TEST REPORT

Test report
On Behalf of
Shenzhen SEI Robotics Co., Ltd.
For
4K HDMI dongle

FCC Model No.: IPA1104HDW-01-400-05T-TiVo, SN8BABX(X=A TO Z),IPA1104HDW 01 400 09T TIVO
ISED Model No./HVIN: IPA1104HDW-01-400-05T-TiVo, SN8BABB

FCC ID: 2AOVU-IPA1104HDW
IC: 25669-IPA1104HDW

Prepared for :	**Shenzhen SEI Robotics Co., Ltd.** 501, Block A, Productivity Building #5 Hi-tech Middle 2nd Road, Nanshan District, Shenzhen, China
Prepared By :	**Shenzhen Tongzhou Testing Co.,Ltd** **1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China**
Date of Test:	**Jun.16, 2020~ Jul.07, 2020**
Date of Report:	**Jul.09, 2020**
Report Number:	**TZ200701470-E1**

TEST RESULT CERTIFICATION

Applicant's name ..... :	**Shenzhen SEI Robotics Co., Ltd.**
Address..... :	501, Block A, Productivity Building #5 Hi-tech Middle 2nd Road, Nanshan District, Shenzhen, China
Manufacture's Name ..... :	**LIAN TECH Co., Ltd.**
Address..... :	Workshop CN-05-06, lot Cn-05,Van Trung Industrial Park, Viet Yen District, Bac Giang Province,Vietnam
Product description	
Trade Mark ..... :	eSTREAM4K
Product name..... :	4K HDMI dongle
ISED Model No./HVIN..... :	Refer to page 1
Standards ..... :	FCC Rules and Regulations Part 15 Subpart E Section 15.407 RSS 247 Issue 2, February 2017 RSS GEN Issue 5, March 2019 ANSI C63.10: 2013

Date of Test ..... :	
Date (s) of performance of tests ..... :	**Jun.16, 2020~ Jul.07, 2020**
Date of Issue ..... :	**Jul.09, 2020**
Test Result ..... :	**Pass**

Testing Engineer : Anna Hu

(Anna Hu)

Technical Manager : Hugo Chen

(Hugo Chen)

Authorized Signatory : Andy Zhang

(Andy Zhang)

Revision History

Revision	Issue Date	Revisions	Revised By
000	Jul.09, 2020	Initial Issue	Andy Zhang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	4K HDMI dongle
ISED Model No./HVIN	:	Refer to page 1
Model Declaration	:	All the same except for the shape and color of cover.
Test Model	:	SN8BABB
Power Supply	:	DC 5V by adapter
Hardware version	:	SMB.195.07
Software version	:	android9.0
Firmware/FVIN	:	V9.0-4.5.0
Bluetooth Version	:	V5.0+EDR
Channel Number	:	79 Channels for Bluetooth EDR(DSS) 40 Channels for Bluetooth BLE(DTS)
Modulation Technology	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth EDR(DSS) GFSK for Bluetooth BLE(DTS)
Data Rates	:	Bluetooth EDR(DSS): 1~3Mbps;Bluetooth BLE(DTS): 1Mbps
WLAN	:	Supported IEEE 802.11a/b/g/n/ac
WLAN FCC Operation Frequency	:	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz / 5180-5240MHz / 5260-5320MHz/5500 – 5720MHz/5745-5825MHz IEEE 802.11n HT40: 5190-5230MHz / 5270 – 5310 MHz/5510 – 5710MHz/5755-5795MHz IEEE 802.11a: 5180-5240MHz / 5260-5320MHz/5500 – 5720MHz/5745-5825MHz IEEE 802.11ac VHT20: 5180-5240MHz / 5260-5320MHz/5500 – 5720MHz/5745-5825MHz IEEE 802.11ac VHT40: 5190-5230MHz / 5270 – 5310 MHz/5510 – 5710MHz/5755-5795MHz IEEE 802.11ac VHT80: 5210MHz /5530MHz/5690MHz/5775MHz
WLAN Channel Number	:	11 Channels for 2412-2462MHz(IEEE 802.11b/g/n HT20) 4 Channels for 5180-5240MHz (IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5190-5230MHz (IEEE 802.11ac VHT40/n HT40) 1 Channels for 5210MHz (IEEE 802.11ac VHT80) 4 Channels for 5260-5320MHz (IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5270-5310MHz (IEEE 802.11ac VHT40/n HT40) 1 Channels for 5290MHz (IEEE 802.11ac VHT80) 12 Channels for 5500-5720MHz (IEEE 802.11a/ac VHT20/n HT20) 6 Channels for 5510-5710MHz (IEEE 802.11ac VHT40/n HT40) 3 Channels for 5530-5690MHz (IEEE 802.11ac VHT80) 5 Channels for 5745-5825MHz(IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5755-5795MHz(IEEE 802.11ac VHT40/n HT40) 1 Channels for 5775MHz(IEEE 802.11ac VHT80)
WLAN Modulation Technology	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)

		IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Type And Gain	:	Two Antennas: Internal Antenna 1: 2.5 dBi(Max.), for TX/RX (WLAN 2.4G Band/Bluetooth), 2.56 dBi(Max.), for TX/RX (WLAN 5.2G/UNII-2A Band) 3.02 dBi(Max.), for TX/RX (WLAN UNII-2C/5.8G Band) Internal Antenna 2: 3.99 dBi(Max.), for TX/RX (WLAN 2.4G Band), 2.73 dBi(Max.), for TX/RX (WLAN 5.2G/UNII-2A Band) 2.82 dBi(Max.), for TX/RX (WLAN UNII-2C/5.8G Band)
Directional Gain	:	6.32 dBi for MIMO(2.4G Band) 5.66 dBi for MIMO(5.2G Band/UNII-2A) 5.93 dBi for MIMO(UNII-2C/5.8G Band)

Note1: Antenna position refer to EUT Photos.
Note2: 5600-5650MHz is forbidden in Canada as this restriction is for the protection of Environment Canada's weather radars operating in this band.

1.2 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

★supplied by the lab ☆supplied by the manufacturer

	Manufacturer	Description	Model	Serial Number	Certificate
☆	Aohai	Adapter	A18A-050100U-US2	N/A	N/A
★	AOC	Monitor	280LM00003	N/A	N/A

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
USB Port	1	1m, unshielded
HDMI Port	1	N/A

1.4. Description of Test Facility

FCC
Designation Number: CN1275
Test Firm Registration Number: 167722
Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission
list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA
Certificate Number: 5463.01
Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

IC
ISED#: 22033
CAB identifier: CN0099
Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the Shenzhen Tongzhou Testing Co.,Ltd quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.08dB	(1)
		30MHz~1000MHz	±4.42dB	(1)
		1GHz~40GHz	±4.06dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±2.23dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

The EUT has been tested under operating condition.

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be IEEE 802.11ac mode (Low Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be IEEE 802.11ac mode (Low Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

IEEE 802.11a Mode : 6 Mbps, OFDM
IEEE 802.11ac VHT20 Mode: MCS0
IEEE 802.11n HT20 Mode: MCS0
IEEE 802.11ac VHT40 Mode: MCS0
IEEE 802.11n HT40 Mode: MCS0
IEEE 802.11ac VHT80 Mode: MCS0

Antenna & Bandwidth

Antenna	Single (Port.1)			Two (Port.1 + Port.2)		
Bandwidth Mode	20MHz	40MHz	80MHz	20MHz	40MHz	80MHz
IEEE 802.11a	☐	☐	☐	☑	☐	☐
IEEE 802.11n	☐	☐	☐	☑	☑	☐
IEEE 802.11ac	☐	☐	☐	☑	☑	☑

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen Tongzhou Testing Co.,Ltd

2.1. 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.

2.2. 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 FCC's request, Test Procedure 789033 D02 General UNII Test Procedures New Rules v02r01 and KDB 662911 are required to be used for this kind of FCC 15.407 UII device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

2.4. Test Sample

The application provides 1 sample to meet requirement;

Sample ID	Description
TZ200501367–2#	WLAN Engineer sample–continuous transmit

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by command (adb command via COM port) provided by application.

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	/	/	/	/	/	/	/

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen Tongzhou Testing Co.,Ltd has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart E				
FCC Rules	**ISED standards**	**Description of Test**	**Sample ID**	**Result**
§15.407(a)	RSS-247 6.2.2.1 RSS-247 6.2.3.1	Maximum Conducted Output Power	TZ200501367–2#	Compliant
§15.407(a)	RSS-247 6.2.2.1 RSS-247 6.2.3.1	Power Spectral Density	TZ200501367–2#	Compliant
§15.407(a)	Not required	26dB Bandwidth	TZ200501367–2#	Compliant
§15.407(a)	RSS-247 6.2.3.1	99% Occupied Bandwidth	TZ200501367–2#	Compliant
§15.407(b)	RSS-GEN 8.9	Radiated Emissions	TZ200501367–2#	Compliant
§15.407(b)	RSS-247 6.2.2.2 RSS-247 6.2.3.2 RSS-Gen 8.10	Band edge Emissions	TZ200501367–2#	Compliant
§15.205	RSS-247 6.2.2.2 RSS-247 6.2.3.2 RSS-Gen 8.10	Emissions at Restricted Band	TZ200501367–2#	Compliant
§15.407(g)	RSS-Gen 8.11	Frequency Stability	TZ200501367–2#	Compliant
§15.207(a)	RSS-Gen 8.8	Line Conducted Emissions	TZ200501367–2#	Compliant
§15.203	/	Antenna Requirements	TZ200501367–2#	Compliant
§2.1093	RSS-102	RF Exposure	TZ200501367–2#	Compliant

5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the spectrum analyzer.

5.1.3. Test Procedures

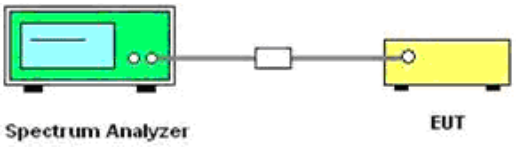
1. Set the centre frequency of the spectrum analyzer to the transmitting frequency;

2. Set the span=0MHz, RBW=10MHz, VBW=10MHz, Sweep time=5ms;

3. Detector = peak;

4. Trace mode = Single hold.

5.1.4. Test Setup Layout



5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.1.6. Test result

Temperature	25.5℃	Humidity	55.2%
Test Engineer	Anna Hu	Configurations	IEEE 802.11b/g/n20

Remark:

1. Please refer to Appendix F of Appendix Test Data for RLAN(UNII2A&2C);

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

FCC

(1) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

ISED

(1)Frequency band 5250-5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

a.The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

b.The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(2) Frequency bands 5470-5600 MHz and 5650-5725 MHz

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the power meter.

5.2.3. Test Procedures

a) Measure the duty cycle D of the transmitter output signal as described in 12.2 of C63.10:2014.

b) Set span to encompass the entire 26 dB EBW or 99% OBW of the signal.

c) Set RBW = 1 MHz.

d) Set VBW ≥ 3 MHz.

e) Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)

f) Sweep time = auto.

g) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

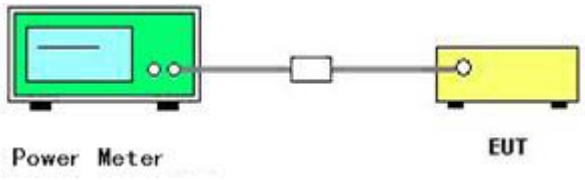
h) Do not use sweep triggering. Allow the sweep to “free run.”

i) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.

j) Compute power by integrating the spectrum across the 26 dB EBW or 99% OBW of the signal using the instrument’s band power measurement function with band limits set equal to the EBW or OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW or 99% OBW of the spectrum.

k) Add [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add [10 log (1 / 0.25)] = 6 dB if the duty cycle is 25%.

5.2.4. Test Setup Layout



5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Maximum Conducted Output Power

Pass

Remark:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *For MIMO mode, limit= 30 –max(Directional Gain,6) + 6;*
5. *Report conducted power = Measured conducted average power + Duty Cycle factor;*
6. *Please refer to Appendix B of Appendix Test Data for RLAN(UNII2A&2C);*

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

FCC

(1) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

ISED

(1)Frequency band 5250-5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band; The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(2) Frequency bands 5470-5600 MHz and 5650-5725 MHz

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 1MHz.
4. Set the VBW ≥ 3MHz

5. Span=Encompass the entire emissions bandwidth (EBW) of the signal (or, alternatively, the entire 99% occupied bandwidth) of the signal.

6. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

7. Manually set sweep time ≥ 10 × (number of points in sweep) × (total on/off period of the transmitted signal).

8. Set detector = power averaging (rms).

9. Sweep time = auto couple.

10. Trace mode = max hold.

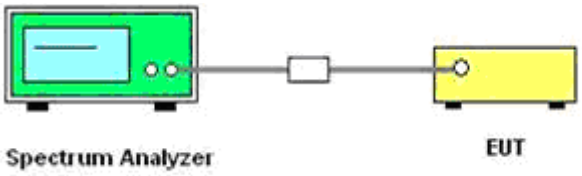
11. Allow trace to fully stabilize.

12. Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively,

13. 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 (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25%.

14. Use the peak marker function to determine the maximum power level in any 1MHz band segment within the fundamental EBW.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.3.6. Test Result of Power Spectral Density

Pass

Remark:

1. *Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *For MIMO mode, limit= 11 –max(Directional Gain,6) + 6;*
5. *Report conducted PSD = Measured conducted PSD + Duty Cycle factor;*
6. *Please refer to Appendix C of Appendix Test Data for RLAN(UNII2A&2C);*

5.4. 99% Occupied Bandwidth and 26dB Emission Bandwidth Measurement

5.4.1. Standard Applicable

No restriction limits. But resolution bandwidth within band edge measurement is 1% of the 99% occupied bandwidth.

5.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span	> 26dB Bandwidth
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5

5.4.3. Test Procedures

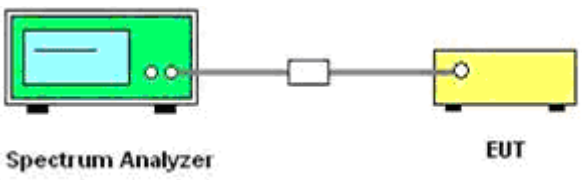
For 26dB Emission Bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW = approximately 1% of the emission bandwidth.
3. Set the VBW ≥ 3 * RBW
4. Measured the spectrum width with power higher than 26dB below carrier.

For 99% Occupied Bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW = approximately 1% ~ 1%of the OBW.
3. Set the VBW ≥ 3 * RBW
4. Measured the 99% Bandwidth

5.4.4. Test Setup Layout



5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.4.6. Test Result of 99% Occupied Bandwidth and 26dB Emission Bandwidth

Pass

Remark:

1. *Measured 99% and 26dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40; , IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *Please refer to Appendix A.1&A.2 of Appendix Test Data for RLAN(UNII2A&2C);*

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz (68.2dBuV/m at 3m).

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

5.5.3. Test Procedures

1) **Sequence of testing 9 kHz to 30 MHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) **Sequence of testing 30 MHz to 1 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) **Sequence of testing 1 GHz to 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) **Sequence of testing above 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

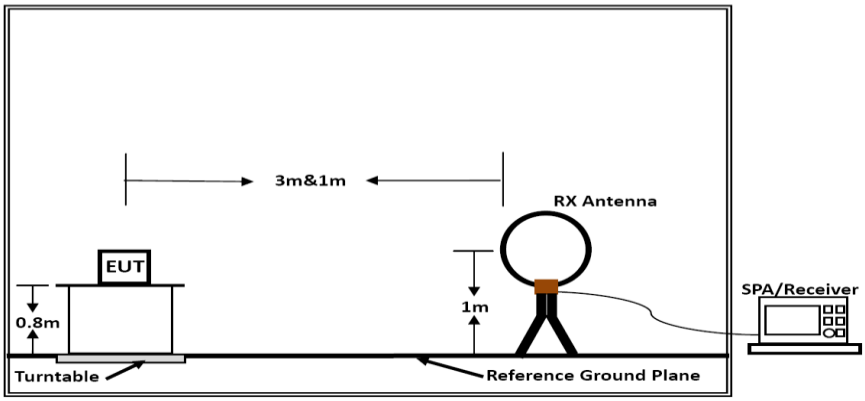
Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

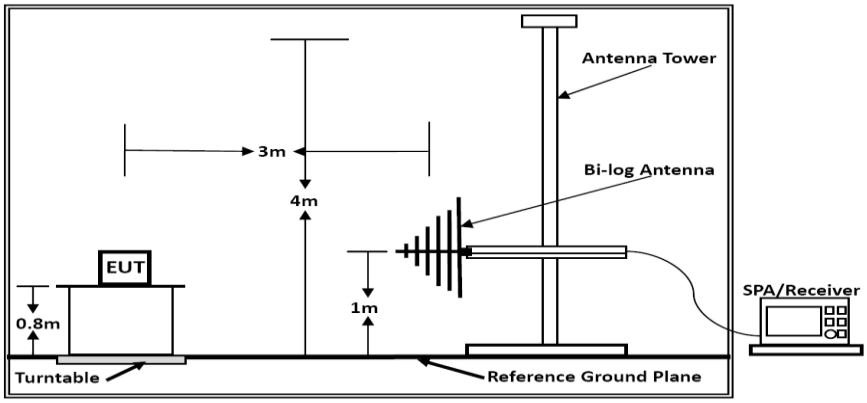
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.5.4. Test Setup Layout

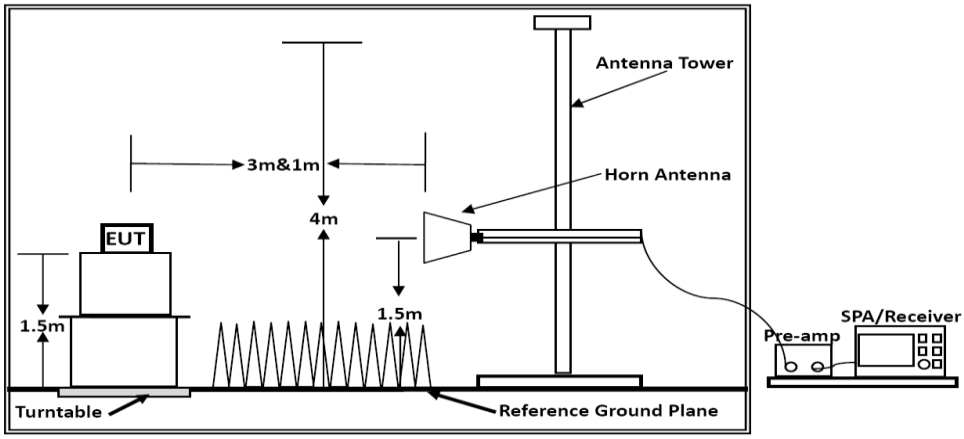
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.5.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	24.5℃	Humidity	56%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a/n/ac

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

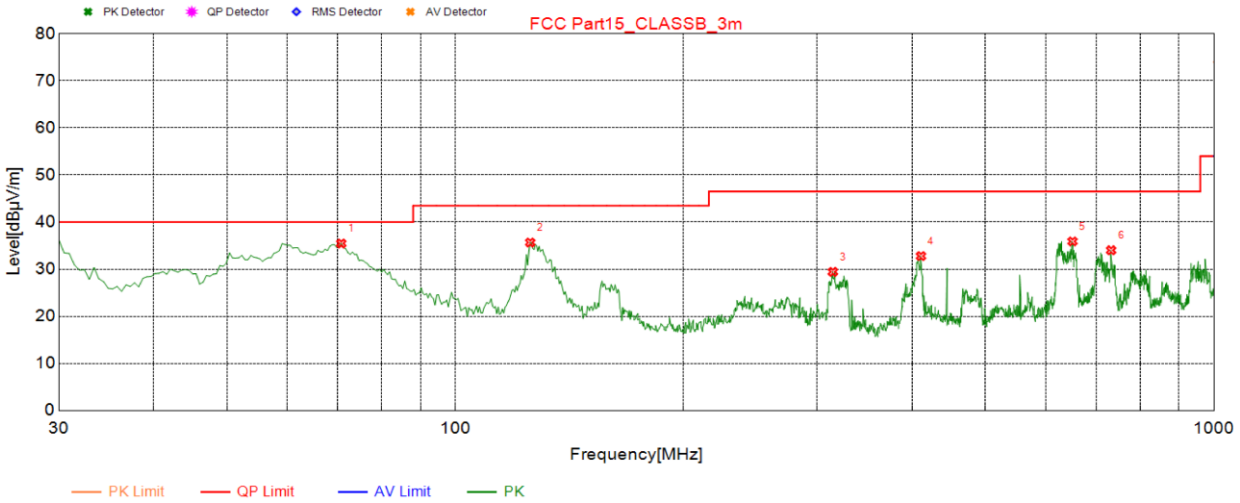
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	24.5℃	Humidity	56%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a/n/ac

Note:The Worst Test result for IEEE 802.11ac, 5260MHz,MIMO

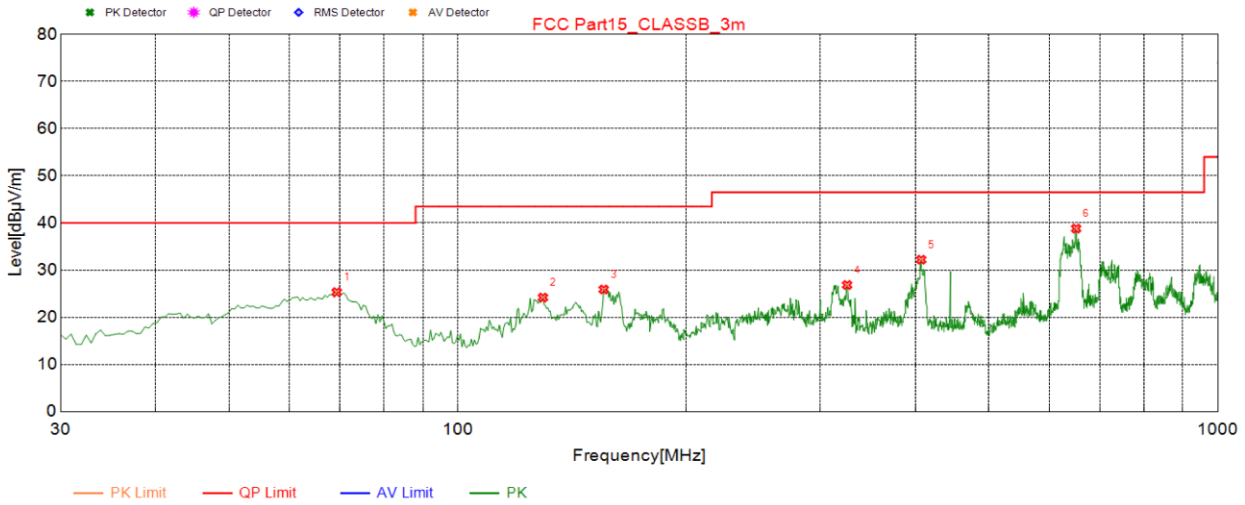
Vertical



Suspected List								
NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	70.740	35.45	-18.35	40	4.55	100	177	Vertical
2	125.545	35.65	-18.43	43.5	7.85	100	0	Vertical
3	314.695	29.42	-12.41	46.5	17.08	200	39	Vertical
4	411.210	32.79	-9.82	46.5	13.71	100	309	Vertical
5	651.285	35.88	-4.95	46.5	10.62	100	321	Vertical
6	732.280	34.02	-3.88	46.5	12.48	100	26	Vertical

Note:
Pre-scan all modes and recorded the worst case results in this report.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Margin(dB)=Limit(dBµV/m) – Result Level(dBµV/m)

Horizontal



Suspected List								
NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	69.285	25.31	-18.02	40	14.69	300	56	Horizontal
2	129.425	24.17	-18.98	43.5	19.33	100	21	Horizontal
3	155.615	25.89	-18.86	43.5	17.61	100	30	Horizontal
4	325.365	26.85	-12.11	46.5	19.65	100	97	Horizontal
5	407.330	32.22	-9.89	46.5	14.28	100	321	Horizontal
6	651.285	38.82	-4.95	46.5	7.68	100	0	Horizontal

Note:
Pre-scan all modes and recorded the worst case results in this report.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Margin(dB)=Limit(dBµV/m) – Result Level(dBµV/m)

5.5.8. Results for Radiated Emissions (Above 1GHz)

Remark: Measured all modes and recorded worst case;

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IEEE 802.11a/ Ant.1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.52	62.58	38.08	46.84	2.40	56.22	68.20	11.98	Peak	Horizontal
10.52	52.51	38.08	46.84	2.40	46.15	54.00	7.85	Average	Horizontal
10.52	63.60	38.08	46.84	2.40	57.24	68.20	10.96	Peak	Vertical
10.52	52.22	38.08	46.84	2.40	45.86	54.00	8.14	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.58	62.12	38.15	46.81	2.41	55.87	68.20	12.33	Peak	Horizontal
10.58	49.36	38.15	46.81	2.41	43.11	54.00	10.89	Average	Horizontal
10.58	63.78	38.15	46.81	2.41	57.53	68.20	10.67	Peak	Vertical
10.58	48.59	38.15	46.81	2.41	42.34	54.00	11.66	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.72	59.87	38.34	46.74	2.43	53.90	68.20	14.30	Peak	Horizontal
10.72	51.01	38.34	46.74	2.43	45.04	54.00	8.96	Average	Horizontal
10.72	59.98	38.34	46.74	2.43	54.01	68.20	14.19	Peak	Vertical
10.72	50.41	38.34	46.74	2.43	44.44	54.00	9.56	Average	Vertical

IEEE 802.11n-HT20/Combined Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.52	63.48	38.08	46.84	2.40	57.12	68.20	11.08	Peak	Horizontal
10.52	48.85	38.08	46.84	2.40	42.49	54.00	11.51	Average	Horizontal
10.52	62.32	38.08	46.84	2.40	55.96	68.20	12.24	Peak	Vertical
10.52	49.53	38.08	46.84	2.40	43.17	54.00	10.83	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.58	60.17	38.15	46.81	2.41	53.92	68.20	14.28	Peak	Horizontal
10.58	51.71	38.15	46.81	2.41	45.46	54.00	8.54	Average	Horizontal
10.58	60.78	38.15	46.81	2.41	54.53	68.20	13.67	Peak	Vertical
10.58	48.92	38.15	46.81	2.41	42.67	54.00	11.33	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.72	59.79	38.34	46.74	2.43	53.82	68.20	14.38	Peak	Horizontal
10.72	49.92	38.34	46.74	2.43	43.95	54.00	10.05	Average	Horizontal
10.72	64.08	38.34	46.74	2.43	58.11	68.20	10.09	Peak	Vertical
10.72	49.36	38.34	46.74	2.43	43.39	54.00	10.61	Average	Vertical

IEEE 802.11n HT40/ Combined Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.54	62.91	38.10	46.83	2.41	56.59	68.20	11.61	Peak	Horizontal
10.54	48.60	38.10	46.83	2.41	42.28	54.00	11.72	Average	Horizontal
10.54	64.24	38.10	46.83	2.41	57.92	68.20	10.28	Peak	Vertical
10.54	51.44	38.10	46.83	2.41	45.12	54.00	8.88	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.62	60.13	38.21	46.79	2.42	53.97	68.20	14.23	Peak	Horizontal
10.62	52.55	38.21	46.79	2.42	46.39	54.00	7.61	Average	Horizontal
10.62	59.60	38.21	46.79	2.42	53.44	68.20	14.76	Peak	Vertical
10.62	48.53	38.21	46.79	2.42	42.37	54.00	11.63	Average	Vertical

IEEE 802.11ac VHT20/ Combined Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.52	59.80	38.08	46.84	2.40	53.44	68.20	14.76	Peak	Horizontal
10.52	51.63	38.08	46.84	2.40	45.27	54.00	8.73	Average	Horizontal
10.52	64.11	38.08	46.84	2.40	57.75	68.20	10.45	Peak	Vertical
10.52	50.69	38.08	46.84	2.40	44.33	54.00	9.67	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.58	62.61	38.15	46.81	2.41	56.36	68.20	11.84	Peak	Horizontal
10.58	50.27	38.15	46.81	2.41	44.02	54.00	9.98	Average	Horizontal
10.58	60.26	38.15	46.81	2.41	54.01	68.20	14.19	Peak	Vertical
10.58	51.92	38.15	46.81	2.41	45.67	54.00	8.33	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.72	61.43	38.34	46.74	2.43	55.46	68.20	12.74	Peak	Horizontal
10.72	51.40	38.34	46.74	2.43	45.43	54.00	8.57	Average	Horizontal
10.72	60.13	38.34	46.74	2.43	54.16	68.20	14.04	Peak	Vertical
10.72	49.50	38.34	46.74	2.43	43.53	54.00	10.47	Average	Vertical

IEEE 802.11ac VHT40 / Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.54	62.91	38.10	46.83	2.41	56.59	68.20	11.61	Peak	Horizontal
10.54	48.60	38.10	46.83	2.41	42.28	54.00	11.72	Average	Horizontal
10.54	64.24	38.10	46.83	2.41	57.92	68.20	10.28	Peak	Vertical
10.54	51.44	38.10	46.83	2.41	45.12	54.00	8.88	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.62	60.13	38.21	46.79	2.42	53.97	68.20	14.23	Peak	Horizontal
10.62	52.55	38.21	46.79	2.42	46.39	54.00	7.61	Average	Horizontal
10.62	59.60	38.21	46.79	2.42	53.44	68.20	14.76	Peak	Vertical
10.62	48.53	38.21	46.79	2.42	42.37	54.00	11.63	Average	Vertical

IEEE 802.11ac VHT80 / Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
10.58	63.74	38.15	46.81	2.41	57.49	68.20	10.71	Peak	Horizontal
10.58	50.20	38.15	46.81	2.41	43.95	54.00	10.05	Average	Horizontal
10.58	64.44	38.15	46.81	2.41	58.19	68.20	10.01	Peak	Vertical
10.58	48.93	38.15	46.81	2.41	42.68	54.00	11.32	Average	Vertical

Notes:

1. *Measuring frequencies from 9 KHz ~40 GHz, No emission found between lowest internal used/generated frequencies to 30MHz.*
2. *Radiated emissions measured in frequency range from 9 KHz ~40GHz were made with an instrument using Peak detector mode.*
3. *Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
5. *Measured Level = Read Level + Ant. Fac - Pre. Fac + Cab.Los;*
   Margin = Limit - Measured Level

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IEEE 802.11a/ Ant.0

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.00	61.56	38.08	46.84	2.47	55.20	68.20	13.00	Peak	Horizontal
11.00	48.47	38.08	46.84	2.47	42.11	54.00	11.89	Average	Horizontal
11.00	62.29	38.08	46.84	2.47	55.93	68.20	12.27	Peak	Vertical
11.00	50.02	38.08	46.84	2.47	43.66	54.00	10.34	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.16	63.56	38.76	46.63	2.49	57.31	68.20	10.89	Peak	Horizontal
11.16	52.09	38.76	46.63	2.49	45.84	54.00	8.16	Average	Horizontal
11.16	61.32	38.76	46.63	2.49	55.07	68.20	13.13	Peak	Vertical
11.16	52.52	38.76	46.63	2.49	46.27	54.00	7.73	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.44	63.50	38.88	46.69	2.53	57.53	68.20	10.67	Peak	Horizontal
11.44	51.08	38.88	46.69	2.53	45.11	54.00	8.89	Average	Horizontal
11.44	62.34	38.88	46.69	2.53	56.37	68.20	11.83	Peak	Vertical
11.44	48.72	38.88	46.69	2.53	42.75	54.00	11.25	Average	Vertical

IEEE 802.11n-HT20/Combined Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.00	60.07	38.08	46.84	2.47	53.78	68.20	14.42	Peak	Horizontal
11.00	52.07	38.08	46.84	2.47	45.78	54.00	8.22	Average	Horizontal
11.00	61.67	38.08	46.84	2.47	55.38	68.20	12.82	Peak	Vertical
11.00	50.88	38.08	46.84	2.47	44.59	54.00	9.41	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.16	60.20	38.76	46.63	2.49	54.82	68.20	13.38	Peak	Horizontal
11.16	49.89	38.76	46.63	2.49	44.51	54.00	9.49	Average	Horizontal
11.16	63.18	38.76	46.63	2.49	57.80	68.20	10.40	Peak	Vertical
11.16	49.12	38.76	46.63	2.49	43.74	54.00	10.26	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.44	63.47	38.88	46.69	2.53	58.19	68.20	10.01	Peak	Horizontal
11.44	48.22	38.88	46.69	2.53	42.94	54.00	11.06	Average	Horizontal
11.44	62.02	38.88	46.69	2.53	56.74	68.20	11.46	Peak	Vertical
11.44	50.64	38.88	46.69	2.53	45.36	54.00	8.64	Average	Vertical

IEEE 802.11n HT40/ Combined Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.02	60.70	38.71	46.60	2.47	55.28	68.20	12.92	Peak	Horizontal
11.02	49.24	38.71	46.60	2.47	43.82	54.00	10.18	Average	Horizontal
11.02	62.52	38.71	46.60	2.47	57.10	68.20	11.10	Peak	Vertical
11.02	50.19	38.71	46.60	2.47	44.77	54.00	9.23	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.42	58.49	38.87	46.68	2.52	53.20	68.20	15.00	Peak	Horizontal
11.42	51.81	38.87	46.68	2.52	46.52	54.00	7.48	Average	Horizontal
11.42	63.26	38.87	46.68	2.52	57.97	68.20	10.23	Peak	Vertical
11.42	52.24	38.87	46.68	2.52	46.95	54.00	7.05	Average	Vertical

IEEE 802.11ac VHT20/ Combined Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.00	62.96	38.08	46.84	2.47	56.67	68.20	11.53	Peak	Horizontal
11.00	53.24	38.08	46.84	2.47	46.95	54.00	7.05	Average	Horizontal
11.00	62.45	38.08	46.84	2.47	56.16	68.20	12.04	Peak	Vertical
11.00	52.86	38.08	46.84	2.47	46.57	54.00	7.43	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.16	61.57	38.76	46.63	2.49	56.19	68.20	12.01	Peak	Horizontal
11.16	47.92	38.76	46.63	2.49	42.54	54.00	11.46	Average	Horizontal
11.16	60.14	38.76	46.63	2.49	54.76	68.20	13.44	Peak	Vertical
11.16	48.14	38.76	46.63	2.49	42.76	54.00	11.24	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.44	61.31	38.88	46.69	2.53	56.03	68.20	12.17	Peak	Horizontal
11.44	48.59	38.88	46.69	2.53	43.31	54.00	10.69	Average	Horizontal
11.44	58.64	38.88	46.69	2.53	53.36	68.20	14.84	Peak	Vertical
11.44	47.43	38.88	46.69	2.53	42.15	54.00	11.85	Average	Vertical

IEEE 802.11ac VHT40 / Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.02	62.30	38.71	46.60	2.47	56.88	68.20	11.32	Peak	Horizontal
11.02	50.16	38.71	46.60	2.47	44.74	54.00	9.26	Average	Horizontal
11.02	62.69	38.71	46.60	2.47	57.27	68.20	10.93	Peak	Vertical
11.02	51.72	38.71	46.60	2.47	46.30	54.00	7.70	Average	Vertical

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.42	62.50	38.87	46.68	2.52	57.21	68.20	10.99	Peak	Horizontal
11.42	50.65	38.87	46.68	2.52	45.36	54.00	8.64	Average	Horizontal
11.42	59.73	38.87	46.68	2.52	54.44	68.20	13.76	Peak	Vertical
11.42	51.36	38.87	46.68	2.52	46.07	54.00	7.93	Average	Vertical

IEEE 802.11ac VHT80 / Antenna Chain 0 and Antenna Chain 1

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit dBuV/m	Margin dB	Remark	Pol/Phase
11.22	63.39	38.79	46.64	2.50	58.04	68.20	10.16	Peak	Horizontal
11.22	51.54	38.79	46.64	2.50	46.19	54.00	7.81	Average	Horizontal
11.22	60.52	38.79	46.64	2.50	55.17	68.20	13.03	Peak	Vertical
11.22	51.52	38.79	46.64	2.50	46.17	54.00	7.83	Average	Vertical

Notes:

1. *Measuring frequencies from 9 KHz ~40 GHz, No emission found between lowest internal used/generated frequencies to 30MHz.*
2. *Radiated emissions measured in frequency range from 9 KHz ~40GHz were made with an instrument using Peak detector mode.*
3. *Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
5. *Measured Level = Read Level + Ant. Fac - Pre. Fac + Cab.Los;*
   Margin = Limit - Measured Level

5.6. Power line conducted emissions

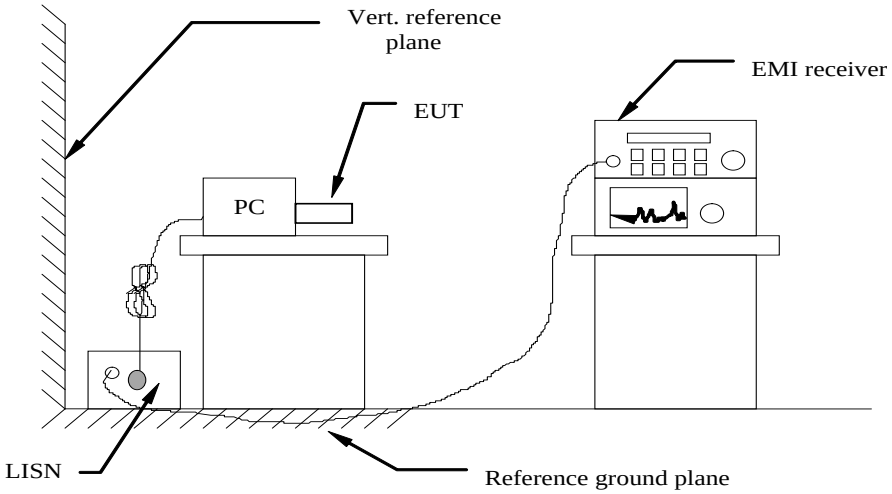
5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

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

* Decreasing linearly with the logarithm of the frequency

5.6.2 Block Diagram of Test Setup



5.6.3 Test Results

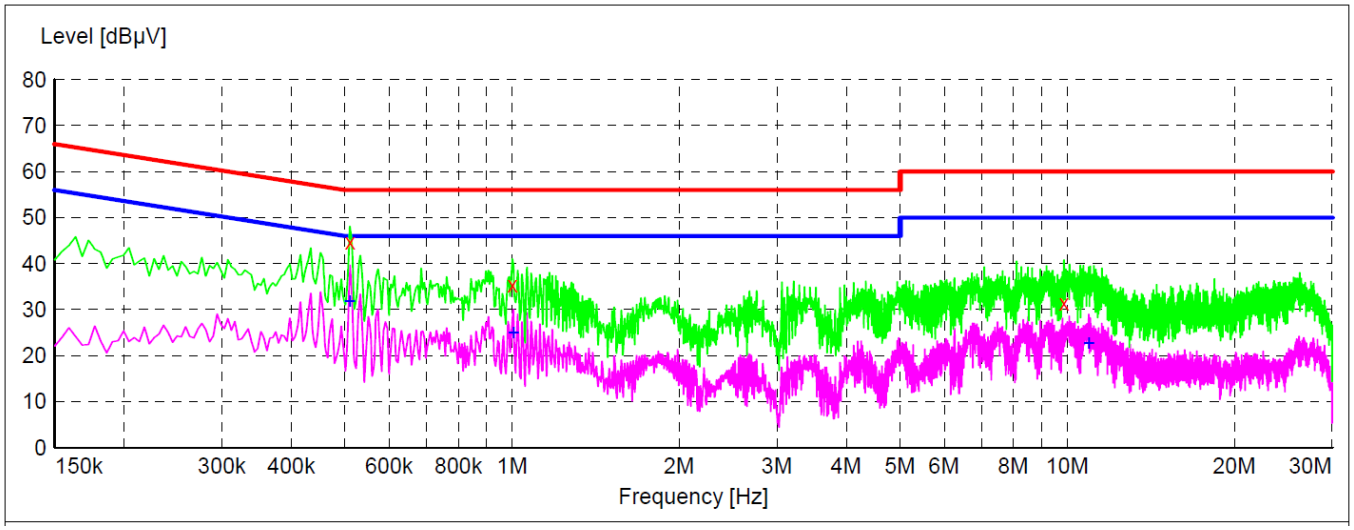
PASS.

Temperature	24.7℃	Humidity	55%
Test Engineer	Tony Luo	Configurations	IEEE 802.11a/n/ac

The test data please refer to following page.

The Worst Test result for IEEE 802.11ac, 5260MHz,MIMO

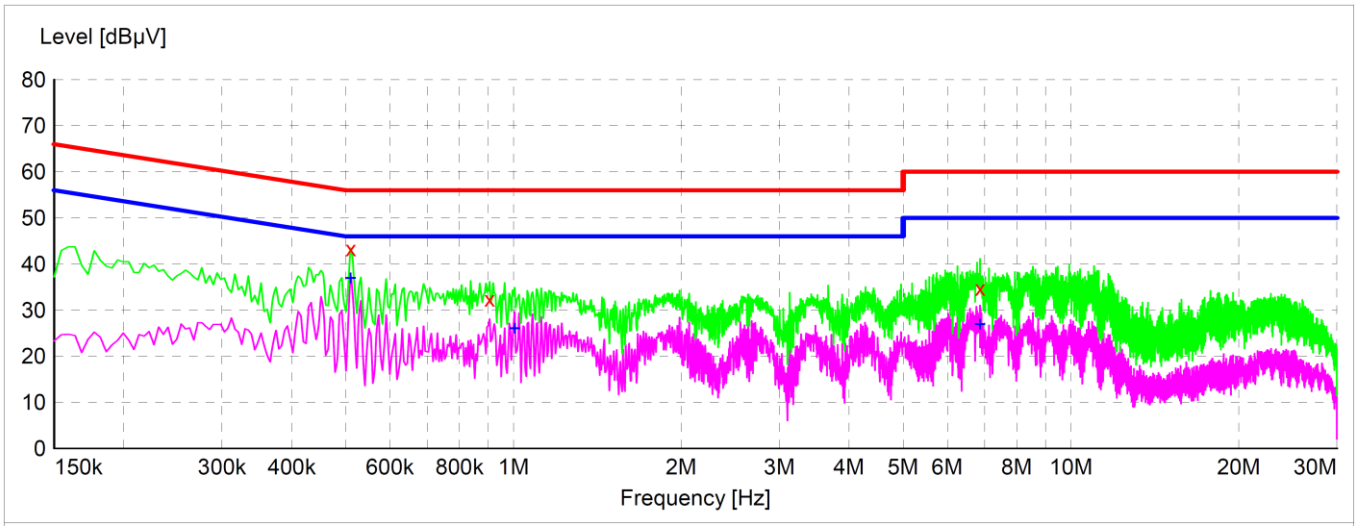
Line



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.510000	44.80	9.9	56	11.2	QP	L1	GND
1.000500	35.30	9.8	56	20.7	QP	L1	GND
9.861000	31.40	9.8	60	28.6	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.510000	31.90	9.9	46	14.1	AV	L1	GND
1.005000	24.90	9.8	46	21.1	AV	L1	GND
10.927500	22.60	9.8	50	27.4	AV	L1	GND

Neutral



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.510000	43.30	9.9	56	12.7	QP	N	GND
0.906000	32.40	9.8	56	23.6	QP	N	GND
6.868500	34.70	9.8	60	25.3	QP	N	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.510000	36.90	9.9	46	9.1	AV	N	GND
1.005000	26.00	9.8	46	20.0	AV	N	GND
6.868500	26.90	9.8	50	23.1	AV	N	GND

******Note: Pre-scan all modes and recorded the worst case results in this report***

5.7 Undesirable Emissions Measurement

5.7.1 LIMIT

FCC

According to ξ15.407 (b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(a) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(b) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(c) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(d) For transmitters operating in the 5.725-5.85 GHz band:

(i) 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.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

(e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(g) The provisions of §15.205 apply to intentional radiators operating under this section.

(h) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

ISED

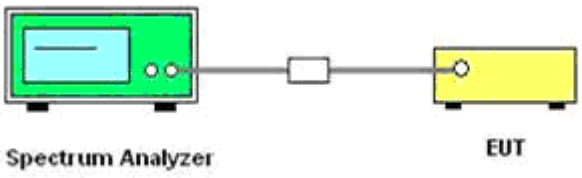
(1)Frequency band 5250-5350 MHz

Devices shall comply with the following:
All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or
All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz.
The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

(2)Frequency bands 5470-5600 MHz and 5650-5725 MHz

Emissions outside the band 5470-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p.at 5850 MHz instead of 5725 MHz.

5.7.2 TEST CONFIGURATION



5.7.3 TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section G: Unwanted Emission Measurement

1. Unwanted Emissions in the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

c) At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

d) For conducted measurements above 1000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172):

i) E[dBμV/m] = EIRP[dBm] - 20 log (d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules;

ii) E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

e) For conducted measurements below 1000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

2. Unwanted Emissions that fall Outside of the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., “Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz.”

d) Section 15.407(b) (1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.

i) Section 15.407(b) (4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b) (4) (i). An alternative to the band emissions mask is specified in Section 15.407(b) (4) (ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

e) If radiated measurements are performed, field strength is then converted to EIRP as follows:

i) EIRP = ((E×d) ^2) / 30

Where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotopically radiated power in watts;

ii) Working in dB units, the above equation is equivalent to:

EIRP [dBm] = E [dBμV/m] + 20 log (d [meters]) - 104.77

iii) Or, if d is 3 meters:

EIRP [dBm] = E [dBμV/m] - 95.23

3) Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:

(i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.

(ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.

(iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.[3] However, for devices that

operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20% of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.

(iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:

- Compute EIRP for each output, as described in (iii), above.
- Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by 10 log (N_{ANT}), where N_{ANT} is the number of outputs.
- Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.

(v) Direction of maximum emission.
For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

5.7.4 TEST RESULT

Pass

Temperature	24.5℃	Humidity	56%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a/n/ac

For UNII-2A

Ant1											
Mode	ChName	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
11ASISO	Low	5350	63.15	30.2	46.18	1.65	48.82	68.2	19.38	Peak	Horizontal
		5350	55.51	30.2	46.18	1.65	41.18	54	12.82	AV	Horizontal
		5350	62.84	30.2	46.18	1.65	48.51	68.2	19.69	Peak	Vertical
		5350	54.8	30.2	46.18	1.65	40.47	54	13.53	AV	Vertical
		5460	66.18	30.46	46.23	1.67	52.08	68.2	16.12	Peak	Horizontal
		5460	54.48	30.46	46.23	1.67	40.38	54	13.62	AV	Horizontal
		5460	66.58	30.46	46.23	1.67	52.48	68.2	15.72	Peak	Vertical
		5460	51.7	30.46	46.23	1.67	37.6	54	16.4	AV	Vertical
	High	5350	74.39	30.2	46.18	1.65	60.06	68.2	8.14	Peak	Horizontal
		5350	61.35	30.2	46.18	1.65	47.02	54	6.98	AV	Horizontal
		5350	69.63	30.2	46.18	1.65	55.3	68.2	12.9	Peak	Vertical
		5350	59.81	30.2	46.18	1.65	45.48	54	8.52	AV	Vertical
		5460	64.56	30.46	46.23	1.67	50.46	68.2	17.74	Peak	Horizontal
		5460	52.43	30.46	46.23	1.67	38.33	54	15.67	AV	Horizontal
		5460	64.85	30.46	46.23	1.67	50.75	68.2	17.45	Peak	Vertical
		5460	55.26	30.46	46.23	1.67	41.16	54	12.84	AV	Vertical

Ant1 & Ant2 MIMO											
Mode	ChName	Freq (MHz)	Read Level (dBµV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Polarization
11N20 MIMO	Low	5350	67.08	30.2	46.18	1.65	52.75	68.2	15.45	Peak	Horizontal
		5350	52.04	30.2	46.18	1.65	37.71	54	16.29	AV	Horizontal
		5350	64.37	30.2	46.18	1.65	50.04	68.2	18.16	Peak	Vertical
		5350	55.42	30.2	46.18	1.65	41.09	54	12.91	AV	Vertical
		5460	67.25	30.46	46.23	1.67	53.15	68.2	15.05	Peak	Horizontal
		5460	52.69	30.46	46.23	1.67	38.59	54	15.41	AV	Horizontal
		5460	62.7	30.46	46.23	1.67	48.6	68.2	19.6	Peak	Vertical
		5460	54.59	30.46	46.23	1.67	40.49	54	13.51	AV	Vertical
	High	5350	72.49	30.2	46.18	1.65	58.16	68.2	10.04	Peak	Horizontal
		5350	59.44	30.2	46.18	1.65	45.11	54	8.89	AV	Horizontal
		5350	72.54	30.2	46.18	1.65	58.21	68.2	9.99	Peak	Vertical
		5350	59.4	30.2	46.18	1.65	45.07	54	8.93	AV	Vertical
		5460	63.97	30.46	46.23	1.67	49.87	68.2	18.33	Peak	Horizontal
		5460	53.85	30.46	46.23	1.67	39.75	54	14.25	AV	Horizontal
		5460	66.02	30.46	46.23	1.67	51.92	68.2	16.28	Peak	Vertical
		5460	52.45	30.46	46.23	1.67	38.35	54	15.65	AV	Vertical

Ant1 & Ant2 MIMO											
Mode	ChName	Freq (MHz)	Read Level (dBµV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Polarization
11N40 MIMO	Low	5350	62.69	30.2	46.18	1.65	48.36	68.2	19.84	Peak	Horizontal
		5350	54.39	30.2	46.18	1.65	40.06	54	13.94	AV	Horizontal
		5350	67.11	30.2	46.18	1.65	52.78	68.2	15.42	Peak	Vertical
		5350	55.85	30.2	46.18	1.65	41.52	54	12.48	AV	Vertical
		5460	65.69	30.46	46.23	1.67	51.59	68.2	16.61	Peak	Horizontal
		5460	54	30.46	46.23	1.67	39.9	54	14.1	AV	Horizontal
		5460	65.58	30.46	46.23	1.67	51.48	68.2	16.72	Peak	Vertical
		5460	55.53	30.46	46.23	1.67	41.43	54	12.57	AV	Vertical
	High	5350	69.58	30.2	46.18	1.65	55.25	68.2	12.95	Peak	Horizontal
		5350	63.17	30.2	46.18	1.65	48.84	54	5.16	AV	Horizontal
		5350	69.24	30.2	46.18	1.65	54.91	68.2	13.29	Peak	Vertical
		5350	60.22	30.2	46.18	1.65	45.89	54	8.11	AV	Vertical
		5460	65.89	30.46	46.23	1.67	51.79	68.2	16.41	Peak	Horizontal
		5460	52.45	30.46	46.23	1.67	38.35	54	15.65	AV	Horizontal
		5460	66.98	30.46	46.23	1.67	52.88	68.2	15.32	Peak	Vertical
		5460	54.63	30.46	46.23	1.67	40.53	54	13.47	AV	Vertical

Ant1 & Ant2 MIMO											
Mode	ChName	Freq (MHz)	Read Level (dBµV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Polarization
11AC20 MIMO	Low	4500.00	54.41	29.19	30.13	10.65	64.12	68.2	-4.08	Peak	Horizontal
		4500.00	36.44	29.19	30.13	10.65	46.15	54	-7.85	AV[1]	Horizontal
		4500.00	55.19	29.19	30.13	10.65	64.90	68.2	-3.30	Peak	Vertical
		4500.00	38.99	29.19	30.13	10.65	48.70	54	-5.30	AV[1]	Vertical
		5150.00	53.54	29.15	29.63	10.95	64.01	68.2	-4.19	Peak	Horizontal
		5150.00	25.12	29.15	29.63	10.95	35.59	54	-18.41	AV[1]	Horizontal
		5150.00	51.50	29.15	29.63	10.95	61.97	68.2	-6.23	Peak	Vertical
		5150.00	27.62	29.15	29.63	10.95	38.09	54	-15.91	AV[1]	Vertical
	High	5350.00	53.15	29.19	30.13	10.65	62.86	68.2	-5.34	Peak	Horizontal
		5350.00	37.93	29.19	30.13	10.65	47.64	54	-6.36	AV[1]	Horizontal
		5350.00	56.20	29.19	30.13	10.65	65.91	68.2	-2.29	Peak	Vertical
		5350.00	40.40	29.19	30.13	10.65	50.11	54	-3.89	AV[1]	Vertical
		5460.00	55.74	29.15	29.63	10.95	66.21	68.2	-1.99	Peak	Horizontal
		5460.00	24.92	29.15	29.63	10.95	35.39	54	-18.61	AV[1]	Horizontal
		5460.00	50.93	29.15	29.63	10.95	61.40	68.2	-6.80	Peak	Vertical
		5460.00	26.25	29.15	29.63	10.95	36.72	54	-17.28	AV[1]	Vertical

Ant1 & Ant2 MIMO											
Mode	ChName	Freq (MHz)	Read Level (dBµV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Polarization
11AC40 MIMO	Low	5350	66.01	30.2	46.18	1.65	51.68	68.2	16.52	Peak	Horizontal
		5350	53.14	30.2	46.18	1.65	38.81	54	15.19	AV	Horizontal
		5350	63.28	30.2	46.18	1.65	48.95	68.2	19.25	Peak	Vertical
		5350	51.8	30.2	46.18	1.65	37.47	54	16.53	AV	Vertical
		5460	63.6	30.46	46.23	1.67	49.5	68.2	18.7	Peak	Horizontal
		5460	51.18	30.46	46.23	1.67	37.08	54	16.92	AV	Horizontal
		5460	64.4	30.46	46.23	1.67	50.3	68.2	17.9	Peak	Vertical
		5460	51.11	30.46	46.23	1.67	37.01	54	16.99	AV	Vertical
	High	5350	72.76	30.2	46.18	1.65	58.43	68.2	9.77	Peak	Horizontal
		5350	61.61	30.2	46.18	1.65	47.28	54	6.72	AV	Horizontal
		5350	72.11	30.2	46.18	1.65	57.78	68.2	10.42	Peak	Vertical
		5350	60.64	30.2	46.18	1.65	46.31	54	7.69	AV	Vertical
		5460	62.55	30.46	46.23	1.67	48.45	68.2	19.75	Peak	Horizontal
		5460	51.11	30.46	46.23	1.67	37.01	54	16.99	AV	Horizontal
		5460	64.69	30.46	46.23	1.67	50.59	68.2	17.61	Peak	Vertical
		5460	52.29	30.46	46.23	1.67	38.19	54	15.81	AV	Vertical

Ant1 & Ant2 MIMO											
Mode	ChName	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
11AC80 MIMO	Low	5350	64.63	30.2	46.18	1.65	50.3	68.2	17.9	Peak	Horizontal
		5350	55.21	30.2	46.18	1.65	40.88	54	13.12	AV	Horizontal
		5350	64.84	30.2	46.18	1.65	50.51	68.2	17.69	Peak	Vertical
		5350	54.69	30.2	46.18	1.65	40.36	54	13.64	AV	Vertical
		5460	66.12	30.46	46.23	1.67	52.02	68.2	16.18	Peak	Horizontal
		5460	55.35	30.46	46.23	1.67	41.25	54	12.75	AV	Horizontal
		5460	65.23	30.46	46.23	1.67	51.13	68.2	17.07	Peak	Vertical
		5460	55.01	30.46	46.23	1.67	40.91	54	13.09	AV	Vertical
	High	5350	69.99	30.2	46.18	1.65	55.66	68.2	12.54	Peak	Horizontal
		5350	59.8	30.2	46.18	1.65	45.47	54	8.53	AV	Horizontal
		5350	73.51	30.2	46.18	1.65	59.18	68.2	9.02	Peak	Vertical
		5350	62.89	30.2	46.18	1.65	48.56	54	5.44	AV	Vertical
		5460	67.01	30.46	46.23	1.67	52.91	68.2	15.29	Peak	Horizontal
		5460	51.76	30.46	46.23	1.67	37.66	54	16.34	AV	Horizontal
		5460	63.21	30.46	46.23	1.67	49.11	68.2	19.09	Peak	Vertical
		5460	52.96	30.46	46.23	1.67	38.86	54	15.14	AV	Vertical

For UNII-2C

The nearest restrict band (5350 - 5460 MHz) is far from the edge UNII-2C.

Remark:

1. *Measured Undesirable emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
3. *Result Level = Read Level + Antenna Factor – PRM + Cable Loss*
4. *Over Limit = Result Level - Limit*

5.8. Antenna Requirements

5.8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited
And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.8.2. Antenna Connector Construction

The directional gains of antenna refer to section 1.1, and the antenna is an internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.8.3. Results: Compliance.

5.9. Frequency Stability

5.9.1 Standard Applicable

According to FCC §15.407(g) “Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual.”

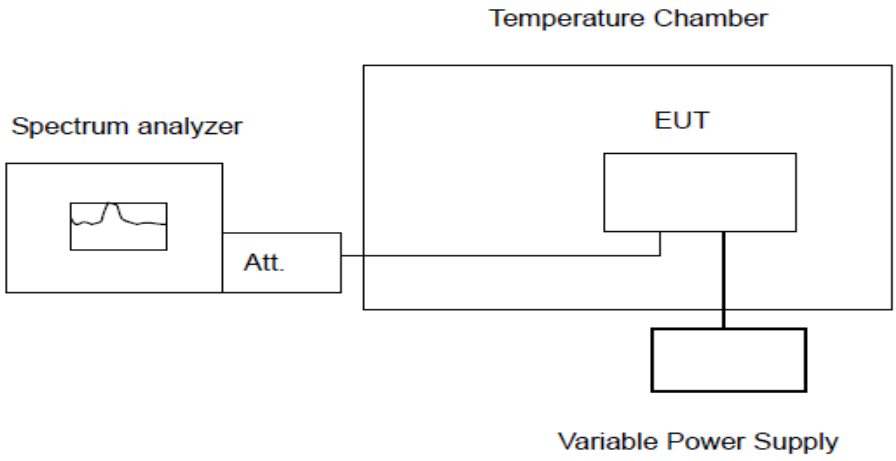
According to FCC §2.1055(a) “The frequency stability shall be measured with variation of ambient temperature as follows:”

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

5.9.2 Test Configuration



5.9.3 Test Procedure

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum anzlyer via feed through attenators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low engouh to obtain the desired frequency resoluation and measure EUT 20 degree operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30 degree. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure wuth 10 degree increased per stage until the highest temperature of +50 degree reached.

5.9.4 Test Results

PASS

Remark:

1. *Measured all conditions and recorded worst case.*

IEEE 802.11a Mode / 5280 MHz

Enviroment Temperature (Dregree)	Voltage (VAC)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	264	5259.961126	5250 – 5350	PASS
20	108	5259.990993	5250 – 5350	PASS
50	120	5259.988468	5250 – 5350	PASS
40	120	5260.062305	5250 – 5350	PASS
30	120	5259.921656	5250 – 5350	PASS
20	120	5259.917717	5250 – 5350	PASS
10	120	5259.909420	5250 – 5350	PASS
0	120	5260.075870	5250 – 5350	PASS
-10	120	5260.001375	5250 – 5350	PASS
-20	120	5260.014716	5250 – 5350	PASS
-30	120	5259.971885	5250 – 5350	PASS

IEEE 802.11a Mode / 5500 MHz

Enviroment Temperature (Dregree)	Voltage (VAC)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	264	5500.023410	5470 – 5725	PASS
20	108	5499.913803	5470 – 5725	PASS
50	120	5499.939982	5470 – 5725	PASS
40	120	5500.038396	5470 – 5725	PASS
30	120	5499.955244	5470 – 5725	PASS
20	120	5500.055200	5470 – 5725	PASS
10	120	5499.964020	5470 – 5725	PASS
0	120	5500.081274	5470 – 5725	PASS
-10	120	5499.948535	5470 – 5725	PASS
-20	120	5500.027064	5470 – 5725	PASS
-30	120	5499.918559	5470 – 5725	PASS

6. LIST OF MEASURING EQUIPMENTS

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2020/1/2	2021/1/1
2	Power Sensor	Agilent	U2021XA	MY5365004	2020/1/2	2021/1/1
3	Power Meter	Agilent	U2531A	TW53323507	2020/1/2	2021/1/1
4	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
5	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
6	EMI Test Receiver	R&S	ESCI	100849/003	2020/1/2	2021/1/1
7	Controller	MF	MF7802	N/A	N/A	N/A
8	Amplifier	schwarzbeck	BBV 9743	209	2020/1/2	2021/1/1
9	Amplifier	Tonscend	TSAMP-0518SE	--	2020/1/2	2021/1/1
10	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2020/1/2	2021/1/1
11	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2020/1/2	2021/1/1
12	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2020/1/2	2021/1/1
12	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
14	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
15	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A
16	Horn Antenna	A-INFO	LB-180400-KF	J211020657	2019/11/16	2022/11/15
17	Amplifier	SKET	LNPA_1840-50	SK2018101801	2019/10/22	2020/10/21

----------THE END OF REPORT----------