# CERTIFICATION TEST REPORT

**Report Number. :** 4789467590-E6V2

| | | |
|---|---|---|
| **Applicant** | : | SAMSUNG ELECTRONICS CO., LTD.<br>129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,<br>GYEONGGI-DO, 16677, KOREA |
| **Model** | : | SM-F707B, SCG04 |
| **FCC ID** | : | A3LSMF707B |
| **EUT Description** | : | GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax,<br>NFC and WPT |
| **Test Standard(s)** | : | FCC 47 CFR PART 15 SUBPART C |

**Date Of Issue:**
June 15, 2020

**Prepared by:**
UL Korea, Ltd.
26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, LTD. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

IAS ACCREDITED
TL-637

# REPORT REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 06/05/20 | Initial issue | Hyunsik Yun |
| V2 | 06/15/20 | Updated to address manufacturer's request | Hyunsik Yun |

# TABLE OF CONTENTS

# 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, NFC and WPT. |
| **MODEL NUMBER:** | SM-F707B, SCG04 |
| **SERIAL NUMBER:** | 4393b319891f7ece (CONDUCTED)<br>4393B6255D1F7ECE, R3CN40D0EAF(RADIATED); |
| **DATE TESTED:** | MAY 04, 2020 – JUN 04, 2020; |

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

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
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Hyunsik Yun
Suwon Lab Engineer
UL Korea, Ltd.

# 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 |

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

# 4. DECISION RULES AND MEASUREMENT UNCERTAINTY

## 4.1. METROLOGICAL TRACEABILITY

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

## 4.3. DECISION RULES

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

## 4.4. 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%.

# 5. EQUIPMENT UNDER TEST

## 5.1. EUT DESCRIPTION

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

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

| Frequency Range [MHz] | Mode | Power Mode | Output Power [dBm] | Output Power [mW] |
|---|---|---|---|---|
| 2 402 ~ 2 480 | Basic GFSK | Average | 15.459 | 35.15 |
| | | Peak | 16.093 | 40.67 |
| | Enhanced Pi/4-DPSK | Average | 15.420 | 34.83 |
| | | Peak | 17.815 | 60.46 |
| | Enhanced 8PSK | Average | 15.451 | 35.08 |
| | | Peak | 18.256 | 66.93 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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 this section.

**The internal antenna was Permanently attached.**
**Therefore this E.U.T Complies with the requirement of §15.203.**

The radio utilizes an internal antennas, with Antenna 1's maximum gain of -1.11 dBi and Antenna 2's maximum gain of -5.37 dBi

"Sub4" and "Sub7" as indicated in antenna specification are written as Antenna 1 and Antenna 2 in this report.

## 5.4. WORST-CASE CONFIGURATION AND MODE

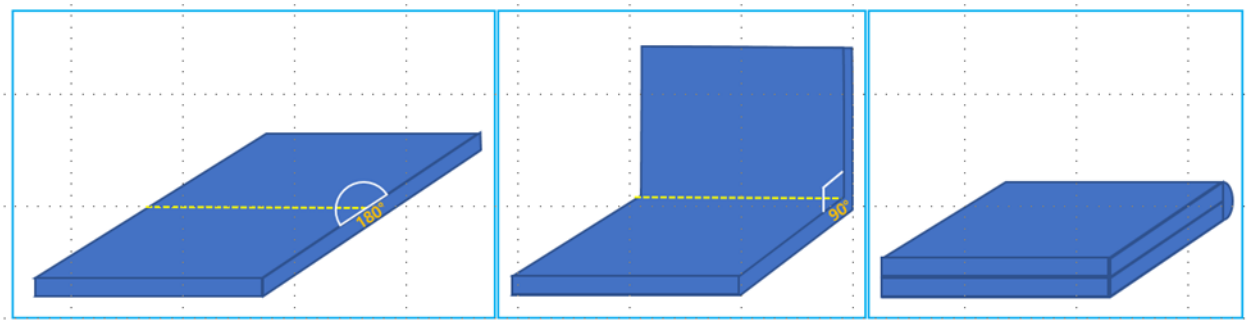
Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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

i. Worst Axis condition

For Antenna 1, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.
For Antenna 2, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

ii. Foldable condition




For Antenna 1, the fundamental of the EUT was investigated in three foldable conditions(Open, Half-folded, Full-folded). It was determined that the “Half-folded” condition was worst-case orientation; therefore, all final radiated testing was performed with the EUT in the “Half-folded” condition.
For Antenna 2, the fundamental of the EUT was investigated in three foldable conditions(Open, Half-folded, Full-folded). It was determined that the “Open” condition was worst-case orientation; therefore, all final radiated testing was performed with the EUT in the “Open” condition.

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.

## 5.5. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Charger | SAMSUNG | EP-TA200 | R37M7QS4CH1DK3 | N/A |
| Data Cable | SAMSUNG | EP-DF700 | N/A | N/A |
| Earphone | SAMSUNG | GH59-15252A | N/A | N/A |

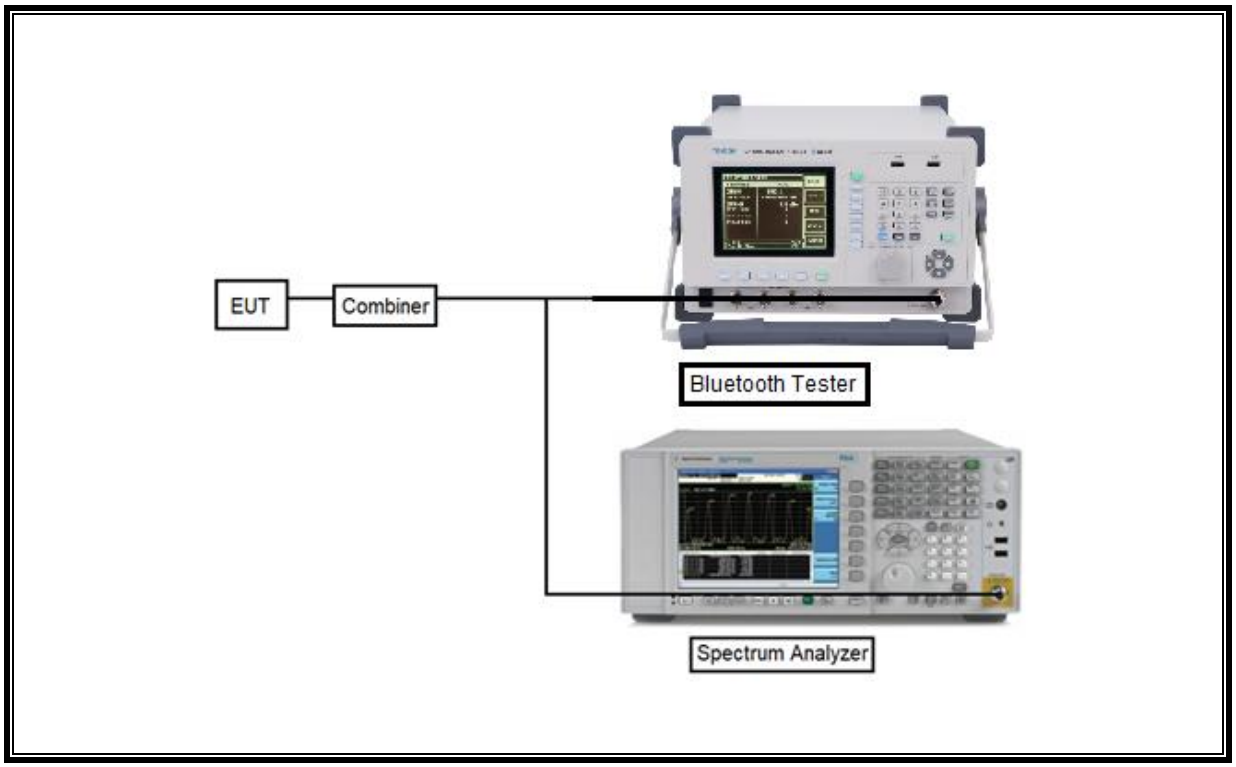
**I/O CABLE**

| 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 | 1.1m | N/A |

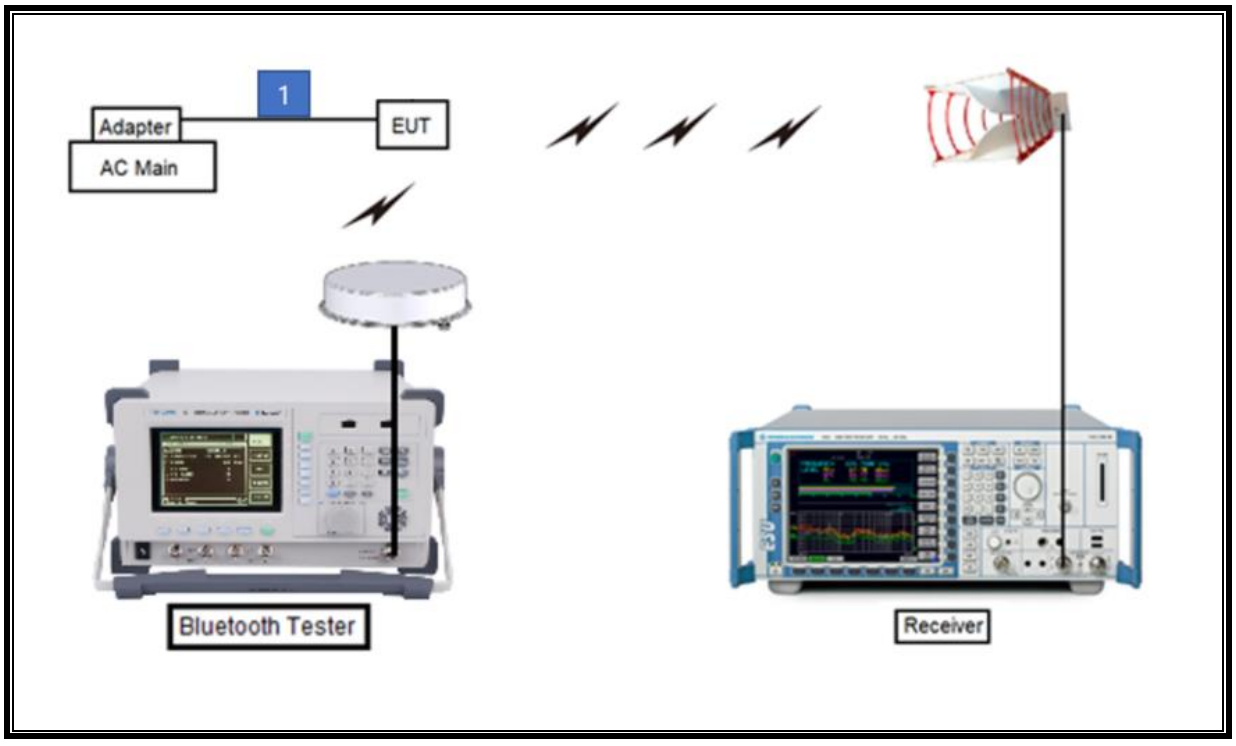
**TEST SETUP**

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

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




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



# 6. 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** | **Next Cal. Date** |
| 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 | Keysight | N9030B | MY57143717 | 01-20-21 |
| 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 |

# 7. TEST RESULTS SUMMARY

| 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 |

# 8. 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.

# 9. ANTENNA PORT TEST RESULTS

## 9.1. ON TIME AND DUTY CYCLE

**LIMITS**

None; for reporting purposes only.

**PROCEDURE**

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

**ON TIME AND DUTY CYCLE RESULTS**

| Mode | On time [msec] | Period [msec] | Duty Cycle [%] | Duty Cycle Correction Factor[dB] | 1/T Minimum VBW [kHz] |
|---|---|---|---|---|---|
| 2 400 ~ 2483.5 MHz Band | | | | | |
| Bluetooth | 2.882 | 3.751 | 76.83 | 1.14 | 0.347 |

## 9.2. 20 dB AND 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

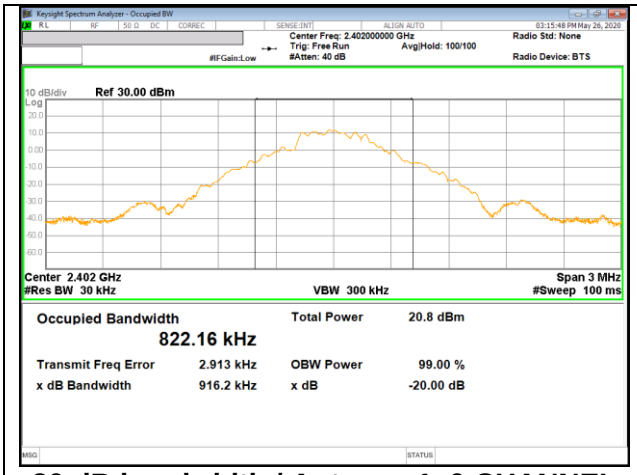
**TEST PROCEDURE**

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.

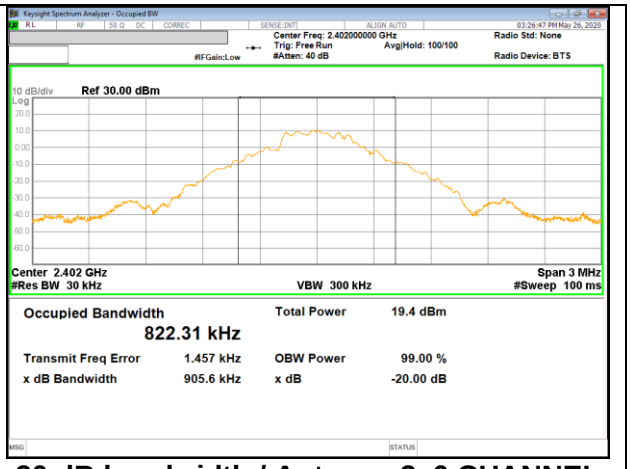
**RESULTS**

## 9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

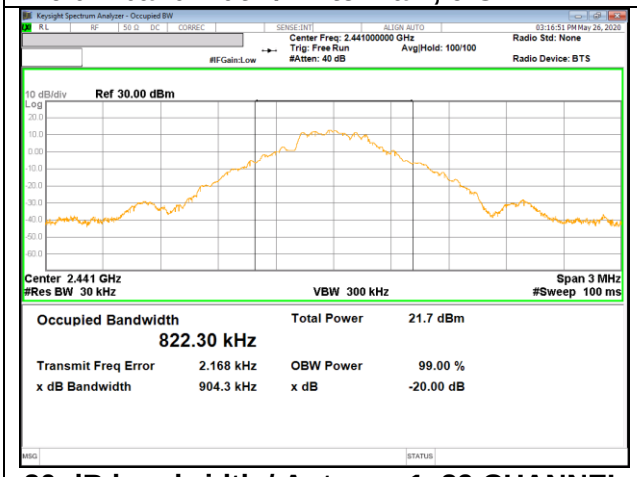
| Chain | Channel | Frequency [MHz] | 20 dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|---|---|
| Antenna 1 | 0 | 2 402 | 916.2 | 822.1 |
| | 39 | 2 440 | 904.3 | 794.6 |
| | 77 | 2 479 | 903.6 | 794.8 |
| | 78 | 2 480 | 905.0 | 823.5 |
| Antenna 2 | 0 | 2 402 | 905.6 | 794.1 |
| | 39 | 2 440 | 905.0 | 825.0 |
| | 77 | 2 479 | 904.0 | 825.0 |
| | 78 | 2 480 | 904.9 | 795.3 |
| Worst | | | **916.2** | **825.0** |



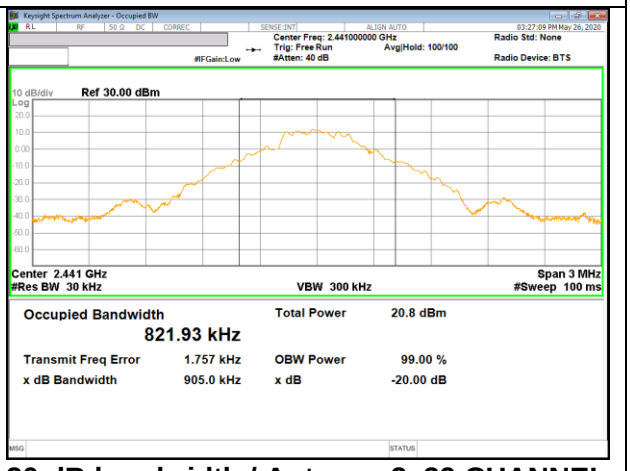

**20 dB bandwidth / Antenna 1, 0 CHANNEL**



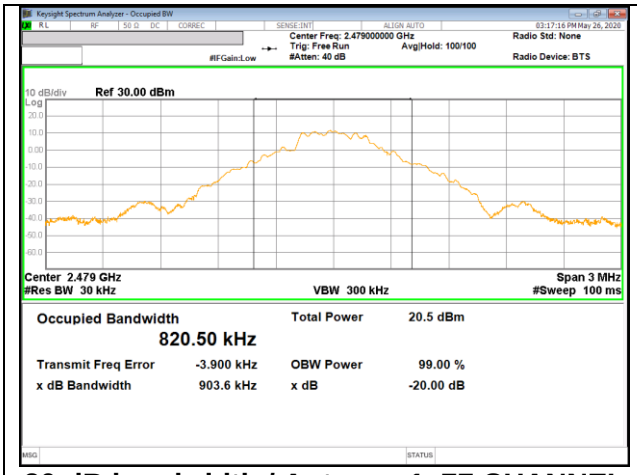

**20 dB bandwidth / Antenna 2, 0 CHANNEL**



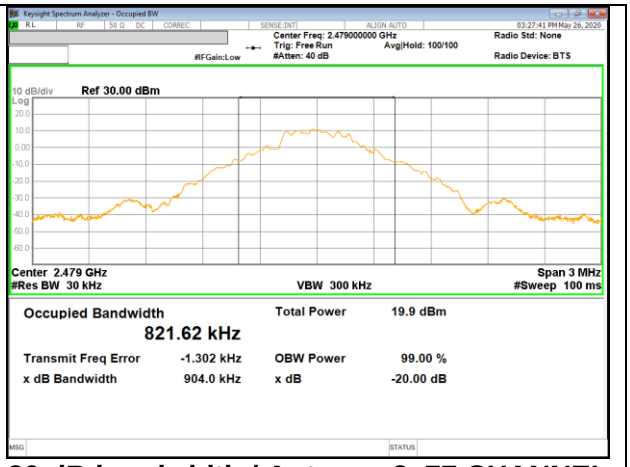

**20 dB bandwidth / Antenna 1, 39 CHANNEL**



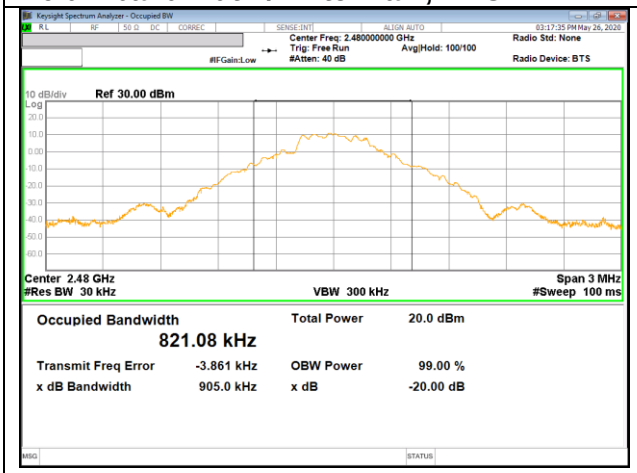

**20 dB bandwidth / Antenna 2, 39 CHANNEL**



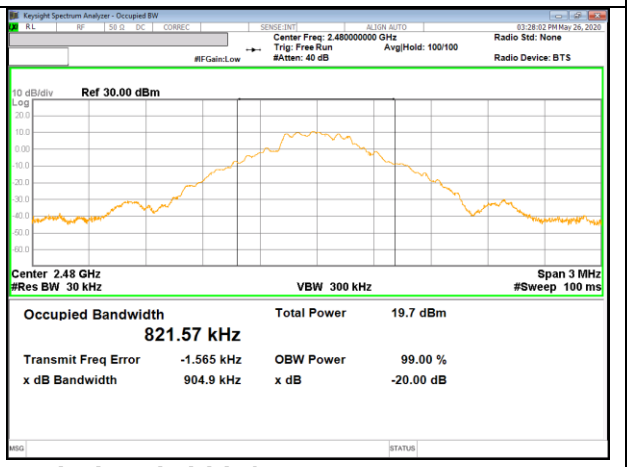

20 dB bandwidth / Antenna 1, 77 CHANNEL




20 dB bandwidth / Antenna 2, 77 CHANNEL

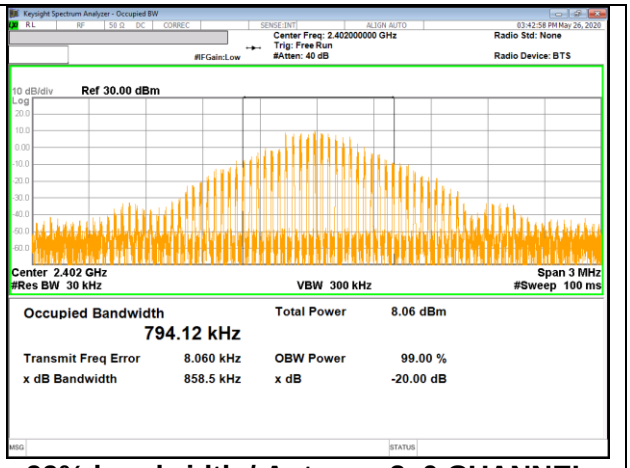



20 dB bandwidth / Antenna 1, 78 CHANNEL

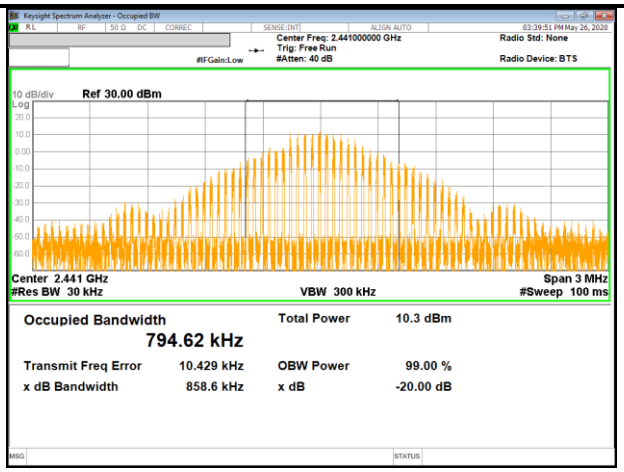



20 dB bandwidth / Antenna 2, 78 CHANNEL

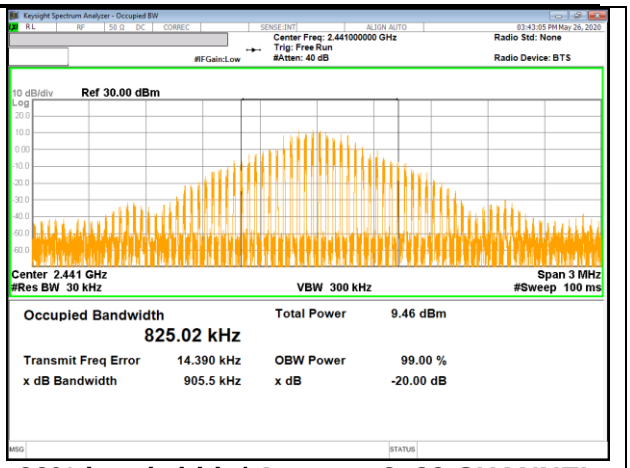

99% bandwidth / Antenna 1, 0 CHANNEL



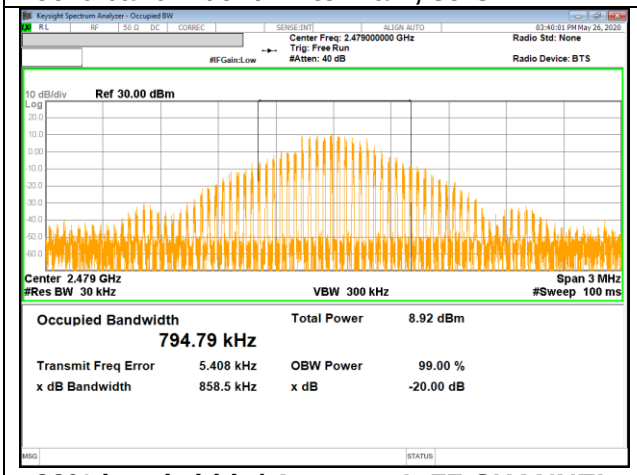

99% bandwidth / Antenna 2, 0 CHANNEL



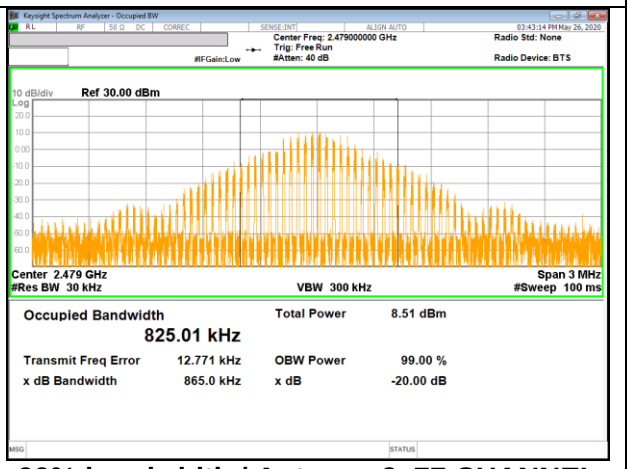

**99% bandwidth / Antenna 1, 39 CHANNEL**



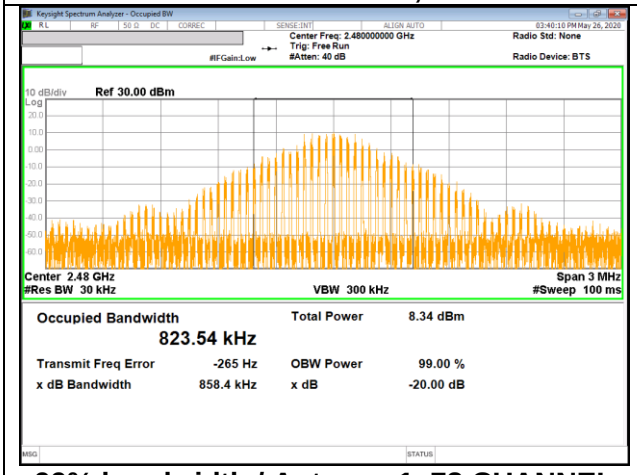

**99% bandwidth / Antenna 2, 39 CHANNEL**



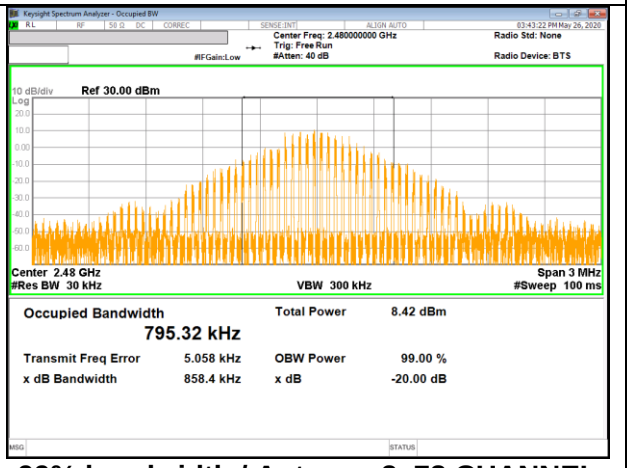

**99% bandwidth / Antenna 1, 77 CHANNEL**




**99% bandwidth / Antenna 2, 77 CHANNEL**



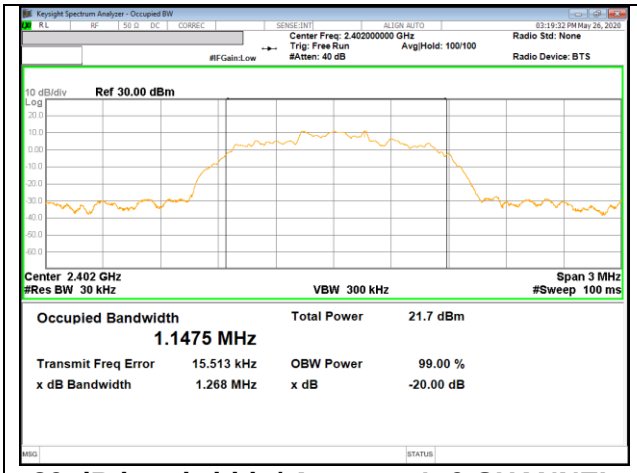

**99% bandwidth / Antenna 1, 78 CHANNEL**



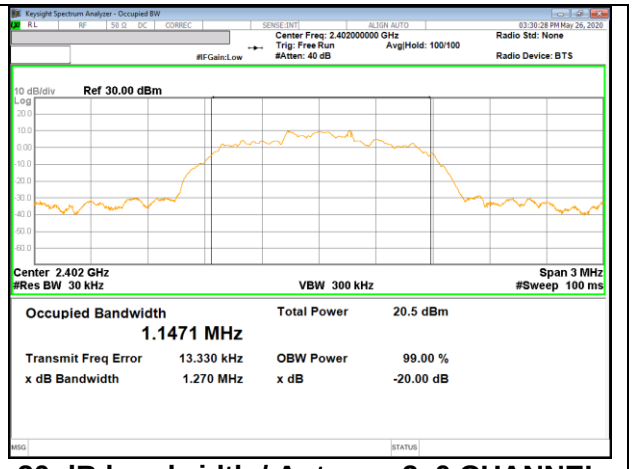

**99% bandwidth / Antenna 2, 78 CHANNEL**

## 9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

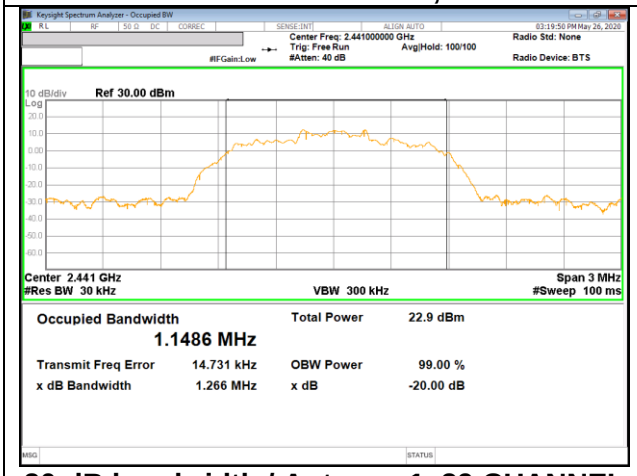
| Chain | Channel | Frequency [MHz] | 20 dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|---|---|
| Antenna 1 | 0 | 2 402 | 1268.0 | 1163.2 |
| | 39 | 2 440 | 1266.0 | 1159.7 |
| | 77 | 2 479 | 1269.0 | 1131.0 |
| | 78 | 2 480 | 1267.0 | 1161.5 |
| Antenna 2 | 0 | 2 402 | 1270.0 | 1162.3 |
| | 39 | 2 440 | 1269.0 | 1162.7 |
| | 77 | 2 479 | 1268.0 | 1131.0 |
| | 78 | 2 480 | 1268.0 | 1161.9 |
| Worst | | | **1270.0** | **1163.2** |



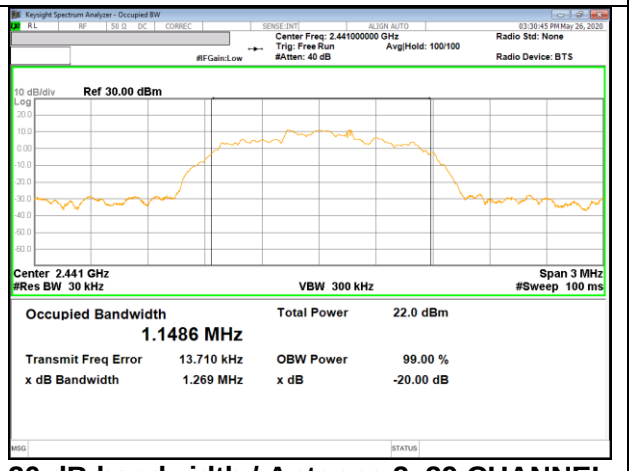

**20 dB bandwidth / Antenna 1, 0 CHANNEL**



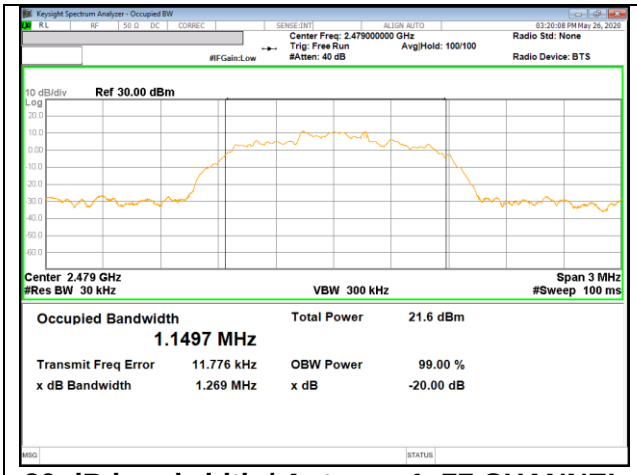

**20 dB bandwidth / Antenna 2, 0 CHANNEL**



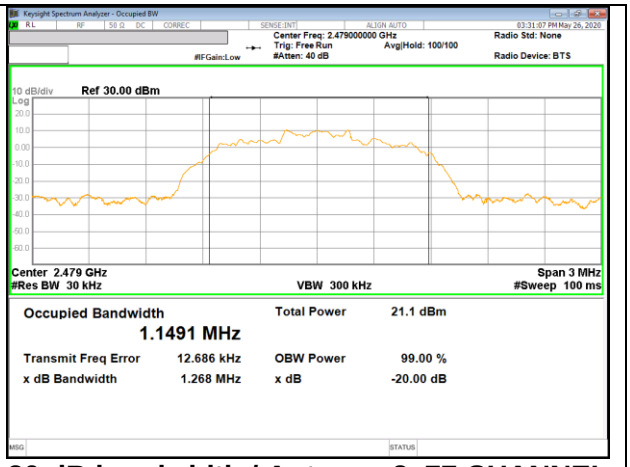

**20 dB bandwidth / Antenna 1, 39 CHANNEL**



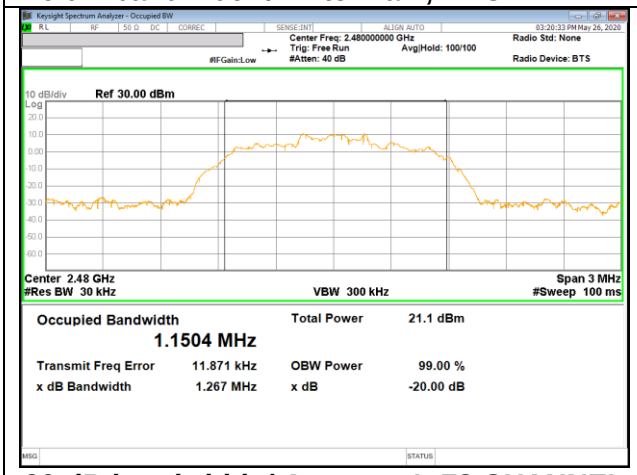

**20 dB bandwidth / Antenna 2, 39 CHANNEL**



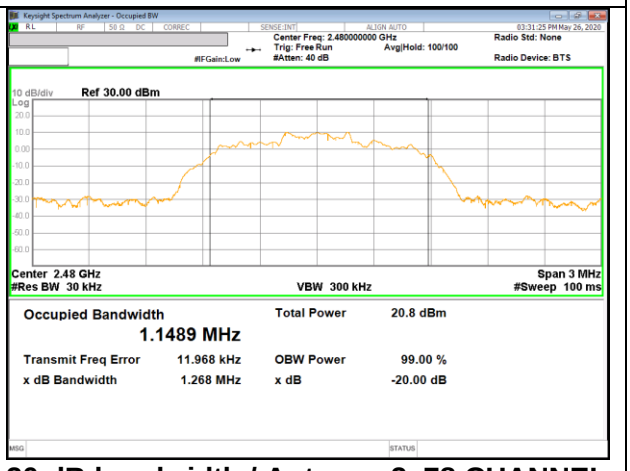

20 dB bandwidth / Antenna 1, 77 CHANNEL




20 dB bandwidth / Antenna 2, 77 CHANNEL

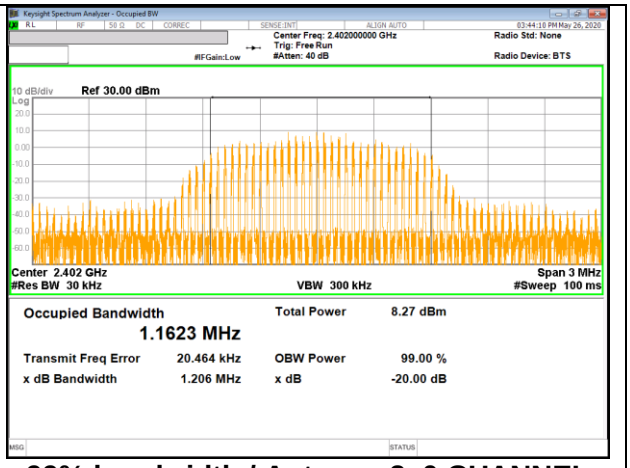



20 dB bandwidth / Antenna 1, 78 CHANNEL

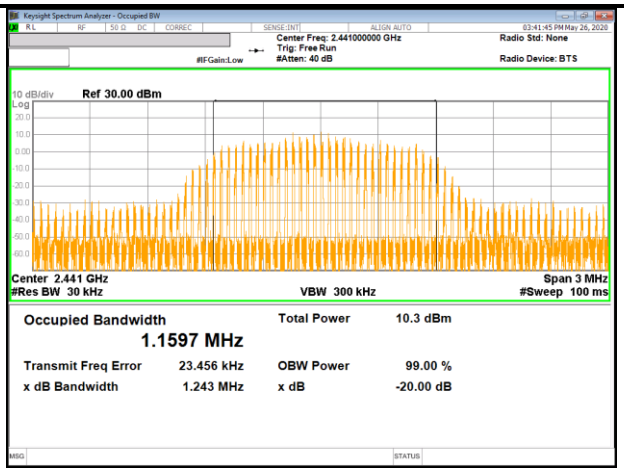



20 dB bandwidth / Antenna 2, 78 CHANNEL

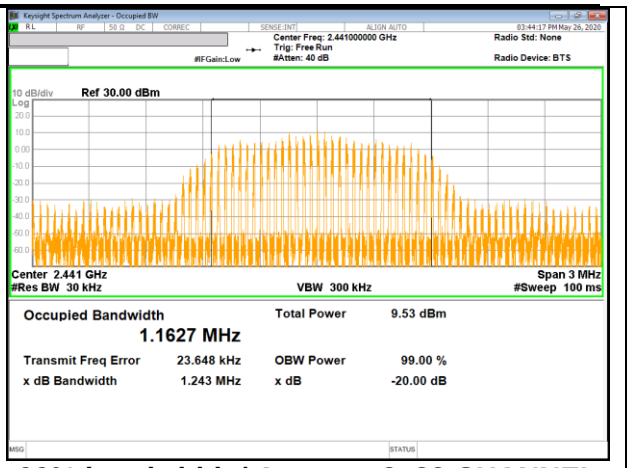

99% bandwidth / Antenna 1, 0 CHANNEL




99% bandwidth / Antenna 2, 0 CHANNEL

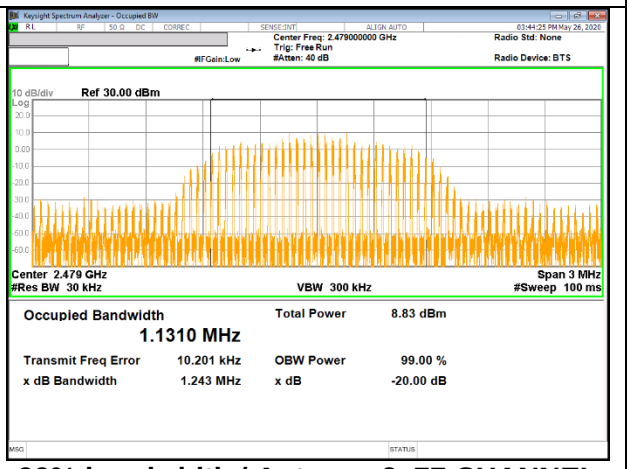



**99% bandwidth / Antenna 1, 39 CHANNEL**




**99% bandwidth / Antenna 2, 39 CHANNEL**


**99% bandwidth / Antenna 1, 77 CHANNEL**




**99% bandwidth / Antenna 2, 77 CHANNEL**


**99% bandwidth / Antenna 1, 78 CHANNEL**


**99% bandwidth / Antenna 2, 78 CHANNEL**

## 9.3. HOPPING FREQUENCY SEPARATION

**LIMITS**

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

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.

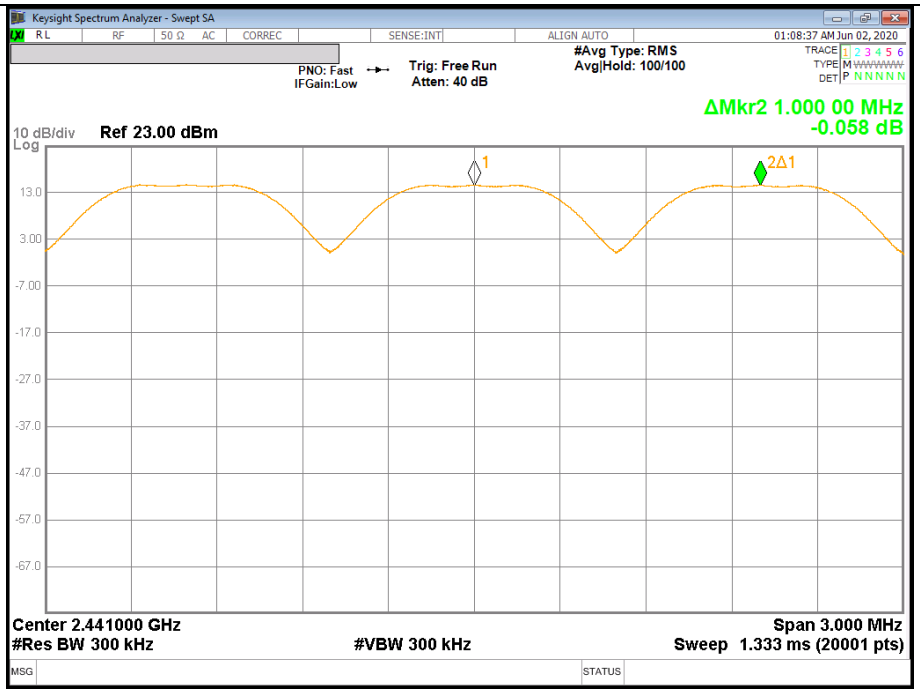
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

**TEST PROCEDURE**

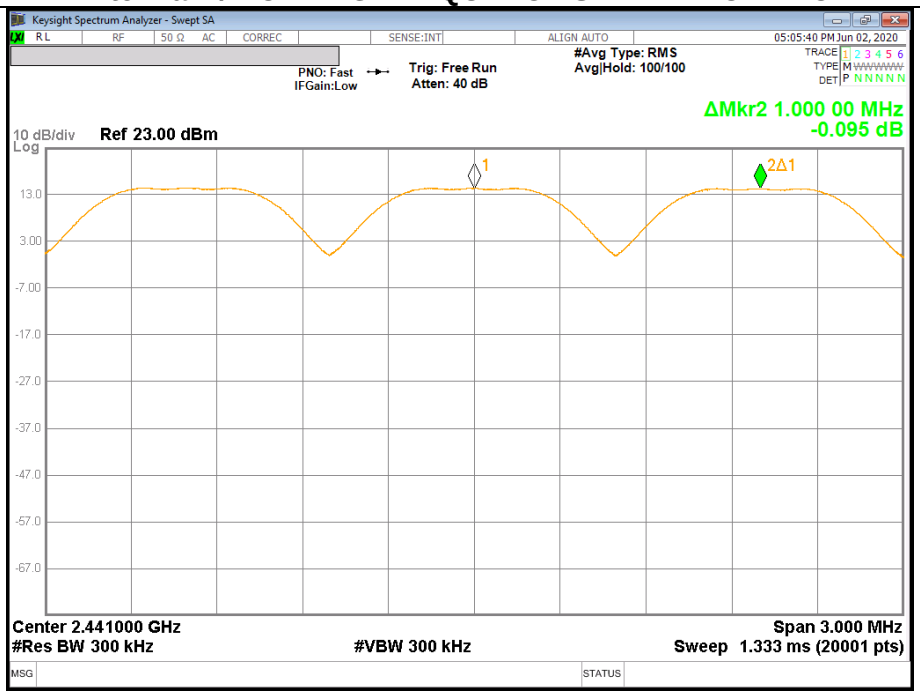
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW >= RBW. The sweep time is coupled.

**RESULTS**

## 9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

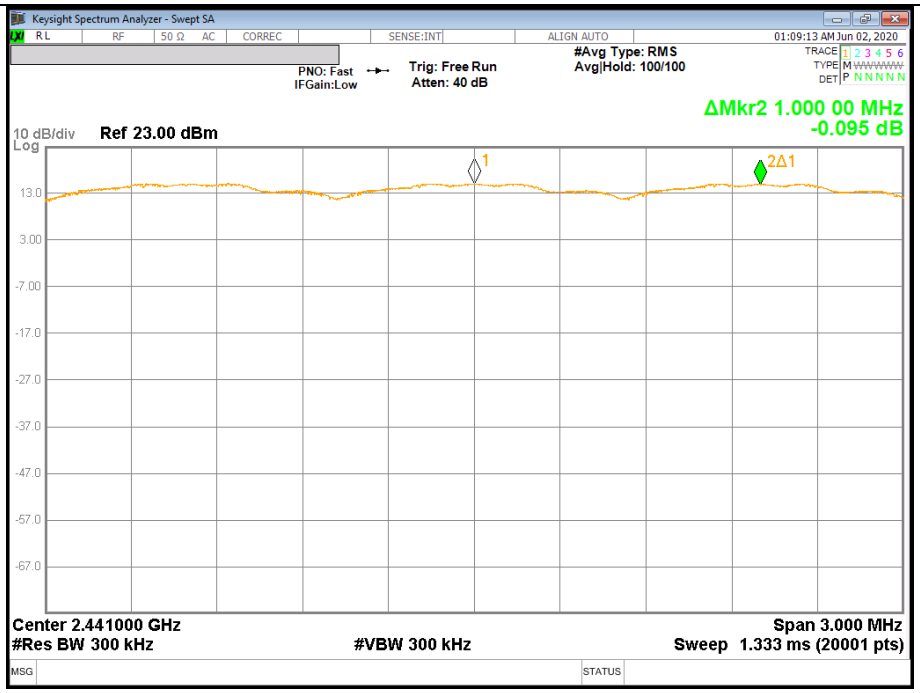



**Antenna 1 / HOPPING FREQUENCY SEPARATION PLOT**

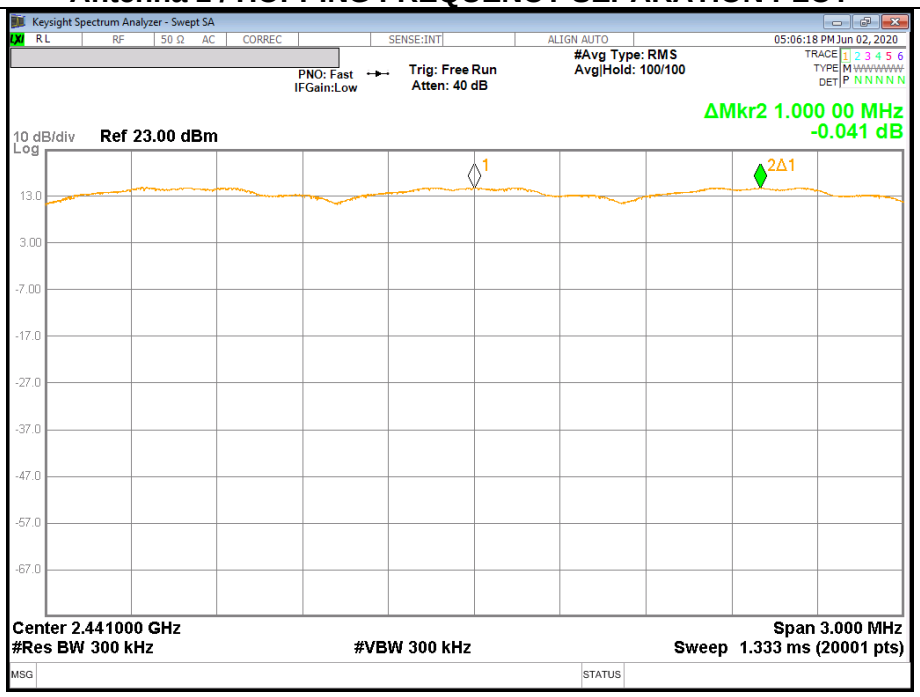



**Antenna 2 / HOPPING FREQUENCY SEPARATION PLOT**

# 9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION




**Antenna 1 / HOPPING FREQUENCY SEPARATION PLOT**




**Antenna 2 / HOPPING FREQUENCY SEPARATION PLOT**

## 9.4. NUMBER OF HOPPING CHANNELS

**LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

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

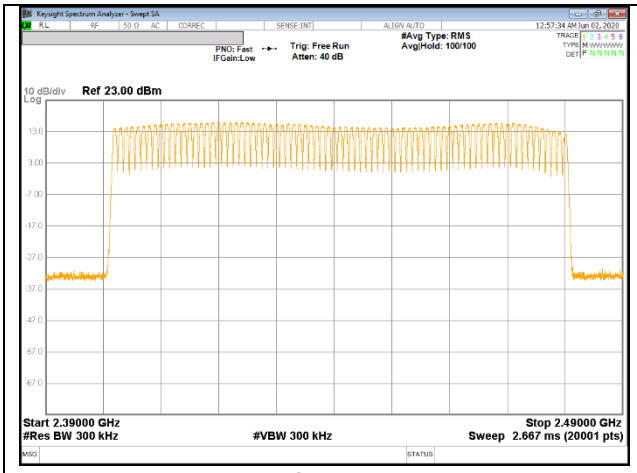
**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

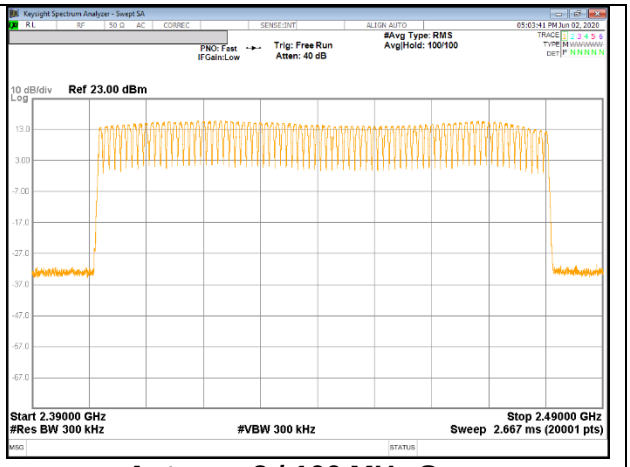
**RESULTS**

Normal Mode: All Channels Observed

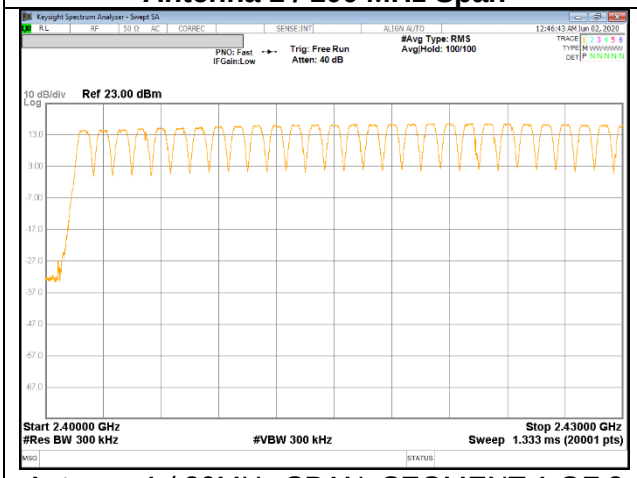
## 9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



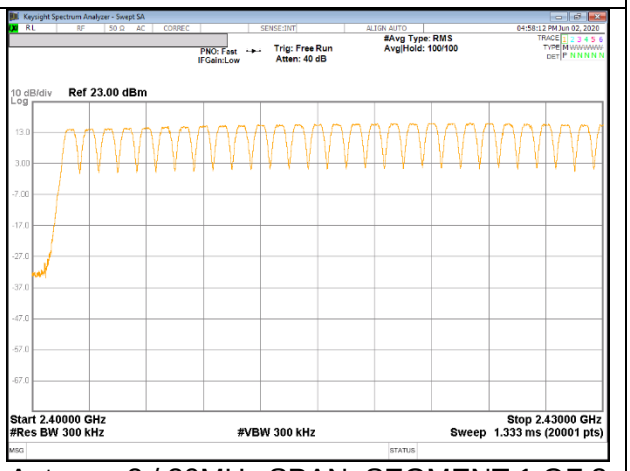

Antenna 1 / 100 MHz Span



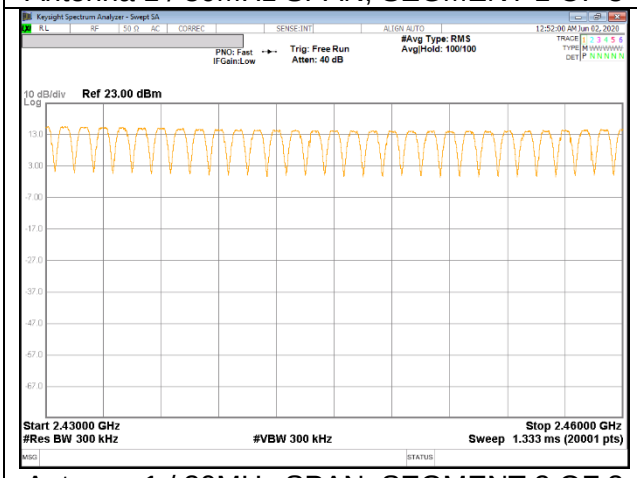

Antenna 2 / 100 MHz Span



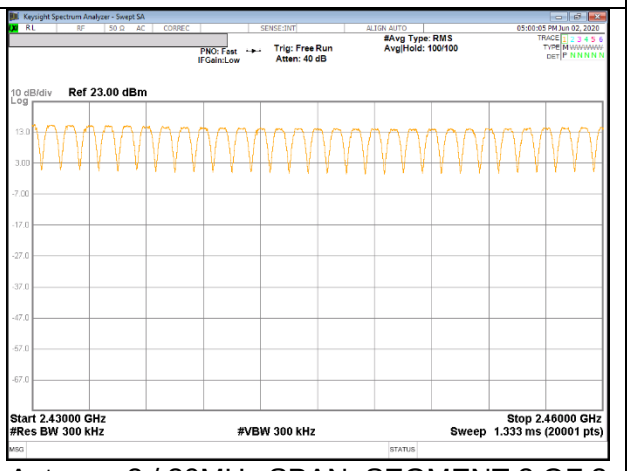

Antenna 1 / 30MHz SPAN, SEGMENT 1 OF 3



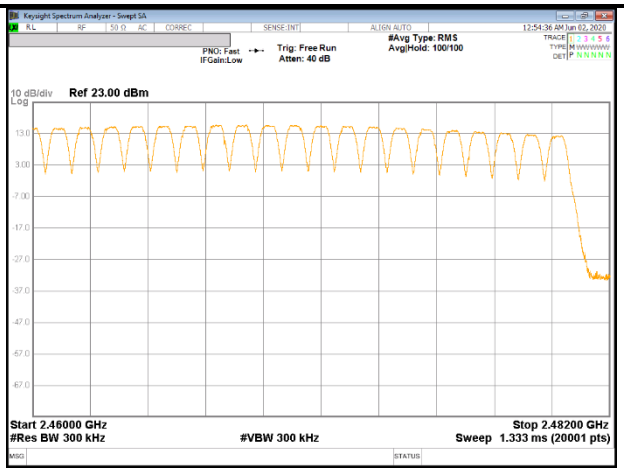

Antenna 2 / 30MHz SPAN, SEGMENT 1 OF 3



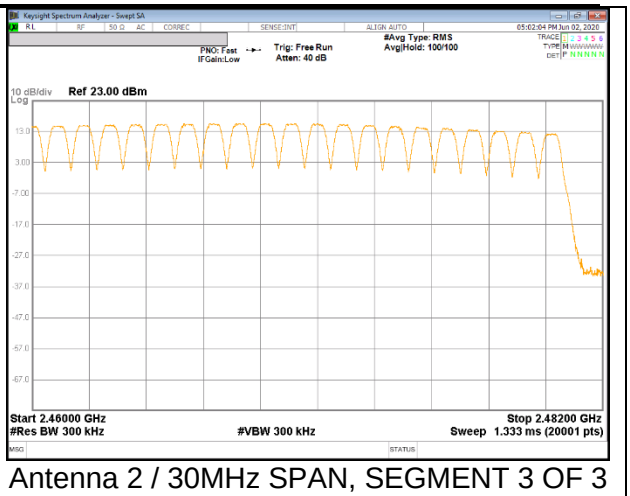

Antenna 1 / 30MHz SPAN, SEGMENT 2 OF 3




Antenna 2 / 30MHz SPAN, SEGMENT 2 OF 3

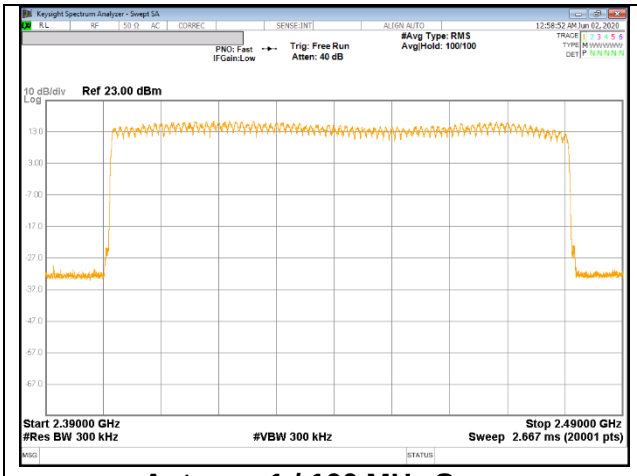



Antenna 1 / 30MHz SPAN, SEGMENT 3 OF 3

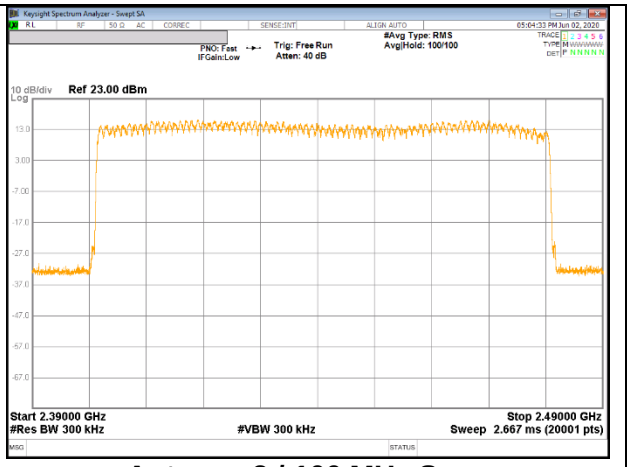



Antenna 2 / 30MHz SPAN, SEGMENT 3 OF 3

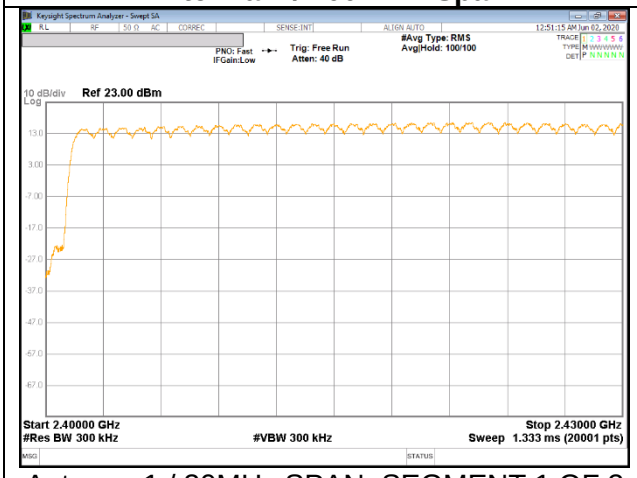
# 9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



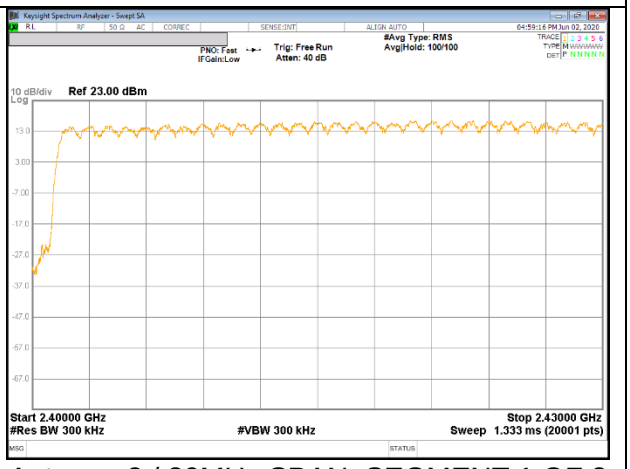

**Antenna 1 / 100 MHz Span**



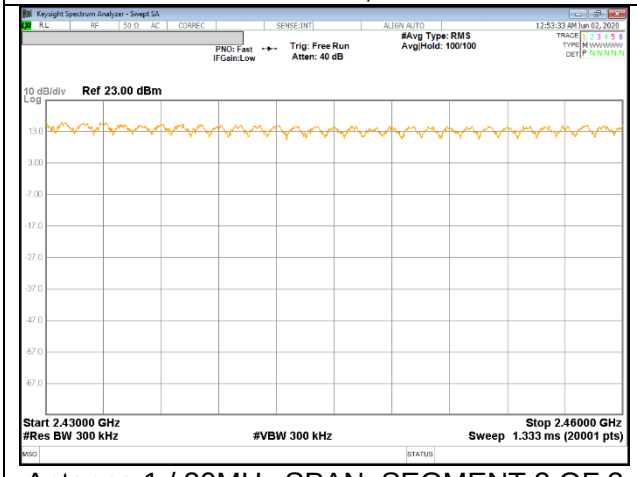

**Antenna 2 / 100 MHz Span**



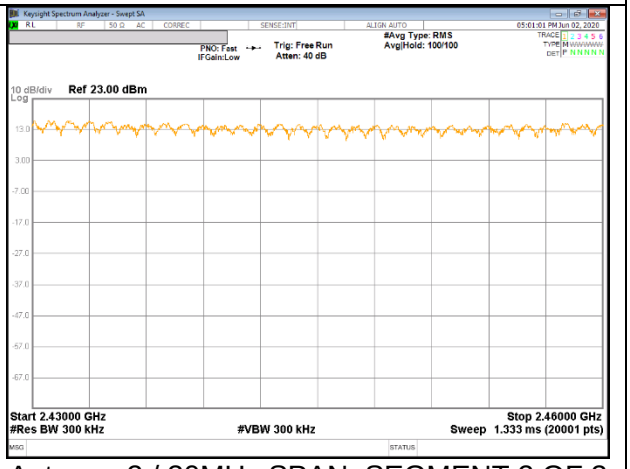

Antenna 1 / 30MHz SPAN, SEGMENT 1 OF 3



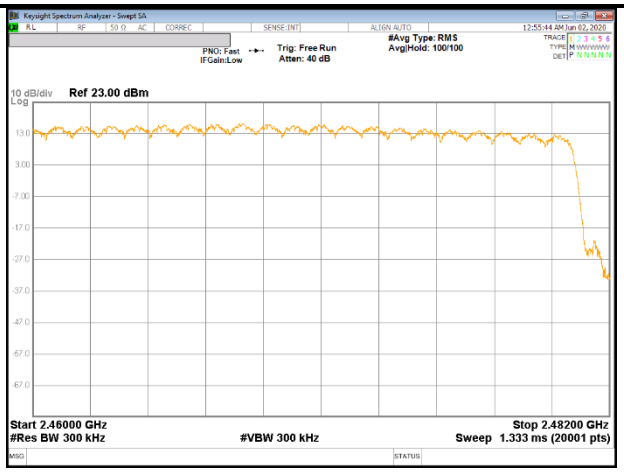

Antenna 2 / 30MHz SPAN, SEGMENT 1 OF 3



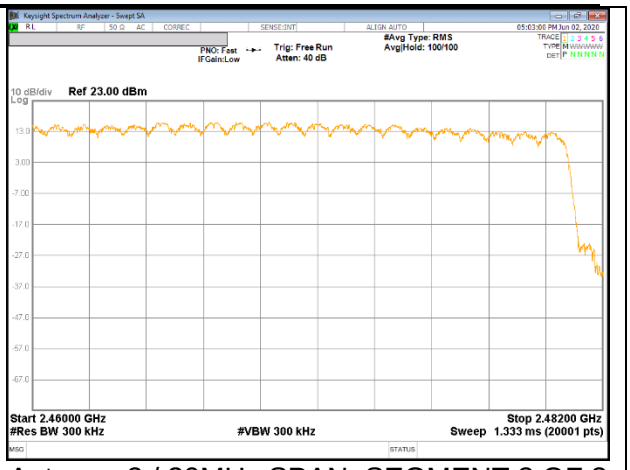

Antenna 1 / 30MHz SPAN, SEGMENT 2 OF 3




Antenna 2 / 30MHz SPAN, SEGMENT 2 OF 3




Antenna 1 / 30MHz SPAN, SEGMENT 3 OF 3




Antenna 2 / 30MHz SPAN, SEGMENT 3 OF 3

# 9.5. AVERAGE TIME OF OCCUPANCY

**LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

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 3.16 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**

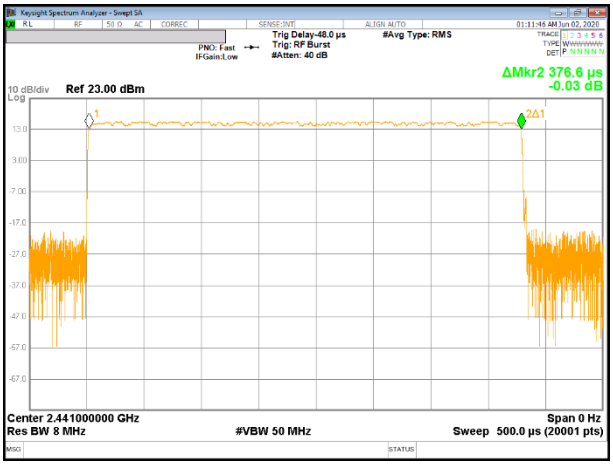
## 9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Antenna 1 Normal | | | | | |
| DH1 | 0.377 | 32 | 0.120512 | 0.4 | -0.2795 |
| DH3 | 1.632 | 16 | 0.261120 | 0.4 | -0.1389 |
| DH5 | 2.88 | 12 | 0.345600 | 0.4 | -0.0544 |

| DH Packet | Pulse Width [msec] | Number of Pulses in 0.8 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Antenna 1 AFH | | | | | |
| DH1 | 0.377 | 8 | 0.030128 | 0.4 | -0.3699 |
| DH3 | 1.632 | 4 | 0.065280 | 0.4 | -0.3347 |
| DH5 | 2.880 | 3 | 0.086400 | 0.4 | -0.3136 |

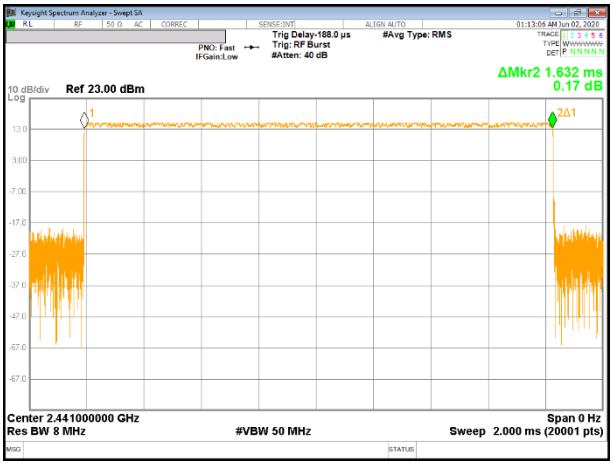
| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Antenna 2 Normal | | | | | |
| DH1 | 0.377 | 32 | 0.120480 | 0.4 | -0.2795 |
| DH3 | 1.632 | 16 | 0.261120 | 0.4 | -0.1389 |
| DH5 | 2.881 | 12 | 0.345720 | 0.4 | -0.0543 |

| DH Packet | Pulse Width [msec] | Number of Pulses in 0.8 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Antenna 2 AFH | | | | | |
| DH1 | 0.377 | 8 | 0.030120 | 0.4 | -0.3699 |
| DH3 | 1.632 | 4 | 0.065280 | 0.4 | -0.3347 |
| DH5 | 2.881 | 3 | 0.086430 | 0.4 | -0.3136 |

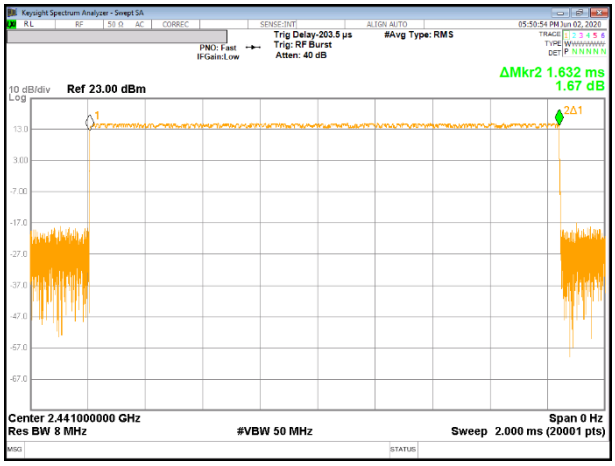



**Antenna 1 / PULSE WIDTH – DH1**

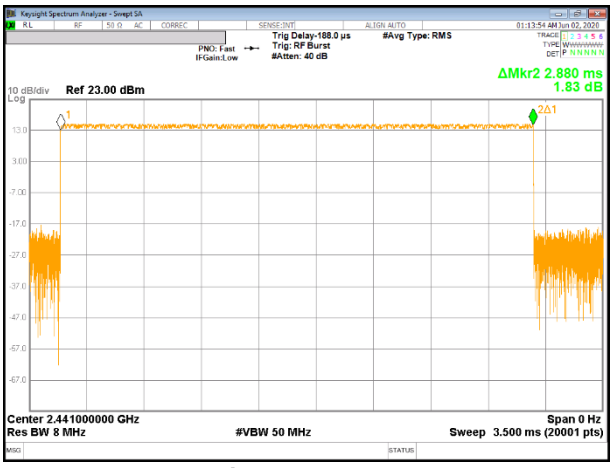

**Antenna 2 / PULSE WIDTH – DH1**



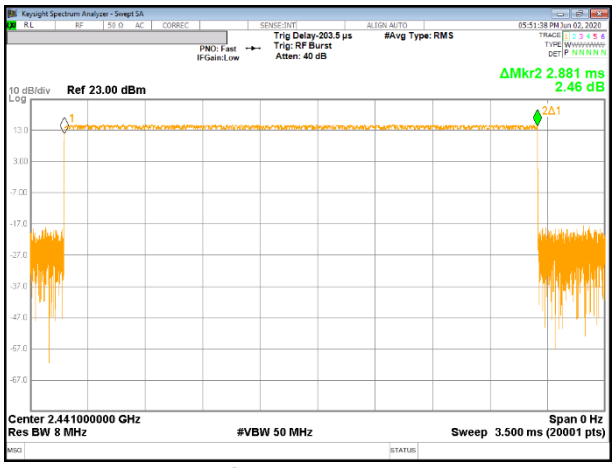

**Antenna 1 / PULSE WIDTH – DH3**



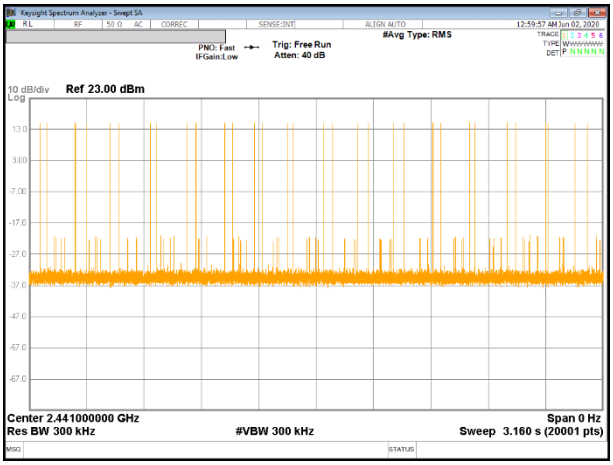

**Antenna 2 / PULSE WIDTH – DH3**



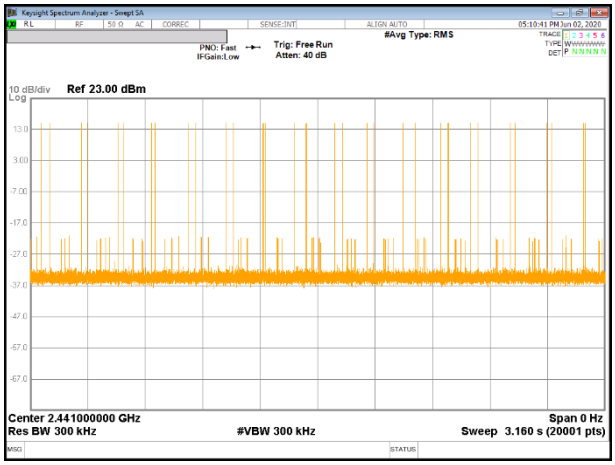

**Antenna 1 / PULSE WIDTH – DH5**



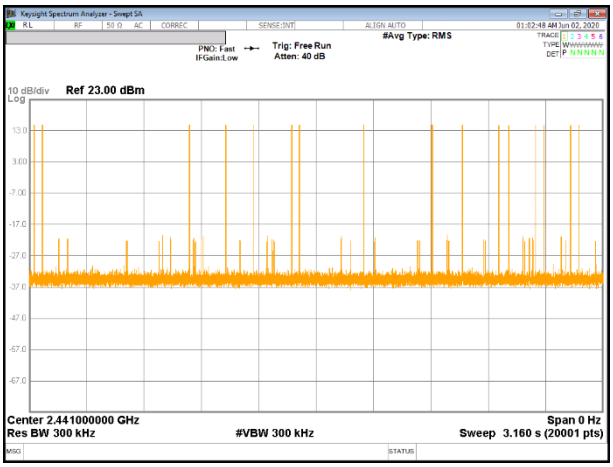

**Antenna 2 / PULSE WIDTH – DH5**



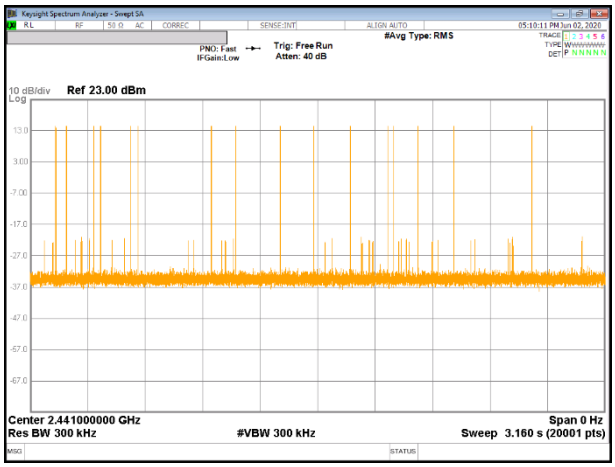

**Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



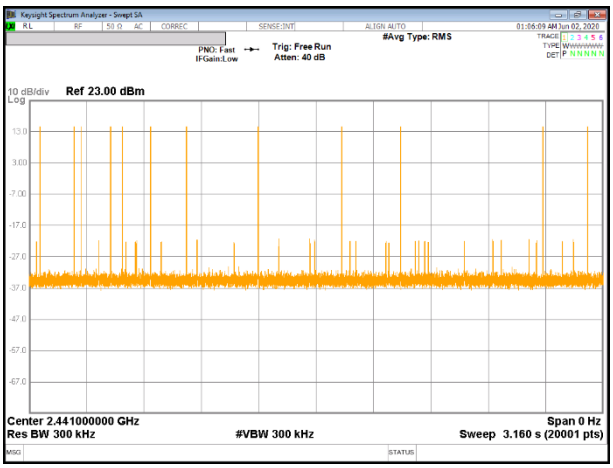

**Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



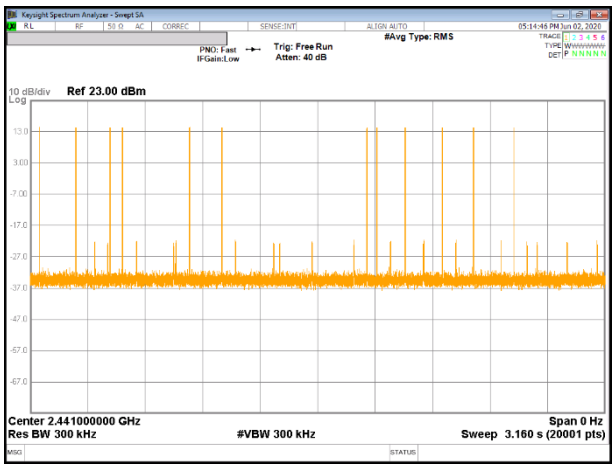

**Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**




**Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**




**Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**




**Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**

## 9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

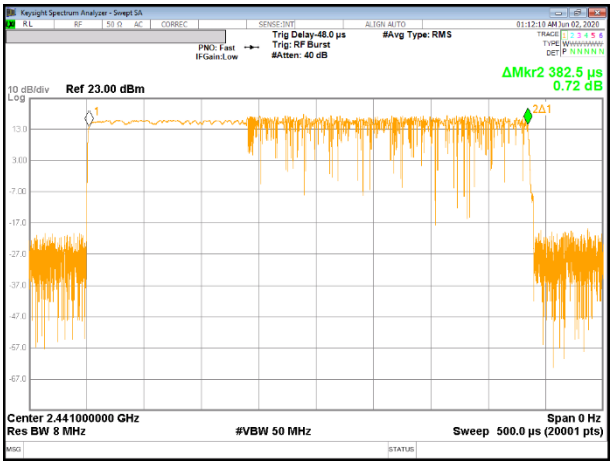
| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| 8PSK Antenna 1 Normal | | | | | |
| 3-DH1 | 0.383 | 32 | 0.122400 | 0.4 | -0.2776 |
| 3-DH3 | 1.633 | 16 | 0.261280 | 0.4 | -0.1387 |
| 3-DH5 | 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] |
|---|---|---|---|---|---|
| 8PSK Antenna 1 AFH | | | | | |
| 3-DH1 | 0.383 | 8 | 0.030600 | 0.4 | -0.3694 |
| 3-DH3 | 1.633 | 4 | 0.065320 | 0.4 | -0.33468 |
| 3-DH5 | 2.884 | 3 | 0.086520 | 0.4 | -0.31348 |

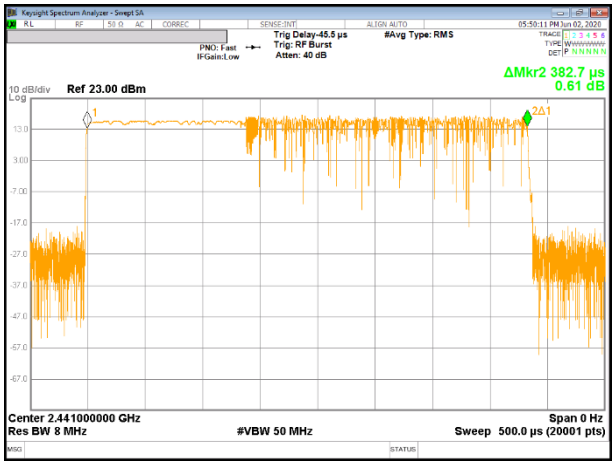
| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| 8PSK Antenna 2 Normal | | | | | |
| 3-DH1 | 0.383 | 32 | 0.122464 | 0.4 | -0.2775 |
| 3-DH3 | 1.633 | 16 | 0.261280 | 0.4 | -0.1387 |
| 3-DH5 | 2.885 | 12 | 0.346200 | 0.4 | -0.0538 |

| DH Packet | Pulse Width [msec] | Number of Pulses in 0.8 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| 8PSK Antenna 2 AFH | | | | | |
| 3-DH1 | 0.383 | 8 | 0.030616 | 0.4 | -0.369384 |
| 3-DH3 | 1.633 | 4 | 0.065320 | 0.4 | -0.33468 |
| 3-DH5 | 2.885 | 3 | 0.086550 | 0.4 | -0.31345 |

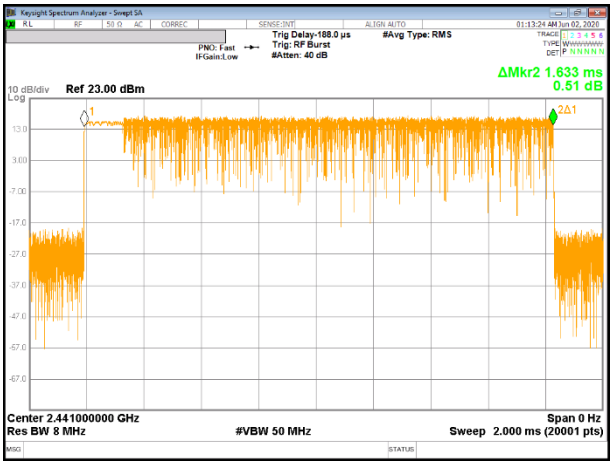
.



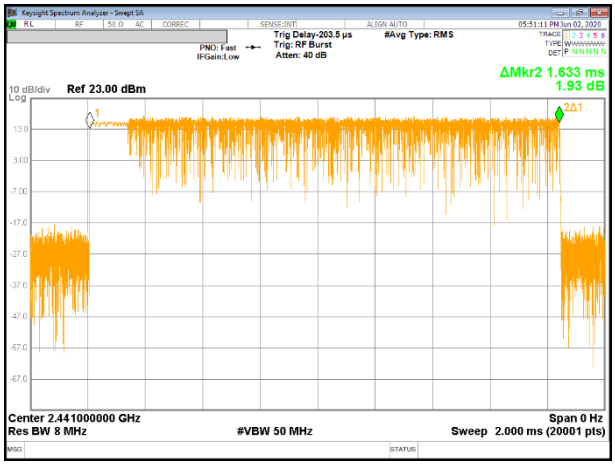

**Antenna 1 / PULSE WIDTH – 3-DH1**



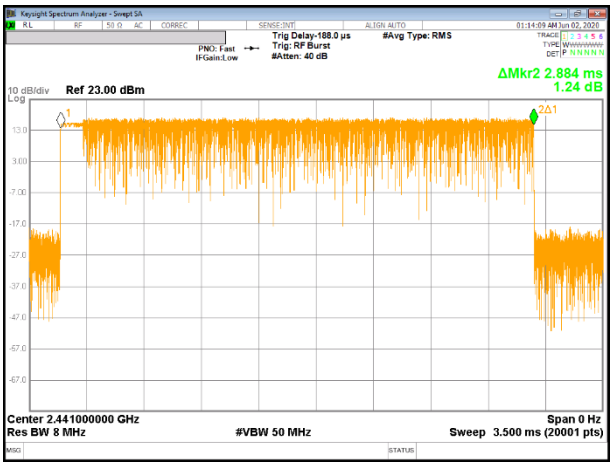

**Antenna 2 / PULSE WIDTH – 3-DH1**



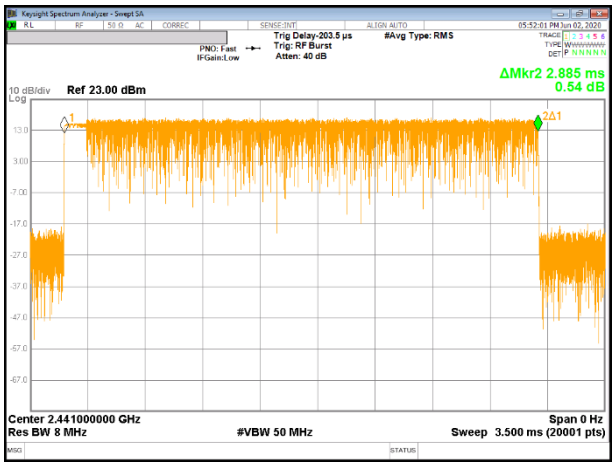

**Antenna 1 / PULSE WIDTH – 3-DH3**



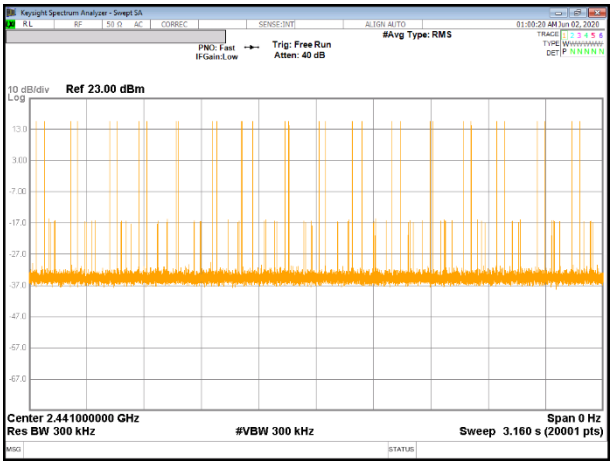

**Antenna 2 / PULSE WIDTH – 3-DH3**



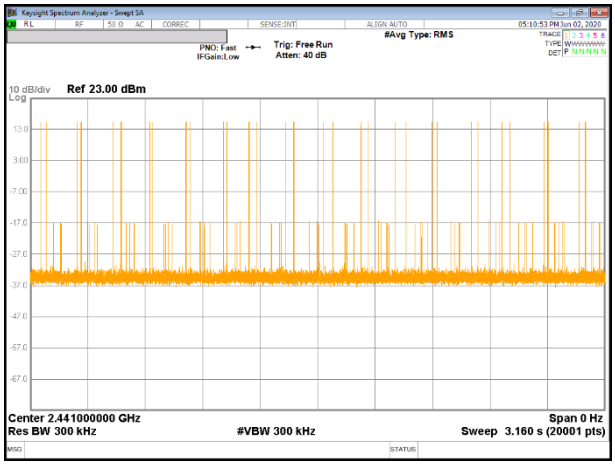

**Antenna 1 / PULSE WIDTH – 3-DH5**



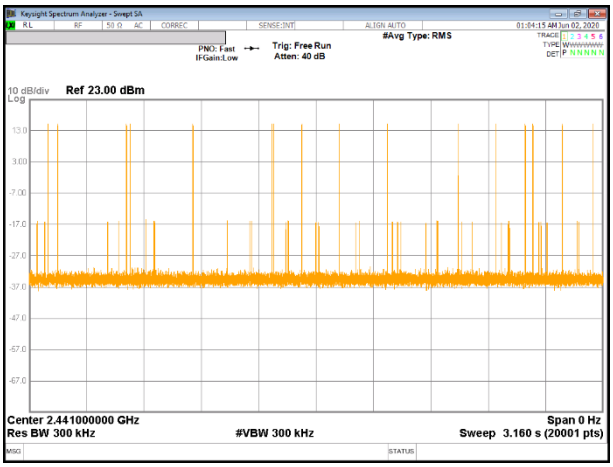

**Antenna 2 / PULSE WIDTH – 3-DH5**



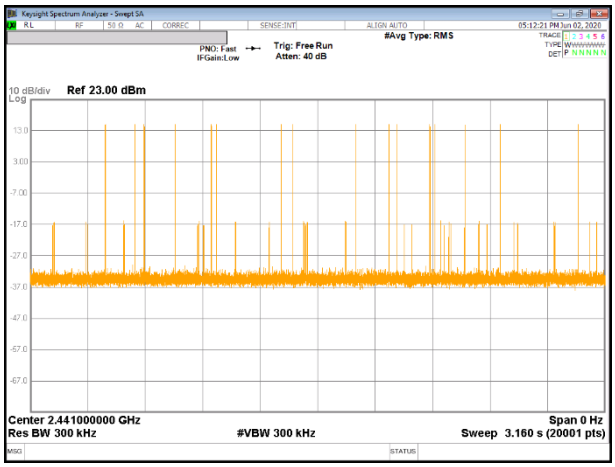

**Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1**



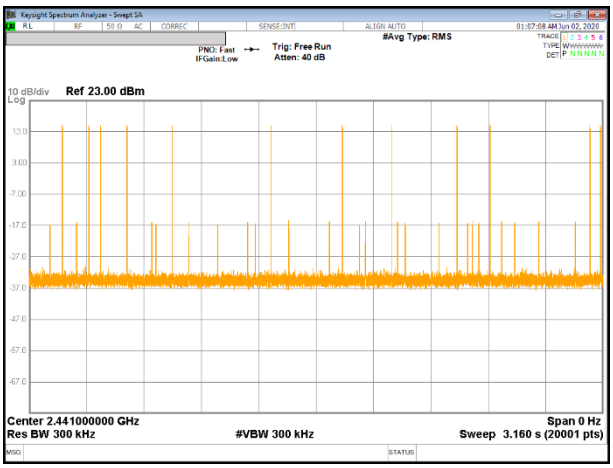

**Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1**



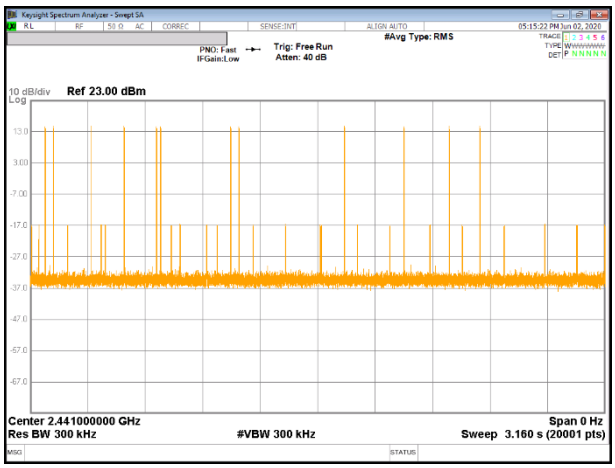

**Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH3**




**Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH3**




**Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH5**




**Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH5**

# 9.6. OUTPUT POWER

**LIMITS**

§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**

## 9.6.1. BASIC DATA RATE GFSK MODULATION

| Chain | Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|
| Antenna 1 | 0 | 2 402 | 15.038 | 21.000 | -5.962 |
| | 39 | 2 441 | **16.093** | **21.000** | **-4.907** |
| | 77 | 2 479 | 14.707 | 21.000 | -6.293 |
| | 78 | 2 480 | 14.255 | 21.000 | -6.745 |
| Antenna 2 | 0 | 2 402 | 13.748 | 21.000 | -7.252 |
| | 39 | 2 441 | 15.222 | 21.000 | -5.778 |
| | 77 | 2 479 | 14.273 | 21.000 | -6.727 |
| | 78 | 2 480 | 14.050 | 21.000 | -6.950 |
| Worst | | | 16.093 | 21.000 | -4.907 |

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

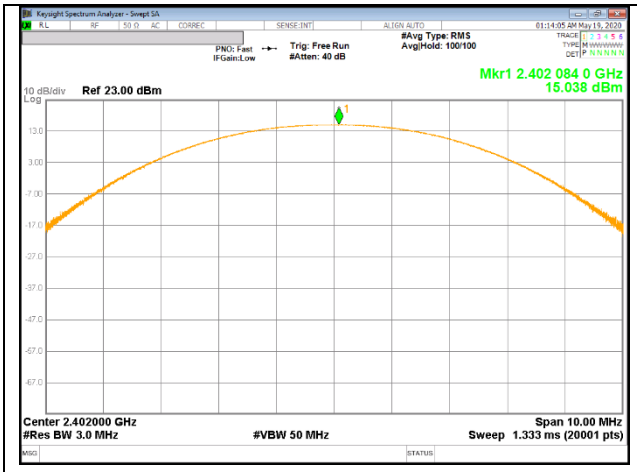
| Chain | Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|
| Antenna 1 | 0 | 2 402 | 16.827 | 21.000 | -4.173 |
| | 39 | 2 441 | **17.815** | **21.000** | **-3.185** |
| | 77 | 2 479 | 16.326 | 21.000 | -4.674 |
| | 78 | 2 480 | 15.799 | 21.000 | -5.201 |
| Antenna 2 | 0 | 2 402 | 15.600 | 21.000 | -5.400 |
| | 39 | 2 441 | 16.999 | 21.000 | -4.001 |
| | 77 | 2 479 | 15.970 | 21.000 | -5.030 |
| | 78 | 2 480 | 15.756 | 21.000 | -5.244 |
| Worst | | | 17.815 | 21.000 | -3.185 |

## 9.6.3. ENHANCED DATA RATE 8PSK MODULATION

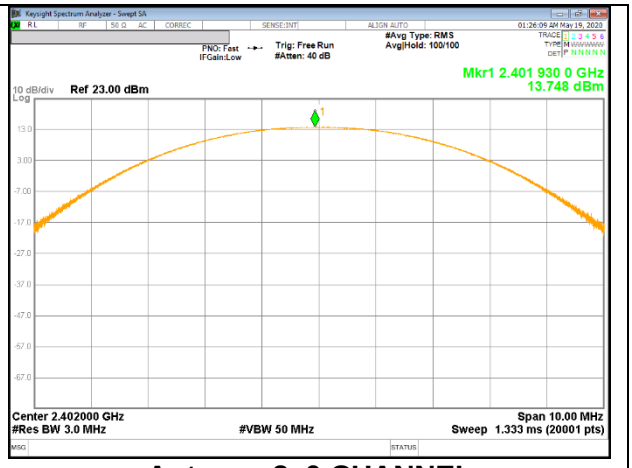
| Chain | Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|
| Antenna 1 | 0 | 2 402 | 17.392 | 21.000 | -3.608 |
| | 39 | 2 441 | **18.256** | **21.000** | **-2.744** |
| | 77 | 2 479 | 16.670 | 21.000 | -4.330 |
| | 78 | 2 480 | 16.253 | 21.000 | -4.747 |
| Antenna 2 | 0 | 2 402 | 16.146 | 21.000 | -4.854 |
| | 39 | 2 441 | 17.544 | 21.000 | -3.456 |
| | 77 | 2 479 | 16.457 | 21.000 | -4.543 |
| | 78 | 2 480 | 16.164 | 21.000 | -4.836 |
| Worst | | | 18.256 | 21.000 | -2.744 |

## 9.6.1. OUTPUT POWER PLOTS

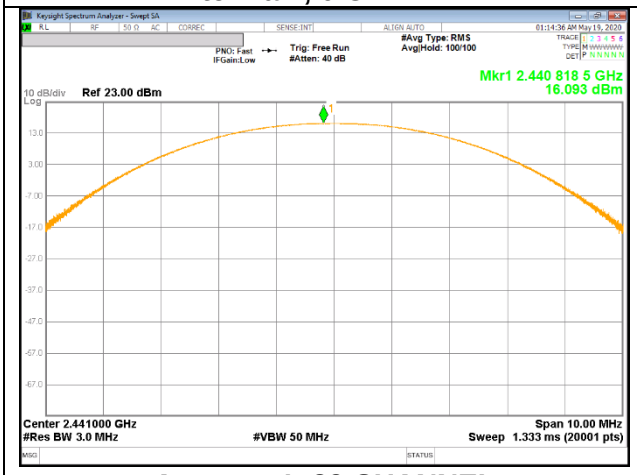
**GFSK OUTPUT POWER**



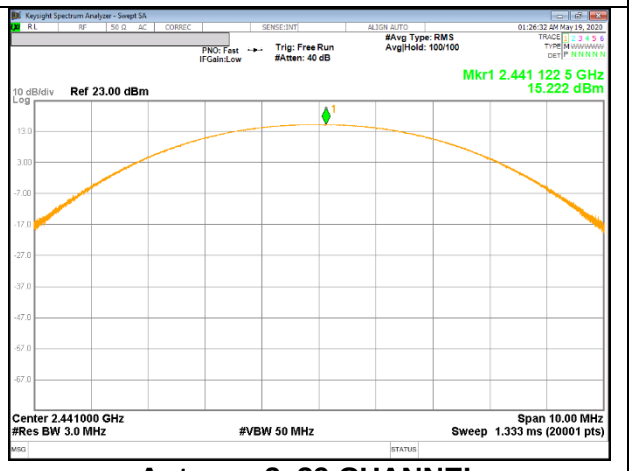

**Antenna 1, 0 CHANNEL**



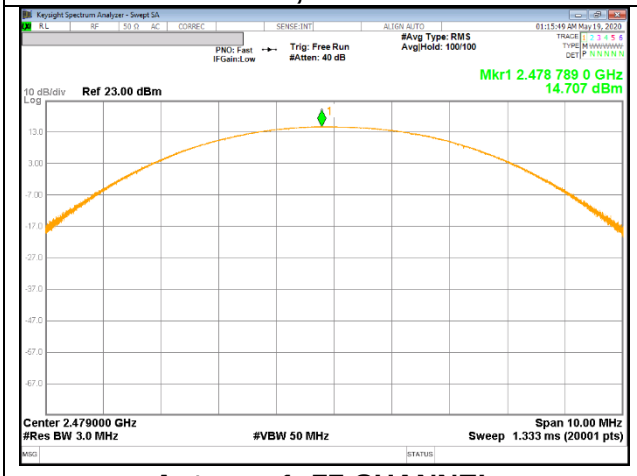

**Antenna 2, 0 CHANNEL**



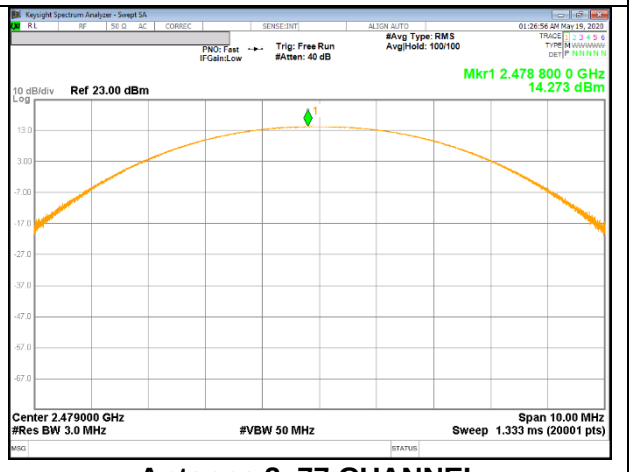

**Antenna 1, 39 CHANNEL**



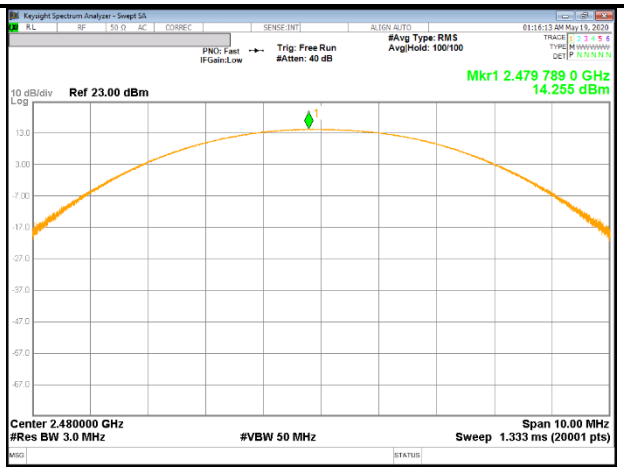

**Antenna 2, 39 CHANNEL**



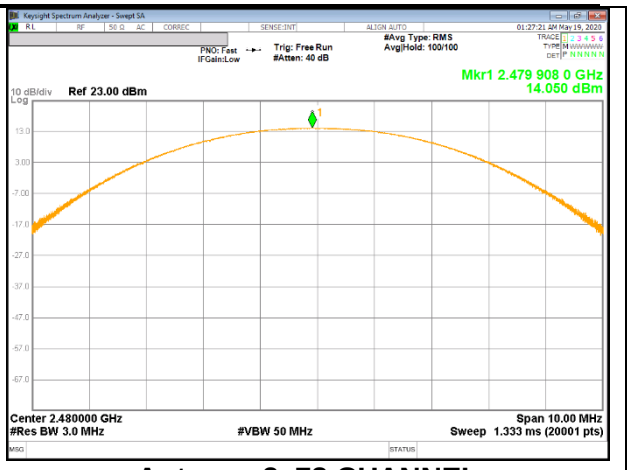

**Antenna 1, 77 CHANNEL**




**Antenna 2, 77 CHANNEL**

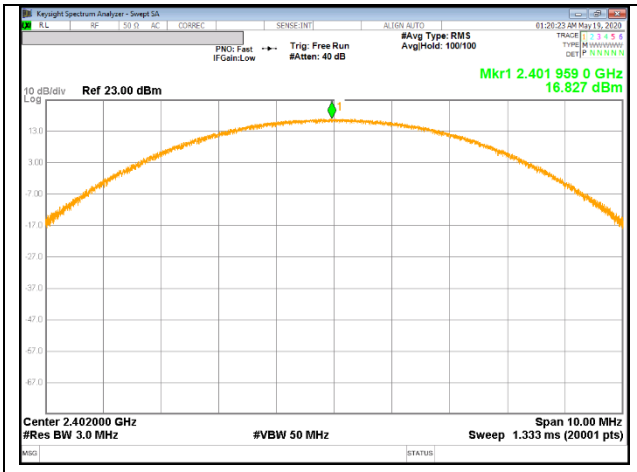



**Antenna 1, 78 CHANNEL**

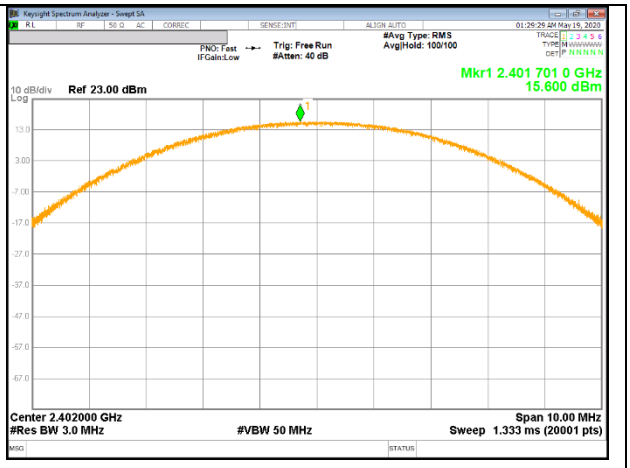



**Antenna 2, 78 CHANNEL**

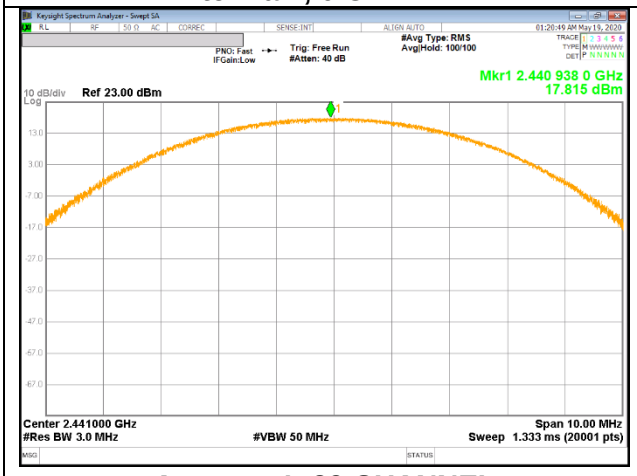
## Pi/4-DPSK OUTPUT POWER



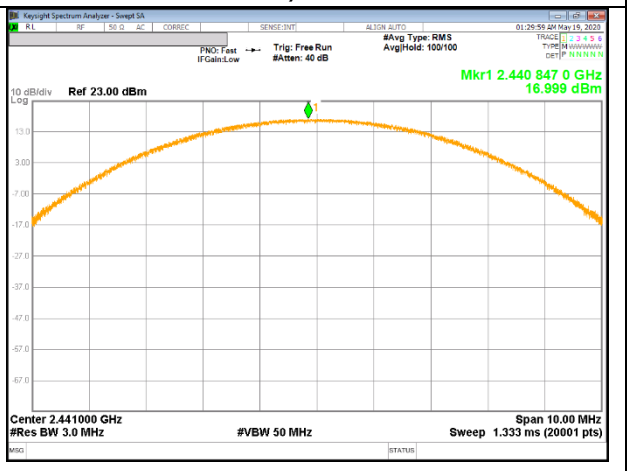

**Antenna 1, 0 CHANNEL**



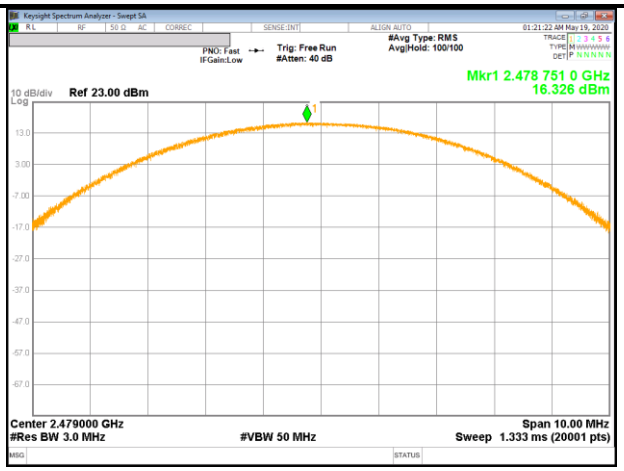

**Antenna 2, 0 CHANNEL**



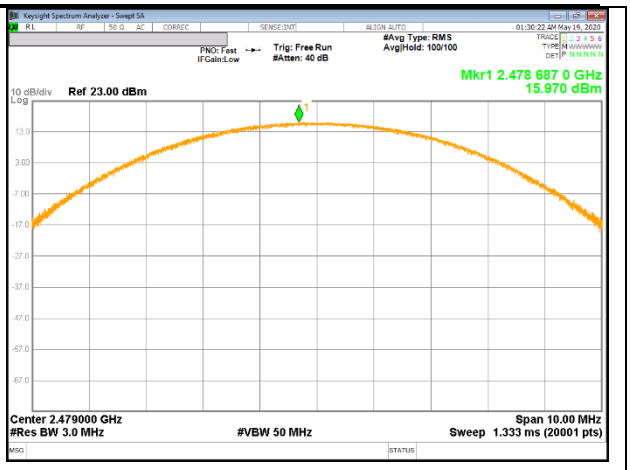

**Antenna 1, 39 CHANNEL**



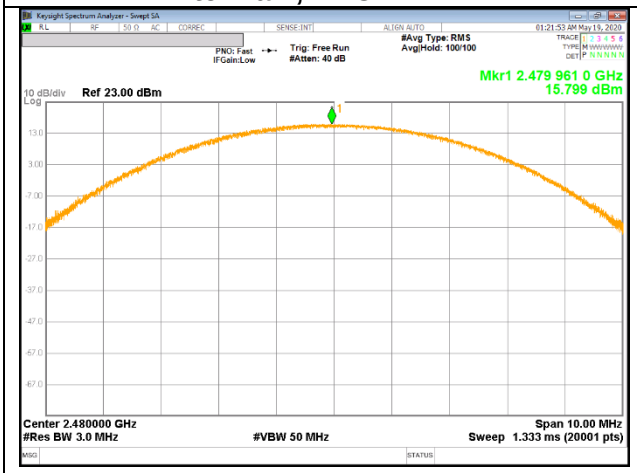

**Antenna 2, 39 CHANNEL**



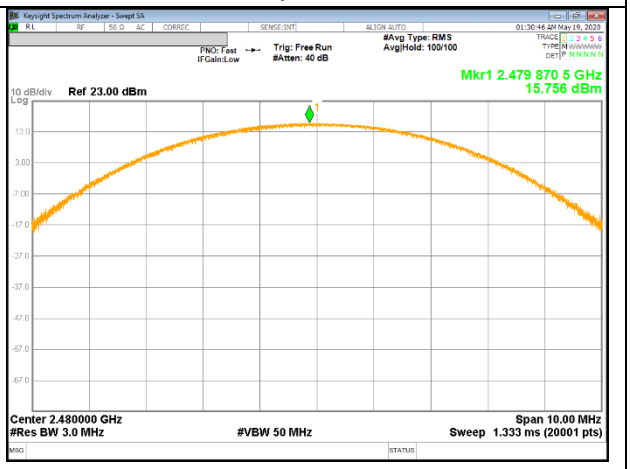

**Antenna 1, 77 CHANNEL**




**Antenna 2, 77 CHANNEL**

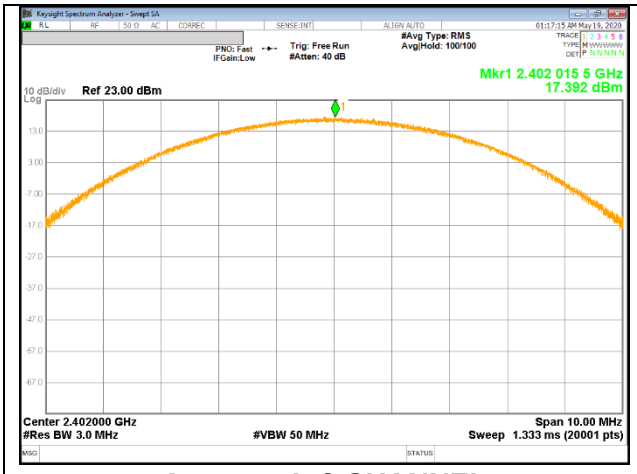



**Antenna 1, 78 CHANNEL**

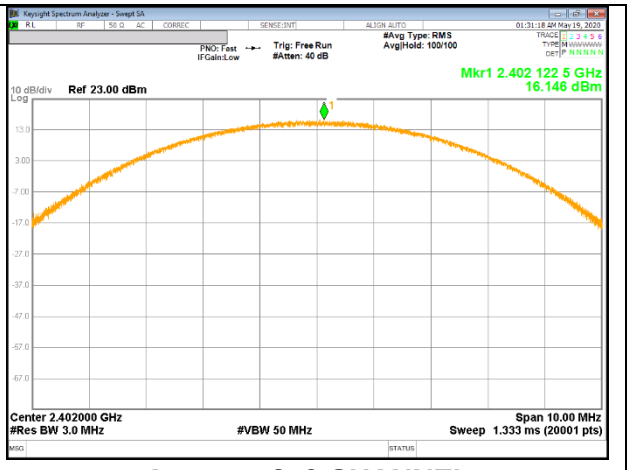



**Antenna 2, 78 CHANNEL**

## 8PSK OUTPUT POWER




**Antenna 1, 0 CHANNEL**




**Antenna 2, 0 CHANNEL**