RF TEST REPORT

FCC

APPLICANT

Owl Labs Inc.

MODEL NAME

MTW405

FCC ID

2ALXJ-MTW405

REPORT NUMBER

HA240429-OWL-001-R11

TEST REPORT

Date of Issue
June 5, 2024

Test Site
Hyundai C-Tech, Inc. dba HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95131, USA

Applicant	Owl Labs Inc.
Applicant Address	33-1/2 Union Square Somerville, MA 02143 U.S.A.
FCC ID	2ALXJ-MTW405
Model Name	MTW405
EUT Type	360-Degree Video Conferencing Platform
Modulation Type	OFDMA
FCC Classification	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s)	Part 15.407
Test Procedure	ANSI C63.10-2013, KDB 789033 D02 v02r01, KDB 662911 D01

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures required. The results of testing in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By	**Reviewed By**
John Park	Yongsoo Park
Test Engineer	Technical Manager

REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA240429-OWL-001-R11	June 5, 2024	Initial Issue

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	MTW405
Product Name	Meeting Owl 4+
Serial Number	Conducted : M4FC1324001C Radiated :M4FV13240003
Power Supply	20 V d.c. (USB type C - External adaptor)
RF Specification	WIFI 2.4 GHz : 802.11b/g/ n(HT20, HT40)/ ac(VHT20, VHT40)/ ax(HE20, HE40) WIFI 5 GHz : 802.11a/n(HT20/40)/ ac(VHT20/40/80)/ ax(HE20, HE40, HE80) Bluetooth 5.0 LE (1M / BR / EDR)
Transmitter Chain	WIFI 2.4 GHz / 5 GHz : 2x2 MIMO Bluetooth LE / Bluetooth BR/EDR : SISO
Operating Environment	Indoor
Operating Temperature	5 °C ~ +30 °C

RF SPECIFICATION SUBJECT TO THE REPORT

RF Specification	IEEE 802.11ax (HE20, HE40, HE80)	
Transmitter Chain	2 x 2 MIMO	
Frequency Range	U-NII 1	20 MHz BW : 5180 MHz – 5240 MHz 40 MHz BW : 5190 MHz – 5230 MHz 80 MHz BW : 5210 MHz
Max. RF Output Power	20.75 dBm (0.119 W)	
Modulation Type	OFDMA	
Antenna Specification [1)]	ANT1	Antenna Type : PCB Antenna Antenna Model : CU23001-1 Antenna Brand: antenova Peak Gain : 3.8 dBi
	ANT2	Antenna Type : PCB Antenna Antenna Model : CU23002-1 Antenna Brand: antenova Peak Gain : 3.2 dBi
Firmware Version [2)]	6.4.21.22	
Hardware Version [2)]	OWL-900-00027 Rev 5	
Date(s) of Tests	May 12, 2024 ~ June 5, 2024	

Note(s) :
1. Antenna information is based on the document provided.
2. Firmware and Hardware Version are as received by the client.

ANTENNA CONFIGURATION

The device employs 2x2 MIMO technologies with possible configurations below.

Frequency	Configuration	SDM	Beamforming	CDD
		ANT1 + ANT2	ANT1 + ANT2	ANT1 + ANT2
2.4 GHz	802.11b	-	-	O
	802.11g	-	-	O
	802.11n	O	-	O
	802.11ac	O	O	O
	802.11ax	O	O	O
5 GHz	802.11a	-	-	O
	802.11n	O	-	O
	802.11ac	O	O	O
	802.11ax	O	O	O

The equipment under test supports Cyclic Diversity mode.
CDD mode was picked as worst case for testing even though the device support both CDD and SDM, Beamforming.

ANTENNA DIRECTIONAL GAIN

Antenna Type	Type	RF Technology	Frequency	Gain (Ant 1)	Gain (Ant 2)
PCB	Dipole	802.11b/g/n	2.4 GHz	2.90 dBi	2.90 dBi
PCB	Dipole	802.11a/n/ac	5 GHz	3.80 dBi	3.20 dBi

Directional Gain (2.4 GHz : Uncorrelated) = 10 log[($10^{(2.90/10)}$+$10^{(2.90/10)}$) / 2] = 2.90 dBi
Directional Gain (5 GHz : Uncorrelated) = 10 log[($10^{(3.80/10)}$+$10^{(3.20/10)}$) / 2] = 3.51 dBi

Directional Gain (2.4 GHz : Correlated) = 10 log[($10^{(2.90/20)}$+$10^{(2.90/20)}$)^2 / 2] = 5.91 dBi
Directional Gain (5 GHz : Correlated) = 10 log[($10^{(3.80/20)}$+$10^{(3.20/20)}$)^2 / 2] = 6.52 dBi

Beamforming Directional Gain (2.4 GHz) = 2.90 dBi + 10 log(2) = 5.91 dBi
Beamforming Directional Gain (5 GHz) = 3.51 dBi + 10 log(2) = 6.52 dBi

OPERATING FREQUENCY CHANNELS

Band	Frequency (MHz)	Channel	802.11a	802.11n HT20	802.11ac VHT20	802.11ax HE20
U-NII 1	5180	36	O	O	O	O
	5200	40	O	O	O	O
	5220	44	O	O	O	O
	5240	48	O	O	O	O

Band	Frequency (MHz)	Channel	802.11n HT40	802.11ac VHT40	802.11ax HE40
U-NII 1	5190	38	O	O	O
	5230	46	O	O	O

Band	Frequency (MHz)	Channel	802.11ac VHT80	802.11ax HE80
U-NII 1	5210	42	O	O

SUMMARY OF TARGET POWER TABLE

U-NII 2 Band		Target Power / Chain
Mode	Tone	
802.11ax HE20	SU	17 dBm ± 2 dB
	242T	17 dBm ± 2 dB
	106T	14 dBm ± 2 dB
	52T	11 dBm ± 2 dB
	26T	8 dBm ± 2 dB
802.11ax HE40	SU	14 dBm ± 2 dB
	484T	14 dBm ± 2 dB
	242T	14 dBm ± 2 dB
	106T	14 dBm ± 2 dB
	52T	11 dBm ± 2 dB
	26T	8 dBm ± 2 dB
802.11ax HE80	Full	12 dBm ± 2 dB
	996T	12 dBm ± 2 dB
	484T	12 dBm ± 2 dB
	242T	12 dBm ± 2 dB
	106T	12 dBm ± 2 dB
	52T	11 dBm ± 2 dB
	26T	8 dBm ± 2 dB

2. METHODOLOGY

The measurement procedure described in FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 dated December 14, 2017 entitled “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part15, Subpart E” and ANSI C63.10(Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’ were used in the measurement.

EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. Also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emission, the relative positions of this hand-held transmitter (EUT) were rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

The EUT has been tested at 5 GHz WLAN test mode. Qualcomm Radio Control Tool was used to control the channels, power level setting at continuous TX and normal RX mode.

3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment’s, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

4. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC (Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at 1726 Ringwood Avenue, San Jose, California 95131, USA.
The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Accredited Laboratory

A2LA has accredited

HYUNDAI C-TECH, INC.
DBA HCT AMERICA, INC.
San Jose, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 17th day of July 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4201.01
Valid to July 31, 2025

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

(1) The antenna of this E.U.T is permanently attached and there is no provision for connection to an external antenna.
(2) The E.U.T Complies with the requirement of §15.203

6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty
Output Power, Conducted	± 0.54 dB
Frequency Tolerance	± 16.78 kHz
Occupied Bandwidth	± 120.66 kHz
Unwanted Emissions, Conducted	± 0.54 dB
Radiated Emissions (below 1 GHz)	± 5.70 dB
Radiated Emissions (Above 1 GHz)	± 5.25 dB

7. DESCRIPTION OF TESTS

7.1. DUTY CYCLE

TEST SETUP

TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.
Measurement is performed in accordance with the section B.2 in KDB 789033 D02 v02r01.

The largest available value of RBW is 8 MHz and VBW is 50 MHz.
The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)
The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

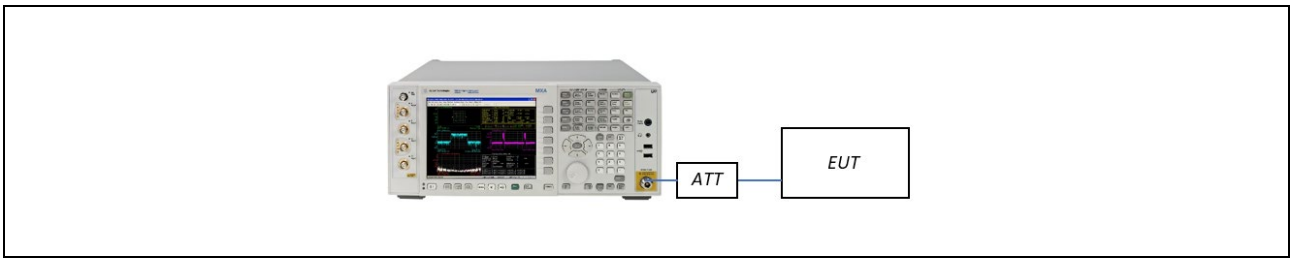
- RBW = 8 MHz (the largest available value)
- VBW = 8 MHz (≥ RBW)
- SPAN = 0 Hz
- Detector = Peak
- Number of points in sweep > 100
- Trace mode = Clear write
- Measure T_{total} and T_{on}
- Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10*log(1/Duty Cycle)

7.2. 26 dB BANDWIDTH / 99 % OCCUPIED BANDWIDTH

LIMIT

Emission bandwidth was measured to define the minimum frequency range which the spectrum is integrated for maximum conducted output power measurement.

TEST SETUP



TEST PROCEDURE (26 dB Bandwidth)

Testing was performed according to the section C.1 in KDB 789033 D02 v02r01.
The transmitter output is connected to the spectrum analyzer.
The Spectrum Analyzer setting :

- RBW = Approximately 1 % of the emission bandwidth
- VBW > RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

TEST PROCEDURE (99% Bandwidth)

Testing was performed according to the section D in KDB 789033 D02 v02r01.
The transmitter output is connected to the spectrum analyzer.

- RBW = 1% ~ 5% of the occupied bandwidth
- VBW ≒ 3 x RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize

Note(s) :
1. The bandwidth measurement function from the spectrum analyzer is used to measure X dB bandwidth.
2. 26 dB bandwidth is used to determine the conducted power limits.

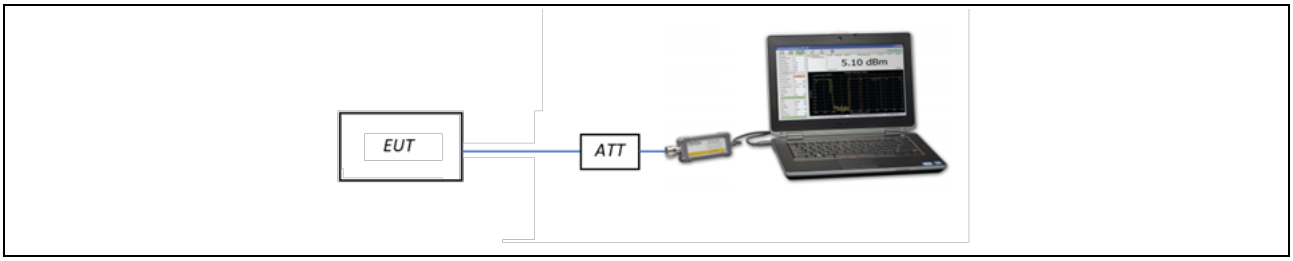
7.3. MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

Band		47 CFR §15.407(a)(1)	
U-NII 1	☐	Master (Outdoor)	≤ 1 W (= 30 dBm) ≤ 125 mW (= 21 dBm) EIRP at max elevation angle (30°) from horizon
	☐	Master (Indoor)	≤ 1 W (= 30 dBm)
	☒	Client	≤ 250 mW (= 24 dBm)

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST SETUP



TEST PROCEDURE (Power Meter)

Refer to the section E.3 in KDB 789033 D02 v02r01
The transmitter output is connected to the Average Power Meter

- Measure the duty cycle.
- Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

Add 10log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times

7.4. POWER SPECTRAL DENSITY

LIMIT

Band		47 CFR §15.407(a)(1)	
U-NII 1	☐	Master Device	≤ 17 dBm/MHz
	☒	Client Device	≤ 11 dBm/MHz

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST SETUP

TEST PROCEDURE

Refer to the section F in KDB 789033 D02 v02r01.

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- RBW = 1 MHz (510 kHz for UNII 3)
- VBW ≥ 3 MHz
- Number of points in sweep ≥ 2*span/RBW.
- Sweep time = auto.
- Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- Do not use sweep triggering. Allow the sweep to “free run”.
- Trace average at least 100 traces in power averaging (RMS) mode
- Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
- If Method SA-2 was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.

Sample Calculation

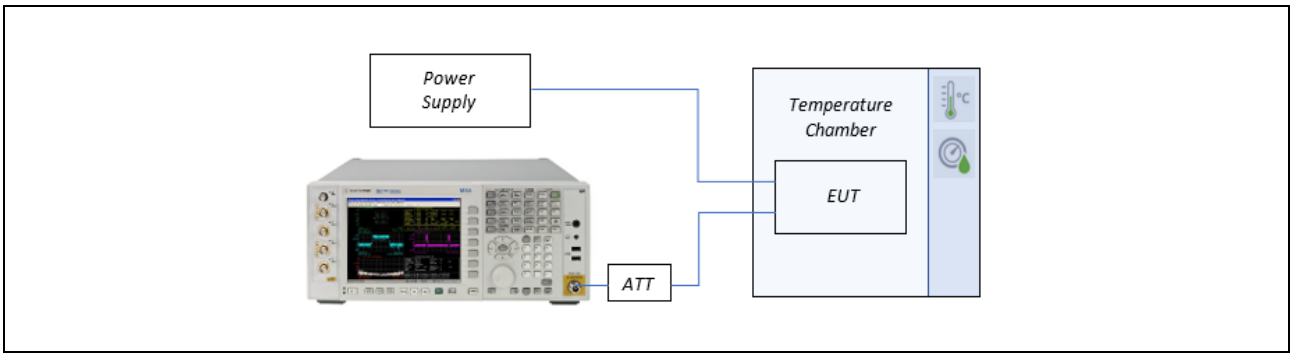
Total PSD (Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

7.5. FREQUENCY STABILITY

LIMIT

§15.407(g)
Fundamental emissions of the radio devices should be kept within at least the central 80% of its permitted operating frequency band to minimize the possibility of out of band operation.

TEST SETUP



TEST PROCEDURE

- The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between -30 ℃ and 50 ℃.
- The temperature was incremented by 10 ℃ intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.
- The primary supply voltage is varied from 85% to 115% of the nominal value for non-hand carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

7.6. UNDESIRABLE EMISSION

LIMIT

Frequency Band	47 CFR §15.407(b)(1)
U-NII 1	In accordance with **47 CFR §15.407(b)(1)** All emissions outside the 5.15-5.35 GHz band shall not exceed an −27 dBm/MHz e.i.r.p.

RADIATION EMISSION LIMIT

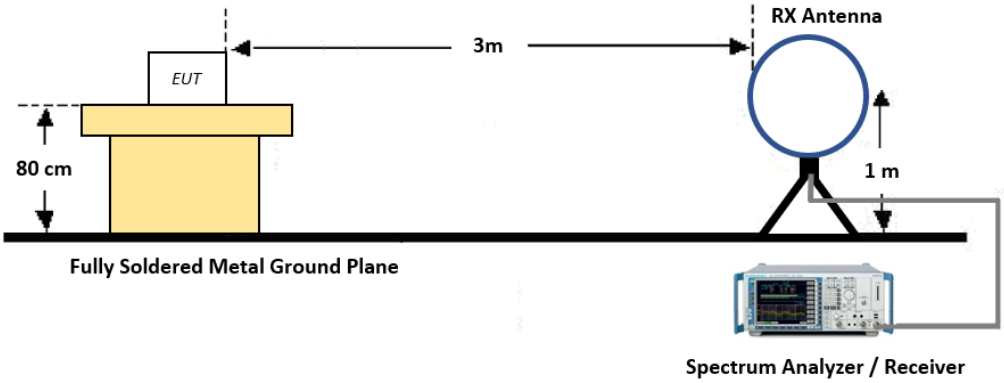
FCC : 47 CFR § 15.209		
Frequency (MHz)	**Field Strength (uV/m)**	**Measurement Distance (m)**
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

RESTRICTED BANDS OF OPERATION

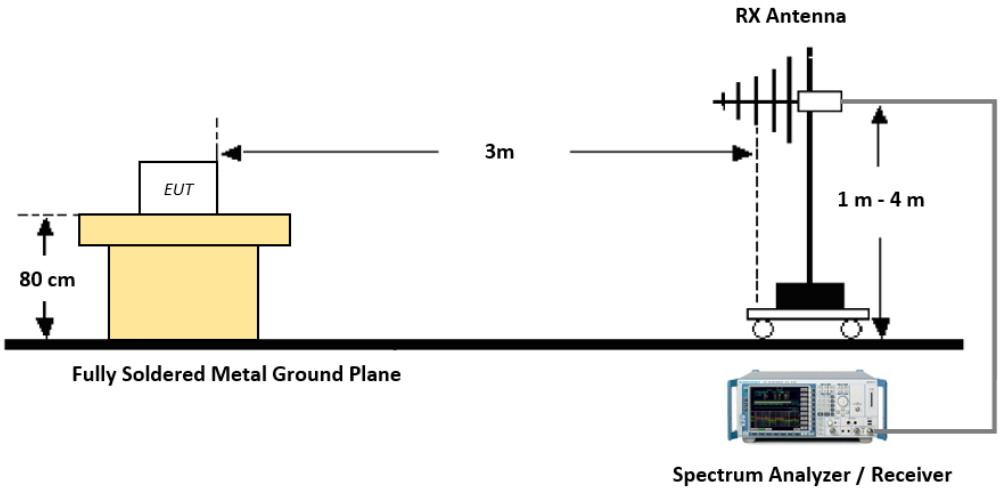
FCC : 47 CFR § 15.205(a)				
Frequency (MHz)	**Frequency (MHz)**	**Frequency (MHz)**	**Frequency (MHz)**	**Frequency (MHz)**
0.090 - 0.110	12.29 - 12.293	149.9 - 150.05	1660.0 - 1710.0	8025 - 8500
0.495 - 0.505	12.51975 - 12.52025	156.52475 - 156.52525	1718.8 - 1722.2	9000 - 9200
2.1735 - 2.1905	12.57675 - 12.57725	156.7 - 156.9	2200.0 - 2300.0	9300 - 9500
4.125 - 4.128	13.36 - 13.41	162.0125 - 167.17	2310.0 - 2390.0	10600 - 12700
4.17725 - 4.17775	16.42 - 16.423	167.72 - 173.2	2483.5 - 2500.0	13250 - 13400
4.20725 - 4.20775	16.69475 - 16.69525	240.0 - 285.0	2690.0 - 2900.0	14470 - 14500
6.215 - 6.218	16.80425 - 16.80475	322.0 - 335.4	3260.0 - 3267.0	15350 - 16200
6.26775 - 6.26825	25.5 - 25.67	399.9 - 410.0	3332.0 - 3339.0	17700 - 21400
6.31175 - 6.31225	37.5 - 38.25	608.0 - 614.0	3345.8 - 3358.0	22010 - 23120
8.291 - 8.294	73 - 74.6	960.0 - 1240.0	3600.0 - 4400.0	23600 - 24000
8.362 - 8.366	74.8 - 75.2	1300.0 - 1427.0	4500.0 - 5150.0	31200 - 31800
8.37625 - 8.38675	108 - 121.94	1435.0 - 1626.5	5350.0 - 5460.0	36430 - 36500
8.41425 - 8.41475	123 - 138	1645.5 - 1646.5	7250.0 - 7750.0	Above 38600

TEST SETUP

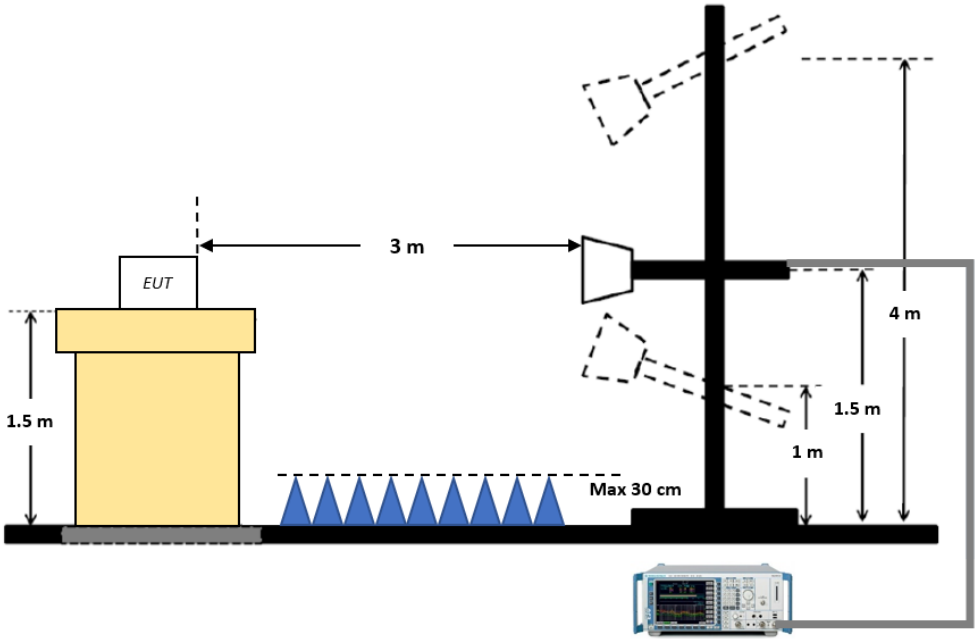
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (BELOW 30 MHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor (0.009 MHz – 0.490 MHz) = 40*log(3 m/300 m) = - 80 dB
   Measurement Distance: 3 m
7. Distance Correction Factor (0.490 MHz – 30 MHz) = 40*log(3 m/30 m) = - 40 dB
   Measurement Distance: 3 m
8. Spectrum Setting

   - Frequency Range = 9 kHz ~ 30 MHz
   - Detector = Peak
   - Trace = Max hold
   - RBW = 9 kHz
   - VBW ≥ 3*RBW

9. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)
10. There is a comparison data both open-field test site and alternative test site – semi-Anechoic chamber according to 414788 D01. And the results are properly calibrated.

TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (30 MHz – 1 GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting

   (1) Measurement Type (Peak):
   - Measured Frequency Range: 30 MHz – 1 GHz
   - Detector = Peak
   - Trace = Max hold
   - RBW = 100 kHz
   - VBW ≥ 3*RBW

   (2) Measurement Type(Quasi-peak):
   - Measured Frequency Range: 30 MHz – 1 GHz
   - Detector = Quasi-Peak
   - RBW = 120 kHz

6. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)

TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (ABOVE 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

(1) Measurement Type(Peak, G.5 in KDB 789033 v02r01):
- RBW = 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = Max hold
- Allow sweeps to continue until the trace stabilizes.
- Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

(2) Measurement Type(Average, G.6.d in KDB 789033 v02r01):
- RBW = 1 MHz
- VBW(Duty cycle ≥ 98 percent) = VBW ≤ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = VBW ≥ 1/T, where T is the minimum transmission duration.
- The analyzer is set to linear detector mode.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = Max hold.
- Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the duty cycle.

9. Measurement value only up to 6 maximum emissions noted or would be lesser if no specific emissions from the EUT are recorded (i.e.: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor

10. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency (or 40 GHz whichever comes first)

11. Sample Calculation

(1) Total (Peak) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
(2) Total (Average, Duty ≥ 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
(3) Total (Average, Duty < 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Duty Cycle Factor

TEST PROCEDURE OF RADIATED RESTRICTED BAND EDGE

1. Radiated test is performed with hopping off (if there is any)
2. The EUT is placed on a turntable, which is 1.5 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

(1) Measurement Type(Peak, G.5 in KDB 789033 v02r01):
- RBW = 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = Max hold
- Allow sweeps to continue until the trace stabilizes.
- Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

(2) Measurement Type(Average, G.6.d in KDB 789033 v02r01):
- RBW = 1 MHz
- VBW(Duty cycle ≥ 98 percent) = VBW ≤ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = VBW ≥ 1/T, where T is the minimum transmission duration.
- The analyzer is set to linear detector mode.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = Max hold.
- Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the duty cycle.

9. Sample Calculation

(1) Total (Peak) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
(2) Total (Average, Duty ≥ 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
(3) Total (Average, Duty < 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Duty Cycle Factor

7.7. AC POWER LINE CONDUCTED EMISSIONS

LIMIT

47 CFR § 15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency.
voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

TEST SETUP

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

According to FCC KDB 174176 D01 Line Conducted FAQ v01r01 :

Devices Operating Above 30 MHz

For a device with a permanent or detachable antenna operating above 30 MHz, measurements must be performed with the antenna connected as specified in clause 6.2 of ANSI C63.10-2013.

Devices Operating Below 30 MHz

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions:

(1) Perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band;

(2) Retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band. All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

8. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
26dB Bandwidth	§15.407	N/A (For power measurement)	Conducted	-
Maximum Conducted Output Power	§15.407(a)(1)	≤ 250 mW (= 24 dBm)		PASS
Power Spectral Density	§15.407(a)(1)	≤ 11 dBm/MHz		PASS
Frequency Stability	§15.407(g) §2.1055	Maintained within the band		PASS (1)
AC Power line Conducted Emissions	§15.207 §15.407(b)(9)	cf. Section 7.7		PASS (1)
Undesirable Emissions	§15.407(b)(1)	cf. Section 7.6	Radiated	PASS
Radiated Spurious Emissions	§15.209 §15.407(b)(9)	cf. Section 7.6		PASS
Radiated Restricted Band Edge	§15.407(b)(7) §15.205(a)	cf. Section 7.6		PASS

Note :
1. Evaluated on original certification.

WORST CASE CONFIGURATION

1. EUT Axis

   - All X, Y, and Z positions for horizontal / vertical antenna polarization were investigated to find the worst-case position.
   - X position was selected for the final evaluation.

2. Operations with all the data rates available were investigated for each different channel BW mode. Lowest datarate was selected as the worst case.

3. Radiated test was performed at the worst case 2 x TX CDD mode
   - The target power of SISO mode per chain is the same as the target power of MIMO mode per chain.

4. Worst-case test mode
   - All the RU tone for each bandwidth were investigated, and the modes below were reported as the worst-case conditions.

U-NII 2 Band		Tone	RU Offset
Test	Mode		
All Conducted Tests	802.11ax HE20	SU	-
		106T	53, 54
		52T	37, 38, 40
		26T	0, 4, 8
	802.11ax HE40	SU	-
		242T	61, 62
		106T	53, 54, 56
	802.11ax HE80	SU	-
Radiated Emission Tests	802.11ax HE20	SU	-
		106T	53, 54
		26T	0, 4, 8
	802.11ax HE40	SU	-
		242T	61, 62
	802.11ax HE80	SU	-
		484T	65, 66

WORST CASE DATA RATE

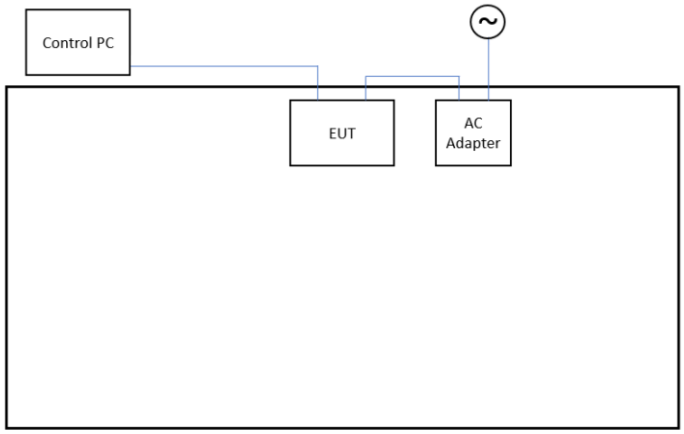
Mode	Worst Case Data Rate
802.11ax HE20	MCS0
802.11ax HE40	MCS0
802.11ax HE80	MCS0

CHANNEL UNDER TEST

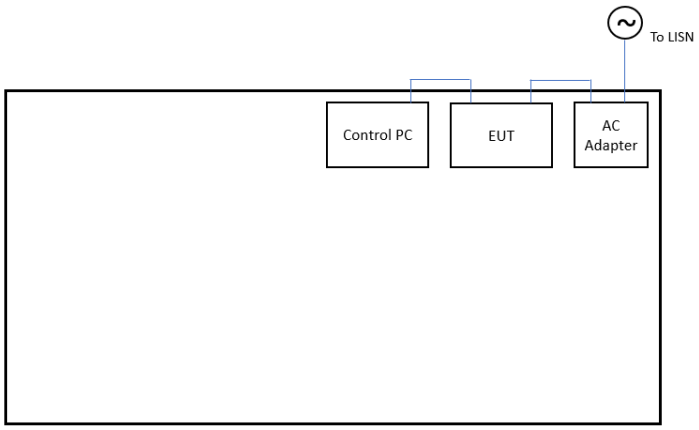
Mode (U-NII 1)	Low Channel (MHz)	Mid Channel (MHz)	High Channel (MHz)
802.11a	5180	5220	5240
802.11n	5180	5220	5240
	5190	-	5230
802.11ac	5210		

TEST CONFIGURATION

Radiated Emission



Conducted Emission



LIST OF SUPPORT EQUIPMENT

Equipment Type	Model No.	Serial No.	Manufacturer	Qty	Note
Power Supply	PA-1650-58	165058LT33803287PEA01	LITEON	1	Input : 100-240 V a.c., 50-60 Hz, 1.6 A Output : 20 V d.c., 3.25 A
Laptop	14-dq1038wrn	5CD04524LL	HP	1	For EUT control

9. TEST RESULT

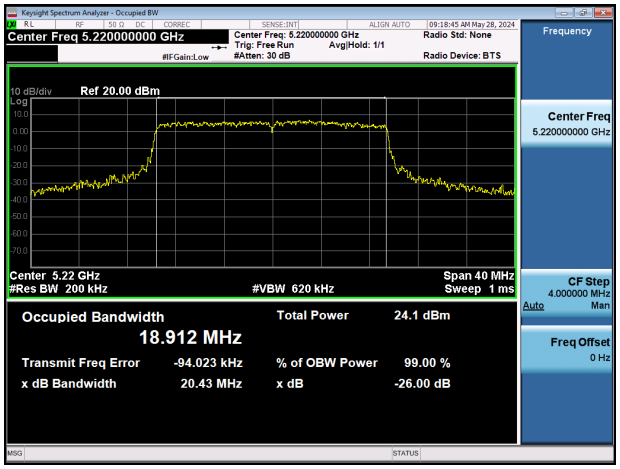
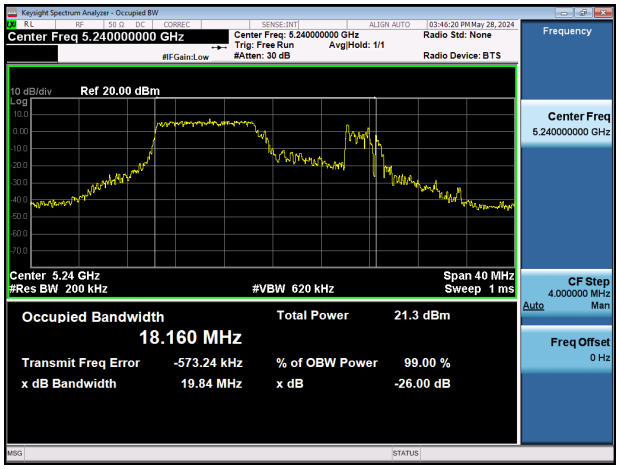
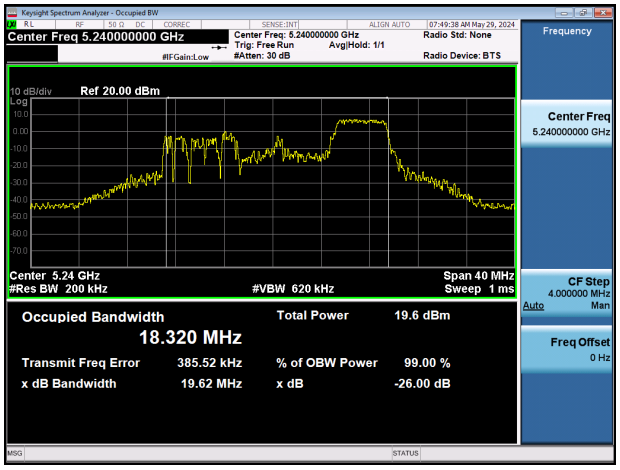
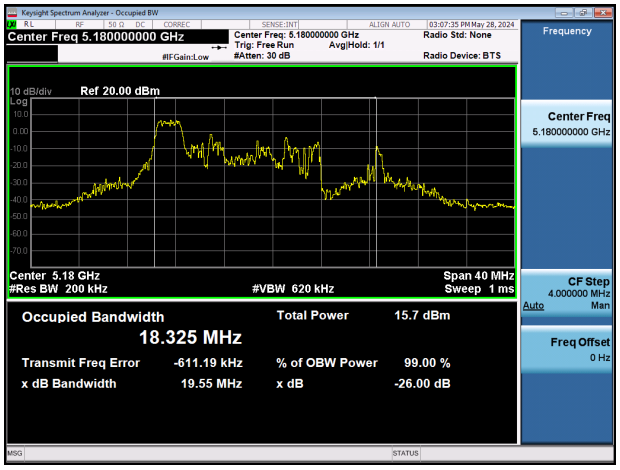
9.1 DUTY CYCLE

Duty cycle is 100 % continuous.

9.2 26 dB BANDWIDTH / 99% BANDWIDTH

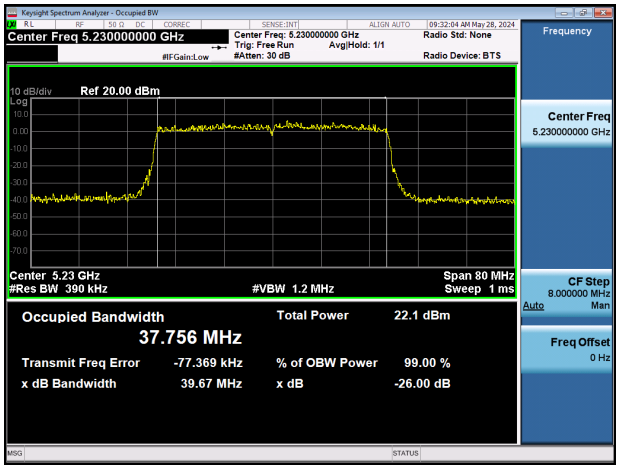
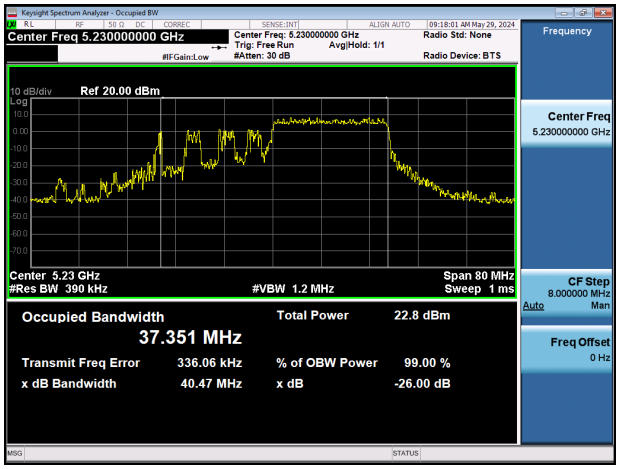
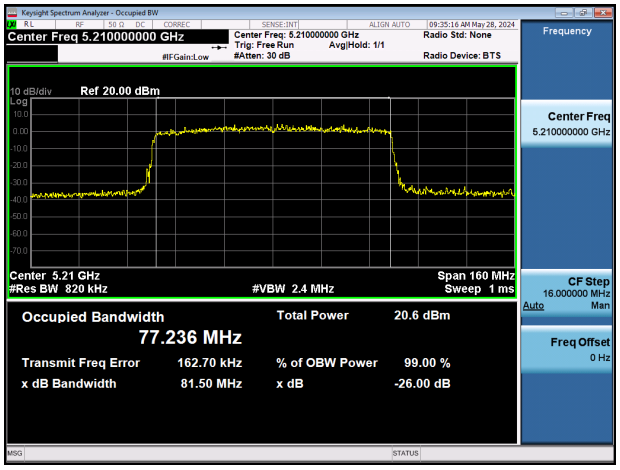
U-NII 1 Band				99% Bandwidth (MHz)		26 dB Bandwidth (MHz)	
Mode / Tone	Frequency (MHz)	Channel	Offset	Chain 0	Chain 1	Chain 0	Chain 1
802.11ax HE20 / SU	5180	36	-	18.901	18.862	20.584	20.410
	5220	44	-	18.912	18.871	20.428	20.381
	5240	48	-	18.879	18.901	20.732	20.391
802.11ax HE20 / 106T	5180	36	53	18.081	17.792	19.655	19.009
			54	16.114	16.072	17.742	17.927
	5220	44	53	17.262	16.378	20.258	17.620
			54	17.182	12.223	18.351	16.523
	5240	48	53	15.612	18.160	20.362	19.843
			54	15.929	18.062	20.258	20.204
802.11ax HE20 / 52T	5180	36	37	16.911	16.527	18.144	17.564
			38	12.165	12.774	15.629	15.954
			40	14.579	18.183	15.542	19.663
	5220	44	37	17.612	17.439	18.968	18.644
			38	8.565	9.204	11.622	15.229
			40	17.182	14.663	18.461	16.249
	5240	48	37	14.892	17.997	16.221	19.162
			38	11.032	12.623	17.014	17.299
			40	18.320	18.265	19.621	19.371
802.11ax HE20 / 26T	5180	36	0	18.325	17.829	19.547	18.598
			4	15.665	15.623	17.106	16.283
			8	17.750	17.926	18.674	19.038
	5220	44	0	18.297	17.803	19.499	18.796
			4	16.698	10.971	17.546	14.187
			8	17.401	17.968	18.401	19.338
	5240	48	0	15.148	17.768	16.112	18.695
			4	16.136	9.353	16.990	13.779
			8	17.923	13.550	19.338	14.616
802.11ax HE40 / SU	5190	38	-	37.711	37.555	39.773	39.972
	5230	46	-	37.756	37.711	39.674	39.781
802.11ax HE40 / 242T	5190	38	61	30.319	30.109	34.478	35.039
			62	35.215	36.526	37.599	40.858
	5230	46	61	30.444	35.801	32.781	40.141
			62	37.351	35.331	40.472	37.681
802.11ax HE40 / 106T	5190	38	53	34.770	37.232	39.865	39.365
			54	30.194	27.185	33.750	37.469
			56	34.086	36.258	36.363	38.867
	5230	46	53	35.993	37.605	38.395	39.932
			54	32.306	24.405	35.617	33.100
			56	35.368	36.992	37.468	39.577
802.11ax HE80 / SU	5210	42	-	77.236	76.940	81.498	81.356

▣ TEST PLOTS

26 dB Bandwidth / 99% Bandwidth	
802.11ax HE20 SU (CH 44 : 5220 MHz)	802.11ax HE20 106T (Offset : 53) (CH 48 : 5240 MHz)
	
802.11ax HE20 52T (Offset : 40) (CH 48 : 5240 MHz)	802.11ax HE20 26T (Offset : 0) (CH 36 : 5180 MHz)
	

Note :
The worst plots are reported for each tone and bandwidth

▣ TEST PLOTS

26 dB Bandwidth / 99% Bandwidth	
802.11ax HE40 SU (CH 46 : 5230 MHz)	802.11ax HE40 242T (Offset : 62) (CH 46 : 5230 MHz)
	
802.11ax HE40 106T (Offset : 53) (CH 46 : 5230 MHz)	802.11ax HE80 SU (CH 42 : 5210 MHz)
	

Note :
The worst plots are reported for each tone and bandwidth

9.3 OUTPUT POWER

U-NII 1 Band				Test Result				Limit (dBm)
Mode / Tone	Frequency (MHz)	Channel	Offset	Measured Power (dBm)		Duty Factor (dB)	Total Power (dBm)	
				Chain 0	Chain 1		All Chain	
802.11ax HE20 / SU	5180	36	-	16.88	16.12	-	19.53	23.46
	5220	44	-	17.55	16.82	-	20.21	23.46
	5240	48	-	18.21	17.22	-	20.75	23.46
802.11ax HE20 / 106T	5180	36	53	14.23	13.22	-	16.76	23.46
			54	14.48	13.65	-	17.10	23.46
	5220	44	53	15.16	14.02	-	17.63	23.46
			54	14.95	14.04	-	17.53	23.46
	5240	48	53	15.42	14.46	-	17.98	23.46
			54	15.61	14.68	-	18.18	23.46
802.11ax HE20 / 52T	5180	36	37	11.22	10.09	-	13.70	23.46
			38	11.29	10.37	-	13.86	23.46
			40	11.46	10.74	-	14.13	23.46
	5220	44	37	12.20	10.80	-	14.57	23.46
			38	12.17	10.91	-	14.60	23.46
			40	11.97	11.02	-	14.53	23.46
	5240	48	37	12.33	11.32	-	14.87	23.46
			38	12.54	11.58	-	15.10	23.46
			40	12.52	11.72	-	15.15	23.46
802.11ax HE20 / 26T	5180	36	0	8.25	6.81	-	10.60	23.46
			4	8.28	7.25	-	10.81	23.46
			8	7.29	6.27	-	9.82	23.46
	5220	44	0	9.22	7.78	-	11.57	23.46
			4	9.04	7.86	-	11.50	23.46
			8	8.12	7.19	-	10.69	23.46
	5240	48	0	9.33	8.13	-	11.78	23.46
			4	9.60	8.48	-	12.09	23.46
			8	9.06	7.96	-	11.55	23.46

Note(s) :

1. The limit is reduced as follows considering beamforming gain.
   Conducted Power limit = 23.98 dBm – (6.52 dBi – 6 dBi) = 23.46 dBm
2. Duty factor is not applied since the duty cycle is 100 %.

U-NII 1 Band				Test Result				Limit (dBm)
Mode / Tone	Frequency (MHz)	Channel	Offset	Measured Power (dBm)		Duty Factor (dB)	Total Power (dBm)	
				Chain 0	Chain 1		All Chain	
802.11ax HE40 / SU	5190	38	-	14.28	13.51	-	16.92	23.46
	5230	46	-	15.12	14.29	-	17.74	23.46
802.11ax HE40 / 242T	5190	38	61	14.33	13.42	-	16.91	23.46
			62	14.94	14.00	-	17.51	23.46
	5230	46	61	15.33	14.13	-	17.78	23.46
			62	15.42	14.59	-	18.03	23.46
802.11ax HE40 / 106T	5190	38	53	14.48	13.58	-	17.07	23.46
			54	15.20	14.34	-	17.80	23.46
			56	15.51	14.44	-	18.02	23.46
	5230	46	53	15.76	14.43	-	18.16	23.46
			54	15.89	14.90	-	18.43	23.46
			56	15.95	15.02	-	18.52	23.46
802.11ax HE80 / SU	5210	42	-	12.95	12.06	-	15.54	23.46

Note(s) :

1. The limit is reduced as follows considering beamforming gain.
   Conducted Power limit = 23.98 dBm – (6.52 dBi – 6 dBi) = 23.46 dBm
2. Duty factor is not applied since the duty cycle is 100 %.

9.4 POWER SPECTRAL DENSITY

U-NII 1 Band				Test Result				Limit (dBm/MHz)
Mode / Tone	Frequency (MHz)	Channel	Offset	Measured PSD (dBm/MHz)		Duty Factor (dB)	Total PSD (dBm/MHz)	
				Chain 0	Chain 1		All Chain	
802.11ax HE20 / SU	5180	36	-	6.01	4.96	-	8.53	10.48
	5220	44	-	6.70	5.56	-	9.18	10.48
	5240	48	-	7.25	5.82	-	9.60	10.48
802.11ax HE20 / 106T	5180	36	53	5.96	5.13	-	8.57	10.48
			54	6.31	5.43	-	8.90	10.48
	5220	44	53	6.80	5.78	-	9.33	10.48
			54	6.63	5.68	-	9.19	10.48
	5240	48	53	7.13	6.49	-	9.83	10.48
			54	7.26	6.39	-	9.86	10.48
802.11ax HE20 / 52T	5180	36	37	5.68	4.99	-	8.36	10.48
			38	5.88	4.93	-	8.44	10.48
			40	6.33	5.54	-	8.96	10.48
	5220	44	37	6.94	5.65	-	9.35	10.48
			38	6.99	5.45	-	9.30	10.48
			40	6.85	5.65	-	9.30	10.48
	5240	48	37	7.09	6.08	-	9.63	10.48
			38	7.32	6.35	-	9.87	10.48
			40	7.44	6.47	-	9.99	10.48
802.11ax HE20 / 26T	5180	36	0	5.65	4.30	-	8.04	10.48
			4	4.97	3.76	-	7.42	10.48
			8	4.91	3.84	-	7.42	10.48
	5220	44	0	6.52	5.28	-	8.95	10.48
			4	5.21	4.37	-	7.82	10.48
			8	5.80	4.79	-	8.33	10.48
	5240	48	0	6.68	5.77	-	9.26	10.48
			4	5.67	4.91	-	8.32	10.48
			8	6.78	6.14	-	9.48	10.48

Note(s) :

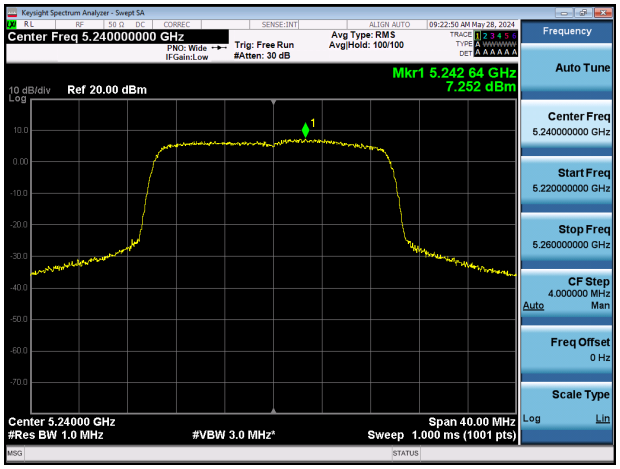
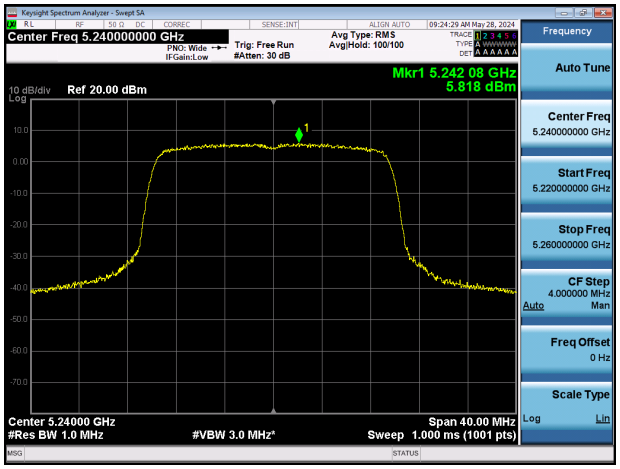
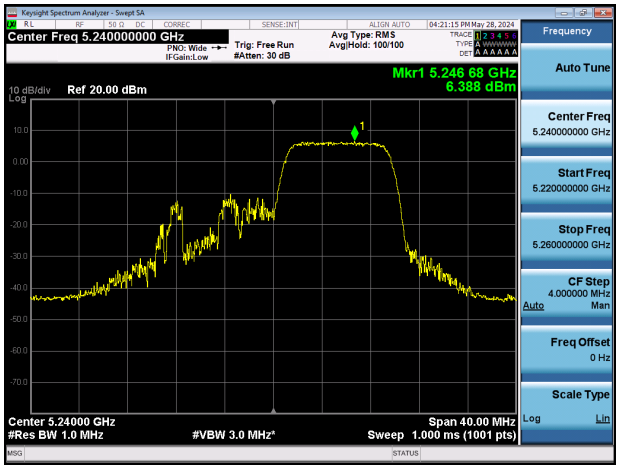
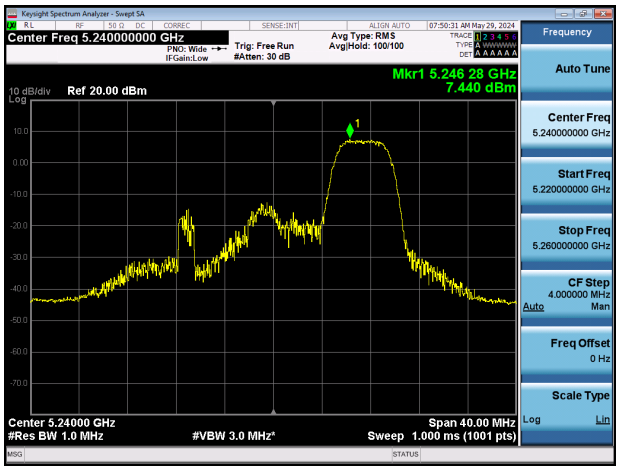
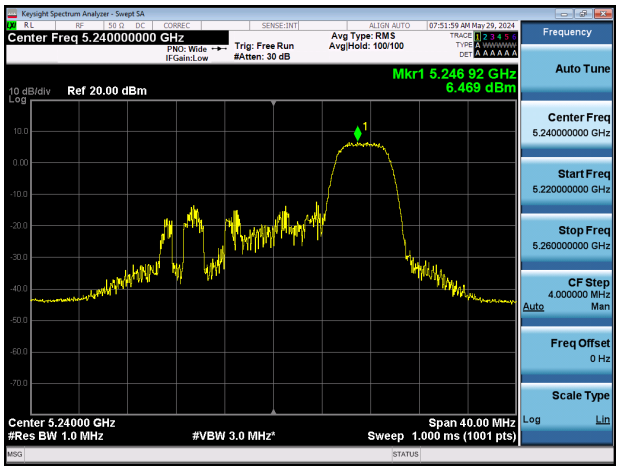
1. Conducted PSD limit = 11 dBm/MHz – (6.52 dBi – 6 dBi) = 10.48 dBm/MHz
2. Duty factor is not applied since the duty cycle is 100 %.

U-NII 1 Band				Test Result				Limit (dBm)
Mode / Tone	Frequency (MHz)	Channel	Offset	Measured PSD (dBm/MHz)		Duty Factor (dB)	Total PSD (dBm/MHz)	
				Chain 0	Chain 1		All Chain	
802.11ax HE40 / SU	5190	38	-	0.47	-0.46	-	3.04	10.48
	5230	46	-	1.12	0.47	-	3.81	10.48
802.11ax HE40 / 242T	5190	38	61	2.57	1.88	-	5.25	10.48
			62	3.10	2.41	-	5.78	10.48
	5230	46	61	3.55	2.45	-	6.04	10.48
			62	3.68	3.00	-	6.36	10.48
802.11ax HE40 / 106T	5190	38	53	6.54	5.30	-	8.97	10.48
			54	6.96	5.89	-	9.47	10.48
			56	7.34	6.19	-	9.81	10.48
	5230	46	53	7.30	6.08	-	9.74	10.48
			54	7.72	6.74	-	10.26	10.48
			56	7.67	6.80	-	10.27	10.48
802.11ax HE80 / SU	5210	42	-	-4.07	-5.12	-	-1.556	10.48

Note(s) :

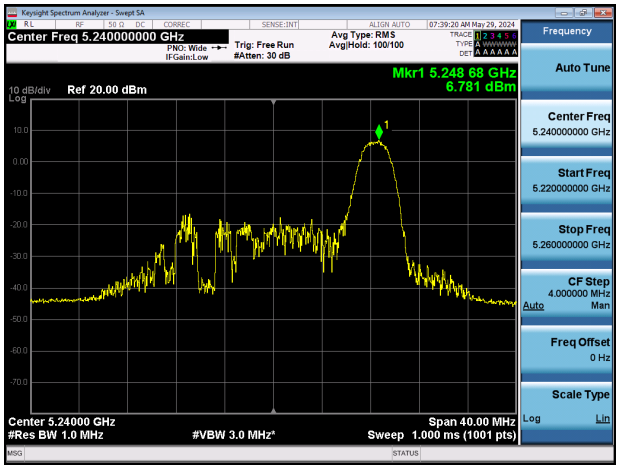
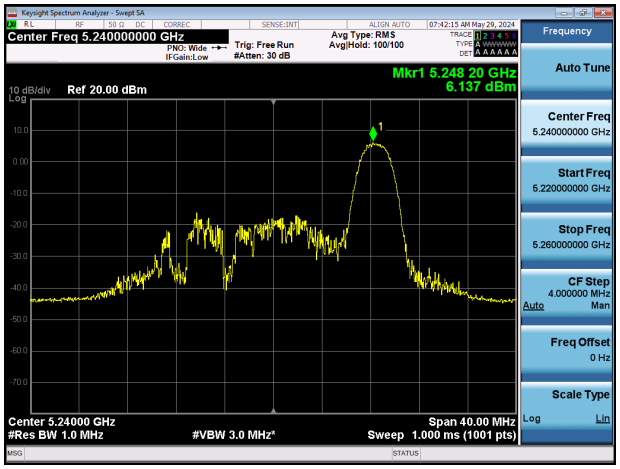
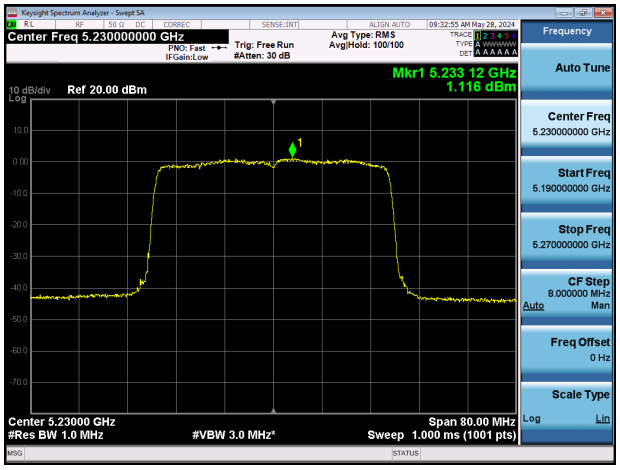
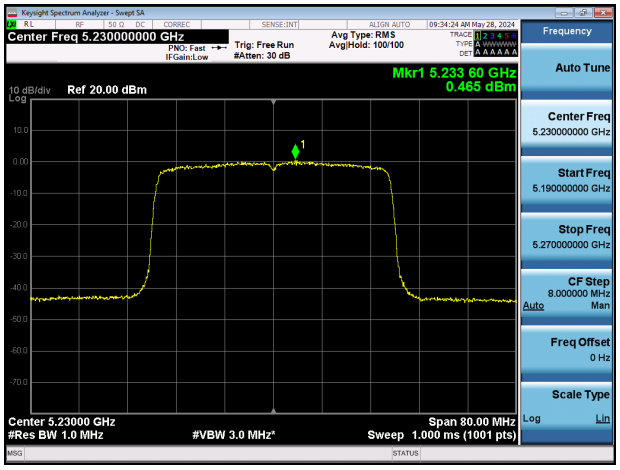
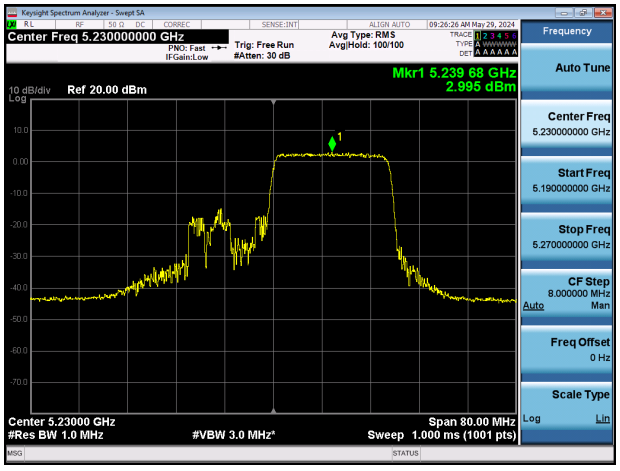
1. Conducted PSD limit = 11 dBm/MHz – (6.52 dBi – 6 dBi) = 10.48 dBm/MHz
2. Duty factor is not applied since the duty cycle is 100 %.

▣ TEST PLOTS

Power Spectral Density -	
802.11ax HE20 SU (CH 48 : 5240 MHz) – Chain 0	**802.11ax HE20 SU (CH 48 : 5240 MHz) – Chain 1**
	
802.11ax HE20 106T Offset : 54 (CH 48 : 5240 MHz) – Chain 0	**802.11ax HE20 106T Offset : 54 (CH 48 : 5240 MHz) – Chain 1**
	
802.11ax HE20 52T Offset : 40 (CH 48 : 5240 MHz) – Chain 0	**802.11ax HE20 52T Offset : 40 (CH 48 : 5240 MHz) – Chain 1**
	

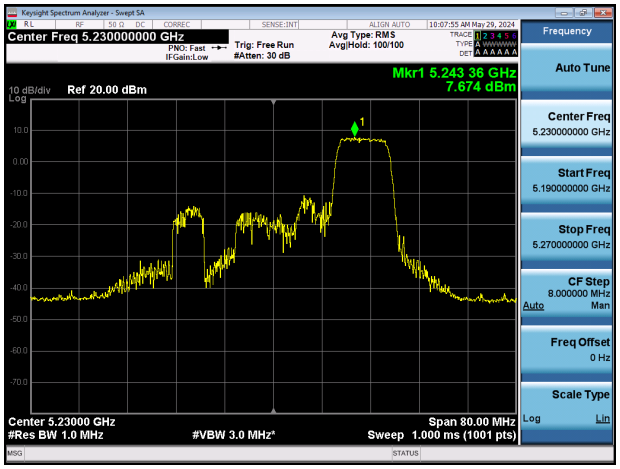
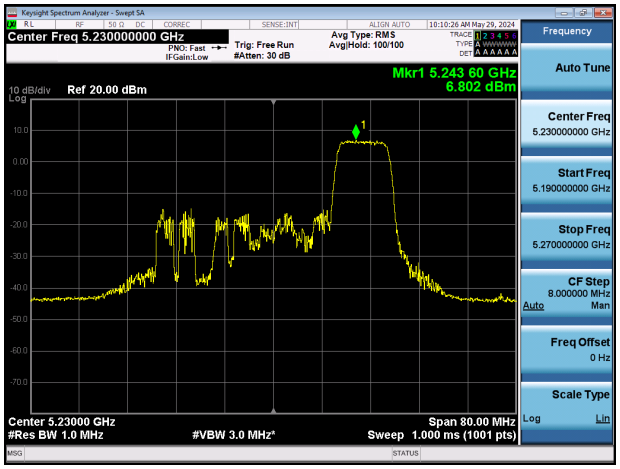
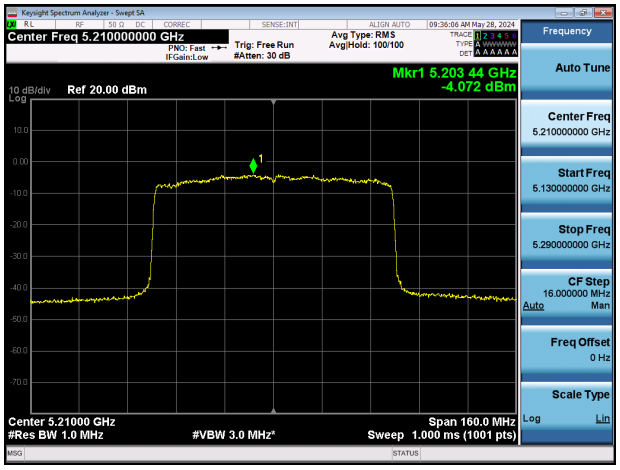
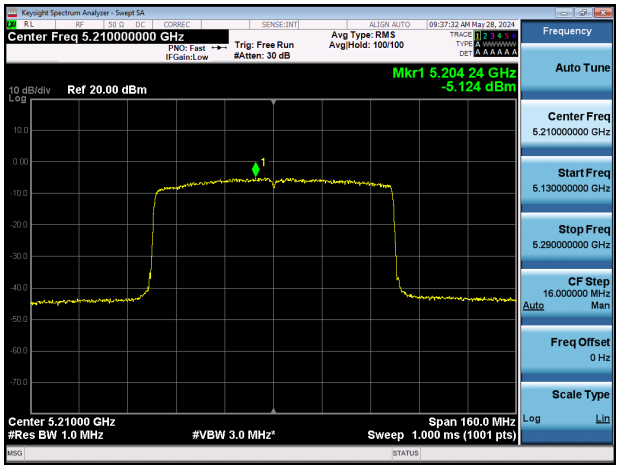
Note :
The worst plots are reported for each tone and bandwidth

▣ TEST PLOTS

Power Spectral Density -	
802.11ax HE20 26T Offset : 8 (CH 48 : 5240 MHz) – Chain 0	**802.11ax HE20 26T Offset : 8 (CH 48 : 5240 MHz) – Chain 1**
	
802.11ax HE40 SU (CH 46 : 5230 MHz) – Chain 0	**802.11ax HE40 SU (CH 46 : 5230 MHz) – Chain 1**
	
802.11ax HE40 242T Offset : 62 (CH 46 : 5230 MHz) – Chain 0	**802.11ax HE40 242T Offset : 62 (CH 46 : 5230 MHz) – Chain 1**
	

Note :
The worst plots are reported for each tone and bandwidth

▣ TEST PLOTS

Power Spectral Density -	
802.11ax HE40 106T Offset : 56 (CH 46 : 5230 MHz) – Chain 0	**802.11ax HE40 106T Offset : 56 (CH 46 : 5230 MHz) – Chain 1**
	
802.11ax HE80 SU (CH 42 : 5210 MHz) – Chain 0	**802.11ax HE80 SU (CH 42 : 5210 MHz) – Chain 1**
	

Note :
The worst plots are reported for each tone and bandwidth

9.5 RADIATED SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

Test Mode 802.11ax HE20 (SU) : TX mode

Operating Frequency 5180 MHz (CH 36)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Test Mode 802.11ax HE20 (SU) : TX mode

Operating Frequency 5200 MHz (CH 40

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Test Mode 802.11ax HE20 (SU) : TX mode

Operating Frequency 5240 MHz (CH 48)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Note(s) :

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

Frequency Range : Above 1 GHz

Test Mode 802.11ax HE20 (SU) : TX mode
Operating Frequency 5180 MHz (CH 36)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Test Mode 802.11ax HE20 (SU) : TX mode
Operating Frequency 5220 MHz (CH 44)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Test Mode 802.11ax HE20 (SU) : TX mode
Operating Frequency 5240 MHz (CH 48)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Test Mode 802.11ax HE20 (26T Offset : 0) : TX mode
Operating Frequency 5180 MHz (CH 36)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

Test Mode 802.11ax HE20 (26T Offset : 0) : TX mode
Operating Frequency 5220 MHz (CH 44)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

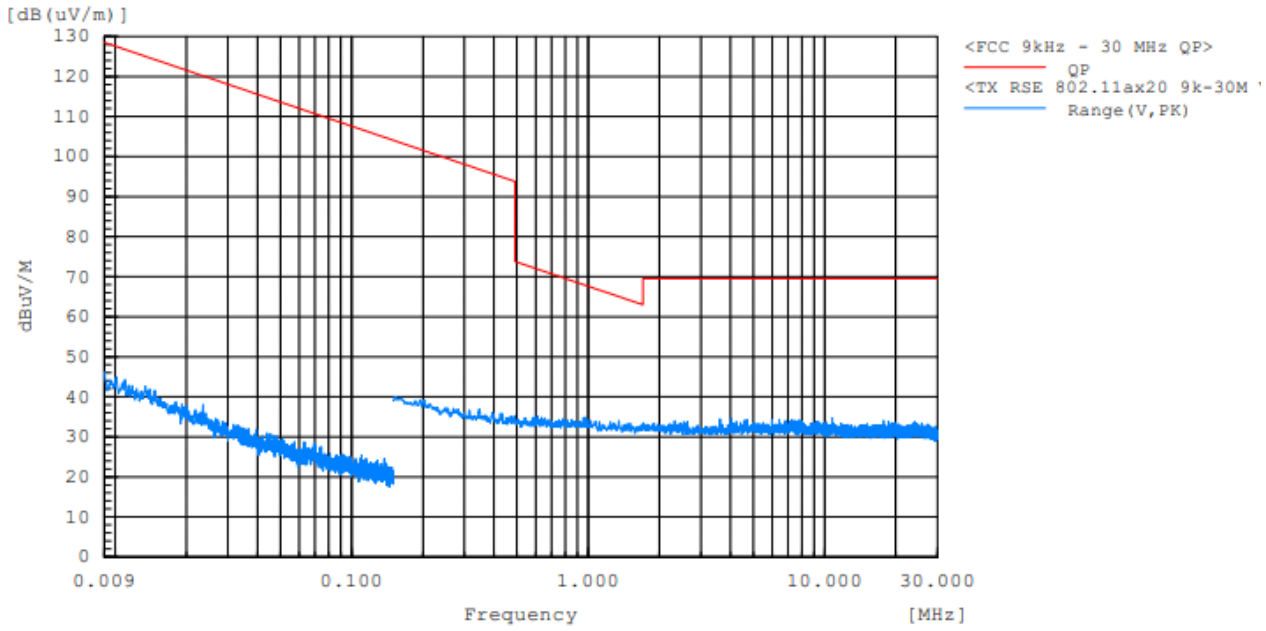
Test Mode 802.11ax HE20 (26T Offset : 0) : TX mode
Operating Frequency 5240 MHz (CH 48)

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [1] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
No major peaks found							

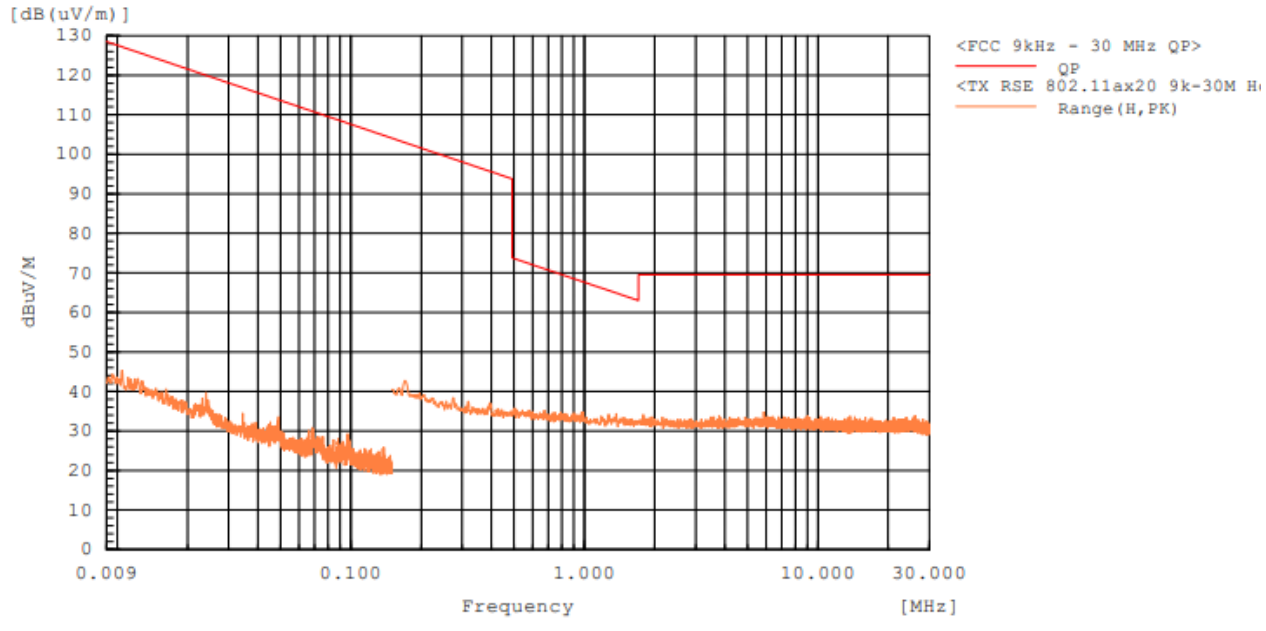
Note(s) :
1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).

▣ TEST PLOTS

Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 90°) : 802.11ax HE20 (SU) (CH 36)



Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 180°) : 802.11ax HE20 (SU) (CH 36)

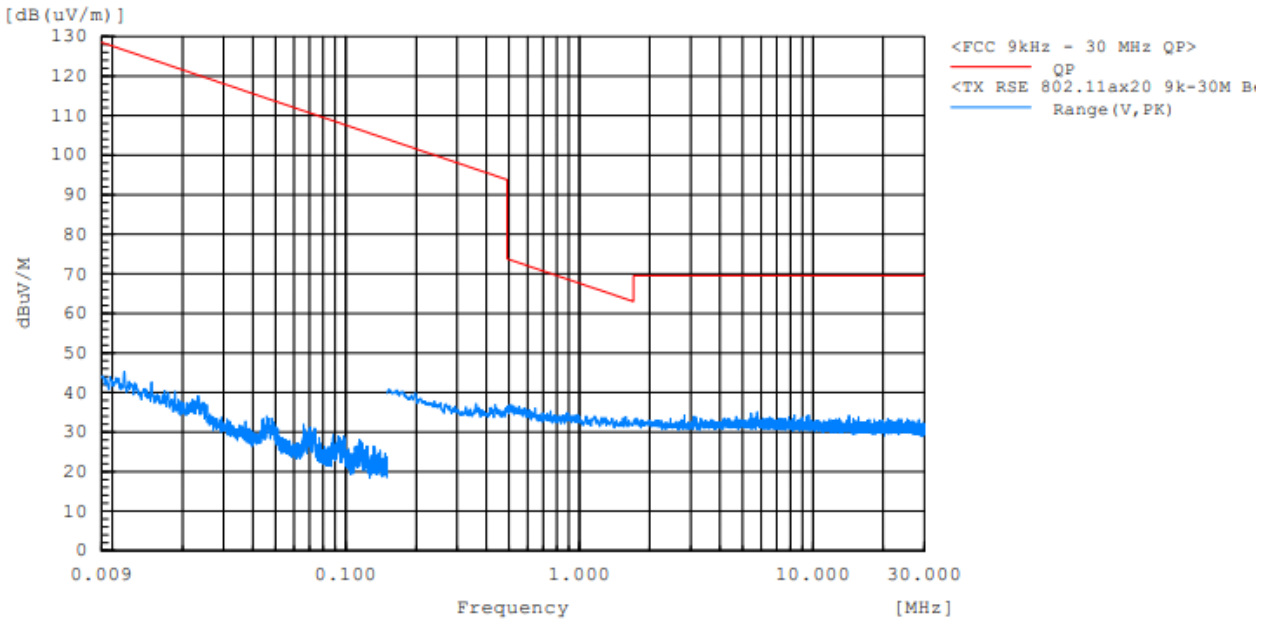


Note:

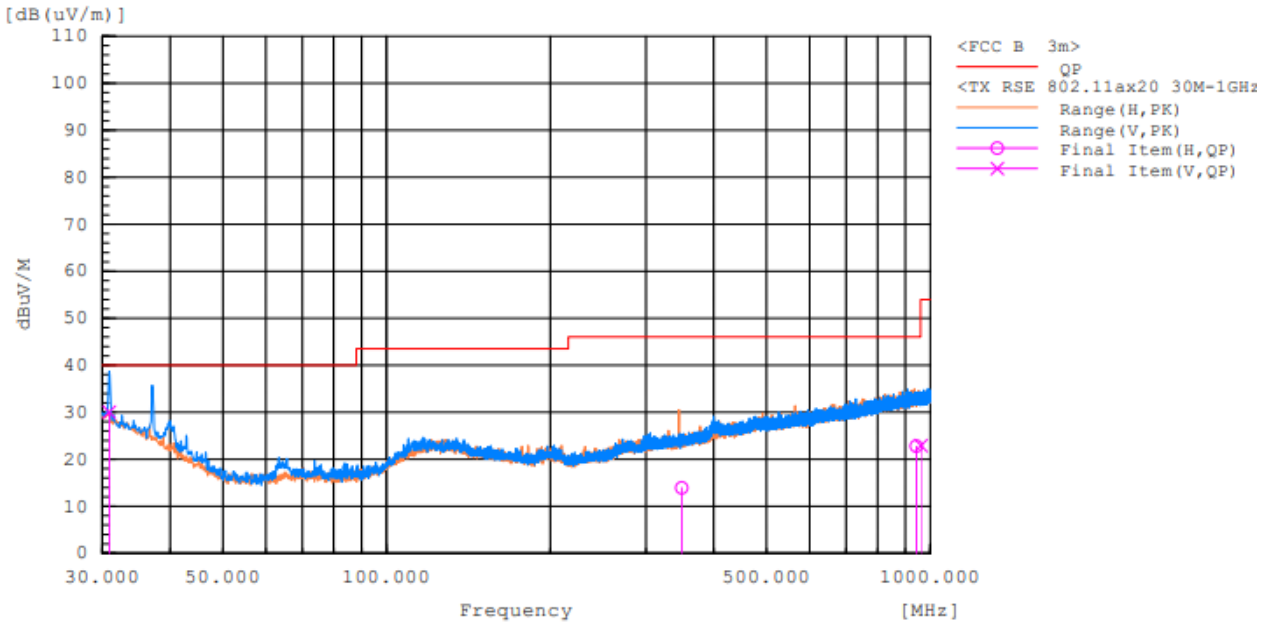
1. There were no major peaks and representative plots are included in this report
2. The plots include all used factor values for cables, antenna, preamplifier, etc.

▣ TEST PLOTS (Continued)

Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position Bent over) : 802.11ax HE20 (SU) (CH 36)



Radiated Spurious Emission 30 MHz – 1 GHz : 802.11ax HE20 (SU) (CH 36)

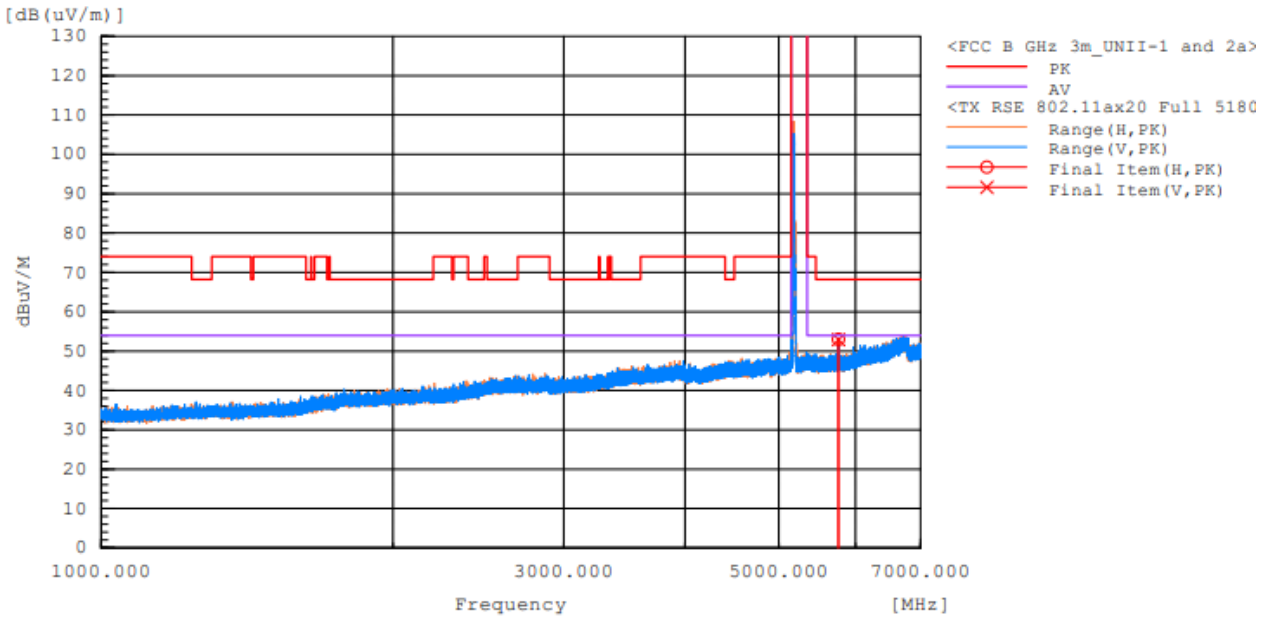


Note:

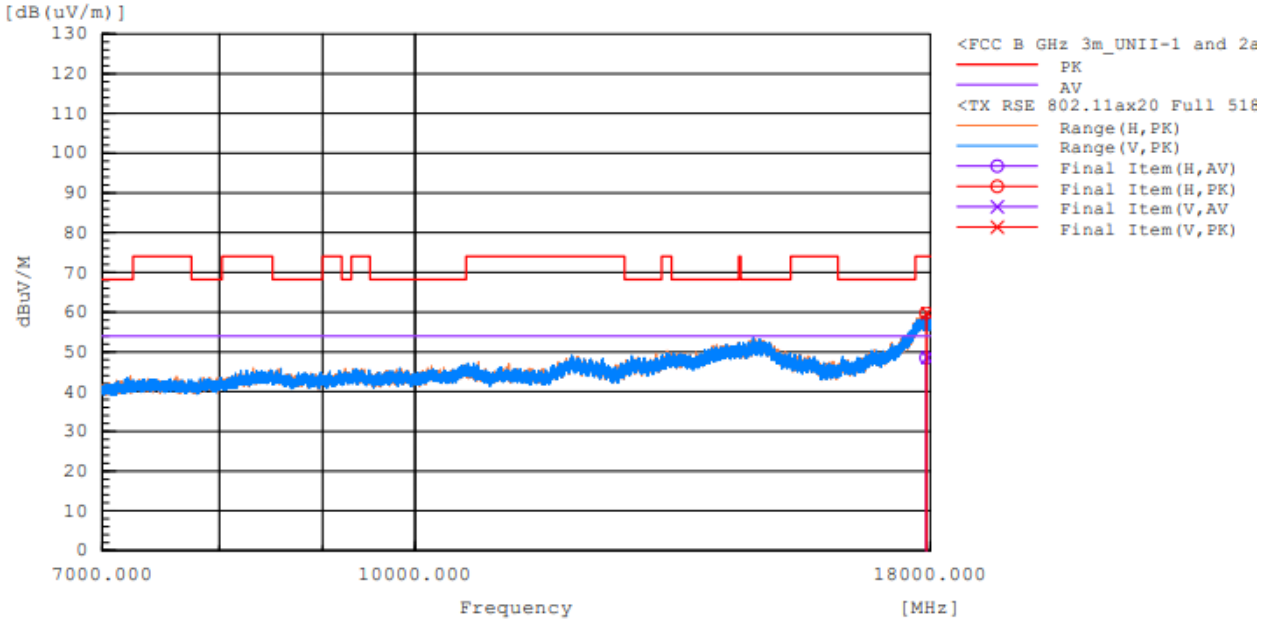
1. There were no major peaks and representative plots are included in this report
2. The plots include all used factor values for cables, antenna, preamplifier, etc.

▣ TEST PLOTS (Continued)

Radiated Spurious Emission 1 GHz - 7 GHz : 802.11ax HE20 (SU) (CH 36)



Radiated Spurious Emission 7 GHz - 18 GHz : 802.11ax HE20 (SU) (CH 36)

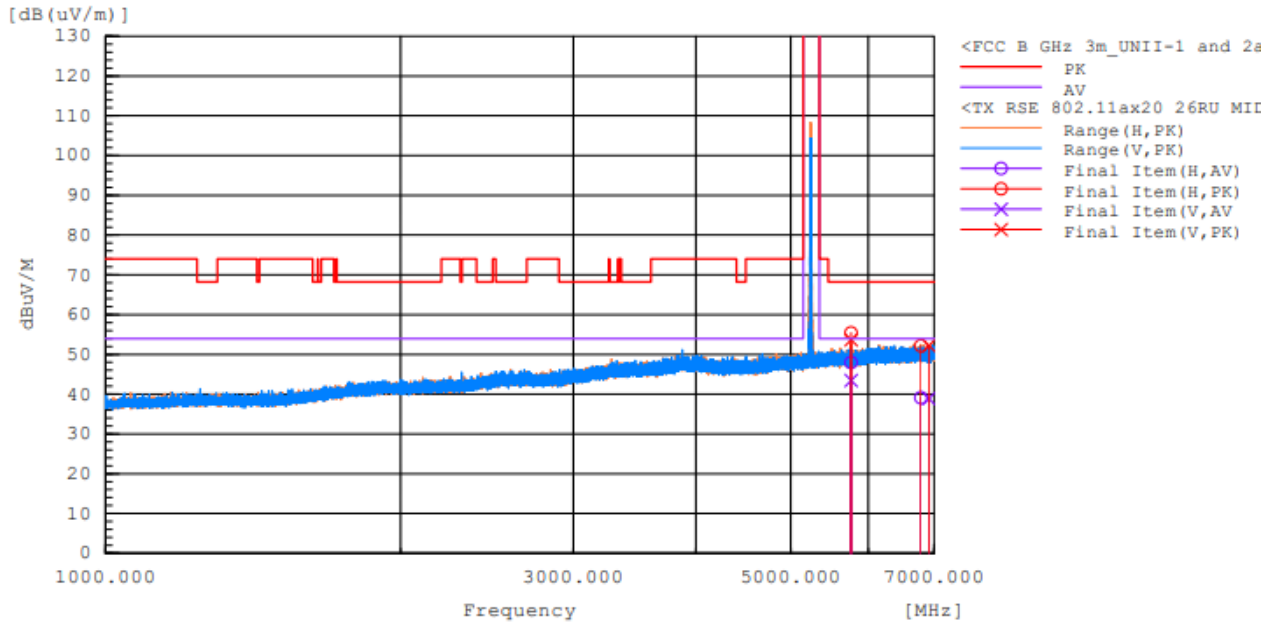


Note:

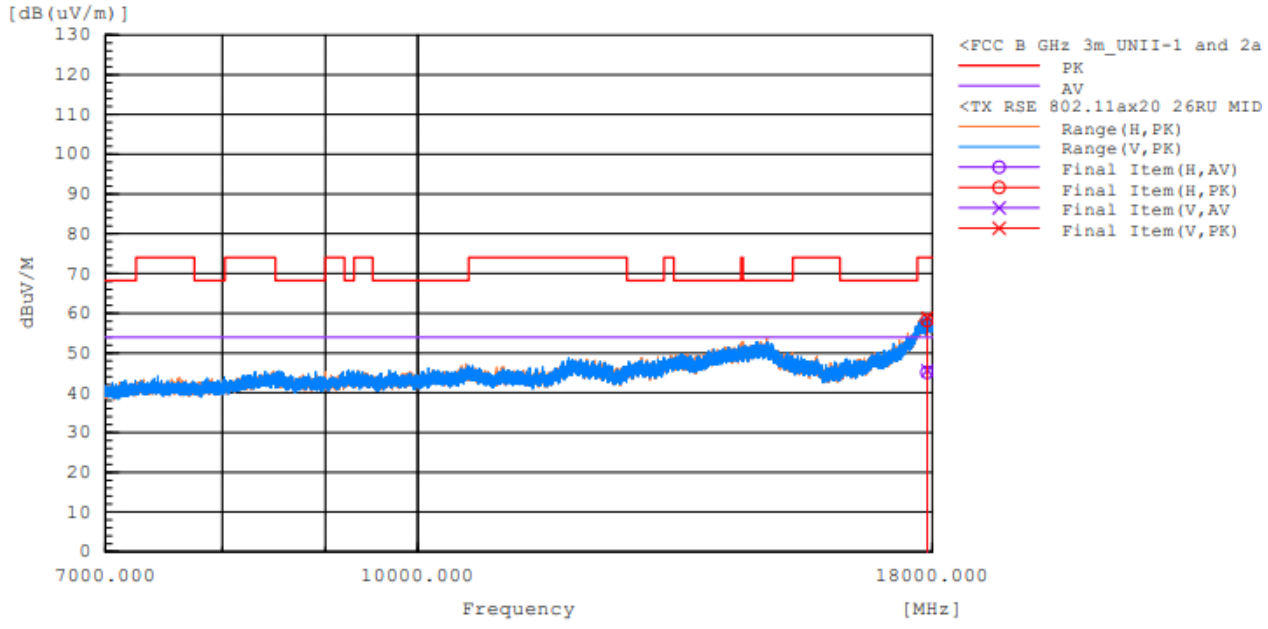
1. There were no major peaks and representative plots are included in this report
2. The plots include all used factor values for cables, antenna, preamplifier, etc.

▣ TEST PLOTS (Continued)

Radiated Spurious Emission 1 GHz - 7 GHz : 802.11ax HE20 (26T Offset : 4) (CH 48)



Radiated Spurious Emission 7 GHz - 18 GHz : 802.11ax HE20 (26T Offset : 4) (CH 48)

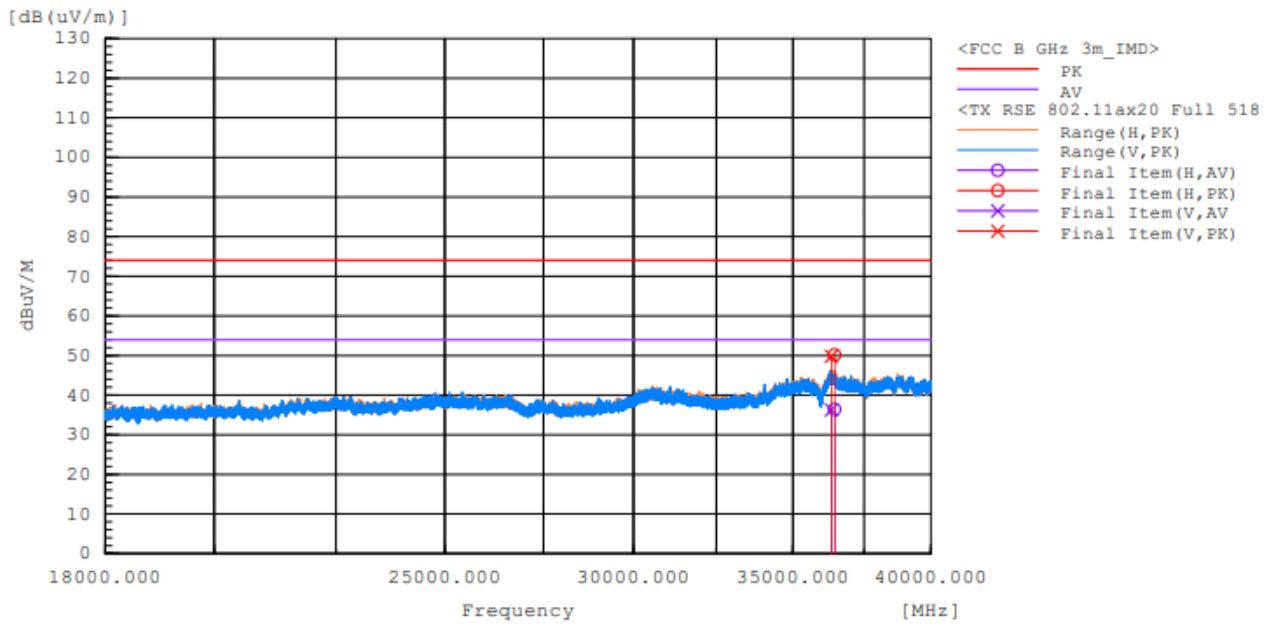


Note:

1. There were no major peaks and representative plots are included in this report
2. The plots include all used factor values for cables, antenna, preamplifier, etc.

▣ TEST PLOTS (Continued)

Radiated Spurious Emission 18 GHz - 40 GHz : 802.11ax HE20 (SU) (CH 36)



Note:

1. There were no major peaks and representative plots are included in this report
2. The plots include all used factor values for cables, antenna, preamplifier, etc.

9.6 RADIATED RESTRICTED BAND EDGES

Test Mode 802.11ax HE20 (SU) : TX mode

Operating Frequency 5180 MHz (CH 36)

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
5149.822	H	40.1	56.5	1.3	-	41.4	57.8	54	74	12.6	16.2
5149.883	V	35.4	50.4	1.3	-	36.7	51.7	54	74	17.3	22.3

Test Mode 802.11ax HE20 (106T Offset : 53) : TX mode

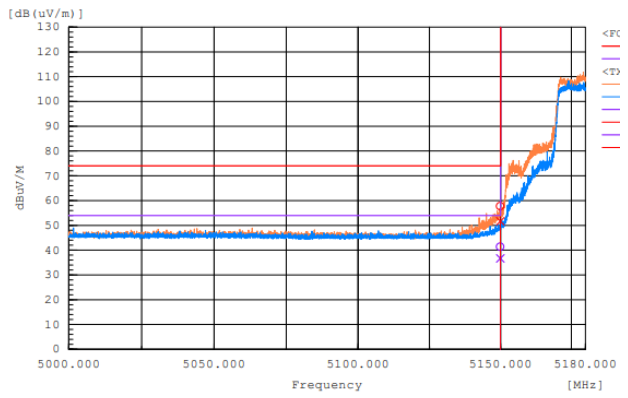
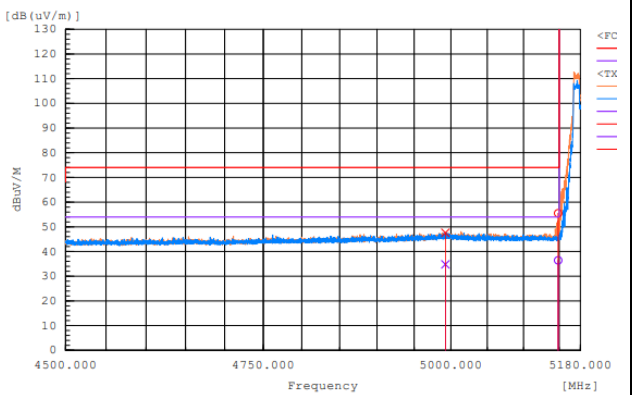
Operating Frequency 5180 MHz (CH 36)

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
4992.283	V	34.1	46.9	0.7	-	34.8	47.6	54	74	19.2	26.4
5148.776	H	35.1	54.2	1.3	-	36.4	55.5	54	74	17.6	18.5

Note(s) :

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).
3. Duty factor is not applied since the duty cycle is 100 %.

▣ TEST PLOTS

802.11ax HE20 (SU) (CH 36) - Low	802.11ax HE20 (106T Offset : 53) (CH 36) - Low
	

Test Mode 802.11ax HE40 (SU) : TX mode

Operating Frequency 5190 MHz (CH 38)

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
5149.817	V	41.3	56.0	1.3	-	42.6	57.3	54	74	11.4	16.7
5149.953	H	50.7	66.6	1.3	-	52.0	67.9	54	74	2.0	6.1

Test Mode 802.11ax HE40 (242T Offset : 61) : TX mode

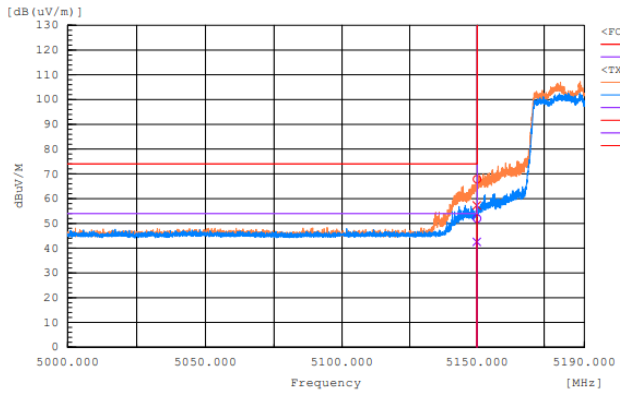
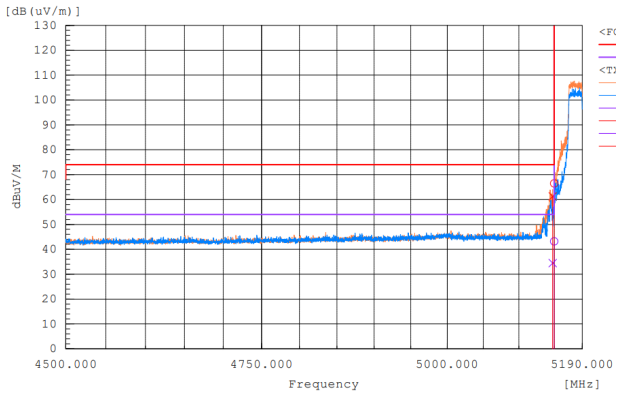
Operating Frequency 5190 MHz (CH 38)

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
5147.680	V	33.2	60.0	1.3		34.5	61.3	54	74	19.5	12.7
5149.881	H	41.9	65.2	1.3		43.2	66.5	54	74	10.8	7.5

Note(s) :

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).
3. Duty factor is not applied since the duty cycle is 100 %.

▣ TEST PLOTS

802.11ax HE40 (SU) (CH 38) - Low	802.11ax HE40 (242T Offset : 61) (CH 38) - Low
	

Test Mode 802.11ax HE80 (SU) : TX mode
Operating Frequency 5210 MHz (CH 42)

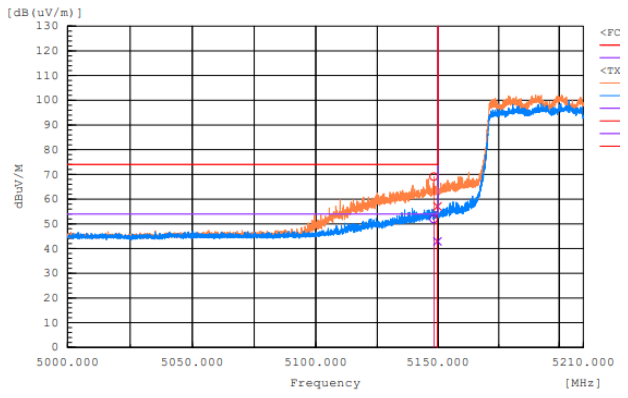
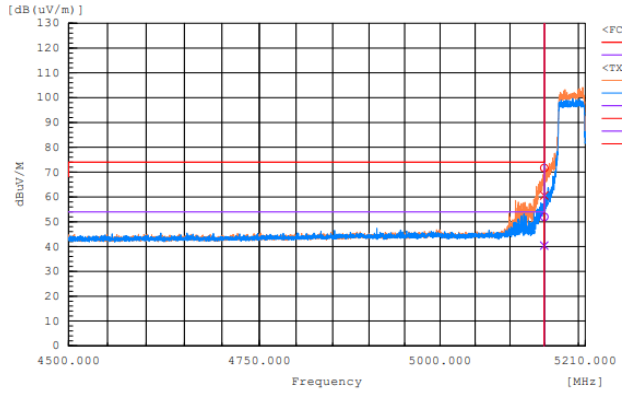
Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
5148.138	H	50.7	67.8	1.3		52.0	69.1	54	74	2.0	4.9
5149.693	V	41.6	55.8	1.3		42.9	57.1	54	74	11.1	16.9

Test Mode 802.11ax HE80 (484T Offset : 65) : TX mode
Operating Frequency 5210 MHz (CH 42)

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
5149.556	V	39.1	59.3	1.3		40.4	60.6	54	74	13.6	13.4
5149.968	H	50.7	70.4	1.3		52.0	71.7	54	74	2.0	2.3

Note(s) :
1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).
3. Duty factor is not applied since the duty cycle is 100 %.

▣ TEST PLOTS

802.11ax HE80 (SU) (CH 42) - Low	802.11ax HE80 (484T Offset : 65) (CH 42) - Low
	

10. LIST OF TEST EQUIPMENT

No.	Instrument	Model No.	Calibration Due (mm/dd/yy)	Manufacture	Serial No.
☒	Signal Analyzer (20 Hz ~ 40.0 GHz)	ESU40	12/01/2024	Rohde & Schwarz	100529
☒	Signal Analyzer (1 Hz ~ 40.0 GHz)	ESW44	10/24/2024	Rohde & Schwarz	102015
☒	Signal Analyzer (3 Hz ~ 50 GHz)	N9030A	06/30/2024	Keysight	MY53311083
☐	Attenuator (20 dB, DC ~ 26.5 GHz)	8493C 20 dB	02/16/2025	KEYSIGHT	89401
☒	Attenuator (10 dB, DC ~ 26.5 GHz)	8493C 10 dB	09/05/2024	KEYSIGHT	89576
☒	Open Switch with Power Sensor	OSP150	04/01/2025	Rohde & Schwarz	100872
☒	Loop Antenna (0.009 ~ 30 MHz)	HLA 6121	09/12/2025	TESEQ	43964
☒	BI-LOG Antenna (30 MHz ~ 6 GHz)	JB6	03/06/2025	Sunol	A060916
☒	LNA (30 MHz ~ 1GHz)	PAM-103	05/03/2025	Com-Power	18020254
☒	Horn Antenna (1 GHz ~ 18 GHz)	DRH-118	01/03/2025	Sunol	A061616
☒	LNA (1 GHz ~ 18 GHz)	PAM-118A	03/13/2025	Com-Power	18040074
☒	Horn Antenna (18 GHz ~ 40 GHz)	DRH-1840	01/20/2025	Sunol	17121
☒	LNA (18 GHz ~ 40 GHz)	CBL18405045-01	01/05/2025	CERNEX, Inc.	27973
☒	High Pass Filter	WHKX8-6090-7000-18000-40SS	11/20/2024	Wainwright	23
☒	EMI Test Receiver	ESR3	12/14/2024	Rohde & Schwarz	102363
☒	LISN	ENV216	10/23/2024	Rohde & Schwarz	101550
☒	Temperature & Humidity Chamber	SH-641	08/01/2024	ESPEC	92002929
☒	DC Power Supply	E3632A	06/12/2024	Agilent	MY40028636

Note(s) :

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

APPENDIX A. TEST SETUP PHOTOS

The setup photos are provided as a separate document.

APPENDIX B. PHOTOGRAPHS OF EUT

B.1. EXTERNAL PHOTOS

The external photos are provided as a separate document.

B.2. INTERNAL PHOTOS

The internal photos are provided as a separate document.

END OF TEST REPORT