

TEST REPORT

Report Number: 15941282-E1V3

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

Model : A3575 (Parent)
A3634, A3635 (Variants)

Brand : APPLE

FCC ID : BCG-E9145A (Parent)
BCG-E9147A, BCG-E9148A (Variants)

IC : 579C-E9145A (Parent)
579C-E9147A, 579C-E9148A (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:
2026-01-06

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2025-12-11	Initial Issue	Tony Li
V2	2025-12-22	Addressed TCB Comments on Sections 6.5, 9.5.1, 9.6, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.7, 10, 10.1, 10.3, & 13	Becky Yu / David Collins
V3	2026-01-06	Addressed comment on Section 9.6	Becky Yu

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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	A3575 (Parent) A3634, A3635 (Variants)	
Brand	APPLE	
FCC ID	BCG-E9145A (Parent) BCG-E9147A, BCG-E9148A (Variants)	
IC	579C-E9145A (Parent) 579C-E9147A, 579C-E9148A (Variants)	
EUT Description	SMARTPHONE	
Serial Number (Parent)	C07HJ80002C00016LY (Conducted) FK4KVKD7K2, LCQJWYHQKN (Radiated)	
Serial Number (Variant, A3634)	C07HJ00000M00016M2 (Conducted) GF4Y1XCGWP (Radiated)	
Serial Number (Variant, A3635)	C07HM3000UL00016M1 (Conducted) L2FXLNQQ44 (Radiated)	
Sample Receipt Date	2025-08-13	
Date Tested	2025-08-15 to 2025-12-08	
Applicable Standards	FCC 47 CRF 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:	Reviewed By:	Prepared By:
		
Frank Ibrahim Staff Engineer UL Verification Services Inc.	Tony Li Lead Test Engineer UL Verification Services Inc.	Becky Yu Laboratory Engineer 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	Comment
Duty Cycle	See Comment		Reporting purposes only	ANSI C63.10 Section 11.6.
20dB BW / 99% OBW	See Comment		Reporting purposes only	ANSI C63.10 Sections 6.9.2 and 6.9.3.
Hopping Frequency Separation	15.247 (a)(1)	RSS-247 (6.2.1) (b)	Complies	None.
Number of Hopping Channels	15.247 (a)(1)(iii)	RSS-247 (6.2.3.1) (b)	Complies	None.
Average Time of Occupancy	15.247 (a)(1)(iii)	RSS-247 (6.2.3.1) (b)	Complies	None.
Output Power	15.247 (b) (1)	RSS-247 (6.2.3.2)	Complies	None
Average Power	See Comment		Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
Conducted Spurious Emissions	15.247 (d)	RSS-247 (6.6)	Complies	None.
Radiated Emissions	15.209, 15.205	RSS-GEN 8.9, 8.10	Complies	None.
AC Mains Conducted Emissions	15.207	RSS-Gen 8.8	Complies	None.

3. TEST METHODOLOGY

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

- ANSI C63.10-2020 (FCC)
- 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 (ISED)

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 (Ave), 1.30 dB (PK)
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)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

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 GSM, GPRS, EGPRS, WCDMA, LTE, 5G NR1, IEEE 802.11a/b/g/n/ac/ax, Bluetooth (BT), Global Positioning System (GPS), Near-Field Communication (NFC) 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 conducted output power as follows:

BT Frequency Range (MHz)	Mode	Antenna	Configuration	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	Ant 4	High Power	20.21	104.95
		Ant 3	High Power	20.16	103.75
		BF, Ant 4 + Ant 3	High Power	20.32	107.65
2402 - 2480	DQPSK	Ant 4	High Power	18.41	69.34
		Ant 3	High Power	18.52	71.12
		BF, Ant 4 + Ant 3	High Power	19.06	80.54
2402 - 2480	Enhanced 8PSK	Ant 4	High Power	18.93	78.16
		Ant 3	High Power	18.81	76.03
		BF, Ant 4 + Ant 3	High Power	19.19	82.99

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK and 8PSK Power are the worst case. Testing is based on these modes to show compliance. For average power data please refer to section 9.7.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS AND CABLE LOSS

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

Frequency Range (GHz)	Antenna Type	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	-3.70	-0.80	-2.01	0.88	1.70	1.80

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 were LuckD23D90.

6.5. WORST-CASE CONFIGURATION AND MODE

EUT was investigated in three orthogonal orientations X (Flatbed), Y (Landscape) and Z (Portrait). The following table exhibits the worst-case orientation. The full tests of the EUT have been made upon the orientations shown in the table below.

Band	ANT4	ANT3	ANT4+3
2.4GHz	X-Flatbed	X-Flatbed	X-Flatbed

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. There were no emissions found below 30MHz within 20dB of the limit.

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

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

GFSK, DQPSK, 8PSK average power are all investigated, The GFSK, 8PSK power are the worst cases. 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 conducted test, High-power mode is fully tested, with additional test on the low power mode on output power and conducted spurious emission.

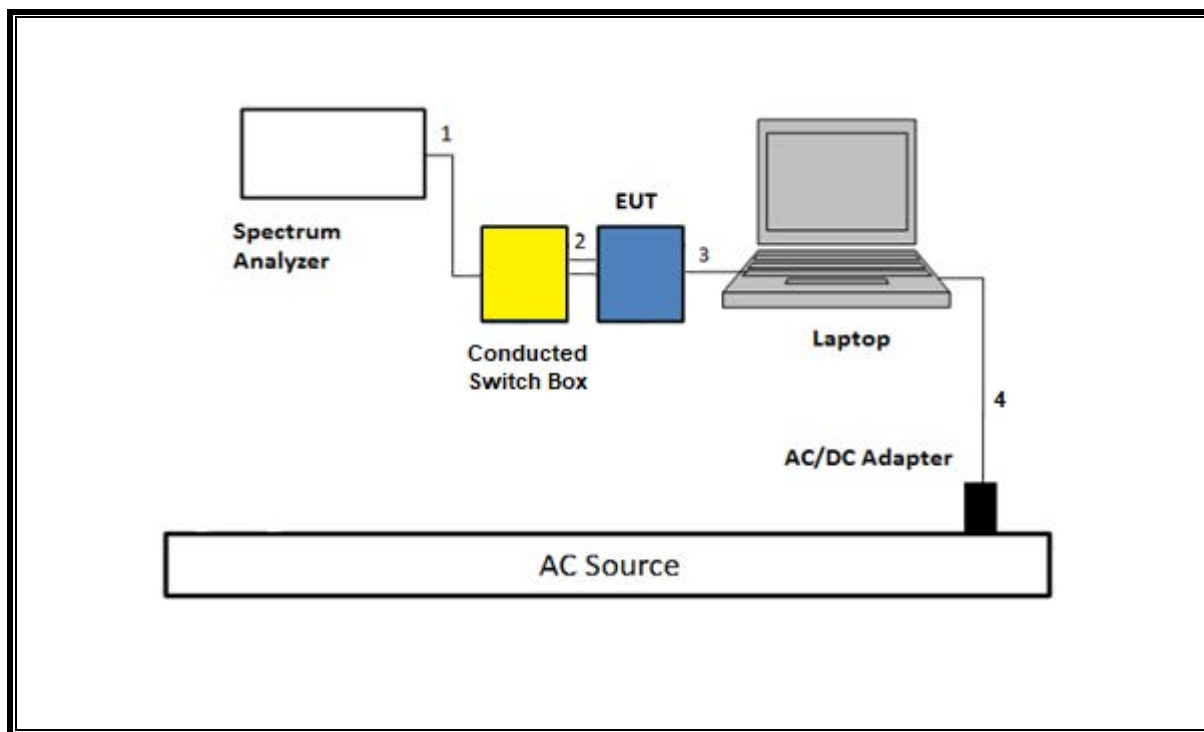
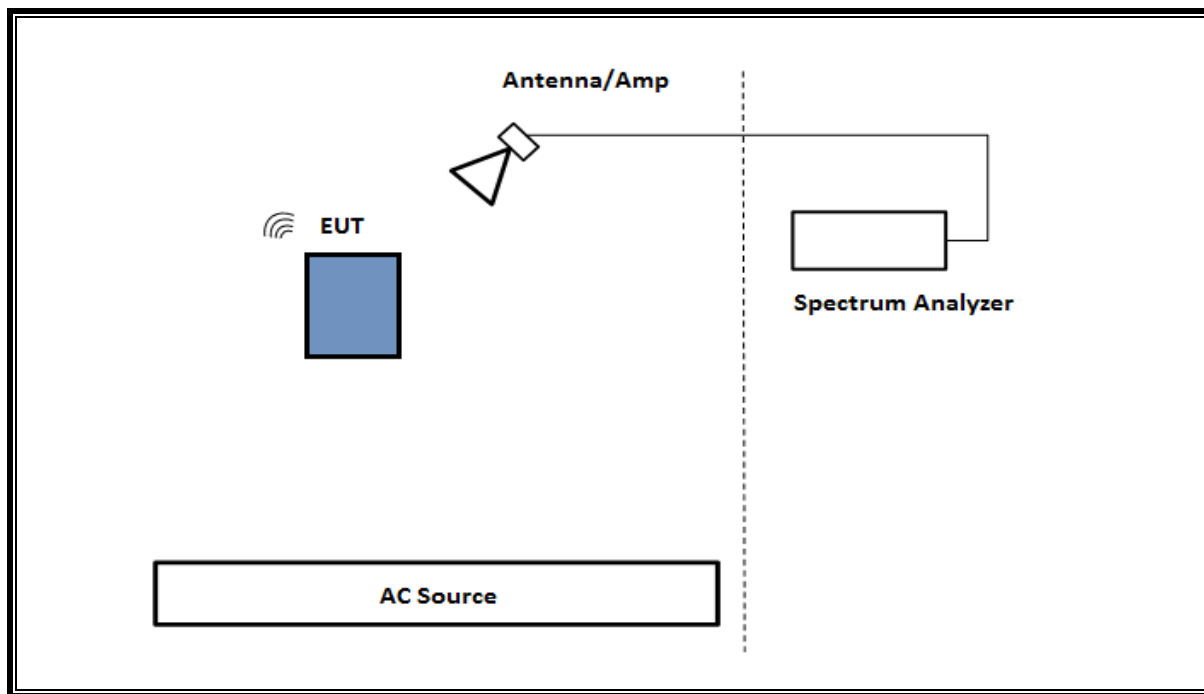
For radiated harmonic spurious emissions test, high power beamforming GFSK mode is set to maximum power per chain to cover both SISO and MIMO modes to comply with radiated spurious emissions limits in the restricted bands between 1GHz and 18GHz low/mid/high channel. For GFSK and 8PSK mode, GFSK mode was selected for test to cover 8PSK as it has higher tune up level.

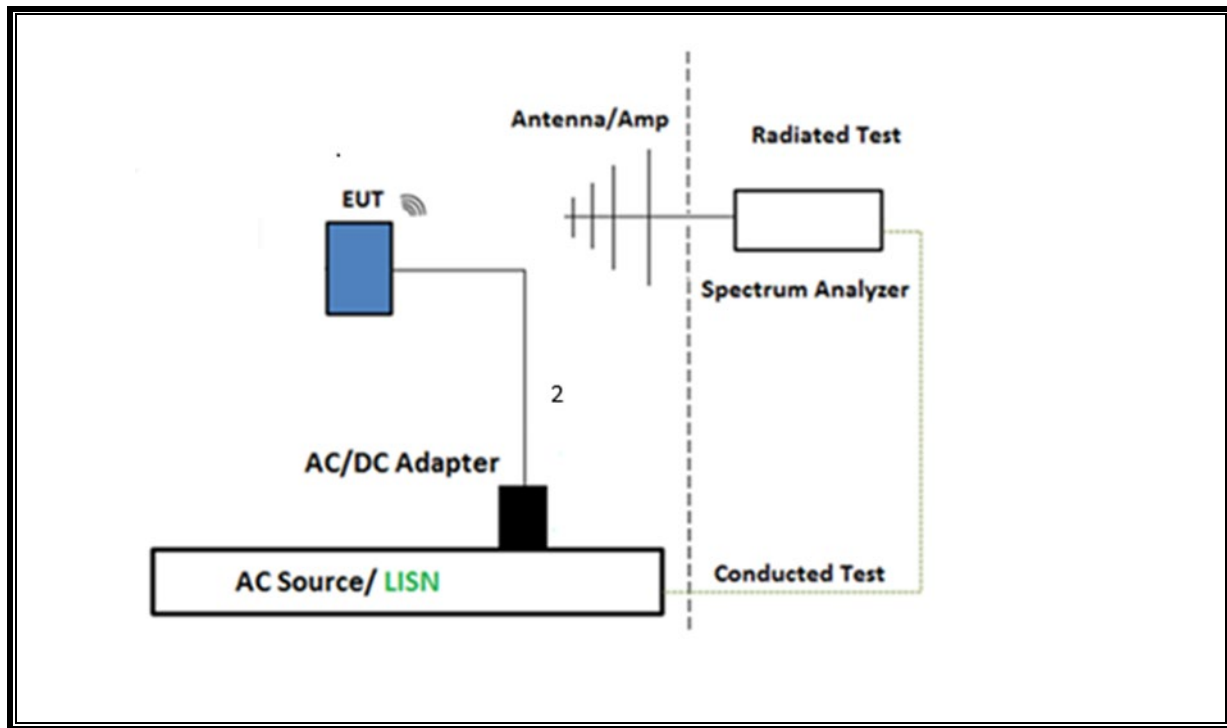
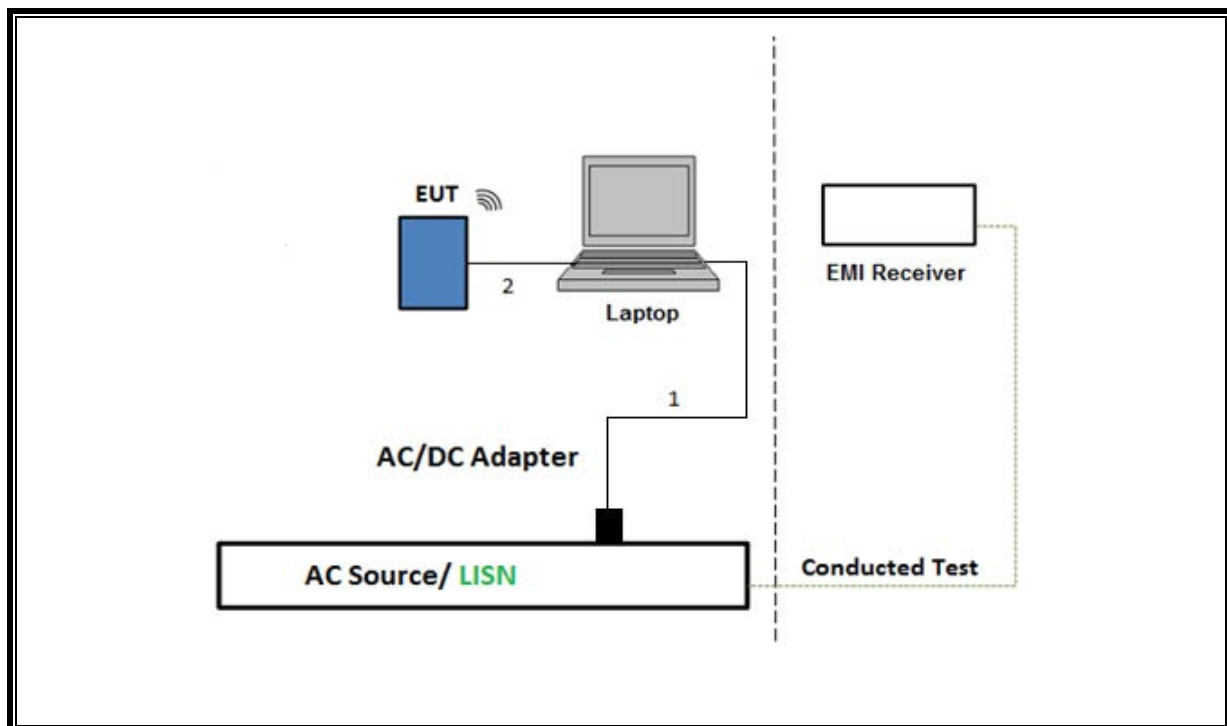
6.6. DESCRIPTION OF TEST SETUP

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	220322		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
I/O CABLES (RF RADIATED AND AC LINE CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Unshielded	2	N/A
2	USB	1	USB-C	Unshielded	1	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 Above 1 GHz (1 to 26GHz)**

SETUP DIAGRAM FOR 30-1000MHz RADIATED EMISSIONS and AC LINE CONDUCTED EMISSIONS TEST**TEST SETUP- AC LINE CONDUCTED EMISSIONS: 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 Num	Cal Due
Spectrum Analyzer, PXA, 3Hz to 44GHz	N9030A	Keysight Technologies Inc	125179	2026-01-31
Conducted Switch Box	UL-FR1	CSB	220322	2026-10-31
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90718	2026-01-31
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90419	2026-07-31
Antenna, Passive Loop, 30Hz - 1MHz	Electro-Metrics	EM-6871	219909	2026-08-31
Antenna, Passive Loop, 100kHz to 30MHz	Electro-Metrics	EM-6872	219911	2026-08-31
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	223084	2026-12-31
*Filter Box	UL-FR1	Frankenstein, 1 Amp, 12 Port	231875	2025-11-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	170063	2026-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	206806	2026-02-28
Filter Box	UL-FR1	RATS 1.0, 1 Amp, 6 Port	173233	2026-04-29
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235266	2026-02-28
Antenna, Horn 1-18GHz	Antenna, Horn 1-18GHz	3117	222740	2026-09-29
Filter Box	UL-FR1	RATS 1.0, 2 Amp, 6 Port	171389	2026-03-30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201497	2026-02-28
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	226674	2026-01-31
Filter Box	UL-FR1	RATS 1.0, 2 Amp, 6 Port	250156	2026-10-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	225683	2026-02-28
Antenna, BroadBand Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	232075	2026-04-30
Amplifier 9 KHz - 1 GHz	SONOMA INSTRUMENT	310N	230308	2026-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235670	2026-02-28
Antenna, Horn 18 to 26.5GHz	A.R.A.	MWH-1826/B	81140	2026-08-31
Link File, RF Amplifier Assembly, 18-26.5GHz, 60dB Gain	Ampical	AMP18G26.5-60	236106	2026-05-31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	191428	2026-02-28

AC Line Conducted				
Description	Manufacturer	Model	ID Num	Cal Due
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	171646	2026-02-28
LISN for Conducted Emissions CISPR-16	Fischer Custom Communications	FCC-LISN-50/250-25-2-01-480V	175765	2026-01-31
Transient Limiter	TE	TBFL1	207996	2026-09-30
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5	
Conducted Software	UL	Antenna Port	Ver 2.23	
Conducted Software	UL	Station Tool	Ver 7.1, 9.0, 10.2, 11	
AC Line Conducted Software	UL	UL EMC	Ver 9.5	

*Testing is completed before equipment expiration date.

8. MEASUREMENT METHOD

TEST ITEM	TEST METHOD
On Time and Duty Cycle	ANSI C63.10 Section 11.6
Occupied BW (20dB)	ANSI C63.10 Section 6.9.2
Occupied BW (99%)	ANSI C63.10 Section 6.9.3
Carrier Frequency Separation	ANSI C63.10 Section 7.8.2
Number of Hopping Frequencies	ANSI C63.10 Section 7.8.3
Time of Occupancy (Dwell Time)	ANSI C63.10 Section 7.8.4
Peak Output Power	ANSI C63.10 Section 7.8.5
Conducted Spurious Emissions	ANSI C63.10 Section 7.8.7
Conducted Band-Edge	ANSI C63.10 Section 6.10.4
Radiated Spurious Emissions Below 30MHz	ANSI C63.10 Section 6.4 & 13
Radiated Spurious Emissions 30-1000MHz	ANSI C63.10 Section 6.3, 6.5 & 13
Radiated Spurious Emissions above 1GHz	ANSI C63.10 Section 6.3, 6.6 & 13
Radiated Band-edge	ANSI C63.10 Section 6.10.5 & 13
AC Power-line conducted emissions	ANSI C63.10 Section 6.2

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

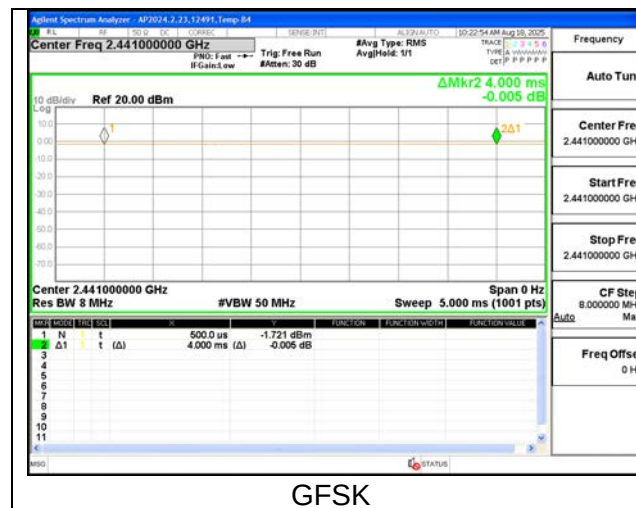
PROCEDURE

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

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time T (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
GFSK	4.00	4.00	1.000	100.0	0.00	0.010
8PSK	4.00	4.00	1.000	100.0	0.00	0.010

Note: Both 1TX and 2TX have the same DCCF.



9.2. 20dB AND 99% BANDWIDTH LIMITS

None; for reporting purposes only.

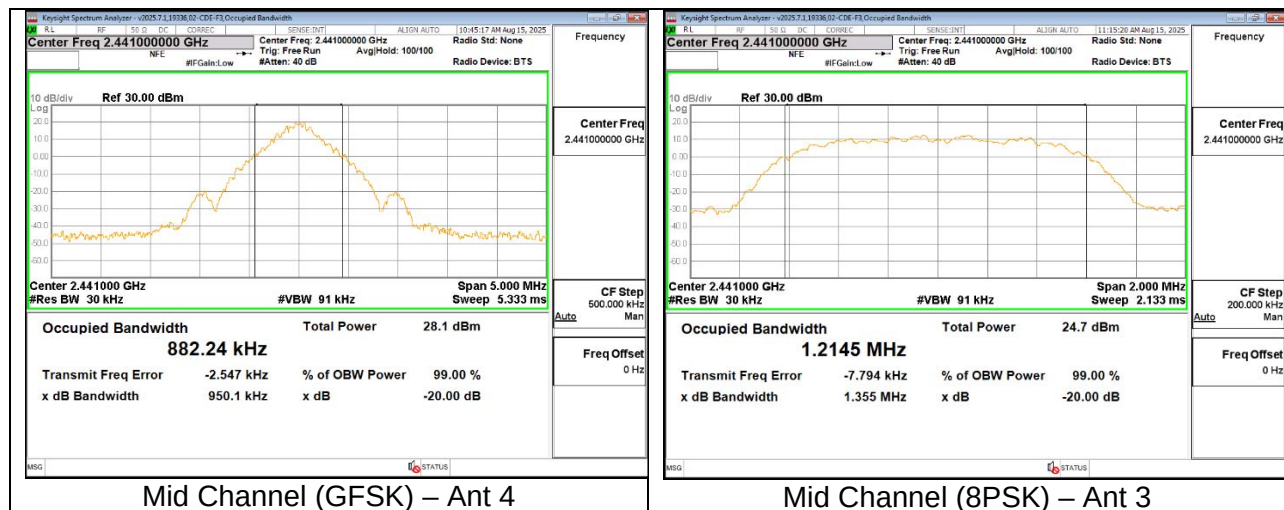
TEST PROCEDURE

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

Both SISO and MIMO modes have already been investigated, and the results between these modes are similar. Only the SISO mode with High-Power data is reported.

Worst-Case Mode (SISO)	Frequency (MHz)	Channel Number	20dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			Ant 4	Ant 3	Ant 4	Ant 3
GFSK	2402	Low	0.9306	0.9554	0.87452	0.88094
	2441	Mid	0.9501	0.9528	0.88224	0.87933
	2480	High	0.9507	0.9554	0.88083	0.88095
8PSK	2402	Low	1.378	1.388	1.2274	1.2326
	2441	Mid	1.368	1.355	1.2222	1.2145
	2480	High	1.381	1.380	1.2292	1.2282



9.3. 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

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to $\text{VBW} \geq 3 \times \text{RBW}$. The sweep time is coupled.

RESULTS

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

9.3.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

HOPPING FREQUENCY SEPARATION



9.3.2. HIGH POWER BASIC DATA RATE 8PSK MODULATION

HOPPING FREQUENCY SEPARATION



9.4. 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

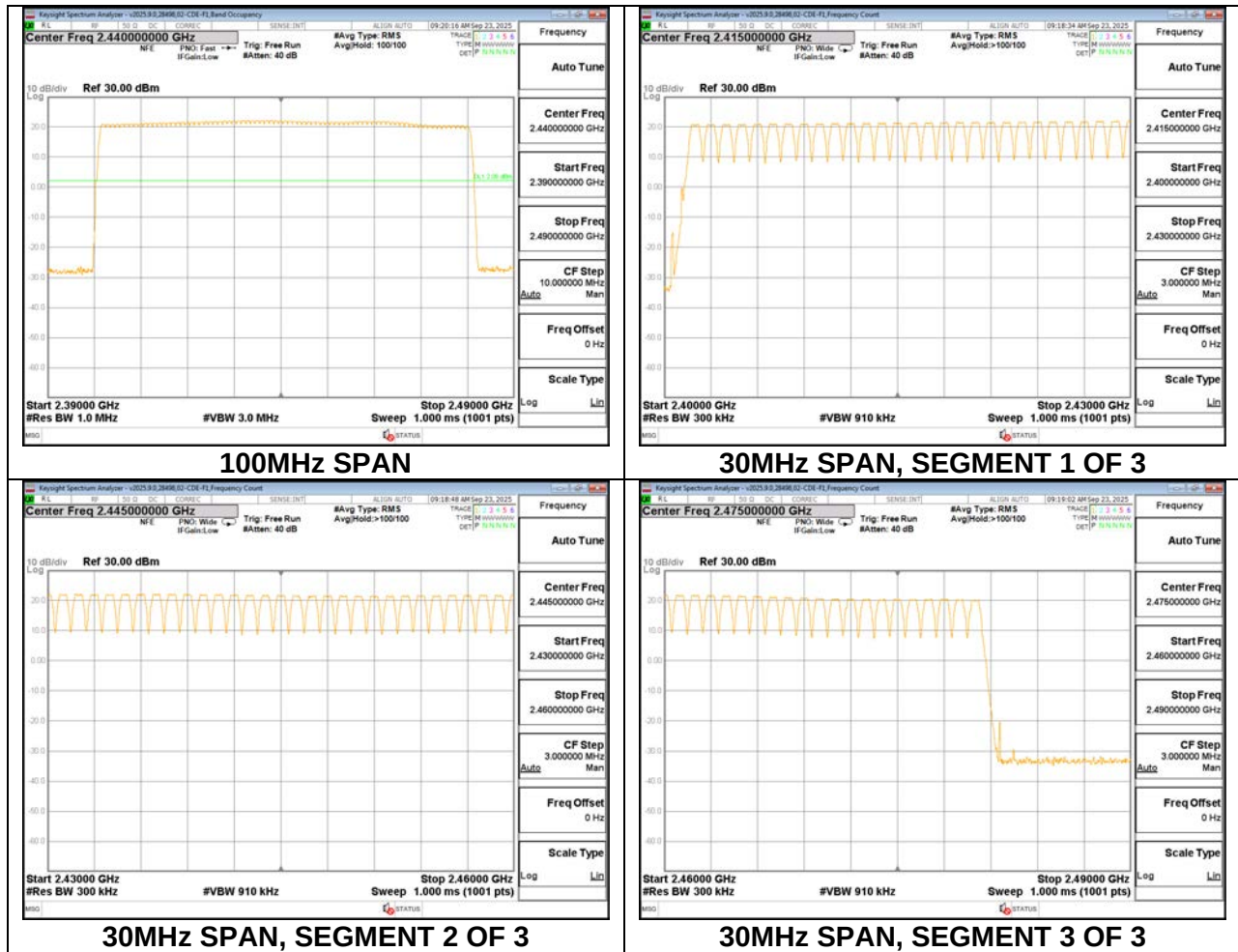
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

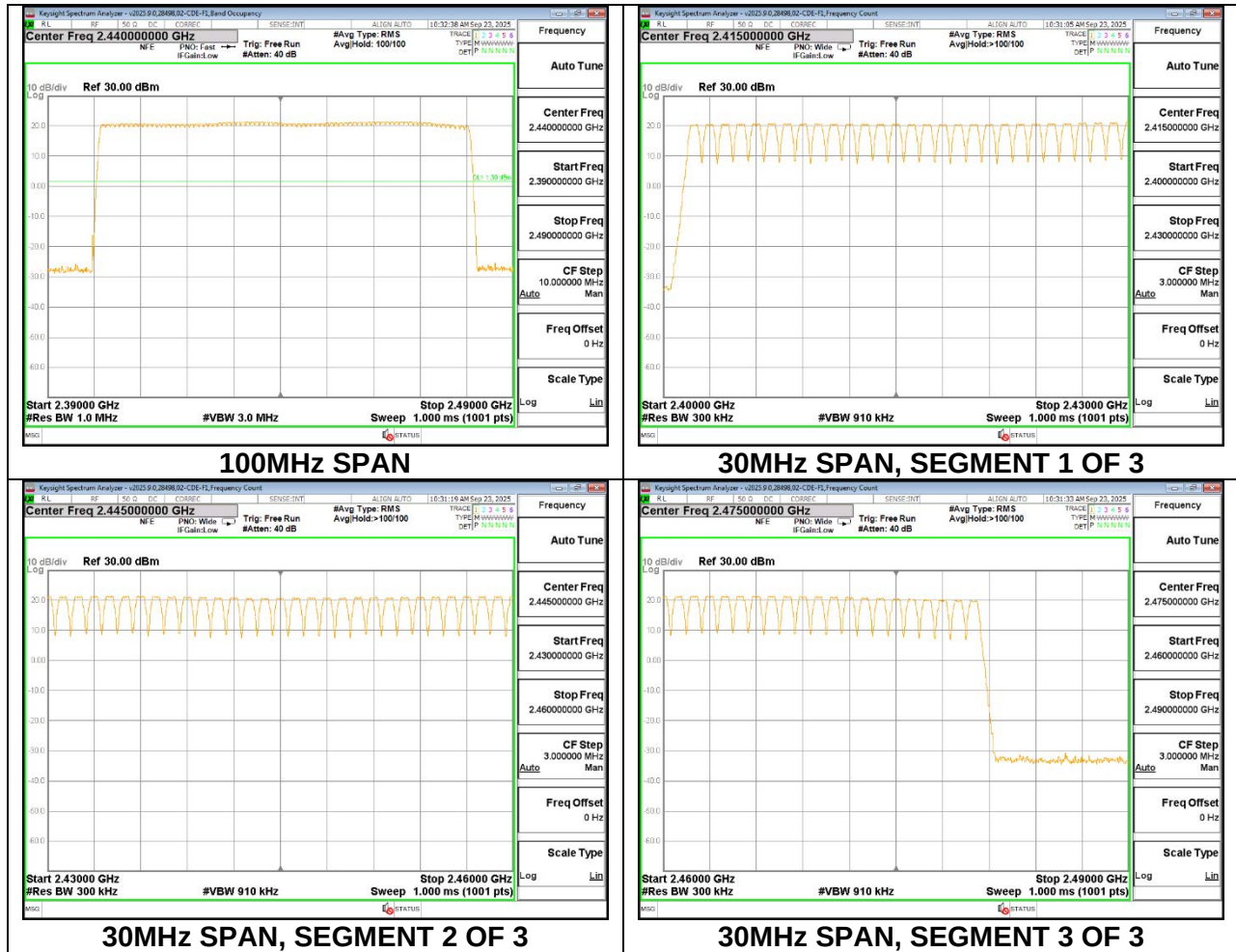
RESULTS

Normal Mode: 79 Channels Observed.

9.4.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

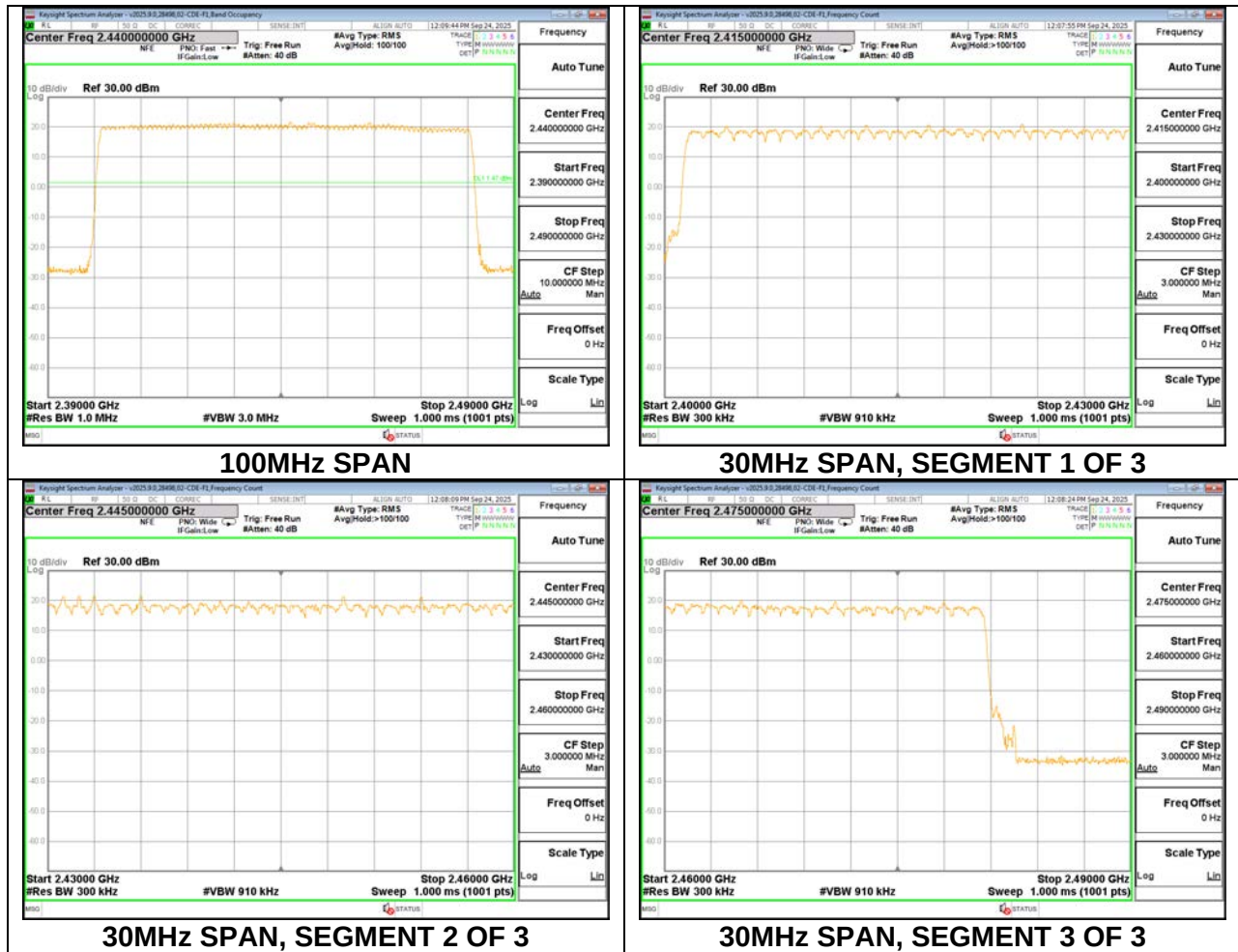
ANT 4

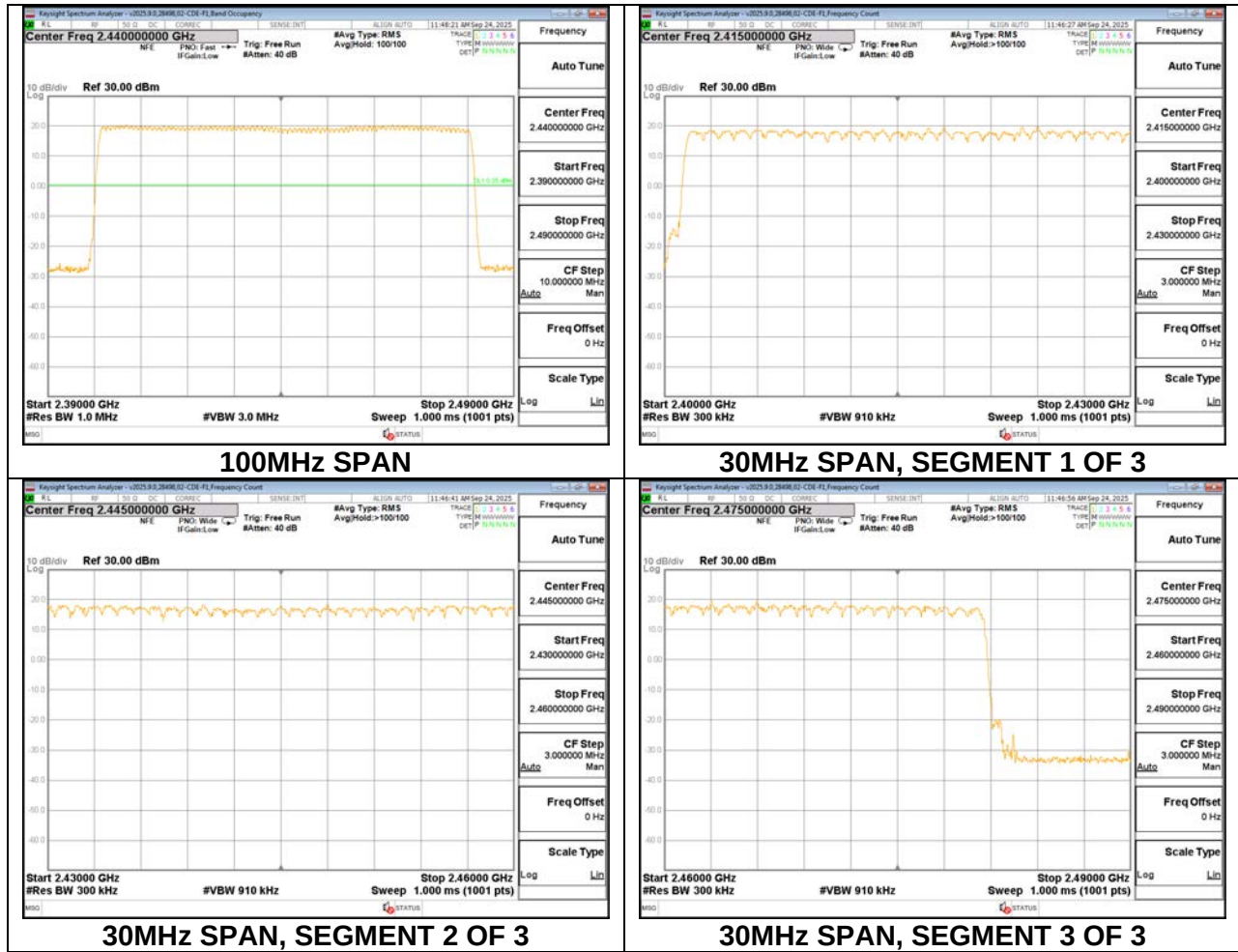


ANT 3

9.4.2. HIGH POWER BASIC DATA RATE 8PSK MODULATION

ANT 4



ANT 3

9.5. 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

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

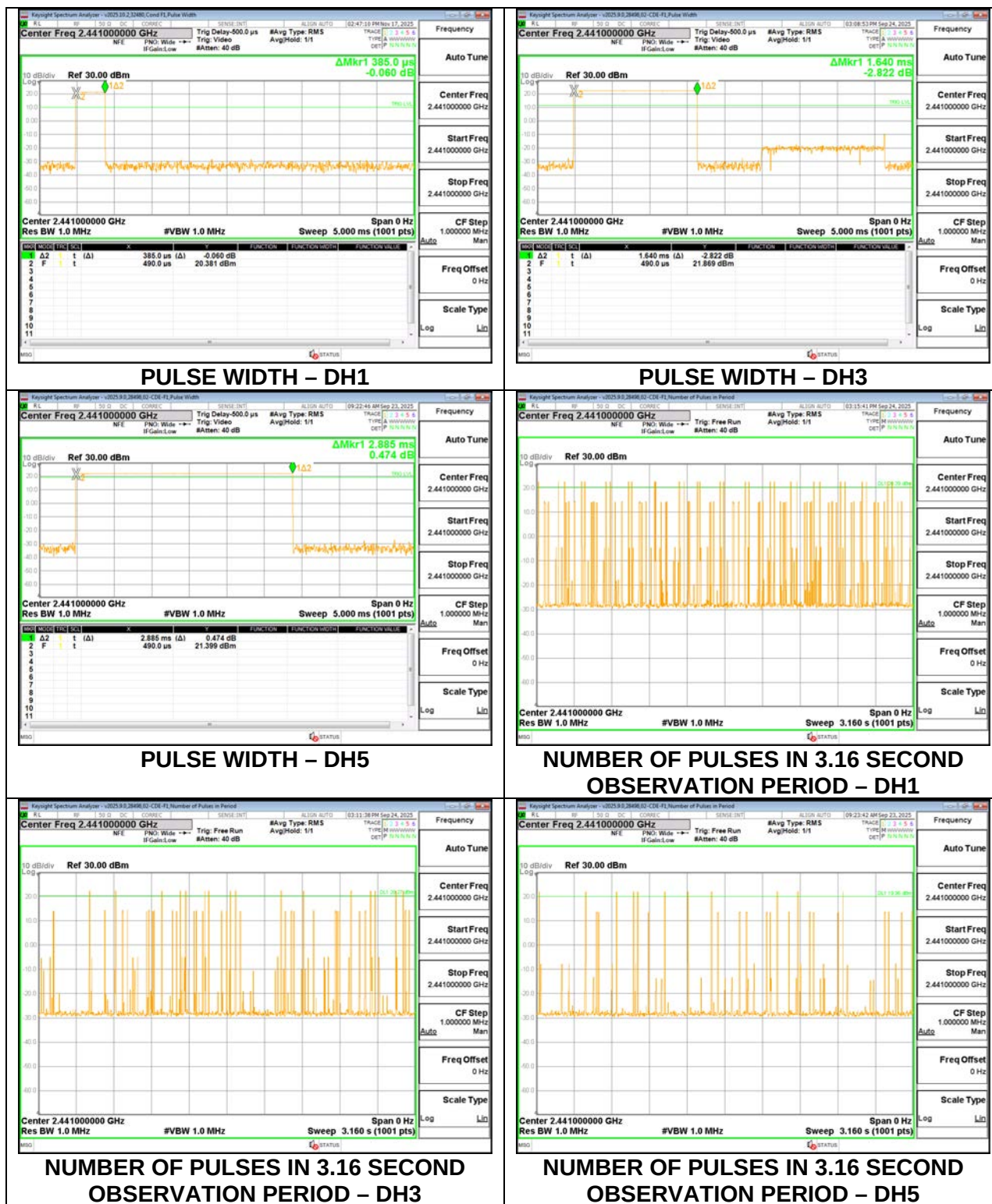
The average time of occupancy in the specified 3.16-second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

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

RESULTS

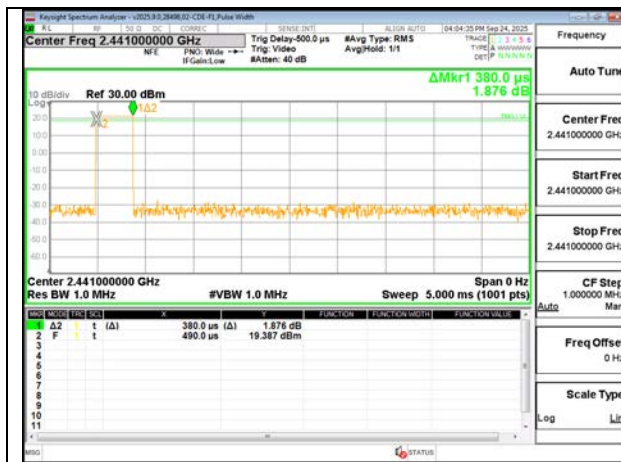
9.5.1. HIGH POWER BASIC DATA RATE GFSK MODULATION**ANT 4**

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	0.385	32	0.123	0.4	-0.277
DH3	1.640	16	0.262	0.4	-0.138
DH5	2.885	11	0.317	0.4	-0.083
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	0.385	8	0.031	0.4	-0.369
DH3	1.64	4	0.066	0.4	-0.334
DH5	2.885	2.75	0.079	0.4	-0.321



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	0.38	32	0.122	0.4	-0.278
DH3	1.64	14	0.230	0.4	-0.170
DH5	2.89	12	0.347	0.4	-0.053
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	0.38	8	0.030	0.4	-0.370
DH3	1.64	3.5	0.057	0.4	-0.343
DH5	2.89	3	0.087	0.4	-0.313



9.5.2. HIGH POWER BASIC DATA RATE 8PSK MODULATION**ANT 4**

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
DH1	0.385	32	0.123	0.4	-0.277
DH3	1.635	14	0.229	0.4	-0.171
DH5	2.89	11	0.318	0.4	-0.082
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK AFH Mode					
DH1	0.385	8	0.031	0.4	-0.369
DH3	1.635	3.5	0.057	0.4	-0.343
DH5	2.89	2.75	0.079	0.4	-0.321



PULSE WIDTH – DH1



PULSE WIDTH – DH3



PULSE WIDTH – DH5

NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH1NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH3NUMBER 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)
8PSK Normal Mode					
DH1	0.385	31	0.119	0.4	-0.281
DH3	1.64	16	0.262	0.4	-0.138
DH5	2.89	10	0.289	0.4	-0.111
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK AFH Mode					
DH1	0.385	7.75	0.030	0.4	-0.370
DH3	1.64	4	0.066	0.4	-0.334
DH5	2.89	2.5	0.072	0.4	-0.328



PULSE WIDTH – DH1



PULSE WIDTH – DH3



PULSE WIDTH – DH5

NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH1NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH3NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – DH5

9.6. 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. FHSS 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

Measurements are performed using a wideband RF power meter.

The power output was measured on the EUT antenna port using an SMA cable connected to a power meter via a wideband 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:

Frequency Range (GHz)	Antenna Type	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	-3.70	-0.80	-2.01	0.88	1.70	1.80

DIRECTIONAL GAIN CALCULATION:

ANSI C63.10 section 14.6.3

$$\text{Uncorrelated Directional Gain} = 10 * \text{LOG} \left[\frac{10^{\frac{\text{ANT4}}{10}} + 10^{\frac{\text{ANT3}}{10}}}{2} \right]$$

$$\text{Correlated Directional Gain} = 10 * \text{LOG} \left[\frac{\left(10^{\frac{\text{ANT4}}{20}} + 10^{\frac{\text{ANT3}}{20}} \right)^2}{2} \right]$$

Sample Calculation:

ANT 4 = -3.70 dB

ANT 3 = -0.80 dB

$$\text{Uncorrelated Directional Gain} = 10 * \text{LOG} \left[\frac{10^{\frac{-3.70}{10}} + 10^{\frac{-0.80}{10}}}{2} \right] = -2.01 \text{ dBi}$$

$$\text{Correlated Directional Gain} = 10 * \text{LOG} \left[\frac{\left(10^{\frac{-3.70}{20}} + 10^{\frac{-0.80}{20}} \right)^2}{2} \right] = 0.88 \text{ dBi}$$

RESULTS

9.6.1. SISO MODE

2.4G (SISO)	
Ant 4 (dBi)	-3.7
Ant 3 (dBi)	-0.8

2.4G (SISO)	Power Config.	Freq (MHz)	Ch. #	Power Limit (dBm)		Output Power (dBm)	
				Ant 4	Ant 3	Ant 4	Ant 3
GFSK	High	2402	Low	21	21	20.19	20.16
		2441	Mid			20.21	20.10
		2480	High			20.06	20.02
DQPSK	High	2402	Low			18.27	18.06
		2441	Mid			18.41	18.38
		2480	High			18.18	18.52
8PSK	High	2402	Low			18.93	18.78
		2441	Mid			18.89	18.81
		2480	High			18.66	18.60

9.6.2. MIMO TXBF MODE

2.4G (MIMO TXBF)	
Un-Correlated Gain (dBi)	-2.01
Correlated Gain (dBi)	0.88

2.4G (MIMO TXBF)	Power Config.	Freq (MHz)	Ch. #	Power Limit (dBm)	Output Power (dBm)		Total Power (dBm)
					Ant 4	Ant 3	
GFSK	High	2402	Low	21	16.95	17.25	20.11
		2441	Mid		17.29	17.33	20.32
		2480	High		17.15	17.17	20.17
DQPSK	High	2402	Low		16.01	15.98	19.01
		2441	Mid		16.10	16.00	19.06
		2480	High		16.01	16.04	19.04
8PSK	High	2402	Low		16.15	16.08	19.13
		2441	Mid		16.06	16.19	19.14
		2480	High		16.13	16.22	19.19

9.7. 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

9.7.1. SISO MODE

2.4G (SISO)	
Ant 4 (dBi)	-3.7
Ant 3 (dBi)	-0.8

2.4G (SISO)	Power Config.	Freq (MHz)	Ch. #	Average Power (Gated) (dBm)	
				Ant 4	Ant 3
GFSK	High	2402	Low	19.97	19.94
		2441	Mid	19.92	19.93
		2480	High	19.72	19.75
	Low	2402	Low	12.42	11.48
		2441	Mid	12.38	11.35
		2480	High	12.47	11.47
DQPSK	High	2402	Low	15.60	15.48
		2441	Mid	15.85	15.73
		2480	High	15.63	16.01
	Low	2402	Low	8.42	7.77
		2441	Mid	8.42	7.41
		2480	High	8.36	8.44
8PSK	High	2402	Low	16.31	16.22
		2441	Mid	16.21	16.11
		2480	High	16.13	16.02
	Low	2402	Low	8.49	8.41
		2441	Mid	8.45	8.45
		2480	High	8.44	8.41

9.7.2. MIMO TXBF MODE

2.4G (MIMO TXBF)	
Un-Correlated Gain (dBi)	-2.01
Correlated Gain (dBi)	0.88

2.4G (MIMO TXBF)	Power Config.	Freq (MHz)	Ch. #	Average Power (Gated) (dBm)		Total MIMO Corrected Average Power (dBm)
				Ant 4	Ant 3	
GFSK	High	2402	Low	16.70	16.93	19.83
		2441	Mid	16.98	16.98	19.99
		2480	High	16.92	16.93	19.94
	Low	2402	Low	12.47	11.25	14.91
		2441	Mid	12.28	11.42	14.88
		2480	High	12.44	11.24	14.89
DQPSK	High	2402	Low	13.44	13.25	16.36
		2441	Mid	13.42	13.30	16.37
		2480	High	13.41	13.30	16.37
	Low	2402	Low	8.32	8.10	11.22
		2441	Mid	8.42	8.23	11.34
		2480	High	8.39	7.80	11.12
8PSK	High	2402	Low	13.47	13.45	16.47
		2441	Mid	13.48	13.49	16.50
		2480	High	13.45	13.45	16.46
	Low	2402	Low	8.45	8.11	11.29
		2441	Mid	8.47	8.26	11.38
		2480	High	8.43	7.82	11.15

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 6.6

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.

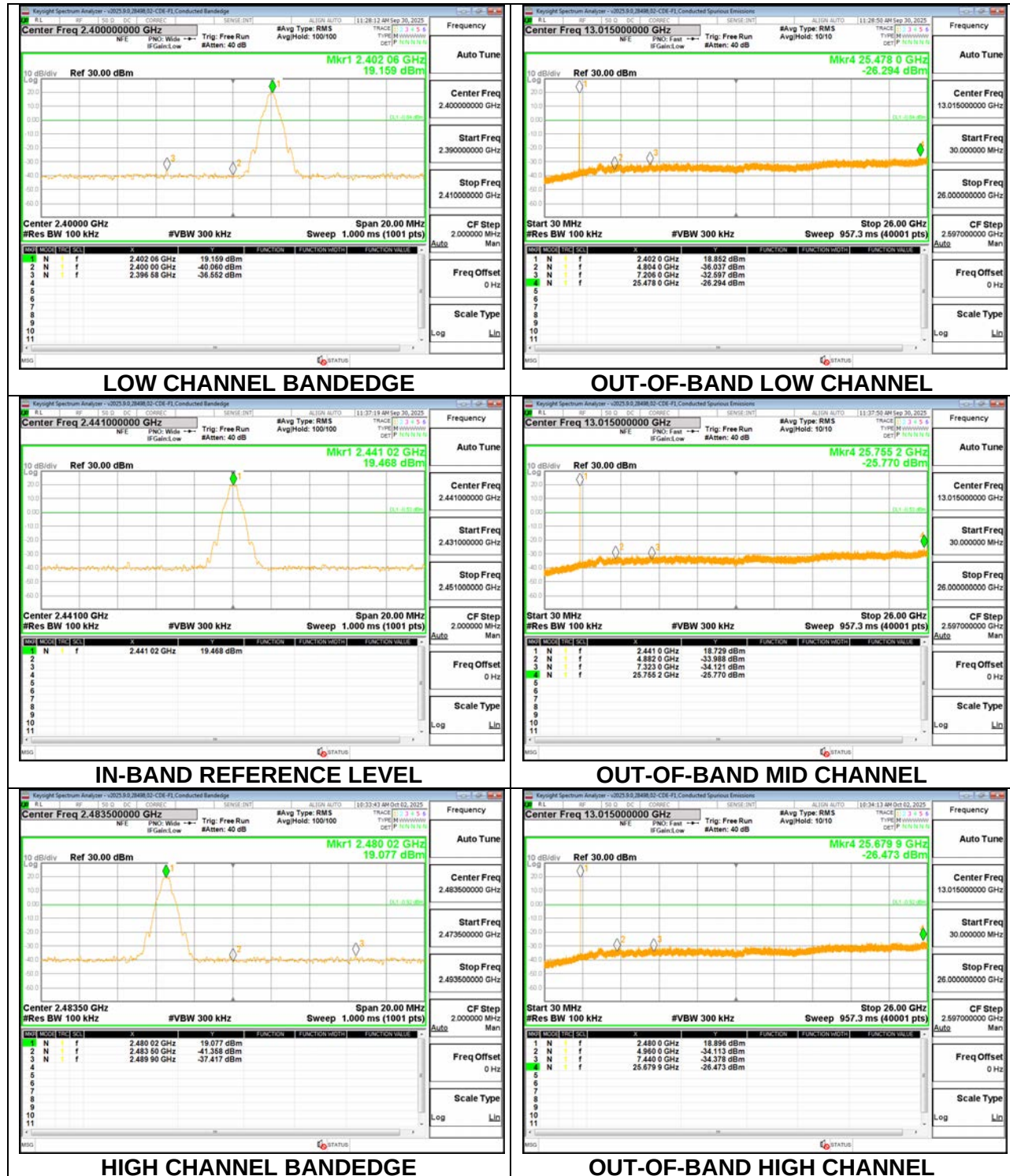
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

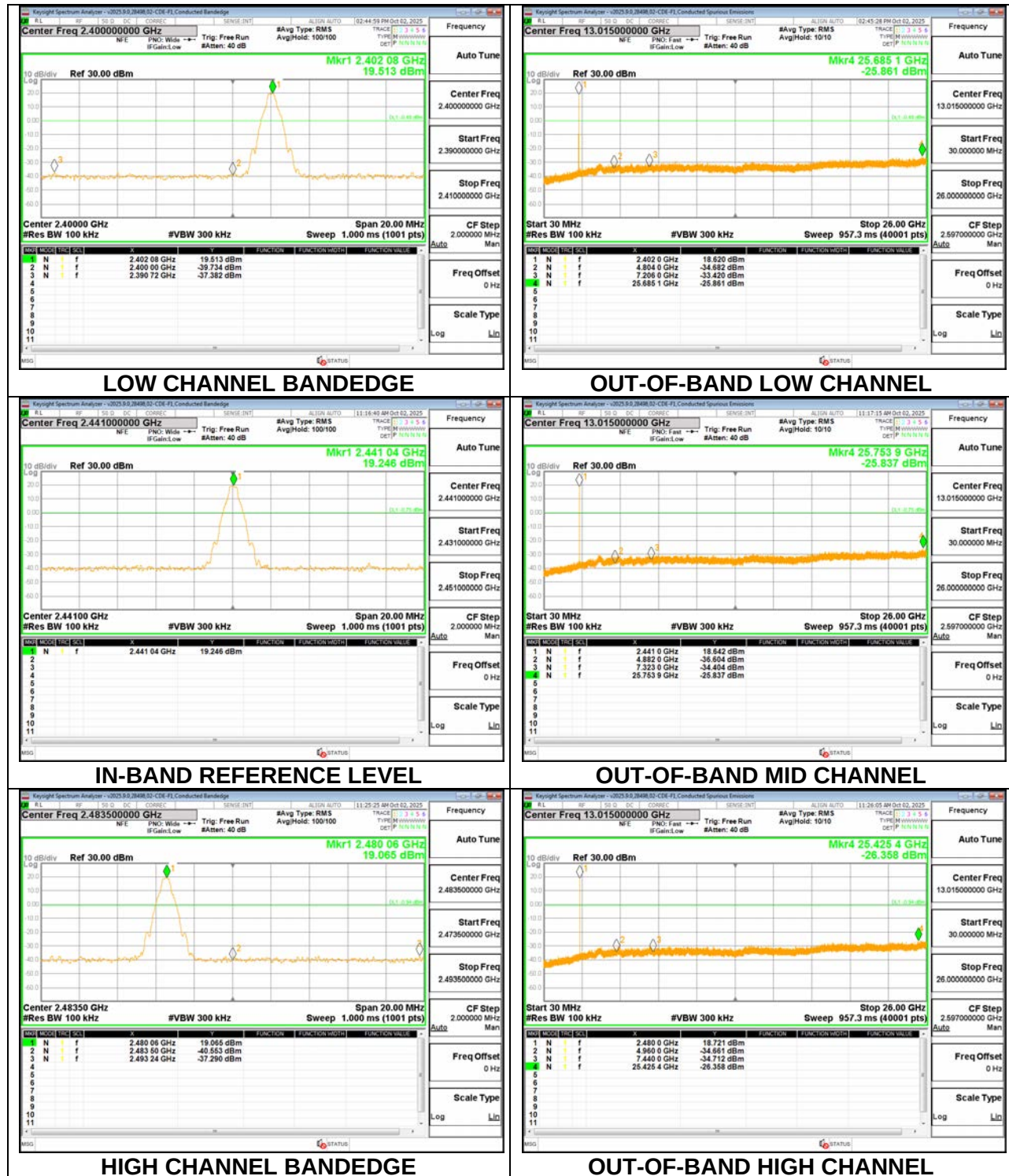
RESULTS

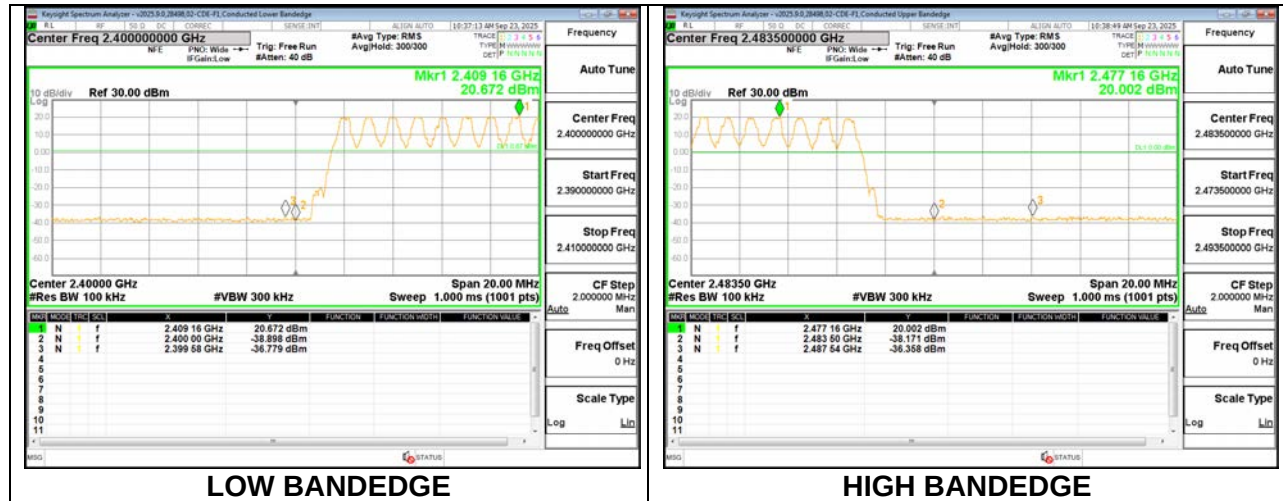
9.8.1. HIGH POWER GFSK

ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



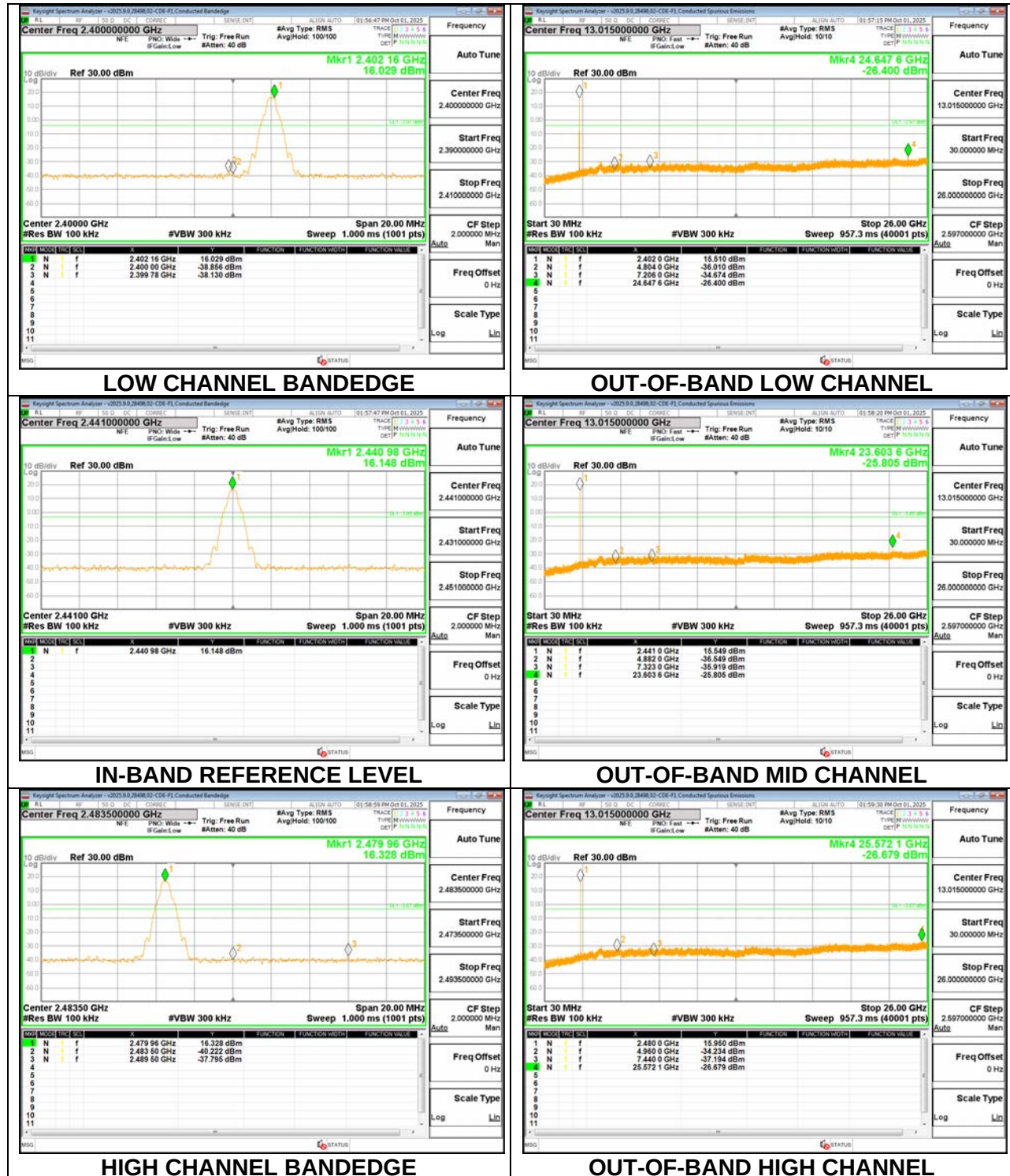
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

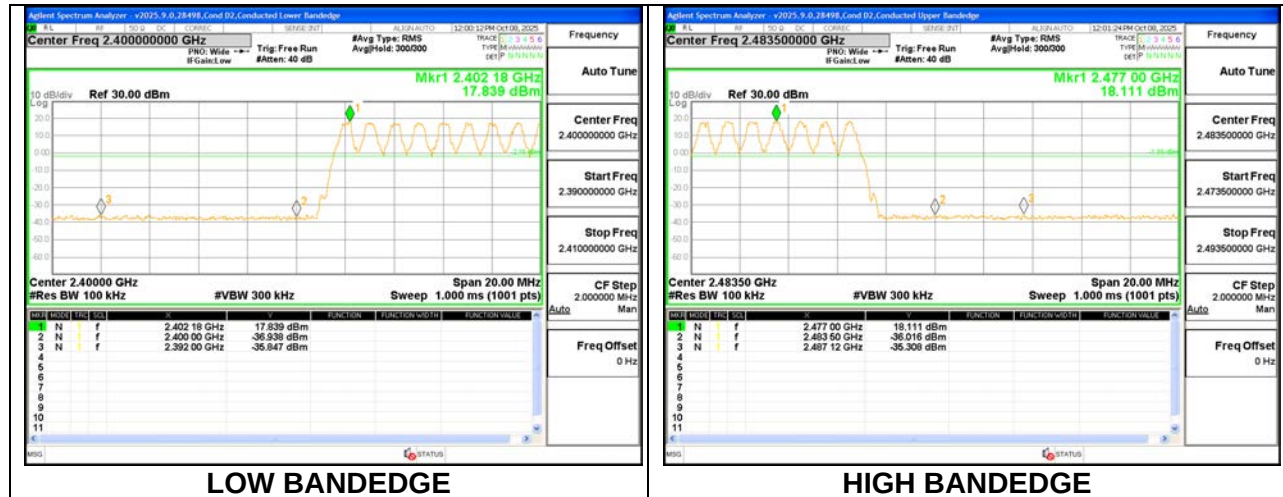
ANT 3 SPURIOUS EMISSIONS, NON-HOPPING

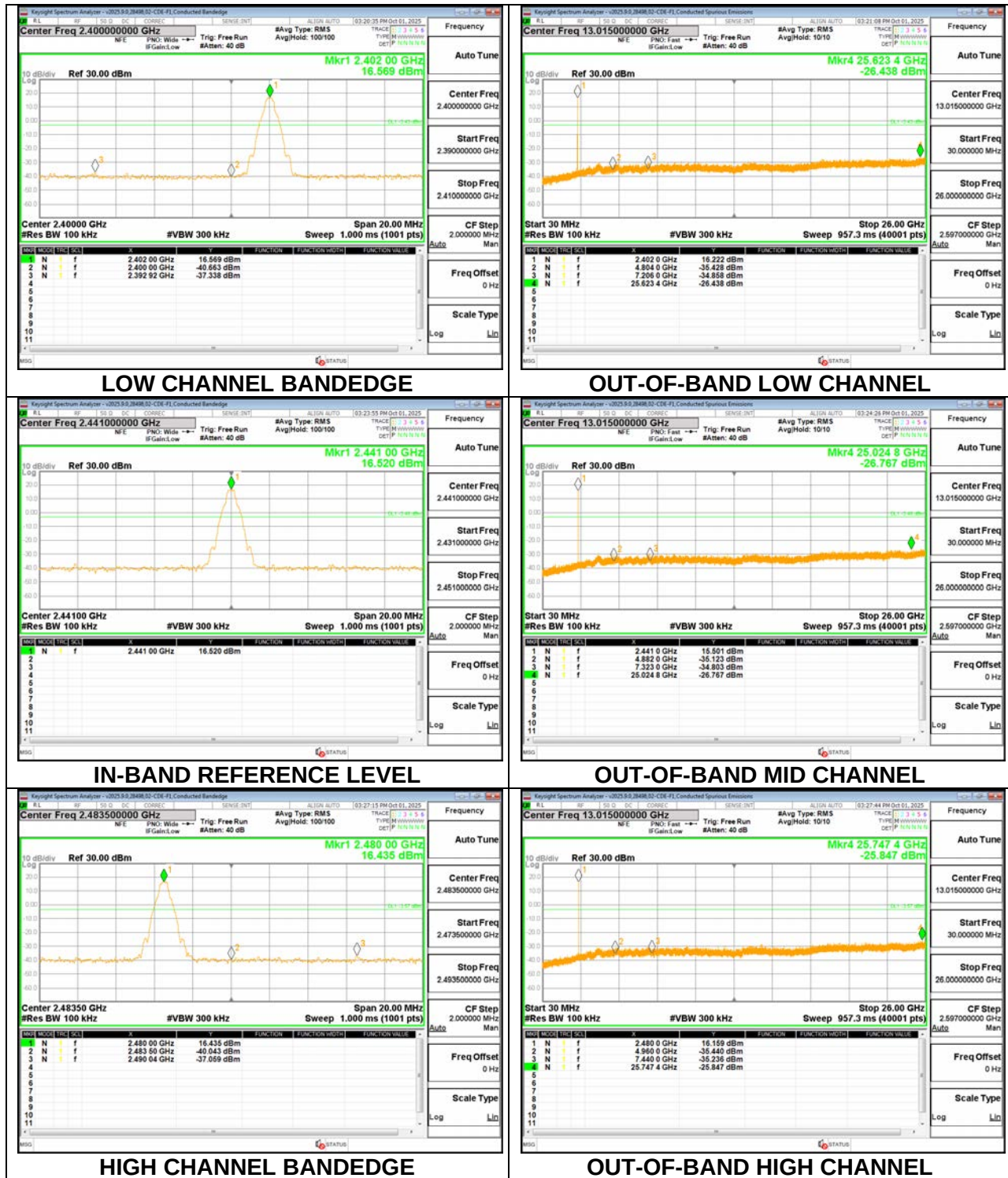
ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

9.8.2. HIGH POWER GFSK MIMO TXBF

ANT 4 SPURIOUS EMISSIONS, NON-HOPPING

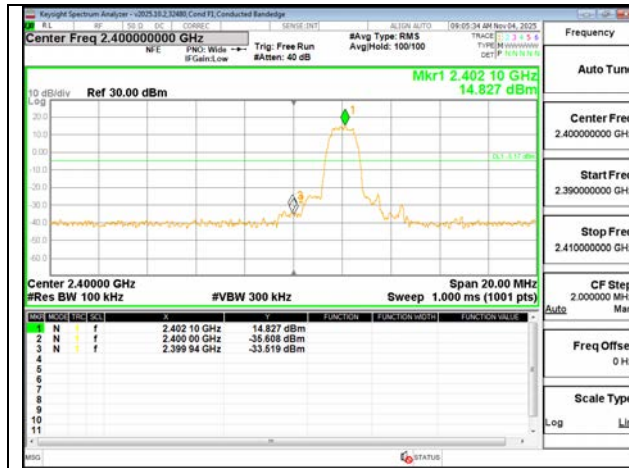
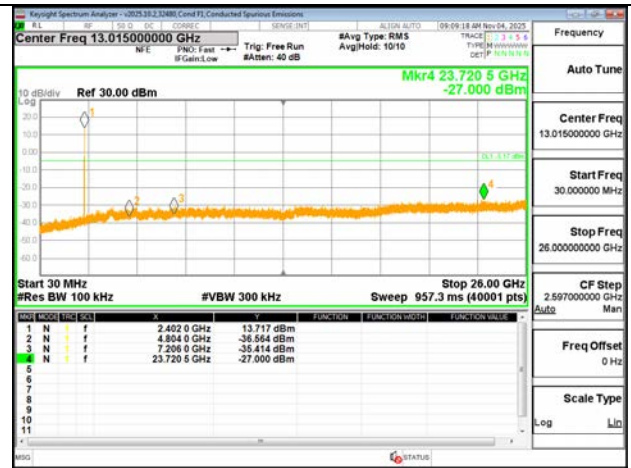
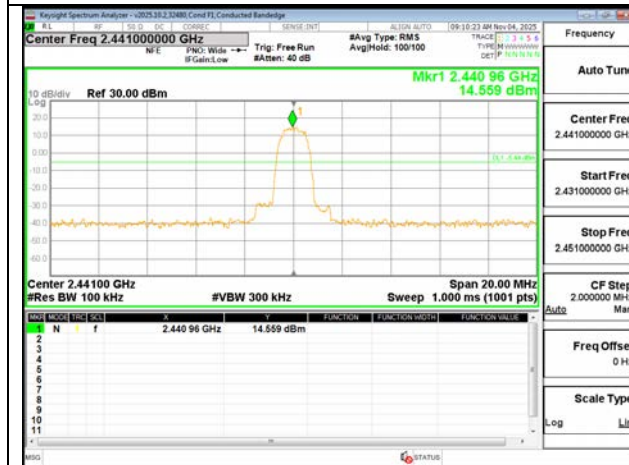
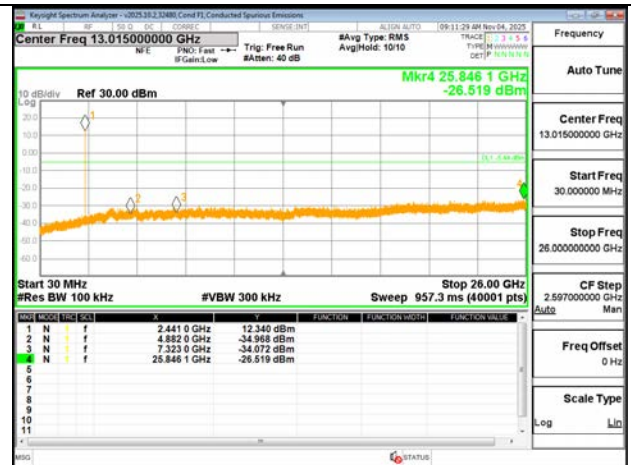
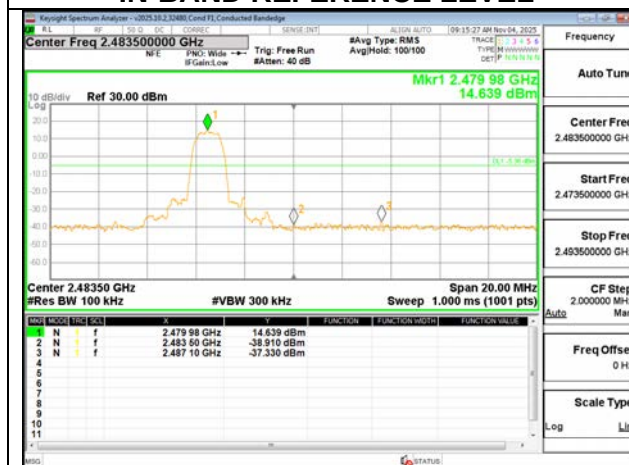
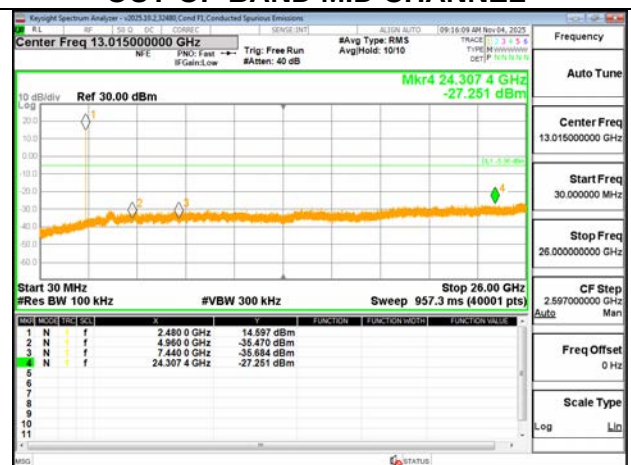


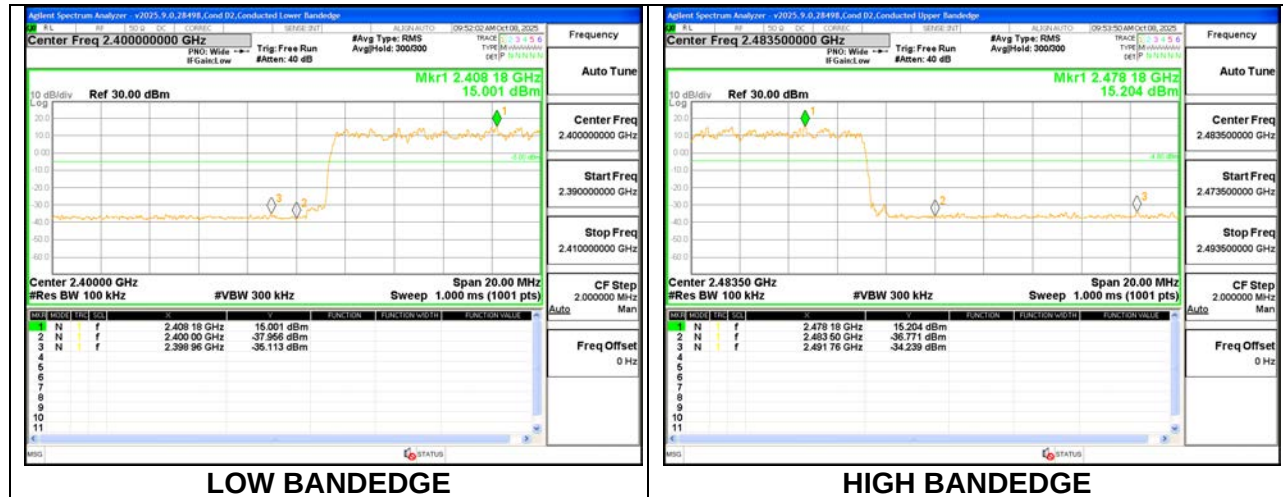
ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

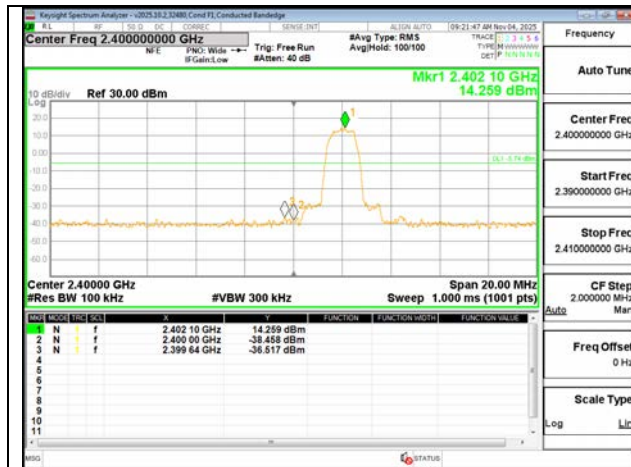
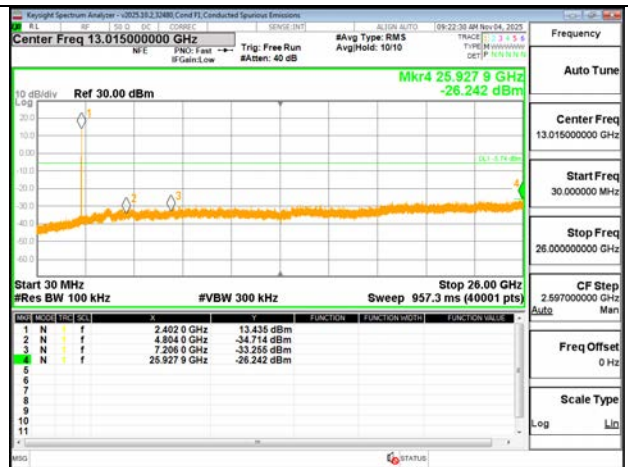
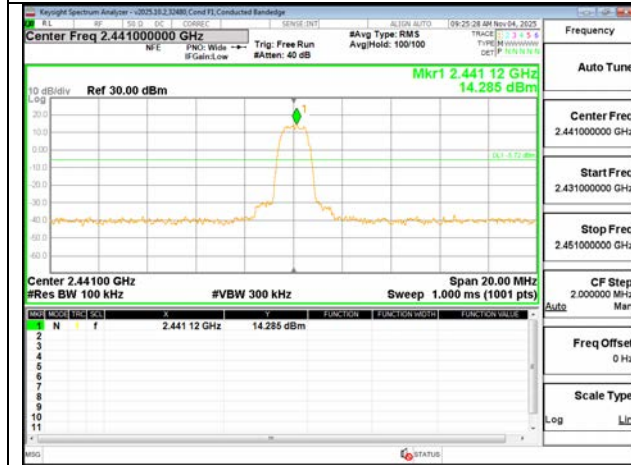
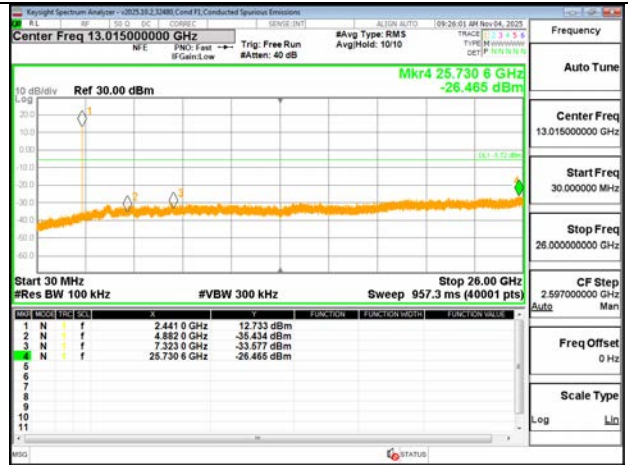
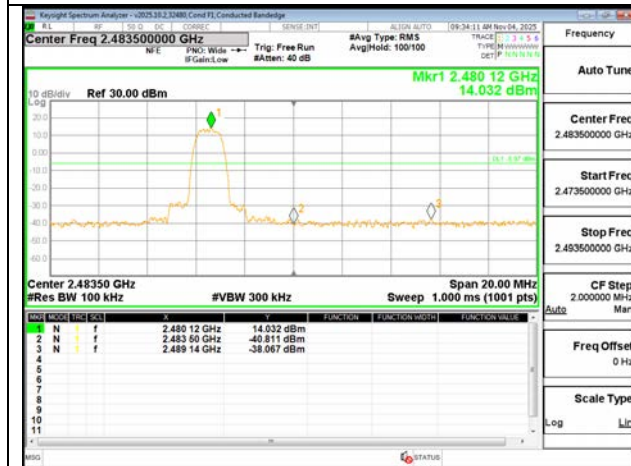
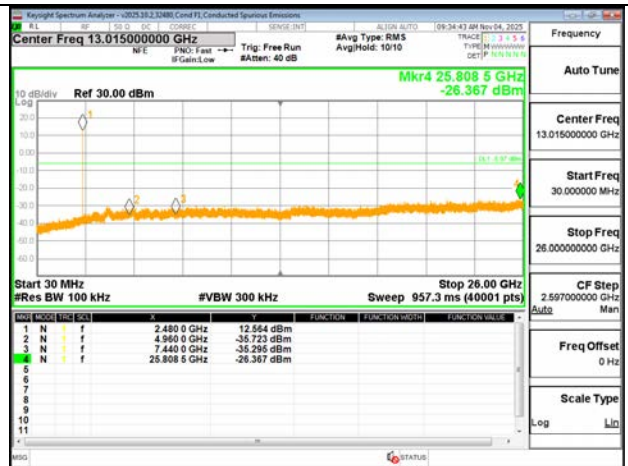
ANT 3 SPURIOUS EMISSIONS, NON-HOPPING

ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

9.8.3. HIGH POWER 8PSK

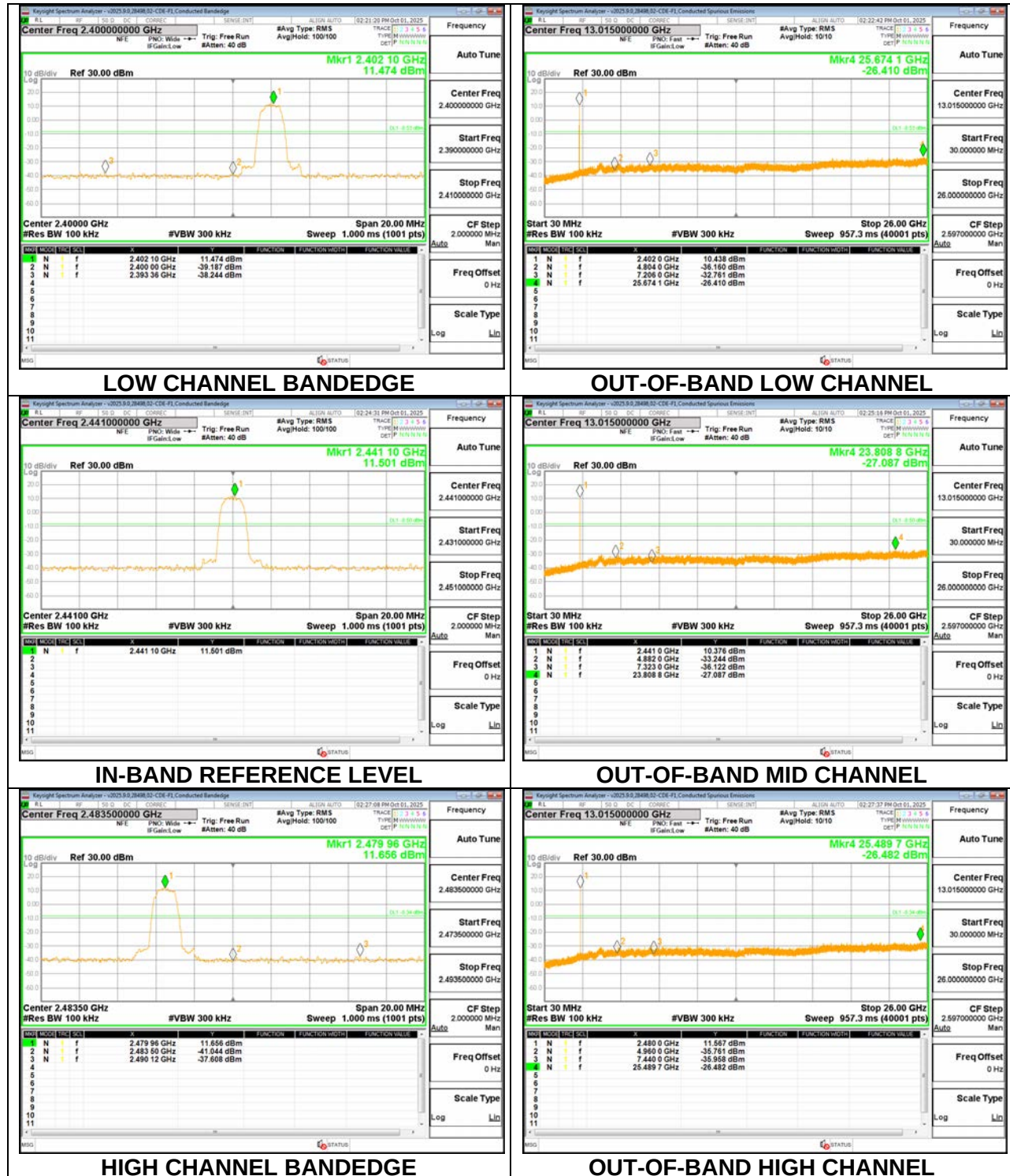
ANT 4 SPURIOUS EMISSIONS, NON-HOPPING**LOW CHANNEL BANDEDGE****OUT-OF-BAND LOW CHANNEL****IN-BAND REFERENCE LEVEL****OUT-OF-BAND MID CHANNEL****HIGH CHANNEL BANDEDGE****OUT-OF-BAND HIGH CHANNEL**

ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

ANT 3 SPURIOUS EMISSIONS, NON-HOPPING**LOW CHANNEL BANDEDGE****OUT-OF-BAND LOW CHANNEL****IN-BAND REFERENCE LEVEL****OUT-OF-BAND MID CHANNEL****HIGH CHANNEL BANDEDGE****OUT-OF-BAND HIGH CHANNEL**

ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

9.8.4. HIGH POWER 8PSK MIMO TXBF

ANT 4 SPURIOUS EMISSIONS, NON-HOPPING

LOW BANDEDGE

HIGH BANDEDGE