RF MEASUREMENT REPORT

FCC ID:	TV7CPG52X
Applicant:	Mikrotikls SIA
Product:	cAP ax
Model No.:	cAPGi-5HaxD2HaxD-US
Brand Name:	MikroTik
FCC Classification:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s):	Part 15 Subpart E (Section 15.407)
Result:	Complies
Received Date:	2022-12-07
Test Date:	2022-12-13 ~ 2022-12-21

Reviewed By: Vincent Yu

Approved By: Robin Wu

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 and KDB 291074. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
2212RSU018-U1	Rev. 01	Initial Report	2022-12-21	Valid

CONTENTS

1. General Information

1.1. Applicant

Mikrotikls SIA

Brivibas gatve 214i, Riga, LV-1039 Latvia

1.2. Manufacturer

Mikrotikls SIA

Brivibas gatve 214i, Riga, LV-1039 Latvia

1.3. Testing Facility

<table>
<tr><td>☒</td><td colspan="5">Test Site – MRT Suzhou Laboratory</td></tr>
<tr><td></td><td colspan="5">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</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="5">A2LA: 3628.01 CNAS: L10551
FCC: CN1166 ISED: CN0001</td></tr>
<tr><td></td><td>VCCI:</td><td>☐R-20025</td><td>☐G-20034</td><td>☐C-20020</td><td>☐T-20020</td></tr>
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<tr><td>☐</td><td colspan="5">Test Site – MRT Shenzhen Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Shenzhen)
1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
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FCC: CN1284 ISED: CN0105</td></tr>
<tr><td>☐</td><td colspan="5">Test Site – MRT Taiwan Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Taiwan)
No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="5">TAF: L3261-190725
FCC: 291082, TW3261 ISED: TW3261</td></tr>
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1.4. Product Information

Product Name	cAP ax
Model No.	cAPGi-5HaxD2HaxD-US
EUT Identification No.	20220920Sample#04
Wi-Fi Specification	802.11a/b/g/n/ac/ax, VHT
Hardware Version	r2
Software Version	RouterOS v7
Antenna Information	Refer to Section 1.7
Operating Temp.	0 ~ 40°C
Operating Environment	Indoor Use
Accessories	
Adapter #1	Model: SAW36-240-1500U Input: 100-240V ~ 50/60Hz, 1.3A Output: 24V, 1.5A
Adapter #2	Model: MT48-480095-11SGU Input: 100-240V ~ 50/60Hz, 1.0A Max Output: 48V, 0.95A
PoE Injector	Gigabit PoE Input Power: 18 - 57VDC
Remark: 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/ax-HE20: 5845MHz, 5865MHz, 5885MHz For 802.11n-HT40/ac-VHT40/ax-HE40: 5835MHz, 5875MHz For 802.11ac-VHT80/ax-HE80: 5855MHz
Type of Modulation	802.11a/n/ac: OFDM 802.11ax: OFDMA
Data Rate	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.6Mbps 802.11ax: up to 1201Mbps

1.6. Working Frequencies

802.11a/n-HT20/ac-VHT20/ax-HE20

Channel	Frequency	Channel	Frequency	Channel	Frequency
169	5845 MHz	173	5865 MHz	177	5885 MHz

802.11n-HT40/ac-VHT40/ax-HE40

Channel	Frequency	Channel	Frequency	Channel	Frequency
167	5835 MHz	175	5875 MHz	--	--

802.11ac-VHT80/ax-HE80

Channel	Frequency	Channel	Frequency	Channel	Frequency
171	5855 MHz	--	--	--	--

1.7. Antenna Details

Antenna Type	Frequency Band (MHz)	Max Peak Gain (dBi)	CDD Directional Gain (dBi)	
			For Power	For PSD
Wi-Fi Antenna (2*2 MIMO)				
Internal; Semi-directional Antenna	2.400 ~ 2483.5	5.90	5.90	8.91
	5150 ~ 5250	5.45	5.45	8.46
	5250 ~ 5350	5.35	5.35	8.36
	5470 ~ 5725	6.20	6.20	9.21
	5850 ~ 5895	5.60	5.60	8.61

Note: 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 $N_{ANT} \leq 4$;

2. Test Configuration

2.1. Test Mode

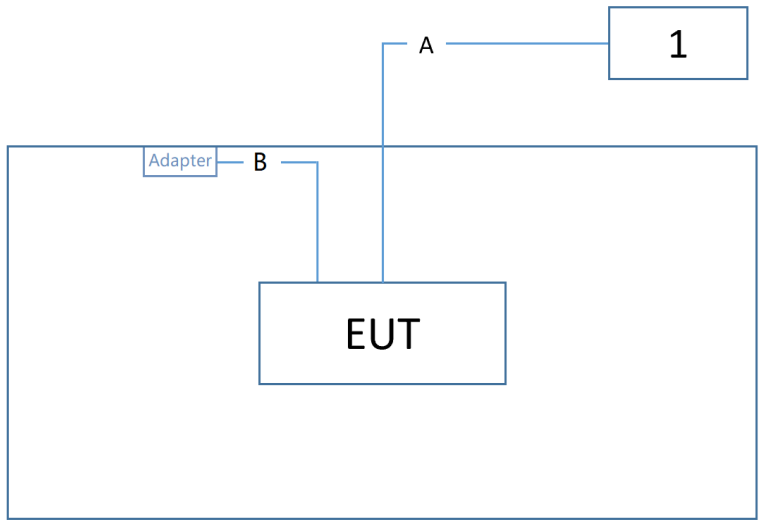
Mode 1: Transmit by 802.11a (6Mbps) _CDD Mode_N_{SS}=1
Mode 2: Transmit by 802.11ac-VHT20 (MCS0) _CDD Mode_N_{SS}=1
Mode 3: Transmit by 802.11ac-VHT40 (MCS0) _CDD Mode_N_{SS}=1
Mode 4: Transmit by 802.11ac-VHT80 (MCS0) _CDD Mode_N_{SS}=1
Mode 5: Transmit by 802.11ax-HE20 (MCS11) _CDD Mode_N_{SS}=1
Mode 6: Transmit by 802.11ax-HE40 (MCS0) _CDD Mode_N_{SS}=1
Mode 7: Transmit by 802.11ax-HE80 (MCS0) _CDD Mode_N_{SS}=1

Note 1: 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.
Note 2: All modes of operation and data rates were investigated, so all RF test requirements shall be executed at the worst data rate.

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	LAN Cable	Non shielded, > 10m
B	Power Cable	Non shielded, 1.5m

Product		Manufacturer	Model No.
1	Notebook	Lenovo	E431

2.3. Test Software

The test utility software was “WinBox”, and the version was 3.37. The test commands used during the test were provided by manufacturer. Refer to the operating description for power settings in each mode.

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 291074 D02v01
- KDB 291074 D01v01
- 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

According to KDB 291074 DR01: An Indoor Access point in the U-NII-4 band (5.850-5.895 GHz) and U-NII -3 & -4 span channels must use an integrated antenna

- The antenna of the device is built in and locked inside the enclosure.

Conclusion:

This device complies with the requirement.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Last Cali. Date	Cali. Due Date	Test Site
Anechoic Chamber	RIKEN	SIP-AC1	MRTSUE06554	1 year	2022-12-23	SIP-AC1
Preamplifier	EMCI	EMC051845SE	MRTSUE06600	1 year	2023-11-07	SIP-AC1
Horn Antenna	R&S	HF907	MRTSUE06610	1 year	2023-07-13	SIP-AC1
Thermohygrometer	testo	608-H1	MRTSUE06616	1 year	2023-11-01	SIP-AC1
Thermohygrometer	testo	608-H1	MRTSUE06620	1 year	2023-11-27	SIP-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06645	1 year	2023-07-30	SIP-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06598	1 year	2023-11-05	SIP-AC2
Preamplifier	EMCI	EMC051845SE	MRTSUE06601	1 year	2023-11-22	SIP-AC2
Thermohygrometer	testo	608-H1	MRTSUE06623	1 year	2023-11-27	SIP-AC2
Thermohygrometer	testo	608-H1	MRTSUE06624	1 year	2023-11-27	SIP-AC2
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06647	1 year	2023-07-13	SIP-AC2
Anechoic Chamber	RIKEN	SIP-AC2	MRTSUE06781	1 year	2022-12-23	SIP-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06648	1 year	2023-10-22	SIP-AC2
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2023-06-08	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2023-07-30	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2023-11-01	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06622	1 year	2023-11-27	SIP-AC3
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2023-01-13	SIP-AC3
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06646	1 year	2023-08-16	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2022-12-23	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2023-06-06	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2023-06-04	WZ-SR5/WZ-TR3
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2023-06-04	WZ-SR5
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2023-10-08	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2023-06-06	WZ-TR3
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	2023-10-08	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2023-10-27	WZ-SR2

Software	Version	Function
EMI Software	V3	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable

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
The maximum measurement uncertainty is evaluated as: 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Disturbance
The maximum measurement uncertainty is evaluated as: Horizontal: 30MHz~200MHz: 3.85dB 200MHz~1GHz: 4.36dB 1GHz~40GHz: 4.98dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~40GHz: 4.91dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.3dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.5dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.3dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 3.2%

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)(3)(ii)	Maximum Conducted Output Power		Pass
15.407(a)(3)(ii)	Peak Power Spectral Density		Pass
15.407(b)(5)	Undesirable Emissions	Radiated	Pass
15.205, 15.209 15.407(b)(5)(i), (8), (9)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)		Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

Notes:

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. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
3. EUT supports one configuration only in 802.11ax full RU mode.
4. For test Items “26dB & 99% Bandwidth” and “6dB Bandwidth”, we only evaluated the Ant 0 RF port.

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

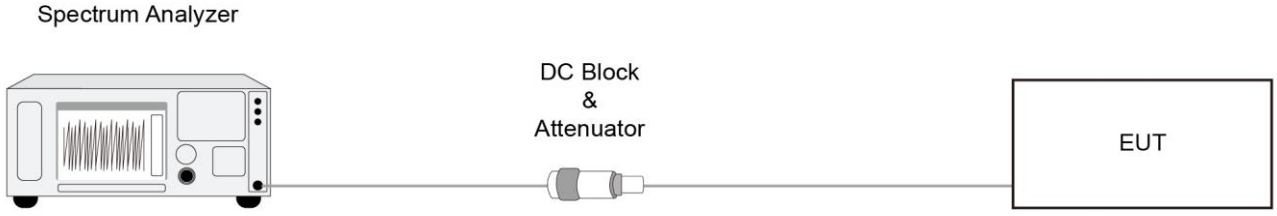
26dB Bandwidth

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold.

99% Bandwidth

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1% to 5% of the OBW
4. Set VBW ≥ 3×RBW
5. Detector = Peak.
6. 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.

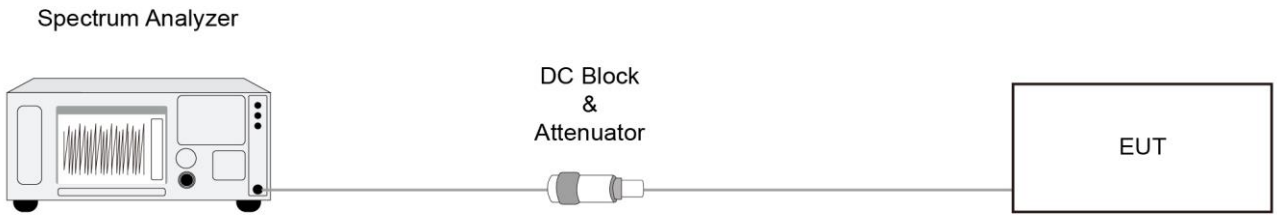
6.3.2. Test Procedure

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 indoor access point operating in the 5.850-5.895 GHz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm. Indoor access points operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 36 dBm.

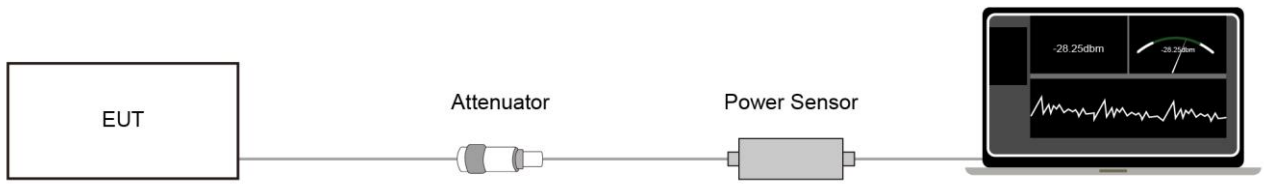
6.4.2. Test Procedure

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

6.4.3. 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.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

6.5. Power Spectral Density Measurement

6.5.1. Test Limit

For an indoor access point operating in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 20 dBm e.i.r.p. in any 1-megahertz band.

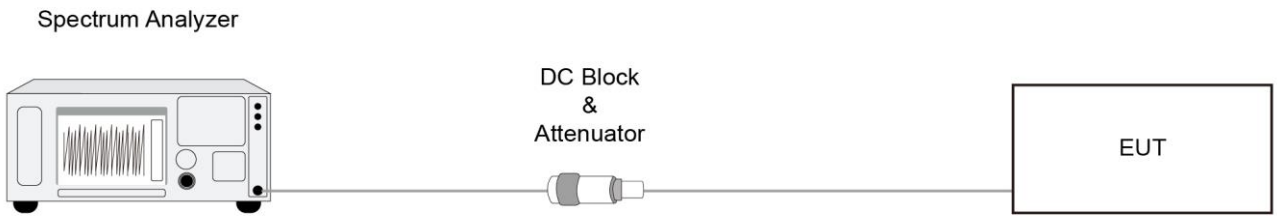
6.5.2. Test Procedure

KDB 789033 D02v02r01-Section II)F)

6.5.3. 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.

6.5.4. Test Setup



6.5.5. Test Result

Refer to Appendix A.5.

6.6. Frequency Stability Measurement

6.6.1. 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.

6.6.2. Test Procedure

Frequency Stability Under Temperature Variations:

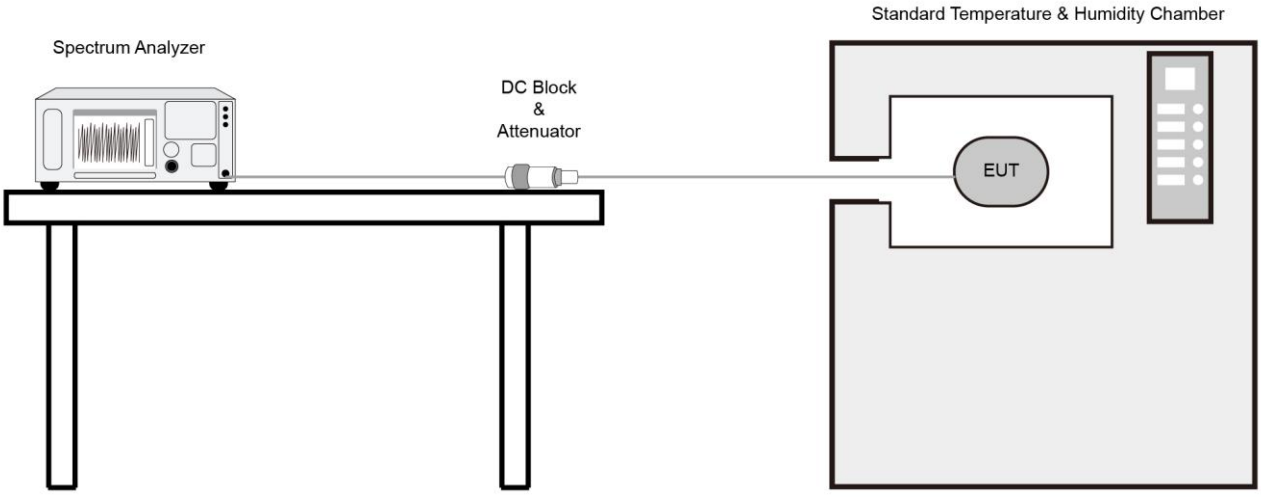
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain 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, record the maximum frequency change.

6.6.3. Test Setup



6.6.4. Test Result

Refer to Appendix A.6.

6.7. Radiated Spurious Emission Measurement

6.7.1. 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	Field Strength	Measured Distance
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

For transmitters operating solely in the 5.850-5.895 GHz band or operating on a channel that spans across 5.725-5.895 GHz:

For an indoor access point or subordinate device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of 15 dBm/MHz and shall decrease linearly to an e.i.r.p. of −7 dBm/MHz at or above 5.925 GHz.

For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an e.i.r.p. of −27 dBm/MHz at 5.65 GHz increasing linearly to 10 dBm/MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.72 GHz, and from 5.72 GHz increasing linearly to a level of 27 dBm/MHz at 5.725 GHz.

6.7.2. Test Procedure

KDB 789033 D02v02r01- Section II)G)

6.7.3. 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.

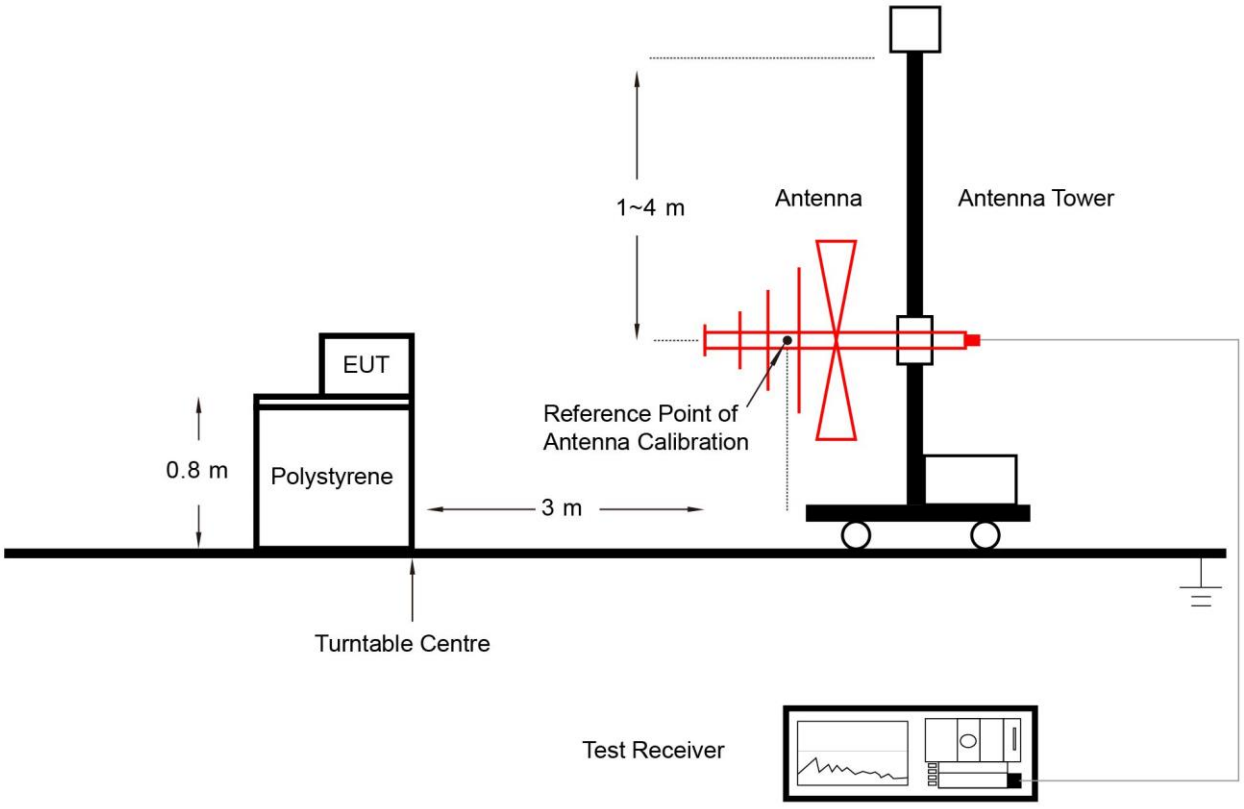
If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.

4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold

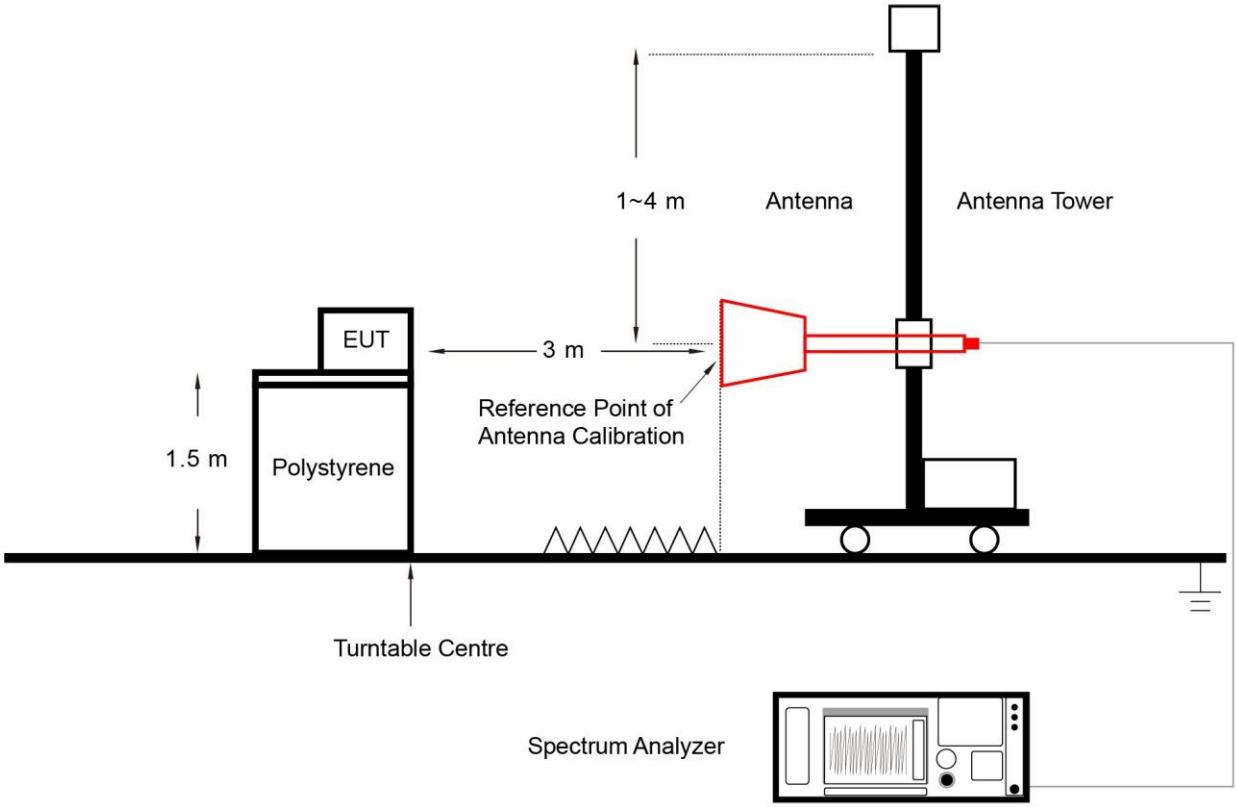
7. Trace was allowed to stabilize

6.7.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.7.5. Test Result

Refer to Appendix A.7.

6.8. Radiated Restricted Band Edge Measurement

6.8.1. Test Limit

For transmitters operating solely in the 5.850-5.895 GHz band or operating on a channel that spans across 5.725-5.895 GHz:

For an indoor access point or subordinate device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of 15 dBm/MHz and shall decrease linearly to an e.i.r.p. of −7 dBm/MHz at or above 5.925 GHz.

For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an e.i.r.p. of −27 dBm/MHz at 5.65 GHz increasing linearly to 10 dBm/MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.72 GHz, and from 5.72 GHz increasing linearly to a level of 27 dBm/MHz at 5.725 GHz.

6.8.2. Test Procedure

KDB 789033 D02v02r01- Section II)G)

6.8.3. Test Setting

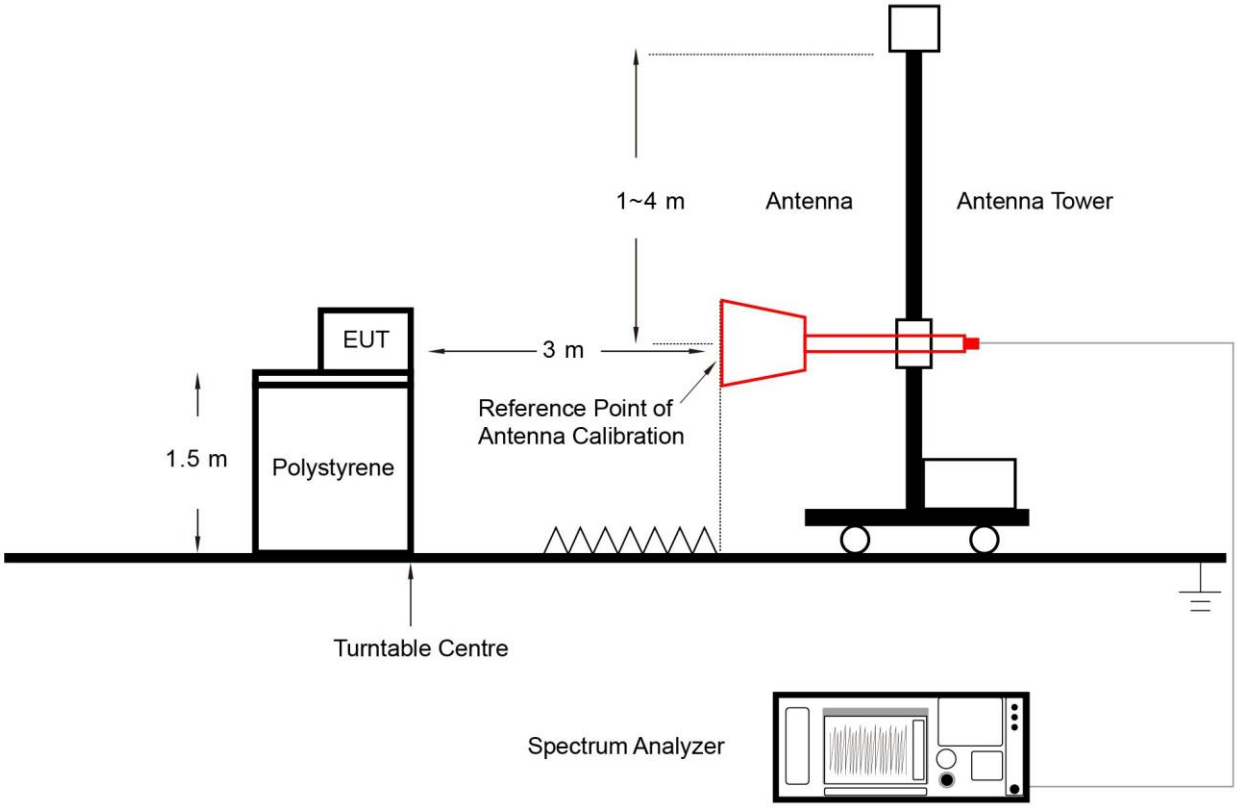
Peak Measurements above 1GHz

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

6.8.4. Test Setup



6.8.5. Test Result

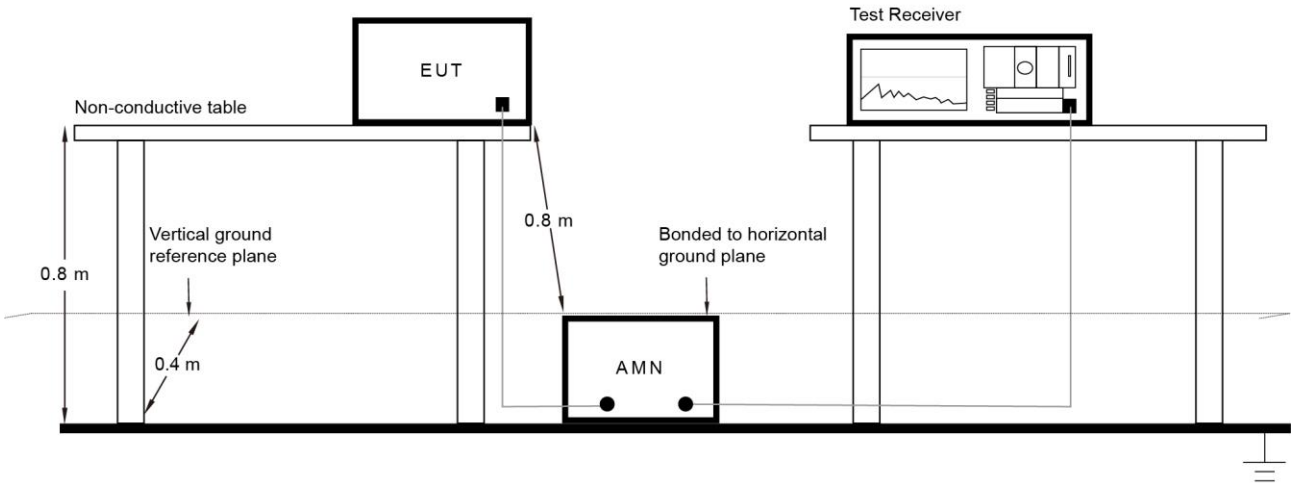
Refer to Appendix A.8.

6.9. AC Conducted Emissions Measurement

6.9.1. 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.		

6.9.2. Test Setup



6.9.3. Test Result

Refer to Appendix A.9.

Appendix A - Test Result

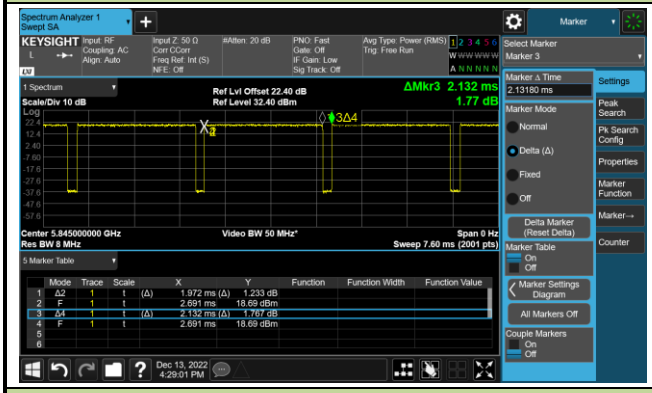
A.1 Duty Cycle Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2022-12-13		

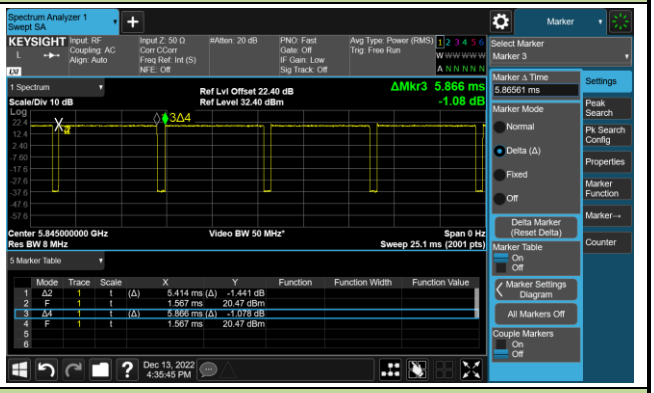
Test Mode	Duty Cycle
802.11a	92.50%
802.11ac-VHT20	92.29%
802.11ac-VHT40	94.23%
802.11ac-VHT80	94.07%
802.11ax-HE20	93.38%
802.11ax-HE40	93.31%
802.11ax-HE80	93.30%

Duty Cycle (T = Transmission Duration)

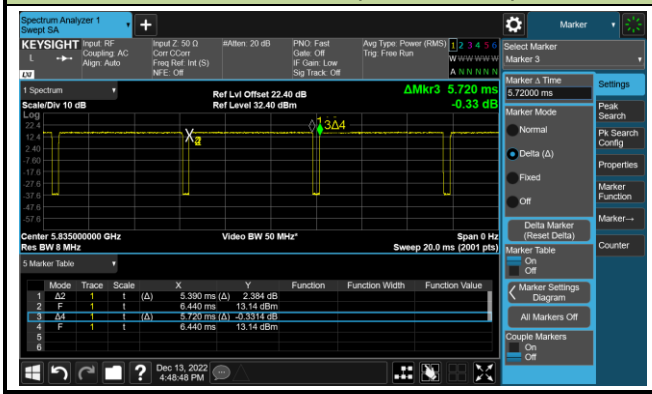
802.11a (T = 1.972ms)



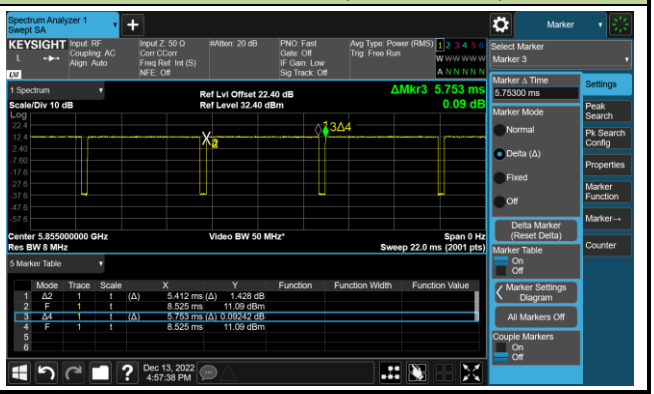
802.11ac-VHT20 (T = 5.414ms)

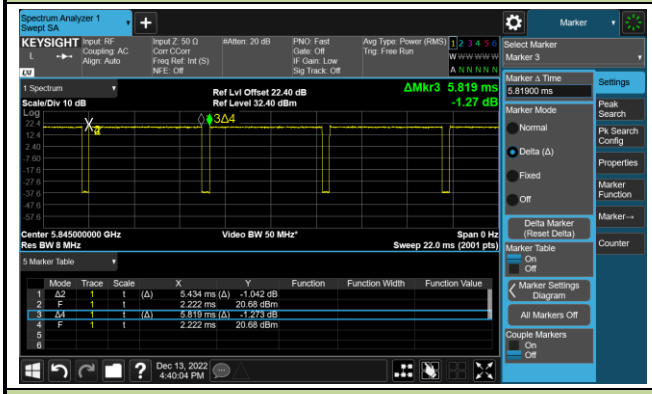
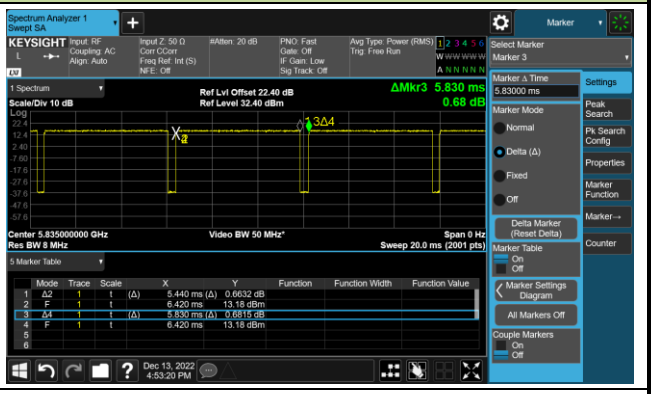
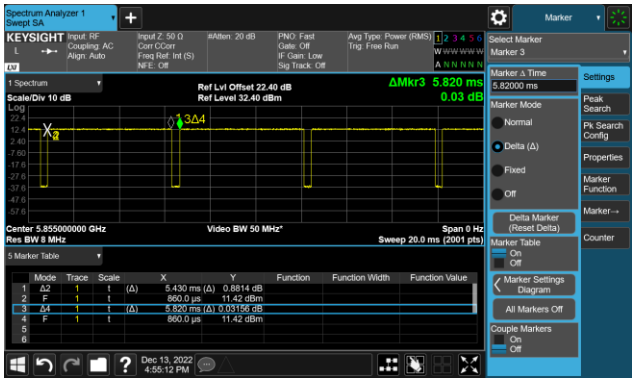


802.11ac-VHT40 (T = 5.390ms)



802.11ac-VHT80 (T = 5.412ms)

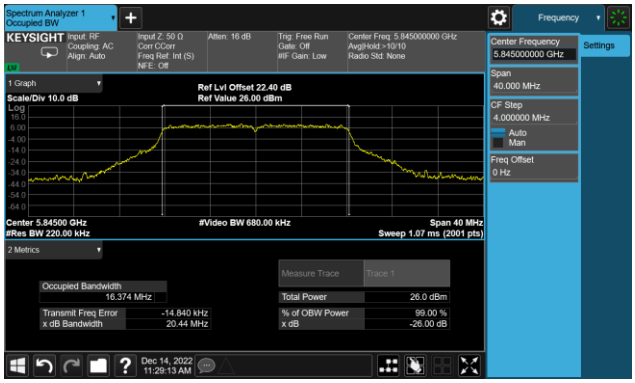
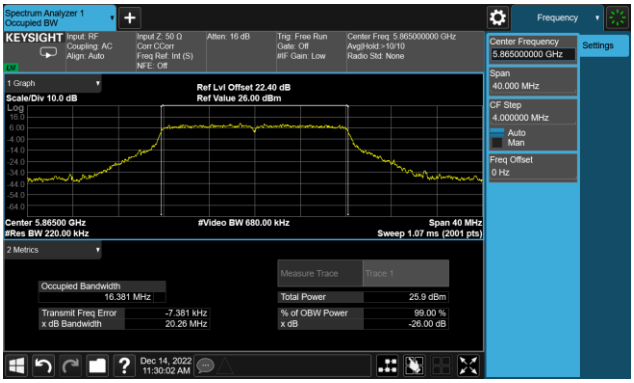
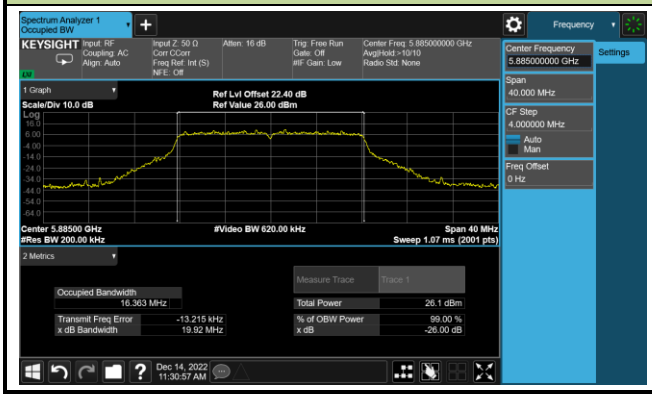


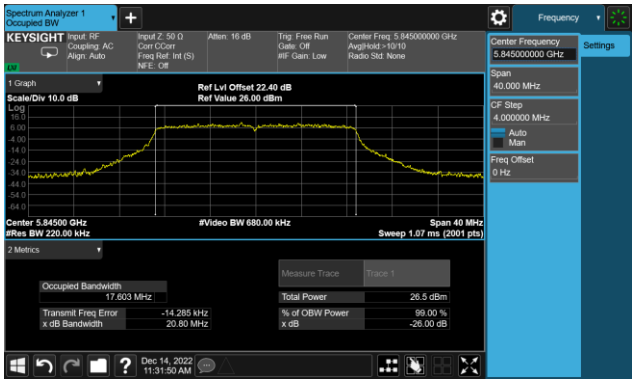
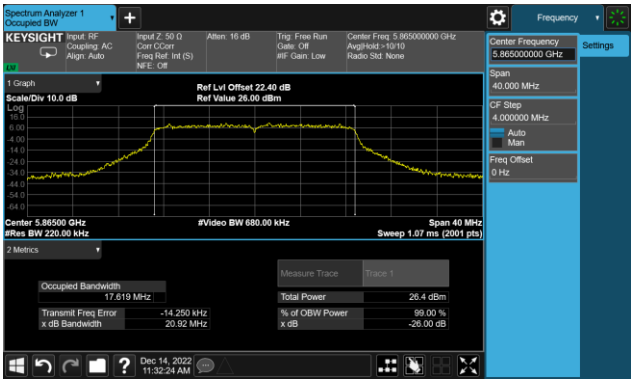
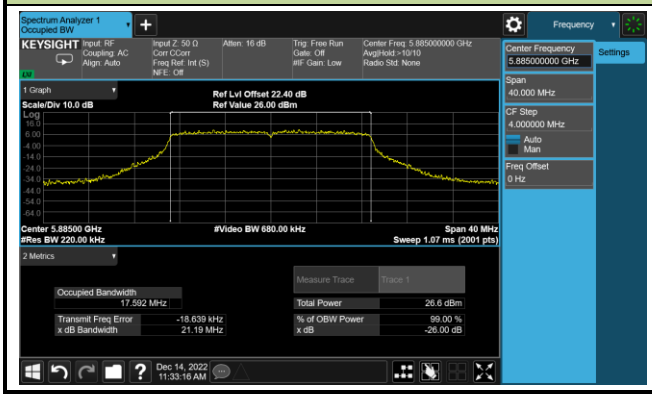
Duty Cycle (T = Transmission Duration)	
802.11ax-HE20 (T = 5.434ms)	802.11ax-HE40 (T = 5.440ms)
	
802.11ax-HE80 (T = 5.430ms)	
	

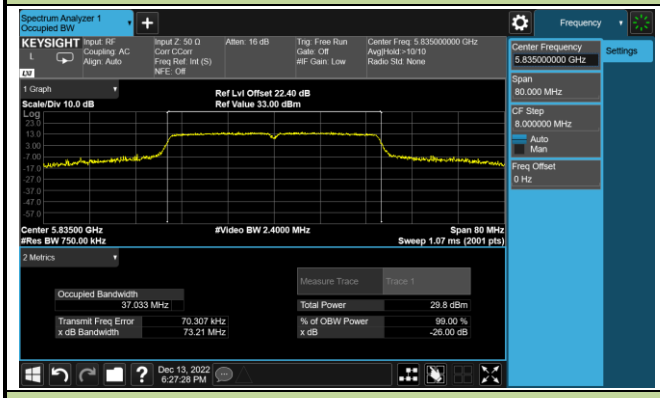
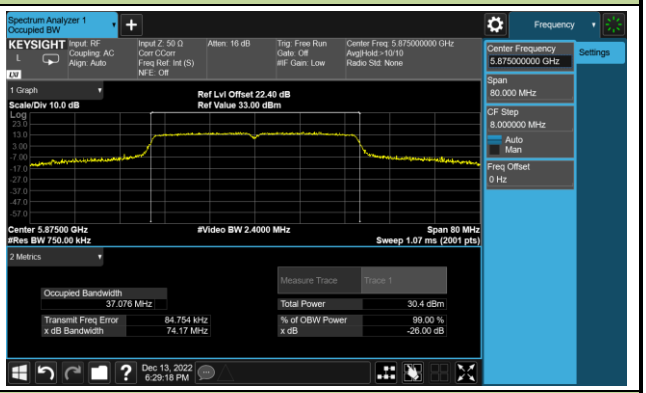
A.2 26dB & 99% Bandwidth Test Result

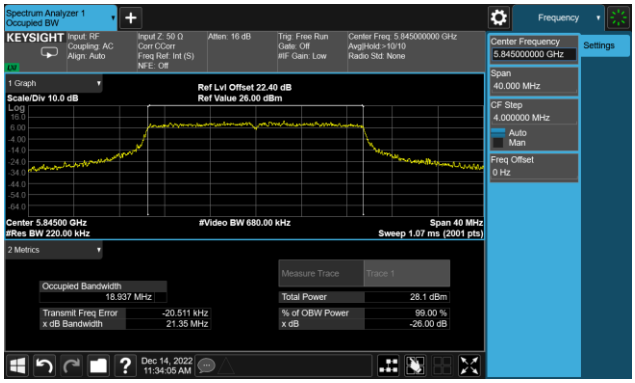
Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2022-12-13 ~ 2022-12-14		

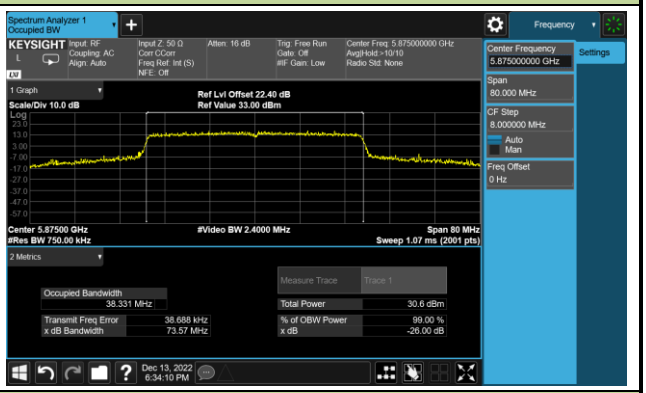
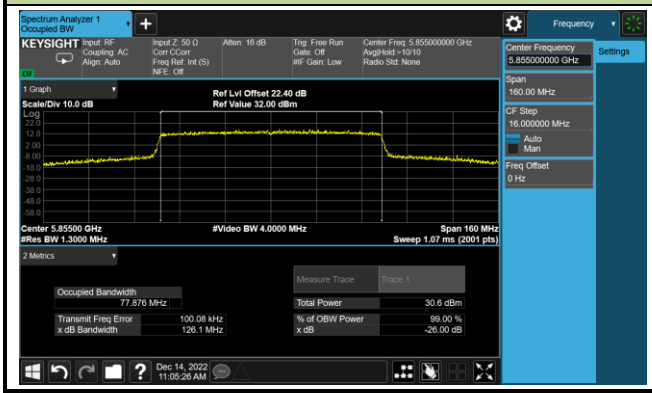
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
11a	6Mbps	169	5845	16.374	20.44
11a	6Mbps	173	5865	16.381	20.26
11a	6Mbps	177	5885	16.363	19.92
11ac-VHT20	MCS0	169	5845	17.603	20.80
11ac-VHT20	MCS0	173	5865	17.619	20.92
11ac-VHT20	MCS0	177	5885	17.592	21.19
11ac-VHT40	MCS0	167	5835	37.033	73.21
11ac-VHT40	MCS0	175	5875	37.076	74.17
11ac-VHT80	MCS0	171	5855	76.249	147.10
11ax-HE20	MCS0	169	5845	18.937	21.35
11ax-HE20	MCS0	173	5865	18.928	21.18
11ax-HE20	MCS0	177	5885	18.914	21.63
11ax-HE40	MCS0	167	5835	38.267	66.66
11ax-HE40	MCS0	175	5875	38.331	73.57
11ax-HE80	MCS0	171	5855	77.876	126.10

802.11a 26dB & 99% Bandwidth	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ac-VHT20 26dB & 99% Bandwidth	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ac-VHT40 26dB & 99% Bandwidth	
Channel 167 (5835MHz)	Channel 175(5875MHz)
	
802.11ac-VHT80 26dB & 99% Bandwidth	
Channel 171 (5855MHz)	
	

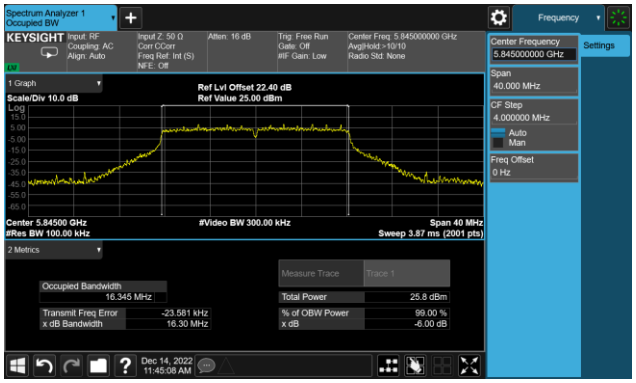
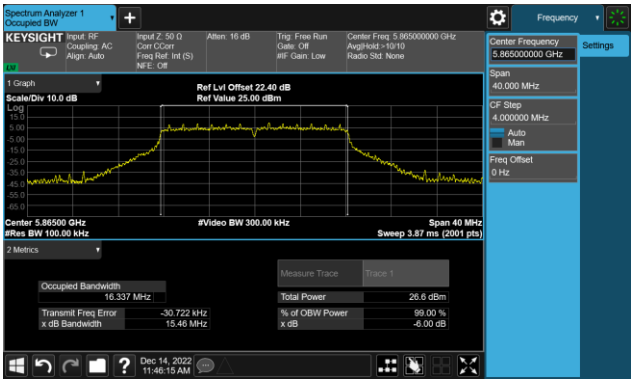
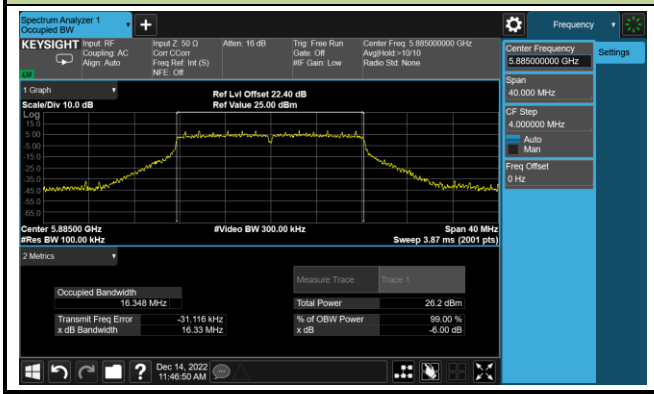
802.11ax-HE20 26dB & 99% Bandwidth	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

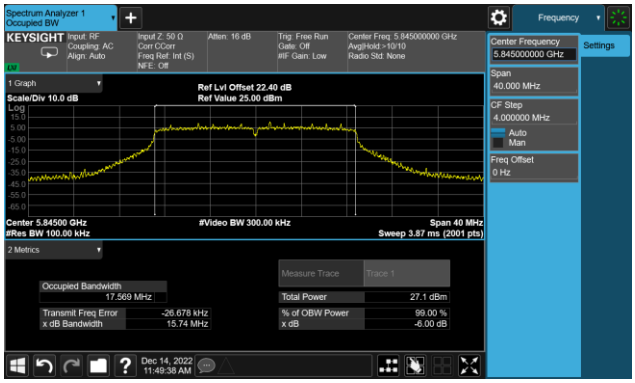
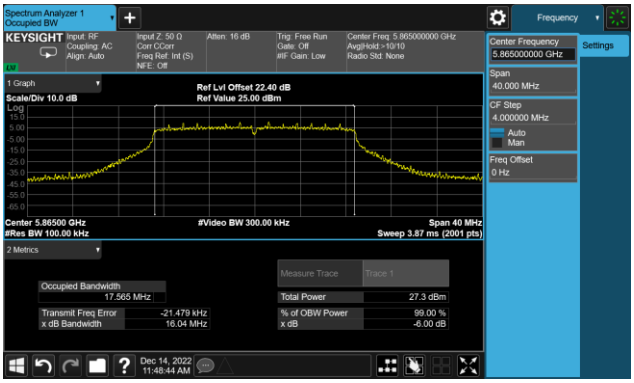
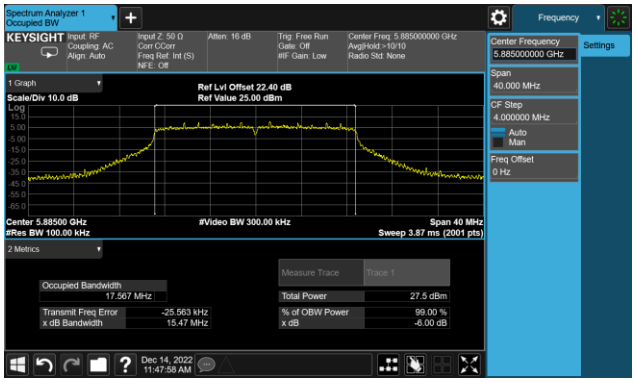
802.11ax-HE40 26dB & 99% Bandwidth	
Channel 167 (5835MHz)	Channel 175(5875MHz)
	
802.11ax-HE80 26dB & 99% Bandwidth	
Channel 171 (5855MHz)	
	

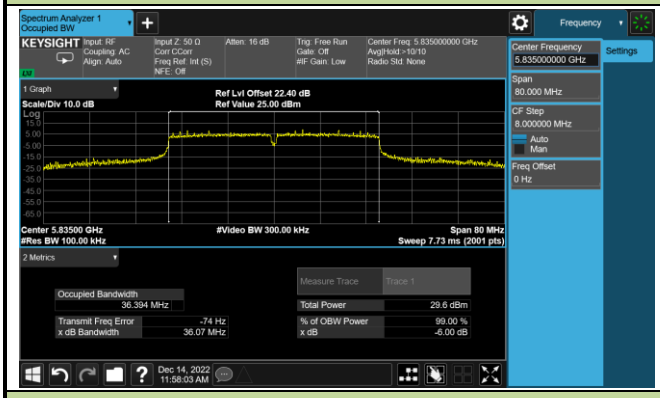
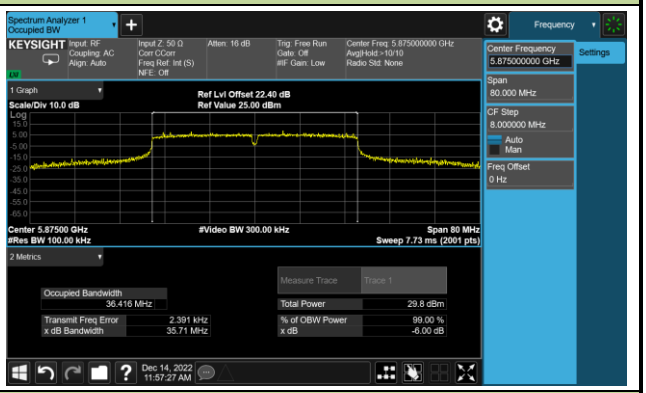
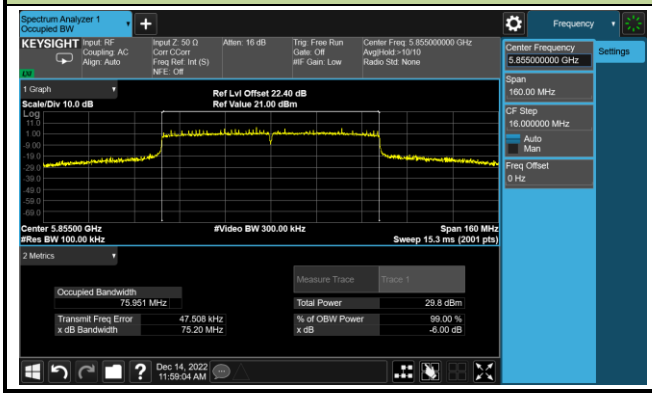
A.3 6dB Bandwidth Test Result

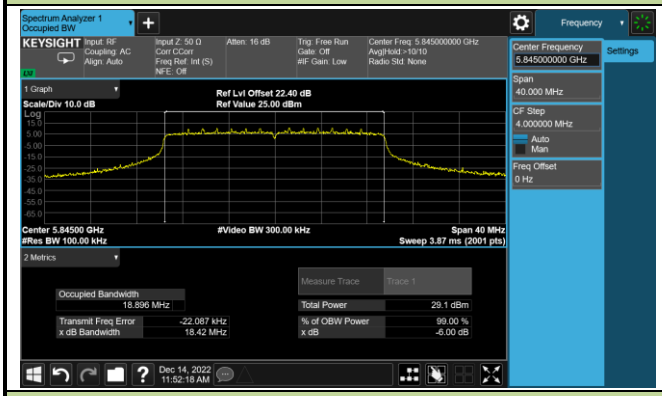
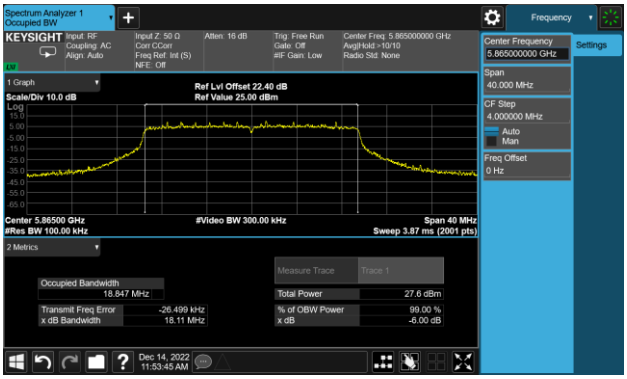
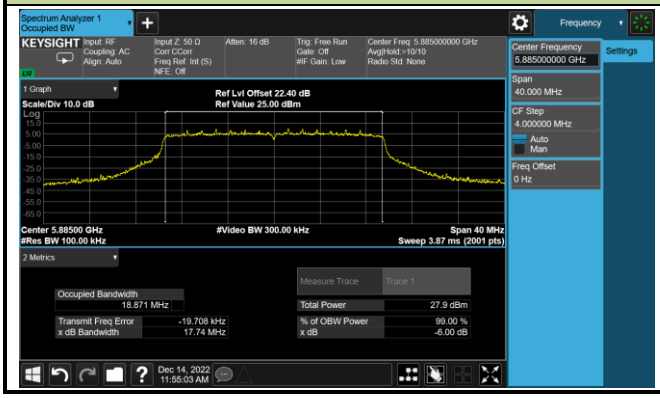
Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2022-12-14		

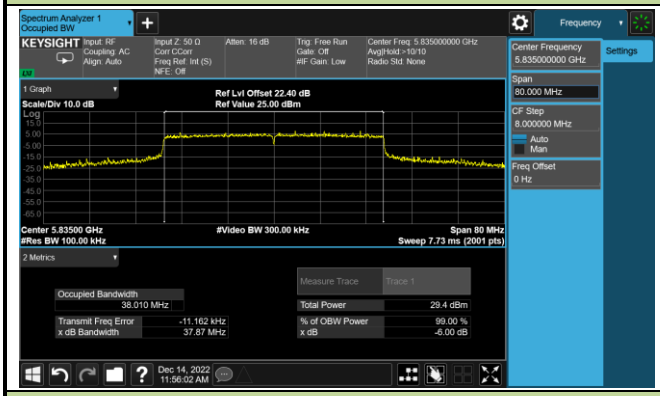
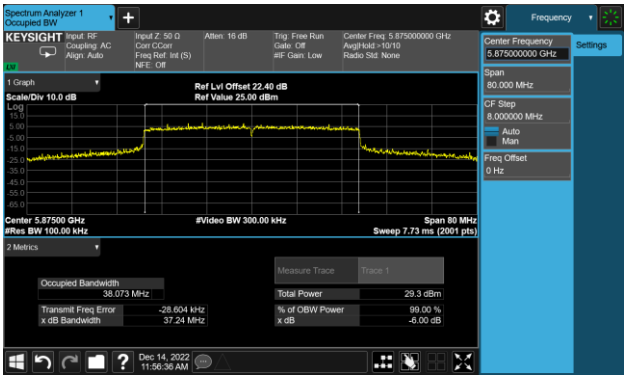
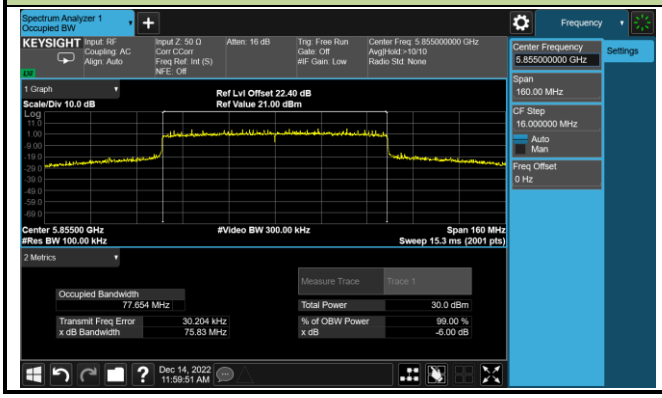
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11a	6Mbps	169	5845	16.30	≥ 0.5
11a	6Mbps	173	5865	15.46	≥ 0.5
11a	6Mbps	177	5885	16.33	≥ 0.5
11ac-VHT20	MCS0	169	5845	15.74	≥ 0.5
11ac-VHT20	MCS0	173	5865	16.04	≥ 0.5
11ac-VHT20	MCS0	177	5885	15.47	≥ 0.5
11ac-VHT40	MCS0	167	5835	36.07	≥ 0.5
11ac-VHT40	MCS0	175	5875	35.71	≥ 0.5
11ac-VHT80	MCS0	171	5855	75.20	≥ 0.5
11ax-HE20	MCS0	169	5845	18.42	≥ 0.5
11ax-HE20	MCS0	173	5865	18.11	≥ 0.5
11ax-HE20	MCS0	177	5885	17.74	≥ 0.5
11ax-HE40	MCS0	167	5835	37.87	≥ 0.5
11ax-HE40	MCS0	175	5875	37.24	≥ 0.5
11ax-HE80	MCS0	171	5855	75.83	≥ 0.5

802.11a 6dB Bandwidth	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ac-VHT20 6dB Bandwidth	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ac-VHT40 6dB Bandwidth	
Channel 167 (5835MHz)	Channel 175(5875MHz)
	
802.11ac-VHT80 6dB Bandwidth	
Channel 171 (5855MHz)	
	

802.11ax-HE20 6dB Bandwidth	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ax-HE40 6dB Bandwidth	
Channel 167 (5835MHz)	Channel 175(5875MHz)
	
802.11ax-HE80 6dB Bandwidth	
Channel 171 (5855MHz)	
	

A.4 Output Power Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2022-12-13 ~ 2022-12-14		

Test Mode	Data Rate MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Average Power (dBm)	EIRP Power (dBm)	Power Limit (dBm)
				Ant 0	Ant 1			
11a	6Mbps	169	5845	19.49	19.36	22.44	28.04	≤ 36.00
11a	6Mbps	173	5865	19.45	19.40	22.44	28.04	≤ 36.00
11a	6Mbps	177	5885	19.48	19.36	22.43	28.03	≤ 36.00
11ac-VHT20	MCS0	169	5845	20.02	20.05	23.05	28.65	≤ 36.00
11ac-VHT20	MCS0	173	5865	20.13	19.99	23.07	28.67	≤ 36.00
11ac-VHT20	MCS0	177	5885	20.01	20.06	23.05	28.65	≤ 36.00
11ac-VHT40	MCS0	167	5835	22.63	22.43	25.54	31.14	≤ 36.00
11ac-VHT40	MCS0	175	5875	22.49	22.55	25.53	31.13	≤ 36.00
11ac-VHT80	MCS0	171	5855	22.12	22.03	25.09	30.69	≤ 36.00
11ax-HE20	MCS0	169	5845	20.97	20.93	23.96	29.56	≤ 36.00
11ax-HE20	MCS0	173	5865	19.98	19.94	22.97	28.57	≤ 36.00
11ax-HE20	MCS0	177	5885	19.92	19.87	22.91	28.51	≤ 36.00
11ax-HE40	MCS0	167	5835	22.40	22.28	25.35	30.95	≤ 36.00
11ax-HE40	MCS0	175	5875	22.33	22.29	25.32	30.92	≤ 36.00
11ax-HE80	MCS0	171	5855	22.01	21.90	24.97	30.57	≤ 36.00

Note 1: Total Average Power (dBm) = 10*log {$10^{(\text{Ant 0 Average Power /10})}$ + $10^{(\text{Ant 1 Average Power /10})}$}.

Note 2: EIRP Power (dBm) = Total Average Power (dBm) + Directional Gain for Power (dBi).

A.5 Power Spectral Density Test Result

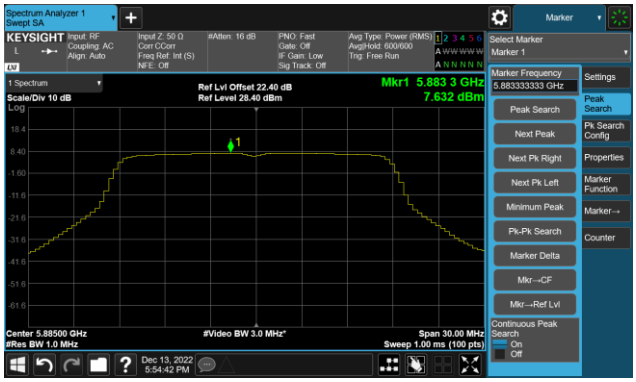
Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2022-12-13 ~ 2022-12-14		

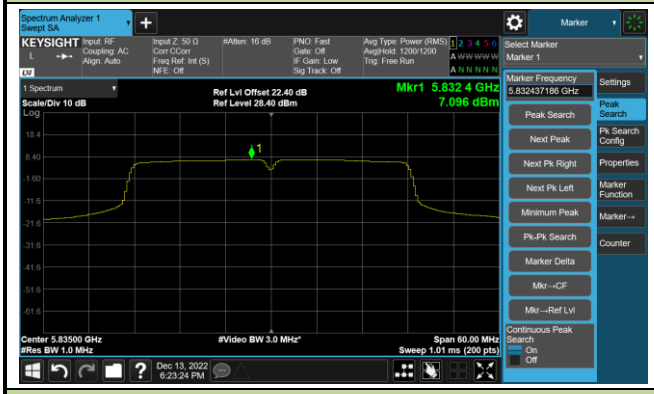
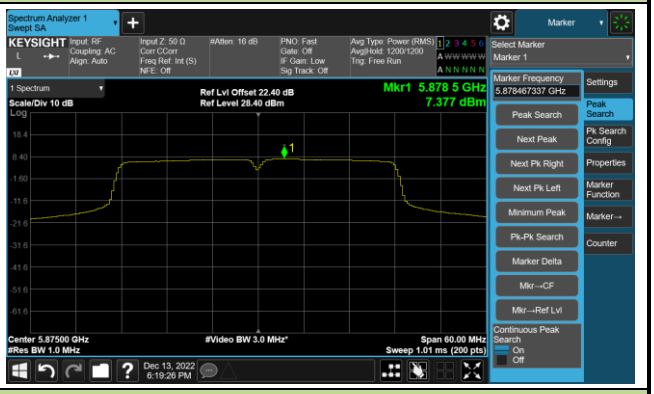
Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	AVPSD (dBm/MHz)		Duty Cycle (%)	Total PSD (dBm/ MHz)	EIRP PSD (dBm/ MHz)	EIRP PSD Limit (dBm/MHz)
				Ant 0	Ant 1				
11a	6Mbps	169	5845	7.419	7.589	92.50	10.85	19.46	≤ 20.00
11a	6Mbps	173	5865	7.556	7.732	92.50	10.99	19.60	≤ 20.00
11a	6Mbps	177	5885	7.826	7.455	92.50	10.99	19.60	≤ 20.00
11ac-VHT20	MCS0	169	5845	7.440	7.597	92.29	10.88	19.49	≤ 20.00
11ac-VHT20	MCS0	173	5865	7.528	7.480	92.29	10.86	19.47	≤ 20.00
11ac-VHT20	MCS0	177	5885	7.632	7.678	92.29	11.01	19.62	≤ 20.00
11ac-VHT40	MCS0	167	5835	7.096	6.991	94.23	10.31	18.92	≤ 20.00
11ac-VHT40	MCS0	175	5875	7.377	7.091	94.23	10.50	19.12	≤ 20.00
11ac-VHT80	MCS0	171	5855	3.647	3.590	94.07	6.89	15.50	≤ 20.00
11ax-HE20	MCS0	169	5845	8.001	7.968	93.38	11.29	19.90	≤ 20.00
11ax-HE20	MCS0	173	5865	7.265	7.225	93.38	10.55	19.16	≤ 20.00
11ax-HE20	MCS0	177	5885	7.300	7.312	93.38	10.61	19.22	≤ 20.00
11ax-HE40	MCS0	167	5835	6.212	6.566	93.31	9.70	18.31	≤ 20.00
11ax-HE40	MCS0	175	5875	6.752	6.873	93.31	10.12	18.73	≤ 20.00
11ax-HE80	MCS0	171	5855	3.567	3.655	93.30	6.92	15.53	≤ 20.00

Note 1: The EUT duty cycle < 98%, the Total PSD (dBm/MHz) =10*log {$10^{(\text{Ant 0 AVGPSD}/10)}$ + $10^{(\text{Ant 1 AVGPSD}/10)}$} +10*log (1/Duty cycle).

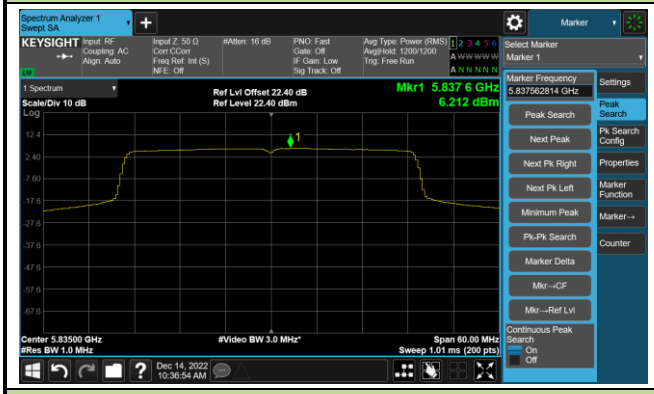
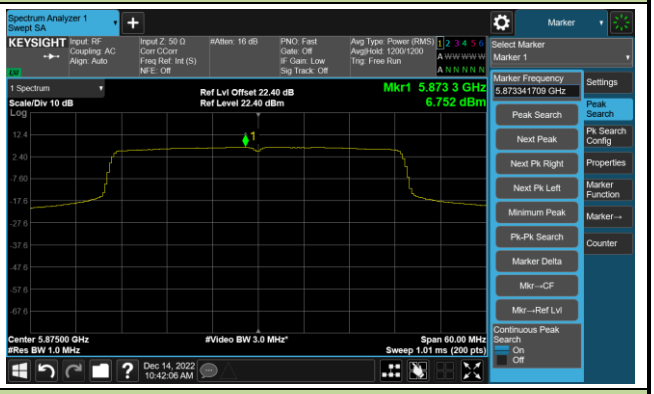
Note 2: EIRP PSD (dBm/MHz) = Total PSD (dBm/MHz) + Directional Gain for PSD (dBi).

802.11a Power Spectral Density - Ant 0	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

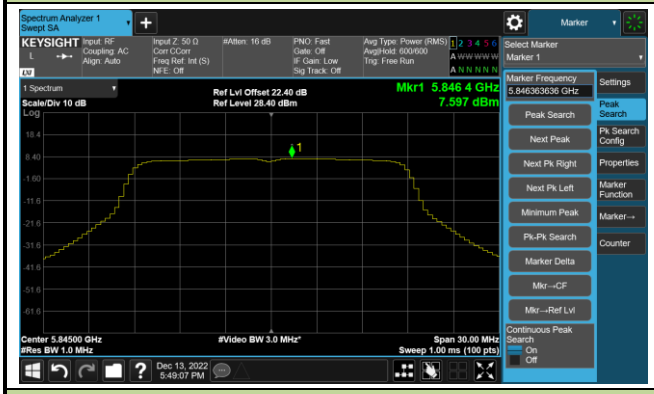
802.11ac-VHT20 Power Spectral Density - Ant 0	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

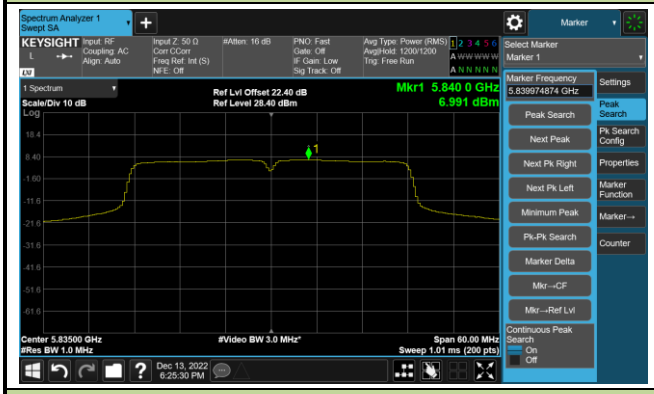
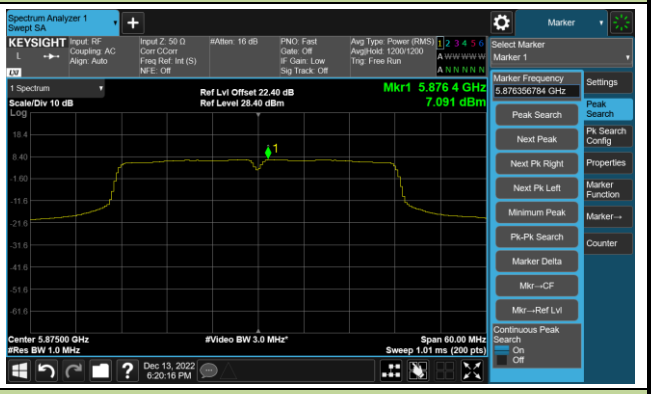
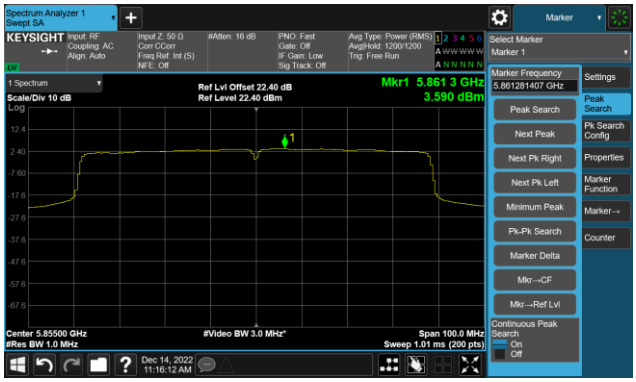
802.11ac-VHT40 Power Spectral Density - Ant 0	
Channel 167 (5835MHz)	Channel 175 (5875MHz)
	
802.11ac-VHT80 Power Spectral Density - Ant 0	
Channel 171 (5855MHz)	
	

802.11ax-HE20 Power Spectral Density - Ant 0	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

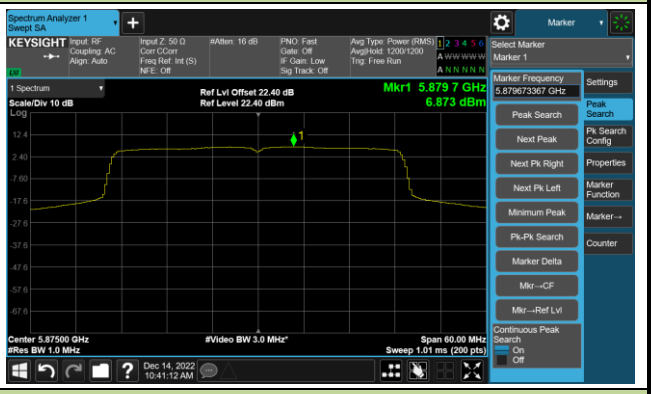
802.11 ax-HE40 Power Spectral Density - Ant 0	
Channel 167 (5835MHz)	Channel 175 (5875MHz)
	
802.11 ax-HE80 Power Spectral Density - Ant 0	
Channel 171 (5855MHz)	
	

802.11a Power Spectral Density - Ant 1	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ac-VHT20 Power Spectral Density - Ant 1	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11ac-VHT40 Power Spectral Density - Ant 1	
Channel 167 (5835MHz)	Channel 175 (5875MHz)
	
802.11ac-VHT80 Power Spectral Density - Ant 1	
Channel 171 (5855MHz)	
	

802.11ax-HE20 Power Spectral Density - Ant 1	
Channel 169 (5845MHz)	Channel 173 (5865MHz)
	
Channel 177 (5885MHz)	
	

802.11 ax-HE40 Power Spectral Density - Ant 1	
Channel 167 (5835MHz)	Channel 175 (5875MHz)
	
802.11 ax-HE80 Power Spectral Density - Ant 1	
Channel 171 (5855MHz)	
	

A.6 Frequency Stability Test Result

Test Site	WZ-TR3	Test Engineer	Lynn Yang
Test Date	2022-12-17		
Test Frequency	5845MHz		

Voltage (%)	Power (VAC)	Temp (°C)	Frequency Tolerance (ppm)			
			0 minutes	2 minutes	5 minutes	10 minutes
100	120	- 30	7.95	6.89	5.83	6.97
		- 20	8.63	8.56	8.20	7.77
		- 10	7.59	8.92	7.60	8.31
		0	5.36	5.98	6.92	6.47
		+ 10	2.86	2.71	1.71	2.72
		+ 20	-0.11	-1.35	-0.14	-1.84
		+ 30	-3.97	-4.76	-4.09	-3.57
		+ 40	-6.53	-7.93	-6.09	-6.29
		+ 50	-6.65	-7.74	-7.55	-7.96
115	138	+ 20	-1.21	-1.35	-0.80	-2.43
85	102	+ 20	-0.81	-1.22	-1.60	-1.15

Note: Frequency Tolerance (ppm) = {[Measured Frequency (Hz) - Declared Frequency (Hz)] / Declared Frequency (Hz)} *10^6.

A.7 Radiated Spurious Emission Test Result

Test Site	SIP-AC1	Test Engineer	Yien Qian
Test Date	2022-12-15 ~ 2022-12-16	Test Mode	802.11a – Channel 169
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	8293.0	50.7	-5.7	45.0	74.0	-29.0	Peak	Horizontal
*	10197.0	49.7	-4.8	44.9	108.2	-63.3	Peak	Horizontal
	11693.0	52.0	-3.9	48.1	74.0	-25.9	Peak	Horizontal
*	14192.0	47.5	-1.0	46.5	108.2	-61.7	Peak	Horizontal
	7579.0	48.8	-6.1	42.7	74.0	-31.3	Peak	Vertical
*	10214.0	49.2	-4.7	44.5	108.2	-63.7	Peak	Vertical
	11684.5	54.7	-4.1	50.6	74.0	-23.4	Peak	Vertical
*	13877.5	46.7	-0.7	46.0	108.2	-62.2	Peak	Vertical

Note 1: "*" is not in restricted band.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)