FCC TEST REPORT

Test report
On Behalf of
TECNO MOBILE LIMITED
For
Mini PC
Model No.:M1AA

FCC ID: 2ADYY-M1AA

Prepared for : **TECNO MOBILE LIMITED**
FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG

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: **31 July 2023~ 08 October 2023**
Date of Report: **09 October 2023**
Report Number: **TZ230904884-NII-1**

TEST RESULT CERTIFICATION

Applicant's name..................	**TECNO MOBILE LIMITED**
Address	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Manufacture's Name	**TECNO MOBILE LIMITED**
Address	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Product description	
Trade Mark	TECNO
Product name	Mini PC
Model and/or type reference	M1AA
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............ :	**31 July 2023~ 08 October 2023**
Date of Issue .... :	**09 October 2023**
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	09 October 2023	Initial Issue	Andy Zhang

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	: Mini PC	
Model Number	: M1AA	
Model Declaration	: NA	
Test Model	: M1AA	
Power Supply	: DC 19 by Adapter	
Hardware version	: NUCAL02_MB_V30	
Software version	: Windows 11	
Sample ID	: TZ230904884–1#	TZ230904884–2#

1.2 Wireless Function Tested in this Report

WiFi	
WLAN	: Supported IEEE 802.11a/n/ac/ax
WLAN FCC Operation Frequency	: IEEE 802.11n HT20: 5180-5240MHz /5260-5320MHz/ 5500-5700MHz/ 5745-5825MHz IEEE 802.11n HT40: 5190-5230MHz / 5270-5310MHz/5510-5670MHz/ 5755-5795MHz IEEE 802.11a: 5180-5240MHz /5260-5320MHz/ 5500-5700MHz/ 5745-5825MHz IEEE 802.11ac VHT20: 5180-5240MHz /5260-5320MHz/ 5500-5700MHz/ 5745-5825MHz IEEE 802.11ac VHT40: 5190-5230MHz / 5270-5310MHz/5510-5670MHz/ 5755-5795MHz IEEE 802.11ac VHT80: 5210MHz/ 5290MHz / 5530MHz/5610MHz/5775MHz IEEE 802.11ax VHT20: 5180-5240MHz /5260-5320MHz/ 5500-5700MHz/ 5745-5825MHz IEEE 802.11ax VHT40: 5190-5230MHz / 5270-5310MHz/5510-5670MHz/ 5755-5795MHz IEEE 802.11ax VHT80: 5210MHz/ 5290MHz / 5530MHz/5610MHz/5775MHz IEEE 802.11ax VHT160: 5250MHz/ 5570MHz
WLAN Channel Number	: 24 Channels for 5180-5825MHz (IEEE 802.11a/ac VHT20/n HT20/ax VHT20) 11 Channels for 5190-5795MHz (IEEE 802.11ac VHT40/n HT40/ax VHT40) 5 Channels for 5210-5775MHz (IEEE 802.11ac /axVHT80) 2 Channels for 5250-5570MHz (IEEE 802.11ax VHT160)
WLAN Modulation Technology	: IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM,QPSK,BPSK) IEEE 802.11ax: OFDM (256QAM, 64QAM, 16QAM, 1024QAM, QPSK, BPSK)
Antenna Type And Gain	: Antenna 1:8.35dBi(Max.), for TX/RX (WLAN 5.2G,5.3G,5.6G,5.8G Band) Antenna 2:7.24dBi(Max.), for TX/RX (WLAN 5.2G,5.3G,5.6G,5.8G Band)

Note 1: Antenna position refer to EUT Photos.

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

Note 3: Models difference

Model	CPU
M1AA	i5
M1AA	i7
The main test is M1AA (i7)	

1.3 EUT configuration

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

- ● supplied by themanufacturer
- ○ supplied by thelab

○	Adapter	Model:	MS-Z6320R190-120D0-E
		Input:	100-240V~50/60Hz 2.0A max
		Output:	120.0W 19.0Vdc,6.32A

1.4 External I/O Cable

I/O Port Description	Quantity	Cable
HDMI	1	NA

1.5 Description of Test Facility

NA

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

1.6 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.

1.7 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.

1.8 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 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be Transfer between USB Disk and SD card mode and recorded in this report.

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, which was determined to be Transfer between USB Disk and SD card mode and recorded in this report.

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 802.11ax VHT20 Mode: MCS0

IEEE 802.11nHT20 Mode: MCS0

IEEE 802.11ac VHT40 Mode: MCS0

IEEE 802.11ax VHT40 Mode: MCS0

IEEE 802.11nHT40 Mode: MCS0

IEEE 802.11ac VHT80 Mode: MCS0

IEEE 802.11ax VHT80 Mode: MCS0

IEEE 802.11ax VHT160 Mode: MCS0

Antenna & Bandwidth

Antenna	Single (Port.1)				Two (Port.1 + Port.2)			
Bandwidth Mode	20MHz	40MHz	80MHz	160MHz	20MHz	40MHz	80MHz	160MHz
IEEE 802.11a	☐	☐	☐	☐	☑	☐	☐	☐
IEEE 802.11n	☐	☐	☐	☐	☑	☑	☐	☐
IEEE 802.11ac	☐	☐	☐	☐	☑	☑	☑	☐
IEEE 802.11ax	☐	☐	☐	☐	☑	☑	☑	☑

2 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard ofProcedures for Compliance Testing ofUnlicensed 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 v02r01and KDB 662911 are required to be used for this kind of FCC15.407UII device.

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

2.3 Test Sample

The application provides2 samples to meet requirement;

Sample ID	Description
TZ230904884–2#	WLAN Engineer sample –continuous transmit
TZ230904884–4#	Normal sample – Intermittent transmit

3 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 software (DRTU) provided by application.

3.3 Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	Monitor	HP	DX2700	CNG7140T7P	/	/	/
2	SD Card	Kingston	/	/	/	/	/
3	USB Disk	Kingston	/	/	/	/	/

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 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	TZ230904884–1#	Compliant
§15.407(a)	Power Spectral Density	TZ230904884–1#	Compliant
§15.407(a)	26dB Bandwidth	TZ230904884–1#	Compliant
/	99% Occupied Bandwidth	TZ230904884–1#	Note 1
§15.407(b)	Radiated Emissions	TZ230904884–1#&TZ230904884–2#	Compliant
§15.407(b)	Band edge Emissions	TZ230904884–1#	Compliant
§15.205	Emissions at Restricted Band	TZ230904884–1#	Compliant
§15.407(g)	Frequency Stability	TZ230904884–1#	Compliant
§15.207(a)	Line Conducted Emissions	TZ230904884–2#	Compliant
§15.203	Antenna Requirements	N/A	Compliant

Note: only for report purpose.

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

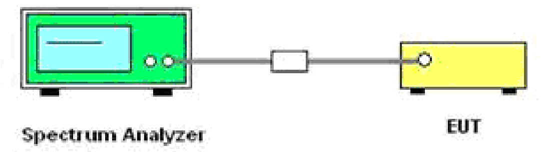
5 5. TEST RESULT

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

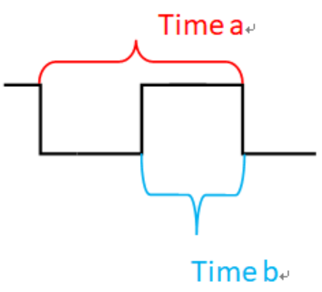


5.1.3 Test Procedures

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

Note:



Duty Cycle(%)=Time b / Time a*100

Correction Factor(dB)=10log(1/ Duty Cycle)

Pass

Remark:

1. Please refer to Appendix G of Appendix Test Data for RLAN(5G);

5.2 Maximum Conducted Output Power Measurement

5.2.1 Standard Applicable

(1) For the band 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 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,5.25-5.35 GHz and 5.47-5.725 GHz 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.

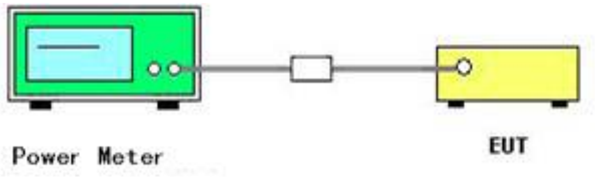
(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without 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 band 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz, 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.

(2)For 5.725-5.85GHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. 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.

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):

1. 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.

2. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.
3. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
4. 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. MIMO Total Power=10log$(10^{(\text{Report conducted power ANT1 }/10)} + 10^{(\text{Report conducted power ANT2 }/10)})$
7. Please refer to Appendix B of Appendix Test Data for RLAN(5G);

5.3 Power Spectral Density Measurement

5.3.1 Standard Applicable

For 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz

(i) For an outdoor access point operating in the band 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 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,5.25-5.35 GHz and 5.47-5.725 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,5.25-5.35 GHz and 5.47-5.725 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.

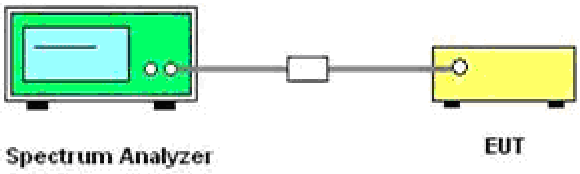
(iv) For mobile and portable client devices in the 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. [note1]

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.

For 5.725-5.85GHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. 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.

5.3.2 Block Diagram of Test Setup



5.3.3 Test Procedures

For 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz

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 ofthe 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, theentire 99% occupied bandwidth) of the signal using the instrument's band powermeasurement 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 spectrumlevels (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 computethe average power during the actual transmission times (because the measurementrepresents 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.

For 5.725-5.85GHz

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 = 510 KHz.

4. Set the VBW ≥ 3*RBW

5. Span=Encompass the entire emissions bandwidth (EBW) of the signal

6. Detector = RMS.

7. Sweep time = auto couple.

8. Trace mode = max hold.

9. Allow trace to fully stabilize.

10. If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolutionbandwidth of the spectrum analyzer set during measurement.

11. If measurement bandwidth of Maximum PSD is specified in 1 MHz, add10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reducedresolution bandwidth of spectrum analyzer set during measurement.

12. Care must be taken to ensure that the measurements are performed during a period ofcontinuous transmission or are corrected upward for duty cycle.

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. MIMO Total PSD=10log$(10^{(\text{Report conducted PSD ANT1}/10)} + 10^{(\text{Report conducted PSD ANT2}/10)})$
7. Please refer to Appendix C of Appendix Test Data for RLAN(5G);

5.4 99%Occupied Bandwidth ,26dBEmission Bandwidth Measurement and 6dBEmission Bandwidth Measurement

5.4.1 Standard Applicable

For 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz

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

For 5.725-5.85GHz

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

5.4.2 Test Procedures

For 5.15-5.25 GHz,5.25-5.35 GHz and 5.47-5.725 GHz

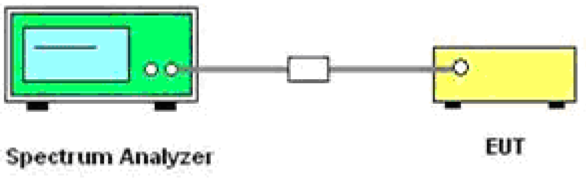
1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW =approximately 1% of the emission bandwidth.
3. Set the VBW ≥3 * RBW
4. Measured the spectrum width with power higher than 26dB below carrier.

For 5.725-5.85GHz

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

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW = 100 KHz
3. Set the VBW >RBW
4. Measured the spectrum width with power higher than 6dB below carrier.

5.4.3 Test Setup Layout



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(5G);

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	10^{th} 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 1.3 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 movementbetween 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.

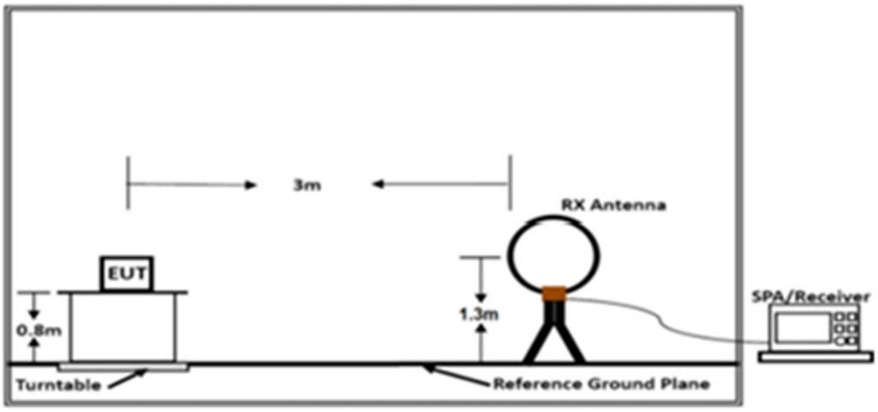
Final measurement:

--- 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.

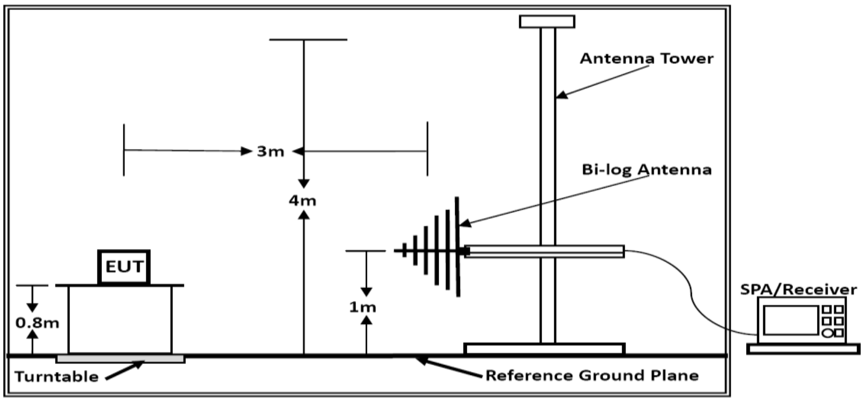
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.5.4 Block Diagram of Test Setup

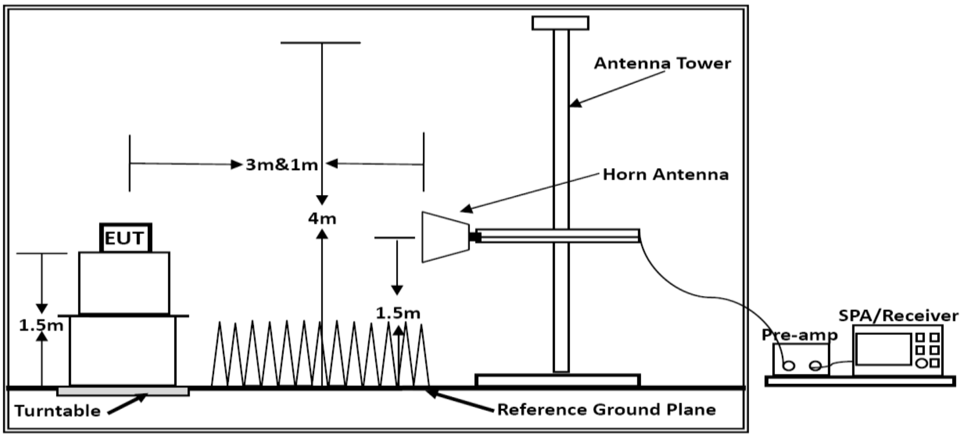
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20dB/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 Test Results

Pass

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

Temperature	24℃	Humidity	55.2%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a/n/ac/ax

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 permissiblevalue has no need to be reported.

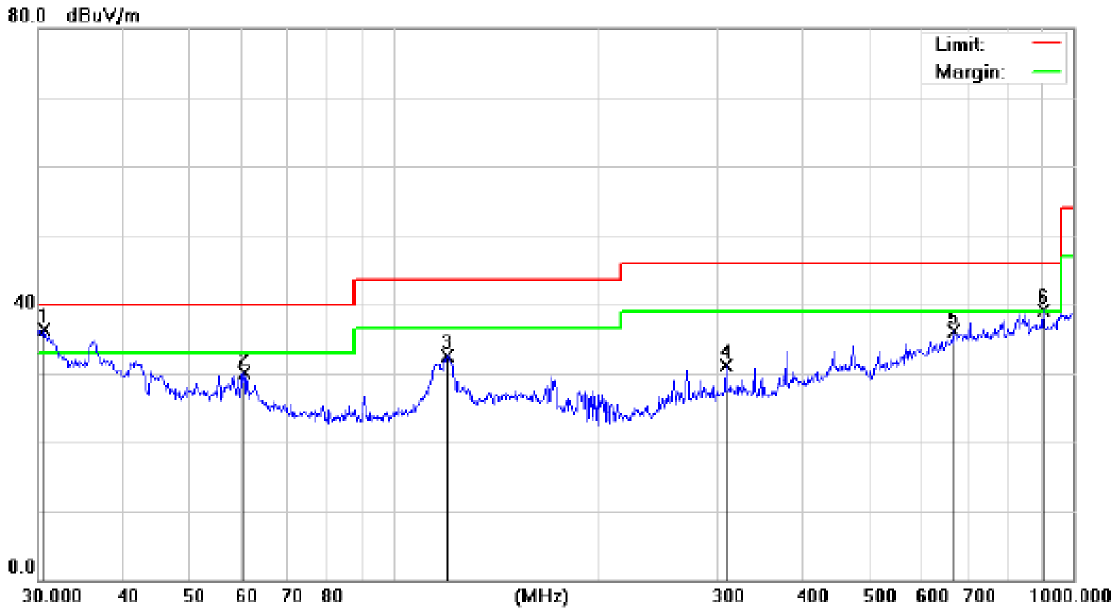
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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	Anna Hu	Configurations	IEEE 802.11a/n/ac/ax

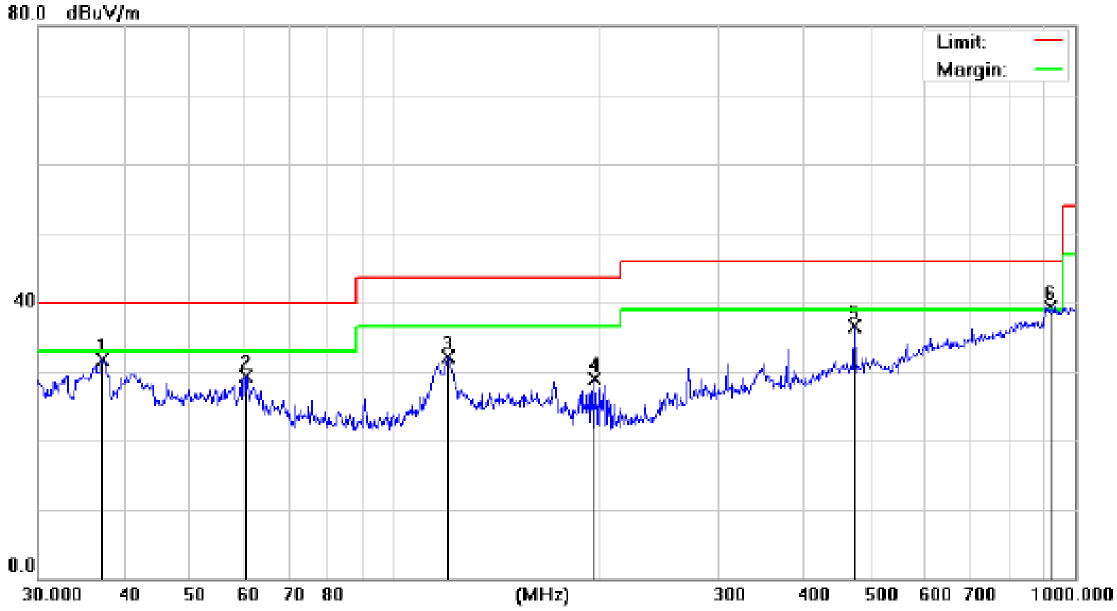
Note：The Worst Test result for5.6G ac80 Hign Channel
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	30.6379	34.08	2.20	36.28	40.00	-3.72	QP
2		60.2801	28.24	1.92	30.16	40.00	-9.84	QP
3		119.8556	31.39	1.16	32.55	43.50	-10.95	QP
4		307.8313	28.61	2.44	31.05	46.00	-14.95	QP
5		668.1423	25.96	10.10	36.06	46.00	-9.94	QP
6	!	903.3094	24.69	14.34	39.03	46.00	-6.97	QP

Remark:
All emissions not reported were more than 20dB below the specified limit or in the noise floor.
Freq. = Emission frequency in MHz
Reading level (dBµV) = Receiver reading
Corr. Factor (dB) = Antenna factor + Cable loss - Amplifier factor.
Measurement (dBµV/m) = Reading level (dBµV) + Corr. Factor (dB)
Over (dB) = Measurement (dBµV/m) – Limit(dBµV/m)
All the x/y/z orientation has been investigated, and only worst case is presented in this report(5.6G ac80 Hign Channel).

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		37.2855	48.22	-16.54	31.68	40.00	-8.32	QP
2		60.7044	45.98	-16.70	29.28	40.00	-10.72	QP
3		119.8556	48.95	-16.83	32.12	43.50	-11.38	QP
4		196.5098	45.77	-16.82	28.95	43.50	-14.55	QP
5		473.8347	53.64	-17.22	36.42	46.00	-9.58	QP
6	*	919.2866	53.93	-14.63	39.30	46.00	-6.70	QP

Remark:
All emissions not reported were more than 20dB below the specified limit or in the noise floor.
Freq. = Emission frequency in MHz
Reading level (dBμV) = Receiver reading
Corr. Factor (dB) = Antenna factor + Cable loss - Amplifier factor.
Measurement (dBμV/m) = Reading level (dBμV) + Corr. Factor (dB)
Over (dB) = Measurement (dBμV/m) – Limit(dBμV/m)
All the x/y/z orientation has been investigated, and only worst case is presented in this report(5.6G ac80 Hign Channel).

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

Temperature	24℃	Humidity	56%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a

Remark: Measured all modes and recorded worst case;

IEEE 802.11a

Freq. (MHz)	Low channel: 5180MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
10360	V	58.08	40.63	74	54	-15.92	-13.37
15540	V	58.10	40.20	74	54	-15.90	-13.80
10360	H	59.59	40.93	74	54	-14.41	-13.07
15540	H	58.42	39.42	74	54	-15.58	-14.58

Freq. (MHz)	Low channel: 5240MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
10480	V	59.23	40.90	74	54	-14.77	-13.10
15720	V	59.35	40.47	74	54	-14.65	-13.53
10480	H	59.21	39.24	74	54	-14.79	-14.76
15720	H	58.93	39.93	74	54	-15.07	-14.07

Freq. (MHz)	Low channel: 5260MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
10520	V	58.68	40.71	74	54	-15.32	-13.29
15780	V	58.82	40.46	74	54	-15.18	-13.54
10520	H	59.08	40.95	74	54	-14.92	-13.05
15780	H	58.19	39.19	74	54	-15.81	-14.81

Freq. (MHz)	Low channel: 5320MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
10640	V	58.53	39.63	74	54	-15.47	-14.37
15960	V	59.23	39.27	74	54	-14.77	-14.73
10640	H	58.01	40.14	74	54	-15.99	-13.86
15960	H	58.34	39.34	74	54	-15.66	-14.66

Freq. (MHz)	Low channel: 5500MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11000	V	60.20	40.31	74	54	-13.80	-13.69
16500	V	59.85	40.67	74	54	-14.15	-13.33
11000	H	59.77	39.01	74	54	-14.23	-14.99
16500	H	59.70	40.70	74	54	-14.30	-13.30

Freq. (MHz)	Low channel: 5700MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11400	V	59.88	39.23	74	54	-14.12	-14.77
17100	V	59.39	40.08	74	54	-14.61	-13.92
11400	H	59.94	40.69	74	54	-14.06	-13.31
17100	H	58.26	39.26	74	54	-15.74	-14.74

Freq. (MHz)	Low channel: 5745MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11490	V	60.40	40.08	74	54	-13.60	-13.92
17235	V	58.57	40.81	74	54	-15.43	-13.19
11490	H	59.59	39.32	74	54	-14.41	-14.68
17235	H	58.88	39.88	74	54	-15.12	-14.12

Freq. (MHz)	Low channel: 5825MHz						
	Ant.Pol	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11650	V	60.25	40.40	74	54	-13.75	-13.60
17475	V	59.79	39.75	74	54	-14.21	-14.25
11650	H	59.93	39.35	74	54	-14.07	-14.65
17475	H	59.23	40.23	74	54	-14.77	-13.77

Notes:
1. All emissions not reported were more than 20dB below the specified limit or in the noise floor.
2. Emission Level= Reading Level+ Probe Factor +Cable Loss.
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.

5.6 Power line conducted emissions

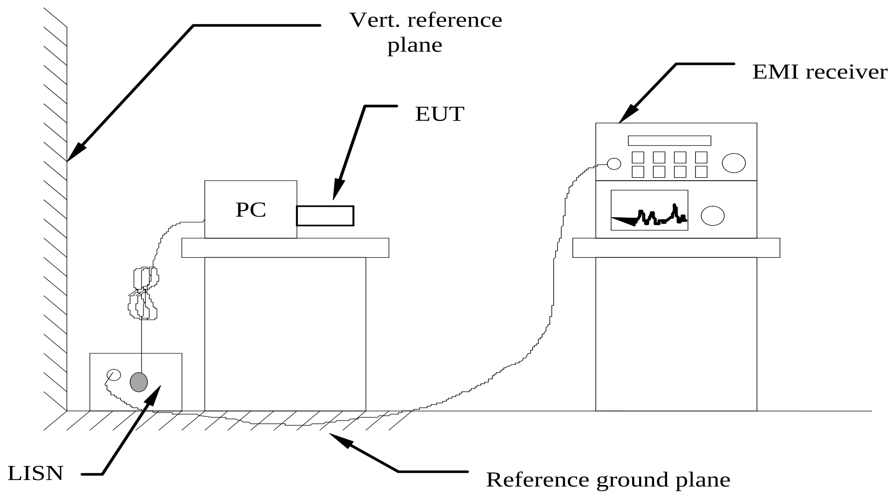
5.6.1 Standard Applicable

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

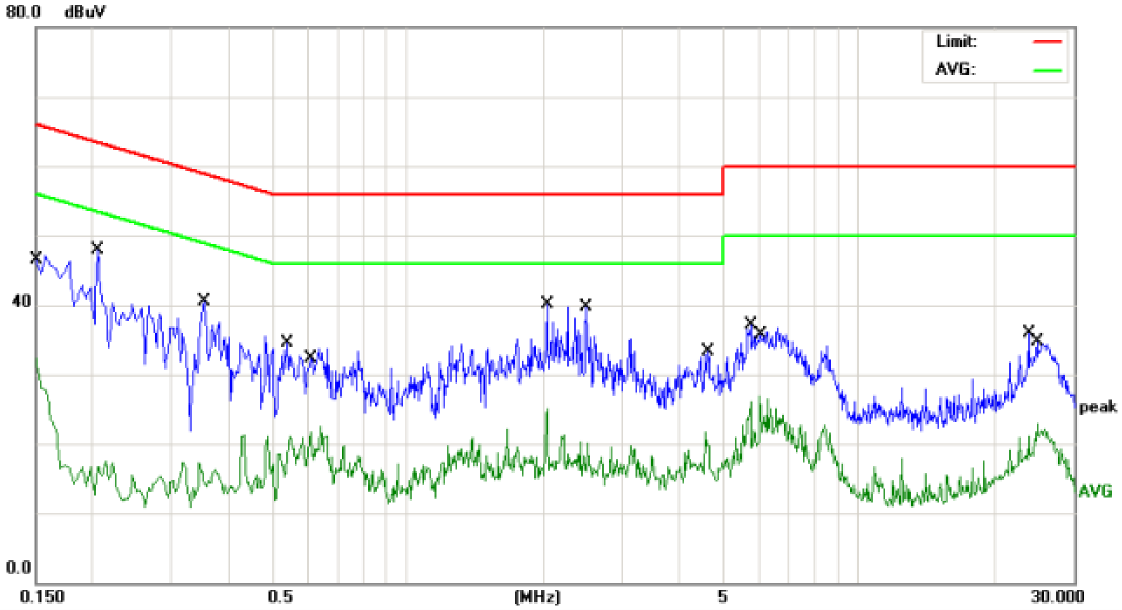
PASS.

Temperature	24.4℃	Humidity	55.2%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a/n/ac

The test data please refer to following page.

Note: *The Worst Test result for5.6G ac80 Hign Channel*

Live



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1516	20.17	10.45	30.62	55.91	-25.29	AVG
2	*	0.2060	37.36	10.45	47.81	63.36	-15.55	QP
3		0.3540	30.02	10.49	40.51	58.87	-18.36	QP
4		0.5420	24.02	10.52	34.54	56.00	-21.46	QP
5		0.6100	11.11	10.53	21.64	46.00	-24.36	AVG
6		2.0340	14.33	10.71	25.04	46.00	-20.96	AVG
7		2.4980	28.99	10.71	39.70	56.00	-16.30	QP
8		4.5739	10.96	10.74	21.70	46.00	-24.30	AVG
9		5.7460	26.27	10.75	37.02	60.00	-22.98	QP
10		6.0540	16.06	10.76	26.82	50.00	-23.18	AVG
11		23.8180	24.81	11.10	35.91	60.00	-24.09	QP
12		24.8180	11.69	11.12	22.81	50.00	-27.19	AVG

Note:

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Corr. Factor (dB) = Attenuation factor + Cable loss

Level (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

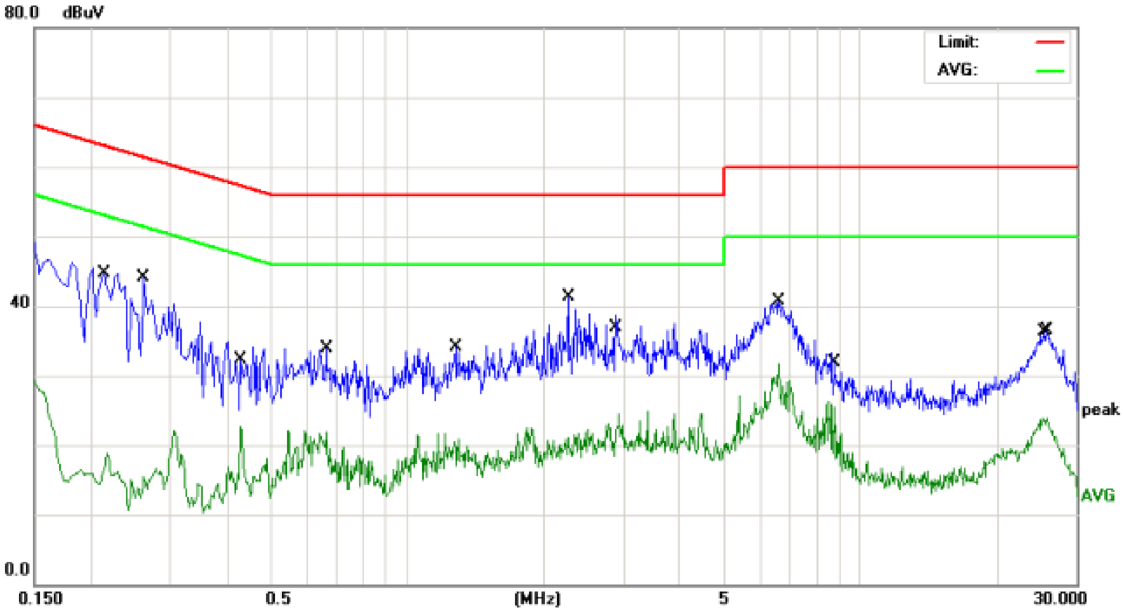
Limit (dBμV) = Limit stated in standard

Over (dB) = Level (dBµV) – Limits (dBµV)

Q.P. =Quasi-Peak

Pre-scan all modes and recorded the worst case results in this report (The Worst Test result for5.6G ac80 Hign Channel).

Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2140	34.34	10.45	44.79	63.04	-18.25	QP
2		0.2620	33.64	10.46	44.10	61.36	-17.26	QP
3		0.4300	12.25	10.50	22.75	47.25	-24.50	AVG
4		0.6620	11.31	10.53	21.84	46.00	-24.16	AVG
5		1.2820	23.50	10.60	34.10	56.00	-21.90	QP
6	*	2.2700	30.60	10.71	41.31	56.00	-14.69	QP
7		2.9340	13.83	10.72	24.55	46.00	-21.45	AVG
8		6.5940	29.95	10.77	40.72	60.00	-19.28	QP
9		6.5940	20.87	10.77	31.64	50.00	-18.36	AVG
10		8.8580	12.02	10.81	22.83	50.00	-27.17	AVG
11		25.2420	12.86	11.12	23.98	50.00	-26.02	AVG
12		25.7420	25.30	11.13	36.43	60.00	-23.57	QP

Note:

Freq. = Emission frequency in MHz

Reading level (dBµV) = Receiver reading

Corr. Factor (dB) = Attenuation factor + Cable loss

Level (dBµV) = Reading level (dBµV) + Corr. Factor (dB)

Limit (dBµV) = Limit stated in standard

Over (dB) = Level (dBμV) – Limits (dBμV)

Q.P. =Quasi-Peak

Pre-scan all modes and recorded the worst case results in this report (The Worst Test result for5.6G ac80 Hign Channel).

5.7 Undesirable Emissions Measurement

5.7.1 Limit

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.

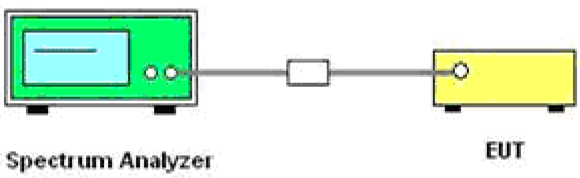
(e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(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.

5.7.2 Block Diagram of Test Setup



5.7.3 TestProcedure

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:

1. 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.

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

3. 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.

4. 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 (NANT), where NANT is the number of outputs.
- Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.

5. 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 Results

Please refer to Appendix E of Appendix Test Data for RLAN(5G);

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 internalantenna 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.”

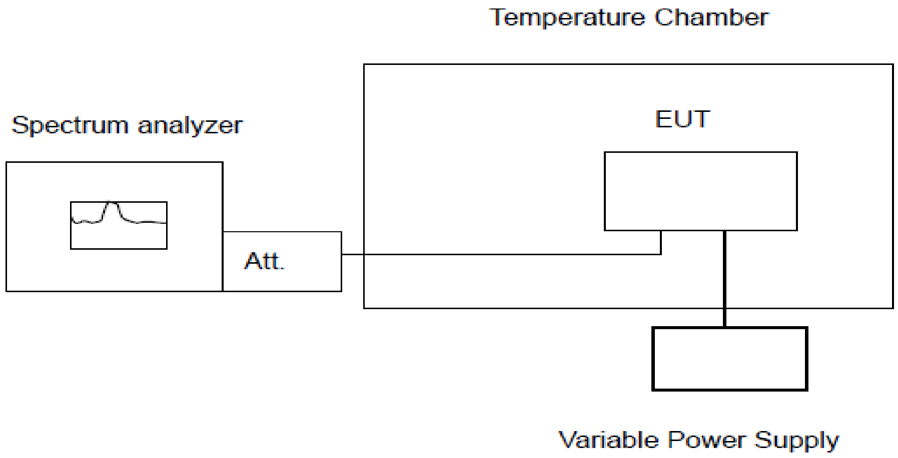
According to FCC §2.1055(a) “The frequency stability shall be measured with variation of ambient temperature as follows:”

(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 Block Diagram of Test Setup



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 with 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.
2. Please refer to AppendixD of Appendix Test Data for RLAN(5G);

5.10 DYNAMIC FREQUENCY SELECTION

LIMIT

According to § 15.407 (h) and FCC 06-96 appendix "compliance measurement procedures forunlicensed-national information infrastructure devices operating in the5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequencyselection".

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client(with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	**Client Without Radar Detection**
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	**Master Device or Client with Radar Detection**	**Client Without Radar Detection**
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. **Note 2:** Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. **Note3:** EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. **Note 2:** The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. **Note 3:** During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

Table 5 – Short Pulse Radar Test Waveforms

<table>
<tr><th>Radar Type</th><th>Pulse Width (µsec)</th><th>PRI (µsec)</th><th>Number of Pulses</th><th>Minimum Percentage of Successful Detection</th><th>Minimum Number of Trials</th></tr>
<tr><td>0</td><td>1</td><td>1428</td><td>18</td><td>See Note 1</td><td>See Note 1</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">1</td><td>Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a</td><td rowspan="2">$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^{6}}{\text{PRI}_{\mu sec}}\right)\right\}$</td><td rowspan="2">60%</td><td rowspan="2">30</td></tr>
<tr><td>Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A</td></tr>
<tr><td>2</td><td>1-5</td><td>150-230</td><td>23-29</td><td>60%</td><td>30</td></tr>
<tr><td>3</td><td>6-10</td><td>200-500</td><td>16-18</td><td>60%</td><td>30</td></tr>
<tr><td>4</td><td>11-20</td><td>200-500</td><td>12-16</td><td>60%</td><td>30</td></tr>
<tr><td colspan="4">Aggregate (Radar Types 1-4)</td><td>80%</td><td>120</td></tr>
<tr><td colspan="6">Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.</td></tr>
</table>

Table 6 – Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Table 7 – Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

DESCRIPTION OF EUT

Overview Of EUT With Respect To §15.407 (H) Requirements

The firmware installed in the EUT during testing was:

The EUT operates over the 5250-5350MHz and 5475-5725MHz range was a slave device associated with the master during these tests and it did not have radar detection + capability.The EUT uses one transmitter connected to 50-ohm coaxial antenna ports via a diversityswitch. Only one antennas port is connected to the test system since the EUT has one antennaonly.

The Slave device associated with the EUT during these tests does not have radar detection+capability.

WLAN traffic is generated by ping data from theMaster to the Slave in full motion video mode using the TFGEN software with UDP protocol.

The EUT utilizes the 802.11ac architecture, with a nominal channel bandwidth of 80MHz.

The Master Device is aaccess point support DFS.

Manufacturer’s Statement Regarding Uniform Channel Spreading

The end product implements an automatic channel selection feature at startup such that operationcommences on channels distributed across the entire set of allowed 5GHz channels. This featurewill ensure uniform spreading is achieved while avoiding non-allowed channels due to priorradar events.

TEST AND MEASUREMENT SYSTEM

System Overview

The measurement system is based on a conducted test method.

The short pulse and long pulse signal generating system utilizes the N7607B software. The VectorSignal Generator has been validated by the N7607B. The software selects waveform parameters from within the bounds of the signal type on arandom basis using uniform distribution.

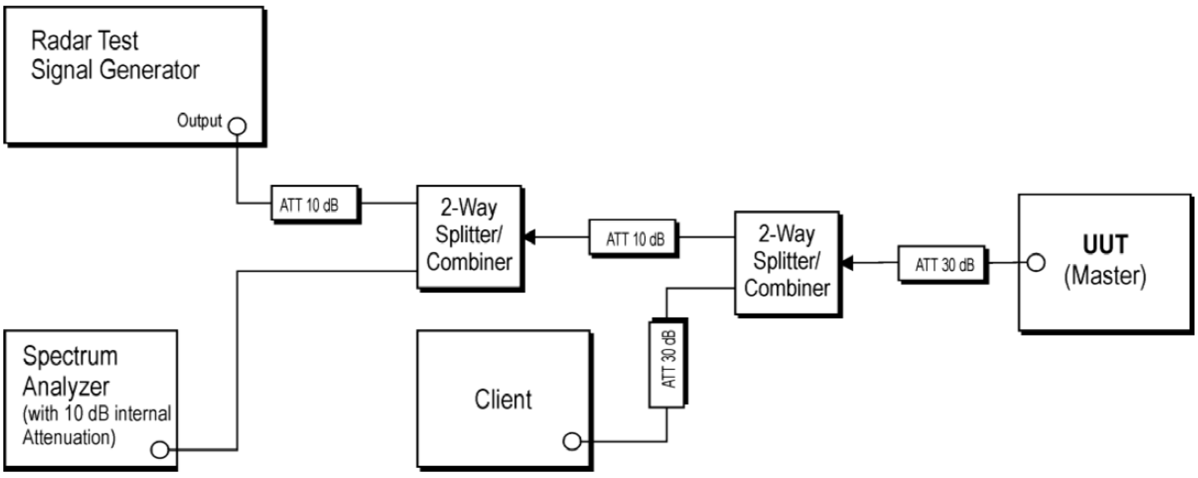
The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized atrun-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on theAugust 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-timeand each subsequent starting point is incremented by 475. Each frequency in the 100-lengthsegment is compared to the boundaries of the EUT Detection Bandwidth and the software createsa hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated FrequencyHopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency ofthe signal generator is incremented in 1 MHz steps from FL to FH for each successive trial. Thisincremental sequence is repeated as required to generate a minimum of 30 total trials and tomaintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer set to display 8001 bins on thehorizontal axis. The time-domain resolution is 2 msec / bin with a 16 second sweep time,meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated bymultiplying the number of bins above a threshold during a particular observation period by thedwell time per bin, with the analyzer set to peak detection and max hold. The time-domainresolution is 3 msec / bin with a 24 second sweep time, meeting the 22 second long pulsereporting criteria and allowing a minimum of 10 seconds after the end of the long pulsewaveform.

Should multiple RF ports be utilized for the Master and/or Slave devices (for example, fordiversity or MIMO implementations), 50 ohm termination would be removed from the splitter sothat connection can be established between splitter and the Master and/or Slave devices.

Conducted Method System Block Diagram



System Calibration

Connect the spectrum analyzer to the test system in place of the master device. Set the signal generator to CW mode. Adjust the amplitude of the signal generator to yield a measured level of –62 dBm on the spectrum analyzer.

Without changing any of the instrument settings, reconnect the spectrum analyzer to the Common port of the Spectrum Analyzer Combiner/Divider and connect a 50 ohm load to the Master Device port of the test system.

Measure the amplitude and calculate the difference from –62 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference. Confirm that the signal is displayed at –62 dBm. Readjust the RBW and VBW to 3 MHz, set the span to 10 MHz, and confirm that the signal is still displayed at –62 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –62 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

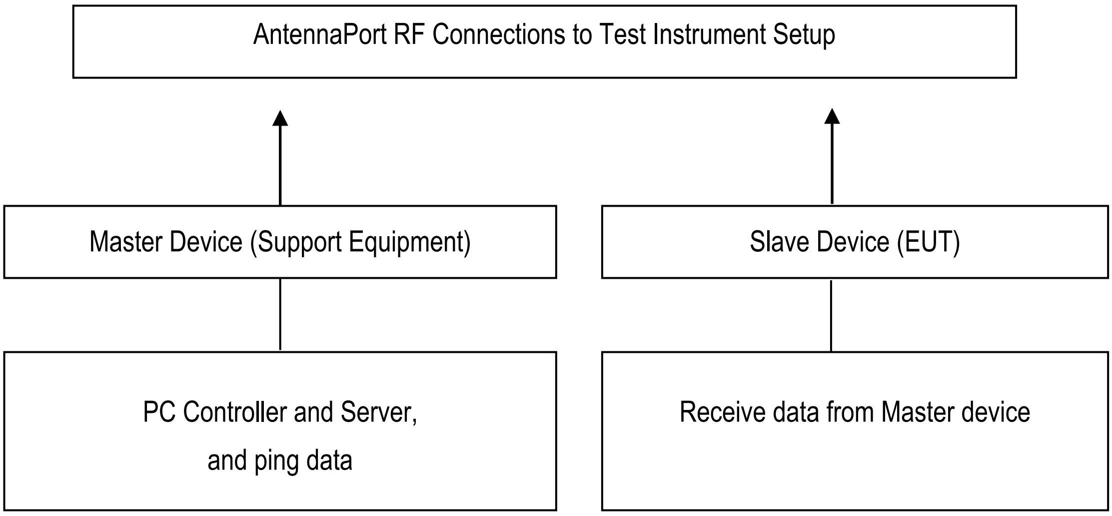
Set the signal generator to produce a radar waveform, trigger a burst manually and measure the level on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

Adjustment Of Displayed Traffic Level

Establish a link between the Master and Slave, adjusting the Link Step Attenuator as needed to provide a suitable received level at the Master and Slave devices. Ping data to generate WLAN traffic. Confirm that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold. Confirm that the displayed traffic is from the Master Device. For Master Device testing confirm that the displayed traffic does not include Slave Device traffic. For Slave Device testing confirm that the displayed traffic does not include Master Device traffic.

If a different setting of the Master Step Attenuator is required to meet the above conditions, perform a new System Calibration for the new Master Step Attenuator setting.

Test Setup


AntennaPort RF Connections to Test Instrument Setup
Master Device (Support Equipment)
Slave Device (EUT)
PC Controller and Server,
and ping data
Receive data from Master device

TEST RESULTS

No non-compliance noted

Please refer to Appendix F of Appendix Test Data for RLAN(5G);

TEST CHANNEL AND METHOD

All tests were performed at a channel center frequency of test frequency utilizing a conducted test method.

CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME

GENERAL REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. Thisdelta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =

(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated

Begins at (Reference Marker + 200 msec) and

Ends no earlier than (Reference Marker + 10 sec).

TEST RESULTS

Note: Please refer to Appendix F of Appendix Test Data for RLAN(5G);

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	2022/12/28	2023/12/27
2	Power Sensor	Agilent	U2021XA	MY5365004	2022/12/28	2023/12/27
3	Power Meter	Agilent	U2531A	TW53323507	2022/12/28	2023/12/27
4	Loop Antenna	schwarzbeck	FMZB1519B	00023	2022/11/13	2025/11/12
5	Wideband Antenna	schwarzbeck	VULB 9163	958	2022/11/13	2025/11/12
6	Horn Antenna	schwarzbeck	BBHA 9120D	01989	2022/11/13	2025/11/12
7	EMI Test Receiver	R&S	ESCI	100849/003	2022/12/28	2023/12/27
8	Controller	MF	MF7802	N/A	N/A	N/A
9	Amplifier	schwarzbeck	BBV 9743	209	2022/12/28	2023/12/27
10	Amplifier	Tonscend	TSAMP-0518 SE	--	2022/12/28	2023/12/27
11	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2022/12/28	2023/12/27
12	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2022/12/28	2023/12/27
12	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2022/12/28	2023/12/27
14	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
15	RE test software	Tonscend	JS32-RE	V0	N/A	N/A
16	Test Software	Tonscend	JS1120-3	V77.0418	N/A	N/A
17	Horn Antenna	A-INFO	LB-180400-KF	J211020657	2022/10/12	2024/10/11
18	Amplifier	CDSA	PAP-1840	17021	2022/10/10	2023/10/09
19	Spectrum Analyzer	R&S	FSP40	100550	2023/1/10	2024/1/9
20	MXA Signal Analyzer	Keysight	N9020A	54123254	2022/11/05	2023/11/04

7 TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8 EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9 INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

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