

TEST REPORT

Report Number: 15496277-E4V3

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

Model : A3258 (Parent)
A3519, A3520, A3521 (Variants)

Brand : APPLE

FCC ID : BCG-E8947A (Parent)
BCG-E8951A, BCG-E8952A, BCG-E8953A (Variants)

IC : 579C-E8947A (Parent)
579C-E8951A, 579C-E8952A, 579C-E8953A (Variants)

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:

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Prepared by:

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2025/08/01	Initial issue	-
V2	2025/08/15	Addressing TCB Feedback	Jordan Bailey
V3	2025/08/19	Addressing TCB Feedback	Vien Tran

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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	A3258 (Parent) A3519, A3520, A3521 (Variants)		
Brand	APPLE		
FCC ID	BCG-E8947A (Parent) BCG-E8951A, BCG-E8952A, BCG-E8953A (Variants)		
IC	579C-E8947A (Parent) 579C-E8951A, 579C-E8952A, 579C-E8953A (Variants)		
EUT Description	SMARTPHONE		
Serial Number	H0233MXH93 (Radiated), J6HHH5000210000WEZ (Conducted)		
Sample Receipt Date	2025/02/28		
Date Tested	2025/04/01 to 2025/08/18		
Applicable Standards	CFR 47 Part 15 Subpart C ISED RSS-247 Issue 3 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 sample tested, 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:	
			
Richard Lee Staff Engineer UL Verification Services, Inc.		Jordan Bailey Test Engineer UL Verification Services, Inc.	

2. TEST RESULTS SUMMARY

This report contains data provided by the customer, which can impact on the validity of the results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

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

1. Antenna gain and type (see section 6.2)
2. Cable loss (see section 6.2)

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power (Average)	Complies	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

3. TEST METHODOLOGY

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

- FCC 47 CFR Part 2
- FCC 47 CFR Part 15C
- *ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024
- 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 3

*Note: The use of ANSI C63.10-2020 + Cor. 1-2023 + C63.10a-2024 does not deviate from the testing procedures of ANSI C63.10-2020

4. FACILITIES AND ACCREDITATION

UL Verification 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 measured uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U _{LAB}
Conducted Antenna Port Emission Measurement	1.94 dB
Power Spectral Density	2.466 dB
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%
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 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. This device is not user-serviceable and requires special tools to disassemble.

6.2. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency Range (GHz)	ANT 4 (dBi)	ANT 3 (dBi)
2.4	0.0	-3.5

The SMA Cable Loss provided by the manufacturer are as follows:

Frequency Range (GHz)	ANT 4 (dB)	ANT 3 (dB)
2.4	1.56	2.29

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

6.3. SOFTWARE AND FIRMWARE

The EUT firmware and software installed during testing was 23A258.

6.4. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
1Tx			
2412 - 2472	802.11b	20.93	123.88
	802.11g	Covered by 802.11n HT20 1TX	
	802.11n HT20	20.99	125.60
	802.11ax HE20	Covered by 802.11be EHT20 1TX	
	802.11be EHT20	20.98	125.31

2Tx			
2412 - 2472	802.11b CDD	23.46	221.82
	802.11n HT20 CDD	23.47	222.33
	802.11g SDM/STBC	Covered by 802.11n HT20 2TX CDD	
	802.11ax HE20	Covered by 802.11be EHT20 OFDMA	
	802.11be EHT20 OFDMA	23.46	221.82

6.5. WORST-CASE CONFIGURATION AND MODE

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

With the same power on Full RU and SU higher data rate, an investigation was performed on both bandedge to determine the worst case, and the SU mode was determined to be the worst case.

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

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

For radiated harmonics spurious below 1GHz, 1-18GHz L/M/H channels, 18-26GHz, and power line conducted emissions were performed with the EUT set at the 2TX CDD mode among the CDD/SDM modes and 2TX EHT mode with power setting equal or higher than SISO modes as a worst-case scenario. G mode is covered by HT20 mode since it has the same power as HT20.

Below 30MHz, 30-1000MHz emissions spurious tests were performed with EUT connected to an AC power adapter and set at X orientation as the worst case; and for above 1GHz tests, the worst-case configuration reported was with EUT only. For AC line conducted emission, a test was conducted with an AC power adapter and with laptop.

The modulation and bandwidth of 802.11ax and 802.11be modes are similar, and the target power of 802.11ax mode is equal to or lower than that of 802.11be mode. The data rate of 802.11be mode is higher than 802.11ax mode; therefore, 802.11be mode is performed in the test to represent worst-case reporting.

The output power and PSD for the 802.11be mode were investigated for all different tones, and we found that the SU mode had the highest output power and RU26 had the highest PSD readings. And after investigation, antenna port conducted tests were performed on both SU and the lowest tones; radiated spurious emission and radiated band edge tests were performed on SU and the lowest tones. Please see the worst-case summary table below.

WIFI DTS 2.4GHz - 802.11be					
BW (MHz)	Tone (T)	RU Index	RU Index from Chipset support	Worst Case Tone (UNII-1)	
				Power	PSD
20	26	0 ~ 8	0 ~ 8		X
	52	37 ~ 40	37 ~ 40		
	52 + 26	70 ~ 81	70, 71, 72		
	106	53 ~ 54	53 ~ 54		
	106 + 26	82 ~ 89	82, 83		
	242	61	61		
	SU	--	--	X	

Low data rate was used to test on the antenna port, conduct tests, and radiate spurious emissions since it has the highest maximum power. For radiated bandedge, the following are the worst-case data rates set for test:

802.11b mode : 1 Mbps
 802.11n HT20 mode : MCS7
 802.11be EHT20mode: MCS9
 802.11be EHT RU26 and SU, MCS9

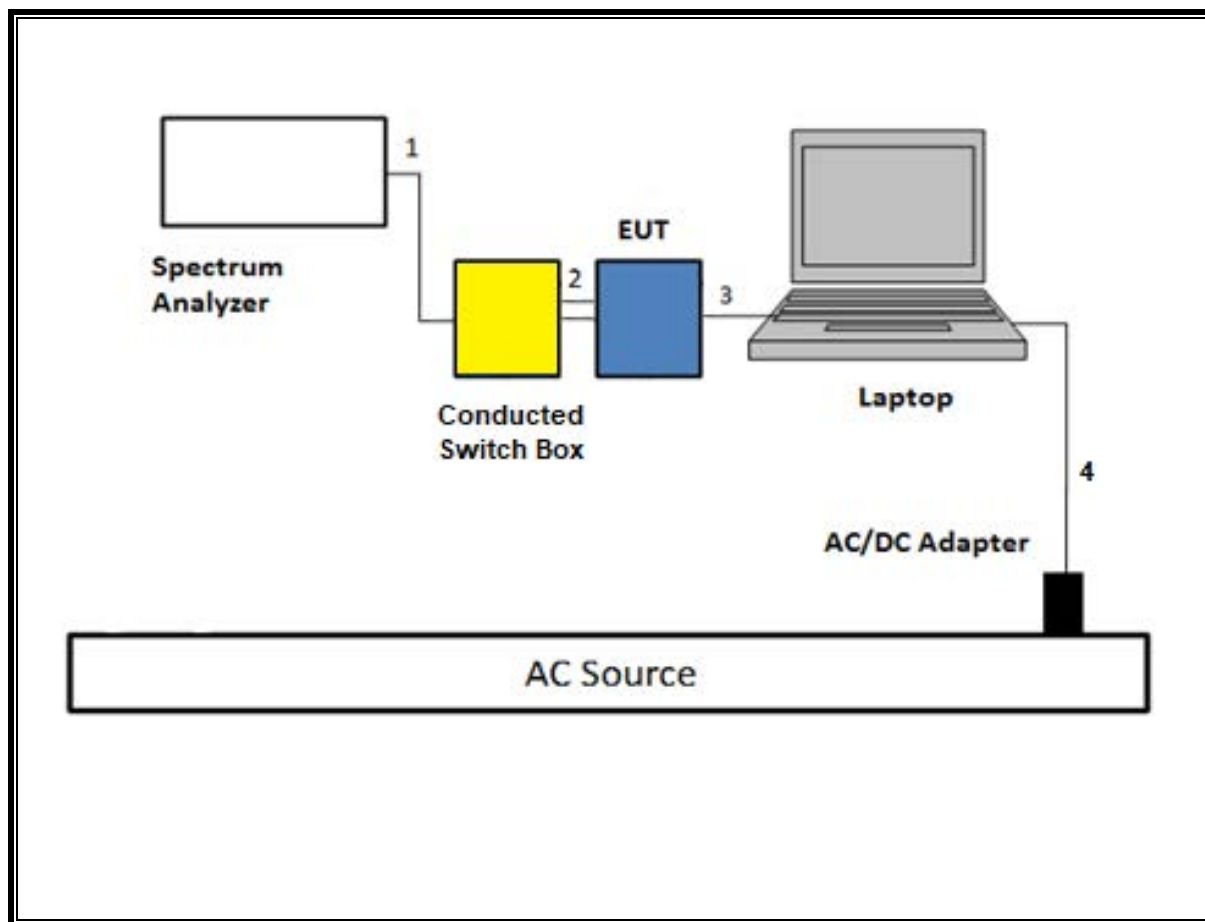
Note: In the Radiated Plots and emissions data, ANT1=ANT4 and ANT2=ANT 3.

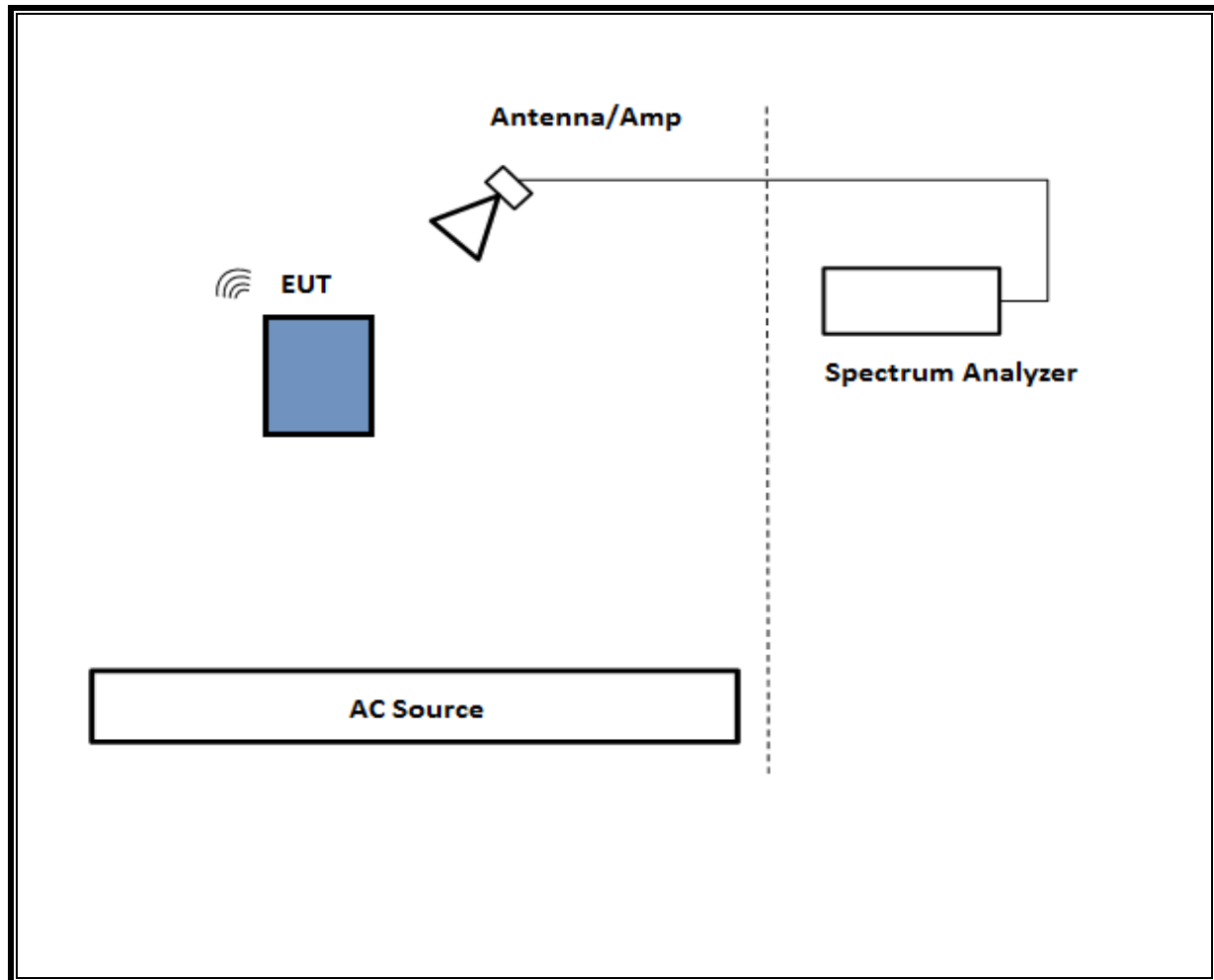
6.6. DESCRIPTION OF TEST SETUP

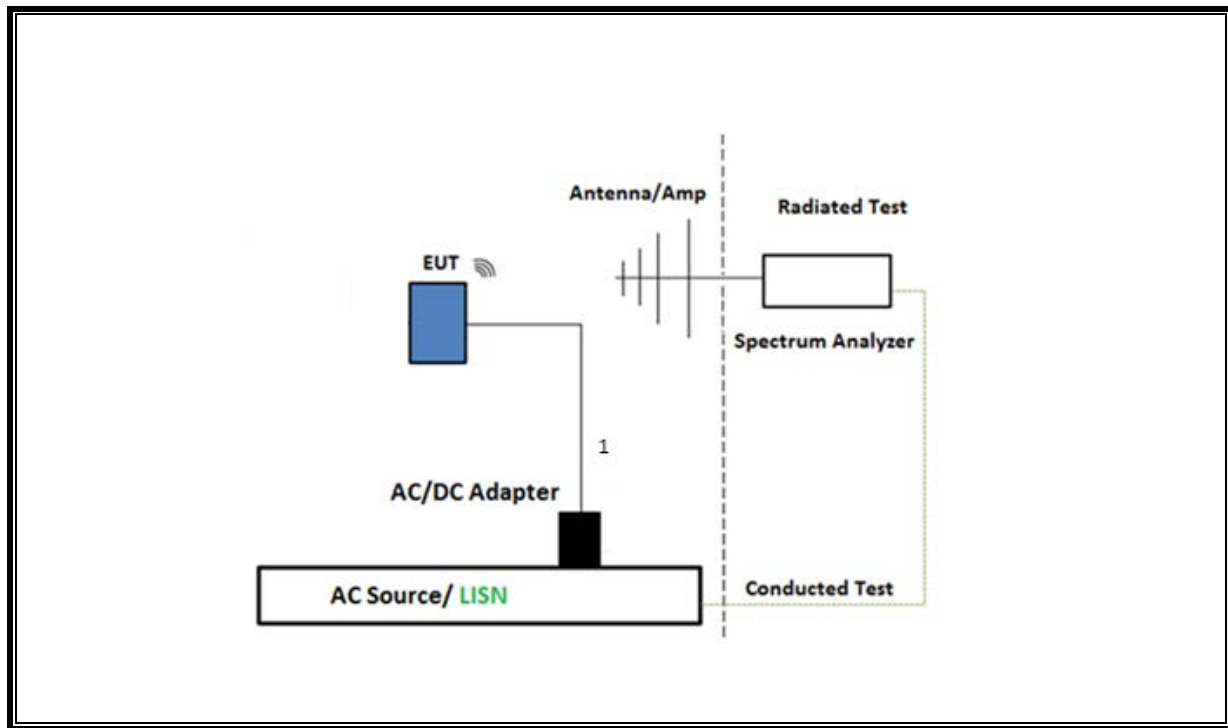
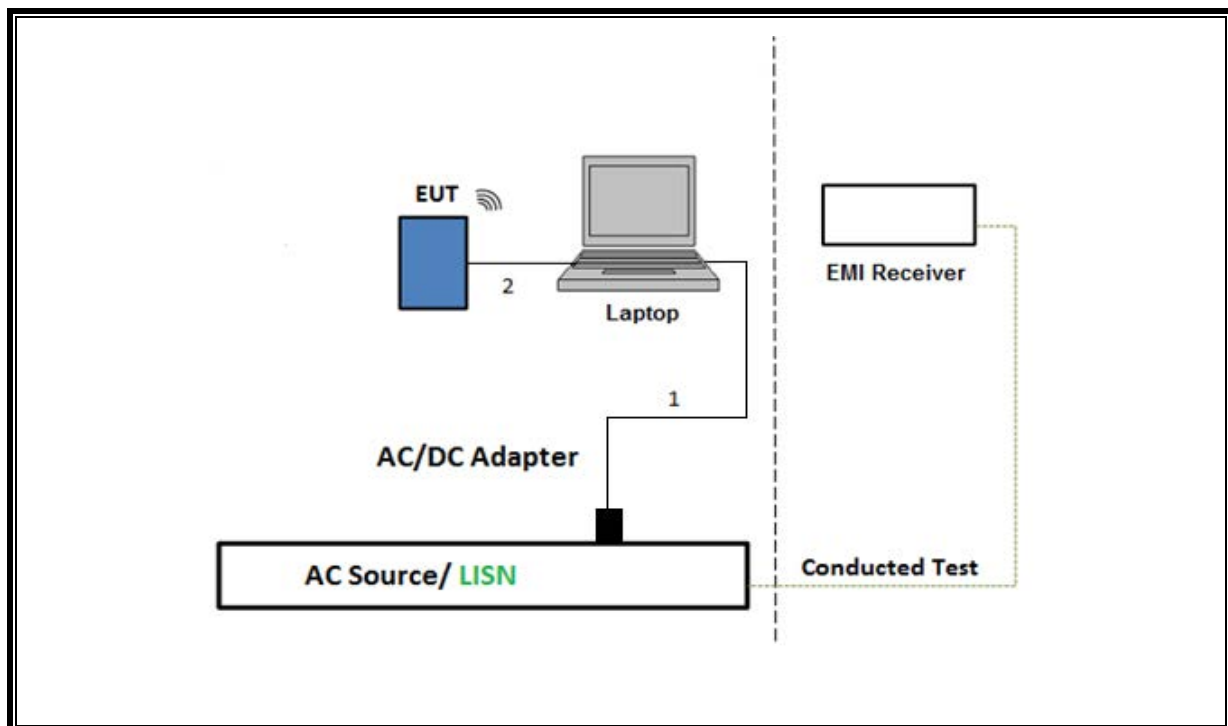
SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Apple	Macbook	G2YKJ9LWH5		N/A
Laptop AC/DC adapter		Apple	N/A	C4H238408AEPM0WAS		DoC
EUT AC/DC adapter		Apple	N/A	C4H238505ARPM0WAP		DoC
Conducted Switch Box		UL	N/A	245782		N/A
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1.0	N/A
3	AC	1	AC	Un-shielded	2	N/A
I/O CABLES (RF RADIATED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	2	N/A
2	USB	1	USB	Un-shielded	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

SETUP DIAGRAM FOR 30-1000MHz and AC LINE CONDUCTED TEST**TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION**

7. MEASUREMENT METHOD

Test Item	Test Method
6 dB BW	ANSI C63.10 Subclause -11.8.1 RBW $\geq$ DTS BW
99% BW	ANSI C63.10-2013, Subclause 6.9.3.
Output Power	ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM G (Measurement using an RF average-reading power meter)
PSD	ANSI C63.10 Subclause -11.10.3 Method AVGPS-1
Radiated emissions non-restricted frequency bands	ANSI C63.10 Subclause -11.11 & Clause 13
Radiated emissions restricted frequency bands	ANSI C63.10 Subclause -11.12.1 & Clause 13
Conducted emissions in restricted frequency bands	ANSI C63.10 Subclause -11.12.2
Band-edge	ANSI C63.10 Subclause -11.13.3.2 & Clause 13: Integration method -Peak detection
Band-edge	ANSI C63.10 Subclause -11.13.3.3 & Clause 13: Integration method -Trace averaging with continuous transmission at full power
Radiated Spurious Emissions Below 30MHz	ANSI C63.10-2013 Subclause 6.4 & Clause 13
AC Power Line Conducted Emissions	ANSI C63.10-2013, Subclause 6.2

8. 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
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	80707	2026/6/30
RF Filter Box, 1-18GHz, 12 Port	UL-FR1	N/A	171875	2026/3/31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	245268	2026/2/28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	222740	2025/8/31
RF Filter Box, 1-18GHz, 12 Port	UL-FR1	Frankenstein	171389	2026/3/30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201497	2026/2/28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	226672	2026/2/28
RF Filter Box, 1-18GHz, 12 Port.	UL-FR1	Frankenstein	231876	2026/4/30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	223459	2026/2/27
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	226673	2026/2/28
Filter Box	UL-FR1	Frankenstein, 1 Amp, 12 Port	231874	2026/6/29
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235670	2026/2/28
Antenna, Passive Loop, 30Hz - 1MHz	Electro-Metrics	EM-6871	170014	2025/08/31
Antenna, Passive Loop, 100kHz to 30MHz	Electro-Metrics	EM-6872	170016	2025/08/31
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	230310	2026/05/31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	191428	2026/2/28
Amplifier 9 KHz - 1 GHz	SONOMA INSTRUMENT	310N	230311	2026/5/31
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	80813	2025/9/29
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235670	2026/2/28
Antenna, Horn 18-26.5GHz	A.R.A	MWH-1826/B	172353	2026/07/31
Link File, RF Amplifier Assembly, 18-26.5GHz, 60dB Gain	Amplical	AMP18G26.5-60	220194	2026/04/29
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	226078	2/28/2026
Spectrum Analyzer, PXA, 3Hz to 44GHz	N9030A	Keysight Technologies Inc	80397	2026/01/31
Spectrum Analyzer, PXA, 3Hz to 44GHz	N9030A	Keysight Technologies Inc	125179	2026/02/28
Conducted Switch Box	UL-FR1	CSB	245782	*2025/07/31
Conducted Switch Box	UL-FR1	CSB	208281	*2025/05/31
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90715	2026/01/31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	81319	2026/01/31

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	ID Num	Cal Due
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200784	2025/01/31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	230548	2025/02/28
RF Filter Box, 1-18GHz, 17 Ports	UL-FR1	RATS 2	225079	2025/04/30
Antenna RECEIVER, Horn 1-18GHz	ETS-Lindgren	3117	206807	2025/02/28
EMI TEST	Rohde & Schwarz	ESW44	201501	2024/11/30
RF Filter Box, 1-18GHz, 8 Port	UL-FR1	SAC 8 port rf box 1	197920	2025/03/31

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	2025-09-30
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 is completed before equipment expiration date.

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.

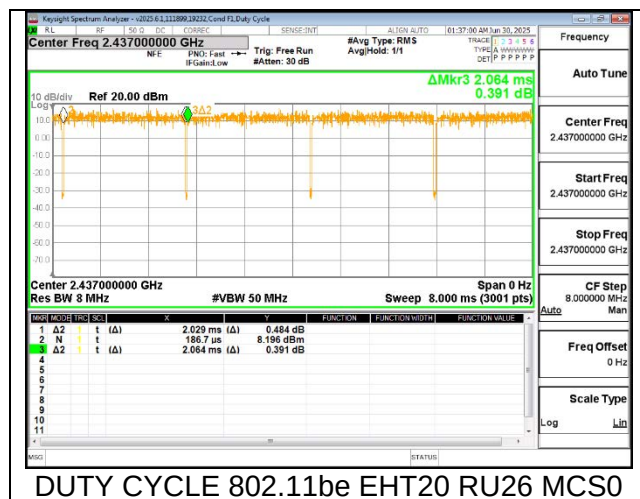
Test Engineer:	19323
Test Date:	June 30, 2025

ON TIME AND DUTY CYCLE RESULTS

Mode	Tone (T)	Data Rate (Mbps)	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
b	--	1Mb/s	12.4300	12.4500	0.9984	99.84%	0.00	0.010
HT20	--	MCS0	3.8250	3.8500	0.9935	99.35%	0.00	0.010
	--	MCS7	4.0100	4.0350	0.9938	99.38%	0.00	0.010
EHT20	SU	MCS0	4.6200	4.6450	0.9946	99.46%	0.00	0.010
		MCS9	5.4130	5.4400	0.9950	99.50%	0.00	0.010
	26	MCS0	2.0290	2.0640	0.9830	98.30%	0.00	0.010
		MCS9	2.0290	2.0640	0.9830	98.30%	0.00	0.010

Note: Duty cycle 2TX is the same as 1TX.

DUTY CYCLE PLOTS

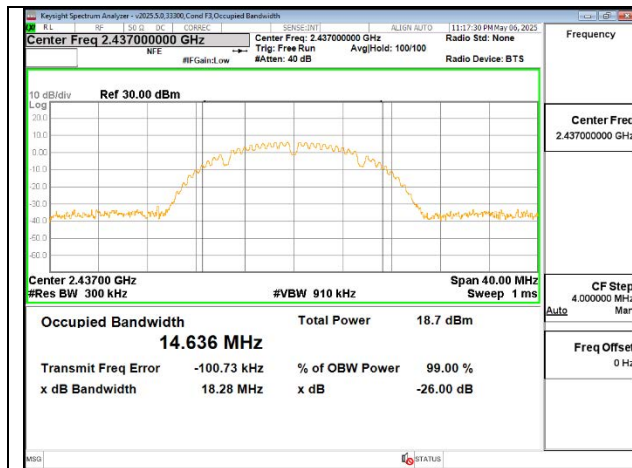


9.2. 99% BANDWIDTH LIMITS

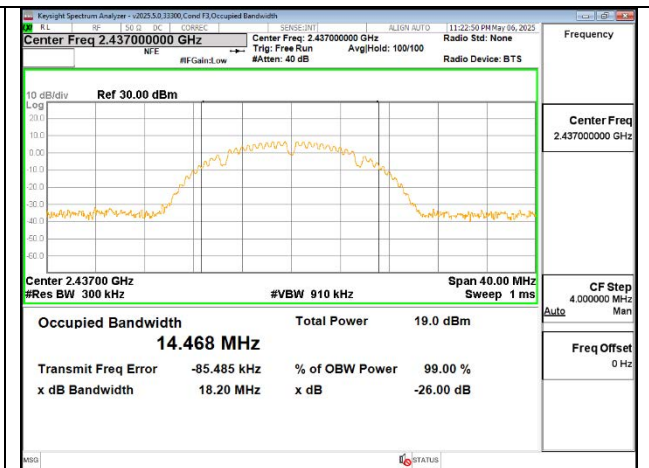
None; for reporting purposes only.

RESULTS

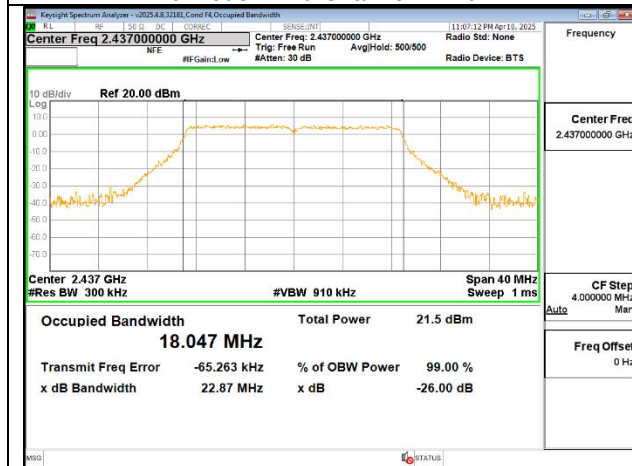
Mode	Frequency (MHz)	Channel Number	Tone	RU Index	99% Bandwidth (MHz)	
					ANT 4	ANT 3
b	2412	1	--	--	14.529	14.617
	2437	6	--	--	14.636	14.468
	2472	13	--	--	14.453	14.382
HT20	2412	1	--	--	18.007	17.938
	2437	6	--	--	18.047	17.807
	2472	13	--	--	17.911	17.682
EHT20	2412	1	SU	--	19.029	19.105
			26	0	18.618	18.485
				4	16.741	17.000
				8	18.473	18.506
	2437	6	SU	--	19.012	18.983
			26	0	18.704	18.122
				4	16.736	16.785
				8	18.451	18.599
	2472	13	SU	--	19.009	18.916
			26	0	18.518	18.128
				4	16.768	16.578
				8	18.512	18.409



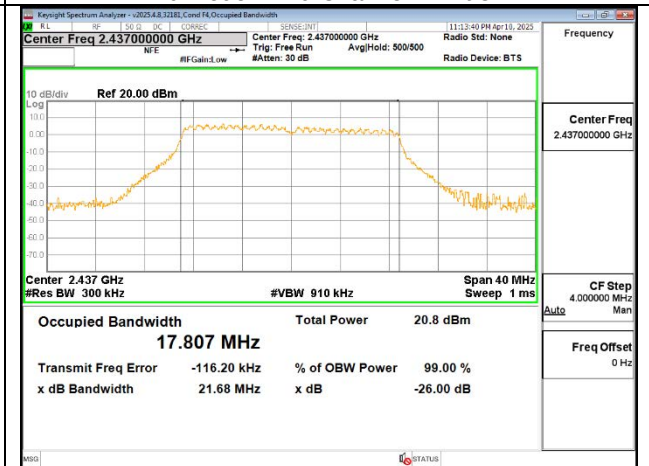
b-mode – Mid Channel – Ant 4



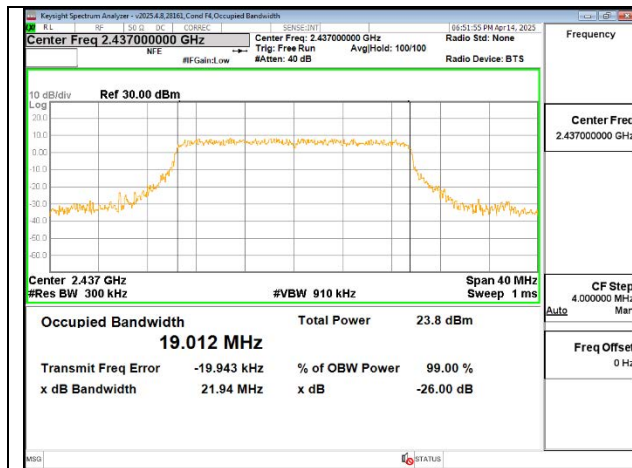
b-mode – Mid Channel – Ant 3



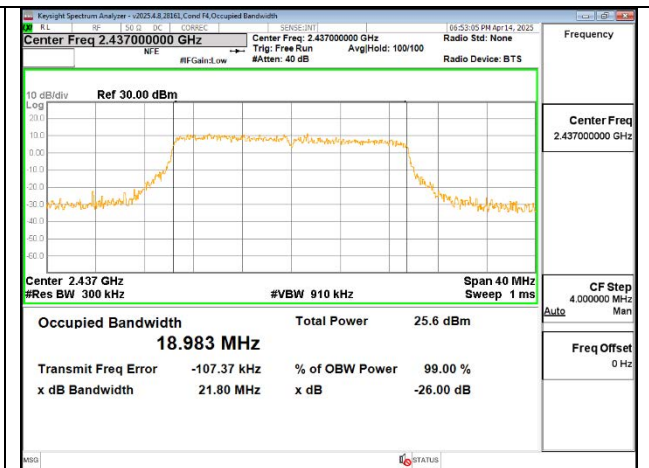
HT20-mode – Mid Channel – Ant 4



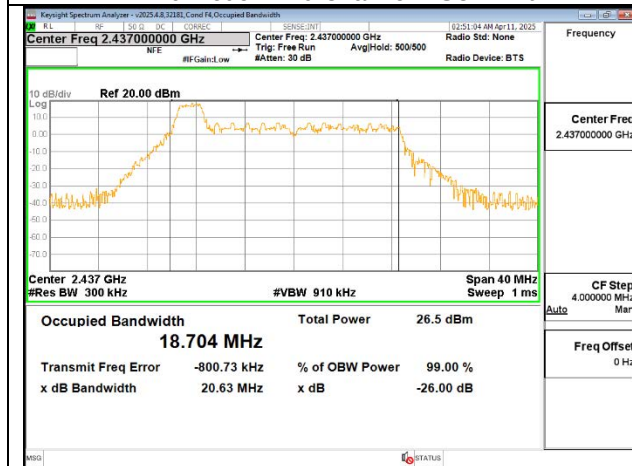
HT20-mode – Mid Channel – Ant 3



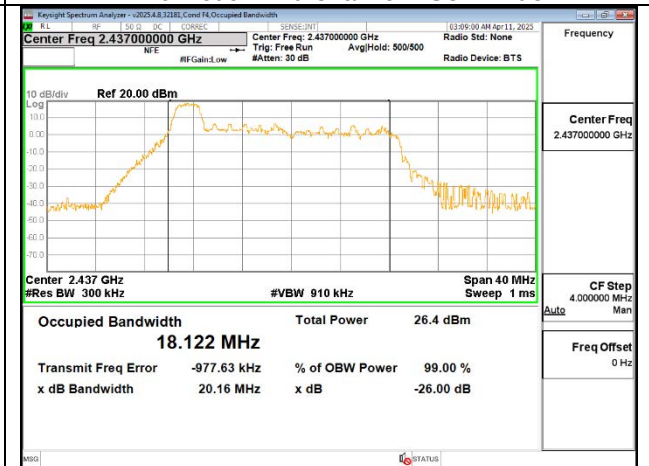
EHT20-mode – Mid Channel – SU – Ant 4



HT20-mode – Mid Channel – SU – Ant 3



EHT20-mode – Mid Channel – Partial RU – Ant 4



HT20-mode – Mid Channel – Partial RU – Ant 3

9.3. 6dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

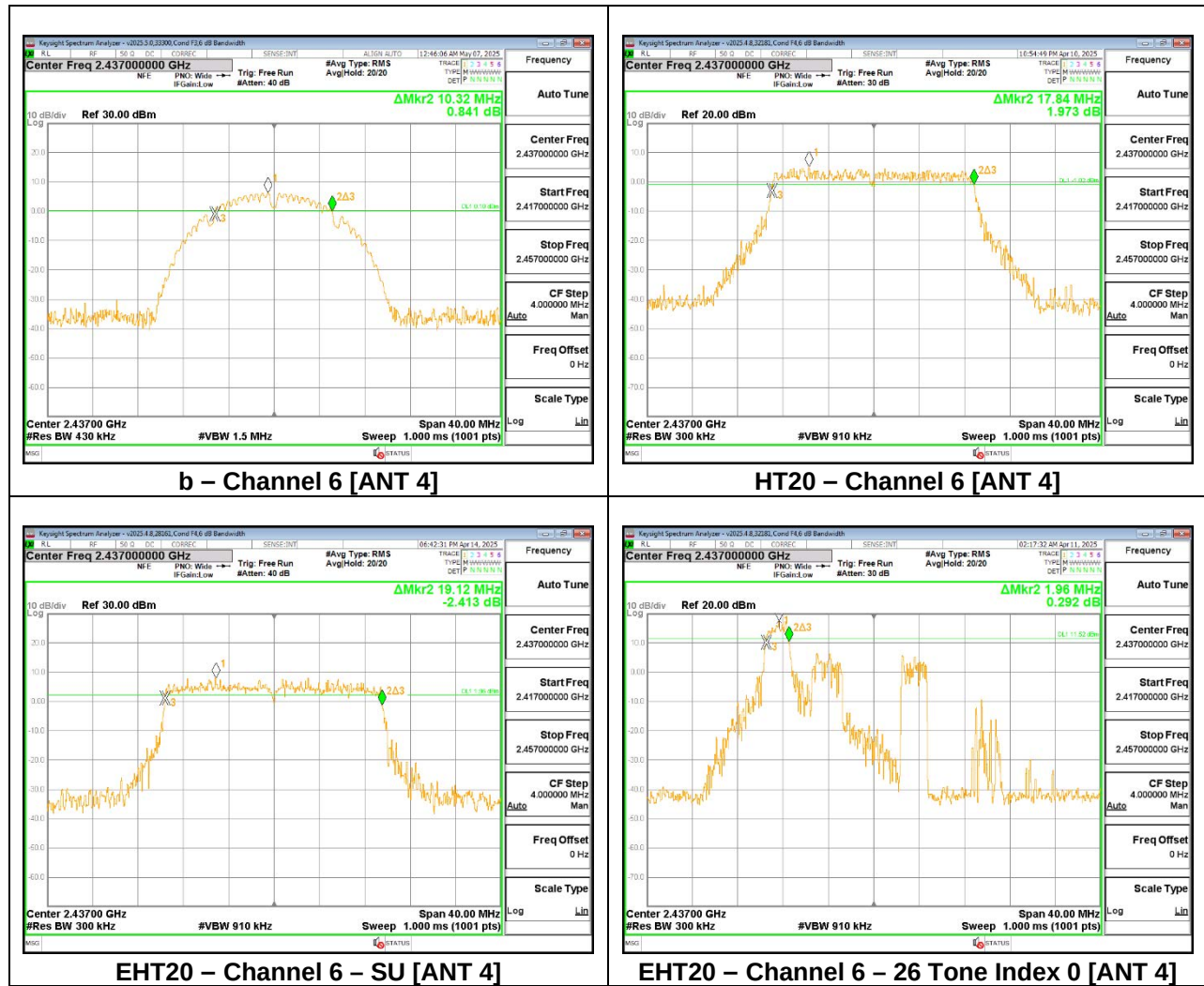
RESULTS

The 6dB bandwidth was measured for the narrowest bandwidth mode, b Mode and 11be Mode 26-Tones as worst case to demonstrate compliance with the minimum required bandwidth of 500 kHz to cover all OFDMA modes.

Only Mid channel plot is reported to show setting parameter complies with testing method/procedure.

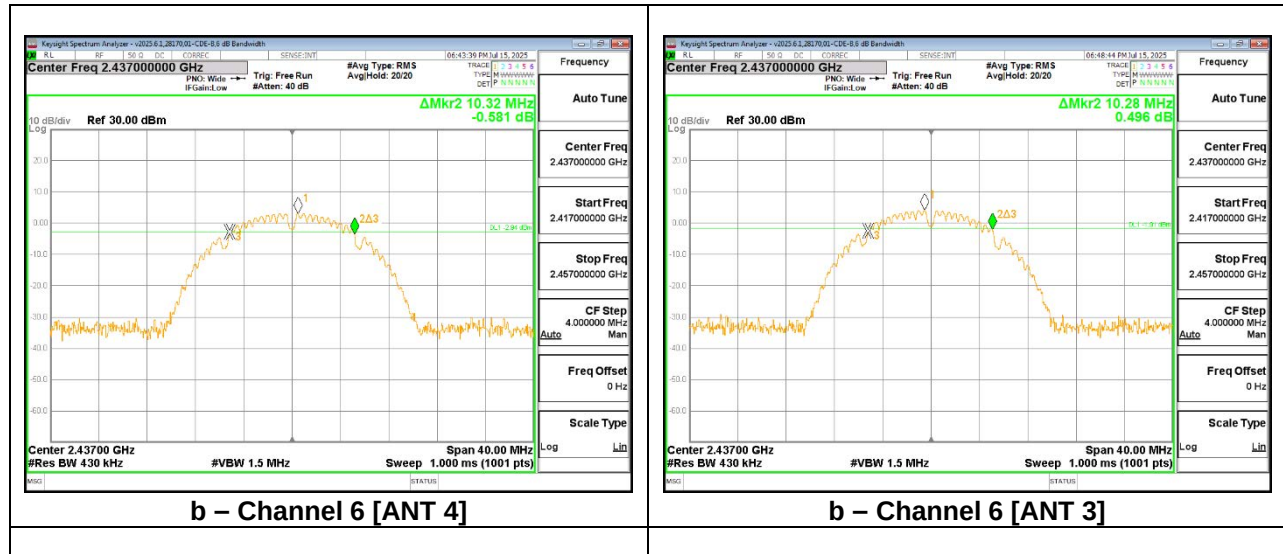
9.3.1. 802.11b/n/be SISO MODE

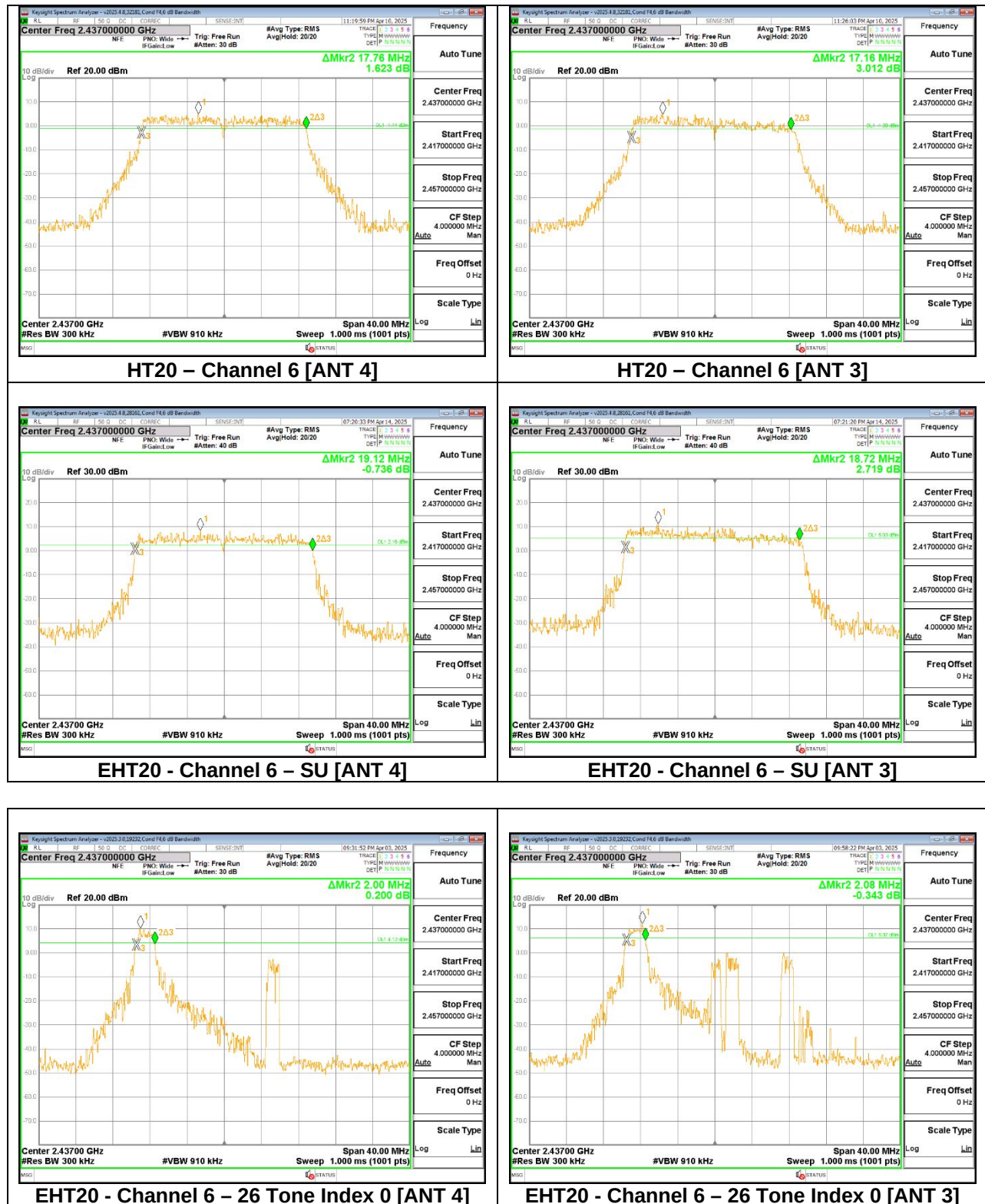
Mode (SISO)	Frequency (MHz)	Channel Number	Tone	RU Index	6dB Bandwidth (MHz)	
					ANT 4	ANT 3
b	2412	1	--	--	10.28	10.32
	2437	6	--	--	10.32	10.28
	2472	13	--	--	10.24	10.28
HT20	2412	1	--	--	17.80	17.80
	2437	6	--	--	17.84	17.72
	2472	13	--	--	17.56	17.00
EHT20	2412	1	SU	--	19.08	18.76
			26	0	2.00	2.00
				4	2.72	2.72
				8	2.20	2.04
	2437	6	SU	--	19.12	18.72
			26	0	1.96	2.08
				4	2.84	2.56
				8	1.88	2.16
	2472	13	SU	--	18.72	18.88
			26	0	2.12	2.12
				4	2.64	2.76
				8	2.12	2.08



9.3.2. 802.11b/n/be MIMO CDD MODE

Mode (MIMO)	Frequency (MHz)	Channel Number	Tone	RU Index	6dB Bandwidth (MHz)	
					ANT 4	ANT 3
11b	2412	1	--	--	10.24	10.32
	2437	6	--	--	10.32	10.28
	2472	13	--	--	10.32	9.8
HT20	2412	1	--	--	17.56	17.76
	2437	6	--	--	17.76	17.16
	2472	13	--	--	17.56	17.56
EHT20	2412	1	SU	--	19.12	18.84
			26	0	2.12	2
				4	2	2.08
				8	1.96	2.04
	2437	6	SU	--	19.12	18.72
			26	0	2.48	2.64
				4	2	2.08
				8	2.68	2.04
	2472	13	SU	--	18.8	18.64
			26	0	2.12	2.04
				4	2.04	2.04
				8	2	2.04





9.4. OUTPUT POWER AND POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (b) (3) & (e)

RSS-247 5.4 (d) & 5.2 (b)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 power sensor. Average 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 uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

Band (GHz)	ANT 4 Gain (dBi)	ANT 3 Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.4	0.00	-3.50	-1.41	1.44

DIRECTIONAL GAIN CALCULATION:

ANSI C63.10-2020 section 14.4.3

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

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

Sample Calculation:

ANT 4 = 0 dB

ANT 3 = -3.5 dB

$$\text{Uncorrelated Directional Gain} = 10 * \text{LOG} \left[\frac{10^{\frac{0.50}{10}} + 10^{\frac{-1.60}{10}}}{2} \right] = -1.41 \text{ dBi}$$

$$\text{Correlated Directional Gain} = 10 * \text{LOG} \left[\frac{\left(10^{\frac{0.50}{20}} + 10^{\frac{-1.60}{20}} \right)^2}{2} \right] = 1.44 \text{ dBi}$$

RESULTS

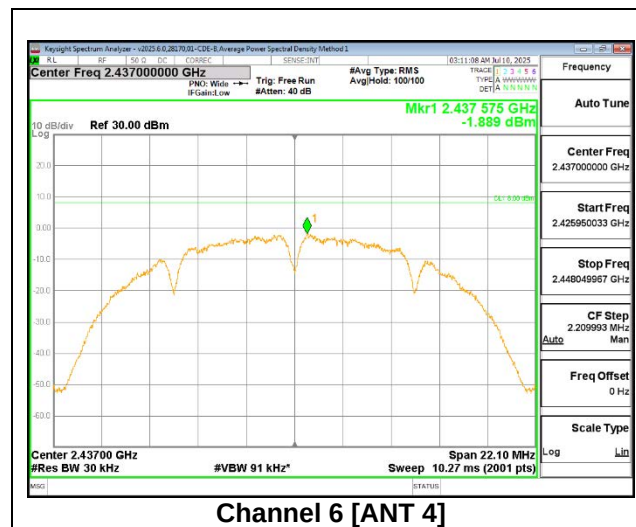
Only Mid channel plot is reported to show setting parameter complies with testing method/procedure.

Note: RBW setting is used greater than 3KHz on PSD measurement

9.4.1. 802.11b SISO MODE

DCCF (MCS0) (dB)	0.00
ANT 4 (dBi)	0.00
ANT 3 (dBi)	-3.50

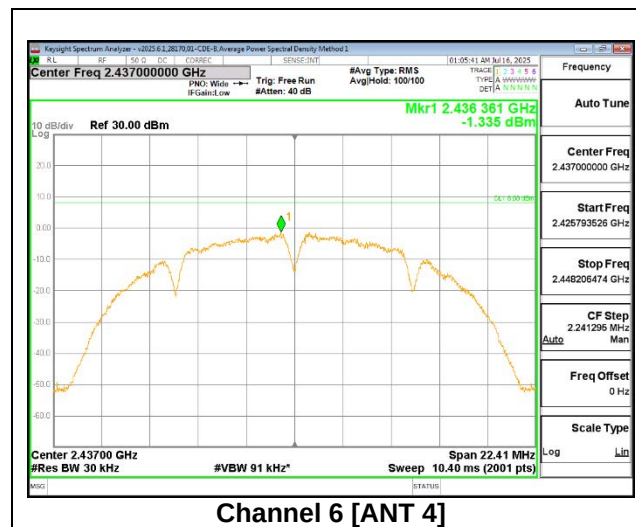
Mode (SISO)	Freq (MHz)	Ch. #	Power Limit (dBm)		Output Power (Gated) (dBm)		Total Corrected Power (dBm)		PSD Limit (dBm/3kHz)		PSD (dBm/kHz)		Total Corrected PSD (dBm/kHz)	
			ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3
b	2412	1	30.00	30.00	20.45	20.93	20.45	20.93	8.000	8.000	-1.932	-1.348	-1.932	-1.348
	2437	6			20.44	20.93	20.44	20.93			-1.889	-0.876	-1.889	-0.876
	2462	11			20.41	20.91	20.41	20.91			-1.958	-1.132	-1.958	-1.132
	2467	12			18.66	20.49	18.66	20.49			-3.427	-1.468	-3.427	-1.468
	2472	13			17.96	18.00	17.96	18.00			-4.102	-4.184	-4.102	-4.184



9.4.2. 802.11b MIMO MODE

DCCF (MCS0) (dB)	0.00
Uncorrelated Gain	-1.41
Correlated Gain	1.44

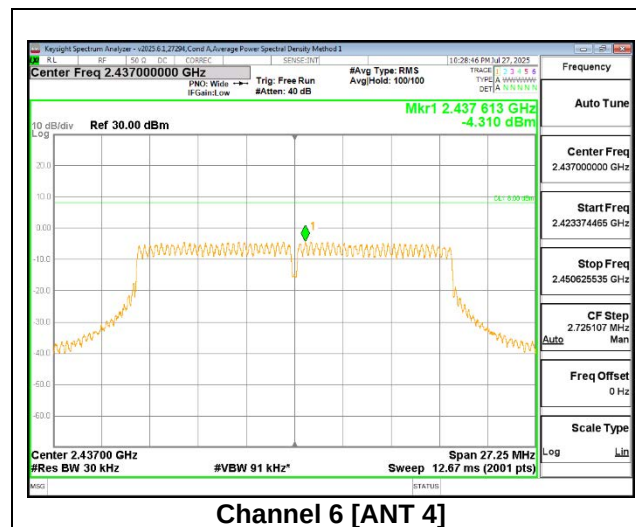
Mode (SISO)	Freq (MHz)	Ch. #	Power Limit (dBm)	Output Power (Gated) (dBm)		Total MIMO Corrected Power (dBm)	PSD Limit (dBm/3kHz)	PSD (dBm/kHz)		Total Corrected PSD (dBm/kHz)
				ANT 4	ANT 3			ANT 4	ANT 3	
b	2412	1	30.00	19.50	19.49	22.51	8.000	-2.727	-2.837	0.229
	2437	6		20.42	20.42	23.43		-1.335	-1.635	1.528
	2462	11		20.41	20.48	23.46		-1.612	-1.685	1.362
	2467	12		17.51	17.53	20.53		-4.811	-4.683	-1.736
	2472	13		16.98	16.98	19.99		-4.782	-5.099	-1.927



9.4.3. 802.11n HT20 SISO MODE

DCCF (MCS0) (dB)	0.00
ANT 4 (dBi)	0.00
ANT 3 (dBi)	-3.50

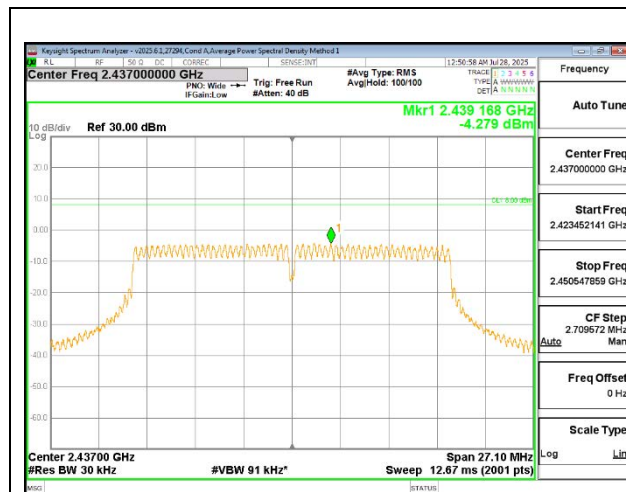
Mode (SISO)	Freq (MHz)	Ch. #	Power Limit (dBm)		Output Power (Gated) (dBm)		Total Corrected Power (dBm)		PSD Limit (dBm/3kHz)		PSD (dBm/kHz)		Total Corrected PSD (dBm/kHz)	
			ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3
HT20	2412	1	30.00	30.00	17.92	17.95	17.92	17.95	8.000	8.000	-6.695	-6.309	-6.695	-6.309
	2417	2			20.49	19.48	20.49	19.48			-4.346	-6.259	-4.346	-6.259
	2422	3			20.47	20.99	20.47	20.99			-3.795	-4.045	-3.795	-4.045
	2437	6			20.49	20.88	20.49	20.88			-4.310	-3.903	-4.310	-3.903
	2452	9			20.48	20.90	20.48	20.90			-4.175	-4.526	-4.175	-4.526
	2457	10			20.41	19.45	20.41	19.45			-4.587	-6.061	-4.587	-6.061
	2462	11			19.46	18.48	19.46	18.48			-5.248	-6.877	-5.248	-6.877
	2467	12			15.93	16.00	15.93	16.00			-8.766	-9.417	-8.766	-9.417
	2472	13			12.95	12.95	12.95	12.95			-11.176	-11.124	-11.176	-11.124



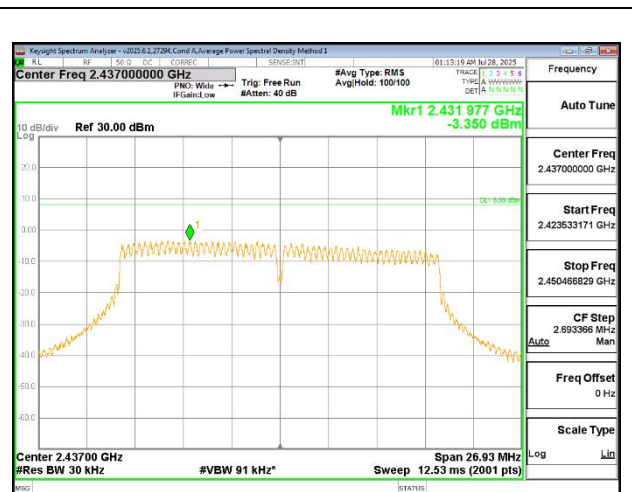
9.4.4. 802.11n HT20 MIMO MODE

DCCF (MCS0) (dB)	0.00
Uncorrelated Gain	-1.41
Correlated Gain	1.44

Mode (SISO)	Freq (MHz)	Ch. #	Power Limit (dBm)	Output Power (Gated) (dBm)		Total MIMO Corrected Power (dBm)	PSD Limit (dBm/3kHz)	PSD (dBm/kHz)		Total Corrected PSD (dBm/kHz)
				ANT 4	ANT 3			ANT 4	ANT 3	
HT20	2412	1	30.00	17.49	17.47	20.49	8.000	-7.342	-6.957	-4.135
	2417	2		18.49	18.48	21.50		-6.098	-5.638	-2.852
	2422	3		19.97	19.96	22.98		-4.473	-4.023	-1.232
	2437	6		20.42	20.42	23.43		-4.279	-3.350	-0.779
	2447	8		20.49	20.43	23.47		-4.059	-3.690	-0.860
	2452	9		20.39	20.49	23.45		-3.719	-3.894	-0.795
	2457	10		18.47	18.44	21.47		-4.723	-4.270	-1.480
	2462	11		17.49	17.48	20.50		-5.865	-5.994	-2.919
	2467	12		14.92	14.90	17.92		-8.543	-8.645	-5.583
	2472	13		11.99	11.98	15.00		-11.256	-11.154	-8.194



Channel 6 [ANT 4]

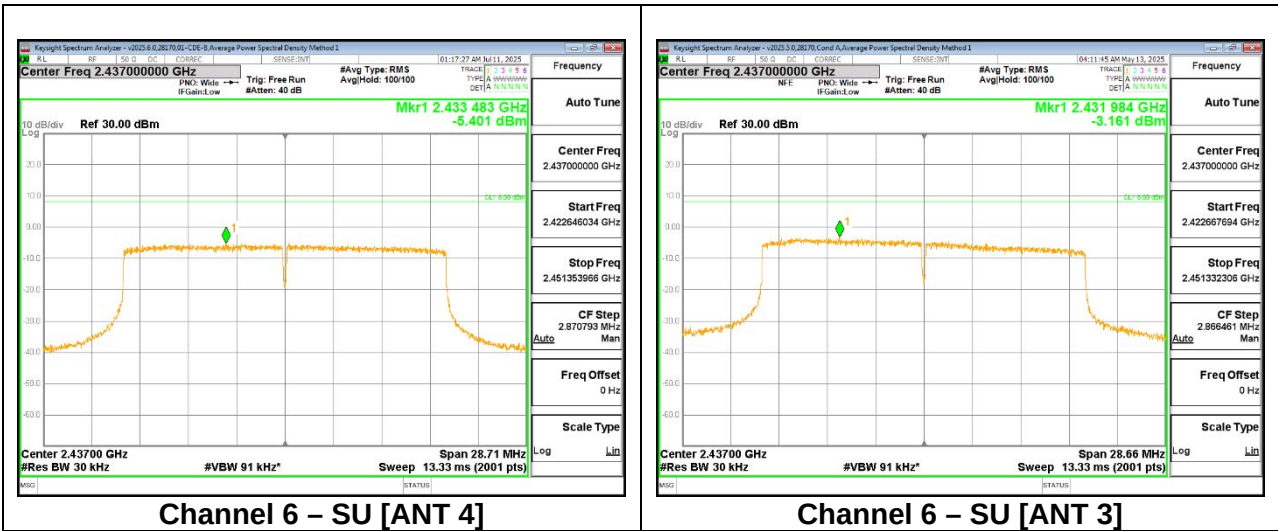


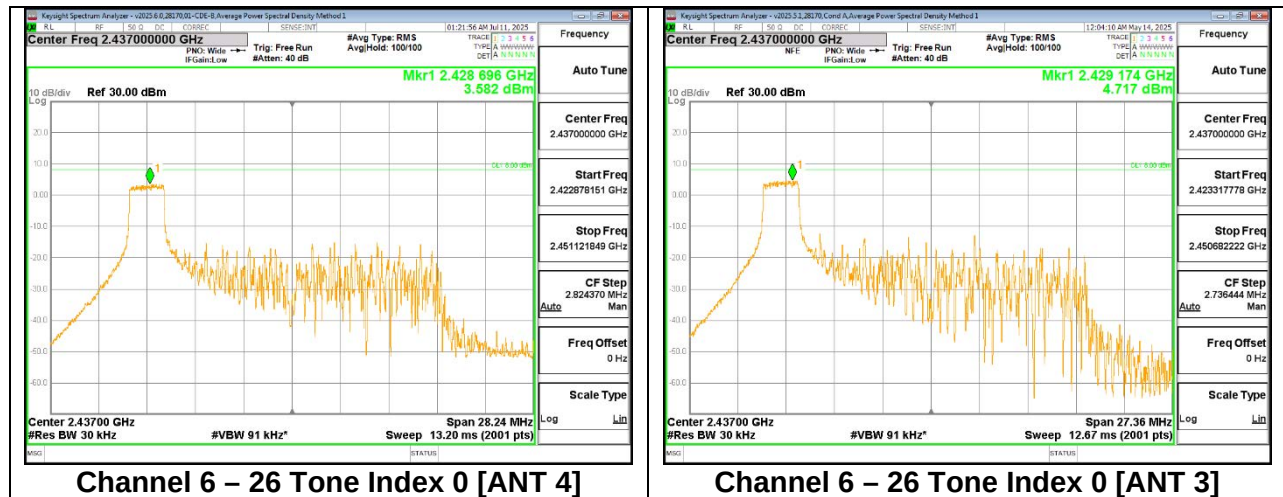
Channel 6 [ANT 3]

9.4.5. 802.11be EHT20 SISO MODE

	SU	26 Tone
DCCF (MCS0) (dB)	0.00	0.00
ANT 4 (dBi)	0.00	
ANT 3 (dBi)	-3.50	

Mode (SISO)	Freq (MHz)	Ch. #	Tone	RU Index	Power Limit (dBm)		Output Power (Gated) (dBm)		Total Corrected Power (dBm)		PSD Limit (dBm/3kHz)		PSD (dBm/kHz)		Total Corrected PSD (dBm/kHz)	
					ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3	ANT 4	ANT 3
EHT20	2412	1	SU	--	30.00	30.00	16.45	16.97	16.45	16.97	8.000	8.000	-9.549	-7.971	-9.549	-7.971
				0			15.97	15.96	15.97	15.96			-1.259	-0.972	-1.259	-0.972
			26	4			15.96	15.98	15.96	15.98			1.047	-1.361	1.047	-1.361
				8			15.81	15.96	15.81	15.96			3.467	3.617	3.467	3.617
	2417	2	SU	--			19.00	17.88	19.00	17.88			-6.883	-6.664	-6.883	-6.664
	2422	3	SU	--			20.42	20.98	20.42	20.98			-5.327	-3.032	-5.327	-3.032
							20.49	20.97	20.49	20.97			-5.401	-3.161	-5.401	-3.161
				0			20.47	20.91	20.47	20.91			3.582	4.717	3.582	4.717
			26	4			20.49	20.87	20.49	20.87			3.600	3.667	3.600	3.667
	2437	6					20.48	20.95	20.48	20.95			3.821	4.283	3.821	4.283
			SU	--			20.41	20.97	20.41	20.97			-5.271	-4.391	-5.271	-4.391
				0			17.89	17.99	17.89	17.99			-7.383	-6.941	-7.383	-6.941
			26	4			16.85	16.89	16.85	16.89			-8.000	-7.928	-8.000	-7.928
	2452	9					15.98	15.97	15.98	15.97			-0.136	-0.389	-0.136	-0.389
				0			15.96	15.92	15.96	15.92			-0.426	-0.439	-0.426	-0.439
			26	4			15.86	15.94	15.86	15.94			-0.396	-0.127	-0.396	-0.127
				8			14.92	14.96	14.92	14.96			-9.952	-9.982	-9.952	-9.982
	2462	11	SU	--			13.94	13.97	13.94	13.97			-2.370	-2.553	-2.370	-2.553
				0			13.89	13.92	13.89	13.92			-2.165	-2.593	-2.165	-2.593
			26	4			13.92	13.97	13.92	13.97			-2.477	-2.002	-2.477	-2.002
				8			8.97	8.99	8.97	8.99			-16.725	-16.490	-16.725	-16.490
	2467	12					-0.10	-0.02	-0.10	-0.02			-16.837	-16.413	-16.837	-16.413
			SU	--			-0.02	-0.02	-0.02	-0.02			-16.899	-16.873	-16.899	-16.873
			26	4			-0.02	-0.02	-0.02	-0.02			-16.794	-16.518	-16.794	-16.518
				8			-0.03	-0.12	-0.03	-0.12						

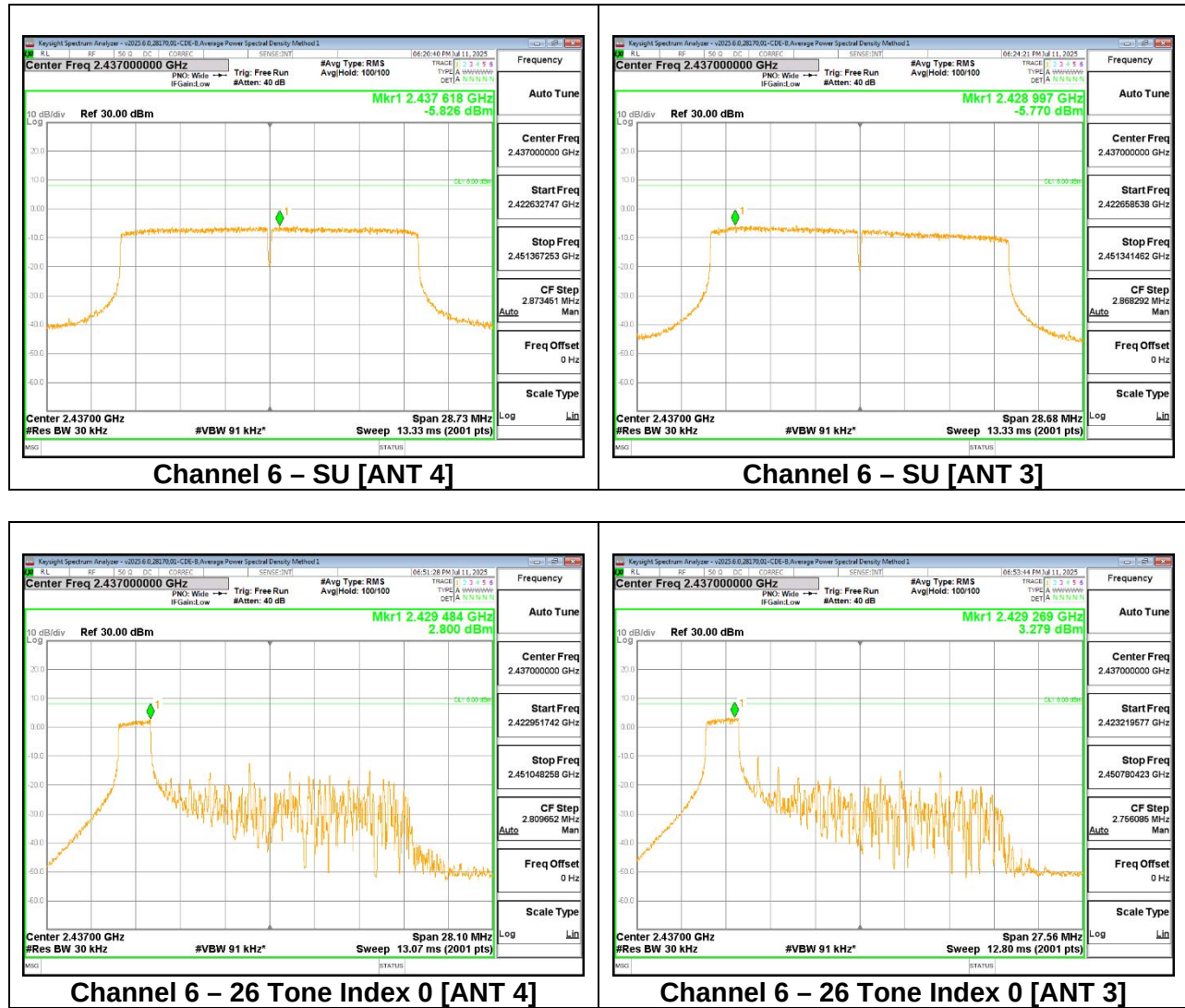




9.4.6. 802.11be EHT20 MIMO MODE

	SU	26 Tone
DCCF (MCS0) (dB)	0.00	0.00
Uncorrelated Gain	-1.41	-1.41
Correlated Gain	1.44	1.44

Mode (MIMO)	Freq (MHz)	Ch. #	Tone	RU Index	Power Limit (dBm)	Output Power (Gated) (dBm)		Total MIMO Corrected Power (dBm)	PSD Limit (dBm/3kHz)	PSD (dBm/kHz)		Total Corrected PSD (dBm/kHz)
						ANT 4	ANT 3			ANT 4	ANT 3	
EHT20	2412	1	SU	--	30.00	14.91	14.95	17.94	8.000	-11.337	-11.246	-8.281
			0	0		16.93	16.98	19.97		0.165	0.245	3.215
			4	4		16.99	16.91	19.96		-0.141	0.161	3.023
			8	8		16.97	16.92	19.96		-0.099	0.177	3.051
	2417	2	SU	--		16.97	16.98	19.99		-8.779	-8.465	-5.609
	2422	3	SU	--		18.98	18.88	21.94		-6.865	-6.716	-3.780
	2427	4	SU	--		20.42	20.43	23.44		-6.251	-6.045	-3.136
	2437	6	SU	--		20.42	20.46	23.45		-5.826	-5.770	-2.788
			0	0		20.48	20.42	23.46		2.800	3.279	6.056
			4	4		20.41	20.42	23.43		2.791	2.610	5.712
			8	8		20.42	20.48	23.46		3.616	3.639	6.638
	2447	8	SU	--		20.42	20.41	23.43		-5.552	-5.170	-2.347
	2452	9	SU	--		19.47	19.41	22.45		-6.435	-6.805	-3.606
	2457	10	SU	--		17.50	17.42	20.47		-8.254	-7.973	-5.101
	2462	11	SU	--		15.92	15.97	18.96		-9.310	-8.947	-6.114
			0	0		15.98	15.98	18.99		-0.762	-1.019	2.122
			4	4		15.94	15.92	18.94		-1.101	-1.159	1.880
			8	8		15.94	15.96	18.96		-0.699	-0.535	2.394
	2467	12	SU	--		13.97	13.99	16.99		-12.024	-11.714	-8.856
			0	0		12.98	12.92	15.96		-3.837	-3.586	-0.699
			4	4		12.91	12.83	15.88		-3.571	-3.762	-0.655
			8	8		12.98	12.97	15.99		-3.427	-3.457	-0.432
	2472	13	SU	--		8.41	8.48	11.46		-17.023	-16.932	-13.967
			0	0		-0.17	-0.29	2.78		-16.897	-16.487	-13.677
			4	4		-0.03	-0.20	2.90		-16.666	-16.653	-13.649
			8	8		-0.12	-0.15	2.88		-16.598	-16.179	-13.373



9.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

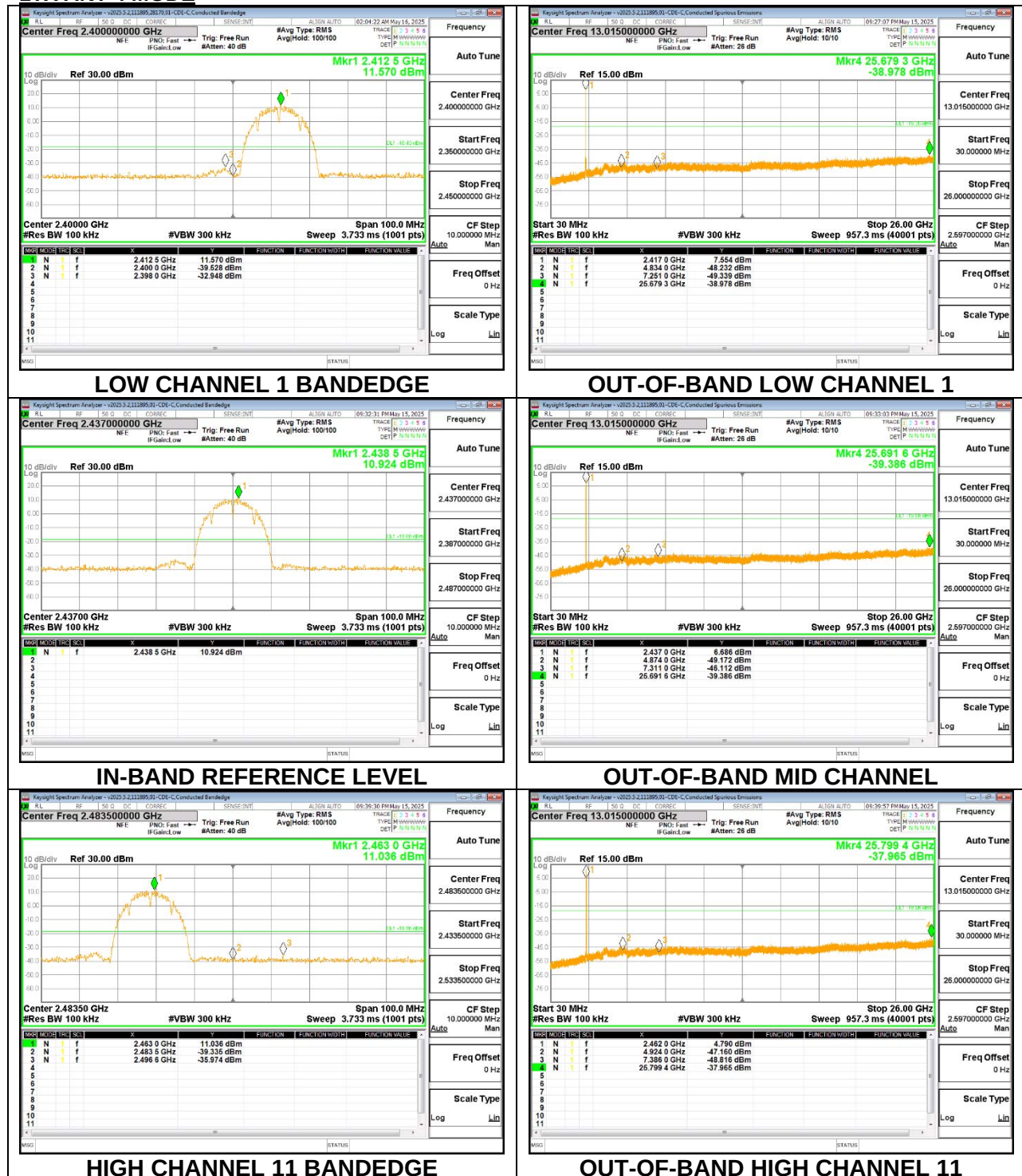
RSS-247 5.5

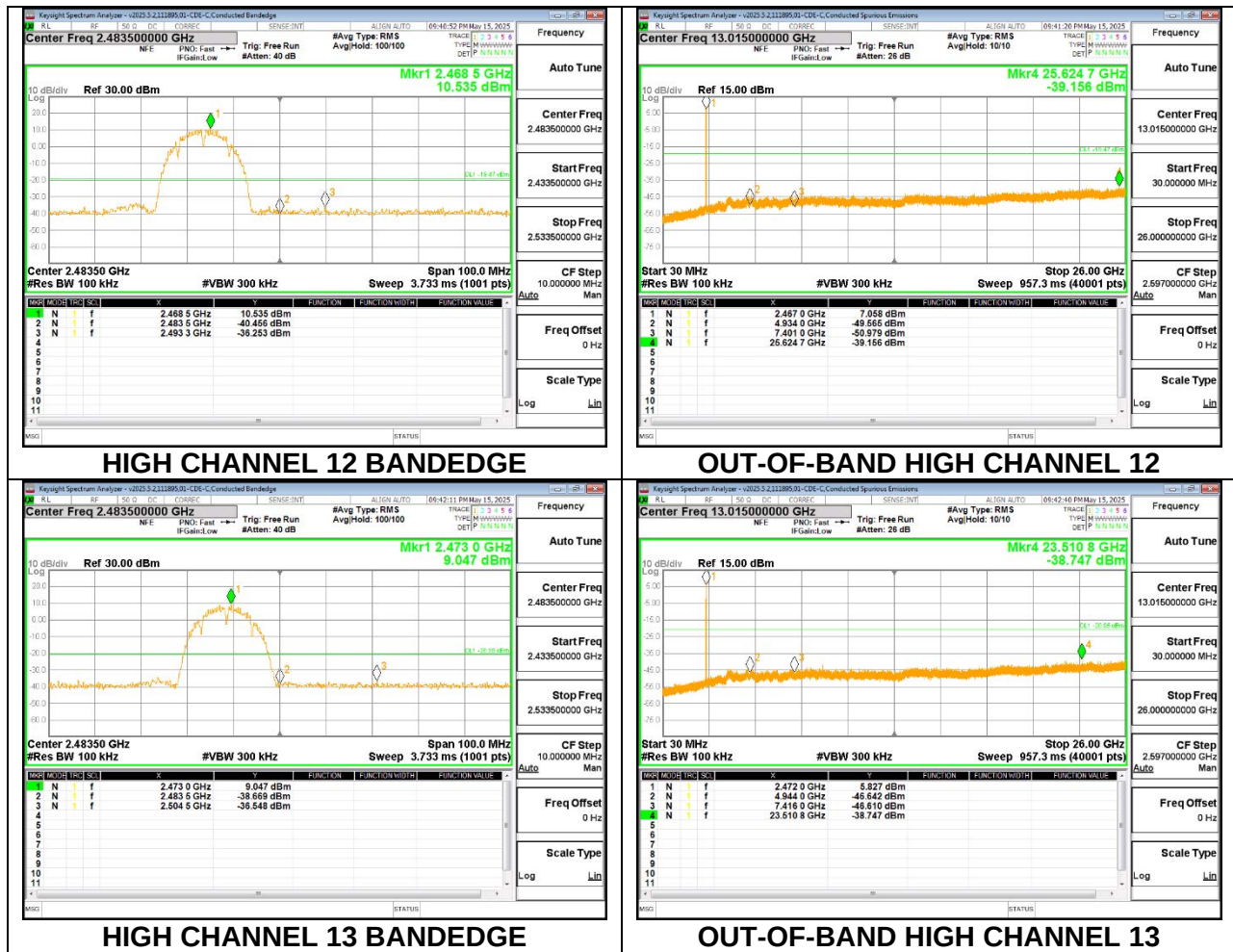
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

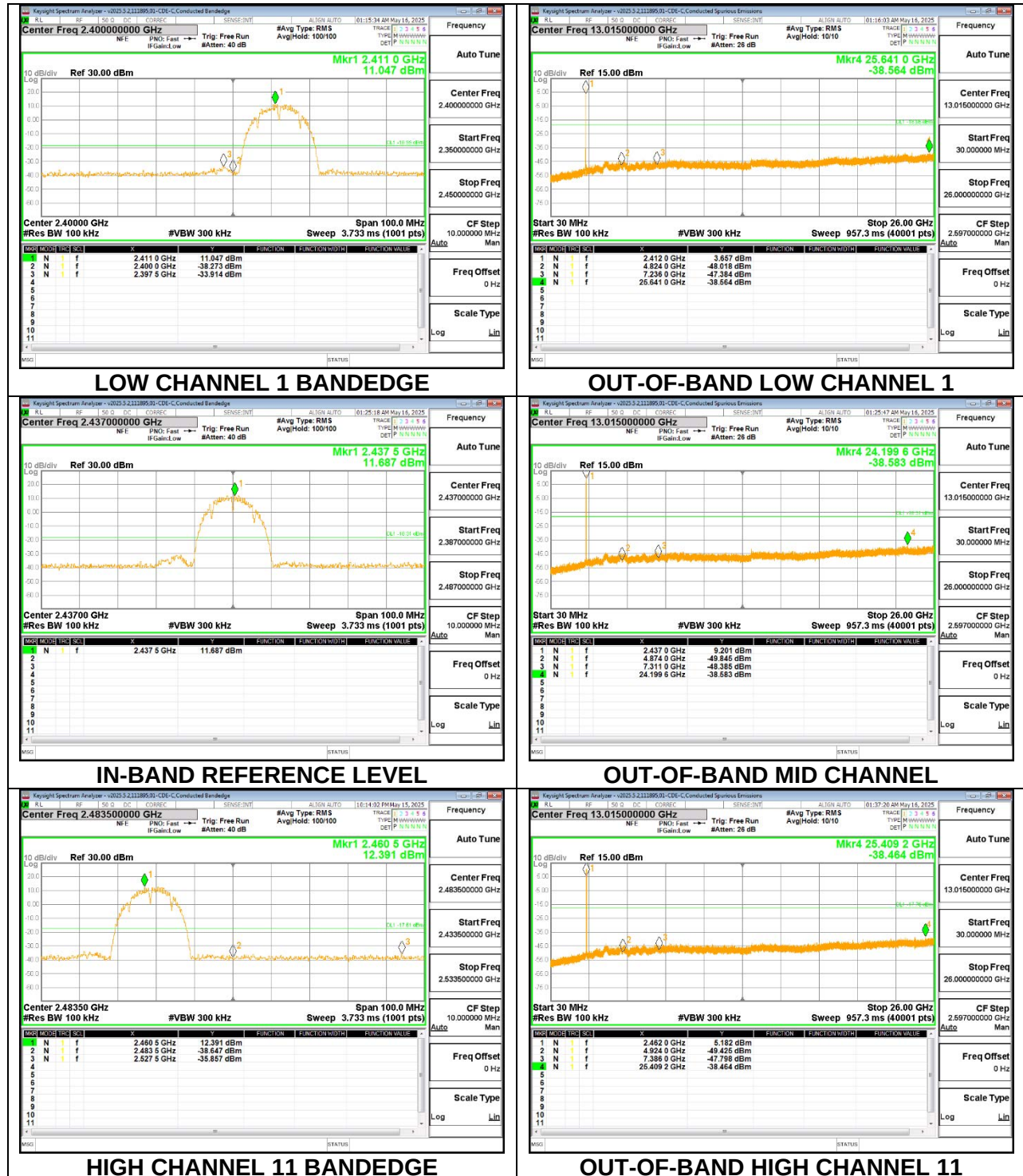
RESULTS

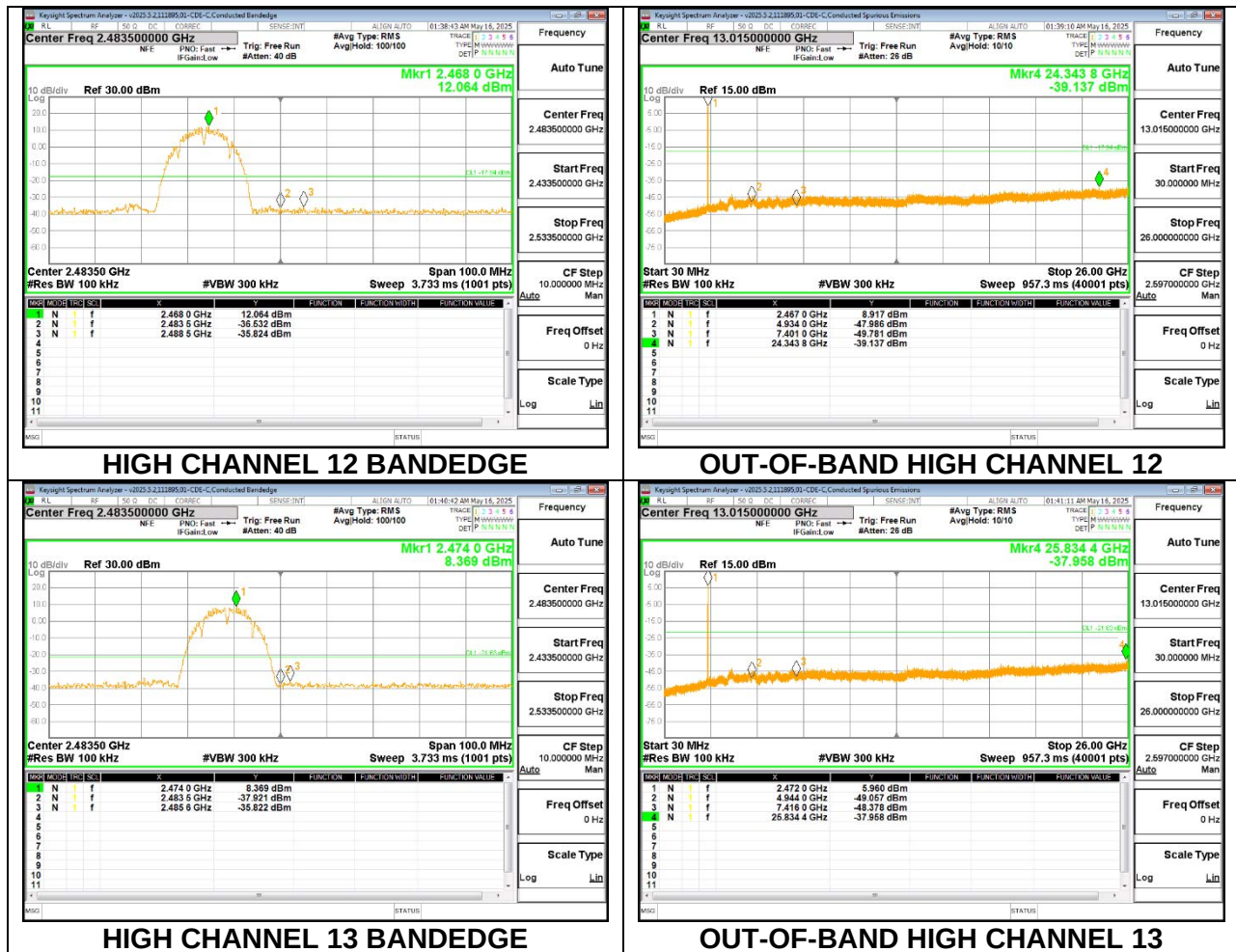
9.5.1. 802.11b MODE 1TX

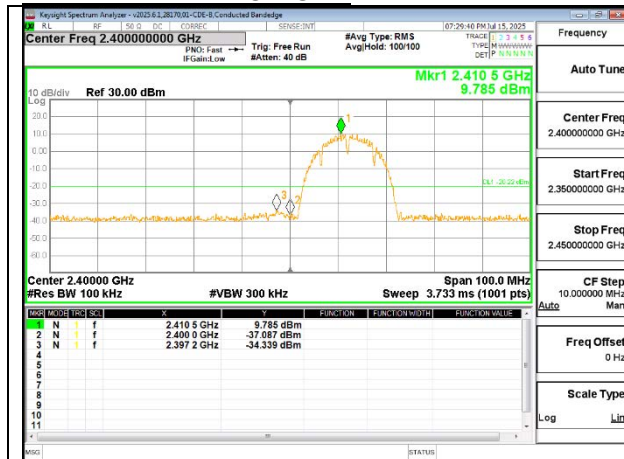
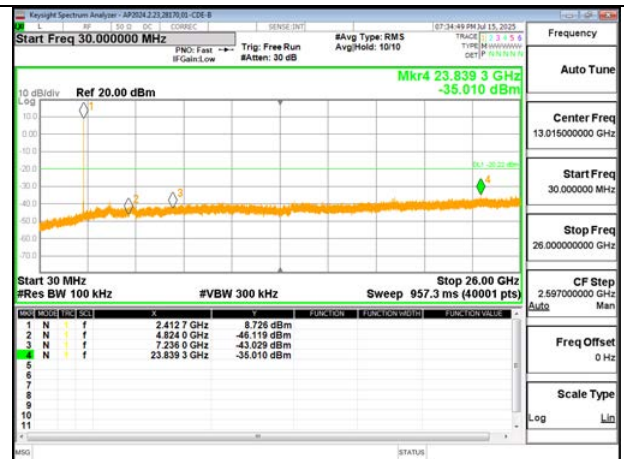
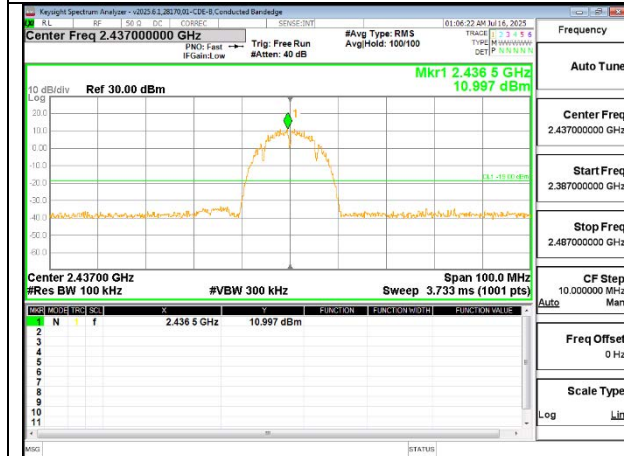
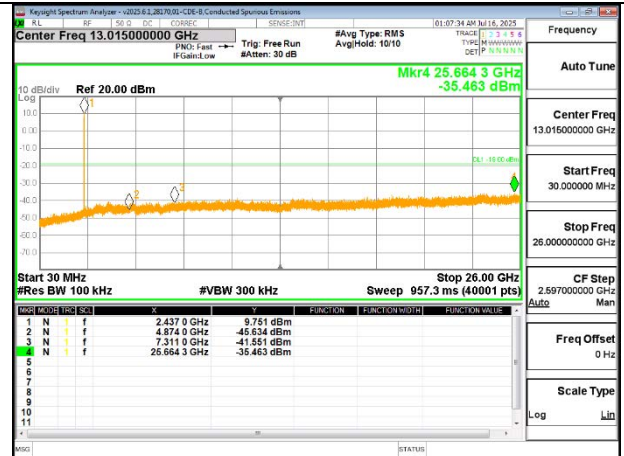
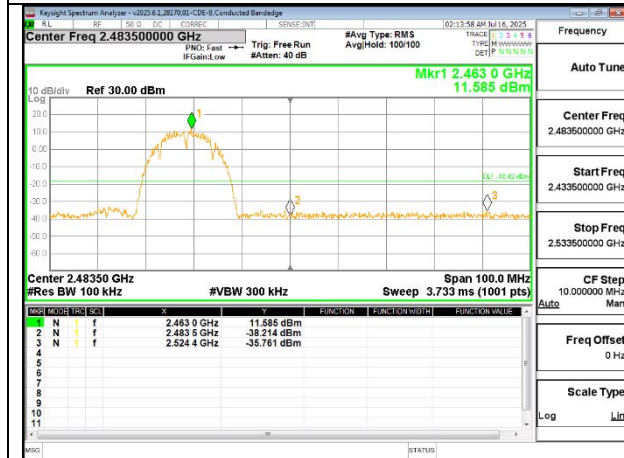
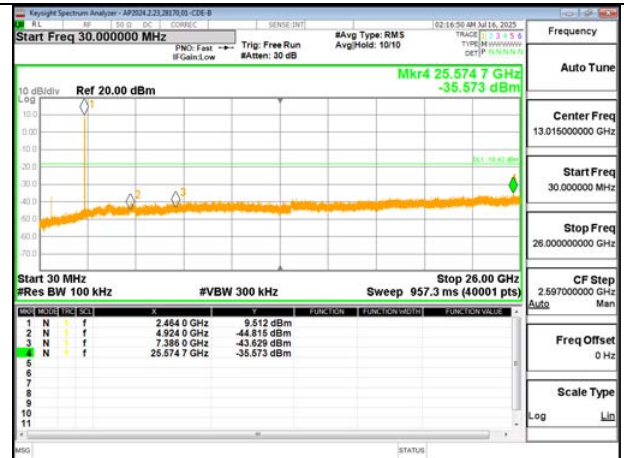
1TX ANT 4 MODE

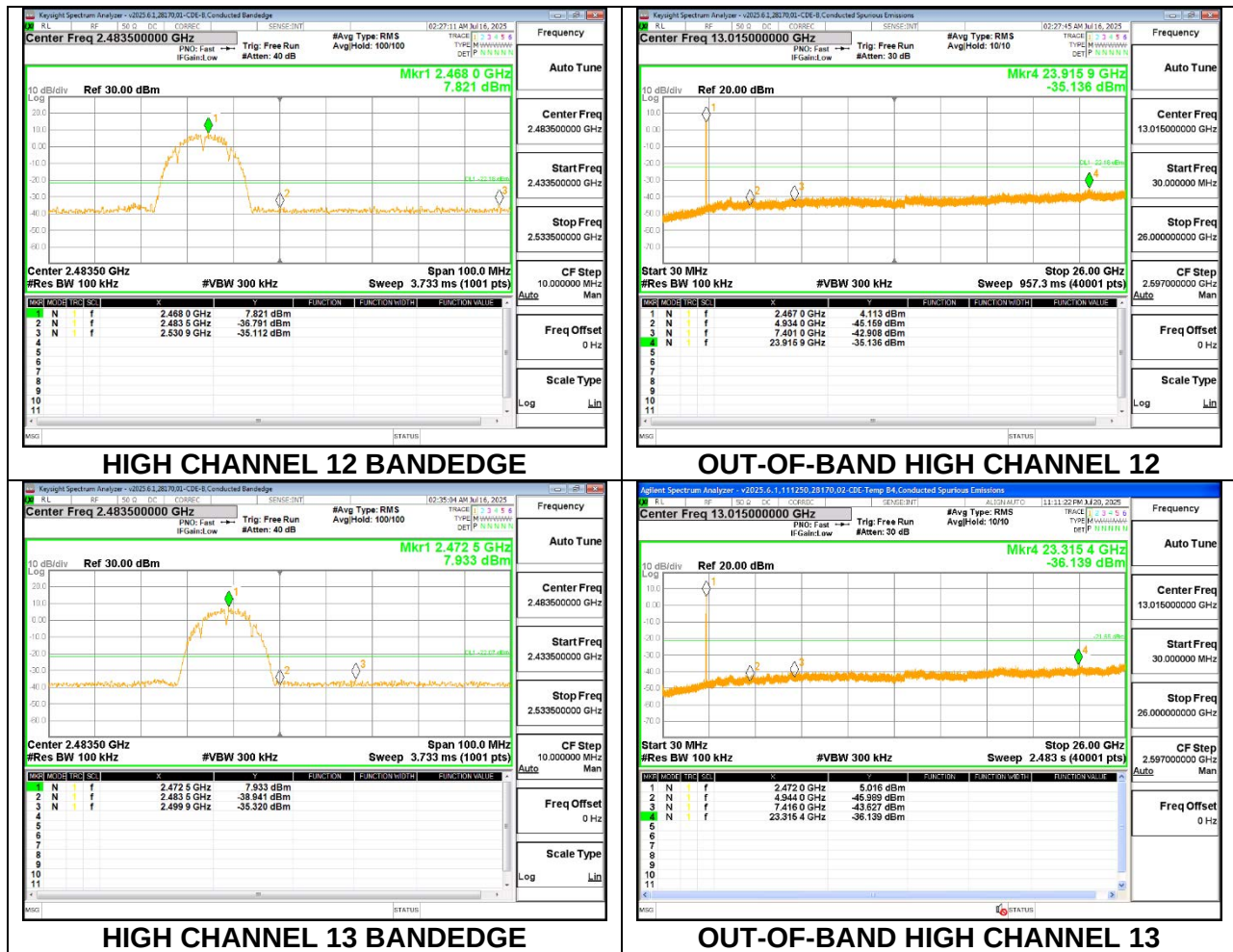


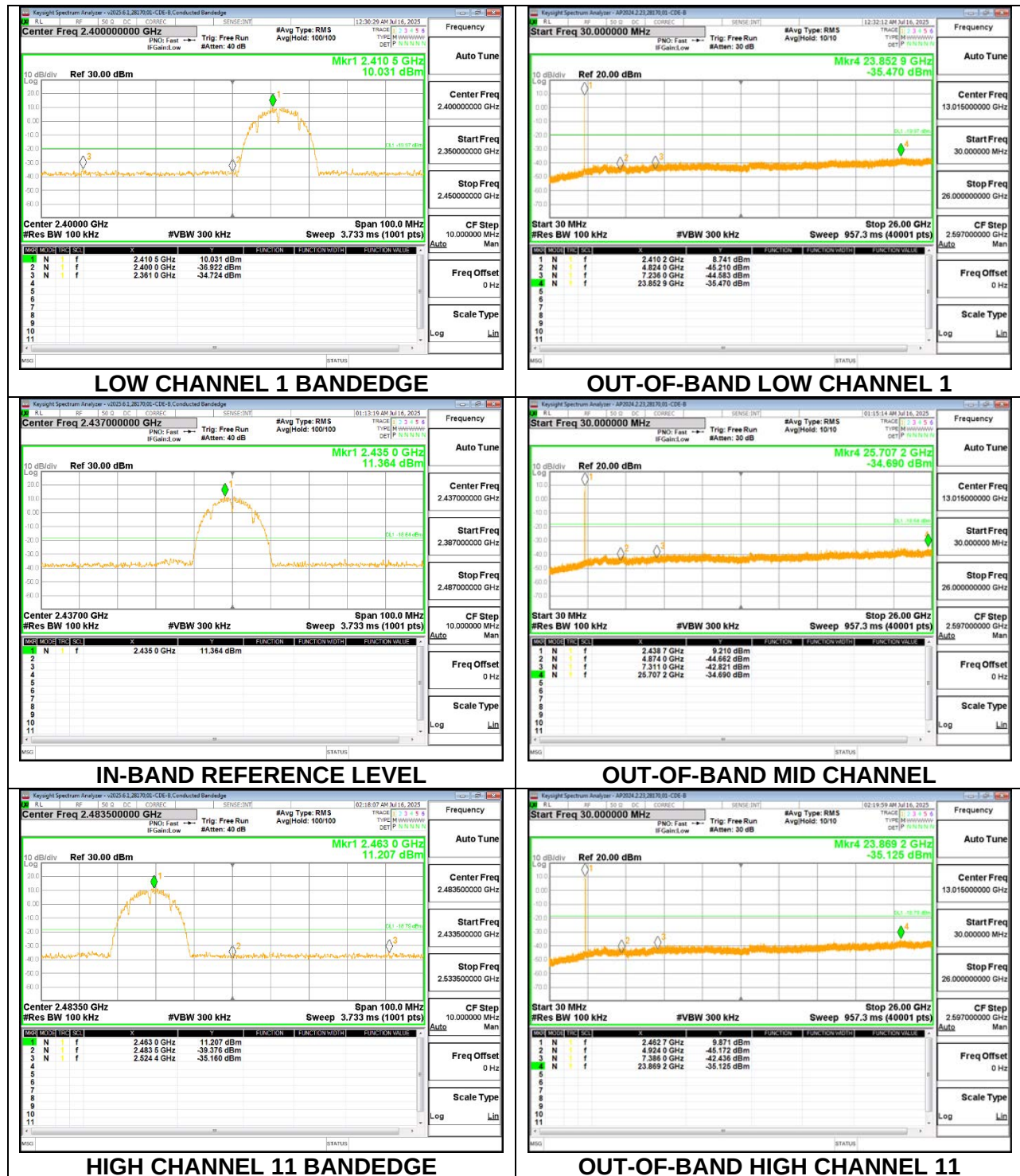


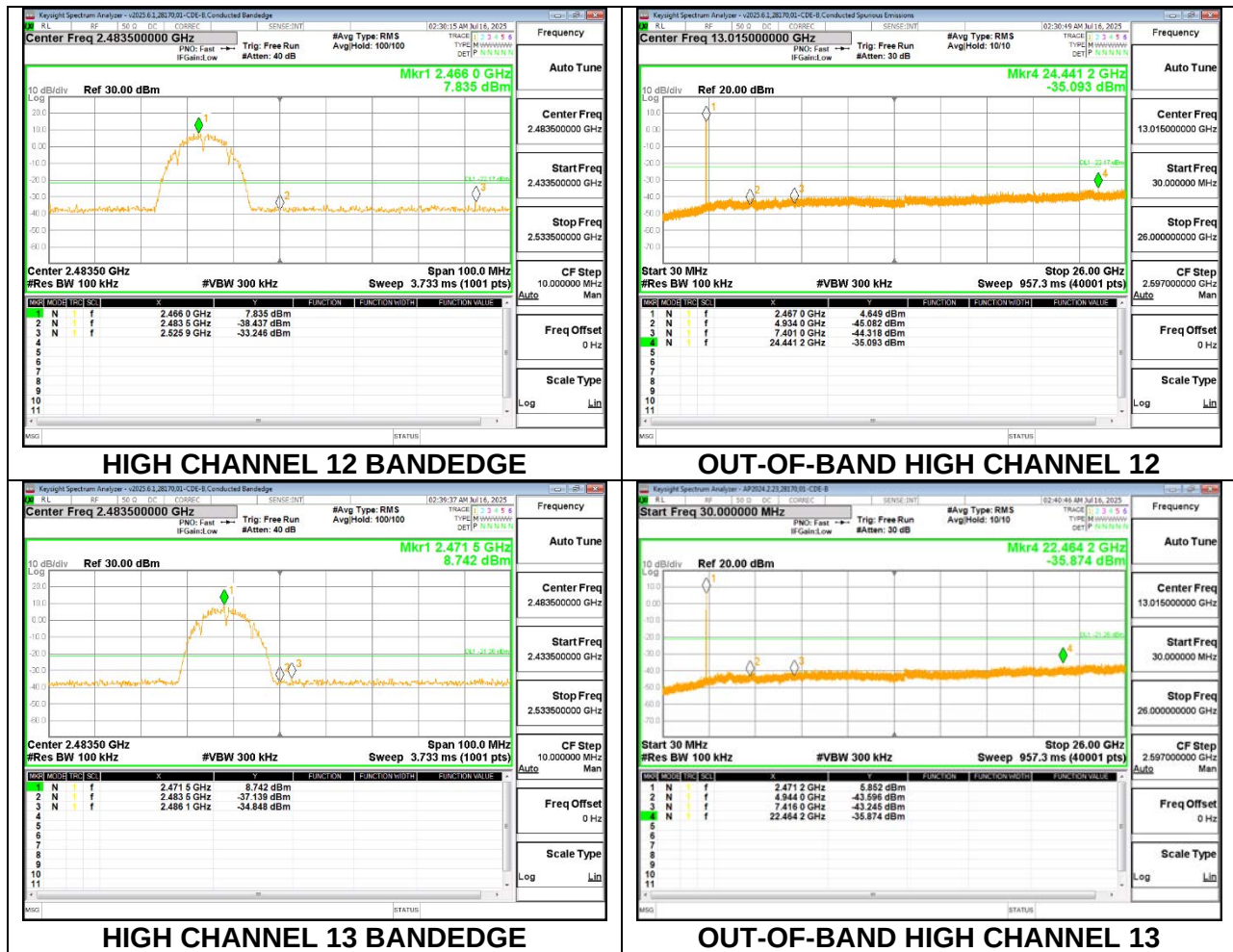
1TX ANT 3 MODE



9.5.2. 802.11b MODE 2TX**2TX ANT 4 + ANT 3 MODE****LOW CHANNEL 1 BANDEDGE****OUT-OF-BAND LOW CHANNEL 1****IN-BAND REFERENCE LEVEL****OUT-OF-BAND MID CHANNEL****HIGH CHANNEL 11 BANDEDGE****OUT-OF-BAND HIGH CHANNEL 11**







9.5.3. 802.11n HT20 SISO MODE

1TX ANT 4 MODE

