

# EMC

## TEST REPORT

**Report No. :** 160300215TWN-001**Model No. :** HURESAC-3XE-C**Issued Date:** May 12, 2016

**Applicant:** Johnson Health Tech. Co., Ltd.  
No. 999, Sec. 2, Dongda Rd., Daya Dist., Taichung City  
428, Taiwan

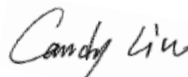
**Test Method/ Standard:** 47 CFR FCC Part 15.249 & ANSI C63.10:2013

**Test By:** Intertek Testing Services Taiwan Ltd.  
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,  
Shiang-Shan District, Hsinchu City, Taiwan

**Registration Number:** 93910

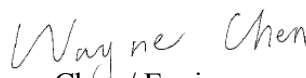
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**Title** Senior Engineer

### Revision History

| Report No.       | Issue Date   | Revision Summary |
|------------------|--------------|------------------|
| 160300215TWN-001 | May 12, 2016 | Original report  |

## Table of Contents

|                                                                          |    |
|--------------------------------------------------------------------------|----|
| Summary of Tests .....                                                   | 4  |
| 1. General information.....                                              | 5  |
| 1.1 Identification of the EUT.....                                       | 5  |
| 1.2 Additional information about the EUT .....                           | 6  |
| 1.3 Antenna description .....                                            | 6  |
| 1.4 Peripherals equipment.....                                           | 6  |
| 2. Test specifications.....                                              | 7  |
| 2.1 Test standard .....                                                  | 7  |
| 2.2 Operation mode .....                                                 | 7  |
| 3. Radiated emission test FCC 15.249 (C) .....                           | 8  |
| 3.1 Operating environment .....                                          | 8  |
| 3.2 Test setup & procedure .....                                         | 8  |
| 3.3 Emission limit .....                                                 | 10 |
| 3.3.1 Fundamental and harmonics emission limits.....                     | 10 |
| 3.3.2 General radiated emission limits .....                             | 11 |
| 3.4 Radiated spurious emission test data .....                           | 11 |
| 3.4.1 Measurement results: frequencies 9kHz ~ 30MHz.....                 | 11 |
| 3.4.2 Measurement results: frequencies equal to or less than 1 GHz ..... | 12 |
| 3.4.3 Measurement results: frequency above 1GHz.....                     | 13 |
| 3.4.5 Measurement results: Fundamental and harmonics emission.....       | 16 |
| 4. Radiated emission on the band edge FCC 15.249(d) .....                | 17 |
| 5. Conducted emission test FCC 15.207 .....                              | 24 |
| 5.1 Operating environment .....                                          | 24 |
| 5.2 Test setup & procedure .....                                         | 24 |
| 5.3 Emission limit.....                                                  | 24 |
| 5.4 Conducted emission data FCC 15.207.....                              | 25 |
| 6. 20dB Bandwidth test .....                                             | 27 |
| 6.1 Operating environment .....                                          | 27 |
| 6.2 Test setup & procedure .....                                         | 27 |
| 6.3 Measured data of modulated bandwidth test results.....               | 27 |
| Appendix A: Test equipment list .....                                    | 34 |
| Appendix B: Measurement Uncertainty .....                                | 36 |



### Summary of Tests

| Test                           | Reference         | Results |
|--------------------------------|-------------------|---------|
| Radiated Emission test         | 15.249(c), 15.209 | Pass    |
| Emission on the Band Edge      | 15.249(d)         | Pass    |
| Conducted Emission of AC Power | 15.207            | Pass    |
| 20dB Bandwidth                 | 15.215(c)         | Pass    |



## 1. General information

### 1.1 Identification of the EUT

Product: Console for Exercise Machine

Model No.: HURESAC-3XE-C

Radio Module: MS-57423

Brand Name: Matrix Fitness

Frequency Range: 2402MHz~2480MHz

Total Hopping Channel No: 79 channels

Frequency of Each Channel: 2402+1k MHz, k=0~78

Type of Modulation: GFSK,  $\pi/4$ DQSP, 8DPSK

Rated Power: DC 12 from adapter

Power Cord: N/A

Data Cable: N/A

Sample Received: Mar. 09, 2016

Test Date(s): Apr. 23, 2016 ~ Apr. 29, 2016

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Note 2: When determining the test conclusion, the Measurement Uncertainty of test has been considered.

## 1.2 Additional information about the EUT

| Modulation mode | Transmit path  |
|-----------------|----------------|
|                 | Chain 0 / Main |
| GFSK            | V              |
| $\pi/4$ DQPSK   | V              |
| 8DPSK           | V              |

Product SW version : UI 0.1.7.2, OS 2.0.19, IO 10  
Product HW version : v1.1  
Radio SW version : N/A  
Radio HW version : 0B  
Test SW Version : USI\_BCM43XX\_Testing\_Tool\_V1\_4\_10r8

## 1.3 Antenna description

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector..

Antenna Gain : 2.8 dBi  
Antenna Type : PIFA Antenna  
Connector Type : I-PEX

## 1.4 Peripherals equipment

| Peripherals | Brand | Model No.     | Serial No. | Data cable                  |
|-------------|-------|---------------|------------|-----------------------------|
| Notebook PC | DELL  | Latitude D610 | 1YWZK1S    | Micro USB cable 1 meter × 1 |
| Adapter     | N/A   | LSE0107A1240  | N/A        | N/A                         |

## **2. Test specifications**

### **2.1 Test standard**

The EUT was performed according to the procedures in FCC Part 15 Subpart C Paragraph 15.249 for non-spread spectrum devices.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band was all meet limit requirement, thus we evaluate the EUT pass the specified test.

### **2.2 Operation mode**

The EUT was supplied with DC 12V from adapter

TX-MODE is based on a specific test program “USI BCM FCC CE REG Tool”, and the program can select different frequency and modulation.

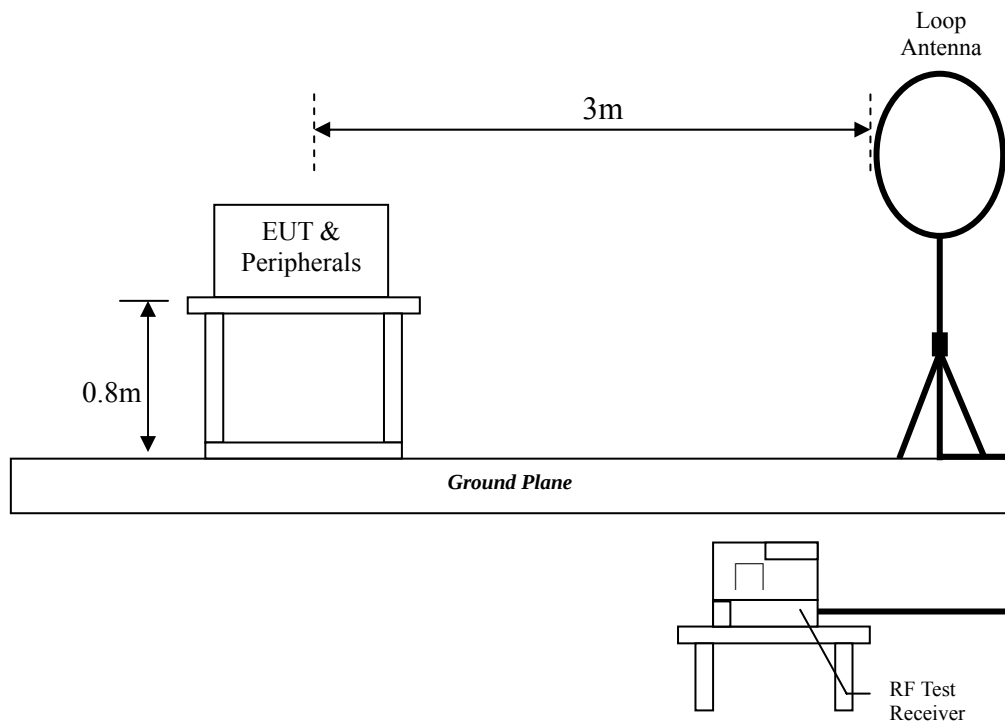
### 3. Radiated emission test FCC 15.249 (C)

#### 3.1 Operating environment

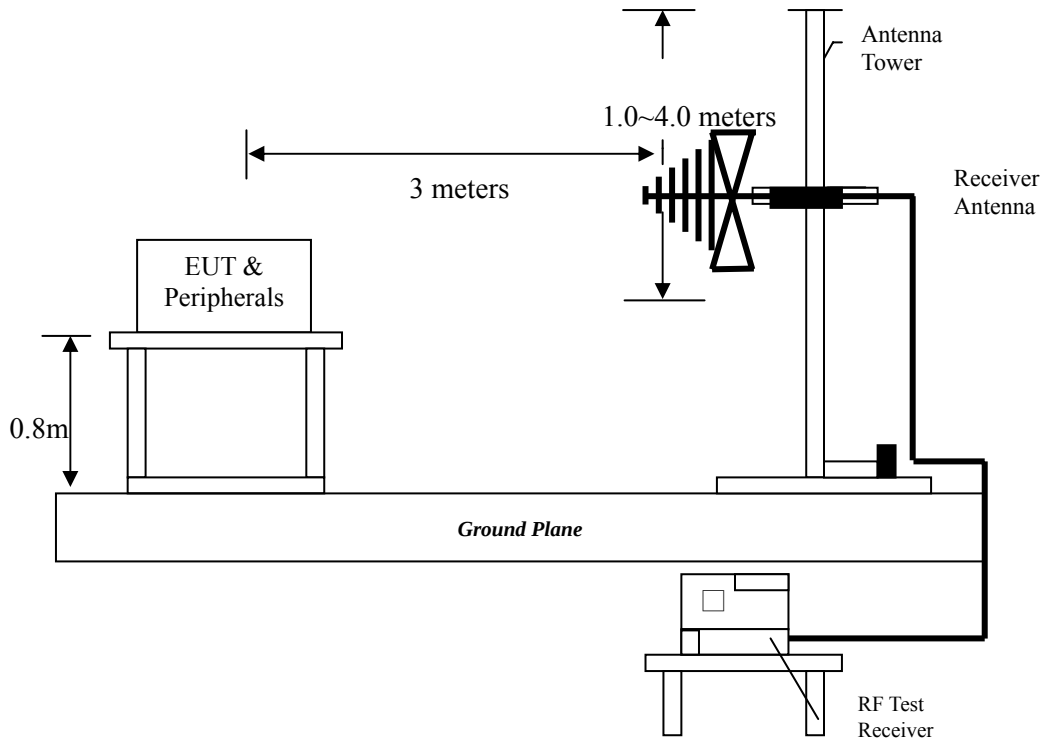
|                      |      |     |
|----------------------|------|-----|
| Temperature:         | 25   | °C  |
| Relative Humidity:   | 55   | %   |
| Atmospheric Pressure | 1008 | hPa |

#### 3.2 Test setup & procedure

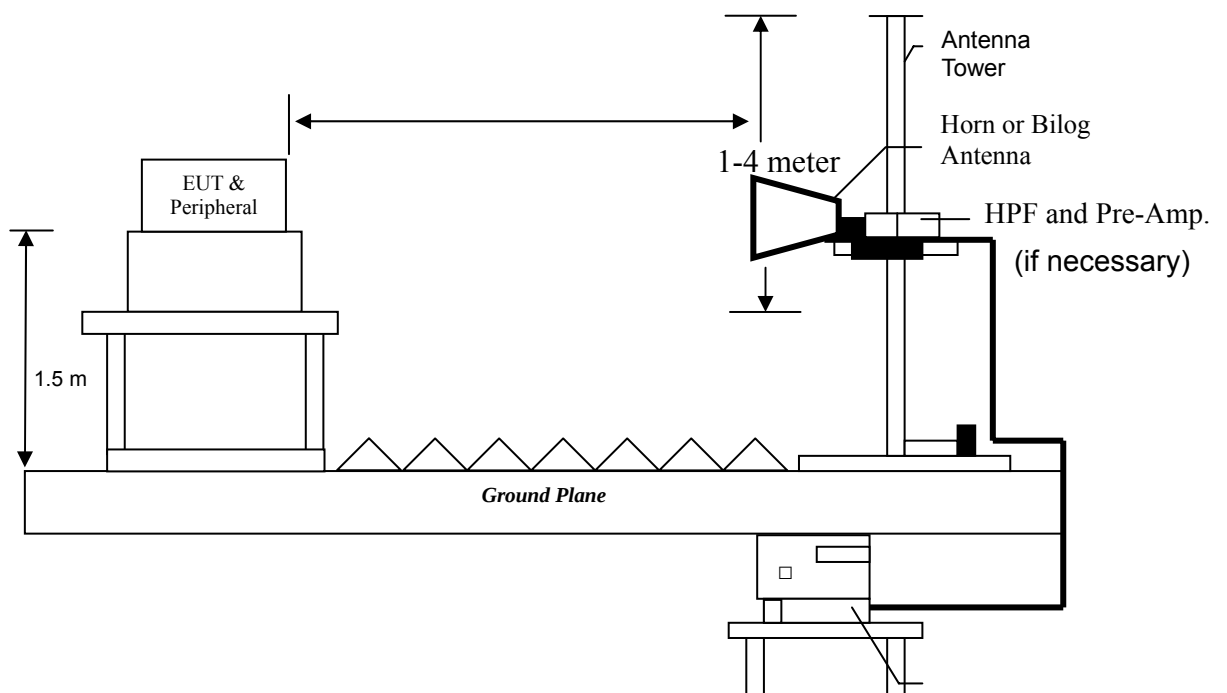
**Radiated emission from 9 kHz to 30 MHz uses Loop Antenna:**



**Radiated emission from 30 MHz to 1 GHz uses Bilog Antenna:**



**Radiated emission above 1 GHz uses Horn Antenna:**



Radiated emissions were investigated cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1 MHz RBW/ 3 MHz VBW) recorded also on the report. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.

The EUT for testing is arranged on a turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The EUT configurations please refer to the “Spurious set-up photo.pdf”.

### 3.3 Emission limit

#### 3.3.1 Fundamental and harmonics emission limits

| Frequency (MHz) | Field Strength of Fundamental |             | Field Strength of Harmonics |             |
|-----------------|-------------------------------|-------------|-----------------------------|-------------|
|                 | (mV/m@3m)                     | (dBuV/m@3m) | (uV/m@3m)                   | (dBuV/m@3m) |
| 2400-2483.5     | 50                            | 94          | 500                         | 54          |

### 3.3.2 General radiated emission limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

| Frequency<br>MHz | 15.209 Limits<br>(dB $\mu$ V/m@3m) |
|------------------|------------------------------------|
| 30-88            | 40                                 |
| 88-216           | 43.5                               |
| 216-960          | 46                                 |
| Above 960        | 54                                 |

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

### 3.4 Radiated spurious emission test data

#### 3.4.1 Measurement results: frequencies 9kHz ~ 30MHz

The test was performed on EUT continuously transmitting mode.

EUT : HURESAC-3XE-C

| Frequency<br>(MHz) | Detection<br>value | factor<br>(dB/m) | Reading<br>(dB $\mu$ V) | value<br>(dB $\mu$ V/m) | Limit<br>@ 3m<br>(dB $\mu$ V/m) | Tolerance<br>(dB) |
|--------------------|--------------------|------------------|-------------------------|-------------------------|---------------------------------|-------------------|
| 0.02               | QP                 | 20.92            | 15.76                   | 36.68                   | 200.00                          | -163.33           |
| 0.03               | QP                 | 20.86            | 19.27                   | 40.13                   | 160.00                          | -119.87           |
| 0.05               | QP                 | 20.83            | 16.10                   | 36.93                   | 128.00                          | -91.07            |
| 0.07               | QP                 | 20.81            | 15.34                   | 36.15                   | 114.29                          | -78.14            |
| 0.11               | QP                 | 20.77            | 15.72                   | 36.49                   | 101.82                          | -65.33            |

Remark: Corr. Factor = Antenna Factor + Cable Loss

### 3.4.2 Measurement results: frequencies equal to or less than 1 GHz

The test was performed on EUT under GFSK,  $\pi/4$ DQSP, & 8-DPSK continuously transmitting mode. Channel 0, 39, 78 were verified. The worst case occurred at 8-DPSK TX Channel 39

EUT : HURESAC-3XE-C

Test Condition : 8-DPSK TX Channel 39

| Antenna Polariz.<br>(V/H) | Freq.<br>(MHz) | Receiver<br>Detector | Corr.<br>Factor<br>(dB/m) | Reading<br>(dBuV) | Corrected<br>Level<br>(dBuV/m) | Limit<br>@ 3 m<br>(dBuV/m) | Margin<br>(dB) |
|---------------------------|----------------|----------------------|---------------------------|-------------------|--------------------------------|----------------------------|----------------|
| Vertical                  | 47.46          | QP                   | 9.04                      | 31.30             | 31.12                          | 40.00                      | -8.88          |
| Vertical                  | 95.96          | QP                   | 14.55                     | 24.22             | 29.89                          | 43.50                      | -13.61         |
| Vertical                  | 191.02         | QP                   | 13.97                     | 26.07             | 34.77                          | 43.50                      | -8.73          |
| Vertical                  | 288.02         | QP                   | 14.72                     | 26.39             | 34.11                          | 46.00                      | -11.89         |
| Vertical                  | 336.52         | QP                   | 15.68                     | 24.37             | 31.35                          | 46.00                      | -14.65         |
| Vertical                  | 528.58         | QP                   | 20.36                     | 20.72             | 37.97                          | 46.00                      | -8.03          |
| Horizontal                | 95.96          | QP                   | 12.20                     | 31.21             | 25.43                          | 43.50                      | -18.07         |
| Horizontal                | 191.02         | QP                   | 14.07                     | 28.97             | 34.36                          | 43.50                      | -9.14          |
| Horizontal                | 216.24         | QP                   | 14.72                     | 30.34             | 32.75                          | 46.00                      | -13.25         |
| Horizontal                | 239.52         | QP                   | 15.68                     | 27.57             | 33.20                          | 46.00                      | -12.80         |
| Horizontal                | 288.02         | QP                   | 17.02                     | 26.27             | 39.59                          | 46.00                      | -6.41          |
| Horizontal                | 336.52         | QP                   | 18.35                     | 27.31             | 37.42                          | 46.00                      | -8.58          |

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

### 3.4.3 Measurement results: frequency above 1GHz

| Mode              | Frequency<br>(MHz) | Spectrum<br>Analyzer<br>Detector | Ant.<br>Pol.<br>(H/V) | Preamp.<br>Gain<br>(dB) | Correction<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Corrected<br>Reading<br>(dBμV/m) | Limit<br>@ 3 m<br>(dBμV/m) | Margin<br>(dB) |
|-------------------|--------------------|----------------------------------|-----------------------|-------------------------|--------------------------------|-------------------|----------------------------------|----------------------------|----------------|
| GFSK<br>Ch_Low    | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 48.11             | 44.38                            | 74.00                      | -29.62         |
|                   | 4804               | PK                               | V                     | 40.13                   | -0.10                          | 42.14             | 42.04                            | 74.00                      | -31.96         |
|                   | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 46.73             | 43.00                            | 74.00                      | -31.00         |
|                   | 4804               | PK                               | H                     | 40.13                   | -0.10                          | 42.98             | 42.88                            | 74.00                      | -31.12         |
| GFSK<br>Ch_Middle | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 48.75             | 45.02                            | 74.00                      | -28.98         |
|                   | 4882               | PK                               | V                     | 39.99                   | 0.16                           | 42.51             | 42.67                            | 74.00                      | -31.33         |
|                   | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 46.09             | 42.36                            | 74.00                      | -31.64         |
|                   | 4882               | PK                               | H                     | 39.99                   | 0.16                           | 41.19             | 41.35                            | 74.00                      | -32.65         |
| GFSK<br>Ch_High   | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 47.43             | 43.70                            | 74.00                      | -30.30         |
|                   | 4960               | PK                               | V                     | 39.84                   | 0.41                           | 42.84             | 43.25                            | 74.00                      | -30.75         |
|                   | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 46.18             | 42.45                            | 74.00                      | -31.55         |
|                   | 4960               | PK                               | H                     | 39.84                   | 0.41                           | 45.00             | 45.41                            | 74.00                      | -28.59         |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss + Power Amplifier
2. Corrected Level = Reading + Correction Factor
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

| Mode                        | Frequency<br>(MHz) | Spectrum<br>Analyzer<br>Detector | Ant.<br>Pol.<br>(H/V) | Preamp.<br>Gain<br>(dB) | Correction<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Corrected<br>Reading<br>(dBμV/m) | Limit<br>@ 3 m<br>(dBμV/m) | Margin<br>(dB) |
|-----------------------------|--------------------|----------------------------------|-----------------------|-------------------------|--------------------------------|-------------------|----------------------------------|----------------------------|----------------|
| $\pi/4$ -DQPSK<br>Ch_Low    | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 47.55             | 43.82                            | 74.00                      | -30.18         |
|                             | 4804               | PK                               | V                     | 40.13                   | -0.10                          | 41.64             | 41.54                            | 74.00                      | -32.46         |
|                             | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 45.83             | 42.10                            | 74.00                      | -31.90         |
|                             | 4804               | PK                               | H                     | 40.13                   | -0.10                          | 41.40             | 41.30                            | 74.00                      | -32.70         |
| $\pi/4$ -DQPSK<br>Ch_Middle | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 47.77             | 44.04                            | 74.00                      | -29.96         |
|                             | 4882               | PK                               | V                     | 39.99                   | 0.16                           | 41.09             | 41.25                            | 74.00                      | -32.75         |
|                             | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 46.62             | 42.89                            | 74.00                      | -31.11         |
|                             | 4882               | PK                               | H                     | 39.99                   | 0.16                           | 41.08             | 41.24                            | 74.00                      | -32.76         |
| $\pi/4$ -DQPSK<br>Ch_High   | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 48.21             | 44.48                            | 74.00                      | -29.52         |
|                             | 4960               | PK                               | V                     | 39.84                   | 0.41                           | 41.11             | 41.52                            | 74.00                      | -32.48         |
|                             | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 46.56             | 42.83                            | 74.00                      | -31.17         |
|                             | 4960               | PK                               | H                     | 39.84                   | 0.41                           | 42.13             | 42.54                            | 74.00                      | -31.46         |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss + Power Amplifier
2. Corrected Level = Reading + Correction Factor
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

| Mode               | Frequency<br>(MHz) | Spectrum<br>Analyzer<br>Detector | Ant.<br>Pol.<br>(H/V) | Preamp.<br>Gain<br>(dB) | Correction<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Corrected<br>Reading<br>(dBμV/m) | Limit<br>@ 3 m<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|--------------------|----------------------------------|-----------------------|-------------------------|--------------------------------|-------------------|----------------------------------|----------------------------|----------------|
| 8DPSK<br>Ch_Low    | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 48.26             | 44.53                            | 74.00                      | -29.47         |
|                    | 4804               | PK                               | V                     | 40.13                   | -0.10                          | 41.06             | 40.96                            | 74.00                      | -33.04         |
|                    | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 47.15             | 43.42                            | 74.00                      | -30.58         |
|                    | 4804               | PK                               | H                     | 40.13                   | -0.10                          | 41.46             | 41.36                            | 74.00                      | -32.64         |
| 8DPSK<br>Ch_Middle | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 47.14             | 43.41                            | 74.00                      | -30.59         |
|                    | 4882               | PK                               | V                     | 39.99                   | 0.16                           | 41.25             | 41.41                            | 74.00                      | -32.59         |
|                    | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 46.10             | 42.37                            | 74.00                      | -31.63         |
|                    | 4882               | PK                               | H                     | 39.99                   | 0.16                           | 40.91             | 41.07                            | 74.00                      | -32.93         |
| 8DPSK<br>Ch_High   | 3150               | PK                               | V                     | 39.85                   | -3.73                          | 47.73             | 44.00                            | 74.00                      | -30.00         |
|                    | 4960               | PK                               | V                     | 39.84                   | 0.41                           | 41.21             | 41.62                            | 74.00                      | -32.38         |
|                    | 3150               | PK                               | H                     | 39.85                   | -3.73                          | 47.11             | 43.38                            | 74.00                      | -30.62         |
|                    | 4960               | PK                               | H                     | 39.84                   | 0.41                           | 41.52             | 41.93                            | 74.00                      | -32.07         |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss + Power Amplifier
2. Corrected Level = Reading + Correction Factor
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

### 3.4.5 Measurement results: Fundamental emission

| Mode          | Channel | Frequency<br>(MHz) | Spectrum<br>Analyzer | Ant.<br>Pol.<br>(H/V) | Correction<br>Factor<br>(dB/m) | Reading<br>(dBuV) | Corrected<br>Reading<br>(dBuV/m) | Limit<br>@ 3 m<br>(dBuV/m) | Margin<br>(dB) |
|---------------|---------|--------------------|----------------------|-----------------------|--------------------------------|-------------------|----------------------------------|----------------------------|----------------|
| GFSK          | Ch0     | 2402               | PK                   | V                     | 32.59                          | 63.02             | 95.61                            | 114                        | -18.39         |
|               | Ch0     | 2402               | AV                   | V                     | 32.59                          | 21.52             | 54.11                            | 94                         | -39.89         |
|               | Ch0     | 2402               | PK                   | H                     | 32.59                          | 60.63             | 93.22                            | 114                        | -20.78         |
|               | Ch0     | 2402               | AV                   | H                     | 32.59                          | 18.04             | 50.63                            | 94                         | -43.37         |
|               | Ch39    | 2441               | PK                   | V                     | 32.63                          | 65.38             | 98.01                            | 114                        | -15.99         |
|               | Ch39    | 2441               | AV                   | V                     | 32.63                          | 18.92             | 51.55                            | 94                         | -42.45         |
|               | Ch39    | 2441               | PK                   | H                     | 32.63                          | 62.36             | 94.99                            | 114                        | -19.01         |
|               | Ch39    | 2441               | AV                   | H                     | 32.63                          | 18.10             | 50.73                            | 94                         | -43.27         |
|               | Ch78    | 2480               | PK                   | V                     | 32.64                          | 62.83             | 95.47                            | 114                        | -18.53         |
|               | Ch78    | 2480               | AV                   | V                     | 32.64                          | 18.36             | 51.00                            | 94                         | -43.00         |
|               | Ch78    | 2480               | PK                   | H                     | 32.64                          | 62.72             | 95.36                            | 114                        | -18.64         |
|               | Ch78    | 2480               | AV                   | H                     | 32.64                          | 17.83             | 50.47                            | 94                         | -43.53         |
| $\pi/4$ -DPSK | Ch0     | 2402               | PK                   | V                     | 32.59                          | 63.90             | 96.49                            | 114                        | -17.51         |
|               | Ch0     | 2402               | AV                   | V                     | 32.59                          | 19.38             | 51.97                            | 94                         | -42.03         |
|               | Ch0     | 2402               | PK                   | H                     | 32.59                          | 61.69             | 94.28                            | 114                        | -19.72         |
|               | Ch0     | 2402               | AV                   | H                     | 32.59                          | 17.67             | 50.26                            | 94                         | -43.74         |
|               | Ch39    | 2441               | PK                   | V                     | 32.63                          | 65.35             | 97.98                            | 114                        | -16.02         |
|               | Ch39    | 2441               | AV                   | V                     | 32.63                          | 18.96             | 51.59                            | 94                         | -42.41         |
|               | Ch39    | 2441               | PK                   | H                     | 32.63                          | 62.25             | 94.88                            | 114                        | -19.12         |
|               | Ch39    | 2441               | AV                   | H                     | 32.63                          | 17.44             | 50.07                            | 94                         | -43.93         |
|               | Ch78    | 2480               | PK                   | V                     | 32.64                          | 62.41             | 95.05                            | 114                        | -18.95         |
|               | Ch78    | 2480               | AV                   | V                     | 32.64                          | 20.35             | 52.99                            | 94                         | -41.01         |
|               | Ch78    | 2480               | PK                   | H                     | 32.64                          | 62.12             | 94.76                            | 114                        | -19.24         |
|               | Ch78    | 2480               | AV                   | H                     | 32.64                          | 18.39             | 51.03                            | 94                         | -42.97         |
| 8-DPSK        | Ch0     | 2402               | PK                   | V                     | 32.59                          | 63.29             | 95.88                            | 114                        | -18.12         |
|               | Ch0     | 2402               | AV                   | V                     | 32.59                          | 21.13             | 53.72                            | 94                         | -40.28         |
|               | Ch0     | 2402               | PK                   | H                     | 32.59                          | 60.52             | 93.11                            | 114                        | -20.89         |
|               | Ch0     | 2402               | AV                   | H                     | 32.59                          | 19.97             | 52.56                            | 94                         | -41.44         |
|               | Ch39    | 2441               | PK                   | V                     | 32.63                          | 65.99             | 98.62                            | 114                        | -15.38         |
|               | Ch39    | 2441               | AV                   | V                     | 32.63                          | 18.55             | 51.18                            | 94                         | -42.82         |
|               | Ch39    | 2441               | PK                   | H                     | 32.63                          | 62.24             | 94.87                            | 114                        | -19.13         |
|               | Ch39    | 2441               | AV                   | H                     | 32.63                          | 17.44             | 50.07                            | 94                         | -43.93         |
|               | Ch78    | 2480               | PK                   | V                     | 32.64                          | 62.86             | 95.50                            | 114                        | -18.50         |
|               | Ch78    | 2480               | AV                   | V                     | 32.64                          | 20.21             | 52.85                            | 94                         | -41.15         |
|               | Ch78    | 2480               | PK                   | H                     | 32.64                          | 62.66             | 95.30                            | 114                        | -18.70         |
|               | Ch78    | 2480               | AV                   | H                     | 32.64                          | 19.67             | 52.31                            | 94                         | -41.69         |

Remark:

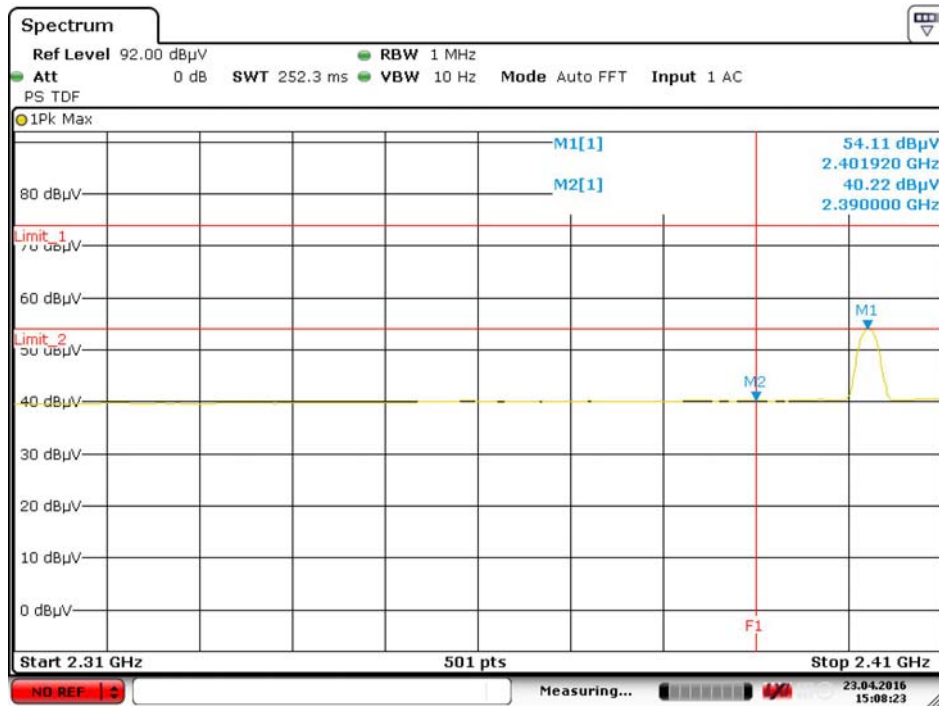
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

#### 4. Radiated emission on the band edge FCC 15.249(d)

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental (2402~2480MHz) or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

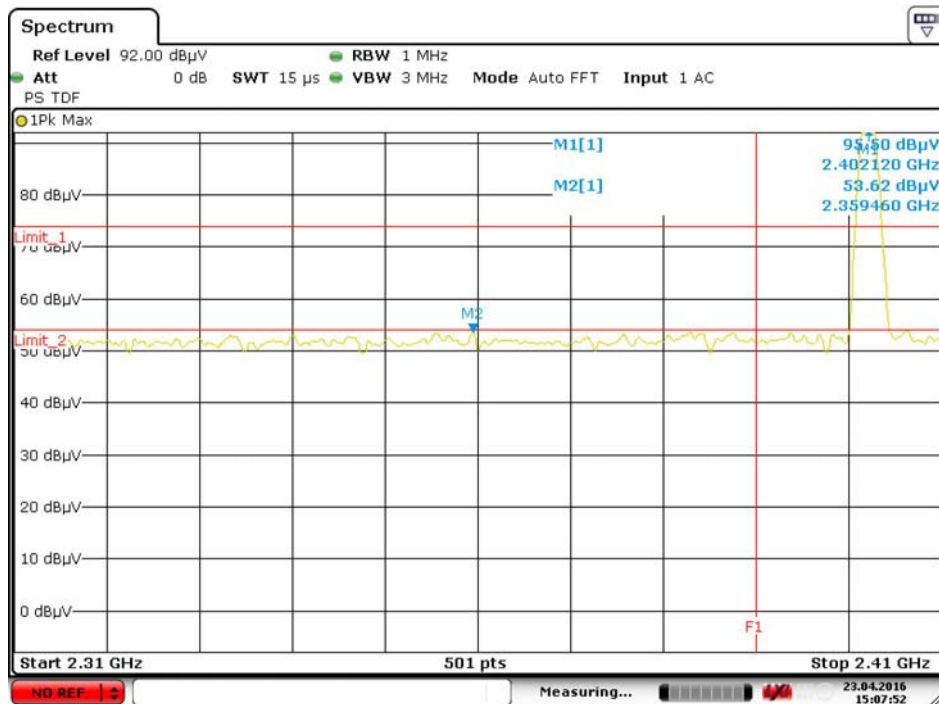
| Mode           | Frequency<br>(MHz) | Spectrum<br>Analyzer<br>Detector | Ant.<br>Pol.<br>(H/V) | Correction<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Corrected<br>Reading<br>(dBμV/m) | Limit<br>@ 3 m<br>(dBμV/m) | Margin<br>(dB) | Restricted<br>band<br>(MHz) |
|----------------|--------------------|----------------------------------|-----------------------|--------------------------------|-------------------|----------------------------------|----------------------------|----------------|-----------------------------|
| GFSK           | 2359.46            | PK                               | V                     | 32.40                          | 21.22             | 53.62                            | 74                         | -20.38         | 2310~2390                   |
|                | 2390.00            | AV                               | V                     | 32.51                          | 7.71              | 40.22                            | 54                         | -13.78         |                             |
|                | 2399.35            | PK                               | V                     | 32.54                          | 21.48             | 54.02                            | 74                         | -19.98         | 2483.5~2500                 |
|                | 2483.50            | AV                               | V                     | 32.84                          | 8.11              | 40.95                            | 54                         | -13.05         |                             |
| $\pi/4$ -DQPSK | 2333.13            | PK                               | V                     | 32.31                          | 21.47             | 53.78                            | 74                         | -20.22         | 2310~2390                   |
|                | 2390.00            | AV                               | V                     | 32.51                          | 7.71              | 40.22                            | 54                         | -13.78         |                             |
|                | 2489.20            | PK                               | V                     | 32.86                          | 21.40             | 54.26                            | 74                         | -19.74         | 2483.5~2500                 |
|                | 2483.50            | AV                               | V                     | 32.84                          | 8.11              | 40.95                            | 54                         | -13.05         |                             |
| 8-DPSK         | 2388.22            | PK                               | V                     | 32.50                          | 20.03             | 52.53                            | 74                         | -21.47         | 2310~2390                   |
|                | 2390.00            | AV                               | V                     | 32.51                          | 7.75              | 40.26                            | 54                         | -13.74         |                             |
|                | 2486.15            | PK                               | V                     | 32.85                          | 21.47             | 54.32                            | 74                         | -19.68         | 2483.5~2500                 |
|                | 2483.50            | AV                               | V                     | 32.84                          | 8.07              | 40.91                            | 54                         | -13.09         |                             |

Band edge @ GFSK mode Channel\_0 2402MHz Vertical AV



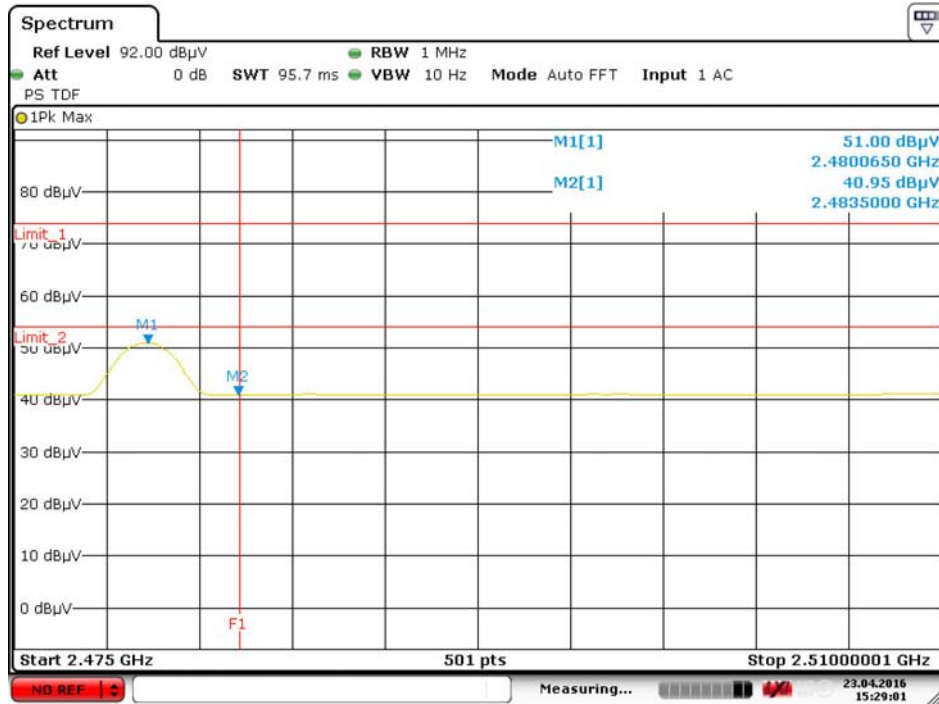
Date: 23.APR.2016 15:08:23

Band edge @ GFSK mode Channel\_0 2402MHz Vertical PK



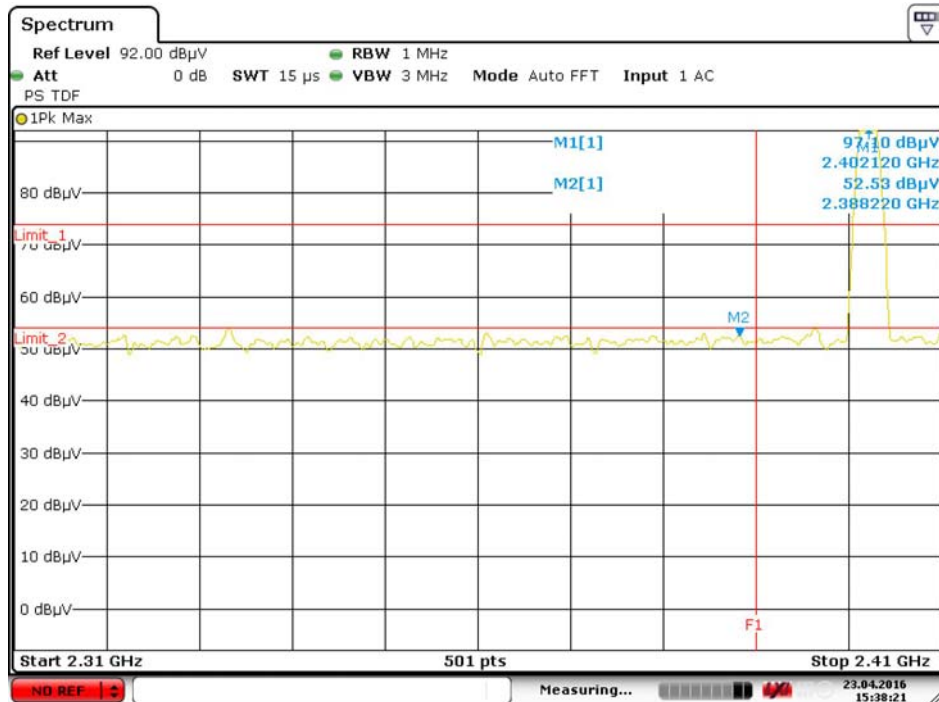
Date: 23.APR.2016 15:07:53

Band edge @ GFSK mode Channel\_78 2480MHz Vertical AV



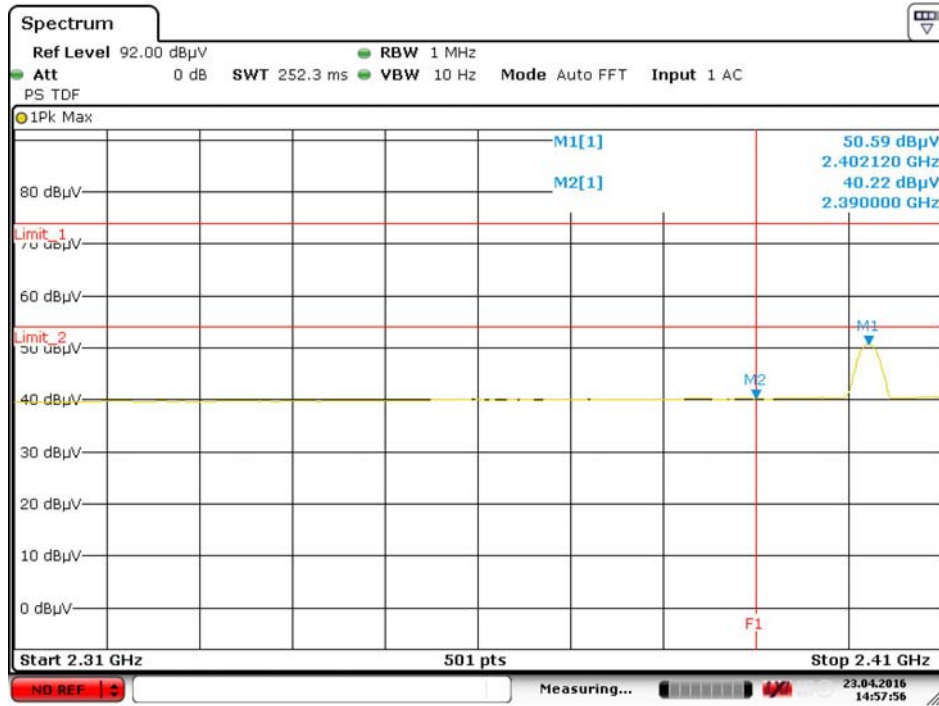
Date: 23.APR.2016 15:29:01

Band edge @ GFSK mode Channel\_78 2480MHz Vertical PK



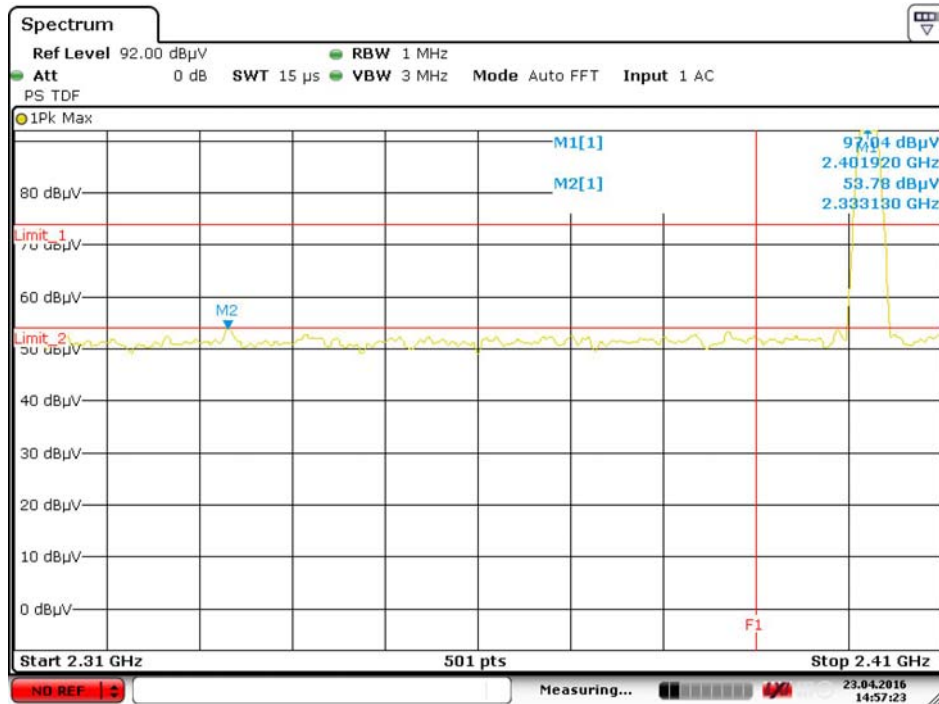
Date: 23.APR.2016 15:38:22

Band edge @  $\pi/4$ -DQPSK mode Channel\_0 2402MHz Vertical AV



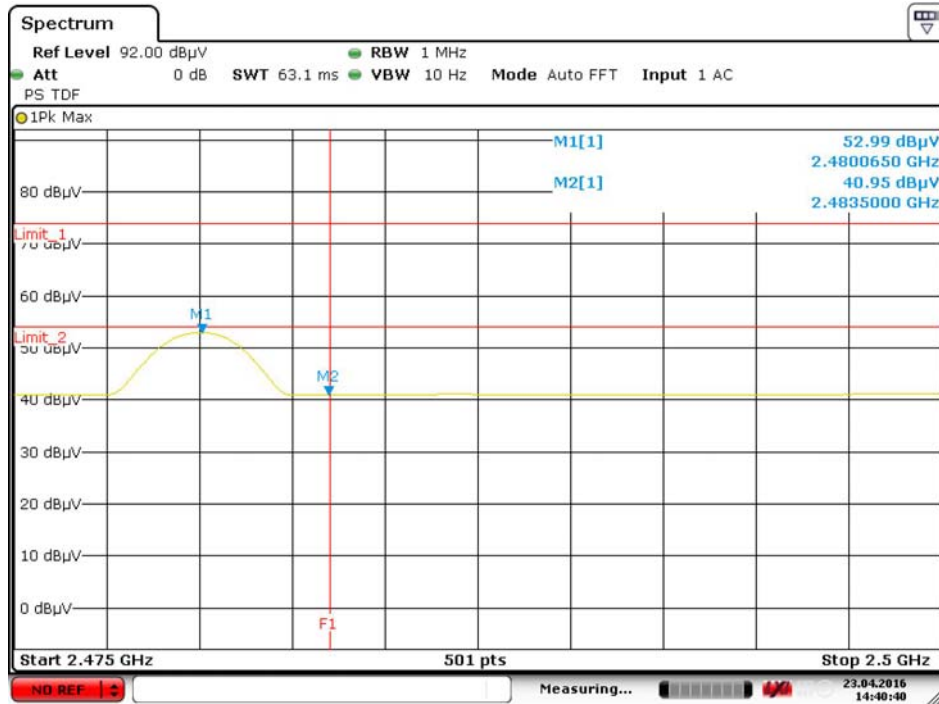
Date: 23.APR.2016 14:57:56

Band edge @  $\pi/4$ -DQPSK mode Channel\_0 2402MHz Vertical PK

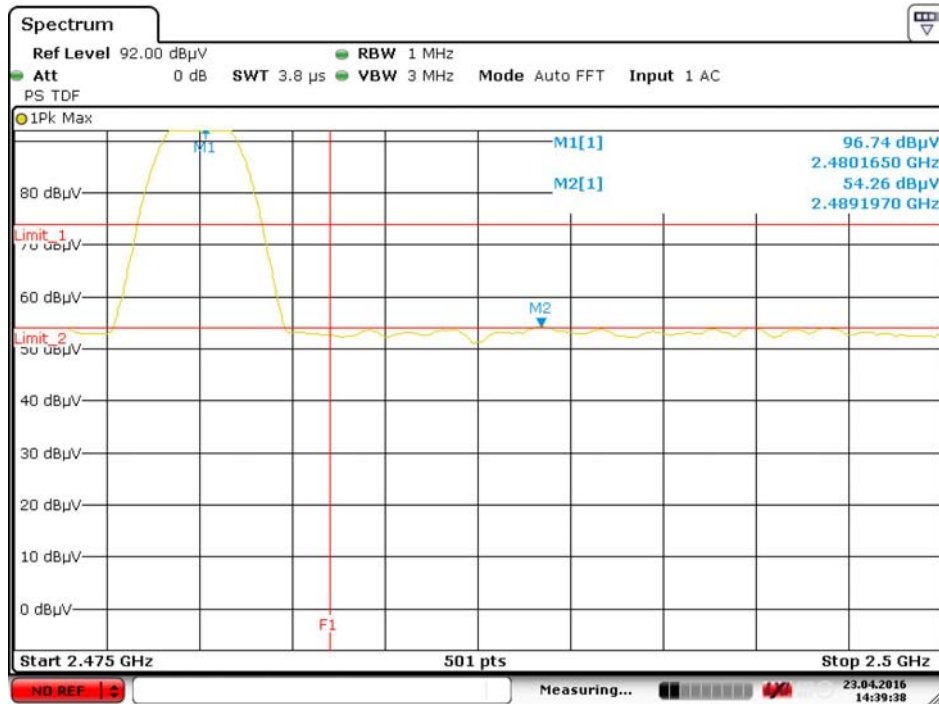


Date: 23.APR.2016 14:57:23

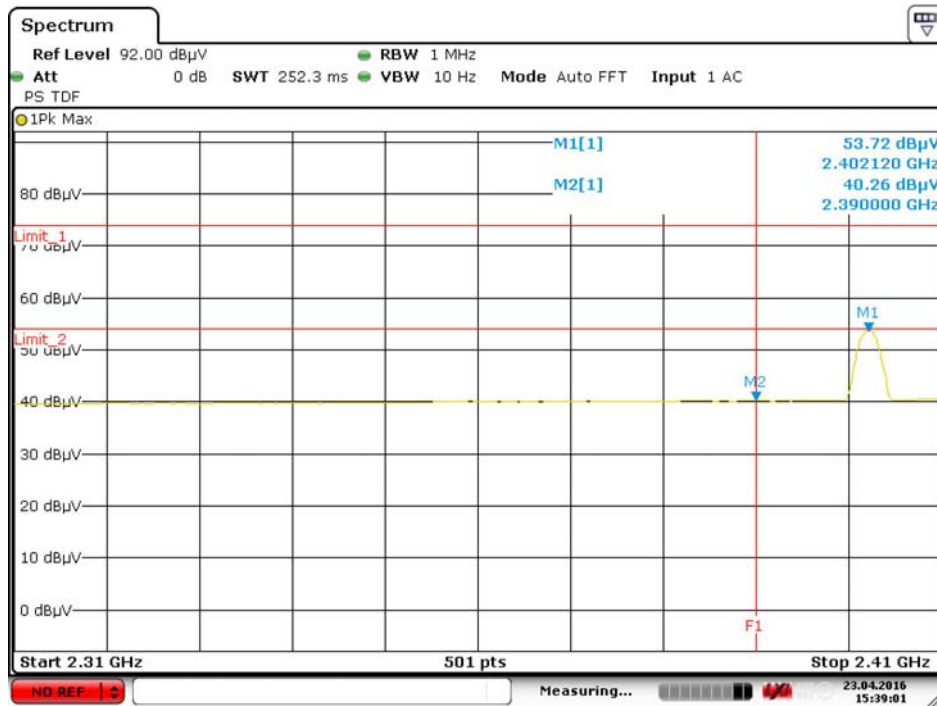
Band edge @  $\pi/4$ -DQPSK mode Channel\_78 2480MHz Vertical AV



Band edge @  $\pi/4$ -DQPSK mode Channel\_78 2480MHz Vertical PK

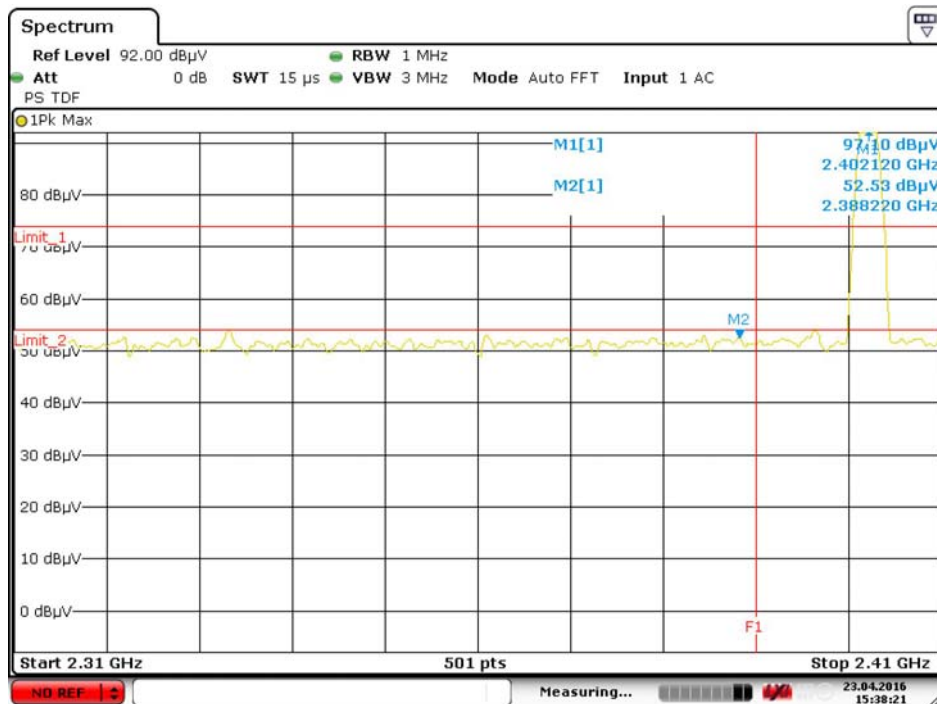


Band edge @ 8-DPSK mode Channel\_0 2402MHz Vertical AV



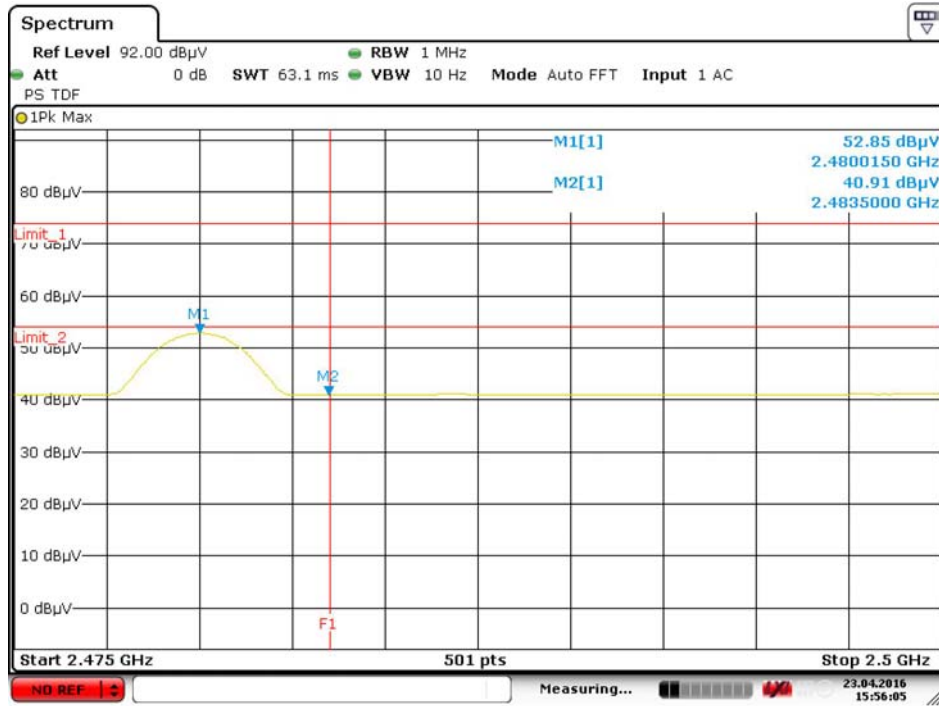
Date: 23.APR.2016 15:39:01

Band edge @ 8-DPSK mode Channel\_0 2402MHz Vertical PK



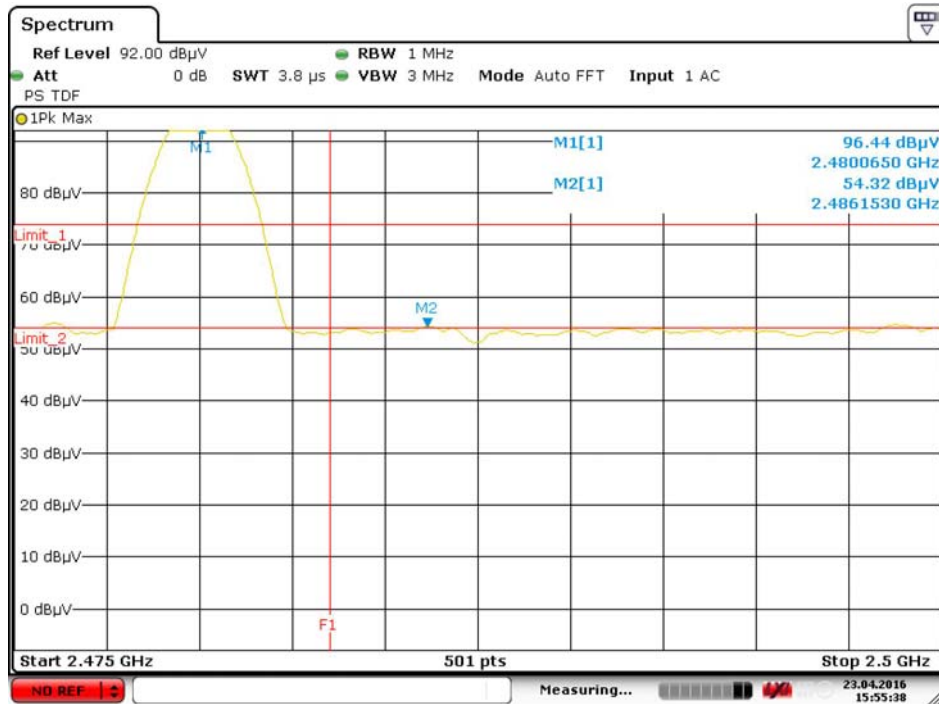
Date: 23.APR.2016 15:38:22

Band edge @ 8-DPSK mode Channel\_78 2480MHz Vertical AV



Date: 23.APR.2016 15:56:06

Band edge @ 8-DPSK mode Channel\_78 2480MHz Vertical PK



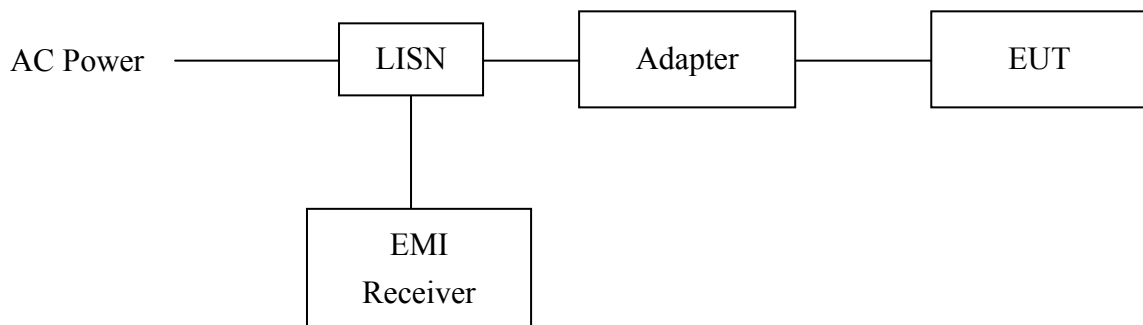
Date: 23.APR.2016 15:55:38

## 5. Conducted emission test FCC 15.207

### 5.1 Operating environment

|                      |      |     |
|----------------------|------|-----|
| Temperature:         | 25   | °C  |
| Relative Humidity:   | 50   | %   |
| Atmospheric Pressure | 1008 | hPa |

### 5.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.

The bandwidth of the field strength meter (R & S Test Receiver ESCI) is set at 9kHz.

The EUT configurations please refer to the “Conducted set-up photo.pdf”.

### 5.3 Emission limit

| Freq.<br>(MHz) | Conducted Limit (dBuV) |          |
|----------------|------------------------|----------|
|                | Q.P.                   | Ave.     |
| 0.15~0.50      | 66 – 56*               | 56 – 46* |
| 0.50~5.00      | 56                     | 46       |
| 5.00~30.0      | 60                     | 50       |

\*Decreases with the logarithm of the frequency.

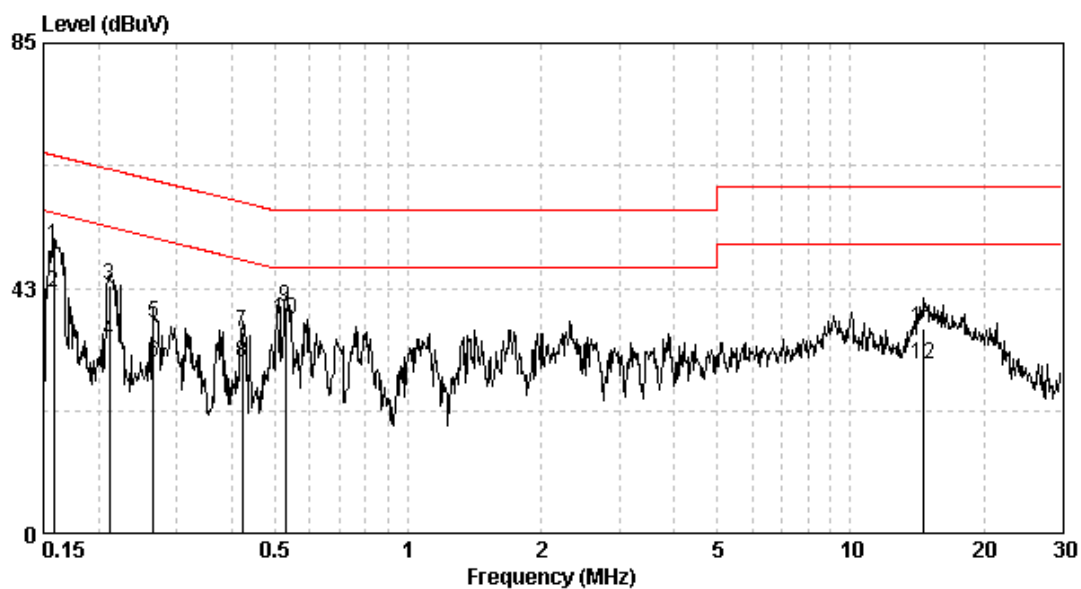
## 5.4 Conducted emission data FCC 15.207

Phase: Live Line  
Model No.: HURESAC-3XE-C  
Test Condition: TX mode  
Test Voltage: 120 Vac, 60 Hz

| Frequency<br>(MHz) | Corr.<br>Factor<br>(dB) | Level<br>Qp<br>(dBuV) | Limit<br>Qp<br>(dBuV) | Level<br>Av<br>(dBuV) | Limit<br>Av<br>(dBuV) | Margin<br>(dB)<br>Qp | Av     |
|--------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|--------|
| 0.158              | 9.74                    | 49.75                 | 65.56                 | 41.75                 | 55.56                 | -15.81               | -13.81 |
| 0.212              | 9.74                    | 43.01                 | 63.14                 | 33.36                 | 53.14                 | -20.13               | -19.78 |
| 0.266              | 9.74                    | 36.39                 | 61.25                 | 29.73                 | 51.25                 | -24.86               | -21.52 |
| 0.421              | 9.73                    | 34.77                 | 57.42                 | 29.50                 | 47.42                 | -22.65               | -17.92 |
| 0.527              | 9.74                    | 39.34                 | 56.00                 | 36.98                 | 46.00                 | -16.66               | -9.02  |
| 14.672             | 9.88                    | 35.41                 | 60.00                 | 29.18                 | 50.00                 | -24.59               | -20.82 |

Remark:

1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

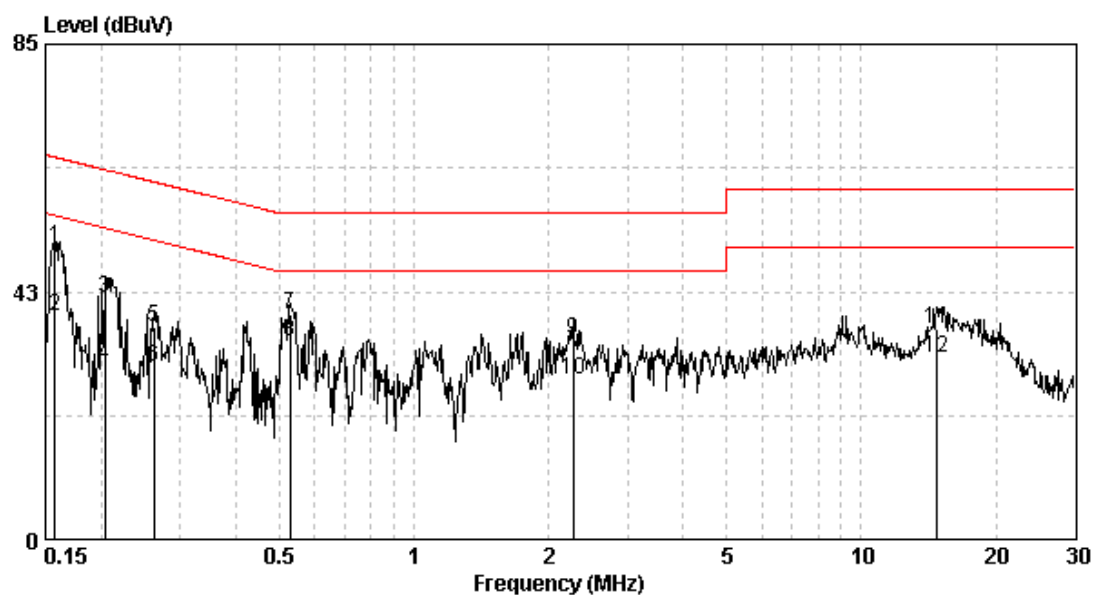


Phase: Neutral Line  
Model No.: HURESAC-3XE-C  
Test Condition: TX mode  
Test Voltage: 120 Vac, 60 Hz

| Frequency<br>(MHz) | Corr.<br>Factor<br>(dB) | Level<br>Qp<br>(dBuV) | Limit<br>Qp<br>(dBuV) | Level<br>Av<br>(dBuV) | Limit<br>Av<br>(dBuV) | Margin<br>(dB)<br>Qp | Av     |
|--------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|--------|
| 0.157              | 9.74                    | 50.11                 | 65.60                 | 38.35                 | 55.60                 | -15.50               | -17.26 |
| 0.204              | 9.74                    | 41.42                 | 63.45                 | 29.98                 | 53.45                 | -22.02               | -23.46 |
| 0.262              | 9.74                    | 36.33                 | 61.38                 | 29.59                 | 51.38                 | -25.05               | -21.79 |
| 0.529              | 9.74                    | 38.65                 | 56.00                 | 33.99                 | 46.00                 | -17.35               | -12.01 |
| 2.273              | 9.85                    | 34.20                 | 56.00                 | 27.54                 | 46.00                 | -21.80               | -18.46 |
| 14.750             | 9.92                    | 36.12                 | 60.00                 | 31.01                 | 50.00                 | -23.88               | -18.99 |

Remark:

1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



## 6. 20dB Bandwidth test

### 6.1 Operating environment

Temperature: 25 °C  
Relative Humidity: 50 %  
Atmospheric Pressure: 1008 hPa

### 6.2 Test setup & procedure

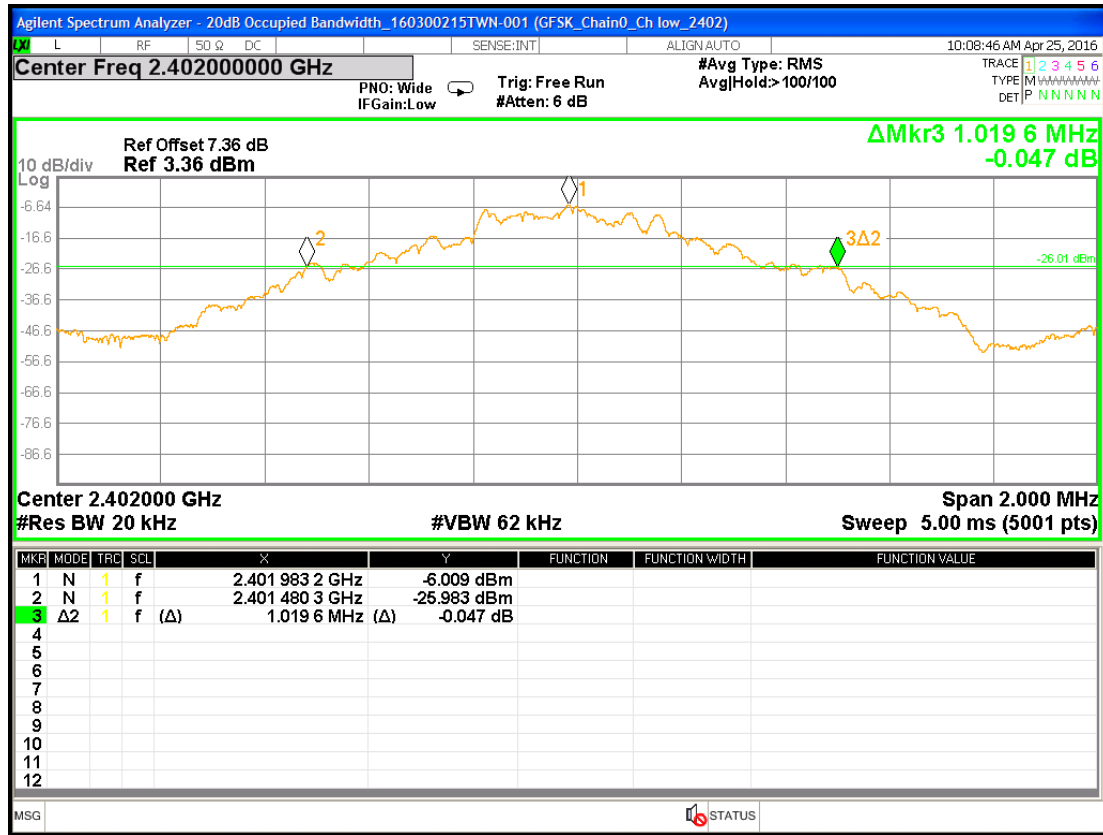
- Step 1: The 20dB bandwidth was measured using a 50 ohm spectrum analyzer  
Step 2: The span range for the SA display shall be between two times and five times the OBW.  
Step 3: The nominal IF filter bandwidth (3 dB RBW) should be approximately 1 % to 5 % of the OBW, unless otherwise specified, depending on the applicable requirement.  
Step 4: The test was performed at 3 channels (lowest, middle and highest channel). The maximum 20dB modulation bandwidth is in the following Table.

### 6.3 Measured data of modulated bandwidth test results

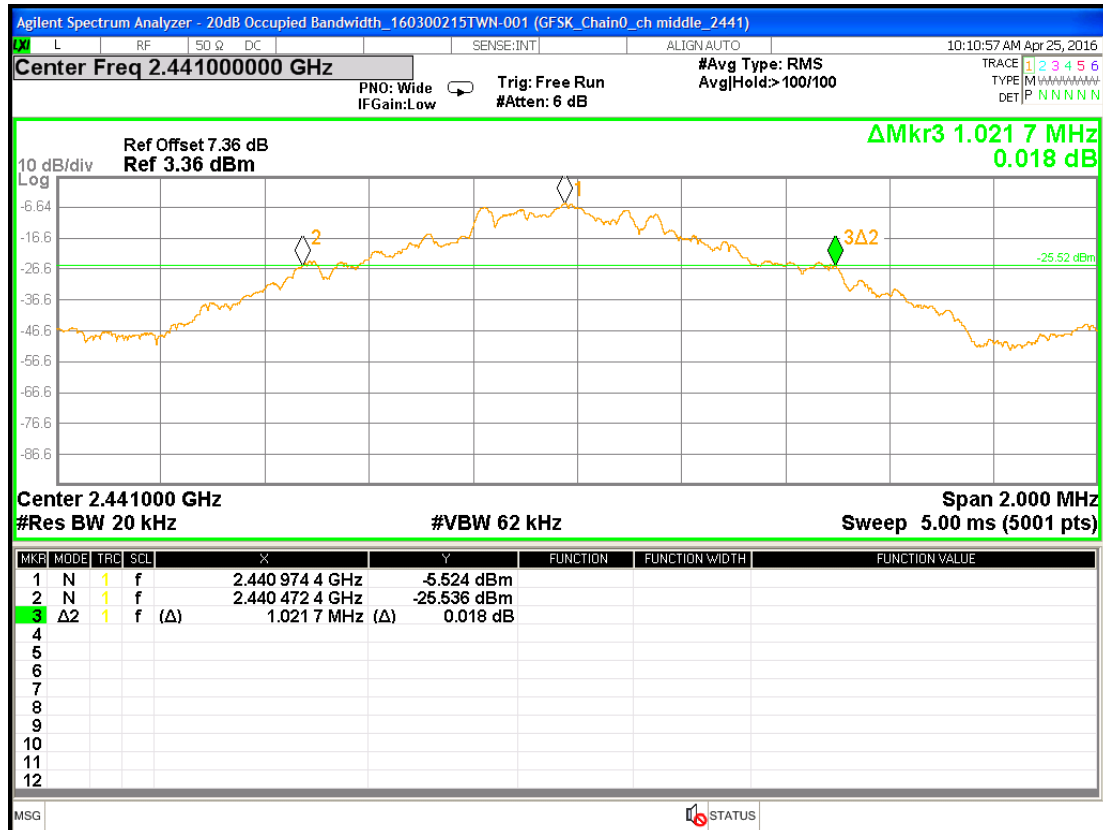
| Modulation     | Channel | Frequency (MHz) | Data Rate Mbps | 20dB Bandwidth(MHz) |
|----------------|---------|-----------------|----------------|---------------------|
| GFSK           | 0       | 2402            | 1              | 1.020               |
|                | 39      | 2441            |                | 1.022               |
|                | 78      | 2480            |                | 0.996               |
| $\pi/4$ -DQPSK | 0       | 2402            | 2              | 1.319               |
|                | 39      | 2441            |                | 1.303               |
|                | 78      | 2480            |                | 1.279               |
| 8-DPSK         | 0       | 2402            | 3              | 1.247               |
|                | 39      | 2441            |                | 1.249               |
|                | 78      | 2480            |                | 1.260               |

Please see the plots from Page 28 through Page 32.

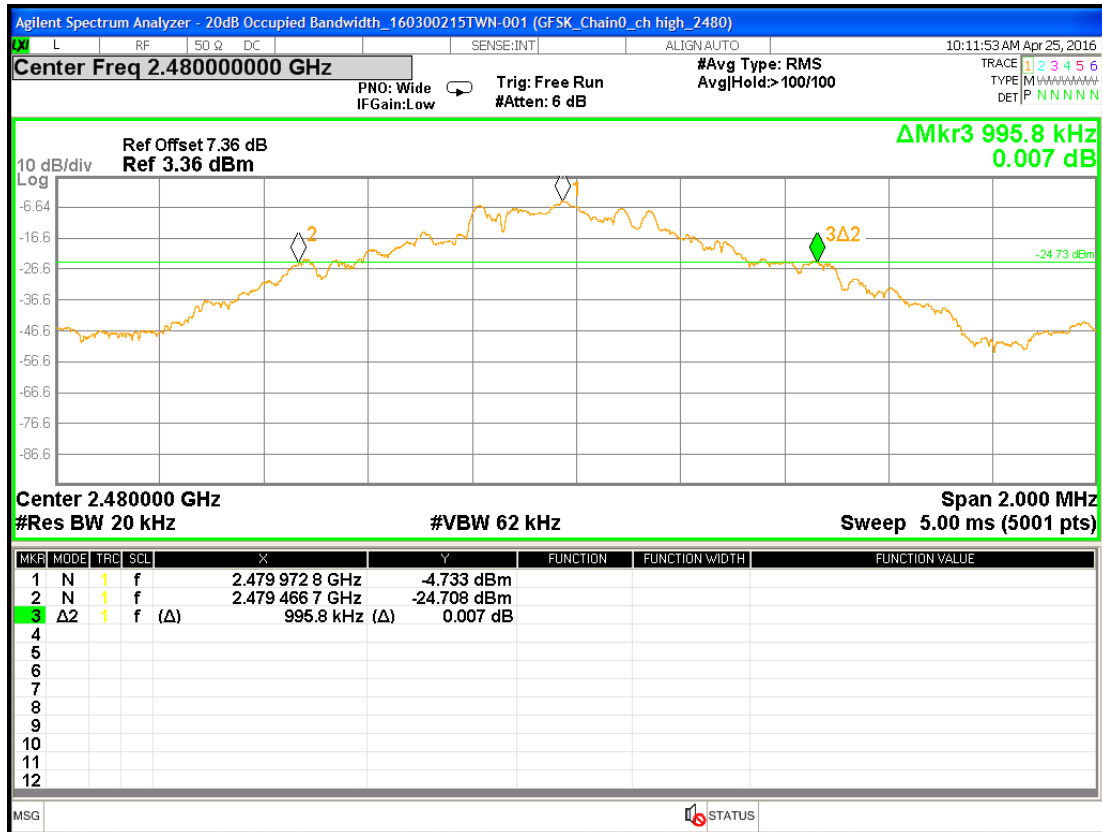
20dB Occupied Bandwidth @ GFSK mode Channel 0 2402MHz



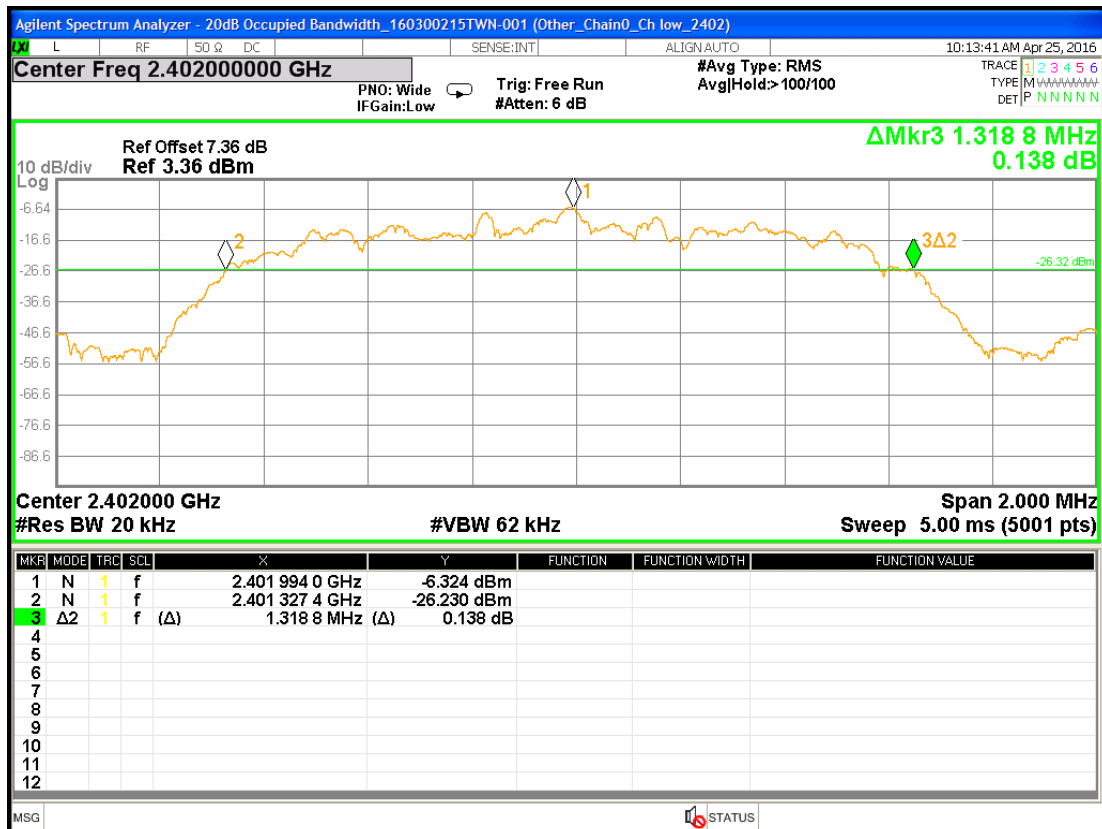
20dB Occupied Bandwidth @ GFSK mode Channel 39 2441MHz



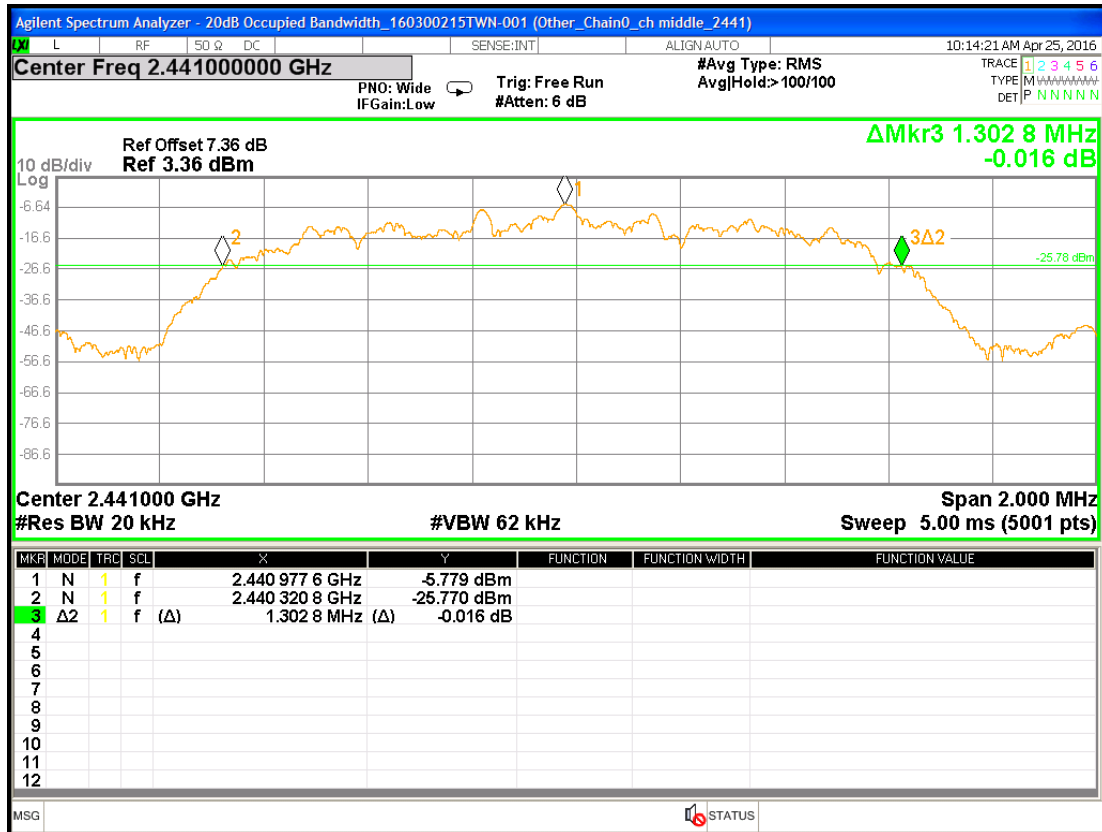
20dB Occupied Bandwidth @ GFSK mode Channel 78 2480MHz



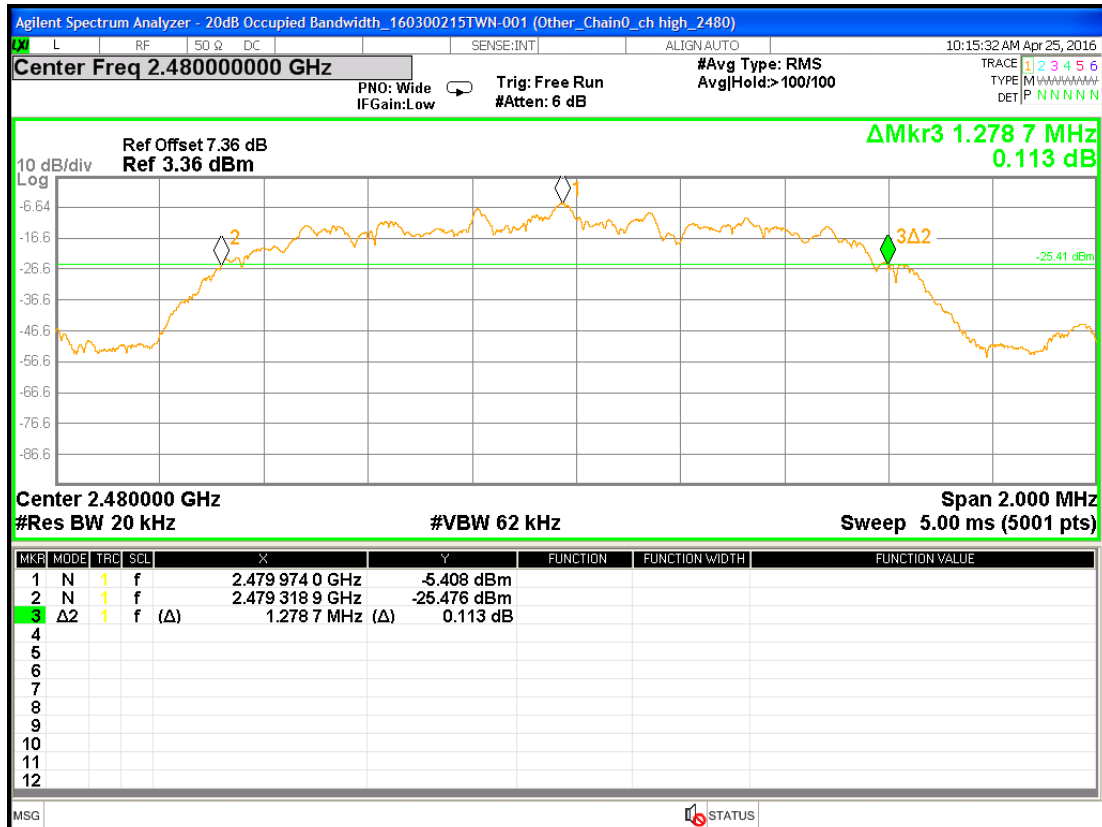
20dB Occupied Bandwidth @  $\pi/4$ -DQPSK mode Channel 0 2402MHz



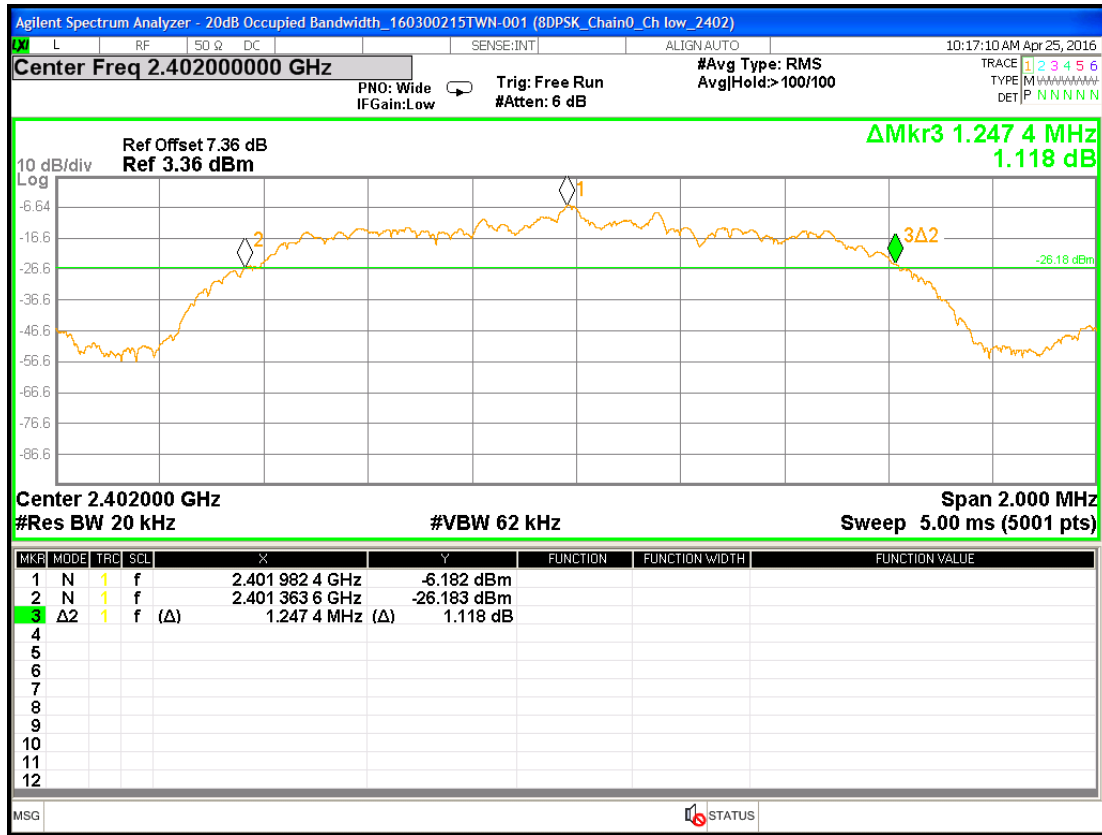
## 20dB Occupied Bandwidth @ $\pi/4$ -DQPSK mode Channel 39 2441MHz



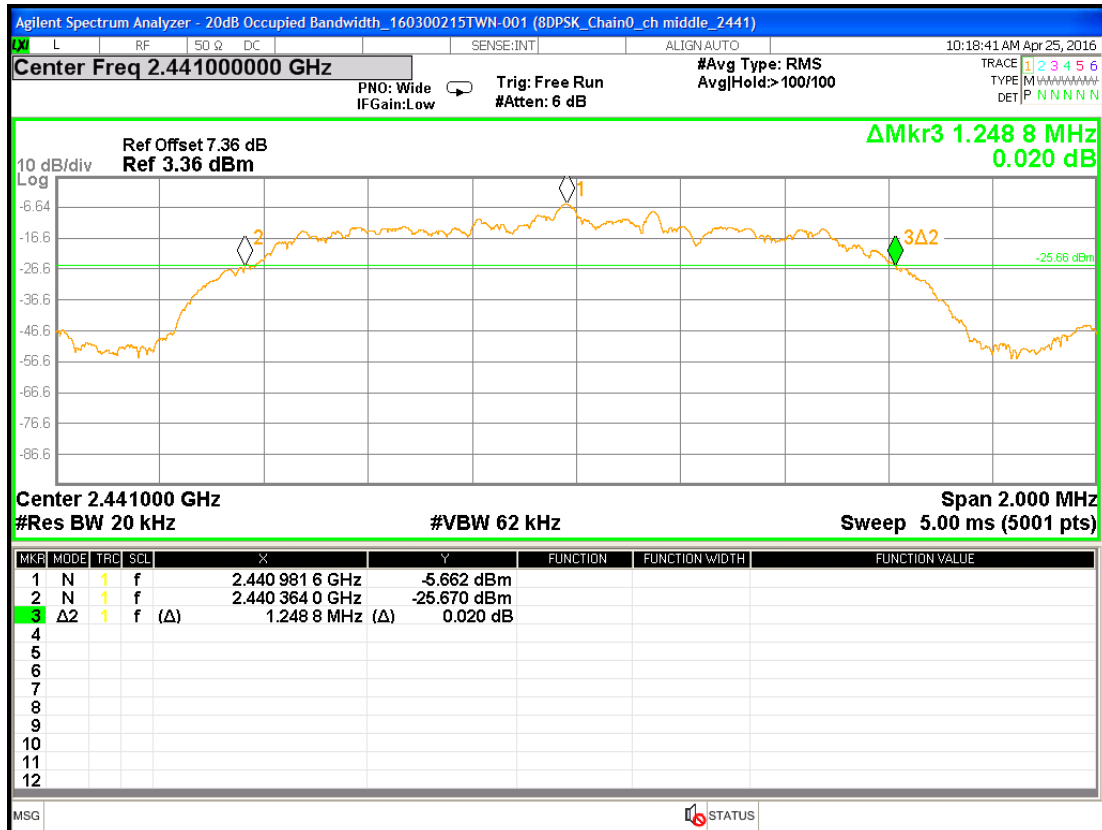
## 20dB Occupied Bandwidth @ $\pi/4$ -DQPSK mode Channel 78 2480MHz



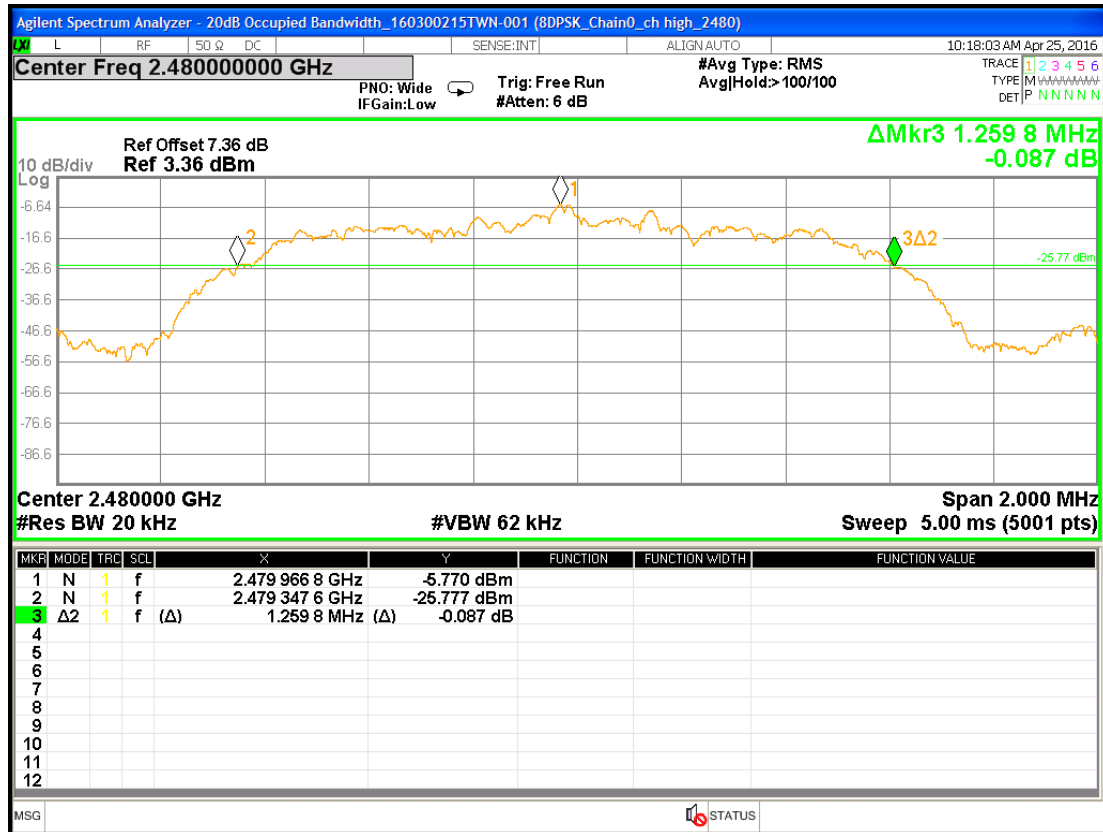
20dB Occupied Bandwidth @ 8DPSK mode Channel 0 2402MHz



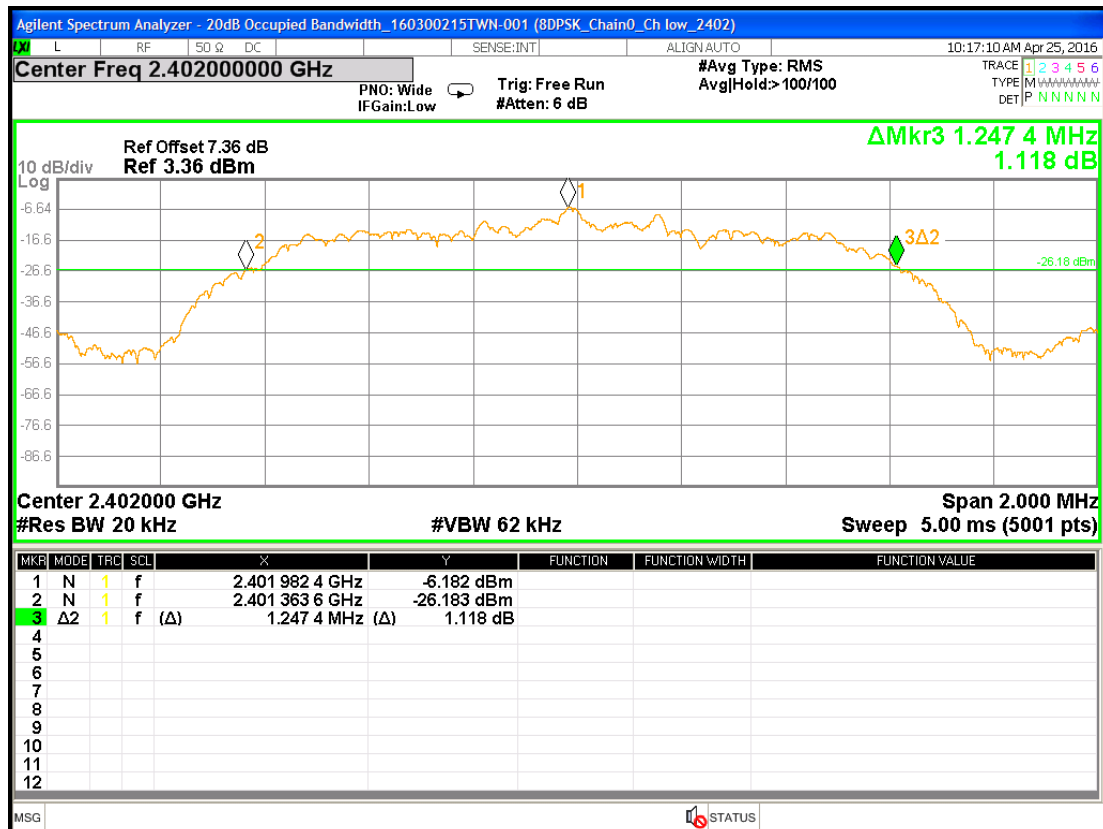
20dB Occupied Bandwidth @ 8DPSK mode Channel 39 2441MHz



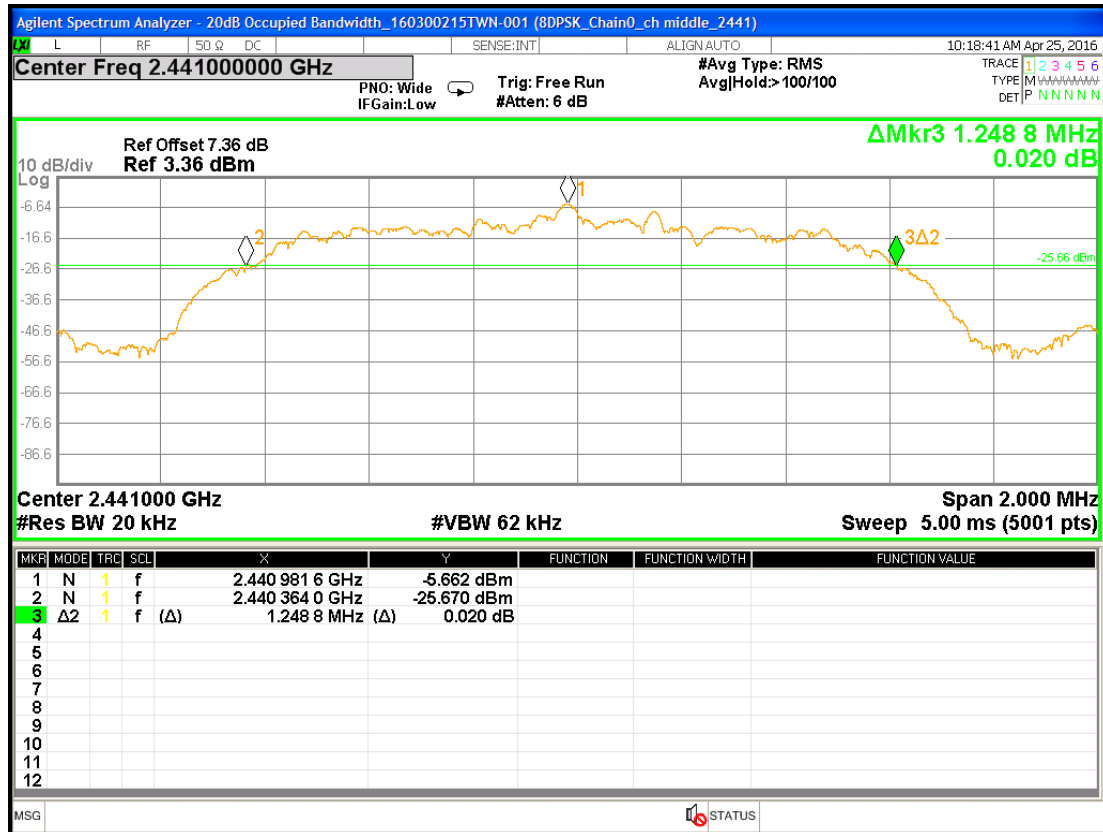
## 20dB Occupied Bandwidth @ 8DPSK mode Channel 78 2480MHz



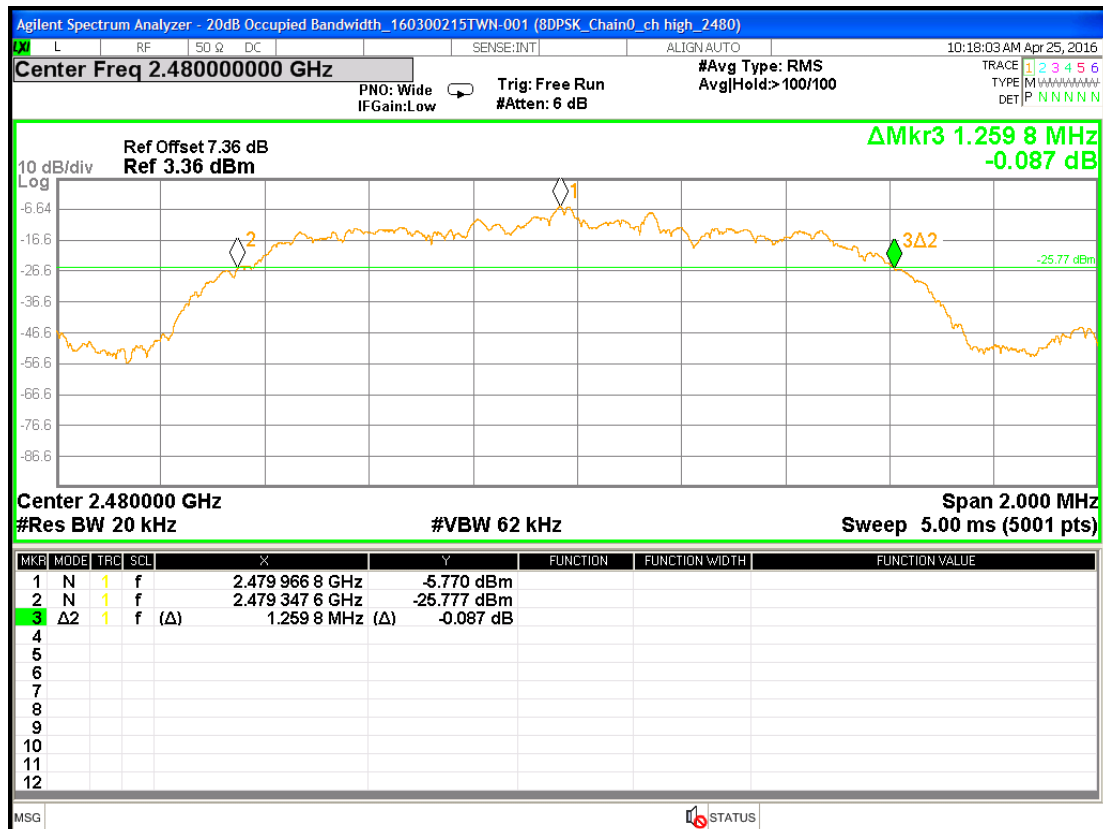
## 20dB Occupied Bandwidth @ 8DPSK mode Channel 0 2402MHz



## 20dB Occupied Bandwidth @ 8DPSK mode Channel 39 2441MHz



## 20dB Occupied Bandwidth @ 8DPSK mode Channel 78 2480MHz



## Appendix A: Test equipment list

| Equipment                       | Brand           | Model No.           | Serial No.   | Calibration Date | Next Calibration Date |
|---------------------------------|-----------------|---------------------|--------------|------------------|-----------------------|
| ESCI EMI Test Receiver          | Rohde & Schwarz | ESCI                | 100018       | 2015/12/02       | 2016/11/30            |
| Spectrum Analyzer               | Rohde & Schwarz | FSP30               | 100137       | 2015/08/18       | 2016/08/16            |
| Horn Antenna (1-18G)            | SHWARZBECK      | BBHA 9120 D         | 9120D-456    | 2014/08/29       | 2017/08/27            |
| Horn Antenna (14-42G)           | SHWARZBECK      | BBHA 9170           | BBHA9170159  | 2014/09/16       | 2017/09/14            |
| Broadband Antenna               | SHWARZBECK      | VULB 9168           | 9168-172     | 2013/08/08       | 2016/08/06            |
| Pre-Amplifier                   | EMC Co.         | EMC12635SE          | 980205       | 2015/10/7        | 2016/10/05            |
| Pre-Amplifier                   | MITEQ           | JS4-26004000--27-8A | 828825       | 2015/09/15       | 2016/09/13            |
| Power Meter                     | Anritsu         | ML2495A             | 0844001      | 2015/11/11       | 2016/11/09            |
| Power Sensor                    | Anritsu         | MA2411B             | 0738452      | 2015/11/11       | 2016/11/09            |
| Two-Line V-Network              | Rohde & Schwarz | ENV216              | 101159       | 2015/06/08       | 2016/06/06            |
| Artificial Mains Network (LISN) | Schaffner       | MN2050D             | 1586         | 2015/05/27       | 2016/05/25            |
| CON-1 Cable                     | SUHNER          | BNC / RG-58         | 1521946      | 2015/05/09       | 2016/05/07            |
| Test software                   | Audix           | e3                  | 4.2004-1-12k | NCR              | NCR                   |
| Signal Analyzer                 | Agilent         | N9030A              | MY51380492   | 2015/09/21       | 2016/09/19            |
| 966-2(A) Cable 9kHz~26.5GHz     | SUHNER          | SMA / EX 100        | N/A          | 2015/05/06       | 2016/05/05            |
| 966-2(B) Cable 9kHz~26.5GHz     | SUHNER          | SMA / SUCOFLEX 104P | CB0005       | 2015/05/06       | 2016/05/04            |

| Equipment                            | Brand                              | Model No.               | Serial No. | Calibration Date | Next Calibration Date |
|--------------------------------------|------------------------------------|-------------------------|------------|------------------|-----------------------|
| RF Cable<br>9kHz~26.5GHz             | SUHNER                             | SUCOFLEX 102            | CB0006     | 2015/05/06       | 2016/05/05            |
| 966-2_3m<br>Semi-Anechoic<br>Chamber | 966_2                              | CEM-966_2               | N/A        | 2016/02/24       | 2017/02/22            |
| High Pass Filter                     | Reactel                            | 7HS-3G/18G-S11          | N/A        | 2015/06/06       | 2016/06/04            |
| Active Loop<br>Antenna               | SCHWARZBECK<br>MESS-ELEKTRO<br>NIC | FMZB1519                | 1519-067   | 2016/03/03       | 2017/03/02            |
| EMI Test<br>Receiver                 | Rohde & Schwarz                    | ESR-7                   | 101232     | 2015/12/02       | 2016/11/30            |
| Test software                        | ADT                                | Radiated test<br>system | 7.5.14     | NCR              | NCR                   |

Note: No Calibration Required (NCR).

## Appendix B: Measurement Uncertainty

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

| Item                                                                                                         | Uncertainty |
|--------------------------------------------------------------------------------------------------------------|-------------|
| Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m    | 5.14 dB     |
| Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m  | 5.22 dB     |
| Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m    | 3.64 dB     |
| Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m  | 3.64 dB     |
| Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m   | 2.7 dB      |
| Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m | 2.7 dB      |
| Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m                         | 3.53 dB     |
| Emission on the Band Edge Test                                                                               | 3.64 dB     |
| 20dB Bandwidth                                                                                               | 0.85 dB     |
| AC Power Line Conducted Emission                                                                             | 2.47 dB     |