



TEST REPORT

Report Number: 14523740-E1V3

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

Model : A2848

Brand : APPLE

FCC ID : BCG-E8435A

IC : 579C-E8435A

EUT Description : SMART PHONE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue:
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REPORT REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised By |
|------|------------|---|------------|
| V1 | 7/13/2023 | Initial Issue | Chin Pang |
| V2 | 7/24/2023 | Address TCB's questions | Chin Pang |
| V3 | 7/26/2003 | Address page 4,10, 55, 87, 112, high power & low power BE | Chin Pang |

TABLE OF CONTENTS

| | |
|--|-----------|
| 1. ATTESTATION OF TEST RESULTS | 6 |
| 2. TEST SUMMARY | 8 |
| 3. TEST METHODOLOGY | 8 |
| 4. FACILITIES AND ACCREDITATION | 9 |
| 5. DECISION RULES AND MEASUREMENT UNCERTAINTY | 9 |
| 5.1. <i>METROLOGICAL TRACEABILITY</i> | 9 |
| 5.2. <i>DECISION RULES</i> | 9 |
| 5.3. <i>MEASUREMENT UNCERTAINTY</i> | 10 |
| 6. EQUIPMENT UNDER TEST | 11 |
| 6.1. <i>EUT DESCRIPTION</i> | 11 |
| 6.2. <i>MAXIMUM OUTPUT POWER</i> | 11 |
| 6.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i> | 11 |
| 6.4. <i>SOFTWARE AND FIRMWARE</i> | 12 |
| 6.5. <i>WORST-CASE CONFIGURATION AND MODE</i> | 12 |
| 6.6. <i>DESCRIPTION OF TEST SETUP</i> | 13 |
| 7. TEST AND MEASUREMENT EQUIPMENT | 17 |
| 8. MEASUREMENT METHODS | 19 |
| 9. ANTENNA PORT TEST RESULTS | 20 |
| 9.1. <i>ON TIME AND DUTY CYCLE</i> | 20 |
| 9.2. <i>20 dB AND 99% BANDWIDTH</i> | 22 |
| 9.2.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i> | 23 |
| 9.2.2. <i>HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION</i> | 24 |
| 9.2.3. <i>HIGH POWER ENHANCED DATA RATE 8PSK MODULATION</i> | 25 |
| 9.2.4. <i>HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION</i> | 26 |
| 9.3. <i>HOPPING FREQUENCY SEPARATION</i> | 27 |
| 9.3.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i> | 28 |
| 9.4. <i>NUMBER OF HOPPING CHANNELS</i> | 29 |
| 9.4.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i> | 30 |
| 9.5. <i>AVERAGE TIME OF OCCUPANCY</i> | 32 |
| 9.5.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i> | 33 |
| 9.6. <i>OUTPUT POWER</i> | 37 |
| 9.6.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i> | 39 |
| 9.6.2. <i>HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION</i> | 39 |
| 9.6.3. <i>HIGH POWER ENHANCED DATA RATE QPSK MODULATION</i> | 40 |
| 9.6.4. <i>HIGH POWER ENHANCED DATA RATE TXBF QPSK MODULATION</i> | 40 |

| | |
|---|------------|
| 9.6.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION | 41 |
| 9.6.6. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION | 41 |
| 9.6.7. LOW POWER BASIC DATA RATE GFSK MODULATION..... | 42 |
| 9.6.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION..... | 42 |
| 9.6.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION | 43 |
| 9.6.10. LOW POWER ENHANCED DATA RATE TXBF QPSK MODULATION..... | 43 |
| 9.6.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION | 44 |
| 9.6.12. LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION | 44 |
| 9.7. AVERAGE POWER..... | 45 |
| 9.7.1. HIGH POWER BASIC DATA RATE GFSK MODULATION | 46 |
| 9.7.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION..... | 46 |
| 9.7.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION | 47 |
| 9.7.4. HIGH POWER BASIC DATA RATE TXBF QPSK MODULATION..... | 47 |
| 9.7.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION | 48 |
| 9.7.6. HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION | 48 |
| 9.7.7. LOW POWER BASIC DATA RATE GFSK MODULATION..... | 49 |
| 9.7.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION..... | 49 |
| 9.7.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION | 50 |
| 9.7.10. LOW POWER BASIC DATA RATE TXBF QPSK MODULATION..... | 50 |
| 9.7.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION | 51 |
| 9.7.12. LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION..... | 51 |
| 9.8. CONDUCTED SPURIOUS EMISSIONS..... | 52 |
| 9.8.1. HIGH POWER BASIC DATA RATE GFSK MODULATION | 53 |
| 9.8.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION..... | 57 |
| 9.8.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION | 61 |
| 9.8.4. HIGH POWER TXBF ENHANCED DATA RATE 8PSK MODULATION | 65 |
| 9.8.5. LOW POWER BASIC DATA RATE GFSK MODULATION..... | 69 |
| 9.8.6. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION..... | 73 |
| 9.8.7. LOW POWER ENHANCED DATA RATE 8PSK MODULATION | 77 |
| 9.8.8. LOW POWER TXBF ENHANCED DATA RATE 8PSK MODULATION | 81 |
| 10. RADIATED TEST RESULTS | 85 |
| 10.1. TRANSMITTER ABOVE 1 GHz..... | 87 |
| 10.1.1. HIGH POWER BASIC DATA RATE GFSK MODULATION | 87 |
| 10.1.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION | 95 |
| 10.1.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION..... | 99 |
| 10.1.4. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION..... | 107 |
| 10.1.5. LOW POWER BASIC DATA RATE GFSK MODULATION | 111 |
| 10.1.6. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION | 119 |
| 10.1.7. LOW POWER ENHANCED DATA RATE 8PSK MODULATION | 123 |
| 10.1.8. LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION | 131 |
| 10.1.9. HARMONICS AND SPURIOUS EMISSIONS..... | 135 |
| 10.2. WORST CASE BELOW 1 GHZ..... | 141 |
| 10.3. WORST CASE 18-26 GHZ..... | 143 |
| 11. AC POWER LINE CONDUCTED EMISSIONS | 145 |
| 11.1. AC Power Line With AC/DC Adapter..... | 146 |
| 11.2. AC Power Line With Laptop..... | 148 |

12. SETUP PHOTOS150

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

EUT DESCRIPTION: SMART PHONE

MODEL: A2848

BRAND: APPLE

SERIAL NUMBER: C07GQU0010S00003PJ (Conducted)
C07GTH0012C00003PJ (Conducted)
LVMPXQW46R (Radiated)

SAMPLE RECEIPT DATE: FEBRUARY 14, 2023

DATE TESTED: MARCH 02, 2023 – JULY 25, 2023

| APPLICABLE STANDARDS | |
|--------------------------------|--------------|
| STANDARD | TEST RESULTS |
| CFR 47 Part 15 Subpart C | Complies |
| ISED RSS-247 Issue 2 | Complies |
| ISED RSS-GEN Issue 5 + A1 + A2 | Complies |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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2. TEST SUMMARY

| FCC Clause | ISED Clause | Requirement | Result | Comment |
|--------------------|-------------------|------------------------------|-------------------------|--------------------------------------|
| See Comment | | Duty Cycle | Reporting purposes only | Per ANSI C63.10, Section 11.6. |
| See Comment | RSS-GEN 6.7 | 20dB BW/99% OBW | Reporting purposes only | ANSI C63.10 Sections 6.9.2 and 6.9.3 |
| 15.247 (a)(1) | RSS-247 (5.1) (b) | Hopping Frequency Separation | Complies | None. |
| 15.247 (a)(1)(iii) | RSS-247 (5.1) (d) | Number of Hopping Channels | Complies | None. |
| 15.247 (a)(1)(iii) | RSS-247 (5.1) (d) | Average Time of Occupancy | Complies | None. |
| 15.247 (b)(1) | RSS-247 (5.4) (b) | Output Power | Complies | None. |
| See Comment | | Average Power | Reporting purposes only | Per ANSI C63.10, Section 11.9.2.3.2. |
| 15.247 (d) | RSS-247 (5.5) | Conducted Spurious Emissions | Complies | None. |
| 15.209, 15.205 | RSS-GEN 8.9, 8.10 | Radiated Emissions | Complies | None. |
| 15.207 | RSS-Gen 8.8 | AC Mains Conducted Emissions | Complies | None. |

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, KDB 662911, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

| | Address | ISED CABID | ISED Company Number | FCC Registration |
|-------------------------------------|--|------------|---------------------|------------------|
| <input type="checkbox"/> | Building 1: 47173 Benicia Street, Fremont, CA 94538, USA | US0104 | 2324A | 550739 |
| <input type="checkbox"/> | Building 2: 47266 Benicia Street, Fremont, CA 94538, USA | | | |
| <input checked="" type="checkbox"/> | Building 3: 843 Auburn Court, Fremont, CA 94538 USA | | | |
| <input checked="" type="checkbox"/> | Building 4: 47658 Kato Rd, Fremont, CA 94538 USA | | | |
| <input checked="" type="checkbox"/> | Building 5: 47670 Kato Rd, Fremont, CA 94538 USA | | | |

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER | U _{LAB} |
|--|-------------------------|
| Conducted Antenna Port Emission Measurement | 1.94 |
| Time Domain Measurements Using SA | 3.39 |
| RF Power Measurement Direct Method Using Power Meter | 0.450 (Peak), 1.3 (Ave) |
| Radio Frequency (Spectrum Analyzer) | 141.16 Hz |
| Occupied Bandwidth | 1.22% |
| Carrier Frequency Separation | 19.70Hz |
| Number of Hopping Frequencies | 0.000dB |
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz | 3.78 dB |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz | 3.40 dB |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz | 2.87 dB |
| Worst Case Radiated Disturbance, 30 to 1000 MHz | 6.01 dB |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz | 4.73 dB |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.51 dB |

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC, NB UNII, 802.15.4, 802.15.4ab-NB and MSS technologies. The rechargeable battery is not user accessible.

6.2. MAXIMUM OUTPUT POWER

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

| Antenna | Config | Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|-------------------|------------|-----------------------|--------------------|--------------------|-------------------|
| ANT 4 | High Power | 2402 - 2480 | Basic GFSK | 20.35 | 108.39 |
| | | 2402 - 2480 | DQPSK | 16.66 | 46.34 |
| | | 2402 - 2480 | Enhanced 8PSK | 16.77 | 47.53 |
| | Low Power | 2402 - 2480 | Basic GFSK | 11.43 | 13.90 |
| | | 2402 - 2480 | DQPSK | 11.33 | 13.58 |
| | | 2402 - 2480 | Enhanced 8PSK | 11.44 | 13.93 |
| ANT 3 | High Power | 2402 - 2480 | Basic GFSK | 20.36 | 108.64 |
| | | 2402 - 2480 | DQPSK | 16.68 | 46.56 |
| | | 2402 - 2480 | Enhanced 8PSK | 16.74 | 47.21 |
| | Low Power | 2402 - 2480 | Basic GFSK | 12.86 | 19.32 |
| | | 2402 - 2480 | DQPSK | 11.44 | 13.93 |
| | | 2402 - 2480 | Enhanced 8PSK | 11.52 | 14.19 |
| BF, ANT 4 + ANT 3 | High Power | 2402 - 2480 | Basic GFSK TxBF | 20.29 | 106.91 |
| | | 2402 - 2480 | DQPSK TxBF | 16.72 | 46.99 |
| | | 2402 - 2480 | Enhanced 8PSK TxBF | 16.82 | 48.08 |
| | Low Power | 2402 - 2480 | Basic GFSK TxBF | 15.13 | 32.58 |
| | | 2402 - 2480 | DQPSK TxBF | 14.30 | 26.92 |
| | | 2402 - 2480 | Enhanced 8PSK TxBF | 14.43 | 27.73 |

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

| Frequency Range (GHz) | ANT 4 (dBi) | ANT 3 (dBi) |
|-----------------------|-------------|-------------|
| 2.4 | -4.0 | -1.5 |

6.4. SOFTWARE AND FIRMWARE

The EUT firmware version installed during testing was Version 21.1.304.2213

6.5. WORST-CASE CONFIGURATION AND MODE

The EUT was investigated in three orthogonal orientations X, Y and Z on ANT 4 and ANT 3, it was determined that X (Flatbed) was the worst-case orientation for ANT 4 and 2TX Beamforming and Y (Landscape) orientation for ANT 3.

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT was set to transmit at highest power on Low/Middle/High channels.

Radiated emissions below 1GHz, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario. There were no emissions found below 30MHz within 20dB of the limit.

For below 1GHz tests EUT was connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. For AC line conducted emission, test was investigated with AC power adapter and with laptop.

For simultaneous transmission of multiple channels in the 2.4GHz BT and 5GHz bands, No noticeable emission was found.

GFSK, DQPSK, 8PSK average power are all investigated, The GFSK & 8PSK power are the worst case. For average power data please refer to section 9.7.

Worst-case data rates as provided by the client were:

GFSK mode: DH5

8PSK mode: 3-DH5

Beamforming : GFSK, DH5, 8PSK, 3-DH5

For radiated harmonic spurious emissions test, high power beamforming GFSK mode is set to maximum power per chain to cover both SISO and MIMO modes to complies with radiated spurious emissions limits in the restricted bands between 1GHz and 18GHz low/mid/high channel.

Note: In the Radiated Plots and emissions data, ANT0=ANT4 and ANT1=ANT3.

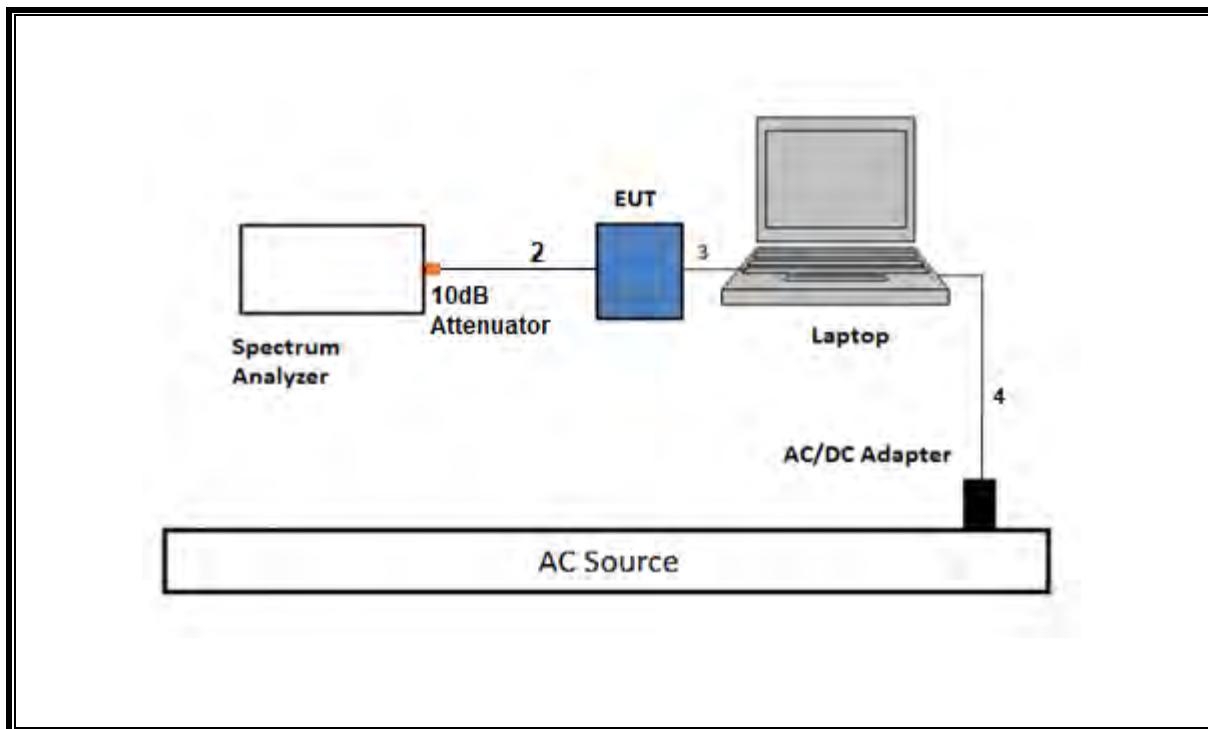
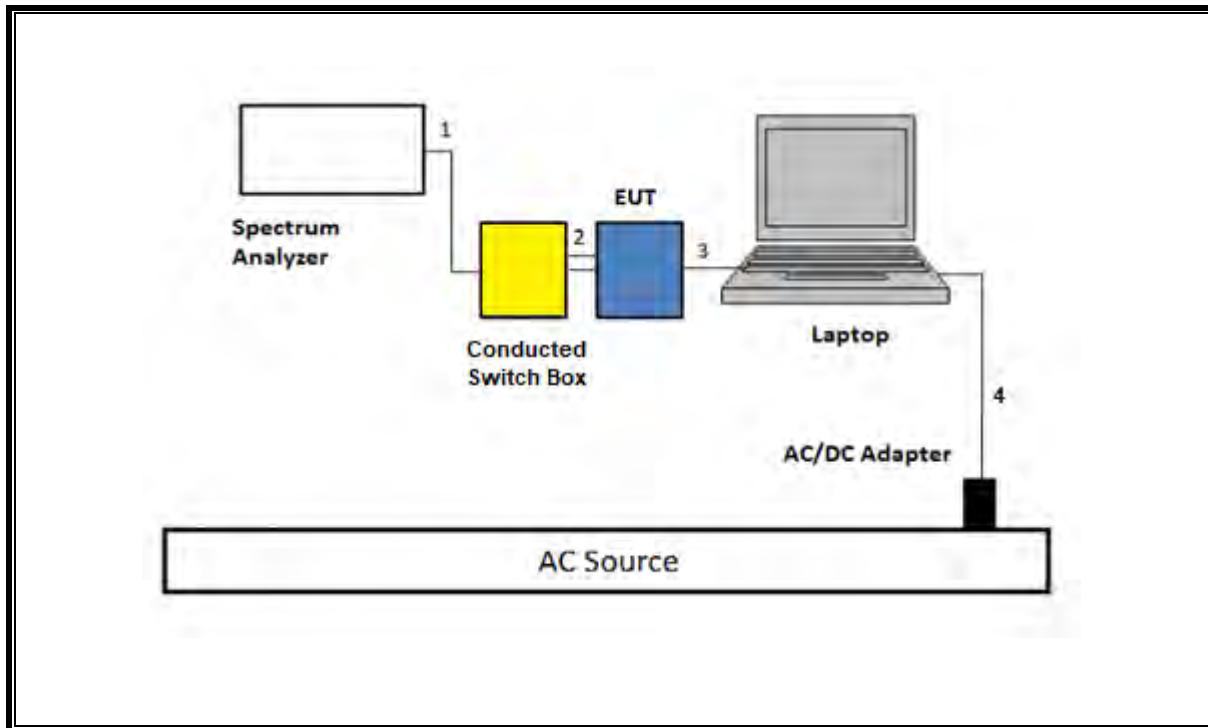
6.6. DESCRIPTION OF TEST SETUP

| SUPPORT TEST EQUIPMENT | | | | | | |
|---|------------------------|----------------------|-------------------|-------------|------------------|-------------------------|
| Description | Manufacturer | Model | Serial Number | FCC ID/ DoC | | |
| Laptop | Apple | Macbook Pro | C02VD7SAHV22 | BCGA1708 | | |
| Laptop AC/DC adapter | Liteon Technology | A1424 | NSW25679 | DoC | | |
| EUT AC/DC adapter | Apple | A1720 | C3D8417A7R93KVPA8 | DoC | | |
| Conducted Switch Box | UL | n/a | 208281 | N/A | | |
| 10dB Fixed Attenuator, 2 Watts Up to 26.5 GHz | Pasternack Enterprises | PE7024-10 | 236358 | N/A | | |
| I/O CABLES (RF CONDUCTED TEST) | | | | | | |
| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | SMA | 1 | SMA | Shielded | 0.75 | To spectrum Analyzer |
| 2 | Antenna | 2 | SMA | Un-shielded | 0.2 | To Conducted Switch Box |
| 3 | USB-C | 1 | USB-C | Shielded | 1.0 | N/A |
| 4 | AC | 1 | AC | Un-shielded | 2 | N/A |
| I/O CABLES (RF RADIATED AND AC LINE CONDUCTED TEST) | | | | | | |
| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | AC | 1 | AC | Un-shielded | 2 | N/A |
| 2 | USB | 1 | USB | Shielded | 1 | N/A |

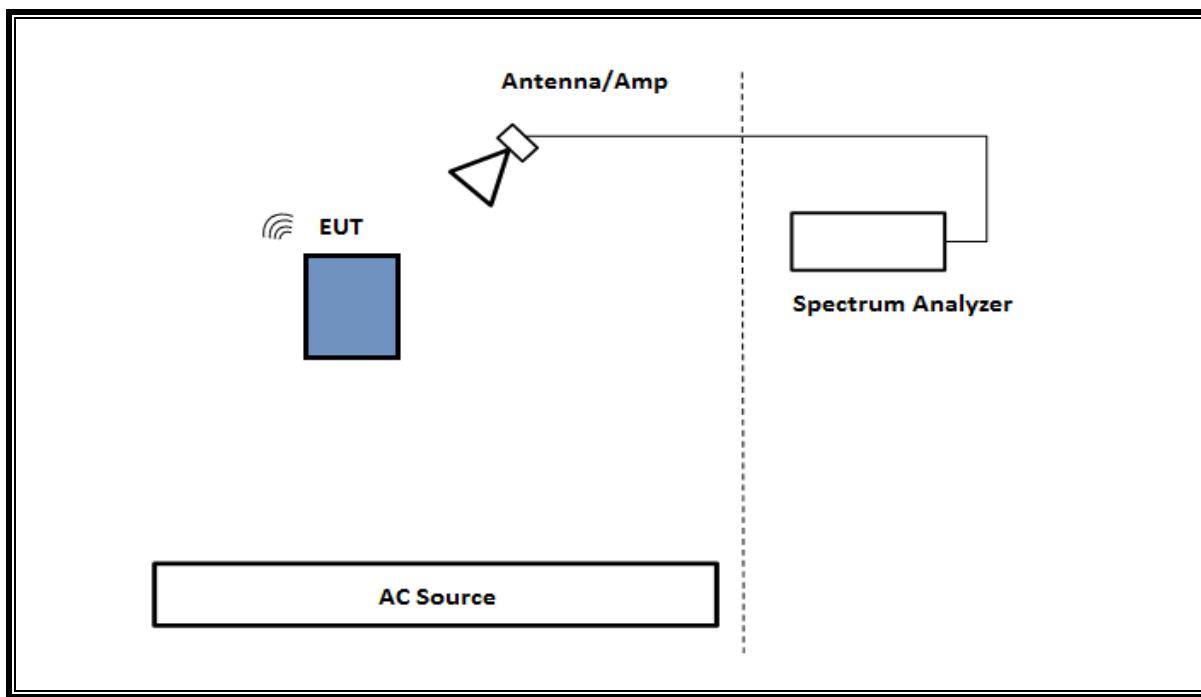
TEST SETUP

The EUT setup is shown as below. Test software exercised the radio card.

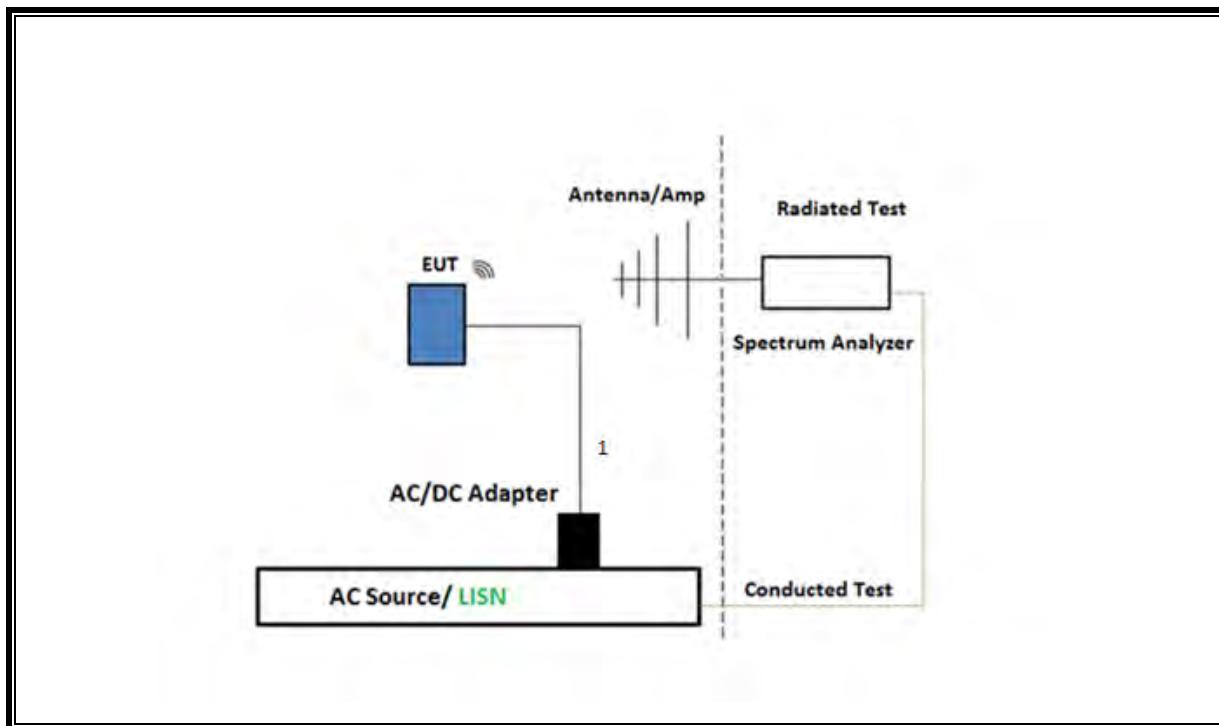
SETUP DIAGRAM FOR CONDUCTED TESTS



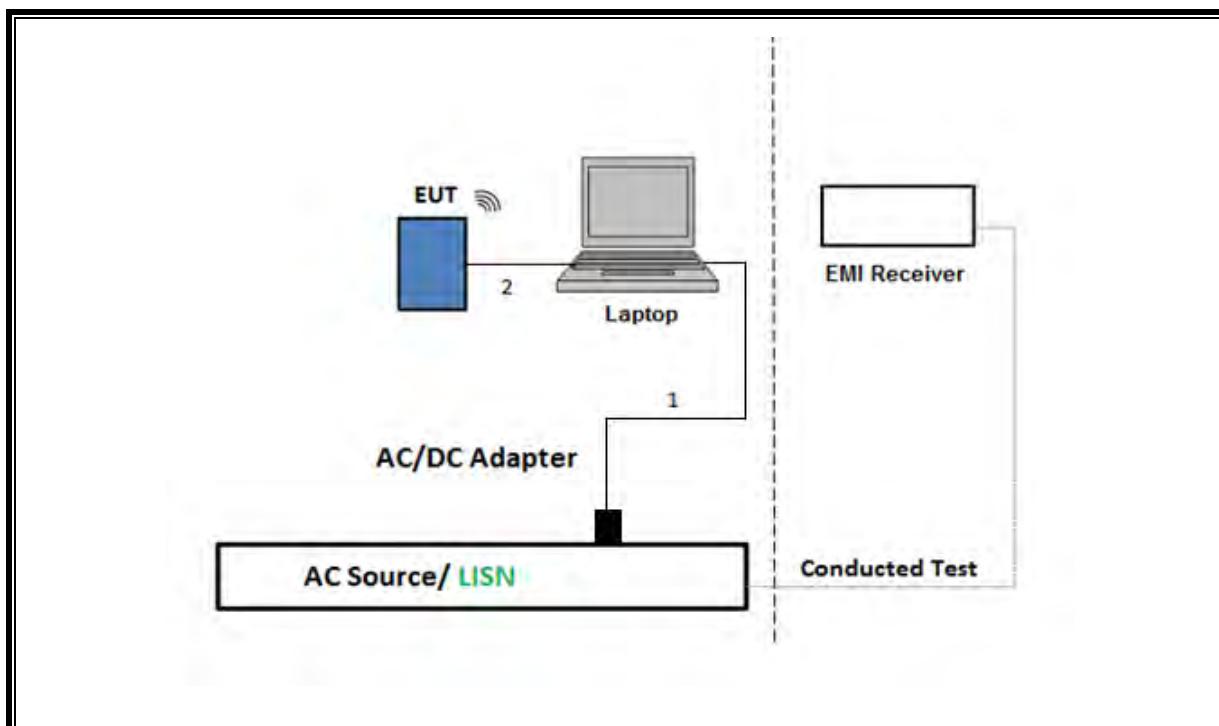
SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz



SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



7. TEST AND MEASUREMENT EQUIPMENT

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

| Description | Manufacturer | Model | ID Num | Cal Due | Last Cal |
|--|---------------------------|---------------|--------|-----------------------------------|------------|
| *Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 80707 | 04/28/2023 | 04/28/2022 |
| *RF Filter Box | UL-FR1 | NA | 173233 | 03/28/2023 | 03/28/2022 |
| EMI Test Receiver | Rohde & Schwarz | ESW44 | 191429 | 02/29/2024 | 02/29/2023 |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 222740 | 08/31/2023 | 08/31/2022 |
| Filter Box, 1-18GHz 12 Port | UL-FR1 | Frankenstein | 217255 | 08/23/2023 | 08/23/2022 |
| Antenna, BroadBand Hybrid, 30MHz to 3GHz | Sunol Sciences Corp. | JB3 | 81560 | 10/13/2023 | 10/13/2022 |
| *Antenna Horn, 18 to 26.5GHz | ARA | MWH-1826/B | 172353 | 06/01/2023 | 06/01/2022 |
| EMI Receiver | Rohde & Schwarz | ESW44 | 201502 | 02/29/2024 | 02/29/2023 |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 230299 | 01/12/2024 | 01/12/2023 |
| Filter Box, 1-18GHz 12 Port | UL-FR1 | Frankenstein | 216812 | 09/17/2023 | 09/17/2022 |
| Antenna, Passive Loop 100KHz to 30MHz | ETS-Lindgren | EM-6872 | 170015 | 07/28/2023 | 07/28/2022 |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 226672 | 01/09/2024 | 01/09/2023 |
| RF Filter Box, 1-18GHz, 12 Port. | UL-FR1 | Frankenstein | 231874 | 04/19/2024 | 04/19/2023 |
| Antenna, Passive Loop 30Hz to 1MHz | Electro-Metrics | EM-6871 | 170013 | 07/28/2023 | 07/28/2022 |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 230300 | 01/12/2024 | 01/12/2023 |
| EMI Test Receiver | Rohde & Schwarz | ESW44 | 201500 | 02/29/2024 | 02/29/2023 |
| RF Filter Box, 1-18GHz, 17 Ports | UL-FR1 | RATS 2 | 226781 | 04/30/2024 | 04/30/2023 |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 226673 | 01/09/2024 | 01/09/2023 |
| EMI TEST RECEIVER | Rohde & Schwarz | ESW44 | 169935 | 02/29/2024 | 02/29/2023 |
| RF Filter Box, 1-18GHz | UL-FR1 | NA | 171875 | 11/10/2023 | 11/10/2022 |
| RF Amplifier Assembly, 18-26.5GHz, 60dB Gain | AMPLICAL | AMP18G26.5-60 | 171583 | 02/29/2024 | 02/29/2023 |
| Amplifier, 9KHz to 1GHz, 32dB | SONOMA INSTRUMENT | 310 | 204041 | 08/24/2023 | 08/24/2022 |
| Spectrum Analyzer, PSA, 3Hz to 26.5GHz | Keysight Technologies Inc | E4440A | 81311 | 02/29/2024 | 02/29/2023 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz | Keysight Technologies Inc | N9030A | 80397 | 02/28/2024 | 02/28/2023 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz | Keysight Technologies Inc | N9030A | 85214 | 02/28/2024 | 02/28/2023 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz | Keysight Technologies Inc | N9030A-544 | 87738 | 02/28/2024 | 02/23/2023 |
| *Conducted Switch Box | N/A | CSB | 221008 | 06/21/2023 | 06/21/2022 |
| Conducted Switch Box | N/A | CSB | 208281 | 04/30/2024 | 04/30/2023 |
| 10dB Fixed Attenuator, 2 Watts Up to 26.5 GHz | Pasternack Enterprises | PE7024-10 | 236358 | Verified/Characterized before use | |
| 10dB Fixed Attenuator, 2 Watts Up to 26.5 GHz | Pasternack Enterprises | PE7024-10 | 236355 | Verified/Characterized before use | |
| Power Meter, P-series single channel | Keysight Technologies Inc | N1911A | 90756 | 01/31/2024 | 01/31/2023 |
| Power Sensor, P - series, 50MHz to 18GHz, Wideband | Keysight Technologies Inc | N1921A | 90389 | 01/31/2024 | 01/31/2023 |

| AC Line Conducted | | | | | |
|--|----------------------------------|--------------------------------------|-----------------------|----------------|-----------------|
| Description | Manufacturer | Model | ID Num | Cal Due | Last Cal |
| EMI Test Receiver 9kHz-7GHz | Rohde & Schwarz | ESR | 93091 | 02/29/2024 | 03/29/2023 |
| LISN for Conducted Emissions CISPR-16 | FISCHER CUSTOM COMMUNICATIONS | FCC-LISN- 50/250-25-2-01- 480V | 175764 | 01/31/2024 | 01/31/2023 |
| Transient Limiter | TE | TBFL1 | 207996 | 07/15/2023 | 07/15/2022 |
| UL AUTOMATION SOFTWARE | | | | | |
| Radiated Software | UL | UL EMC | Ver 9.5, May 1 , 2023 | | |
| Conducted Software | UL | UL EMC | 2020.8.16 | | |
| AC Line Conducted Software | UL | UL EMC | Ver 9.5, Mar 3, 2023 | | |

*Testing was completed before equipment calibration date

8. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

&

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4 & 13

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3, 6.5 & 13

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3, 6.6 & 13

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5 & 13

AC Power-line conducted emissions: 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 B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/T Minimum VBW (kHz) |
|----------------|------------------------|------------------|-----------------------------|----------------------|---|-----------------------------|
| Bluetooth GFSK | 4.00 | 4.00 | 1.000 | 100.0% | 0.00 | 0.010 |
| Bluetooth 8PSK | 4.00 | 4.00 | 1.000 | 100.0% | 0.00 | 0.010 |

Note: There are the same DC factor on 1TX and 2TX.

DUTY CYCLE PLOTS



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 $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq 3 \times \text{RBW}$. The sweep time is coupled.

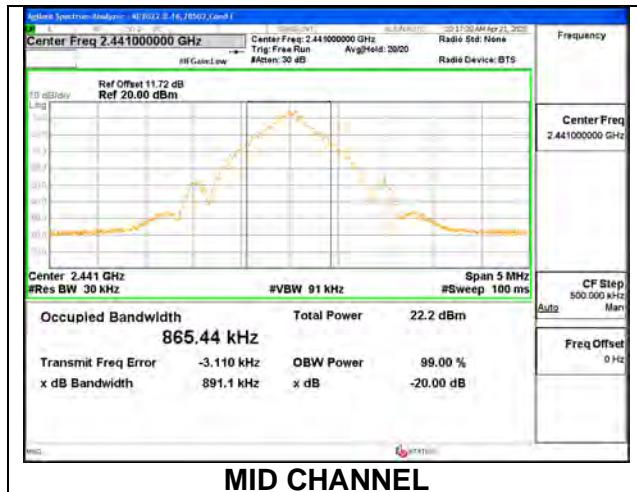
RESULTS

Only High Power modes result is reported, it covers all Low Power modes. Only Mid channel plot is reported to show setting parameter complies with testing method/procedure.

9.2.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

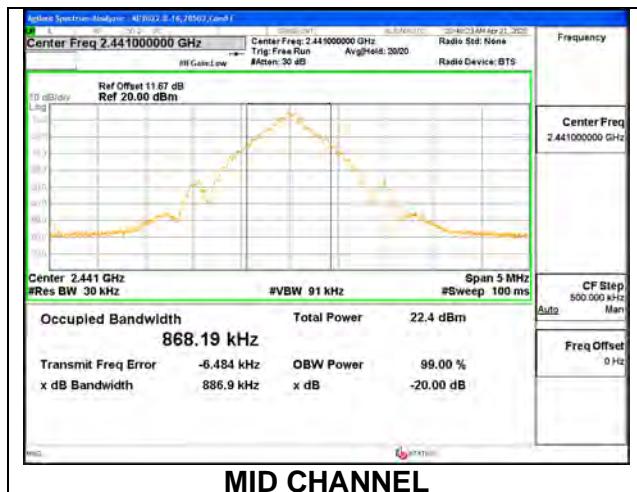
ANT 4

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low | 2402 | 0.88960 | 0.86597 |
| Mid | 2441 | 0.89110 | 0.86544 |
| High | 2480 | 0.87730 | 0.86968 |



ANT 3

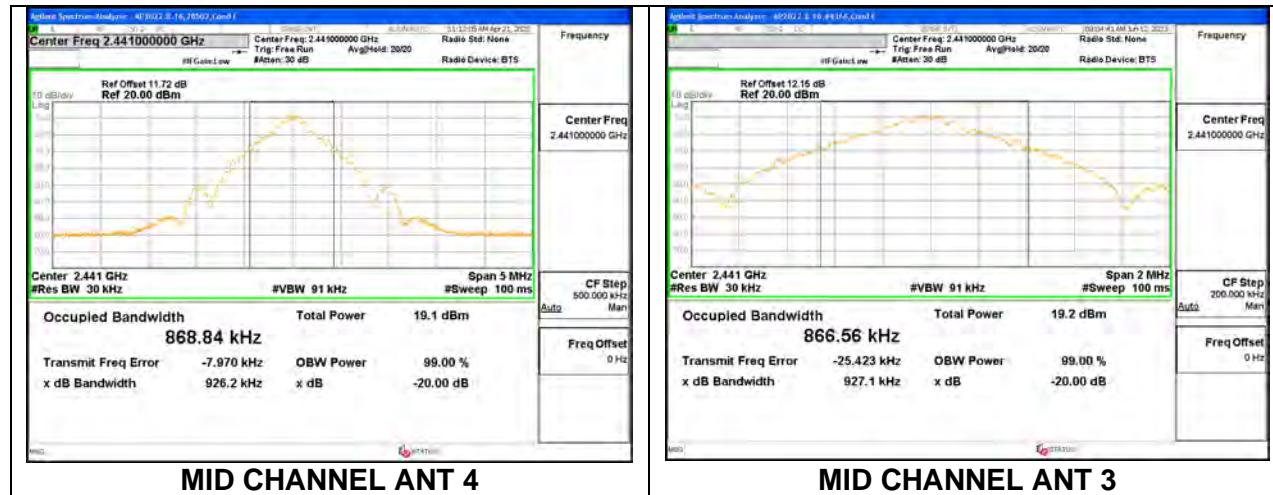
| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low | 2402 | 0.88640 | 0.86615 |
| Mid | 2441 | 0.88690 | 0.86819 |
| High | 2480 | 0.88950 | 0.86866 |



9.2.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

| Channel | Frequency (MHz) | 20dB Bandwidth ANT 4 (MHz) | 20dB Bandwidth ANT 3 (MHz) | 99% Bandwidth ANT 4 (MHz) | 99% Bandwidth ANT 3 (MHz) |
|---------|--------------------|----------------------------------|----------------------------------|---------------------------------|---------------------------------|
| Low | 2402 | 0.89070 | 0.88940 | 0.86891 | 0.86728 |
| Mid | 2441 | 0.92620 | 0.92710 | 0.86884 | 0.86656 |
| High | 2480 | 0.86570 | 0.88980 | 0.86566 | 0.86618 |

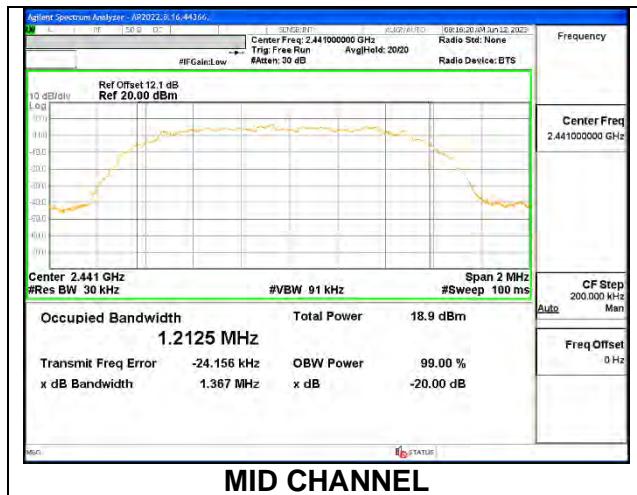
Note: Test procedures and setting on beamforming mode are same as BT basic and EDR mode



9.2.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

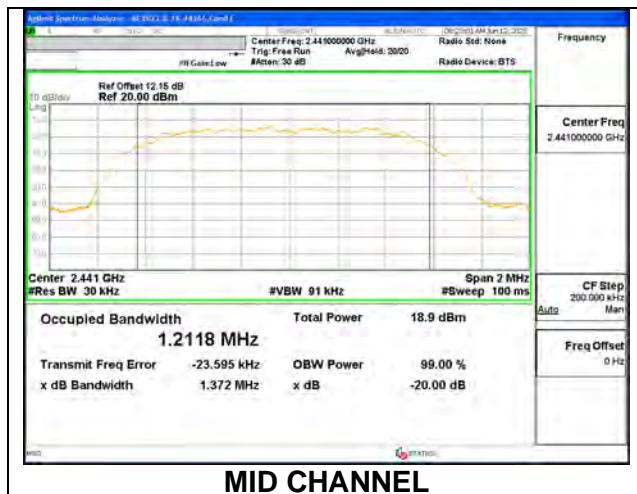
ANT 4

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low | 2402 | 1.3690 | 1.2108 |
| Mid | 2441 | 1.3670 | 1.2125 |
| High | 2480 | 1.3640 | 1.2106 |



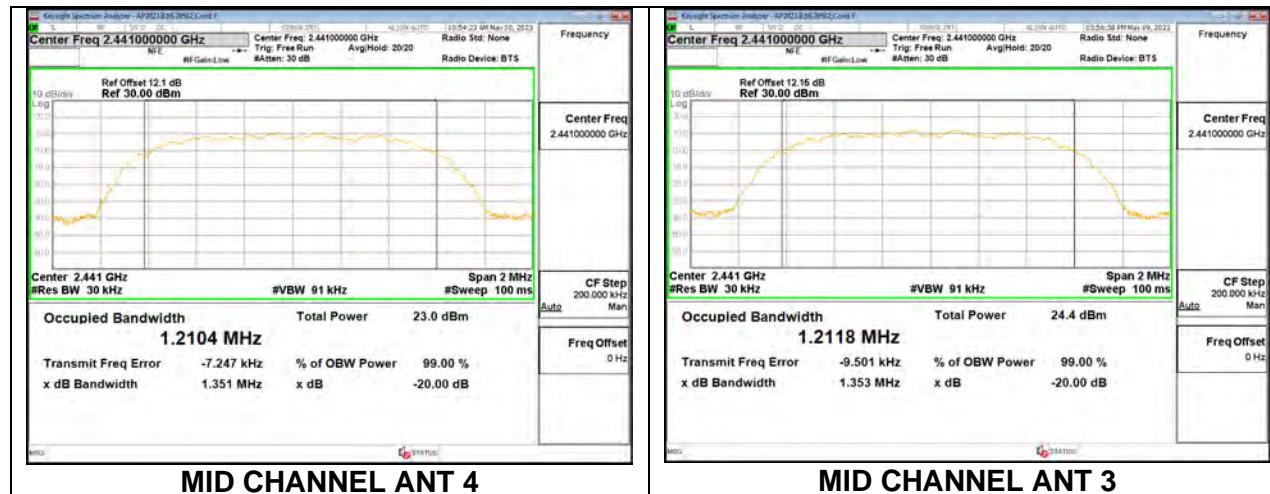
ANT 3

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low | 2402 | 1.3660 | 1.2099 |
| Mid | 2441 | 1.3720 | 1.2118 |
| High | 2480 | 1.3670 | 1.2099 |



9.2.4. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

| Channel | Frequency | 20dB Bandwidth ANT 4 (MHz) | 20dB Bandwidth ANT 3 (MHz) | 99% Bandwidth ANT 4 (MHz) | 99% Bandwidth ANT 3 (MHz) |
|---------|-----------|----------------------------------|----------------------------------|---------------------------------|---------------------------------|
| Low | 2402 | 1.3510 | 1.3520 | 1.2093 | 1.2137 |
| Mid | 2441 | 1.3510 | 1.3530 | 1.2104 | 1.2118 |
| High | 2480 | 1.3510 | 1.3510 | 1.2105 | 1.2114 |



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 hopping channel, whichever is greater.

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

TEST PROCEDURE

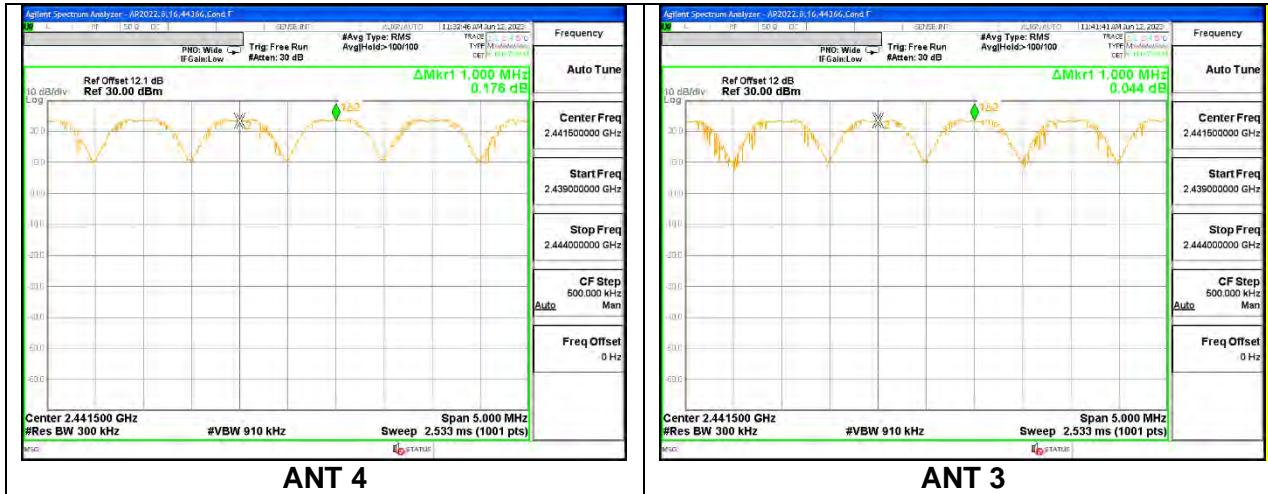
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW \geq 3xRBW. The sweep time is coupled.

RESULTS

Only High Power GFSK mode result is reported since EDR (QPSK/8PSK) has exact same channel plan.

9.3.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

HOPPING FREQUENCY SEPARATION



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

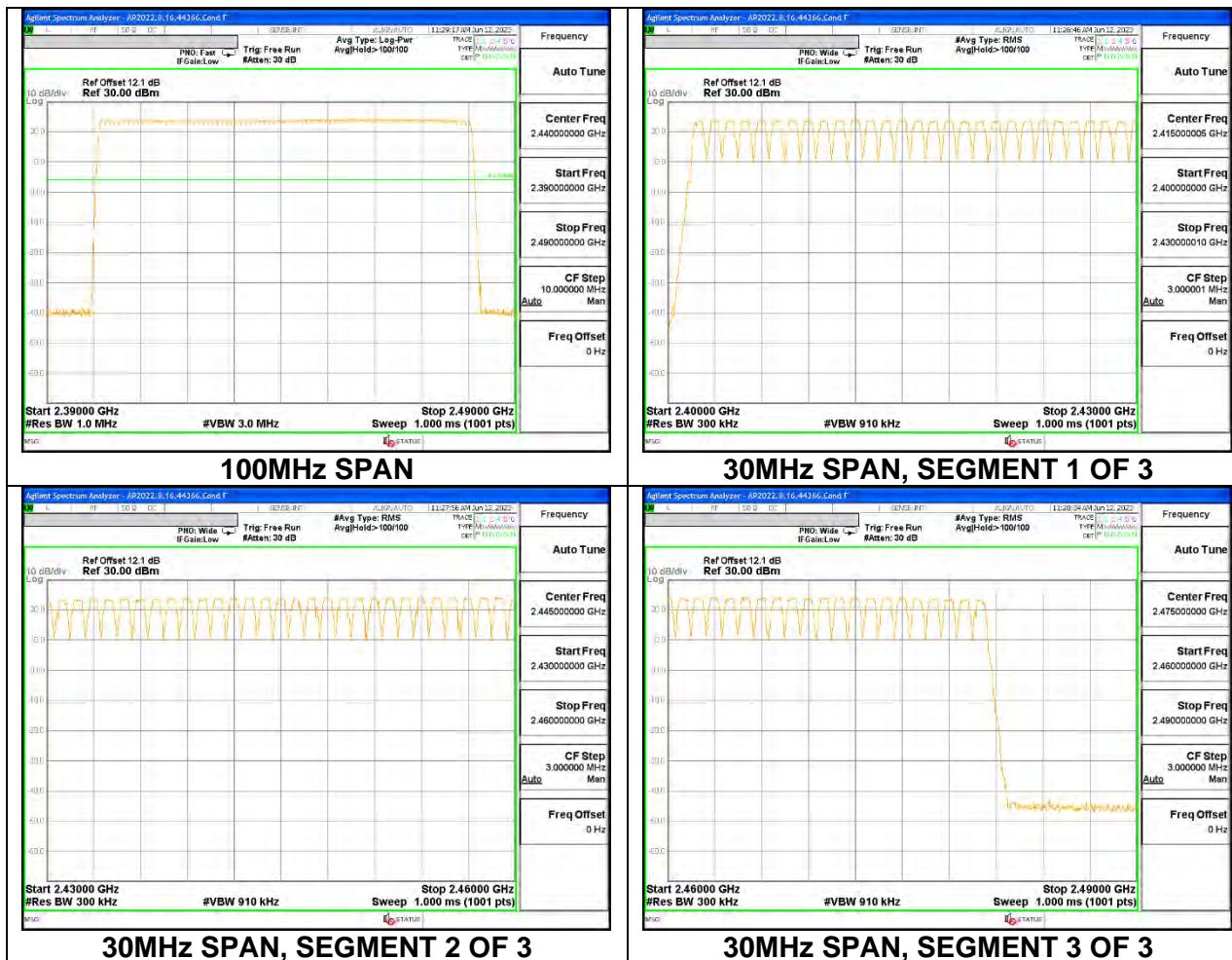
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

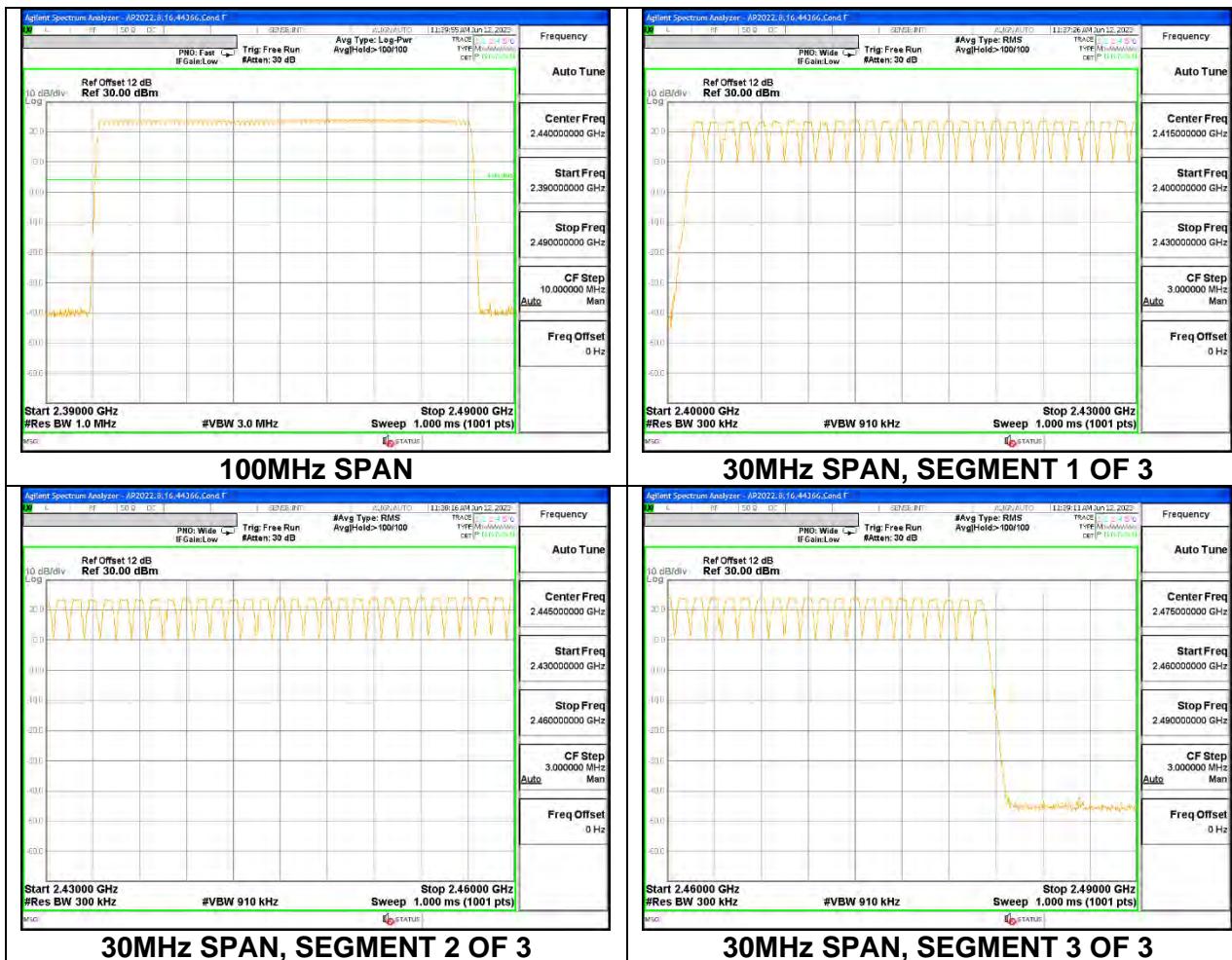
Normal Mode: 79 Channels Observed. Only High Power GFSK mode result is reported since EDR (QPSK/8PSK) has exact same channel plan.

9.4.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

ANT 4



ANT 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 $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

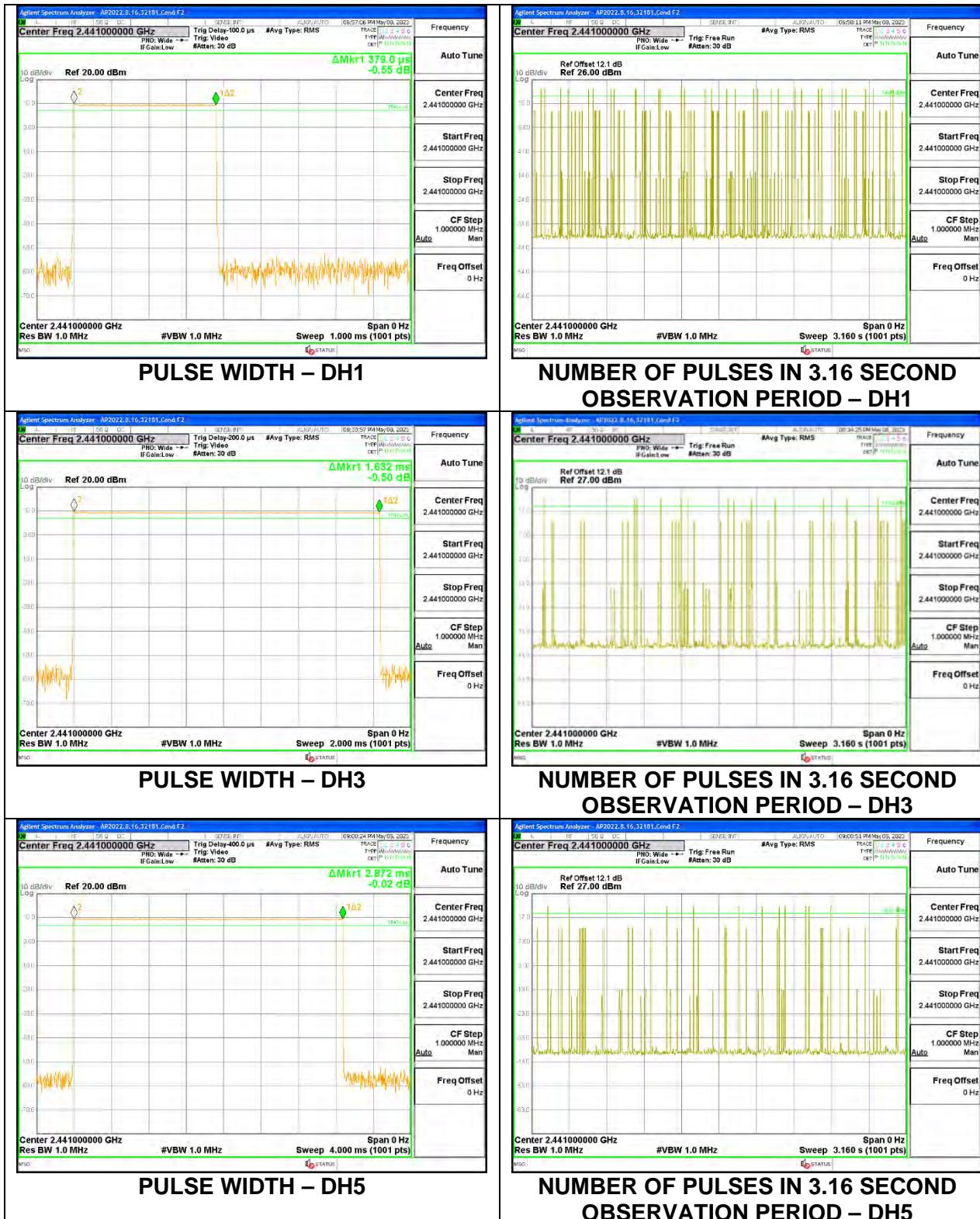
RESULTS

Only High Power GFSK mode result is reported since EDR (QPSK/8PSK) has exact same timing.

9.5.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

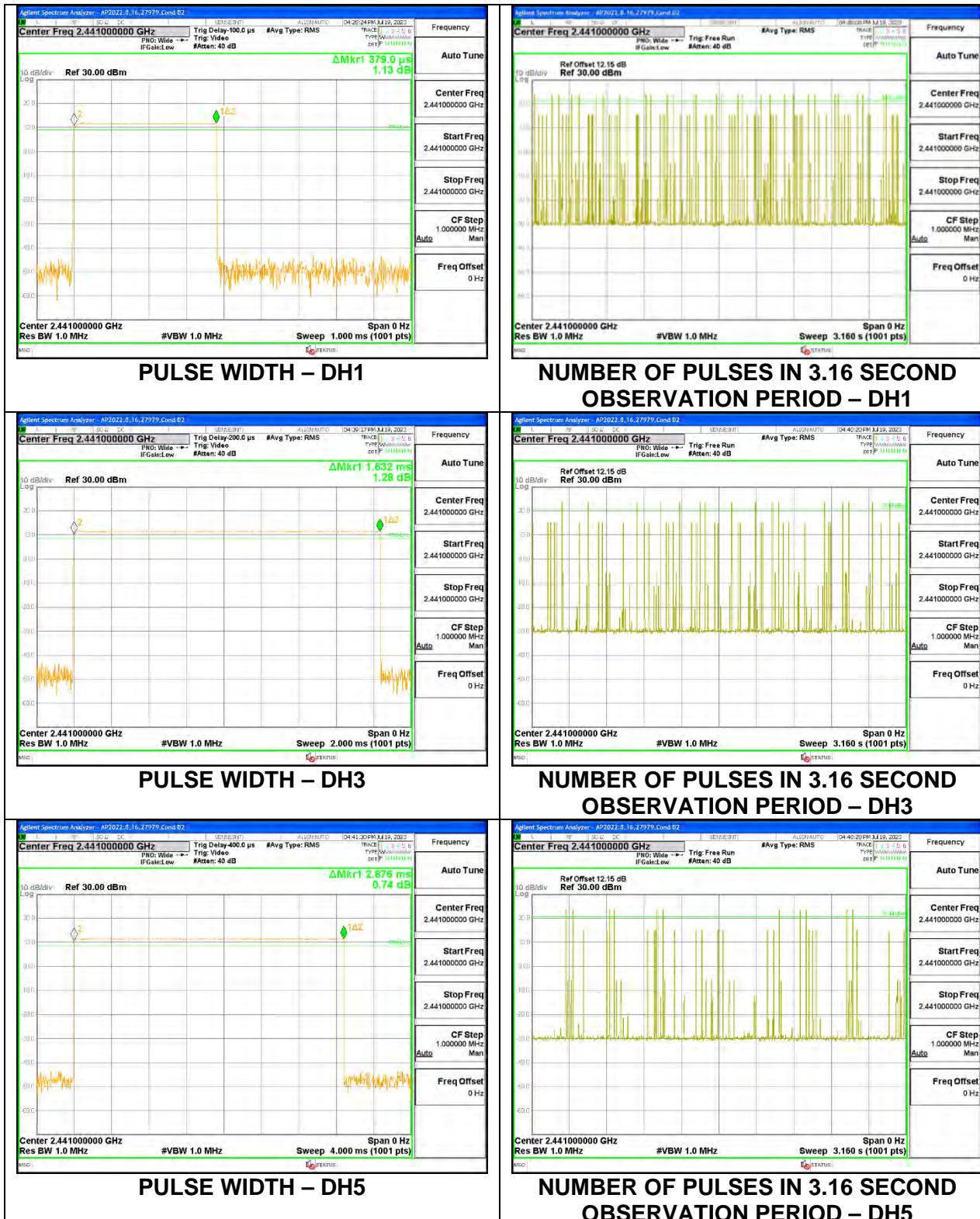
ANT 4

| DH Packet | Pulse Width (msec) | Number of Pulses in 3.16 seconds | Average Time of Occupancy (sec) | Limit (sec) | Margin (sec) |
|-------------------------|--------------------|----------------------------------|---------------------------------|-------------|--------------|
| GFSK Normal Mode | | | | | |
| DH1 | 0.379 | 29 | 0.110 | 0.4 | -0.290 |
| DH3 | 1.632 | 15 | 0.245 | 0.4 | -0.155 |
| DH5 | 2.872 | 12 | 0.345 | 0.4 | -0.055 |
| DH Packet | Pulse Width (sec) | Number of Pulses in 0.8 seconds | Average Time of Occupancy (sec) | Limit (sec) | Margin (sec) |
| GFSK AFH Mode | | | | | |
| DH1 | 0.379 | 7.25 | 0.027 | 0.4 | -0.373 |
| DH3 | 1.632 | 3.75 | 0.061 | 0.4 | -0.339 |
| DH5 | 2.872 | 3 | 0.086 | 0.4 | -0.314 |



ANT 3

| DH Packet | Pulse Width (msec) | Number of Pulses in 3.16 seconds | Average Time of Occupancy (sec) | Limit (sec) | Margin (sec) |
|-------------------------|--------------------|----------------------------------|---------------------------------|-------------|--------------|
| GFSK Normal Mode | | | | | |
| DH1 | 0.379 | 32 | 0.121 | 0.4 | -0.279 |
| DH3 | 1.632 | 16 | 0.261 | 0.4 | -0.139 |
| DH5 | 2.876 | 11 | 0.316 | 0.4 | -0.084 |
| | | | | | |
| DH Packet | Pulse Width (sec) | Number of Pulses in 0.8 seconds | Average Time of Occupancy (sec) | Limit (sec) | Margin (sec) |
| GFSK AFH Mode | | | | | |
| DH1 | 0.379 | 8 | 0.030 | 0.4 | -0.370 |
| DH3 | 1.632 | 4 | 0.065 | 0.4 | -0.335 |
| DH5 | 2.876 | 2.75 | 0.079 | 0.4 | -0.321 |



9.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

RSS-247 (5.4) (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. 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.

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

TEST PROCEDURE

Measurements perform using a wideband RF power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband peak power sensor. Peak output power was read directly from the power meter.

DIRECTIONAL ANTENNA GAIN

For 1 TX:

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

For 2 TX:

Tx chains are correlated for power due to the device supporting Beamforming documented in section 8.13. The directional gains are as follows:

| Band (GHz) | ANT 4 Antenna Gain (dBi) | ANT 3 Antenna Gain (dBi) | Uncorrelated Chains Directional Gain (dBi) | Correlated Chains Directional Gain (dBi) |
|------------|-----------------------------------|-----------------------------------|---|---|
| 2.4 | -4.00 | -1.50 | -2.57 | 0.35 |

DIRECTIONAL GAIN CALCULATION:

ANSI C63.10-2013 section 14.4.3

Uncorrelated directional gain= $10 \cdot \log((10^{(\text{Ant1}/10)} + 10^{(\text{Ant2}/10)})/2)$
Correlated directional Gain= $10 \cdot \log(((10^{(\text{Ant1}/20)} + 10^{(\text{Ant2}/20)})^2)/2)$

Sample Calculation:

Ant4=-4, Ant3=-1.5

Uncorrelated Antenna gain= $10 \log[(10^{(-3.24/10)} + 10^{(-1.56/10)})/2] = -2.57 \text{ dBi}$

Correlated Antenna gain= $10 \log[(10^{(-3.24/20)} + 10^{(-1.56/20)})^2/2] = 0.35 \text{ dBi}$

RESULTS

9.6.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 20.10 | 21 | -0.9 |
| Middle | 2441 | 20.26 | 21 | -0.74 |
| High | 2480 | 20.35 | 21 | -0.65 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 20.36 | 21 | -0.64 |
| Middle | 2441 | 20.14 | 21 | -0.86 |
| High | 2480 | 20.21 | 21 | -0.79 |

9.6.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power ANT 4 (dBm) | Output Power ANT 3 (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|--------------------------------|----------------------|----------------|----------------|
| Low | 2402 | 17.42 | 17.07 | 20.26 | 21 | -0.74 |
| Middle | 2441 | 17.17 | 17.29 | 20.24 | 21 | -0.76 |
| High | 2480 | 17.23 | 17.33 | 20.29 | 21 | -0.71 |

9.6.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 16.57 | 21 | -4.43 |
| Middle | 2441 | 16.66 | 21 | -4.34 |
| High | 2480 | 16.64 | 21 | -4.36 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 16.58 | 21 | -4.42 |
| Middle | 2441 | 16.68 | 21 | -4.32 |
| High | 2480 | 16.49 | 21 | -4.51 |

9.6.4. HIGH POWER ENHANCED DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

| Tested By: | 44366 | | | | | |
|------------|--------------------|--------------------------------|--------------------------------|----------------------|----------------|----------------|
| Date: | 5/30/2023 | | | | | |
| <hr/> | | | | | | |
| Channel | Frequency (MHz) | Output Power ANT 4 (dBm) | Output Power ANT 3 (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
| Low | 2402 | 13.66 | 13.54 | 16.61 | 21 | -4.39 |
| Middle | 2441 | 13.55 | 13.68 | 16.63 | 21 | -4.37 |
| High | 2480 | 13.68 | 13.73 | 16.72 | 21 | -4.28 |

9.6.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 16.70 | 21 | -4.3 |
| Middle | 2441 | 16.77 | 21 | -4.23 |
| High | 2480 | 16.74 | 21 | -4.26 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 16.73 | 21 | -4.27 |
| Middle | 2441 | 16.74 | 21 | -4.26 |
| High | 2480 | 16.64 | 21 | -4.36 |

9.6.6. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power ANT 4 (dBm) | Output Power ANT 3 (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|--------------------------------|----------------------|----------------|----------------|
| Low | 2402 | 13.71 | 13.69 | 16.71 | 21 | -4.29 |
| Middle | 2441 | 13.65 | 13.73 | 16.70 | 21 | -4.30 |
| High | 2480 | 13.76 | 13.85 | 16.82 | 21 | -4.18 |

9.6.7. LOW POWER BASIC DATA RATE GFSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 11.43 | 21 | -9.57 |
| Middle | 2441 | 11.40 | 21 | -9.6 |
| High | 2480 | 11.02 | 21 | -9.98 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 12.86 | 21 | -8.14 |
| Middle | 2441 | 12.66 | 21 | -8.34 |
| High | 2480 | 12.85 | 21 | -8.15 |

9.6.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power ANT 4 (dBm) | Output Power ANT 3 (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|--------------------------------|----------------------|----------------|----------------|
| Low | 2402 | 11.32 | 12.79 | 15.13 | 21 | -5.87 |
| Middle | 2441 | 11.19 | 12.75 | 15.05 | 21 | -5.95 |
| High | 2480 | 10.83 | 12.69 | 14.87 | 21 | -6.13 |

9.6.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 11.27 | 21 | -9.73 |
| Middle | 2441 | 11.33 | 21 | -9.67 |
| High | 2480 | 11.04 | 21 | -9.96 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 11.31 | 21 | -9.69 |
| Middle | 2441 | 11.44 | 21 | -9.56 |
| High | 2480 | 11.07 | 21 | -9.93 |

9.6.10. LOW POWER ENHANCED DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power ANT 4 (dBm) | Output Power ANT 3 (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|--------------------------------|----------------------|----------------|----------------|
| Low | 2402 | 11.16 | 11.42 | 14.30 | 21 | -6.70 |
| Middle | 2441 | 11.21 | 11.02 | 14.13 | 21 | -6.87 |
| High | 2480 | 10.92 | 11.18 | 14.06 | 21 | -6.94 |

9.6.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 11.34 | 21 | -9.66 |
| Middle | 2441 | 11.44 | 21 | -9.56 |
| High | 2480 | 11.09 | 21 | -9.91 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low | 2402 | 11.41 | 21 | -9.59 |
| Middle | 2441 | 11.52 | 21 | -9.48 |
| High | 2480 | 11.19 | 21 | -9.81 |

9.6.12. LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Output Power ANT 4 (dBm) | Output Power ANT 3 (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---------|--------------------|--------------------------------|--------------------------------|----------------------|----------------|----------------|
| Low | 2402 | 11.27 | 11.57 | 14.43 | 21 | -6.57 |
| Middle | 2441 | 11.33 | 11.09 | 14.22 | 21 | -6.78 |
| High | 2480 | 11.03 | 11.31 | 14.18 | 21 | -6.82 |

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband RF power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

RESULTS

9.7.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 19.88 |
| Middle | 2441 | 19.87 |
| High | 2480 | 19.95 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 19.92 |
| Middle | 2441 | 19.90 |
| High | 2480 | 19.79 |

9.7.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power ANT 4 (dBm) | Average Power ANT 3 (dBm) | Total Power (dBm) |
|---------|--------------------|---------------------------------|---------------------------------|----------------------|
| Low | 2402 | 16.98 | 16.84 | 19.92 |
| Middle | 2441 | 16.95 | 16.97 | 19.97 |
| High | 2480 | 16.86 | 16.83 | 19.86 |

9.7.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 16.27 |
| Middle | 2441 | 16.34 |
| High | 2480 | 16.32 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 16.30 |
| Middle | 2441 | 16.36 |
| High | 2480 | 16.18 |

9.7.4. HIGH POWER BASIC DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power ANT 4 (dBm) | Average Power ANT 3 (dBm) | Total Power (dBm) |
|---------|--------------------|---------------------------------|---------------------------------|----------------------|
| Low | 2402 | 13.36 | 13.25 | 16.32 |
| Middle | 2441 | 13.28 | 13.37 | 16.34 |
| High | 2480 | 13.37 | 13.46 | 16.43 |

9.7.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 16.40 |
| Middle | 2441 | 16.45 |
| High | 2480 | 16.42 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 16.45 |
| Middle | 2441 | 16.42 |
| High | 2480 | 16.33 |

9.7.6. HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power ANT 4 (dBm) | Average Power ANT 3 (dBm) | Total Power (dBm) |
|---------|--------------------|---------------------------------|---------------------------------|----------------------|
| Low | 2402 | 13.41 | 13.40 | 16.42 |
| Middle | 2441 | 13.38 | 13.42 | 16.41 |
| High | 2480 | 13.45 | 13.48 | 16.48 |

9.7.7. LOW POWER BASIC DATA RATE GFSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 10.93 |
| Middle | 2441 | 10.97 |
| High | 2480 | 10.53 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 12.47 |
| Middle | 2441 | 12.44 |
| High | 2480 | 12.38 |

9.7.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power ANT 4 (dBm) | Average Power ANT 3 (dBm) | Total Power (dBm) |
|---------|--------------------|---------------------------------|---------------------------------|----------------------|
| Low | 2402 | 10.97 | 12.45 | 14.78 |
| Middle | 2441 | 10.90 | 12.44 | 14.75 |
| High | 2480 | 10.62 | 12.38 | 14.60 |

9.7.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 8.36 |
| Middle | 2441 | 8.35 |
| High | 2480 | 8.08 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 8.23 |
| Middle | 2441 | 8.33 |
| High | 2480 | 8.04 |

9.7.10. LOW POWER BASIC DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power ANT 4 (dBm) | Average Power ANT 3 (dBm) | Total Power (dBm) |
|---------|--------------------|---------------------------------|---------------------------------|----------------------|
| Low | 2402 | 8.29 | 8.28 | 11.30 |
| Middle | 2441 | 8.30 | 8.31 | 11.32 |
| High | 2480 | 8.02 | 7.92 | 10.98 |

9.7.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 8.43 |
| Middle | 2441 | 8.46 |
| High | 2480 | 8.13 |

ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|--------------------|------------------------|
| Low | 2402 | 8.33 |
| Middle | 2441 | 8.41 |
| High | 2480 | 8.16 |

9.7.12. LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

| | |
|------------|-----------|
| Tested By: | 44366 |
| Date: | 5/30/2023 |

| Channel | Frequency (MHz) | Average Power ANT 4 (dBm) | Average Power ANT 3 (dBm) | Total Power (dBm) |
|---------|--------------------|---------------------------------|---------------------------------|----------------------|
| Low | 2402 | 8.40 | 8.43 | 11.43 |
| Middle | 2441 | 8.42 | 8.38 | 11.41 |
| High | 2480 | 8.13 | 8.05 | 11.10 |

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

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.

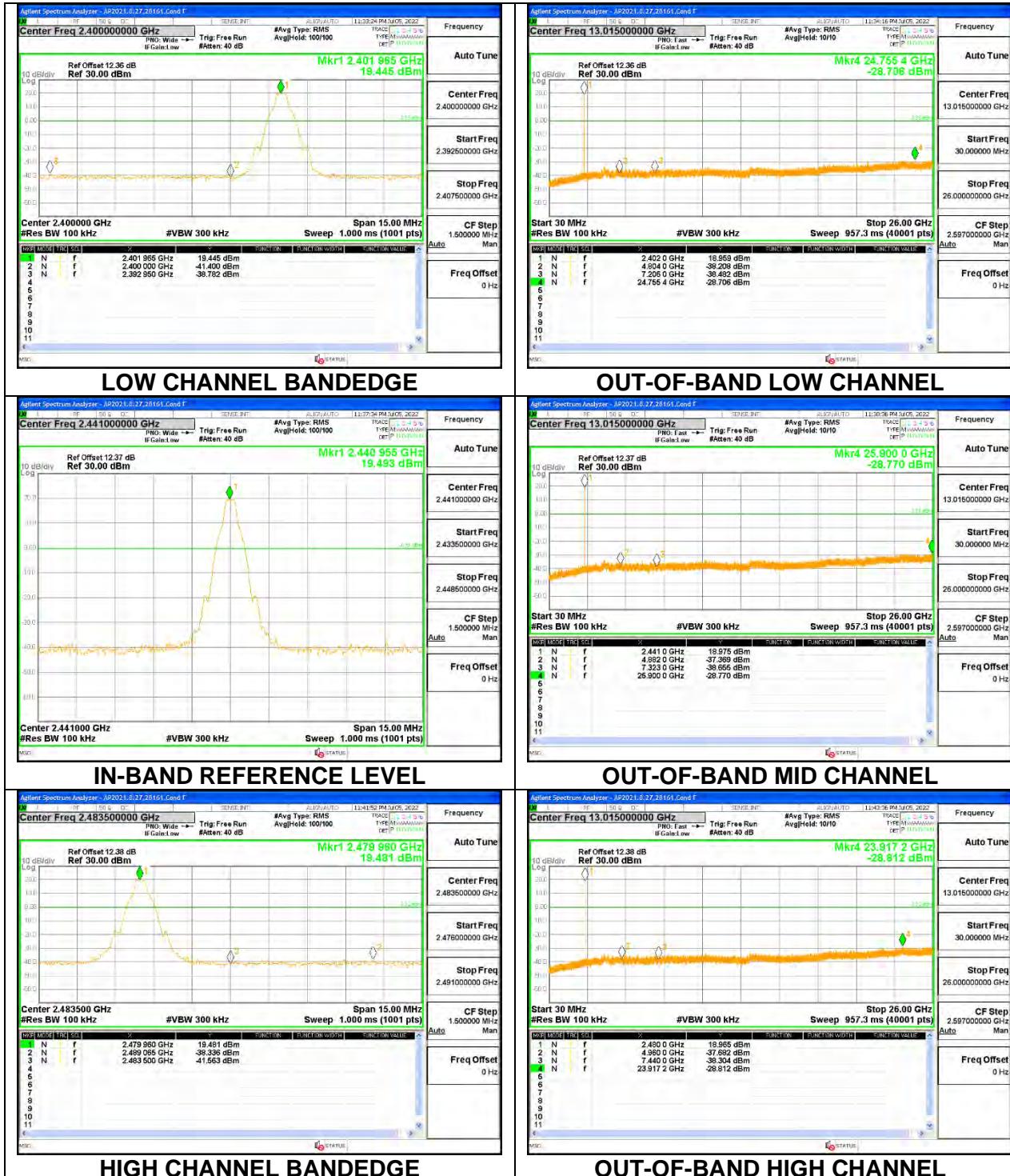
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

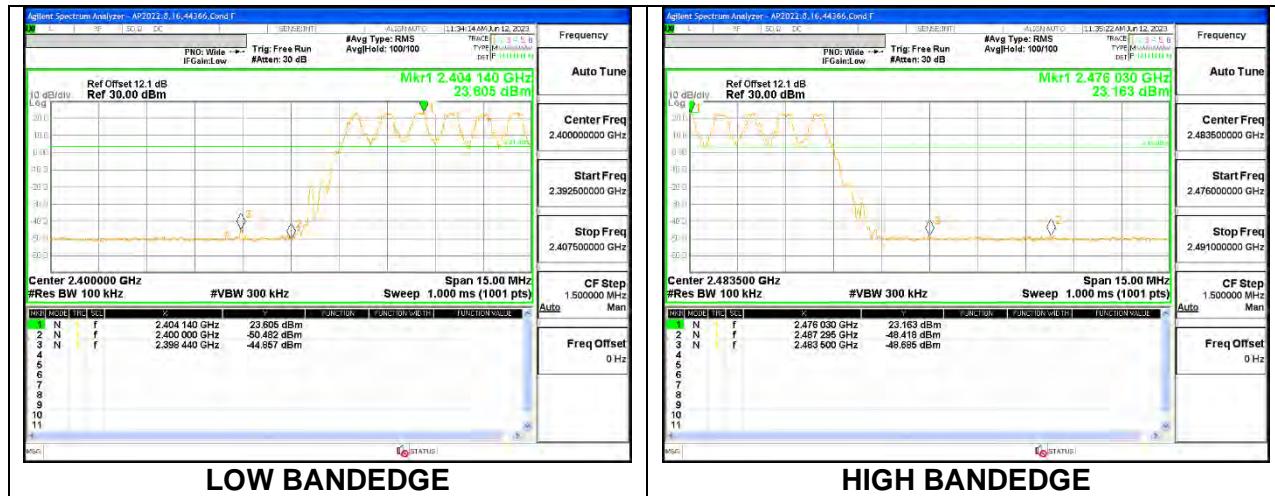
RESULTS

9.8.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

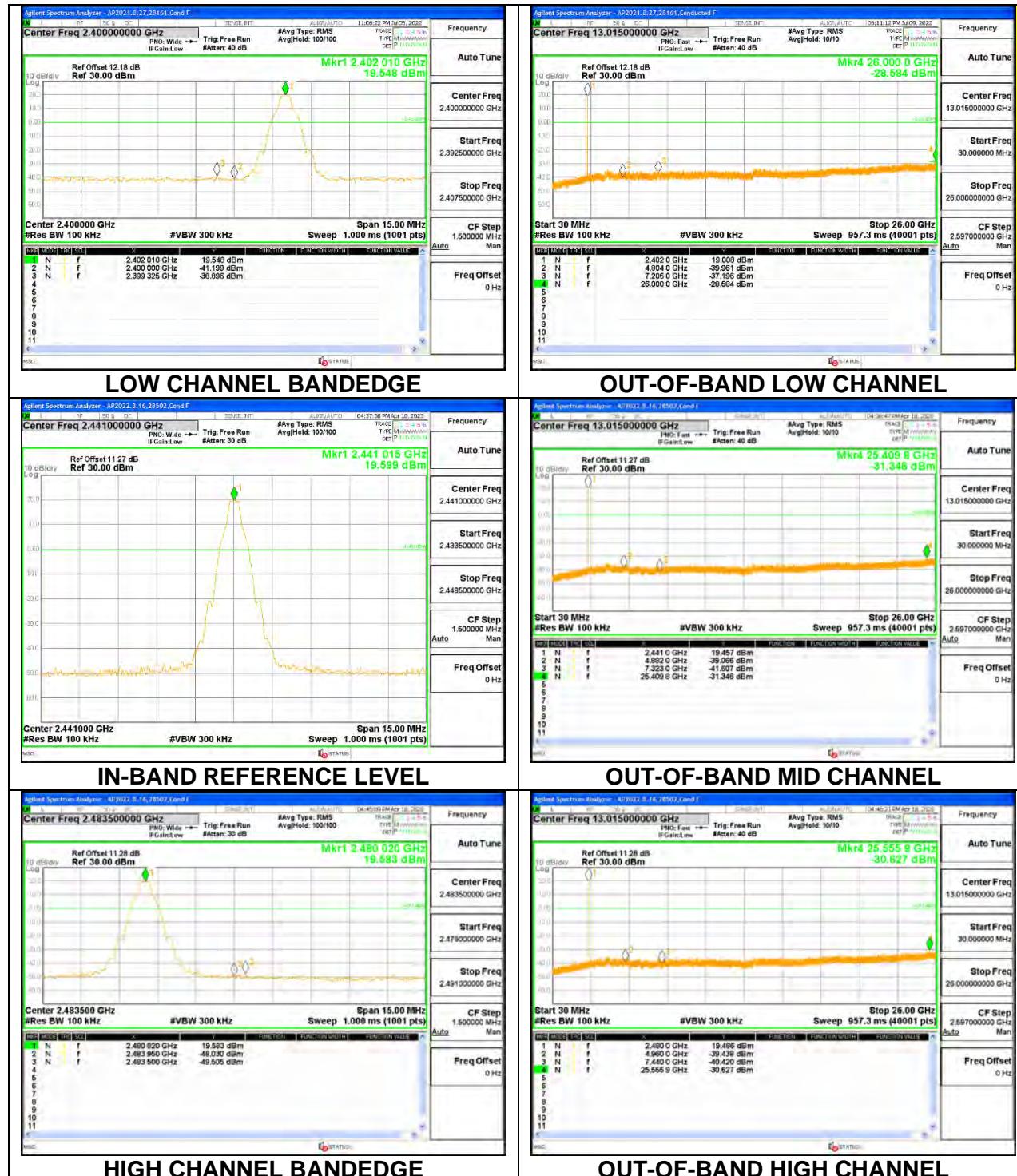
ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



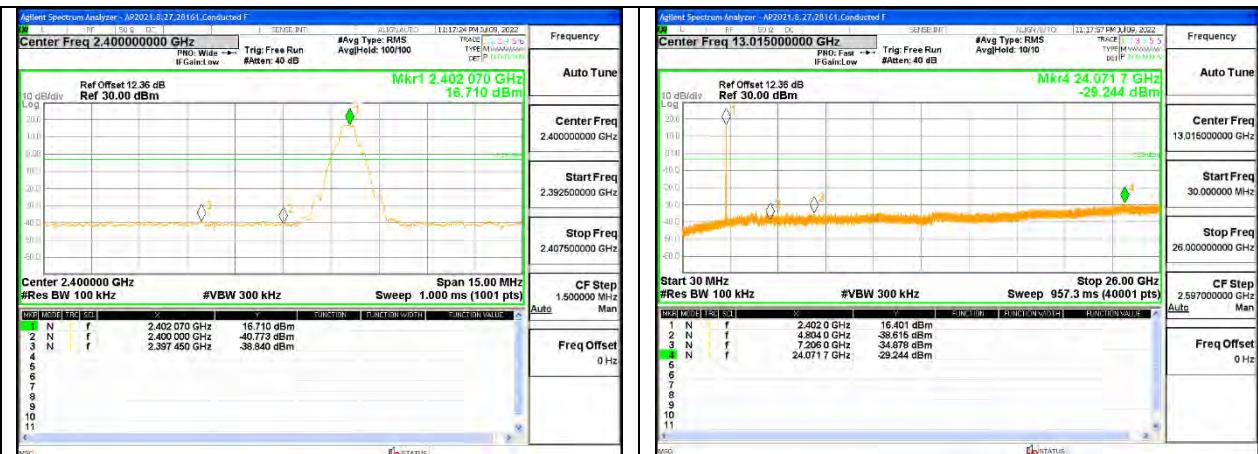
ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



9.8.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

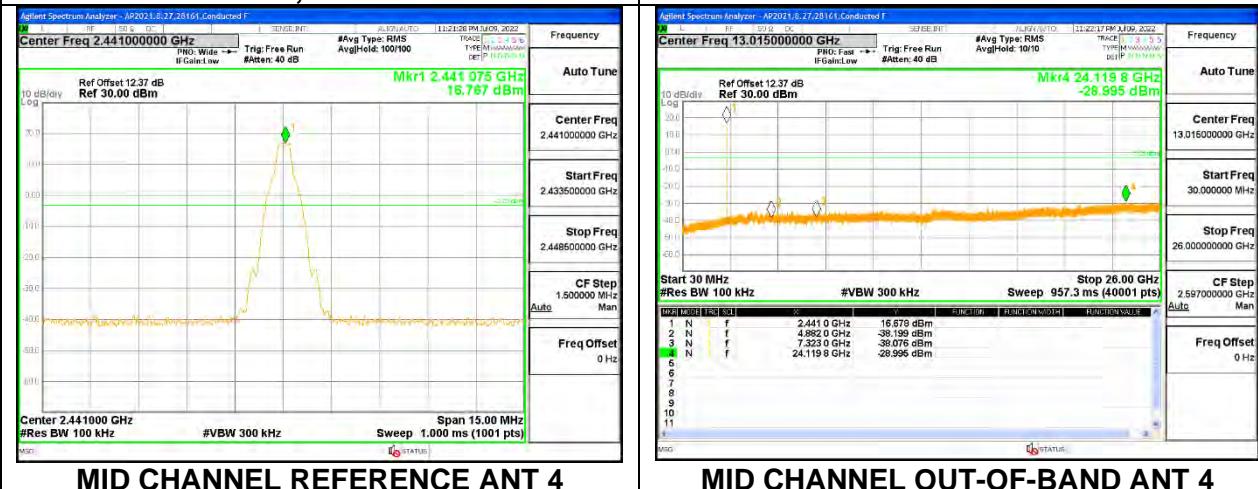
Note: Test procedure on beamforming mode is same as BT basic and EDR mode

ANT 4



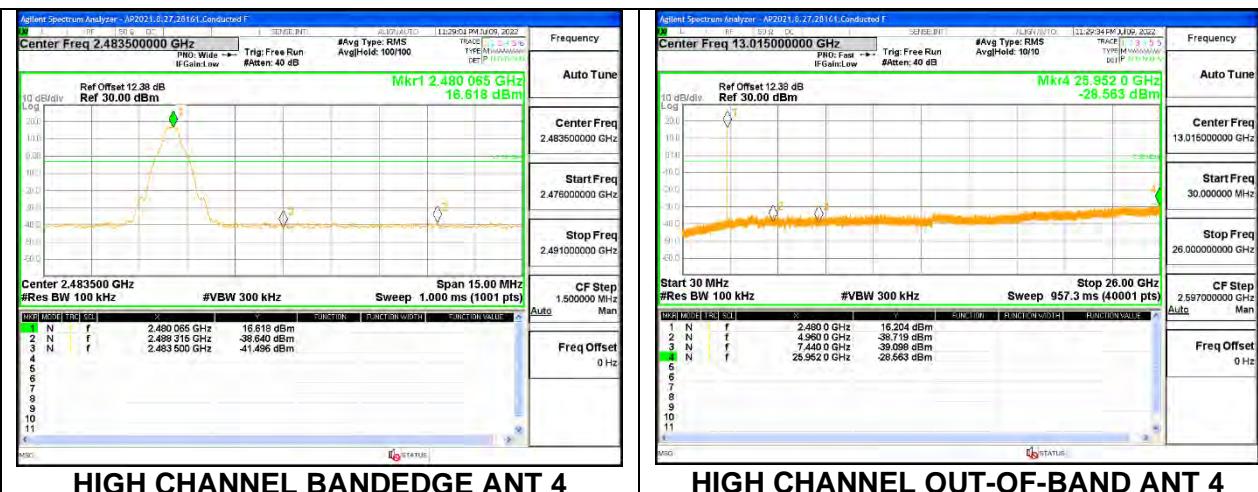
LOW CHANNEL, BANDEdge ANT 4

LOW CHANNEL OUT-OF-BAND ANT 4



MID CHANNEL REFERENCE ANT 4

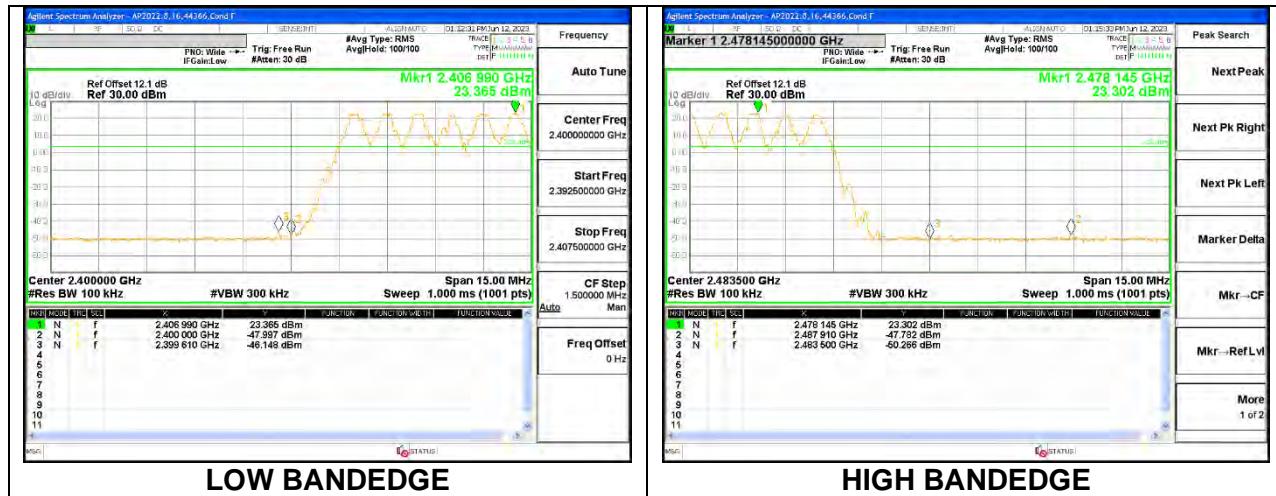
MID CHANNEL OUT-OF-BAND ANT 4



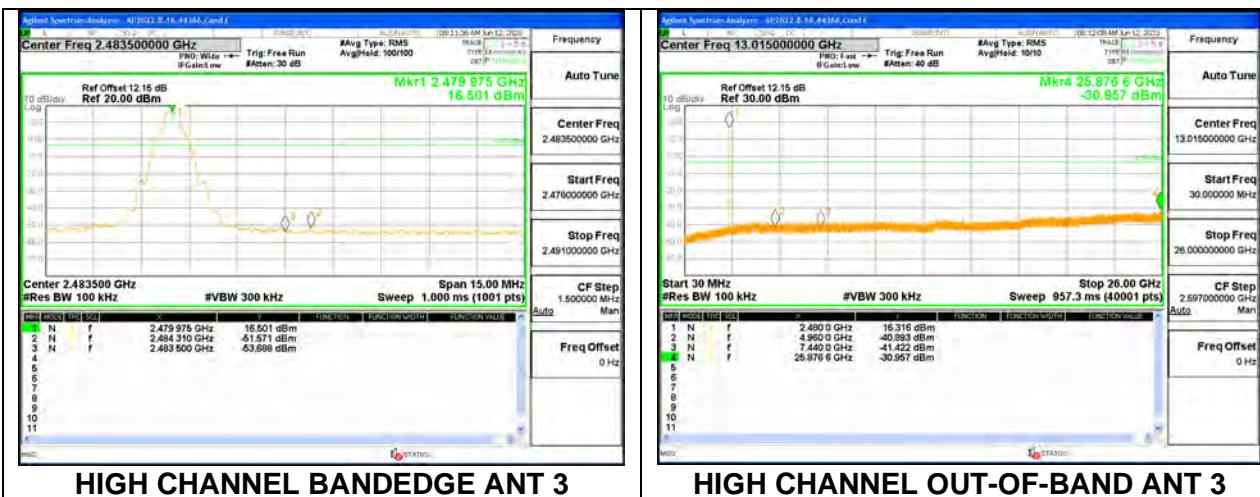
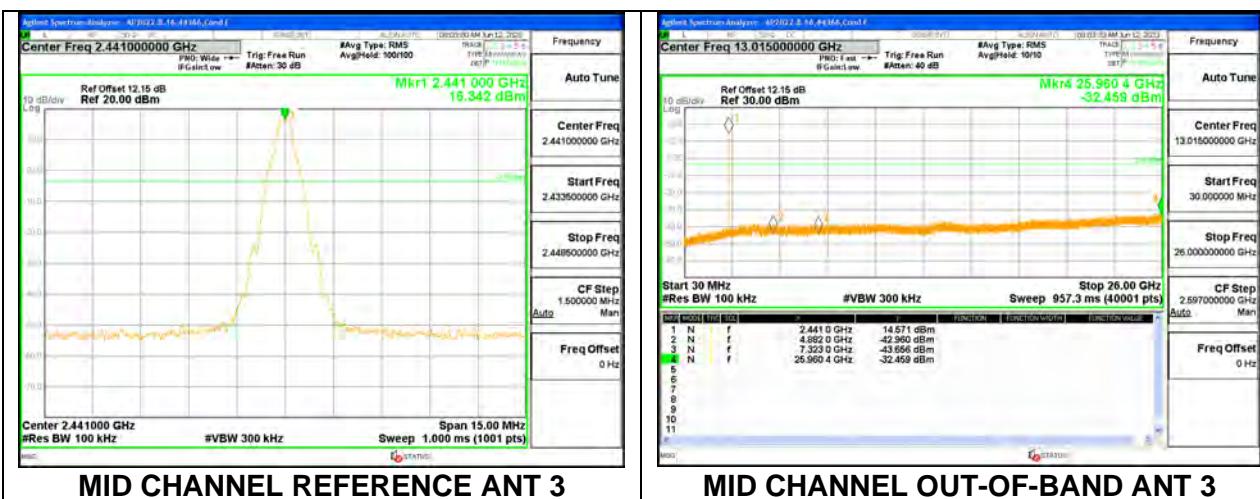
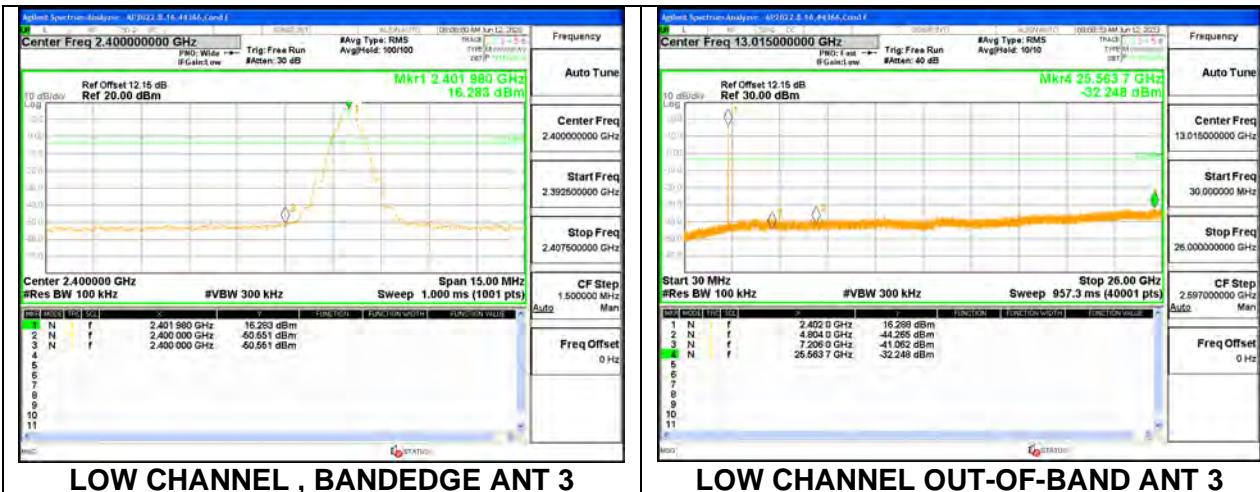
HIGH CHANNEL BANDEdge ANT 4

HIGH CHANNEL OUT-OF-BAND ANT 4

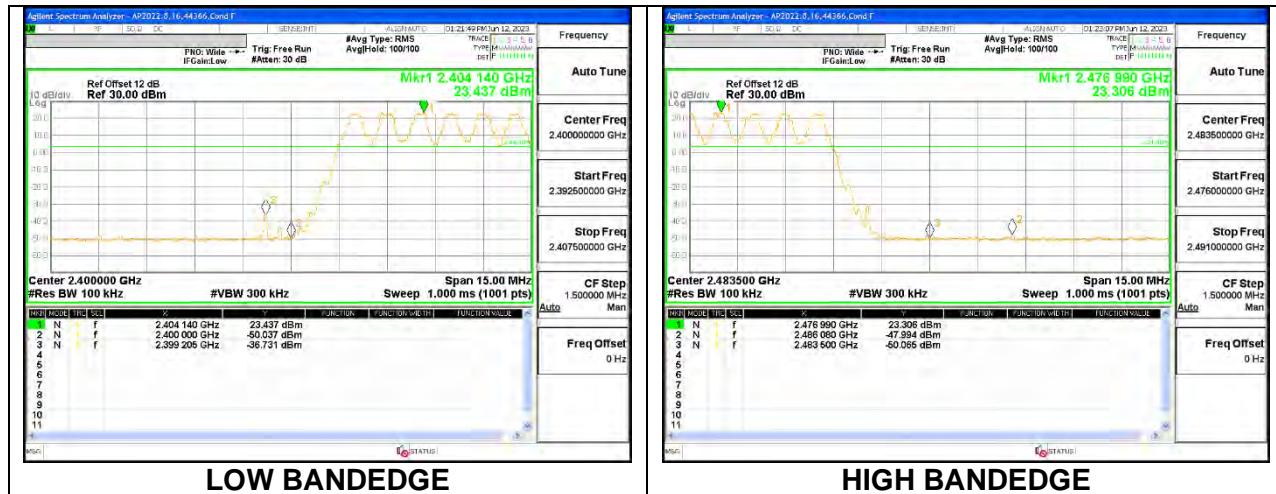
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



ANT 3



ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



9.8.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

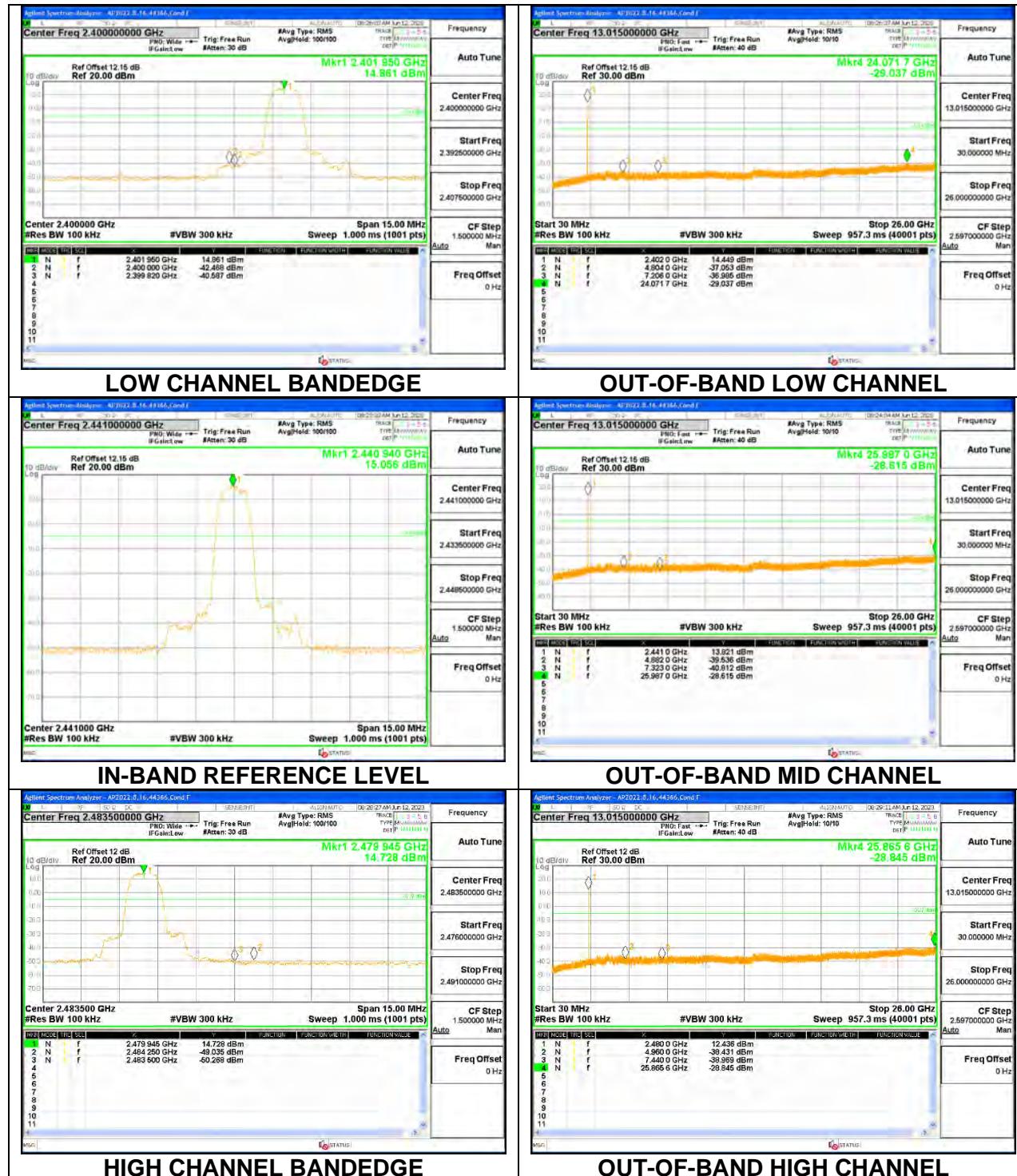
ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



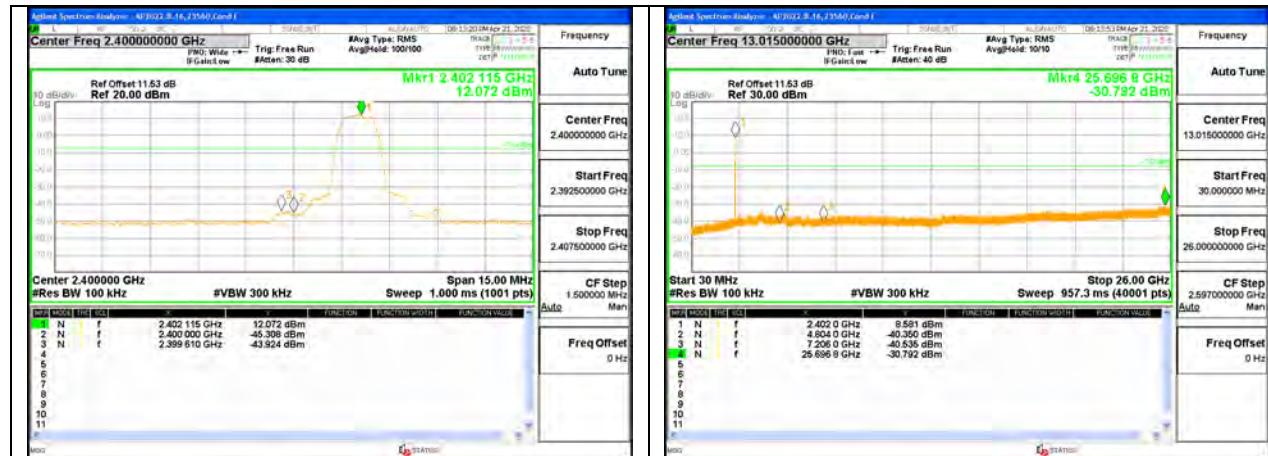
ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



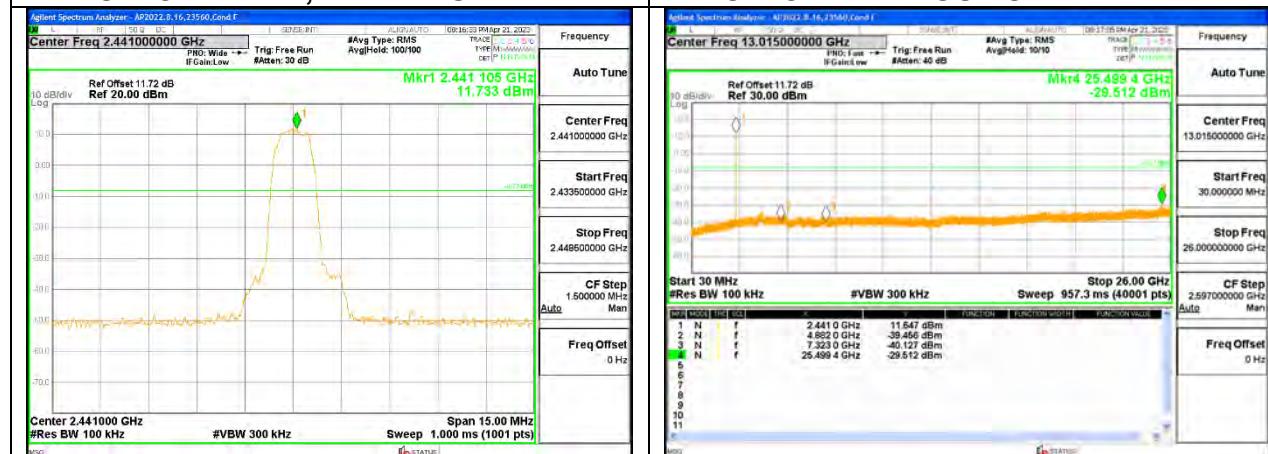
9.8.4. HIGH POWER TXBF ENHANCED DATA RATE 8PSK MODULATION

Note: Test procedure on beamforming mode is same as BT basic and EDR mode

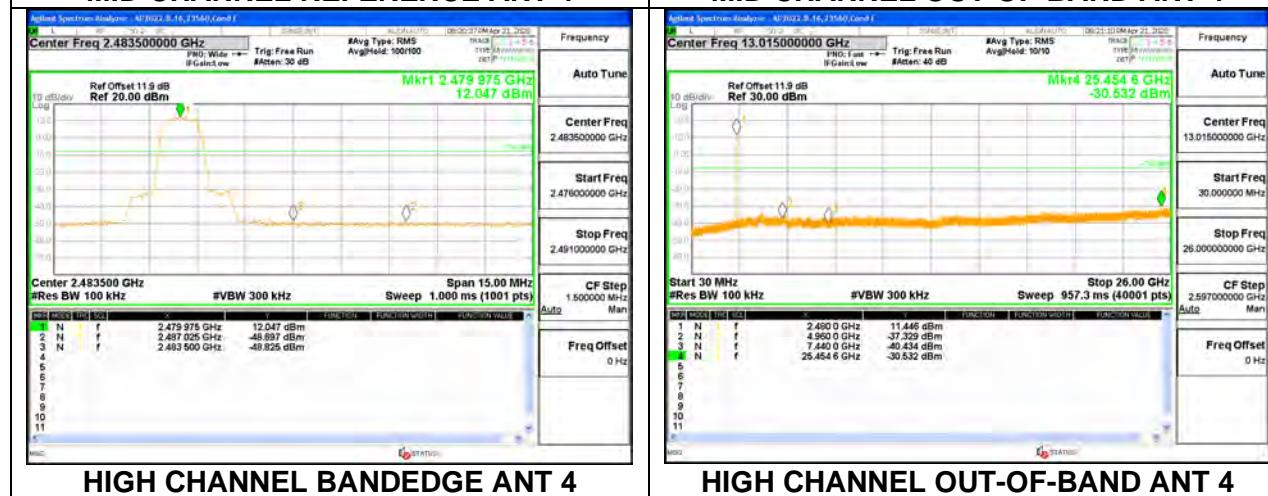
ANT 4



LOW CHANNEL , BANDEdge ANT 4



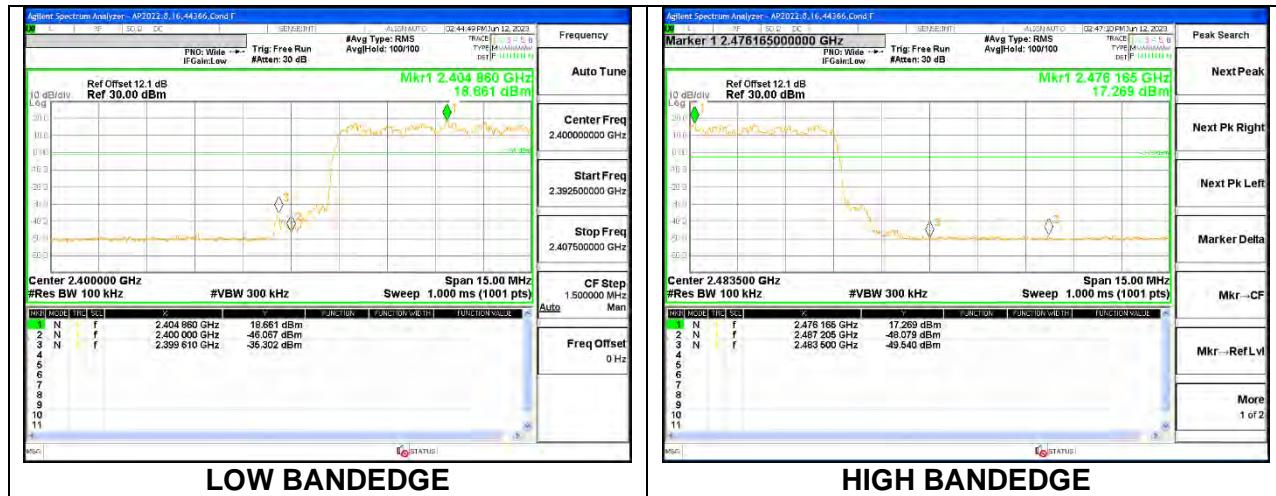
LOW CHANNEL OUT-OF-BAND ANT 4



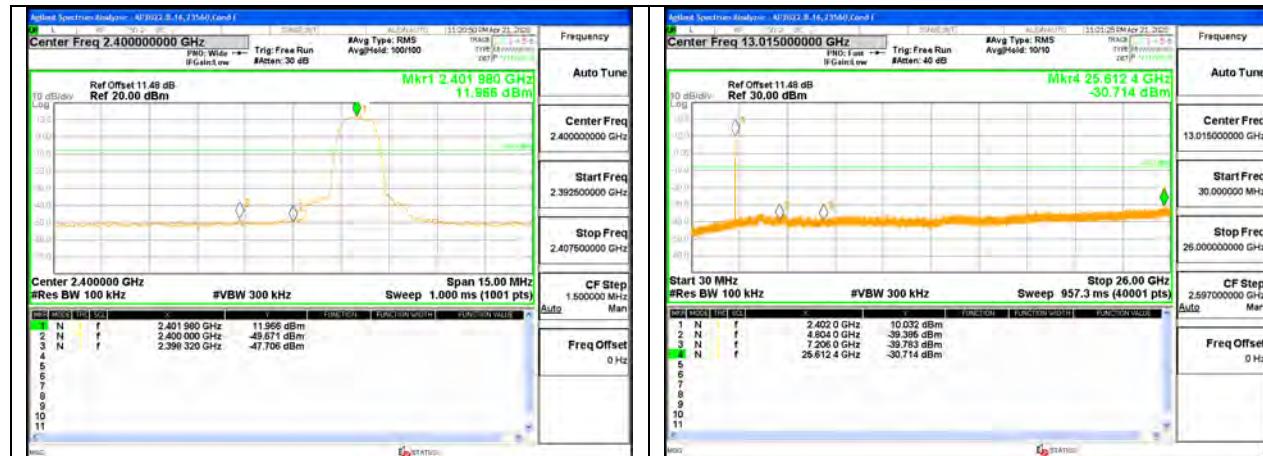
HIGH CHANNEL BANDEdge ANT 4

HIGH CHANNEL OUT-OF-BAND ANT 4

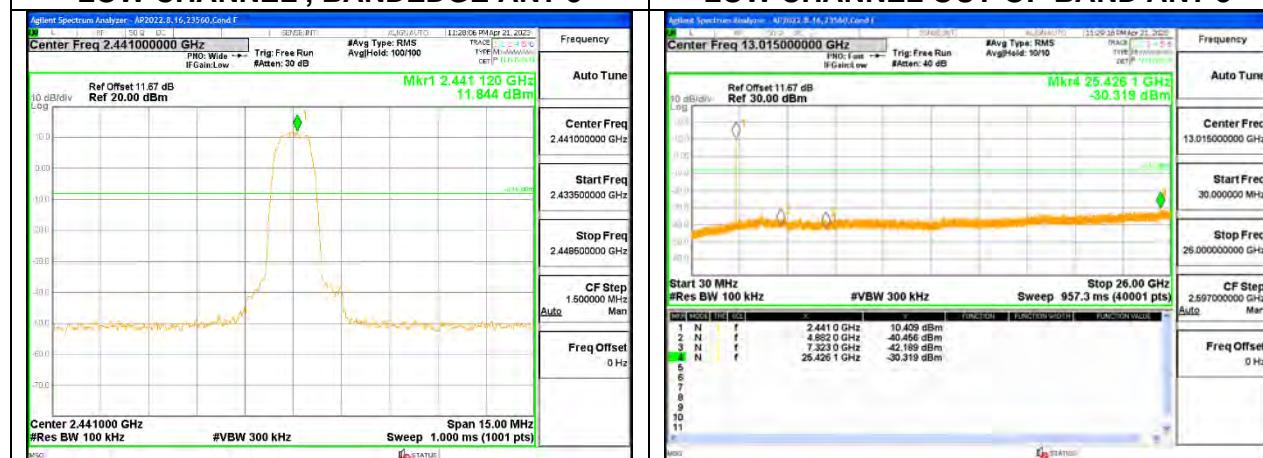
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



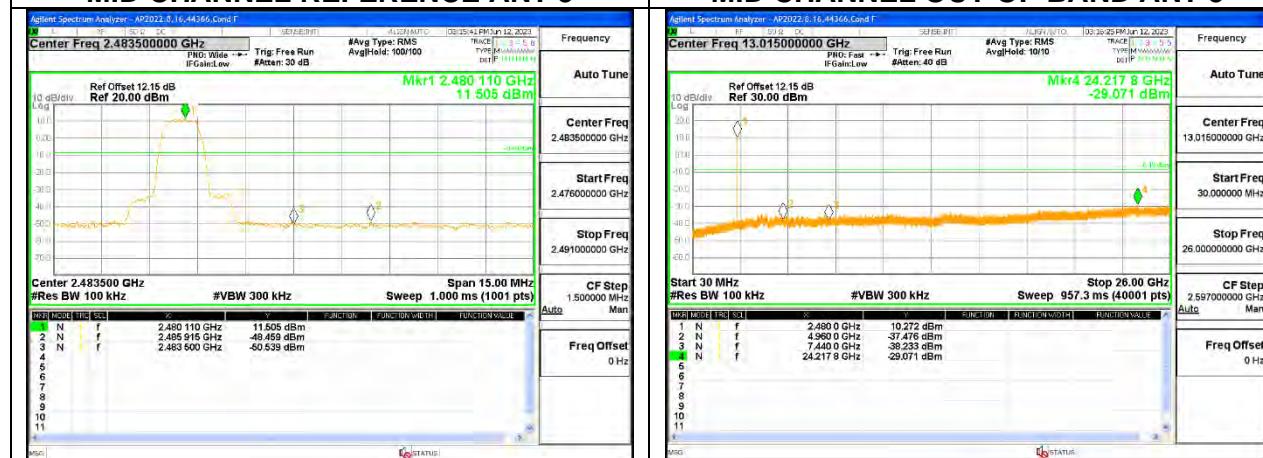
ANT 3



LOW CHANNEL, BANDEDGE ANT 3



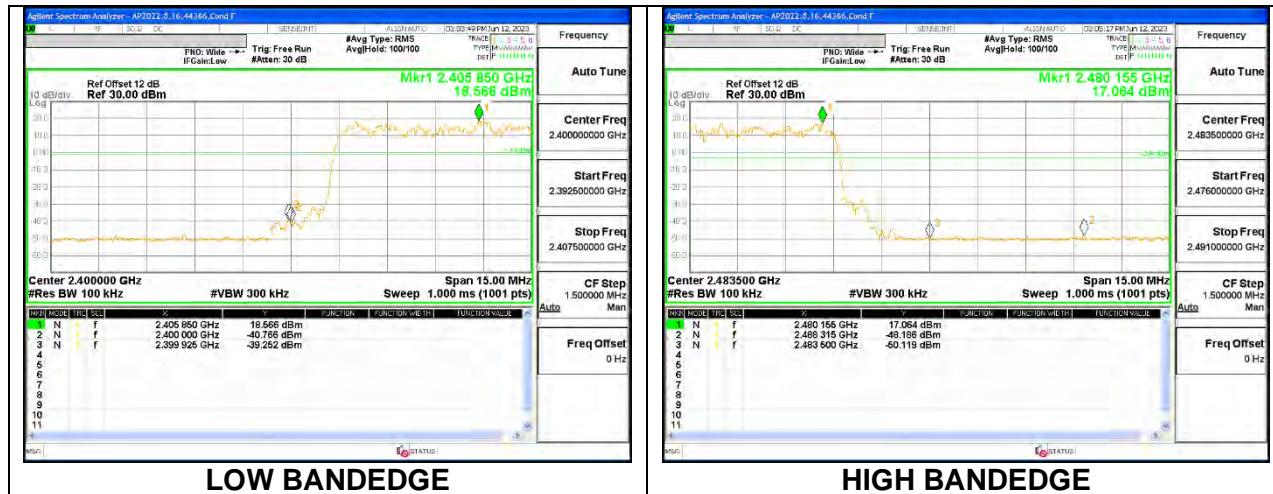
MID CHANNEL REFERENCE ANT 3



HIGH CHANNEL BANDEDGE ANT 3

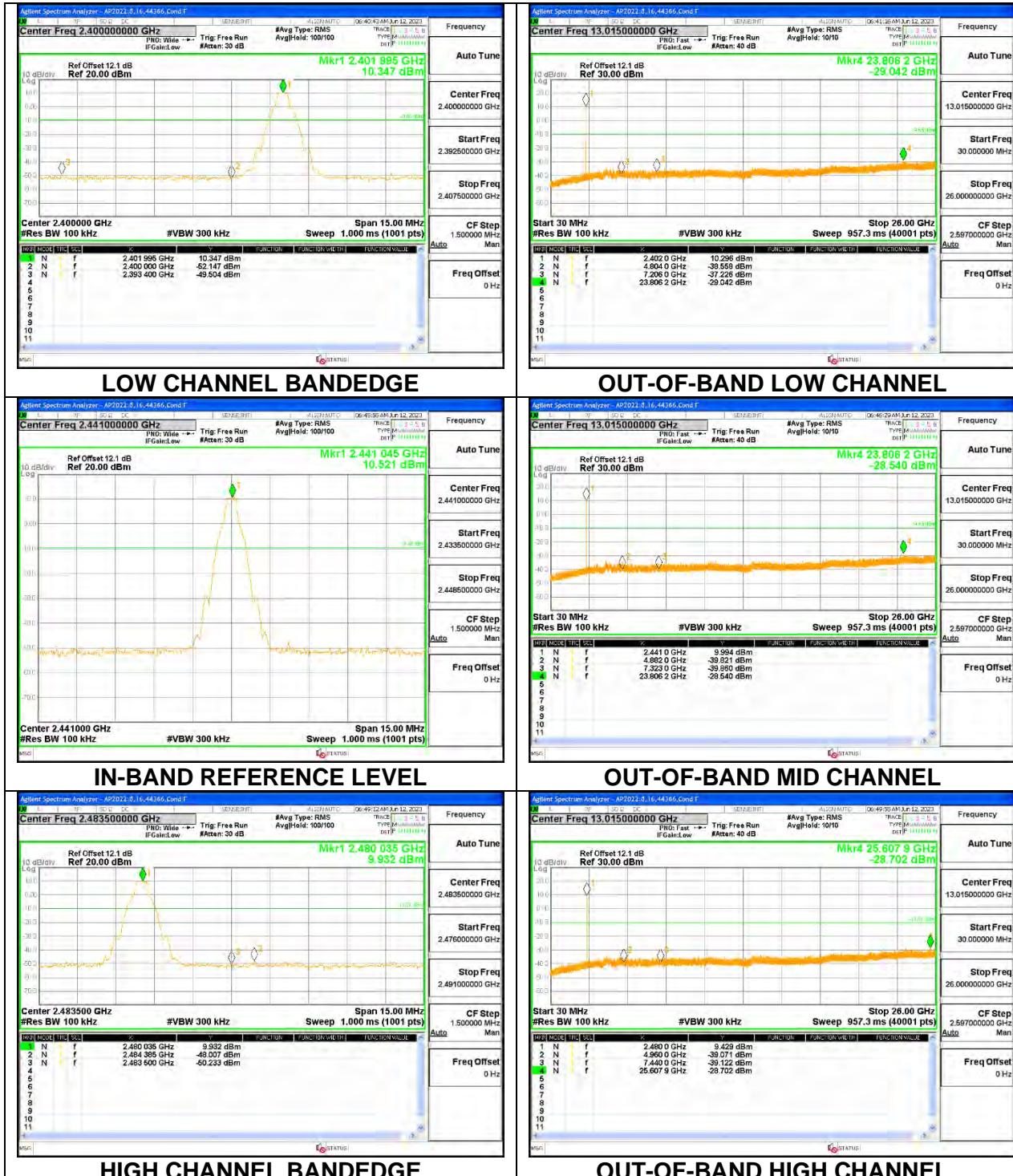
HIGH CHANNEL OUT-OF-BAND ANT 3

ANT 3 SPURIOUS BANDEdge EMISSIONS WITH HOPPING ON

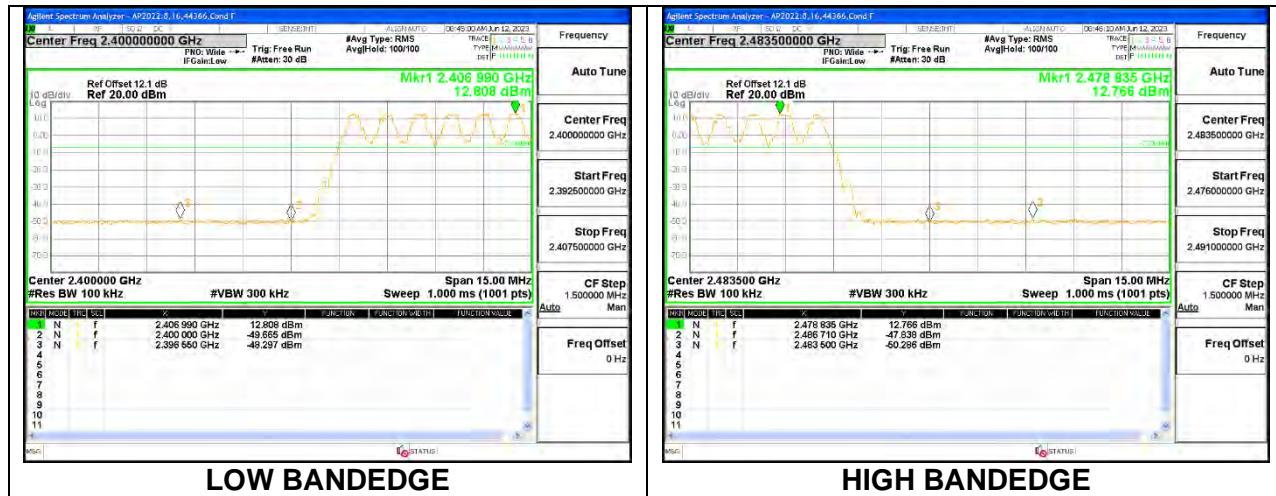


9.8.5. LOW POWER BASIC DATA RATE GFSK MODULATION

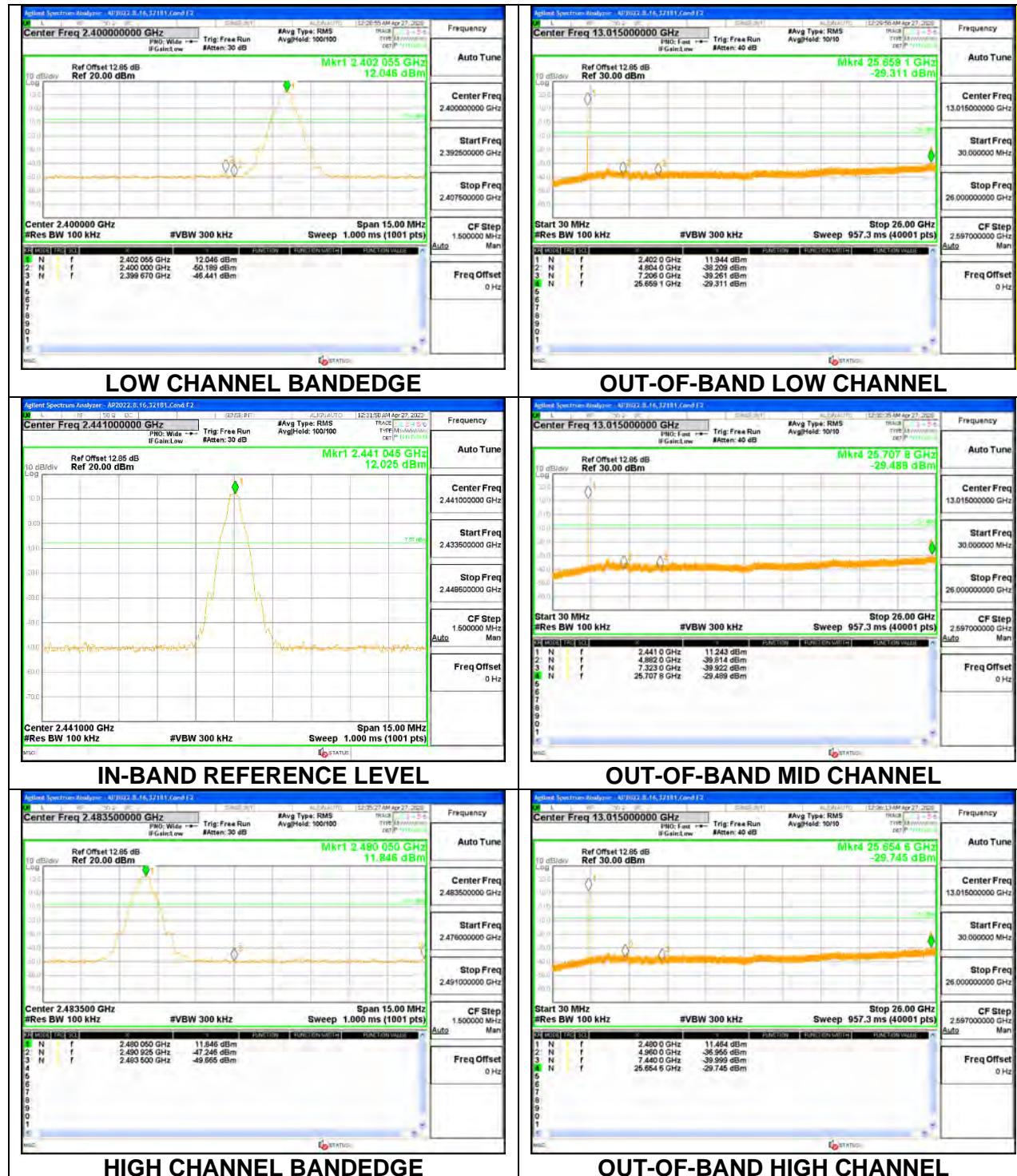
ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



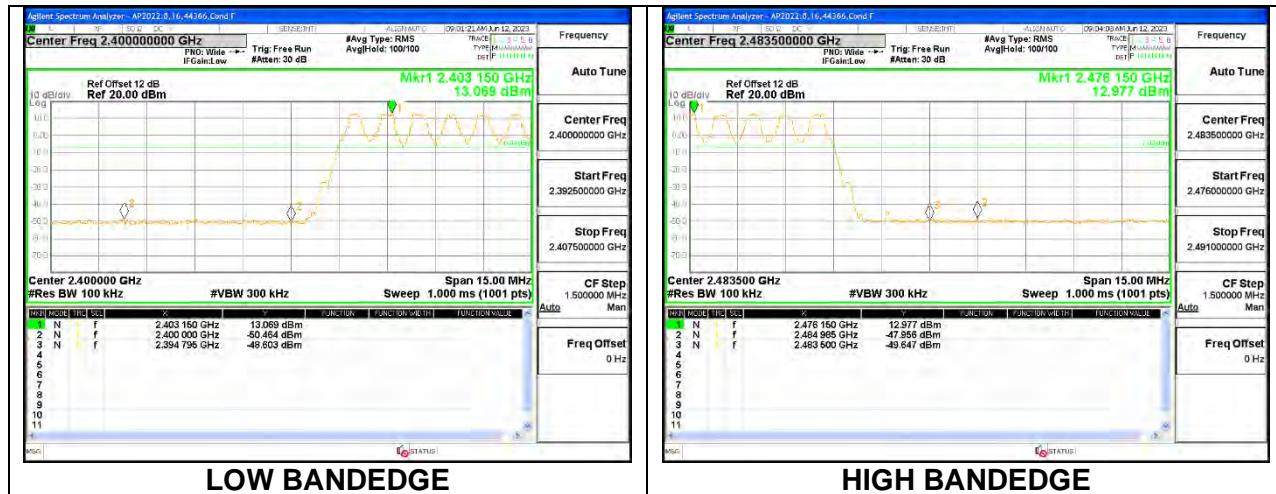
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



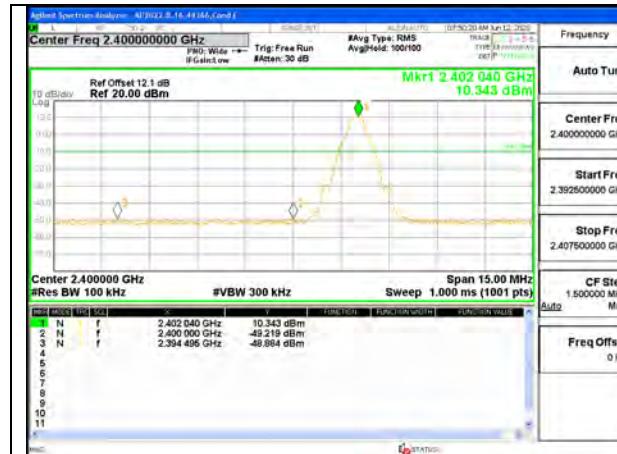
ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



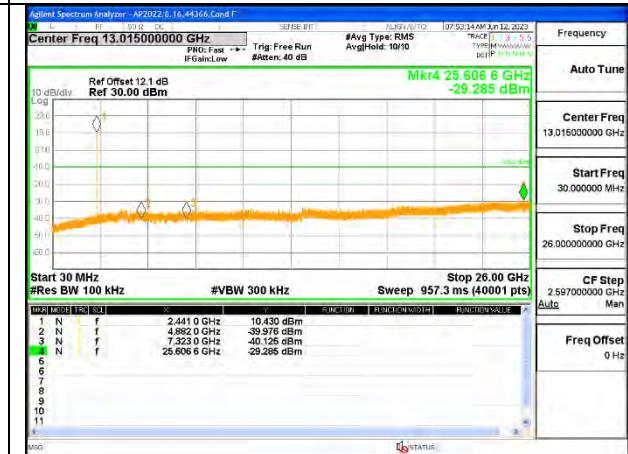
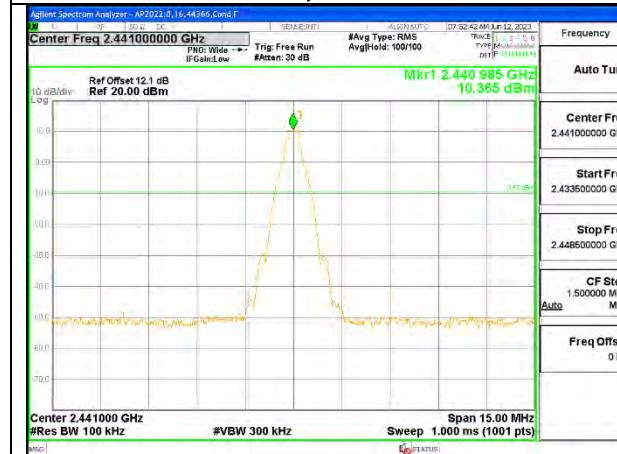
9.8.6. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

Note: Test procedure on beamforming mode is same as BT basic and EDR mode

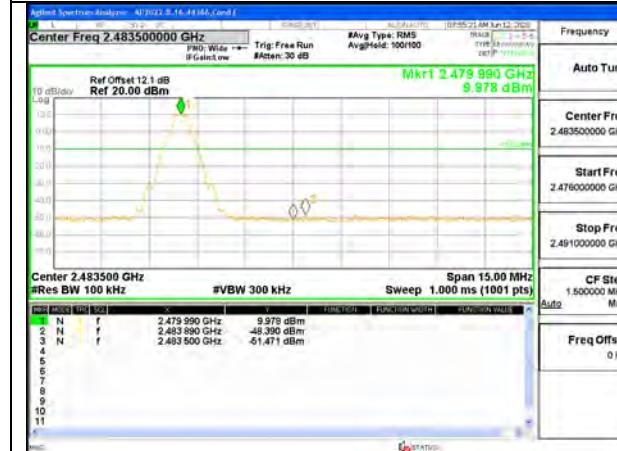
ANT 4



LOW CHANNEL, BANDEDGE ANT 4



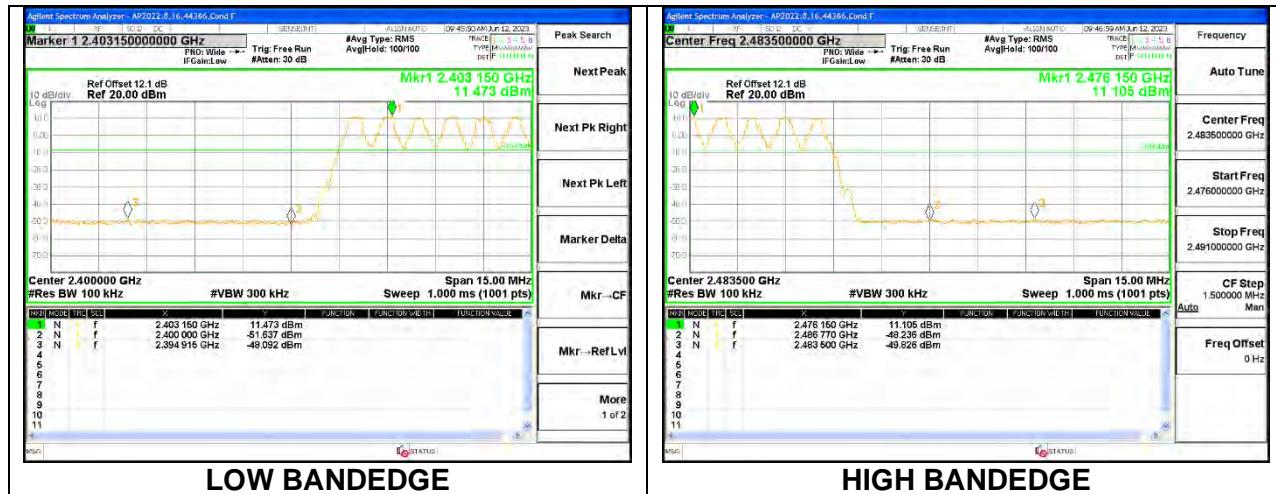
MID CHANNEL REFERENCE ANT 4



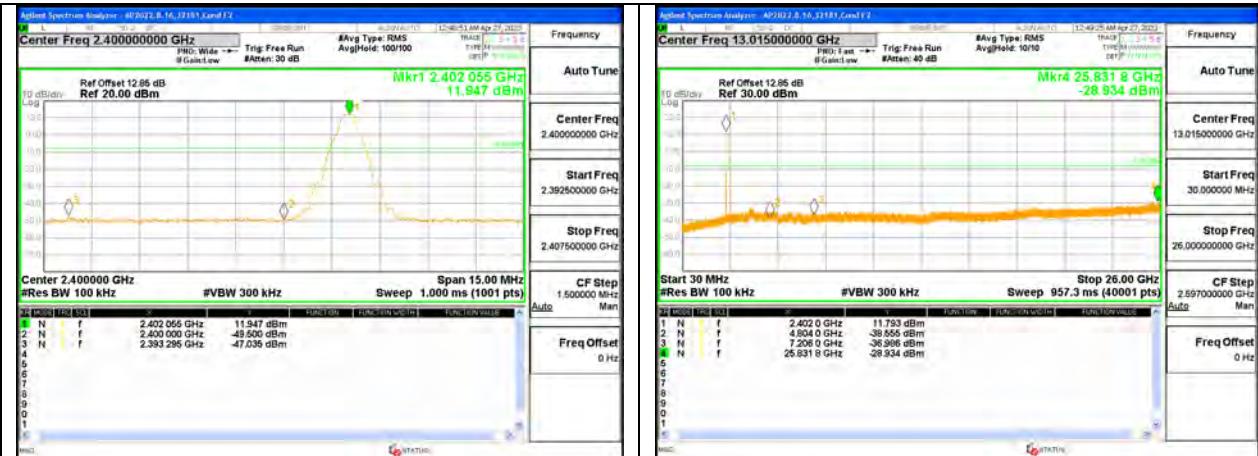
HIGH CHANNEL BANDEDGE ANT 4

HIGH CHANNEL OUT-OF-BAND ANT 4

ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



ANT 3



LOW CHANNEL , BANDEDGE ANT 3



MID CHANNEL REFERENCE ANT 3



HIGH CHANNEL BANDEDGE ANT 3

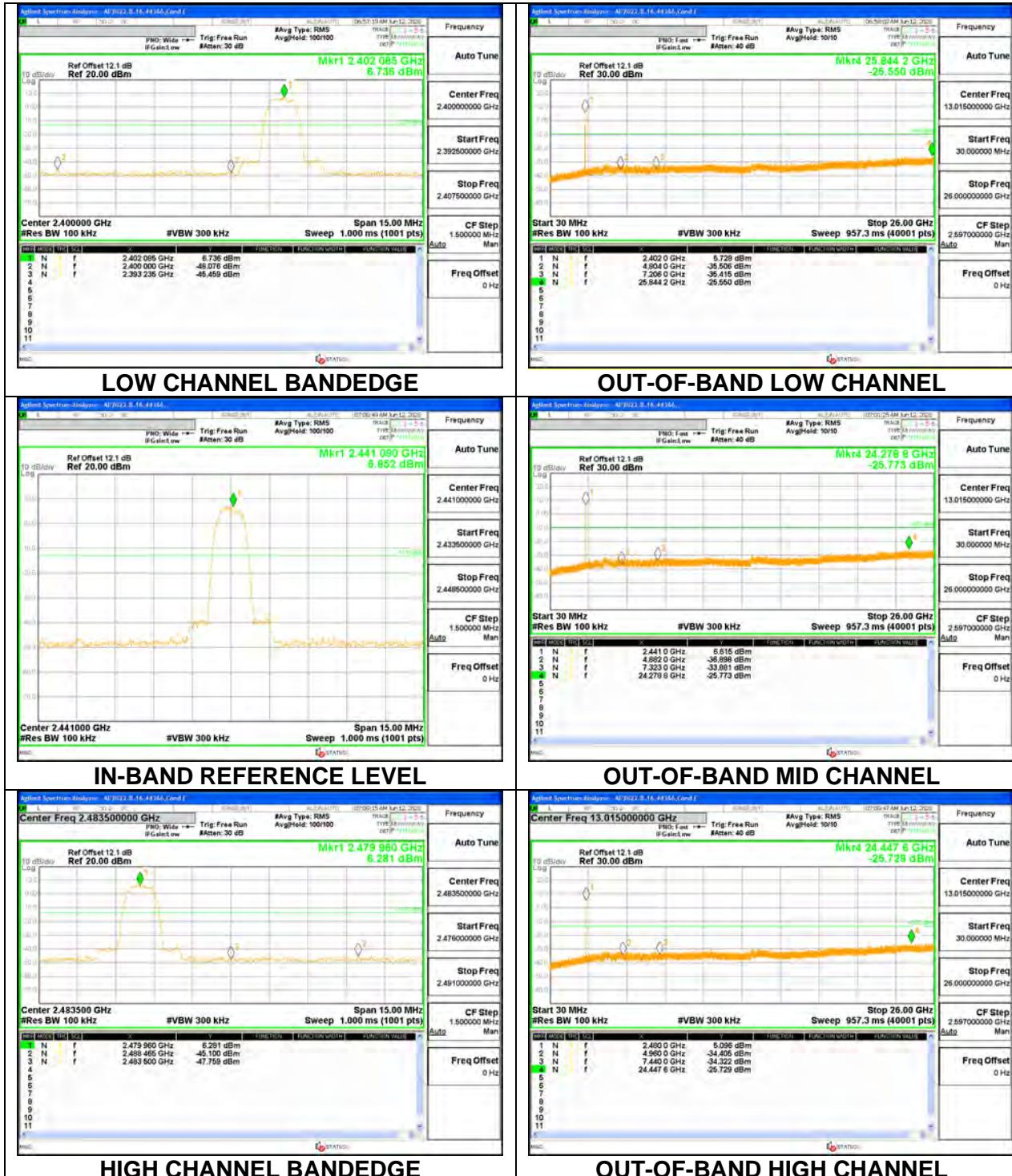
HIGH CHANNEL OUT-OF-BAND ANT 3

ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

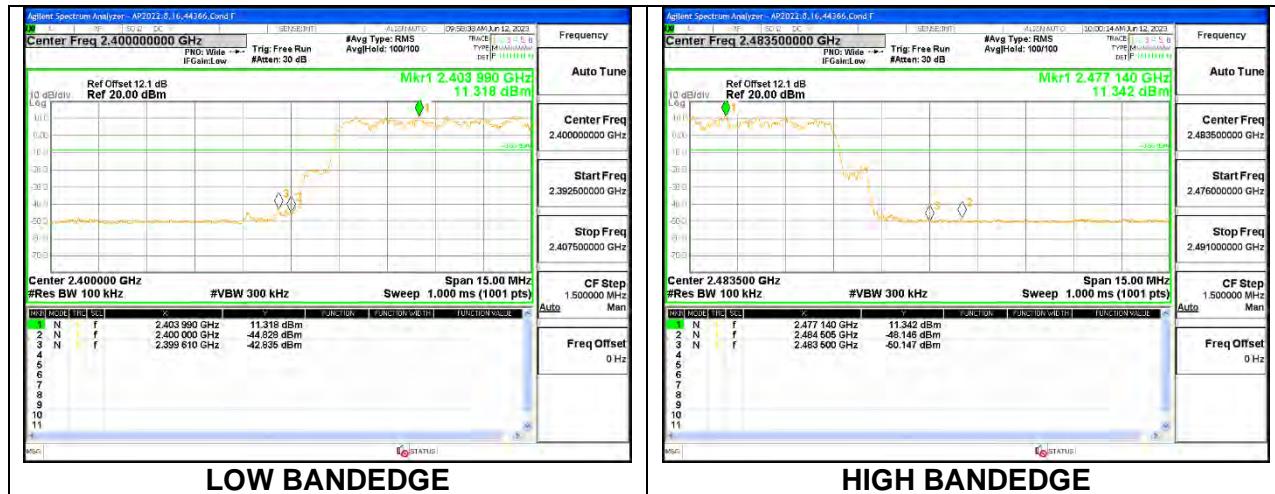


9.8.7. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



9.8.8. LOW POWER TXBF ENHANCED DATA RATE 8PSK MODULATION

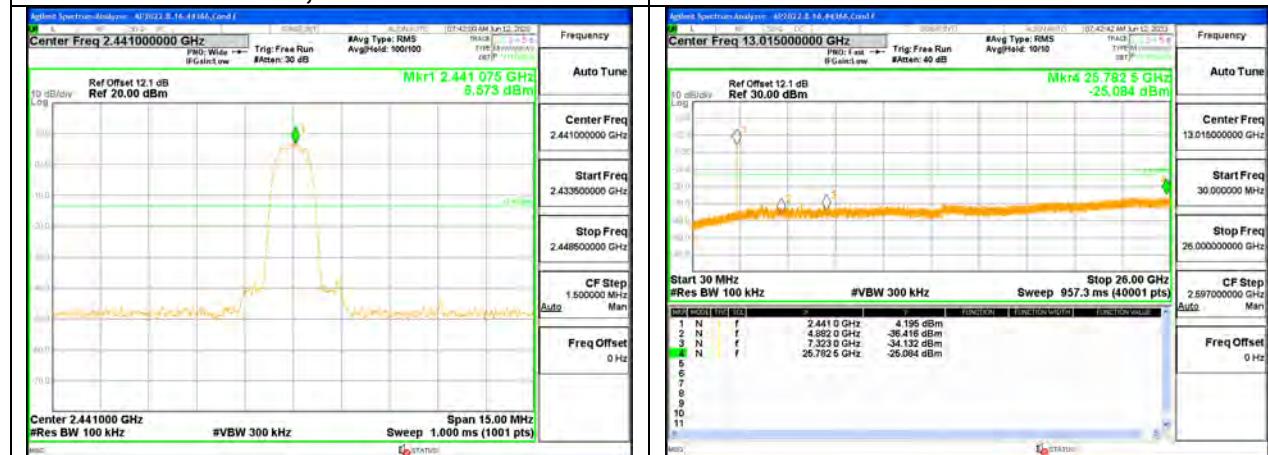
Note: Test procedure on beamforming mode is same as BT basic and EDR mode

ANT 4



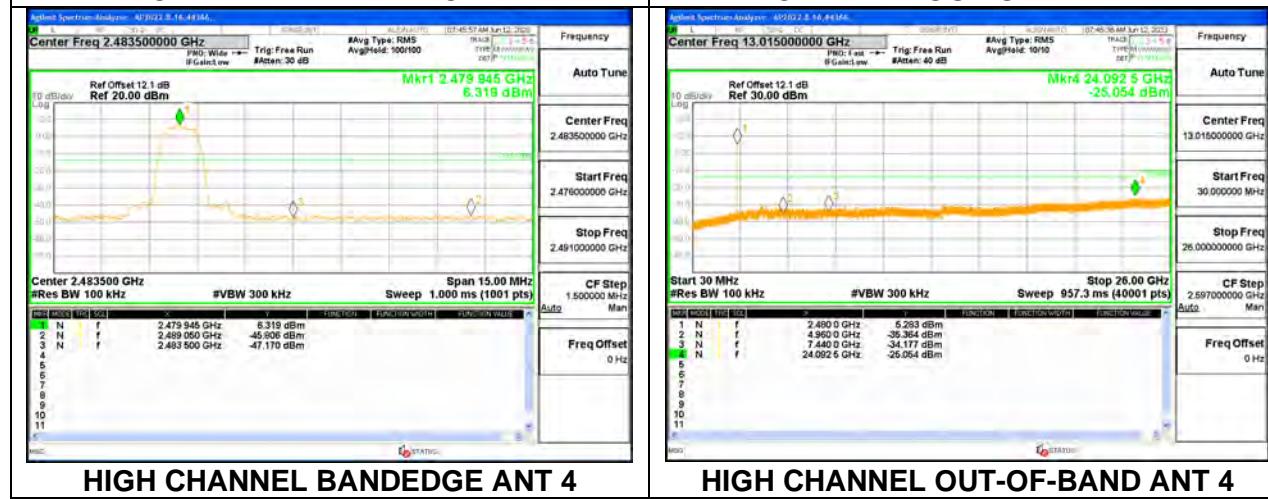
LOW CHANNEL, BANDEDGE ANT 4

LOW CHANNEL OUT-OF-BAND ANT 4



MID CHANNEL REFERENCE ANT 4

MID CHANNEL OUT-OF-BAND ANT 4



HIGH CHANNEL BANDEDGE ANT 4

HIGH CHANNEL OUT-OF-BAND ANT 4