

TEST REPORT

FCC UNII Test for LGSBWAC95
Class II Permissive Change

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2407-FC002

DATE OF ISSUE
July 5, 2024

Tested by
Kyung Jun Woo



Technical Manager
Jong Seok Lee



Accredited by KOLAS, Republic of KOREA

HCT CO., LTD.
BongJai Huh
BongJai Huh / CEO



HCT CO.,LTD.

2-6, 73, 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 645 6300 Fax. +82 31 645 6401



TEST REPORT

REPORT NO.
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DATE OF ISSUE
July 05, 2024

Applicant

LG Electronics Inc.
222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 17709, Republic of Korea

Product Name Model Name

RF Module
LGSBWAC95

FCC ID

BEJLGSBWAC95

Modulation type

OFDM

Date of Test

April 25, 2024 ~ July 05, 2024

FCC Classification

Unlicensed National Information Infrastructure(NII)

Test Standard Used

FCC Rule Part(s): Part 15.407

Test Results

PASS

Location of Test

☒ Permanent Testing Lab ☐ On Site Testing Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	June 05, 2024	Initial Release

Notice

Content

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

This test report provides test result(s) under the scope accredited by the Korea Laboratory Accreditation Scheme (KOLAS), which signed the ILAC-MRA.

(KOLAS (KS Q ISO/IEC 17025) Accreditation No. KT197)

This test report provides test result(s) under the lab's valid Scope of Accreditation by A2LA (American Association for Laboratory Accreditation), signatory of the ILAC-MRA.

(A2LA (ISO/IEC 17025) Certificate No. 4114.01)

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	LGSBWAC95	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 3.30 V	
Modulation Type	OFDM : 802.11a, 802.11n, 802.11ac	
Frequency Range (MHz)	U-NII-1	20MHz BW : 5180 - 5240 40MHz BW : 5190 - 5230 80MHz BW : 5210
	U-NII-2A	20MHz BW : 5260 - 5320 40MHz BW : 5270 - 5310 80MHz BW : 5290
	U-NII-2C	20MHz BW : 5500 - 5720 40MHz BW : 5510 - 5710 80MHz BW : 5530 - 5690
	U-NII-3	20MHz BW : 5745 - 5825 40MHz BW : 5755 - 5795 80MHz BW : 5775
Antenna type	Metal press Ant	
Straddle channel	Supported	
TDWR Band	Not Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	April 25, 2024 ~ July 05, 2024	
EUT serial numbers	Conducted : D48660BEE1D0 Radiated : 0409860B54A0	

ANTENNA CONFIGURATIONS

1. Antenna configuration

Configurations	SISO		MIMO	
	Ant.1	Ant.2	CDD	SDM
802.11a	O	O	O	X
802.11n	O	O	O	O
802.11ac	O	O	O	O

Note:

1. O = Support, X = Not Support
2. SISO = Single Input Single Output
3. SDM = Spatial Diversity Multiplexing
4. CDD = Cyclic Delay Diversity

2. Directional Gain Calculation

According to KDB 662911 D01 Multiple Transmitter Output v02r01 F) 2) e) (iii), f) ii)

$$\text{Directional Gain(CDD)} = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right]$$

$$\text{Directional gain(SDM)} = G_{\max} + 10 \cdot \text{LOG}(N_{ANT}/N_{SS})$$

Band	Ant Gain (dBi)		N _{ANT} / N _{SS}	Directional Gain (dBi)	
	ANT1	ANT2		CDD	SDM
UNII 1	0.05	1.42	2 / 2	3.77	1.42
UNII 2A	0.98	1.45		4.23	1.45
UNII 2C	1.41	1.37		4.40	1.41
UNII 3	1.44	1.42		4.44	1.44

Note

According to Ansi C63.10-2013 section 14.4.3, the directional gain is calculated using the formula, where GN is the gain of the nth antenna and NANT is the total number of antennas used.

$$\text{Directional gain(CDD)} = 10 \cdot \log \left(\frac{(10^{(ANT1 \text{ Gain}/20)} + 10^{(ANT2 \text{ Gain}/20)})^2}{2} \right) \text{ dBi}$$

$$\text{Directional gain(SDM)} = G_{\max} + 10 \cdot \text{LOG}(N_{ANT}/N_{SS})$$

Sample Calculation (Conducted Power, MIMO):

Ex) Ant 1 : 11.58 dBm Ant 2 : 12.08 dBm

$$\text{Ant1} + \text{Ant 2} = \text{MIMO}$$

$$(11.58 \text{ dBm} + 12.08 \text{ dBm}) = (14.387 \text{ mW} + 16.143 \text{ mW}) = 30.53 \text{ mW} = 14.88 \text{ dBm}$$

Sample Calculation (E.I.R.P & E.I.R.P Spectral Density, MIMO):

Ex) ANT1 : 15.35 dBm , ANT2 : 15.12 dBm, Directional Gain : 3 dBi

$$\text{Conducted Power} = (15.35 \text{ dBm} + 15.12 \text{ dBm}) = (34.276 \text{ mW} + 32.508 \text{ mW}) = 66.784 \text{ mW} = 18.25 \text{ dBm}$$

$$\text{E.I.R.P} = 18.25 \text{ dBm} + 3 \text{ dBi} = 21.25 \text{ dBm}$$

2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted average output power as follows:

Band	Mode	MIMO_CDD(Ant.1+ Ant.2)					
		Ant.1 Power		Ant.2 Power		Ant.1 + Ant.2 Power	
		(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
UNII1	802.11a	12.90	0.019	12.38	0.017	15.66	0.037
	802.11n (HT20)	12.79	0.019	12.40	0.017	15.61	0.036
	802.11n (HT40)	12.52	0.018	12.76	0.019	15.65	0.037
	802.11ac (VHT20)	12.65	0.018	12.42	0.017	15.55	0.036
	802.11ac (VHT40)	12.74	0.019	12.60	0.018	15.68	0.037
	802.11ac (VHT80)	10.52	0.011	11.01	0.013	13.78	0.024
UNII2A	802.11a	12.64	0.018	12.63	0.018	15.65	0.037
	802.11n (HT20)	12.66	0.018	12.81	0.019	15.75	0.038
	802.11n (HT40)	12.65	0.018	13.05	0.020	15.86	0.039
	802.11ac (VHT20)	12.40	0.017	12.86	0.019	15.65	0.037
	802.11ac (VHT40)	12.54	0.018	12.78	0.019	15.67	0.037
	802.11ac (VHT80)	8.50	0.007	9.11	0.008	11.83	0.015
UNII2C	802.11a	12.71	0.019	11.69	0.015	15.24	0.033
	802.11n (HT20)	12.66	0.018	11.83	0.015	15.28	0.034
	802.11n (HT40)	12.64	0.018	12.34	0.017	15.50	0.036
	802.11ac (VHT20)	12.77	0.019	11.98	0.016	15.40	0.035
	802.11ac (VHT40)	12.27	0.017	12.80	0.019	15.55	0.036
	802.11ac (VHT80)	12.13	0.016	12.73	0.019	15.45	0.035
UNII3	802.11a	12.80	0.019	12.52	0.018	15.67	0.037
	802.11n (HT20)	12.76	0.019	12.61	0.018	15.70	0.037
	802.11n (HT40)	12.75	0.019	12.92	0.020	15.85	0.038
	802.11ac (VHT20)	12.33	0.017	12.75	0.019	15.56	0.036
	802.11ac (VHT40)	12.33	0.017	12.85	0.019	15.61	0.036
	802.11ac (VHT80)	12.53	0.018	13.10	0.020	15.83	0.038

3. TEST 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. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

4. 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).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated March 11, 2024 (Registration Number: KR0032).

5.2 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."

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR § 15.203, § 15.407

“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 antennas of this E.U.T are permanently attached.

(2) The E.U.T Complies with the requirement of § 15.203, § 15.407

7. 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.

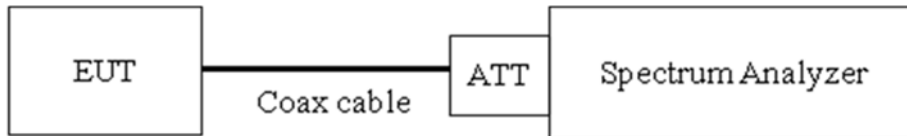
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.98 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.36 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.52 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.66 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.58 (Confidence level about 95 %, $k=2$)

8. DESCRIPTION OF TESTS

8.1. Duty Cycle

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure B.2 in KDB 789033 D02 v02r01.

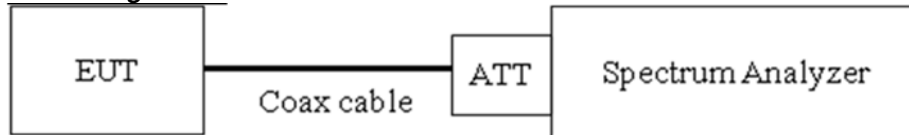
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ($\geq$ RBW)
3. SPAN = 0 Hz
4. Measurement Type = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = $T_{\text{on}} / T_{\text{total}}$ and Duty Cycle Factor = $10\log(1/\text{Duty Cycle})$

8.2. 6 dB Bandwidth & 26 dB Bandwidth

Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Configuration



Test Procedure(26 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure C.1 in KDB 789033 D02 v02r01.

1. RBW = approximately 1 % of the emission bandwidth
2. VBW > RBW
3. Measurement Type = Peak
4. Trace mode = max hold
5. 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 (6 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure C.2 in KDB 789033 D02 v02r01.

1. RBW = 100 kHz
2. VBW $\geq 3 \times$ RBW
3. Measurement Type = Peak
4. Trace mode = max hold
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points(upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note:

1. We tested X dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer.
2. DFS test channels should be defined. So, We performed the OBW test to prove that no part of the fundamental emissions of any channels belong to UNII1 and UNII3 band for DFS.
3. The 99 % Bandwidth is used to determine the conducted power limits.

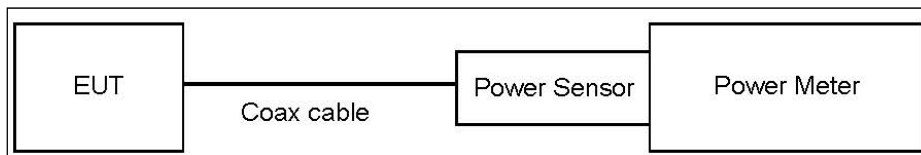
8.3. Output Power Measurement

Limit

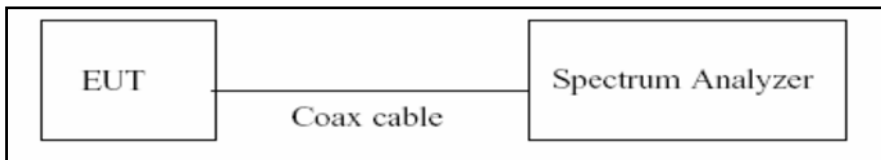
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30 dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30 dBm)

Test Configuration

Power Meter



Spectrum Analyzer(Only Straddle Channel)



Test Procedure(Power Meter)

We tested according to Procedure E.3.a in KDB 789033 D02 v02r01.

1. Measure the duty cycle.
2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
3. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Test Procedure(Spectrum Analyzer)

The transmitter output is connected to the Spectrum Analyzer.

We use the spectrum analyzer's integrated band power measurement function.

We tested according to Procedure E.2.d) in KDB 789033 D02 v02r01.

1. Measure the duty cycle.
2. Set span to encompass the 26 dB EBW of the signal.
3. RBW = 1 MHz.
4. VBW $\geq$ 3 MHz.
5. Number of points in sweep $\geq$ 2 x span/RBW.
6. Sweep time = auto.
7. Measurement Type = RMS.
8. Do not use sweep triggering. Allow the sweep to "free run".
9. Trace average at least 100 traces in power averaging(RMS) mode
10. Integrated bandwidth = OBW
11. Add $10\log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Sample Calculation

Total Power(dBm) = Measured Value(dBm) + ATT loss(dB) + Cable loss(dB) + Duty Cycle Factor(dB)

Note

1. Spectrum Measured Levels are not plot data.

The power results in plot is already including the actual values of loss for the attenuator and cable combination.

2. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	11.82
UNII 2A	11.82
UNII 2C	11.82
UNII 3	11.82

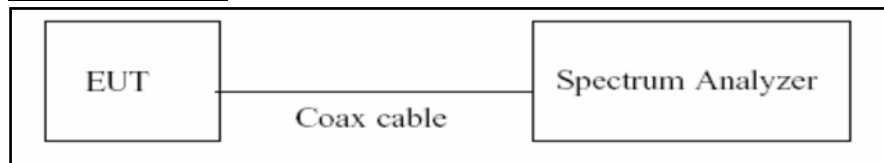
(Actual value of loss for the attenuator and cable combination)

8.4. Power Spectral Density

Limit

Band	Limit
UNII 1	11 dBm/MHz
UNII 2A, 2C	11 dBm/MHz
UNII 3	30 dBm/500 kHz

Test Configuration



Test Procedure

We tested according to Procedure F in KDB 789033 D02 v02r01.

1. Set span to encompass the entire emission bandwidth(EBW) of the signal.
2. RBW = 1 MHz(510 kHz for UNII 3)
→ For portion within the NII-3 be used RBW 510kHz
3. VBW $\geq$ 3 MHz
4. Number of points in sweep $\geq$ 2 x span/RBW.
5. Sweep time = auto.
6. Measurement Type = RMS(i.e., power averaging), if available. Otherwise, use sample Measurement Type mode.
7. Do not use sweep triggering. Allow the sweep to “free run”.
8. Trace average at least 100 traces in power averaging(RMS) mode
9. Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
10. 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(dBm) = Measured Value(dBm) + ATT loss(dB) + Cable loss(dB) + Duty Cycle Factor(dB)

Note

1. Spectrum Measured Levels are not plot data.

The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.

2. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	11.82
UNII 2A	11.82
UNII 2C	11.82
UNII 3	11.82

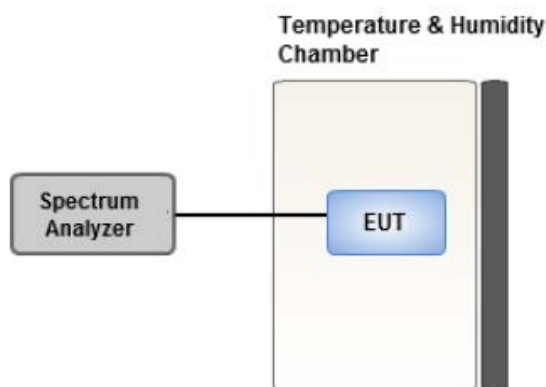
(Actual value of loss for the attenuator and cable combination)

8.5. Frequency Stability

Limit

Maintained within the band

Test Configuration



Test Procedure

1. The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between -30 °C and 50 °C.
2. The temperature was incremented by 10 °C 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.
3. 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.
4. 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.

8.6. AC Power line Conducted Emissions

Limit

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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56 ^(a)	56 to 46 ^(a)
0.50 to 5	56	46
5 to 30	60	50

^(a)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 Configuration

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. Measurement Types : Quasi Peak and Average Measurement Type.

Sample Calculation

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

8.7. Radiated Test

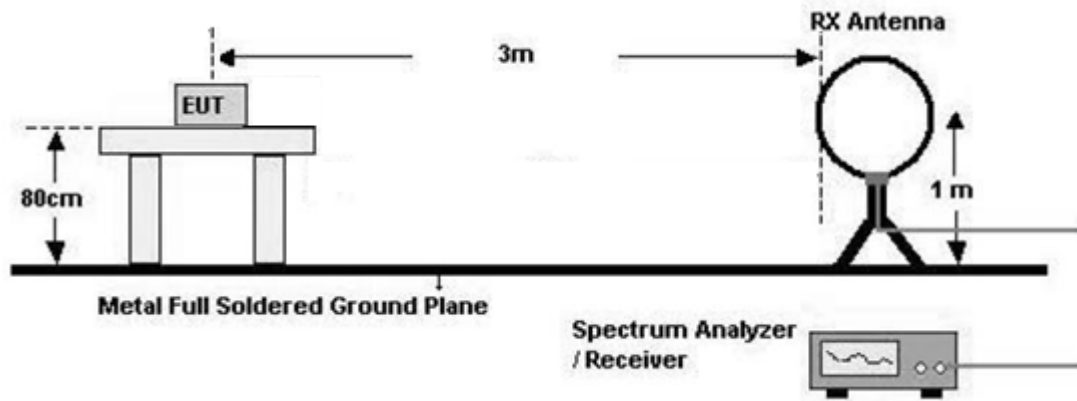
Limit

1. UNII 1: All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.
2. UNII 2A, 2C: All emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.
3. UNII 3: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
4. All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Section 15.209.

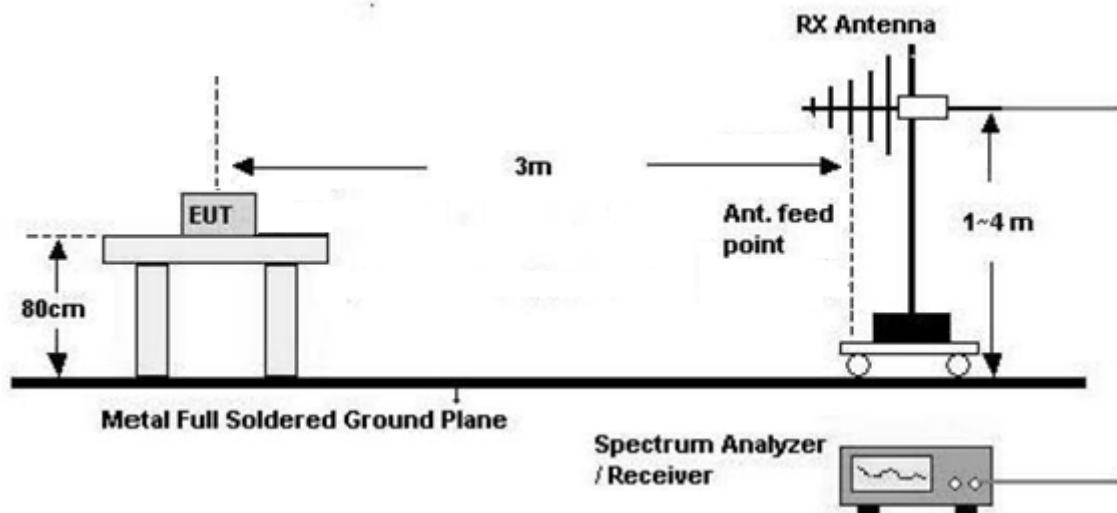
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

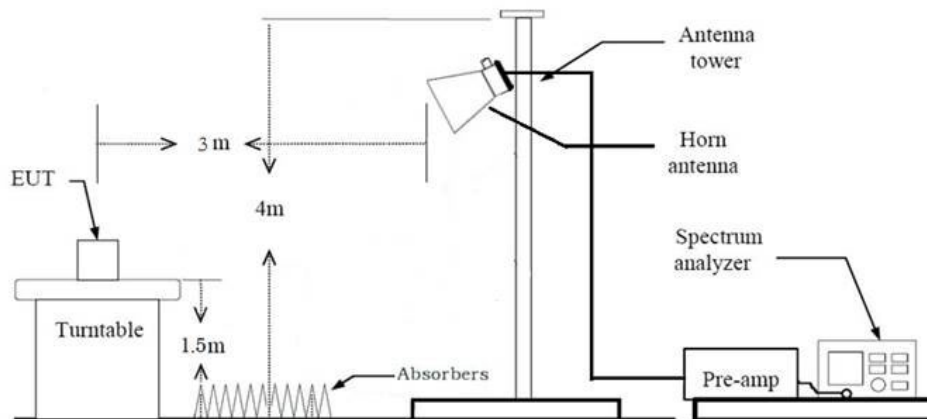
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



Test Procedure of Radiated spurious emissions(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 3 m 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 and Parallel to the ground plane 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) = $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
Measurement Distance : 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Max Hold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ RBW
9. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

KDB 414788 OFS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making

measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Test Procedure of Radiated spurious emissions(Below 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 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1 m to 4 m to find out the highest emissions.
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. Spectrum Setting

(1) Measurement Type(Peak):

- Measured Frequency Range : 30 MHz – 1 GHz
- Detector = Peak
- Trace = Max Hold
- RBW = 100 kHz
- VBW $\geq$ 3 x RBW

(2) Measurement Type(Quasi-peak):

- Measured Frequency Range : 30 MHz – 1 GHz
- Detector = Quasi-Peak
- RBW = 120 kHz

※In general, (1) is used mainly

7.Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)

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

Test Procedure of Radiated spurious emissions (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 1 m to 4 m 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 $\geq$ 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 $\geq$ 98 percent) = VBW $\leq$ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = VBW $\geq$ $1/T$, 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 (ie: 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
11. Distance extrapolation factor = $20\log(\text{test distance} / \text{specific distance})$ (dB)
12. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(A.G)
+ Distance Factor(D.F)

Test Procedure of Radiated Restricted Band Edge

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 1 m to 4 m 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 $\geq$ 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 $\geq$ 98 percent) = VBW $\leq$ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = VBW $\geq$ $1/T$, 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. Measured Frequency Range :

- 4 500 MHz ~ 5 150 MHz
- 5 350 MHz ~ 5 460 MHz
- 5 460 MHz ~ 5 470 MHz
- (75 MHz or more below the 5 725 MHz) ~ 5 725 MHz
- 5 850 MHz ~ (75 MHz or more above the 5 850 MHz)

10. Distance extrapolation factor = $20\log(\text{test distance} / \text{specific distance})$ (dB)

11. Total

(1) Measurement(Peak)

= Measured Value(Peak)

(2) Measurement(Avg)

= Measured Value (Avg)

- We apply to the offset in the range 1 GHz - 18 GHz.

- The offset = Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F) – Amp. Gain(A.G)
+ Attenuator(ATT)

8.8. Worst case configuration and mode

Radiated test

1. All modes of operation were investigated and the worst case configuration results are reported.
2. All configurations of antenna were investigated and the worst case configuration results are reported.
 - Mode : Ant1(SISO), Ant2(SISO), Ant1+Ant2(CDD,SDM)
 - Worstcase : Ant1+Ant2(CDD)
3. EUT Axis
 - Radiated Spurious Emissions : Z
 - Radiated Restricted Band Edge : X
4. All datarate of operation were investigated and the worst case datarate results are reported
 - 802.11a : 6 Mbps
 - 802.11n(20M, 40M) : MCS 0
 - 802.11ac(20M, 40M, 80M) : MCS 0
5. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
 - Position : Horizontal, Vertical, Parallel to the ground plane
6. All test was performed with continuous signal.(Duty Cycle $\geq$ 98%)

Conducted test

1. All datarate of operation were investigated and the worst case datarate results are reported.
 - 802.11a : 6 Mbps
 - 802.11n(20M, 40M) : MCS 0
 - 802.11ac(20M, 40M, 80M) : MCS 0
2. All configurations of antenna were investigated and All case results are reported.
 - Mode : Ant1(SISO), Ant2(SISO), Ant1+Ant2(MIMO)
3. All test was performed with continuous signal.(Duty Cycle $\geq$ 98%)

AC Power line Conducted Emissions

1. Not Tested

9. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result	Status
26 dB Bandwidth	§ 15.407 (for Power Measurement)	N/A	Conducted	PASS	NT ^{Note2}
6 dB Bandwidth	§ 15.407(e)	>500 kHz (5725-5850 MHz)(UNII-3)		PASS	NT ^{Note2}
Maximum Conducted Output Power	§ 15.407(a)(1),(2),(3)	< 250 mW(5150-5250 MHz) < 250 mW or 11+10log ₁₀ (BW) dBm (5250-5350 MHz) < 250 mW or 11+10log ₁₀ (BW) dBm (5470-5725 MHz) <1 W (5725-5850 MHz)		PASS	C
Maximum Power Spectral Density	§ 15.407(a)(1),(2),(3)	<11 dBm/ MHz (5150-5250 MHz) <11 dBm/ MHz (5250-5350 MHz) <11 dBm/ MHz (5470-5725 MHz) <30 dBm/500 kHz(5725-5850 MHz)		PASS	C
Frequency Stability	§ 15.407(g) § 2.1055	Maintained within the band		PASS	NT ^{Note2}
AC Conducted Emissions 150 kHz-30 MHz	15.207 15.407(b)(8)	<FCC 15.207 limits		PASS	NT ^{Note2}
Undesirable Emissions	§ 15.407(b) (1),(2),(3),(4) § 15.407(b)(5)(ii),(iii) § 15.35(b)	<-27 dBm/MHz EIRP (UNII1, 2A, 2C) cf. Section 8.7 (UNII 3)		PASS	C ^{Note3}
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	15.205, 15.407(b)(9),(10)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	PASS	C ^{Note3}

Note:

1. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
2. C2PC model is electrically identical to the Original mode
3. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 10
4. Output power was verified to be within the expected tune up tolerances prior to performing the spot checks for radiated spurious emissions and band edge to confirm that the proposed changes to the digital circuitry had not adversely affected the previously reported values in the original filing.

10. TEST RESULT

10.1 OUTPUT POWER MEASUREMENT

Note:

1. Limit

Limit

(UNII 1) : 23.98 dBm

(UNII 2A, 2C) : 23.98 dBm or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)

(UNII 3) : 30.00 dBm

2. MIMO_CDD(Ant.1+ Ant.2) Total Power [dBm] = Ant.1 Total Power [dBm] + Ant.2 Total Power [dBm]

Mode	Frequency [MHz]	Channel	Datarate	Conducted Average Power [dBm]			Limit [dBm]
				ANT1	ANT2	MIMO	
802.11a	5180	36	6 M	12.56	12.70	15.64	23.98
	5200	40	6 M	12.76	12.15	15.48	23.98
	5240	48	6 M	12.90	12.38	15.66	23.98
	5260	52	6 M	12.64	12.63	15.65	23.98
	5300	60	6 M	12.58	12.48	15.54	23.98
	5320	64	6 M	12.47	12.53	15.51	23.98
	5500	100	6 M	12.72	11.64	15.22	23.98
	5580	116	6 M	12.74	11.24	15.06	23.97
	5720	144	6 M	12.71	11.69	15.24	23.98
	5745	149	6 M	12.79	12.34	15.58	30
	5785	157	6 M	12.80	12.52	15.67	30
	5825	165	6 M	12.52	11.53	15.06	30
802.11n20	5180	36	MCS 0	13.18	11.71	15.52	23.98
	5200	40	MCS 0	12.79	12.40	15.61	23.98
	5240	48	MCS 0	12.43	11.90	15.18	23.98
	5260	52	MCS 0	12.66	12.81	15.75	23.98
	5300	60	MCS 0	12.35	13.01	15.70	23.98
	5320	64	MCS 0	12.23	12.75	15.51	23.98
	5500	100	MCS 0	12.71	11.70	15.24	23.98
	5580	116	MCS 0	12.57	11.40	15.03	23.98
	5720	144	MCS 0	12.66	11.83	15.28	23.98
	5745	149	MCS 0	12.76	12.61	15.70	30
	5785	157	MCS 0	12.48	12.73	15.62	30
	5825	165	MCS 0	12.65	11.90	15.30	30

Mode	Frequency [MHz]	Channel	Datarate	Conducted Average Power [dBm]			Limit [dBm]
				ANT1	ANT2	MIMO	
802.11ac20	5180	36	MCS 0	12.65	12.42	15.55	23.98
	5200	40	MCS 0	12.39	12.45	15.43	23.98
	5240	48	MCS 0	12.54	12.33	15.45	23.98
	5260	52	MCS 0	12.40	12.86	15.65	23.98
	5300	60	MCS 0	12.08	12.78	15.45	23.98
	5320	64	MCS 0	12.01	12.80	15.43	23.98
	5500	100	MCS 0	12.52	12.15	15.35	23.98
	5580	116	MCS 0	12.24	12.06	15.16	23.98
	5720	144	MCS 0	12.77	11.98	15.40	23.98
	5745	149	MCS 0	12.39	12.68	15.55	30
	5785	157	MCS 0	12.33	12.75	15.56	30
	5825	165	MCS 0	12.34	12.24	15.30	30
802.11n40	5190	38	MCS 0	12.71	12.20	15.47	23.98
	5230	46	MCS 0	12.52	12.76	15.65	23.98
	5270	54	MCS 0	12.65	13.05	15.86	23.98
	5310	62	MCS 0	10.84	11.81	14.36	23.98
	5510	102	MCS 0	12.38	11.63	15.03	23.98
	5550	110	MCS 0	12.64	12.34	15.50	23.98
	5710	142	MCS 0	12.61	12.32	15.48	23.98
	5755	151	MCS 0	12.83	12.75	15.80	30
	5795	159	MCS 0	12.75	12.92	15.85	30
802.11ac40	5190	38	MCS 0	12.48	12.53	15.52	23.98
	5230	46	MCS 0	12.74	12.60	15.68	23.98
	5270	54	MCS 0	12.54	12.78	15.67	23.98
	5310	62	MCS 0	10.91	11.63	14.55	23.98
	5510	102	MCS 0	11.30	9.91	13.42	23.98
	5550	110	MCS 0	12.27	12.80	15.55	23.98
	5710	142	MCS 0	12.21	12.34	15.29	23.98
	5755	151	MCS 0	12.33	12.85	15.61	30
	5795	159	MCS 0	12.62	12.47	15.56	30
802.11ac80	5 210	42	MCS 0	10.52	11.01	13.78	23.98
	5 290	58	MCS 0	8.50	9.11	11.83	23.98
	5 530	106	MCS 0	10.28	9.37	12.86	23.98
	5690	138	MCS 0	12.13	12.73	15.45	23.98
	5775	155	MCS 0	12.53	13.10	15.83	30

10.2 POWER SPECTRAL DENSITY

Note:

1. MIMO_CDD(Ant.1+ Ant.2) Total PSD [dBm/MHz] = Ant.1 Total PSD [dBm/MHz] + Ant.2 Total PSD [dBm/MHz]

Mode	Frequency [MHz]	Channel	Datarate	Power Spectral Density (dBm/MHz)			Limit
				ANT1	ANT2	MIMO	
802.11a	5180	36	6 M	2.890	2.068	5.509	11dBm/MHz
	5200	40	6 M	2.008	1.185	4.626	11dBm/MHz
	5240	48	6 M	2.210	2.050	5.141	11dBm/MHz
	5260	52	6 M	2.115	2.809	5.486	11dBm/MHz
	5300	60	6 M	2.181	2.084	5.143	11dBm/MHz
	5320	64	6 M	2.937	2.682	5.822	11dBm/MHz
	5500	100	6 M	1.911	0.377	4.222	11dBm/MHz
	5580	116	6 M	1.444	-0.751	3.494	11dBm/MHz
	5720	144	6 M	1.446	1.308	4.388	11dBm/MHz
	5745	149	6 M	-1.439	-0.696	1.959	30 dBm/500 kHz
	5785	157	6 M	-1.219	-0.840	1.985	30 dBm/500 kHz
	5825	165	6 M	-2.225	-1.372	1.233	30 dBm/500 kHz
802.11n20	5180	36	MCS 0	2.404	3.030	5.739	11dBm/MHz
	5200	40	MCS 0	2.975	2.704	5.852	11dBm/MHz
	5240	48	MCS 0	2.470	2.670	5.581	11dBm/MHz
	5260	52	MCS 0	2.567	2.017	5.311	11dBm/MHz
	5300	60	MCS 0	1.246	1.283	4.275	11dBm/MHz
	5320	64	MCS 0	0.783	1.672	4.261	11dBm/MHz
	5500	100	MCS 0	1.041	0.677	3.873	11dBm/MHz
	5580	116	MCS 0	1.324	0.092	3.762	11dBm/MHz
	5720	144	MCS 0	0.588	0.851	3.732	11dBm/MHz
	5745	149	MCS 0	-1.768	-0.721	1.797	30 dBm/500 kHz
	5785	157	MCS 0	-2.363	-2.378	0.640	30 dBm/500 kHz
	5825	165	MCS 0	-2.300	-1.538	1.108	30 dBm/500 kHz

Mode	Frequency [MHz]	Channel	Datarate	Power Spectral Density (dBm/MHz)			Limit
				ANT1	ANT2	MIMO	
802.11ac20	5180	36	MCS 0	2.937	2.820	5.889	11dBm/MHz
	5200	40	MCS 0	2.642	1.158	4.973	11dBm/MHz
	5240	48	MCS 0	2.664	2.237	5.466	11dBm/MHz
	5260	52	MCS 0	1.441	2.924	5.256	11dBm/MHz
	5300	60	MCS 0	1.292	0.613	3.976	11dBm/MHz
	5320	64	MCS 0	1.273	1.994	4.659	11dBm/MHz
	5500	100	MCS 0	0.210	1.425	3.870	11dBm/MHz
	5580	116	MCS 0	1.730	1.481	4.618	11dBm/MHz
	5720	144	MCS 0	1.826	1.903	4.875	11dBm/MHz
	5745	149	MCS 0	-1.569	-0.636	1.933	30 dBm/500 kHz
	5785	157	MCS 0	-3.357	-0.857	1.081	30 dBm/500 kHz
	5825	165	MCS 0	-1.695	-1.534	1.397	30 dBm/500 kHz
802.11n40	5190	38	MCS 0	-0.904	-2.040	1.575	11dBm/MHz
	5230	46	MCS 0	-1.823	-0.669	1.803	11dBm/MHz
	5270	54	MCS 0	-0.826	-1.489	1.865	11dBm/MHz
	5310	62	MCS 0	-2.187	-1.277	1.302	11dBm/MHz
	5510	102	MCS 0	-2.720	-1.227	1.101	11dBm/MHz
	5550	110	MCS 0	-1.525	-1.939	1.283	11dBm/MHz
	5710	142	MCS 0	-2.546	-1.436	1.055	11dBm/MHz
	5755	151	MCS 0	-5.047	-3.896	-1.423	30 dBm/500 kHz
	5795	159	MCS 0	-5.622	-4.208	-1.847	30 dBm/500 kHz
802.11ac40	5190	38	MCS 0	-1.775	-1.049	1.613	11dBm/MHz
	5230	46	MCS 0	-0.548	-0.915	2.283	11dBm/MHz
	5270	54	MCS 0	-1.424	-1.367	1.615	11dBm/MHz
	5310	62	MCS 0	-4.869	-1.918	-0.137	11dBm/MHz
	5510	102	MCS 0	-5.045	-3.588	-1.245	11dBm/MHz
	5550	110	MCS 0	-0.749	-1.494	1.905	11dBm/MHz
	5710	142	MCS 0	-1.884	-2.339	0.905	11dBm/MHz
	5755	151	MCS 0	-4.936	-4.633	-1.772	30 dBm/500 kHz
	5795	159	MCS 0	-6.851	-3.587	-1.909	30 dBm/500 kHz
802.11ac80	5 210	42	MCS 0	-4.961	-4.798	-1.868	11dBm/MHz
	5 290	58	MCS 0	-8.174	-7.268	-4.687	11dBm/MHz
	5 530	106	MCS 0	-7.270	-8.074	-4.643	11dBm/MHz
	5690	138	MCS 0	-6.130	-4.959	-2.495	11dBm/MHz
	5775	155	MCS 0	-8.280	-8.179	-5.219	30 dBm/500 kHz

[MIMO_CDD(Ant.1+ Ant.2)]

☒ Test Plots

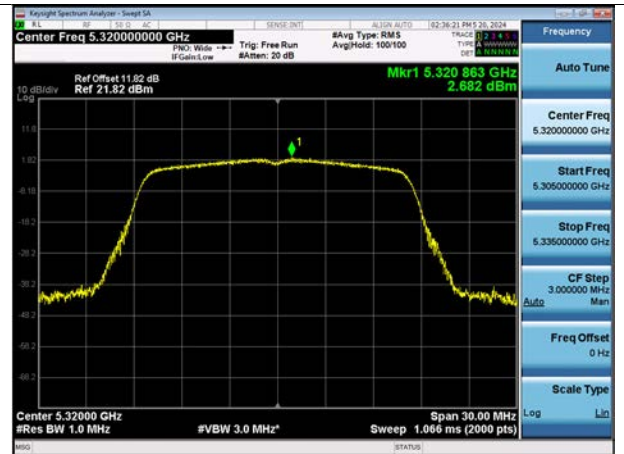
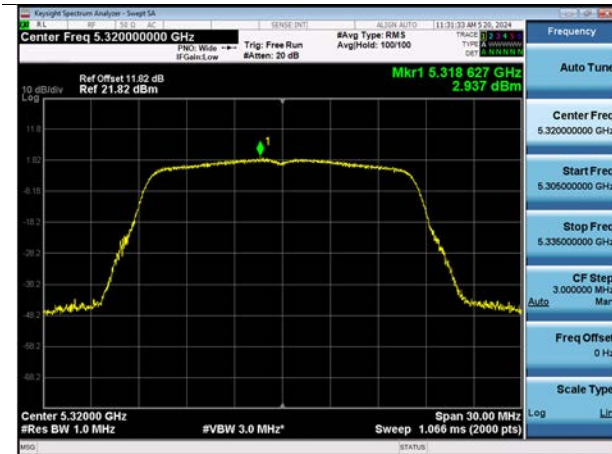
Note:

In order to simplify the report, attached plots were only channel of the highest PSD.

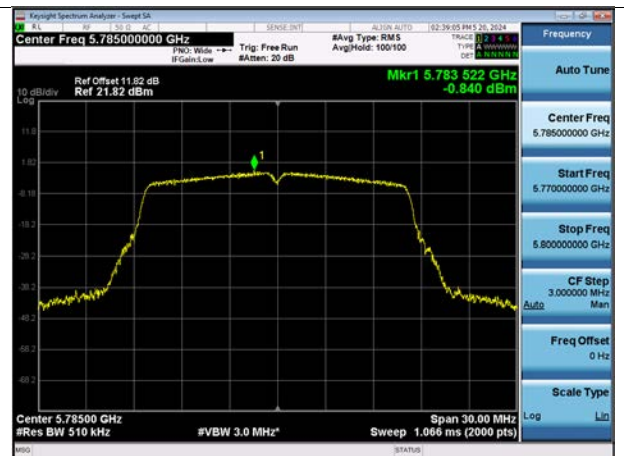
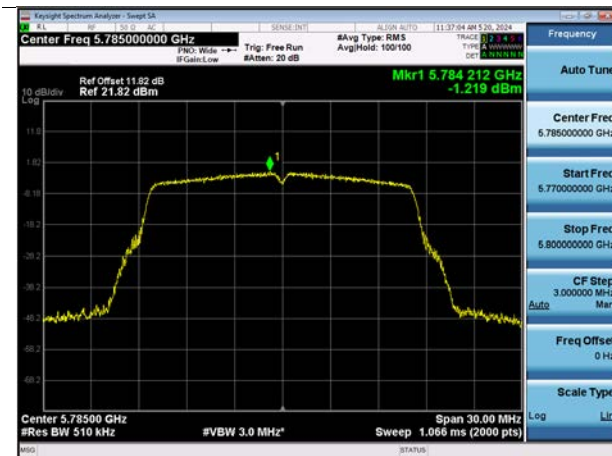
ANT. 1

ANT. 2

802.11a UNII 1-2C (Ch. 64)



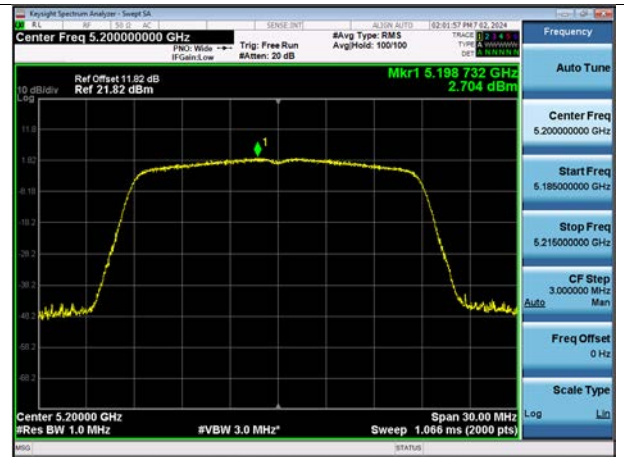
802.11a UNII 3 (Ch. 157)



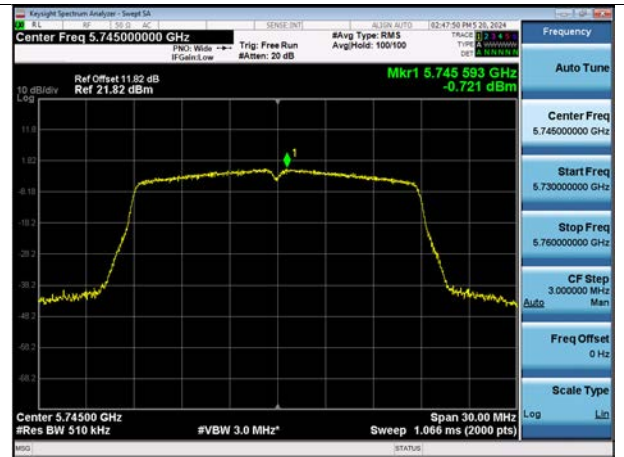
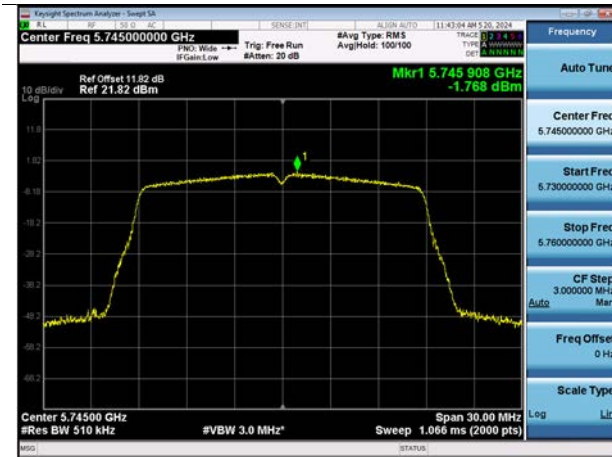
ANT. 1

ANT. 2

802.11n(HT20) UNII 1-2C (Ch. 40)



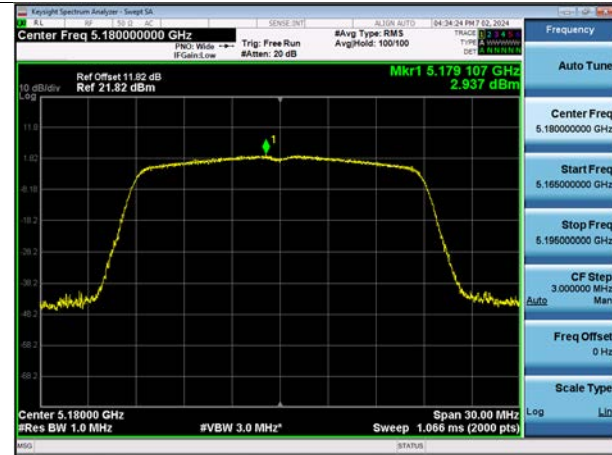
802.11 n(HT20) UNII 3 (Ch. 149)



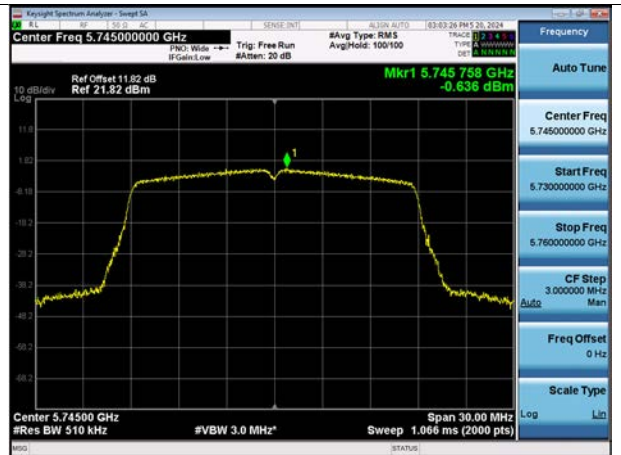
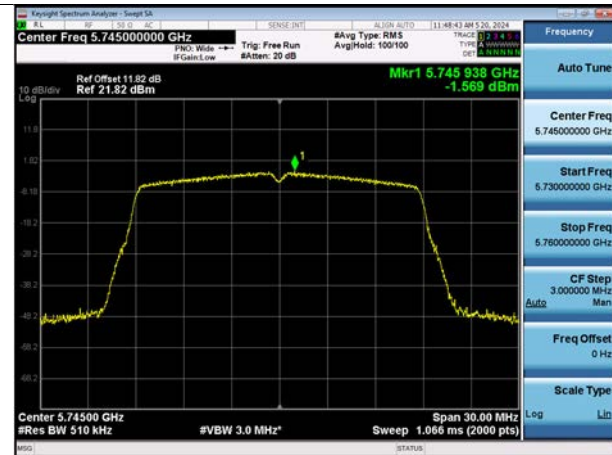
ANT. 1

ANT. 2

802.11ac(VHT20) UNII 1-2C (Ch. 36)



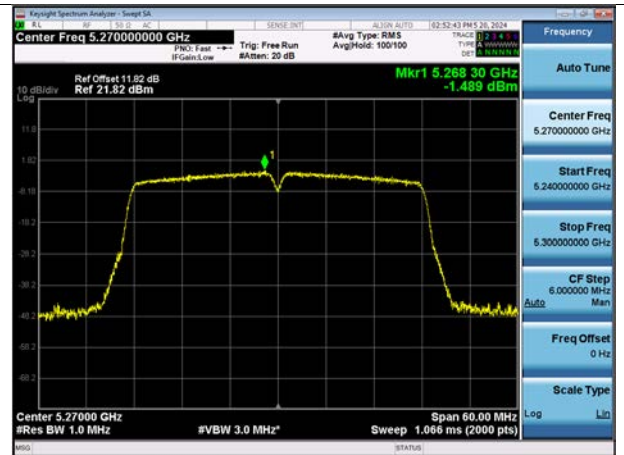
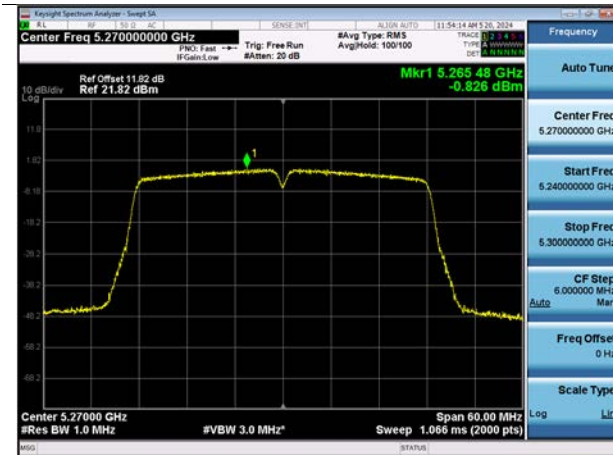
802.11 ac(VHT20) UNII 3 (Ch. 149)



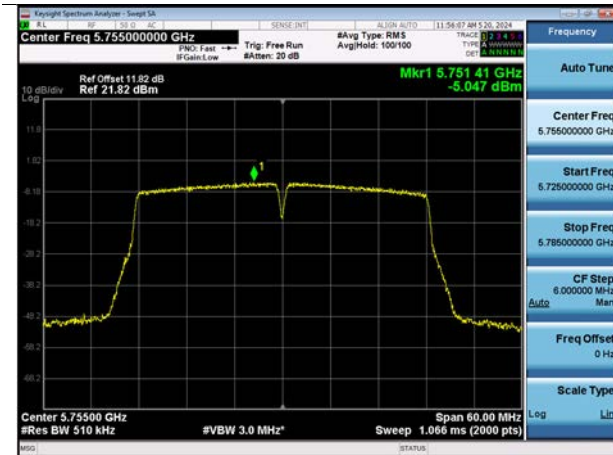
ANT. 1

ANT. 2

802.11n(HT40) UNII 1-2C (Ch. 54)



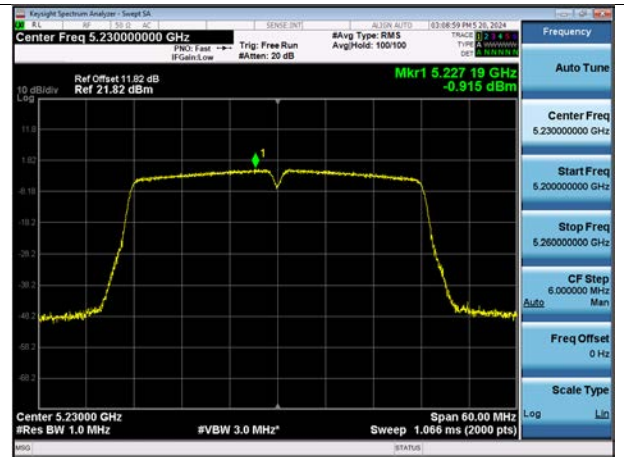
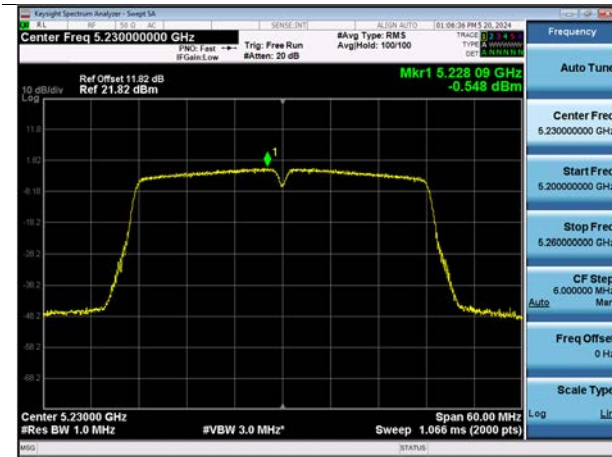
802.11 n(HT40) UNII 3 (Ch. 151)



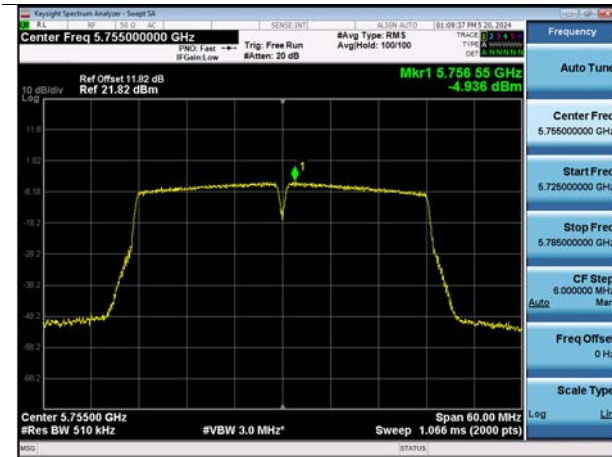
ANT. 1

ANT. 2

802.11ac(VHT40) UNII 1-2C (Ch. 46)



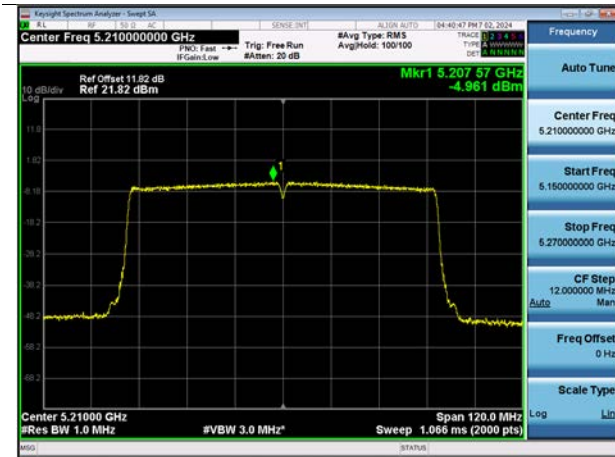
802.11 ac(VHT40) UNII 3 (Ch. 151)



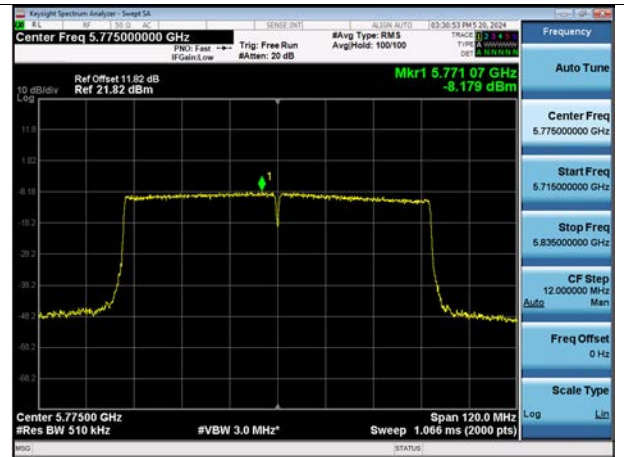
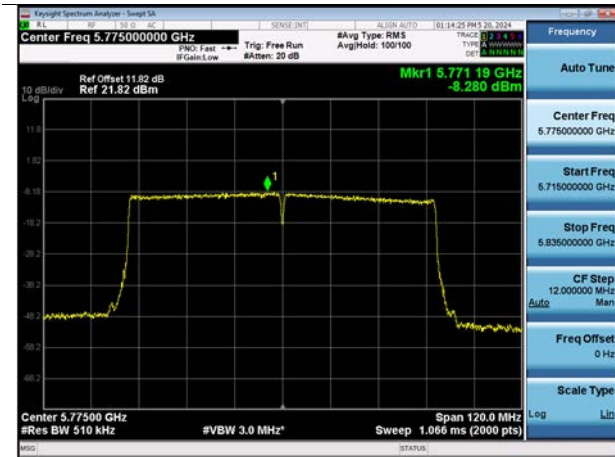
ANT. 1

ANT. 2

802.11ac(VHT80) UNII 1-2C (Ch. 42)



802.11 ac(VHT80) UNII 3 (Ch. 155)



10.3 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

Frequency	Measured Value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]

No Critical peaks found

Note:

1. The Measured Value of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
2. Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)
3. Limit line = specific Limits (dBμV) + Distance extrapolation factor

Frequency Range : Below 1 GHz

Frequency	Measured Value	A.F+C.L	ANT. POL	Total	Limit	Margin
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]

No Critical peaks found

Note:

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode

[MIMO_(Ant1+Ant2)]

Frequency Range : Above 1 GHz

Band :	UNII 1
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5240 MHz
Channel No.	48 Ch

Frequency [MHz]	Measured Value [dBμV]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
10480	56.28	6.24	V	62.52	68.20	5.68	PK
15720	49.04	6.52	V	55.56	73.98	18.42	PK
15720	34.71	6.52	V	41.23	53.98	12.75	AV
10480	57.72	6.24	H	63.96	68.20	4.24	PK
15720	49.01	6.52	H	55.53	73.98	18.45	PK
15720	34.05	6.52	H	40.57	53.98	13.41	AV

Band :	UNII 1
Operation Mode:	802.11n_HT40
Transfer MCS Index:	MCS0
Operating Frequency	5190 MHz
Channel No.	38 Ch

Frequency [MHz]	Measured Value [dBμV]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
10380	50.64	5.58	V	56.22	68.20	11.98	PK
15570	48.12	7.72	V	55.84	73.98	18.14	PK
15570	34.10	7.72	V	41.82	53.98	12.16	AV
10380	50.22	5.58	H	55.80	68.20	12.40	PK
15570	47.93	7.72	H	55.65	73.98	18.33	PK
15570	33.96	7.72	H	41.68	53.98	12.30	AV

Band :	UNII 2A
Operation Mode:	802.11 a
Transfer Rate:	6 Mbps
Operating Frequency	5260 MHz
Channel No.	52 Ch

Frequency [MHz]	Measured Value [dBμV]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
10520	59.28	5.77	V	65.05	68.20	3.15	PK
15780	51.10	6.51	V	57.61	73.98	16.37	PK
15780	36.52	6.51	V	43.03	53.98	10.95	AV
10520	59.41	5.77	H	65.18	68.20	3.02	PK
15780	50.91	6.51	H	57.42	73.98	16.56	PK
15780	36.18	6.51	H	42.69	53.98	11.29	AV

Band :	UNII 2A
Operation Mode:	802.11n_HT20
Transfer MCS Index:	MCS0
Operating Frequency	5320 MHz
Channel No.	64 Ch

Frequency [MHz]	Measured Value [dBμV]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
10640	60.66	6.45	V	67.11	73.98	6.87	PK
10640	44.51	6.45	V	50.96	53.98	3.02	AV
15960	48.82	7.28	V	56.10	73.98	17.88	PK
15960	35.49	7.28	V	42.77	53.98	11.21	AV
10640	60.28	6.45	H	66.73	73.98	7.25	PK
10640	44.26	6.45	H	50.71	53.98	3.27	AV
15960	48.14	7.28	H	55.42	73.98	18.56	PK
15960	35.05	7.28	H	42.33	53.98	11.65	AV

Band : UNII 2C

Operation Mode: 802.11 a

Transfer Rate: 6 Mbps

Operating Frequency 5500 MHz

Channel No. 100 Ch

Frequency [MHz]	Measured Value [dB V]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dB V/m]	Limit [dB V/m]	Margin [dB]	Measurement Type
11000	57.57	6.55	V	64.12	73.98	9.86	PK
11000	44.13	6.55	V	50.68	53.98	3.30	AV
16500	48.18	8.63	V	56.81	68.20	11.39	PK
11000	57.16	6.55	H	63.71	73.98	10.27	PK
11000	43.58	6.55	H	50.13	53.98	3.85	AV
16500	48.06	8.63	H	56.69	68.20	11.51	PK

Band : UNII 2C

Operation Mode: 802.11ac_VHT80

Transfer MCS Index: MCS0

Operating Frequency 5530 MHz

Channel No. 106 Ch

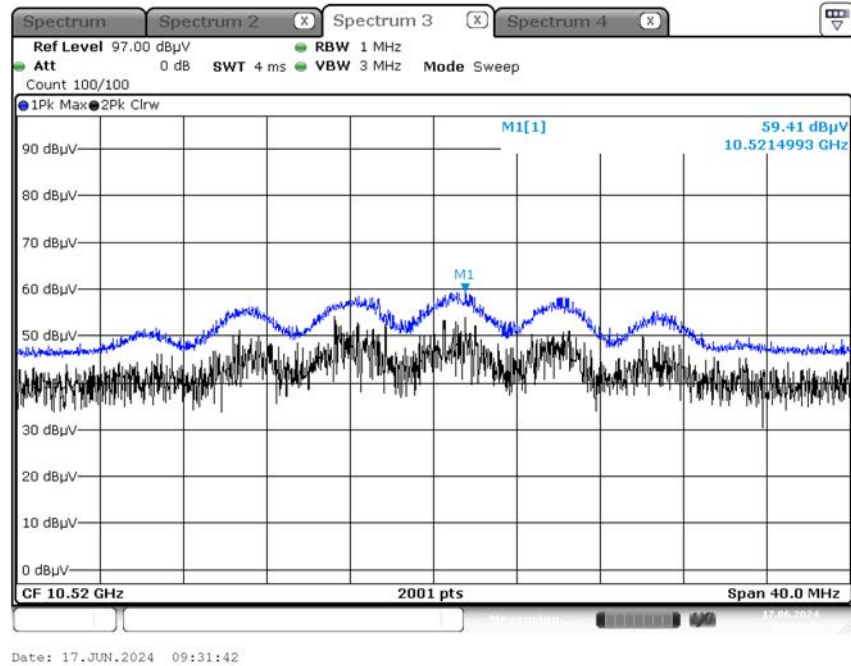
Frequency [MHz]	Measured Value [dBμV]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
11060	50.58	7.08	V	57.66	73.98	16.32	PK
11060	37.97	7.08	V	45.05	53.98	8.93	AV
16590	45.70	9.02	V	54.72	68.20	13.48	PK
11060	49.93	7.08	H	57.01	73.98	16.97	PK
11060	37.54	7.08	H	44.62	53.98	9.36	AV
16590	45.16	9.02	H	54.18	68.20	14.02	PK

Band :	UNII 3
Operation Mode:	802.11ac_VHT80
Transfer MCS Index:	MCS0
Operating Frequency	5775 MHz
Channel No.	155 Ch

Frequency [MHz]	Measured Value [dB μ V]	C.L+A.F+ D.F-A.G [dB/m]	POL [H/V]	Total [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Measurement Type
11550	51.83	6.24	V	58.07	73.98	15.91	PK
11550	39.18	6.24	V	45.42	53.98	8.56	AV
17325	48.91	11.48	V	60.39	68.20	7.81	PK
11550	50.88	6.24	H	57.12	73.98	16.86	PK
11550	39.05	6.24	H	45.29	53.98	8.69	AV
17325	46.94	11.48	H	58.42	68.20	9.78	PK

Test Plots

Peak Reading (802.11a, Ch.52 2nd Harmonic, Z-H)



Note:

Only the worst case plots for Radiated Spurious Emissions.

10.4 RADIATED RESTRICTED BAND EDGE

[MIMO_(Ant1+Ant2)]

Band :	UNII 1
Operation Mode:	802.11 n_HT40
Transfer MCS Index:	0
Operating Frequency	5190 MHz
Channel No.	38 Ch

Frequency	Measured Value	C.L+A.F+ D.F-A.G+ATT	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
5150	63.20	-	H	63.20	73.98	10.78	PK
5150	48.18	-	H	48.18	53.98	5.80	AV
5150	62.41	-	V	62.41	73.98	11.57	PK
5150	47.51	-	V	47.51	53.98	6.47	AV

Band :	UNII 1
Operation Mode:	802.11 ac_VHT40
Transfer MCS Index:	0
Operating Frequency	5190 MHz
Channel No.	38 Ch

Frequency	Measured Value	C.L+A.F+ D.F-A.G+ATT	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
5150	64.76	-	H	64.76	73.98	9.22	PK
5150	48.10	-	H	48.10	53.98	5.88	AV
5150	63.85	-	V	63.85	73.98	10.13	PK
5150	47.22	-	V	47.22	53.98	6.76	AV

Band :	UNII 1
Operation Mode:	802.11 ac_VHT80
Transfer MCS Index:	0
Operating Frequency	5210 MHz
Channel No.	42 Ch

Frequency	Measured Value	C.L+A.F+ D.F-A.G+ATT	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
5150	66.16	-	H	66.16	73.98	7.82	PK
5150	50.68	-	H	50.68	53.98	3.30	AV
5150	65.30	-	V	65.30	73.98	8.68	PK
5150	49.70	-	V	49.70	53.98	4.28	AV

Band :	UNII 2A
Operation Mode:	802.11 ac_VHT40
Transfer MCS Index:	0
Operating Frequency	5310 MHz
Channel No.	62 Ch

Frequency	Measured Value	C.L+A.F+ D.F-A.G+ATT	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
5350	69.62	-	H	69.62	73.98	4.36	PK
5350	48.66	-	H	48.66	53.98	5.32	AV
5350	67.27	-	V	67.27	73.98	6.71	PK
5350	48.55	-	V	48.55	53.98	5.43	AV

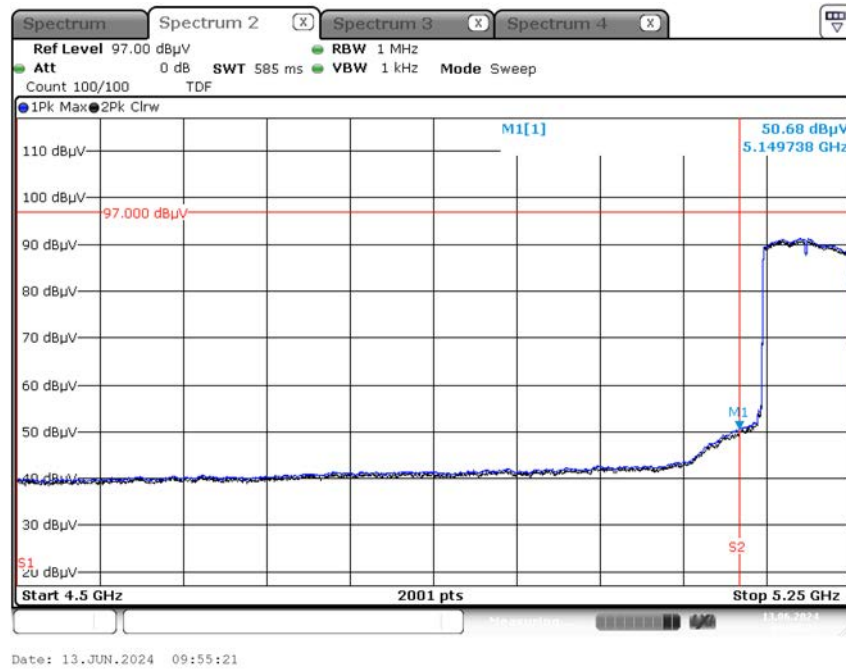
Band :	UNII 2C
Operation Mode:	802.11 ac_VHT40
Transfer MCS Index:	0
Operating Frequency	5510 MHz
Channel No.	102 Ch

Frequency	Measured Value	C.L+A.F+ D.F-A.G+ATT	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
5460	59.89	-	H	59.89	73.98	14.09	PK
5460	46.00	-	H	46.00	53.98	7.98	AV
#5470	63.24	-	H	63.24	68.20	4.96	PK
5460	59.25	-	V	59.25	73.98	14.73	PK
5460	45.22	-	V	45.22	53.98	8.76	AV
#5470	63.05	-	V	63.05	68.20	5.15	PK

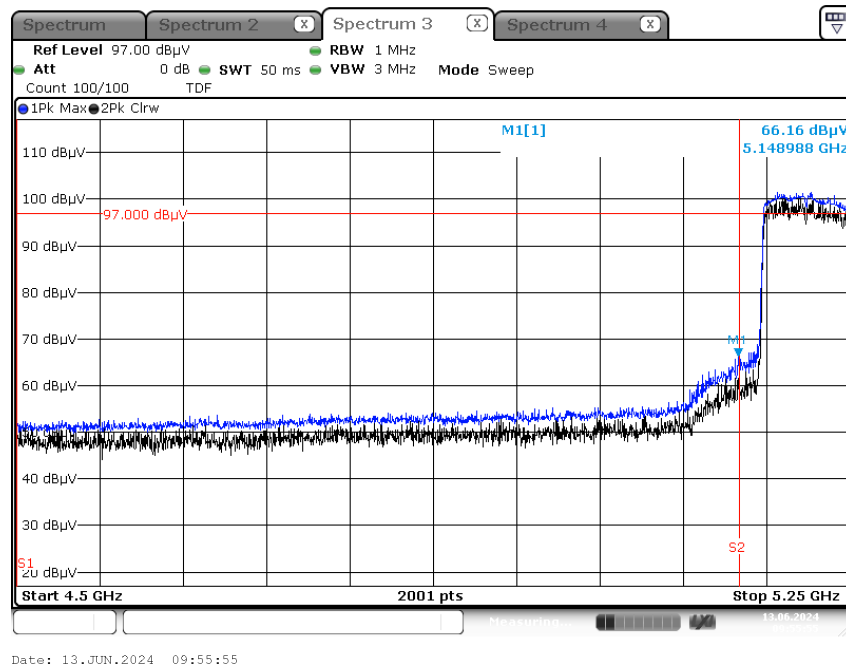
Note : # Integration method Used (KDB 789033 D02 v02r01 Section 3) d) (ii)

Test Plots(UNII 1, 2A, 2C)

Average Reading (802.11 ac_VHT80, Ch.42, X-H)



Peak Reading (802.11 ac_VHT80, Ch.42, X-H)



Note:

Only the worst case plots for Radiated Restricted Band Edge.

11. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	08/02/2024	Annual
EMI Test Receiver	ESCI	Rohde & Schwarz	100584	05/08/2025	Annual
Temperature Chamber	SU-642	ESPEC	93008124	02/19/2025	Annual
Signal Analyzer	N9030A	Keysight	MY55410508	09/04/2024	Annual
Power Meter	N1911A	Agilent	MY45100523	02/28/2025	Annual
Power Sensor	N1921A	Agilent	MY57820067	02/22/2025	Annual
Directional Coupler	87300B	Agilent	3116A03621	10/30/2024	Annual
Power Splitter	11667B	Hewlett Packard	10545	02/06/2025	Annual
DC Power Supply	E3632A	Agilent	KR75305528	01/02/2025	Annual
Attenuator(10 dB)(DC-26.5 GHz)	8493C-010	Agilent	08285	05/28/2025	Annual
Attenuator(20 dB)	18N-20dB	Rohde & Schwarz	8	02/20/2025	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	HCT CO., LTD.	N/A	N/A	N/A
Bluetooth Tester	CBT	Rohde & Schwarz	100808	02/15/2025	Annual

Note:

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.

Radiated Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller(Antenna mast)	CO3000	Innco system	CO3000-4p	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	S3AM	08/03/2025	Biennial
Controller	EM2090	Emco	060520	N/A	N/A
Turn Table	N/A	Ets	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/07/2026	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	08/16/2024	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/07/2025	Biennial
Horn Antenna(15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Amp & Filter Bank Switch Controller	FBSM-01A	TNM system	0	N/A	N/A
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/02/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	5	06/04/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	6	06/04/2025	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/14/2025	Annual
RF Switching System	FBSR-03A (3G HPF+LNA)	T&M SYSTEM	S3L1	11/17/2024	Annual
RF Switching System	FBSR-03A (10dB ATT+LNA)	T&M SYSTEM	S3L2	11/17/2024	Annual
RF Switching System	FBSR-03A (7G HPF+LNA)	T&M SYSTEM	S3L3	11/17/2024	Annual
RF Switching System	FBSR-03A (3dB ATT+LNA)	T&M SYSTEM	S3L4	11/17/2024	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/17/2024	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual
Bluetooth Tester	TC-3000C	TESCOM	3000C000175	03/19/2025	Annual
Spectrum Analyzer	FSV40 (9 kHz ~ 40 GHz)	Rohde & Schwarz	100900	12/06/2024	Annual

Note:

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.
3. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5(Version : 2017).

12. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2407-FC002-P