

# RF Test Report

## Bluetooth

**Report No.** : FCCBVDW-WAY-P22080084-1  
**Customer** : C&A Marketing, Inc.  
**Customer Address** : 114 Tived Lane East, Edison, New Jersey, United States 08837  
**Manufacturer** : C&A Marketing, Inc.  
**Manufacturer Address:** 114 Tived Lane East, Edison, New Jersey, United States 08837  
**Use of Report** : Certification  
**Model Name** : RODSMPCAM  
**FCC ID** : 2AD2W-RODSMPACAM  
**IC No. (Model)** : 25971-RODSMPACAM  
**HVIN** : RODSMPCAM  
**Date of Test** : 2022.08.23 to 2022.09.04  
**Test Method Used** : FCC 47 CFR PART 15 Subpart C (Section §15.247)  
ISED RSS-247  
**Testing Environment** : Refer to the Test Condition

**Test Result** : ☒ Pass ☐ Fail

**ISSUED BY:** BV CPS ADT Korea Ltd., EMC/RF Laboratory

**ADDRESS:** Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu,  
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**TEST LOCATION:** HeungAn-daero 49, DongAn-gu, Anyang-si,  
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Tested by

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2022. 09. 28

**BV CPS ADT Korea Ltd.**

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**RELEASE CONTROL RECORD**

| REPORT NO.              | REASON FOR CHANGE | DATE ISSUED |
|-------------------------|-------------------|-------------|
| FCCBVDW-WAY-P22080084-1 | Original release  | 2022.09.28  |
|                         |                   |             |

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## 1 Summary of Test Results

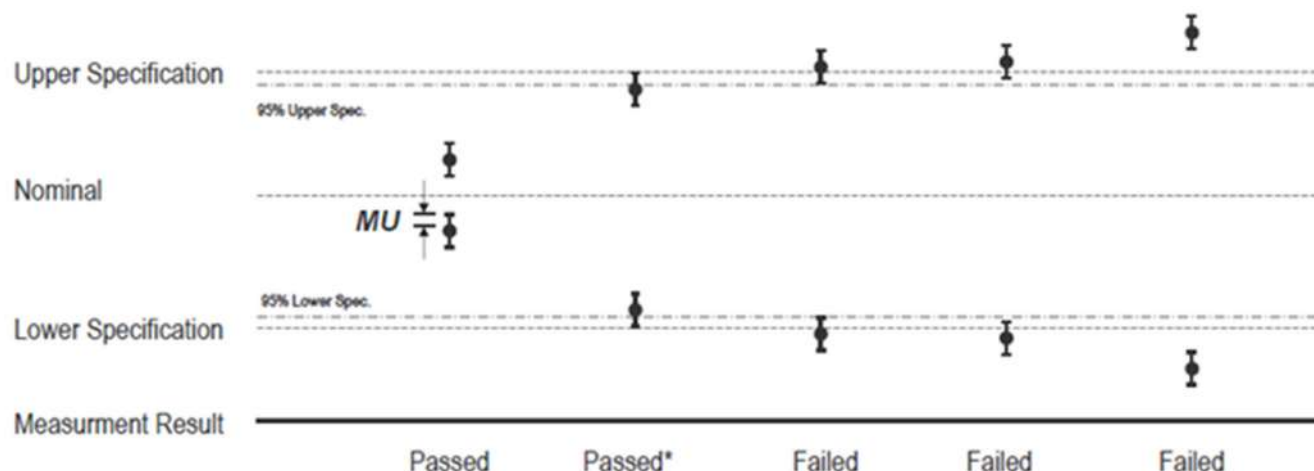
The EUT has been tested according to the following specifications

| Applied Standard : FCC Part 15, Subpart C 15.247, RSS-247 |                  |   |  |             |             |
|---|------------------|---|--|-------------|-------------|
| FCC Part Section(s)                                       | RSS Section(s)   | Test Description  | Limit  | Test Result | Reference   |
| 15.247(b)(1)  | RSS-247 [5.4(2)] | Maximum Peak Output Power   | < 1 Watt if $\geq 75$ non-overlapping channels used                            | PASS        | Section 3.2 |
| 15.247(a)(1)  | RSS-247 [5.1(2)] | Carrier Frequency Separation  | > 2/3 of 20 dB BW for systems with Output Power < 125 mW                       | PASS        | Section 3.3 |
| 15.247(a)(1)(iii)   | RSS-247 [5.1(1)] | 20 dB Channel Bandwidth   | N/A  | PASS        | Section 2.5 |
| -   | RSS-Gen [6.7]    | Occupied Bandwidth (99 % Bandwidth)   | N/A  | PASS        | Section 2.5 |
| 15.247(a)(1)(iii)   | RSS-247 [5.1(4)] | Number of Hopping Channels  | > 15 Channels  | PASS        | Section 3.4 |
| 15.247(a)(1)(iii)   | RSS-247 [5.1(4)] | Time of Occupancy (Dwell Time)  | < 0.4 sec in 31.6 sec period   | PASS        | Section 3.5 |
| 15.247(d)   | RSS-247 [5.5]    | Band Edge / Out-of-Band Emissions (Conducted Spurious Emission)               | > 20 dBc   | PASS        | Section 3.6 |
| 15.205<br>15.209  | RSS-Gen [8.9]    | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Emissions in Restricted bands must meet the radiated limits detailed in 15.209 | PASS        | Section 3.6 |
| 15.207  | RSS-Gen [8.8]    | AC Conducted Emissions (150 kHz – 30 MHz)                                     | < FCC 15.207 limits  | PASS        | Section 3.7 |

### NOTES

- 1) The general test methods used to test on this devices are ANSI C63.10.
- 2) If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.
- 3) Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- 4) According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz.  
Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

## 1.1 Decision Rules for Statement of Conformity



QUA-52 Decision Rule(QA Document) was applied.

**Step 1)** : Reference Check, Daily Check, Peripheral device Check

**Step 2)** : Re-test Procedure (Repeat the test maximum 3 times, Different Test Engineer)

- 1) If the original test results are subject to retesting and the judgement is unclear, the retest is carried out.
- 2) If the result of the first retest is the same as the initial test, the judgement is made based on the value.
- 3) If the result of the first retest differ from the results of the initial test, the second re-test is carried out.
- 4) After completion of the second retest, the average of the three test results is determined as the final result. However, if the deviation of the three test values is more than 5 % of the reference value, the technical manager should review the reproducibility of the test from the beginning.

## 1.2 Measurement Uncertainty


Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2

| Measurement Items                 | Frequency Range   | Expanded Uncertainty<br>$U = kU_c (k = 2)$ |
|-----------------------------------|-------------------|--|
| Conducted Emissions at main ports | 150 kHz – 30 MHz  | 2.99                                       |
| Radiated Spurious Emissions       | 9 kHz – 30 MHz    | 1.92                                       |
|                                   | 30 MHz – 1 GHz    | 4.00                                       |
|                                   | 1 GHz – 18 GHz    | 5.68                                       |
|                                   | 18 GHz – 26.5 GHz | 5.24                                       |

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

## 2 General Information

### 2.1 General Description of EUT

|                                  |  |
|----------------------------------|--|
| <b>Product</b>                   | KODAK Smile + Digital Instant Print Camera   |
| <b>Brand</b>                     |  KODAK                        |
| <b>Model</b>                     | RODSMPCAM  |
| <b>Identification No. of EUT</b> | -  |
| <b>Series Model</b>              | -  |
| <b>Model Difference</b>          | -  |
| <b>HVIN</b>                      | RODSMPCAM  |
| <b>FVIN</b>                      | -  |
| <b>Power Supply</b>              | DC 7.4 V(Battery)  |
| <b>Modulation Type</b>           | BDR(GFSK), EDR( $\pi/4$ DQPSK), EDR(8DPSK)   |
| <b>Transfer Rate</b>             | 1 Mbps, 2 Mbps, 3 Mbps   |
| <b>Operating Frequency</b>       | 2 402 MHz – 2 480 MHz  |
| <b>Number of Channel</b>         | 79 Channels  |
| <b>Output Power</b>              | BDR(GFSK) : 3.24 dBm (2.11 mW)<br>EDR( $\pi/4$ DQPSK) : -0.37 dBm (0.92 mW)<br>EDR(8DPSK) : 1.14 dBm (1.30 mW) |
| <b>Antenna Type</b>              | Chip Antenna   |
| <b>Antenna Connector</b>         | Internal   |
| <b>H/W Version</b>               | V1.0   |
| <b>S/W Version</b>               | V1.0.0   |

#### NOTES

- 1) The above equipment has been tested by **Bureau Veritas Consumer Products Services ADT Korea**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.
- 2) The following antennas were provided to the EUT

| Antenna   | Type         | Connector | Peak Gain (dBi) |
|-----------|--------------|-----------|-----------------|
|           |              |           | 2.4 GHz         |
| Bluetooth | Chip Antenna | Internal  | 0.5             |

### 3) List of Accessories

| Accessories | Brand | Model | Manufacturer | Specification |
|-------------|-------|-------|--------------|---------------|
| USB Cable   | -     | -     | -            | 0.5 m         |

### 4) Auxiliary test equipment

| Accessories      | Brand                         | Model       | Manufacturer                                  | Specification  |
|------------------|-------------------------------|-------------|---|--|
| Notebook PC      | Samsung Electronics Co., Ltd. | NT950XBV    | Samsung Electronics Suzhou Computer Co., Ltd. | -  |
| Notebook Adaptor | Samsung Electronics Co., Ltd. | PSCV650105A | Samsung Electronics Co., Ltd.                 | Input : AC 100 – 240 V<br>50 – 60 Hz<br>Output : DC 19 V |



## 2.2 Description of Test Mode

[Test Channel of EUT]

| Channel | Frequency [MHz] | Channel | Frequency [MHz] | Channel | Frequency [MHz] | Channel | Frequency [MHz] |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 0       | 2 402           | 20      | 2 422           | 40      | 2 442           | 60      | 2 462           |
| 1       | 2 403           | 21      | 2 423           | 41      | 2 443           | 61      | 2 463           |
| 2       | 2 404           | 22      | 2 424           | 42      | 2 444           | 62      | 2 464           |
| 3       | 2 405           | 23      | 2 425           | 43      | 2 445           | 63      | 2 465           |
| 4       | 2 406           | 24      | 2 426           | 44      | 2 446           | 64      | 2 466           |
| 5       | 2 407           | 25      | 2 427           | 45      | 2 447           | 65      | 2 467           |
| 6       | 2 408           | 26      | 2 428           | 46      | 2 448           | 66      | 2 468           |
| 7       | 2 409           | 27      | 2 429           | 47      | 2 449           | 67      | 2 469           |
| 8       | 2 410           | 28      | 2 430           | 48      | 2 450           | 68      | 2 470           |
| 9       | 2 411           | 29      | 2 431           | 49      | 2 451           | 69      | 2 471           |
| 10      | 2 412           | 30      | 2 432           | 50      | 2 452           | 70      | 2 472           |
| 11      | 2 413           | 31      | 2 433           | 51      | 2 453           | 71      | 2 473           |
| 12      | 2 414           | 32      | 2 434           | 52      | 2 454           | 72      | 2 474           |
| 13      | 2 415           | 33      | 2 435           | 53      | 2 455           | 73      | 2 475           |
| 14      | 2 416           | 34      | 2 436           | 54      | 2 456           | 74      | 2 476           |
| 15      | 2 417           | 35      | 2 437           | 55      | 2 457           | 75      | 2 477           |
| 16      | 2 418           | 36      | 2 438           | 56      | 2 458           | 76      | 2 478           |
| 17      | 2 419           | 37      | 2 439           | 57      | 2 459           | 77      | 2 479           |
| 18      | 2 420           | 38      | 2 440           | 58      | 2 460           | 78      | 2 480           |
| 19      | 2 421           | 39      | 2 441           | 59      | 2 461           |         |                 |

### 2.2.1 Test Mode Applicability and Tested Channel Details

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X axis for radiated emission. Following channel(s) was(were) selected for the final test as listed below :

| EUT Configure mode | Applicable to |         |     |      | Description |
|--------------------|---------------|---------|-----|------|-------------|
|                    | RE < 1G       | RE ≥ 1G | PLC | APCM |             |
| -                  | √             | √       | √   | √    | -           |

Where RE ≥ 1 G : Radiated Emission above 1 GHz & Bandedge Measurement

RE < 1 G : Radiated Emission below 1 GHz

PLC : Power Line Conducted Emission

APCM : Antenna Port Conducted Measurement

#### **Radiated Emission Test (Below 1 GHz)**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Available Channel | Tested Channel | Modulation Type | Packet Type |
|-------------------|----------------|-----------------|-------------|
| 0 to 78           | 39             | BDR(GFSK)       | DH1         |

#### **Radiated Emission Test (Above 1 GHz)**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Available Channel | Tested Channel | Modulation Type | Packet Type |
|-------------------|----------------|-----------------|-------------|
| 0 to 78           | 0, 39, 78      | BDR(GFSK)       | DH1         |
| 0 to 78           | 0, 39, 78      | EDR(8DPSK)      | 3DH1        |

#### **Radiated Emission Test (Above 18 GHz)**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Available Channel | Tested Channel | Modulation Type | Packet Type |
|-------------------|----------------|-----------------|-------------|
| 0 to 78           | 39             | BDR(GFSK)       | DH1         |

### Power line Conducted Emission Test

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Available Channel | Tested Channel | Modulation Type | Packet Type |
|-------------------|----------------|-----------------|-------------|
| 0 to 78           | 39             | BDR(GFSK)       | DH1         |

### Antenna Port Conducted Measurement

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Available Channel | Tested Channel | Modulation Type | Packet Type |
|-------------------|----------------|-----------------|-------------|
| 0 to 78           | 0, 39, 78      | BDR(GFSK)       | DH1         |
| 0 to 78           | 0, 39, 78      | EDR(8DPSK)      | 3DH1        |

### Test Condition

| Applicable to | Environmental Conditions         | Test Voltage    | Tested by   |
|---------------|----------------------------------|-----------------|-------------|
| RE < 1G       | (20.8 ± 2) °C, (49.1 ± 3) % R.H. | DC 7.4 V        | Sooyeon Kim |
| RE ≥ 1G       | (20.2 ± 2) °C, (49.1 ± 3) % R.H. | DC 7.4 V        | Sooyeon Kim |
| PLC           | (20.1 ± 2) °C, (49.8 ± 3) % R.H. | AC 120 V, 60 Hz | Sooyeon Kim |
| APCM          | (20.1 ± 2) °C, (49.8 ± 3) % R.H. | DC 7.4 V        | Sooyeon Kim |

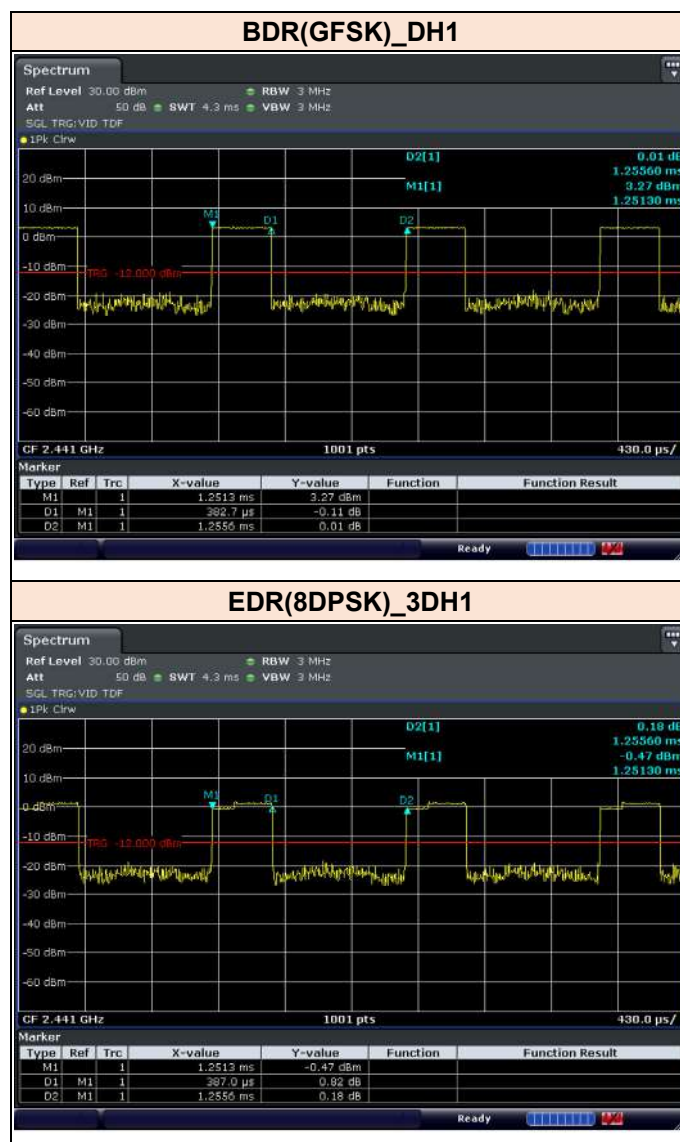
## 2.3 Maximum Output Power

| Frequency Range [MHz] | Test Items    | Test Mode           | Packet Type | Result [dBm] | Result [mW] |
|-----------------------|---------------|---------------------|-------------|--------------|-------------|
| 2 402 – 2 480         | Peak Power    | BDR(GFSK)           | DH1         | 3.24         | 2.11        |
|                       |               |                     | DH3         | 2.92         | 1.96        |
|                       |               |                     | DH5         | 2.99         | 1.99        |
|                       |               | EDR( $\pi$ /4DQPSK) | 2DH1        | -0.37        | 0.92        |
|                       |               |                     | 2DH3        | -0.38        | 0.92        |
|                       |               |                     | 2DH5        | -0.72        | 0.85        |
|                       |               | EDR(8DPSK)          | 3DH1        | 1.14         | 1.30        |
|                       |               |                     | 3DH3        | -0.42        | 0.91        |
|                       |               |                     | 3DH5        | -0.79        | 0.83        |
|                       | Average Power | BDR(GFSK)           | DH1         | -2.51        | 0.56        |
|                       |               |                     | DH3         | -3.90        | 0.41        |
|                       |               |                     | DH5         | -3.73        | 0.42        |
|                       |               | EDR( $\pi$ /4DQPSK) | 2DH1        | -6.28        | 0.24        |
|                       |               |                     | 2DH3        | -7.50        | 0.18        |
|                       |               |                     | 2DH5        | -7.05        | 0.20        |
|                       |               | EDR(8DPSK)          | 3DH1        | -6.26        | 0.24        |
|                       |               |                     | 3DH3        | -6.26        | 0.24        |
|                       |               |                     | 3DH5        | -6.58        | 0.22        |

## 2.4 Duty Cycle of Test Signal

| Test Mode  | Test Items | Packet Type | On Time B [msec] | Period [msec] | Duty Cycle X [Linear] | Duty Cycle [%] | DCCF [dB] | 1/T Min. VBW [kHz] |
|------------|------------|-------------|------------------|---------------|-----------------------|----------------|-----------|--------------------|
| BDR(GFSK)  | Duty Cycle | DH1         | 0.383            | 1.256         | 0.305                 | 30.5           | 5.16      | 2.613              |
| EDR(8DPSK) | Duty Cycle | 3DH1        | 0.387            | 1.256         | 0.308                 | 30.8           | 5.11      | 2.584              |

## Test Plot of Duty Cycle

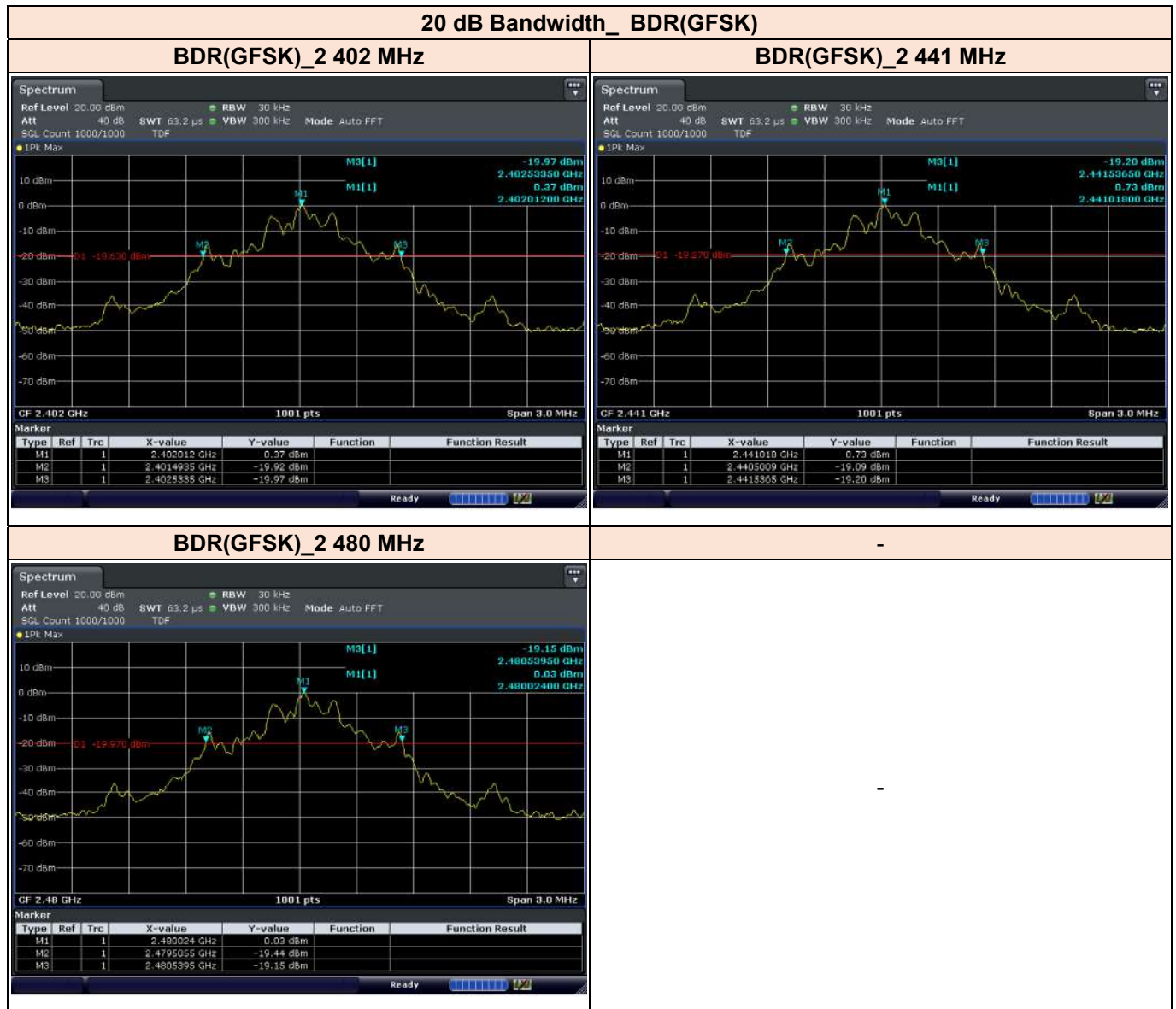


## 2.5 20 dB and 99 % Bandwidth

### [Test Data of 20 dB Bandwidth and 99 % Bandwidth]

| Test Mode    | Channel | Frequency<br>[MHz] | 20 dB BW<br>[MHz] | 99 BW<br>[MHz] |
|--------------|---------|--------------------|-------------------|----------------|
| BDR(GFSK)    | Lowest  | 2 402              | 1.040             | 1.004          |
|              | Middle  | 2 441              | 1.036             | 1.004          |
|              | Highest | 2 480              | 1.034             | 1.007          |
| Worst Result |         |                    | 1.040             | 1.007          |
| EDR(8DPSK)   | Lowest  | 2 402              | 1.211             | 1.100          |
|              | Middle  | 2 441              | 1.208             | 1.118          |
|              | Highest | 2 480              | 1.214             | 1.136          |
| Worst Result |         |                    | 1.214             | 1.136          |

## Test Plot of 20 dB Bandwidth





## 20 dB Bandwidth\_ EDR(8DPSK)

### EDR(8DPSK)\_2 402 MHz



### EDR(8DPSK)\_2 441 MHz

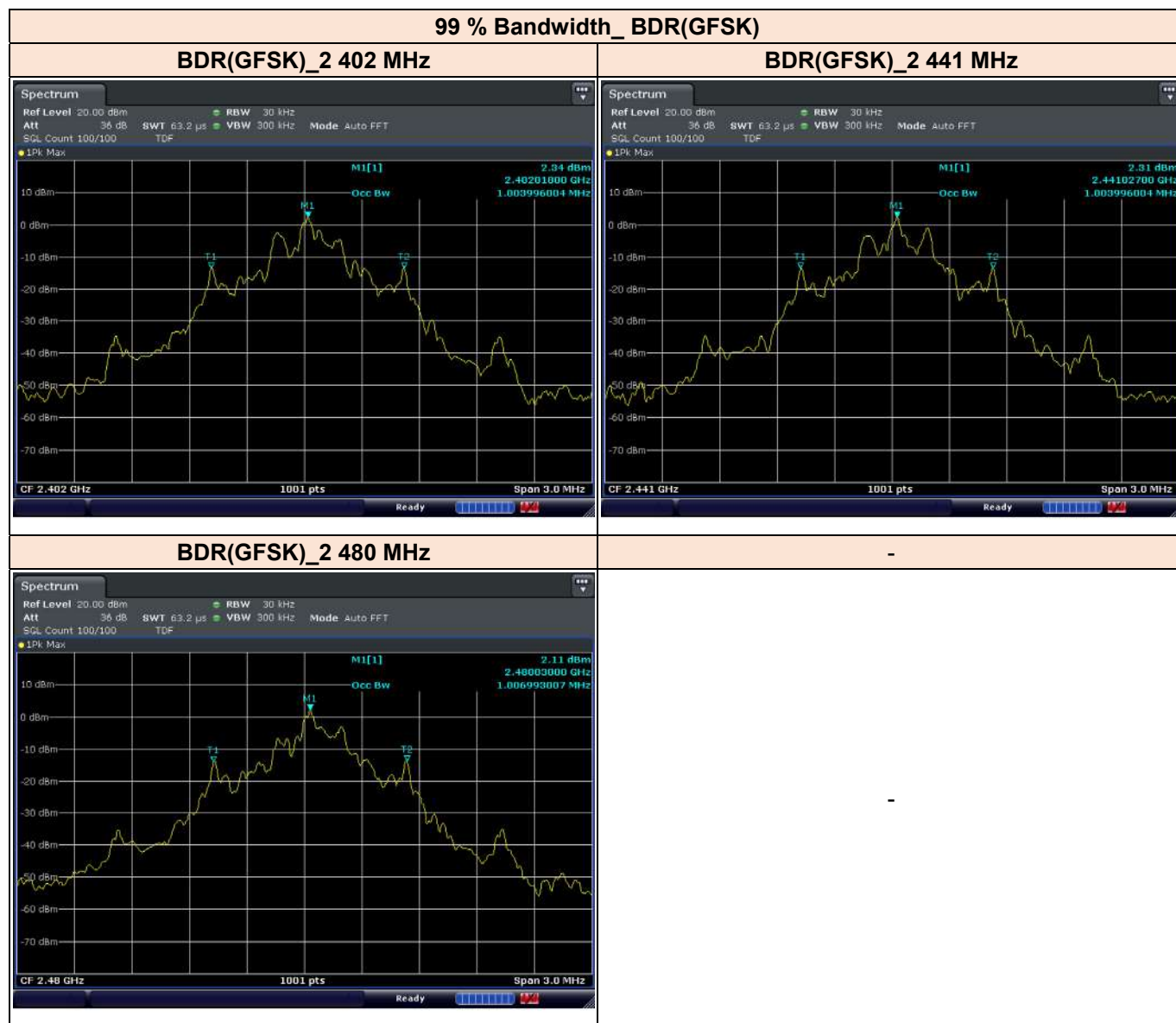


### EDR(8DPSK)\_2 480 MHz





## Test Plot of 99 % Bandwidth



### 99 % Bandwidth\_ EDR(8DPSK)

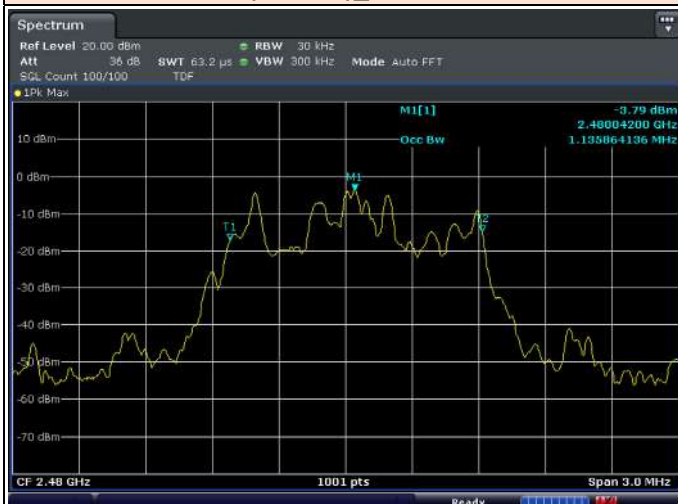
#### EDR(8DPSK)\_2 402 MHz



#### EDR(8DPSK)\_2 441 MHz



#### EDR(8DPSK)\_2 480 MHz



## 2.6 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards.

**FCC CFR 47 Part 15, Subpart C (§15.247)**

**KDB 558074 D01 15.247 Meas Guidance v05r02**

**ANSI C63.10-2013**

**RSS-247 Issue 2**

**RSS-GEN Issue 5**

All test items in this test report have been performed and recorded as per the above standards.

## 2.7 Test Equipment

Test Equipment is traceable to the National Institute of Standards and Technology (NIST). Measurement antenna used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

| Equipment         | Model               | Serial Number | Manufacturer   | Description  | Cal Date   | Cal Due    |
|-------------------|---------------------|---------------|----------------|--|------------|------------|
| Loop Antenna      | HFH2-Z2E            | 349806        | R&S            | Active Loop Antenna, 30 MHz  | 2022-02-18 | 2023-02-18 |
| Bi-log Antenna    | VULB 9163           | 1099          | Schwarzbeck    | Trilog Antenna, 3 GHz (with 6 dB ATT.)   | 2022-09-03 | 2023-09-03 |
| Horn Antenna      | HF907               | 102772        | R&S            | Horn Antenna, 18 GHz   | 2021-12-03 | 2022-12-03 |
| Horn Antenna      | BBHA9170            | 00955         | Schwarzbeck    | 15 - 40 GHz, 10 W (cont.) 25 W (peak)  | 2021-12-13 | 2022-12-13 |
| Amplifier         | SCU08F2             | 8400016       | R&S            | Signal Conditioning Unit, 8 GHz  | 2021-11-23 | 2022-11-23 |
| Amplifier         | SCU-18F             | 180111        | R&S            | Signal Conditioning Unit, 18 GHz   | 2021-11-23 | 2022-11-23 |
| Amplifier         | JS44-18004000-33-8P | 2142086       | L3 Narda-MITEQ | Amplifier, 40 GHz  | 2021-11-29 | 2022-11-29 |
| Signal analyzer   | FSW50               | 101403        | R&S            | DC Coupled : 2 Hz to 50 GHz<br>AC Coupled : 10 MHz to 50 GHz   | 2021-11-22 | 2022-11-22 |
| Attenuator        | PE7087-10           | 1712-2        | Pasternack     | 10 dB Atten / 2 W / DC to 26 GHz   | 2022-06-04 | 2023-06-04 |
| High Pass Filter  | HPM17543            | 28            | Micro-Tronics  | 3 GHz High Pass Filter   | 2022-06-04 | 2023-06-04 |
| EMI Receiver      | ESR                 | 102529        | R&S            | DC ~ 7 GHz   | 2021-11-23 | 2022-11-23 |
| Signal Generator  | SMB100A             | MY41006053    | R&S            | 100 kHz ~ 40 GHz   | 2022-06-04 | 2023-06-03 |
| Signal analyzer   | FSV30               | 103631        | R&S            | 10 Hz to 30 GHz / 1W   | 2021-11-22 | 2022-11-22 |
| Power Splitter    | 1579                | 71667         | Weinschel      | DC to 26.5 GHz / 0.5 W   | 2021-11-30 | 2022-11-30 |
| Power Meter       | NRX                 | 103577        | R&S            | CW mode: -20 to +20 dBm  | 2022-03-17 | 2023-03-17 |
| Power Sensor      | NRP-Z211            | 102376        | R&S            | Two Path Diode Power Sensor,<br>Frequency range : 10 MHz to 8 GHz<br>/ Level range: -60 dBm to +20 dBm | 2022-03-17 | 2023-03-17 |
| Attenuator        | 40AH2W-10           | 1             | Aeroflex       | DC to 40 GHz / 10 dB / 2 W   | 2022-11-30 | 2023-11-30 |
| LISN              | ENV216              | 102437        | R&S            | 9 kHz - 30 MHz   | 2021-11-23 | 2022-11-23 |
| EMI Test Receiver | ESR                 | 102529        | R&S            | 9 kHz - 3.6 GHz  | 2021-11-23 | 2022-11-23 |

### 3 Test Results

#### 3.1 Antenna Requirement

**Except from §15.203 of the FCC Rules/Regulations:**

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of the section.

- The antenna(s) of the EUT are Permanently attached.
- There are no provisions for connection to an external antenna.

**Result**

The EUT complies with the requirement of §15.203

## 3.2 Pseudorandom Frequency Hopping Sequence

### TEST APPLICABLE

For 47 CFR Part 15C section 15.247 (a) (1) requirement:

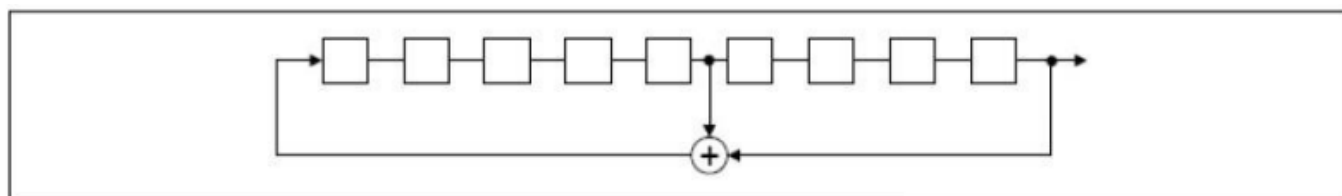
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that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

mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### EUT Pseudorandom Frequency Hopping Sequence Requirement

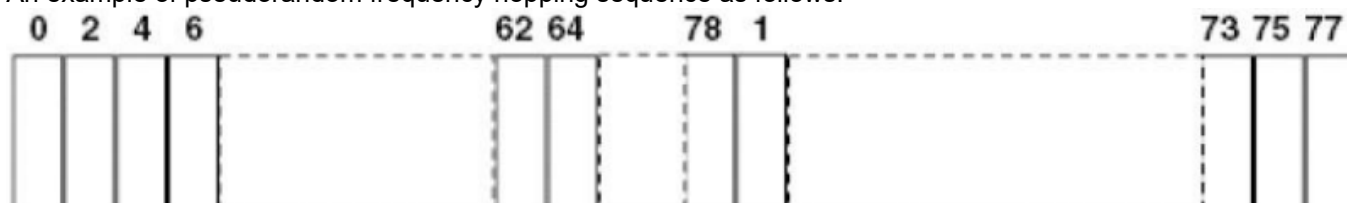
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:  $2^9 - 1 = 511$  bits
- Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

### 3.3 Maximum Peak Output Power

#### 3.3.1 Regulation

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

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

§15.247(b)(4) : The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 3.3.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

This is an RF conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation.

- a) Use the following spectrum analyzer settings:

##### Peak Power Measurement

- 1) Span : Approximately five times the 20 dB bandwidth, centered on hopping channel.
- 2) RBW > 20 dB bandwidth of emission being measured.
- 3) VBW  $\geq$  RBW.
- 4) Sweep : Auto.
- 5) Detector function : Peak.
- 6) Trace : Max hold.
- b) Allow trace to stabilize
- c) Use the marker-to-peak function to set the marker to the peak of the emissions
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
- e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

### Average Power Measurement

Measurement using a power meter.

a) Average Power measurement using an RF average power meter, as follows:

- 1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
- 2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
- 3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle, D, of the transmitter output signal.

c) Measure the average power of the transmitter.

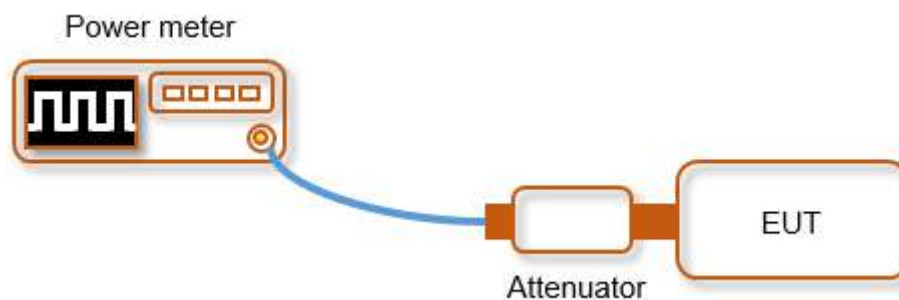
This measurement is an average over both the ON and OFF periods of the transmitter.

d) Correct the measurement in dBm by adding  $[10 \log (1 / D)]$ , where D is the duty cycle.

### 3.3.3 Deviation from Test Standard

No deviation.

### 3.3.4 Test Setup





### 3.3.5 Test Result

#### [Test Data of Peak Power]

| Test Mode   | Channel      | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|-------------|--------------|-----------------|--------------------|-------------|-------------|
| BDR (GFSK)  | Lowest       | 2 402           | 2.95               | 21.00       | 18.05       |
|             | Middle       | 2 441           | 3.24               | 21.00       | 17.76       |
|             | Highest      | 2 480           | 3.02               | 21.00       | 17.98       |
|             | Worst Result |                 | 3.24               | 21.00       | 17.76       |
| EDR (8DPSK) | Lowest       | 2 402           | 0.92               | 21.00       | 20.08       |
|             | Middle       | 2 441           | 1.14               | 21.00       | 19.86       |
|             | Highest      | 2 480           | 0.42               | 21.00       | 20.58       |
|             | Worst Result |                 | 1.14               | 21.00       | 19.86       |

#### [Test Data of Average Power]

| Test Mode   | Channel | Frequency [MHz] | Average Power [dBm] | Average Power [mW] |
|-------------|---------|-----------------|---------------------|--------------------|
| BDR (GFSK)  | Lowest  | 2 402           | -3.17               | 0.48               |
|             | Middle  | 2 441           | -2.51               | 0.56               |
|             | Highest | 2 480           | -2.66               | 0.54               |
| EDR (8DPSK) | Lowest  | 2 402           | -6.29               | 0.23               |
|             | Middle  | 2 441           | -6.26               | 0.24               |
|             | Highest | 2 480           | -6.26               | 0.24               |

#### Remarks

1. Peak Power(dBm) = Peak Reading Value(dBμV/m)
2. Average Power(dBm) = Average Reading Value(dBμV/m) + Duty Cycle Correction Factor(dB)

## 3.4 Carrier Frequency Separation

### 3.4.1 Regulation

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

### 3.4.2 Test Procedure

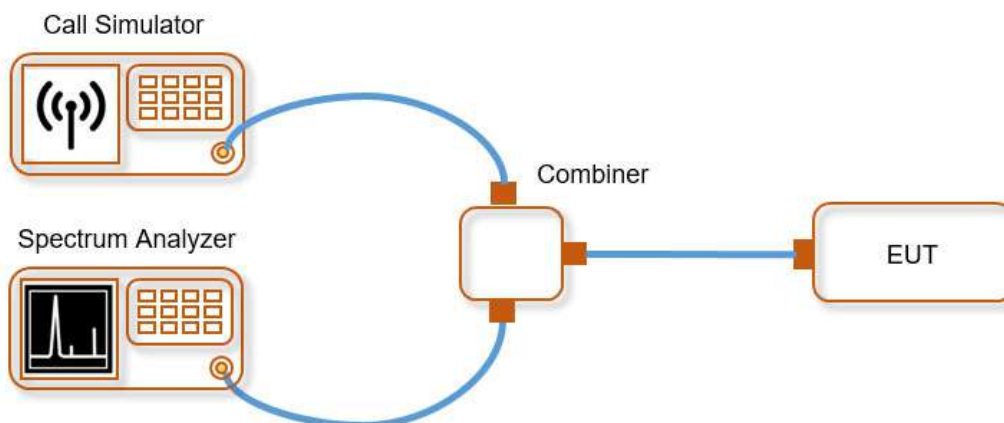
The method of measurement used to test this FHSS device is ANSI C63.10-2013.

- The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
- Span: Wide enough to capture the peaks of two adjacent channels.
- RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- Video (or average) bandwidth (VBW)  $\geq$  RBW.
- Sweep: Auto.
- Detector function: Peak.
- Trace: Max hold.
- Allow the trace to stabilize.
- Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

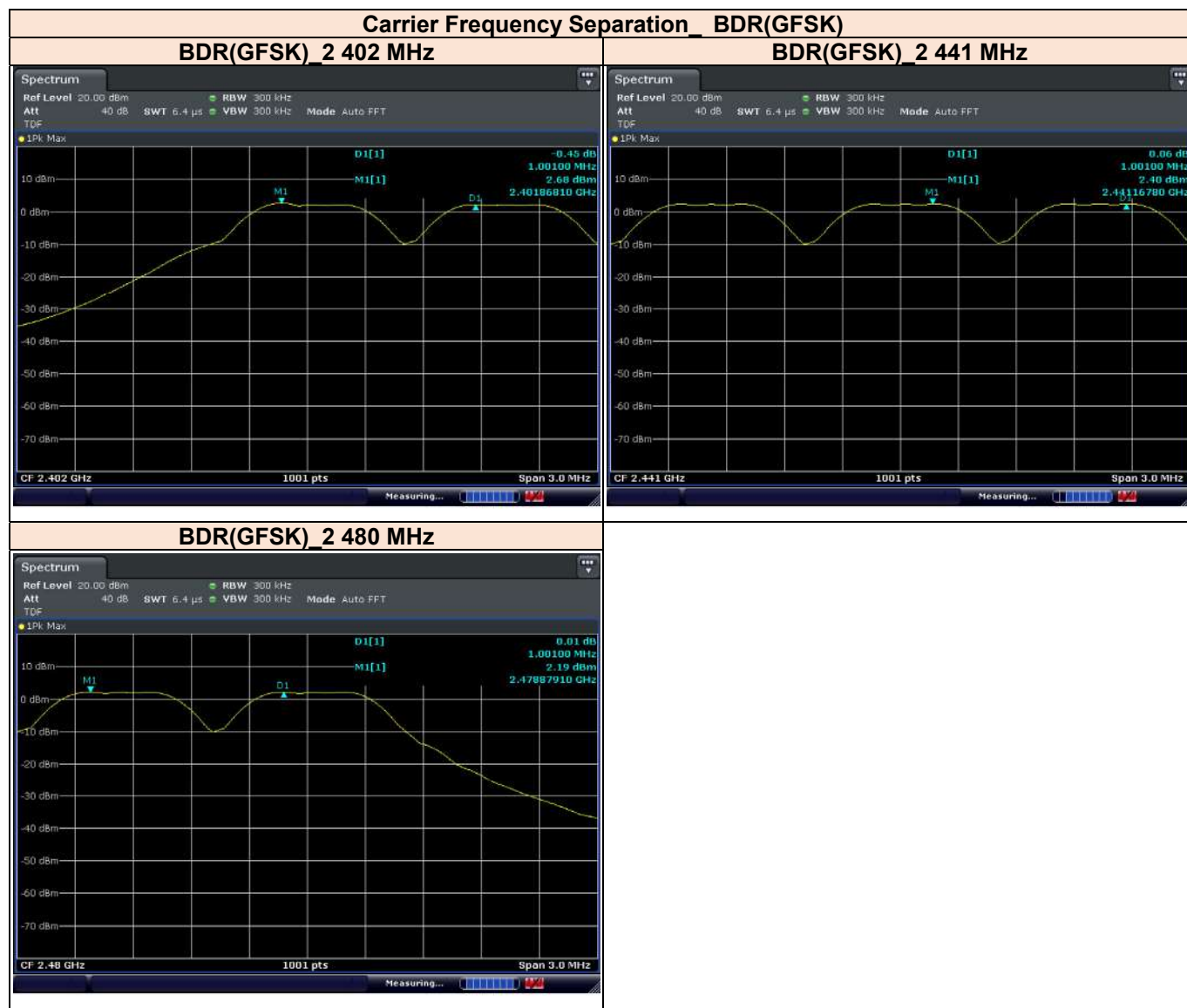
### 3.4.3 Deviation from Test Standard

No deviation.

### 3.4.4 Test Setup



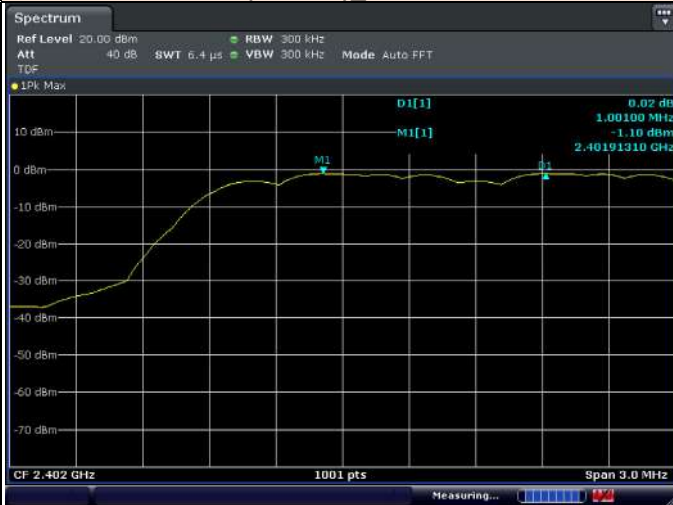
### 3.4.5 Test Result



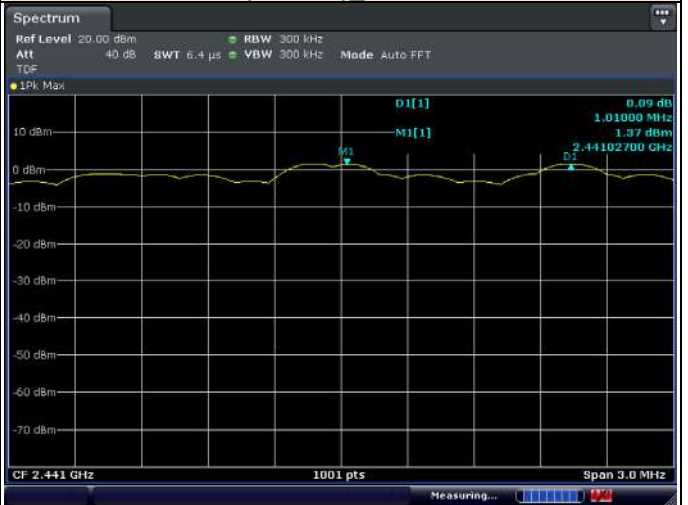


### Carrier Frequency Separation\_ EDR(8DPSK)

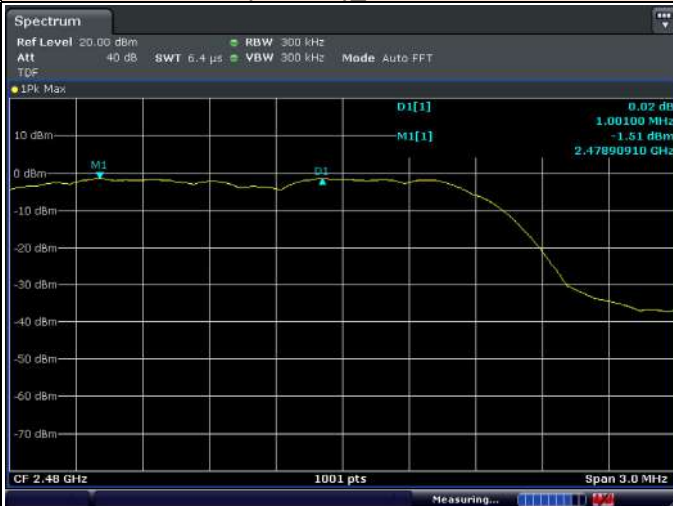
#### EDR(8DPSK)\_2 402 MHz



#### EDR(8DPSK)\_2 441 MHz



#### EDR(8DPSK)\_2 480 MHz



## 3.5 Number of Hopping Channels

### 3.5.1 Regulation

§15.247(a)(1)(iii) : Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

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

### 3.5.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

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

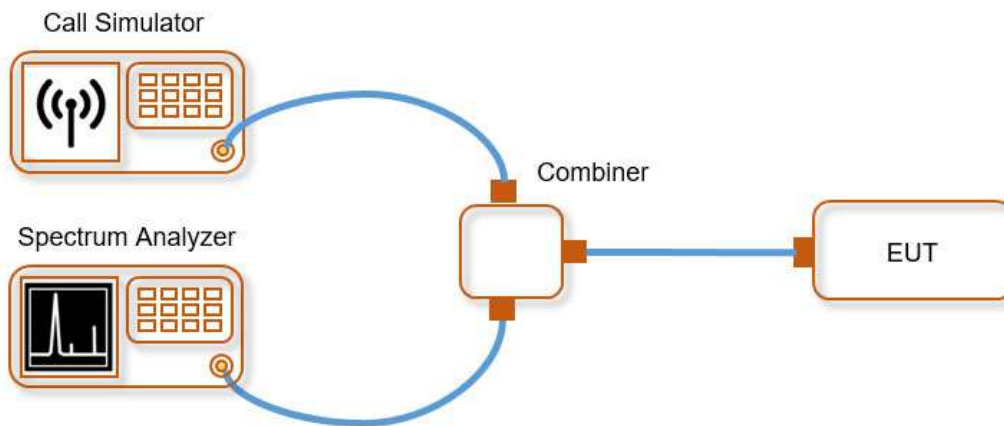
- a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c) VBW  $\geq$  RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

### 3.5.3 Deviation from Test Standard

No deviation.

### 3.5.4 Test Setup

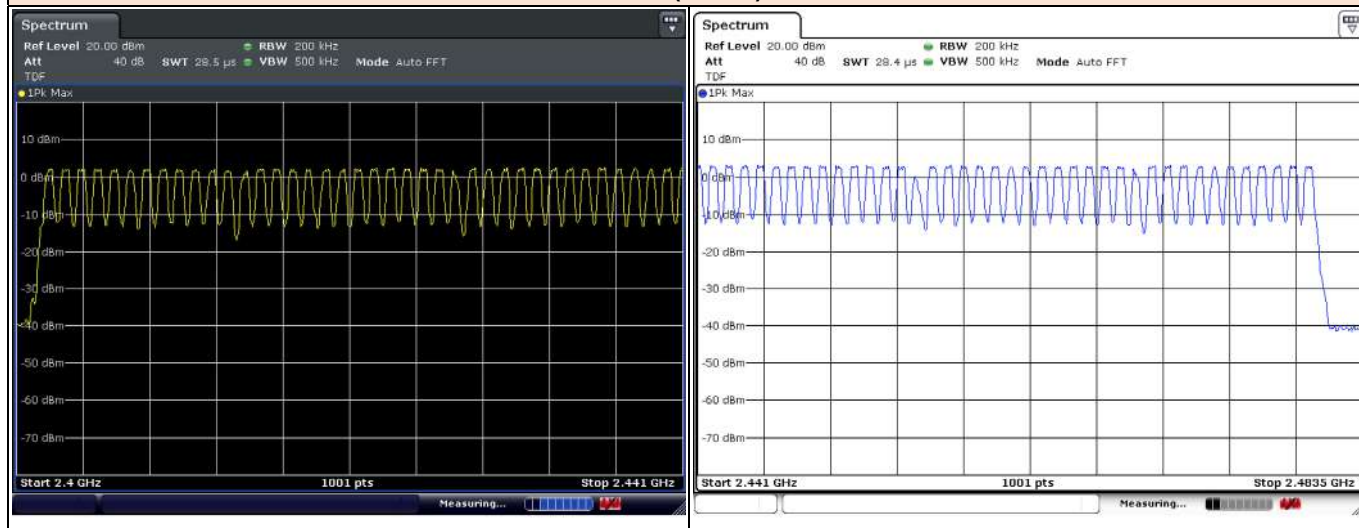


### 3.5.5 Test Result

[Test Plot]

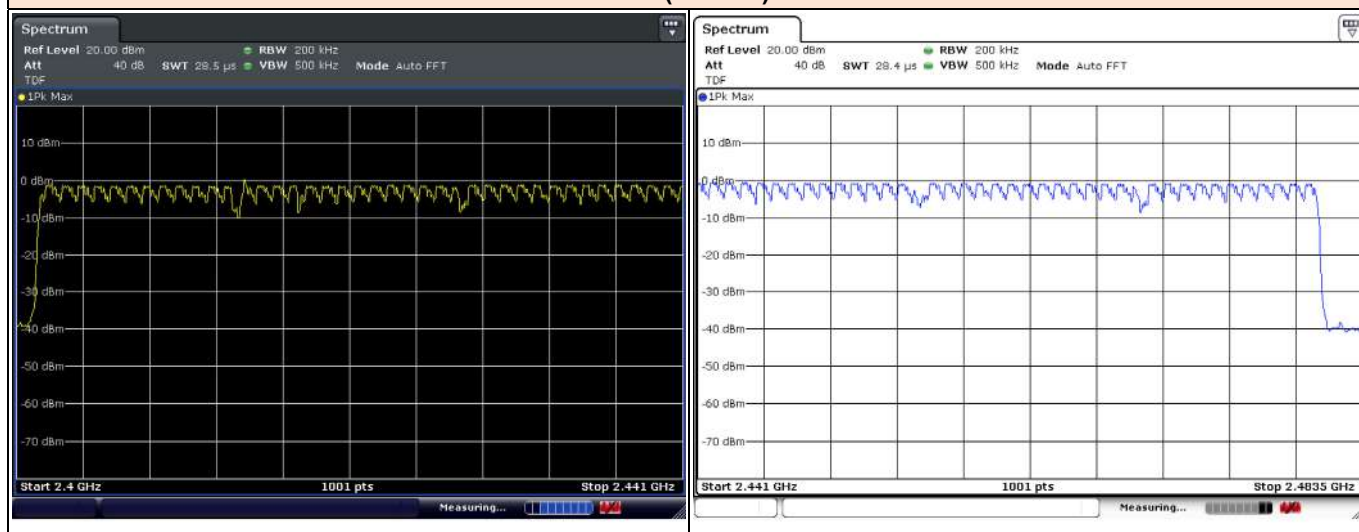
#### Number of Hopping Channels\_ BDR(GFSK)

##### BDR(GFSK)



#### Number of Hopping Channels\_ EDR(8DPSK)

##### EDR(8DPSK)



## 3.6 Time of Occupancy (Dwell Time)

### 3.6.1 Regulation

§15.247(a)(1)(iii) : Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 3.6.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

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

- a) Span: Zero span, centered on a hopping channel.
- b) RBW shall be  $\leq$  channel spacing and where possible RBW should be set  $\gg 1 / T$ , where T is the expected dwell time per channel.
- c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- d) Detector function: Peak.
- e) Trace: Clear-write, single sweep

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

$$\begin{aligned} & \text{(Number of hops in the period specified in the requirements)} = \\ & \text{(number of hops on spectrum analyzer)} \times \text{(period specified in the requirements / analyzer sweep time)} \end{aligned}$$

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

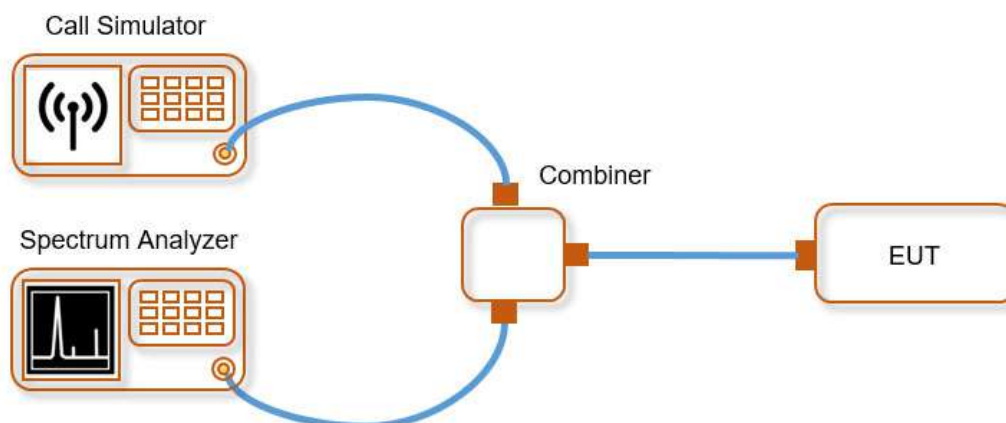
The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.



### 3.6.3 Deviation from Test Standard

No deviation.

### 3.6.4 Test Setup

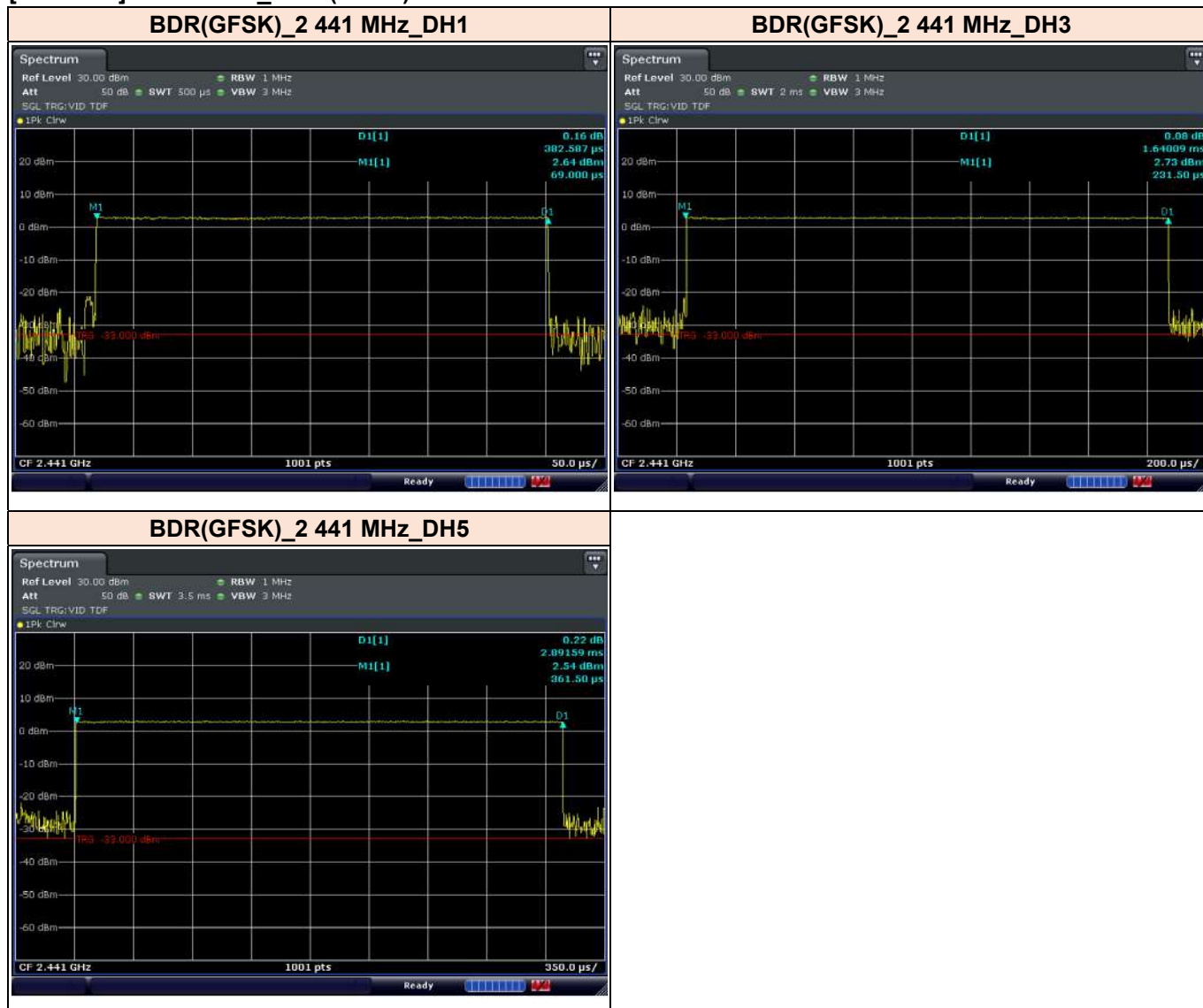


### 3.6.5 Test Result

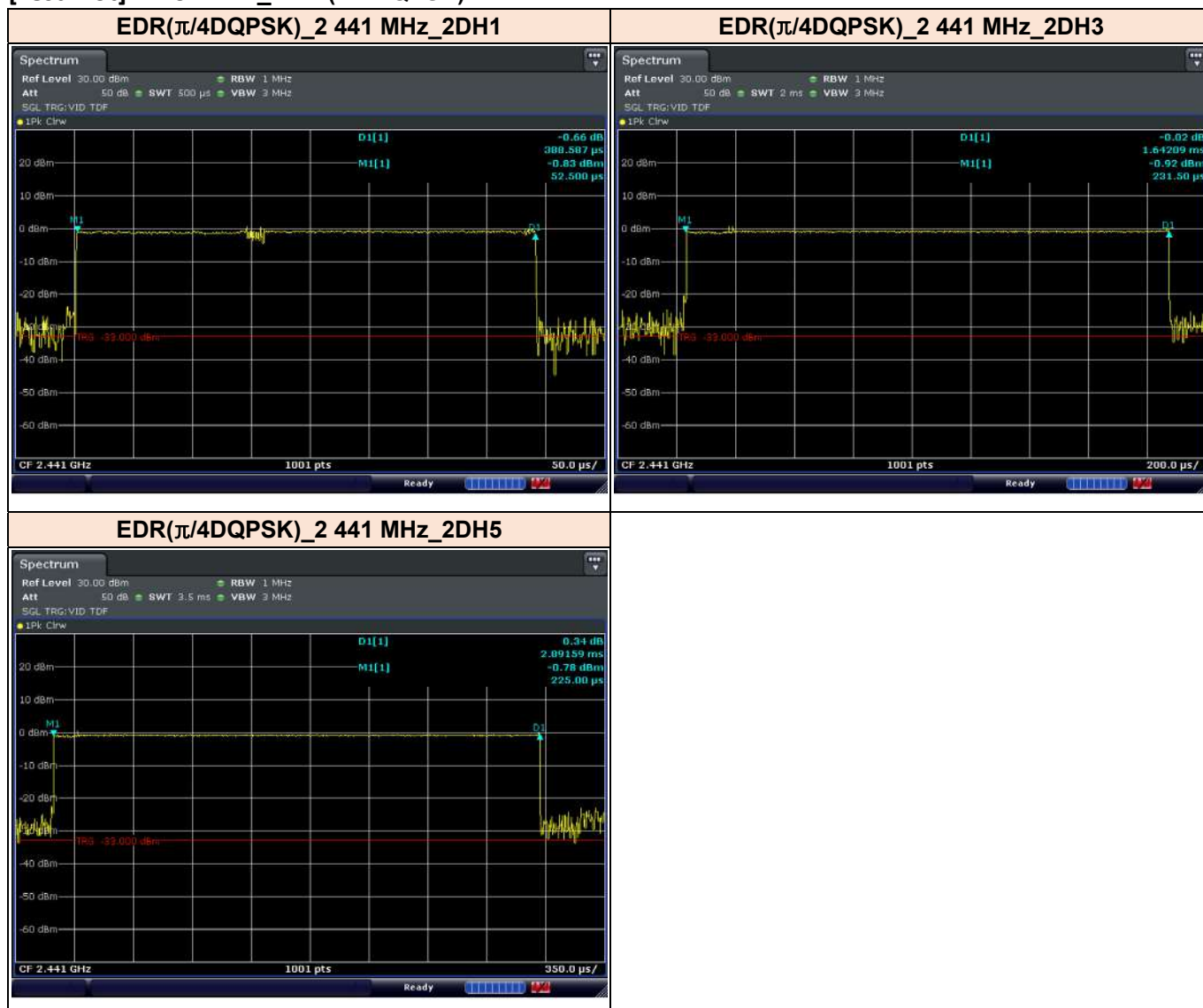
[Test Data]

| Adaptive Mode | Test Mode            | Packet Type | Pulse Width [msec] | Hopping Rate [Hop/Sec] | Number of Channels | Results [sec] | Limit [sec] | Margin [sec] |
|---------------|----------------------|-------------|--------------------|------------------------|--------------------|---------------|-------------|--------------|
| Normal        | BDR (GFSK)           | DH1         | 0.383              | 800.00                 | 79                 | 0.122         | 0.400       | 0.278        |
|               |                      | DH3         | 1.640              | 400.00                 | 79                 | 0.262         | 0.400       | 0.138        |
|               |                      | DH5         | 2.892              | 266.67                 | 79                 | 0.308         | 0.400       | 0.092        |
|               | EDR ( $\pi/4$ DQPSK) | 2-DH1       | 0.389              | 800.00                 | 79                 | 0.124         | 0.400       | 0.276        |
|               |                      | 2-DH3       | 1.642              | 400.00                 | 79                 | 0.263         | 0.400       | 0.137        |
|               |                      | 2-DH5       | 2.892              | 266.67                 | 79                 | 0.308         | 0.400       | 0.092        |
|               | EDR (8DPSK)          | 3-DH1       | 0.388              | 800.00                 | 79                 | 0.124         | 0.400       | 0.276        |
|               |                      | 3-DH3       | 1.642              | 400.00                 | 79                 | 0.263         | 0.400       | 0.137        |
|               |                      | 3-DH5       | 2.895              | 266.67                 | 79                 | 0.309         | 0.400       | 0.091        |
| AFH           | BDR (GFSK)           | DH1         | 0.383              | 400.00                 | 20                 | 0.061         | 0.400       | 0.339        |
|               |                      | DH3         | 1.641              | 200.00                 | 20                 | 0.131         | 0.400       | 0.269        |
|               |                      | DH5         | 2.893              | 133.33                 | 20                 | 0.154         | 0.400       | 0.246        |
|               | EDR ( $\pi/4$ DQPSK) | 2-DH1       | 0.388              | 400.00                 | 20                 | 0.062         | 0.400       | 0.338        |
|               |                      | 2-DH3       | 1.641              | 200.00                 | 20                 | 0.131         | 0.400       | 0.269        |
|               |                      | 2-DH5       | 2.886              | 133.33                 | 20                 | 0.154         | 0.400       | 0.246        |
|               | EDR (8DPSK)          | 3-DH1       | 0.388              | 400.00                 | 20                 | 0.062         | 0.400       | 0.338        |
|               |                      | 3-DH3       | 1.643              | 200.00                 | 20                 | 0.131         | 0.400       | 0.269        |
|               |                      | 3-DH5       | 2.891              | 133.33                 | 20                 | 0.154         | 0.400       | 0.246        |

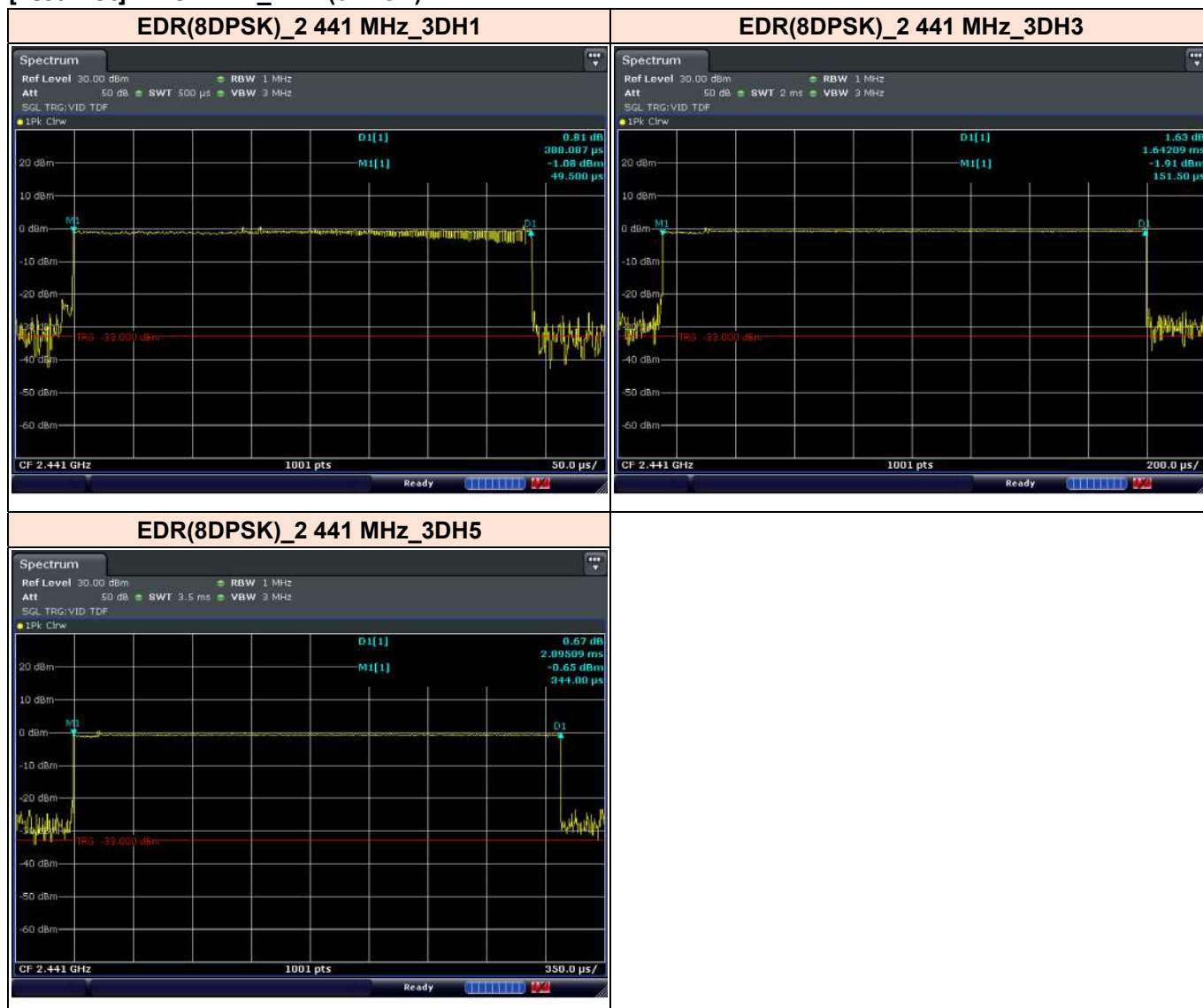
[Test Plot] – Non AFH\_ BDR(GFSK)



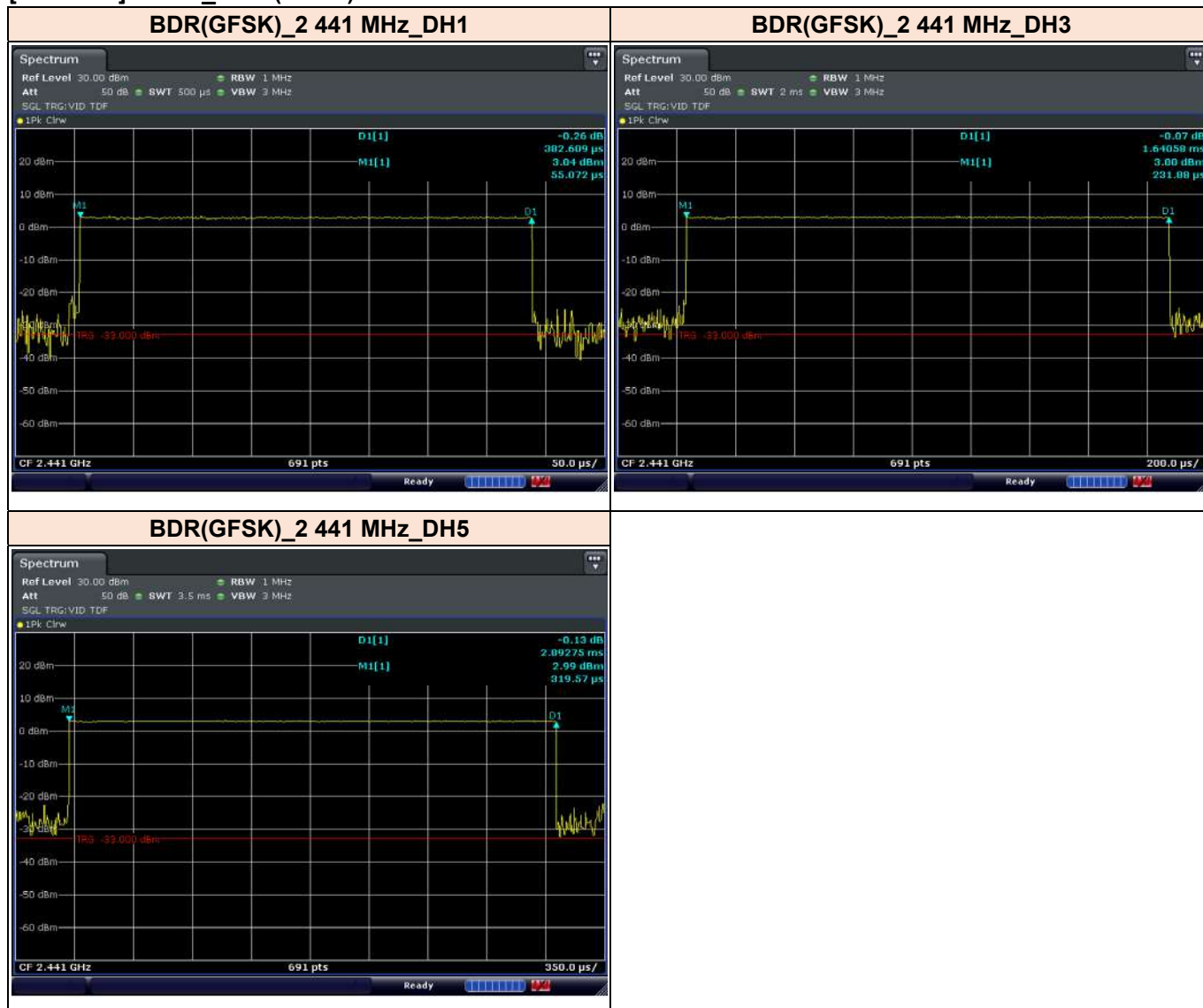
[Test Plot] – Non AFH\_ EDR( $\pi/4$ DQPSK)



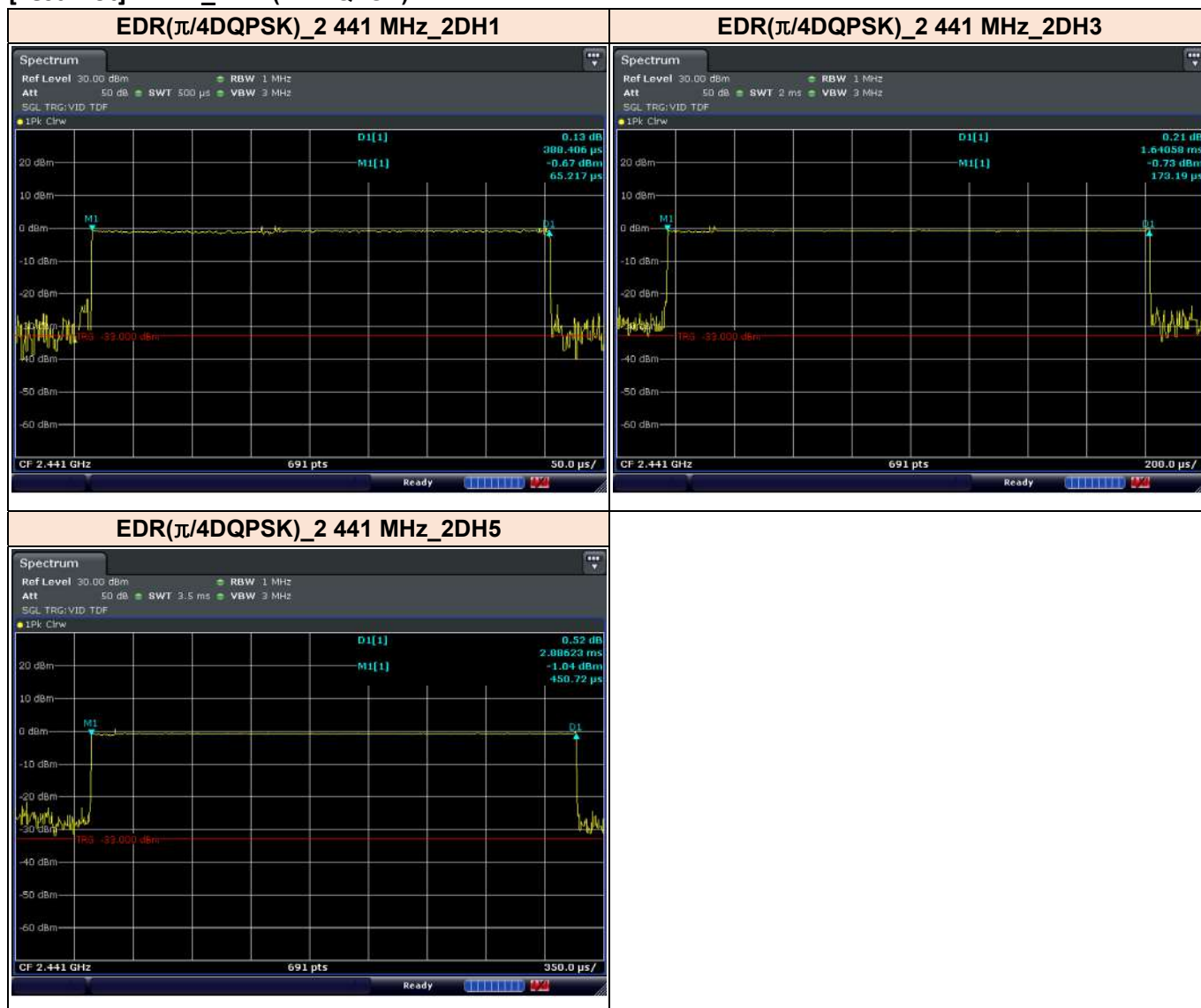
[Test Plot] – Non AFH\_ EDR(8DPSK)



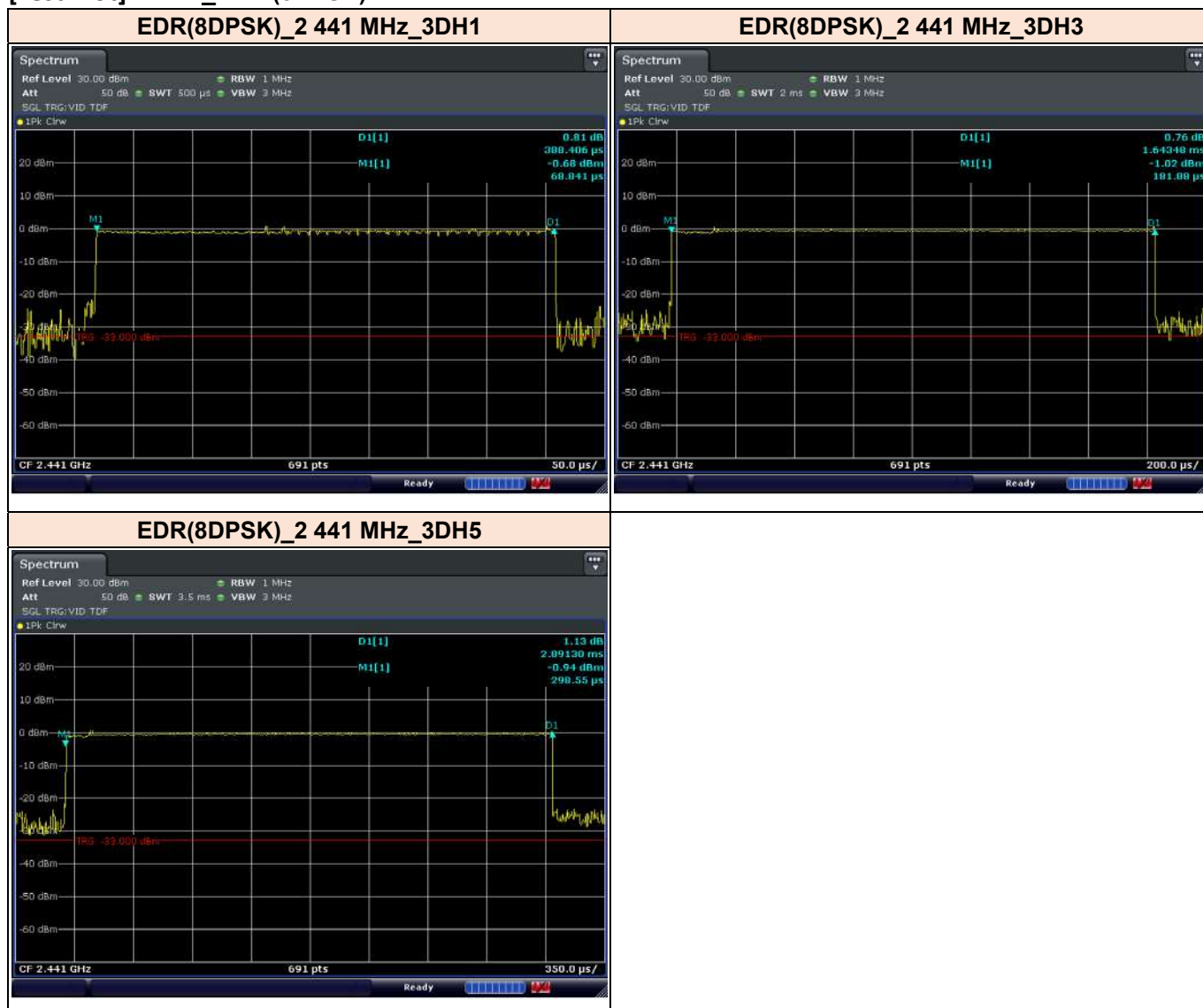
[Test Plot] – AFH\_ BDR(GFSK)



[Test Plot] – AFH\_ EDR( $\pi/4$ DQPSK)



[Test Plot] – AFH\_ EDR(8DPSK)





## 3.7 Spurious Emission, Band edge and Restricted Bands

### 3.7.1 Regulation

§15.247(d) : In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§15.209(a) : Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field strength (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                             |

\*\*Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.



§15.205(a) : Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                      | MHz                 | MHz           | GHz              |
|--------------------------|---------------------|---------------|------------------|
| 0.090-0.110              | 16.42-16.423        | 399.9-410     | 4.5-5.15         |
| <sup>1</sup> 0.495-0.505 | 16.69475-16.69525   | 608-614       | 5.35-5.46        |
| 2.1735-2.1905            | 16.80425-16.80475   | 960-1240      | 7.25-7.75        |
| 4.125-4.128              | 25.5-25.67          | 1300-1427     | 8.025-8.5        |
| 4.17725-4.17775          | 37.5-38.25          | 1435-1626.5   | 9.0-9.2          |
| 4.20725-4.20775          | 73-74.6             | 1645.5-1646.5 | 9.3-9.5          |
| 6.215-6.218              | 74.8-75.2           | 1660-1710     | 10.6-12.7        |
| 6.26775-6.26825          | 108-121.94          | 1718.8-1722.2 | 13.25-13.4       |
| 6.31175-6.31225          | 123-138             | 2200-2300     | 14.47-14.5       |
| 8.291-8.294              | 149.9-150.05        | 2310-2390     | 15.35-16.2       |
| 8.362-8.366              | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4        |
| 8.37625-8.38675          | 156.7-156.9         | 2690-2900     | 22.01-23.12      |
| 8.41425-8.41475          | 162.0125-167.17     | 3260-3267     | 23.6-24.0        |
| 12.29-12.293             | 167.72-173.2        | 3332-3339     | 31.2-31.8        |
| 12.51975-12.52025        | 240-285             | 3345.8-3358   | 36.43-36.5       |
| 12.57675-12.57725        | 322-335.4           | 3600-4400     | ( <sup>2</sup> ) |
| 13.36-13.41              |                     |               |                  |

<sup>1</sup>Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup>Above 38.6

§15.205 (b) : Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

### 3.7.2 Test Procedure

#### Band-edge Compliance for RF Conducted Emissions

These procedures are applicable for determining compliance at authorized-band band-edges where the requirements are expressed as a value relative to the in-band signal level. Procedures for determining compliance with field strength limits at or close to the band-edges are given in 6.10.6 (see also Table A.2).

Band-edge tests are typically performed as a conducted test but may be performed as radiated measurements on a test site meeting the specifications in 5.2, at the measurement distances specified in 5.3. The instrumentation shall meet the requirements in 4.1.1 using the bandwidths and detectors specified in 4.1.4.2.

When performing radiated measurements, the measurement antenna(s) shall meet the specifications in 4.3. The EUT shall be connected to an antenna and operated at the highest power settings following procedures in 6.3.

For other than frequency-hopping devices, this test sequence shall be performed once. For devices that support frequency hopping, this test sequence shall be performed twice: once with the hopping function turned OFF and then repeated with the hopping function turned ON. The purpose of the test with the hopping function turned on is to confirm that the RF power remains OFF while the device is changing frequencies, and that the oscillator stabilizes at the new frequency before RF power is turned back ON. Overshoot of any oscillator, including phase-lock-loop stabilized oscillators, can cause the device to be temporarily tuned to frequencies outside the authorized band, and it is important that no transmissions occur during such temporary periods. Particular attention to the hopping sequence requirements specified below is needed in the case of adaptive frequency-hopping devices:

- a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
- b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
- c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normal mode of operation” as specified in 6.10.3.
- d) If using the radiated method, then use the applicable procedure(s) of 6.4, 6.5, or 6.6, and orient the EUT and measurement antenna positions to produce the highest emission level.
- e) Perform the test as follows:
  - 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
  - 2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (OBW/RBW)]$  below the reference level. Specific guidance is given in 4.1.5.2.
  - 3) Attenuation: Auto (at least 10 dB preferred).
  - 4) Sweep time: Coupled.
  - 5) Resolution bandwidth: 100 kHz.
  - 6) Video bandwidth: 300 kHz.
  - 7) Detector: Peak.
  - 8) Trace: Max hold.
- f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.

- g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- h) Repeat step c) through step e) for every applicable modulation.
- i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
- j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

### **Spurious RF Conducted Emissions**

Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the maximum transmit powers.

Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

### **Spurious Radiated Emissions**

1. The preliminary radiated measurement were performed to determine the frequency producing the maximum emissions in an semi-anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the Bi-Log antenna, and from 1000 MHz to 26500 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 x 4 meter in an semi-anechoic chamber. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector fuction with specified bandwidth.
6. The 0.8 m height is for below 1 GHz testing, and 1.5 m is for above 1GHz testing.

#### **- Procedure for unwanted emissions measurements below 1 000 MHz**

The procedure for unwanted emissions measurements below 1 000 MHz is as follows:

- a) Follow the requirements in 12.7.4.
- b) Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

#### **- Procedure for peak unwanted emissions measurements above 1 000 MHz**

The procedure for peak unwanted emissions measurements above 1 000 MHz is as follows:

- a) Follow the requirements in 12.7.4.
- b) Peak emission levels are measured by setting the instrument as follows:
  - 1) RBW = 1 MHz.
  - 2) VBW  $\geq$  [3  $\times$  RBW].
  - 3) Detector = peak.
  - 4) Sweep time = auto.
  - 5) Trace mode = max hold.
  - 6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle. For example, at 50 % duty cycle, the measurement time will increase by a factor of two, relative to measurement time for continuous transmission.

#### **- Procedure for average unwanted emissions measurements above 1 000 MHz**

Option 1)

Method VB-A is averaging using reduced video bandwidth. The procedure for this method is as follows:

- a) RBW = 1 MHz.
- b) Video bandwidth:
  - 1) If the EUT is configured to transmit with  $D \geq 98 \%$ , then set  $VBW \leq RBW / 100$  (i.e., 10 kHz), but not less than 10 Hz.
  - 2) If the EUT D is  $< 98\%$ , then set  $VBW \geq 1 / T$ , where T is defined in item a1) of 12.2.

c) Video bandwidth mode or display mode:

- 1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).
- 2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to “voltage” regardless of the display mode.

d) Detector = peak.

e) Sweep time = auto.

f) Trace mode = max hold.

g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 % duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of  $1/x$ , where D is the duty cycle. For example, use at least 200 traces if the duty cycle is 25 %. (If a specific emission is demonstrated to be continuous—i.e., 100 % duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

Option 2)

From the peak value of the emission :

The measured peak value in dB $\mu$ V/m is corrected by  $20\log(\text{maximum dwell time in 100 ms} / 100)$

#### **- Sample Calculation**

- Field Strength Level [dB $\mu$ V/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m] + Duty Cycle Correction [dB]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable loss [dB]
- Margin [dB] = Field Strength Level [dB $\mu$ V/m] – Limit [dB $\mu$ V/m]

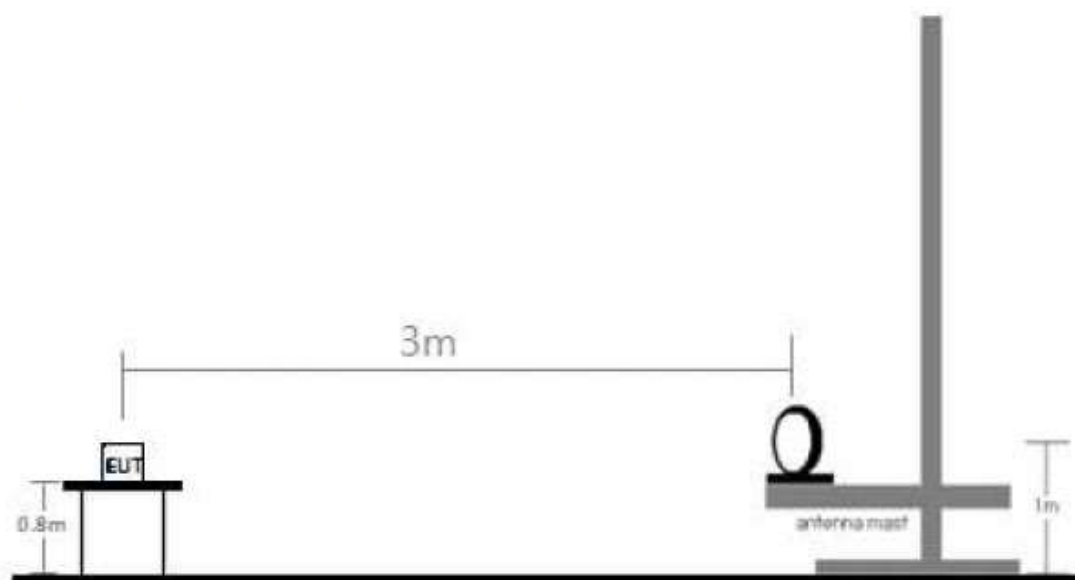
#### **- Duty Cycle Correction Factor Calculation - worst**

- Channel hop rate = 800 hops/second
- Adjusted channel hop rate for DH5 mode = 133.33 hops/second
- Time per channel hop =  $1 / 133.33 \text{ hops/second} = 7.50 \text{ ms}$
- Time to cycle through all channels =  $7.50 \times 20 \text{ channels} = 150 \text{ ms}$
- Number of times transmitter hits on one channel =  $100 \text{ ms} / 150 \text{ ms} = 1 \text{ time(s)}$
- Worst case dwell time = 7.5 ms
- Duty cycle correction factor =  $20\log_{10}(7.5 \text{ ms} / 100 \text{ ms}) = -22.5 \text{ dB}$

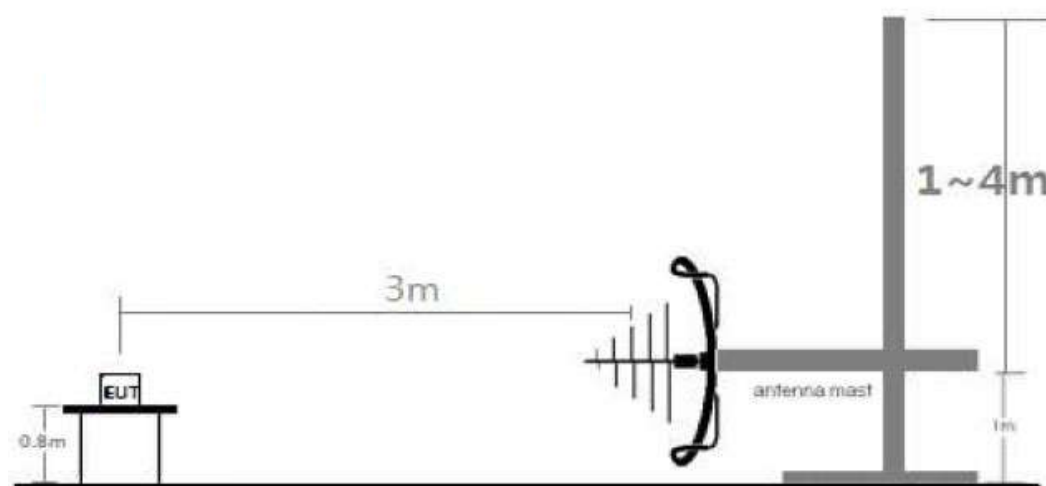
### 3.7.3 Deviation from Test Standard

No deviation.

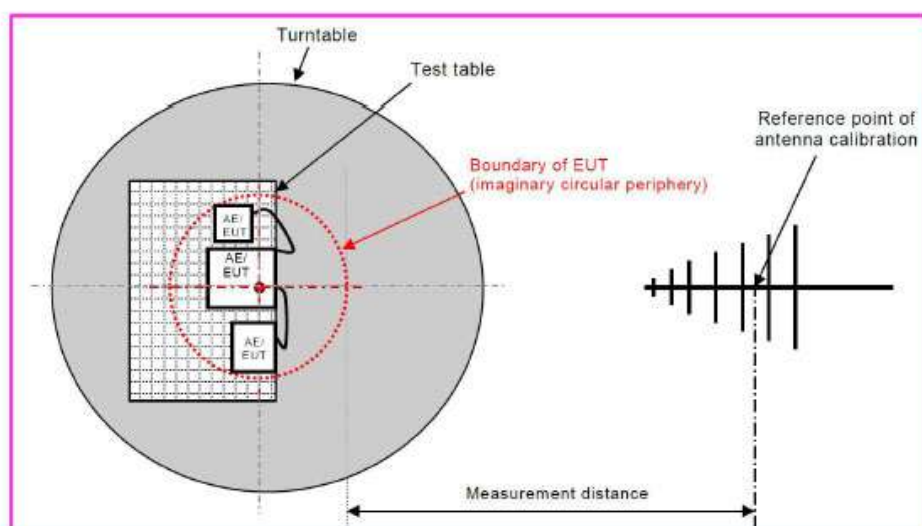
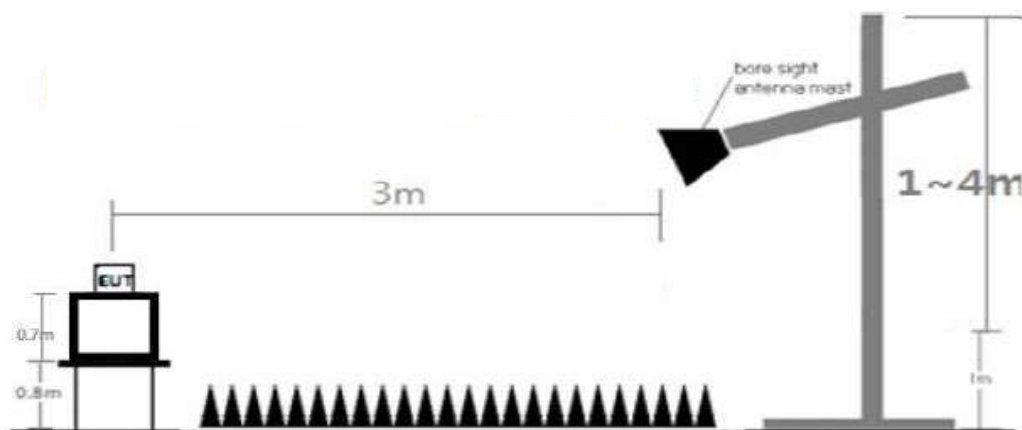
### 3.7.4 Test Setup



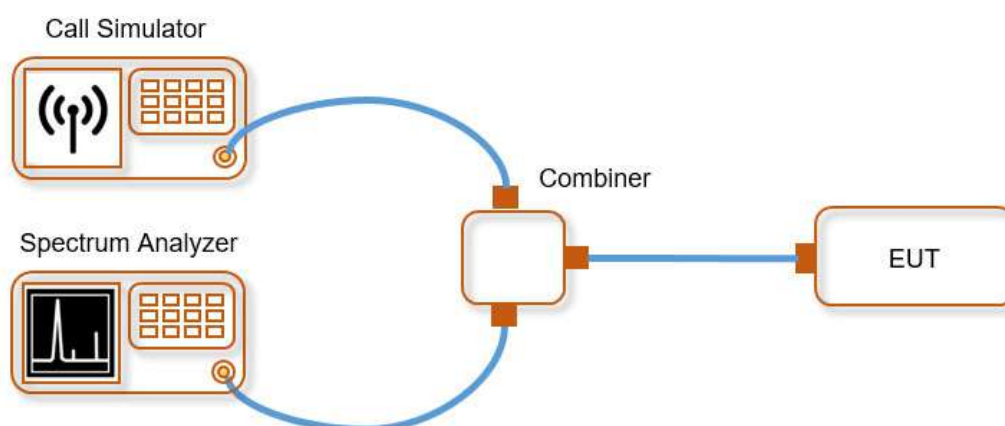
[Radiated Emission Test Setup Below 30 MHz]



[Radiated Emission Test Setup Below 1 GHz]



**[Radiated Emission Test Setup Above 1 GHz]**

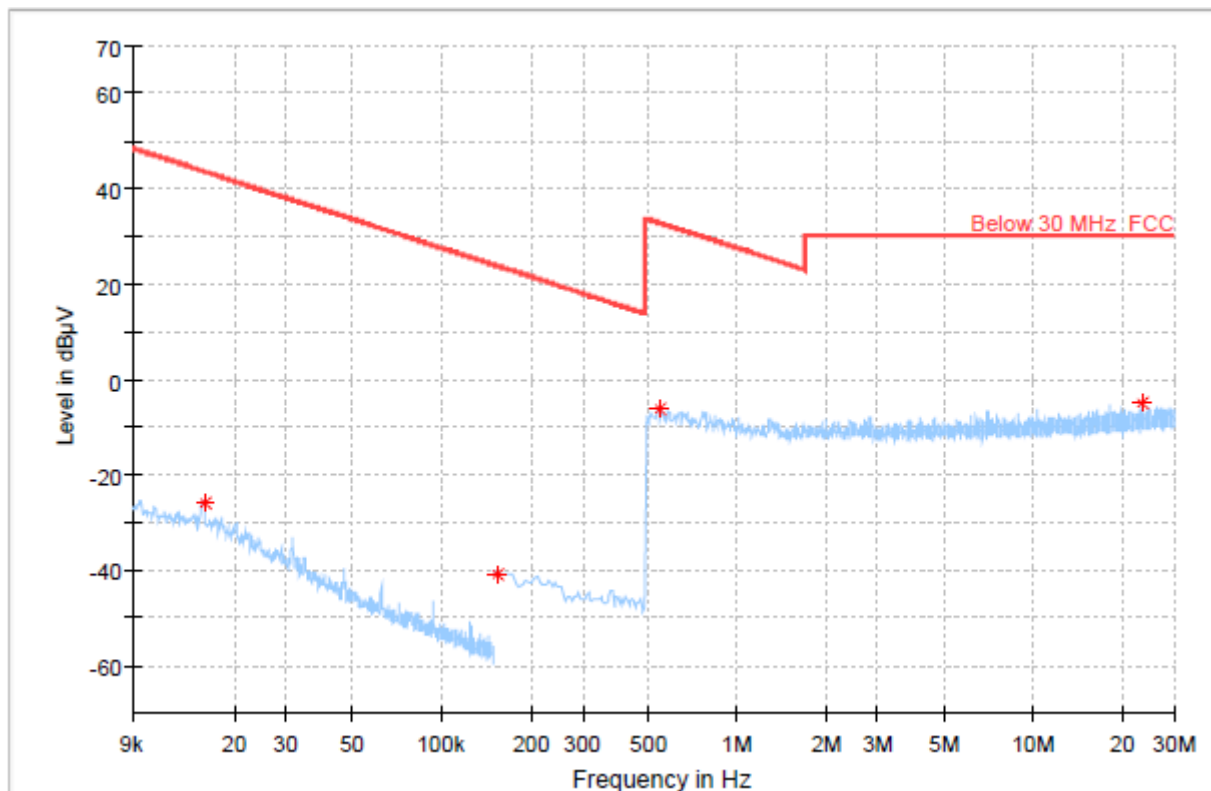


**[Conducted Spurious Emission]**

### 3.7.5 Test Result of Radiated Spurious Emission

#### 3.7.5.1 Radiated Emissions (Below 30 MHz)

Worst case - RSE(Below 30 MHz)\_BDR\_GFSK\_2 441 MHz



#### FCC

| Frequency [MHz] | QuasiPeak Reading Value [dBμV] | QuasiPeak [dBμV/m] | Distance Correction Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Pol             | Azimuth [deg] | Correction Factor [dB/m] |
|-----------------|--------------------------------|--------------------|---------------------------------|----------------|-------------|-------------|-----------------|---------------|--------------------------|
| 0.02            | 33.76                          | -25.74             | -80.00                          | 43.62          | 69.36       | 100.00      | Ground parallel | 293.00        | -59.50                   |
| 0.54            | 12.97                          | -6.33              | -40.00                          | 32.93          | 39.26       | 100.00      | Ground parallel | 0.00          | -19.30                   |
| 23.39           | 11.77                          | -5.03              | -40.00                          | 30.00          | 35.03       | 100.00      | Ground parallel | 135.00        | -16.80                   |

#### IC

| Frequency [MHz] | QuasiPeak Reading Value [dBμA] | QuasiPeak [dBμA/m] | Distance Correction Factor [dB] | Limit [dBμA/m] | Margin [dB] | Height [cm] | Pol             | Azimuth [deg] | Correction Factor [dB/m] |
|-----------------|--------------------------------|--------------------|---------------------------------|----------------|-------------|-------------|-----------------|---------------|--------------------------|
| 0.02            | -17.74                         | -77.24             | -80.00                          | -7.88          | 69.36       | 100.00      | Ground Parallel | 293.00        | -59.50                   |
| 0.54            | -38.53                         | -57.83             | -40.00                          | -18.57         | 39.26       | 100.00      | Ground Parallel | 0.00          | -19.30                   |
| 23.39           | -39.73                         | -56.53             | -40.00                          | -21.50         | 35.03       | 100.00      | Ground Parallel | 135.00        | -16.80                   |

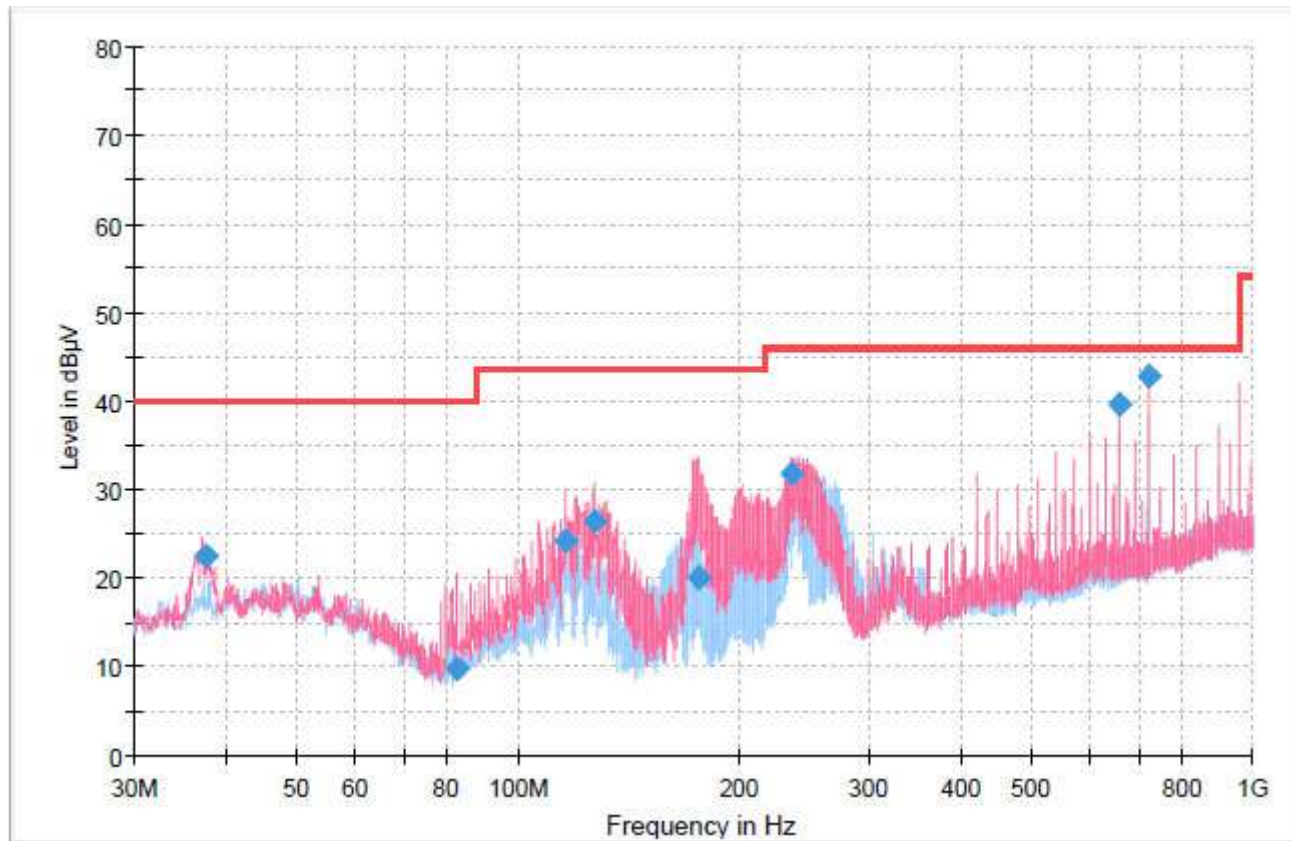
#### Remarks

1. Quasi Peak(dBuV/m) = QP Reading Value(dBuV/m) + Correction Factor(dB) + Distance Factor(dB)
2. Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = (Quasi Peak) Limit (dBμV/m) – (Quasi Peak) Result (dBμV/m)
4. dBuA/m = dBuV/m – 51.5 dB
5. We tested three kind of Antenna Pol (Parallel, Perpendicular, Ground parallel) and reported worst case antenna Pol.



### 3.7.5.2 Radiated Emissions (Below 1 GHz)

Worst case - RSE(Below 1 GHz)\_BDR\_GFSK\_2 441 MHz



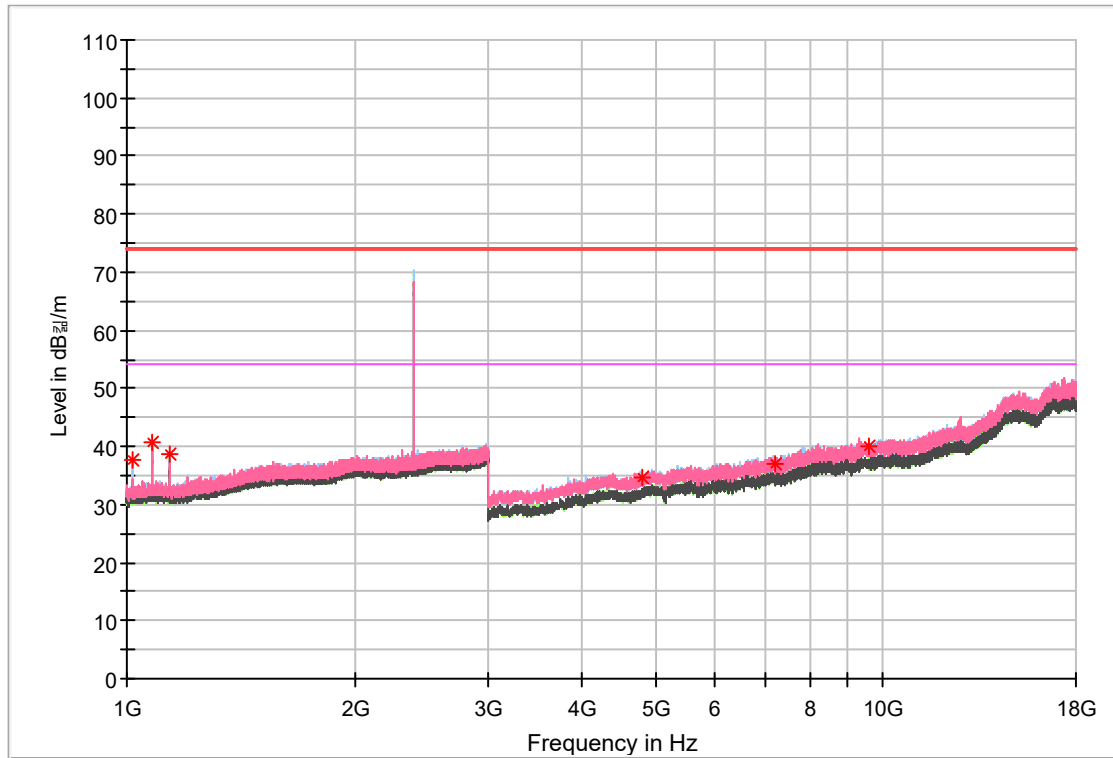
| Frequency [MHz] | Quasi Reading Value [dBμV] | Quasi Peak [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Pol | Azimuth [deg] | Correction Factor [dB/m] |
|-----------------|----------------------------|---------------------|----------------|-------------|-------------|-----|---------------|--------------------------|
| 37.75           | 42.77                      | 22.57               | 40.00          | 17.43       | 107         | V   | 358           | -20.20                   |
| 82.79           | 36.03                      | 9.83                | 40.00          | 30.17       | 140         | V   | 358           | -26.20                   |
| 127.50          | 51.44                      | 26.44               | 43.50          | 17.06       | 116         | V   | 172           | -25.00                   |
| 176.36          | 44.63                      | 20.03               | 43.50          | 23.47       | 113         | V   | 61            | -24.60                   |
| 235.67          | 53.19                      | 31.89               | 46.00          | 14.11       | 100         | V   | 297           | -21.30                   |
| 720.01          | 54.76                      | 42.76               | 46.00          | 3.24        | 136         | V   | 133           | -12.00                   |

#### Remarks

1. Quasi Peak(dBμV/m) = Quasi Peak Reading Value(dBμV/m) + Correction Factor(dB)
2. Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = (Quasi Peak) Limit (dBμV/m) – (Quasi Peak) Result (dBμV/m)

### 3.7.5.3 Radiated Emissions (Above 1 GHz)

RSE BDR\_GFSK\_2 402 MHz

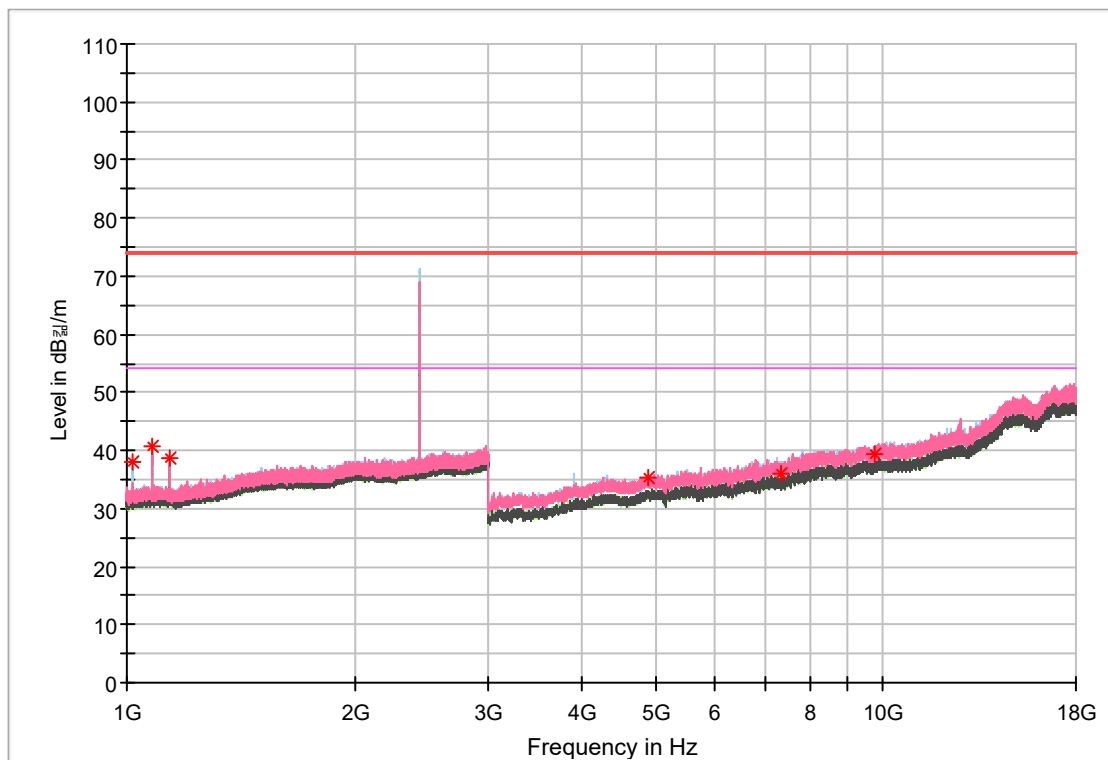


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 4 804.22        | 31.89                     | 34.69                | ---                      | ---                 | ---       | 100         | V         | 0             | 2.80                     | 39.31            | 74.00               | ---             | ---                |
| 7 206.09        | 29.55                     | 36.95                | ---                      | ---                 | ---       | 100         | V         | 3             | 7.40                     | 37.05            | 74.00               | ---             | ---                |
| 9 608.44        | 29.50                     | 40.00                | ---                      | ---                 | ---       | 200         | V         | 18            | 10.50                    | 34.00            | 74.00               | ---             | ---                |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.

### RSE BDR\_GFSK\_2 441 MHz

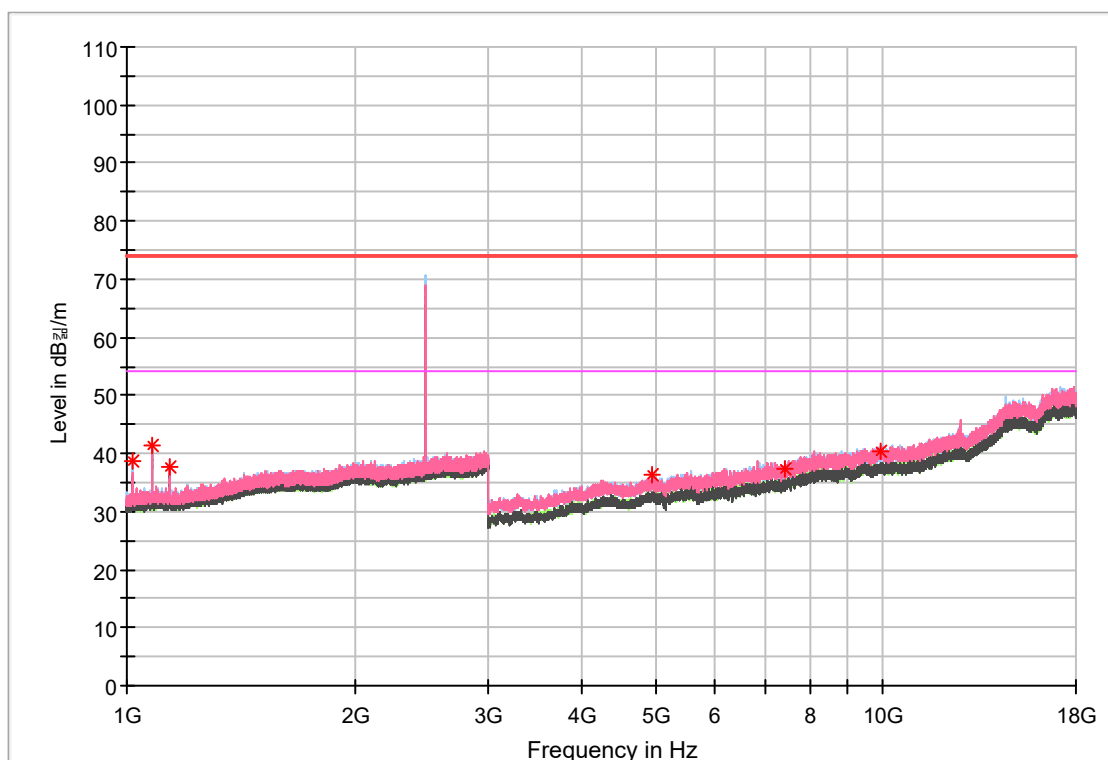


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 4 880.16        | 32.24                     | 35.34                | ---                      | ---                 | ---       | 100         | H         | 358           | 3.10                     | 38.66            | 74.00               | ---             | ---                |
| 7 320.00        | 26.52                     | 36.02                | ---                      | ---                 | ---       | 200         | V         | 160           | 7.50                     | 37.98            | 74.00               | ---             | ---                |
| 9 760.31        | 28.69                     | 39.39                | ---                      | ---                 | ---       | 300         | H         | 67            | 10.70                    | 34.61            | 74.00               | ---             | ---                |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) =  $20 \times \log(\text{worst dwell time}/100 \text{ ms})$
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.

### RSE BDR\_GFSK\_2 480 MHz

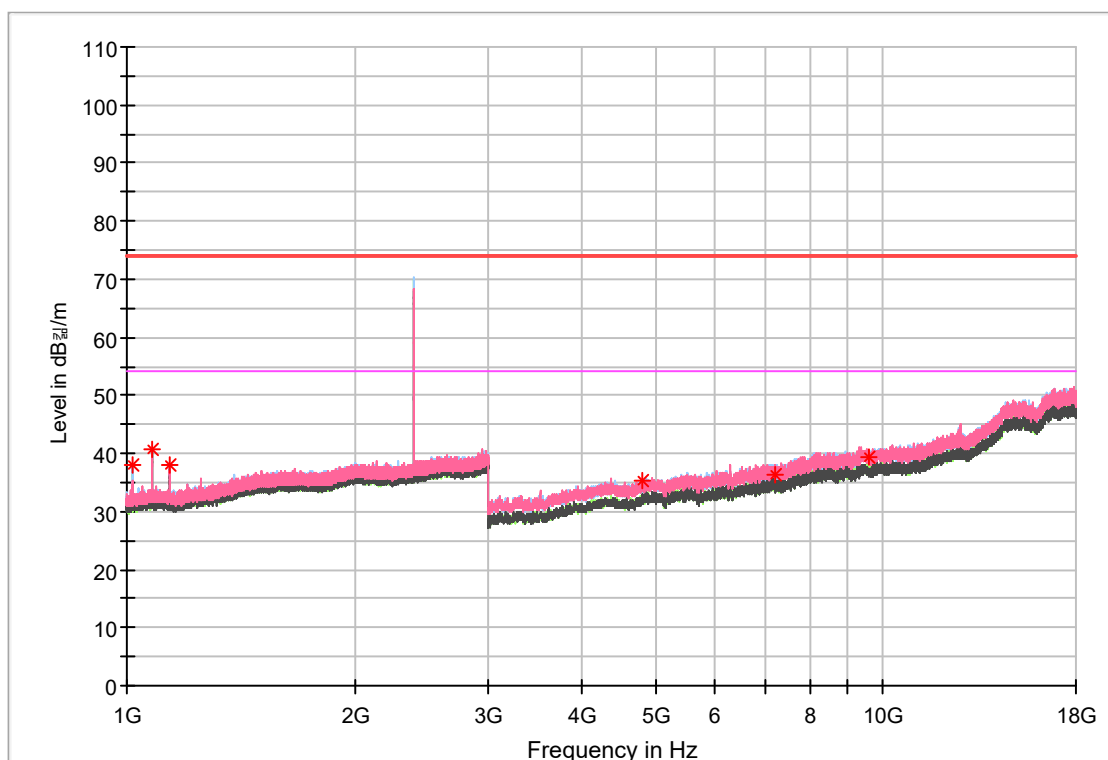


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 4 960.31        | 33.01                     | 36.31                | ---                      | ---                 | ---       | 300         | H         | 358           | 3.30                     | 37.69            | 74.00               | ---             | ---                |
| 7 440.00        | 29.73                     | 37.43                | ---                      | ---                 | ---       | 100         | H         | 111           | 7.70                     | 36.57            | 74.00               | ---             | ---                |
| 9 920.63        | 29.38                     | 40.48                | ---                      | ---                 | ---       | 400         | H         | 209           | 11.10                    | 33.52            | 74.00               | ---             | ---                |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) =  $20 \times \log(\text{worst dwell time}/100 \text{ ms})$
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.

### RSE EDR\_8DPSK\_2 402 MHz

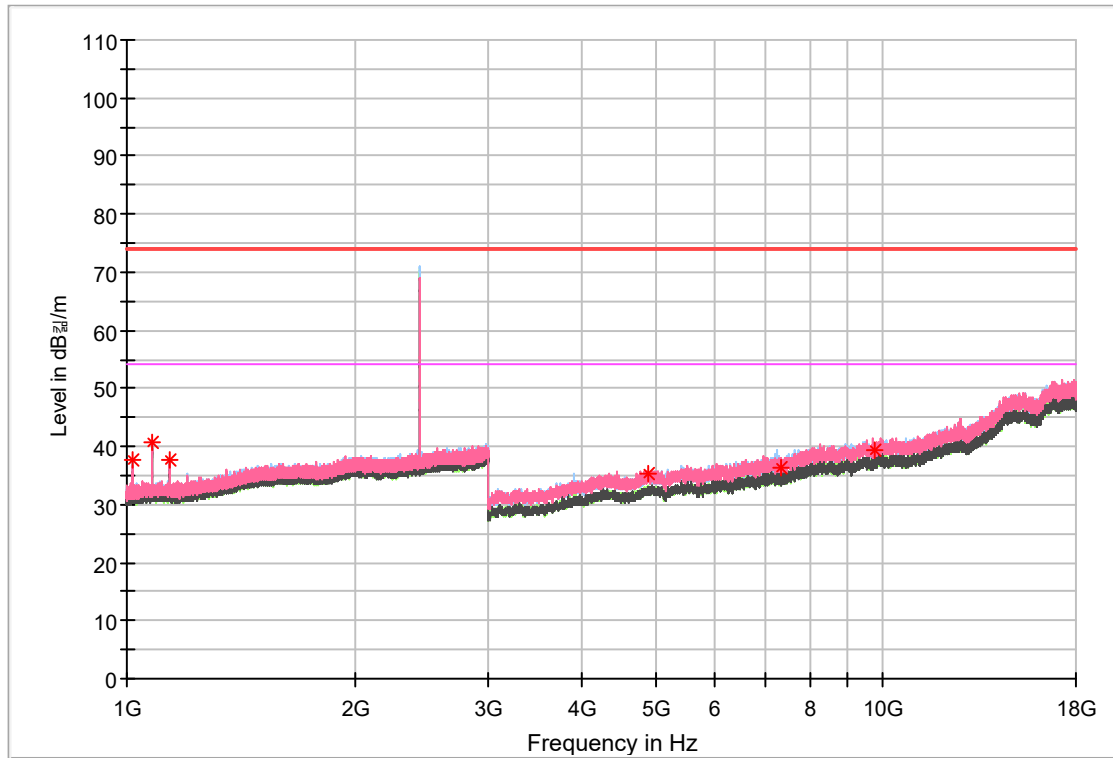


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 4 804.69        | 32.42                     | 35.22                | ---                      | ---                 | ---       | 100         | V         | 109           | 2.80                     | 38.78            | 74.00               | ---             | ---                |
| 7 206.56        | 28.82                     | 36.22                | ---                      | ---                 | ---       | 300         | V         | 338           | 7.40                     | 37.78            | 74.00               | ---             | ---                |
| 9 608.44        | 26.96                     | 39.46                | ---                      | ---                 | ---       | 300         | H         | 0             | 10.50                    | 34.54            | 74.00               | ---             | ---                |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.

### RSE EDR\_8DPSK\_2 441 MHz

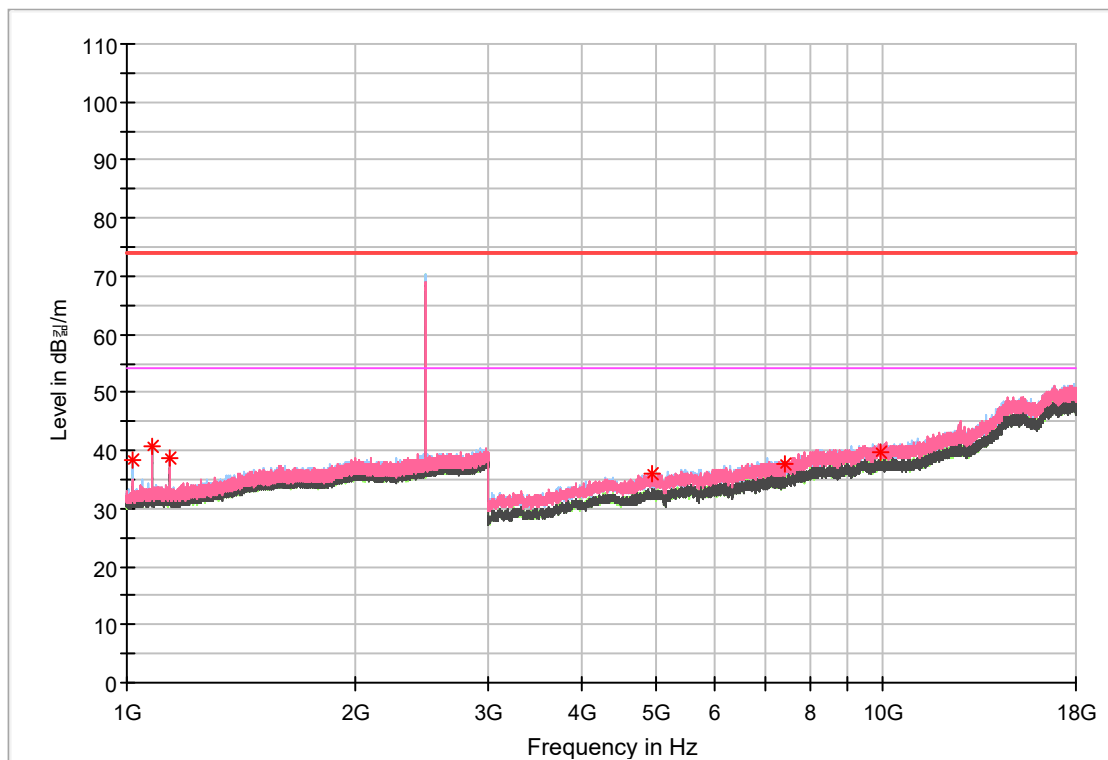


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 4 880.16        | 32.08                     | 35.18                | ---                      | ---                 | ---       | 300         | V         | 1             | 3.10                     | 38.82            | 74.00               | ---             | ---                |
| 7 320.00        | 28.88                     | 36.38                | ---                      | ---                 | ---       | 300         | H         | 32            | 7.50                     | 37.62            | 74.00               | ---             | ---                |
| 9 760.31        | 28.72                     | 39.42                | ---                      | ---                 | ---       | 400         | H         | 2             | 10.70                    | 34.58            | 74.00               | ---             | ---                |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) =  $20 \times \log(\text{worst dwell time}/100 \text{ ms})$
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.

### RSE EDR\_8DPSK\_2 480 MHz



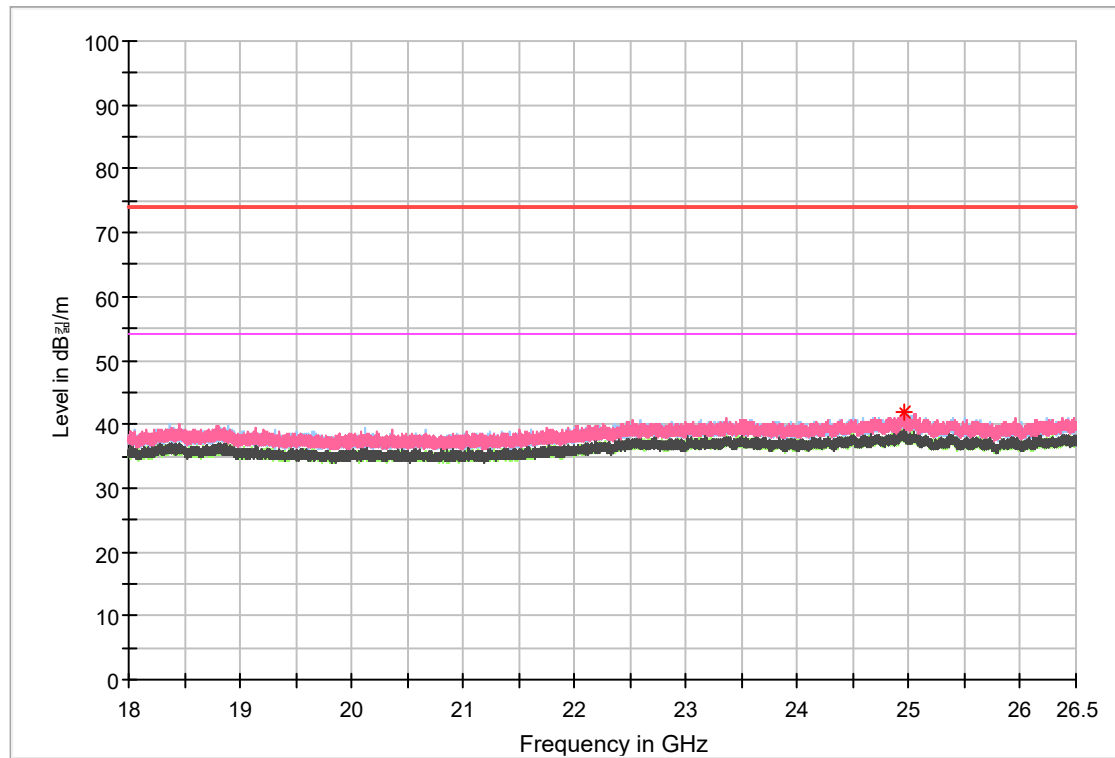
| Frequency [MHz] | Peak Reading Value [dBμV] | Peak Result [dBμV/m] | AVG Reading Value [dBμV] | AVG Result [dBμV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBμV/m] | AVG Margin [dB] | AVG Limit [dBμV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 4 960.31        | 32.80                     | 36.10                | ---                      | ---                 | ---       | 100         | H         | 65            | 3.30                     | 37.90            | 74.00               | ---             | ---                |
| 7 440.00        | 30.04                     | 37.74                | ---                      | ---                 | ---       | 200         | V         | 209           | 7.70                     | 36.26            | 74.00               | ---             | ---                |
| 9 920.16        | 28.61                     | 39.71                | ---                      | ---                 | ---       | 100         | H         | 184           | 11.10                    | 34.29            | 74.00               | ---             | ---                |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.

### 3.7.5.4 Radiated Emissions (Above 18 GHz)

**Worst Case - RSE(Above 18 GHz)\_BDR\_GFSK\_2 441 MHz**



| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 24 953.80       | 39.85                     | 41.75                | -                        | -                   | -         | 300         | V         | 318           | 1.90                     | 32.25            | 74.00               | -               | -                  |

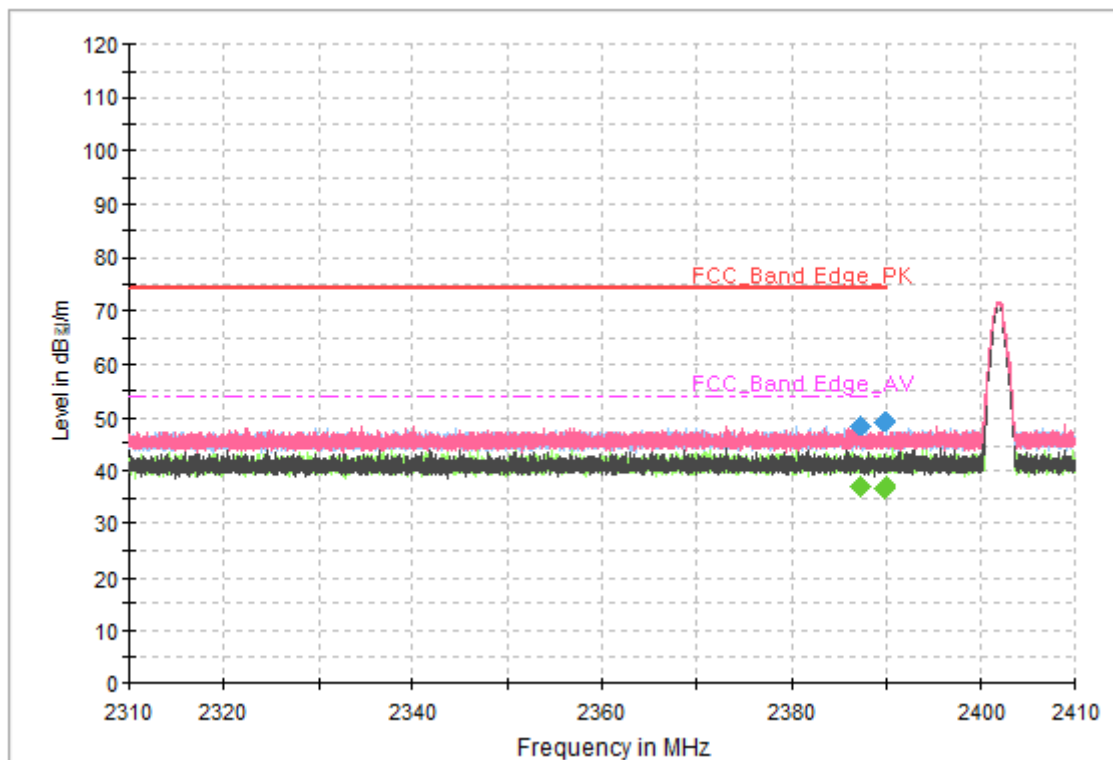
#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) =  $20 \times \log(\text{worst dwell time}/100 \text{ ms})$
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)
6. \* - indicates frequency in Restricted Band.



### 3.7.5.5 Restricted Band Edge Measurements

Band\_Edge\_BDR\_GFSK\_2 402 MHz

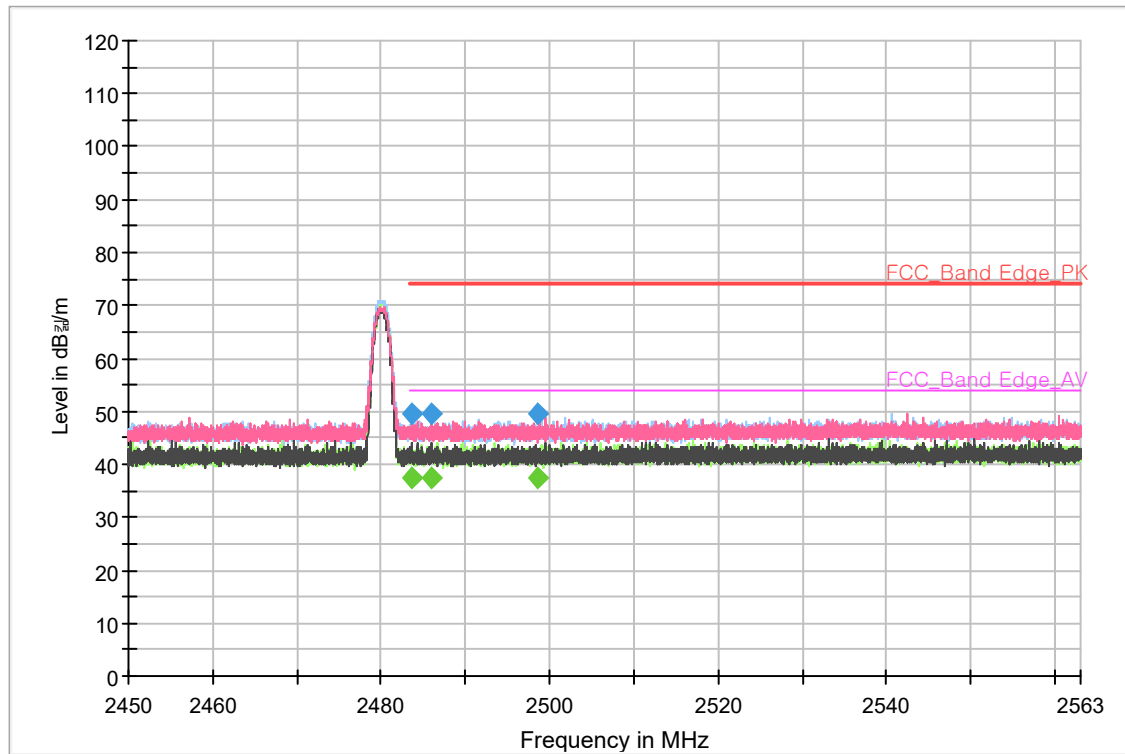


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 2 387.26        | 45.32                     | 48.62                | ---                      | ---                 | ---       | 187         | V         | 335           | 3.30                     | 25.38            | 74.00               | ---             | ---                |
| 2 387.26        | ---                       | ---                  | ---                      | 26.12               | -22.50    | 187         | V         | 335           | 3.30                     | ---              | ---                 | 27.88           | 54.00              |
| 2 389.77        | 45.71                     | 49.01                | ---                      | ---                 | ---       | 350         | V         | 273           | 3.30                     | 24.99            | 74.00               | ---             | ---                |
| 2 389.77        | ---                       | ---                  | ---                      | 26.51               | -22.50    | 350         | V         | 273           | 3.30                     | ---              | ---                 | 27.49           | 54.00              |
| 2 389.98        | 45.85                     | 49.15                | ---                      | ---                 | ---       | 184         | H         | 133           | 3.30                     | 24.85            | 74.00               | ---             | ---                |
| 2 389.98        | ---                       | ---                  | ---                      | 26.65               | -22.50    | 184         | H         | 133           | 3.30                     | ---              | ---                 | 27.35           | 54.00              |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)

### Band Edge\_BDR\_GFSK\_2 480 MHz

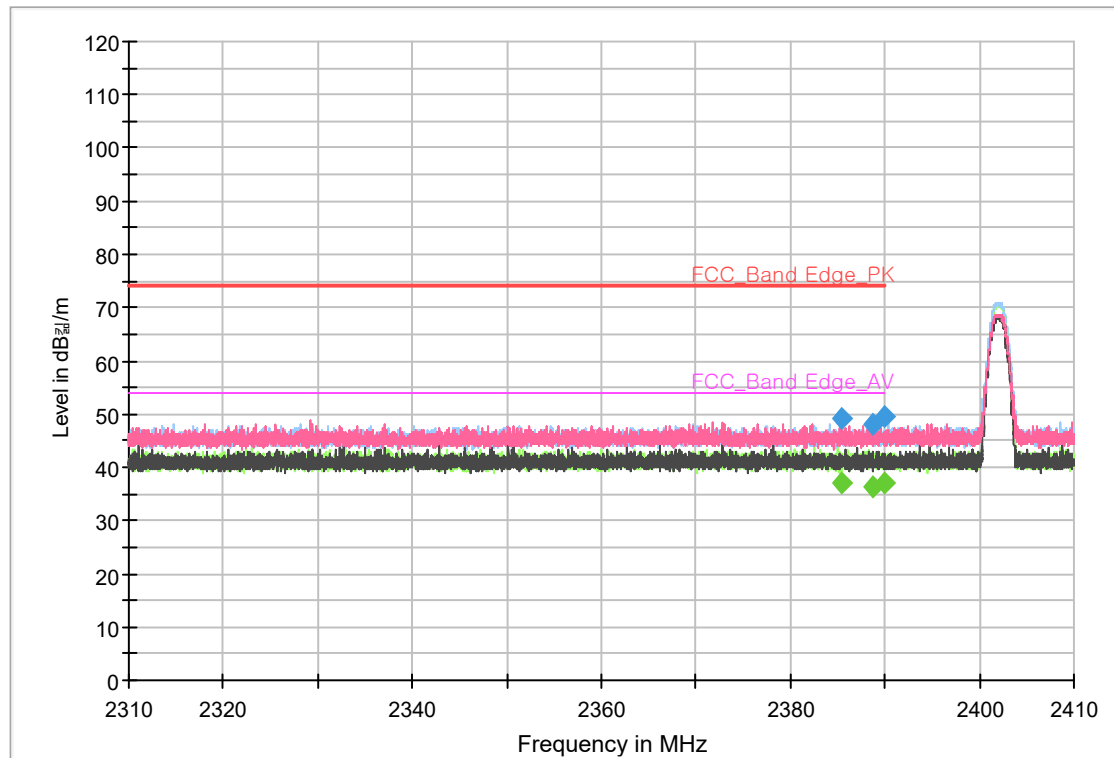


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 2 485.85        | 45.57                     | 49.37                | ---                      | ---                 | ---       | 226         | H         | 226           | 3.80                     | 24.63            | 74.00               | ---             | ---                |
| 2 485.85        | ---                       | ---                  | ---                      | 26.87               | -22.50    | 226         | H         | 226           | 3.80                     | ---              | ---                 | 27.13           | 54.00              |
| 2 498.56        | 45.90                     | 49.70                | ---                      | ---                 | ---       | 251         | V         | 350           | 3.80                     | 24.30            | 74.00               | ---             | ---                |
| 2 498.56        | ---                       | ---                  | ---                      | 27.20               | -22.50    | 251         | V         | 350           | 3.80                     | ---              | ---                 | 26.80           | 54.00              |
| 2 483.55        | 45.47                     | 49.37                | ---                      | ---                 | ---       | 200         | V         | 106           | 3.90                     | 24.63            | 74.00               | ---             | ---                |
| 2 490.38        | ---                       | ---                  | ---                      | 26.87               | -22.50    | 200         | V         | 106           | 3.90                     | ---              | ---                 | 27.13           | 54.00              |

#### Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)

**Band Edge\_ EDR\_8DPSK \_2 402 MHz**

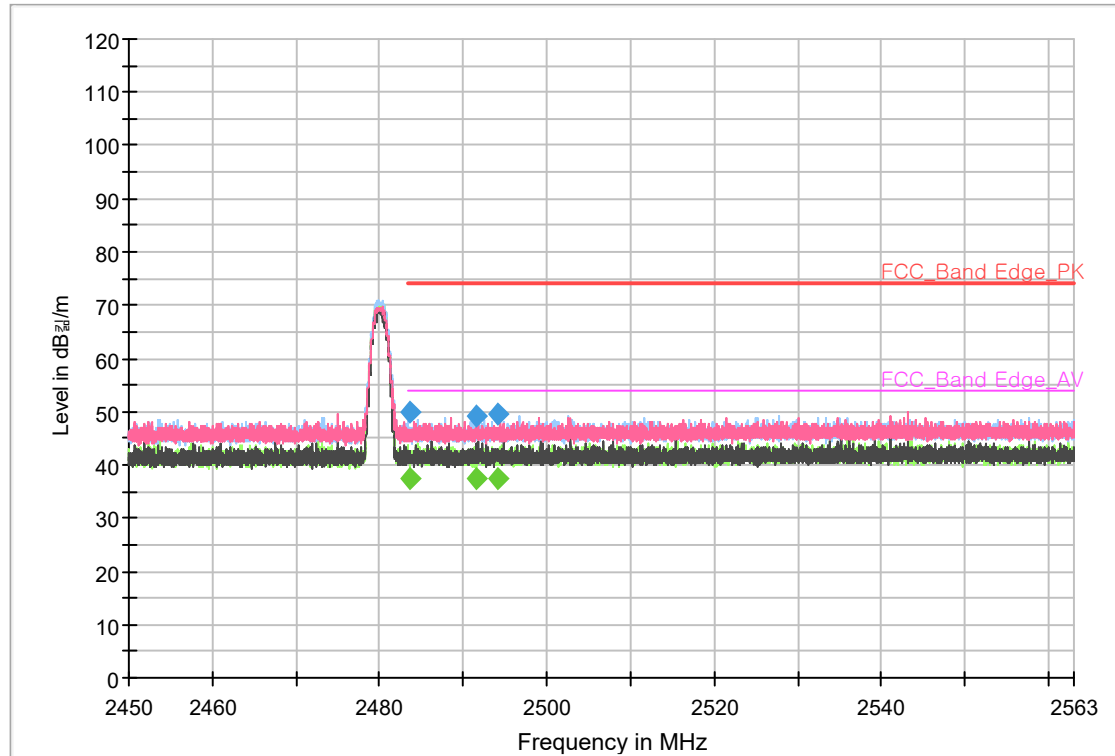


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 2 389.93        | 46.21                     | 49.51                | ---                      | ---                 | ---       | 303         | V         | 68            | 3.30                     | 24.49            | 74.00               | ---             | ---                |
| 2 389.93        | ---                       | ---                  | ---                      | 27.01               | -22.50    | 303         | V         | 68            | 3.30                     | ---              | ---                 | 26.99           | 54.00              |
| 2 385.39        | 45.93                     | 49.23                | ---                      | ---                 | ---       | 159         | V         | 267           | 3.30                     | 24.77            | 74.00               | ---             | ---                |
| 2 385.39        | ---                       | ---                  | ---                      | 26.73               | -22.50    | 159         | V         | 267           | 3.30                     | ---              | ---                 | 27.27           | 54.00              |
| 2 388.74        | 44.95                     | 48.25                | ---                      | ---                 | ---       | 275         | H         | 347           | 3.30                     | 25.75            | 74.00               | ---             | ---                |
| 2 388.74        | ---                       | ---                  | ---                      | 25.75               | -22.50    | 275         | H         | 347           | 3.30                     | ---              | ---                 | 28.25           | 54.00              |

**Remarks**

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)

**Band Edge\_EDR\_8DPSK\_2 480 MHz**

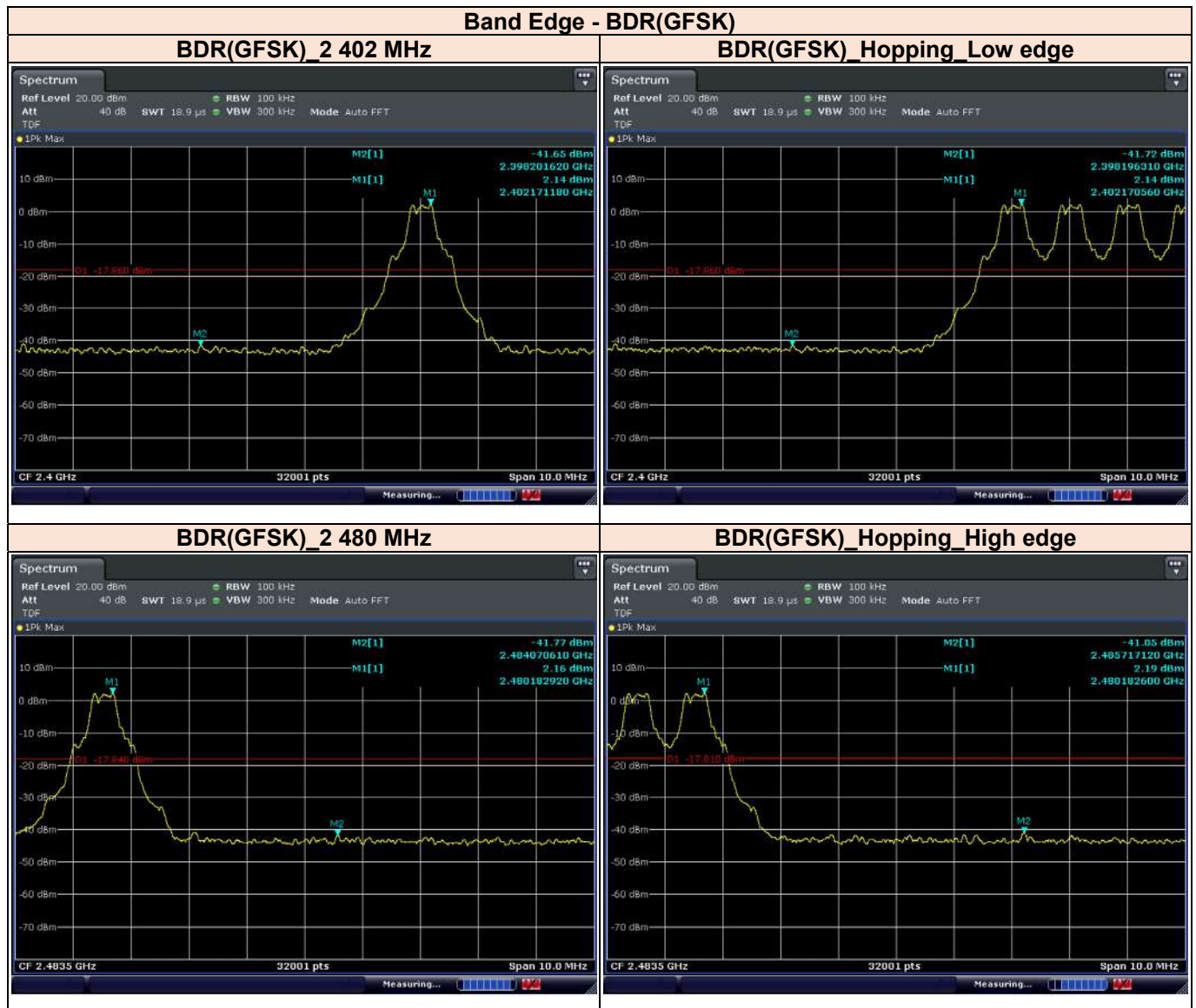


| Frequency [MHz] | Peak Reading Value [dBuV] | Peak Result [dBuV/m] | AVG Reading Value [dBuV] | AVG Result [dBuV/m] | DCCF [dB] | Height [cm] | Pol [H/V] | Azimuth [deg] | Correction Factor [dB/m] | Peak Margin [dB] | Peak Limit [dBuV/m] | AVG Margin [dB] | AVG Limit [dBuV/m] |
|-----------------|---------------------------|----------------------|--------------------------|---------------------|-----------|-------------|-----------|---------------|--------------------------|------------------|---------------------|-----------------|--------------------|
| 2 491.58        | 45.32                     | 49.12                | ---                      | ---                 | ---       | 186         | V         | 267           | 3.80                     | 24.88            | 74.00               | ---             | ---                |
| 2 491.58        | ---                       | ---                  | ---                      | 26.62               | -22.50    | 186         | V         | 267           | 3.80                     | ---              | ---                 | 27.38           | 54.00              |
| 2 494.09        | 45.59                     | 49.39                | ---                      | ---                 | ---       | 314         | V         | 126           | 3.80                     | 24.61            | 74.00               | ---             | ---                |
| 2 494.09        | ---                       | ---                  | ---                      | 26.89               | -22.50    | 314         | V         | 126           | 3.80                     | ---              | ---                 | 27.11           | 54.00              |
| 2 483.58        | 46.14                     | 50.04                | ---                      | ---                 | ---       | 350         | V         | 311           | 3.90                     | 23.96            | 74.00               | ---             | ---                |
| 2 483.58        | ---                       | ---                  | ---                      | 27.54               | -22.50    | 350         | V         | 311           | 3.90                     | ---              | ---                 | 26.46           | 54.00              |

**Remarks**

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Limit (dBuV/m) – (Peak/AVG) Result (dBuV/m)

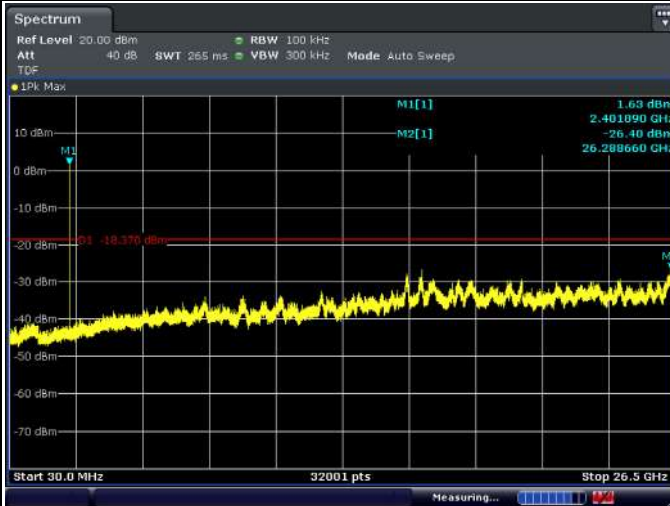
### 3.7.6 Test Result of Conducted Spurious Emission



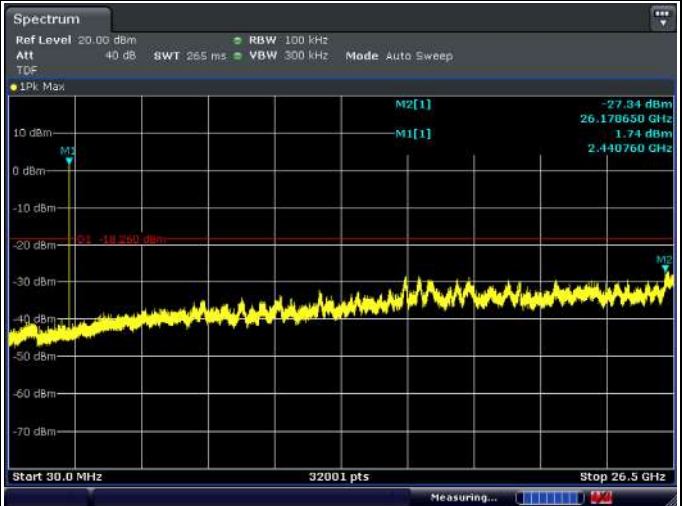


### Spurious - BDR(GFSK)

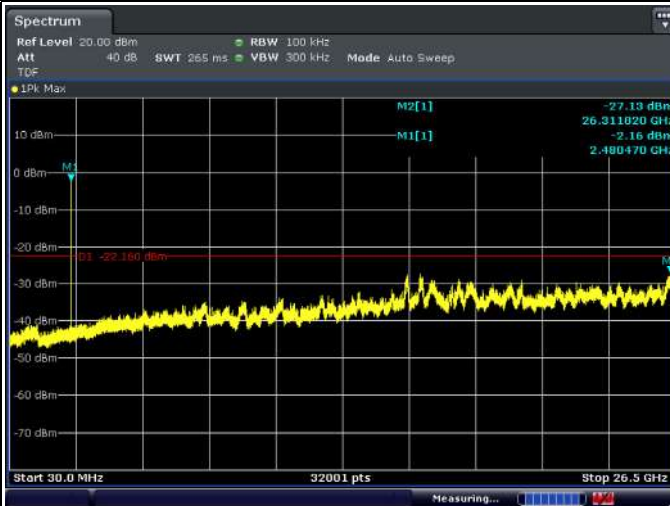
#### BDR(GFSK)\_2 402 MHz



#### BDR(GFSK)\_2 441 MHz



#### BDR(GFSK)\_2 480 MHz

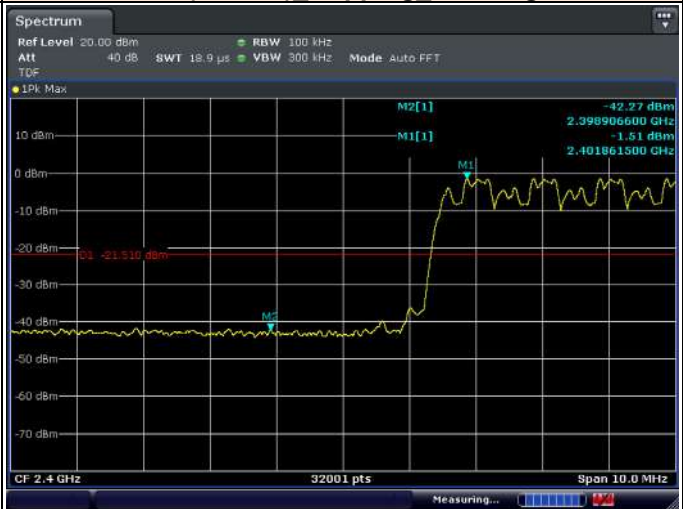


### Band Edge - EDR(8DPSK)

#### EDR(8DPSK)\_2 402 MHz



#### EDR(8DPSK)\_Hopping\_Low edge



#### EDR(8DPSK)\_2 480 MHz



#### EDR(8DPSK)\_Hopping\_High edge

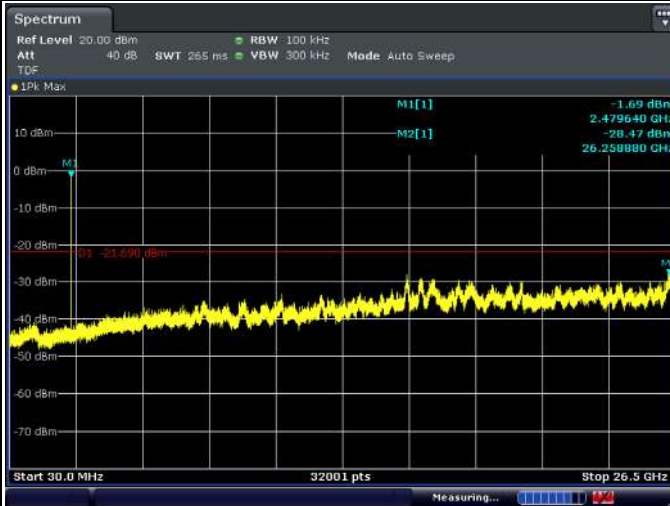




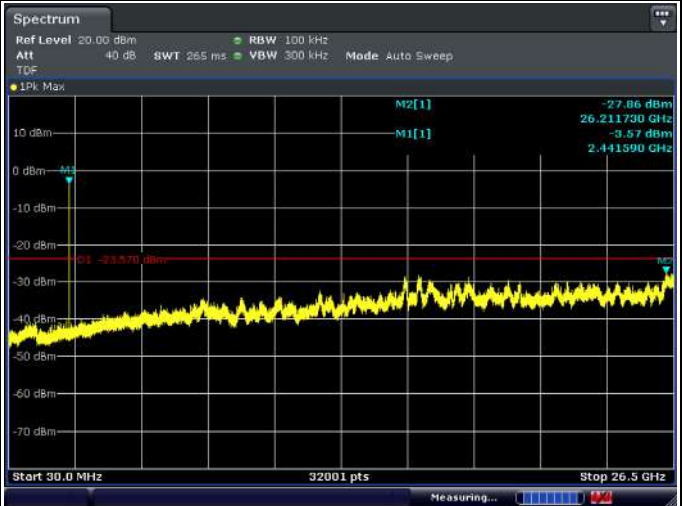


### Spurious - EDR(8DPSK)

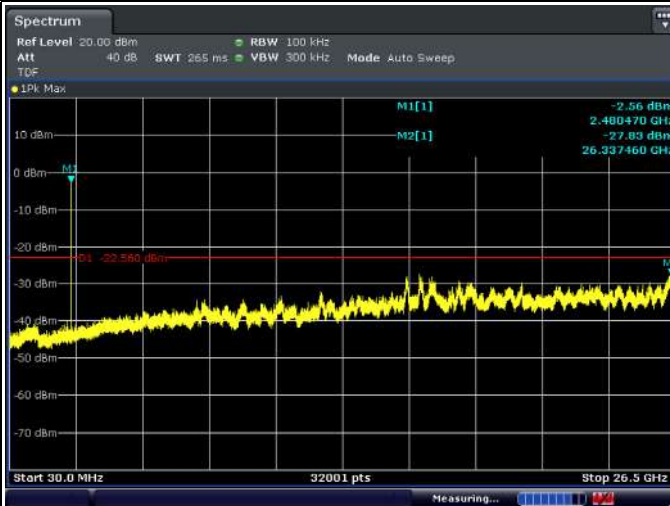
#### EDR(8DPSK)\_2 402 MHz



#### EDR(8DPSK)\_2 441 MHz



#### EDR(8DPSK)\_2 480 MHz





## 3.8 AC Conducted Emissions (150 kHz to 30 MHz)

### 3.8.1 Regulation

§15.207(a) : Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\* Decreases with the logarithm of the frequency.

### 3.8.2 Test Procedure

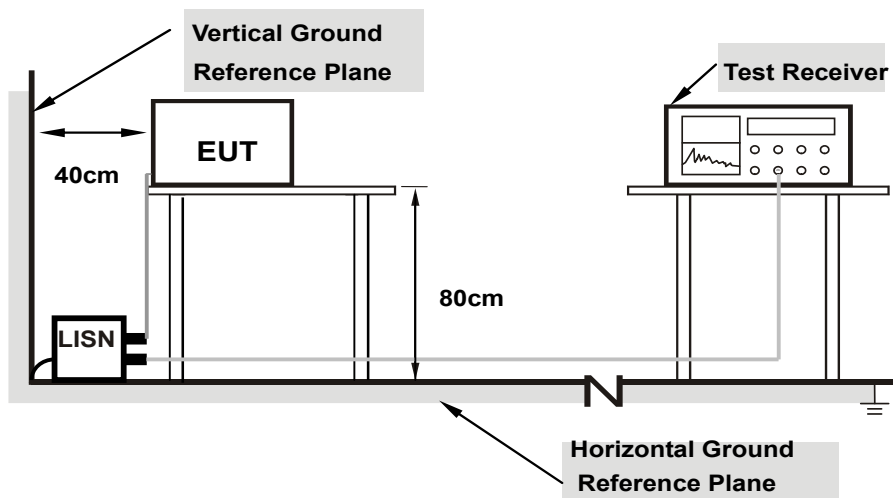
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm / 50  $\mu$ H of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

**Remark :** The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

### 3.8.3 Deviation from Test Standard

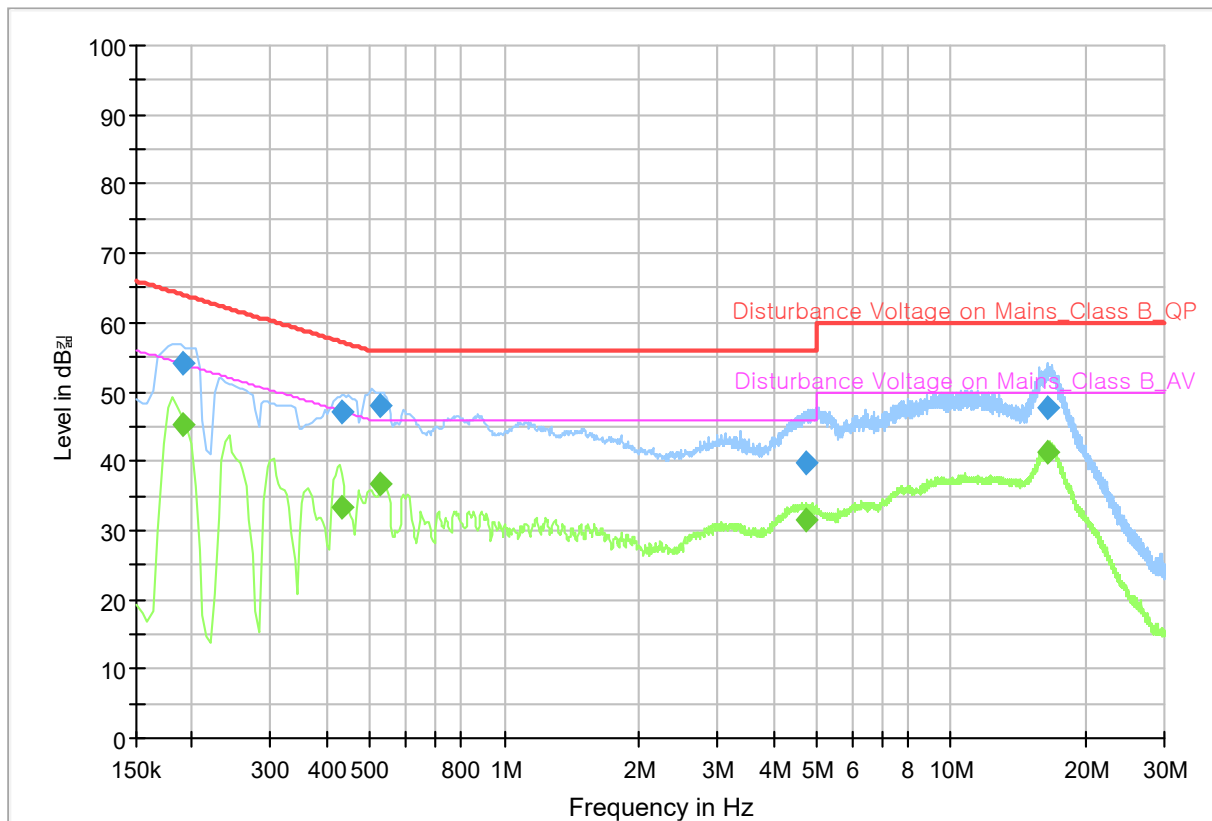
No deviation.

### 3.8.4 Test Setup



### 3.8.5 Test Result

**Worst Case - BDR\_GFSK\_2 441 MHz**



| Frequency [MHz] | Quasi Peak Reading Value [dBuV] | Quasi Peak Result [dBuV] | CAV Reading Value [dBuV] | CAV Result [dBuV] | Line | Correction Factor [dB/m] | Quasi Peak Margin [dBuV] | Quasi Peak Limit [dBuV] | CAV Margin [dBuV] | CAV Limit [dBuV] |
|-----------------|---------------------------------|--------------------------|--------------------------|-------------------|------|--------------------------|--------------------------|-------------------------|-------------------|------------------|
| 0.19            | 44.44                           | 54.14                    | ---                      | ---               | N    | 9.70                     | 10.41                    | 64.55                   | ---               | ---              |
| 0.19            | ---                             | ---                      | 35.62                    | 45.32             | N    | 9.70                     | ---                      | ---                     | 9.34              | 54.66            |
| 0.43            | 37.46                           | 47.16                    | ---                      | ---               | L1   | 9.70                     | 8.84                     | 56.00                   | ---               | ---              |
| 0.43            | ---                             | ---                      | 23.57                    | 33.27             | L1   | 9.70                     | ---                      | ---                     | 12.73             | 46.00            |
| 0.52            | 38.45                           | 48.15                    | ---                      | ---               | N    | 9.70                     | 7.85                     | 56.00                   | ---               | ---              |
| 0.52            | ---                             | ---                      | 27.07                    | 36.77             | N    | 9.70                     | ---                      | ---                     | 9.23              | 46.00            |
| 4.73            | 30.06                           | 39.86                    | ---                      | ---               | N    | 9.80                     | 16.14                    | 56.00                   | ---               | ---              |
| 4.73            | ---                             | ---                      | 21.72                    | 31.52             | N    | 9.80                     | ---                      | ---                     | 14.48             | 46.00            |
| 16.52           | 37.38                           | 47.68                    | ---                      | ---               | L1   | 10.30                    | 8.32                     | 56.00                   | ---               | ---              |
| 16.52           | ---                             | ---                      | 31.02                    | 41.32             | L1   | 10.30                    | ---                      | ---                     | 4.68              | 46.00            |

#### Remarks

- Final Value (QP and/or CAV) = Reading Value (QP and/or CAV) + Corr. (LISN Insertion Loss + Cable Loss)  
Margin (QP and/or CAV) = Limit – Final Value (QP and/or CAV)  
QP = Quasi-Peak, CAV = CISPR-Average, Corr. = Correction Factor
- Two graphs measured for both Live (L1) and Neutral (N) of the LISN are combined into one graph.

## **Appendix – Information of the Testing Laboratories**

We, Bureau Veritas Consumer Products Services Korea. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

**Test Firm Name : BV CPS ADT Korea Ltd.**

**Main Address : Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675 KOREA**

**Satellite Address : Bureau Veritas Bldg, HeungAn-daero 49, DongAn-gu, Anyang-si, Gyeonggi-do, 14119, KOREA**

### **FCC**

**Designation Number : KR0158**

**Test Firm Registration Number : 666061**

### **ISED**

**Designation Number : KR0158**

**Test Firm Registration Number : 25944 (Main)**

**Test Firm Registration Number : 26316 (Satellite)**

If you have any comments, please feel free to contact us at the following:

**Email:** [Meyer.Shin@bureauveritas.com](mailto:Meyer.Shin@bureauveritas.com)

**Web Site:** [www.bureauveritas.co.kr/cps/eaw](http://www.bureauveritas.co.kr/cps/eaw)

The address and road map of all our labs can be found in our web site also.

**- End of report -**