




# FCC RADIO TEST REPORT

**FCC ID** : 2AG0Z-NB34  
**Equipment** : VR Controller  
**Brand Name** :  **oculus**  
**Model Name** : JD96CX  
**Applicant** : Facebook Technologies, LLC  
1601 Willow Road, Menlo Park, CA 94025,  
United States Of America.  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Apr. 10, 2020 and testing was started from Apr. 15, 2020 and completed on Apr. 23, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

*Louis Wu*

Approved by: Louis Wu

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**  
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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### History of this test report

| Report No.  | Version | Description             | Issued Date   |
|-------------|---------|-------------------------|---------------|
| FR9D1830-01 | 01      | Initial issue of report | Jun. 02, 2020 |
|             |         |                         |               |
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### Summary of Test Result

| Report Clause | Ref Std. Clause    | Test Items                                 | Result (PASS/FAIL) | Remark                              |
|---------------|--------------------|--|--------------------|-------------------------------------|
| 3.1           | 15.247(a)(2)       | 6dB Bandwidth                              | Pass               | -                                   |
| 3.1           | 2.1049             | 99% Occupied Bandwidth                     | Reporting only     | -                                   |
| 3.2           | 15.247(b)(3)       | Output Power                               | Pass               | -                                   |
| 3.3           | 15.247(e)          | Power Spectral Density                     | Pass               | -                                   |
| 3.4           | 15.247(d)          | Conducted Band Edges and Spurious Emission | Pass               | -                                   |
| 3.5           | 15.247(d)          | Radiated Band Edges and Spurious Emission  | Pass               | Under limit 3.89 dB at 2484.080 MHz |
| -             | 15.207             | AC Conducted Emission                      | Not Required       | -                                   |
| 3.6           | 15.203 & 15.247(b) | Antenna Requirement                        | Pass               | -                                   |

**Note:** Not required means after assessing, test items are not necessary to carry out.

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Reviewed by: Wii Chang**

**Report Producer: Lucy Wu**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

GFSK

| Product Specification subjective to this standard |                      |
|---|----------------------|
| Antenna Type                                      | GFSK: Dipole Antenna |

## 1.2 Modification of EUT

No modifications are made to the EUT during all test items.



### 1.3 Testing Location

|                           |   |
|---------------------------|---|
| <b>Test Site</b>          | SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory   |
| <b>Test Site Location</b> | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>   |
|                           | TH05-HY   |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

|                           |   |
|---------------------------|---|
| <b>Test Site</b>          | SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory   |
| <b>Test Site Location</b> | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>   |
|                           | 03CH12-HY   |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW0007

### 1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ ANSI C63.10-2013

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



## 2 Test Configuration of Equipment Under Test

### 2.1 Carrier Frequency Channel

| Frequency Band  | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|-----------------|---------|-------------|---------|-------------|
| 2400-2483.5 MHz | 0       | 2402        | 21      | 2444        |
|                 | 1       | 2404        | 22      | 2446        |
|                 | 2       | 2406        | 23      | 2448        |
|                 | 3       | 2408        | 24      | 2450        |
|                 | 4       | 2410        | 25      | 2452        |
|                 | 5       | 2412        | 26      | 2454        |
|                 | 6       | 2414        | 27      | 2456        |
|                 | 7       | 2416        | 28      | 2458        |
|                 | 8       | 2418        | 29      | 2460        |
|                 | 9       | 2420        | 30      | 2462        |
|                 | 10      | 2422        | 31      | 2464        |
|                 | 11      | 2424        | 32      | 2466        |
|                 | 12      | 2426        | 33      | 2468        |
|                 | 13      | 2428        | 34      | 2470        |
|                 | 14      | 2430        | 35      | 2472        |
|                 | 15      | 2432        | 36      | 2474        |
|                 | 16      | 2434        | 37      | 2476        |
|                 | 17      | 2436        | 38      | 2478        |
|                 | 18      | 2438        | -       | -           |
|                 | 19      | 2440        | -       | -           |
| 20              | 2442    | -           | -       |             |

## 2.2 Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

| Summary table of Test Cases |                                     |
|-----------------------------|-------------------------------------|
| Test Item                   | Data Rate / Modulation              |
|                             | GFSK                                |
| Conducted Test Cases        | Mode 1: GFSK Tx CH00_2402 MHz_1Mbps |
|                             | Mode 2: GFSK Tx CH19_2440 MHz_1Mbps |
|                             | Mode 3: GFSK Tx CH38_2478 MHz_1Mbps |
| Radiated Test Cases         | Mode 1: GFSK Tx CH00_2402 MHz_1Mbps |
|                             | Mode 2: GFSK Tx CH19_2440 MHz_1Mbps |
|                             | Mode 3: GFSK Tx CH38_2478 MHz_1Mbps |

## 2.3 Connection Diagram of Test System

<GFSK Tx Mode>







## 2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name    | FCC ID  | Data Cable | Power Cord   |
|------|-----------|------------|---------------|---------|------------|--|
| 1.   | Notebook  | DELL       | Latitude 3400 | FCC DoC | N/A        | AC I/P:<br>Unshielded, 1.2 m<br>DC O/P:<br>Shielded, 1.8 m |

## 2.5 EUT Operation Test Setup

The RF test items, utility “SecureCRT” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

## 2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example :

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

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

### 3 Test Result

#### 3.1 6dB and 99% Bandwidth Measurement

##### 3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

##### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

##### 3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW)  $\geq 3 * RBW$ .
6. Measure and record the results in the test report.

##### 3.1.4 Test Setup

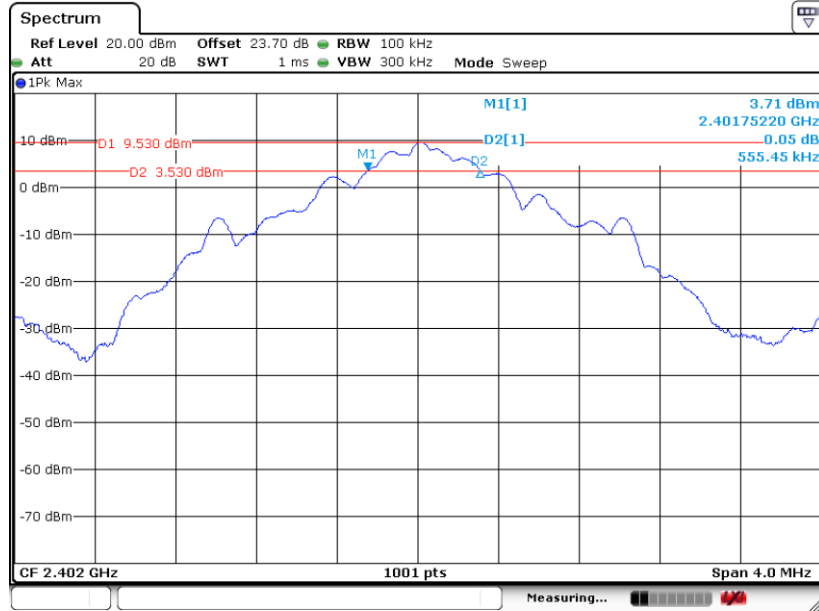




### 3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

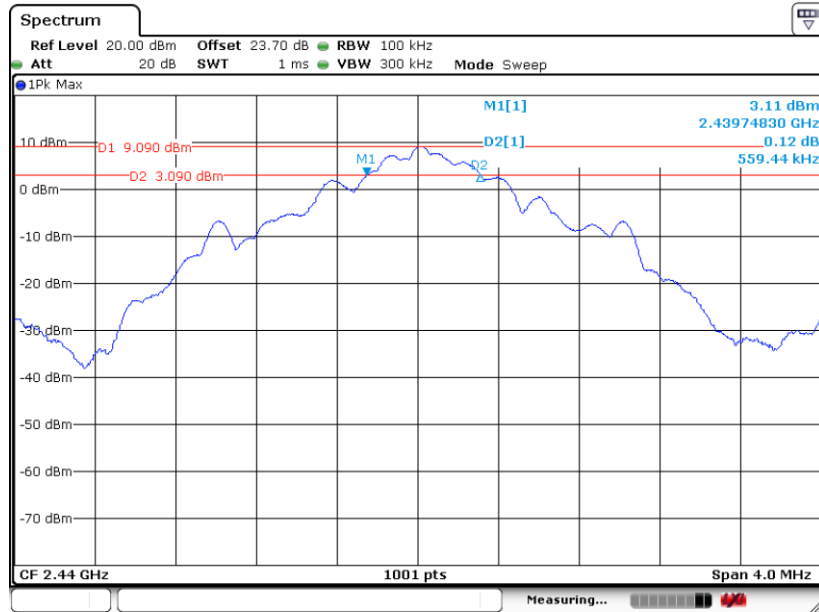
6 dB Bandwidth Plot on Channel 00



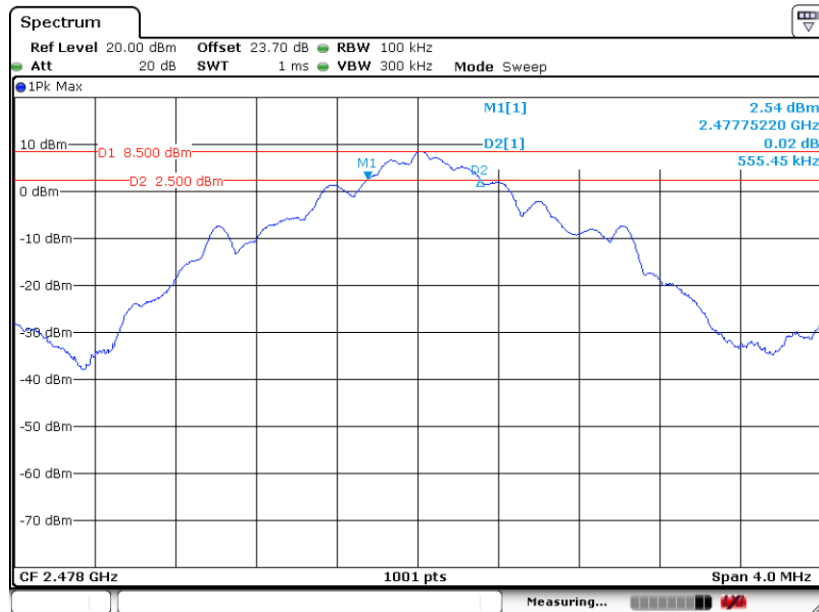
Date: 15.APR.2020 00:19:12



### 6 dB Bandwidth Plot on Channel 19



### 6 dB Bandwidth Plot on Channel 38

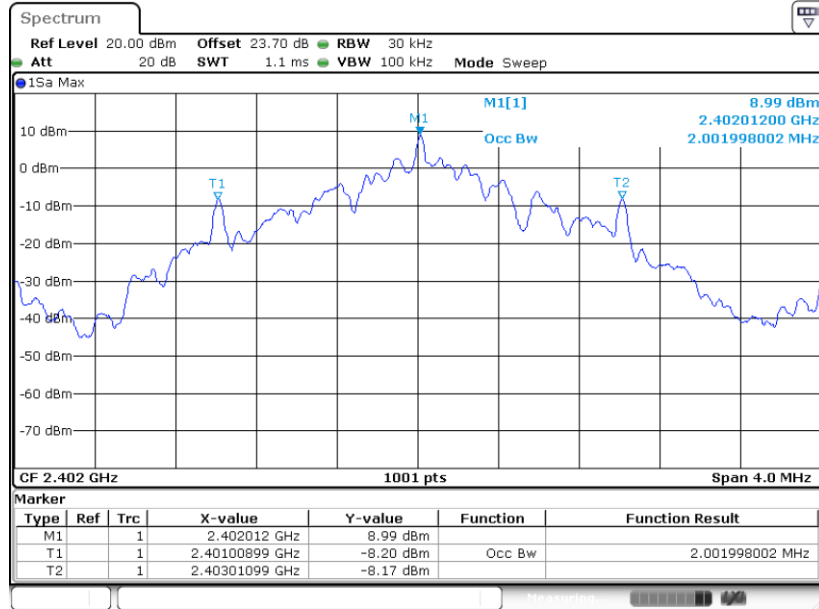




### 3.1.6 Test Result of 99% Occupied Bandwidth

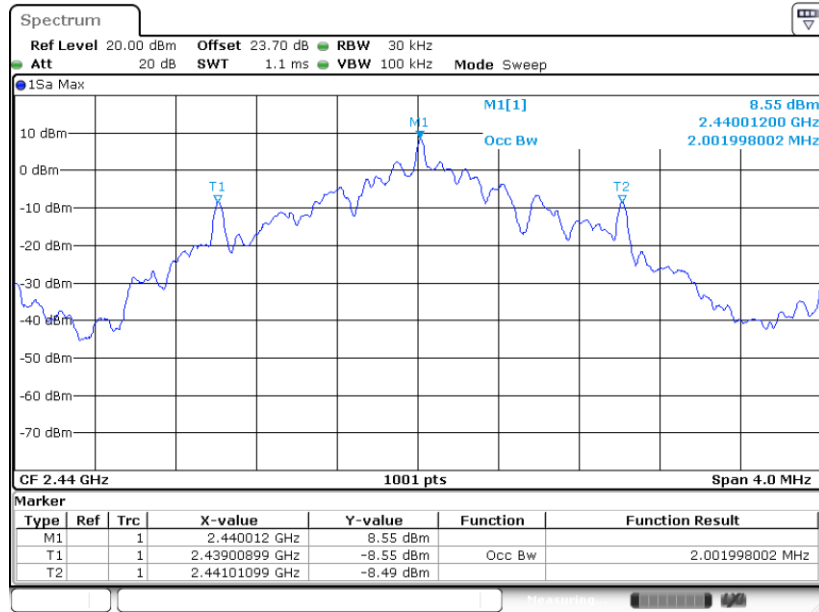
Please refer to Appendix A.

99% Bandwidth Plot on Channel 00



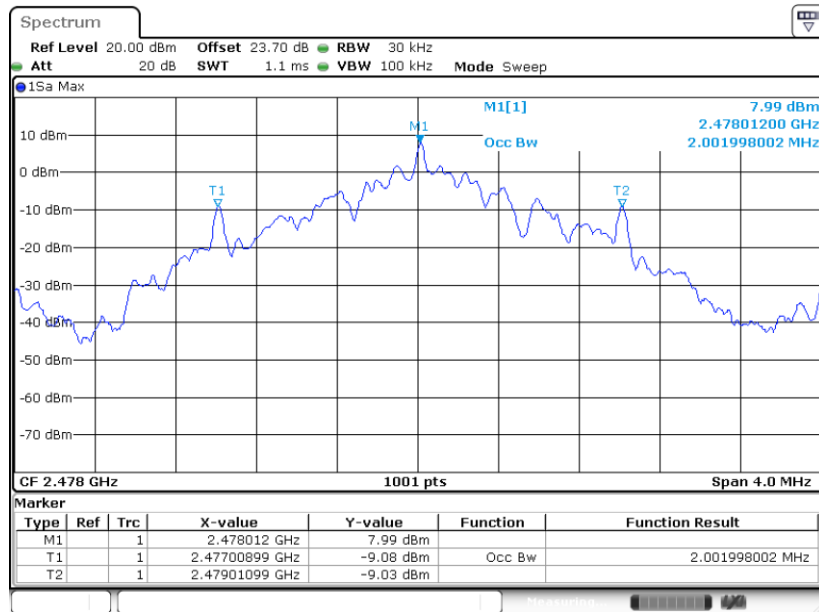


99% Occupied Bandwidth Plot on Channel 19



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99% Occupied Bandwidth Plot on Channel 38



Date: 15.APR.2020 00:39:15

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

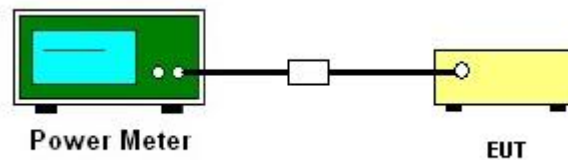
### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT was connected to the power meter by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Measure the conducted output power and record the results in the test report.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

### 3.3 Power Spectral Density Measurement

#### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

#### 3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

#### 3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

#### 3.3.4 Test Setup



#### 3.3.5 Test Result of Power Spectral Density

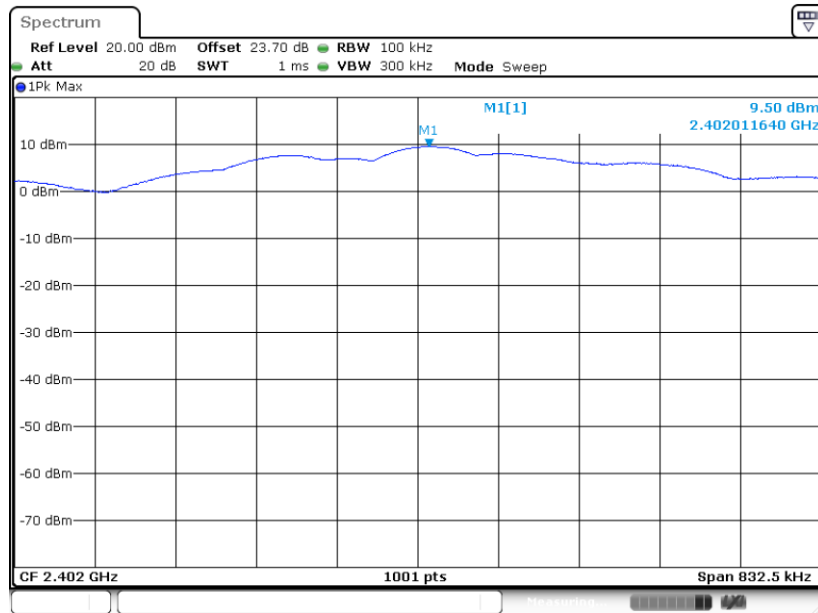
Please refer to Appendix A.



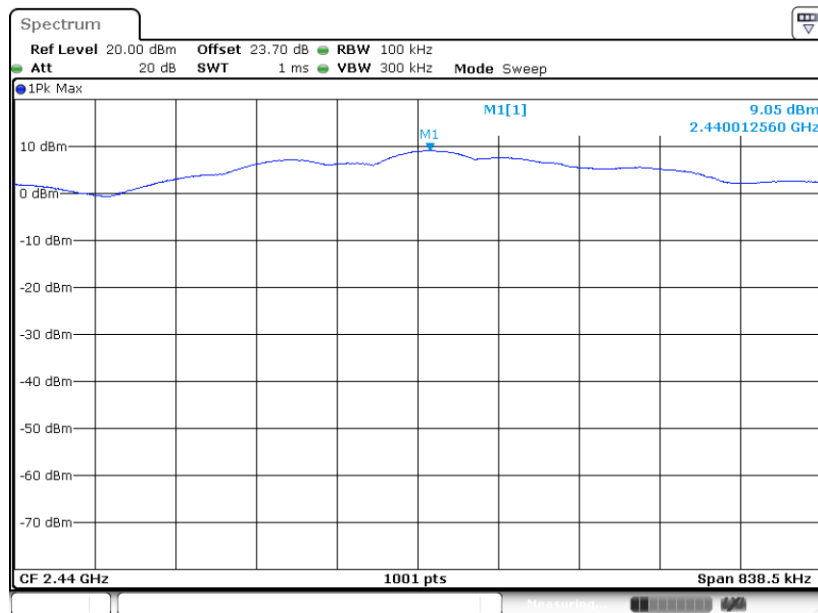


### 3.3.6 Test Result of Power Spectral Density Plots (100kHz)

PSD 100kHz Plot on Channel 00

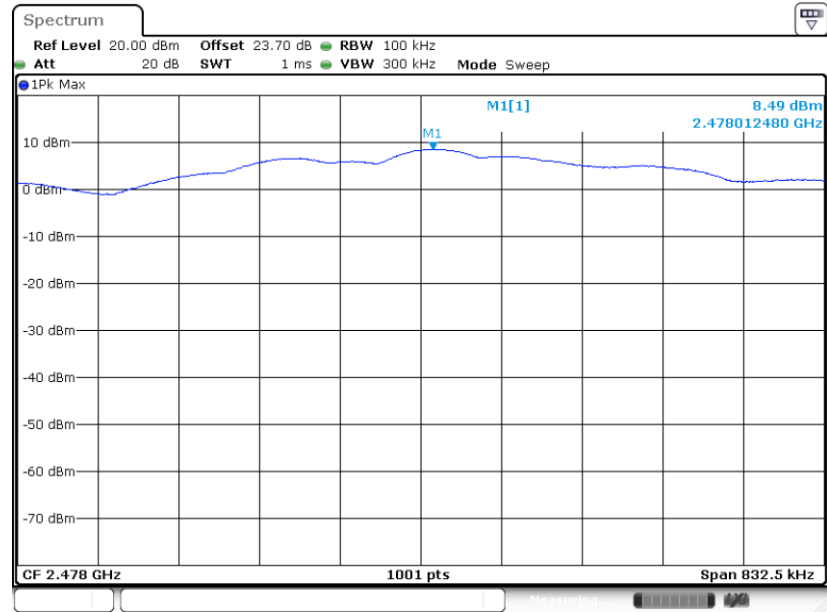


PSD 100kHz Plot on Channel 19





PSD 100kHz Plot on Channel 38

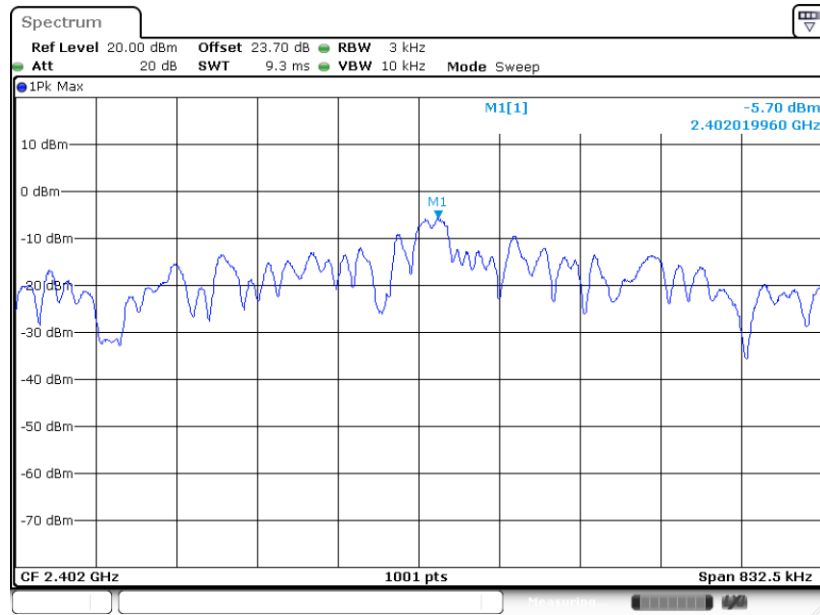


Date: 15.APR.2020 00:36:36



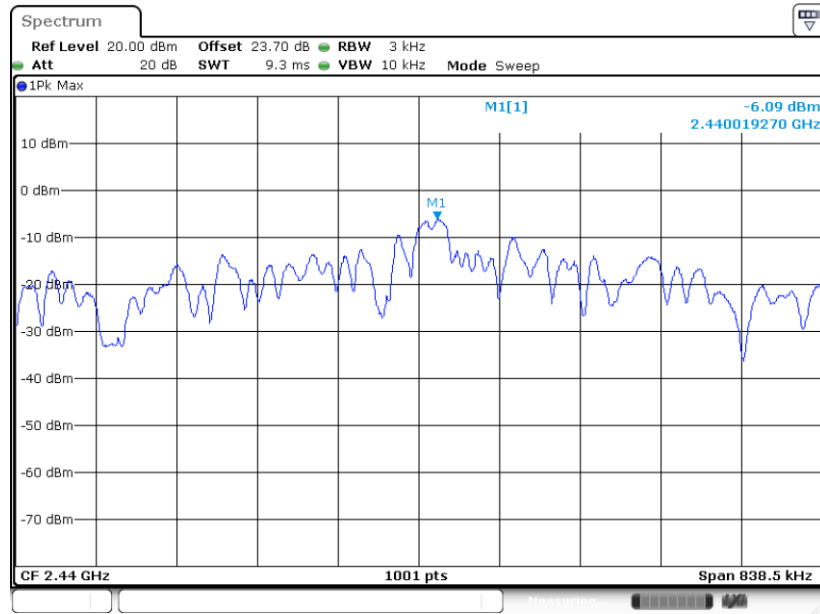
### 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

PSD 3kHz Plot on Channel 00



Date: 15.APR.2020 00:23:22

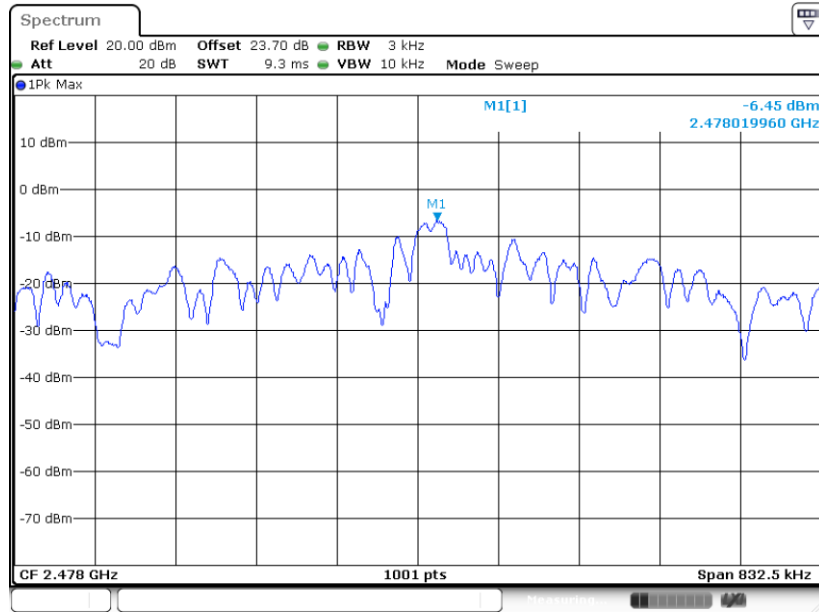
PSD 3kHz Plot on Channel 19



Date: 15.APR.2020 00:30:01



PSD 3kHz Plot on Channel 38



Date: 15.APR.2020 00:36:15

## 3.4 Conducted Band Edges and Spurious Emission Measurement

### 3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

### 3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.4.3 Test Procedure

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

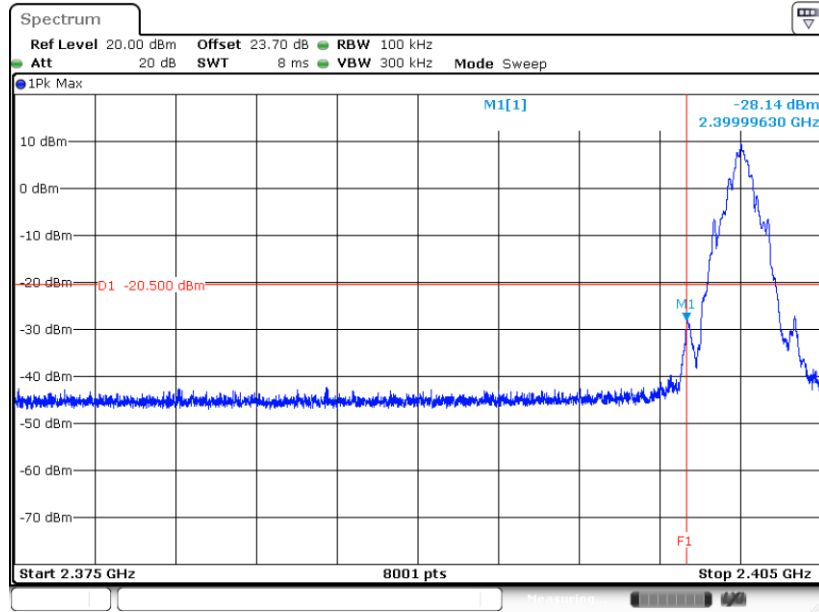
### 3.4.4 Test Setup





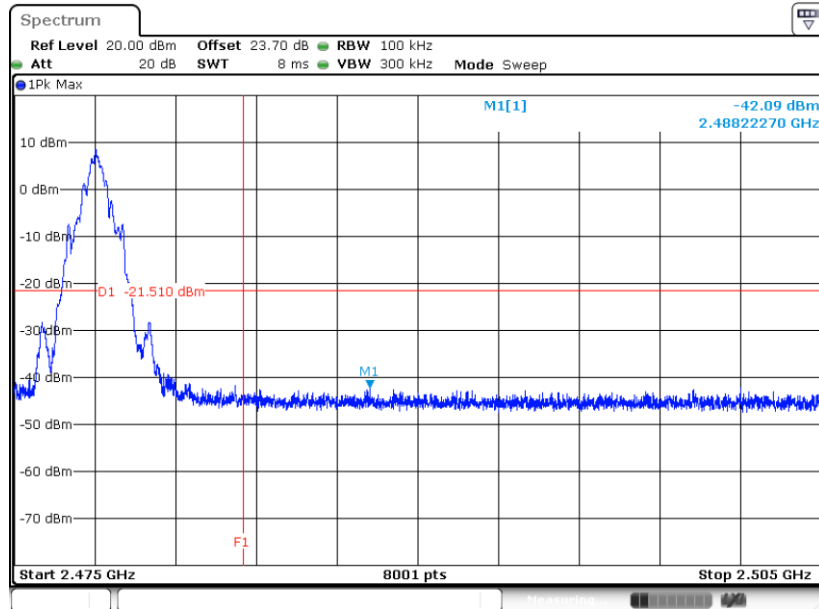
### 3.4.5 Test Result of Conducted Band Edges Plots

#### Low Band Edge Plot on Channel 00



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#### High Band Edge Plot on Channel 38

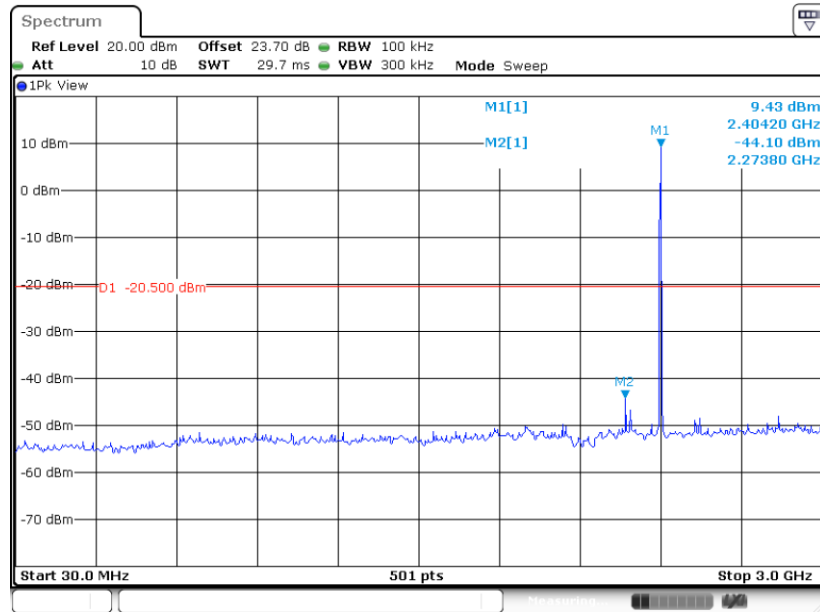


Date: 15.APR.2020 00:43:31



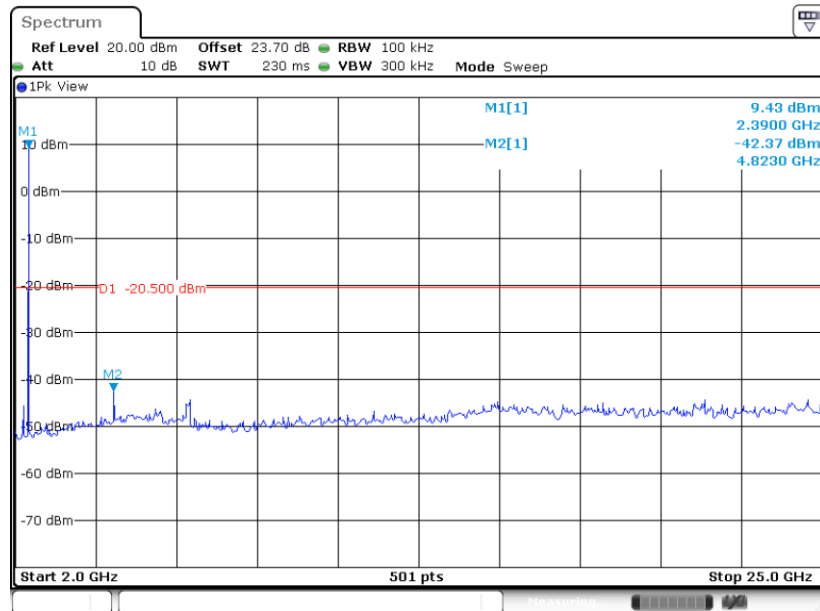
### 3.4.6 Test Result of Conducted Spurious Emission Plots

Conducted Spurious Emission Plot on 1Mbps GFSK Channel 00



Date: 15.APR.2020 00:25:28

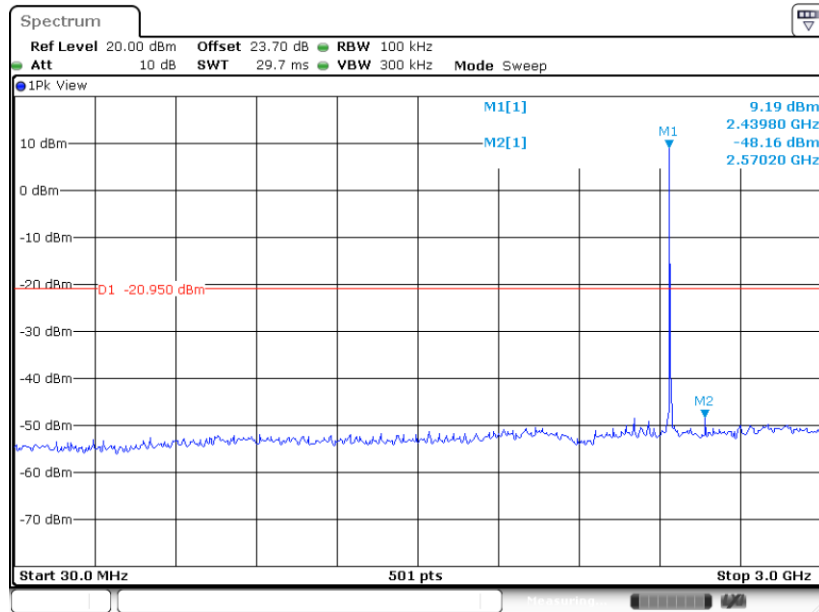
Conducted Spurious Emission Plot on 1Mbps GFSK Channel 00



Date: 15.APR.2020 00:25:46

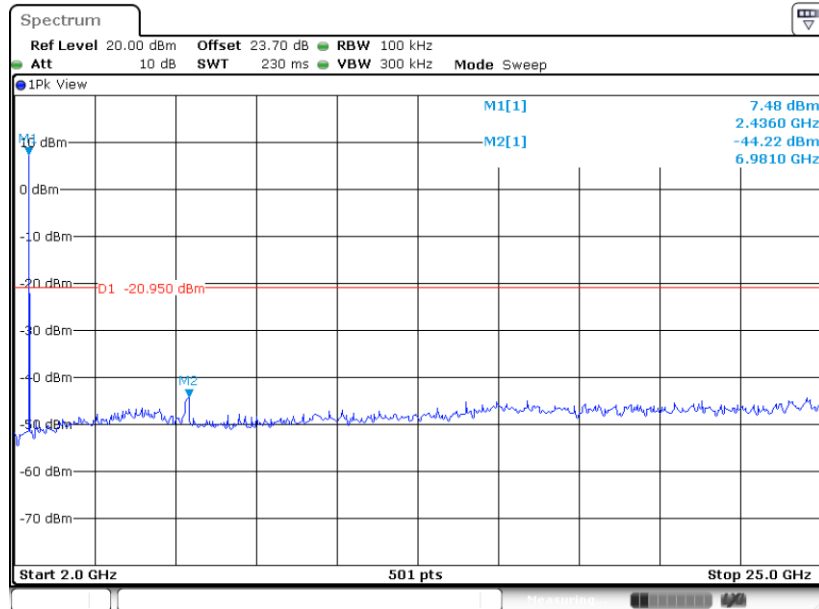


Conducted Spurious Emission Plot on 1Mbps GFSK Channel 19



Date: 15.APR.2020 00:30:45

Conducted Spurious Emission Plot on 1Mbps GFSK Channel 19

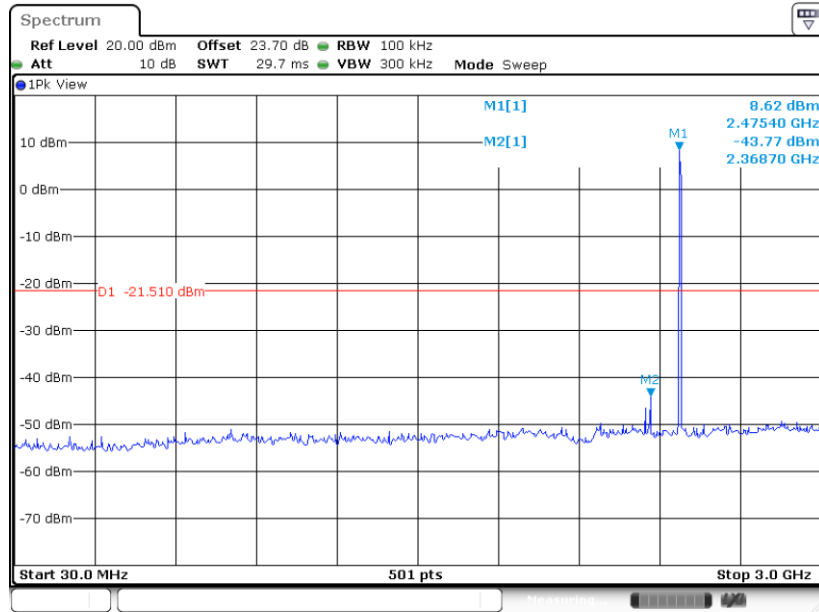


Date: 15.APR.2020 00:31:14



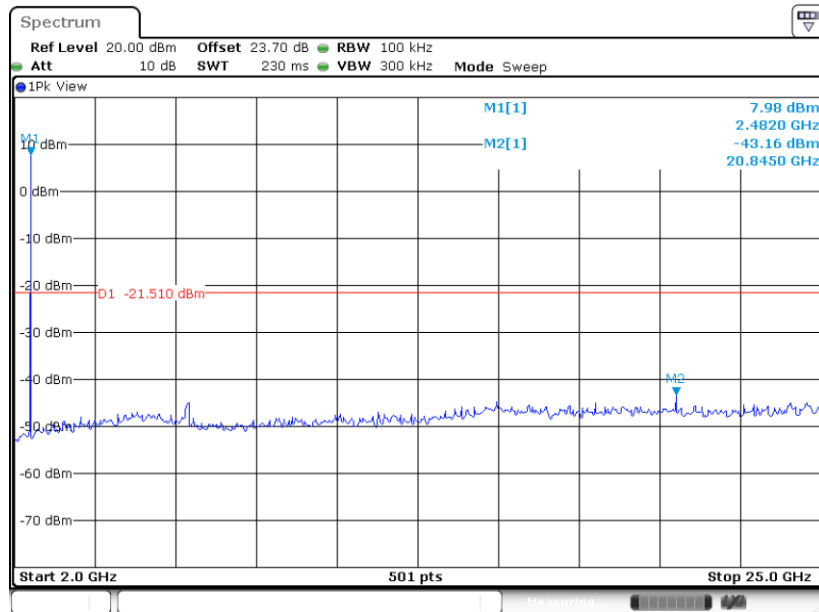


Conducted Spurious Emission Plot on 1Mbps GFSK Channel 38



Date: 15.APR.2020 00:38:38

Conducted Spurious Emission Plot on 1Mbps GFSK Channel 38



Date: 15.APR.2020 00:38:57



### 3.5 Radiated Band Edges and Spurious Emission Measurement

#### 3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-----------------|-----------------------------------|-------------------------------|
| 0.009 – 0.490   | 2400/F(kHz)                       | 300                           |
| 0.490 – 1.705   | 24000/F(kHz)                      | 30                            |
| 1.705 – 30.0    | 30                                | 30                            |
| 30 – 88         | 100                               | 3                             |
| 88 – 216        | 150                               | 3                             |
| 216 - 960       | 200                               | 3                             |
| Above 960       | 500                               | 3                             |

#### 3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

**3.5.3 Test Procedures**

1. The testing follows the ANSI C63.10 Section 11.12.2 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for  $f < 1$  GHz;  $VBW \geq RBW$ ; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.

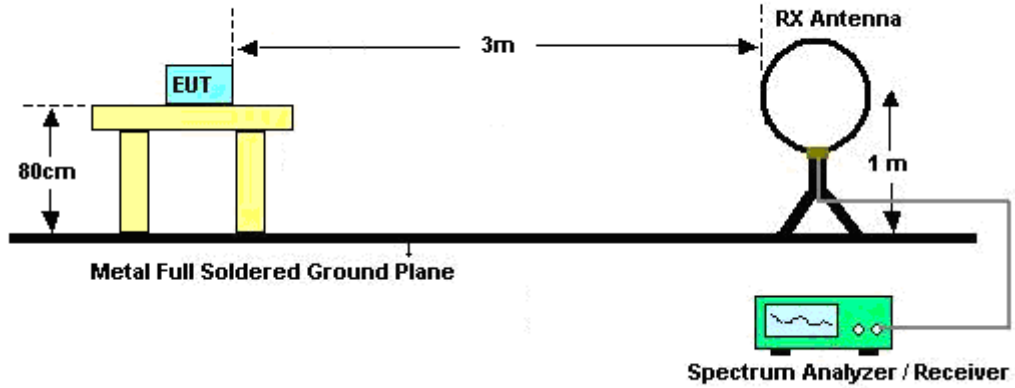
For average measurement:

    - Set RBW = 1 MHz, VBW= 3MHz; Sweep = auto; Detector function = RMS; Averaging type = power;
    - Perform a trace average of at least 100 traces.

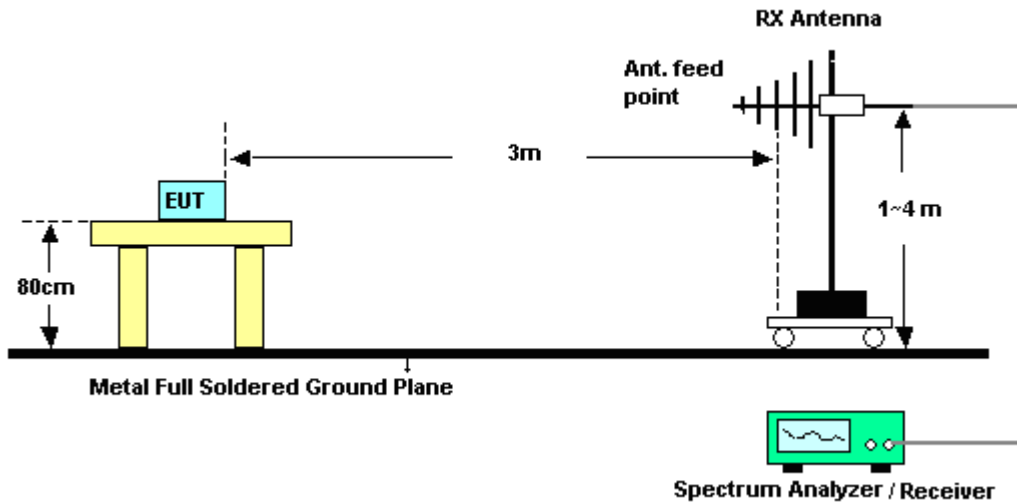
A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed  $[10 \log (1 / D)]$ , where D is the duty cycle.

### 3.5.4 Test Setup

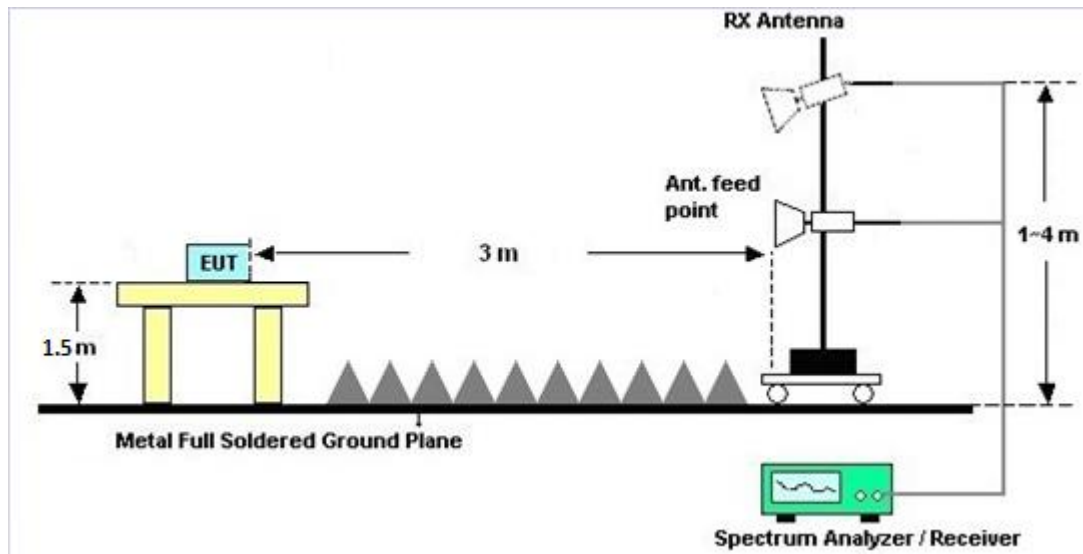
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



### 3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

### 3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

### 3.5.7 Duty Cycle

Please refer to Appendix D.

### 3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B and C.



## **3.6 Antenna Requirements**

### **3.6.1 Standard Applicable**

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

### **3.6.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.6.3 Antenna Gain**

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



## 4 List of Measuring Equipment

| Instrument            | Manufacturer      | Model No.                         | Serial No.        | Characteristics                  | Calibration Date | Test Date                       | Due Date      | Remark                   |
|-----------------------|-------------------|-----------------------------------|-------------------|----------------------------------|------------------|---------------------------------|---------------|--------------------------|
| Hygrometer            | Testo             | 608-H2                            | 41410069          | N/A                              | Jun. 17, 2019    | Apr. 15, 2020~<br>Apr. 16, 2020 | Jun. 16, 2020 | Conducted<br>(TH05-HY)   |
| Power Sensor          | DARE              | RPR3006W                          | 16I00054S<br>NO10 | 10MHz~6GHz                       | Dec. 23, 2019    | Apr. 15, 2020~<br>Apr. 16, 2020 | Dec. 22, 2020 | Conducted<br>(TH05-HY)   |
| Signal Analyzer       | Rohde & Schwarz   | FSV40                             | 101566            | 10Hz~40GHz                       | Jul. 15, 2019    | Apr. 15, 2020~<br>Apr. 16, 2020 | Jul. 14, 2020 | Conducted<br>(TH05-HY)   |
| Switch Box & RF Cable | Burgeon           | ETF-058                           | EC130048<br>4     | N/A                              | Aug. 22, 2019    | Apr. 15, 2020~<br>Apr. 16, 2020 | Aug. 21, 2020 | Conducted<br>(TH05-HY)   |
| Loop Antenna          | Rohde & Schwarz   | HFH2-Z2                           | 100315            | 9 kHz~30 MHz                     | Dec. 26, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Dec. 25, 2020 | Radiation<br>(03CH12-HY) |
| Bilog Antenna         | TESEQ             | CBL 6111D &<br>00800N1D01<br>N-06 | 37059 &<br>01     | 30MHz~1GHz                       | Oct. 12, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Oct. 11, 2020 | Radiation<br>(03CH12-HY) |
| Horn Antenna          | SCHWARZBE<br>CK   | BBHA 9120D                        | 9120D-132<br>8    | 1GHz ~ 18GHz                     | Nov. 14, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Nov. 13, 2020 | Radiation<br>(03CH12-HY) |
| SHF-EHF Horn Antenna  | SCHWARZBE<br>CK   | BBHA 9170                         | BBHA9170<br>584   | 18GHz ~ 40GHz                    | Dec. 10, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Dec. 09, 2020 | Radiation<br>(03CH12-HY) |
| Preamplifier          | COM-POWER         | PA-103                            | 161075            | 10MHz~1GHz                       | Mar. 25, 2020    | Apr. 20, 2020~<br>Apr. 23, 2020 | Mar. 24, 2021 | Radiation<br>(03CH12-HY) |
| Preamplifier          | Jet-Power         | JPA00101800<br>-30-10P            | 160118000<br>2    | 1GHz~18GHz                       | Feb. 07, 2020    | Apr. 20, 2020~<br>Apr. 23, 2020 | Feb. 06, 2021 | Radiation<br>(03CH12-HY) |
| Preamplifier          | Keysight          | 83017A                            | MY532701<br>48    | 1GHz~26.5GHz                     | Dec. 20, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Dec. 19, 2020 | Radiation<br>(03CH12-HY) |
| Preamplifier          | EMEC              | EM18G40G                          | 060715            | 18GHz ~ 40GHz                    | Dec. 13, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Dec. 12, 2020 | Radiation<br>(03CH12-HY) |
| Spectrum Analyzer     | Rohde & Schwarz   | FSV40                             | 101408            | 10Hz~40GHz                       | Aug. 13, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Aug. 12, 2020 | Radiation<br>(03CH12-HY) |
| RF Cable              | HUBER +<br>SUHNER | SUCOFLEX<br>126E                  | 0058/126E         | 30M-18G                          | Dec. 12, 2019    | Apr. 20, 2020~<br>Apr. 23, 2020 | Dec. 11, 2020 | Radiation<br>(03CH12-HY) |
| RF Cable              | HUBER +<br>SUHNER | SUCOFLEX<br>102                   | 505134/2          | 30M~40GHz                        | Feb. 25, 2020    | Apr. 20, 2020~<br>Apr. 23, 2020 | Feb. 24, 2021 | Radiation<br>(03CH12-HY) |
| RF Cable              | HUBER +<br>SUHNER | SUCOFLEX<br>102                   | 800740/2          | 30M~40GHz                        | Feb. 25, 2020    | Apr. 20, 2020~<br>Apr. 23, 2020 | Feb. 24, 2021 | Radiation<br>(03CH12-HY) |
| Controller            | EMEC              | EM1000                            | N/A               | Control Turn<br>table & Ant Mast | N/A              | Apr. 20, 2020~<br>Apr. 23, 2020 | N/A           | Radiation<br>(03CH12-HY) |
| Antenna Mast          | EMEC              | AM-BS-4500-<br>B                  | N/A               | 1m~4m                            | N/A              | Apr. 20, 2020~<br>Apr. 23, 2020 | N/A           | Radiation<br>(03CH12-HY) |
| Turn Table            | EMEC              | TT2000                            | N/A               | 0~360 Degree                     | N/A              | Apr. 20, 2020~<br>Apr. 23, 2020 | N/A           | Radiation<br>(03CH12-HY) |
| Software              | Audix             | E3<br>6.2009-8-24                 | RK-00098<br>9     | N/A                              | N/A              | Apr. 20, 2020~<br>Apr. 23, 2020 | N/A           | Radiation<br>(03CH12-HY) |



## 5 Uncertainty of Evaluation

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

|   |     |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 5.1 |
|---|-----|

### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

|   |     |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 5.6 |
|---|-----|

### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

|   |     |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 5.0 |
|---|-----|



**Appendix A. Test Result of Conducted Test Items**

|                |                       |                    |       |    |
|----------------|-----------------------|--------------------|-------|----|
| Test Engineer: | Hank Hsu              | Temperature:       | 21~25 | °C |
| Test Date:     | 2020/04/15~2020/04/16 | Relative Humidity: | 51~54 | %  |

**TEST RESULTS DATA**  
**6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| GFSK | 1Mbps     | 1   | 0   | 2402        | 2.002                 | 0.555        | 0.50               | Pass      |
| GFSK | 1Mbps     | 1   | 19  | 2440        | 2.002                 | 0.559        | 0.50               | Pass      |
| GFSK | 1Mbps     | 1   | 38  | 2478        | 2.002                 | 0.555        | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Average Power Table**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| GFSK | 1Mbps     | 1   | 0   | 2402        | 9.60                          | 30.00                       | 3.00     | 12.60            | 36.00                  | Pass       |
| GFSK | 1Mbps     | 1   | 19  | 2440        | 9.20                          | 30.00                       | 3.00     | 12.20            | 36.00                  | Pass       |
| GFSK | 1Mbps     | 1   | 38  | 2478        | 8.80                          | 30.00                       | 3.00     | 11.80            | 36.00                  | Pass       |

**TEST RESULTS DATA**  
**Peak Power Density**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|----------------------|----------|----------------------------|-----------|
| GFSK | 1Mbps     | 1   | 0   | 2402        | 9.50                   | -5.70                | 3.00     | 8.00                       | Pass      |
| GFSK | 1Mbps     | 1   | 19  | 2440        | 9.05                   | -6.09                | 3.00     | 8.00                       | Pass      |
| GFSK | 1Mbps     | 1   | 38  | 2478        | 8.49                   | -6.45                | 3.00     | 8.00                       | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.



## Appendix B. Radiated Spurious Emission

|                 |   |                     |             |
|-----------------|---|---------------------|-------------|
| Test Engineer : | Jack Cheng , Lance Chiang and Chuan Chu | Temperature :       | 22.5~25.2°C |
|                 |   | Relative Humidity : | 58.3~66.5%  |

### 2.4GHz 2400~2483.5MHz

### GFSK (Band Edge @ 3m)

| GFSK            | Note | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |   |
|-----------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|---|
|                 |      | ( MHz )   | ( dBμV/m ) | ( dB ) | Limit      | Line     | Level    | Factor | Loss   | Factor | Pos     | Pos     | Avg.    |   |
|                 |      |           |            |        | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |   |
| GFSK<br>2402MHz |      | 2320.71   | 57.44      | -16.56 | 74         | 43.28    | 27.72    | 15.74  | 29.3   | 275    | 217     | P       | H       |   |
|                 |      | 2382.765  | 49.3       | -4.7   | 54         | 35.21    | 27.53    | 15.84  | 29.28  | 275    | 217     | A       | H       |   |
|                 | *    | 2402      | 103.53     | -      | -          | 89.44    | 27.5     | 15.87  | 29.28  | 275    | 217     | P       | H       |   |
|                 | *    | 2402      | 97.42      | -      | -          | 83.33    | 27.5     | 15.87  | 29.28  | 275    | 217     | A       | H       |   |
|                 |      |           |            |        |            |          |          |        |        |        |         |         | H       |   |
|                 |      |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                 |      |           | 2334.255   | 58.08  | -15.92     | 74       | 43.96    | 27.66  | 15.76  | 29.3   | 155     | 56      | P       | V |
|                 |      |           | 2348.325   | 49.11  | -4.89      | 54       | 35.01    | 27.61  | 15.78  | 29.29  | 155     | 56      | A       | V |
|                 | *    |           | 2402       | 103.23 | -          | -        | 89.14    | 27.5   | 15.87  | 29.28  | 155     | 56      | P       | V |
|                 | *    |           | 2402       | 97.4   | -          | -        | 83.31    | 27.5   | 15.87  | 29.28  | 155     | 56      | A       | V |
| GFSK<br>2440MHz |      | 2324.56   | 57.32      | -16.68 | 74         | 43.17    | 27.7     | 15.75  | 29.3   | 263    | 41      | P       | H       |   |
|                 |      | 2342.34   | 49.27      | -4.73  | 54         | 35.16    | 27.63    | 15.77  | 29.29  | 263    | 41      | A       | H       |   |
|                 | *    | 2440      | 104.44     | -      | -          | 90.37    | 27.42    | 15.92  | 29.27  | 263    | 41      | P       | H       |   |
|                 | *    | 2440      | 98.61      | -      | -          | 84.54    | 27.42    | 15.92  | 29.27  | 263    | 41      | A       | H       |   |
|                 |      |           | 2493.07    | 56.97  | -17.03     | 74       | 42.91    | 27.31  | 16     | 29.25  | 263     | 41      | P       | H |
|                 |      |           | 2483.97    | 49.03  | -4.97      | 54       | 34.97    | 27.33  | 15.98  | 29.25  | 263     | 41      | A       | H |
|                 |      |           | 2361.1     | 57.07  | -16.93     | 74       | 42.97    | 27.58  | 15.81  | 29.29  | 100     | 243     | P       | V |
|                 |      |           | 2376.08    | 49.2   | -4.8       | 54       | 35.1     | 27.55  | 15.83  | 29.28  | 100     | 243     | A       | V |
|                 | *    |           | 2440       | 101.91 | -          | -        | 87.84    | 27.42  | 15.92  | 29.27  | 100     | 243     | P       | V |
|                 | *    |           | 2440       | 96.11  | -          | -        | 82.04    | 27.42  | 15.92  | 29.27  | 100     | 243     | A       | V |
|                 |      | 2495.1    | 57.1       | -16.9  | 74         | 43.04    | 27.31    | 16     | 29.25  | 100    | 243     | P       | V       |   |
|                 |      | 2484.46   | 49.02      | -4.98  | 54         | 34.96    | 27.33    | 15.98  | 29.25  | 100    | 243     | A       | V       |   |



|                         |   |         |        |        |    |       |       |       |       |     |     |   |   |
|-------------------------|---|---------|--------|--------|----|-------|-------|-------|-------|-----|-----|---|---|
| <b>GFSK<br/>2478MHz</b> | *   | 2478    | 104.17 | -      | -  | 90.11 | 27.34 | 15.98 | 29.26 | 301 | 278 | P | H |
|                         | *   | 2478    | 98.44  | -      | -  | 84.38 | 27.34 | 15.98 | 29.26 | 301 | 278 | A | H |
|                         |   | 2483.52 | 62.14  | -11.86 | 74 | 48.08 | 27.33 | 15.98 | 29.25 | 301 | 278 | P | H |
|                         |   | 2484.08 | 50.11  | -3.89  | 54 | 36.05 | 27.33 | 15.98 | 29.25 | 301 | 278 | A | H |
|                         |   |         |        |        |    |       |       |       |       |     |     |   | H |
|                         |   |         |        |        |    |       |       |       |       |     |     |   | H |
|                         | *   | 2478    | 100.85 | -      | -  | 86.79 | 27.34 | 15.98 | 29.26 | 101 | 61  | P | V |
|                         | *   | 2478    | 95.3   | -      | -  | 81.24 | 27.34 | 15.98 | 29.26 | 101 | 61  | A | V |
|                         |   | 2484    | 59.34  | -14.66 | 74 | 45.28 | 27.33 | 15.98 | 29.25 | 101 | 61  | P | V |
|                         |   | 2483.84 | 49.31  | -4.69  | 54 | 35.25 | 27.33 | 15.98 | 29.25 | 101 | 61  | A | V |
|                         |   |         |        |        |    |       |       |       |       |     |     |   | V |
|                         |   |         |        |        |    |       |       |       |       |     |     |   | V |
| <b>Remark</b>           | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. |         |        |        |    |       |       |       |       |     |     |   |   |



2.4GHz 2400~2483.5MHz  
GFSK (Harmonic @ 3m)

| GFSK            | Note  | Frequency<br>( MHz ) | Level<br>( dBμV/m ) | Over<br>Limit<br>( dB ) | Limit<br>Line<br>( dBμV/m ) | Read<br>Level<br>( dBμV ) | Antenna<br>Factor<br>( dB/m ) | Path<br>Loss<br>( dB ) | Preamp<br>Factor<br>( dB ) | Ant<br>Pos<br>( cm ) | Table<br>Pos<br>( deg ) | Peak<br>Avg.<br>( P/A ) | Pol.<br>( H/V ) |   |
|-----------------|---|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| GFSK<br>2402MHz |   | 4804                 | 52.07               | -21.93                  | 74                          | 71.59                     | 31.1                          | 9.84                   | 60.46                      | 102                  | 92                      | P                       | H               |   |
|                 |   | 4804                 | 49.37               | -4.63                   | 54                          | 68.89                     | 31.1                          | 9.84                   | 60.46                      | 102                  | 92                      | A                       | H               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |   |
|                 |   | 4804                 | 47.51               | -26.49                  | 74                          | 67.03                     | 31.1                          | 9.84                   | 60.46                      | 100                  | 0                       | P                       | V               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         |                 | V |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         |                 | V |
| GFSK<br>2440MHz |   | 4880                 | 49.31               | -24.69                  | 74                          | 68.68                     | 31.1                          | 9.93                   | 60.4                       | 100                  | 0                       | P                       | H               |   |
|                 |   | 7320                 | 51.62               | -22.38                  | 74                          | 61.74                     | 36.38                         | 12.61                  | 59.11                      | 239                  | 57                      | P                       | H               |   |
|                 |   | 7320                 | 40.3                | -13.7                   | 54                          | 50.42                     | 36.38                         | 12.61                  | 59.11                      | 239                  | 57                      | A                       | H               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |   |
|                 |   | 4880                 | 46.78               | -27.22                  | 74                          | 66.15                     | 31.1                          | 9.93                   | 60.4                       | 100                  | 0                       | P                       | V               |   |
|                 |   | 7320                 | 48.91               | -25.09                  | 74                          | 59.03                     | 36.38                         | 12.61                  | 59.11                      | 100                  | 0                       | P                       | V               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         |                 | V |
| GFSK<br>2478MHz |   | 4956                 | 52.16               | -21.84                  | 74                          | 71.26                     | 31.22                         | 10.02                  | 60.34                      | 100                  | 116                     | P                       | H               |   |
|                 |   | 4956                 | 49.06               | -4.94                   | 54                          | 68.16                     | 31.22                         | 10.02                  | 60.34                      | 100                  | 116                     | A                       | H               |   |
|                 |   | 7434                 | 47.99               | -26.01                  | 74                          | 57.75                     | 36.4                          | 12.88                  | 59.04                      | 100                  | 0                       | P                       | H               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |   |
|                 |   | 4956                 | 48.21               | -25.79                  | 74                          | 67.31                     | 31.22                         | 10.02                  | 60.34                      | 100                  | 0                       | P                       | V               |   |
|                 |   | 7434                 | 47.94               | -26.06                  | 74                          | 57.7                      | 36.4                          | 12.88                  | 59.04                      | 100                  | 0                       | P                       | V               |   |
|                 |   |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         |                 | V |
| Remark          | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         |                 |   |



Emission below 1GHz

2.4GHz GFSK (LF)

| GFSK                 | Note   | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |   |
|----------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|---|
|                      |  | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |   |
| 2.4GHz<br>GFSK<br>LF |  | 30.97     | 24.69      | -15.31 | 40         | 29.81    | 24.01    | 0.51   | 29.64  | -      | -       | P       | H       |   |
|                      |  | 315.18    | 30.48      | -15.52 | 46         | 38.67    | 19.27    | 1.82   | 29.28  | -      | -       | P       | H       |   |
|                      |  | 315.18    | 30.48      | -15.52 | 46         | 38.67    | 19.27    | 1.82   | 29.28  | -      | -       | P       | H       |   |
|                      |  | 443.22    | 38.73      | -7.27  | 46         | 42.58    | 22.96    | 2.3    | 29.11  | 100    | 0       | P       | H       |   |
|                      |  | 729.37    | 33.4       | -12.6  | 46         | 31.42    | 27.5     | 3.07   | 28.59  | -      | -       | P       | H       |   |
|                      |  | 947.62    | 37.01      | -8.99  | 46         | 30.99    | 30.49    | 3.67   | 28.14  | -      | -       | P       | H       |   |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                      |  |           | 30.97      | 30.48  | -9.52      | 40       | 35.6     | 24.01  | 0.51   | 29.64  | -       | -       | P       | V |
|                      |  |           | 94.99      | 26.3   | -17.2      | 43.5     | 39.81    | 15.29  | 0.81   | 29.61  | -       | -       | P       | V |
|                      |  |           | 343.31     | 33.73  | -12.27     | 46       | 41.01    | 20.07  | 1.91   | 29.26  | -       | -       | P       | V |
|                      |  |           | 441.28     | 32.71  | -13.29     | 46       | 36.63    | 22.92  | 2.28   | 29.12  | -       | -       | P       | V |
|                      |  |           | 714.82     | 35.47  | -10.53     | 46       | 34.38    | 26.68  | 2.98   | 28.57  | -       | -       | P       | V |
|                      |  |           | 746.83     | 38.58  | -7.42      | 46       | 35.97    | 28.05  | 3.17   | 28.61  | 100     | 0       | P       | V |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | V |
|                      |  |           |            |        |            |          |          |        |        |        |         |         |         | V |
|                      |  |           |            |        |            |          |          |        |        |        |         |         | V       |   |
|                      |  |           |            |        |            |          |          |        |        |        |         |         | V       |   |
|                      |  |           |            |        |            |          |          |        |        |        |         |         | V       |   |
|                      |  |           |            |        |            |          |          |        |        |        |         |         | V       |   |
| Remark               | 1. No other spurious found.<br>2. All results are PASS against limit line. |           |            |        |            |          |          |        |        |        |         |         |         |   |



**Note symbol**

|     |  |
|-----|--|
| *   | <b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| !   | Test result is <b>over limit</b> line.   |
| P/A | <b>Peak</b> or <b>Average</b>  |
| H/V | <b>Horizontal</b> or <b>Vertical</b>   |



A calculation example for radiated spurious emission is shown as below:

| GFSK    | Note | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|         |      | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| GFSK    |      | 2390      | 55.45      | -18.55 | 74         | 54.51    | 32.22    | 4.58   | 35.86  | 103    | 308     | P       | H       |
| CH 00   |      | 2390      | 43.54      | -10.46 | 54         | 42.6     | 32.22    | 4.58   | 35.86  | 103    | 308     | A       | H       |
| 2402MHz |      |           |            |        |            |          |          |        |        |        |         |         |         |

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =  
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)  
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)  
= 55.45 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 55.45(dBμV/m) – 74(dBμV/m)  
= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)  
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)  
= 43.54 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 43.54(dBμV/m) – 54(dBμV/m)  
= -10.46(dB)

**Both peak and average measured complies with the limit line, so test result is “PASS”.**



## Appendix C. Radiated Spurious Emission Plots

|                 |   |                     |             |
|-----------------|---|---------------------|-------------|
| Test Engineer : | Jack Cheng , Lance Chiang and Chuan Chu | Temperature :       | 22.5~25.2°C |
|                 |   | Relative Humidity : | 58.3~66.5%  |

### Note symbol

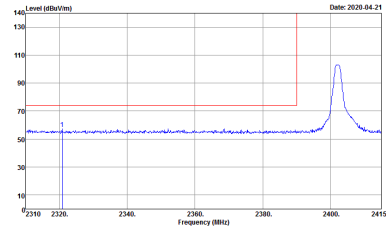
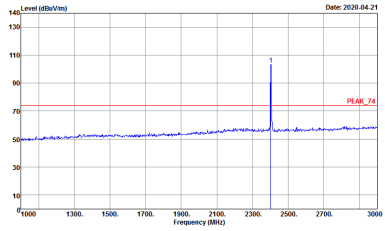
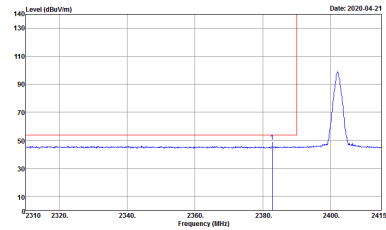
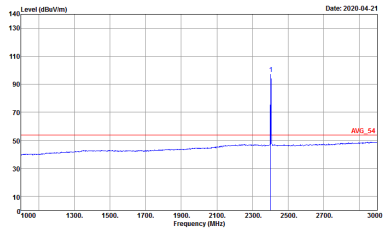
|    |                       |
|----|-----------------------|
| -L | Low channel location  |
| -R | High channel location |



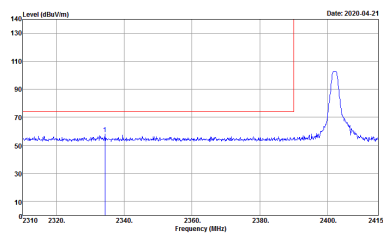
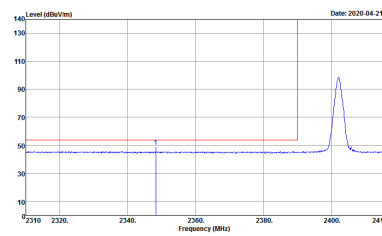
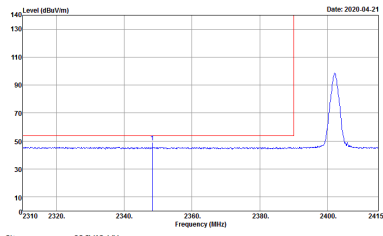
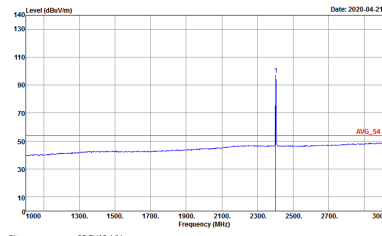


2.4GHz 2400~2483.5MHz

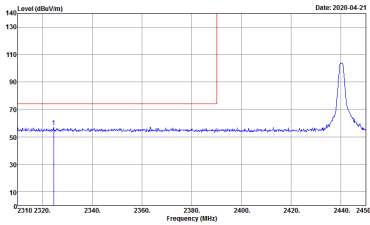
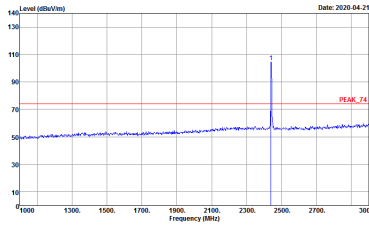
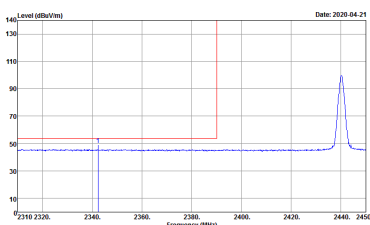
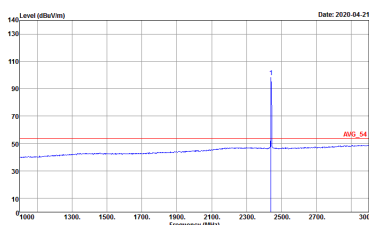
GFSK (Band Edge @ 3m)

| GFSK        | 2.4GHz 2400~2483.5MHz Band Edge @ 3m  |   |
|-------------|---|---|
|             | GFSK 2402MHz  |   |
|             | Horizontal  | Fundamental   |
| <b>Peak</b> |  <p>Site : 03CH12-HY<br/>           Condition : PEAK_BE_74 3m HORN_91200_1328 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 901830-01<br/>           Setting : 0</p>                                |  <p>Site : 03CH12-HY<br/>           Condition : PEAK_74 3m HORN_91200_1328 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 901830-01<br/>           Setting : 0</p>                                |
| <b>Avg.</b> |  <p>Site : 03CH12-HY<br/>           Condition : AVG_BE_54 3m HORN_91200_1328 HORIZONTAL<br/>           Detector : RMS<br/>           Project : 901830-01<br/>           Setting : 0<br/>           Trace : Average</p> |  <p>Site : 03CH12-HY<br/>           Condition : AVG_54 3m HORN_91200_1328 HORIZONTAL<br/>           Detector : RMS<br/>           Project : 901830-01<br/>           Setting : 0<br/>           Trace : Average</p> |

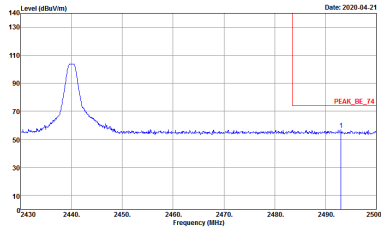
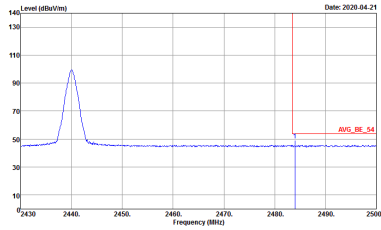


| GFSK |   | 2.4GHz 2400~2483.5MHz Band Edge @ 3m   |             |
|------|---|--|-------------|
|      |   | GFSK 2402MHz   |             |
|      |   | Vertical   | Fundamental |
| Peak |  <p>140 Level (dBuV/m)<br/>Date: 2020-04-21</p> <p>Site : 03CH12-HY<br/>Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL<br/>Detector : Peak<br/>Project : 901830-01<br/>Setting : 0</p>                     |  <p>140 Level (dBuV/m)<br/>Date: 2020-04-21</p> <p>Site : 03CH12-HY<br/>Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 901830-01<br/>Setting : 0<br/>Trace : Average</p> |             |
|      |  <p>140 Level (dBuV/m)<br/>Date: 2020-04-21</p> <p>Site : 03CH12-HY<br/>Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 901830-01<br/>Setting : 0<br/>Trace : Average</p> |  <p>140 Level (dBuV/m)<br/>Date: 2020-04-21</p> <p>Site : 03CH12-HY<br/>Condition : AVG_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 901830-01<br/>Setting : 0<br/>Trace : Average</p>  |             |

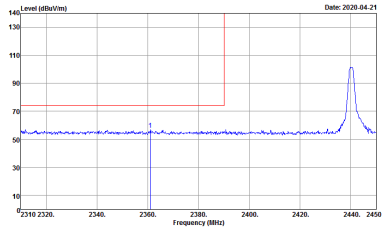
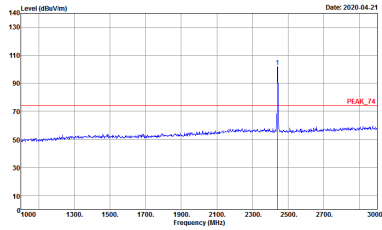
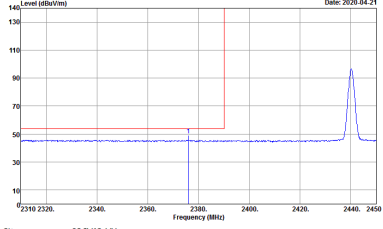
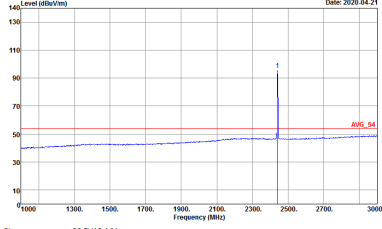


| GFSK |  | 2.4GHz 2400~2483.5MHz Band Edge @ 3m  |             |
|------|--|---|-------------|
|      |  | GFSK 2440MHz - L  |             |
|      |  | Horizontal  | Fundamental |
| Peak |  <p>Level (dBm/100kHz) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10 to 140 dBm/100kHz, and the x-axis ranges from 2310 to 2450 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Site : 03CH12-HY<br/>           Condition : PEAK_BE_74 3m HORN_91200_1328 HORIZONTAL<br/>           RBW:1000.000kHz VBW:3000.000kHz SWT:Auto<br/>           Detector : Peak<br/>           Project : 901830-01<br/>           Setting : 0</p>                                 |  <p>Level (dBm/100kHz) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10 to 140 dBm/100kHz, and the x-axis ranges from 9000 to 30000 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Site : 03CH12-HY<br/>           Condition : PEAK_T4 3m HORN_91200_1328 HORIZONTAL<br/>           RBW:1000.000kHz VBW:3000.000kHz SWT:Auto<br/>           Detector : Peak<br/>           Project : 901830-01<br/>           Setting : 0</p>                                 |             |
|      |  <p>Level (dBm/100kHz) vs Frequency (MHz) plot showing an average spectrum. The y-axis ranges from 10 to 140 dBm/100kHz, and the x-axis ranges from 2310 to 2450 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Site : 03CH12-HY<br/>           Condition : AVG_BE_54 3m HORN_91200_1328 HORIZONTAL<br/>           RBW:1000.000kHz VBW:3000.000kHz SWT:Auto<br/>           Detector : RMS<br/>           Project : 901830-01<br/>           Setting : 0<br/>           Trace : Average</p> |  <p>Level (dBm/100kHz) vs Frequency (MHz) plot showing an average spectrum. The y-axis ranges from 10 to 140 dBm/100kHz, and the x-axis ranges from 9000 to 30000 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Site : 03CH12-HY<br/>           Condition : AVG_54 3m HORN_91200_1328 HORIZONTAL<br/>           RBW:1000.000kHz VBW:3000.000kHz SWT:Auto<br/>           Detector : RMS<br/>           Project : 901830-01<br/>           Setting : 0<br/>           Trace : Average</p> |             |

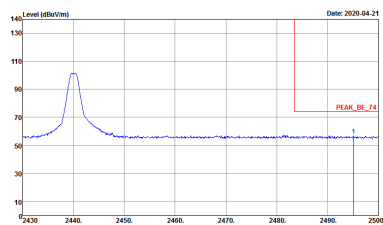



| GFSK               | 2.4GHz 2400~2483.5MHz Band Edge @ 3m   |                   |
|--------------------|--|-------------------|
| GFSK 2440MHz - R   |  |                   |
| Horizontal         |  | Fundamental       |
| <p><b>Peak</b></p> |  <p>Site : 03CH2-HY<br/>           Condition : PEAK_BE_74 3m HORN_9120D_1328 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 901830-01<br/>           Setting : 0</p>                                | <p>Left blank</p> |
| <p><b>Avg.</b></p> |  <p>Site : 03CH2-HY<br/>           Condition : AVG_BE_54 3m HORN_9120D_1328 HORIZONTAL<br/>           Detector : RMS<br/>           Project : 901830-01<br/>           Setting : 0<br/>           Trace : Average</p> | <p>Left blank</p> |

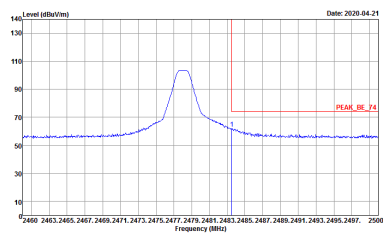
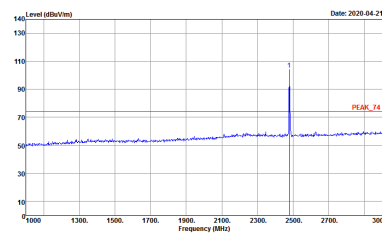
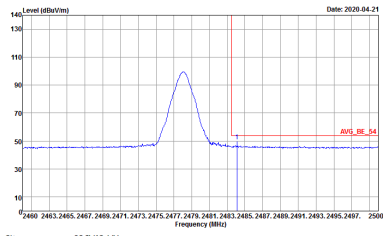
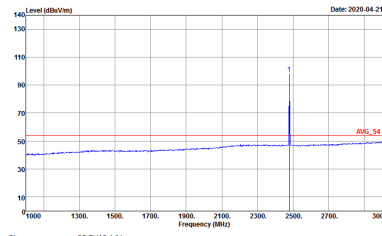


| GFSK |  | 2.4GHz 2400~2483.5MHz Band Edge @ 3m   |             |
|------|--|--|-------------|
|      |  | GFSK 2440MHz - L   |             |
|      |  | Vertical   | Fundamental |
| Peak |  <p>Site : 03CH12-HY<br/>Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p>                     |  <p>Site : 03CH12-HY<br/>Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p>                     |             |
|      |  <p>Site : 03CH12-HY<br/>Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 9D1830-01<br/>Setting : 0<br/>Trace : Average</p> |  <p>Site : 03CH12-HY<br/>Condition : AVG_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 9D1830-01<br/>Setting : 0<br/>Trace : Average</p> |             |

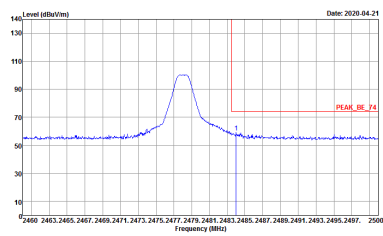
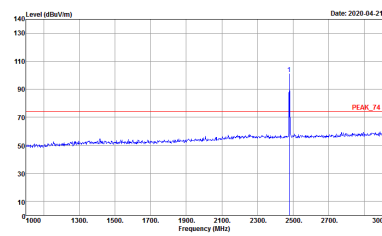
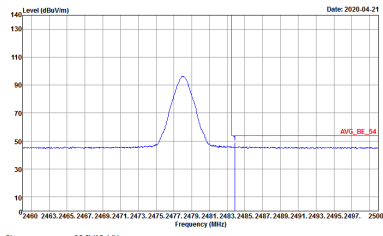
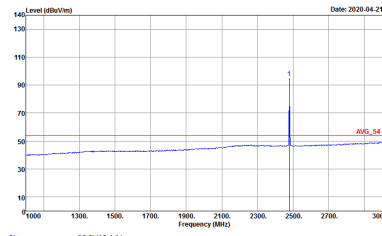


| GFSK               | 2.4GHz 2400~2483.5MHz Band Edge @ 3m   |                   |
|--------------------|--|-------------------|
| GFSK 2402MHz - R   |  |                   |
| Vertical           |  | Fundamental       |
| <p><b>Peak</b></p> |  <p>Site : 03CH2-HY<br/>           Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL<br/>           Detector : Peak<br/>           Project : 901830-01<br/>           Setting : 0</p>                                | <p>Left blank</p> |
| <p><b>Avg.</b></p> |  <p>Site : 03CH2-HY<br/>           Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL<br/>           Detector : RMS<br/>           Project : 901830-01<br/>           Setting : 0<br/>           Trace : Average</p> | <p>Left blank</p> |



| GFSK |   | 2.4GHz 2400~2483.5MHz Band Edge @ 3m  |             |
|------|---|---|-------------|
|      |   | GFSK 2478MHz  |             |
|      |   | Horizontal  | Fundamental |
| Peak |  <p>Site : 03CH12-HY<br/>           Condition : PEAK_BE_74 3m HORN_9120D_1328 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 9D1830-01<br/>           Setting : 0</p>                                |  <p>Site : 03CH12-HY<br/>           Condition : PEAK_74 3m HORN_9120D_1328 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 9D1830-01<br/>           Setting : 0</p>                                |             |
|      |  <p>Site : 03CH12-HY<br/>           Condition : AVG_BE_54 3m HORN_9120D_1328 HORIZONTAL<br/>           Detector : RMS<br/>           Project : 9D1830-01<br/>           Setting : 0<br/>           Trace : Average</p> |  <p>Site : 03CH12-HY<br/>           Condition : AVG_54 3m HORN_9120D_1328 HORIZONTAL<br/>           Detector : RMS<br/>           Project : 9D1830-01<br/>           Setting : 0<br/>           Trace : Average</p> |             |



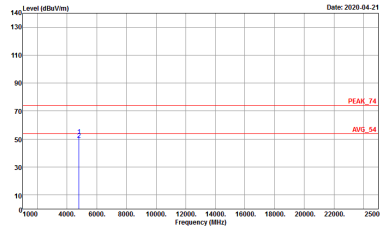
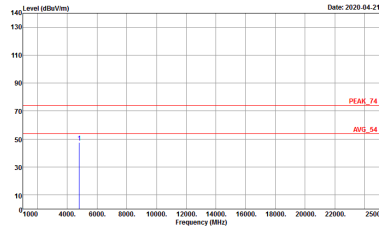
| GFSK |  | 2.4GHz 2400~2483.5MHz Band Edge @ 3m   |             |
|------|--|--|-------------|
|      |  | GFSK 2478MHz   |             |
|      |  | Vertical   | Fundamental |
| Peak |  <p>Site : 03CH12-HY<br/>Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p>                     |  <p>Site : 03CH12-HY<br/>Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p>                     |             |
|      |  <p>Site : 03CH12-HY<br/>Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 9D1830-01<br/>Setting : 0<br/>Trace : Average</p> |  <p>Site : 03CH12-HY<br/>Condition : AVG_54 3m HORN_9120D_1328 VERTICAL<br/>Detector : RMS<br/>Project : 9D1830-01<br/>Setting : 0<br/>Trace : Average</p> |             |



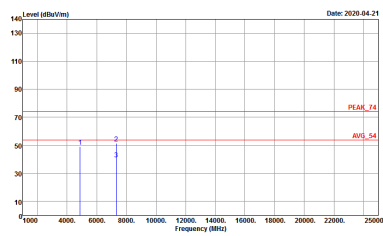
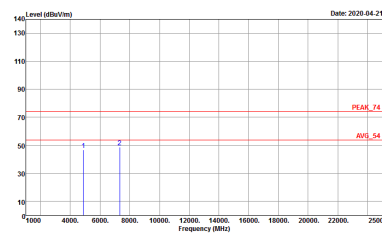


2.4GHz 2400~2483.5MHz

GFSK (Harmonic @ 3m)

| GFSK                               | 2.4GHz 2400~2483.5MHz Harmonic @ 3m   |  |
|------------------------------------|---|--|
|                                    | GFSK 2402MHz  |  |
|                                    | Horizontal  | Vertical   |
| <p><b>Peak</b><br/><b>Avg.</b></p> |  <p>Site : 03CH12-HY<br/>Condition : PEAK_74 3m HORN_91200_1328 HORIZONTAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p> |  <p>Site : 03CH12-HY<br/>Condition : PEAK_74 3m HORN_91200_1328 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p> |



| GFSK                                  | 2.4GHz 2400~2483.5MHz Harmonic @ 3m   |  |
|---------------------------------------|---|--|
|                                       | GFSK 2440MHz  |  |
|                                       | Horizontal  | Vertical   |
| <p><b>Peak</b></p> <p><b>Avg.</b></p> |  <p>Site : 03CH12-HY<br/>           Condition : PEAK_74 3m HORN_91200_1328 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 9D1830-01<br/>           Setting : 0</p> |  <p>Site : 03CH12-HY<br/>           Condition : PEAK_74 3m HORN_91200_1328 VERTICAL<br/>           Detector : Peak<br/>           Project : 9D1830-01<br/>           Setting : 0</p> |



| GFSK | 2.4GHz 2400~2483.5MHz Harmonic @ 3m   |   |
|------|---|---|
|      | GFSK 2478MHz  |   |
|      | Horizontal  | Vertical  |
| Peak | <p>Site : 03CH12-HY<br/>Condition : PEAK_74 3m HORN_91200_1328 HORIZONTAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p> | <p>Site : 03CH12-HY<br/>Condition : PEAK_74 3m HORN_91200_1328 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01<br/>Setting : 0</p> |



Emission below 1GHz

2.4GHz GFSK (LF)

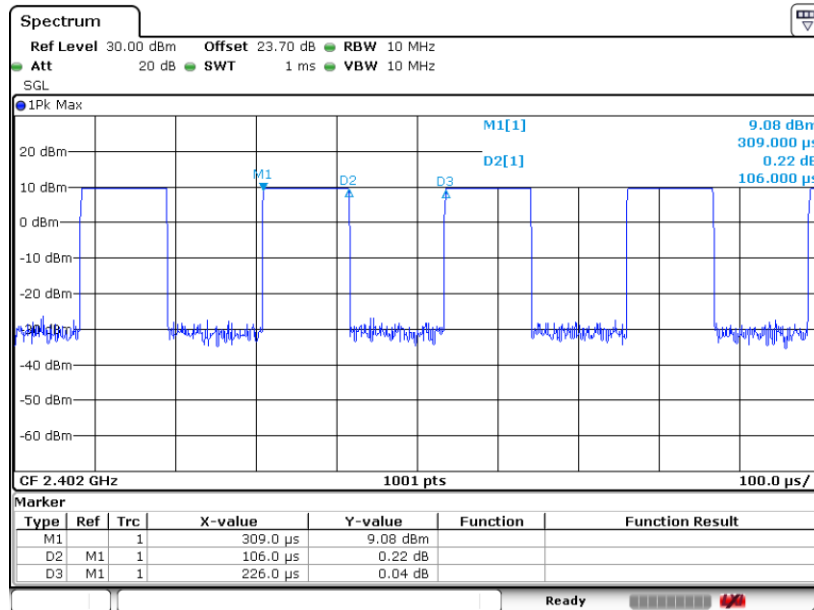
| GFSK         | 2.4GHz 2400~2483.5MHz  |  |
|--------------|--|--|
|              | GFSK LF  |  |
|              | Horizontal   | Vertical   |
| QP /<br>Peak | <p>Site : 03CH12-HY<br/>Condition : QP 3m BIL06_6111D_37059 HORIZONTAL<br/>Detector : Peak<br/>Project : 9D1830-01</p> | <p>Site : 03CH12-HY<br/>Condition : QP 3m BIL06_6111D_37059 VERTICAL<br/>Detector : Peak<br/>Project : 9D1830-01</p> |



### Appendix D. Duty Cycle Plots

| Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor(dB) |
|------|---------------|-------|----------|-------------|-----------------|
| GFSK | 46.9          | 106   | 9.43     | 10kHz       | 3.29            |

#### GFSK



Date: 15.APR.2020 00:16:27