



TEST REPORT

Report Number: 14982479-E1V2

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

Model : A3084 (Parent Model)
A3295, A3296, A3297 (Variant Models)

Brand : APPLE

FCC ID : BCG-E8684A (Parent Model)
BCG-E8685A, BCG-E8686A, BCG-E8687A
(Variant Models)

IC : 579C-E8684A (Parent Model)
579C-E8685A, 579C-E8686A, 579C-
E8687A (Variant Models)

EUT Description : Smartphone

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 3
ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue:
2024/08/02

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2024/07/30	Initial Issue	Chin Pang
V2	2024/08/02	Addressed TCB Feedback on Section 7, 9 and page 74	Tony Li

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
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>	12
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>	14
7. TEST AND MEASUREMENT EQUIPMENT	19
8. MEASUREMENT METHODS	21
9. ANTENNA PORT TEST RESULTS	22
9.1. <i>ON TIME AND DUTY CYCLE</i>	22
9.2. <i>20 dB AND 99% BANDWIDTH</i>	24
9.2.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i>	25
9.2.2. <i>HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION</i>	26
9.2.3. <i>HIGH POWER ENHANCED DATA RATE 8PSK MODULATION</i>	27
9.2.4. <i>HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION</i>	28
9.3. <i>HOPPING FREQUENCY SEPARATION</i>	29
9.3.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i>	30
9.4. <i>NUMBER OF HOPPING CHANNELS</i>	31
9.4.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i>	32
9.5. <i>AVERAGE TIME OF OCCUPANCY</i>	34
9.5.1. <i>HIGH POWER BASIC DATA RATE GFSK MODULATION</i>	35
9.6. <i>OUTPUT POWER</i>	39

9.6.1.	HIGH POWER BASIC DATA RATE GFSK MODULATION	41
9.6.2.	HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION	41
9.6.3.	HIGH POWER ENHANCED DATA RATE QPSK MODULATION	42
9.6.4.	HIGH POWER ENHANCED DATA RATE TXBF QPSK MODULATION	42
9.6.5.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	43
9.6.6.	HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION	43
9.6.7.	LOW POWER BASIC DATA RATE GFSK MODULATION	44
9.6.8.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	44
9.6.9.	LOW POWER ENHANCED DATA RATE QPSK MODULATION	45
9.6.10.	LOW POWER ENHANCED DATA RATE TXBF QPSK MODULATION	45
9.6.11.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	46
9.6.12.	LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION	46
9.7.	<i>AVERAGE POWER</i>	47
9.7.1.	HIGH POWER BASIC DATA RATE GFSK MODULATION	48
9.7.2.	HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION	48
9.7.3.	HIGH POWER ENHANCED DATA RATE QPSK MODULATION	49
9.7.4.	HIGH POWER BASIC DATA RATE TXBF QPSK MODULATION	49
9.7.5.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	50
9.7.6.	HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION	50
9.7.7.	LOW POWER BASIC DATA RATE GFSK MODULATION	51
9.7.8.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	51
9.7.9.	LOW POWER ENHANCED DATA RATE QPSK MODULATION	52
9.7.10.	LOW POWER BASIC DATA RATE TXBF QPSK MODULATION	52
9.7.11.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	53
9.7.12.	LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION	53
9.8.	<i>CONDUCTED SPURIOUS EMISSIONS</i>	54
9.8.1.	HIGH POWER BASIC DATA RATE GFSK MODULATION	55
9.8.2.	HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION	59
9.8.3.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	63
9.8.4.	HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION	67
9.8.5.	LOW POWER BASIC DATA RATE GFSK MODULATION	71
9.8.6.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	75
9.8.7.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	79
9.8.8.	LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION	83
10.	RADIATED TEST RESULTS	87
10.1.	<i>TRANSMITTER ABOVE 1 GHz</i>	89
10.1.1.	HIGH POWER BASIC DATA RATE GFSK MODULATION	89
10.1.2.	HIGH POWER BASIC DATA RATE TX BF GFSK MODULATION	97
10.1.3.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	101
10.1.4.	HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION	109
10.1.5.	LOW POWER BASIC DATA RATE GFSK MODULATION	113
10.1.6.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	121
10.1.7.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	125
10.1.8.	LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION	133
10.1.9.	WORST CASE TXBF HARMONICS AND SPURIOUS EMISSIONS	137
10.2.	<i>WORST CASE BELOW 1 GHZ</i>	143
10.3.	<i>WORST CASE 18-26 GHZ</i>	145
11.	AC POWER LINE CONDUCTED EMISSIONS	147

11.1.1.	AC POWER LINE WITH LAPTOP	148
11.1.2.	AC POWER LINE WITH AC/DC ADAPTER	150
12.	SETUP PHOTOS	152

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Smartphone

MODEL: A3084 (Parent Model)
A3295, A3296, A3297 (Variant Models)

BRAND: APPLE

SERIAL NUMBER: DP4Q0WG2IX

SAMPLE RECEIPT DATE: 2024/03/08

DATE TESTED: 2024/03/09 – 2024/07/24

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 3	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 can demonstrate 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 ensure 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 considered unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



Chin Pang
Senior Lab Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Tony Li
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

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		None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Number of Hopping Channels		None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Average Time of Occupancy		None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power		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		None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions		None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions		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 3.

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 checked="" 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 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%.

SAMPLE CALCULATION

RADIATED EMISSIONS

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)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The Apple iPhone is a smartphone with cellular GSM, GPRS, EGPRS, WCDMA, LTE, 5GNR1, 5GNR2, IEEE 802.11a/b/g/n/ac/ax/be, Bluetooth (BT), Ultra-Wideband (UWB), Global Positioning System (GPS), Near-Field Communication (NFC), Narrow-Band (NB) UNII, 802.15.4, 802.15.4ab-Narrow Band (NB) and Mobile Satellite Service (MSS) technologies. The rechargeable battery is not user accessible. This device is not user-serviceable and requires special tools to disassemble.

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	20.32	107.65
		2402 - 2480	DQPSK	18.94	78.34
		2402 - 2480	Enhanced 8PSK	19.13	81.85
	Low Power	2402 - 2480	Basic GFSK	11.80	15.14
		2402 - 2480	DQPSK	9.39	8.69
		2402 - 2480	Enhanced 8PSK	9.65	9.23
ANT 3	High Power	2402 - 2480	Basic GFSK	20.25	105.93
		2402 - 2480	DQPSK	18.99	79.25
		2402 - 2480	Enhanced 8PSK	19.15	82.22
	Low Power	2402 - 2480	Basic GFSK	11.33	13.58
		2402 - 2480	DQPSK	9.47	8.85
		2402 - 2480	Enhanced 8PSK	9.66	9.25
BF, ANT 4 + ANT 3	High Power	2402 - 2480	Basic GFSK TxBF	20.30	107.15
		2402 - 2480	DQPSK TxBF	18.88	77.27
		2402 - 2480	Enhanced 8PSK TxBF	19.14	82.04
	Low Power	2402 - 2480	Basic GFSK TxBF	14.63	29.04
		2402 - 2480	DQPSK TxBF	12.46	17.62
		2402 - 2480	Enhanced 8PSK TxBF	12.62	18.28

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. For average power data please refer to section 9.7.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) type is IFA type.

The antenna(s) gains, as provided by the manufacturer, are as follows:

Frequency Range (GHz)	ANT 4 (dBi)	ANT 3 (dBi)
2.4	-2.0	-1.7

SMA Cable used for RF conducted testing has a loss as follows:

Cable Loss used for Antenna 4 is 2.0 dB

Cable Loss used for Antenna 3 is 2.2 dB

The cables were used for RF antenna port tests that had been offset to the test equipment during testing.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware and software version is 22.1.93.334.

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, ANT 3 and 2TX Beamforming.

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 30MHz, 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.

For below 30MHz, 30-1000MHz emissions spurious tests EUT was connected to AC power adapter and set at X orientation 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

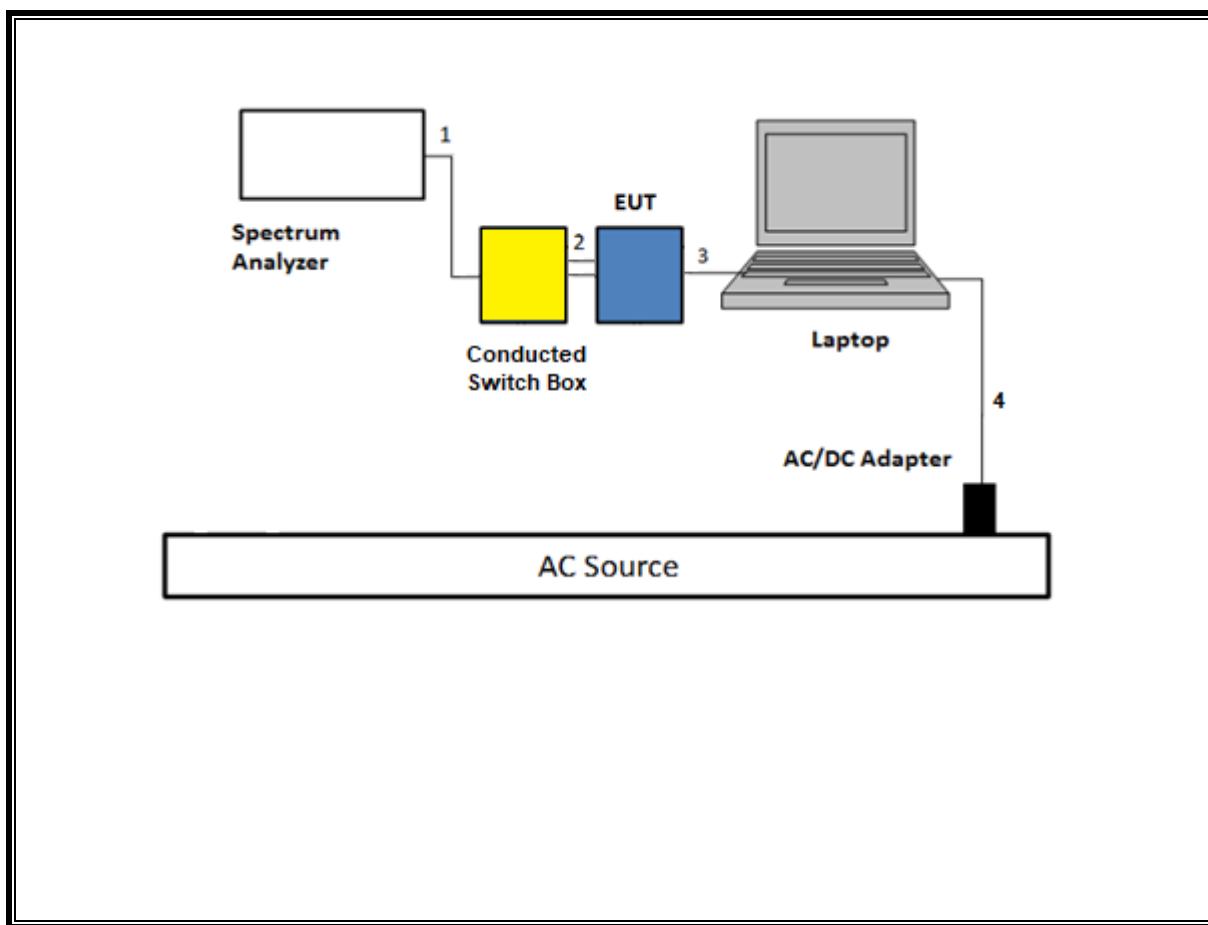
For radiated harmonic spurious emissions test, high power beamforming GFSK mode is set to maximum power per chain to cover both SISO and MIMO modes to complies with radiated spurious emissions limits in the restricted bands between 1GHz and 18GHz low/mid/high channel.

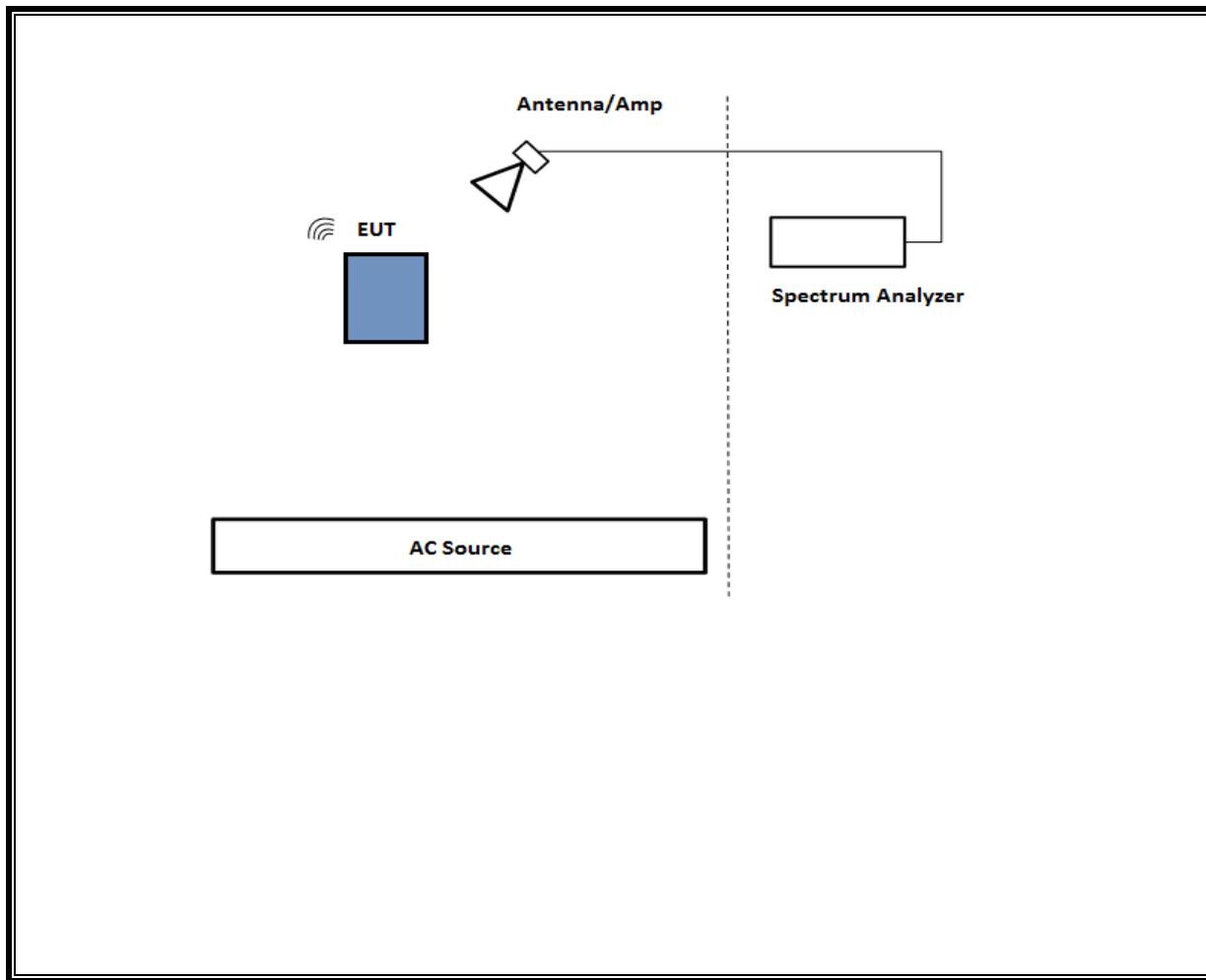
6.6. DESCRIPTION OF TEST SETUP

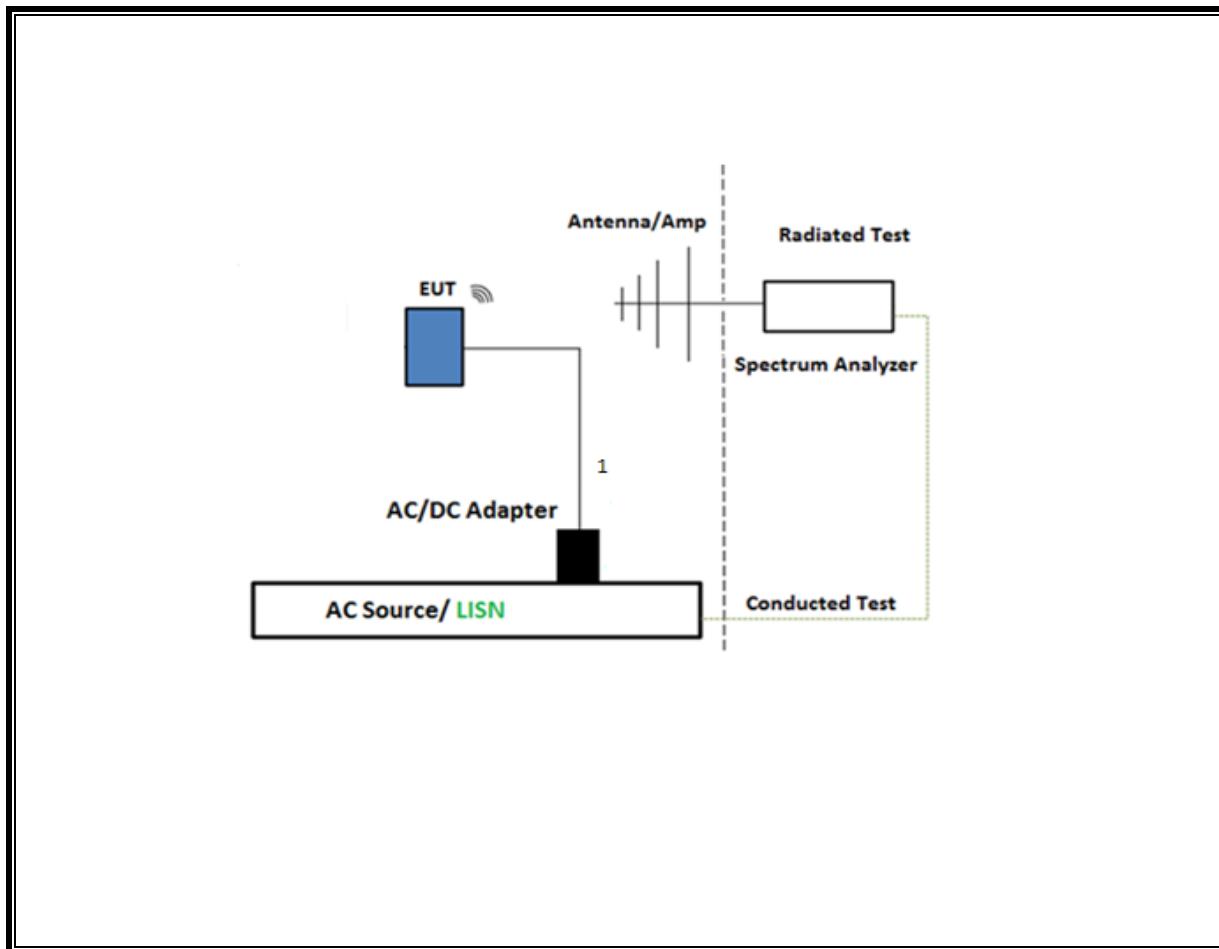
SUPPORT TEST EQUIPMENT					
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC	
Laptop	Apple	Macbook Pro	C02VD7SAHV22	BCGA1708	
Laptop AC/DC adapter	Liteon Technology	A1424	NSW25679		DoC
EUT AC/DC adapter	Apple	A1720	C3D8417A7R93KVPA8		DoC
Conducted Switch Box	UL	n/a	208281		N/A
I/O CABLES (RF CONDUCTED TEST)					
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)
1	SMA	1	SMA	Shielded	0.75
2	Antenna	2	SMA	Un-shielded	0.2
3	USB-C	1	USB-C	Shielded	1.0
4	AC	1	AC	Un-shielded	2
I/O CABLES (RF RADIATED TEST)					
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)
1	AC	1	AC	Un-shielded	2
2	USB	1	USB	Un-shielded	1

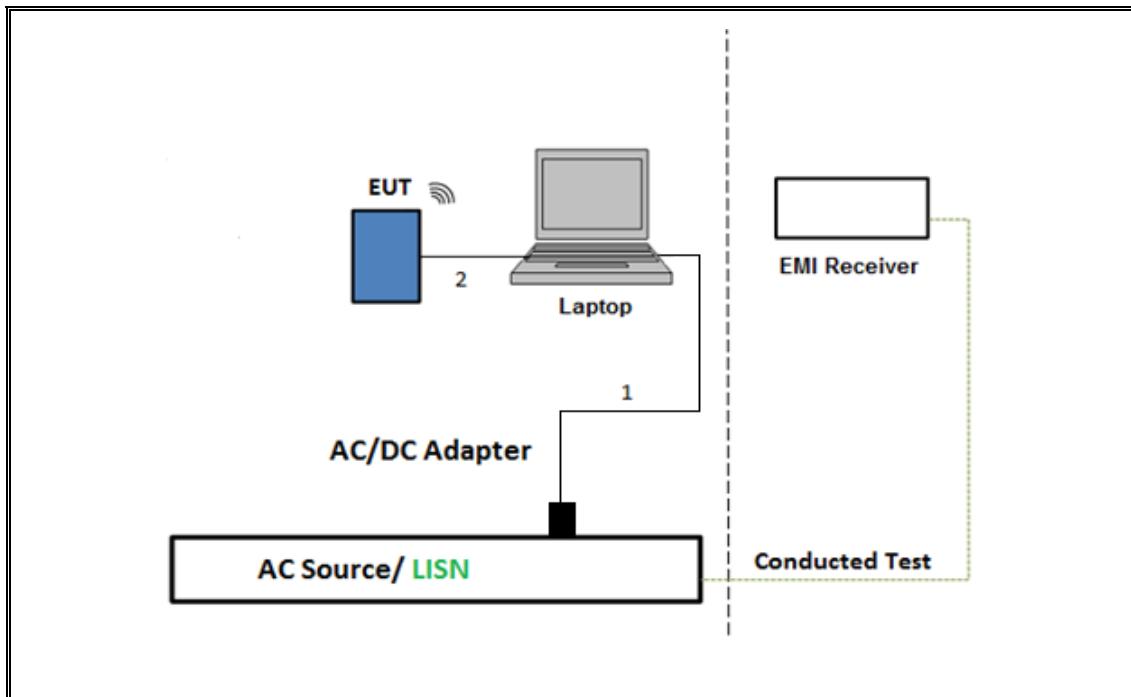
TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR CONDUCTED TESTS

SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz (1 to 26.5GHz)

SETUP DIAGRAM FOR 30-1000MHz 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
*EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235670	2024/04/30
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	223084	2024/10/31
*EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235670	2024/04/30
*RF Filter Box, 1-18GHz	Miteq	UL-FR1	171875	2024/05/31
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200896	2025/04/24
RF Filter Box, 1-18GHz, 17 Ports	UL-FR1	RATS 2	225474	2025/04/30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	170063	2024/11/30
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	226673	2025/01/31
EMI Test Receiver	Rohde & Schwarz	ESW44	169936	2025/02/28
RF Filter Box, 1-18GHz, 12 Ports	UL-FR1	Frankenstein	217521	2024/08/31
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	85151	2024/04/30
Link File, @3m, 9kHz-1000MHz Hybrid Path Loss	UL-FR1	Port 0 Factors	232001	2025/02/28
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	169935	2025/02/28
*Antenna, Horn 18 to 26.5GHz	A.R.A	MWH-1826/B	172353	2024/06/30
RF Amplifier Assembly, 18-26.5GHz, 60dB Gain	AMPLICAL	AMP18G26.5-60	171583	2025/03/31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	223461	2024/08/29
Antenna, Passive Loop 30Hz to 1MHz	Electro-Metrics	EM-6871	170014	2024/08/31
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO-METRICS	EM-6872	170016	2024/08/31
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90731	2025/01/31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	80120	2025/01/31
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90719	2025/01/31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90389	2025/01/31
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	80397	2025/01/31
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight Technologies Inc	N9030A	80400	2025/02/02
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	178557	
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	178558	
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	125178	2025/01/31
*Conducted Switch Box	N/A	CSB	208281	2024/04/30
Conducted Switch Box	N/A	CSB	208281	2025/05/08

AC Line Conducted				
Description	Manufacturer	Model	ID Num	Cal Due
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESR	93091	2025/02/28
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01-480V	175765	2025/01/31
Transient Limiter	TE	TBFL1	207996	2024/08/31
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, May 1, 2023	
Conducted Software	UL	UL EMC	2023.2.23	
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 is 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.

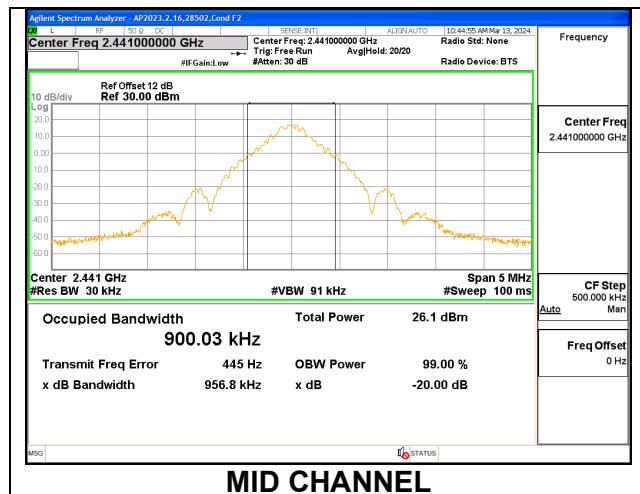
RESULTS

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

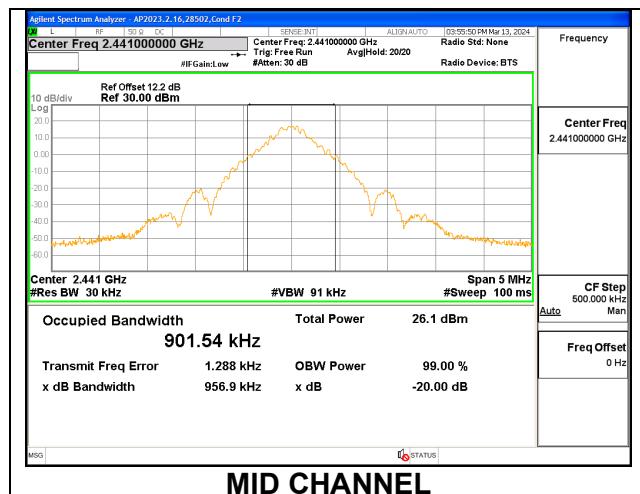
ANT 4

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.95510	0.89815
Mid	2441	0.95680	0.90003
High	2480	0.95840	0.89827



ANT 3

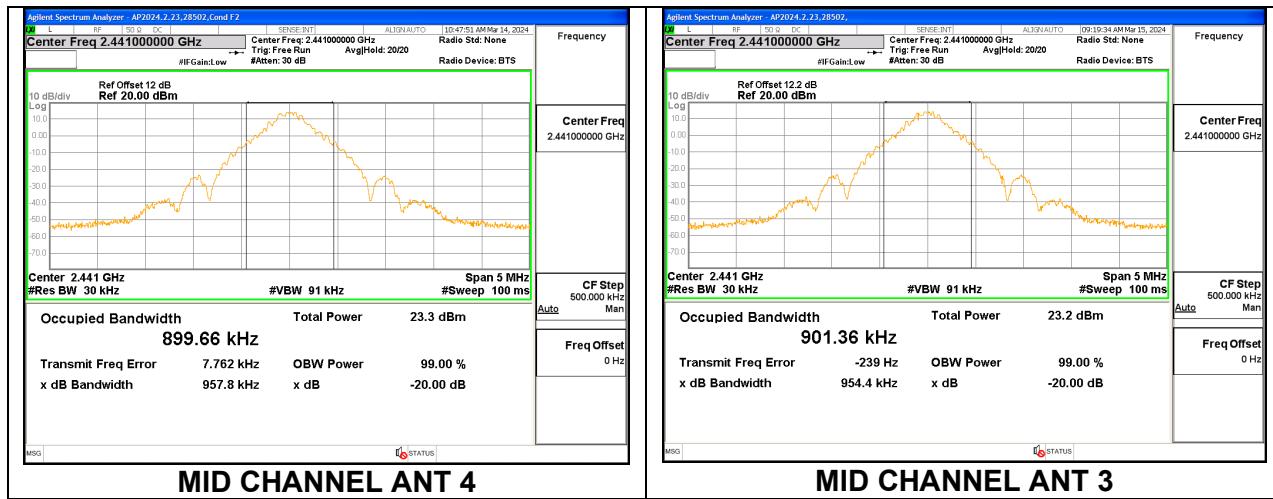
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.95140	0.90185
Mid	2441	0.95690	0.90154
High	2480	0.95890	0.89972



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	0.95630	0.95680	0.90025	0.89953
Mid	2441	0.95780	0.95440	0.89966	0.90136
High	2480	0.95720	0.95670	0.89796	0.89957

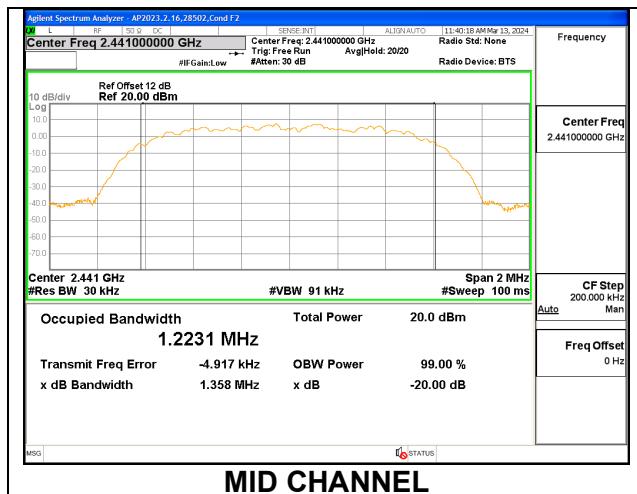
Note: Test procedures and setting on beamforming mode are same as BT basic and EDR mode



9.2.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

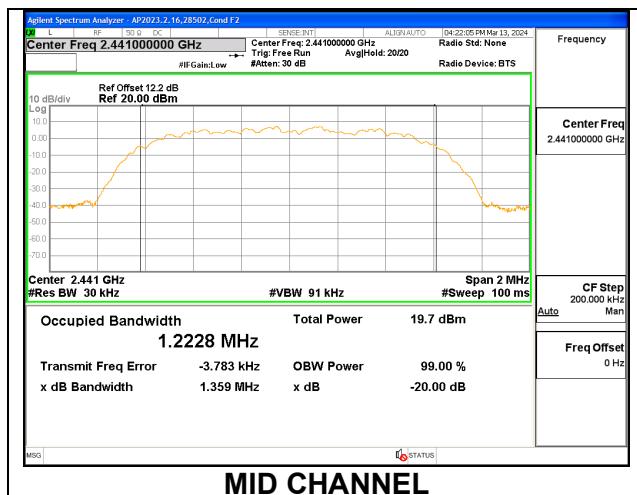
ANT 4

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.3590	1.2216
Mid	2441	1.3580	1.2231
High	2480	1.3590	1.2226



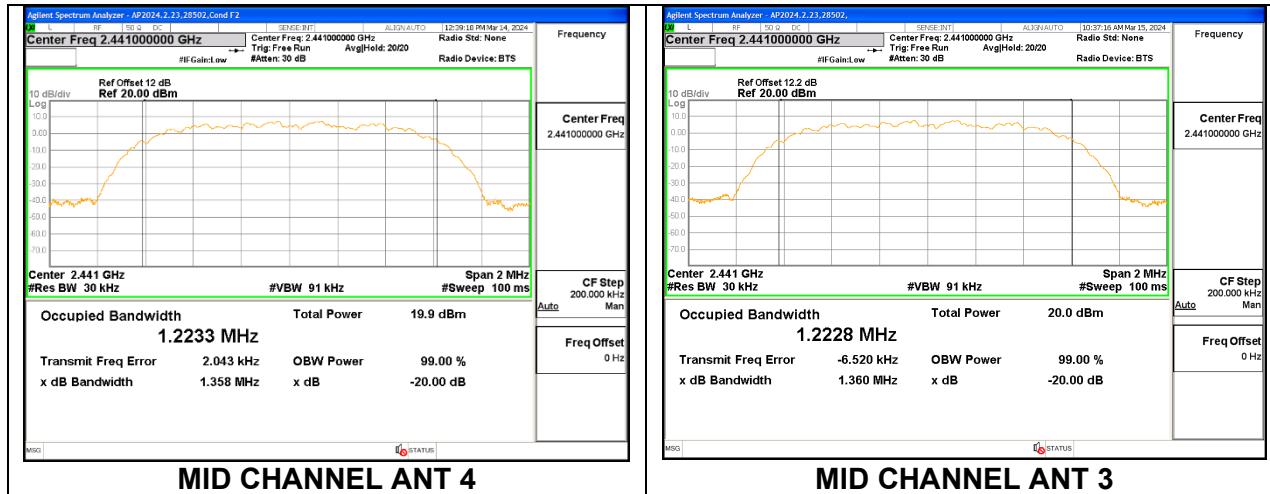
ANT 3

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.3590	1.2224
Mid	2441	1.3590	1.2228
High	2480	1.3590	1.2225



9.2.4. HIGH POWER ENHANCED DATA RATE TXBF 8PSK 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	1.3590	1.3590	1.2225	1.2211
Mid	2441	1.3580	1.3600	1.2233	1.2228
High	2480	1.3600	1.3590	1.2224	1.2224



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

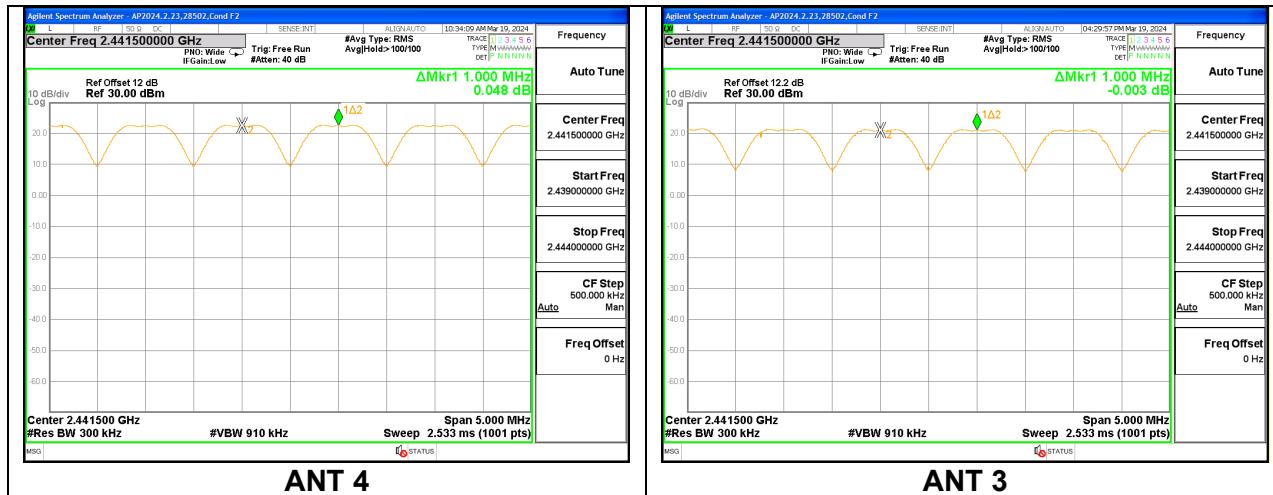
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW \geq 3xRBW. The sweep time is coupled.

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

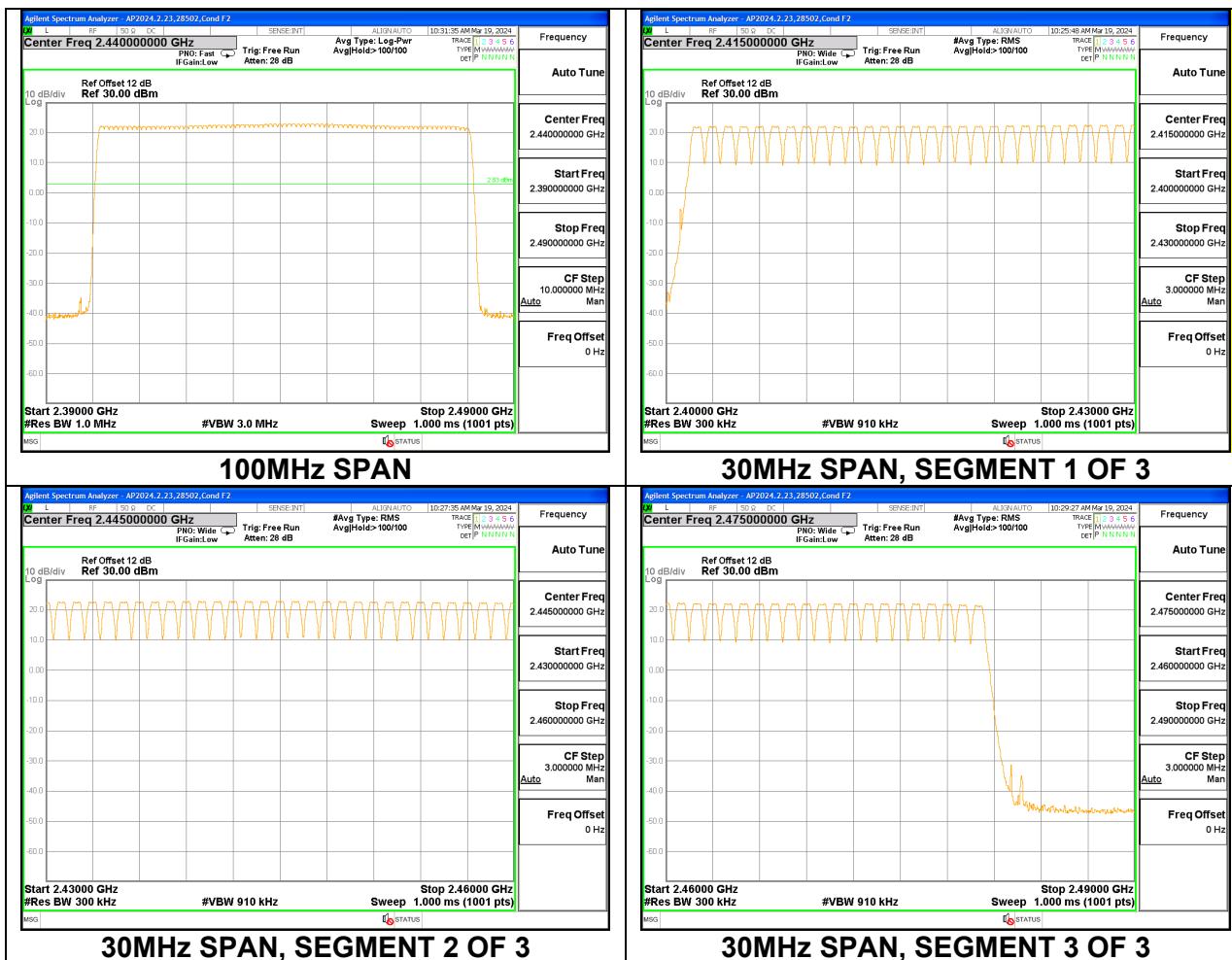
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

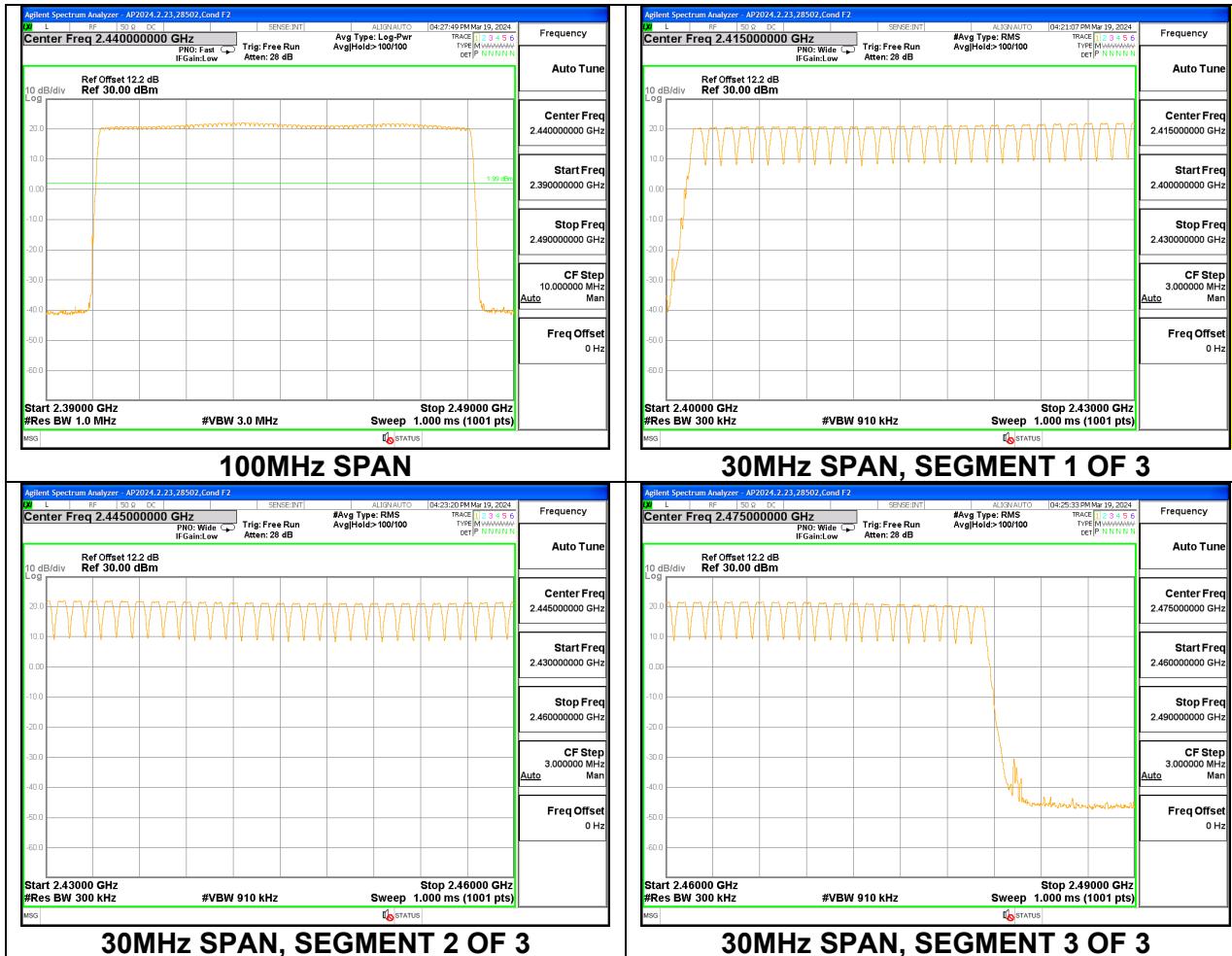
RESULTS

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.

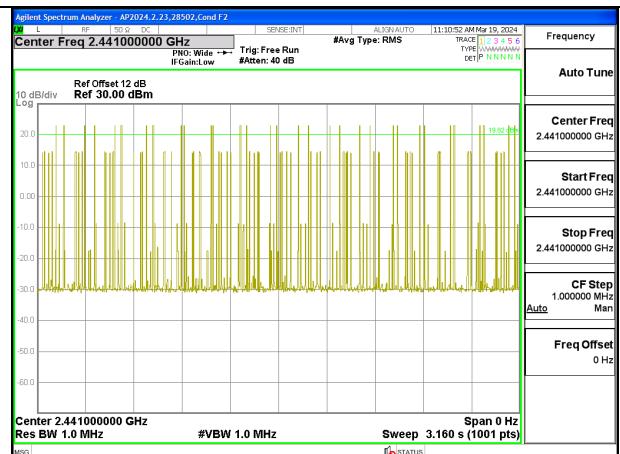
9.5.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

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	30	0.114	0.4	-0.286
DH3	1.632	15	0.245	0.4	-0.155
DH5	2.876	12	0.345	0.4	-0.055
GFSK AFH Mode					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.379	7.5	0.028	0.4	-0.372
DH3	1.632	3.75	0.061	0.4	-0.339
DH5	2.876	3	0.086	0.4	-0.314



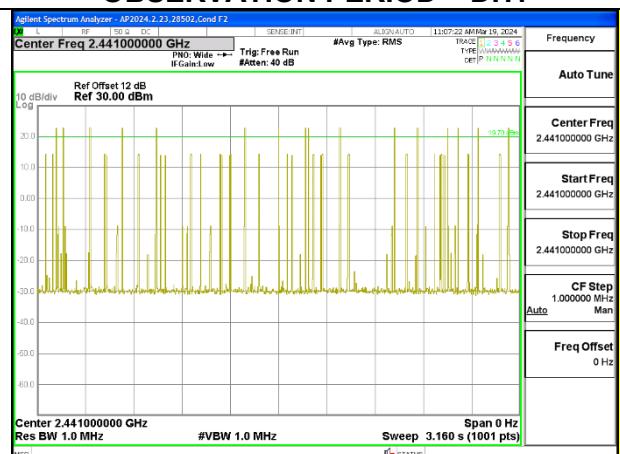
PULSE WIDTH – DH1



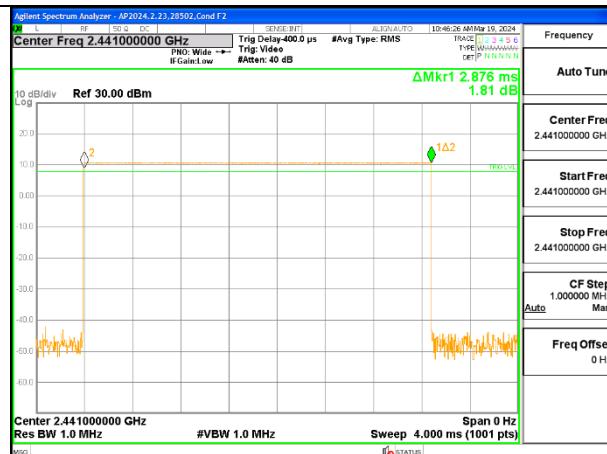
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



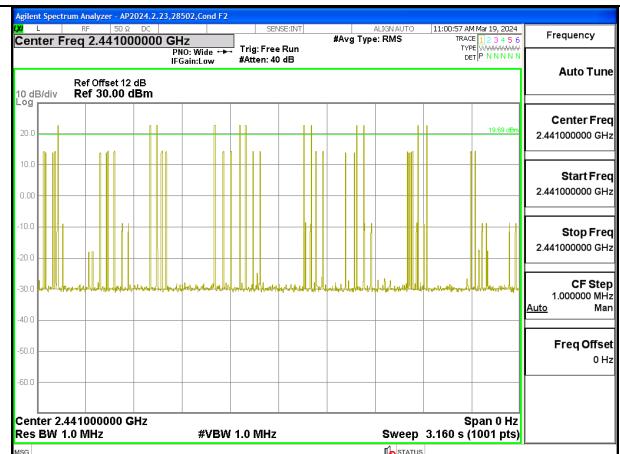
PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



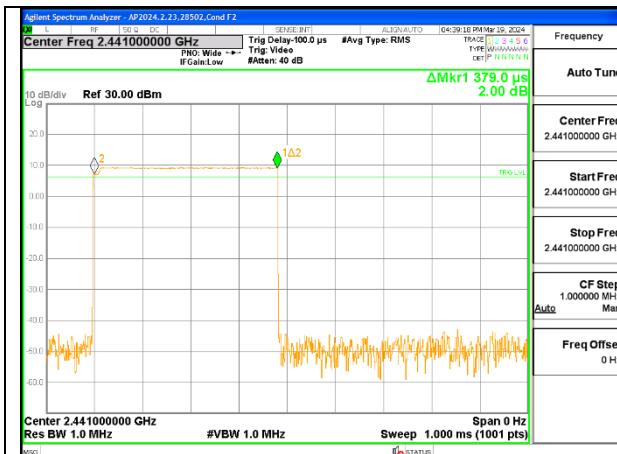
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

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	30	0.114	0.4	-0.286
DH3	1.632	15	0.245	0.4	-0.155
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	7.5	0.028	0.4	-0.372
DH3	1.632	3.75	0.061	0.4	-0.339
DH5	2.876	2.75	0.079	0.4	-0.321



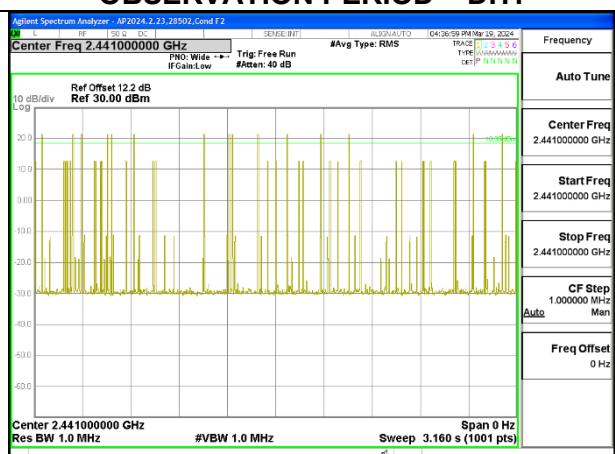
PULSE WIDTH – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



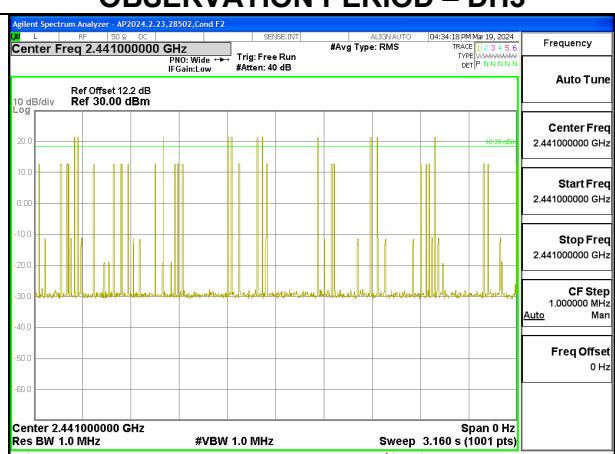
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

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. 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	-2.00	-1.70	-1.85	1.16

DIRECTIONAL GAIN CALCULATION:

ANSI C63.10-2013 section 14.4.3

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

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

Sample Calculation:

Ant4=-2.0, Ant3=-1.70

Uncorrelated Antenna gain= $10 \log[(10^{(-2.0/10)} + 10^{(-1.7/10)})/2] = -1.85 \text{ dBi}$

Correlated Antenna gain= $10 \log[(10^{(-2.0/20)} + 10^{(-1.7/20)})^2/2] = 1.16$

RESULTS

9.6.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

ANT 4

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.32	21	-0.68
Middle	2441	20.23	21	-0.77
High	2480	20.10	21	-0.9

ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.16	21	-0.84
Middle	2441	20.25	21	-0.75
High	2480	20.21	21	-0.79

9.6.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	17.12	17.24	20.19	21	-0.81
Middle	2441	17.29	17.29	20.30	21	-0.70
High	2480	17.11	17.19	20.16	21	-0.84

9.6.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	18.81	21	-2.19
Middle	2441	18.94	21	-2.06
High	2480	18.91	21	-2.09

ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	18.99	21	-2.01
Middle	2441	18.90	21	-2.1
High	2480	18.98	21	-2.02

9.6.4. HIGH POWER ENHANCED DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	15.87	15.87	18.88	21	-2.12
Middle	2441	15.72	15.63	18.69	21	-2.31
High	2480	15.77	15.82	18.81	21	-2.19

9.6.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.02	21	-1.98
Middle	2441	19.12	21	-1.88
High	2480	19.13	21	-1.87

ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.15	21	-1.85
Middle	2441	18.94	21	-2.06
High	2480	19.09	21	-1.91

9.6.6. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.1	16.15	19.14	21	-1.86
Middle	2441	16.05	16.15	19.11	21	-1.89
High	2480	16.05	16.07	19.07	21	-1.93

9.6.7. LOW POWER BASIC DATA RATE GFSK MODULATION

ANT 4

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.78	21	-9.22
Middle	2441	11.80	21	-9.2
High	2480	11.68	21	-9.32

ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.25	21	-9.75
Middle	2441	11.33	21	-9.67
High	2480	11.31	21	-9.69

9.6.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.84	11.13	14.51	21	-6.49
Middle	2441	11.77	11.38	14.59	21	-6.41
High	2480	11.9	11.33	14.63	21	-6.37

9.6.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.38	21	-11.62
Middle	2441	9.37	21	-11.63
High	2480	9.39	21	-11.61

ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.38	21	-11.62
Middle	2441	9.44	21	-11.56
High	2480	9.47	21	-11.53

9.6.10. LOW POWER ENHANCED DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.41	9.45	12.44	21	-8.56
Middle	2441	9.46	9.43	12.46	21	-8.54
High	2480	9.44	9.45	12.46	21	-8.54

9.6.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.65	21	-11.35
Middle	2441	9.58	21	-11.42
High	2480	9.60	21	-11.4

ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.53	21	-11.47
Middle	2441	9.58	21	-11.42
High	2480	9.66	21	-11.34

9.6.12. LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.57	9.63	12.61	21	-8.39
Middle	2441	9.65	9.55	12.61	21	-8.39
High	2480	9.61	9.60	12.62	21	-8.38

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:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	20.00
Middle	2441	19.92
High	2480	19.78

ANT 3

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	19.85
Middle	2441	19.93
High	2480	19.89

9.7.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	16.82	16.93	19.89
Middle	2441	16.99	16.98	20.00
High	2480	16.81	16.89	19.86

9.7.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.40
Middle	2441	16.49
High	2480	16.47

ANT 3

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.49
Middle	2441	16.39
High	2480	16.46

9.7.4. HIGH POWER BASIC DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	13.39	13.36	16.39
Middle	2441	13.24	13.13	16.20
High	2480	13.27	13.32	16.31

9.7.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.37
Middle	2441	16.47
High	2480	16.48

ANT 3

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.50
Middle	2441	16.28
High	2480	16.43

9.7.6. HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	13.46	13.49	16.49
Middle	2441	13.40	13.48	16.45
High	2480	13.39	13.42	16.42

9.7.7. LOW POWER BASIC DATA RATE GFSK MODULATION

ANT 4

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	11.48
Middle	2441	11.47
High	2480	11.30

ANT 3

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	10.85
Middle	2441	10.95
High	2480	10.92

9.7.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	11.44	10.73	14.11
Middle	2441	11.38	10.99	14.20
High	2480	11.50	10.93	14.23

9.7.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION

ANT 4

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.91
Middle	2441	6.90
High	2480	6.92

ANT 3

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.91
Middle	2441	6.95
High	2480	7.00

9.7.10. LOW POWER BASIC DATA RATE TXBF QPSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	6.94	6.98	9.97
Middle	2441	6.99	6.96	9.99
High	2480	6.97	6.98	9.99

9.7.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

ANT 4

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.00
Middle	2441	6.93
High	2480	6.94

ANT 3

Tested By:	28502 AY
Date	3/21/2024

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.88
Middle	2441	6.92
High	2480	7.00

9.7.12. LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION

ANT 4 + ANT 3

Tested By:	28502 AY
Date:	3/21/2024

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	6.91	6.98	9.96
Middle	2441	6.99	6.89	9.95
High	2480	6.95	6.94	9.96

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.

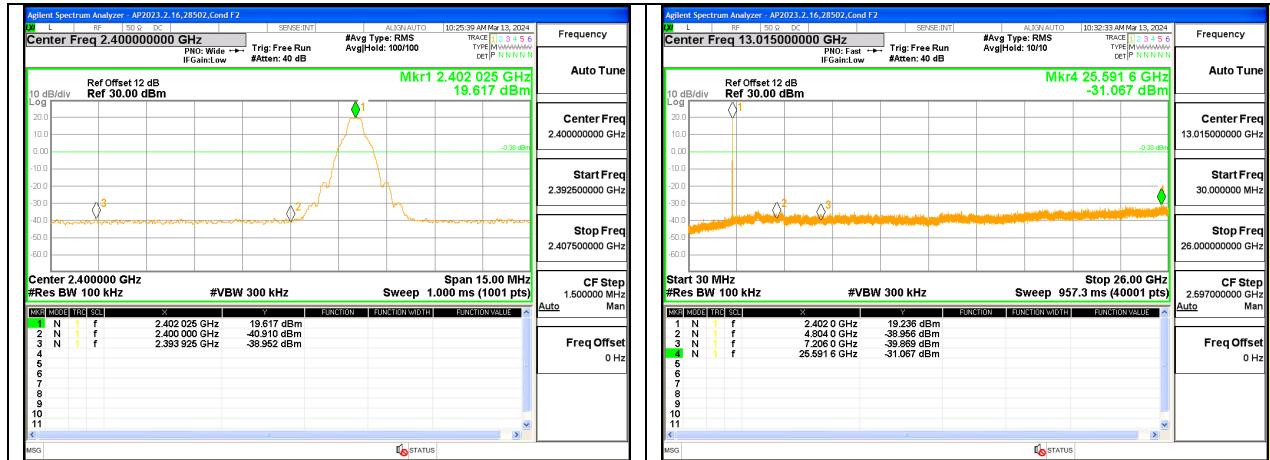
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

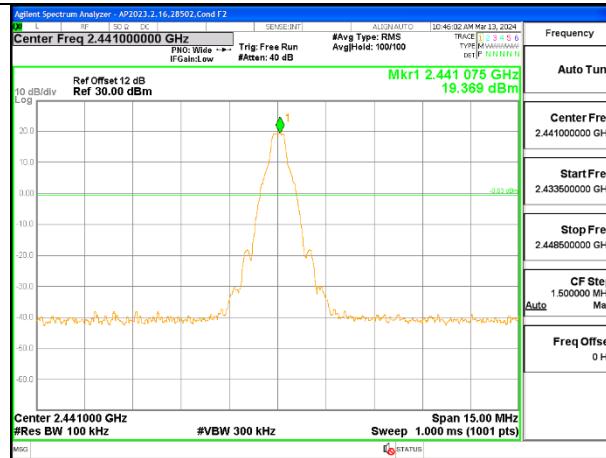
RESULTS

9.8.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

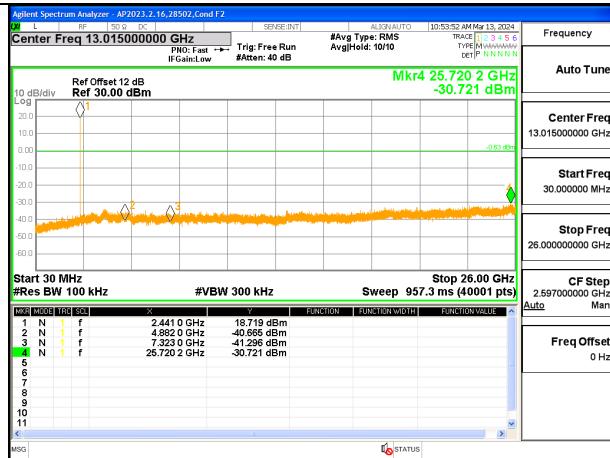
ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



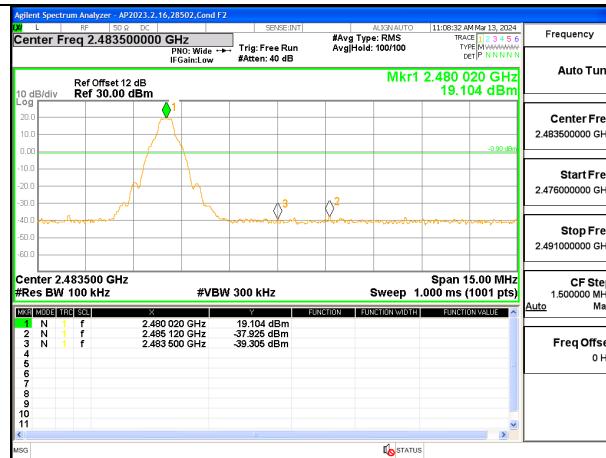
LOW CHANNEL BANDEDGE



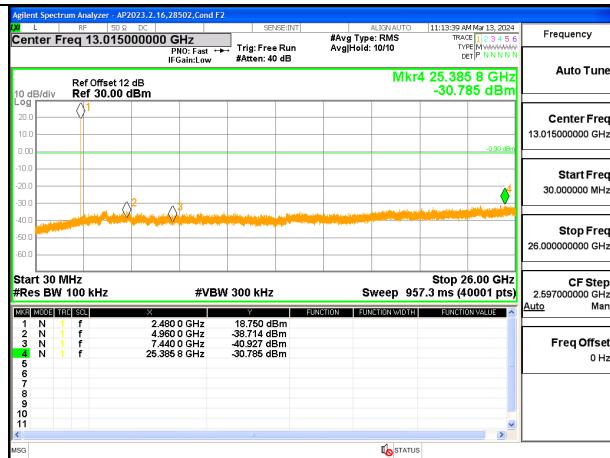
OUT-OF-BAND LOW CHANNEL



IN-BAND REFERENCE LEVEL



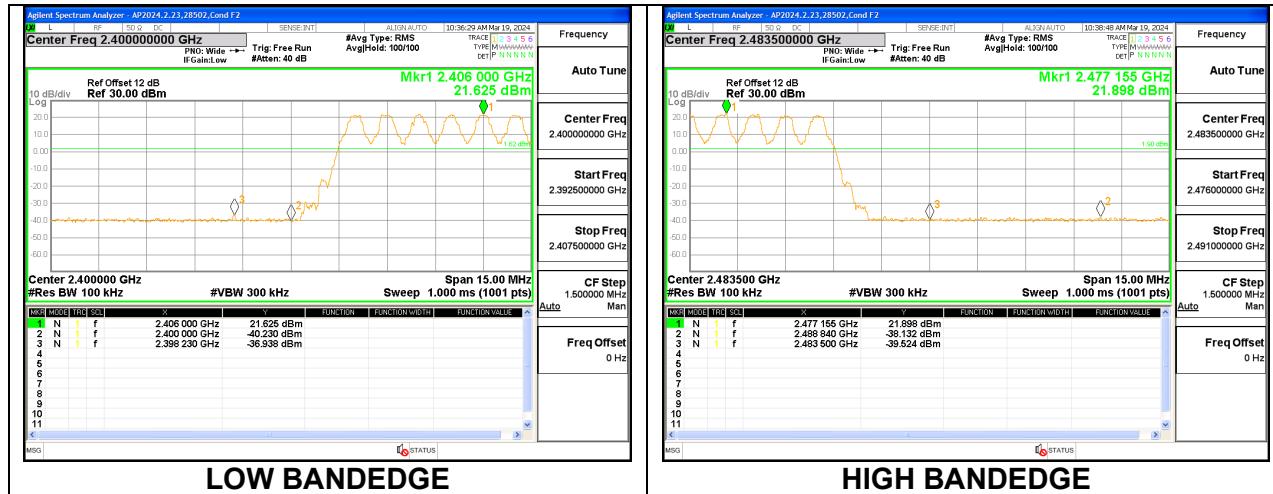
OUT-OF-BAND MID CHANNEL



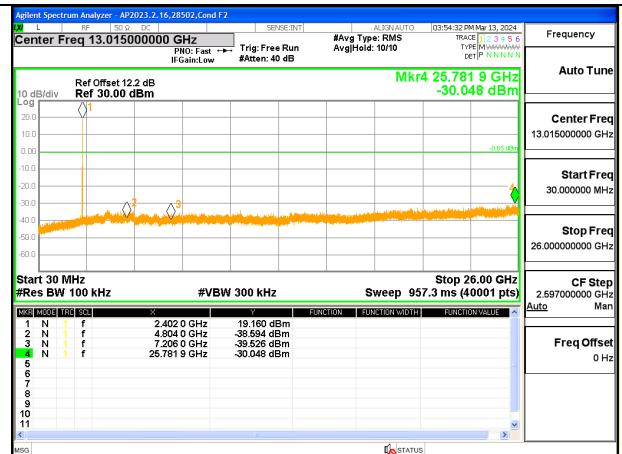
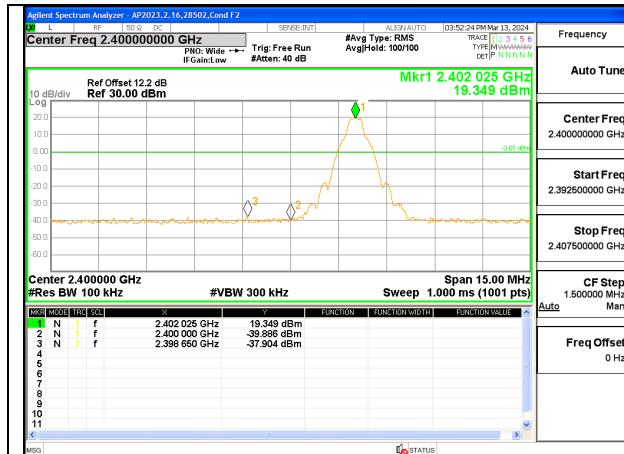
HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

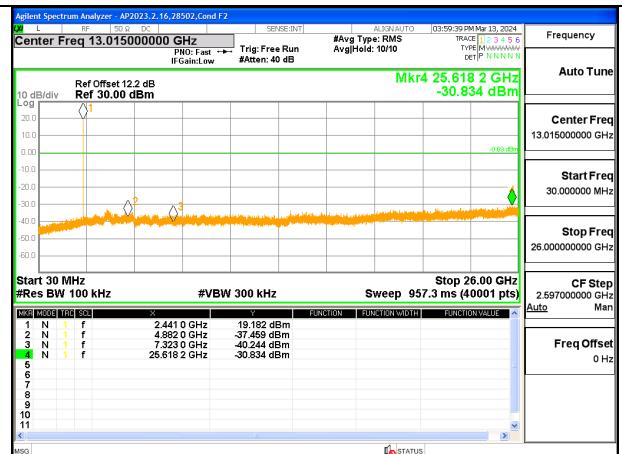
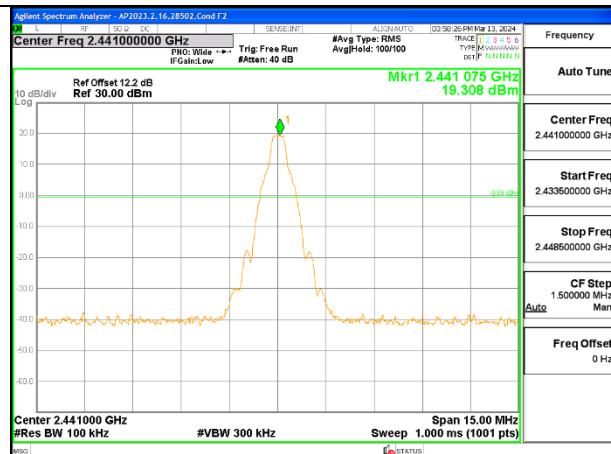
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



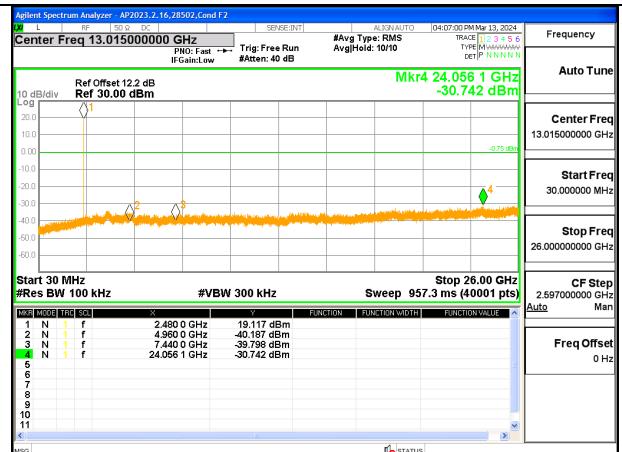
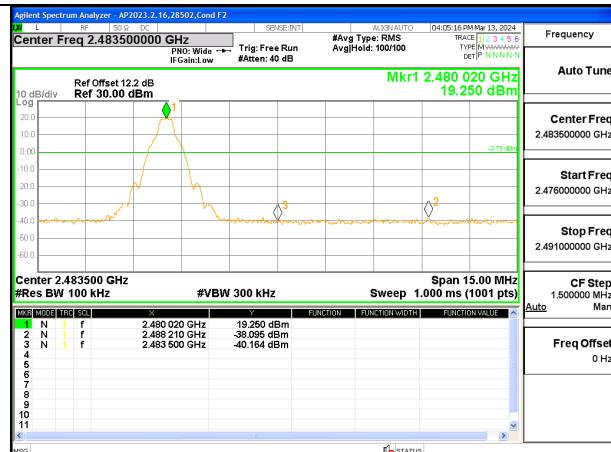
ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



LOW CHANNEL BANDEDGE



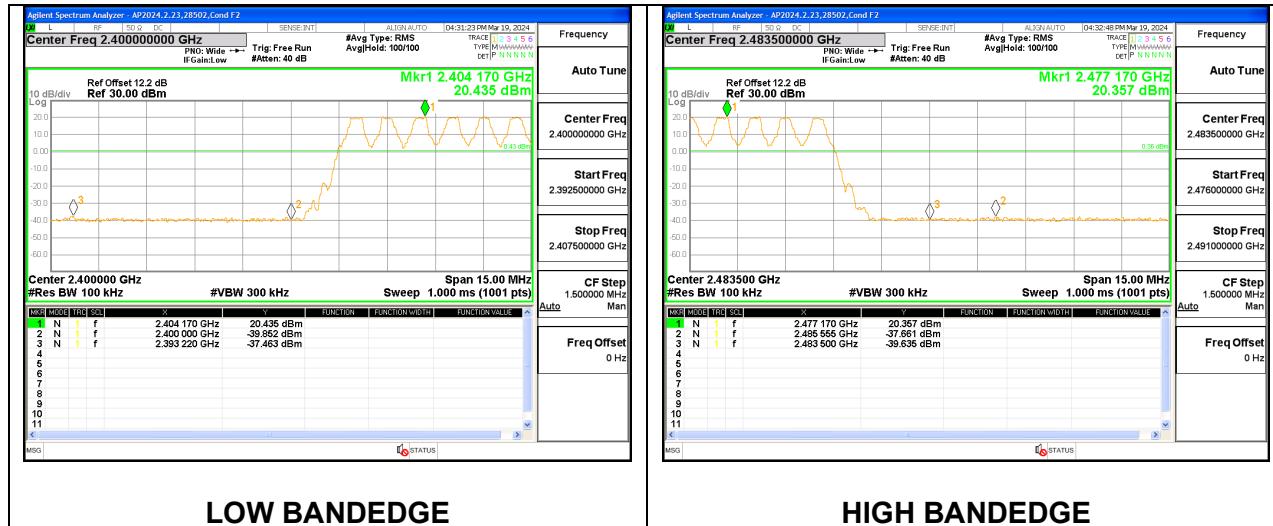
IN-BAND REFERENCE LEVEL



HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

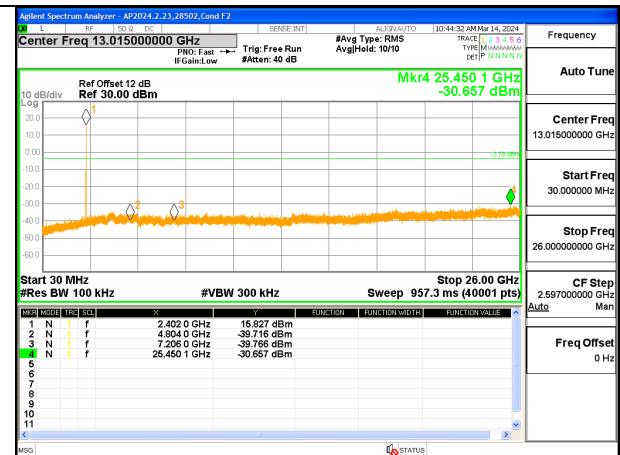
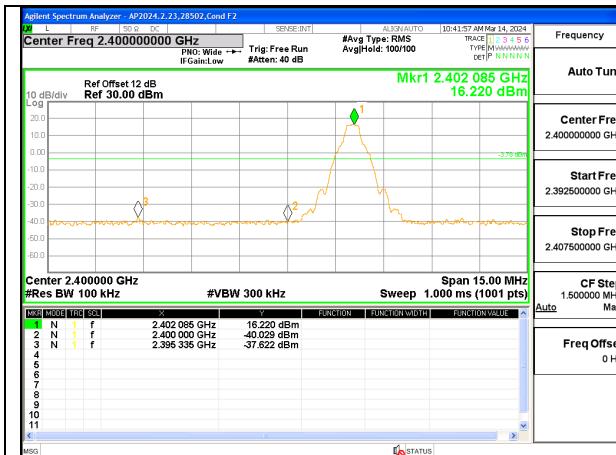
ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



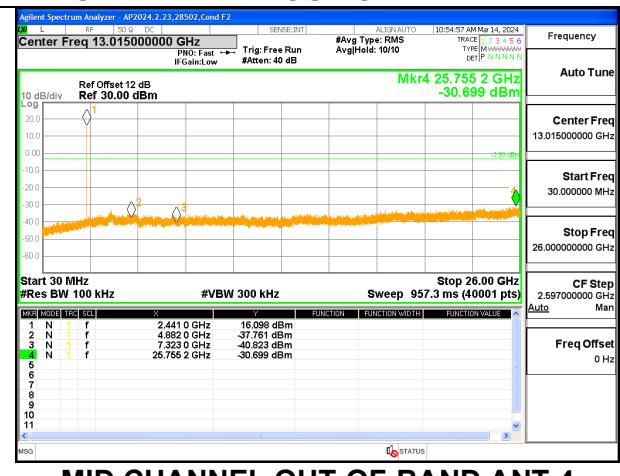
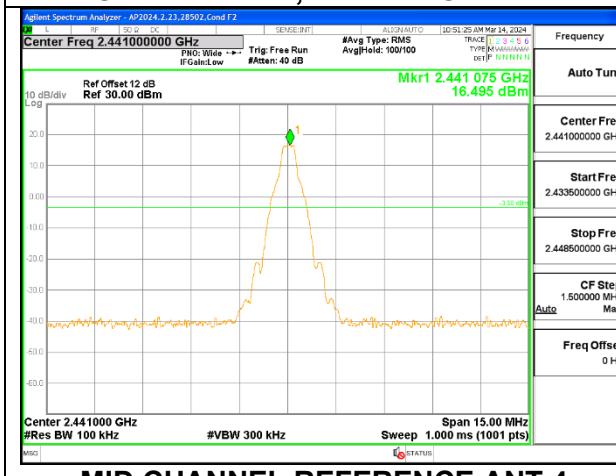
9.8.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

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

ANT 4

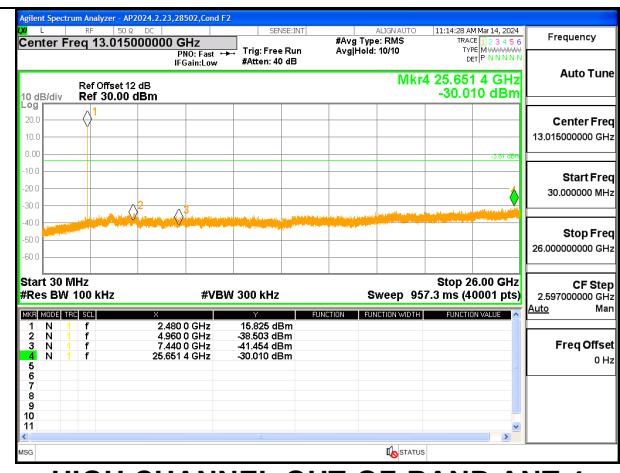
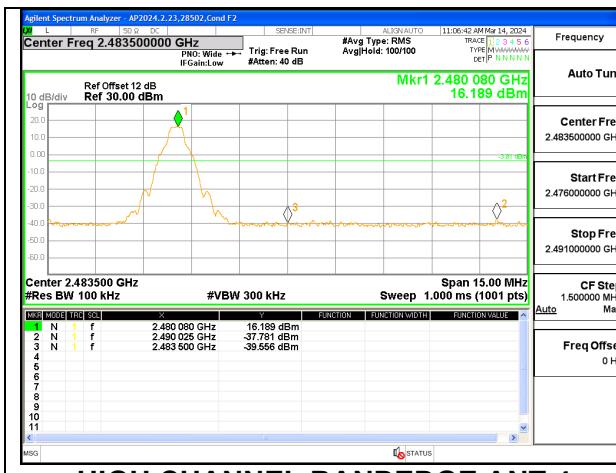


LOW CHANNEL, BANDEdge ANT 4



MID CHANNEL REFERENCE ANT 4

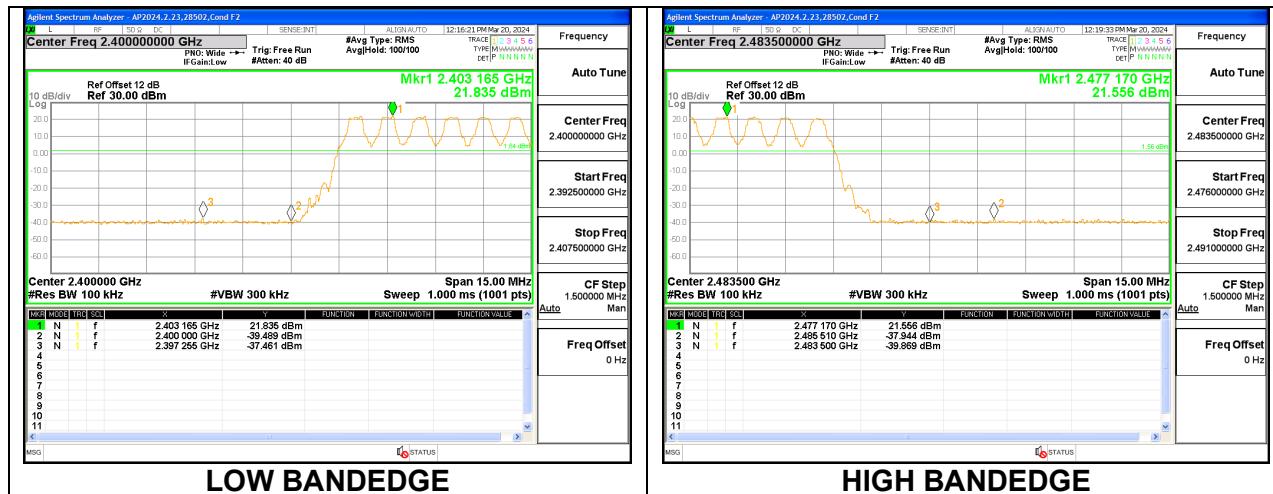
LOW CHANNEL OUT-OF-BAND ANT 4



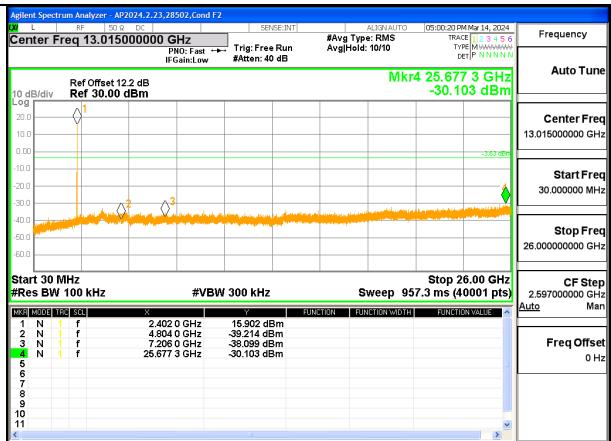
HIGH CHANNEL BANDEdge ANT 4

HIGH CHANNEL OUT-OF-BAND ANT 4

ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

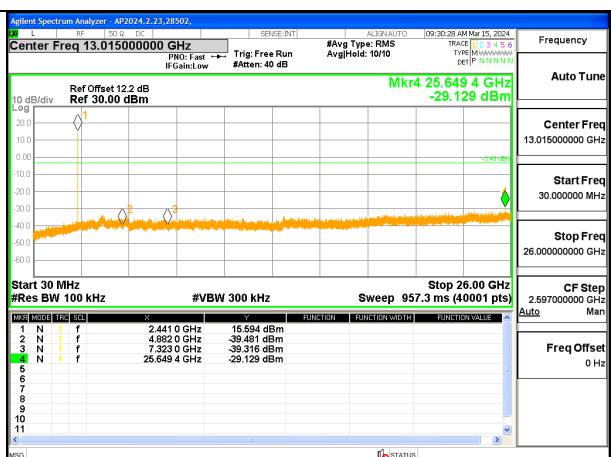
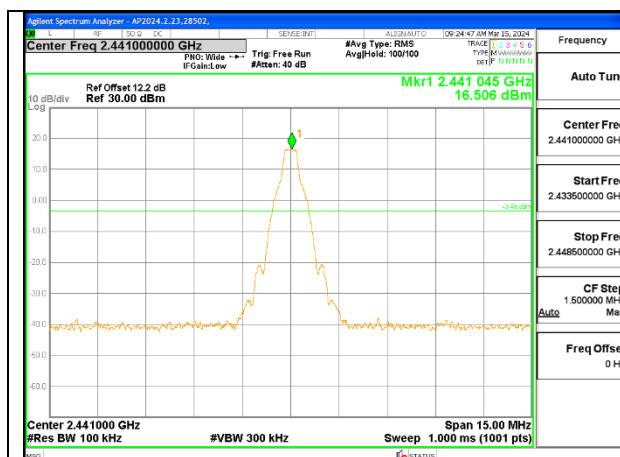


ANT 3



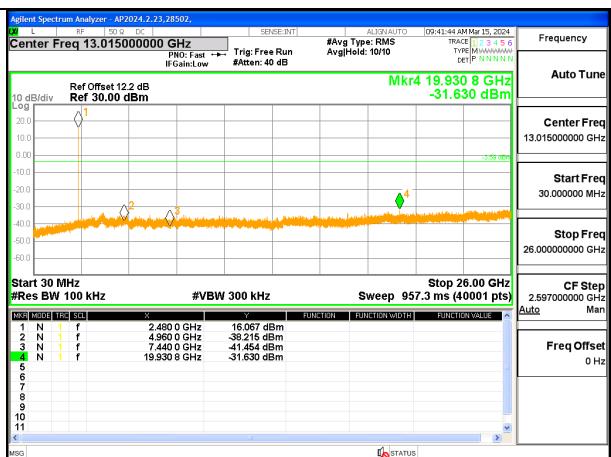
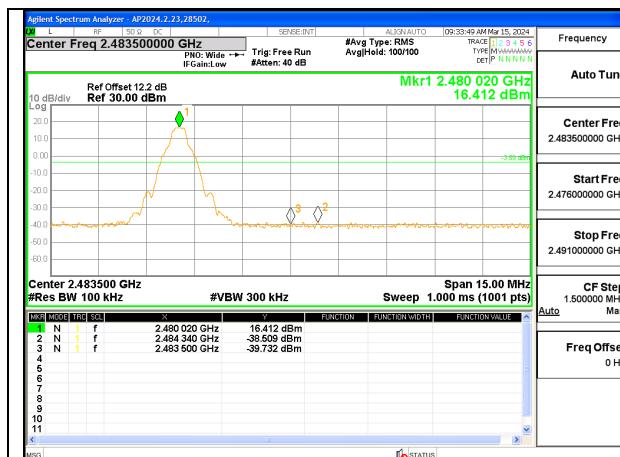
LOW CHANNEL, BANDEDGE ANT 3

LOW CHANNEL OUT-OF-BAND ANT 3



MID CHANNEL REFERENCE ANT 3

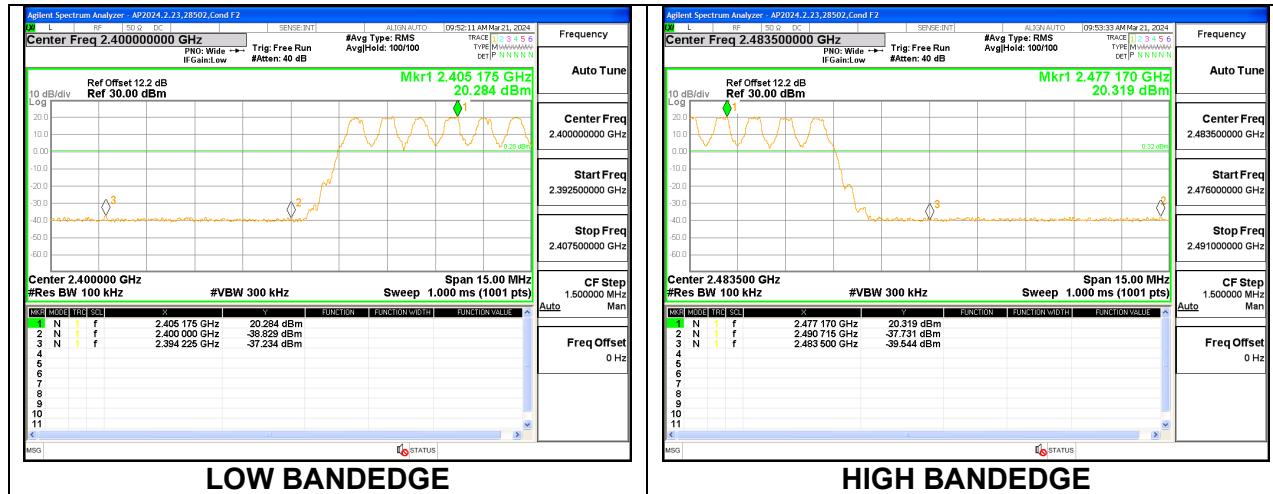
MID CHANNEL OUT-OF-BAND ANT 3



HIGH CHANNEL BANDEDGE ANT 3

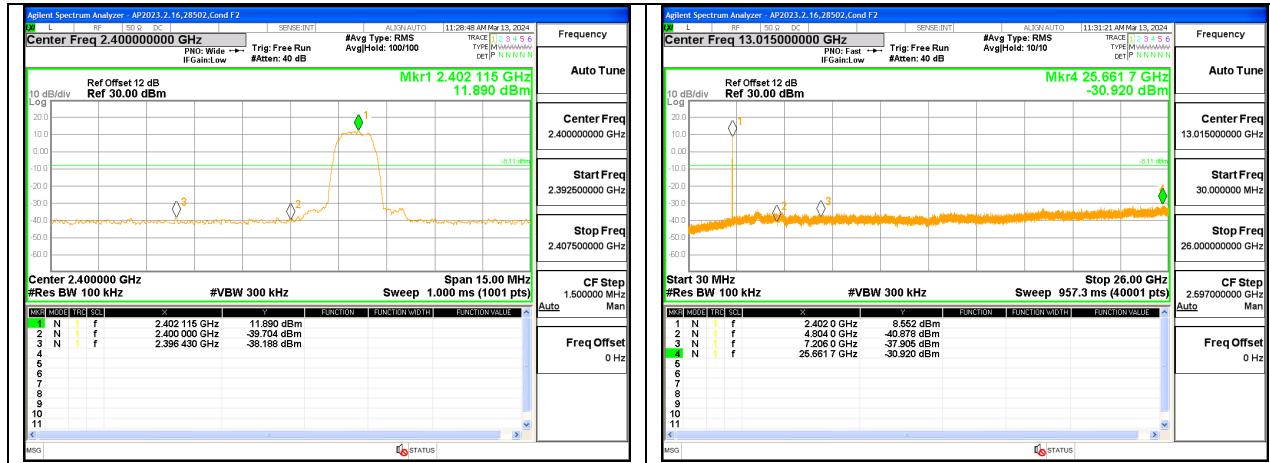
HIGH CHANNEL OUT-OF-BAND ANT 3

ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

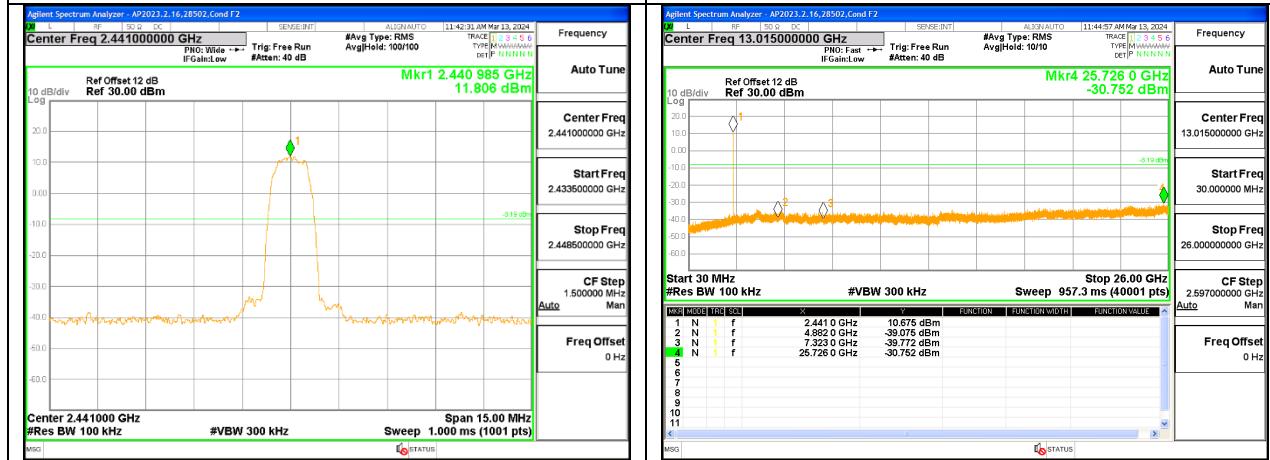


9.8.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

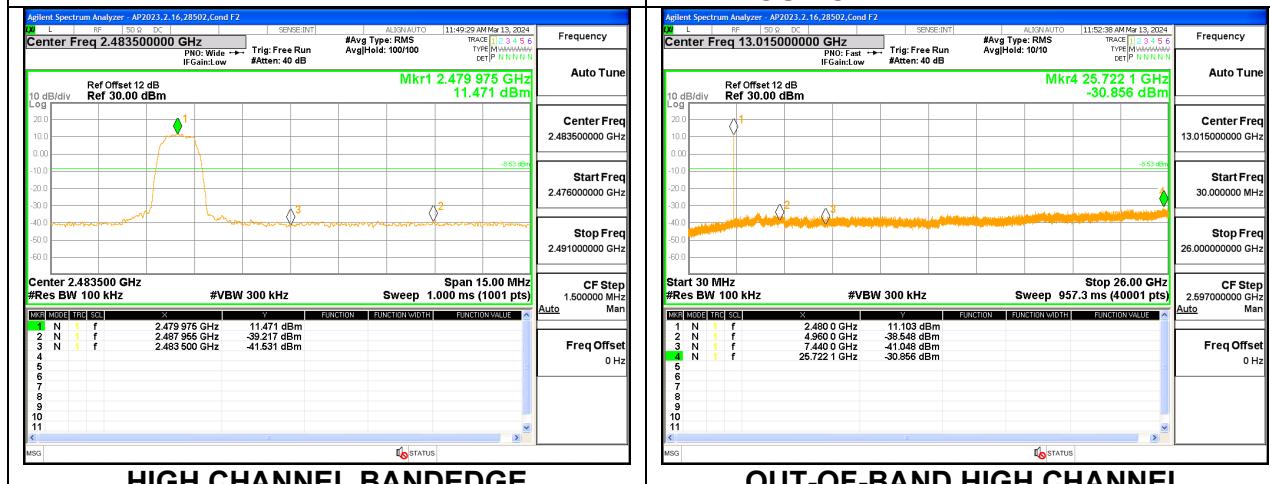
ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



LOW CHANNEL BANDEDGE

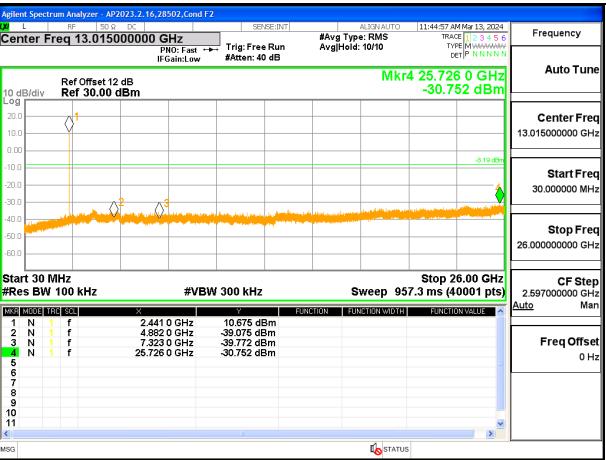


IN-BAND REFERENCE LEVEL

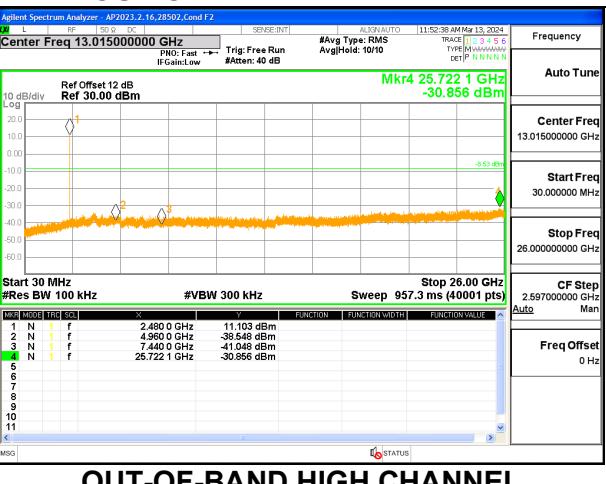


HIGH CHANNEL BANDEDGE

OUT-OF-BAND LOW CHANNEL

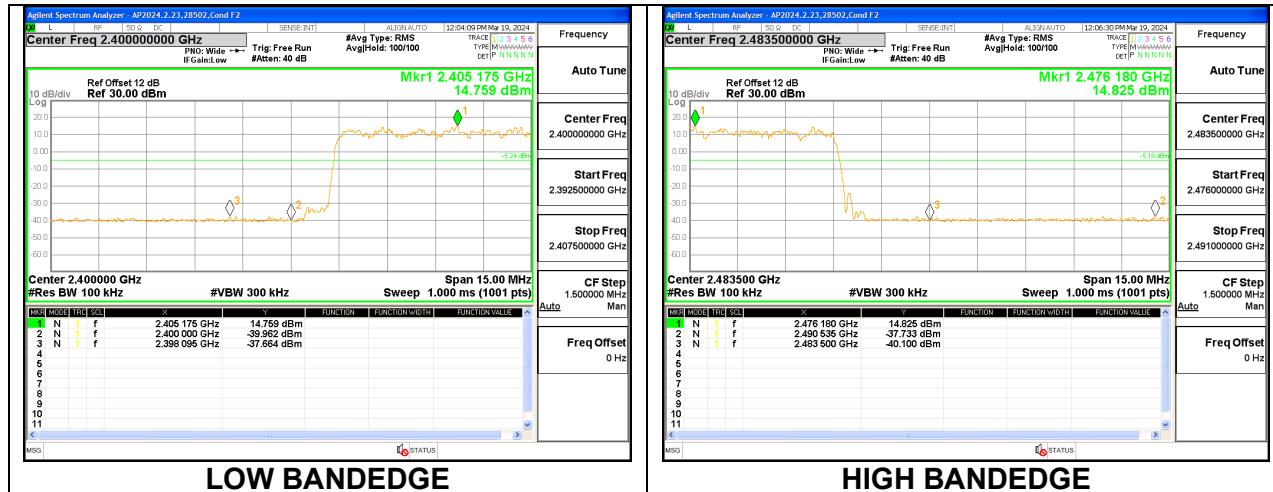


OUT-OF-BAND MID CHANNEL

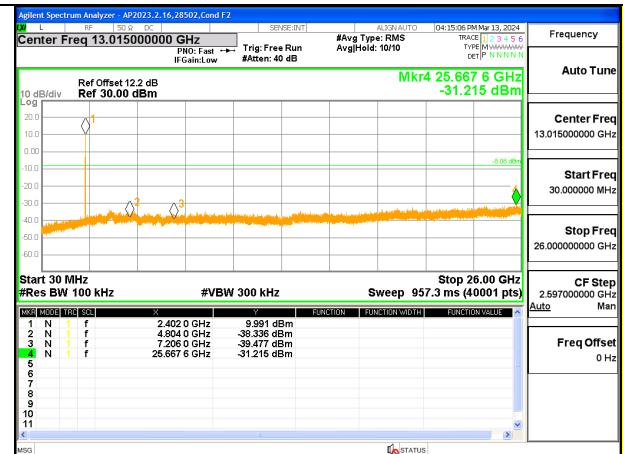
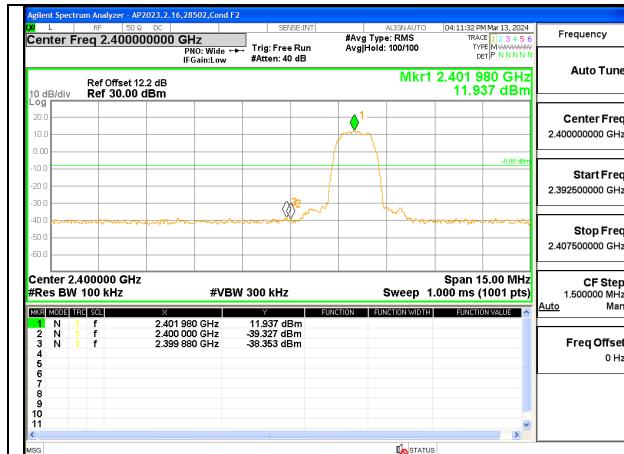


OUT-OF-BAND HIGH CHANNEL

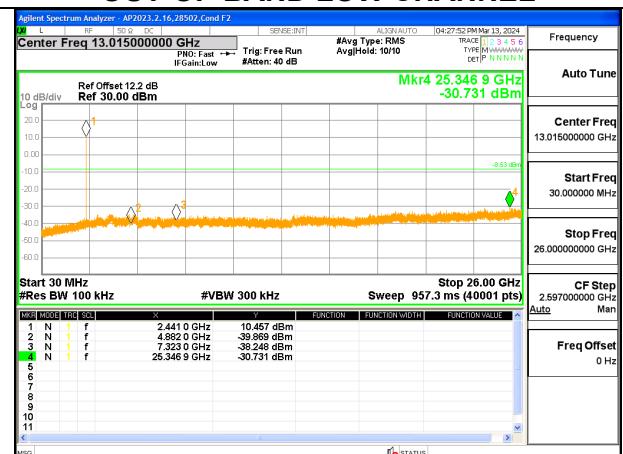
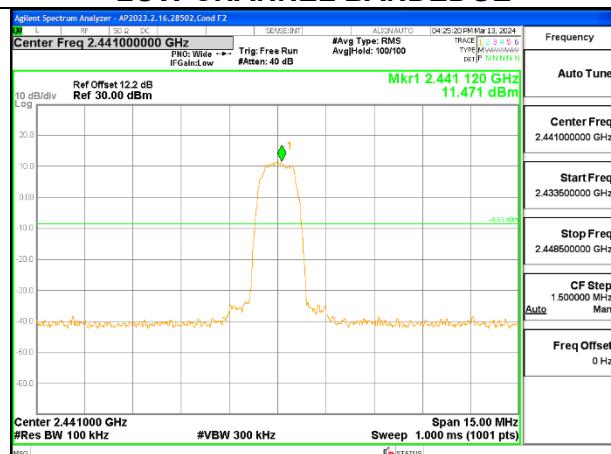
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



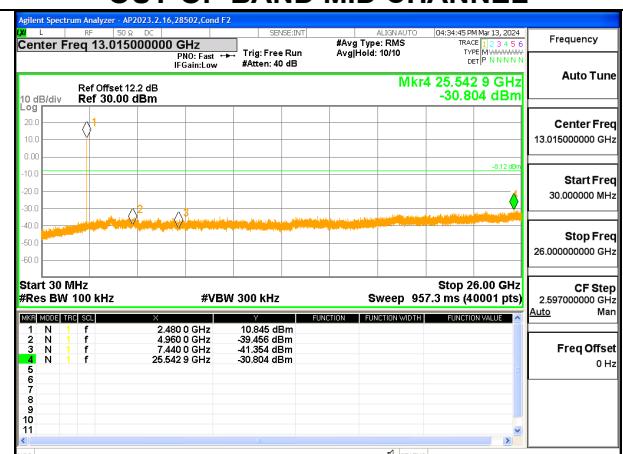
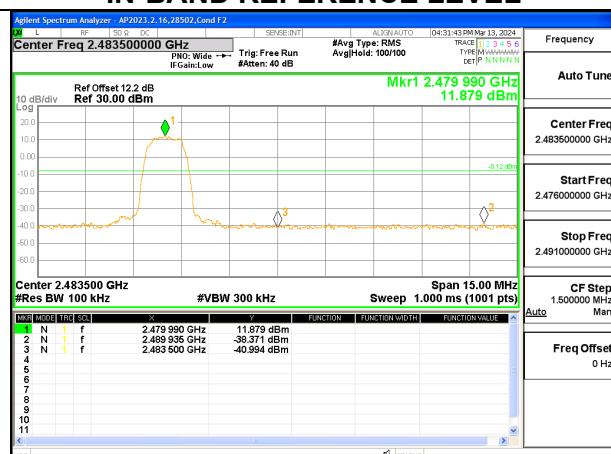
ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



LOW CHANNEL BANDEDGE



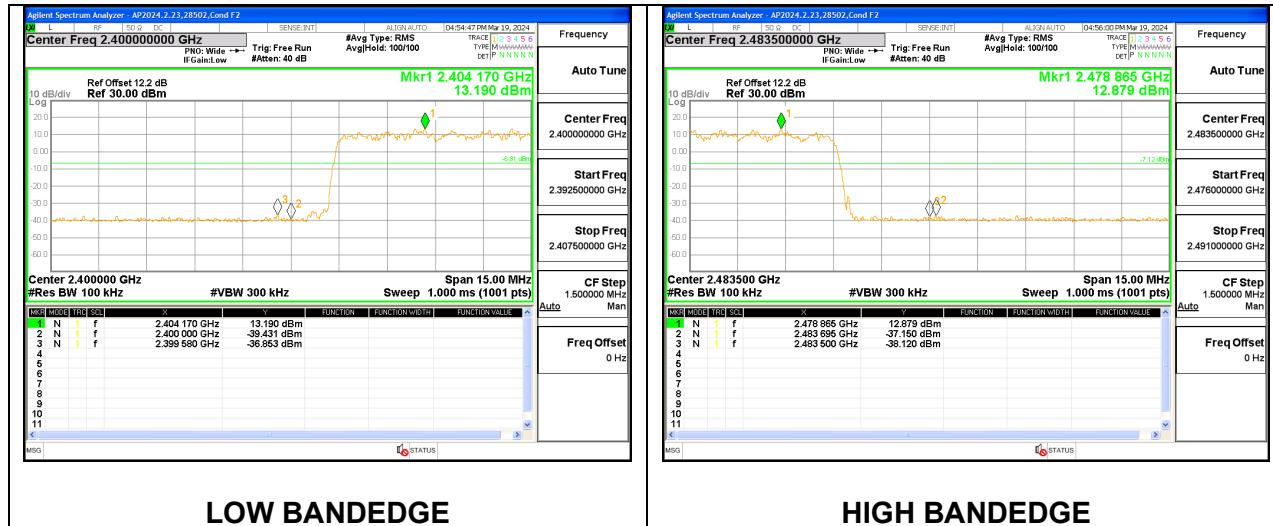
IN-BAND REFERENCE LEVEL



HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

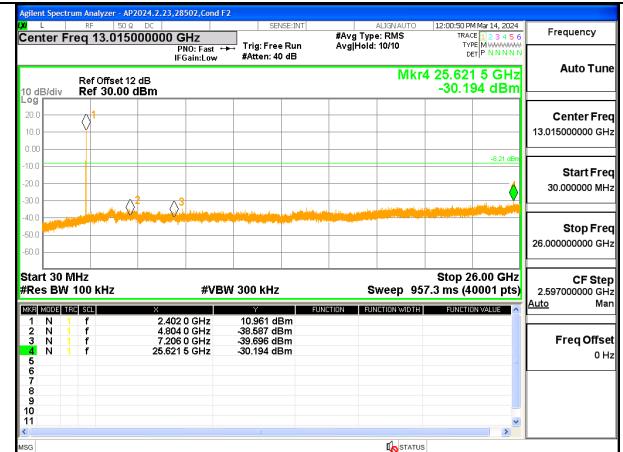
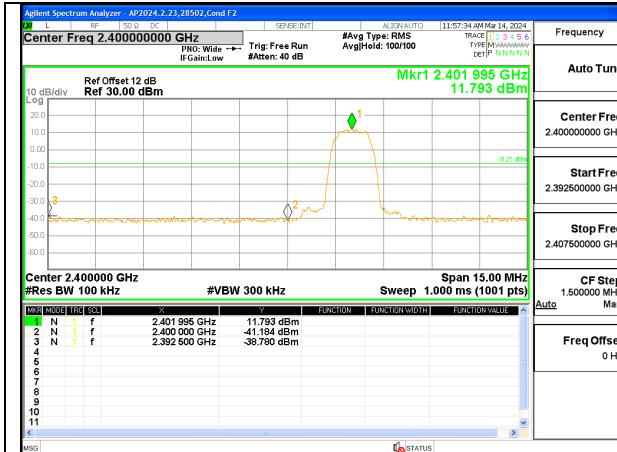
ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



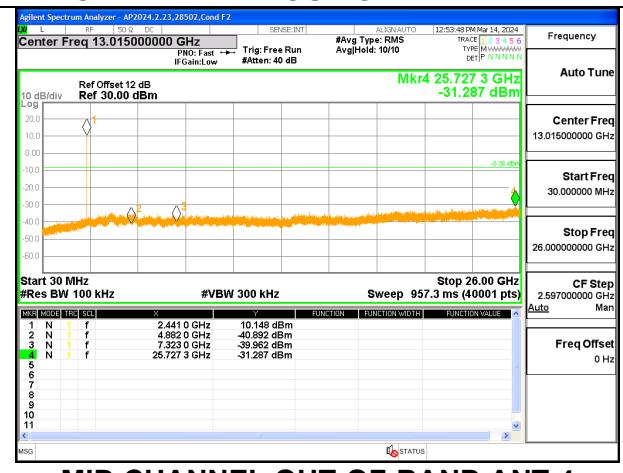
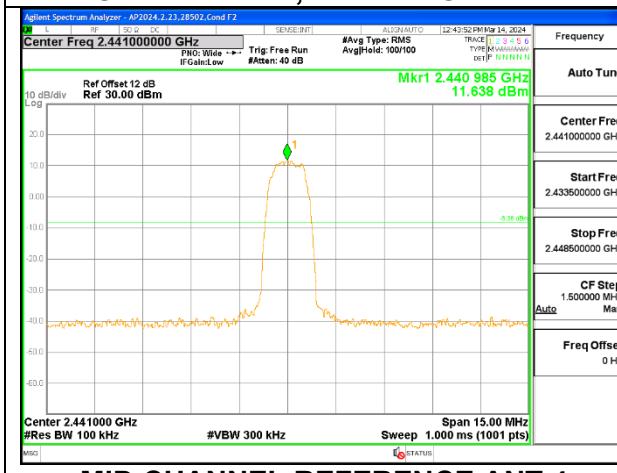
9.8.4. HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION

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

ANT 4

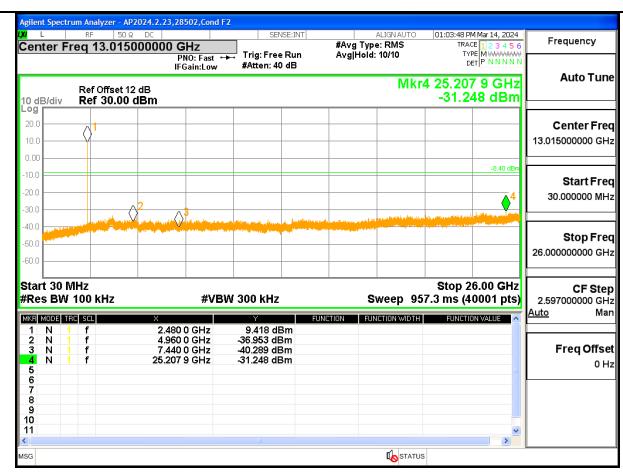
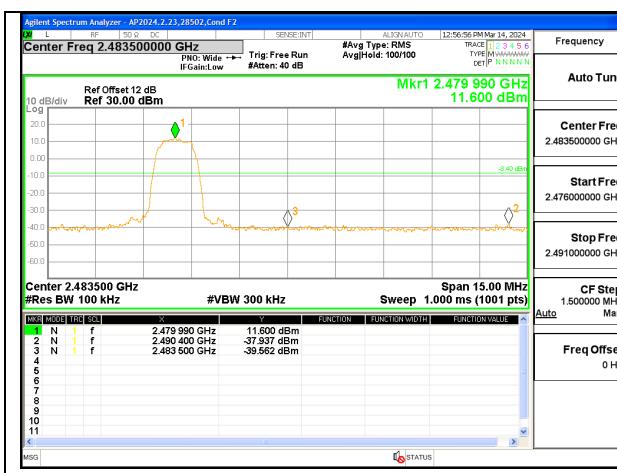


LOW CHANNEL, BANDEDGE ANT 4



MID CHANNEL REFERENCE ANT 4

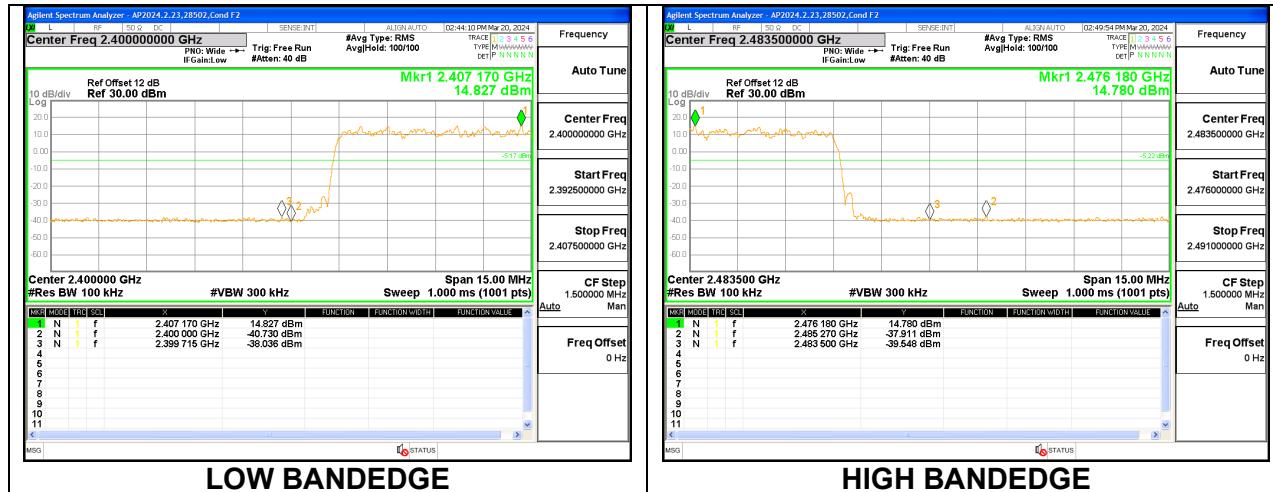
MID CHANNEL OUT-OF-BAND ANT 4



STATUS

HIGH CHANNEL OUT-OF-BAND ANT 4

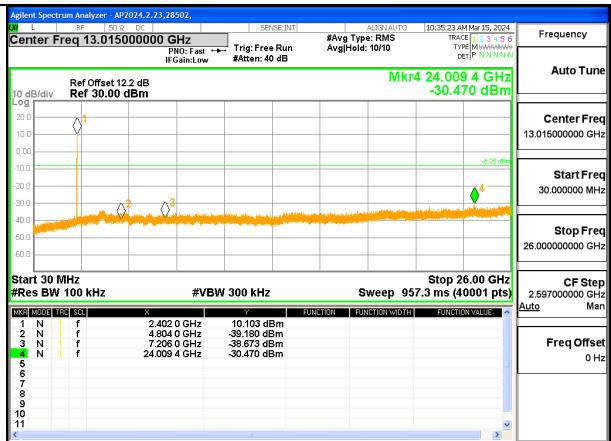
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



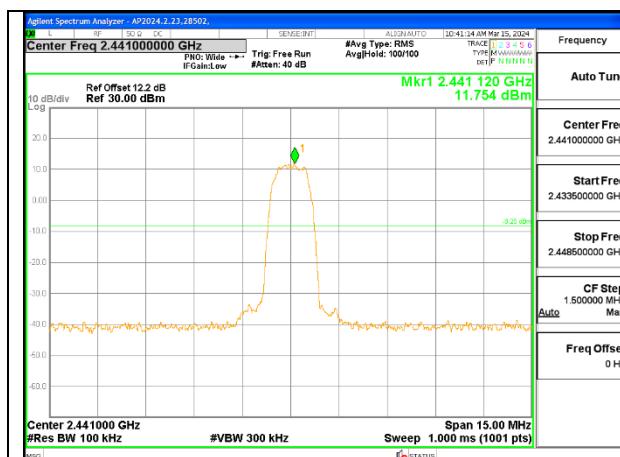
ANT 3



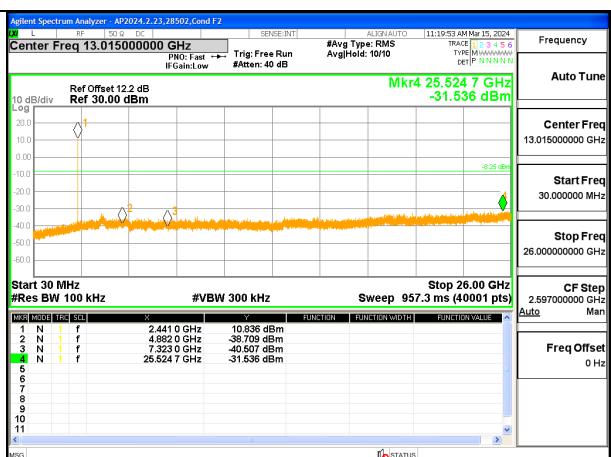
LOW CHANNEL, BANDEDGE ANT 3



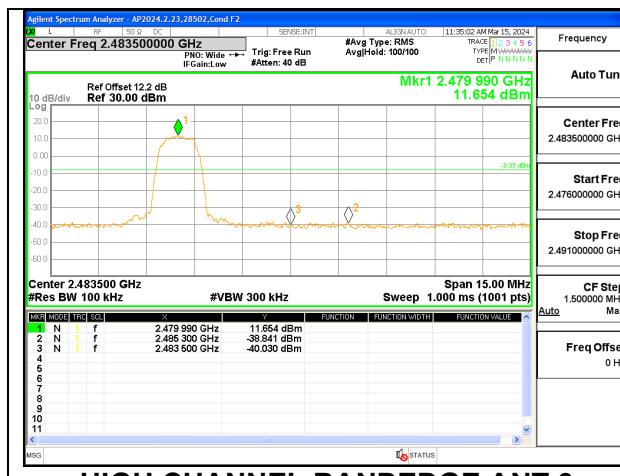
LOW CHANNEL OUT-OF-BAND ANT 3



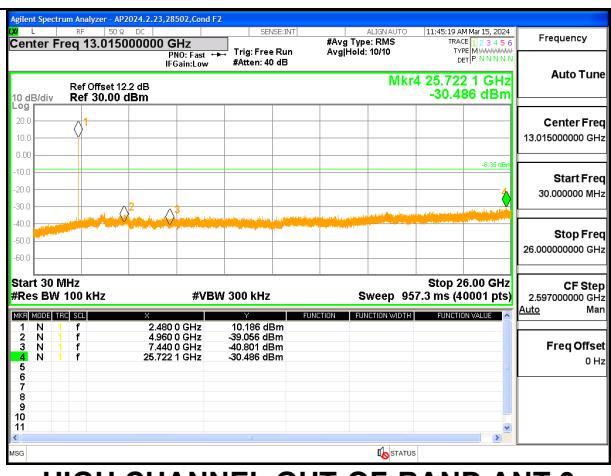
MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3



HIGH CHANNEL BANDEDGE ANT 3



HIGH CHANNEL OUT-OF-BAND ANT 3

ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

