FCC TEST REPORT

Test report

On Behalf of

Shenzhen wanbo Technology Co., Ltd.

For

Wanbo Projector

Model No.: WPA34, WPA31, WPA32, WPA33, WPA35, WPA36, WPA37, WPA38, WPA39, X5, X5 Air, X5 Pro, WPD21, WPD22, WPD23, WPD24, WPC91, WPC92, WPC93, WPC94, WPC31, WPC32, WPC33, WPC34, WPC11, WPC12, WPC13, WPC14, WPB21, X3, X3 Pro, X3 Air, X3 Max, WPB82, WPB83, WPA21, WPA24, WPE02, WPE03, WPE04, WPE05, WPD12, WPD13, WPD14, WPD15, WPL12, WPL13, WPL14, WPL15, WPC23, WPC25

FCC ID: 2A7PIX5PRO

Prepared for :	**Shenzhen wanbo Technology Co., Ltd.** 4th Floor, Building 1, Chuangjian Phase 2 Industrial Park, Yingrenshi Community, Shiyan Street, Baoan 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:	**Jan.11,2024~ Jan.30,2024**
Date of Report:	**Jul.30,2024**
Report Number:	**TZ240505711-NII-1**

The test report apply only to the specific sample(s) tested under stated test conditions

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

TEST RESULT CERTIFICATION

Applicant's name	**Shenzhen wanbo Technology Co., Ltd.**
Address	4th Floor, Building 1, Chuangjian Phase 2 Industrial Park, Yingrenshi Community, Shiyan Street, Baoan District, Shenzhen, China
Manufacture's Name	**Shenzhen wanbo Technology Co., Ltd.**
Address	4th Floor, Building 1, Chuangjian Phase 2 Industrial Park, Yingrenshi Community, Shiyan Street, Baoan District, Shenzhen, China
Product description	
Trade Mark	Wanbo
Product name	Wanbo Projector
Model and/or type reference	WPA34, WPA31, WPA32, WPA33, WPA35, WPA36, WPA37, WPA38, WPA39, X5, X5 Air, X5 Pro, WPD21, WPD22, WPD23, WPD24, WPC91, WPC92, WPC93, WPC94, WPC31, WPC32, WPC33, WPC34, WPC11, WPC12, WPC13, WPC14, WPB21, X3, X3 Pro, X3 Air, X3 Max, WPB82, WPB83, WPA21, WPA24, WPE02, WPE03, WPE04, WPE05, WPD12, WPD13, WPD14, WPD15, WPL12, WPL13, WPL14, WPL15, WPC23, WPC25
Standards	FCC Rules and Regulations Part 15 Subpart E Section 15.407 ANSI C63.10: 2013

Date of Test:	
Date (s) of performance of tests:	**Jan.11,2024~ Jan.30,2024**
Date of Issue:	**Jul.30,2024**
Test Result:	**Pass**

Testing Engineer : Allen Lai

(Allen Lai)

Technical Manager : Hugo Chen

(Hugo Chen)

Authorized Signatory : Andy Zhang

(Andy Zhang)

Revision History

Revision	Issue Date	Revisions	Revised By
000	Jul.30,2024	Initial Issue	Andy Zhang

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	Wanbo Projector
Model Number	:	WPA34, WPA31, WPA32, WPA33, WPA35, WPA36, WPA37, WPA38, WPA39, X5, X5 Air, X5 Pro, WPD21, WPD22, WPD23, WPD24, WPC91, WPC92, WPC93, WPC94, WPC31, WPC32, WPC33, WPC34, WPC11, WPC12, WPC13, WPC14, WPB21, X3, X3 Pro, X3 Air, X3 Max, WPB82, WPB83, WPA21, WPA24, WPE02, WPE03, WPE04, WPE05, WPD12, WPD13, WPD14, WPD15, WPL12, WPL13, WPL14, WPL15, WPC23, WPC25
Model Declaration	:	All the same except for the model name
Test Model	:	WPA34
Power Supply	:	AC 100-240V 50/60Hz 4A(Max)
Hardware version	:	ZY_352_X3_WB
Software version	:	WB_C445AFH031A

1.2 Wireless Function Tested in this Report

WiFi		
WLAN	:	Supported IEEE 802.11a/n/ac
WLAN FCC Operation Frequency	:	IEEE 802.11a: 5180-5240MHz IEEE 802.11ac VHT20: 5180-5240MHz IEEE 802.11ac VHT40: 5190-5230MHz IEEE 802.11ac VHT80: 5210MHz
WLAN Channel Number	:	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)
WLAN Modulation Technology	:	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	:	Internal Antenna, 4.07dBi(Antenna 1),4.56dBi(Antenna 2) 802.11n/ac support 2T2R.[Antenna 1 and Antenna 2]

Note 1: Antenna position refer to EUT Photos.

Note 2: the above information was supplied by the applicant.

1.3 EUT configuration

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

● supplied by the manufacturer

○ supplied by the lab

○	/	Model:	/
		Input:	/
		Output:	/

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 Innovation, Science and Economic Development Canada 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.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

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 **802.11ac VHT80_5210MHz**.

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 **802.11ac VHT80_5210MHz**

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case datarates 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	Antenna 1			Antenna 2			Simultaneously
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 Test Sample

The application provides 2 samples to meet requirement;

Sample ID	Description
TZ240505711–2#	Engineer sample – continuous transmit
TZ240505711–4#	Normal sample – Intermittent 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 engineer mode (adb command V1.0.32) provided by application.

3.3 Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	ASUS	X454L	15105-0038A100	/	/	/

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	**Description of Test**	**Sample ID**	**Result**
§15.407(a)	Maximum Conducted Output Power	TZ240505711–1#	Compliant
§15.407(a)	Power Spectral Density	TZ240505711–1#	Compliant
§15.407(a)	26dB Bandwidth	TZ240505711–1#	Compliant
/	99% Occupied Bandwidth	TZ240505711–1#	Note 1
§15.407(b)	Radiated Emissions	TZ240505711–1#& TZ240505711–2#	Compliant
§15.407(b)	Band edge Emissions	TZ240505711–1#	Compliant
§15.205	Emissions at Restricted Band	TZ240505711–1#	Compliant
§15.407(g)	Frequency Stability	TZ240505711–1#	Compliant
§15.207(a)	Line Conducted Emissions	TZ240505711–2#	Compliant
§15.203	Antenna Requirements	N/A	Compliant

Note: only for report purpose.

Remark: The measurement uncertainty is not included in the test result.

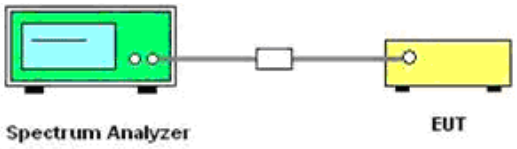
5 TEST RESULT

5.1 On Time and Duty Cycle

5.1.1 Standard Applicable

None; for reporting purpose only.

5.1.2 Block Diagram of Test Setup



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 result

Pass

Remark:

1. Please refer to Appendix F of Appendix Test Data for RLAN(5.2G);

5.2 Maximum Conducted Output Power Measurement

5.2.1 Standard Applicable

(1) For the band 5.15-5.25 GHz.

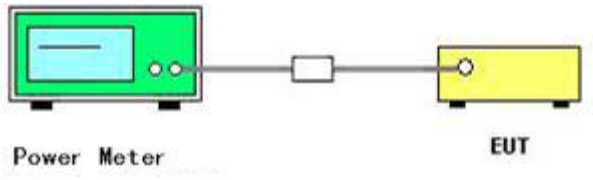
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the 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 e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.2 Block Diagram of Test Setup



5.2.3 Test Procedures

The transmitter output (antenna port) was connected to the power meter.

According to KDB 789033 D02 Section 3 (a) Method PM (Measurement using an RF average power meter):

Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

The EUT is configured to transmit continuously or to transmit with a constant duty cycle.

At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.

The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

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

Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

5.2.4 Test Results

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. For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;
4. Directional gain = 10 log[(10G1 /10 + 10G2 /10 + … + 10GN /10)/NANT] dBi, where antenna gains given by G1, G2, …, GN dBi, NANT is the antennas total Number if applicable.
5. Report conducted power = Measured conducted average power + Duty Cycle factor;
6. Please refer to Appendix B of Appendix Test Data for RLAN(5.2G);

5.3 Power Spectral Density Measurement

5.3.1 Standard Applicable

For 5150~5250MHz

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.note1

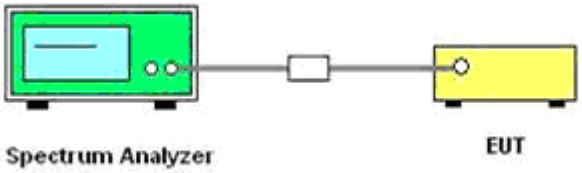
(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.note1

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2 Block Diagram of Test Setup



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 Results

Pass

Remark:

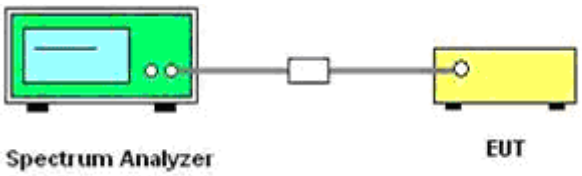
1. Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;
4. Directional gain = 10 log[(10G1 /10 + 10G2 /10 + … + 10GN /10)/NANT] dBi, where antenna gains given by G1, G2, …, GN dBi, NANT is the antennas total Number if applicable;
5. Report conducted PSD = Measured conducted PSD + Duty Cycle factor;
6. Please refer to Appendix C of Appendix Test Data for RLAN(5.2G);

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 Block Diagram of Test Setup



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 Results

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. Please refer to Appendix A of Appendix Test Data for RLAN(5.2G);

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.Android 10-6.218	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

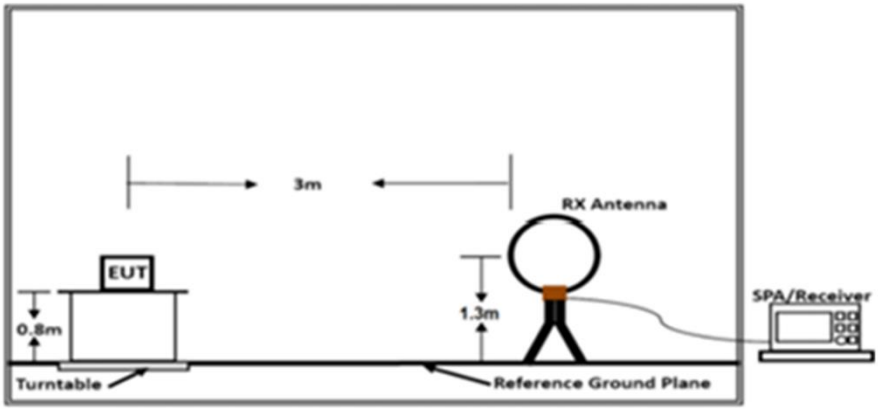
Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

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

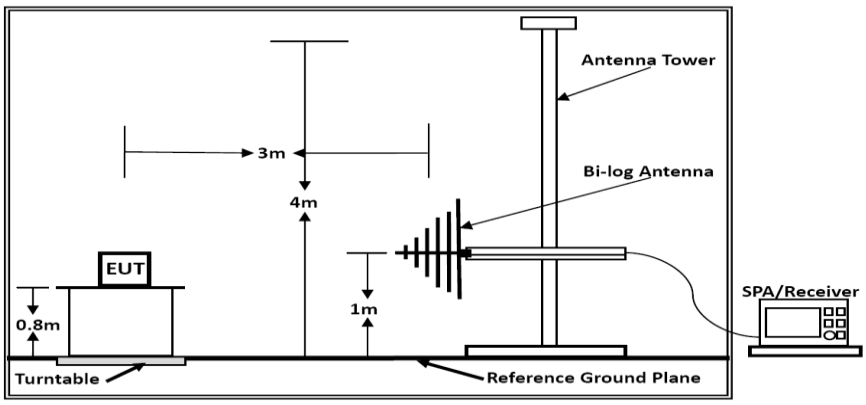
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

5.5.3 Block Diagram of Test Setup

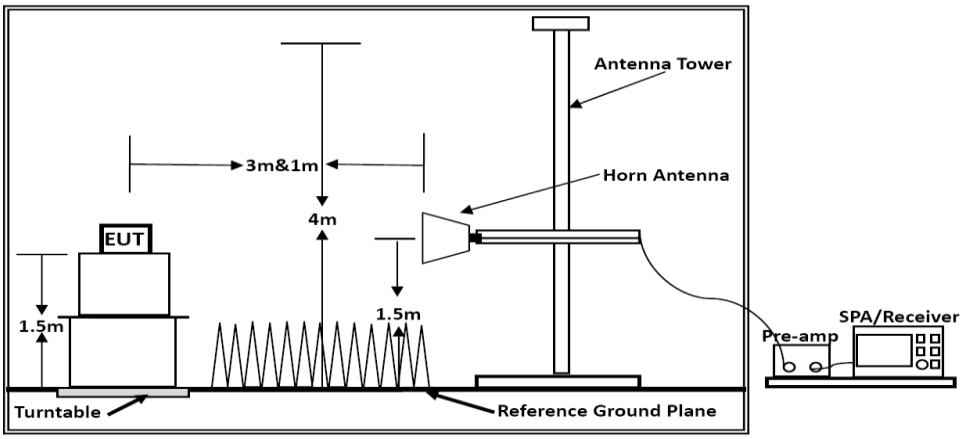
For radiated emissions below 30MHz



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].

5.5.4 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 1.3 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.

5.5.5 Test Results

Pass

5.5.5.1 Results of Radiated Emissions (9 KHz~30MHz)

Temperature	24℃	Humidity	55.2%
Test Engineer	Allen Lai	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);

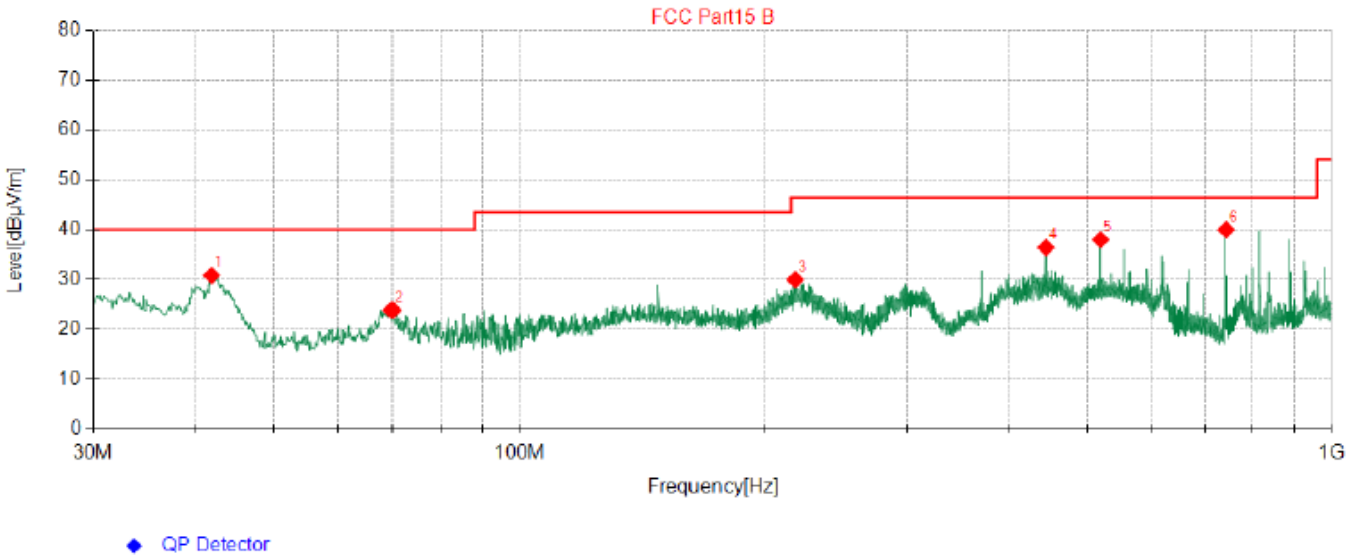
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.5.2 Results of Radiated Emissions (30MHz~1GHz)

Temperature	24℃	Humidity	55.2%
Test Engineer	Allen Lai	Configurations	IEEE 802.11a/n/ac

Below 1GHz

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	42.00	45.18	-14.36	30.82	40.00	9.18	100	207	Vertical
2	69.89	42.06	-18.18	23.88	40.00	16.12	100	344	Vertical
3	218.6	44.84	-14.85	29.99	46.50	16.51	100	338	Vertical
4	445.0	45.58	-9.15	36.43	46.50	10.07	100	252	Vertical
5	519.7	45.58	-7.58	38.00	46.50	8.50	100	64	Vertical
6	741.8	43.75	-3.74	40.01	46.50	6.49	100	114	Vertical

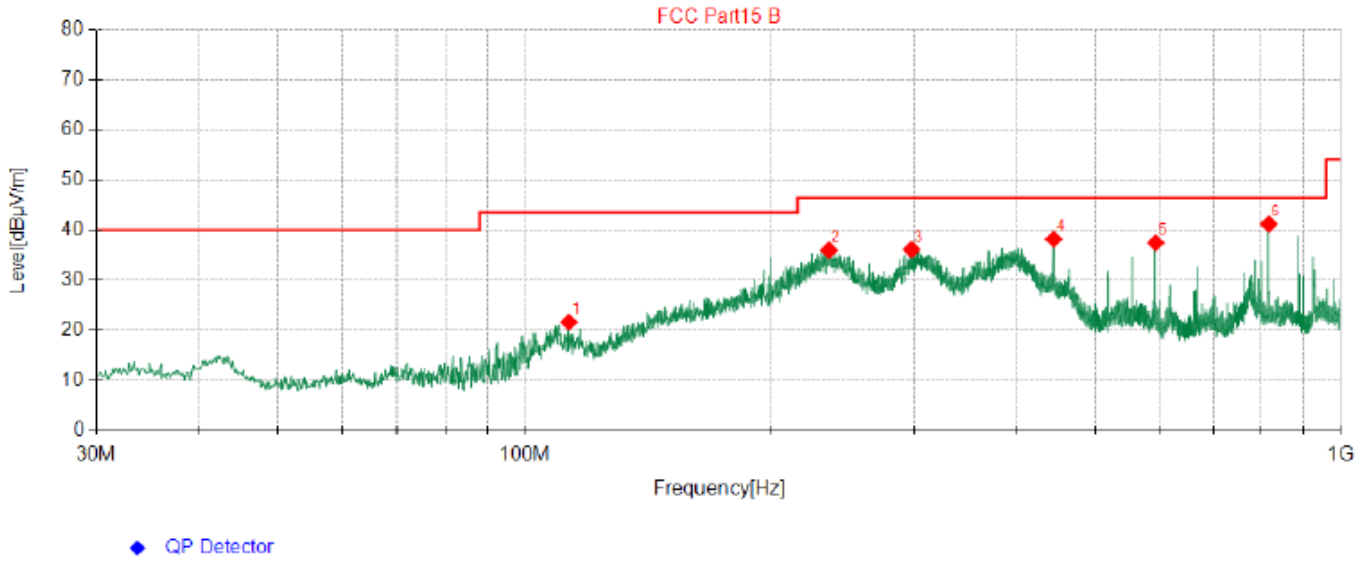
****Note:*

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]

2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]

3.Pre-scan all modes and recorded the worst case results in this report.

Horizontal



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	113.2	38.23	-16.55	21.68	43.50	21.82	100	188	Horizontal
2	236.1	50.28	-14.30	35.98	46.50	10.52	100	68	Horizontal
3	298.0	48.99	-12.85	36.14	46.50	10.36	100	225	Horizontal
4	445.0	47.35	-9.15	38.20	46.50	8.30	100	247	Horizontal
5	593.4	43.20	-5.75	37.45	46.50	9.05	100	289	Horizontal
6	816.7	43.79	-2.59	41.20	46.50	5.30	100	337	Horizontal

****Note:*

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]

2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]

3.Pre-scan all modes and recorded the worst case results in this report.

5.5.5.3 Results for Radiated Emissions (1GHz~40GHz)

Temperature	24℃	Humidity	56%
Test Engineer	Allen Lai	Configurations	IEEE 802.11a/n/ac

Remark: Measured all modes and recorded worst case;

IEEE 802.11a

Channel 36 / 5180 MHz

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
15.54	53.66	33.06	35.04	3.94	55.62	68.20	12.58	Peak	Horizontal
15.54	40.23	33.06	35.04	3.94	42.19	54.00	11.81	Average	Horizontal
15.54	52.16	33.06	35.04	3.94	54.12	68.20	14.08	Peak	Vertical
15.54	40.87	33.06	35.04	3.94	42.83	54.00	11.17	Average	Vertical

Channel 40 / 5200 MHz

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
15.60	52.98	33.16	35.15	3.96	54.95	68.20	13.25	Peak	Horizontal
15.60	40.45	33.16	35.15	3.96	42.42	54.00	11.58	Average	Horizontal
15.60	52.74	33.16	35.15	3.96	54.71	68.20	13.49	Peak	Vertical
15.60	42.22	33.16	35.15	3.96	44.19	54.00	9.81	Average	Vertical

Channel 48 / 5240 MHz

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
15.72	52.91	33.26	35.14	3.98	55.01	68.20	13.19	Peak	Horizontal
15.72	43.23	33.26	35.14	3.98	45.33	54.00	8.67	Average	Horizontal
15.72	53.77	33.26	35.14	3.98	55.87	68.20	12.33	Peak	Vertical
15.72	43.01	33.26	35.14	3.98	45.11	54.00	8.89	Average	Vertical

IEEE 802.11n-HT20

Channel 36 / 5180 MHz

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
15.54	55.38	33.06	35.04	3.94	57.34	68.20	10.86	Peak	Horizontal
15.54	41.11	33.06	35.04	3.94	43.07	54.00	10.93	Average	Horizontal
15.54	54.99	33.06	35.04	3.94	56.95	68.20	11.25	Peak	Vertical
15.54	44.89	33.06	35.04	3.94	46.85	54.00	7.15	Average	Vertical

Channel 40 / 5200 MHz

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
15.60	51.71	33.16	35.15	3.96	53.68	68.20	14.52	Peak	Horizontal
15.60	41.64	33.16	35.15	3.96	43.61	54.00	10.39	Average	Horizontal
15.60	54.14	33.16	35.15	3.96	56.11	68.20	12.09	Peak	Vertical
15.60	41.46	33.16	35.15	3.96	43.43	54.00	10.57	Average	Vertical

Channel 48 / 5240 MHz

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
15.72	52.02	33.26	35.14	3.98	54.12	68.20	14.08	Peak	Horizontal
15.72	41.08	33.26	35.14	3.98	43.18	54.00	10.82	Average	Horizontal
15.72	54.01	33.26	35.14	3.98	56.11	68.20	12.09	Peak	Vertical
15.72	42.48	33.26	35.14	3.98	44.58	54.00	9.42	Average	Vertical

IEEE 802.11ac VHT20

Channel 36 / 5180 MHz

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
15.54	54.89	33.06	35.04	3.94	56.85	68.20	11.35	Peak	Horizontal
15.54	42.17	33.06	35.04	3.94	44.13	54.00	9.87	Average	Horizontal
15.54	51.94	33.06	35.04	3.94	53.90	68.20	14.30	Peak	Vertical
15.54	42.64	33.06	35.04	3.94	44.60	54.00	9.40	Average	Vertical

Channel 40 / 5200 MHz

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
15.60	54.22	33.16	35.15	3.96	56.19	68.20	12.01	Peak	Horizontal
15.60	41.37	33.16	35.15	3.96	43.34	54.00	10.66	Average	Horizontal
15.60	54.33	33.16	35.15	3.96	56.30	68.20	11.90	Peak	Vertical
15.60	41.87	33.16	35.15	3.96	43.84	54.00	10.16	Average	Vertical

Channel 48 / 5240 MHz

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
15.72	55.89	33.26	35.14	3.98	57.99	68.20	10.21	Peak	Horizontal
15.72	41.56	33.26	35.14	3.98	43.66	54.00	10.34	Average	Horizontal
15.72	53.05	33.26	35.14	3.98	55.15	68.20	13.05	Peak	Vertical
15.72	41.37	33.26	35.14	3.98	43.47	54.00	10.53	Average	Vertical

IEEE 802.11n HT40

Channel 38 / 5190 MHz

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
15.57	54.97	33.06	35.04	3.94	56.93	68.20	11.27	Peak	Horizontal
15.57	44.31	33.06	35.04	3.94	46.27	54.00	7.73	Average	Horizontal
15.57	55.08	33.06	35.04	3.94	57.04	68.20	11.16	Peak	Vertical
15.57	44.79	33.06	35.04	3.94	46.75	54.00	7.25	Average	Vertical

Channel 46 / 5230 MHz

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
15.69	52.93	33.16	35.15	3.96	54.90	68.20	13.30	Peak	Horizontal
15.69	41.92	33.16	35.15	3.96	43.89	54.00	10.11	Average	Horizontal
15.69	54.37	33.16	35.15	3.96	56.34	68.20	11.86	Peak	Vertical
15.69	40.65	33.16	35.15	3.96	42.62	54.00	11.38	Average	Vertical

IEEE 802.11ac VHT40

Channel 38 / 5190 MHz

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
15.57	53.73	33.06	35.04	3.94	55.69	68.20	12.51	Peak	Horizontal
15.57	40.66	33.06	35.04	3.94	42.62	54.00	11.38	Average	Horizontal
15.57	53.42	33.06	35.04	3.94	55.38	68.20	12.82	Peak	Vertical
15.57	40.85	33.06	35.04	3.94	42.81	54.00	11.19	Average	Vertical

Channel 46 / 5230 MHz

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
15.69	54.09	33.16	35.15	3.96	56.06	68.20	12.14	Peak	Horizontal
15.69	40.57	33.16	35.15	3.96	42.54	54.00	11.46	Average	Horizontal
15.69	52.60	33.16	35.15	3.96	54.57	68.20	13.63	Peak	Vertical
15.69	44.80	33.16	35.15	3.96	46.77	54.00	7.23	Average	Vertical

IEEE 802.11ac VHT80

Channel 42 / 5210 MHz

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
15.63	55.87	33.06	35.04	3.94	57.83	68.20	10.37	Peak	Horizontal
15.63	40.91	33.06	35.04	3.94	42.87	54.00	11.13	Average	Horizontal
15.63	56.21	33.06	35.04	3.94	58.17	68.20	10.03	Peak	Vertical
15.63	44.75	33.06	35.04	3.94	46.71	54.00	7.29	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. Measured Level= Reading + Ant. Fac - Pre. Fac. + Cab. Loss; Over limit dB = Measured Level- Limit Line