RF MEASUREMENT REPORT

FCC ID:	2AAJGR5020
Applicant:	Guangzhou Robustel Co., Ltd.
Product:	High Speed Smart 5G Router
Model No.:	R5020-5G-A09GL-A, R5020-5G-A09GL-B
Trade Mark:	robustel
FCC Classification:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s):	Part 15 Subpart E (Section 15.407)
Result:	Complies
Test Date:	2022-09-09 ~ 2022-09-27

Reviewed By: Vincent Yu

Approved By: Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB789033. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
2208RSU044-U2	Rev. 01	Initial Report	2022-11-08	Valid

CONTENTS

1. General Information

1.1. Applicant

Guangzhou Robustel Co., Ltd.

501, Building #2,63 Yongan Road, Huangpu District, Guangzhou

1.2. Manufacturer

Guangzhou Robustel Co., Ltd.

501, Building #2,63 Yongan Road, Huangpu District, Guangzhou

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China **Laboratory Location (Suzhou - SIP)** 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: L3261-190725				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	High Speed Smart 5G Router
Model No.	R5020-5G-A09GL-A, R5020-5G-A09GL-B
EUT Identification No.	20220817Sample#12
Wi-Fi Specification	802.11a/b/g/n/ac
Antenna Information	Refer to Section 1.7
Power Type	AC Adapter Input or PoE Input
Operating Environment	Vehicle Use and Indoor Use
Operating Temperature	-25 to +70 °C
Input Voltage	9 to 36V DC (without Ignition sensing) 10 to 30V DC (with Ignition sensing)
Accessories	
Adapter	Model: GQ24-120150-AX Input: 100-240V ~ 50/60Hz, 1.0A Max Output: 12.0V, 1.5A, 18W
Remark: 1. This device contains a certified WCDMA/LTE/5G NR module (FCC ID: XMR2020RM500QAE). 2. Model difference information refers to Applicant's model difference declaration letter. 3. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5775MHz
Type of Modulation	802.11a/n/ac: OFDM
Data Rate	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps

1.6. Working Frequencies

802.11a/n-HT20/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	149	5745 MHz	153	5765 MHz
157	5785 MHz	161	5805 MHz	165	5825 MHz

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	151	5755 MHz
159	5795 MHz	--	--	--	--

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	155	5775 MHz	--	--

1.7. Antenna Details

Antenna Type	Frequency Band (MHz)	N_{SS}	Max. Peak Gain (dBi)	Max. Peak Gain (at any elevation angle above 30 degrees)	CDD Directional Gain (dBi)	
					For Power	For PSD
Wi-Fi Antenna (2*2 MIMO)						
Dipole Antenna #1	2.400 ~ 2483.5	1	2.0	--	2.0	5.01
	5150 ~ 5250	1	3.0	3.0	3.0	6.01
	5725 ~ 5850		3.0	--	3.0	6.01
Dipole Antenna #2	2.400 ~ 2483.5	1	3.1	--	3.1	6.11
	5150 ~ 5250	1	2.4	2.4	2.4	5.41
	5725 ~ 5850		2.4	--	2.4	5.41

Note 1: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

For CDD transmissions, directional gain is calculated as follows, $N_{ANT} = 2$, $N_{SS} = 1$.

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,

  Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 3.01;

- For power measurements on IEEE 802.11 devices,

  Array Gain = 0 dB for $N_{ANT} \leq 4$;

Note 2: This device has two sets of Wi-Fi antennas. The maximum antenna directional antenna gain of above

two antennas is used for the EIRP Power and PSD/Conducted power limit calculation for 2.4GHz or 5GHz. For example, the directional gain of antenna #2 is used for 2.4GHz power/PSD limit calculation.

2. Test Configuration

2.1. Test Mode

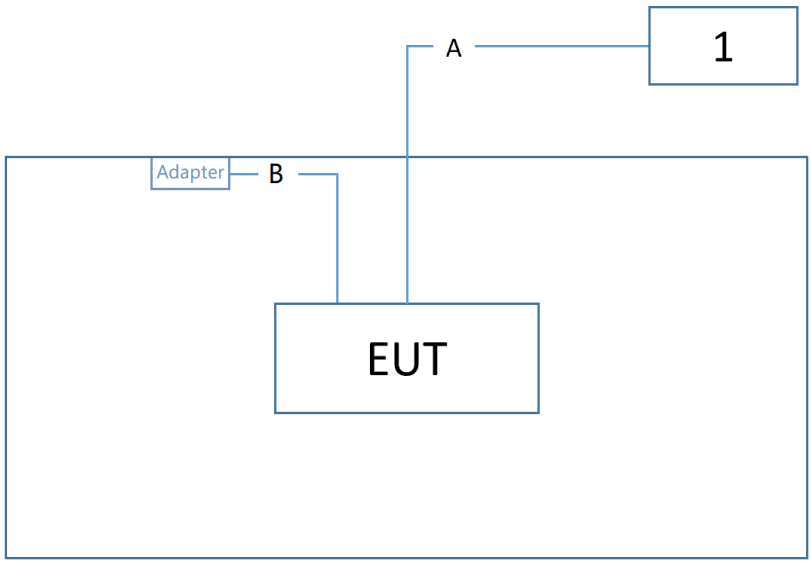
Mode 1: Transmit by 802.11a (6Mbps) _CDD Mode (2T1S)
Mode 2: Transmit by 802.11ac-VHT20 (MCS0) _CDD Mode (2T1S)
Mode 3: Transmit by 802.11ac-VHT40 (MCS0) _CDD Mode (2T1S)
Mode 4: Transmit by 802.11ac-VHT80 (MCS0) _CDD Mode (2T1S)

Note: The modulation and bandwidth are similar for 802.11n mode for 20MHz/40MHz and 802.11ac mode for 20MHz/40MHz. Therefore, 802.11ac mode was selected as representative test mode in this report, and the power level of 802.11n mode will be controlled to be the same as or lower than that of 802.11ac mode.

2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing and AC line conducted testing.

Connection Diagram – Radiated Emission testing & AC Conducted Emissions



Cable Type		Cable Description
A	Power Cable	Non-Shielded, 1.2m
B	LAN Cable	Non-Shielded, >10.0m

Product		Manufacturer	Model No.
1	Notebook	Lenovo	E495

2.3. Test Software

The test utility software used during testing was “QA Tool”, and the version was 1.0.3.14.

2.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.407
- KDB 789033 D02v02r01
- KDB 662911 D01v02r01
- ANSI C63.10-2013

2.5. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~ 75%RH

3. Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the device is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2023-05-20	WZ-AC2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2023-06-04	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2022-12-01	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2022-10-21	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2022-11-12	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2023-04-21	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11038	1 year	2022-11-11	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2022-12-01	WZ-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2023-01-13	WZ-AC2
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2022-10-28	WZ-AC2
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2023-06-04	WZ-SR2
Shielding Room	MIX-BEP	WZ-SR2	MRTSUE06215	5 years	2026-12-20	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2023-06-06	WZ-SR2
Four-Line V-Network	R&S	ENV432	MRTSUE06615	1 year	2022-10-13	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2022-11-01	WZ-SR2
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2022-10-10	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2023-06-06	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE07027	1 year	2022-12-05	WZ-TR3/WZ-SR5
Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2023-04-06	WZ-TR3/WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11089	1 year	2023-06-09	WZ-TR3/WZ-SR5
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2023-06-06	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2023-06-04	WZ-SR5

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	1.02	RE Antenna & Turntable
BenchVue Power Meter	2018.1	Power

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.2. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.13dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.15dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%

6. Test Result

6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.407(a)	26dB & 99% Bandwidth	Conducted	Pass
15.407(e)	6dB Bandwidth		Pass
15.407(a)(1)(i), (a)(1)(ii), (a)(3)(i)	Maximum Conducted Output Power		Pass
15.407(h)(1)	Transmit Power Control		N/A
15.407(a)(1)(ii), (2), (3)(i), (12)	Peak Power Spectral Density		Pass
15.407(g), 2.1055, 15.215(c)	Frequency Stability	Conducted	Pass
15.407(b)(1), (2), (3), (4)(i)	Undesirable Emissions	Radiated	Pass
15.205, 15.209 15.407(b)(8), (9), (10)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)		Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

Remark:

1. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
2. Output power test was verified over all data rates of each mode, and then choose the maximum power output (low data rate) for final test of each channel.
3. Test Items “6dB Bandwidth” and “26dB & 99% Bandwidth” were only performed on Wi-Fi 2 Port.
4. “N/A” means that this item is not applicable, and the detail information refer to relevant section.

6.2. 26dB & 99% Bandwidth Measurement

6.2.1. Test Limit

N/A

6.2.2. Test Procedure

KDB 789033 D02v02r01- Section II)C)1) (26dB Bandwidth)

KDB 789033 D02v02r01- Section II)D) (99% Bandwidth)

6.2.3. Test Setting

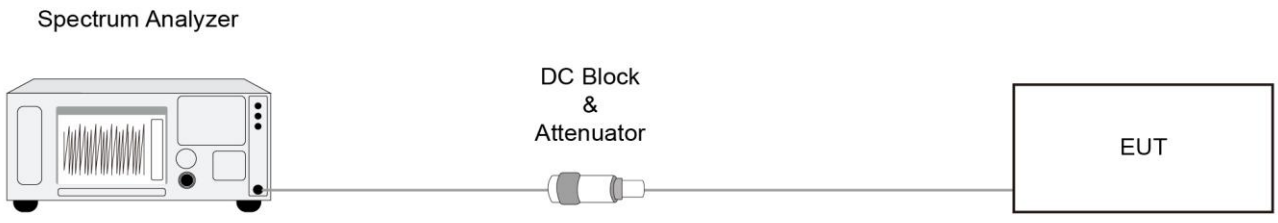
26dB Bandwidth

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth
2. RBW = approximately 1% of the emission bandwidth.
3. VBW > RBW
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

99% Bandwidth

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 1% to 5% of the OBW
3. VBW ≥ 3 × RBW
4. Span = 1.5 times to 5 times the OBW
5. Detector = peak
6. Trace mode = max hold
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrument.

6.2.4. Test Setup



6.2.5. Test Result

Refer to Appendix A.2.

6.3. 6dB Bandwidth Measurement

6.3.1. Test Limit

The minimum 6dBbandwidth shall be at least 500 kHz.

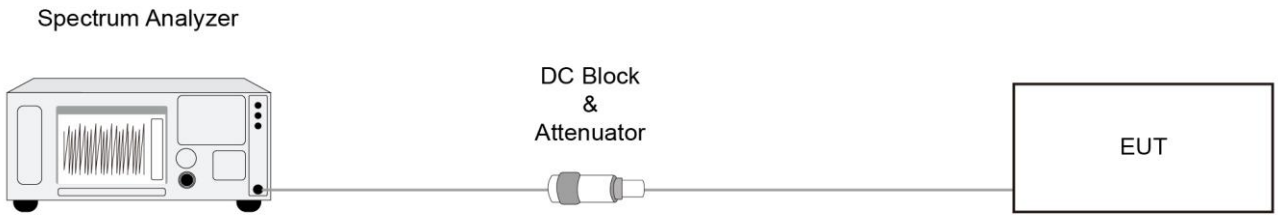
6.3.2. Test Procedure

KDB 789033 D02v02r01- Section II)C)2)

6.3.3. Test Setting

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 100 kHz.
3. VBW ≥ 3 × RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.3.4. Test Setup



6.3.5. Test Result

Refer to Appendix A.3.

6.4. Output Power Measurement

6.4.1. Test Limit

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. 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).

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.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

6.4.2. Test Procedure

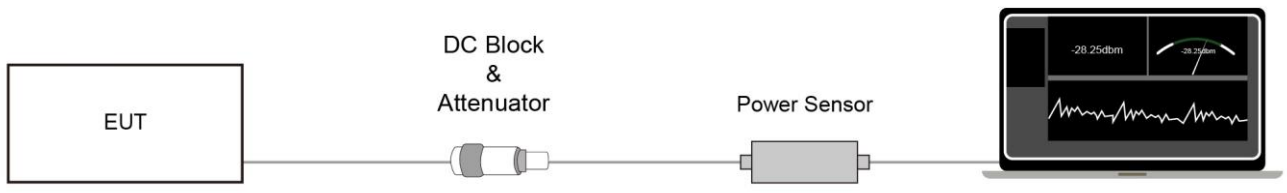
KDB 789033D02v02r01- Section II)E)3)b) Method PM-G

6.4.3. Test Setting

Average Power Measurement

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

6.5. Transmit Power Control Measurement

6.5.1. Test Limit

The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

6.5.2. Test Procedure

KDB 789033 D02v01- Section II)E)3)b) Method PM-G

6.5.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

6.5.4. Test Setup

6.5.5. Test Result

This device only operating in the 5.15- 5.25 GHz and 5.725-5.85 GHz, so the requirement is not applicable.

6.6. Power Spectral Density Measurement

6.6.1. Test Limit

For the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

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

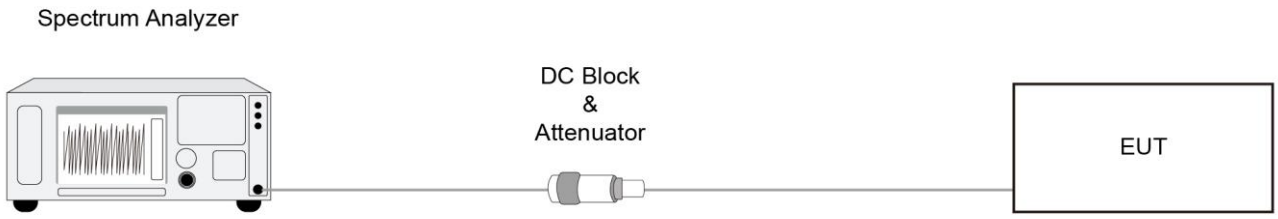
6.6.2. Test Procedure

KDB 789033 D02v02r01-Section II)F)

6.6.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz (510kHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz)
4. VBW = 3 × RBW
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (Average)
7. Sweep time = auto
8. Trigger = free run
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
10. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
11. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (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 percent.

6.6.4. Test Setup



6.6.5. Test Result

Refer to Appendix A.5.

6.7. Frequency Stability Measurement

6.7.1. Test Limit

Manufactures 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's manual.

6.7.2. Test Procedure

Frequency Stability Under Temperature Variations:

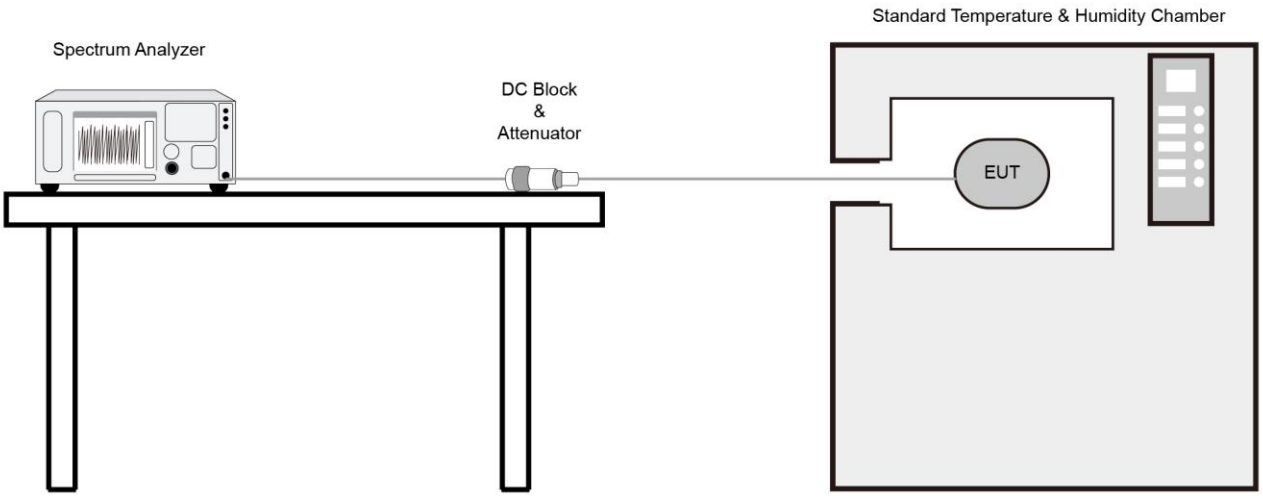
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, recordthe maximum frequency change.

6.7.3. Test Setup



6.7.4. Test Result

Refer to Appendix A.6.

6.8. Radiated Spurious Emission Measurement

6.8.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.8.2. Test Procedure

KDB 789033 D02v02r01- Section II)G)

6.8.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000MHz	1MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. Span was set greater than 1MHz

3. RBW = as specified in Table 1

4. Detector = CISPR quasi-peak

5. Sweep time = auto couple

6. Trace was allowed to stabilize

Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW = 1MHz

3. VBW = 3MHz

4. Detector = peak

5. Sweep time = auto couple

6. Trace mode = max hold

7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW = 1MHz

3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.

4. Detector = Peak

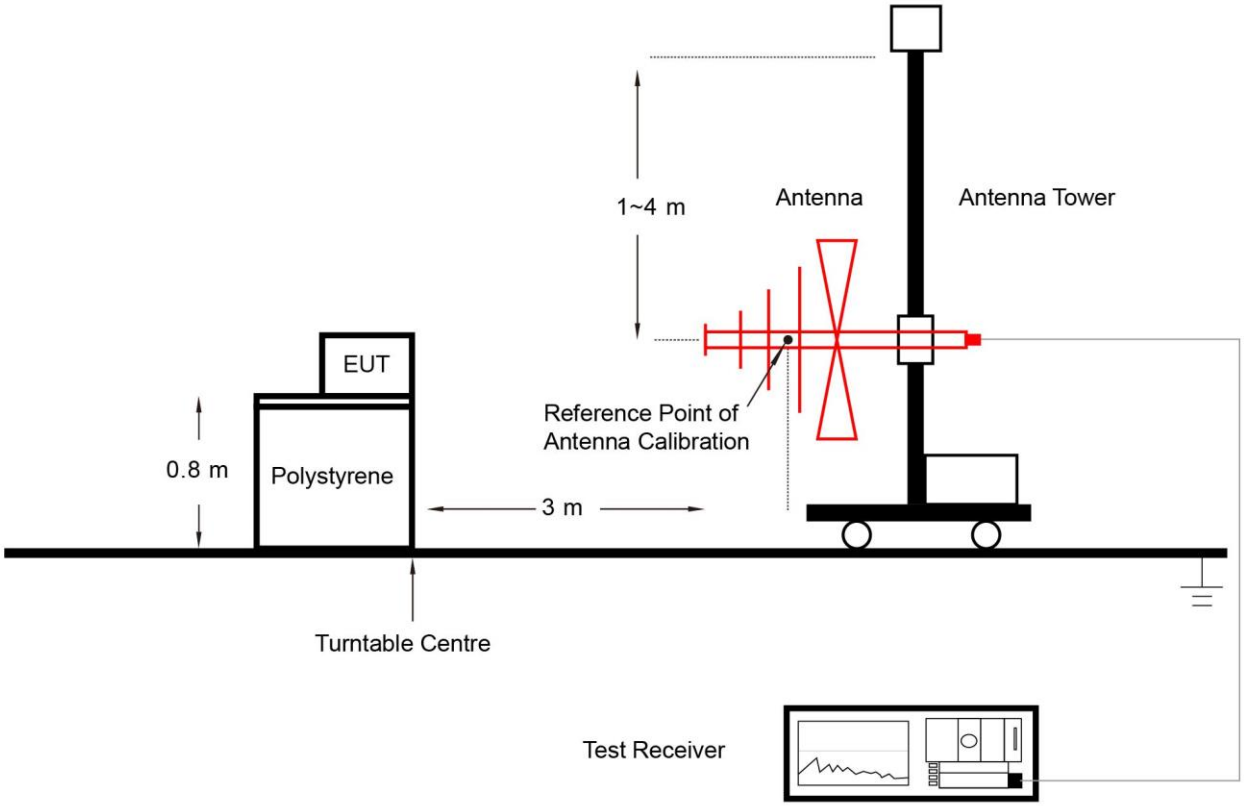
5. Sweep time = auto

6. Trace mode = max hold

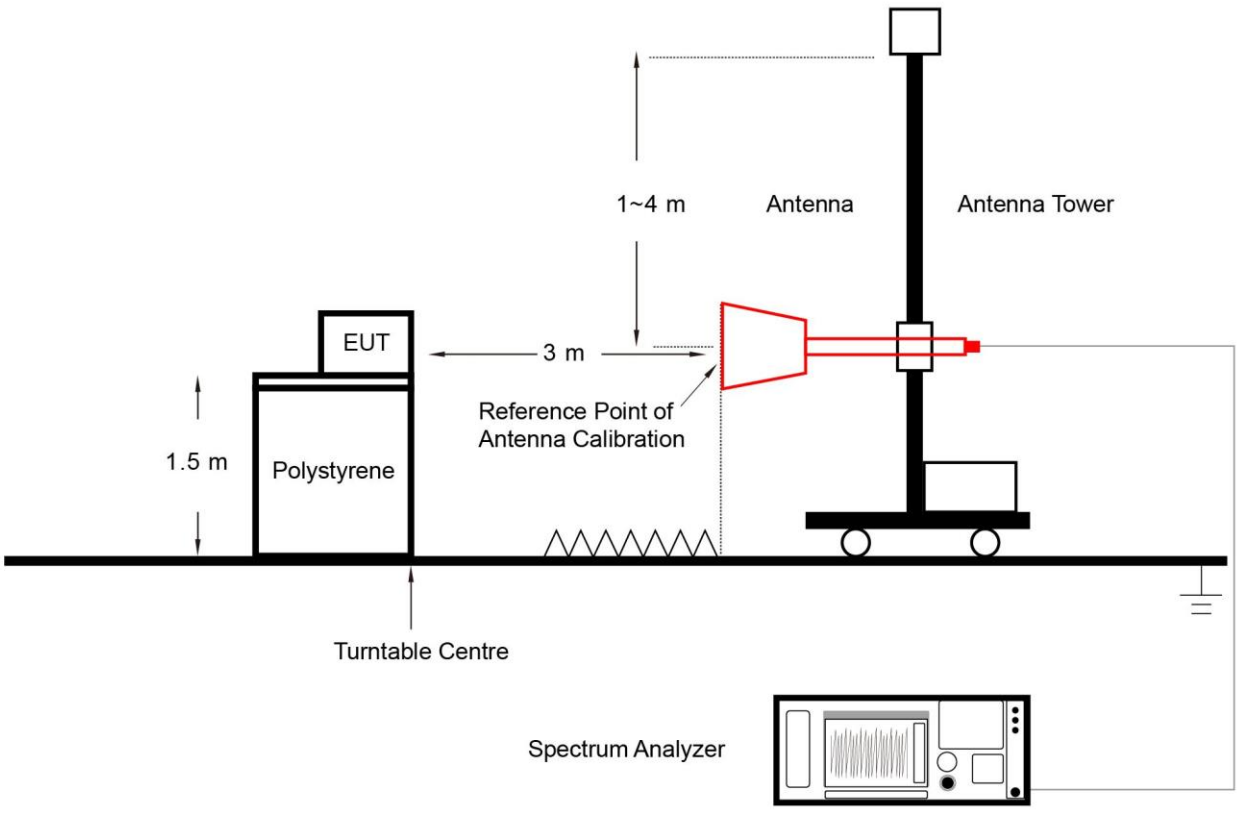
7. Trace was allowed to stabilize

6.8.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.8.5. Test Result

Refer to Appendix A.7.

6.9. Radiated Restricted Band Edge Measurement

6.9.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

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

For 15.407(b) requirement:

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.

For transmitters operating in the 5.725-5.85 GHz band: 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.

Refer to KDB 789033 D02v02r01 G)2)c), as specified in § 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in § 15.407(b)(4)). However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.9.2. Test Procedure

KDB 789033 D02v02r01- Section II)G)

6.9.3. Test Setting

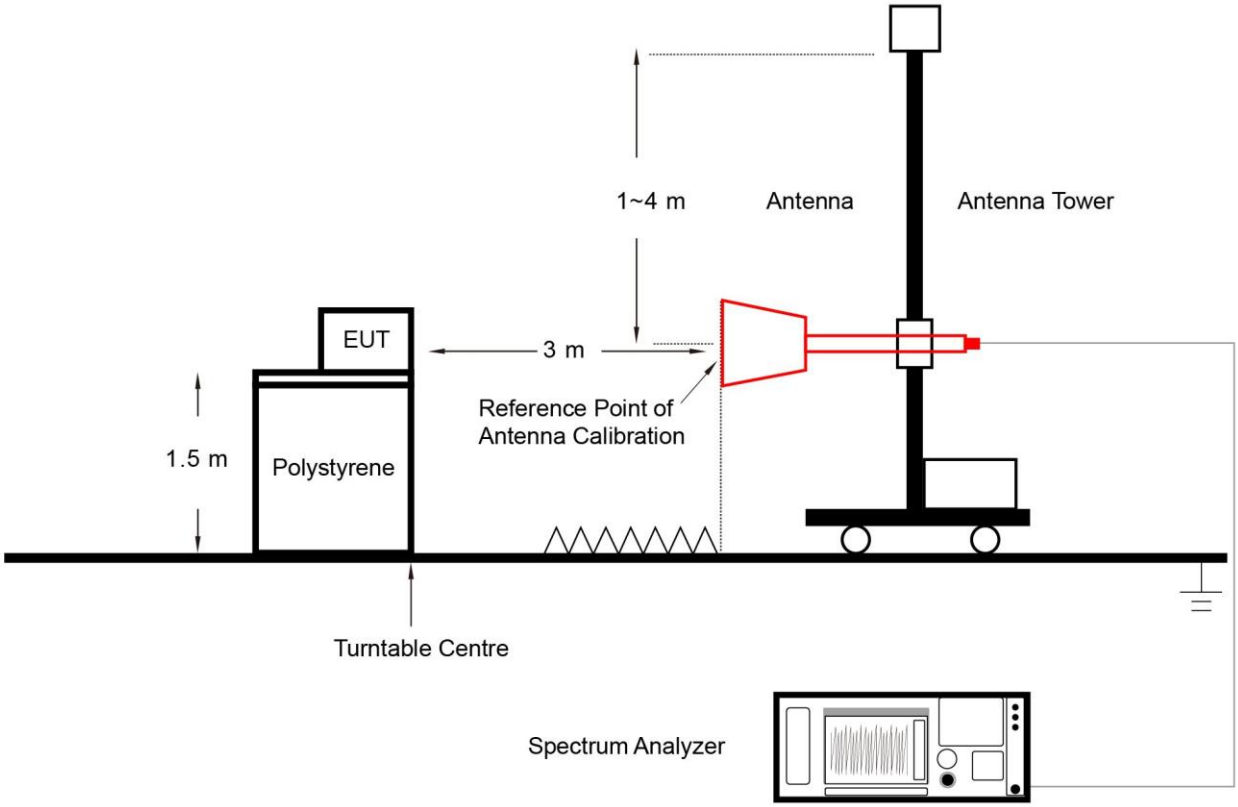
Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; if the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10Hz
4. If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration
5. Detector = Peak
6. Sweep time = Auto
7. Trace mode = Max hold
8. Trace was allowed to stabilize

6.9.4. Test Setup



6.9.5. Test Result

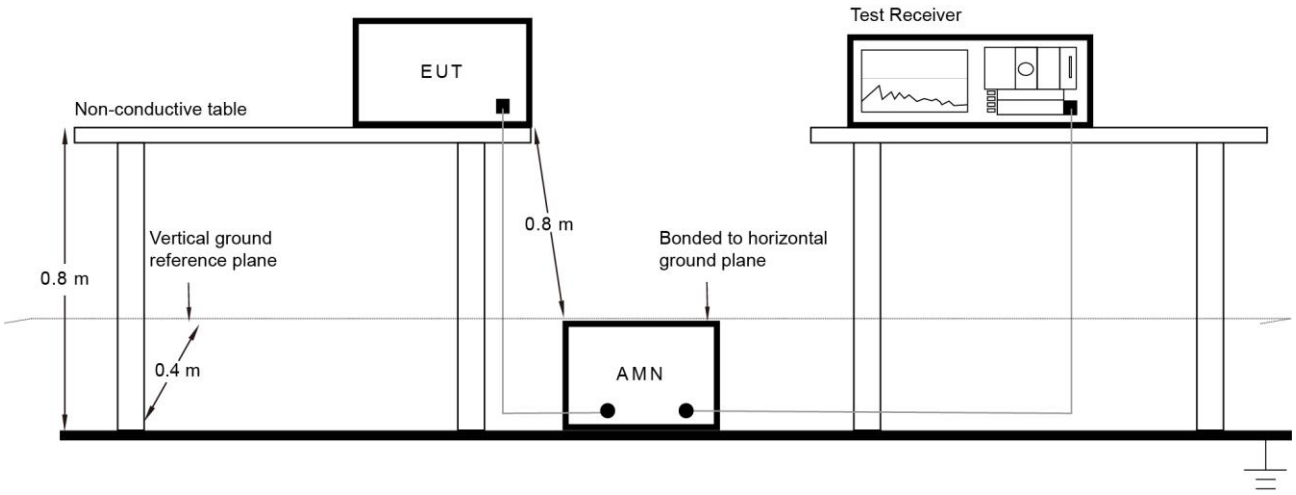
Refer to Appendix A.8.

6.10. AC Conducted Emissions Measurement

6.10.1. Test Limit

FCC Part 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50
Note 1: The lower limit shall apply at the transition frequencies.		
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.		

6.10.2. Test Setup



6.10.3. Test Result

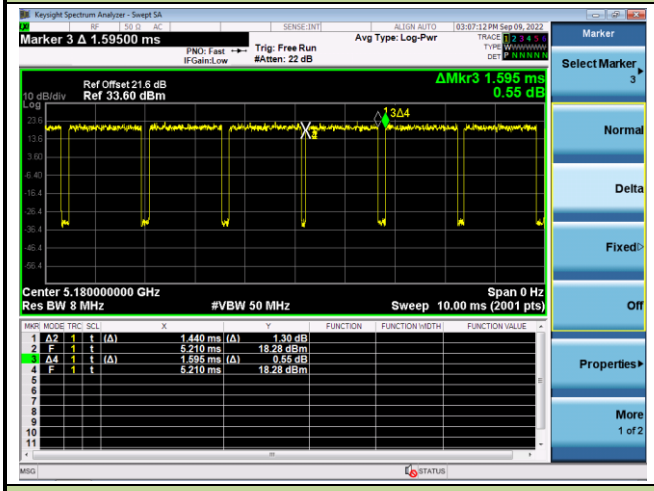
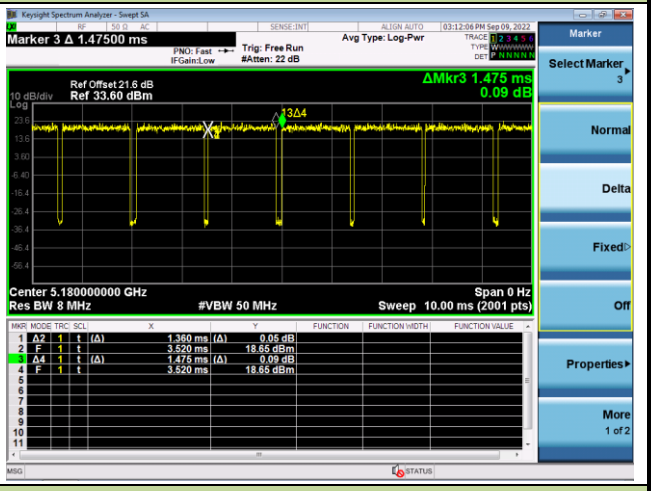
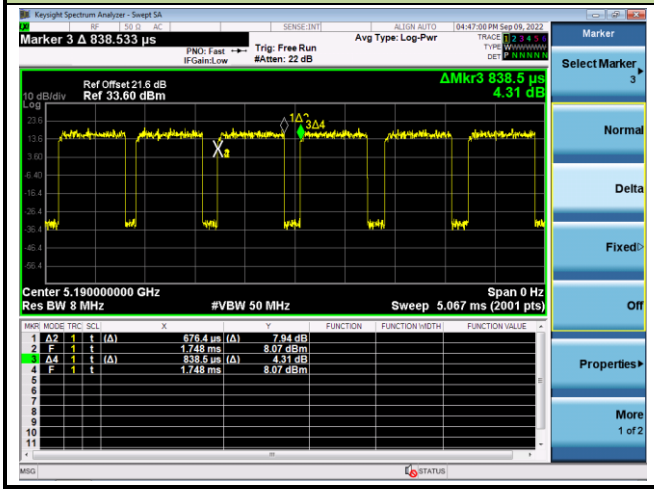
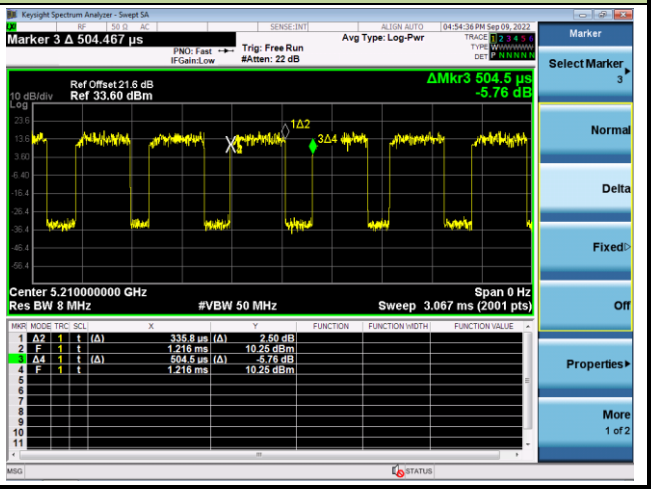
Refer to Appendix A.9.

Appendix A – Test Result

A.1 Duty Cycle Test Result

Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-09		

Test Mode	Duty Cycle
802.11a	90.28%
802.11ac-VHT20	92.20%
802.11ac-VHT40	80.67%
802.11ac-VHT80	66.56%

Duty Cycle (T = Transmission Duration)	
802.11a (T = 1.440ms)	802.11ac-VHT20 (T = 1.360ms)
	
802.11ac-VHT40 (T = 676.4us)	802.11ac-VHT80 (T = 335.8us)
	

A.2 26dB & 99% Bandwidth Test Result

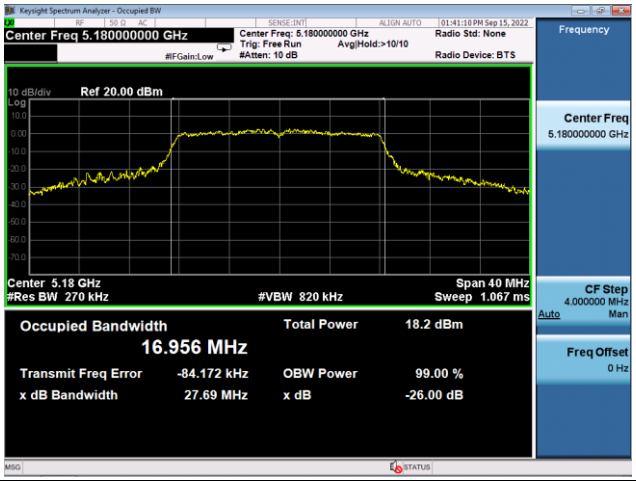
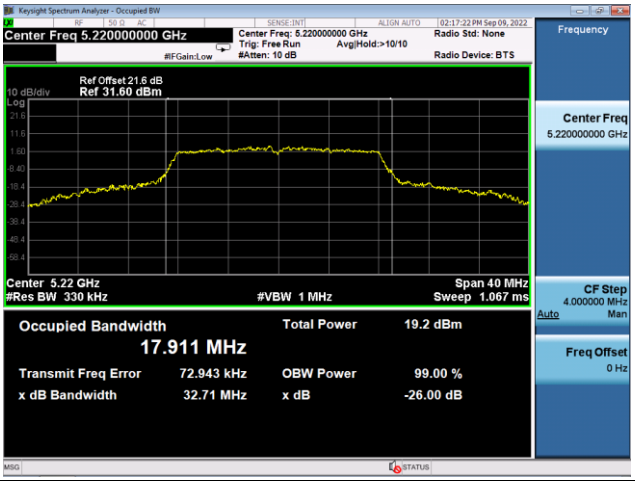
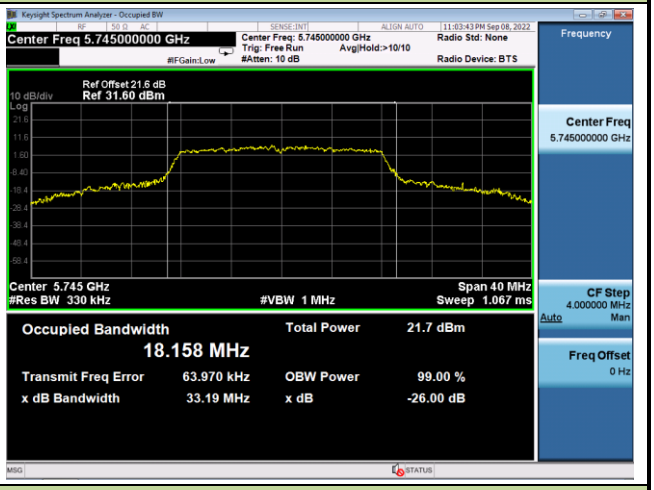
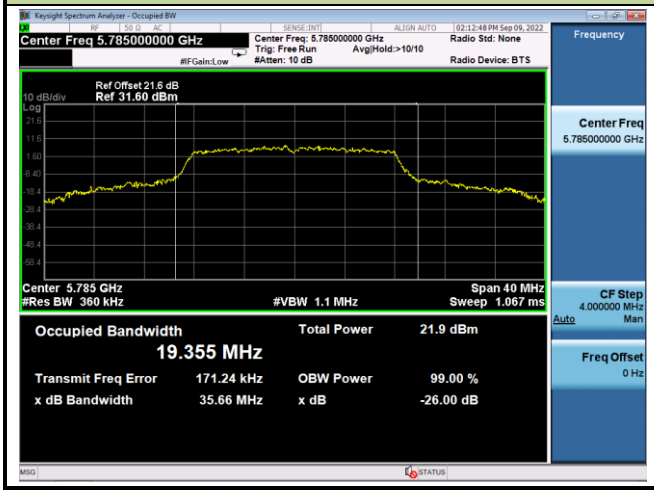
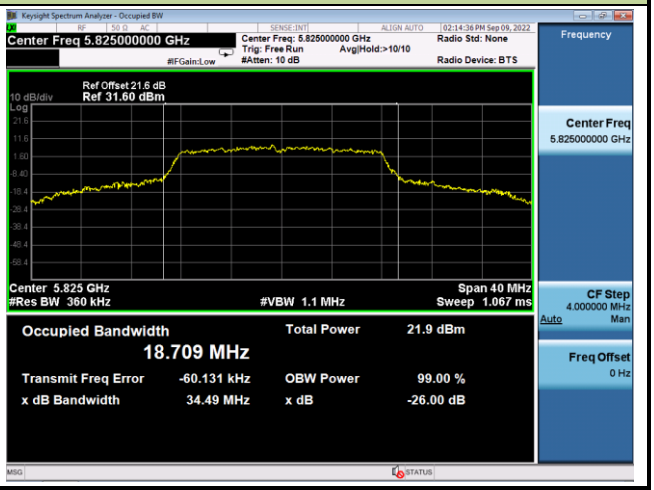
Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-15		

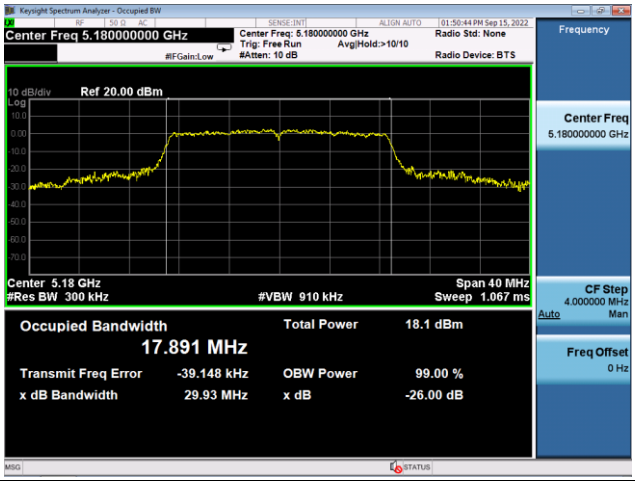
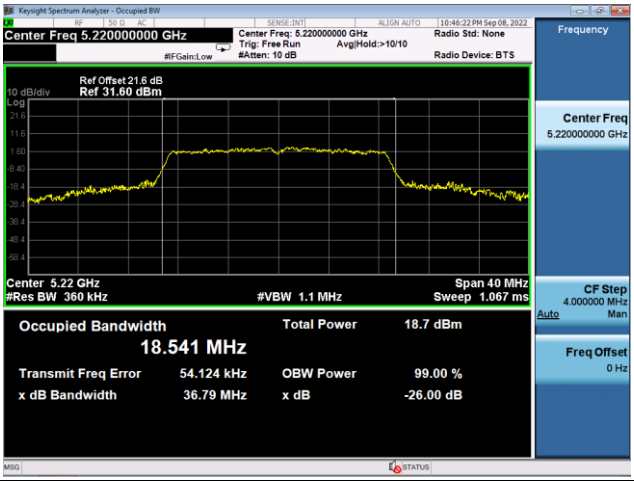
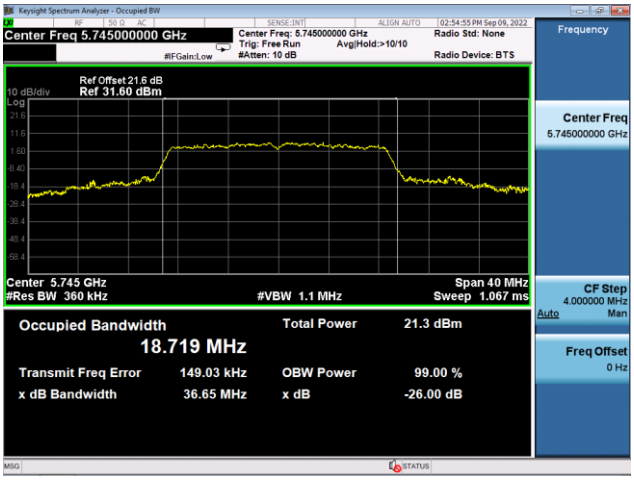
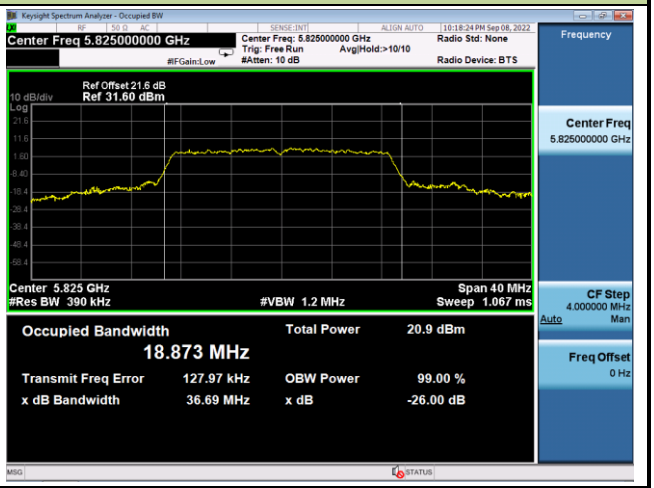
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	6Mbps	36	5180	27.69	16.956
11a	6Mbps	44	5220	32.71	17.911
11a	6Mbps	48	5240	34.46	18.596
11a	6Mbps	149	5745	33.19	18.158
11a	6Mbps	157	5785	35.66	19.355
11a	6Mbps	165	5825	34.49	18.709
11ac-VHT20	MCS0	36	5180	29.93	17.891
11ac-VHT20	MCS0	44	5220	36.79	18.541
11ac-VHT20	MCS0	48	5240	36.78	18.687
11ac-VHT20	MCS0	149	5745	36.65	18.719
11ac-VHT20	MCS0	157	5785	36.71	18.568
11ac-VHT20	MCS0	165	5825	36.69	18.873
11ac-VHT40	MCS0	38	5190	39.84	36.057
11ac-VHT40	MCS0	46	5230	74.06	37.823
11ac-VHT40	MCS0	151	5755	77.20	39.171
11ac-VHT40	MCS0	159	5795	76.51	38.559
11ac-VHT80	MCS0	42	5210	81.08	75.074
11ac-VHT80	MCS0	155	5775	157.40	78.315

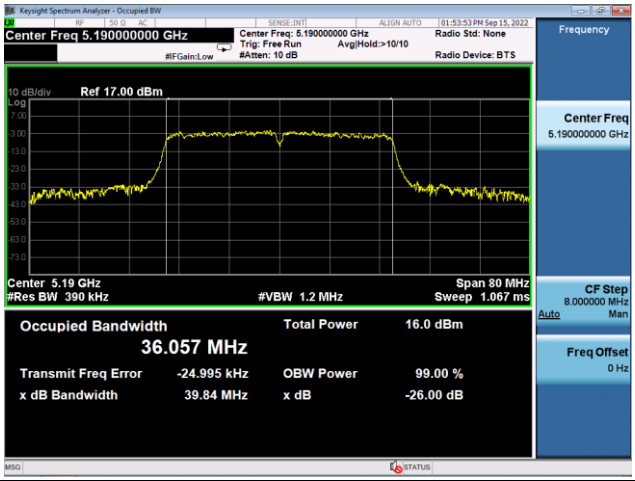
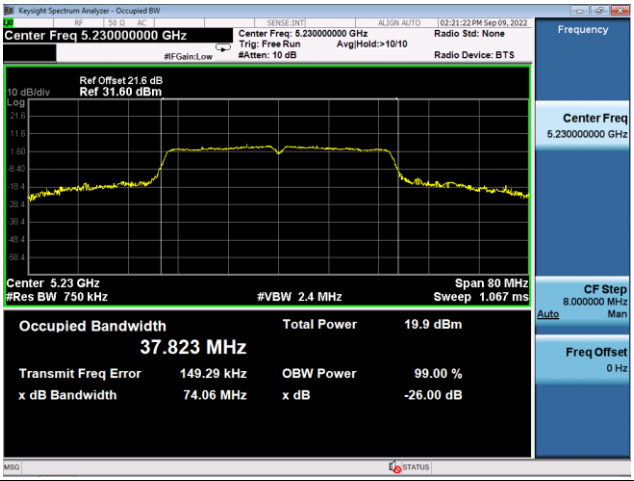
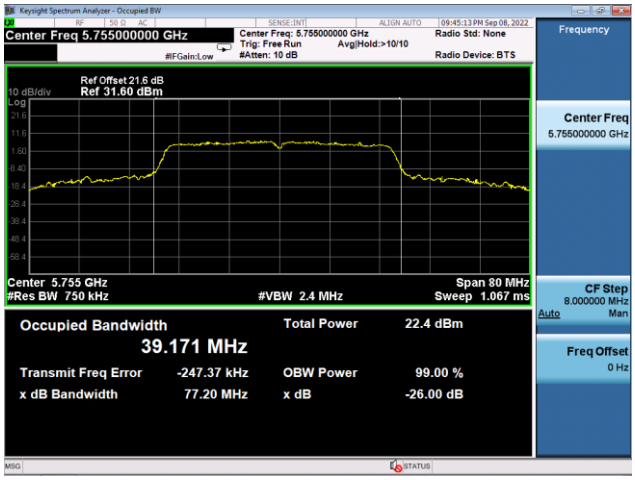
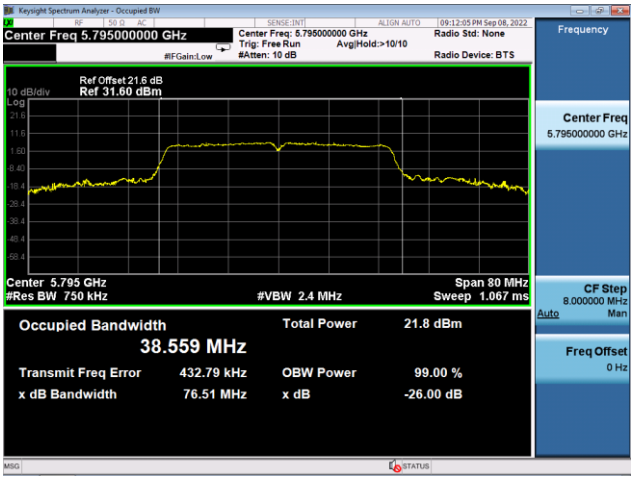
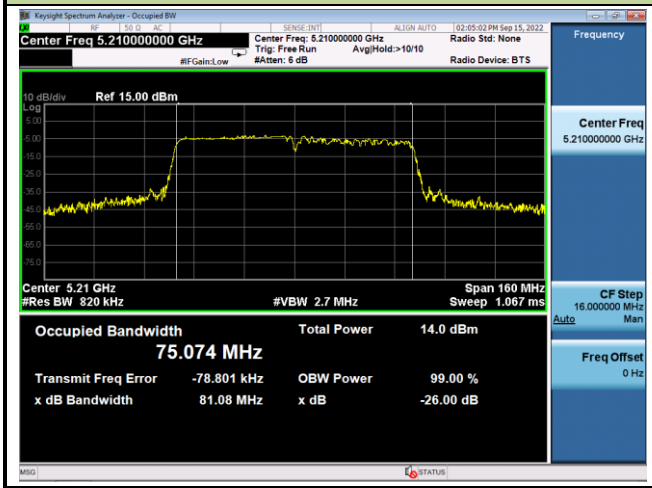
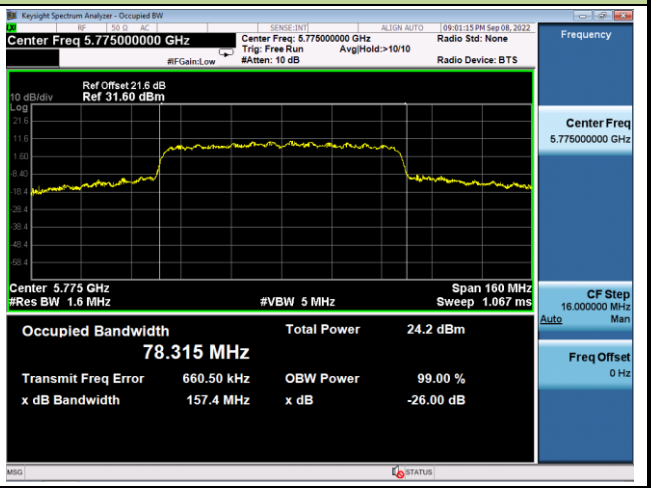
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	F_H (MHz)	Limit (MHz)
802.11a	6Mbps	48	5240	5249.30	< 5250
802.11ac-VHT20	MCS0	48	5240	5249.34	< 5250
802.11ac-VHT40	MCS0	46	5230	5248.91	< 5250
802.11ac-VHT80	MCS0	42	5210	5247.54	< 5250

Note: F_H = Centre frequency + 99% OBW / 2

For example, 802.11a 5240MHz, F_H = 5240 MHz + 18.596 MHz / 2 = 5249.30 MHz.

802.11a 26dB & 99% Bandwidth	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

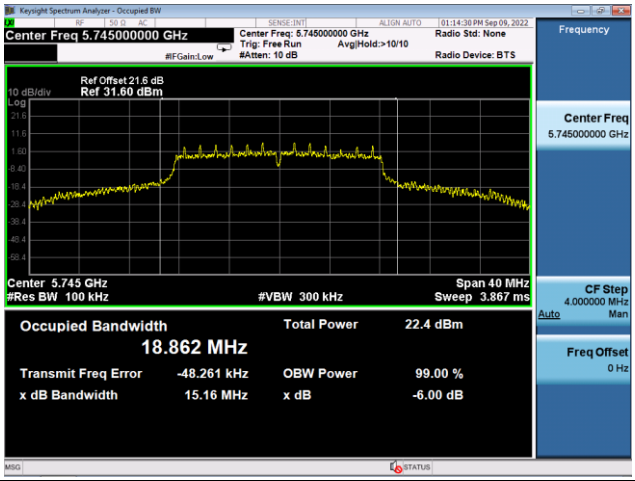
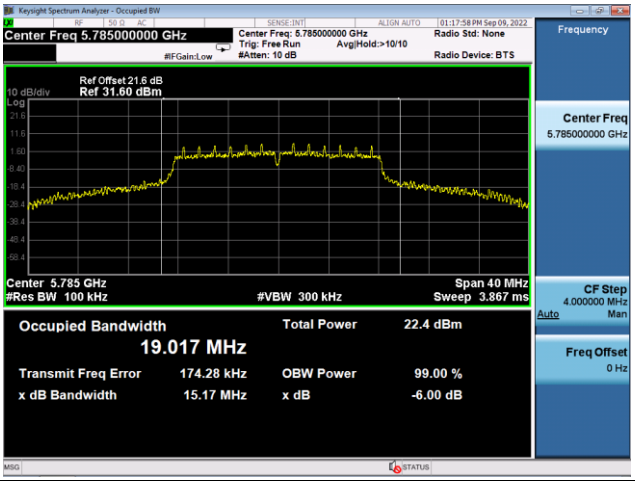
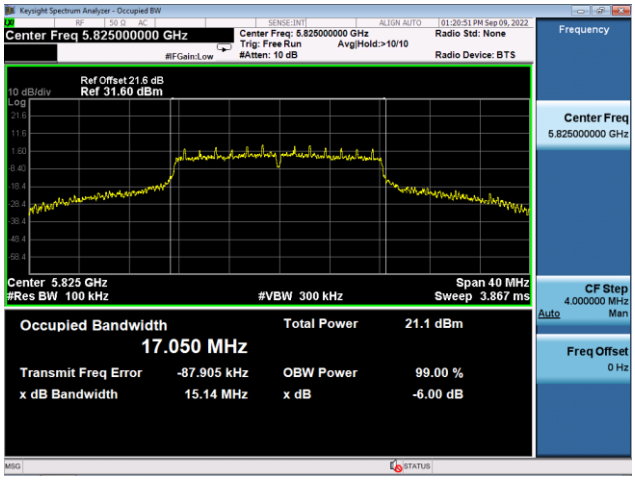
802.11ac-VHT20 26dB & 99% Bandwidth	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

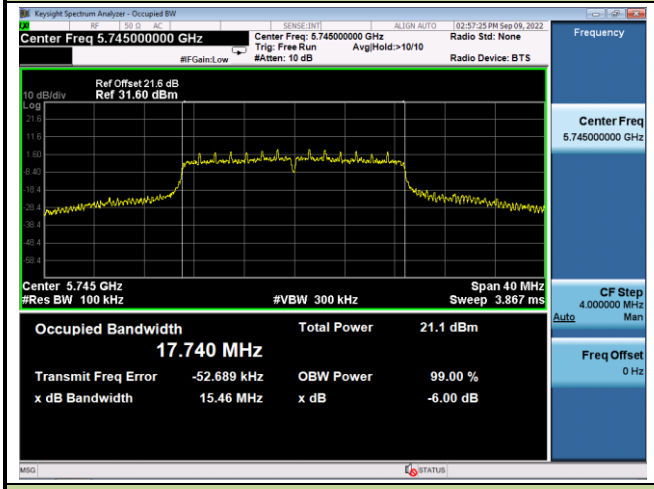
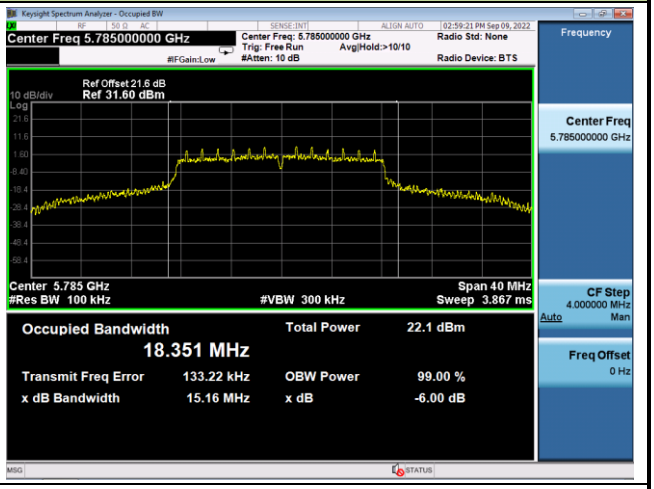
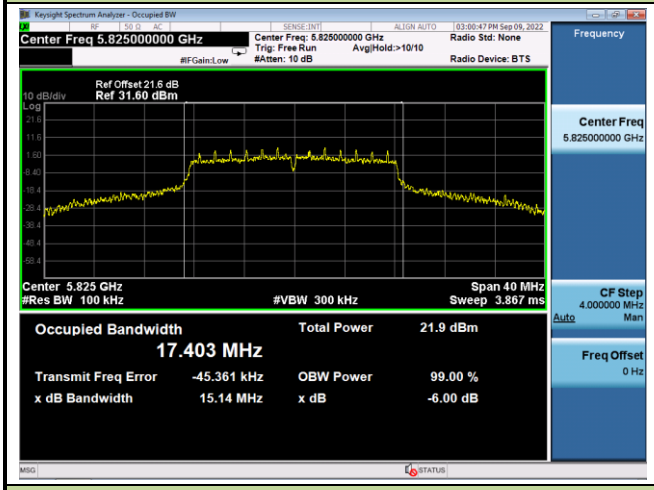
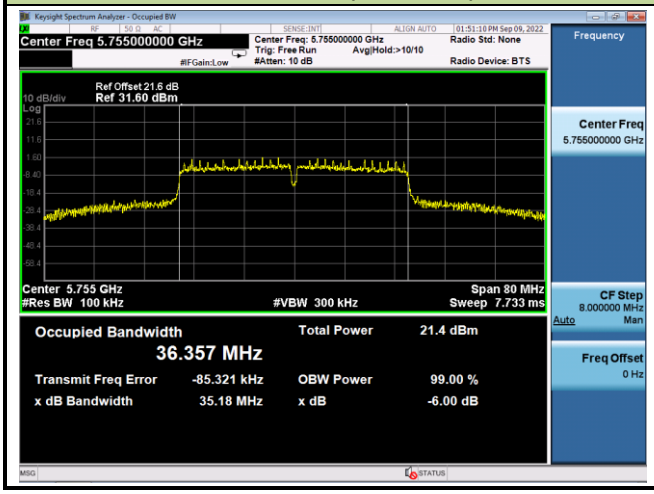
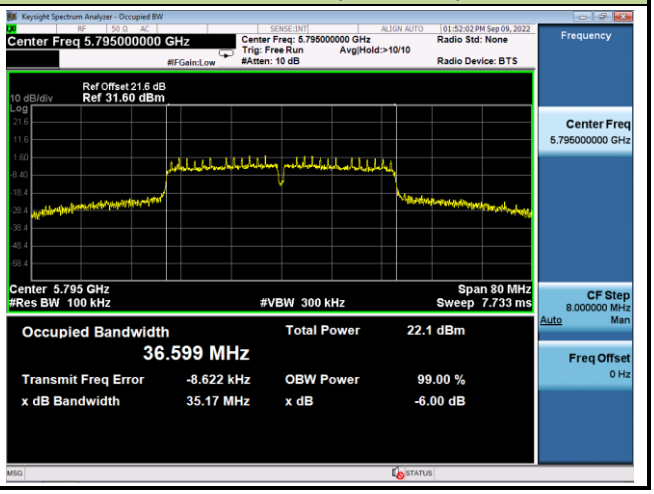
802.11ac-VHT40 26dB & 99% Bandwidth	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	
802.11ac-VHT80 26dB & 99% Bandwidth	
Channel 42 (5210MHz)	Channel 155 (5775MHz)
	

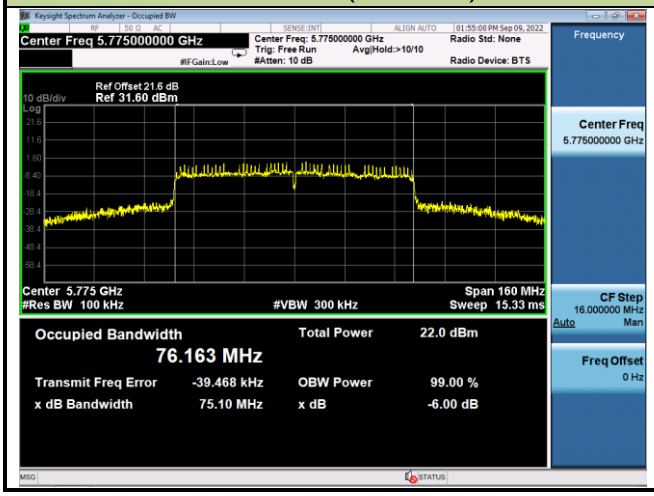
A.3 6dB Bandwidth Test Result

Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-09		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11a	6Mbps	149	5745	15.16	≥0.5
11a	6Mbps	157	5785	15.17	≥0.5
11a	6Mbps	165	5825	15.14	≥0.5
11ac-VHT20	MCS0	149	5745	15.46	≥0.5
11ac-VHT20	MCS0	157	5785	15.16	≥0.5
11ac-VHT20	MCS0	165	5825	15.14	≥0.5
11ac-VHT40	MCS0	151	5755	35.18	≥0.5
11ac-VHT40	MCS0	159	5795	35.17	≥0.5
11ac-VHT80	MCS0	155	5775	75.10	≥0.5

802.11a 6dB Bandwidth	
Channel 149 (5745MHz)	Channel 157 (5785MHz)
	
Channel 165 (5825MHz)	
	

802.11ac-VHT20 6dB Bandwidth	
Channel 149 (5745MHz)	Channel 157 (5785MHz)
	
Channel 165 (5825MHz)	
	
802.11ac-VHT40 6dB Bandwidth	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT80 6dB Bandwidth	
Channel 155 (5775MHz)	
	

A.4 Output Power Test Result

Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-13		
UNII Band	NII-1		

Test Mode	Data Rate MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Average Power (dBm)	Average Power Limit (dBm)	30 Degree EIRP (dBm)	EIRP Limit (dBm)
				Wi-Fi 1	Wi-Fi 2				
11a	6Mbps	36	5180	11.55	12.48	15.05	≤ 30.00	18.05	≤ 21.00
11a	6Mbps	44	5220	12.88	15.88	17.64	≤ 30.00	20.64	≤ 21.00
11a	6Mbps	48	5240	13.40	15.64	17.67	≤ 30.00	20.67	≤ 21.00
11ac-VHT20	MCS0	36	5180	11.05	14.69	16.25	≤ 30.00	19.25	≤ 21.00
11ac-VHT20	MCS0	44	5220	12.80	15.91	17.64	≤ 30.00	20.64	≤ 21.00
11ac-VHT20	MCS0	48	5240	13.20	15.77	17.68	≤ 30.00	20.68	≤ 21.00
11ac-VHT40	MCS0	38	5190	9.20	11.83	13.72	≤ 30.00	16.72	≤ 21.00
11ac-VHT40	MCS0	46	5230	12.94	15.65	17.51	≤ 30.00	20.51	≤ 21.00
11ac-VHT80	MCS0	42	5210	7.65	9.08	11.43	≤ 30.00	14.43	≤ 21.00

Note 1: Total Average Power (dBm) = $10*\log\{10^{(\text{Wi-Fi 1 Average Power }/10)} + 10^{(\text{Wi-Fi 2 Average Power }/10)}\}$

Note 2: Max EIRP Above 30 Degree Angle (dBm) = Total Average Power (dBm) + Antenna #1 30 Degree Gain (dBi).

Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-13		
UNII Band	NII-3		

Test Mode	Data Rate MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Average Power (dBm)	Average Power Limit (dBm)
				Wi-Fi 1	Wi-Fi 2		
11a	6Mbps	149	5745	14.95	15.62	18.31	≤ 30.00
11a	6Mbps	157	5785	14.22	15.57	17.96	≤ 30.00
11a	6Mbps	165	5825	14.86	15.92	18.43	≤ 30.00
11ac-VHT20	MCS0	149	5745	14.36	15.90	18.21	≤ 30.00
11ac-VHT20	MCS0	157	5785	13.82	15.83	17.95	≤ 30.00
11ac-VHT20	MCS0	165	5825	14.23	15.85	18.13	≤ 30.00
11ac-VHT40	MCS0	151	5755	14.64	15.74	18.24	≤ 30.00
11ac-VHT40	MCS0	159	5795	15.01	15.75	18.41	≤ 30.00
11ac-VHT80	MCS0	155	5775	14.79	15.94	18.41	≤ 30.00

Note: Total Average Power (dBm) = $10*\log \{10^{(\text{Wi-Fi 1 Average Power }/10)} + 10^{(\text{Wi-Fi 2 Average Power }/10)}\}$

A.5 Power Spectral Density Test Result

Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-09~2022-09-15		
Test Item	Power Spectral Density (UNII-Band 1)		

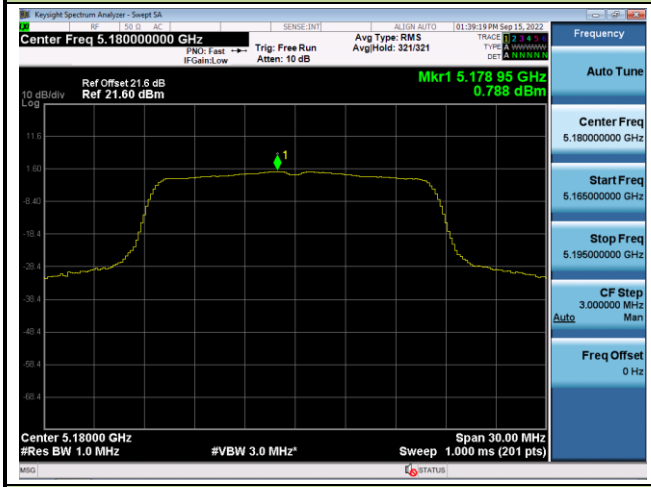
Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	AVPSD (dBm/MHz)		Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/MHz)
				Wi-Fi 1	Wi-Fi 2			
11a	6Mbps	36	5180	0.788	2.669	90.28	5.284	16.99
11a	6Mbps	44	5220	1.810	4.103	90.28	6.560	16.99
11a	6Mbps	48	5240	2.005	5.136	90.28	7.301	16.99
11ac-VHT20	MCS0	36	5180	0.240	3.111	92.20	5.272	16.99
11ac-VHT20	MCS0	44	5220	0.114	4.822	92.20	6.440	16.99
11ac-VHT20	MCS0	48	5240	1.080	4.833	92.20	6.713	16.99
11ac-VHT40	MCS0	38	5190	-5.333	-2.947	80.67	-0.035	16.99
11ac-VHT40	MCS0	46	5230	-2.294	0.731	80.67	3.420	16.99
11ac-VHT80	MCS0	42	5210	-9.931	-7.856	66.56	-3.993	16.99

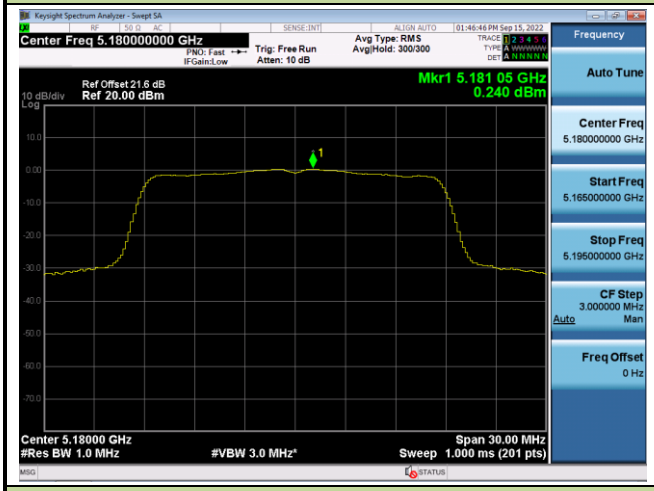
Note: The EUT duty cycle < 98%, the total PSD (dBm/MHz) =10*log {$10^{(\text{Wi-Fi 1 AVGPSD}/10)}$ + $10^{(\text{Wi-Fi 2 AVGPSD}/10)}$} +10*log (1/Duty cycle).

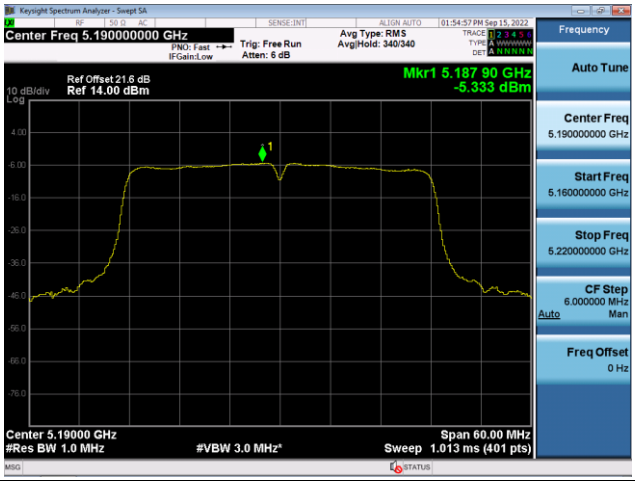
Test Site	WZ-SR5	Test Engineer	Liz Yuan
Test Date	2022-09-09		
Test Item	Power Spectral Density (UNII-Band 3)		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	AVPSD (dBm/510kHz)		Duty Cycle (%)	Total PSD (dBm/ 510kHz)	PSD Limit (dBm/ 500kHz)
				Wi-Fi 1	Wi-Fi 2			
11a	6Mbps	149	5745	0.710	2.483	90.28	5.141	≤ 29.99
11a	6Mbps	157	5785	0.748	1.607	90.28	4.653	≤ 29.99
11a	6Mbps	165	5825	0.550	2.330	90.28	4.985	≤ 29.99
11ac-VHT20	MCS0	149	5745	0.257	1.155	92.20	4.092	≤ 29.99
11ac-VHT20	MCS0	157	5785	-0.816	1.952	92.20	4.148	≤ 29.99
11ac-VHT20	MCS0	165	5825	-0.113	2.002	92.20	4.435	≤ 29.99
11ac-VHT40	MCS0	151	5755	-3.029	-1.485	80.67	1.754	≤ 29.99
11ac-VHT40	MCS0	159	5795	-3.424	-1.572	80.67	1.543	≤ 29.99
11ac-VHT80	MCS0	155	5775	-6.025	-4.298	66.56	-0.298	≤ 29.99

Note: The EUT duty cycle < 98%, the total PSD (dBm/510kHz) =10*log {$10^{(\text{Wi-Fi 1 AVGPSD}/10)}$ + $10^{(\text{Wi-Fi 2 AVGPSD}/10)}$} +10*log (1/Duty cycle).

802.11a Power Spectral Density - Wi-Fi 1	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11ac-VHT20 Power Spectral Density - Wi-Fi 1	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11ac-VHT40 Power Spectral Density - Wi-Fi 1	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	
802.11ac-VHT80 Power Spectral Density - Wi-Fi 1	
Channel 42 (5210MHz)	Channel 155 (5775MHz)