# 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 / 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

**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.
HCT-RF-2407-FC002

DATE OF ISSUE
July 05, 2024

| | |
|---|---|
| Applicant | **LG Electronics Inc.**<br>222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 17709, Republic of Korea |
| Product Name<br>Model Name | RF Module<br>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<br>(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)

## CONTENTS

# 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<br>40MHz BW : 5190 - 5230<br>80MHz BW : 5210 |
| | U-NII-2A | 20MHz BW : 5260 - 5320<br>40MHz BW : 5270 - 5310<br>80MHz BW : 5290 |
| | U-NII-2C | 20MHz BW : 5500 - 5720<br>40MHz BW : 5510 - 5710<br>80MHz BW : 5530 – 5690 |
| | U-NII-3 | 20MHz BW : 5745 - 5825<br>40MHz BW : 5755 - 5795<br>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<br>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)

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

Directional gain(SDM) = Gmax + 10·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.

Directional gain(CDD) = 10·log(((10$^{(ANT1\ Gain/20)}$+10$^{(ANT2\ Gain/20)}$)$^2$)/2) dBi

Directional gain(SDM) = Gmax + 10·LOG($N_{ANT}$/ $N_{ss}$)

**Sample Calculation (Conducted Power, MIMO):**

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

Ant1 + Ant 2 = MIMO

(11.58 dBm + 12.08 dBm) = (14.387 mW + 16.143 mW) = 30.53 mW = 14.88 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

Conducted Power = (15.35 dBm + 15.12 dBm) = (34.276 mW + 32.508 mW) = 66.784 mW = 18.25 dBm

E.I.R.P = 18.25 dBm + 3 dBi = 21.25 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.

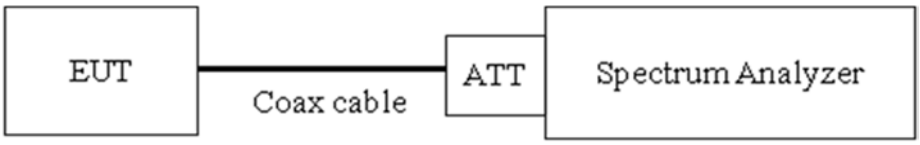
The measurement data shown herein meets or exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| 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.

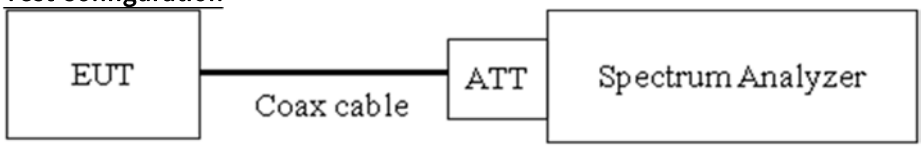
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Measurement Type = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure $T_{total}$ and $T_{on}$
8. Calculate Duty Cycle = $T_{on}$/ $T_{total}$ and Duty Cycle Factor = 10log(1/Duty Cycle)

## 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 ≥ 3 x 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 lever 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.

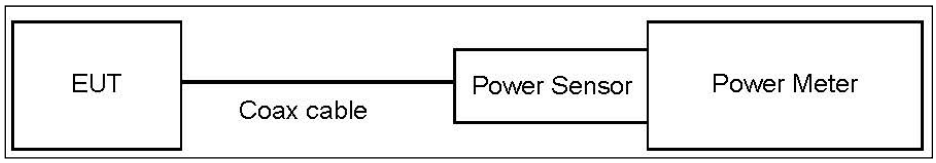
## 8.3. Output Power Measurement

**Limit**

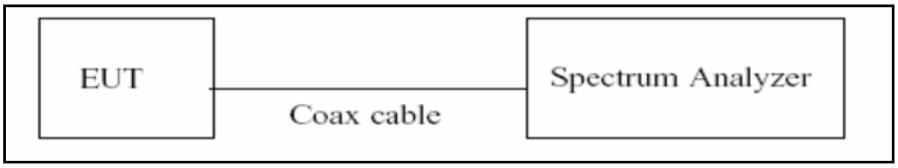
| Band | Limit |
|---|---|
| UNII 1 | - Master : Not exceed 1 W(=30 dBm)<br>- Slave : Not exceed 250 mW(=23.98 dBm) |
| UNII 2A, 2C | Not exceed the lesser of 250 mW or 11 dBm + 10 log B,<br>(where B is the 26 dB emission bandwidth in megahertz.) |
| UNII 3 | Not exceed 1 W(=30 dBm) |

**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 ≥ 3 MHz.
5. Number of points in sweep ≥ 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 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.

**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 |

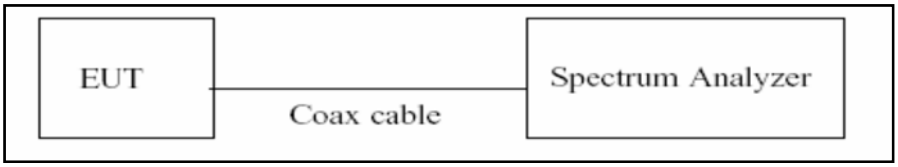
(Actual value of loss for the attenuator and cable combination)

## 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 ≥ 3 MHz
4. Number of points in sweep ≥ 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 |

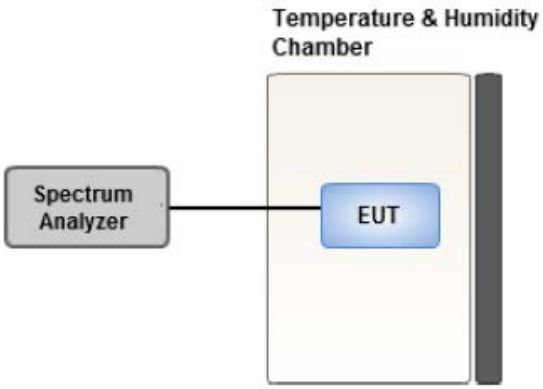
(Actual value of loss for the attenuator and cable combination)

## 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 battety 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 μH/50 ohms line impedance stabilization network (LISN).

| Frequency Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | 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

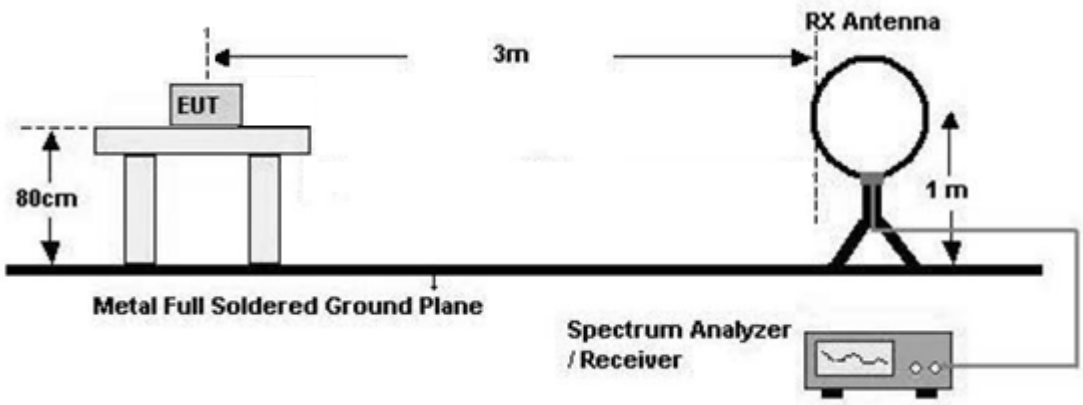
**Limit**

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.

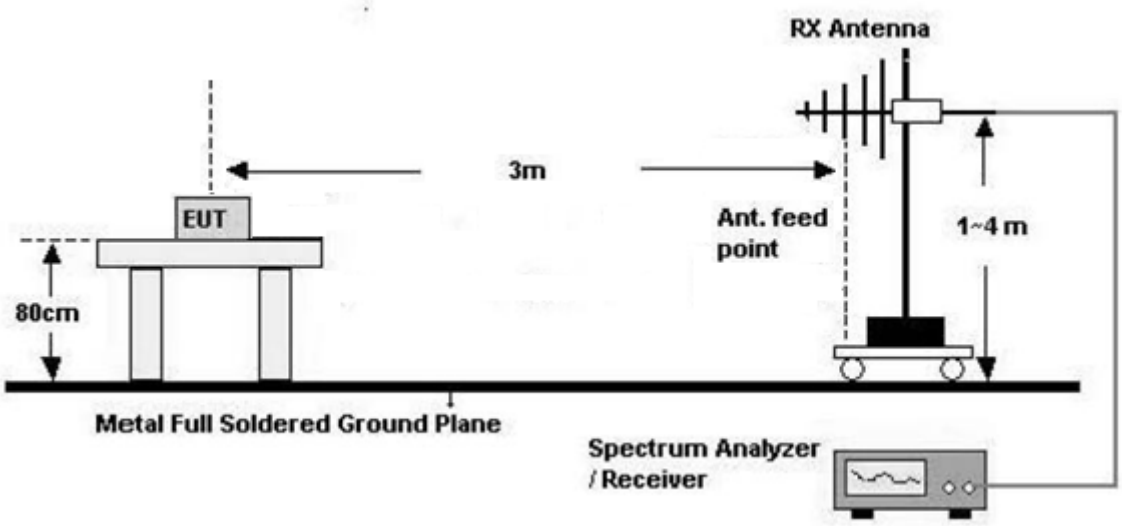
| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

## Test Configuration

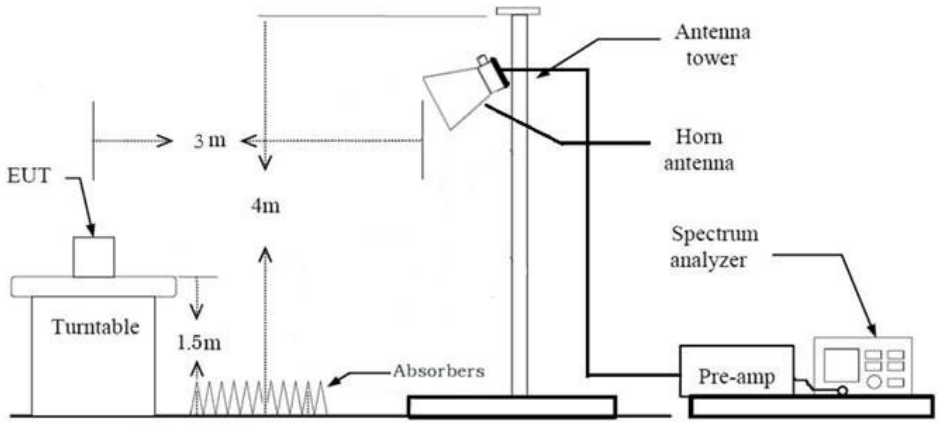
Below 30 MHz




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) =40log(3 m/300 m)= - 80 dB
   Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) =40log(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 x 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 ≥ 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 ≥ 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 (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 = 20log (test distance / 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 ≥ 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. 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 = 20log (test distance / 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 ≥ 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 ≥ 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)<br>< 250 mW or 11+10log$_{10}$ (BW) dBm (5250-5350 MHz)<br>< 250 mW or 11+10log$_{10}$ (BW) dBm (5470-5725 MHz)<br><1 W (5725-5850 MHz) | | PASS | C |
| Maximum Power Spectral Density | § 15.407(a)(1),(2),(3) | <11 dBm/ MHz (5150-5250 MHz)<br><11 dBm/ MHz (5250-5350 MHz)<br><11 dBm/ MHz (5470-5725 MHz)<br><30 dBm/500 kHz(5725-5850 MHz) | | PASS | C |
| Frequency Stability | § 15.407(g)<br>§ 2.1055 | Maintained within the band | | PASS | NT[Note2] |
| AC Conducted Emissions 150 kHz-30 MHz | 15.207<br>15.407(b)(8) | <FCC 15.207 limits | | PASS | NT[Note2] |
| Undesirable Emissions | § 15.407(b) (1),(2),(3),(4)<br>§ 15.407(b)(5)(ii),(iii)<br>§ 15.35(b) | <-27 dBm/MHz EIRP (UNII1, 2A, 2C)<br>cf. Section 8.7 (UNII 3) | | PASS | C[Note3] |
| General Field Strength Limits(Restricted Bands and Radiated Emission Limits) | 15.205,<br>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 |

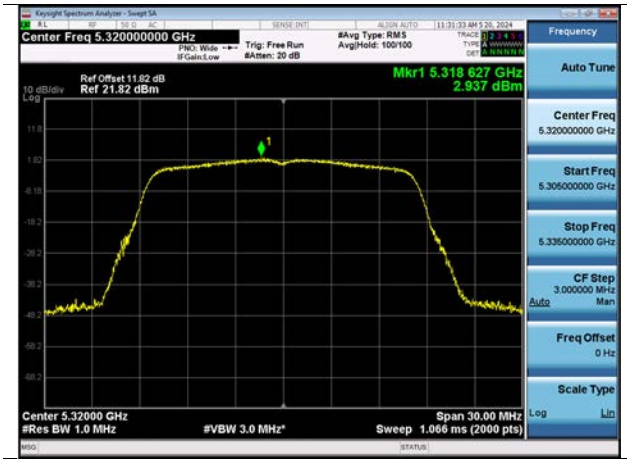
| Mode | Frequency [MHz] | Channel | Datarate | Power Spectral Density (dBm/MHz) | | | Limit |
|---|---|---|---|---|---|---|---|
| | | | | ANT1 | ANT2 | MIMO | |
| 802.11ac20 | 5180 | 36 | MCS 0 | 2.937 | 2.820 | 5.889 | 11dBm/MHz |
| | 5200 | 40 | MCS 0 | 2.642 | 1.158 | 4.973 | 11dBm/MHz |
| | 5240 | 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

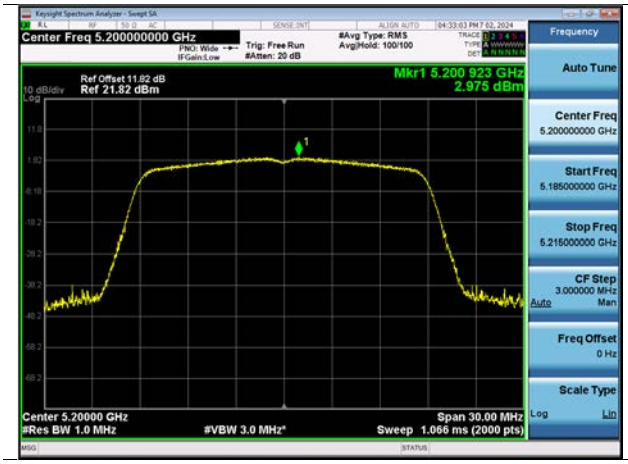
Note:

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) | |
|  |  |

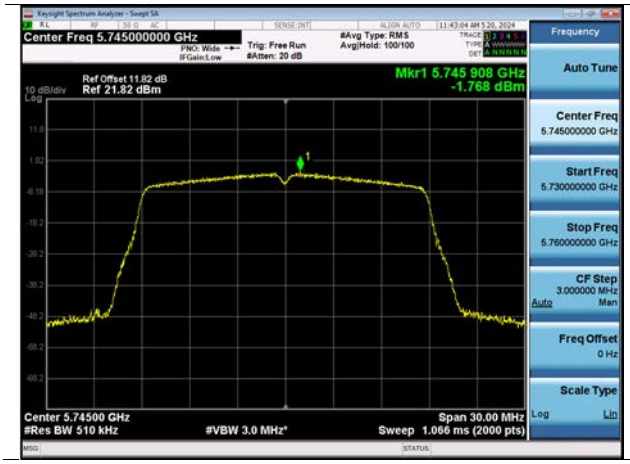
| ANT. 1 | ANT. 2 |
|---|---|

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



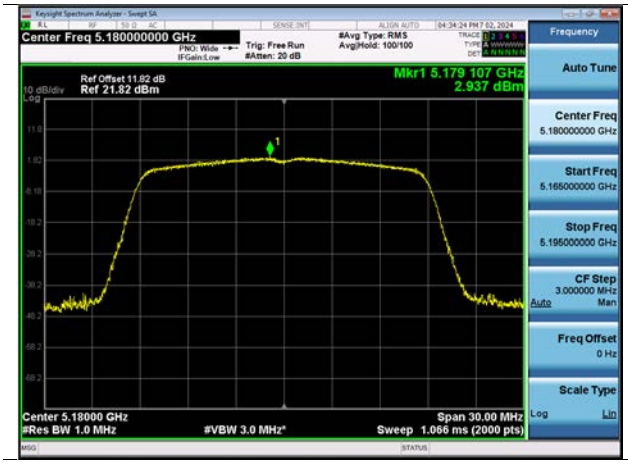


802.11 n(HT20) UNII 3 (Ch. 149)



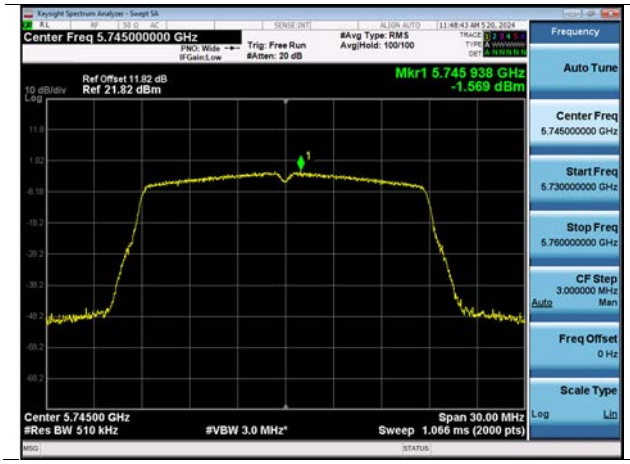

| ANT. 1 | ANT. 2 |
|---|---|

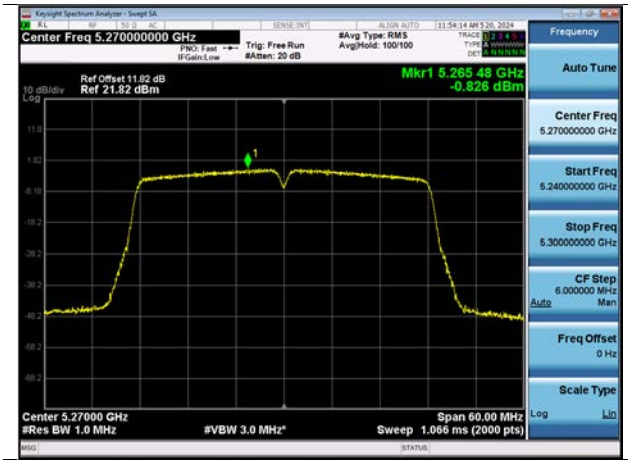
802.11ac(VHT20) UNII 1-2C (Ch. 36)

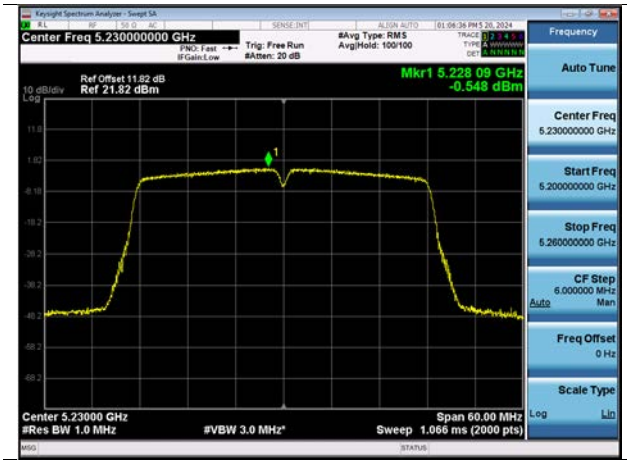


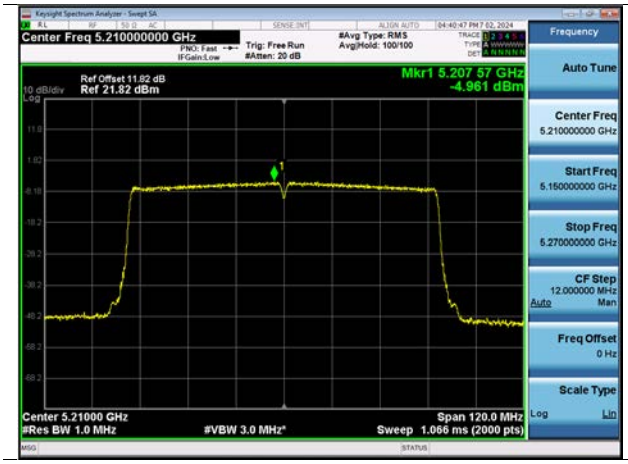
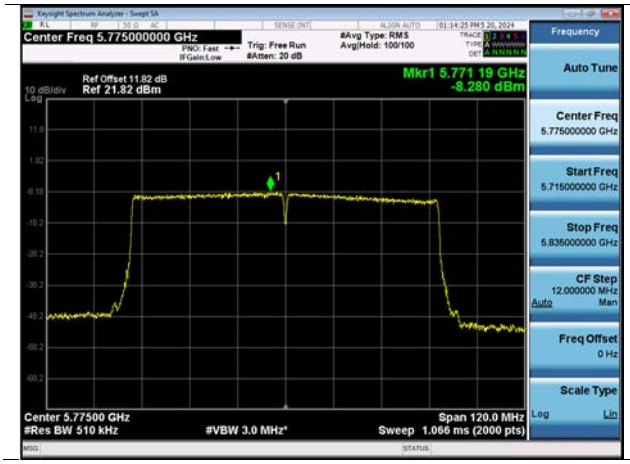


802.11 ac(VHT20) UNII 3 (Ch. 149)




| 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 Val;ue 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 = 40log (specific distance / 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 |

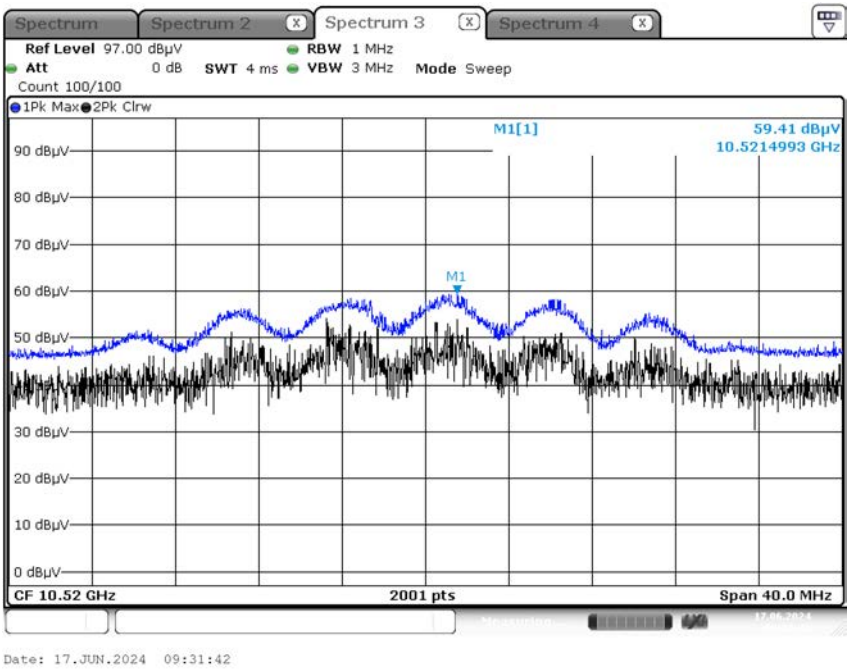
| Frequency [MHz] | Measured Value [dBµV] | C.L+A.F+ D.F-A.G [dB/m] | POL [H/V] | Total [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Measurement Type |
|---|---|---|---|---|---|---|---|
| 11060 | 50.58 | 7.08 | V | 57.66 | 73.98 | 16.32 | PK |
| 11060 | 37.97 | 7.08 | V | 45.05 | 53.98 | 8.93 | AV |
| 16590 | 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 [dBμV] | C.L+A.F+ D.F-A.G [dB/m] | POL [H/V] | Total [dBμV/m] | Limit [dBμV/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 |

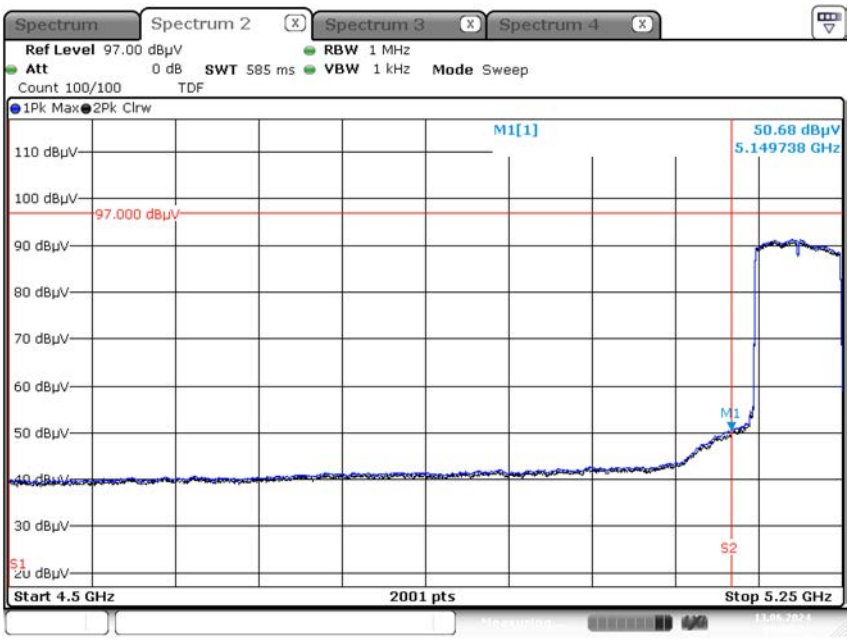
| | |
|---|---|
| Band : | UNII 2C |
| Operation Mode: | 802.11 ac_VHT40 |
| Transfer MCS Index: | 0 |
| Operating Frequency | 5510 MHz |
| Channel No. | 102 Ch |

| 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 |

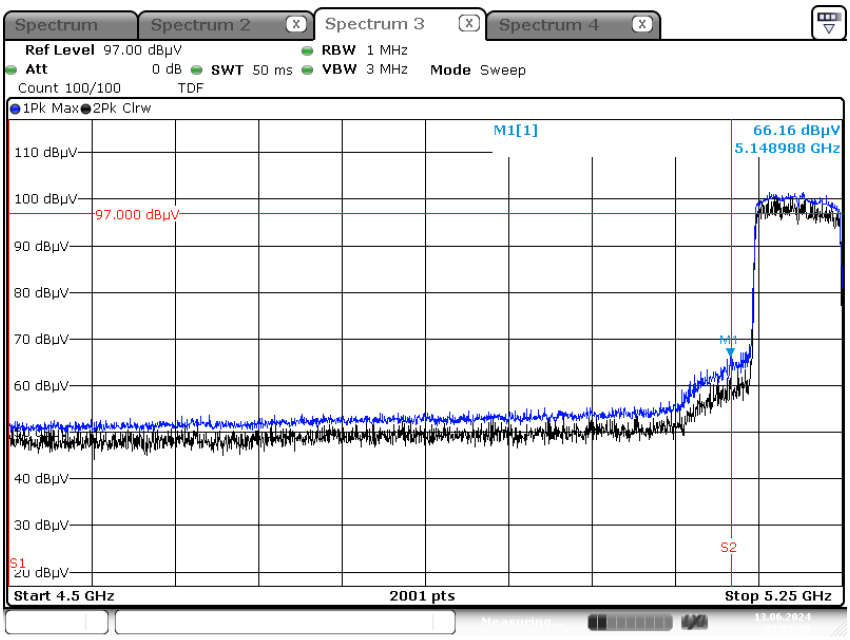
Note : # Integration method Used (KDB 789033 D02 v02r01 Section 3) d) (ii)

## ▣ 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 |