# CERTIFICATION TEST REPORT

**Report Number. :** 4789247752-E6V1

**Applicant :** SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

**Model :** SM-G980F/DS, SM-G980F

**FCC ID :** A3LSMG980F

**EUT Description :** GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C

**Date Of Issue:**
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IAS ACCREDITED
Testing Laboratory
TL-637

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# TABLE OF CONTENTS

**1. ATTESTATION OF TEST RESULTS ..... 5**
*1.1. INTRODUCTION OF TEST DATA REUSE ..... 6*
*1.2. DIFFERENCE ..... 6*
*1.3. SPOT CHECK VERIFICATION DATA ..... 6*
*1.4. REFERENCE DETAIL ..... 7*
**2. TEST METHODOLOGY ..... 8**
**3. FACILITIES AND ACCREDITATION ..... 8**
**4. CALIBRATION AND UNCERTAINTY ..... 8**
*4.1. MEASURING INSTRUMENT CALIBRATION ..... 8*
*4.2. SAMPLE CALCULATION ..... 8*
*4.3. MEASUREMENT UNCERTAINTY ..... 9*
*4.4. DECISION RULE ..... 9*
**5. EQUIPMENT UNDER TEST ..... 10**
*5.1. DESCRIPTION OF EUT ..... 10*
*5.2. MAXIMUM OUTPUT POWER ..... 10*
*5.3. DESCRIPTION OF AVAILABLE ANTENNAS ..... 10*
*5.4. WORST-CASE CONFIGURATION AND MODE ..... 10*
*5.5. DESCRIPTION OF TEST SETUP ..... 11*
**6. MEASUREMENT METHODS ..... 13**
**7. TEST AND MEASUREMENT EQUIPMENT ..... 14**
**8. REFERENCE MEASUREMENT RESULTS ..... 15**
*8.1. ON TIME AND DUTY CYCLE RESULTS ..... 15*
*8.2. 20 dB AND 99% BANDWIDTH ..... 16*
8.2.1. BASIC DATA RATE GFSK MODULATION ..... 16
8.2.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION ..... 16
8.2.3. ENHANCED DATA RATE 8PSK MODULATION ..... 16
8.2.4. 20 dB AND 99% BANDWIDTH PLOTS ..... 17
**9. SUMMARY TABLE ..... 20**
**10. ANTENNA PORT TEST RESULTS ..... 21**
*10.1. HOPPING FREQUENCY SEPARATION ..... 21*
*10.2. NUMBER OF HOPPING CHANNELS ..... 22*
*10.3. AVERAGE TIME OF OCCUPANCY ..... 26*


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*10.4. OUTPUT POWER ..... 34*
10.4.1. BASIC DATA RATE GFSK MODULATION ..... 34
10.4.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION ..... 34
10.4.3. ENHANCED DATA RATE 8PSK MODULATION ..... 34
10.4.4. OUTPUT POWER PLOTS ..... 35

*10.5. AVERAGE POWER ..... 38*
10.5.1. BASIC DATA RATE GFSK MODULATION ..... 38
10.5.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION ..... 38
10.5.3. ENHANCED DATA RATE 8PSK MODULATION ..... 38

*10.6. CONDUCTED SPURIOUS EMISSIONS ..... 39*
10.6.1. BASIC DATA RATE GFSK MODULATION ..... 40
10.6.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION ..... 44
10.6.3. ENHANCED DATA RATE 8PSK MODULATION ..... 48

**11. RADIATED TEST RESULTS ..... 52**

*11.1. LIMITS AND PROCEDURE ..... 52*

*11.2. TRANSMITTER ABOVE 1 GHz ..... 54*
11.2.1. BASIC DATA RATE GFSK MODULATION ..... 54
11.2.2. ENHANCED DATA RATE 8PSK MODULATION ..... 64

*11.3. WORST-CASE BELOW 1 GHz ..... 74*

**12. AC POWER LINE CONDUCTED EMISSIONS ..... 76**


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# 1. ATTESTATION OF TEST RESULTS

| | |
|---|---|
| **COMPANY NAME:** | SAMSUNG ELECTRONICS CO., LTD. |
| **EUT DESCRIPTION:** | GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT |
| **MODEL NUMBER:** | SM-G980F/DS, SM-G980F |
| **SERIAL NUMBER:** | 397147485c1f7ece, 39989048ab1f7ece (CONDUCTED, Original); R3CMA0D7LSP, R3CMA0D84RA (RADIATED, Original); R38MB0AHJQN (RADIATED, Spot check) |
| **DATE TESTED:** | OCT 31, 2019 – NOV 22, 2019 (Original); NOV 05, 2019 – NOV 22, 2019 (Spot check) |

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Pass |

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
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Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Hyunsik Yun
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## 1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMG981B DSS BT(FCC CFR 47 Part 15C).
And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

## 1.2. DIFFERENCE

The FCC ID: A3LSMG980F shares the same enclosure and circuit board as FCC ID: A3LSMG981B. The WLAN antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMG981B remains representative of FCC ID: A3LSMG980F. The test data of FCC ID: A3LSMG981B being submitted for this application to cover BT features.

## 1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated spurious and band edge emissions)

| Band | Test Item | Mode | Frequency | Test Limit | Original model SM-G981B/DS FCC ID : A3LSMG981B | Spot check model SM-G980F/DS FCC ID : A3LSMG980F | Deviation | Remark |
|---|---|---|---|---|---|---|---|---|
| DSS BT | Band Edge | GFSK_2480 | 2480 MHz | 54 dBuV/m | 40.38 dBuV/m | 40.42 dBuV/m | 0.04 dB | - |
| | RSE | GFSK_2441 | 2441 MHz | 54 dBuV/m | 40.44 dBuV/m | 33.20 dBuV/m | -7.24 dB | 2nd Harmonic |

Comparison of two models, upper deviation is within 3dB range and all test results are under FCC Technical Limits.


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## 1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

| Equipment Class | Reference FCC ID (Parent) | Application Type | Reference Test report number | Exhibit Type | Variant Test Report Number | Data Re-used |
|---|---|---|---|---|---|---|
| PCE | A3LSMG981B | Original Grant | 4789230288-E2 | Test Report | 4789247752-E2 | All |
| DTS | A3LSMG981B | Original Grant | 4789230288-E3 (802.11b/g/n) | Test Report | 4789247752-E3 (802.11b/g/n) | All |
| | | | 4789230288-E4 (802.11ax) | Test Report | 4789247752-E4 (802.11ax) | All |
| | | | 4789230288-E5 Bluetooth LE | Test Report | 4789247752-E5 Bluetooth LE | All |
| DSS | A3LSMG981B | Original Grant | 4789230288-E6 (Bluetooth) | Test Report | 4789247752-E6 (Bluetooth) | All |
| NII | A3LSMG981B | Original Grant | 4789230288-E7 (802.11a/n/ac) | Test Report | 4789247752-E7 (802.11a/n/ac) | All |
| | | | 4789230288-E8 (802.11ax) | Test Report | 4789247752-E8 (802.11ax) | All |
| DXX | A3LSMG981B | Original Grant | 4789230288-E9 (ANT+) | Test Report | 4789247752-E9 (ANT+) | All |
| | | | 4789230288-E10 (NFC) | Test Report | 4789247752-E10 (NFC) | All |
| DCD | A3LSMG981B | Original Grant | 4789230288-E11 (WPT) | Test Report | 4789247752-E11 (WPT) | All |

For this application the data reuse is summarized below for each equipment class:

| Equipment Class | Reference FCC ID (Parent) | Application Type | Test Item | Data Re-used |
|---|---|---|---|---|
| PCE | A3LSMG981B | Original Grant | WWAN | All except SAR (full test), HAC (full test) |
| DTS | A3LSMG981B | Original Grant | BLE | All |
| | | | WLAN | All except SAR (full test), HAC (full test) |
| | | | WLAN 802.11ax | All except HAC (full test) |
| DSS | A3LSMG981B | Original Grant | BT | All except SAR (full test) |
| NII | A3LSMG981B | Original Grant | WLAN | All except SAR (full test), HAC (full test) |
| | | | WLAN 802.11ax | All except HAC (full test) |
| DXX | A3LSMG981B | Original Grant | ANT+ | All |
| | | | NFC | All |
| DCD | A3LSMG981B | Original Grant | WPT | All except RF exposure |


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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02
4. ANSI C63.10-2013.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 218 Maeyeong-ro |
|---|
| ☒ Chamber 1 |
| ☒ Chamber 2 |
| ☐ Chamber 3 |

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# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m


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## 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | 2.35 dB |
| Radiated Disturbance, 30 MHz to 1 GHz | 3.49 dB |
| Radiated Disturbance, 1 GHz to 18 GHz | 5.82 dB |
| Radiated Disturbance, 18 GHz to 40 GHz | 5.49 dB |

Uncertainty figures are valid to a confidence level of 95%.

## 4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.


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# 5. EQUIPMENT UNDER TEST

## 5.1.DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT. This test report addresses the DSS (BT) operational mode.

This report covers the Samsung models SM-G980F/DS and SM-G980F.
These models are identical in hardware except SM-G980F has single SIM tray.
With some pre-scan, model SM-G980F/DS was set for spot check test.

## 5.2.MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

| Frequency Range [MHz] | Mode | Power Mode | Output Power [dBm] | Output Power [mW] |
|---|---|---|---|---|
| 2 402 ~ 2 480 | Basic GFSK | Average | 17.417 | 55.17 |
| | | Peak | 17.818 | 60.51 |
| | Enhanced Pi/4-DPSK | Average | 11.326 | 13.57 |
| | | Peak | 13.897 | 24.53 |
| | Enhanced 8PSK | Average | 11.358 | 13.67 |
| | | Peak | 14.488 | 28.11 |

## 5.3.DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -3.80 dBi.

## 5.4.WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance. For average power data please refer to section 9.5. All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.


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## 5.5.DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| Charger | SAMSUNG | EP-TA800 | R37M5WSB411SE3 | N/A |
| Data Cable | SAMSUNG | EP-DG977 | N/A | N/A |

**I/O CABLE**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No** | **Port** | **# of identical ports** | **Connector Type** | **Cable Type** | **Cable Length (m)** | **Remarks** |
| 1 | DC Power | 1 | C Type | Shielded | 1.0m | N/A |

**TEST SETUP**

The EUT is continuously communicating to the Bluetooth tester during the tests.
Test software enable BT communications.


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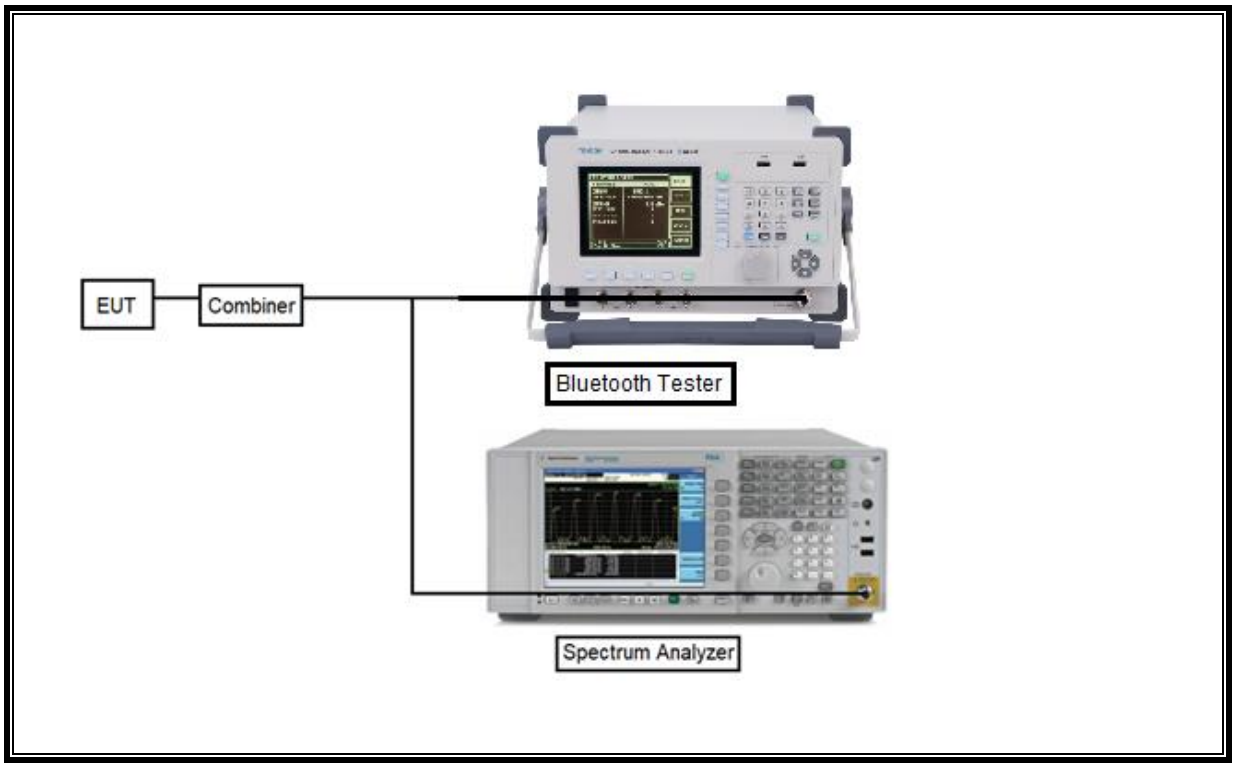
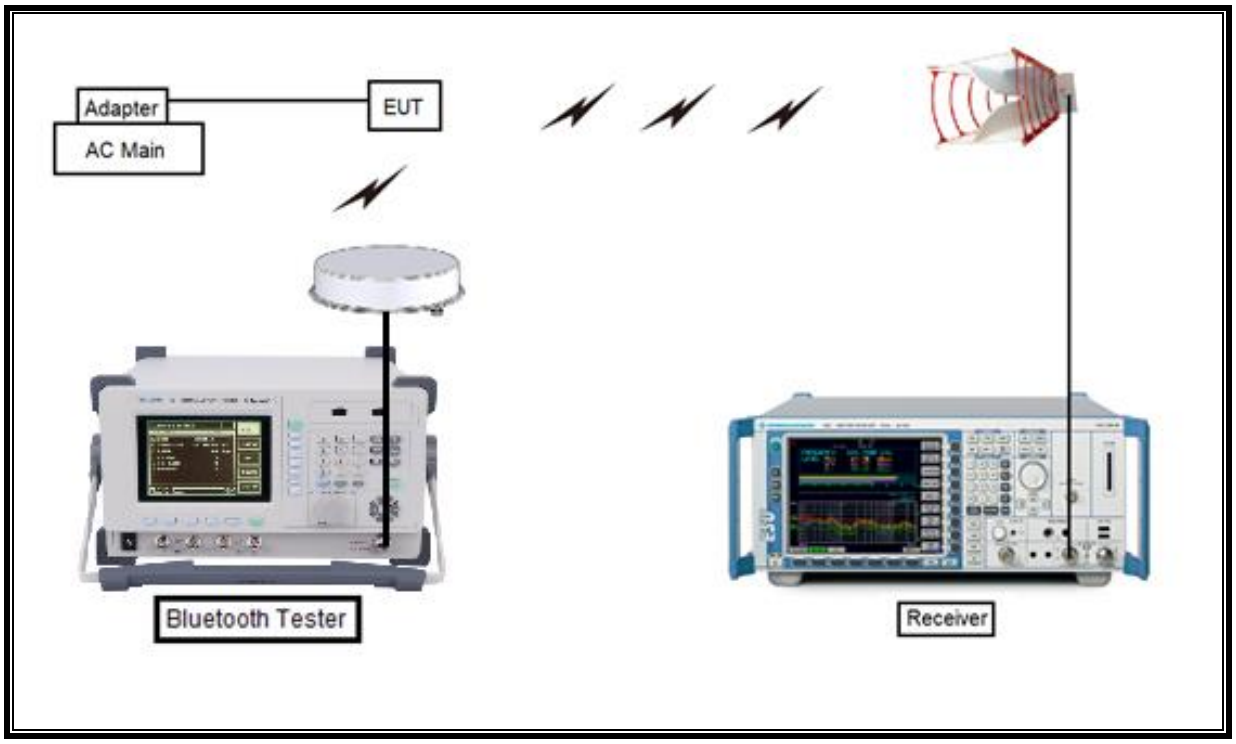
**SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)**




**SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)**





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# 6. MEASUREMENT METHODS

20dB BW : ANSI C63.10, Section 6.9.2

99% BW : ANSI C63.10, Section 6.9.3

HOPPING FREQUENCY SEPARATION : ANSI C63.10, Section 7.8.2

NUMBER OF HOPPING CHANNELS : ANSI C63.10, Section 7.8.3

AVERAGE TIME OF OCCUPANCY : ANSI C63.10, Section 7.8.4

OUTPUT POWER : ANSI C63.10, Section 7.8.5.

Out-of-band EMISSIONS (Conducted) : ANSI C63.10, Section 7.8.6, 7.8.8

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: ANSI C63.10, Section 6.

Out-of-band EMISSIONS IN RESTRICTED BANDS : ANSI C63.10, Section 6.

AC Power Line Conducted Emission : ANSI C63.10-2013, Section 6.2.


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# 7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **S/N** | **Cal Due** |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 750 | 08-04-20 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 749 | 08-04-20 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 845 | 08-04-20 |
| Antenna, Loop, 9kHz-30MHz | R&S | HFH2-Z2 | 100418 | 10-02-21 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00167211 | 08-04-20 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00161451 | 08-04-20 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168724 | 08-04-20 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168717 | 08-04-20 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00205959 | 08-04-20 |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00166155 | 08-14-20 |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00168645 | 10-02-21 |
| Preamplifier | ETS | 3116C-PA | 00168841 | 08-08-20 |
| Directional Antenna | Cobham | FPA3-0.8-6.0R/1329 | 80108-0004 | N/A |
| Directional Antenna | Cobham | FPA3-0.8-6.0R/1329 | 110367-0003 | N/A |
| Preamplifier, 1000 MHz | Sonoma | 310N | 341282 | 08-05-20 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 351741 | 08-05-20 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 370599 | 08-05-20 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1876511 | 08-06-20 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1896138 | 08-06-20 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 2029169 | 08-06-20 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54170614 | 08-06-20 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54490312 | 08-06-20 |
| Average Power Sensor | Agilent / HP | U2000 | MY54270007 | 08-09-20 |
| Bluetooth Tester | TESCOM | TC-3000C | 3000C000546 | 08-07-20 |
| Combiner | WEINCHEL | 1575 | 2150 | 08-08-20 |
| Attenuator | PASTERNACK | PE7087-10 | A001 | 08-08-20 |
| Attenuator | PASTERNACK | PE7087-10 | A008 | 08-08-20 |
| Attenuator | PASTERNACK | PE7087-10 | 2 | 08-06-20 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100439 | 08-06-20 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100457 | 08-06-20 |
| EMI Test Receive, 44 GHz | R&S | ESW44 | 101590 | 08-05-20 |
| EMI Test Receive, 3 GHz | R&S | ESR3 | 101832 | 08-05-20 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 009 | 08-06-20 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 015 | 08-06-20 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 020 | 08-06-20 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 010 | 08-06-20 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 015 | 08-06-20 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 020 | 08-06-20 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 009 | 08-06-20 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 016 | 08-06-20 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 021 | 08-06-20 |
| LISN | R&S | ENV-216 | 101837 | 08-09-20 |
| Termination | WEINSCHEL | M1406A | T01 | 08-08-20 |
| **UL Software** | | | | |
| **Description** | **Manufacturer** | **Model** | **Version** | |
| Radiated software | UL | UL EMC | Ver 9.5 | |
| AC Line Conducted software | UL | UL EMC | Ver 9.5 | |


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# 8. REFERENCE MEASUREMENT RESULTS

## 8.1.ON TIME AND DUTY CYCLE RESULTS

**LIMITS**

None: for reporting purposes only.

| Mode | ON Time B [msec] | Period [msec] | Duty Cycle x [linear] | Duty Cycle [%] | Duty Cycle Correction Factor [dB] | 1/T Minimum VBW [kHz] |
|---|---|---|---|---|---|---|
| 2400MHz Bands | | | | | | |
| BT | 2.885 | 3.750 | 0.769 | 76.9% | 1.14 | 0.347 |

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## 8.2.20 dB AND 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

**RESULTS**

### 8.2.1. BASIC DATA RATE GFSK MODULATION

| Channel | Frequency [MHz] | 20 dB Bandwidth [MHz] | 99% Bandwidth [kHz] |
|---|---|---|---|
| Low | 2 402 | 1.028 | 894.120 |
| Mid | 2 440 | 1.034 | 866.130 |
| High | 2 480 | 1.043 | 867.970 |
| Worst | | 1.043 | 894.120 |

### 8.2.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

| Channel | Frequency [MHz] | 20 dB Bandwidth [MHz] | 99% Bandwidth [kHz] |
|---|---|---|---|
| Low | 2 402 | 1.336 | 1.167 |
| Mid | 2 440 | 1.326 | 1.194 |
| High | 2 480 | 1.335 | 1.164 |
| Worst | | 1.336 | 1.194 |

### 8.2.3. ENHANCED DATA RATE 8PSK MODULATION

| Channel | Frequency [MHz] | 20 dB Bandwidth [MHz] | 99% Bandwidth [kHz] |
|---|---|---|---|
| Low | 2 402 | 1.296 | 1.164 |
| Mid | 2 440 | 1.280 | 1.165 |
| High | 2 480 | 1.323 | 1.194 |
| Worst | | 1.323 | 1.194 |


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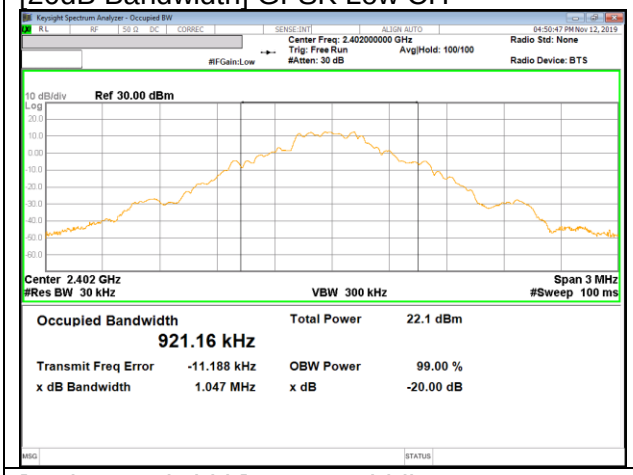
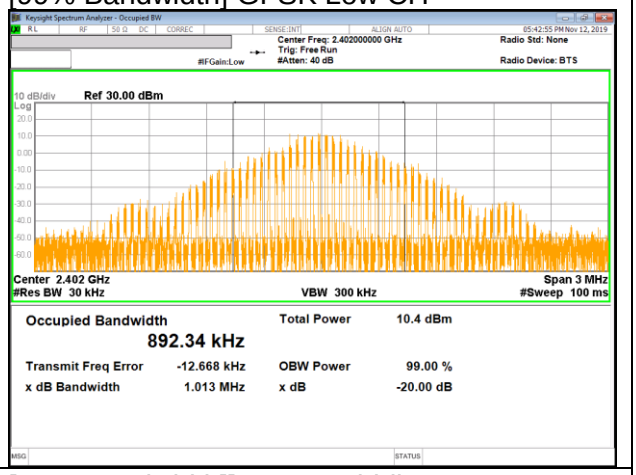
## 8.2.4. 20 dB AND 99% BANDWIDTH PLOTS

**GFSK BANDWIDTH**

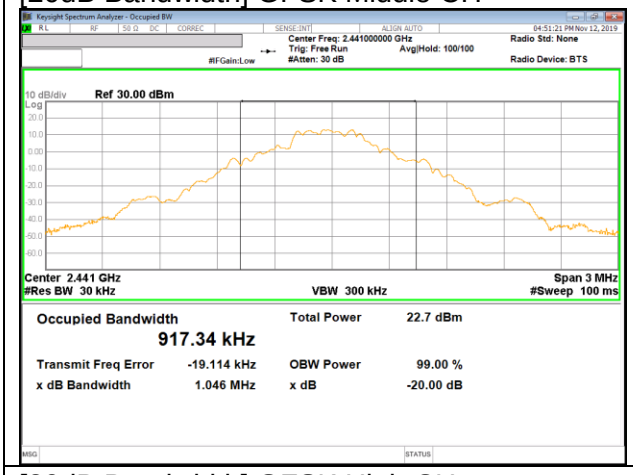
[20dB Bandwidth] GFSK Low CH



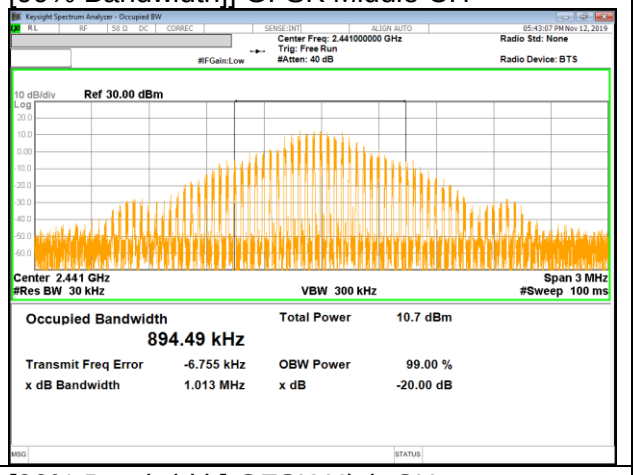

[99% Bandwidth] GFSK Low CH



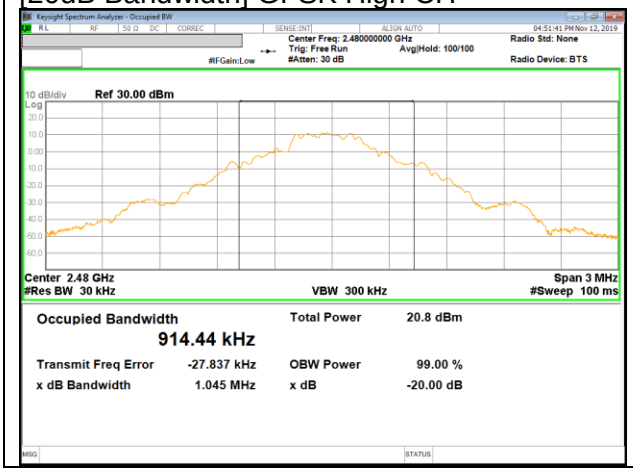

[20dB Bandwidth] GFSK Middle CH



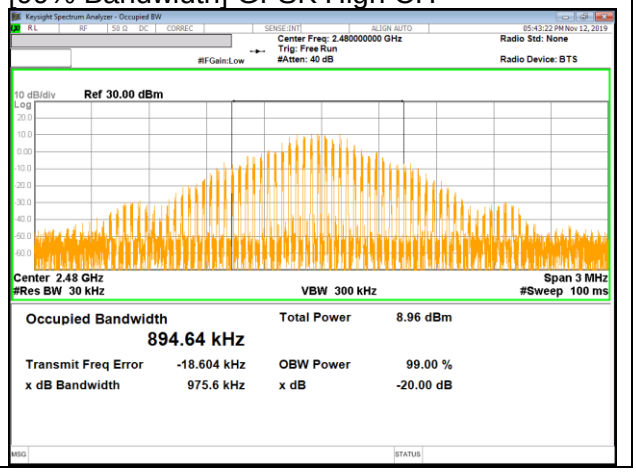

[99% Bandwidth]] GFSK Middle CH




[20dB Bandwidth] GFSK High CH




[99% Bandwidth] GFSK High CH





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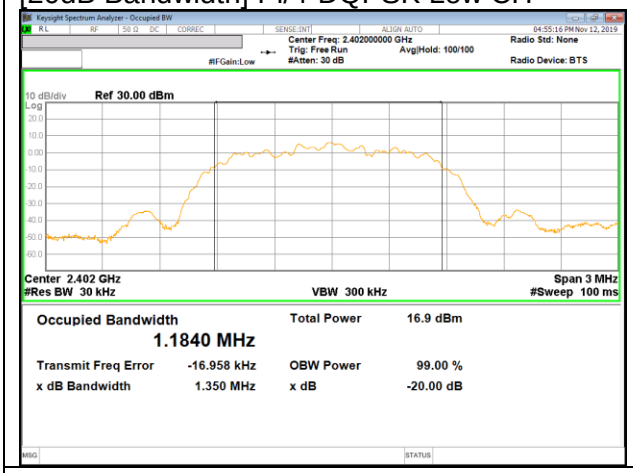
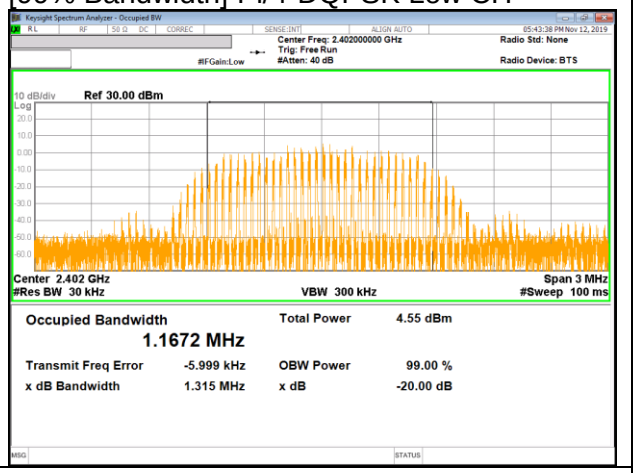
**Pi/4-DQPSK BANDWIDTH**

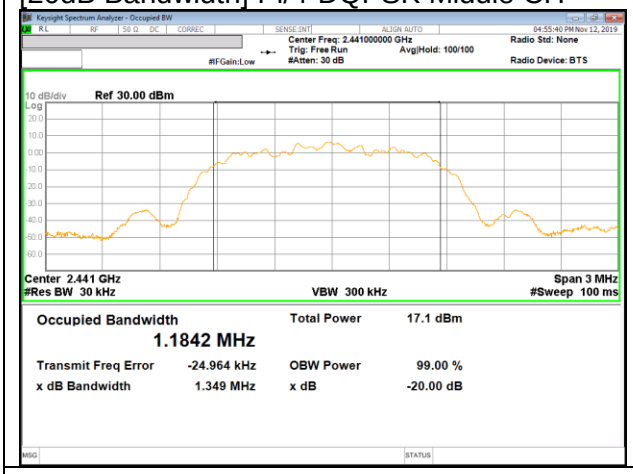
[20dB Bandwidth] Pi/4-DQPSK Low CH



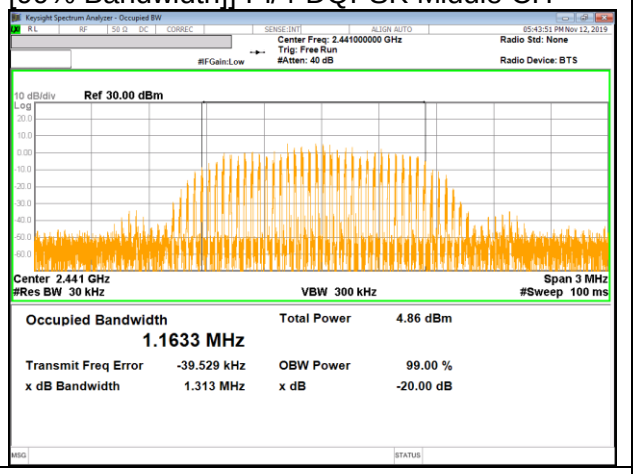

[99% Bandwidth] Pi/4-DQPSK Low CH



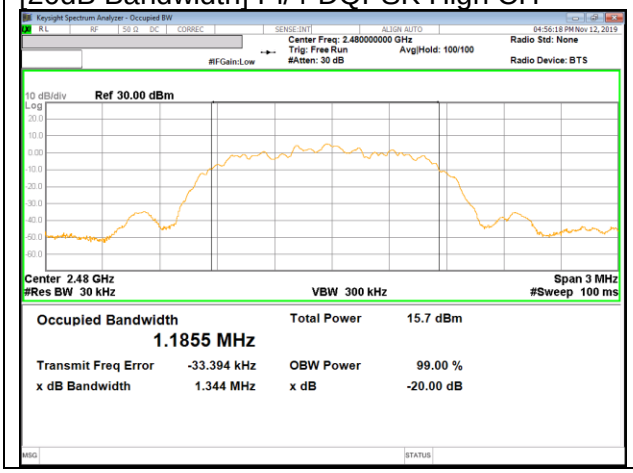

[20dB Bandwidth] Pi/4-DQPSK Middle CH



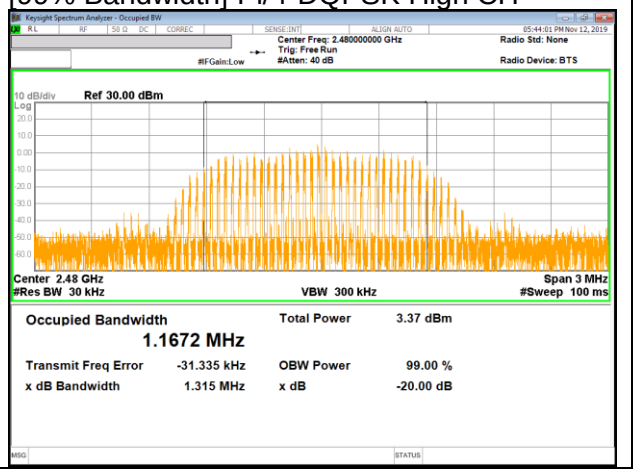

[99% Bandwidth]] Pi/4-DQPSK Middle CH




[20dB Bandwidth] Pi/4-DQPSK High CH




[99% Bandwidth] Pi/4-DQPSK High CH





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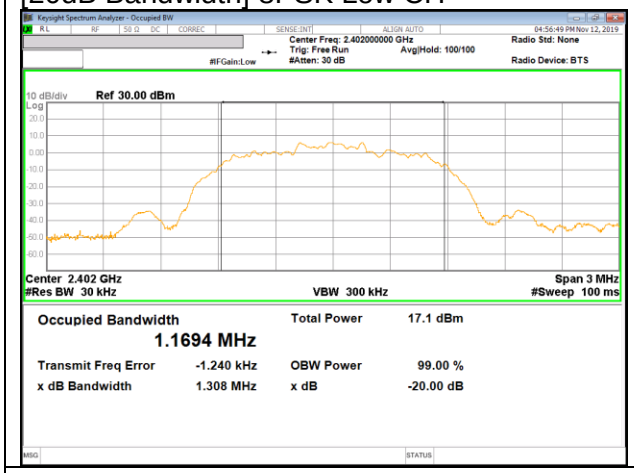
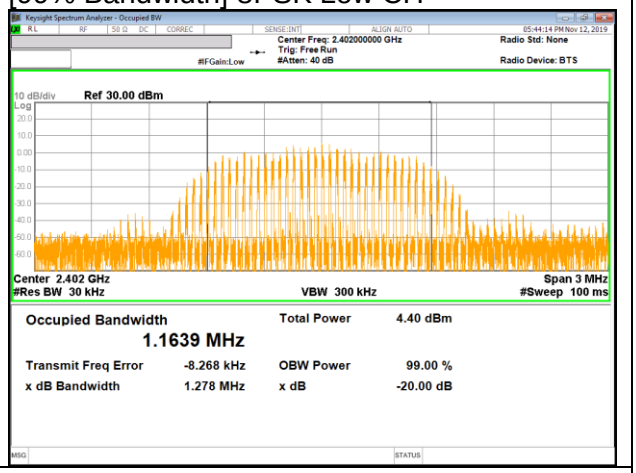
**8PSK BANDWIDTH**

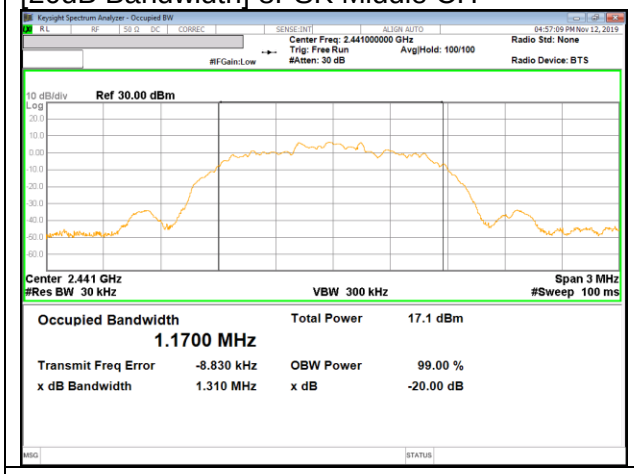
[20dB Bandwidth] 8PSK Low CH



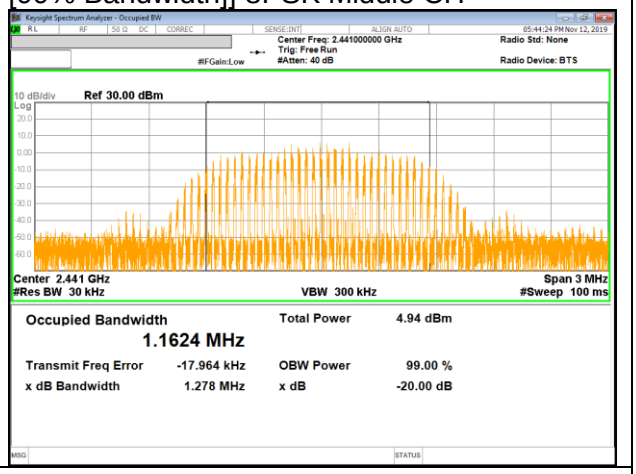

[99% Bandwidth] 8PSK Low CH



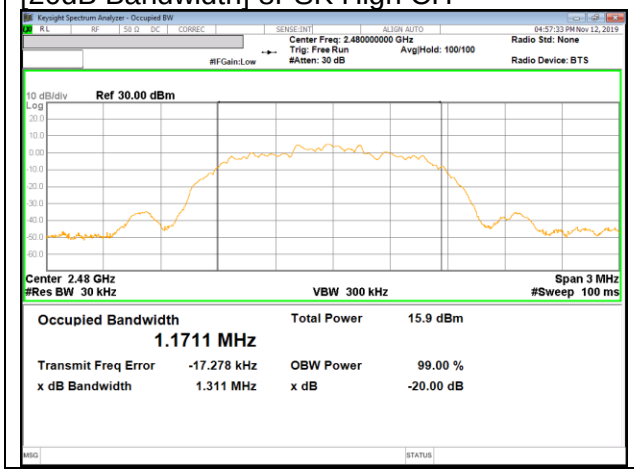

[20dB Bandwidth] 8PSK Middle CH



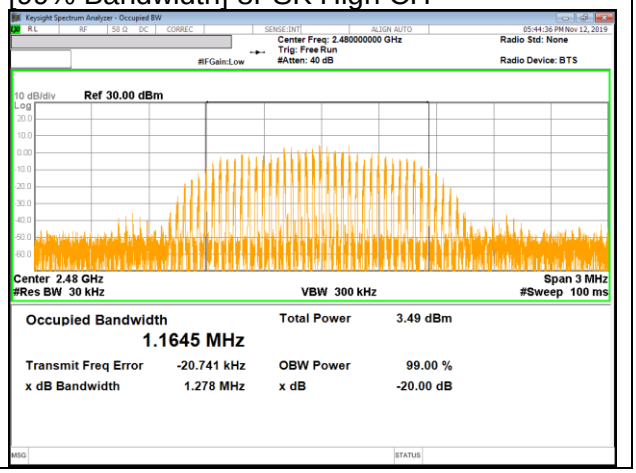

[99% Bandwidth]] 8PSK Middle CH




[20dB Bandwidth] 8PSK High CH




[99% Bandwidth] 8PSK High CH





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# 9. SUMMARY TABLE

| FCC Part Section | Test Description | Test Limit | Test Condition | Test Result |
|---|---|---|---|---|
| 2.1051, 15.247 (d) | Band Edge / Conducted Spurious Emission | -20dBc | Conducted | Pass |
| 15.247 (b)(1) | TX conducted output power | <21dBm | | Pass |
| 15.247 (a)(1) | Hopping frequency separation | > two-thirds of the 20 dB bandwidth | | Pass |
| 15.247 (a)(1)(iii) | Number of Hopping channels | More than 15 non-overlapping channels | | Pass |
| 15.247 (a)(1)(iii) | Avg Time of Occupancy | < 0.4sec | | Pass |
| 15.207 (a) | AC Power Line conducted emissions | Section 10 | Power Line conducted | Pass |
| 15.205, 15.209 | Radiated Spurious Emission | < 54dBuV/m | Radiated | Pass |


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# 10. ANTENNA PORT TEST RESULTS

## 10.1. HOPPING FREQUENCY SEPARATION

**LIMIT**

FCC §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 hoping channel, whichever is greater.

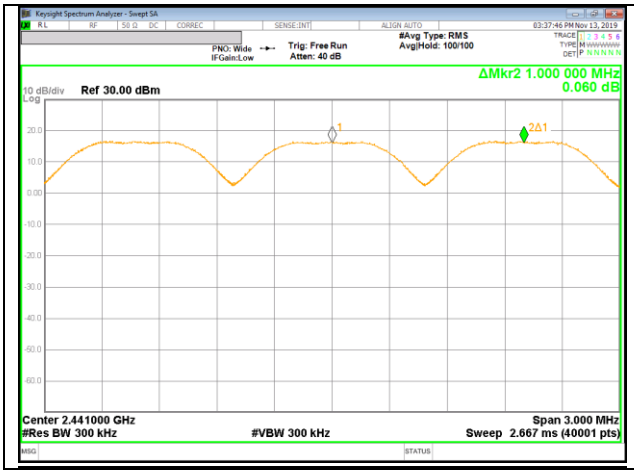
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

**TEST PROCEDURE**

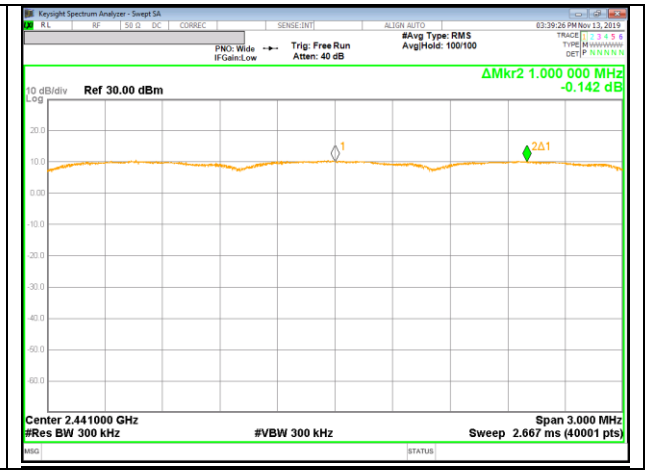
Span = wide enough to capture the peaks of two adjacent channels
RBW = Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW ≥ RBW
Sweep = Auto
Detector function = Peak
Trace = Max hold

**RESULTS**

**HOPPING FREQUENCY SEPARATION PLOT**




**[GFSK]**




**[8PSK]**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## 10.2. NUMBER OF HOPPING CHANNELS

**LIMIT**

FCC §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

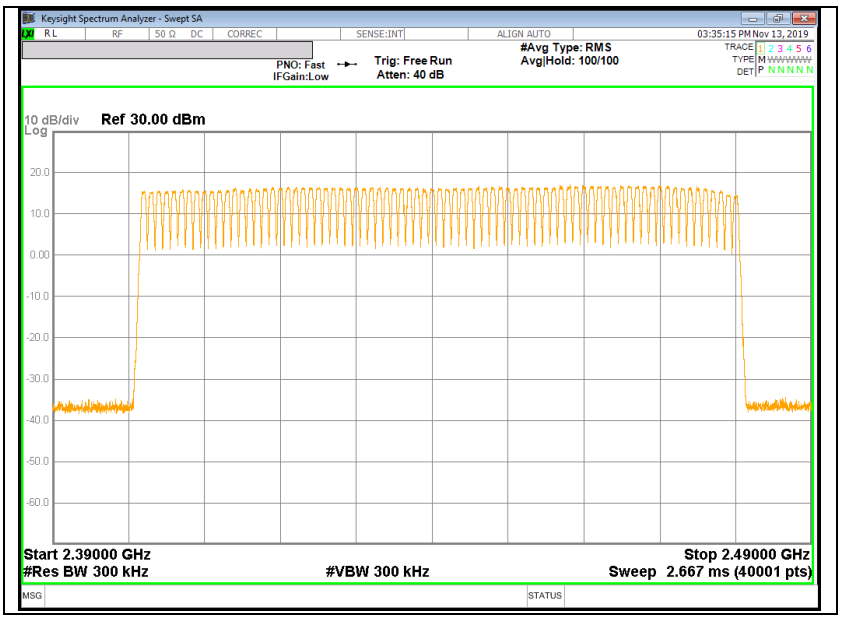
**TEST PROCEDURE**

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.
VBW ≥ RBW
Sweep = Auto
Detector function = Peak
Trace = Max hold

**RESULTS**

Normal Mode: 79 Channels observed.

### NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)





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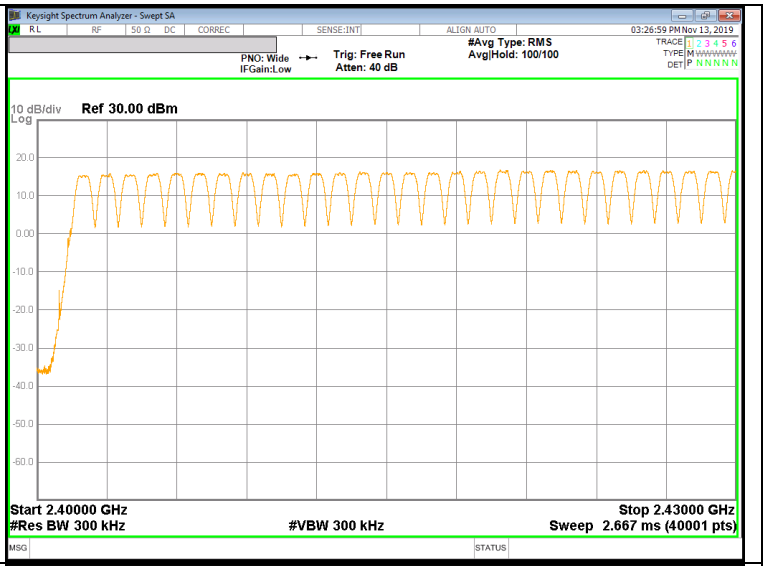
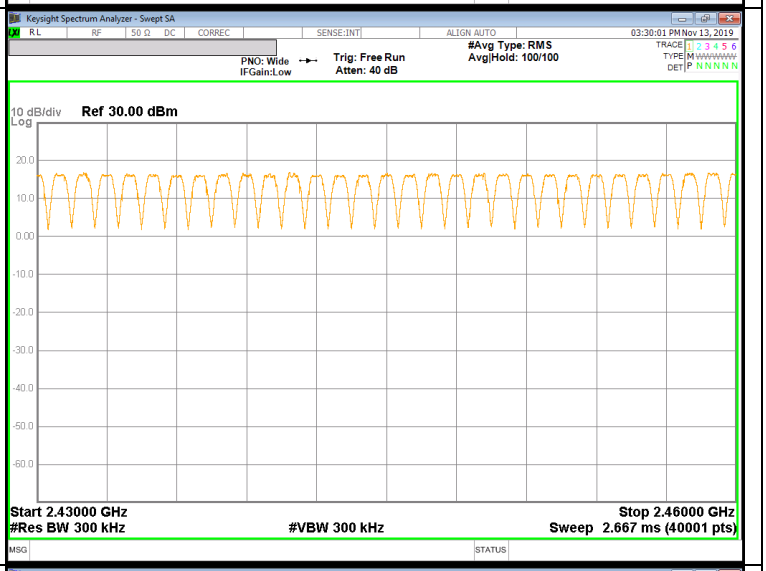
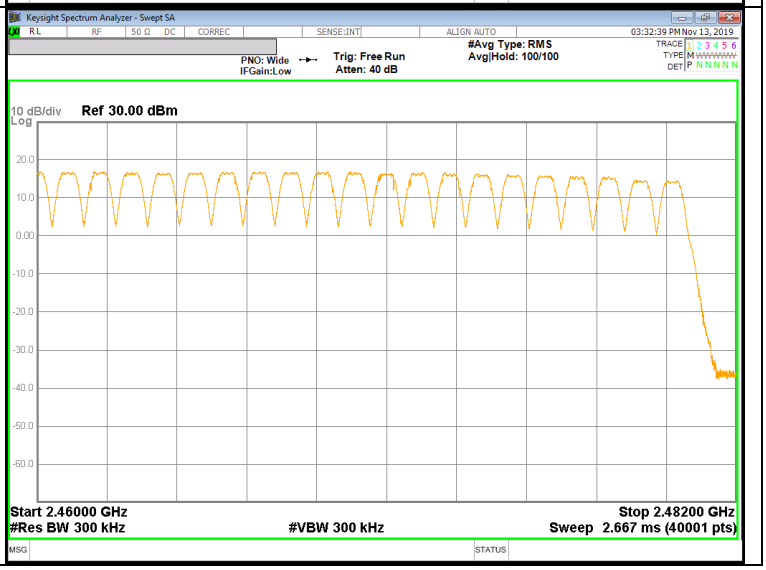
| | |
|---|---|
| 1st SEGMENT<br><br>2400 to 2430 MHz |  |
| 2nd SEGMENT<br><br>2430 to 2460 MHz |  |
| 3rd SEGMENT<br><br>2460 to 2482 MHz |  |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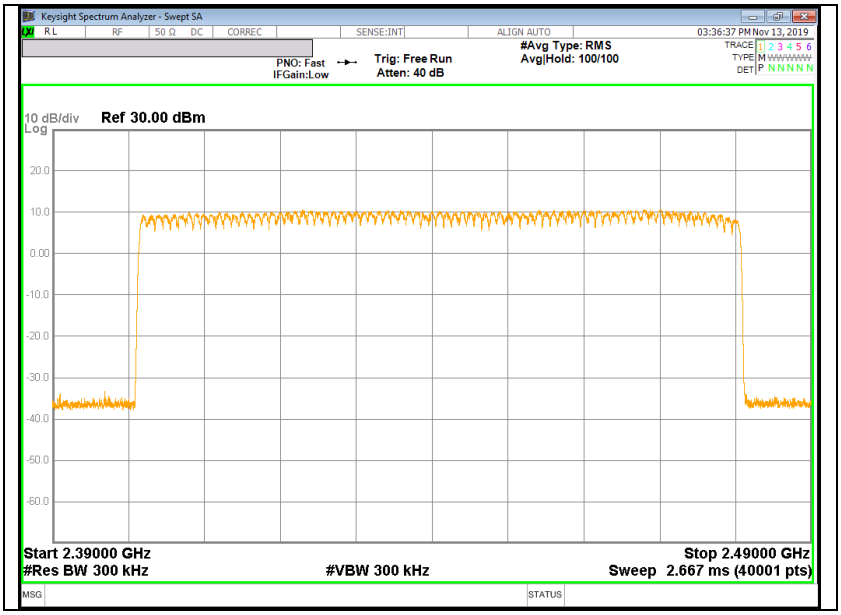
**NUMBER OF HOPPING CHANNELS PLOTS[8PSK]**

## NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)





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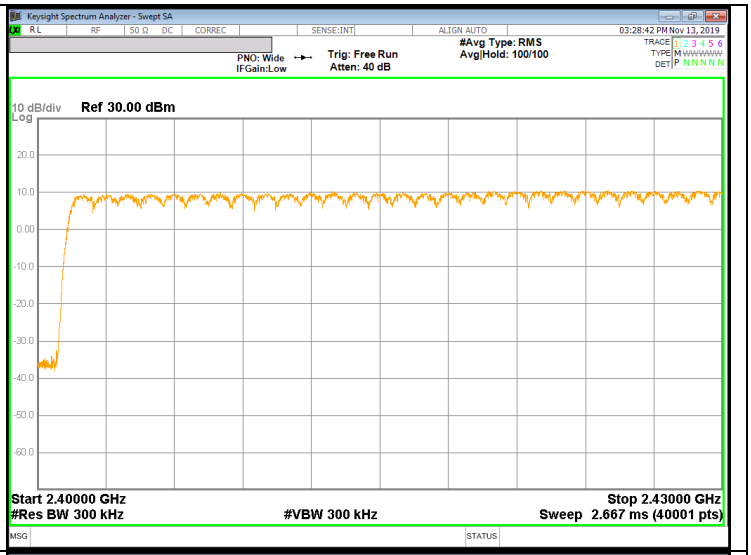
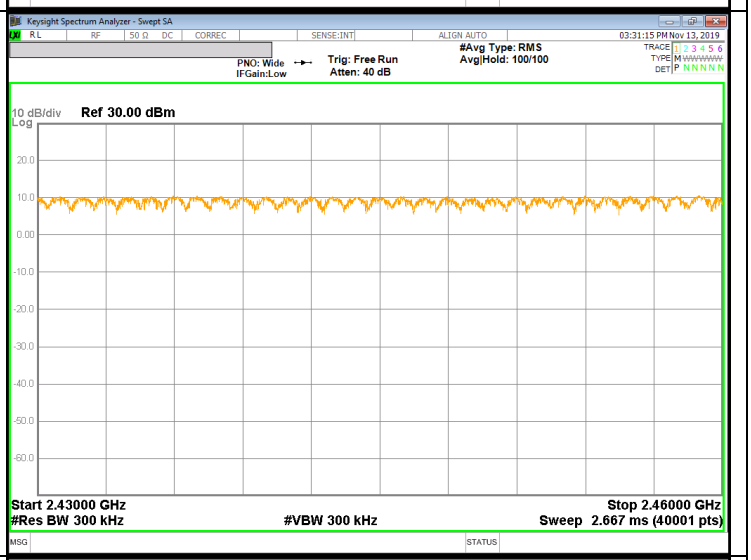
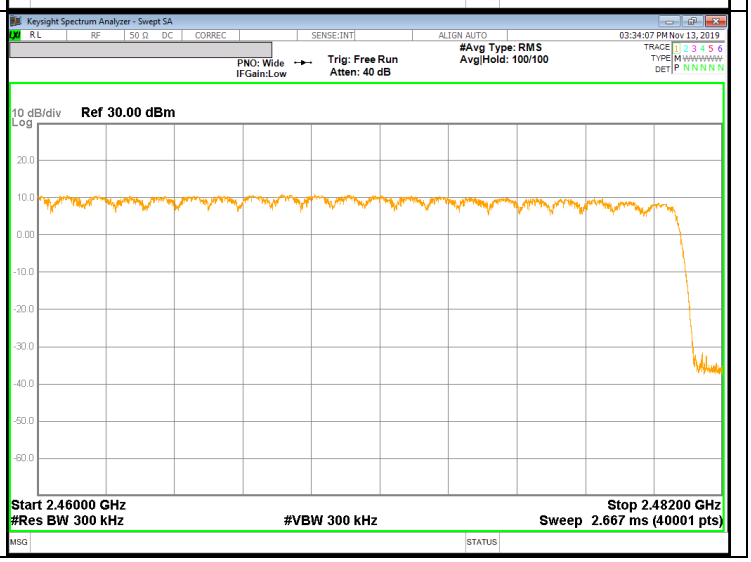
| | |
|---|---|
| 1st SEGMENT<br><br>2400 to 2430 MHz |  |
| 2nd SEGMENT<br><br>2430 to 2460 MHz |  |
| 3rd SEGMENT<br><br>2460 to 2482 MHz |  |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## 10.3. AVERAGE TIME OF OCCUPANCY

**LIMIT**

FCC §15.247 (a) (1) (iii)

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.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

**RESULTS[GFSK]**

| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Normal | | | | | |
| DH1 | 0.381 | 32 | 0.121856 | 0.4 | -0.2781 |
| DH3 | 1.636 | 16 | 0.261760 | 0.4 | -0.1382 |
| DH5 | 2.884 | 12 | 0.346080 | 0.4 | -0.0539 |
| | | | | | |
| **DH Packet** | **Pulse Width [msec]** | **Number of Pulses in 0.8 seconds** | **Average Time of Occupancy [sec]** | **Limit [sec]** | **Margin [sec]** |
| GFSK AFH | | | | | |
| DH1 | 0.381 | 8 | 0.030464 | 0.4 | -0.3695 |
| DH3 | 1.636 | 4 | 0.065440 | 0.4 | -0.3346 |
| DH5 | 2.884 | 3 | 0.086520 | 0.4 | -0.3135 |


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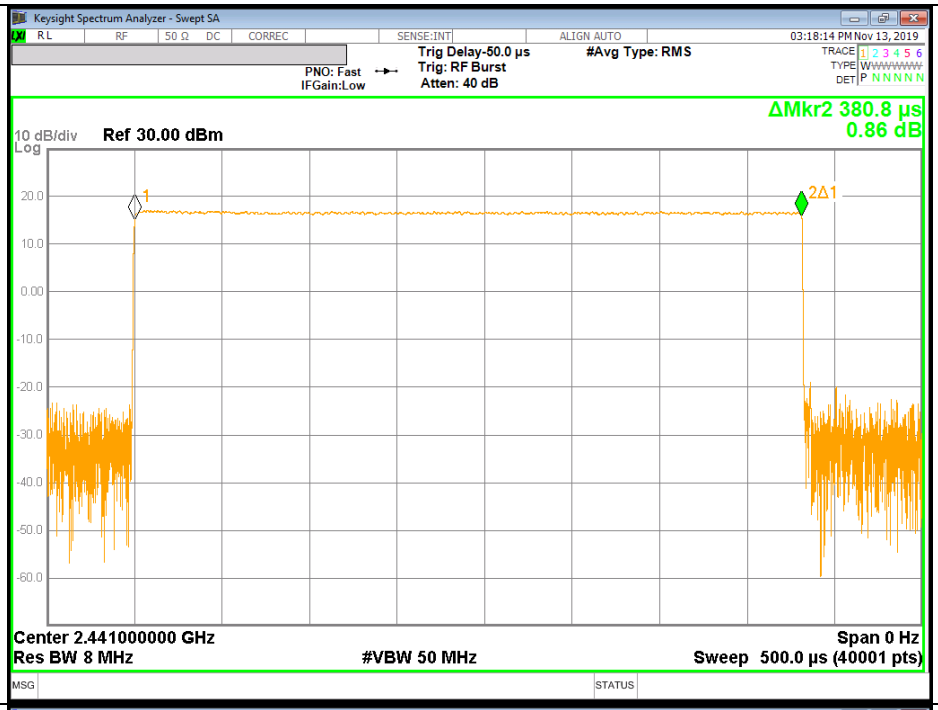
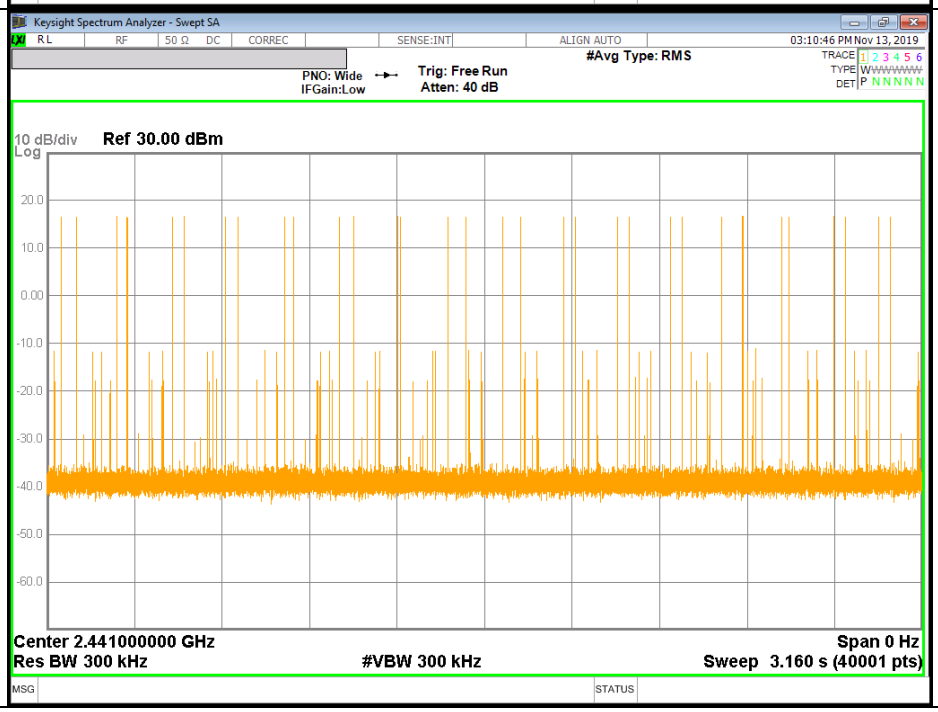
## DH1

| | |
|---|---|
| DH1<br><br>Pulse Width |  |
| DH1<br><br>NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD |  |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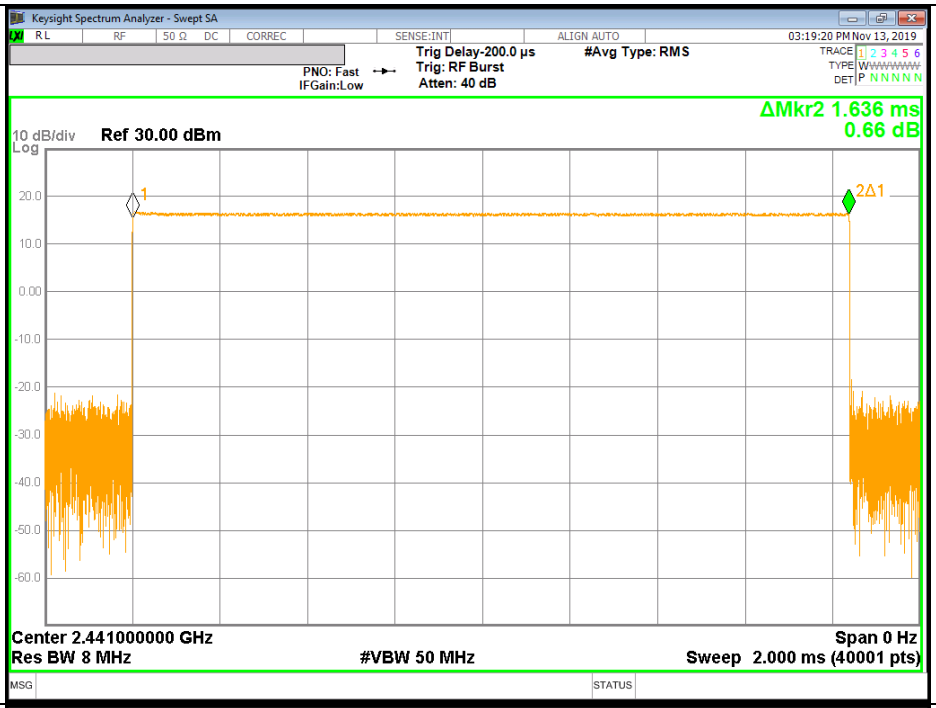
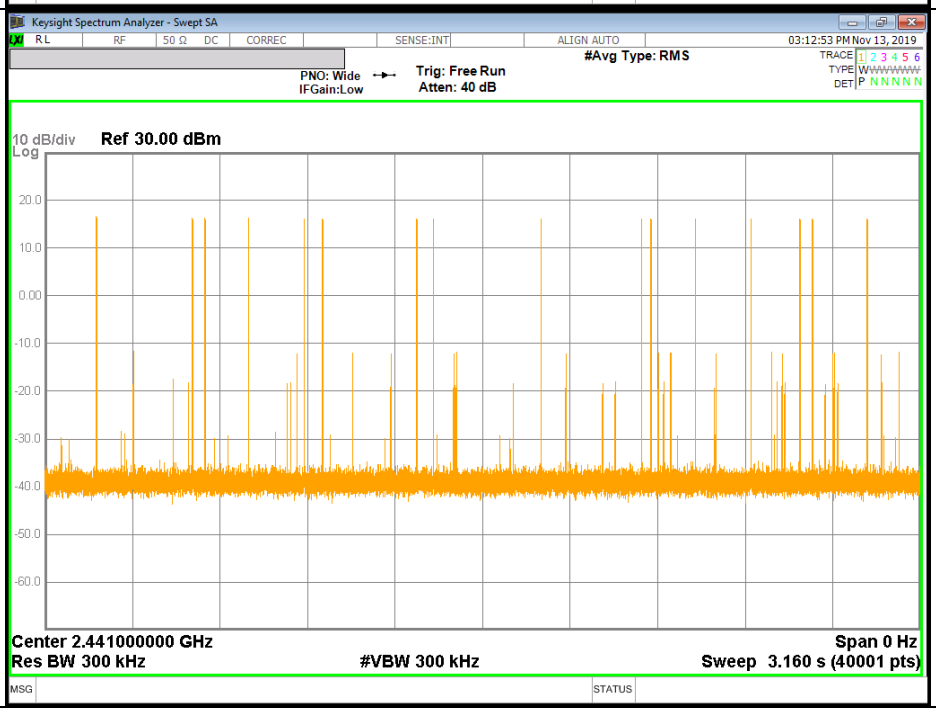
## DH3

| | |
|---|---|
| DH3<br><br>Pulse Width |  |
| DH3<br><br>NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD |  |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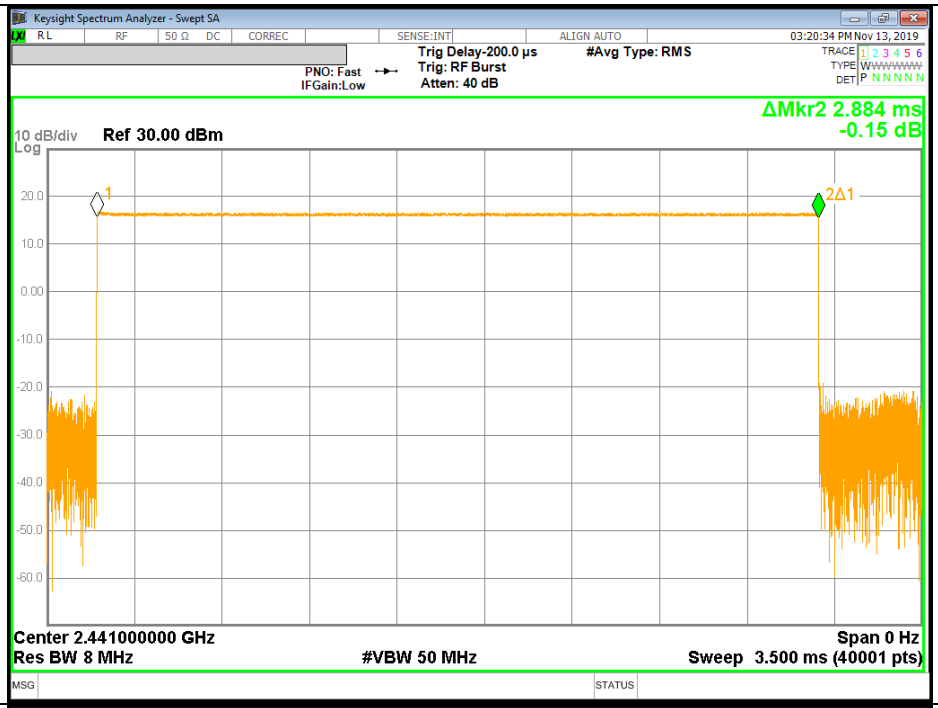
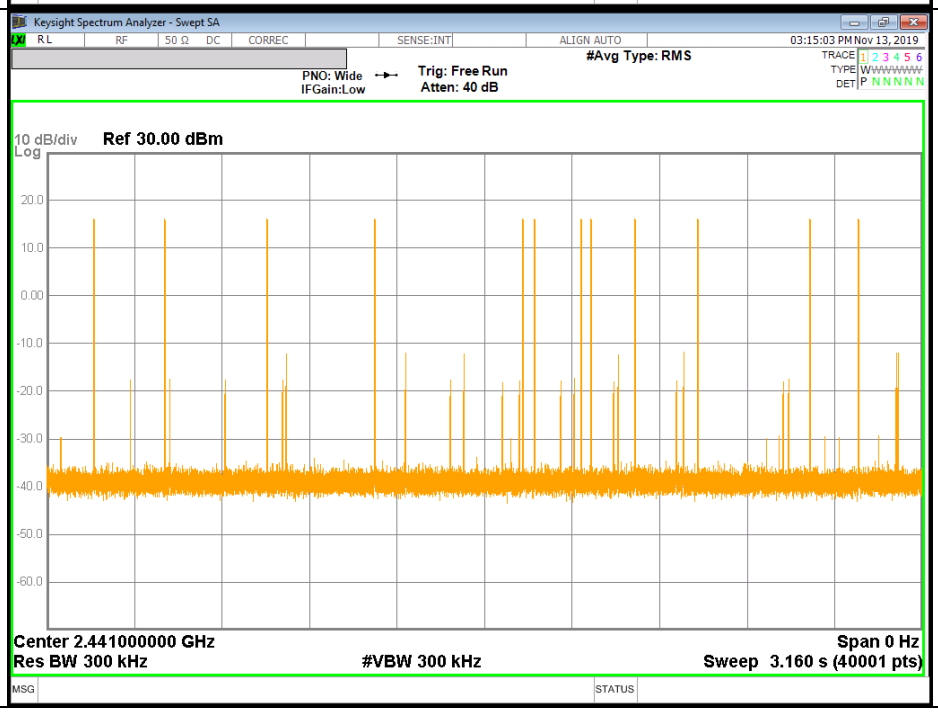
## DH5

| | |
|---|---|
| DH5<br><br>Pulse Width |  |
| DH5<br><br>NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD |  |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**RESULTS[8PSK]**

| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Normal | | | | | |
| DH1 | 0.387 | 32 | 0.123776 | 0.4 | -0.2762 |
| DH3 | 1.638 | 16 | 0.262080 | 0.4 | -0.1379 |
| DH5 | 2.888 | 12 | 0.346560 | 0.4 | -0.0534 |
| | | | | | |
| **DH Packet** | **Pulse Width [msec]** | **Number of Pulses in 0.8 seconds** | **Average Time of Occupancy [sec]** | **Limit [sec]** | **Margin [sec]** |
| GFSK AFH | | | | | |
| DH1 | 0.387 | 8 | 0.030944 | 0.4 | -0.369056 |
| DH3 | 1.638 | 4 | 0.065520 | 0.4 | -0.33448 |
| DH5 | 2.888 | 3 | 0.086640 | 0.4 | -0.31336 |


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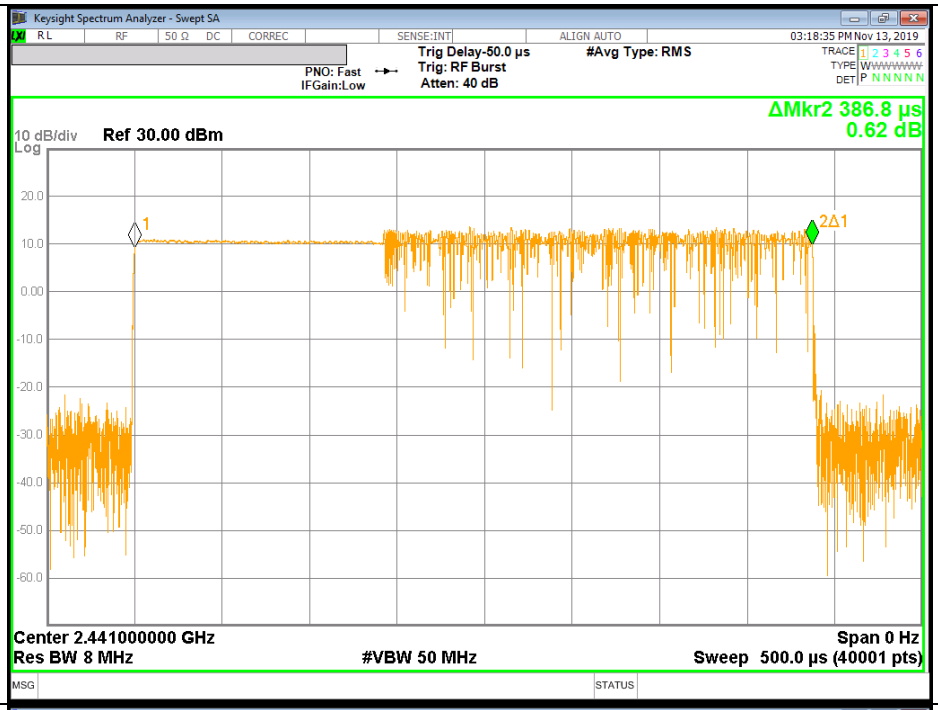
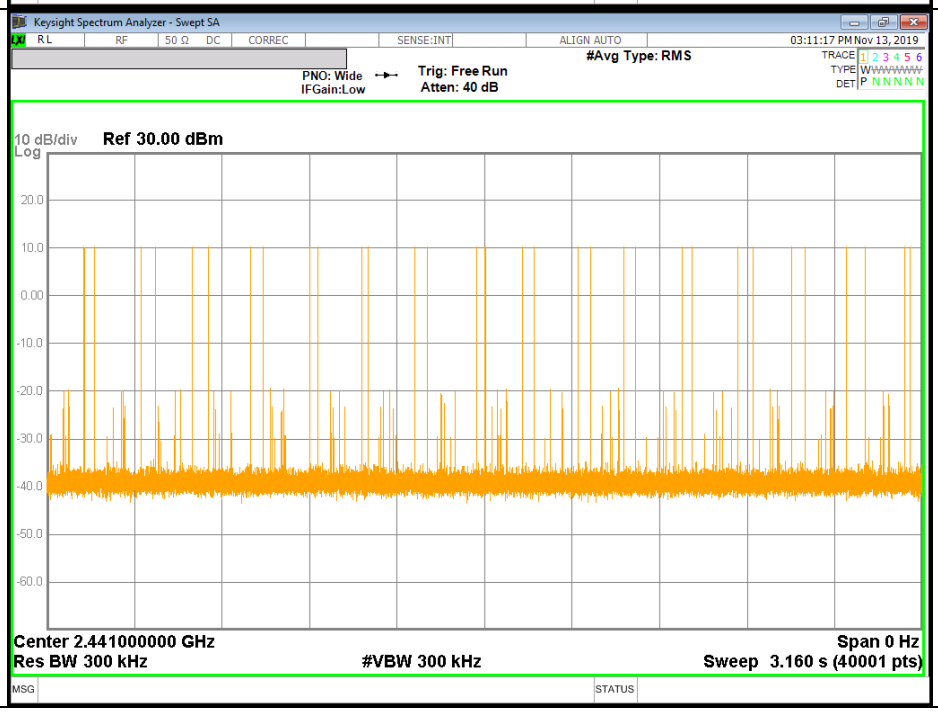
## DH1

| | |
|---|---|
| DH1<br><br>Pulse Width |  |
| DH1<br><br>NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD |  |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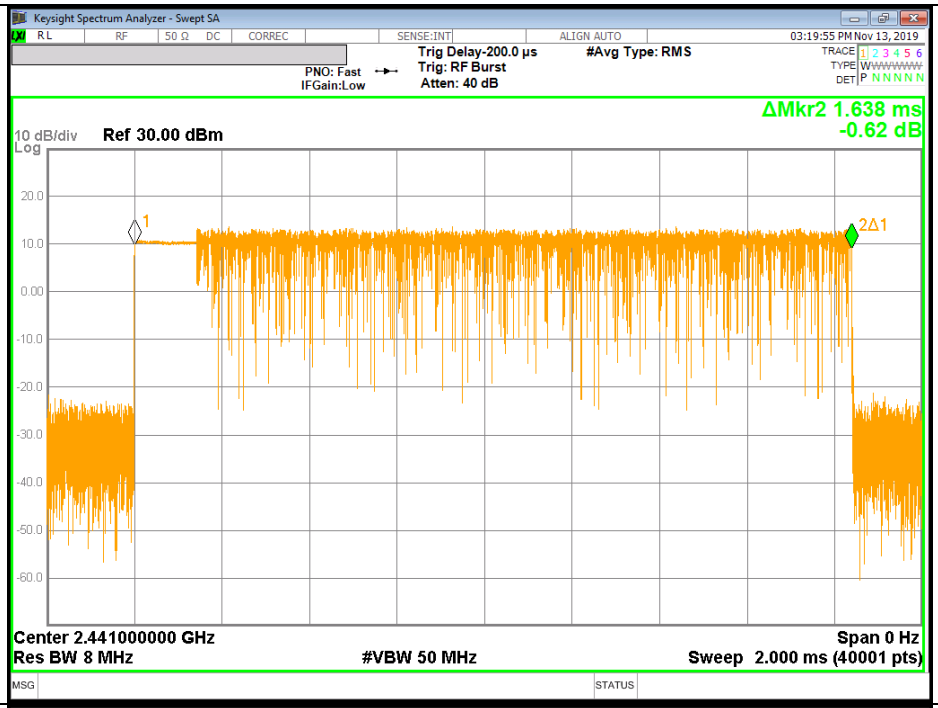
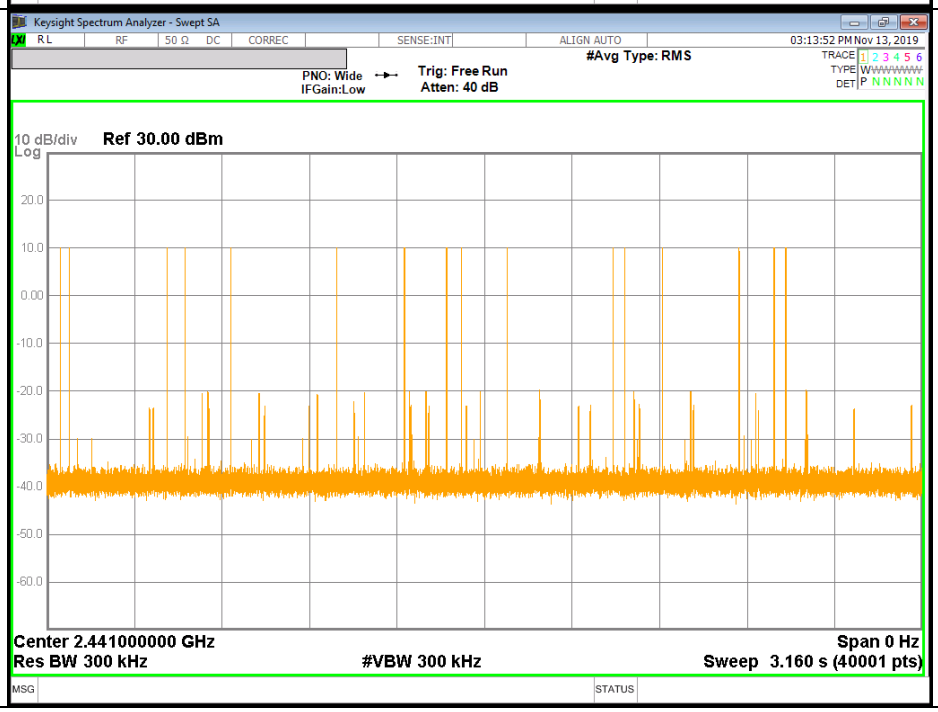
## DH3

| | |
|---|---|
| DH3<br><br>Pulse Width |  |
| DH3<br><br>NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD |  |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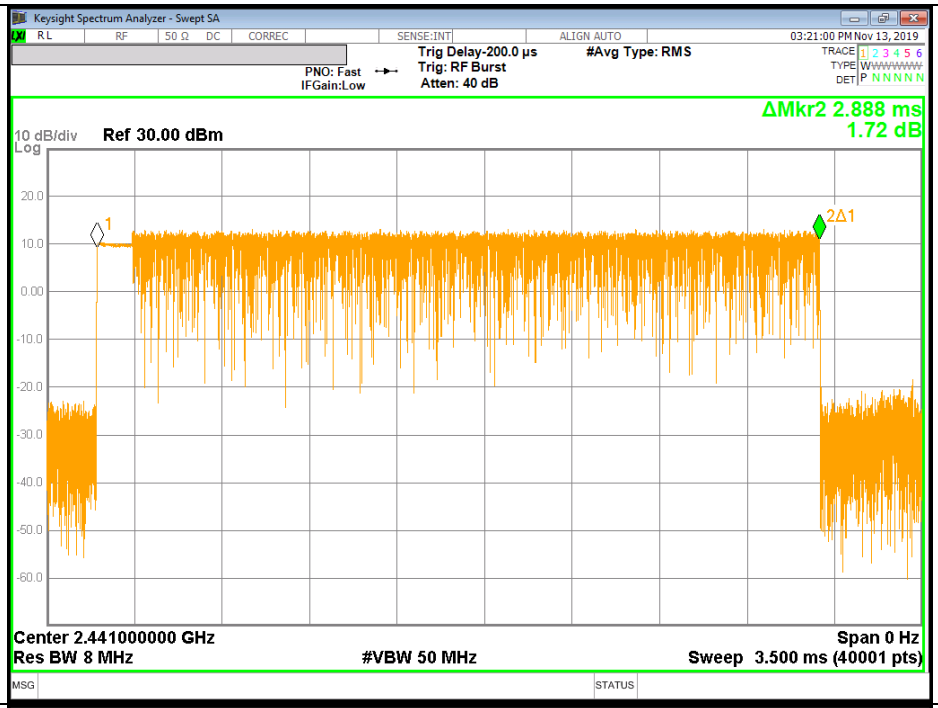
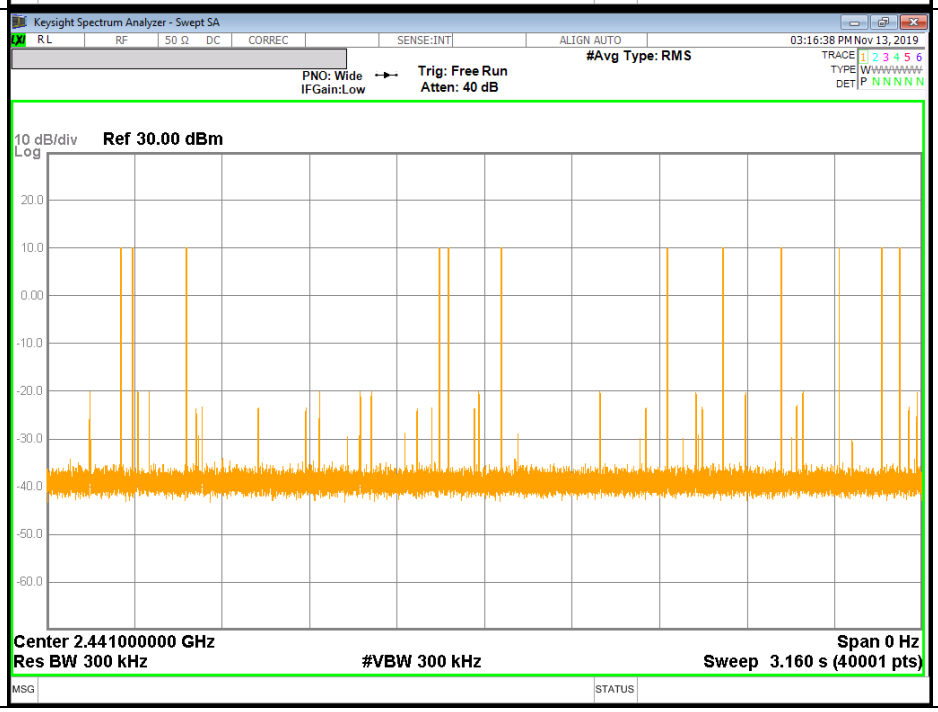
## DH5

| | |
|---|---|
| DH5<br><br>Pulse Width |  |
| DH5<br><br>NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD |  |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## 10.4. OUTPUT POWER

**LIMIT**

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

**RESULTS**

### 10.4.1. BASIC DATA RATE GFSK MODULATION

| Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|
| Low | 2 402 | 16.298 | 21.000 | -4.702 |
| Mid | 2 441 | **17.818** | **21.000** | **-3.182** |
| High | 2 480 | 16.341 | 21.000 | -4.659 |
| Worst | | 17.818 | 21.000 | -3.182 |

### 10.4.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

| Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|
| Low | 2 402 | 12.404 | 21.000 | -8.596 |
| Mid | 2 441 | **13.897** | **21.000** | **-7.103** |
| High | 2 480 | 12.491 | 21.000 | -8.509 |
| Worst | | 13.897 | 21.000 | -7.103 |

### 10.4.3. ENHANCED DATA RATE 8PSK MODULATION

| Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|
| Low | 2 402 | 12.800 | 21.000 | -8.200 |
| Mid | 2 441 | **14.488** | **21.000** | **-6.512** |
| High | 2 480 | 12.955 | 21.000 | -8.045 |
| Worst | | 14.488 | 21.000 | -6.512 |


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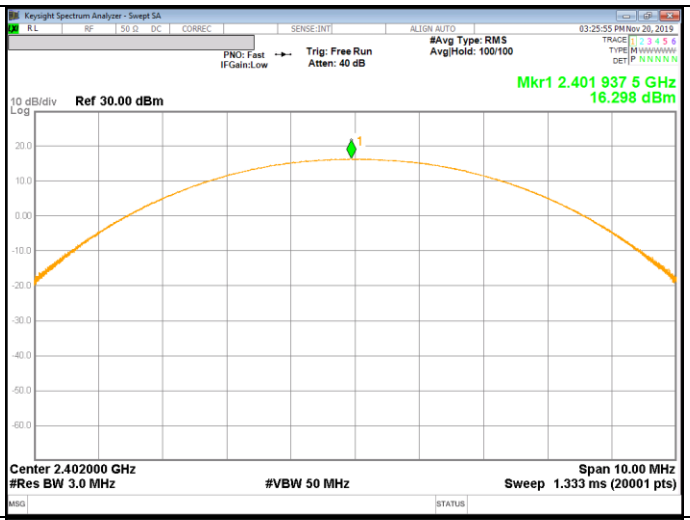
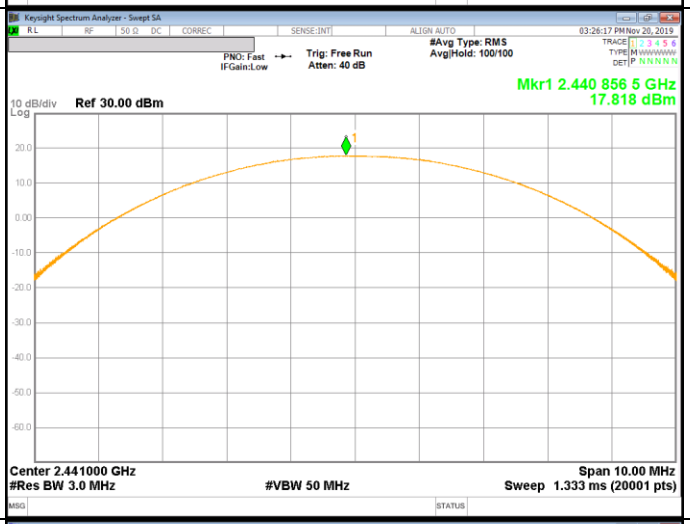
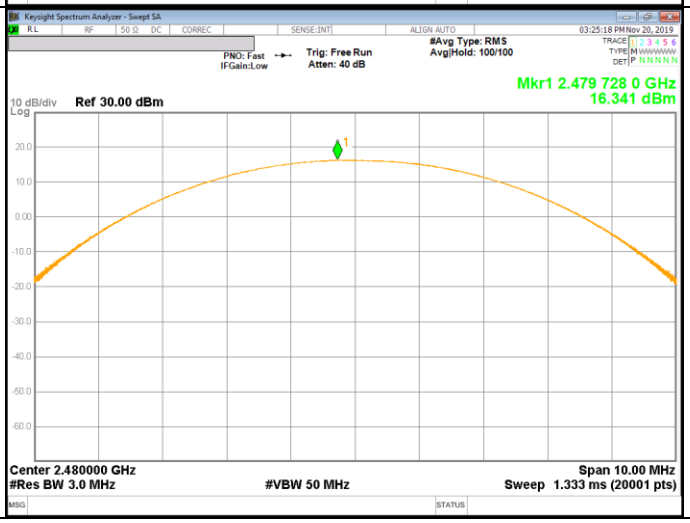
### 10.4.4. OUTPUT POWER PLOTS

**GFSK OUTPUT POWER**

| | | | |
|---|---|---|---|
| GFSK<br><br>Low CH | |  | |
| GFSK<br><br>Middle CH | |  | |
| GFSK<br><br>High CH | |  | |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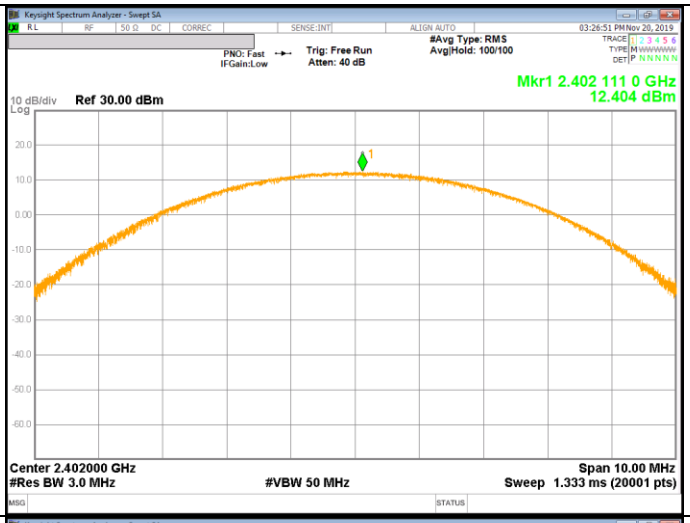
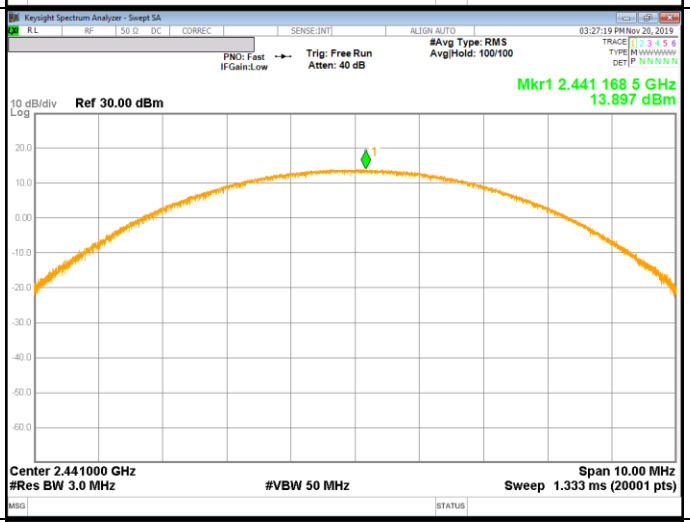
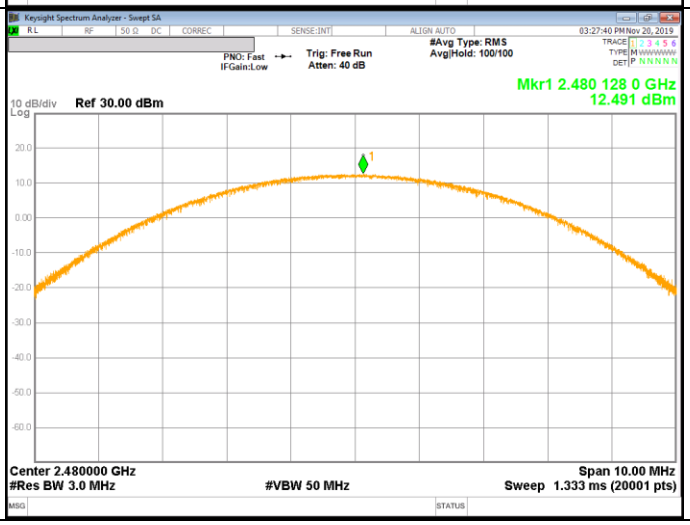
**Pi/4-DPSK OUTPUT POWER**

| | | | |
|---|---|---|---|
| Pi/4-DPSK<br><br>Low CH | |  | |
| Pi/4-DPSK<br><br>Middle CH | |  | |
| Pi/4-DPSK<br><br>High CH | |  | |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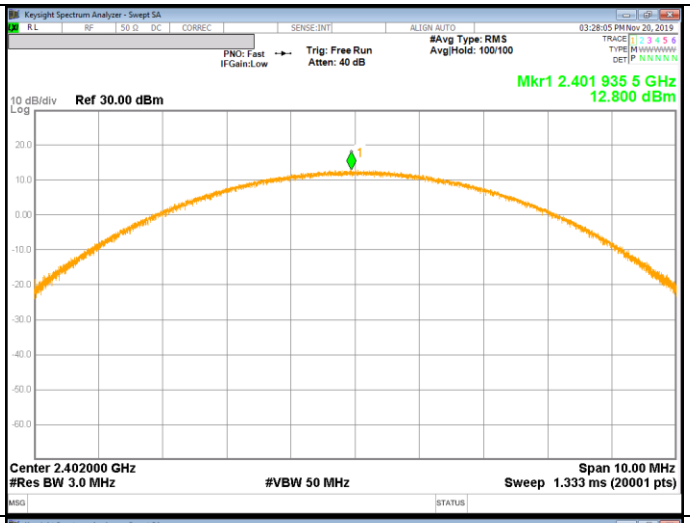
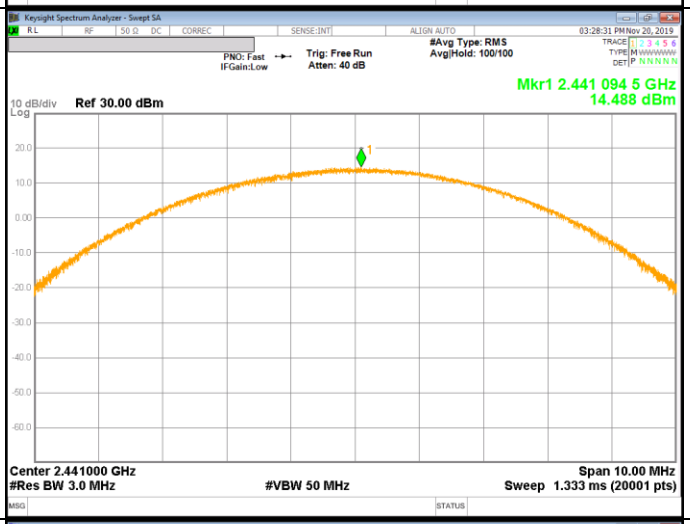
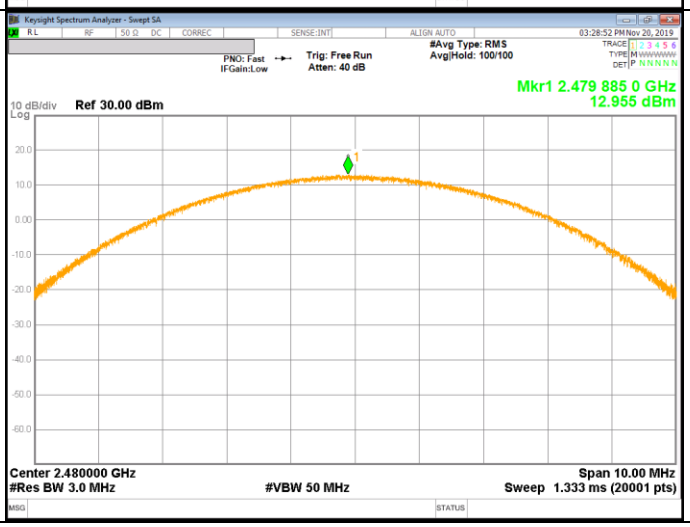
**8PSK OUTPUT POWER**

| | | |
|---|---|---|
| 8PSK<br><br>Low CH | |  |
| 8PSK<br><br>Middle CH | |  |
| 8PSK<br><br>High CH | |  |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## 10.5. AVERAGE POWER

**LIMIT**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

### 10.5.1. BASIC DATA RATE GFSK MODULATION

| Channel | Frequency [MHz] | AV power [dBm] | AV power [mW] |
|---|---|---|---|
| Low | 2 402 | 15.877 | 38.699 |
| Middle | 2 441 | **17.417** | **55.170** |
| High | 2 480 | 15.794 | 37.966 |

### 10.5.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

| Channel | Frequency [MHz] | AV power [dBm] | AV power [mW] |
|---|---|---|---|
| Low | 2 402 | 9.846 | 9.652 |
| Middle | 2 441 | **11.326** | **13.571** |
| High | 2 480 | 9.889 | 9.747 |

### 10.5.3. ENHANCED DATA RATE 8PSK MODULATION

| Channel | Frequency [MHz] | AV power [dBm] | AV power [mW] |
|---|---|---|---|
| Low | 2 402 | 9.721 | 9.377 |
| Middle | 2 441 | **11.358** | **13.671** |
| High | 2 480 | 9.919 | 9.814 |


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## 10.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

Limit = -20 dBc

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**


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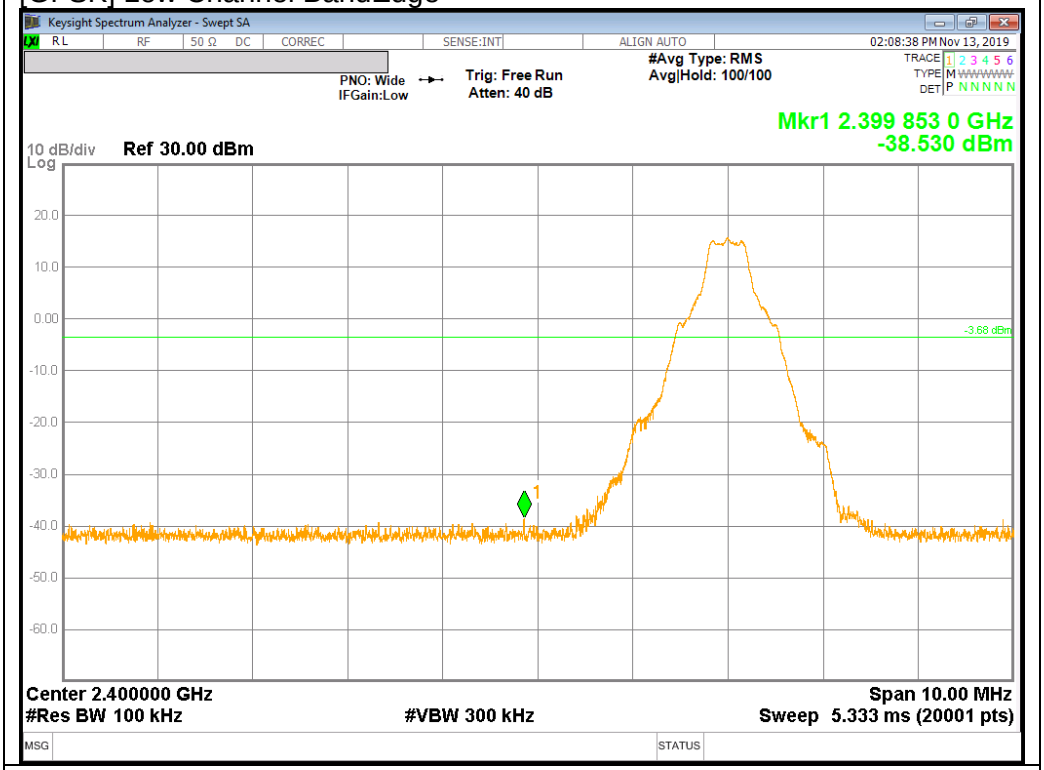
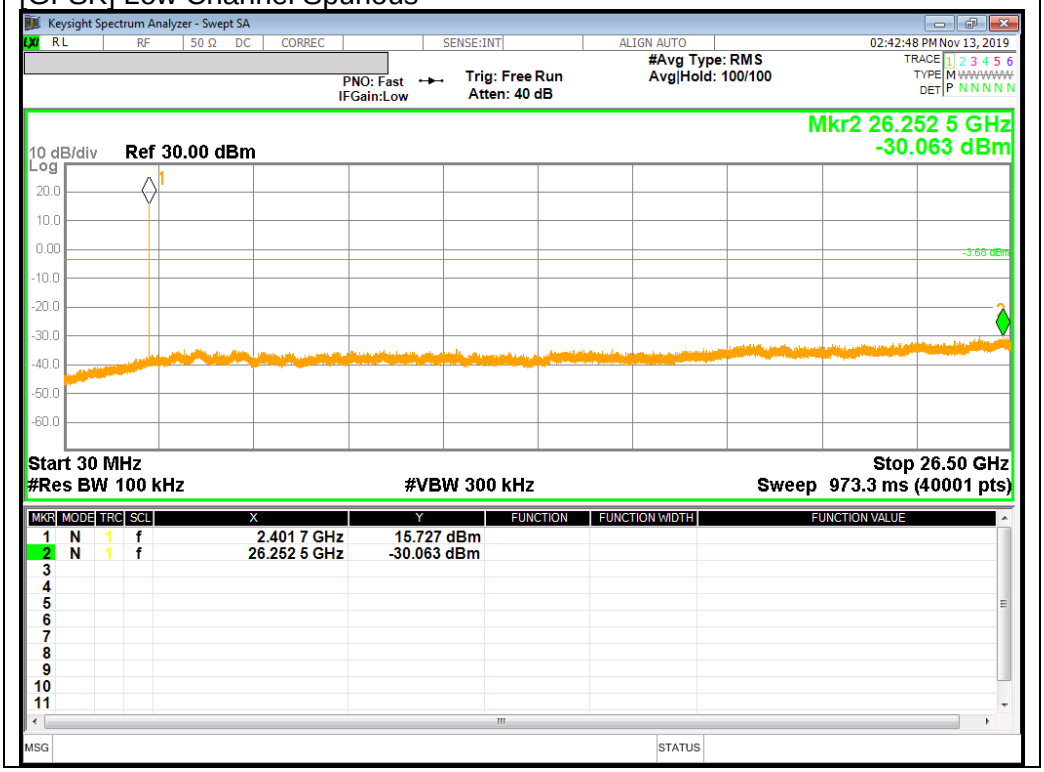
### 10.6.1. BASIC DATA RATE GFSK MODULATION

**GFSK Mode**

[GFSK] Low Channel BandEdge




[GFSK] Low Channel Spurious





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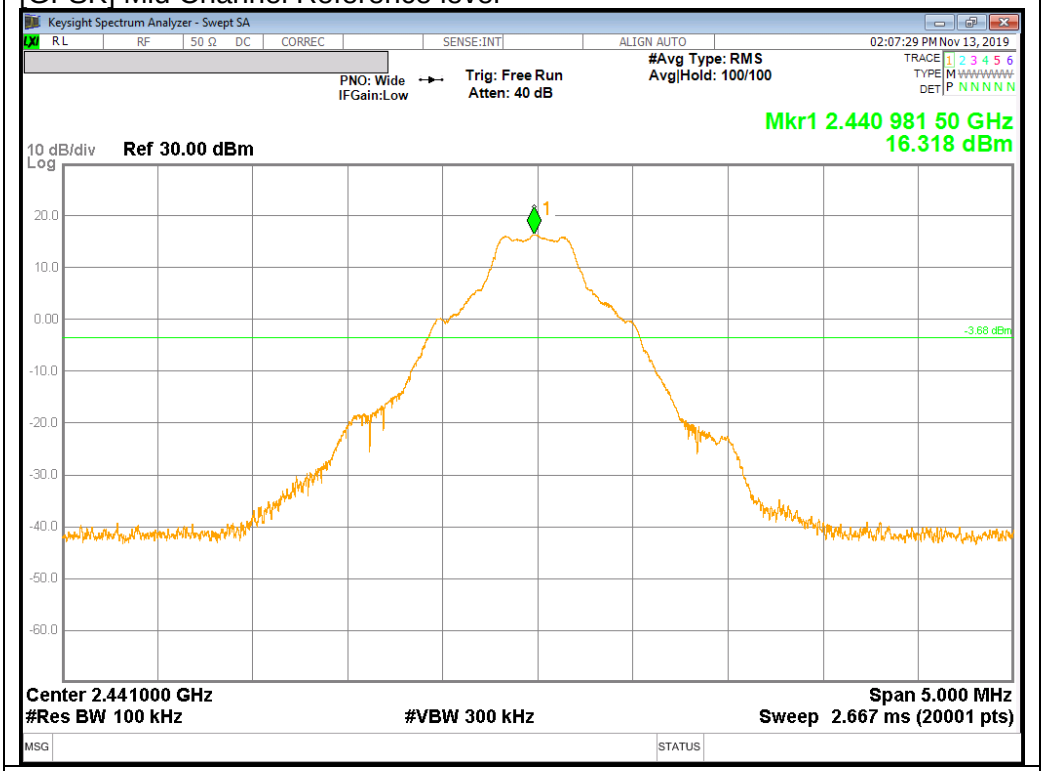
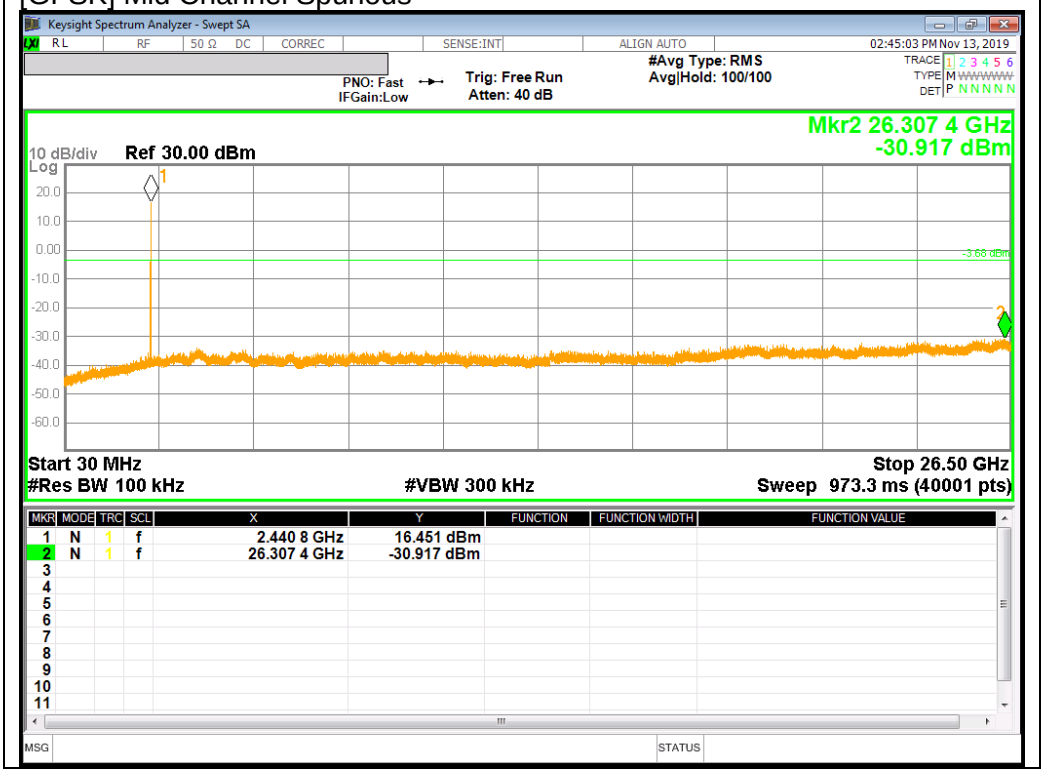
[GFSK] Mid Channel Reference level




[GFSK] Mid Channel Spurious





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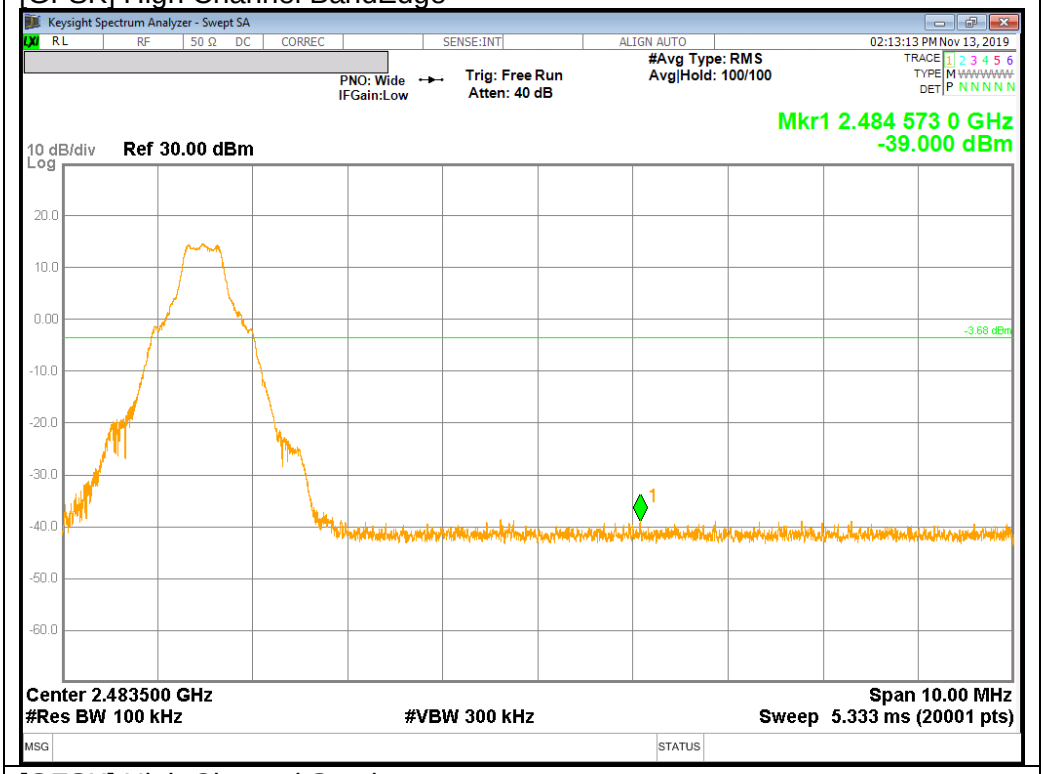
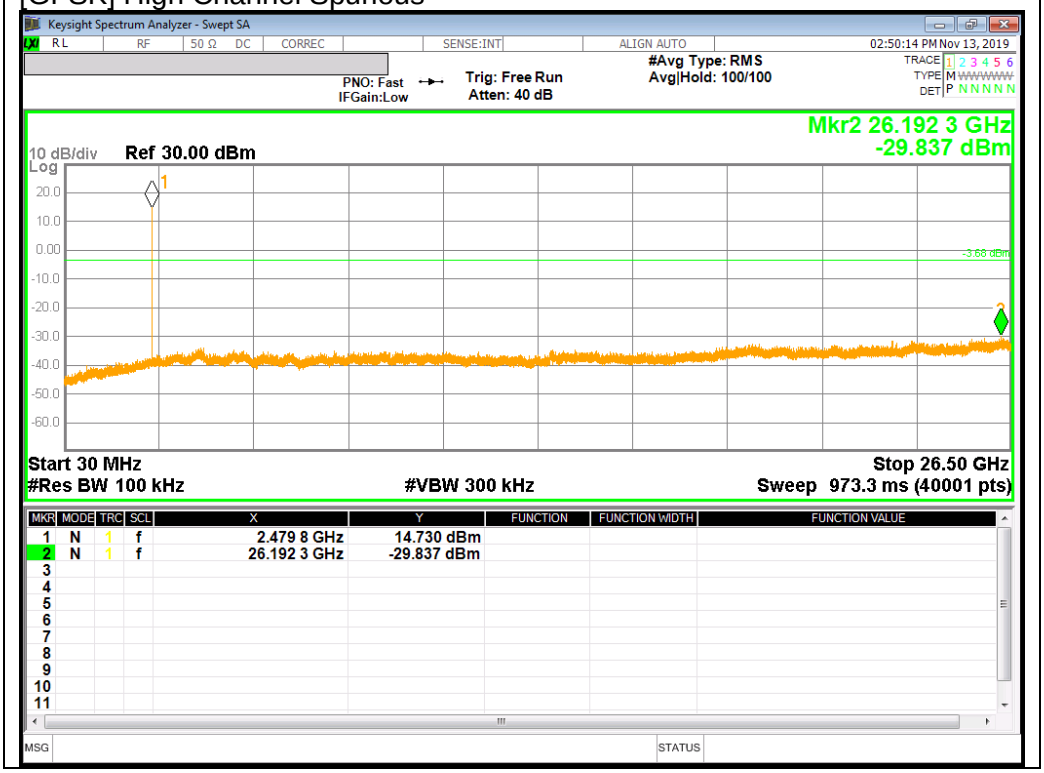
[GFSK] High Channel BandEdge




[GFSK] High Channel Spurious





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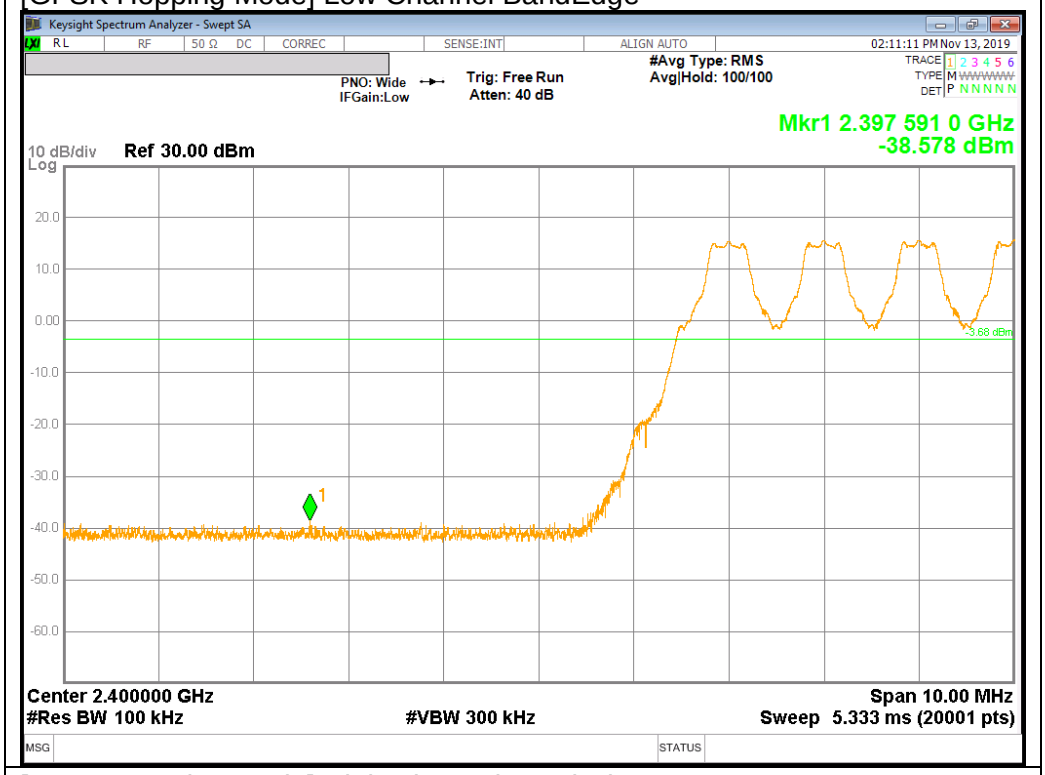
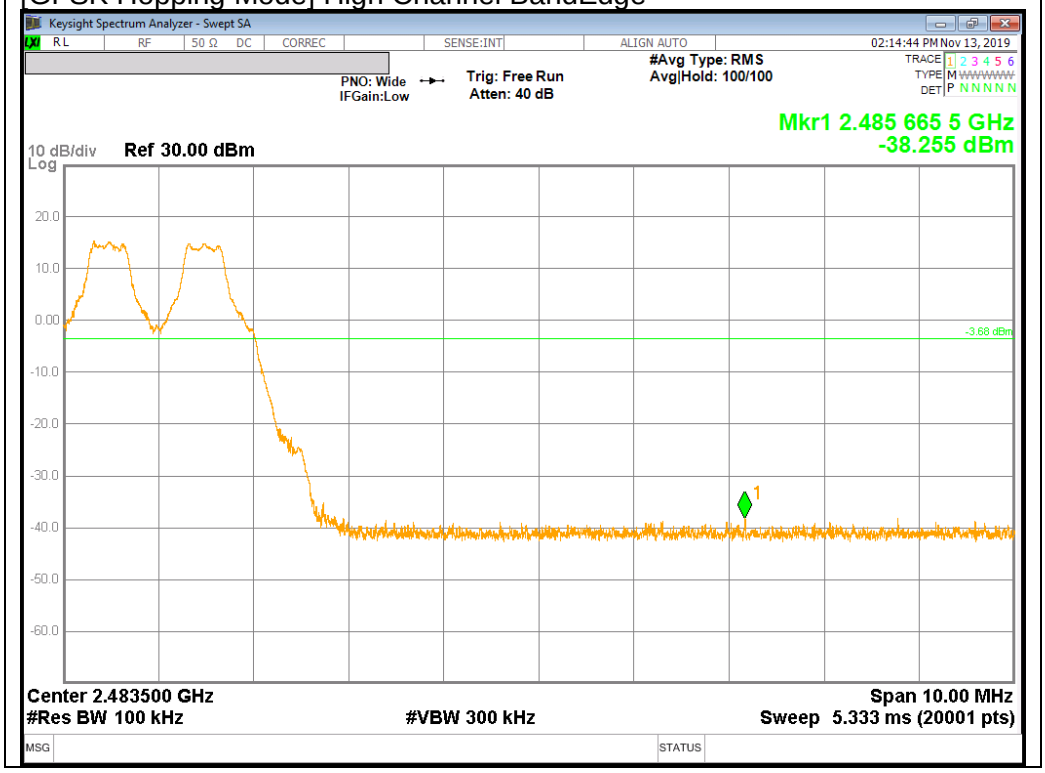
**BandEdge Emission at GFSK Hopping Mode**

[GFSK Hopping Mode] Low Channel BandEdge




[GFSK Hopping Mode] High Channel BandEdge





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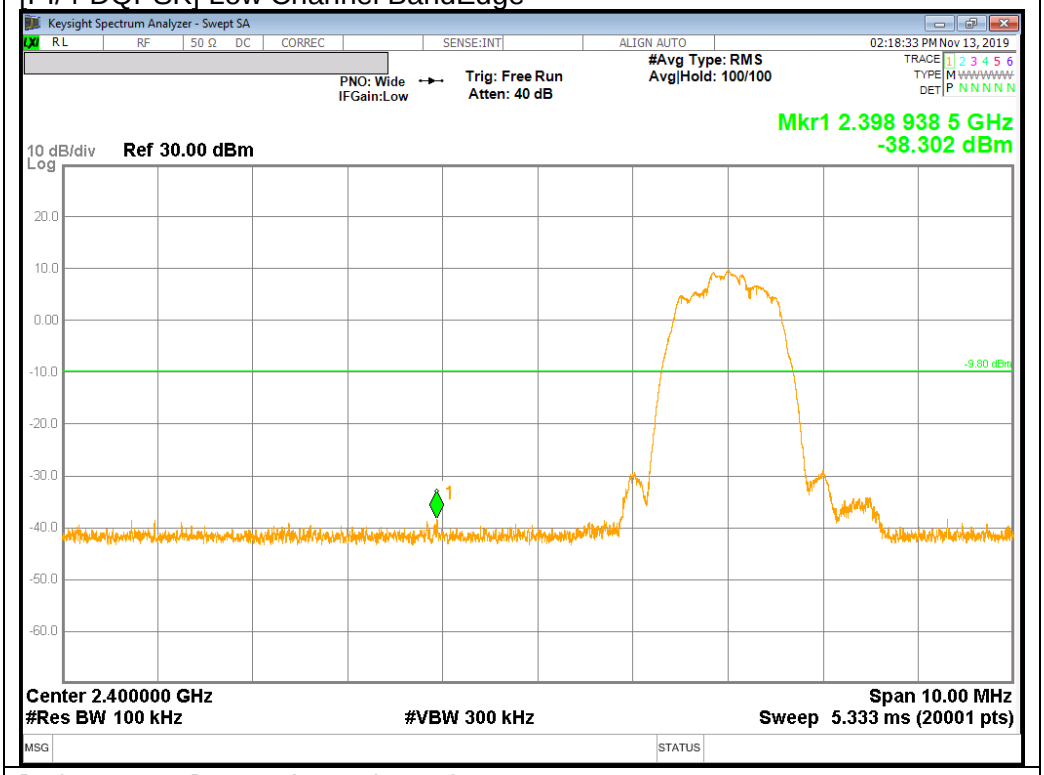
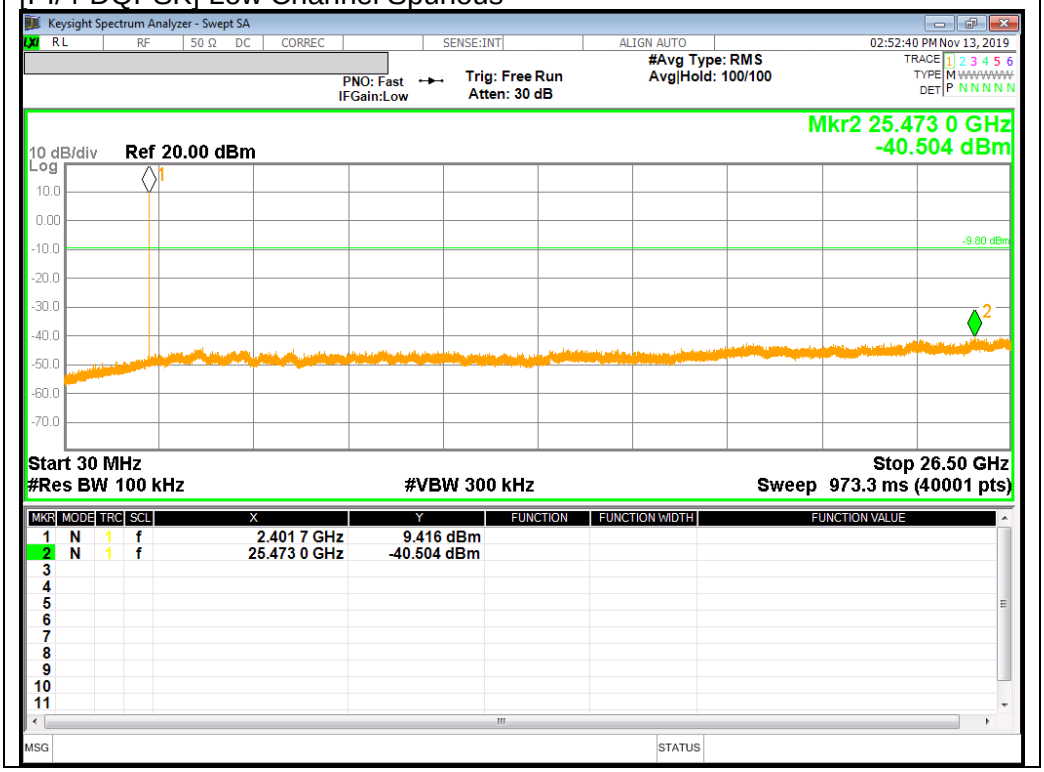
## 10.6.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

**PI/4-DQPSK Mode**

[PI/4-DQPSK] Low Channel BandEdge




[PI/4-DQPSK] Low Channel Spurious





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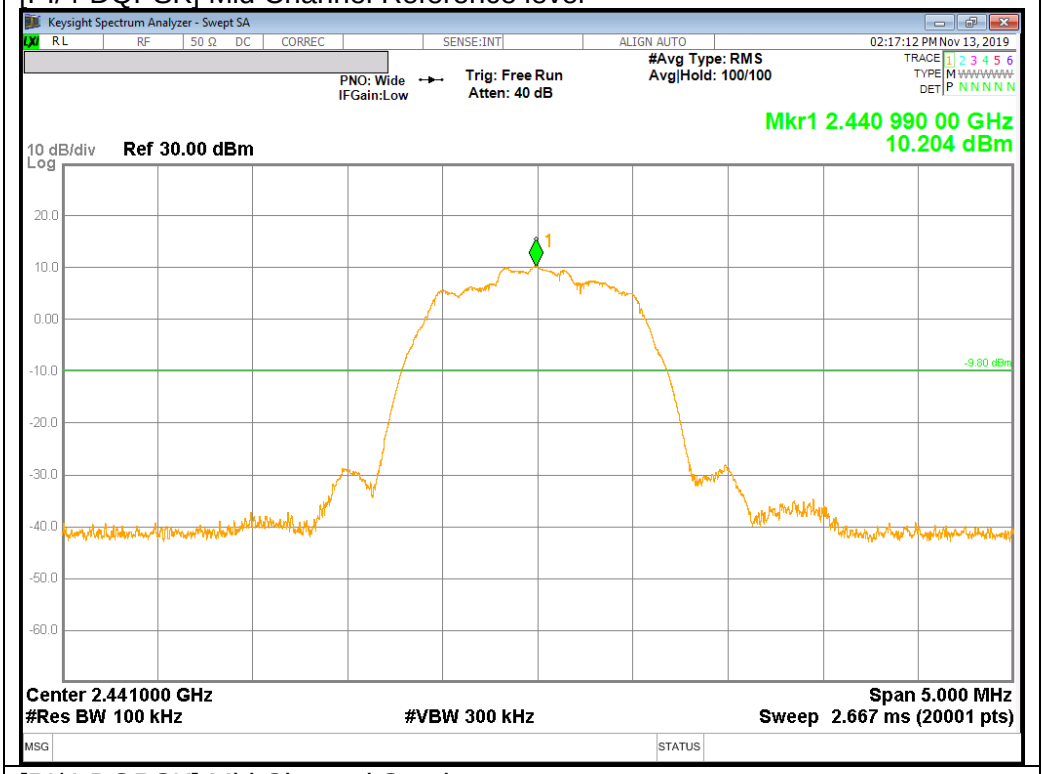
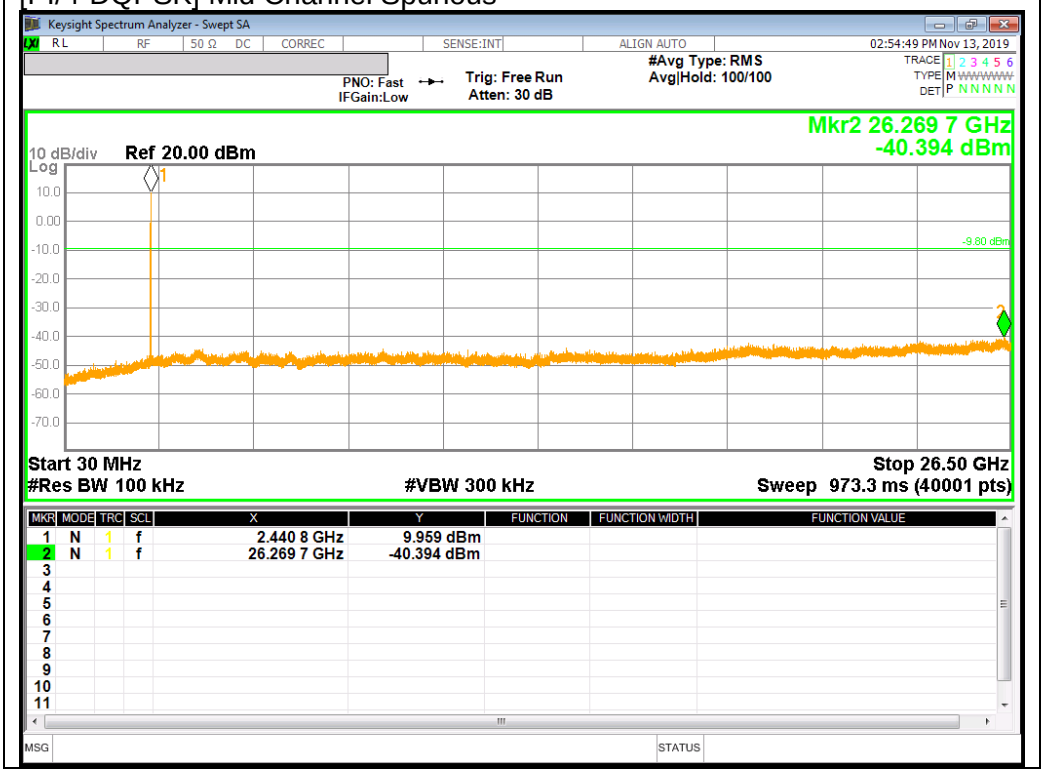
[PI/4-DQPSK] Mid Channel Reference level




[PI/4-DQPSK] Mid Channel Spurious





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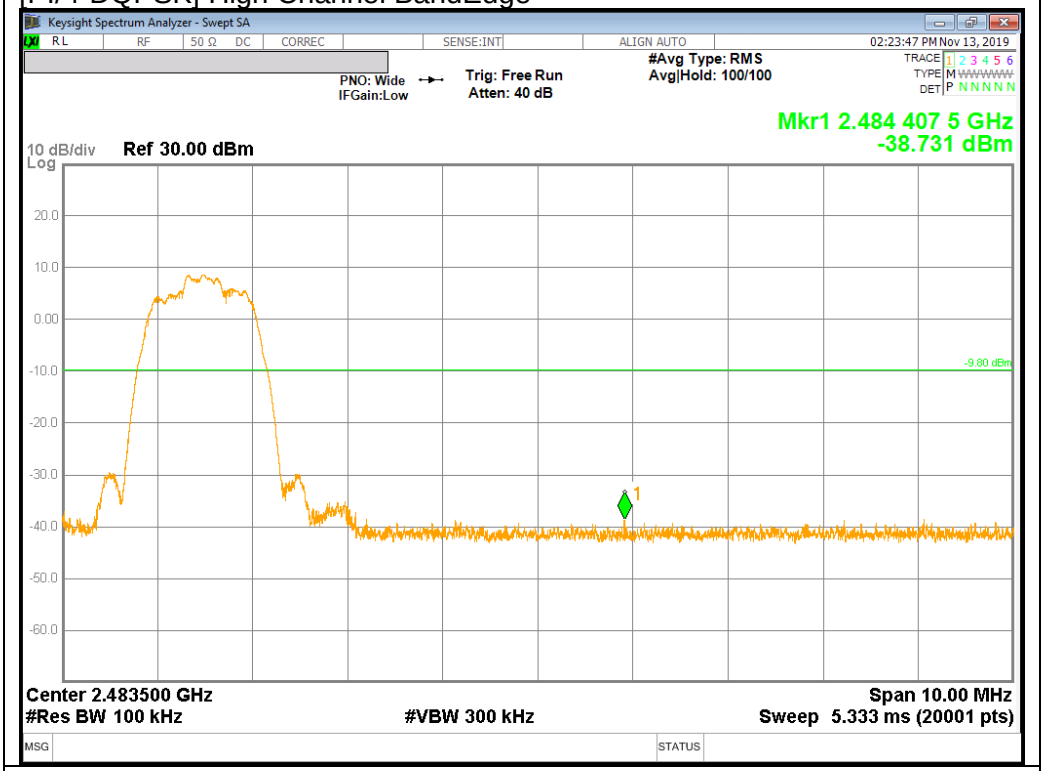
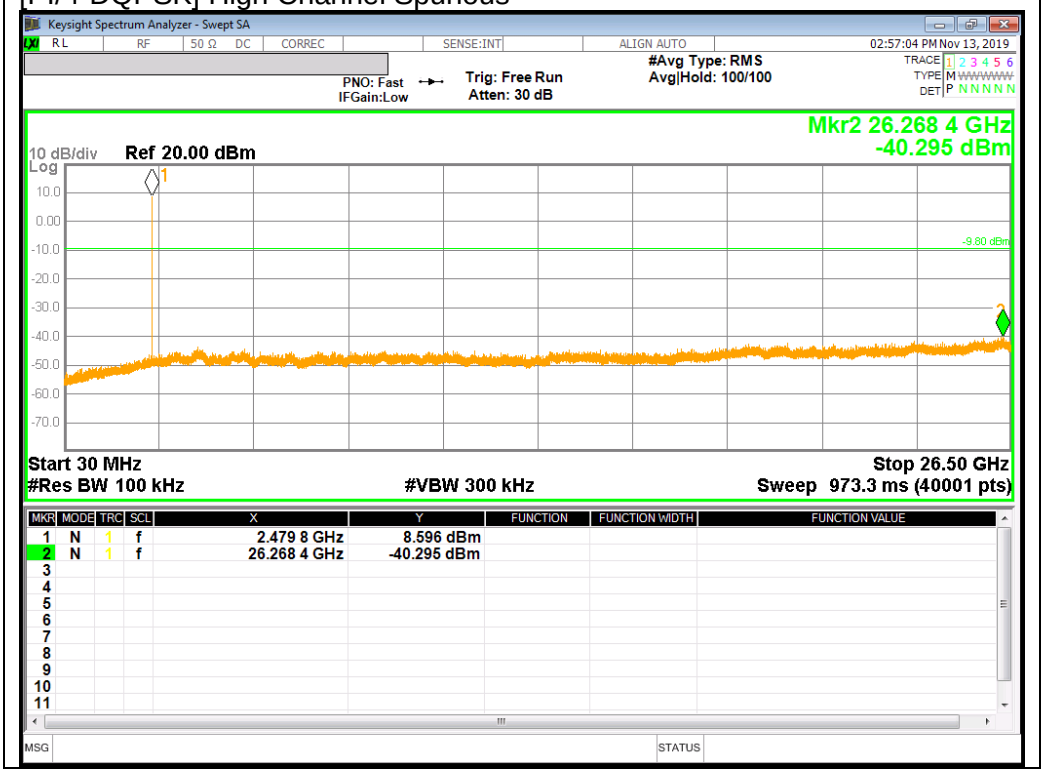
[PI/4-DQPSK] High Channel BandEdge




[PI/4-DQPSK] High Channel Spurious





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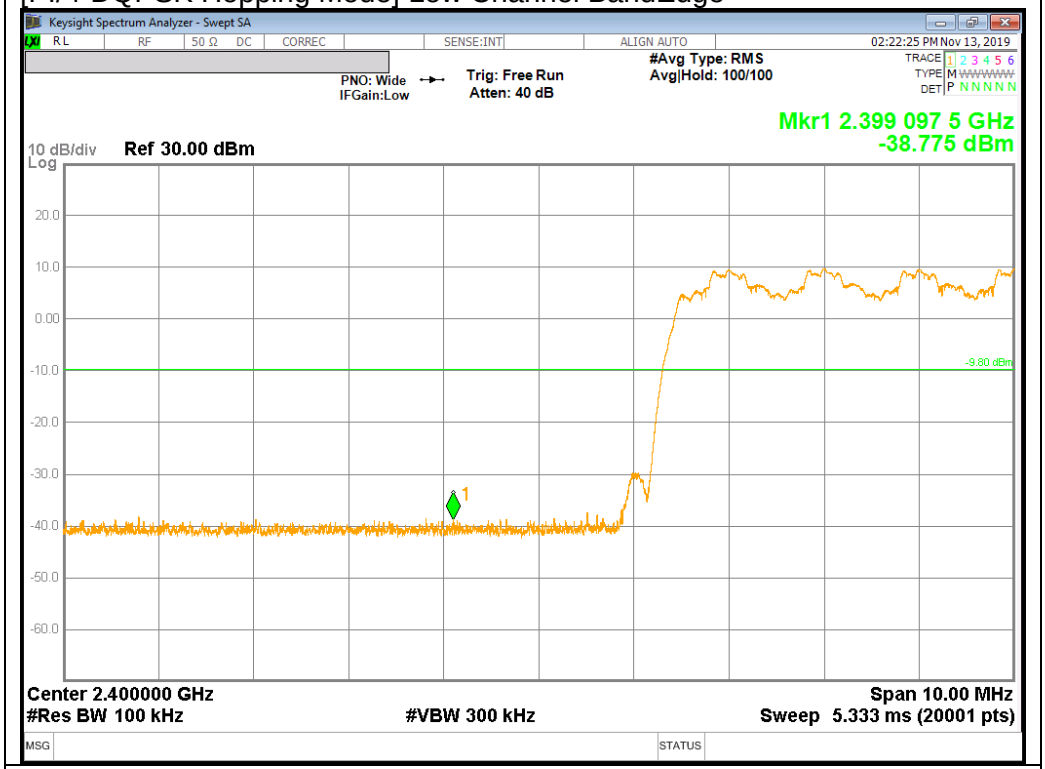
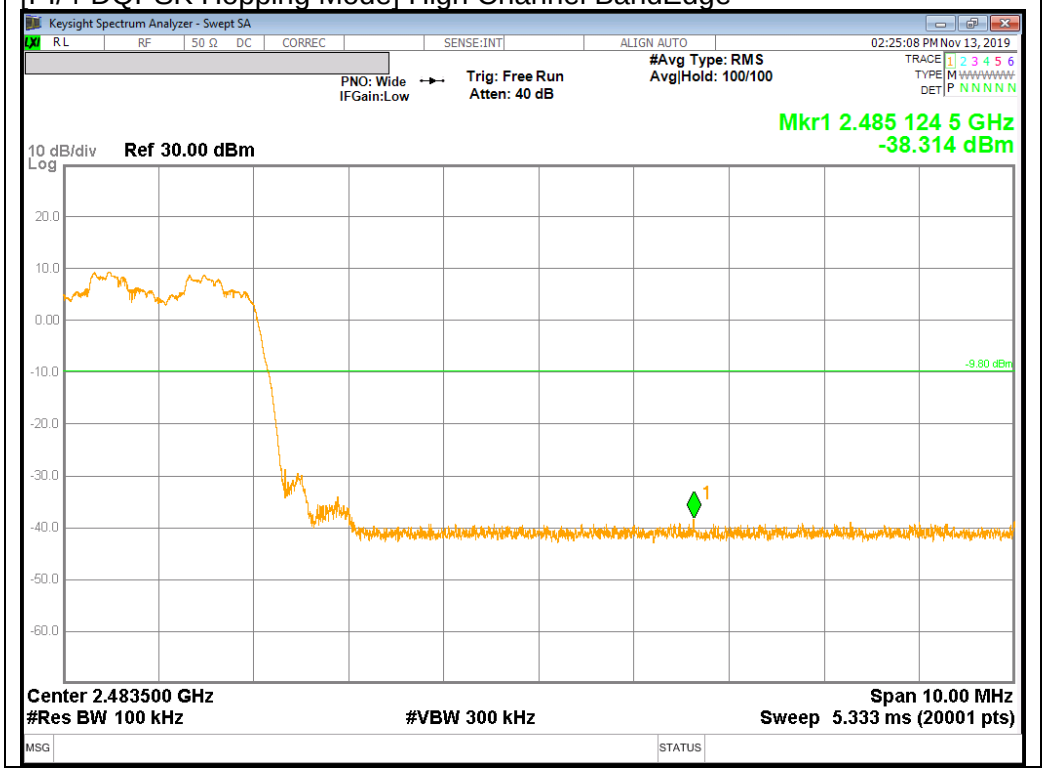
**BandEdge Emission at PI/4-DQPSK Hopping Mode**

[PI/4-DQPSK Hopping Mode] Low Channel BandEdge




[PI/4-DQPSK Hopping Mode] High Channel BandEdge





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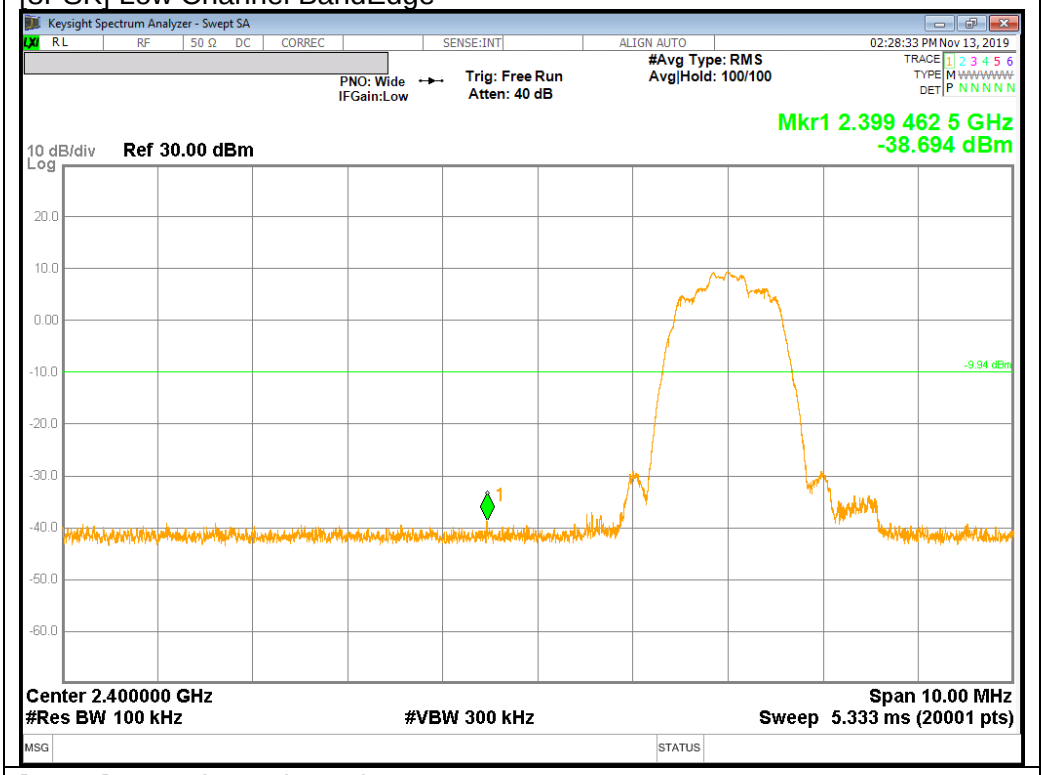
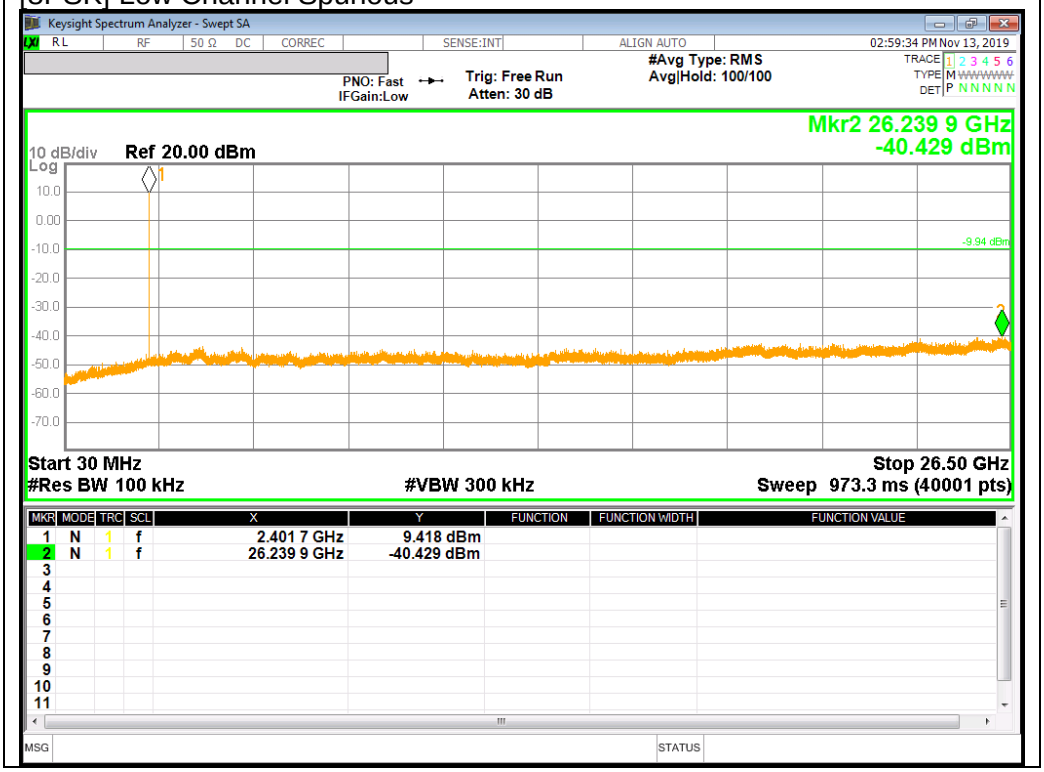
### 10.6.3. ENHANCED DATA RATE 8PSK MODULATION

**8PSK Mode**

[8PSK] Low Channel BandEdge




[8PSK] Low Channel Spurious





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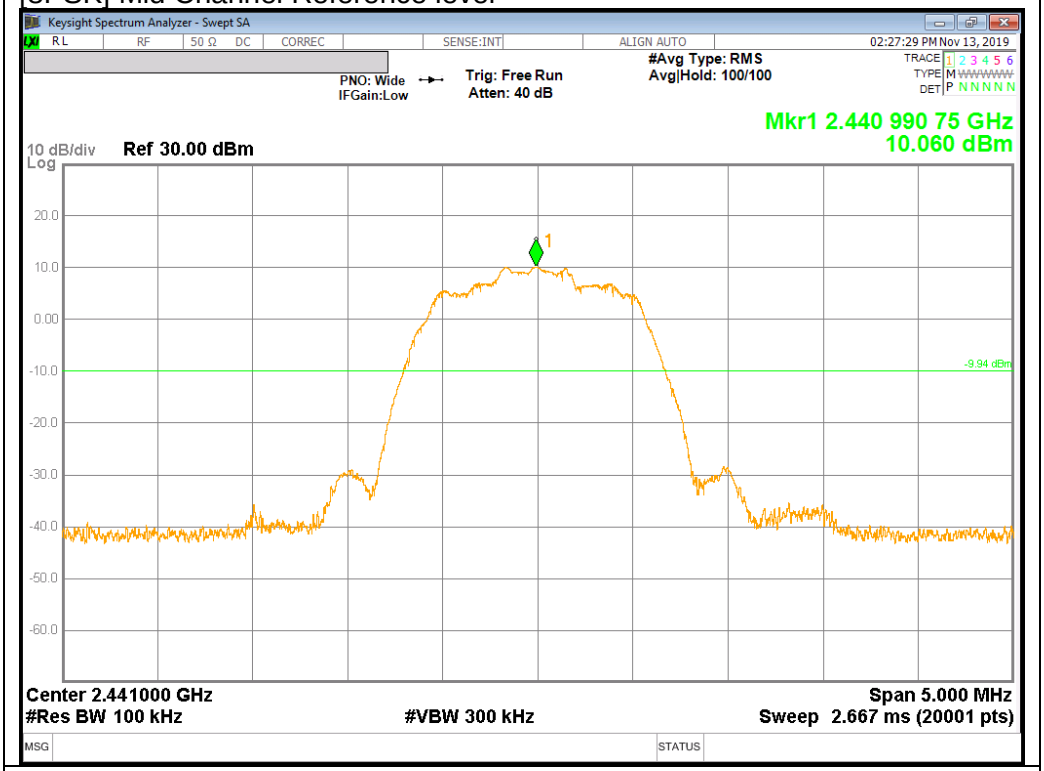
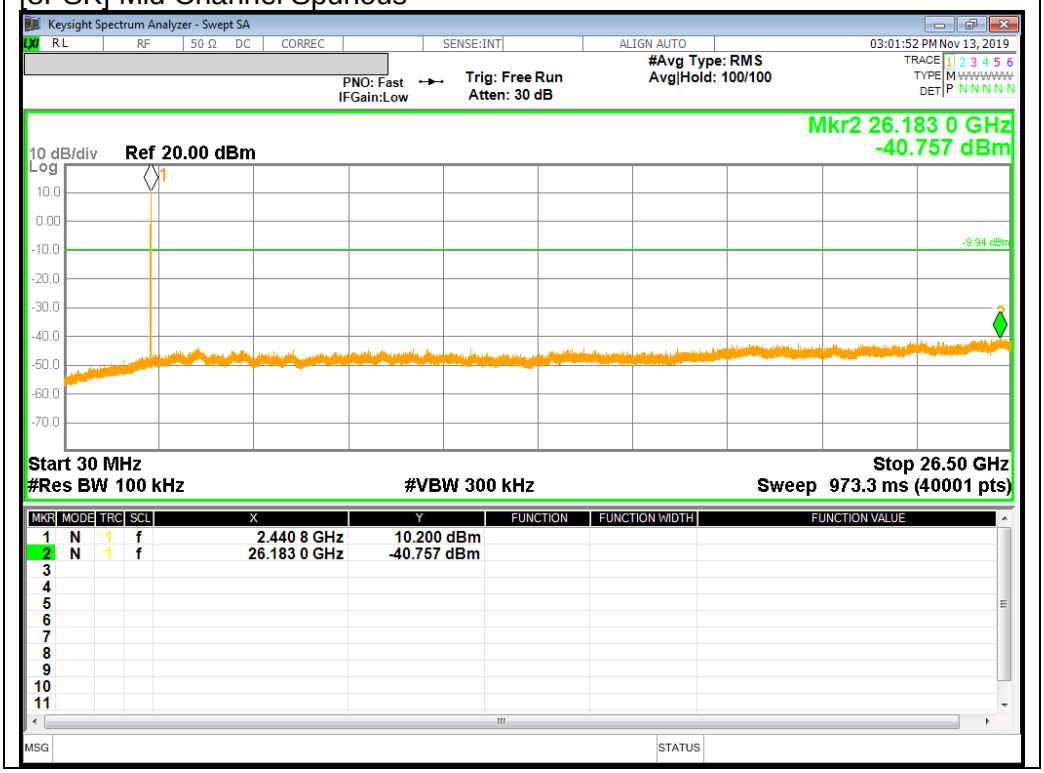
[8PSK] Mid Channel Reference level




[8PSK] Mid Channel Spurious





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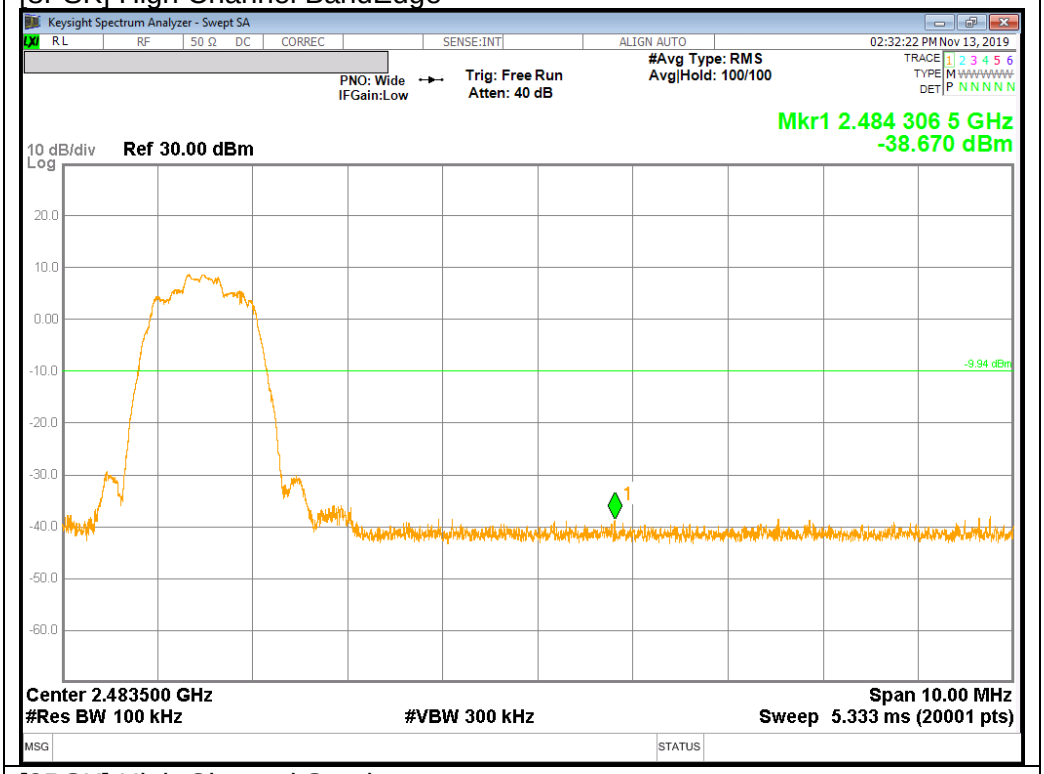
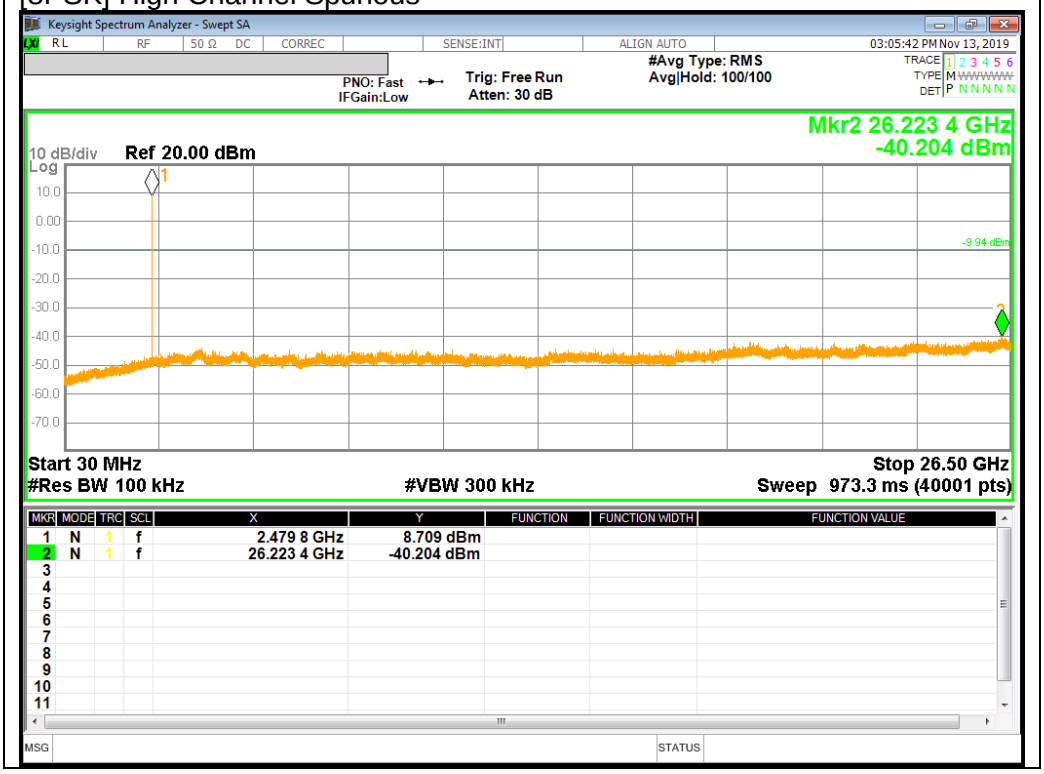
[8PSK] High Channel BandEdge




[8PSK] High Channel Spurious





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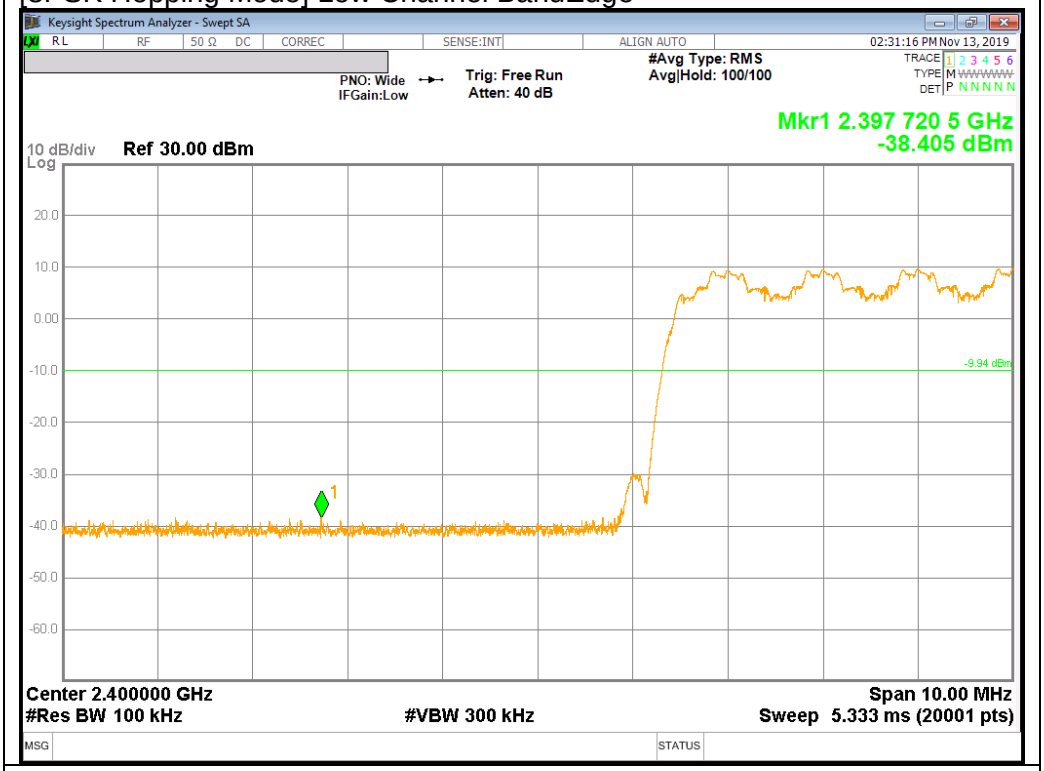
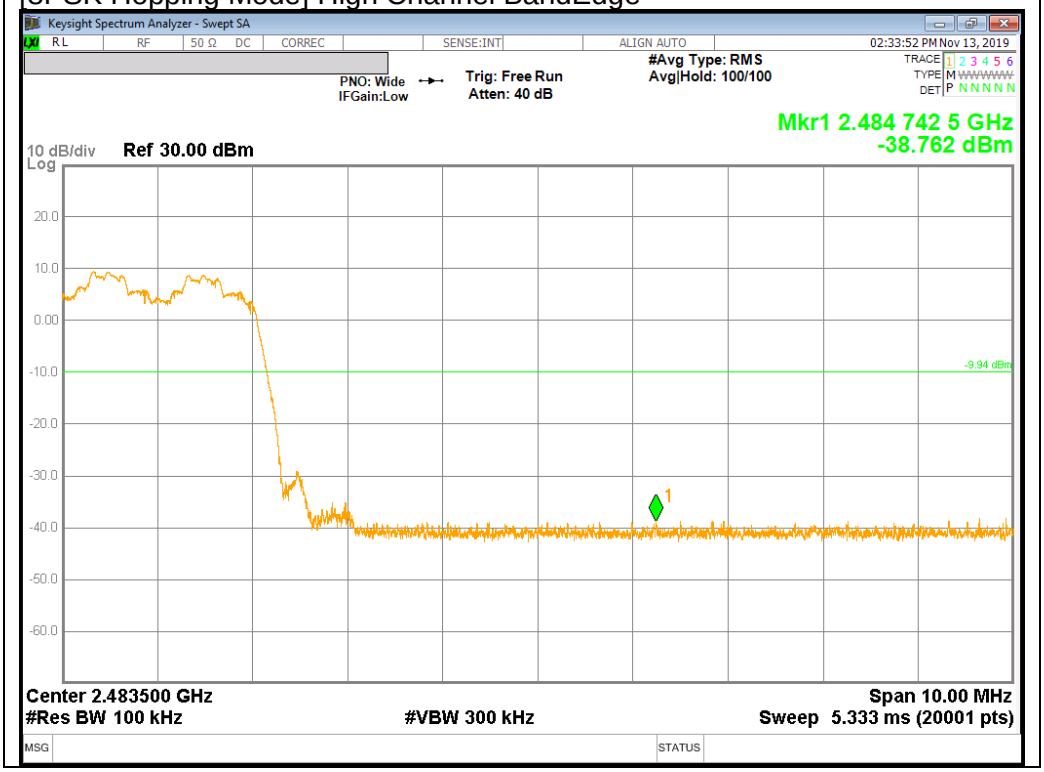
**BandEdge Emission at 8PSK Hopping Mode**

[8PSK Hopping Mode] Low Channel BandEdge




[8PSK Hopping Mode] High Channel BandEdge





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# 11. RADIATED TEST RESULTS

## 11.1. LIMITS AND PROCEDURE

**LIMITS**

FCC §15.205 and §15.209

| Limits for radiated disturbance of an intentional radiator | | |
|---|---|---|
| Frequency range (MHz) | Limits (µV/m) | Measurement Distance (m) |
| 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.


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**TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.(Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.)

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1/T (on time) for average measurement.

GFSK = 1/T = 1 / 0.002885S = 347Hz.

The minimum VBW was 347Hz, but test receiver(ESU40) couldn't set value 347Hz. Due to this reason, testing VBW was set to 500Hz(Worst cases).

The spectrum from 1GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.


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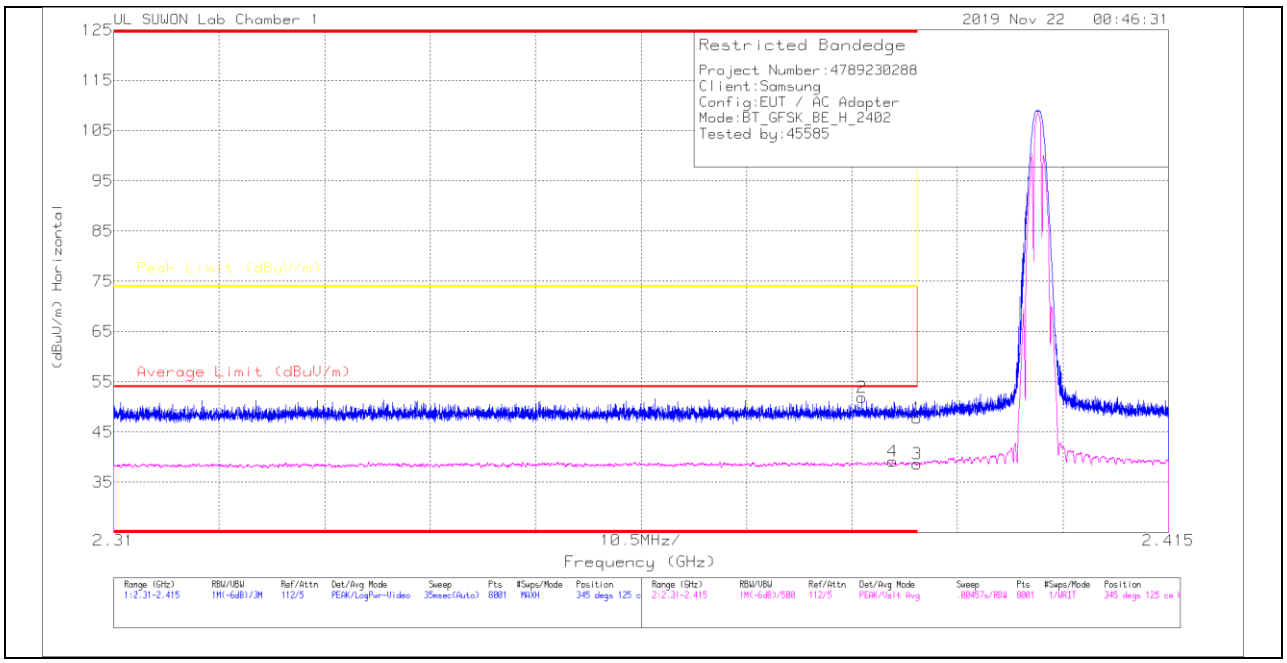
# 11.2. TRANSMITTER ABOVE 1 GHz

## 11.2.1. BASIC DATA RATE GFSK MODULATION

## RESTRICTED BANDEDGE (LOW CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT




### HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 41.61 | Pk | 31.7 | -25.5 | 47.81 | - | - | 74 | -26.19 | 345 | 125 | H |
| 2 | * 2.38448 | 45.7 | Pk | 31.7 | -25.5 | 51.9 | - | - | 74 | -22.1 | 345 | 125 | H |
| 3 | * 2.39 | 32.52 | VA1T | 31.7 | -25.5 | 38.72 | 54 | -15.28 | - | - | 345 | 125 | H |
| 4 | * 2.38753 | 32.94 | VA1T | 31.7 | -25.5 | 39.14 | 54 | -14.86 | - | - | 345 | 125 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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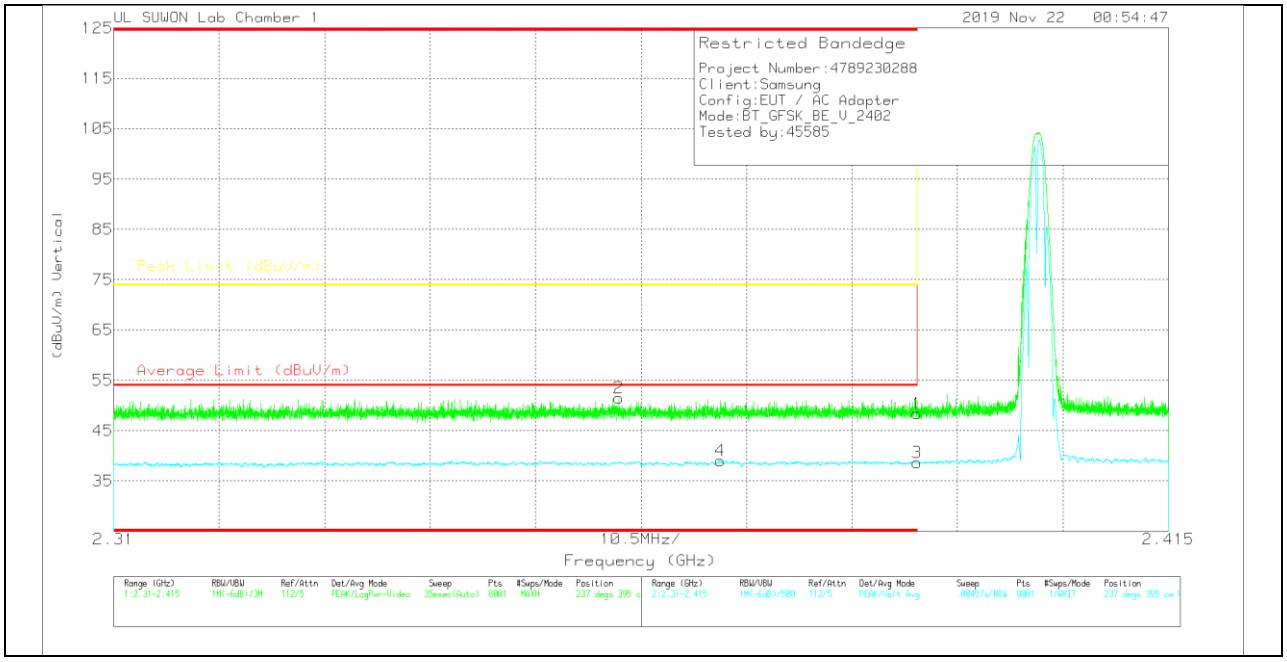
## VERTICAL PEAK AND AVERAGE PLOT




## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 42.24 | Pk | 31.7 | -25.5 | 48.44 | - | - | 74 | -25.56 | 237 | 395 | V |
| 2 | * 2.3603 | 45.51 | Pk | 31.6 | -25.6 | 51.51 | - | - | 74 | -22.49 | 237 | 395 | V |
| 3 | * 2.39 | 32.48 | VA1T | 31.7 | -25.5 | 38.68 | 54 | -15.32 | - | - | 237 | 395 | V |
| 4 | * 2.37039 | 32.98 | VA1T | 31.6 | -25.5 | 39.08 | 54 | -14.92 | - | - | 237 | 395 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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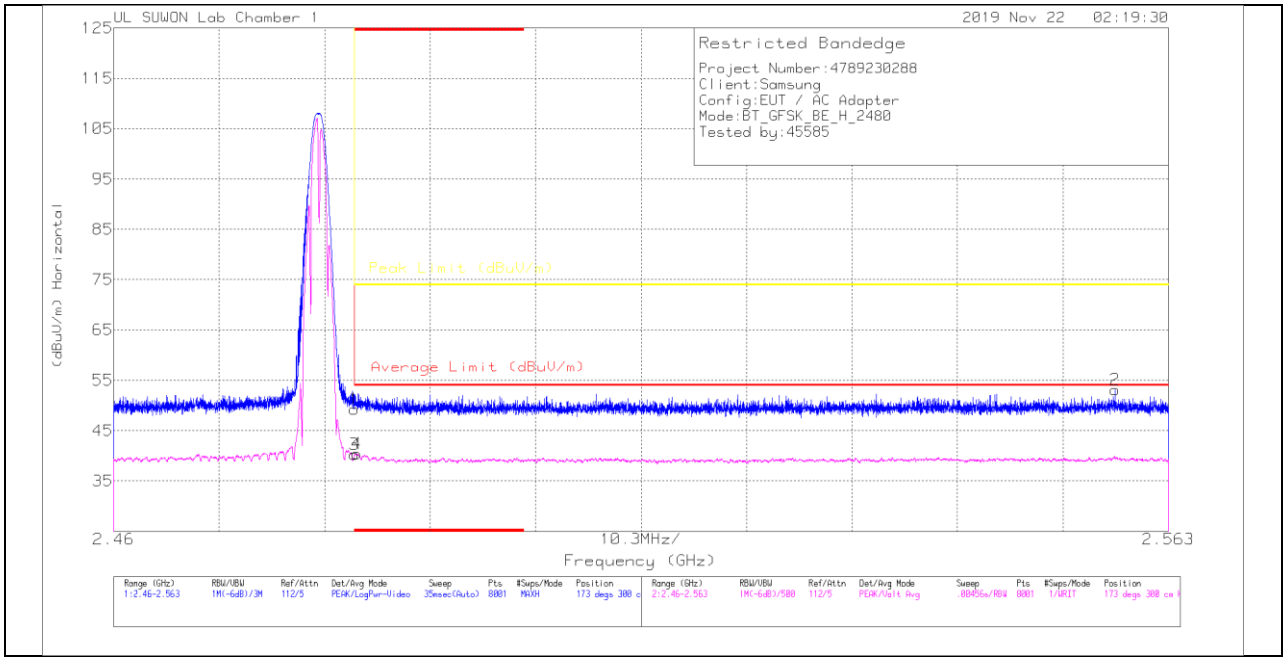
# AUTHORIZED BANDEDGE (HIGH CHANNEL)

## HORIZONTAL PEAK AND AVERAGE PLOT




## HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 42.55 | Pk | 31.9 | -25.2 | 49.25 | - | - | 74 | -24.75 | 173 | 300 | H |
| 2 | 2.55781 | 46.1 | Pk | 32 | -25 | 53.1 | - | - | 74 | -20.9 | 173 | 300 | H |
| 3 | * 2.48351 | 33.54 | VA1T | 31.9 | -25.2 | 40.24 | 54 | -13.76 | - | - | 173 | 300 | H |
| 4 | * 2.48373 | 33.68 | VA1T | 31.9 | -25.2 | 40.38 | 54 | -13.62 | - | - | 173 | 300 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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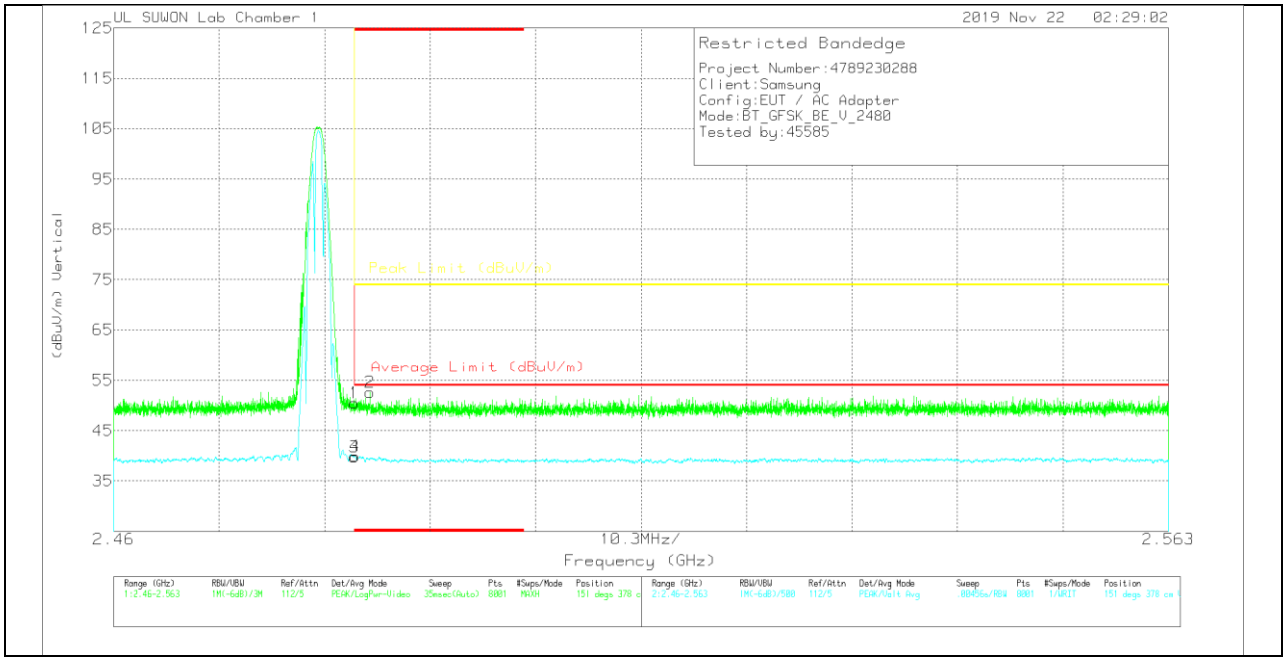
## VERTICAL PEAK AND AVERAGE PLOT




## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 43.82 | Pk | 31.9 | -25.2 | 50.52 | - | - | 74 | -23.48 | 151 | 378 | V |
| 2 | * 2.48503 | 45.92 | Pk | 31.9 | -25.2 | 52.62 | - | - | 74 | -21.38 | 151 | 378 | V |
| 3 | * 2.48351 | 33.08 | VA1T | 31.9 | -25.2 | 39.78 | 54 | -14.22 | - | - | 151 | 378 | V |
| 4 | * 2.48355 | 33.24 | VA1T | 31.9 | -25.2 | 39.94 | 54 | -14.06 | - | - | 151 | 378 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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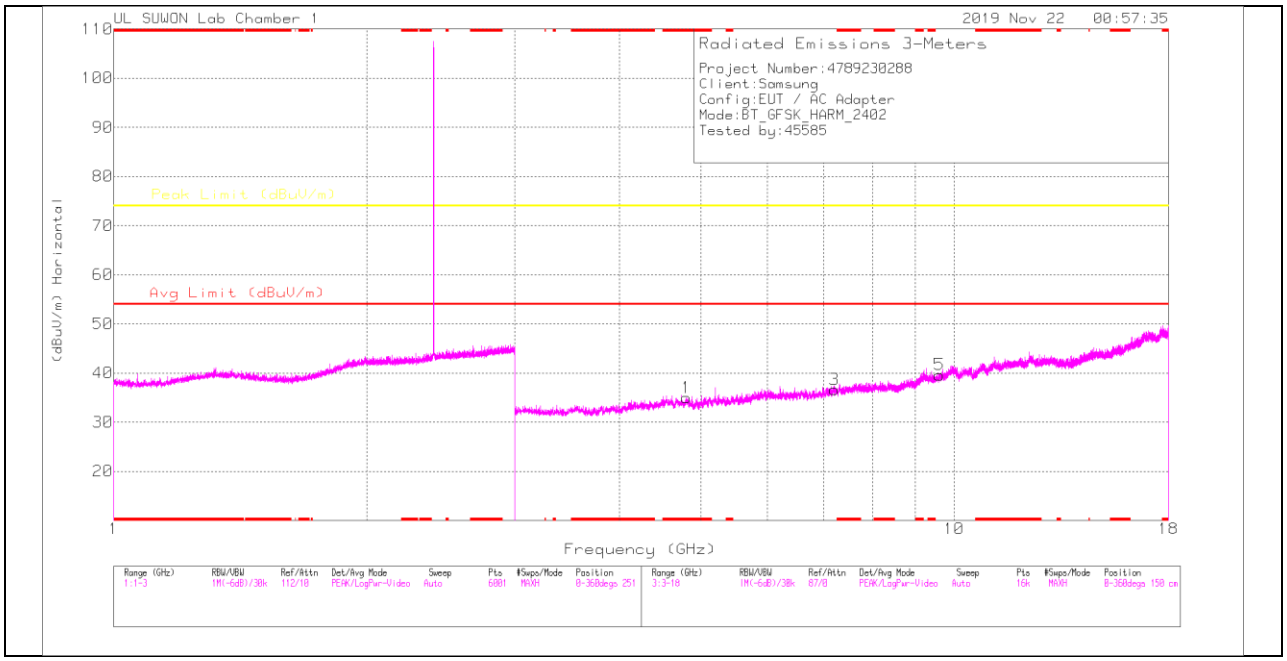
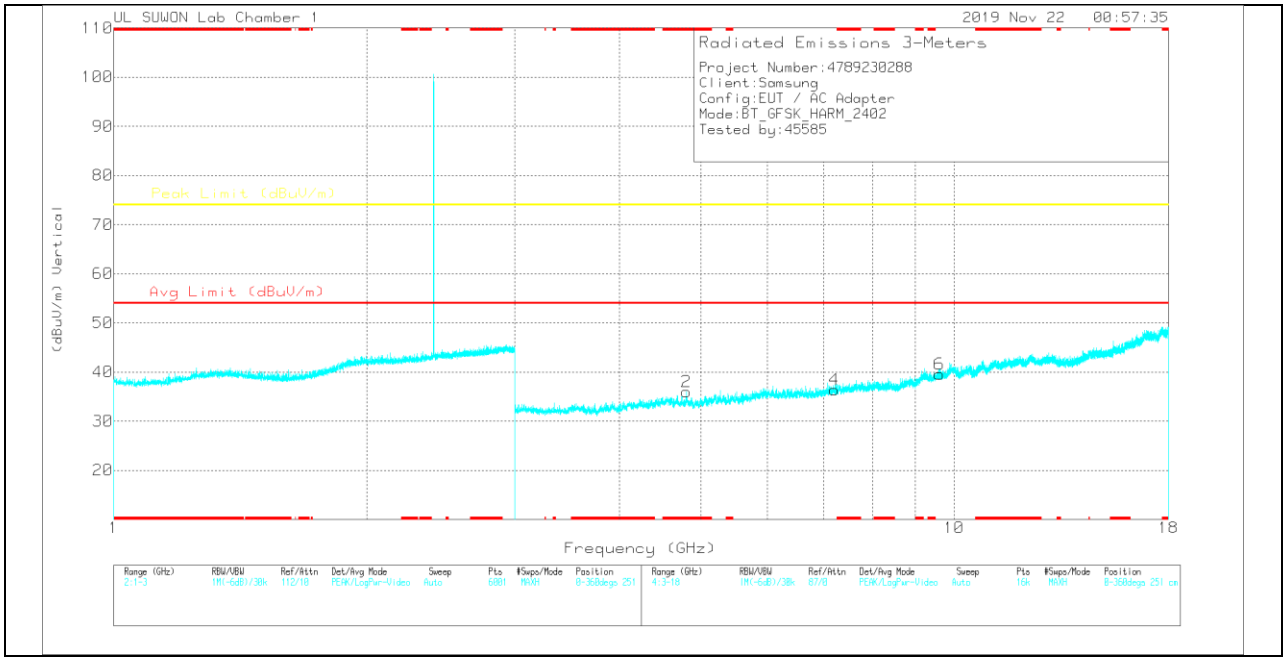
# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL HORIZONTAL




## LOW CHANNEL VERTICAL




Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.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## LOW CHANNEL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 4.80364 | 32.26 | PK | 34.2 | -31.5 | 34.96 | - | - | 74 | -39.04 | 0-360 | 250 | H |
| 3 | 7.20724 | 28.66 | PK | 35.8 | -27.8 | 36.66 | - | - | 74 | -37.34 | 0-360 | 150 | H |
| 5 | 9.60802 | 25.83 | PK | 37 | -23.2 | 39.63 | - | - | 74 | -34.37 | 0-360 | 150 | H |
| 2 | * 4.80364 | 33.29 | PK | 34.2 | -31.5 | 35.99 | - | - | 74 | -38.01 | 0-360 | 149 | V |
| 4 | 7.20724 | 28.39 | PK | 35.8 | -27.8 | 36.39 | - | - | 74 | -37.61 | 0-360 | 149 | V |
| 6 | 9.60802 | 25.79 | PK | 37 | -23.2 | 39.59 | - | - | 74 | -34.41 | 0-360 | 251 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

### Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.80381 | 39.74 | PKFH | 34.2 | -31.5 | 42.44 | - | - | 74 | -31.56 | 360 | 100 | H |
| * 4.80424 | 39.76 | PKFH | 34.2 | -31.5 | 42.46 | - | - | 74 | -31.54 | 360 | 100 | V |
| 7.20516 | 35.31 | PKFH | 35.8 | -27.8 | 43.31 | - | - | 74 | -30.69 | 360 | 100 | H |
| 7.20496 | 36.26 | PKFH | 35.8 | -27.8 | 44.26 | - | - | 74 | -29.74 | 360 | 100 | V |
| 9.60972 | 32.99 | PKFH | 37 | -23.2 | 46.79 | - | - | 74 | -27.21 | 360 | 100 | H |
| 9.60898 | 32.96 | PKFH | 37 | -23.2 | 46.76 | - | - | 74 | -27.24 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).


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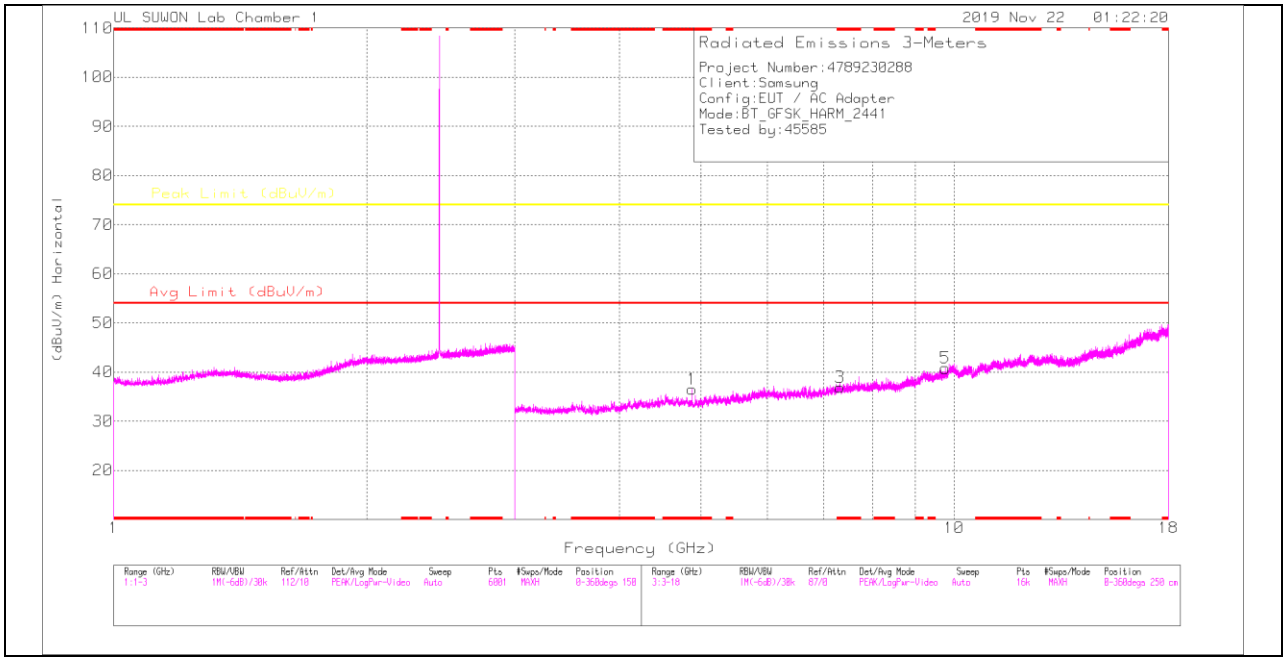
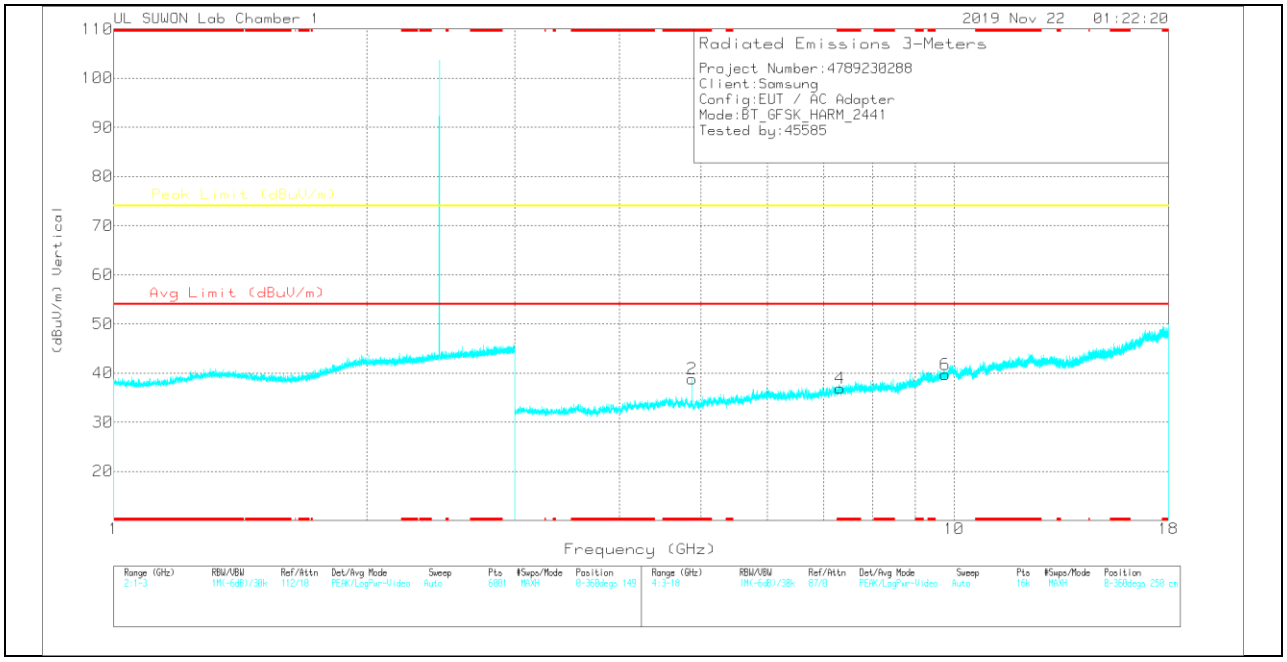
**MID CHANNEL HORIZONTAL**




**MID CHANNEL VERTICAL**




Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.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## MID CHANNEL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 4.88144 | 33.93 | PK | 34.2 | -31.6 | 36.53 | - | - | 74 | -37.47 | 0-360 | 149 | H |
| 3 | * 7.31973 | 28.28 | PK | 35.8 | -27.2 | 36.88 | - | - | 74 | -37.12 | 0-360 | 250 | H |
| 5 | 9.76551 | 27.48 | PK | 37.2 | -23.9 | 40.78 | - | - | 74 | -33.22 | 0-360 | 250 | H |
| 2 | * 4.88144 | 36.2 | PK | 34.2 | -31.6 | 38.8 | - | - | 74 | -35.2 | 0-360 | 250 | V |
| 4 | * 7.3216 | 28.31 | PK | 35.8 | -27.2 | 36.91 | - | - | 74 | -37.09 | 0-360 | 250 | V |
| 6 | 9.76364 | 26.54 | PK | 37.2 | -24 | 39.74 | - | - | 74 | -34.26 | 0-360 | 150 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

### Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.88212 | 41.43 | PKFH | 34.2 | -31.6 | 44.03 | - | - | 74 | -29.97 | 126 | 122 | H |
| * 4.88182 | 33.3 | VA1T | 34.2 | -31.6 | 35.9 | 54 | -18.1 | - | - | 126 | 122 | H |
| * 4.88244 | 43.44 | PKFH | 34.2 | -31.6 | 46.04 | - | - | 74 | -27.96 | 133 | 100 | V |
| * 4.88197 | 37.84 | VA1T | 34.2 | -31.6 | 40.44 | 54 | -13.56 | - | - | 133 | 100 | V |
| * 7.31837 | 35.56 | PKFH | 35.8 | -27.3 | 44.06 | - | - | 74 | -29.94 | 360 | 100 | H |
| * 7.31945 | 35.86 | PKFH | 35.8 | -27.3 | 44.36 | - | - | 74 | -29.64 | 360 | 100 | V |
| 9.76701 | 34.25 | PKFH | 37.3 | -24 | 47.55 | - | - | 74 | -26.45 | 360 | 100 | H |
| 9.76546 | 32.69 | PKFH | 37.2 | -23.9 | 45.99 | - | - | 74 | -28.01 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).


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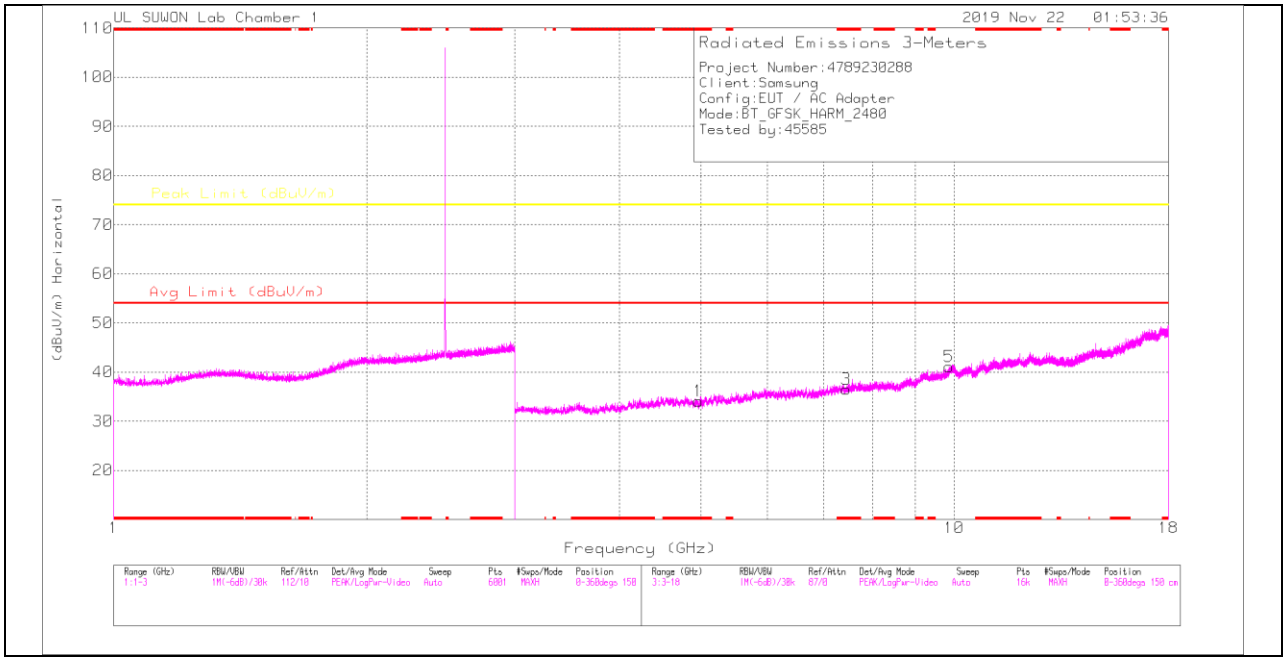
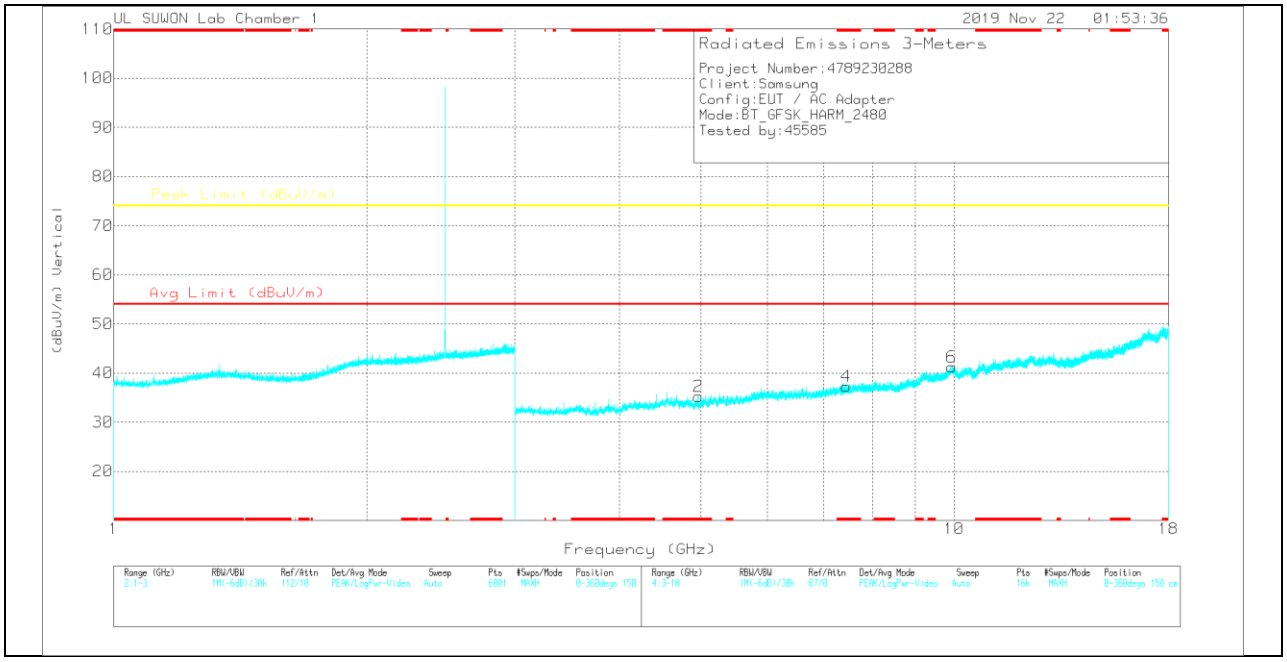
**HIGH CHANNEL HORIZONTAL**




**HIGH CHANNEL VERTICAL**




Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.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## HIGH CHANNEL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 4.96019 | 31.54 | PK | 34.2 | -31.6 | 34.14 | - | - | 74 | -39.86 | 0-360 | 150 | H |
| 3 | * 7.44066 | 27.79 | PK | 35.8 | -27.1 | 36.49 | - | - | 74 | -37.51 | 0-360 | 250 | H |
| 5 | 9.87425 | 26.2 | PK | 37.4 | -22.5 | 41.1 | - | - | 74 | -32.9 | 0-360 | 250 | H |
| 2 | * 4.96019 | 32.6 | PK | 34.2 | -31.6 | 35.2 | - | - | 74 | -38.8 | 0-360 | 150 | V |
| 4 | * 7.43972 | 28.58 | PK | 35.8 | -27.1 | 37.28 | - | - | 74 | -36.72 | 0-360 | 250 | V |
| 6 | 9.92863 | 25.37 | PK | 37.5 | -21.7 | 41.17 | - | - | 74 | -32.83 | 0-360 | 150 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

### Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.95852 | 39.14 | PKFH | 34.2 | -31.6 | 41.74 | - | - | 74 | -32.26 | 360 | 100 | H |
| * 4.96039 | 38.54 | PKFH | 34.2 | -31.6 | 41.14 | - | - | 74 | -32.86 | 360 | 100 | V |
| * 7.44146 | 36.14 | PKFH | 35.8 | -27.1 | 44.84 | - | - | 74 | -29.16 | 360 | 100 | H |
| * 7.44187 | 36.07 | PKFH | 35.8 | -27.1 | 44.77 | - | - | 74 | -29.23 | 360 | 100 | V |
| 9.87454 | 33.09 | PKFH | 37.4 | -22.5 | 47.99 | - | - | 74 | -26.01 | 360 | 100 | V |
| 9.87484 | 32.1 | PKFH | 37.4 | -22.5 | 47 | - | - | 74 | -27 | 360 | 100 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).


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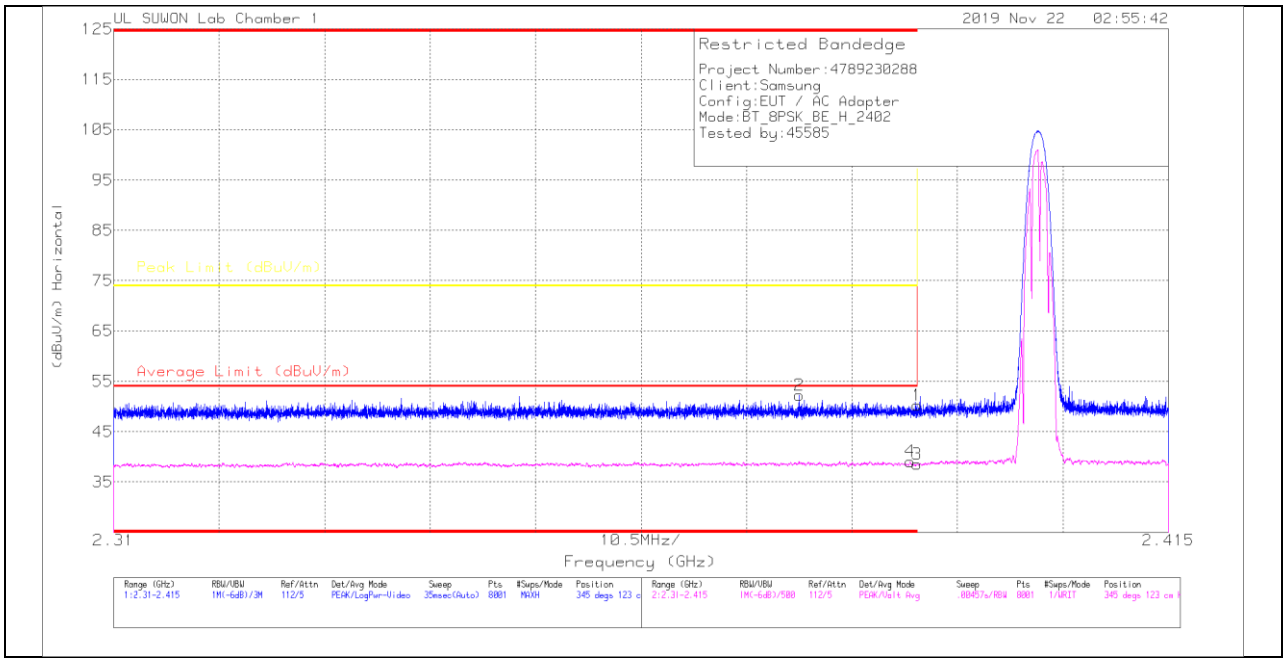
## 11.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT




### HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 44.03 | Pk | 31.7 | -25.5 | 50.23 | - | - | 74 | -23.77 | 345 | 123 | H |
| 2 | * 2.37822 | 46.2 | Pk | 31.6 | -25.5 | 52.3 | - | - | 74 | -21.7 | 345 | 123 | H |
| 3 | * 2.39 | 32.32 | VA1T | 31.7 | -25.5 | 38.52 | 54 | -15.48 | - | - | 345 | 123 | H |
| 4 | * 2.38929 | 33 | VA1T | 31.7 | -25.6 | 39.1 | 54 | -14.9 | - | - | 345 | 123 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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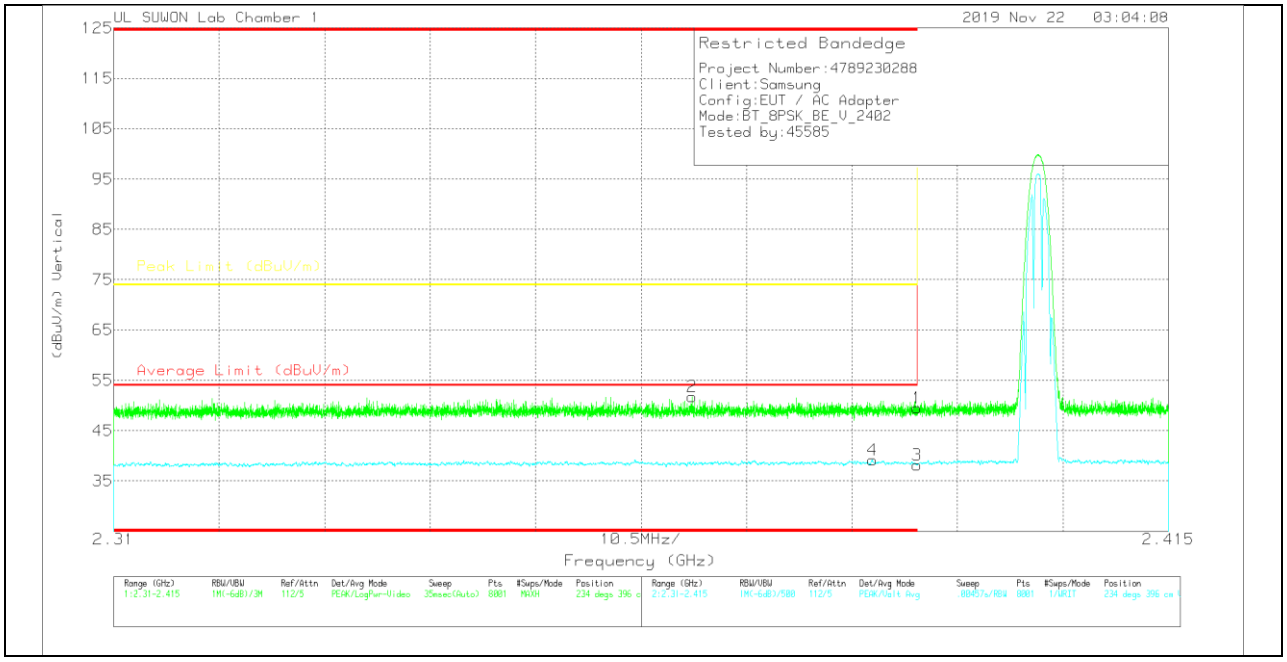
## VERTICAL PEAK AND AVERAGE PLOT




## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 43.28 | Pk | 31.7 | -25.5 | 49.48 | - | - | 74 | -24.52 | 234 | 396 | V |
| 2 | * 2.36759 | 45.74 | Pk | 31.6 | -25.6 | 51.74 | - | - | 74 | -22.26 | 234 | 396 | V |
| 3 | * 2.39 | 31.98 | VA1T | 31.7 | -25.5 | 38.18 | 54 | -15.82 | - | - | 234 | 396 | V |
| 4 | * 2.38552 | 32.99 | VA1T | 31.7 | -25.5 | 39.19 | 54 | -14.81 | - | - | 234 | 396 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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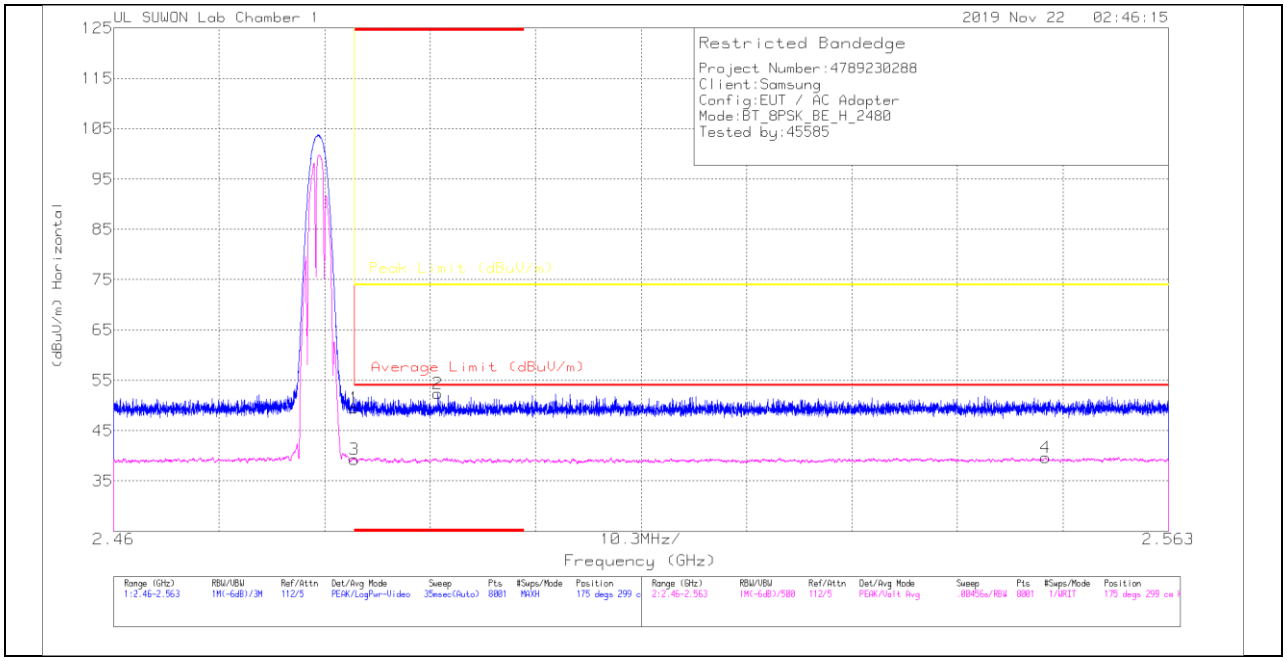
# AUTHORIZED BANDEDGE (HIGH CHANNEL)

## HORIZONTAL PEAK AND AVERAGE PLOT




## HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 42.81 | Pk | 31.9 | -25.2 | 49.51 | - | - | 74 | -24.49 | 175 | 299 | H |
| 2 | * 2.49165 | 45.69 | Pk | 31.9 | -25.2 | 52.39 | - | - | 74 | -21.61 | 175 | 299 | H |
| 3 | * 2.48351 | 32.62 | VA1T | 31.9 | -25.2 | 39.32 | 54 | -14.68 | - | - | 175 | 299 | H |
| 4 | 2.55101 | 32.77 | VA1T | 32 | -25.1 | 39.67 | 54 | -14.33 | - | - | 175 | 299 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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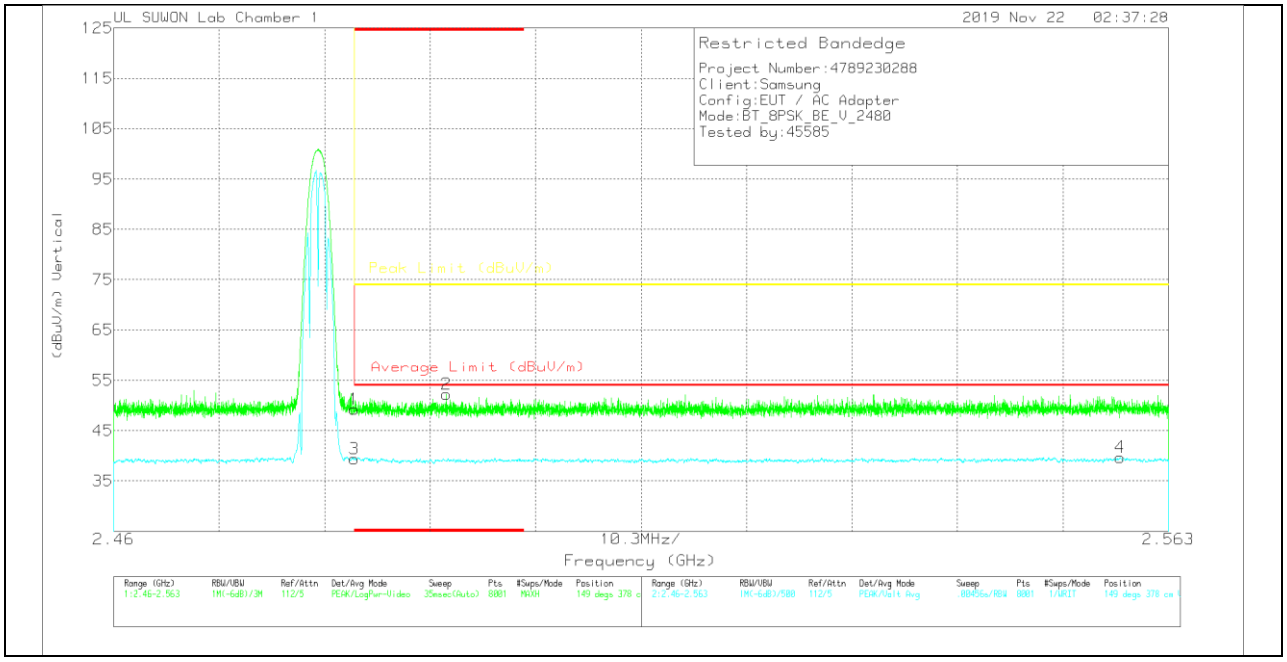
## VERTICAL PEAK AND AVERAGE PLOT




## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 42.6 | Pk | 31.9 | -25.2 | 49.3 | - | - | 74 | -24.7 | 149 | 378 | V |
| 2 | * 2.49247 | 45.54 | Pk | 31.9 | -25.2 | 52.24 | - | - | 74 | -21.76 | 149 | 378 | V |
| 3 | * 2.48351 | 32.76 | VA1T | 31.9 | -25.2 | 39.46 | 54 | -14.54 | - | - | 149 | 378 | V |
| 4 | 2.55829 | 32.72 | VA1T | 32 | -25 | 39.72 | 54 | -14.28 | - | - | 149 | 378 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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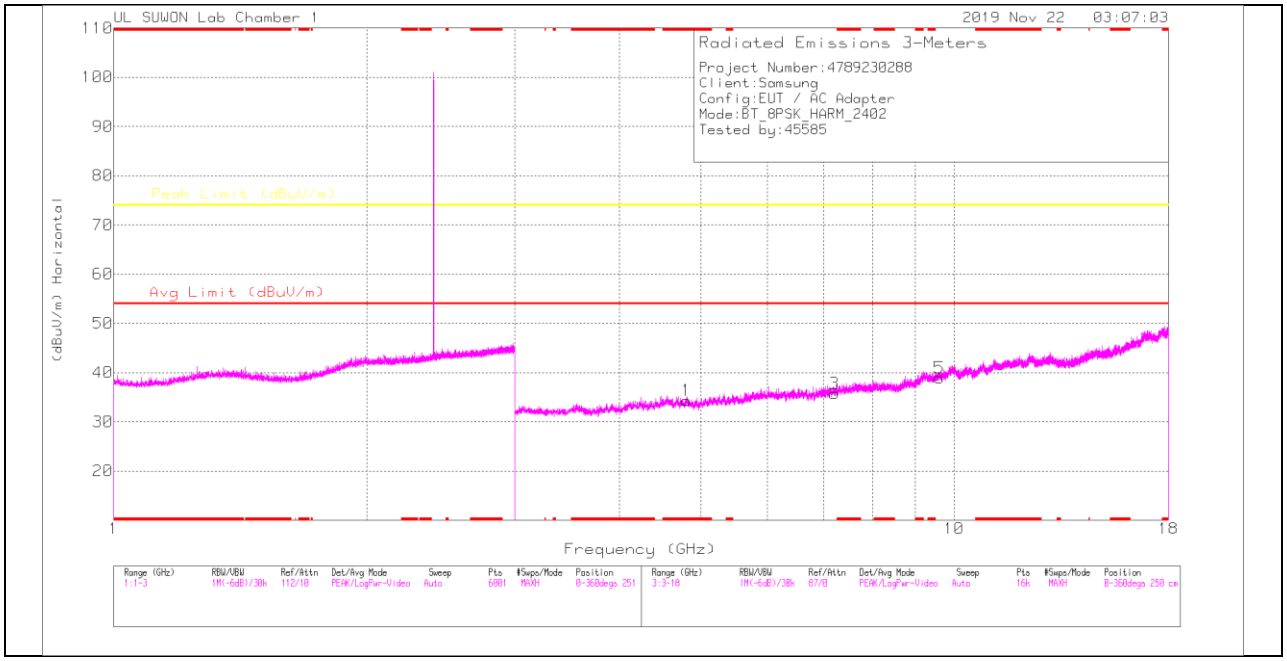
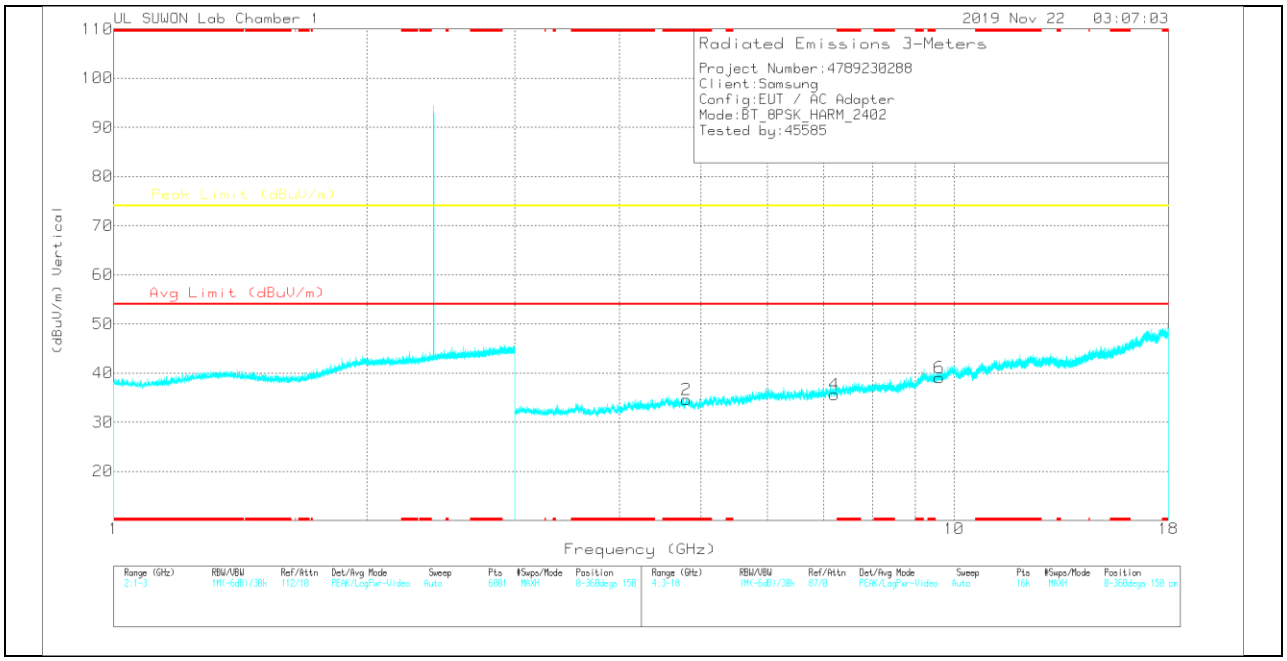
# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL HORIZONTAL




## LOW CHANNEL VERTICAL




Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.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## LOW CHANNEL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 4.80457 | 31.67 | PK | 34.2 | -31.5 | 34.37 | - | - | 74 | -39.63 | 0-360 | 150 | H |
| 3 | 7.2063 | 27.69 | PK | 35.8 | -27.8 | 35.69 | - | - | 74 | -38.31 | 0-360 | 150 | H |
| 5 | 9.60802 | 25.12 | PK | 37 | -23.2 | 38.92 | - | - | 74 | -35.08 | 0-360 | 250 | H |
| 2 | * 4.80457 | 31.95 | PK | 34.2 | -31.5 | 34.65 | - | - | 74 | -39.35 | 0-360 | 150 | V |
| 4 | 7.2063 | 27.63 | PK | 35.8 | -27.8 | 35.63 | - | - | 74 | -38.37 | 0-360 | 150 | V |
| 6 | 9.60802 | 25.28 | PK | 37 | -23.2 | 39.08 | - | - | 74 | -34.92 | 0-360 | 150 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

### Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.80273 | 39.48 | PKFH | 34.2 | -31.5 | 42.18 | - | - | 74 | -31.82 | 360 | 100 | H |
| * 4.80512 | 39.58 | PKFH | 34.2 | -31.5 | 42.28 | - | - | 74 | -31.72 | 360 | 100 | V |
| 7.20563 | 35.6 | PKFH | 35.8 | -27.8 | 43.6 | - | - | 74 | -30.4 | 360 | 100 | H |
| 7.20708 | 35.09 | PKFH | 35.8 | -27.8 | 43.09 | - | - | 74 | -30.91 | 360 | 100 | V |
| 9.60828 | 33.48 | PKFH | 37 | -23.2 | 47.28 | - | - | 74 | -26.72 | 360 | 100 | H |
| 9.60609 | 33.44 | PKFH | 37 | -23.3 | 47.14 | - | - | 74 | -26.86 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).


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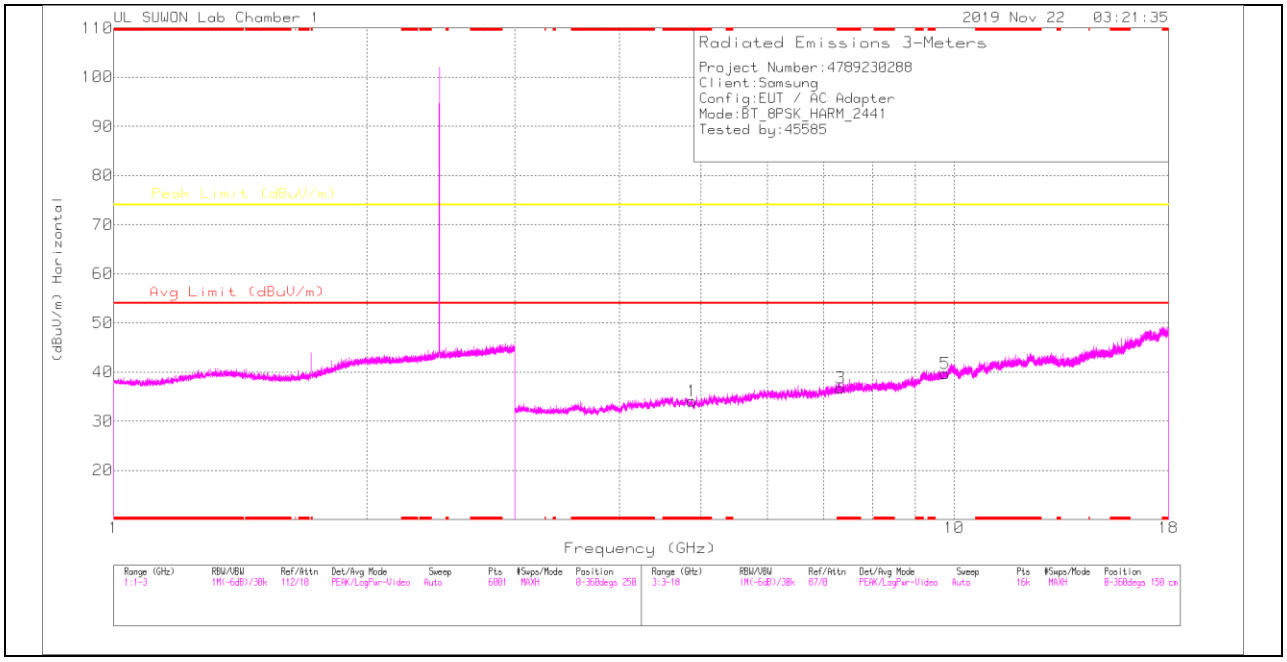
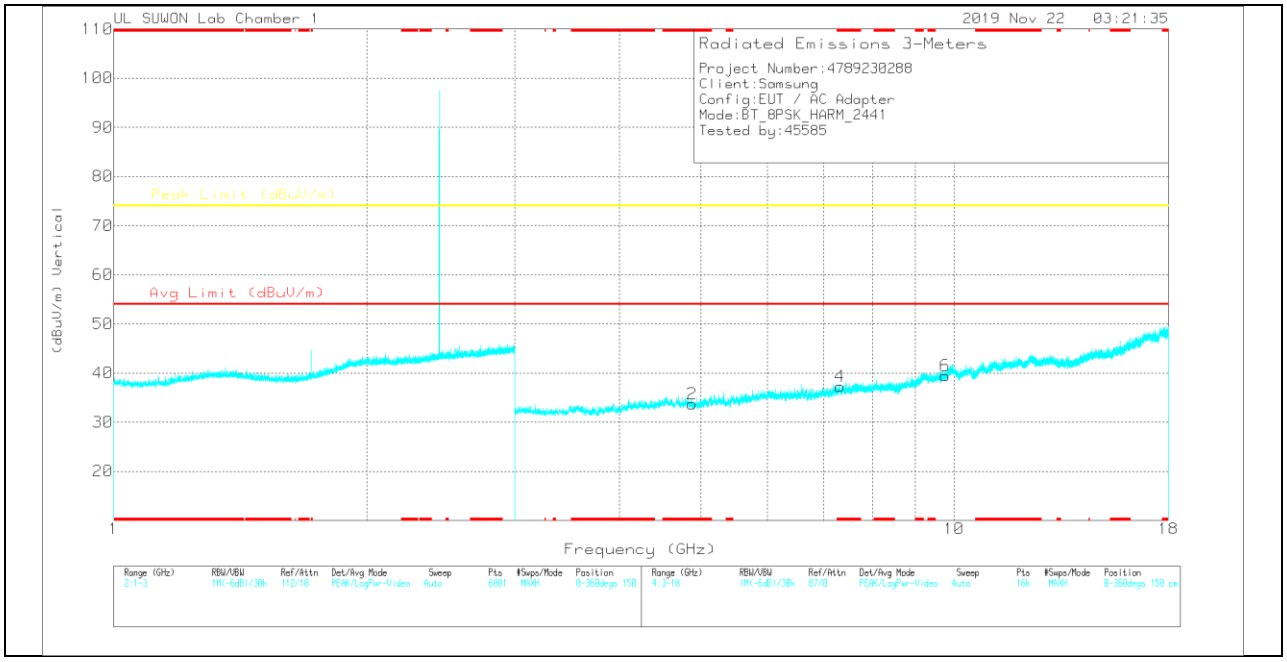
**MID CHANNEL HORIZONTAL**




**MID CHANNEL VERTICAL**




Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.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## MID CHANNEL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 4.88238 | 31.52 | PK | 34.2 | -31.6 | 34.12 | - | - | 74 | -39.88 | 0-360 | 150 | H |
| 3 | * 7.32535 | 28.29 | PK | 35.8 | -27.3 | 36.79 | - | - | 74 | -37.21 | 0-360 | 250 | H |
| 5 | 9.76457 | 26.42 | PK | 37.2 | -23.9 | 39.72 | - | - | 74 | -34.28 | 0-360 | 250 | H |
| 2 | * 4.88238 | 31.07 | PK | 34.2 | -31.6 | 33.67 | - | - | 74 | -40.33 | 0-360 | 150 | V |
| 4 | * 7.3216 | 28.63 | PK | 35.8 | -27.2 | 37.23 | - | - | 74 | -36.77 | 0-360 | 150 | V |
| 6 | 9.76457 | 26.19 | PK | 37.2 | -23.9 | 39.49 | - | - | 74 | -34.51 | 0-360 | 150 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

### Radiated Emissions

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.88416 | 39.2 | PKFH | 34.2 | -31.6 | 41.8 | - | - | 74 | -32.2 | 360 | 100 | H |
| * 4.88404 | 39.24 | PKFH | 34.2 | -31.6 | 41.84 | - | - | 74 | -32.16 | 360 | 100 | V |
| * 7.32661 | 35.64 | PKFH | 35.8 | -27.3 | 44.14 | - | - | 74 | -29.86 | 360 | 100 | H |
| * 7.32697 | 36.76 | PKFH | 35.8 | -27.3 | 45.26 | - | - | 74 | -28.74 | 360 | 100 | V |
| 9.76305 | 32.67 | PKFH | 37.2 | -23.9 | 45.97 | - | - | 74 | -28.03 | 360 | 100 | H |
| 9.76558 | 33.29 | PKFH | 37.2 | -23.9 | 46.59 | - | - | 74 | -27.41 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).


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