

TEST REPORT

Report Number: 16064952-E1V2

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

Model : A3447 (Parent)
A3719, A3720, A3721 (Variants)

Brand : APPLE

FCC ID : BCG-E9188A (Parent)
BCG-E9198A, BCG-E9203A, BCG-E9204A (Variants)

IC : 579C-E9188A (Parent)
579C-E9198A, 579C-E9203A, 579C-E9204A (Variants)

EUT Description : SMARTPHONE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 4
ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue:
2026-07-11

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2026-07-07	Initial Issue	--
V2	2026-07-11	Addressed TCB Questions: Sections 3, 8.3, 8.4, 9	Chris Xiong

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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	A3447 (Parent) A3719, A3720, A3721 (Variants)
Brand	APPLE
FCC ID	BCG-E9188A (Parent) BCG-E9198A, BCG-E9203A, BCG-E9204A (Variants)
IC	579C-E9188A (Parent) 579C-E9198A, 579C-E9203A, 579C-E9204A (Variants)
EUT Description	SMARTPHONE
Serial Number	C07HPF000800000ZYA, C07HTH000DS0001B59 (Conducted) K2DLVM4C2D, J0C02TN797 (Radiated)
Sample Receipt Date	2026-02-17
Date Tested	2026-02-18 to 2025-07-11
Applicable Standards	FCC 47 CFR Part 15 Subpart C ISED RSS-247 Issue 4 ISED RSS-GEN Issue 5 + A1 + A2
Test Results	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 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 taken into account 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 duly 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.	
Approved & Released By: 	Prepared & Reviewed By: 
Frank Ibrahim Staff Engineer UL Verification Services Inc.	Chris Xiong Lab Supervisor UL Verification Services Inc.

2. TEST RESULTS SUMMARY

This report contains data provided by the customer, which can impact the validity of the results. UL Verification Services Inc. is only responsible for correctly integrating customer-provided data with measurements performed by UL Verification Services Inc.

Below is a list of the data provided by the customer:

1. Antenna gain and type (see Section 6.3)
2. Cable loss (see Section 6.3)

Requirement Description	Requirement Clause Number (FCC)	Requirement Clause Number (ISED)	Result
Duty Cycle	See Comment		Reporting purposes only
20dB BW / 99% OBW	N/A	RSS-GEN 6.7	Complies
Hopping Frequency Separation	15.247 (a)(1)	RSS-247 (6.2.1) (b)	Complies
Number of Hopping Channels	15.247 (a)(1)(iii)	RSS-247 (6.2.3.1) (b)	Complies
Average Time of Occupancy	15.247 (a)(1)(iii)	RSS-247 (6.2.3.1) (b)	Complies
Output Power	15.247 (a) (1) 15.247 (b) (1)	RSS-247 (6.2.3.1) RSS-247 (6.2.3.2)	Complies
Average Power	See Comment		Reporting purposes only
Conducted Spurious Emissions	15.247 (d)	RSS-247 (6.6)	Complies
Radiated Emissions	15.209, 15.205	RSS-GEN 8.9, 8.10	Complies
AC Mains Conducted Emissions	15.207	RSS-Gen 8.8	Complies

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with:

- FCC 47 CFR Part 2
- FCC 47 CFR Part 15C
- KDB 558074 D01 15.247 Meas Guidance
- KDB 414788 D01 Radiated Test Site
- KDB 662911 D01 Multiple Transmitter Output
- KDB 484596 D01 Referencing Test Data
- RSS-GEN Issue 5 + A1 + A2
- RSS-247 Issue 4
- ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

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
☒	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA			
☐	Building 3: 843 Auburn Court, Fremont, CA 94538, USA			
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA			
☒	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 regularly, with a maximum time between calibrations of one year or the manufacturer's 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 dB
Time Domain Measurements Using SA	3.39 %
RF Power Measurement Direct Method Using Power Meter	0.450 dB (Average) 1.30 dB (Peak)
Radio Frequency (Spectrum Analyzer)	141.16 Hz
Occupied Bandwidth	1.22 %
Carrier Frequency Separation	19.70 Hz
Number of Hopping Frequencies	0.000 dB
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%.

5.4. 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 dBuV + 18.7 dB/m + 0.6 dB - 26.9 dB = 28.9 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 dBuV + 0 dB + 10.1 dB + 0 dB = 46.6 dBuV

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The Apple iPhone is a smartphone (foldable) with cellular GSM, GPRS, EGPRS, WCDMA, LTE, 5G NR1, 5G NR2, 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), Wireless Power Transfer (WPT) and Mobile Satellite Service (MSS) technologies. The rechargeable battery is not user accessible. It can be operated in two unique operating states – phone “fully closed” (State A) and phone “fully open” (State B).

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Antenna	Configuration	Output Power (dBm)	Output Power (mW)
2402 - 2480	BDR (GFSK)	ANT 4	High Power	20.11	102.57
		ANT 3	High Power	20.13	103.04
		BF, ANT 4 + ANT 3	High Power	20.15	103.51
2402 - 2480	EDR (DQPSK)	ANT 4	High Power	19.11	81.47
		ANT 3	High Power	19.01	79.62
		BF, ANT 4 + ANT 3	High Power	19.05	80.35
2402 - 2480	EDR (8PSK)	ANT 4	High Power	19.24	83.95
		ANT 3	High Power	19.24	83.95
		BF, ANT 4 + ANT 3	High Power	19.22	83.56
2402 - 2480	BTCSM2	ANT 4	High Power	20.14	103.28
		ANT 3	High Power	20.08	101.86

6.3. DESCRIPTION OF AVAILABLE ANTENNAS AND CABLE LOSS

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

Frequency Range (GHz)	Antenna Type	Configuration	Antenna Peak Gain				Cable Loss	
			ANT 4 (dBi)	ANT 3 (dBi)	Uncorrelated Chains (dBi)	Correlated Chains (dBi)	ANT 4 (dB)	ANT 3 (dB)
2.4	IFA	STATE A	-4.40	-4.30	-5.20	-2.20	3.15	3.03
		STATE B	-3.40	-3.60	-3.70	-0.70	3.15	3.03

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 installed during testing was 24A343.

6.5. WORST-CASE CONFIGURATION AND MODE

The EUT was evaluated in two configurations: State A (fully closed) and State B (fully open), and in three orthogonal orientations: X (Flatbed), Y (Landscape), and Z (Portrait). The table below identifies the worst-case orientation for each configuration, and full testing was conducted in those orientations.

Band	State	ANT 4	ANT 3	ANT 4 + 3
2.4 GHz	A	X (Flatbed)	Z (Landscape)	X (Flatbed)
	B	X (Flatbed)	Y (Landscape)	Y (Landscape)

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

Radiated emissions below 30MHz, below 1 GHz, 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 1 GHz tests, EUT was connected to AC power adapter as the worst case; and for above 1 GHz, 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.

All simultaneous transmission combinations have been investigated, and no signal emissions were observed.

BDR (GFSK), EDR (DQPSK), EDR (8PSK), and BTCSM2 average power levels were evaluated. BDR (GFSK), EDR (8PSK), and BTCSM2 were identified as the worst-case modes. For average power data, please refer to Section 8.7.

The worst-case data rates, as provided by the client, are as follows:

Configuration	Mode	Data Rate
SISO	BDR (GFSK)	1 Mbps
	EDR (8PSK)	3 Mbps
	BTCSM2	2 Mbps
TXBF (MIMO)	BDR (GFSK)	1 Mbps
	EDR (8PSK)	3 Mbps

The plots presented in this report are representative of the test methods and parameter settings used during the evaluation.

The output power for ANT 4 and ANT 3 (SISO and TxBF) between State A and State B are identical. Both State A and B were evaluated, and no significant differences were observed between the two states for SISO and TxBF. Therefore only a single representative set of conducted test results is presented. Where applicable, the higher antenna gain of the two States has been used to assess compliance. However, due to variations in antenna gain between State A and State B, full radiated testing was performed for both states.

For AC line conducted emissions, radiated emissions below 1 GHz, and radiated emissions above 18 GHz, only the worst-case test results are included in this report.

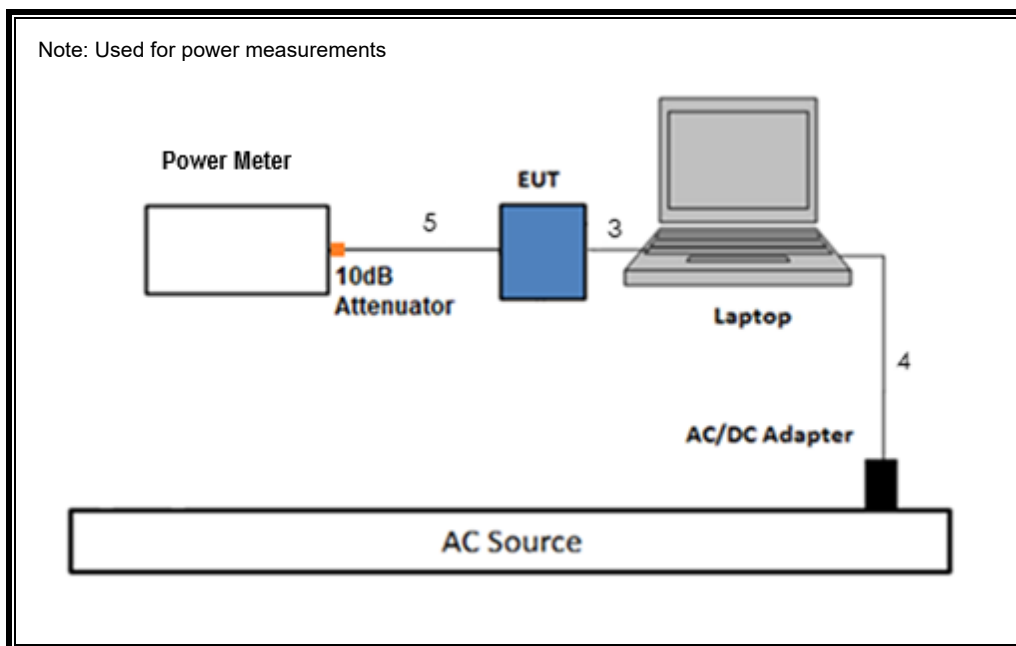
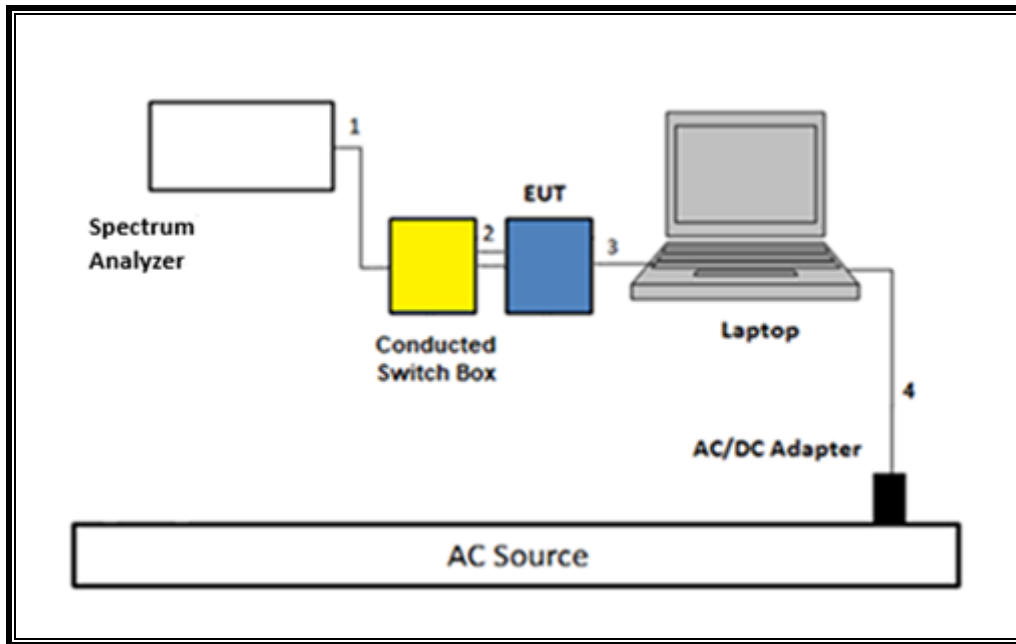
If the Keysight PXA supports both AC and DC coupling, a warning message stating "DC coupled" will appear on the status line.

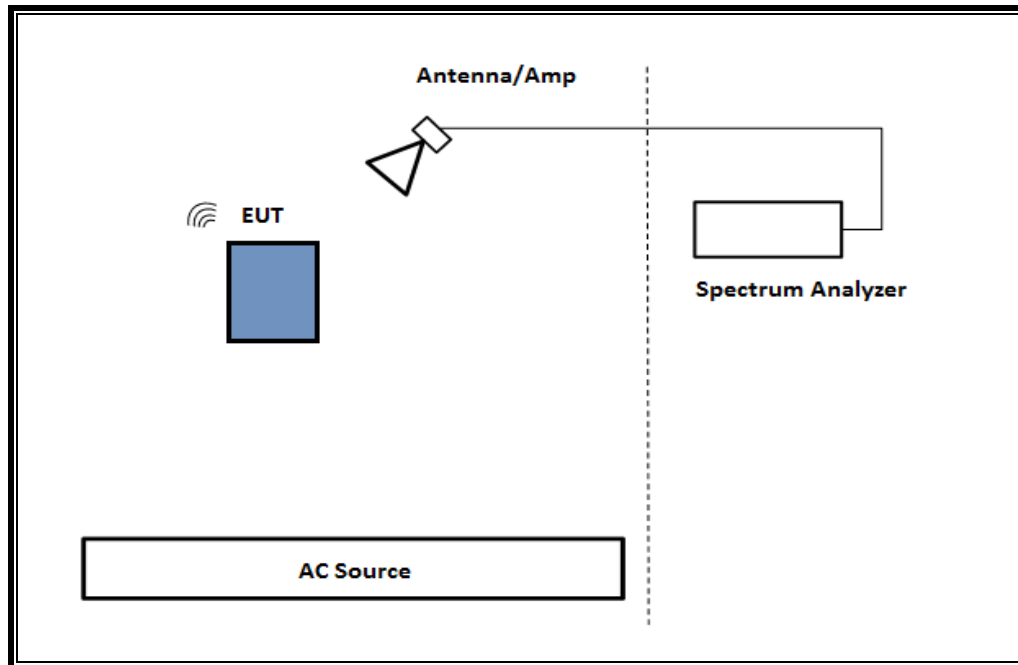
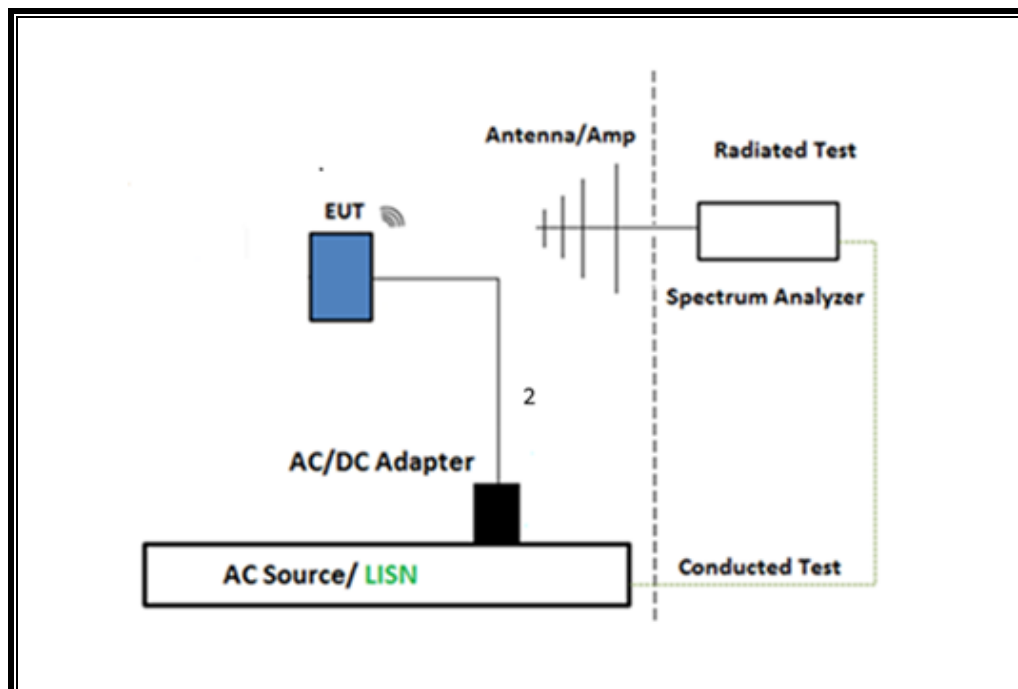
6.6. DESCRIPTION OF TEST SETUP

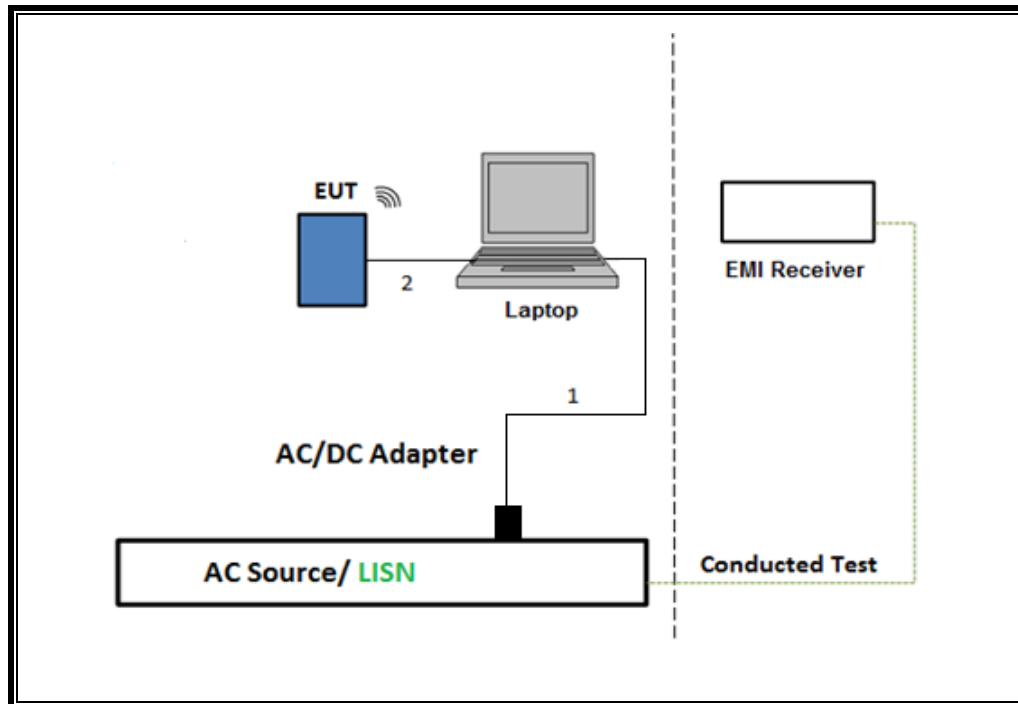
SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Macbook Pro		Apple	A2992	DVJJ642FYM		BCGA2992
96W USB-C Power Adapter		Apple	A2166	C4H238408ABPMOWAV		DoC
Conducted Switch Box		UL	CSB	235779		N/A
20W USB-C Power Adapter		Apple	A2305	C4H951600C3PF4F4U		DoC
10dB Fixed Attenuator		Pasternack Enterprises	PE7087-10	236360		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	0.2	To the spectrum Analyzer
2	Antenna	1	SMA	Shielded	0.2	EUT to Switchbox
3	USB	1	USB-C	Shielded	1.0	N/A
4	DC	1	DC	Shielded	2.0	N/A
5	Antenna	1	SMA	Shielded	0.1	EUT to Power Meter
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	DC	1	DC	Shielded	2.0	N/A
2	USB	1	USB-C	Shielded	1.0	N/A

TEST SETUP

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

SETUP DIAGRAM FOR CONDUCTED TESTS

SETUP DIAGRAM FOR RADIATED TESTS 1 GHz - 26 GHz**SETUP DIAGRAM FOR RADIATED TESTS 30 MHz - 1 GHz 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:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	ID Number	Cal Due
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	275999	2027-03-31
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200784	2027-03-31
Filter Box	UL-FR1	R103, 2 Amp, 12 Port	279299	2027-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	191428	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	226674	2027-03-31
Filter Box	UL-FR1	RATS 1.0, 2 Amp, 6 Port	250156	2026-10-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	169935	2027-03-31
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200897	2027-09-30
Filter Box	UL-FR1	R102, 1 Amp, 12 Port	230878	2027-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	230548	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200896	2027-03-31
* Filter Box	UL-FR1	Frankenstein, 1 Amp, 12 Port	216812	2026-06-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	223461	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	222741	2027-09-30
Filter Box	UL-FR1	Frankenstein, 1 Amp, 12 Port	217521	2026-09-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201499	2027-03-30
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	80430	2027-09-30
Filter Box	UL-FR1	Frankenstein, 2 Amp, 12 Port	224478	2027-01-31
Antenna, Horn 18 to 26.5GHz	A.R.A.	MWH-1826/B	172354	2027-05-31
RF Amplifier Assembly, 18-26.5GHz, 60dB Gain	AMPLICAL	AMP18G26.5-60	221832	2027-04-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201500	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200785	2026-12-31
Filter Box	UL-FR1	R103 2Amp 12Port	235088	2027-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	223460	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	80403	2027-07-31
Filter Box	UL-FR1	RATS 2.0, 1 Amp, 17 Port	236726	2026-09-30
Antenna, Broadband Hybrid, 30MHz-3GHz	Sunol Sciences Corp.	JB3	204045	2027-05-31
Amplifier 9 KHz - 1 GHz	SONOMA INSTRUMENT	310N	224489	2026-09-30
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO-METRICS	EM-6871	170014	2027-09-30
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO-METRICS	EM-6872	170016	2027-09-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201501	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	230300	2027-03-31
Filter Box	UL-FR1	RATS 2.0, 1 Amp, 17 Port	225474	2027-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	223459	2027-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	206805	2027-08-31
Filter Box	UL-FR1	RATS 2.0, 1 Amp, 17 Port	226780	2027-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	226079	2027-02-28
Antenna, Horn 18 to 26.5GHz	A.R.A.	MWH-1826/B	81139	2027-10-31
RF Amplifier Assembly, 18-26.5GHz, 60dB Gain	AMPLICAL	AMP18G26.5-60	220194	2027-06-30

* - Testing was completed prior to the calibration due date of the equipment.

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	ID Number	Cal Due
PXA Signal Analyzer 2Hz to 44GHz	Keysight Technologies Inc	N9030B	231912	2027-01-31
Conducted Switch Box	UL	CSB	187984	2027-01-31
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	85214	2027-01-31
Conducted Switch Box	UL	CSB	245783	2027-01-31
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	85313	2027-01-31
Conducted Switch Box	UL	CSB	235779	2027-01-31
P-Series Power Meter	Keysight Technologies Inc	N1912A-CFG003	259286	2027-01-31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90389	2027-01-31
P-Series Power Meter	Keysight Technologies Inc	N1911A	90731	2027-01-31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	257705	2027-01-31
** 10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236360	N/A (Verified)
** 10dB Fixed Attenuator	Pasternack Enterprises	PE7024-10	238180	N/A (Verified)

** - The equipment does not require calibration. Performance is verified prior to use in accordance with laboratory procedures.

AC LINE CONDUCTED				
Description	Manufacturer	Model	ID Num	Cal Due
EMI TEST RECEIVER	Rohde & Schwarz	ESCI7	82297	2027-02-28
LISN	Fischer Custom Communications	FCC-LISN-50/250-25-2-01-480V	175765	2027-01-31
Transient Limiter	TE	TBFL1	207996	2026-12-30

UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, Aug 15, 2025 Ver 9.5, Dec 15, 2025	
Conducted Software	UL	Station Tool	V2026.6.0	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, Aug 25, 2025	

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

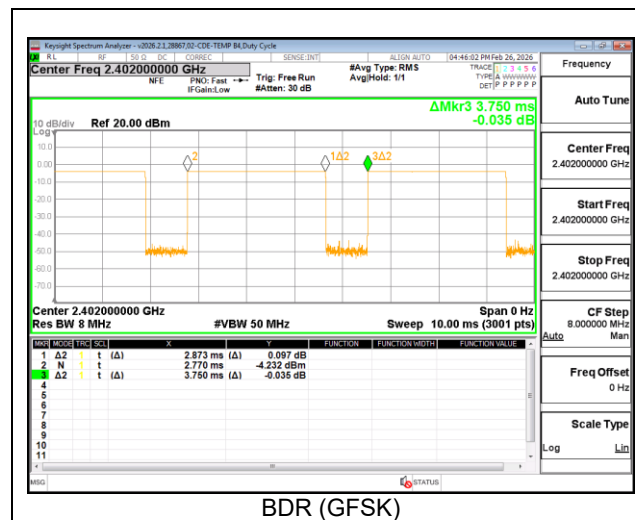
TEST PROCEDURE

ANSI C63.10, Subclause 11.6.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time T (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
BDR (GFSK)	2.873	3.750	0.766	76.6	1.16	0.348
EDR (8PSK)	2.740	3.750	0.731	73.1	1.36	0.365
BTCM2	0.042	0.415	0.100	10.0	9.99	24.096

Note: The duty cycle is identical for both 1TX and 2TX configurations.



8.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

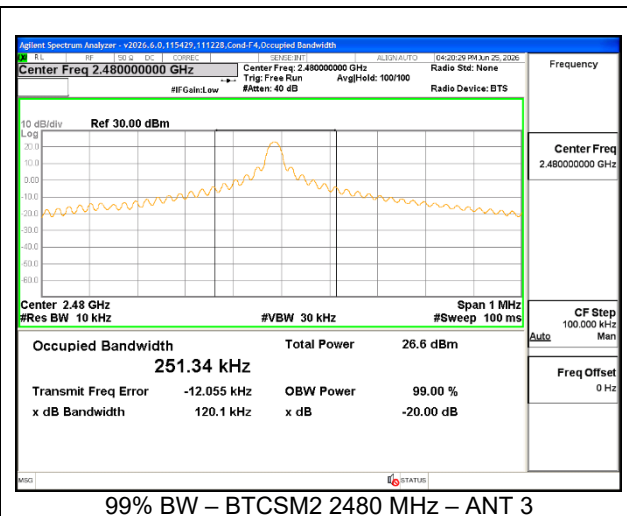
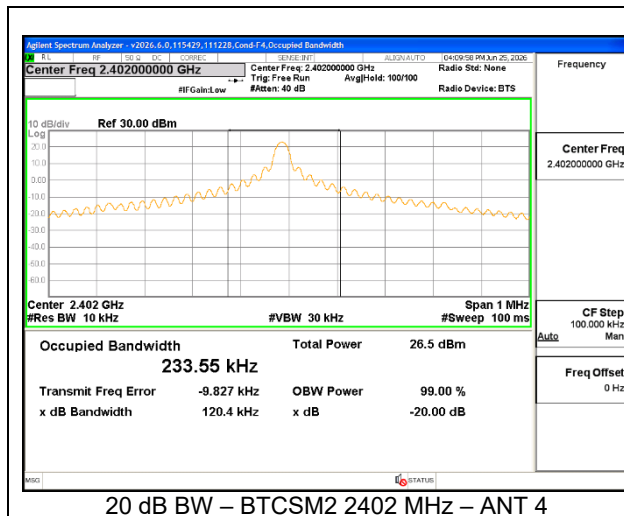
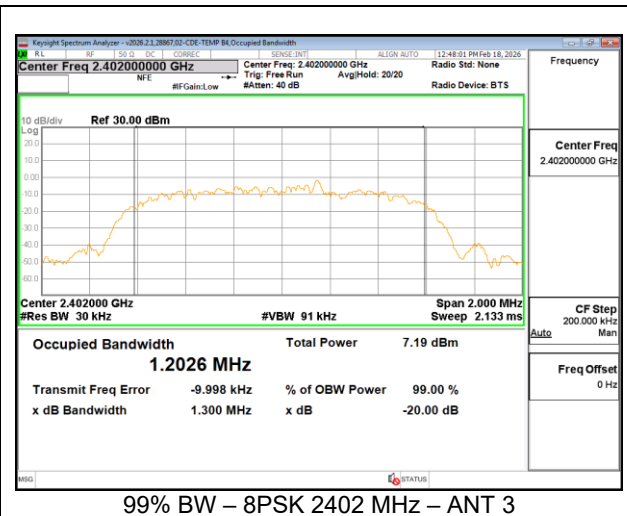
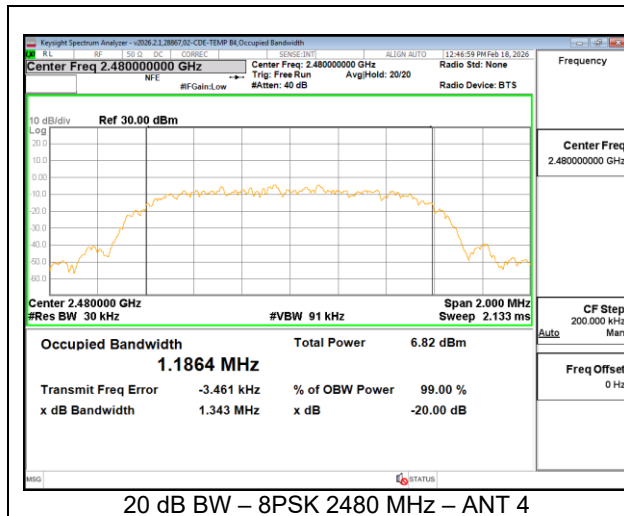
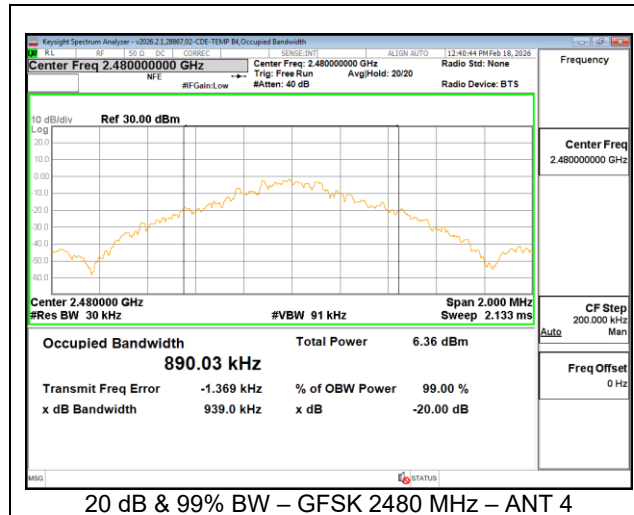
Occupied Bandwidth (20 dB): ANSI C63.10 Section 6.9.2

Occupied Bandwidth (99%): ANSI C63.10 Section 6.9.3

RESULTS

Both SISO and MIMO TXBF modes were evaluated, and no significant differences were observed. Accordingly, only the SISO high-power results are presented.

Mode (SISO)	Frequency (MHz)	Channel	20 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			ANT 4	ANT 3	ANT 4	ANT 3
BDR (GFSK)	2402	Low	0.8699	0.9296	0.83788	0.87179
	2441	Mid	0.9341	0.8711	0.87311	0.84006
	2480	High	0.9390	0.8649	0.89003	0.83688
EDR (8PSK)	2402	Low	1.2940	1.3000	1.19360	1.20260
	2441	Mid	1.3260	1.2970	1.19520	1.19110
	2480	High	1.3430	1.3430	1.18640	1.20110
BTCM2	2402	Low	0.1204	0.1201	0.23355	0.24266
	2441	Mid	0.1201	0.1200	0.23788	0.24563
	2480	High	0.1203	0.1201	0.24133	0.25134

WORST MAXIMUM PLOTS

8.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

RSS-247 (6.2.1) (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

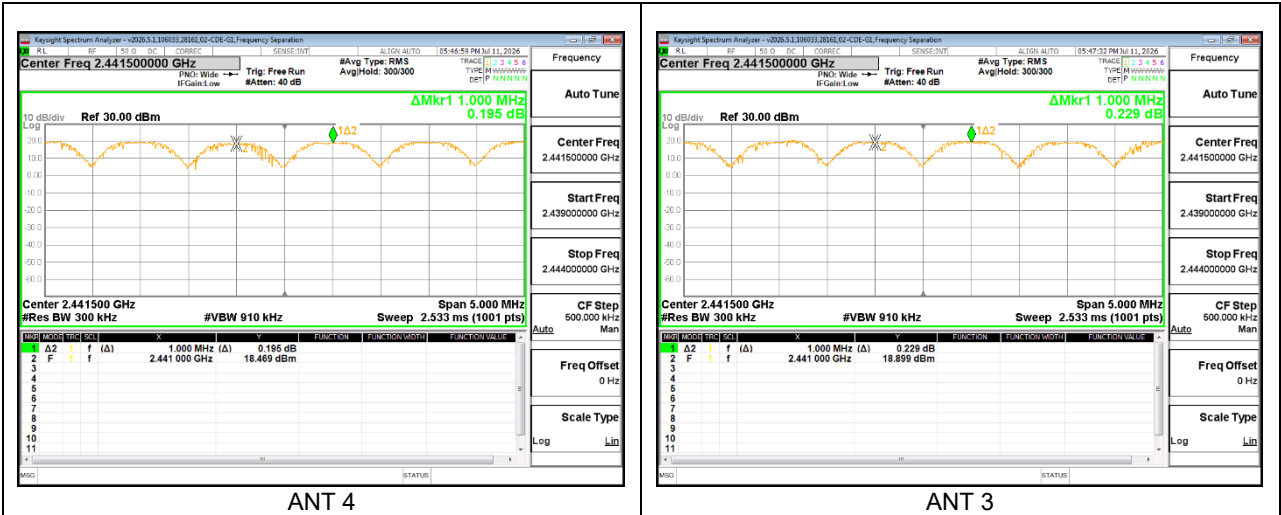
ANSI C63.10 Section 7.8.2

RESULTS

Mode	Hopping Frequency Separation (MHz)		Limit (MHz)		Power Limit
	ANT 4	ANT 3	Min 25 kHz or 20 dB BW	25 kHz or 2/3 of 20 dB BW	
GFSK	1.00	1.00	0.939	0.626	1W
8PSK	1.00	1.00	1.343	0.895	125mW
BTCSM2	1.00	1.00	0.125	0.083	1W

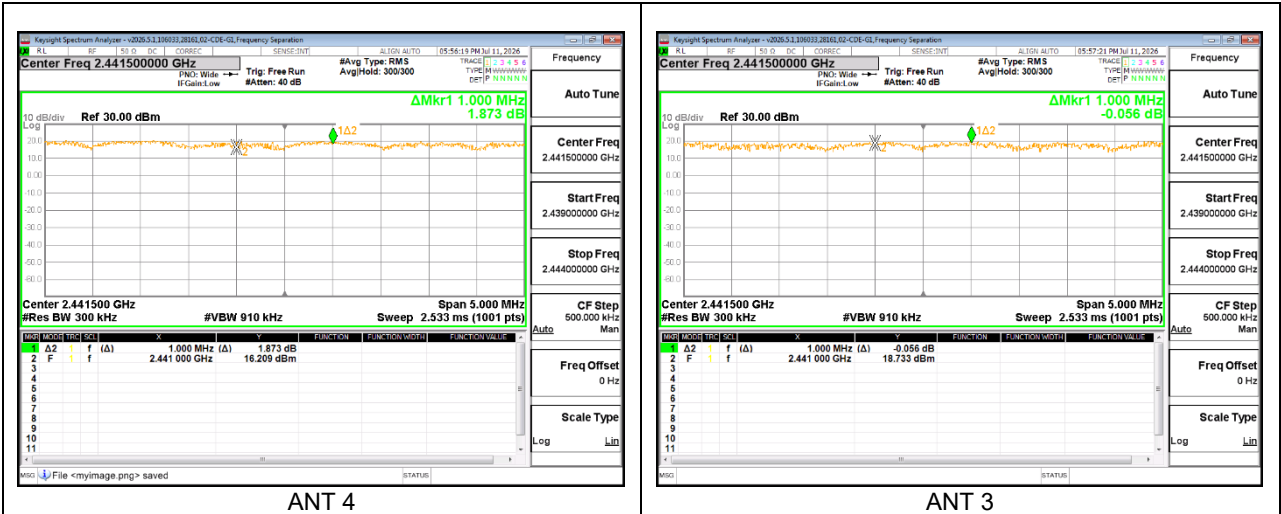
8.3.1. BDR (GFSK) – HIGH POWER

HOPPING FREQUENCY SEPARATION



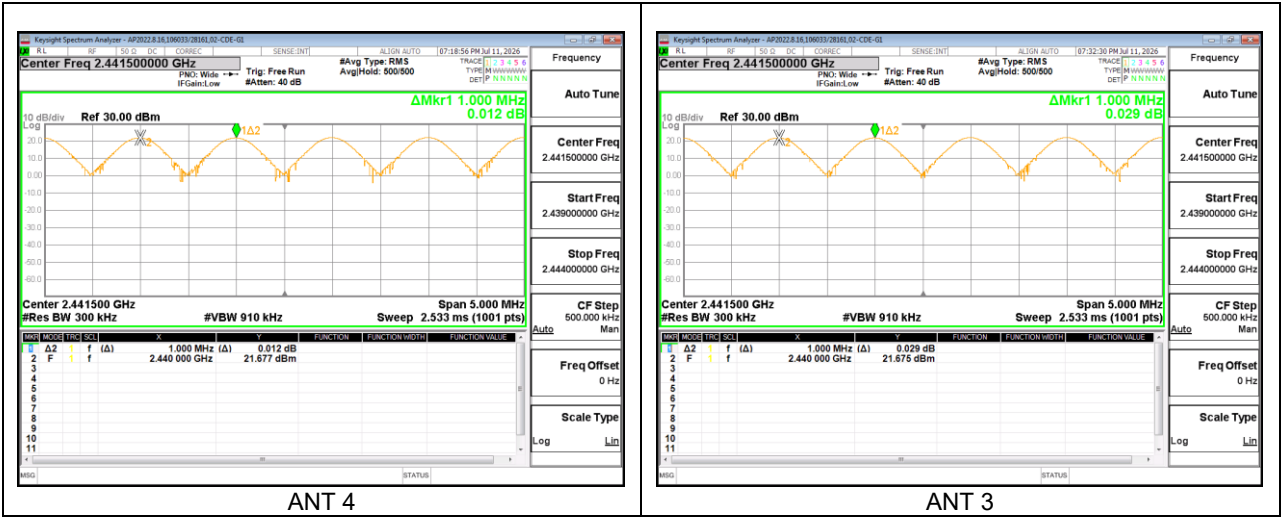
8.3.2. EDR (8PSK) – HIGH POWER

HOPPING FREQUENCY SEPARATION



8.3.3. BTCSM2 – HIGH POWER

HOPPING FREQUENCY SEPARATION



8.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (6.2.3.1) (b)

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

TEST PROCEDURE

ANSI C63.10 Section 7.8.3

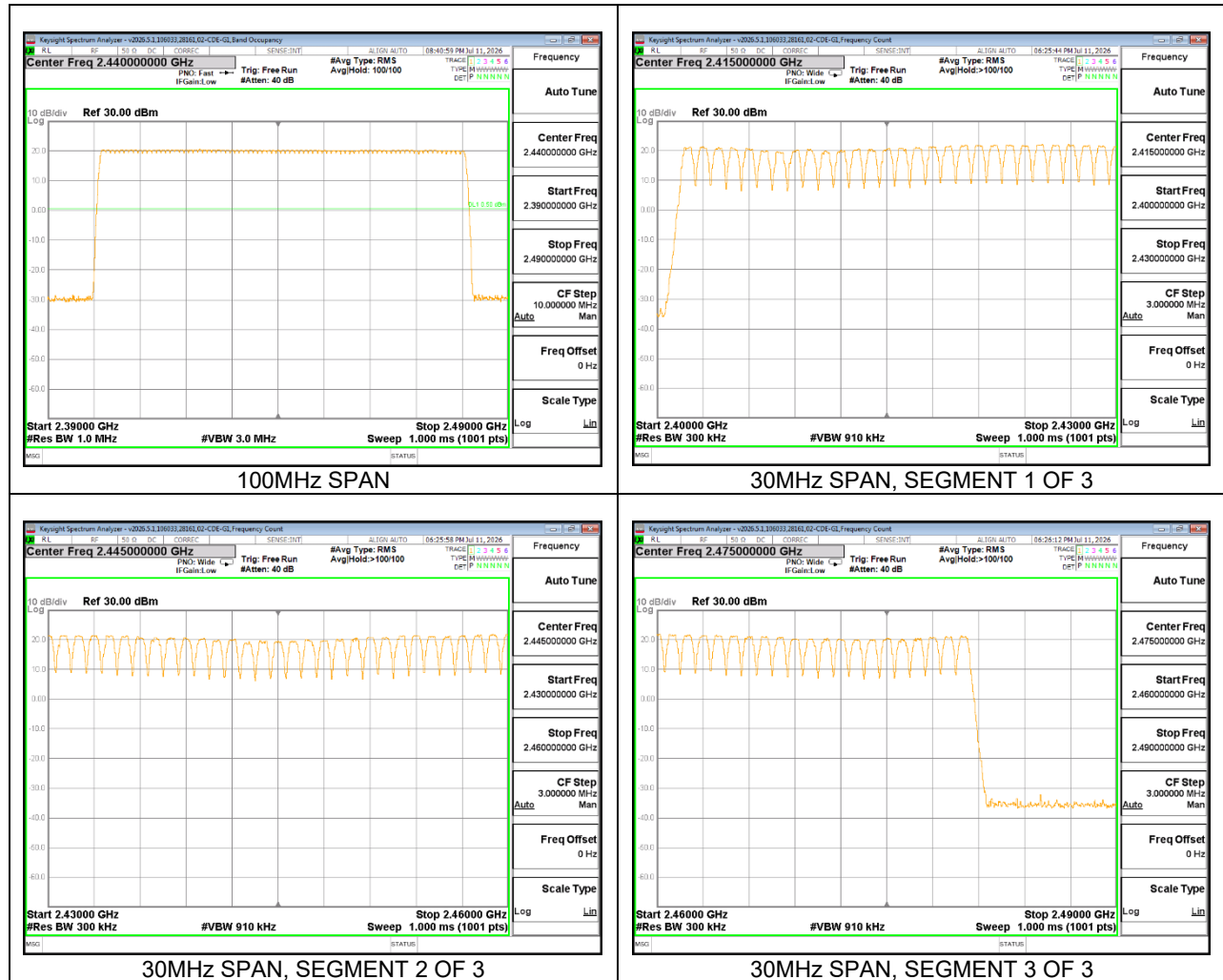
RESULTS

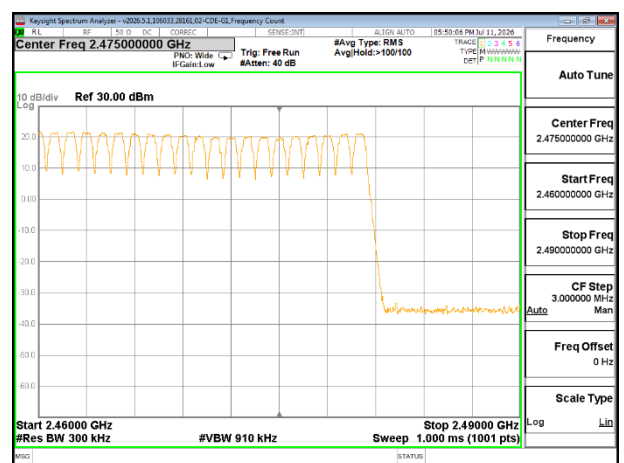
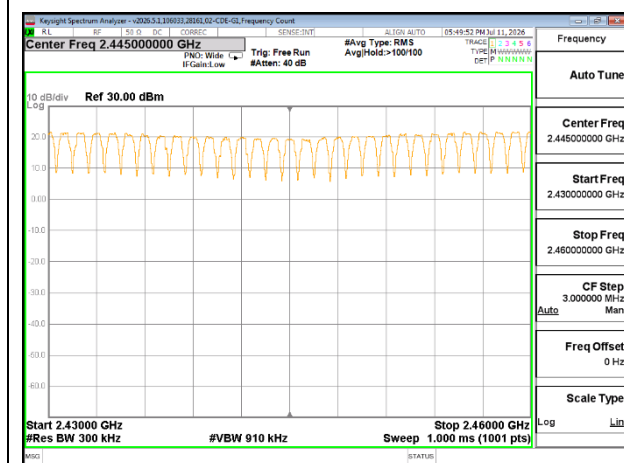
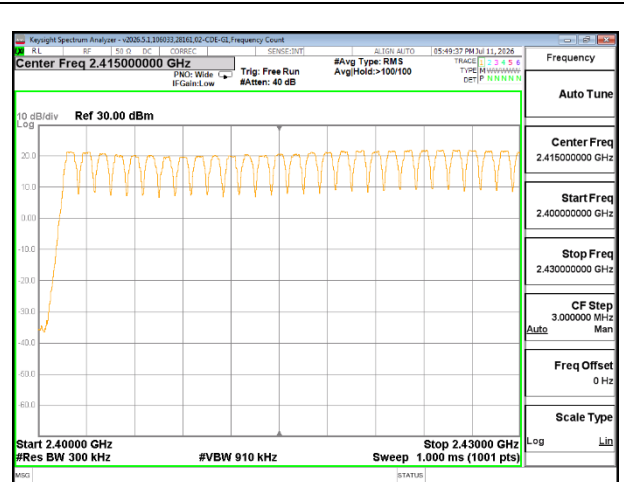
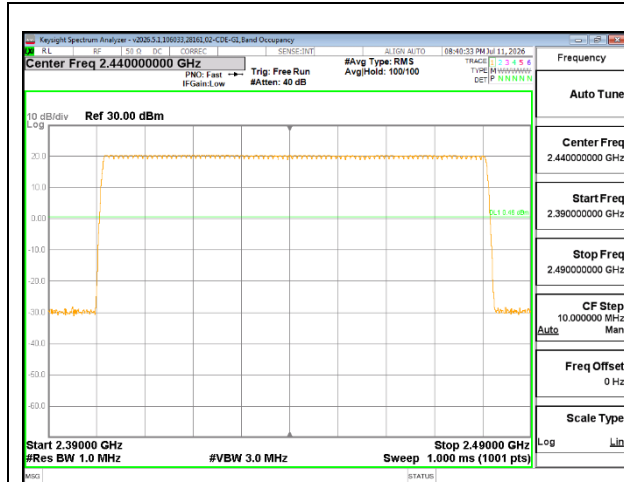
Normal Mode: 79 Channels Observed.

Note: Only the High-Power BDR (GFSK) mode results are reported, as EDR (QPSK/8PSK) utilizes the same channel plan.

8.4.1. BDR (GFSK) – HIGH POWER

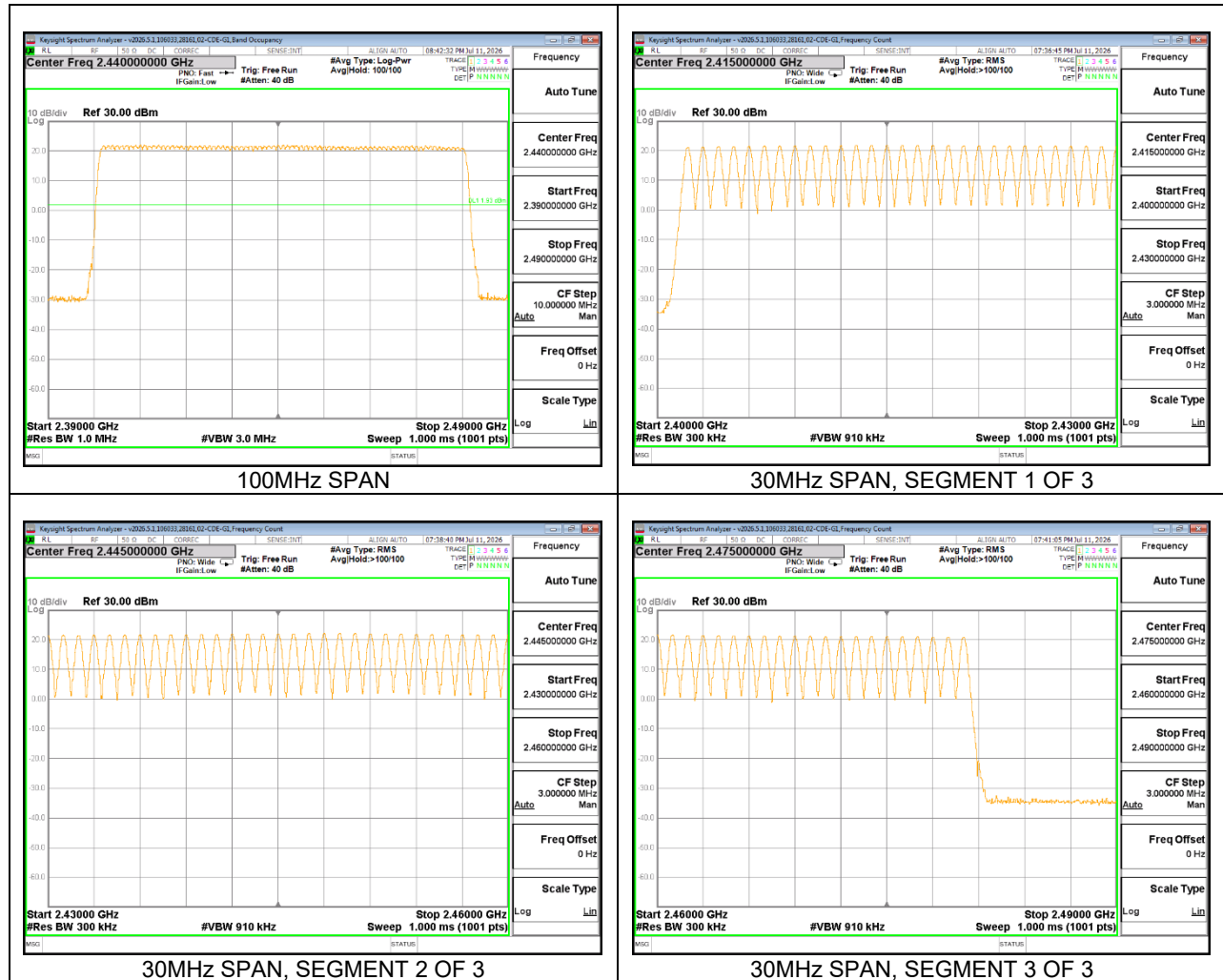
ANT 4

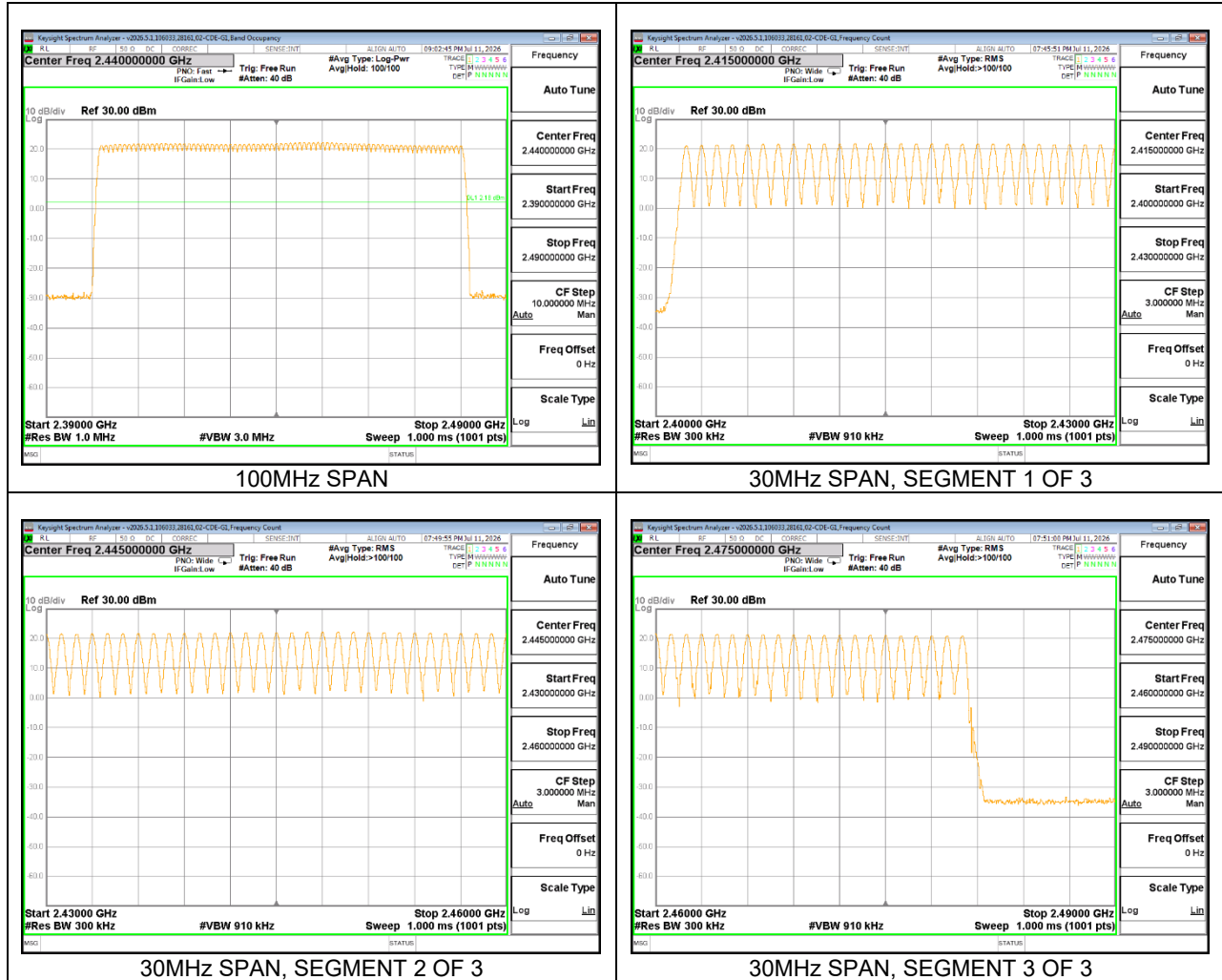


ANT 3

8.4.2. BTCSM2 – HIGH POWER

ANT 4



ANT 3

8.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (6.2.3.1) (b)

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

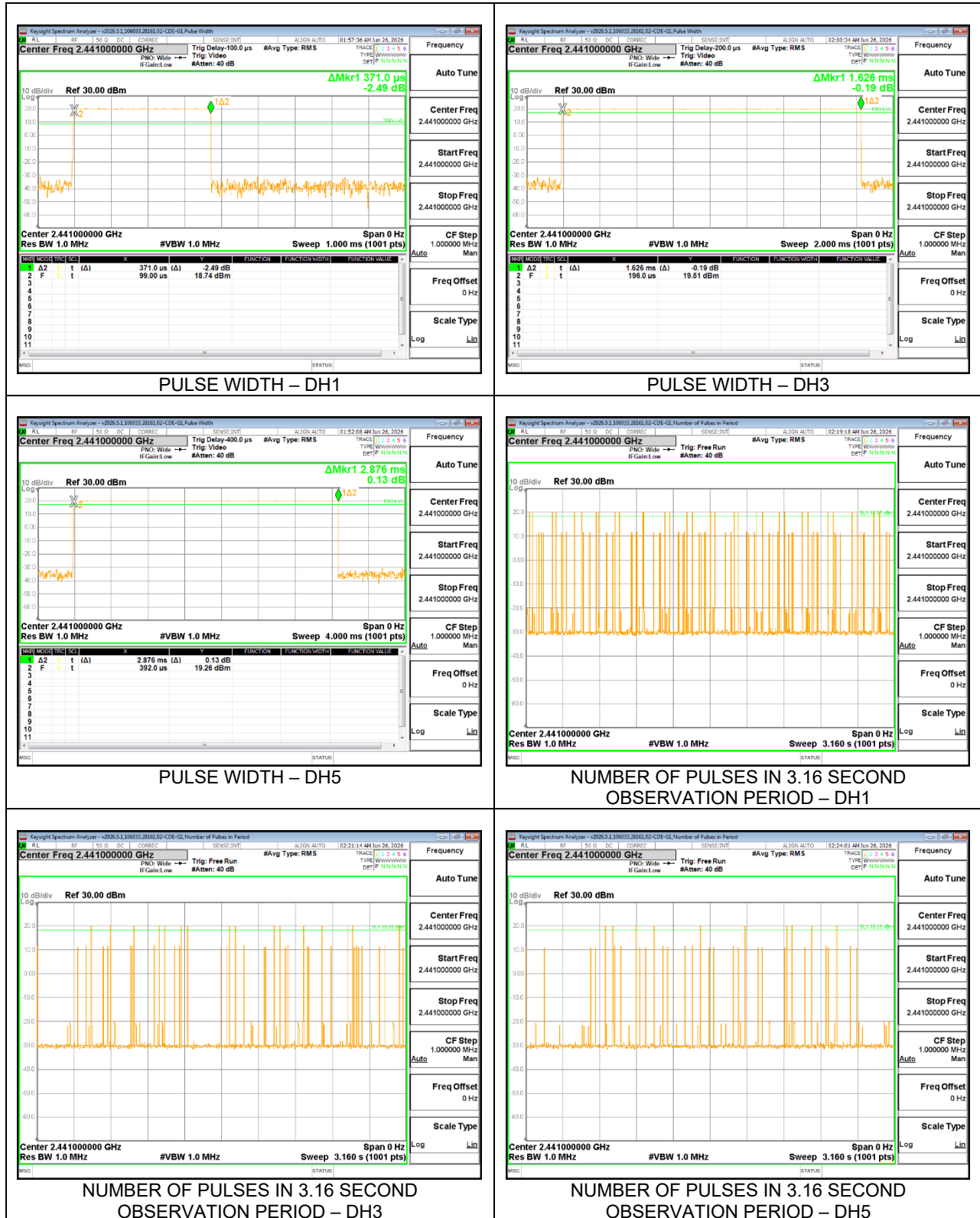
ANSI C63.10 Section 7.8.4

RESULTS

Only the High-Power BDR (GFSK) mode result is reported, as the EDR (QPSK/8PSK) modes utilize identical timing.

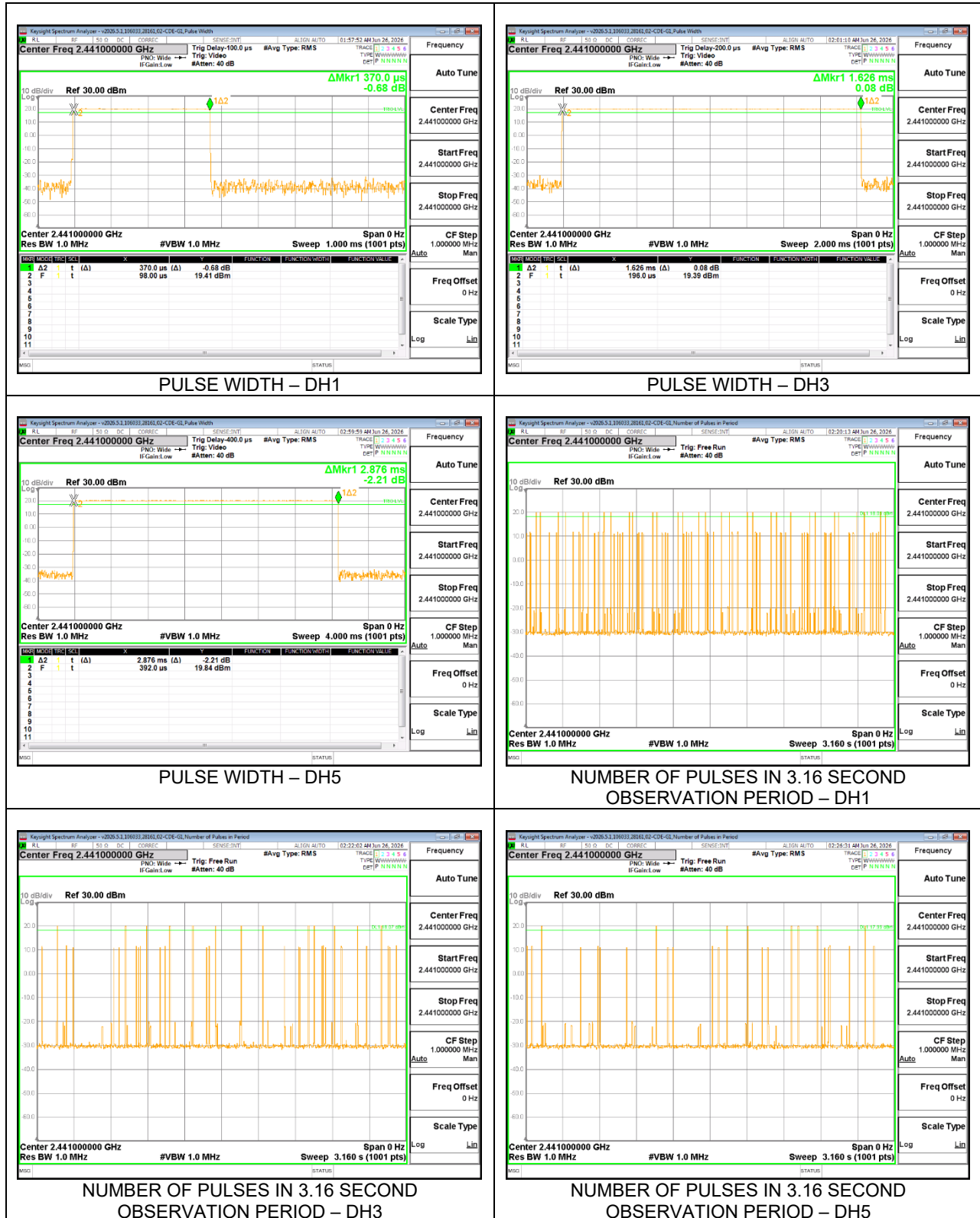
8.5.1. BDR (GFSK) – HIGH POWER**ANT 4**

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	0.371	32	0.119	0.4	-0.281
DH3	1.626	16	0.260	0.4	-0.140
DH5	2.876	10	0.288	0.4	-0.112
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.371	8	0.030	0.4	-0.370
DH3	1.626	4	0.065	0.4	-0.335
DH5	2.876	2.5	0.072	0.4	-0.328



ANT 3

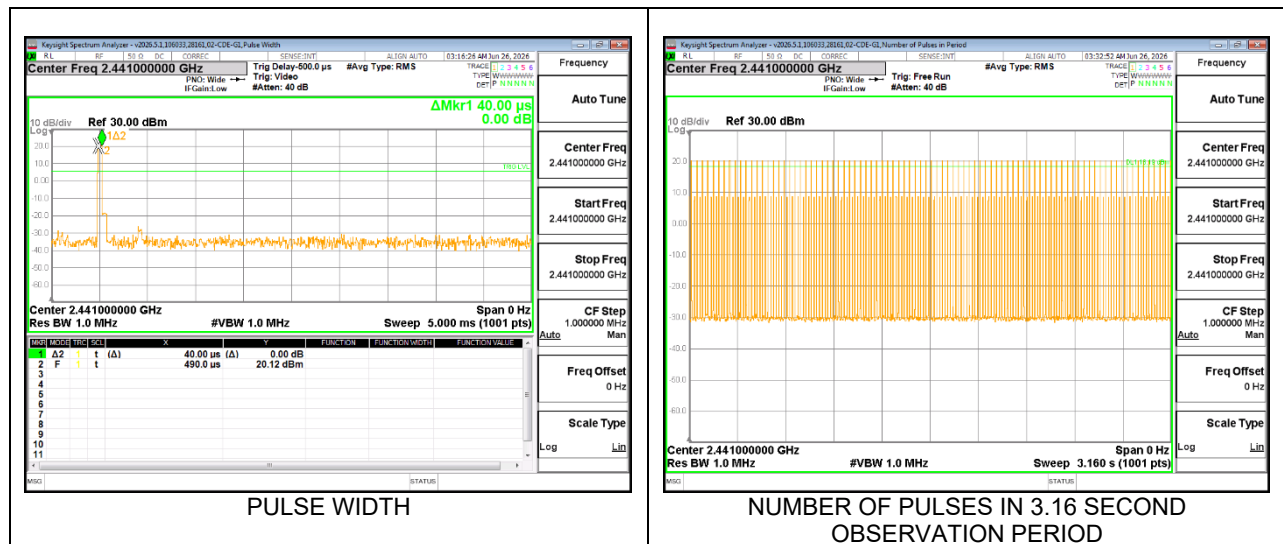
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.370	31	0.115	0.4	-0.285
DH3	1.626	14	0.228	0.4	-0.172
DH5	2.876	8	0.230	0.4	-0.170
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.370	7.75	0.029	0.4	-0.371
DH3	1.626	3.5	0.057	0.4	-0.343
DH5	2.876	2	0.058	0.4	-0.342



8.5.2. BTCSM2 – HIGH POWER

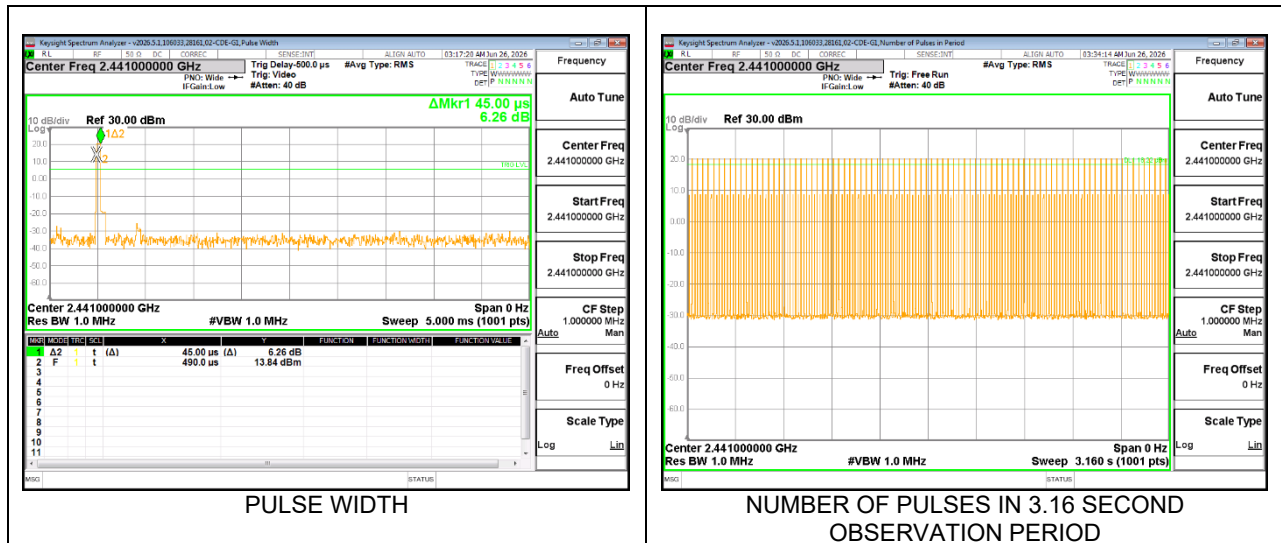
ANT 4

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
BTCSM2 Normal Mode					
DH1	0.04	89	0.036	0.4	-0.364
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
BTCSM2 AFH Mode					
DH1	0.04	22.25	0.009	0.4	-0.391



ANT 3

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
BTCSM2 Normal Mode					
DH1	0.045	88	0.040	0.4	-0.360
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
BTCSM2 AFH Mode					
DH1	0.045	22	0.010	0.4	-0.390



8.6. OUTPUT POWER

LIMITS

§15.247

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

RSS-247

(6.2.3.1)

a. FHS operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

(6.2.3.2)

The following transmitter output power and e.i.r.p. requirements shall apply:

- a. if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 1.0 W.
- b. if the hopset uses less than 75 hopping channels the maximum peak conducted output power shall not exceed 0.125 W.
- c. the e.i.r.p. shall not exceed 4 W, except as provided in sections 6.5 a) and b).

TEST PROCEDURE

ANSI C63.10 Section 7.8.5

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

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:

Frequency Range (GHz)	Antenna Type	Configuration	Antenna Peak Gain			
			ANT 4 (dBi)	ANT 3 (dBi)	Uncorrelated Chains (dBi)	Correlated Chains (dBi)
2.4	IFA	STATE A	-4.40	-4.30	-5.20	-2.20
		STATE B	-3.40	-3.60	-3.70	-0.70

RESULTS

Only the mid-channel plot is presented to illustrate the analyzer settings.

Note: The RBW setting used for PSD measurement is greater than or equal to 3 kHz.

8.6.1. SISO

2.4G (SISO)	
ANT 4 (dBi)	-3.40
ANT 3 (dBi)	-3.60

Mode (SISO)	Power Config.	Frequency (MHz)	Channel	Power Limit (dBm)		Peak Power (dBm)	
				ANT 4	ANT 3	ANT 4	ANT 3
BDR (GFSK)	High	2402	Low	21	21	19.98	20.05
		2441	Mid			20.11	20.08
		2480	High			19.93	20.13
	Low	2402	Low			8.78	8.44
		2441	Mid			8.80	8.38
		2480	High			8.83	8.38
EDR (DQPSK)	High	2402	Low			19.11	19.01
		2441	Mid			19.10	18.97
		2480	High			19.09	18.91
	Low	2402	Low			8.23	8.01
		2441	Mid			8.24	8.01
		2480	High			8.30	8.15
EDR (8PSK)	High	2402	Low			19.24	19.24
		2441	Mid			19.01	19.21
		2480	High			18.98	19.22
	Low	2402	Low			8.30	8.12
		2441	Mid			8.43	8.16
		2480	High			8.45	8.18
BTCM2	High	2402	Low			20.00	20.00
		2441	Mid			20.11	20.01
		2480	High			20.14	20.08
	Low	2402	Low			8.76	8.53
		2441	Mid			8.87	8.55
		2480	High			8.82	8.57

8.6.2. MIMO TXBF

2.4G (MIMO TXBF)	
Un-Correlated Gain (dBi)	-3.70
Correlated Gain (dBi)	-0.70

Mode (TXBF MIMO)	Power Config.	Frequency (MHz)	Channel	Power Limit (dBm)	Peak Power (dBm)		Total MIMO Peak Power (dBm)
					ANT 4	ANT 3	
BDR (GFSK)	High	2402	Low	21	17.11	17.16	20.15
		2441	Mid		17.16	17.09	20.14
		2480	High		17.16	17.03	20.11
	Low	2402	Low		8.84	8.45	11.66
		2441	Mid		8.81	8.35	11.60
		2480	High		8.91	8.49	11.72
EDR (DQPSK)	High	2402	Low		16.03	16.04	19.05
		2441	Mid		15.91	15.99	18.96
		2480	High		15.98	15.98	18.99
	Low	2402	Low		8.29	7.97	11.14
		2441	Mid		8.30	7.98	11.15
		2480	High		8.33	8.11	11.23
EDR (8PSK)	High	2402	Low		16.24	16.18	19.22
		2441	Mid		16.02	16.03	19.04
		2480	High		16.14	16.05	19.11
	Low	2402	Low		8.36	8.05	11.22
		2441	Mid		8.32	8.12	11.23
		2480	High		8.39	8.27	11.34

8.7. AVERAGE OUTPUT 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 connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

RESULTS

8.7.1. SISO

Mode (SISO)	Power Config.	Frequency (MHz)	Channel	Average Power (Gated) (dBm)	
				ANT 4	ANT 3
BDR (GFSK)	High	2402	Low	19.83	19.93
		2441	Mid	19.98	19.90
		2480	High	19.76	19.98
	Low	2402	Low	8.70	8.33
		2441	Mid	8.71	8.26
		2480	High	8.71	8.22
EDR (DQPSK)	High	2402	Low	16.42	16.38
		2441	Mid	16.48	16.44
		2480	High	16.47	16.39
	Low	2402	Low	5.64	5.40
		2441	Mid	5.63	5.40
		2480	High	5.66	5.49
EDR (8PSK)	High	2402	Low	16.40	16.40
		2441	Mid	16.27	16.45
		2480	High	16.12	16.33
	Low	2402	Low	5.60	5.44
		2441	Mid	5.65	5.41
		2480	High	5.66	5.46
BTCSM2	High	2402	Low	19.91	19.89
		2441	Mid	19.97	19.92
		2480	High	19.95	19.96
	Low	2402	Low	8.69	8.46
		2441	Mid	8.72	8.49
		2480	High	8.70	8.49

8.7.2. MIMO TXBF

Mode (TXBF MIMO)	Power Config.	Frequency (MHz)	Channel	Average Power (Gated) (dBm)		Total MIMO Average Power (Gated) (dBm)
				ANT 4	ANT 3	
BDR (GFSK)	High	2402	Low	16.93	16.95	19.95
		2441	Mid	16.98	16.91	19.96
		2480	High	16.97	16.89	19.94
	Low	2402	Low	8.71	8.29	11.52
		2441	Mid	8.72	8.22	11.49
		2480	High	8.74	8.33	11.55
EDR (DQPSK)	High	2402	Low	13.39	13.35	16.38
		2441	Mid	13.36	13.41	16.40
		2480	High	13.41	13.39	16.41
	Low	2402	Low	5.73	5.39	8.57
		2441	Mid	5.71	5.37	8.55
		2480	High	5.74	5.49	8.63
EDR (8PSK)	High	2402	Low	13.43	13.44	16.45
		2441	Mid	13.40	13.32	16.37
		2480	High	13.42	13.27	16.36
	Low	2402	Low	5.68	5.40	8.55
		2441	Mid	5.66	5.39	8.54
		2480	High	5.68	5.41	8.56

8.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 6.6

Limit = -20 dBc

TEST PROCEDURE

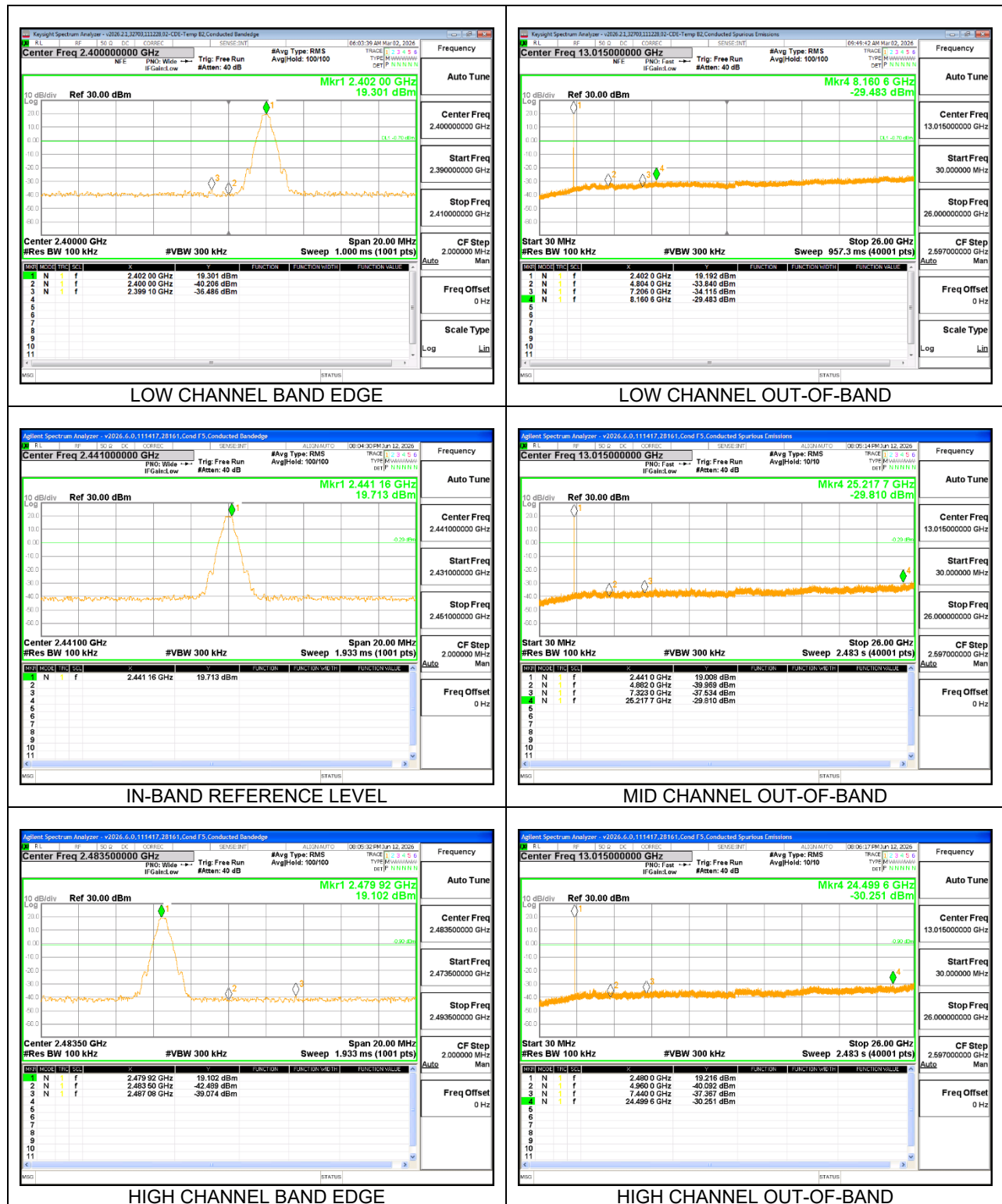
Conducted Spurious Emissions: ANSI C63.10 Section 7.8.7

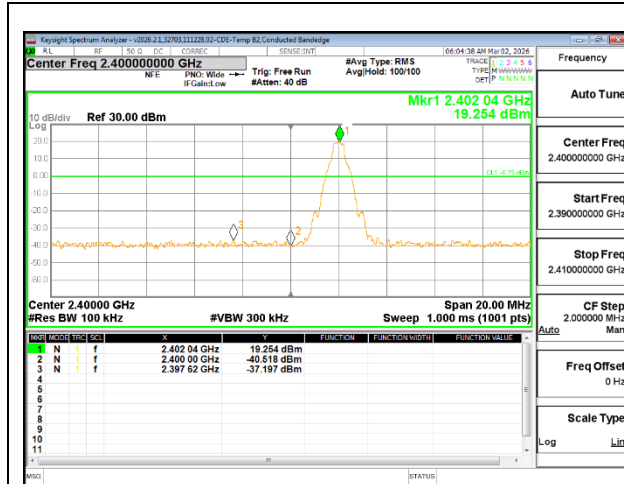
Conducted Band-Edge: ANSI C63.10 Section 6.10.4

RESULTS

8.8.1. BDR (GFSK) – HIGH POWER – SISO

ANT 4 (NON-HOPPING)

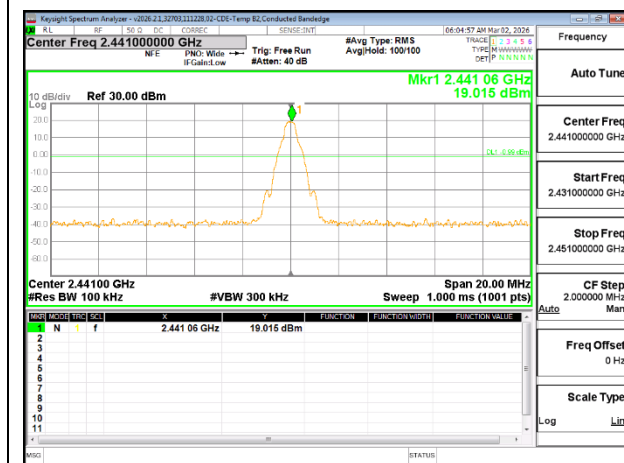


ANT 3 (NON-HOPPING)

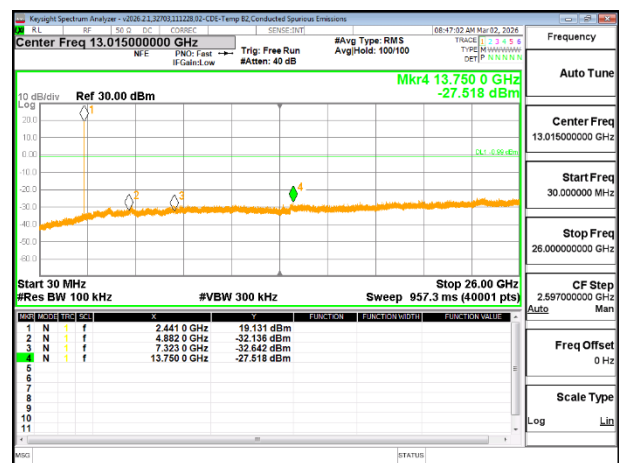
LOW CHANNEL BAND EDGE



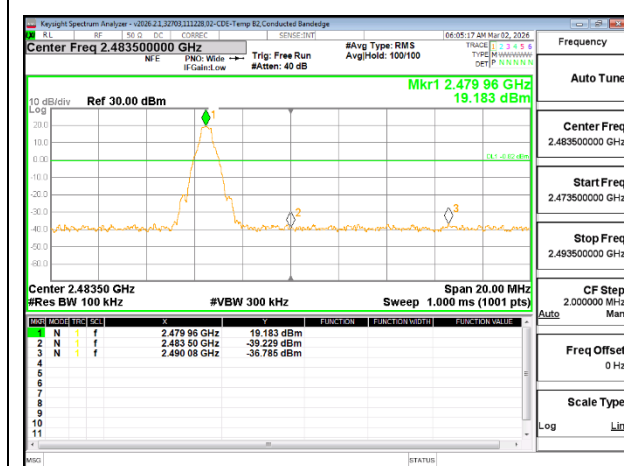
LOW CHANNEL OUT-OF-BAND



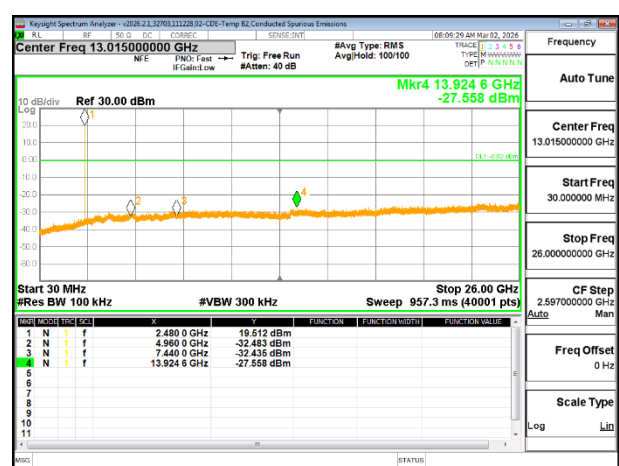
IN-BAND REFERENCE LEVEL



MID CHANNEL OUT-OF-BAND



HIGH CHANNEL BAND EDGE



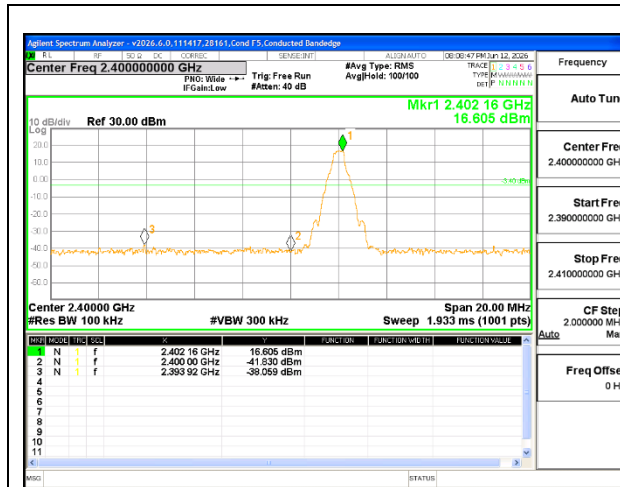
HIGH CHANNEL OUT-OF-BAND

ANT 3 (HOPPING)

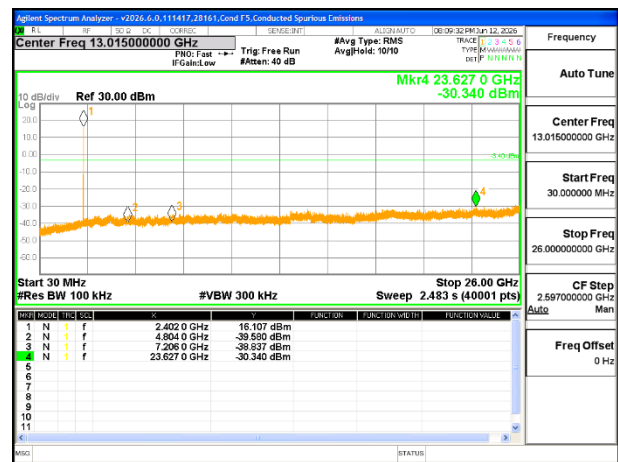


8.8.2. BDR (GFSK) – HIGH POWER – MIMO TXBF

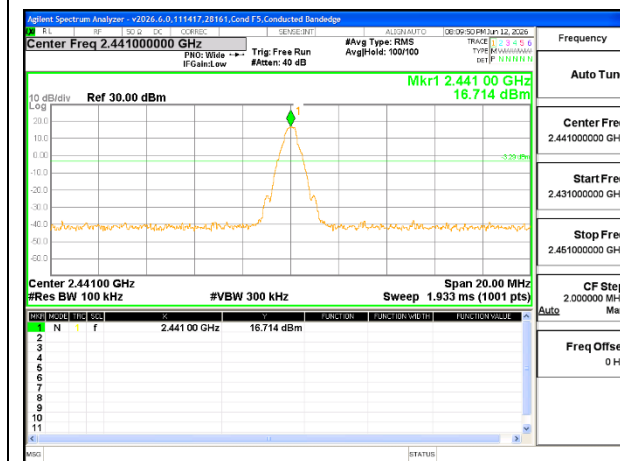
ANT 4 (NON-HOPPING)



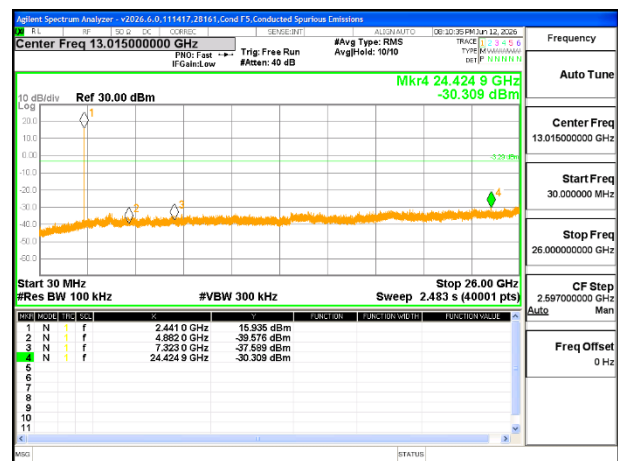
LOW CHANNEL BAND EDGE



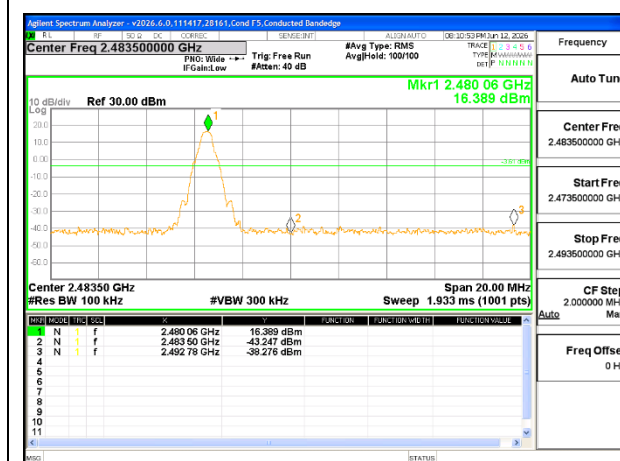
LOW CHANNEL OUT-OF-BAND



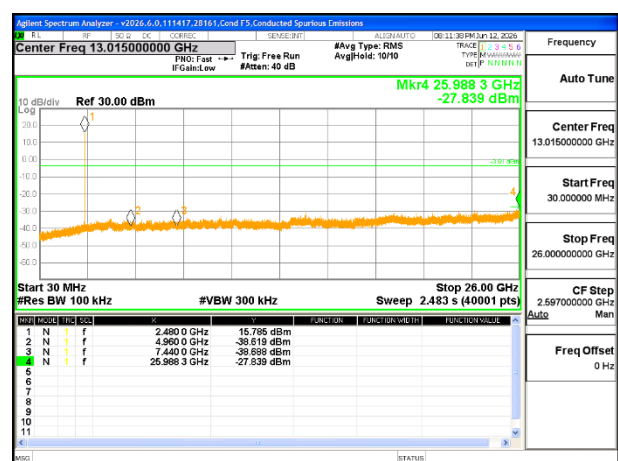
IN-BAND REFERENCE LEVEL



MID CHANNEL OUT-OF-BAND

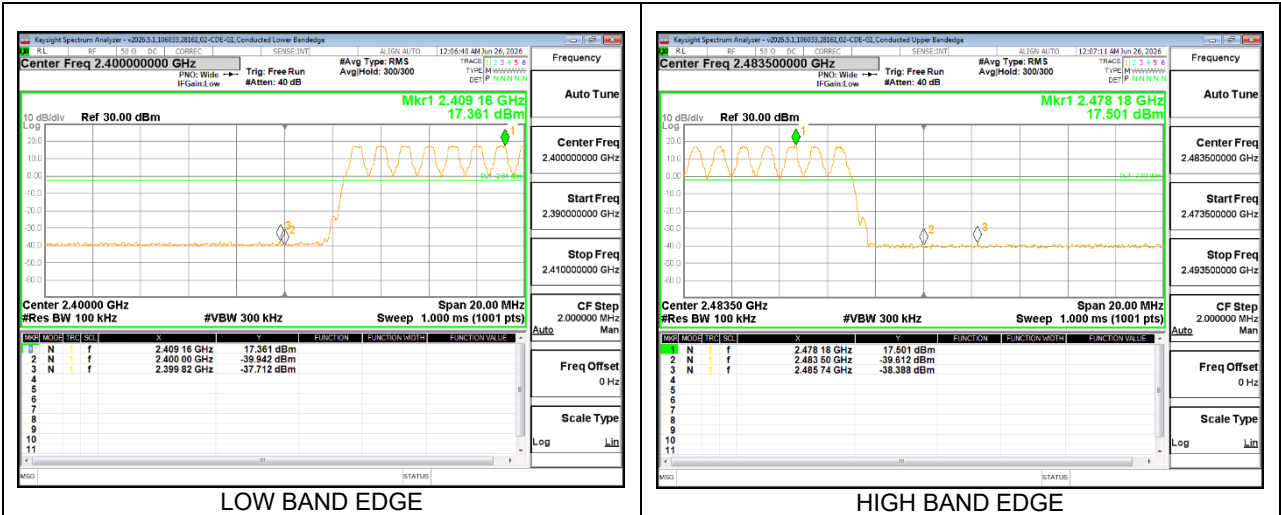


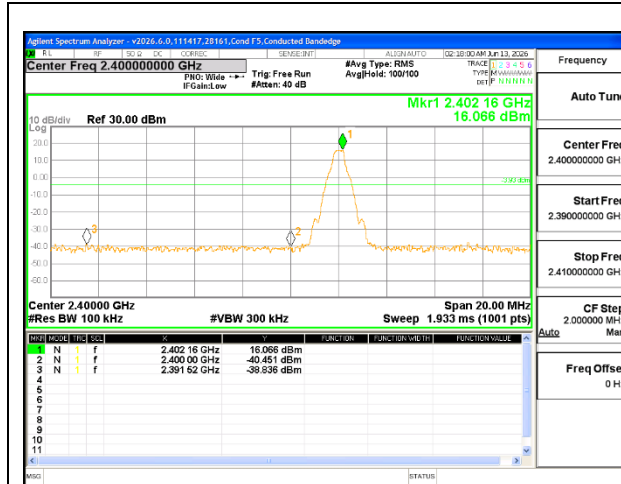
HIGH CHANNEL BAND EDGE



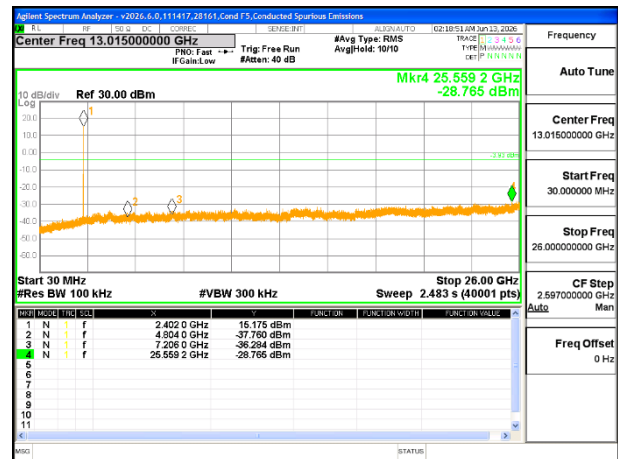
HIGH CHANNEL OUT-OF-BAND

ANT 4 (HOPPING)

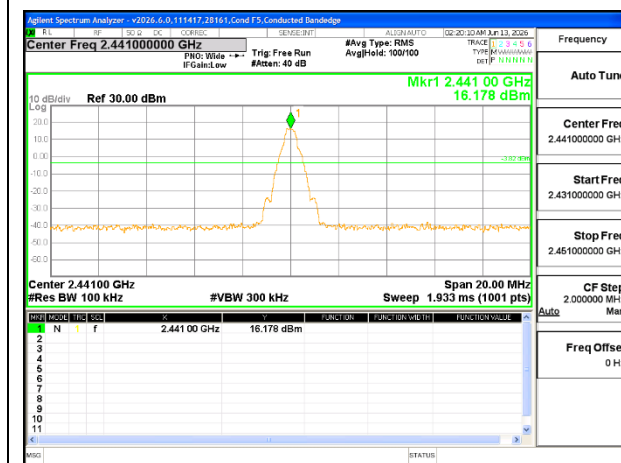


ANT 3 (NON-HOPPING)

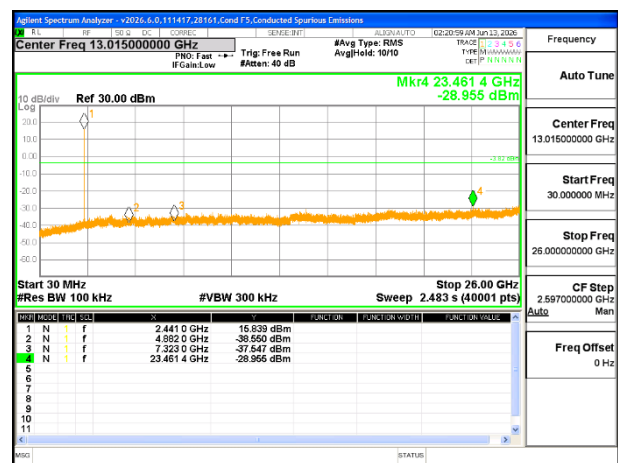
LOW CHANNEL BAND EDGE



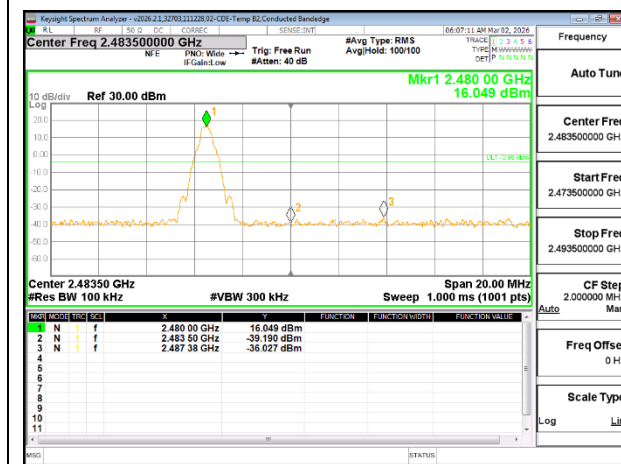
LOW CHANNEL OUT-OF-BAND



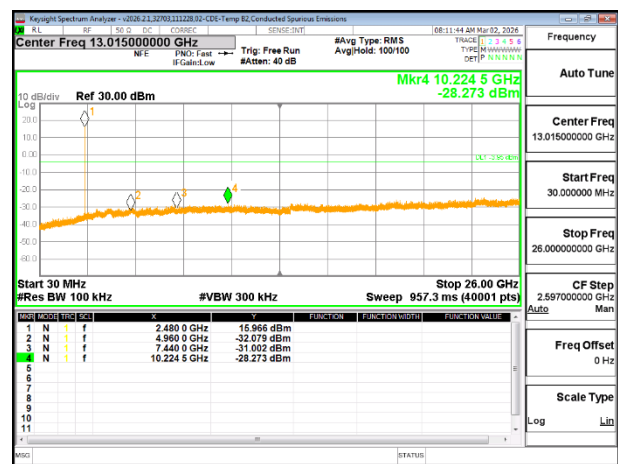
IN-BAND REFERENCE LEVEL



MID CHANNEL OUT-OF-BAND



HIGH CHANNEL BAND EDGE



HIGH CHANNEL OUT-OF-BAND