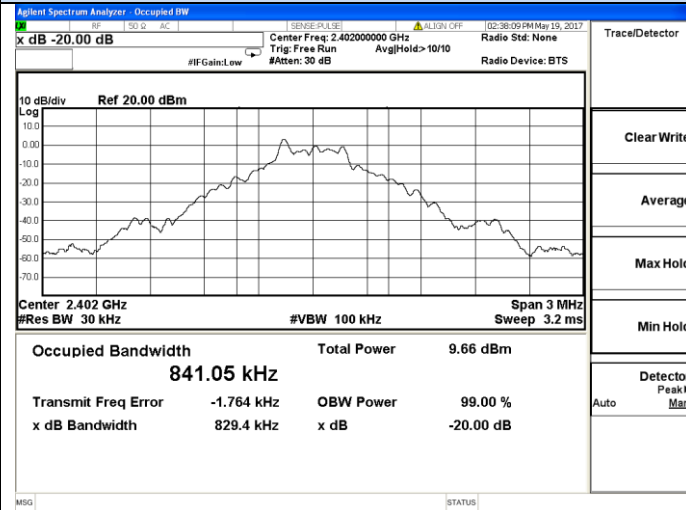
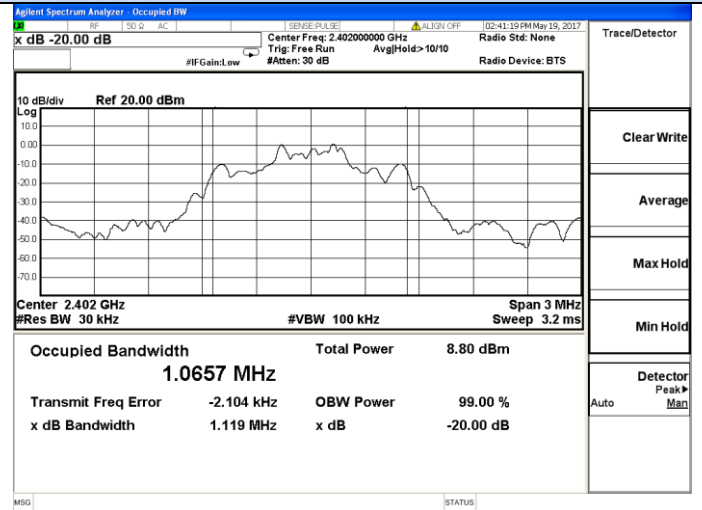


Channel 78 / 2480 MHz

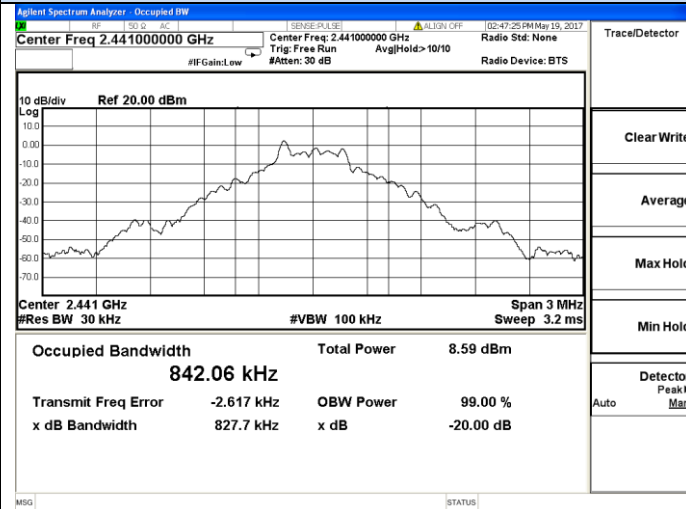


## 20dB Bandwidth

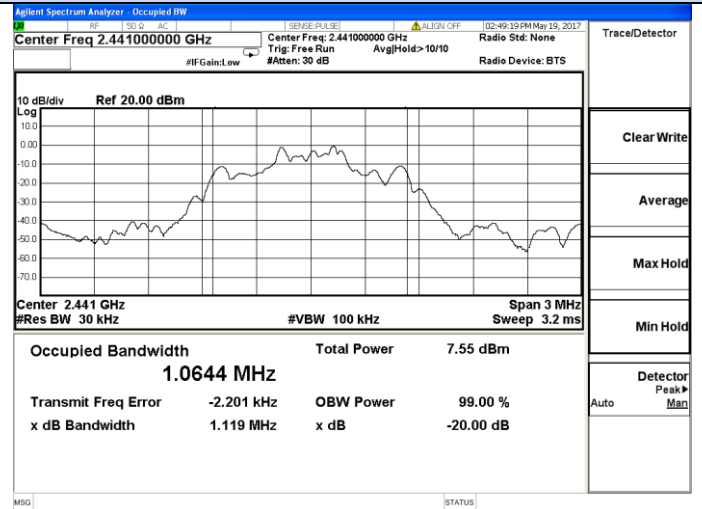
## GFSK

 $\pi/4$ -DQPSK

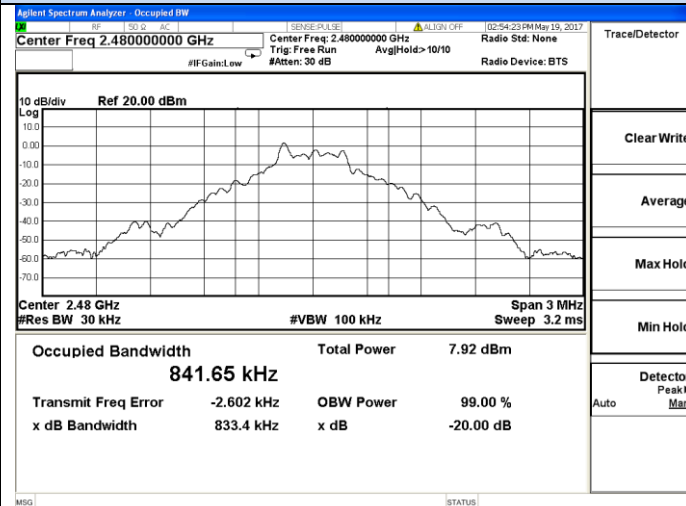
## Channel 0 / 2402 MHz



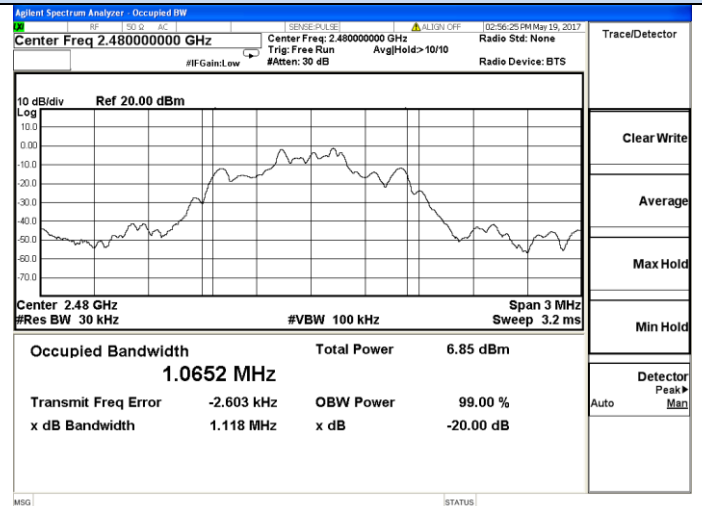
## Channel 0 / 2402 MHz



## Channel 39 / 2441 MHz



## Channel 39 / 2441 MHz



## Channel 78 / 2480 MHz

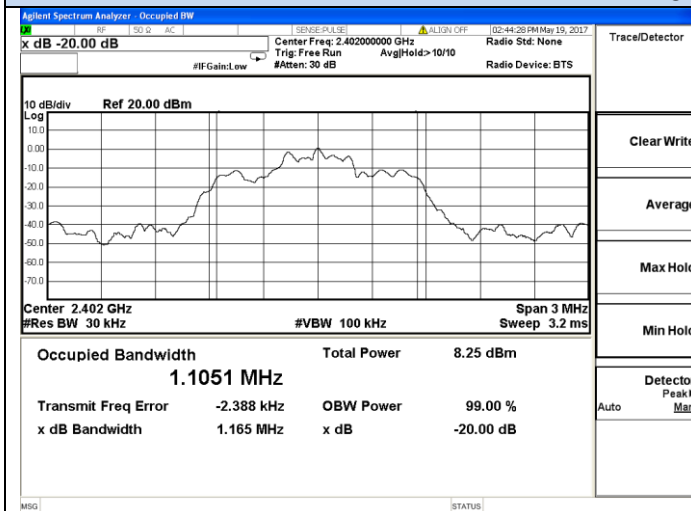


## Channel 78 / 2480 MHz

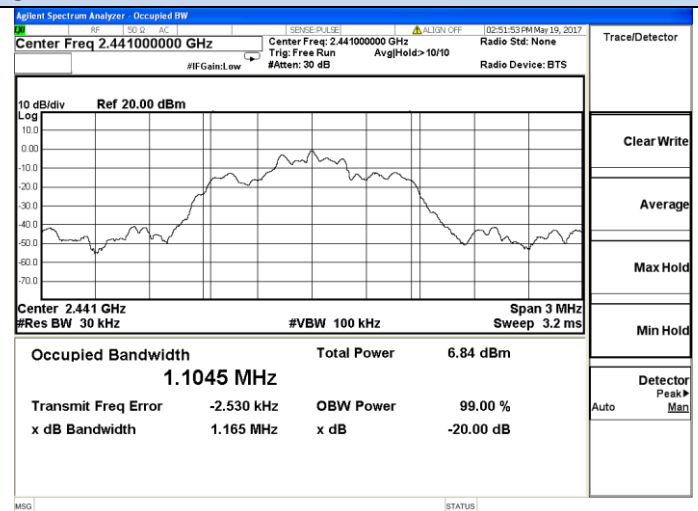


## Test Plot of Test Result

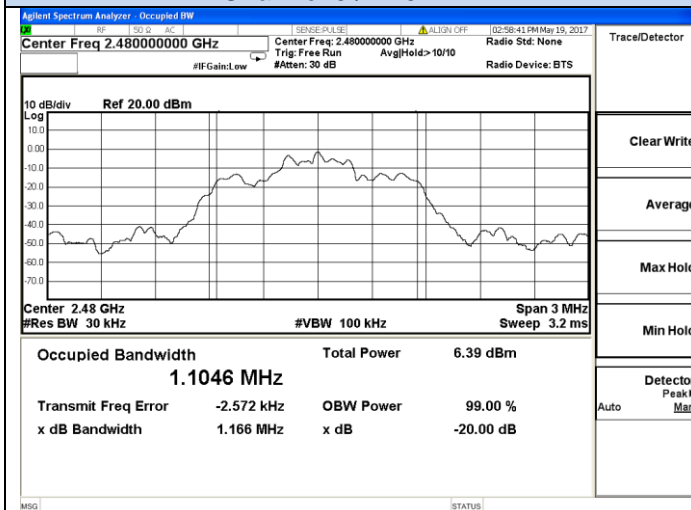
## 8DPSK



Channel 0 / 2402 MHz



Channel 39 / 2441 MHz



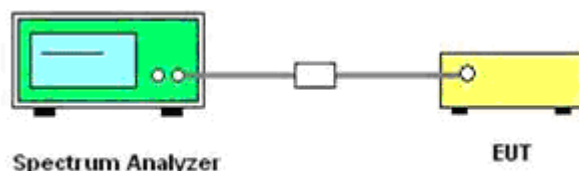
Channel 78 / 2480 MHz

## 6.3 Number of Hopping Frequency

### 6.3.1 Limit

According to §15.247(a)(1)(ii) or A8.1 (d), Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

### 6.3.2 Block Diagram of Test Setup



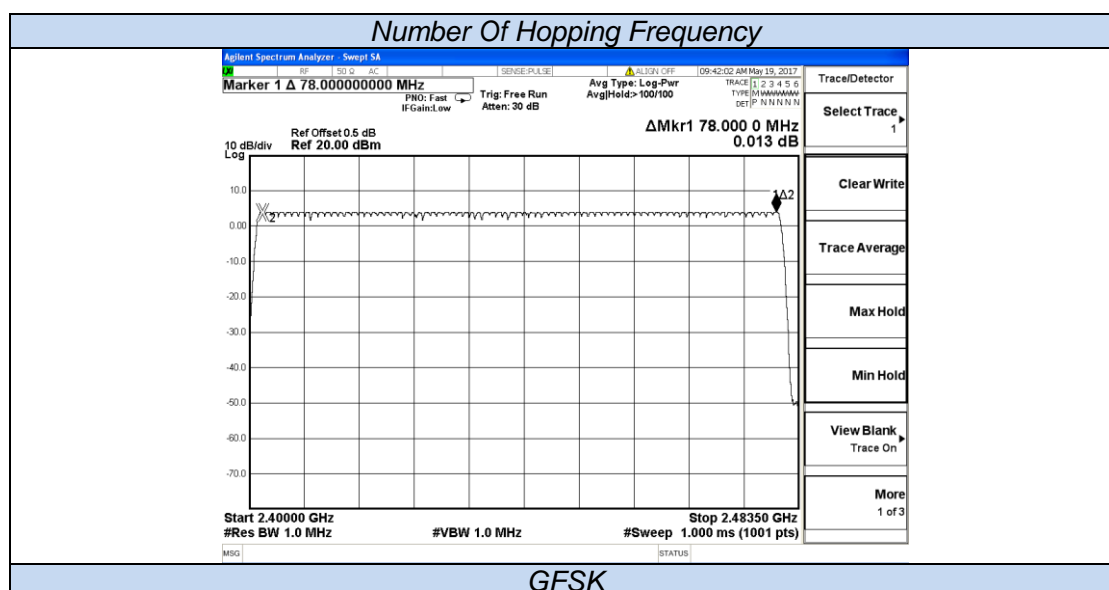
### 6.3.3 Test Procedure

- 1). Place the EUT on the table and set it in transmitting mode.
- 2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- 3). Set Spectrum Analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- 4). Set the Spectrum Analyzer as RBW, VBW=1MHz.
- 5). Max hold, view and count how many channel in the band.

### 6.3.4 Test Results

| The Measurement Result With The Worst Case of 1Mbps For GFSK Modulation |                                |             |        |
|---|--------------------------------|-------------|--------|
| Total No. of Hopping Channel  | Measurement Result (No. of Ch) | Limit (MHz) | Result |
|   | 79                             | ≥15         | Pass   |

Note: The test data refer to the following page.

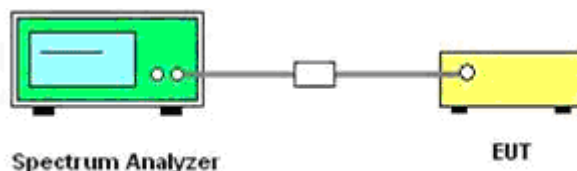


## 6.4 Time of Occupancy (Dwell Time)

### 6.4.1 Limit

According to §15.247(a)(1)(iii) or A8.1 (d), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

### 6.4.2 Block Diagram of Test Setup



### 6.4.3 Test Procedure

- 1). Place the EUT on the table and set it in transmitting mode.
- 2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- 3). Set center frequency of Spectrum Analyzer = operating frequency.
- 4). Set the Spectrum Analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
- 5). Repeat above procedures until all frequency measured was complete.

### 6.4.4 Test Results

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

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

The burst width [ms/hop/ch], which is directly measured, refers to the duration on one channel hop.

The hops per second for all channels: The selected EUT Conf uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600 [ch\*hop/s] for all channels. So the final hopping rate for all channels is  $1600/6=266.67 [\text{ch} \cdot \text{hop/s}]$

The hops per second on one channel:  $266.67 [\text{ch} \cdot \text{hops/s}] / 79 [\text{ch}] = 3.38 [\text{hop/s}]$ ;

The total hops for all channels within the dwell time calculation duration:  $3.38 [\text{hop/s}] \times 31.6[s \cdot \text{ch}] = 106.67 [\text{hop} \cdot \text{ch}]$ ;

The dwell time for all channels hopping:  $106.67 [\text{hop} \cdot \text{ch}] \times \text{Burst Width} [\text{ms/hop/ch}]$ .

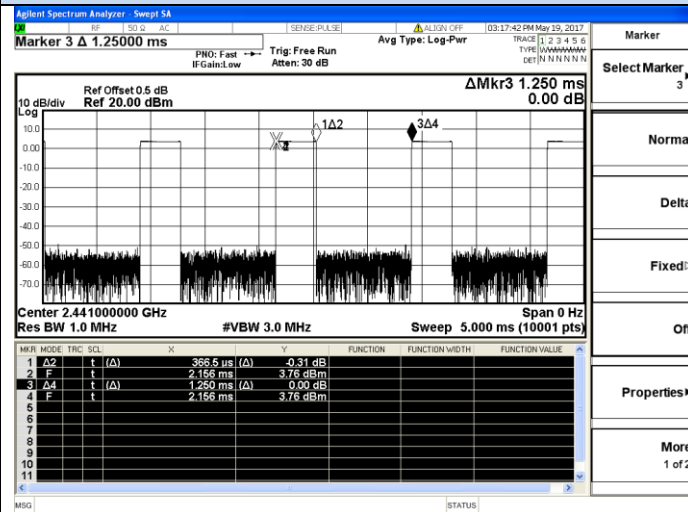
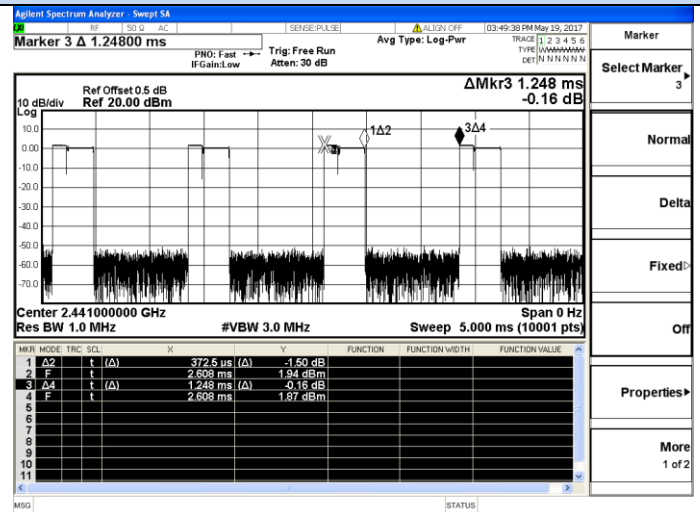
| Mode      | Frequency (MHz) | Burst Type | Pulse Width (ms) | Dwell Time (S) | Limit (S) | Verdict |
|-----------|-----------------|------------|------------------|----------------|-----------|---------|
| GFSK      | 2441            | DH1        | 0.3665           | 0.117          | 0.4       | PASS    |
|           |                 | DH3        | 1.621            | 0.259          |           |         |
|           |                 | DH5        | 2.868            | 0.306          |           |         |
| π/4-DQPSK | 2441            | 2DH1       | 0.3725           | 0.119          | 0.4       | PASS    |
|           |                 | 2DH3       | 1.621            | 0.259          |           |         |
|           |                 | 2DH5       | 2.869            | 0.306          |           |         |
| 8DPSK     | 2441            | 3DH1       | 0.374            | 0.120          | 0.4       | PASS    |
|           |                 | 3DH3       | 1.626            | 0.260          |           |         |
|           |                 | 3DH5       | 2.874            | 0.307          |           |         |

*Remark:*

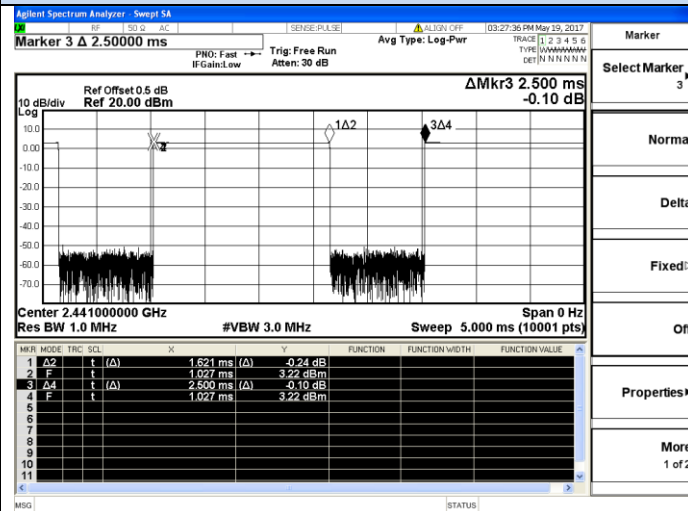
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded woest case for each mode.*
4. *Dwell Time Calculate formula:*  
*DH1: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second*  
*DH3: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second*  
*DH5: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second*
5. *Measured at low, middle and high channel, recorded worst at middle channel;*

## Dwell time

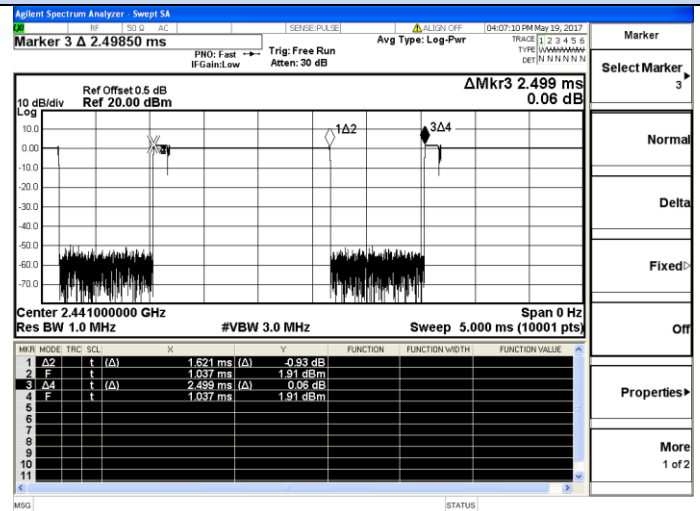
## GFSK

 $\pi/4$ -DQPSK

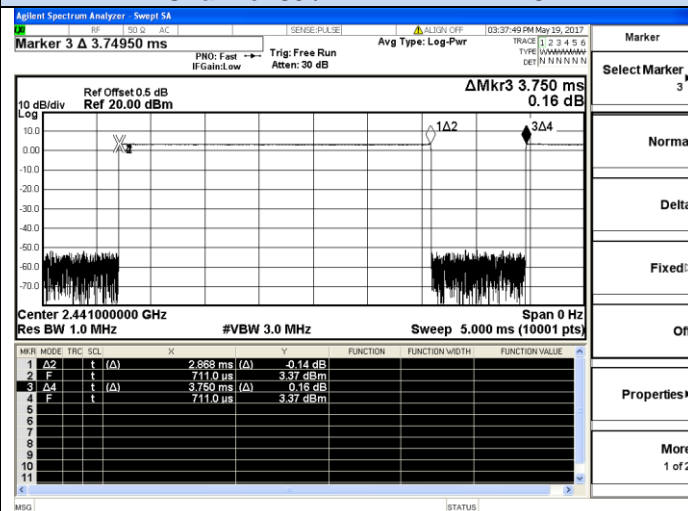
## Channel 39 / 2441 MHz - DH1



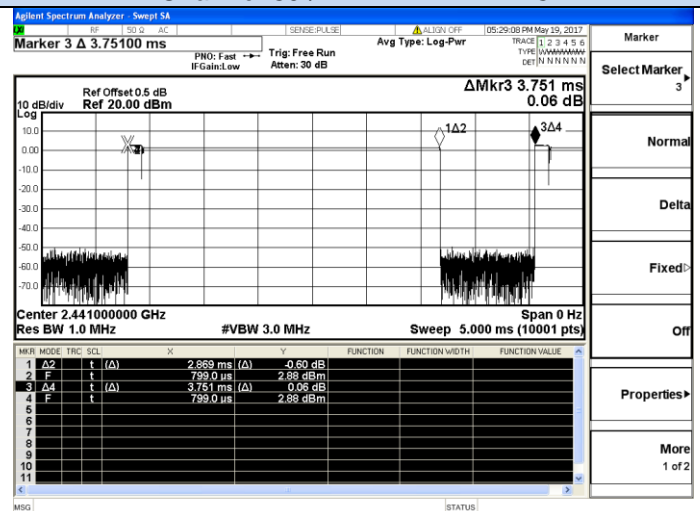
## Channel 39 / 2441 MHz - 2DH1



## Channel 39 / 2441 MHz - DH3



## Channel 39 / 2441 MHz - 2DH3



## Channel 39 / 2441 MHz - DH5

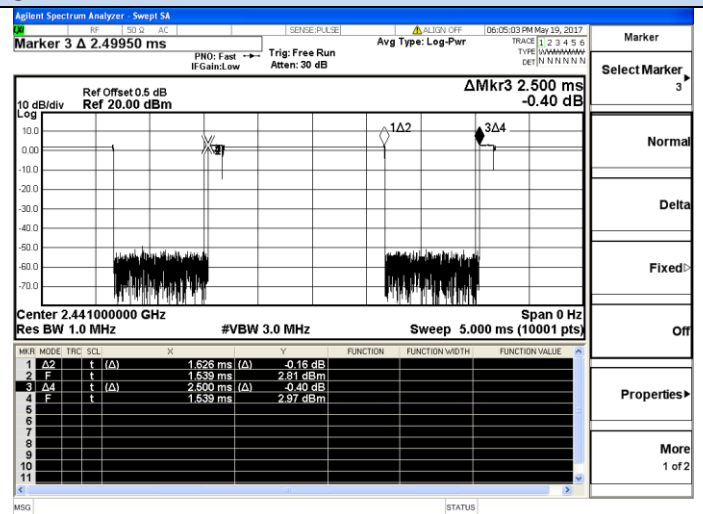
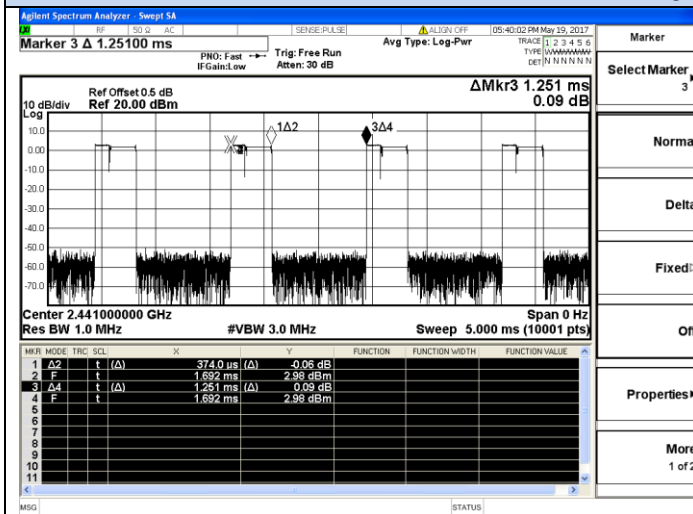


## Channel 39 / 2441 MHz - 2DH5

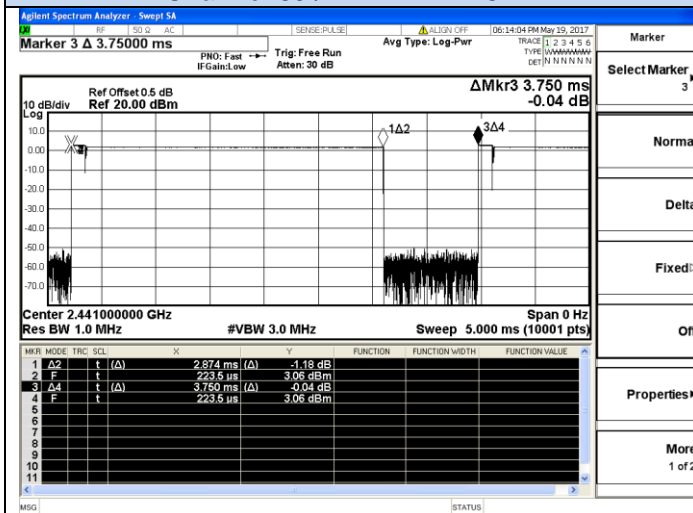


## Dwell time

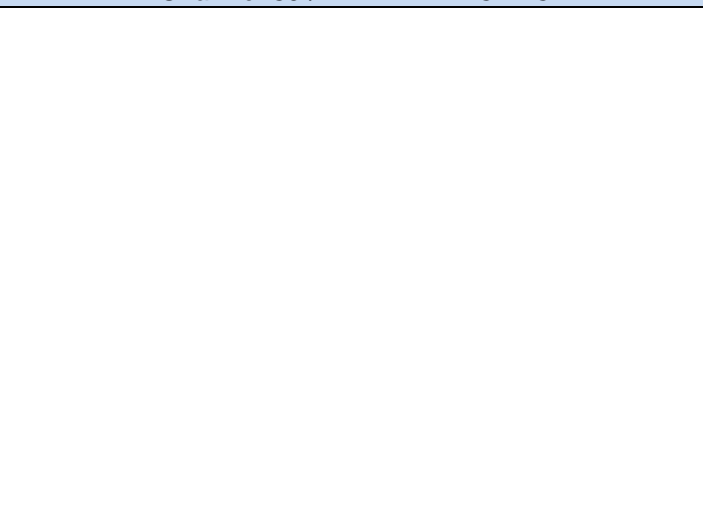
## 8DPSK



## Channel 39 / 2441 MHz - 3DH1



## Channel 39 / 2441 MHz - 3DH3



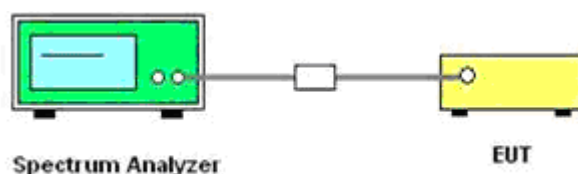
## Channel 39 / 2441 MHz - 3DH5

## 6.5 Conducted Spurious Emissions and Band Edges Test

### 6.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

### 6.5.2 Block Diagram of Test Setup



### 6.5.3 Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 9 kHz to 26.5GHz range with the transmitter set to the lowest, middle, and highest channels

### 6.5.4 Test Results of Conducted Spurious Emissions

No non-compliance noted. Only record the worst test result in this report. The test data refer to the following page.

| Test Mode      | Channel | Frequency (MHz) | Spurious RF Conducted Emission (dBc) | Limits (dBc) | Verdict |
|----------------|---------|-----------------|--------------------------------------|--------------|---------|
| GFSK           | 0       | 2402            | <-20                                 | -20          | PASS    |
|                | 39      | 2441            | <-20                                 |              |         |
|                | 78      | 2480            | <-20                                 |              |         |
| $\pi/4$ -DQPSK | 0       | 2402            | <-20                                 | -20          | PASS    |
|                | 39      | 2441            | <-20                                 |              |         |
|                | 78      | 2480            | <-20                                 |              |         |
| 8DPSK          | 0       | 2402            | <-20                                 | -20          | PASS    |
|                | 39      | 2441            | <-20                                 |              |         |
|                | 78      | 2480            | <-20                                 |              |         |

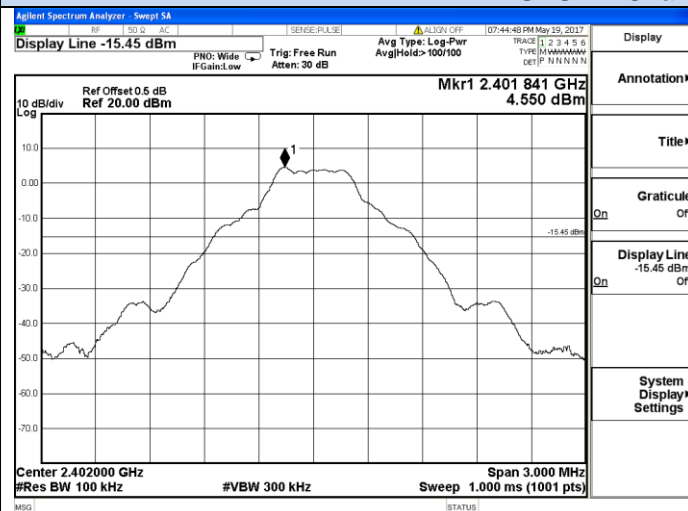
#### Remark:

1. Test results including cable loss;
2. please refer to following plots;
3. Measured at difference Packet Type for each mode and recorded worst case for each mode.

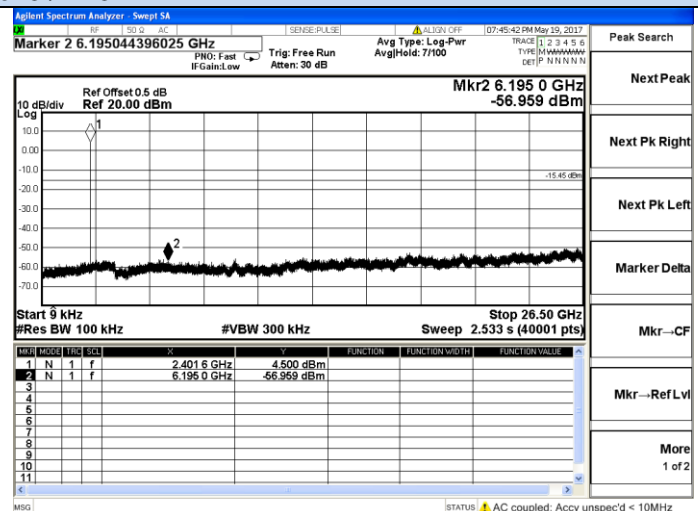


## RF Conducted Spurious Emissions

## GFSK – Channel 0 / 2402 MHz

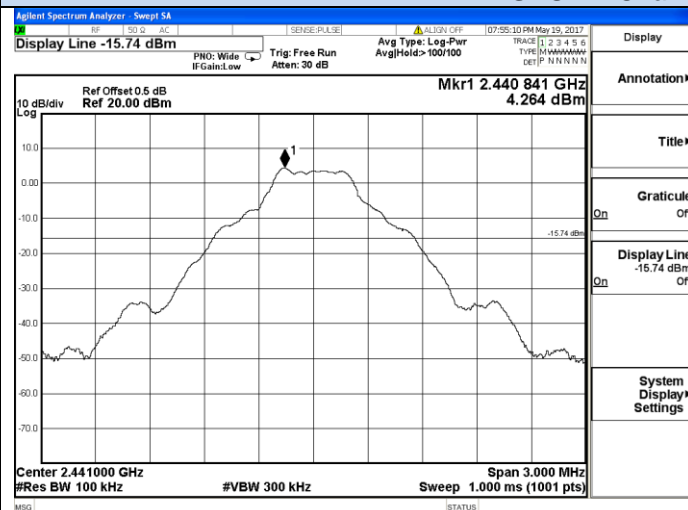


2399.5 – 2404.5 MHz

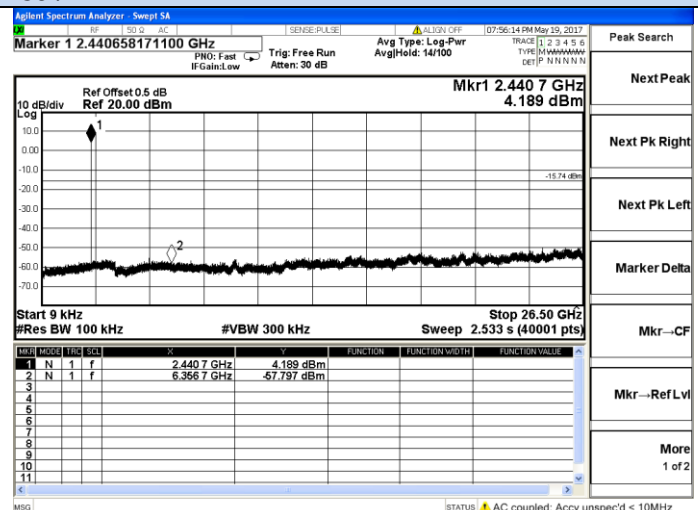


9 KHz – 26.5 GHz

## GFSK – Channel 39 / 2441 MHz

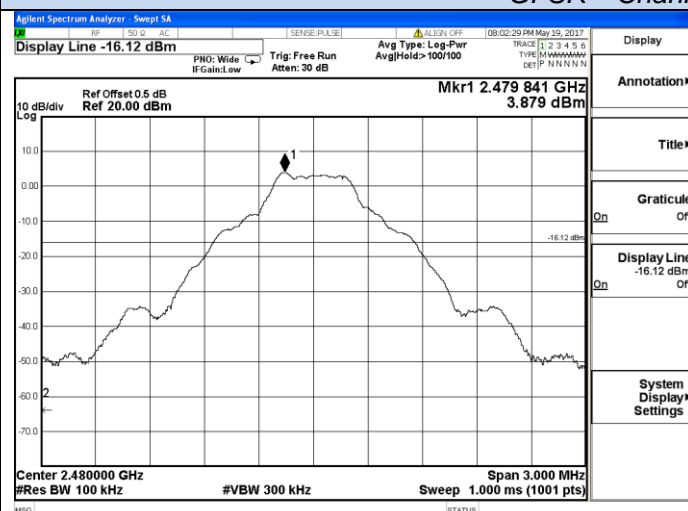


2438.5 – 2443.5 MHz

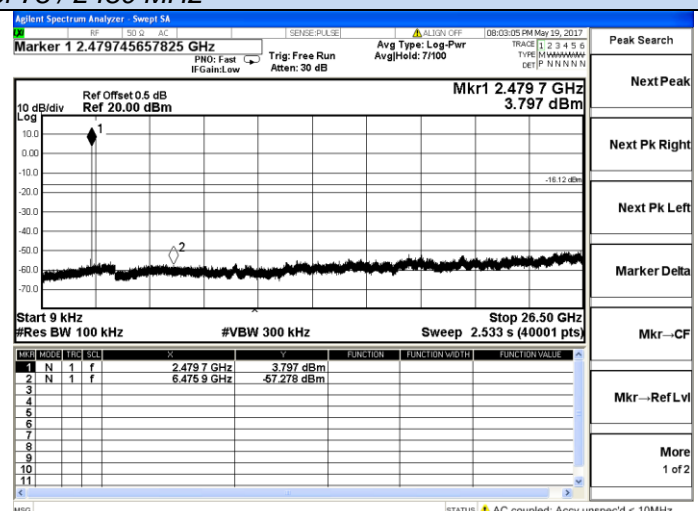


9 KHz – 26.5 GHz

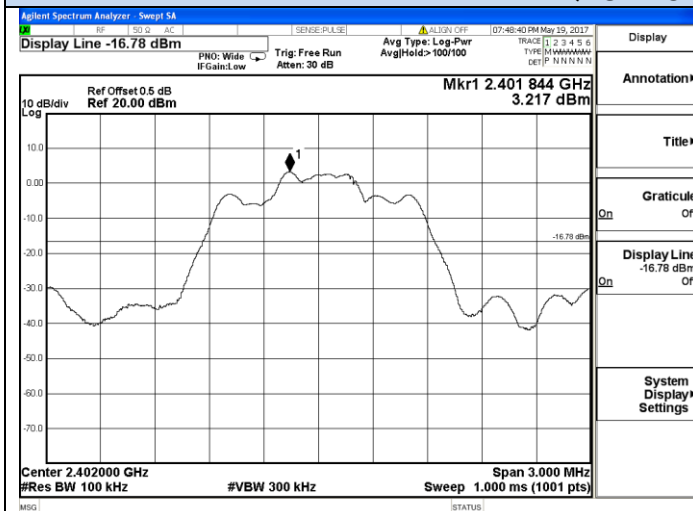
## GFSK – Channel 78 / 2480 MHz



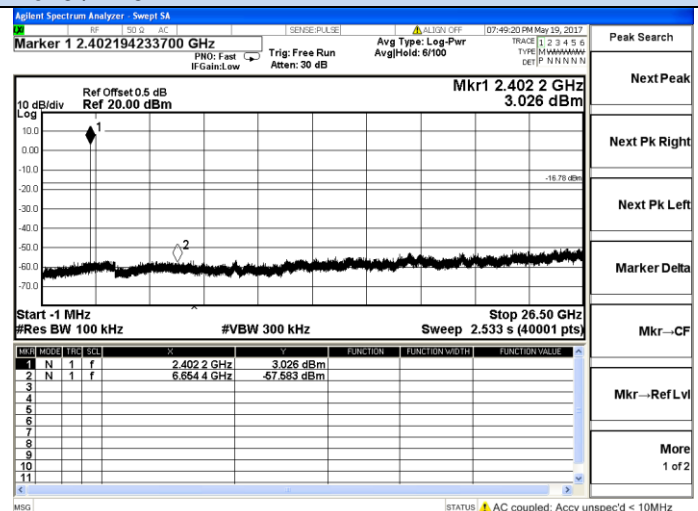
2477.5 – 2482.5 MHz



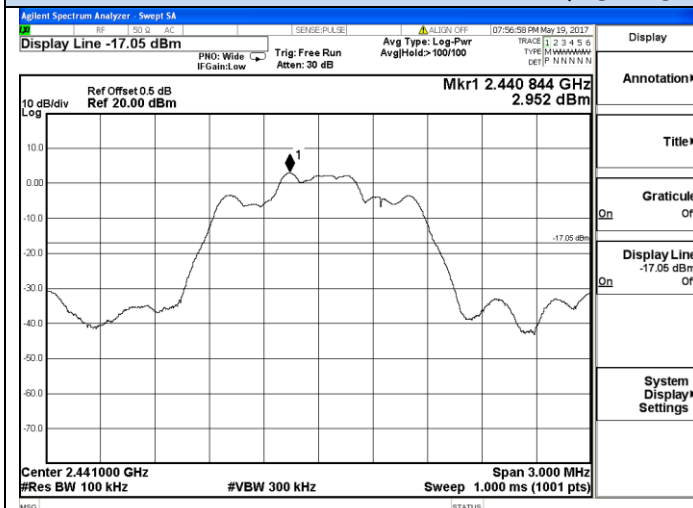
9 KHz – 26.5 GHz

RF Conducted Spurious Emissions  
 $\pi/4$ -DQPSK - Channel 0 / 2402 MHz

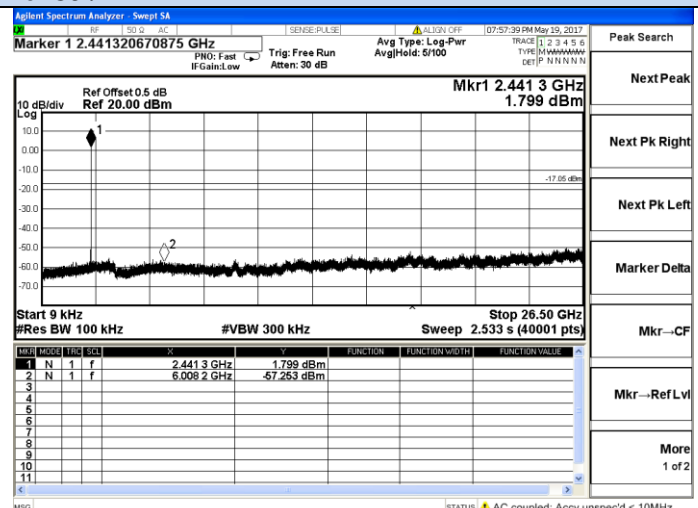
2399.5 – 2404.5 MHz



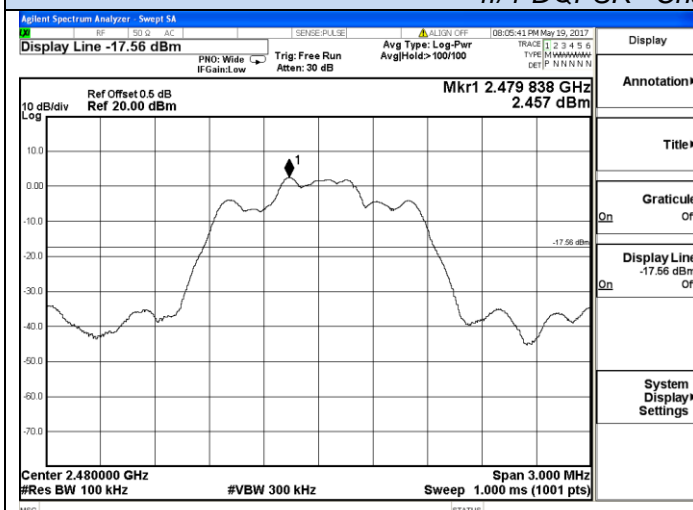
9 KHz – 26.5 GHz

 $\pi/4$ -DQPSK - Channel 39 / 2441 MHz

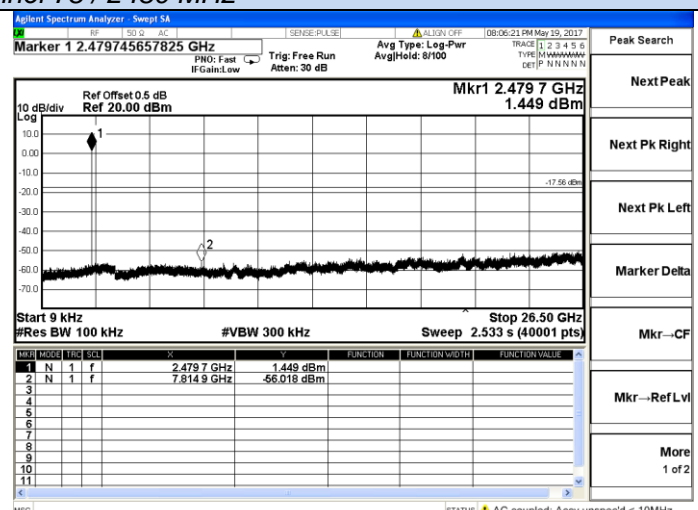
2438.5 – 2443.5 MHz



9 KHz – 26.5 GHz

 $\pi/4$ -DQPSK - Channel 78 / 2480 MHz

2477.5 – 2482.5 MHz



9 KHz – 26.5 GHz