RF MEASUREMENT REPORT

FCC ID:	VW3FAST5689E
Applicant:	SAGEMCOM BROADBAND SAS
Product:	Giga Hub
Model No.:	FAST 5689E
Brand Name:	SAGEMCOM
FCC Classification:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s):	Part 15 Subpart E (Section 15.407)
Test Date:	January 11 ~ 27, 2022

Reviewed By: Sunny Sun

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.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2201RSU021-U4	Rev. 01	Initial Report	02-27-2022	Valid

CONTENTS

Description Page

1. General Information 6

1.1. Applicant 6
1.2. Manufacturer 6
1.3. Testing Facility 6
1.4. Product Information 7
1.5. Radio Specification 7
1.6. Working Frequencies 8
1.7. Antenna Details 8

2. Test Configuration 9

2.1. Test Mode 9
2.2. Test System Connection Diagram 9
2.3. Test Software 9
2.4. Applied Standards 10
2.5. Test Environment Condition 10

3. Antenna Requirements 11

4. Measuring Instrument 12

5. Measurement Uncertainty 13

6. Test Result 14

6.1. Summary 14
6.2. 26dB Bandwidth Measurement 15
6.2.1. Test Limit 15
6.2.2. Test Procedure 15
6.2.3. Test Setting 15
6.2.4. Test Setup 16
6.2.5. Test Result 16
6.3. 6dB Bandwidth Measurement 17
6.3.1. Test Limit 17
6.3.2. Test Procedure 17
6.3.3. Test Setting 17
6.3.4. Test Setup 17
6.3.5. Test Result 17
6.4. Output Power Measurement 18
6.4.1. Test Limit 18
6.4.2. Test Procedure 18
6.4.3. Test Setting 18

6.4.4. Test Setup 18
6.4.5. Test Result 18
6.5. Power Spectral Density Measurement 19
6.5.1. Test Limit 19
6.5.2. Test Procedure 19
6.5.3. Test Setting 19
6.5.4. Test Setup 20
6.5.5. Test Result 20
6.6. Frequency Stability Measurement 21
6.6.1. Test Limit 21
6.6.2. Test Procedure 21
6.6.3. Test Setup 22
6.6.4. Test Result 22
6.7. Radiated Spurious Emission Measurement 23
6.7.1. Test Limit 23
6.7.2. Test Procedure 23
6.7.3. Test Setting 23
6.7.4. Test Setup 25
6.7.5. Test Result 25
6.8. Radiated Restricted Band Edge Measurement 26
6.8.1. Test Limit 26
6.8.2. Test Procedure 27
6.8.3. Test Setting 27
6.8.4. Test Setup 28
6.8.5. Test Result 28
6.9. AC Conducted Emissions Measurement 29
6.9.1. Test Limit 29
6.9.2. Test Setup 29
6.9.3. Test Result 29

Appendix A – Test Result 30

A.1 Duty Cycle Test Result 30
A.2 26dB Bandwidth Test Result 32
A.3 6dB Bandwidth Test Result 40
A.4 Output Power Test Result 46
A.5 Power Spectral Density Test Result 48
A.6 Frequency Stability Test Result 78
A.7 Radiated Spurious Emission Test Result 79
A.8 Radiated Restricted Band Edge Test Result 111
A.9 AC Conducted Emissions Test Result 163

Appendix B – Test Setup Photograph.....165

Appendix C – EUT Photograph 166

1. General Information

1.1. Applicant

SAGEMCOM BROADBAND SAS

250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE

1.2. Manufacturer

SAGEMCOM BROADBAND SAS

250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE

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	Giga Hub
Model No.	FAST 5689E
EUT Identification No.	20220107Sample#17(Radiated) 20220107Sample#16(Conducted)
Wi-Fi Specification	802.11b/g/n/ac/ax
Zigbee Specification	802.15.4
Z-Wave Specification	800 ~ 900MHz radio frequency range
Antenna Information	Refer to Section 1.7
Power Type	AC Adapter
Operating Environment	Indoor Use
Accessories	
Adapter 1#	Model No.: NBS60E120500M2 Input: 100-127V, 50/60Hz, 1.5A Output: 12.0V⎓5.0A
Adapter 2#	Model No.: MS-Z5000R120-060C0-P Input: 100-127V, 50/60Hz, 1.5A Output: 12.0V⎓5.0A
Adapter 3#	Model No.: ADS-65HI-12A-2 12060E-L Input: 100-127V, 50/60Hz, 1.5A Output: 12.0V⎓5.0A
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

Frequency Range	For 802.11a/n-HT20/ac-VHT20/ax-HE20: 5180 ~ 5240MHz, 5745 ~ 5825MHz For 802.11n-HT40/ac-VHT40/ax-HE40: 5190 ~ 5230MHz, 5755 ~ 5795MHz For 802.11ac-VHT80/ax-HE80: 5210MHz, 5775MHz
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 600Mbps 802.11ac: up to 3466.7Mbps; 802.11ax: up to 4804Mbps

Note: For other features of this EUT, test report will be issued separately.

1.6. Working Frequencies

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

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/ax-HE40

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

802.11ac-VHT80/ax-HE80

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

1.7. Antenna Details

Antenna Type	Frequency Band (GHz)	Antenna Gain (dBi)				Directional Gain (dBi)	
		Ant 0	Ant 1	Ant 2	Ant 3	For Power	For PSD
Wi-Fi Antenna (4*4 MIMO)							
PIFA & Dipole	2.4 ~ 2.5	2.79	2.38	2.95	1.91	2.95	6.40
	5.15 ~ 5.85	4.89	4.53	3.51	3.88	4.89	6.90
ZigBee Antenna							
Dipole	2.4 ~ 2.5	2.85					
Z-Wave Antenna							
Dipole	0.9 ~ 1	-0.46					

2. Test Configuration

2.1. Test Mode

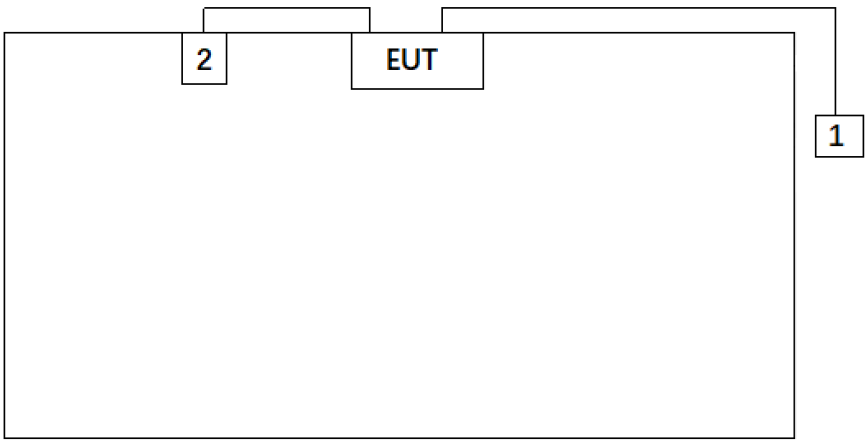
Mode 1: Transmit by 802.11a (6Mbps)
Mode 2: Transmit by 802.11ac-VHT20 (MCS0)
Mode 3: Transmit by 802.11ac-VHT40 (MCS0)
Mode 4: Transmit by 802.11ac-VHT80 (MCS0)
Mode 5: Transmit by 802.11ax-HE20 (MCS0)
Mode 6: Transmit by 802.11ax-HE40 (MCS0)
Mode 7: Transmit by 802.11ax-HE80 (MCS0)

Note: Due to the same modulation between 802.11n and 802.11ac, so 802.11n are covered by 802.11ac in this report, meanwhile, power setting for 802.11n will not be greater than 802.11ac.

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



Product		Manufacturer	Model No.
1	Notebook	DELL	Precision 3510
2	AC Adapter	Sagemcom	NBS60E120500M2

2.3. Test Software

The test utility software used during testing was “accessMTool”, and the version was 3.2.1.3.

Note: Final power setting please refer to operational description.

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
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2022/12/29	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2022/9/16	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2022/11/12	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2022/8/5	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2022/4/29	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2022/6/28	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2022/12/29	WZ-AC1
Thermohygrometer	testo	Testo 608-H1	MRTSUE11039	1 year	2022/11/11	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2022/10/28	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2022/12/1	WZ-AC1
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2023/1/13	WZ-AC1
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2022/10/10	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2022/6/28	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2022/6/24	WZ-TR3
Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2022/4/13	WZ-TR3
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2022/6/8	WZ-TR3
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2022/6/8	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2022/6/28	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	2022/11/1	WZ-SR2

Software	Version	Function
EMI Software	V3	EMI Test Software

5. 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 Bandwidth	Conducted	Pass
15.407(e)	6dB Bandwidth		Pass
15.407(a)(1)(ii), (3)	Maximum Conducted Output Power		Pass
15.407(a)(1)(ii), (3), (12)	Peak Power Spectral Density		Pass
15.407(b)(1), (4)(i)	Undesirable Emissions		Pass
15.205, 15.209 15.407 (8), (9)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Radiated	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 (data refers to operational description), and then choose the maximum power output (low data rate) for final test of each channel.
3. EUT supports one configuration only in 802.11ax full RU mode.

6.2. 26dB Bandwidth Measurement

6.2.1. Test Limit

N/A

6.2.2. Test Procedure

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

KDB 789033 D02v02r01- Section D (99% Bandwidth)

6.2.3. Test Setting

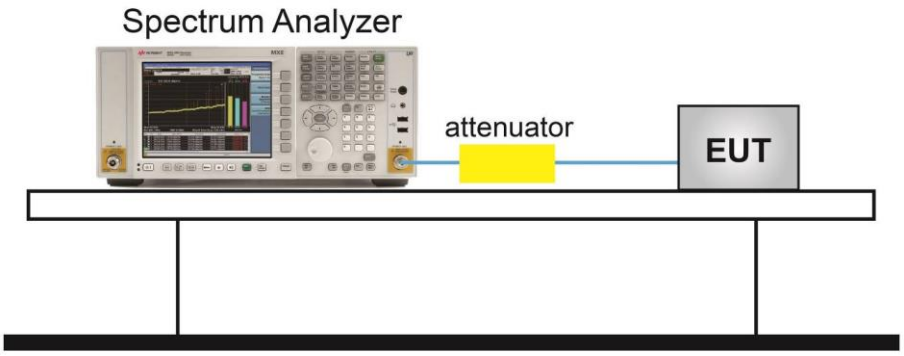
26dB Bandwidth

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 ≥ 3×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.

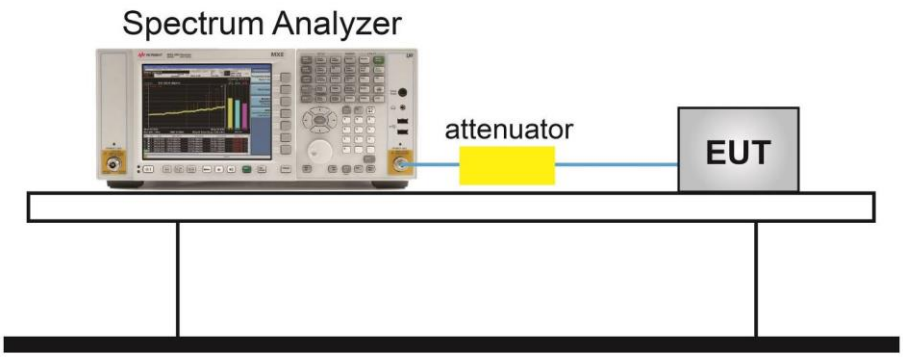
6.3.2. Test Procedure

KDB 789033 D02v02r01- Section 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 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

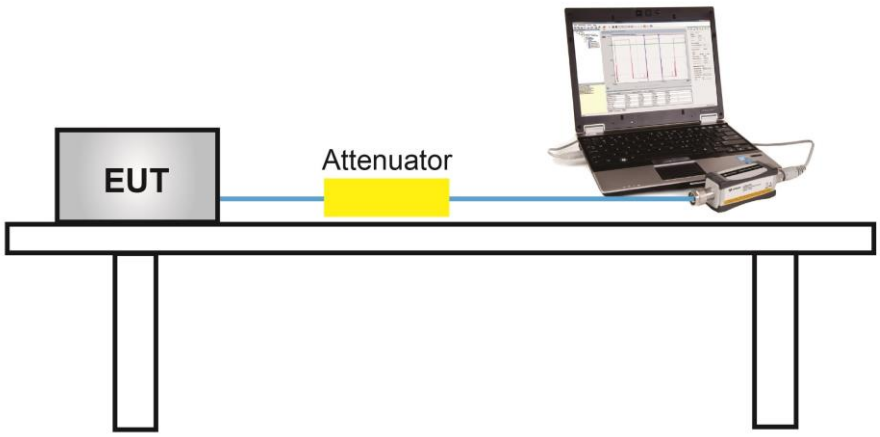
KDB 789033D02v02r01- Section E)3)b) Method PM-G

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. Power Spectral Density Measurement

6.5.1. 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.

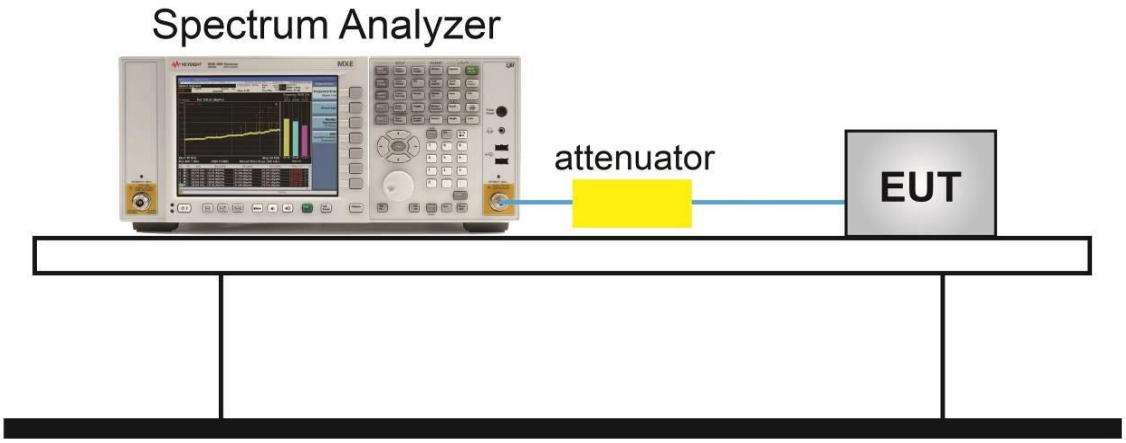
6.5.2. Test Procedure

KDB 789033 D02v02r01-SectionF

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, if measurement bandwidth of Maximum PSD is specified in 500 kHz,
4. RBW = 510 kHz
5. VBW = 3MHz
6. Number of sweep points ≥ 2 × (span / RBW)
7. Detector = power averaging (Average)
8. Sweep time = auto
9. Trigger = free run
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:

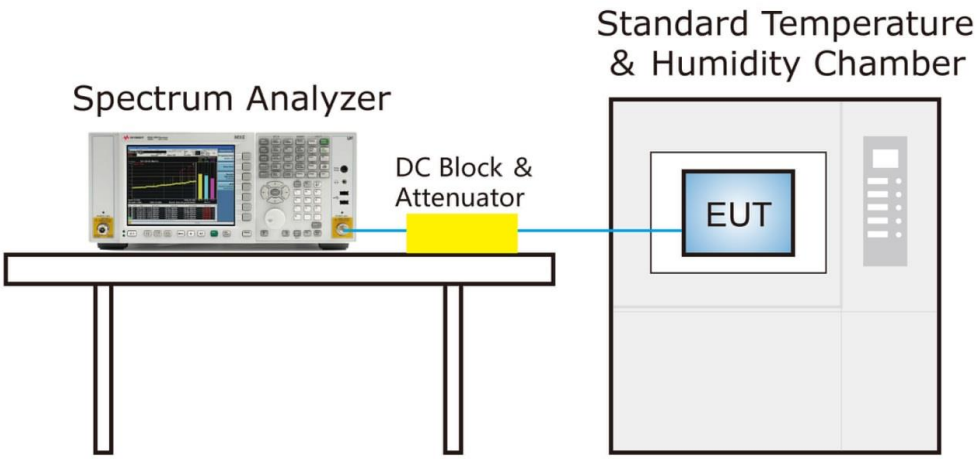
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain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

6.7.2. Test Procedure

KDB 789033 D02v02r01- Section 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

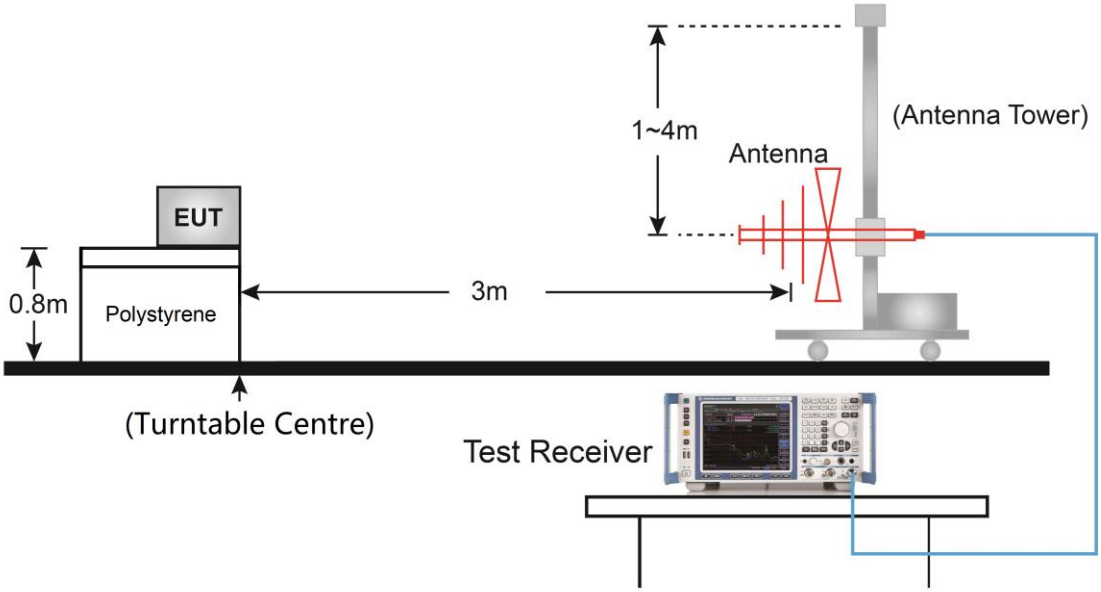
5. Sweep time = auto

6. Trace mode = max hold

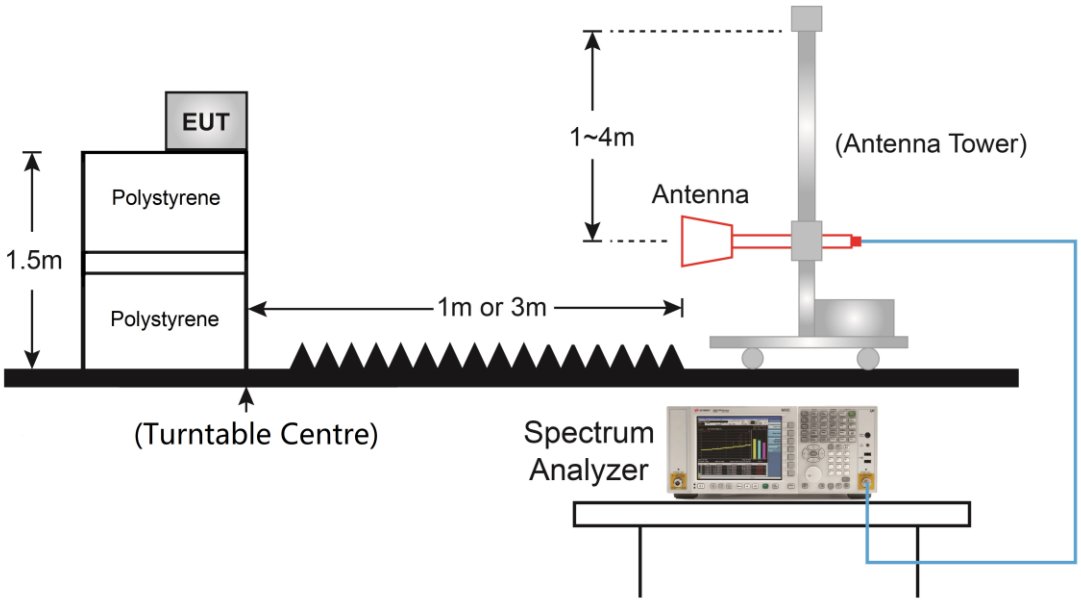
7. Trace was allowed to stabilize

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 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

6.8.2. Test Procedure

KDB 789033 D02v02r01- Section G

6.8.3. Test Setting

Peak Measurements above 1GHz

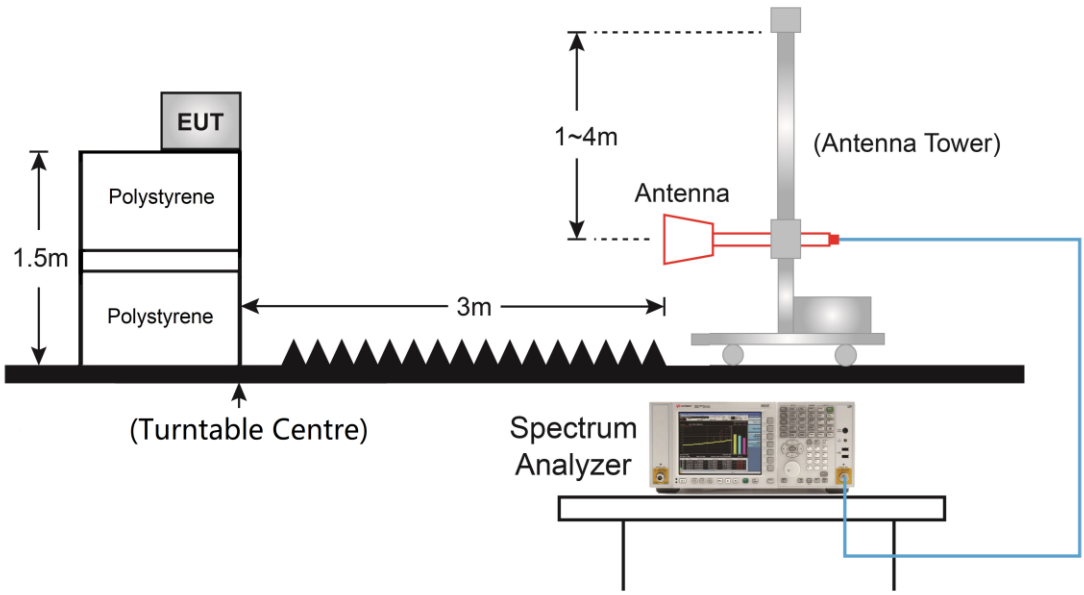
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

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

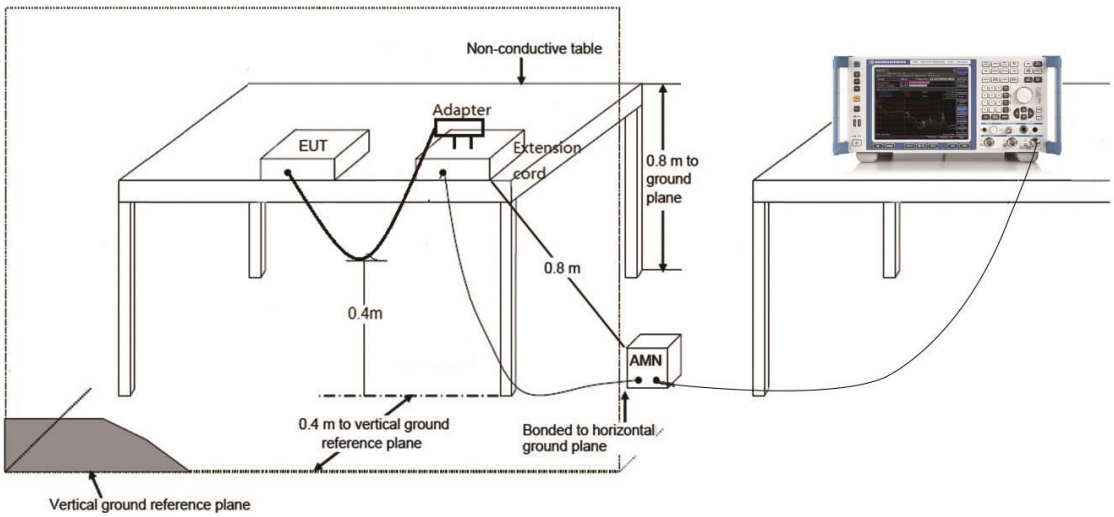
Refer to Appendix A.8.

6.9. AC Conducted Emissions Measurement

6.9.1. Test Limit

FCC Part 15 Subpart C Paragraph 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.

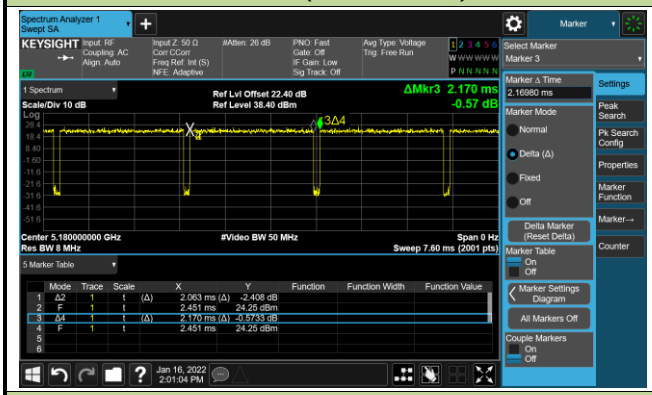
Appendix A – Test Result

A.1 Duty Cycle Test Result

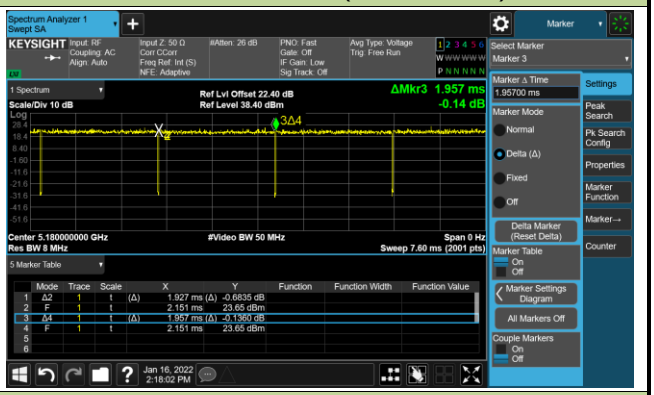
Test Mode	Duty Cycle
802.11a	95.07%
802.11ac-VHT20	98.47%
802.11ac-VHT40	97.18%
802.11ac-VHT80	94.25%
802.11ac-VHT160	89.82%
802.11ax-HE20	98.28%
802.11ax-HE40	96.39%
802.11ax-HE80	93.65%
802.11ax-HE160	89.39%

Duty Cycle (T = Transmission Duration)

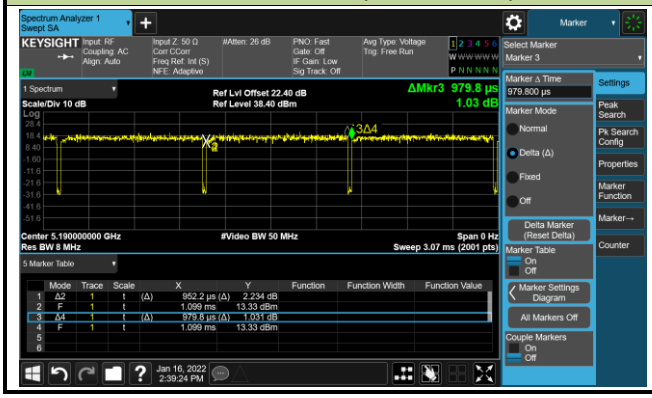
802.11a (T = 2.063ms)



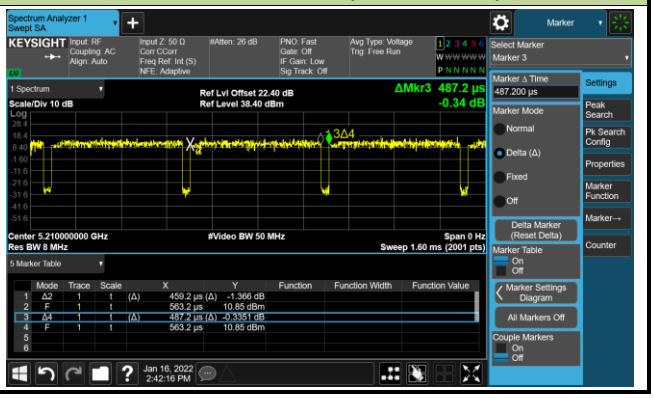
802.11ac-VHT20 (T = 1.927ms)

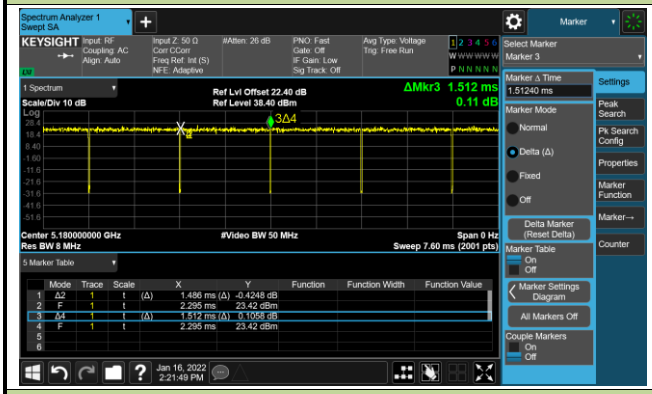
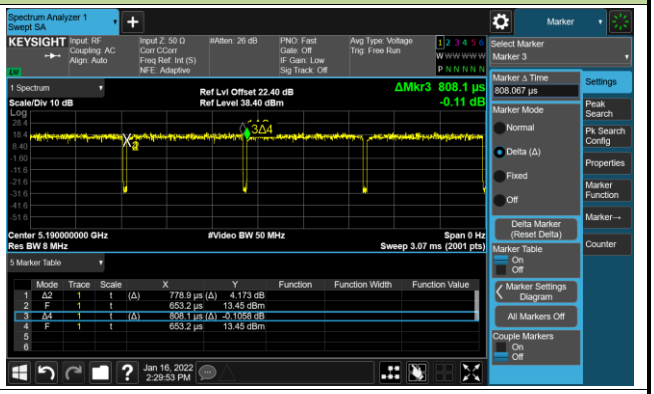
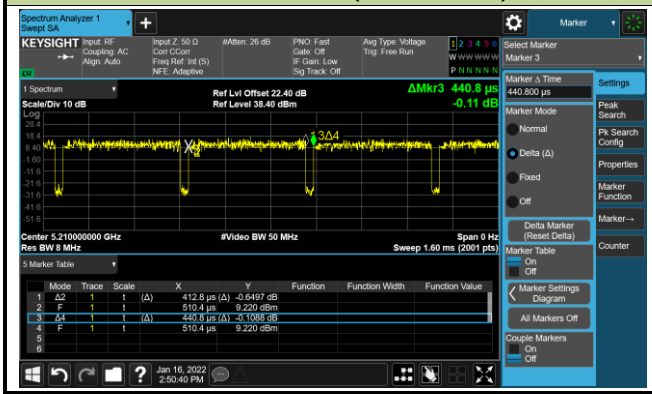


802.11ac-VHT40 (T = 952.2us)



802.11ac-VHT80 (T = 459.2us)



Duty Cycle (T = Transmission Duration)	
802.11ax-HE20 (T = 1.486ms)	802.11ax-HE40 (T = 778.9us)
	
802.11ax-HE80 (T = 412.8us)	
	

A.2 26dB Bandwidth Test Result

Test Site	WZ-SR4	Test Engineer	Luis Yang
Test Date	2022/01/19 ~ 2022/01/27		

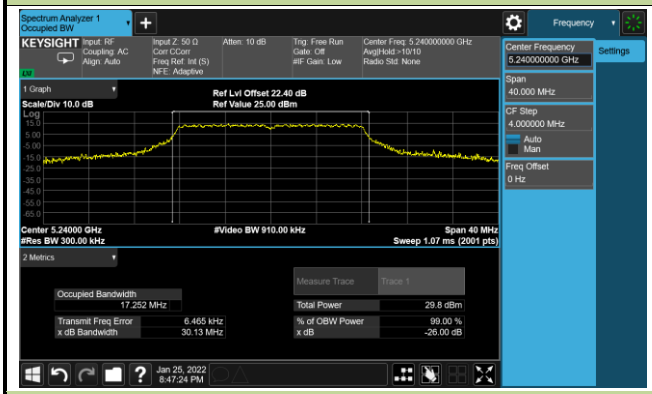
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)
11a	6Mbps	36	5180	22.25
11a	6Mbps	44	5220	29.91
11a	6Mbps	48	5240	30.13
11a	6Mbps	149	5745	35.73
11a	6Mbps	157	5785	38.06
11a	6Mbps	165	5825	37.28
11ac-VHT20	MCS0	36	5180	30.09
11ac-VHT20	MCS0	44	5220	35.08
11ac-VHT20	MCS0	48	5240	38.39
11ac-VHT20	MCS0	149	5745	35.20
11ac-VHT20	MCS0	157	5785	35.26
11ac-VHT20	MCS0	165	5825	38.90
11ac-VHT40	MCS0	38	5190	47.19
11ac-VHT40	MCS0	46	5230	67.55
11ac-VHT40	MCS0	151	5755	75.66
11ac-VHT40	MCS0	159	5795	79.45
11ac-VHT80	MCS0	42	5210	89.26
11ac-VHT80	MCS0	155	5775	97.67
11ax-HE20	MCS0	36	5180	25.49
11ax-HE20	MCS0	44	5220	39.33
11ax-HE20	MCS0	48	5240	38.98
11ax-HE20	MCS0	149	5745	33.83
11ax-HE20	MCS0	157	5785	37.49
11ax-HE20	MCS0	165	5825	39.57
11ax-HE40	MCS0	38	5190	42.23
11ax-HE40	MCS0	46	5230	50.48
11ax-HE40	MCS0	151	5755	60.56
11ax-HE40	MCS0	159	5795	78.93
11ax-HE80	MCS0	42	5210	86.51
11ax-HE80	MCS0	155	5775	86.02

802.11a 26dB Bandwidth

Channel 36 (5180MHz)

Channel 44 (5220MHz)

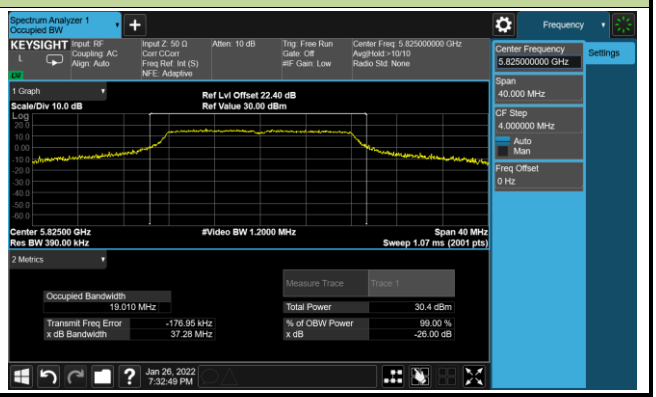
Channel 48 (5240MHz)



Channel 149 (5745MHz)

Channel 157 (5785MHz)

Channel 165 (5825MHz)

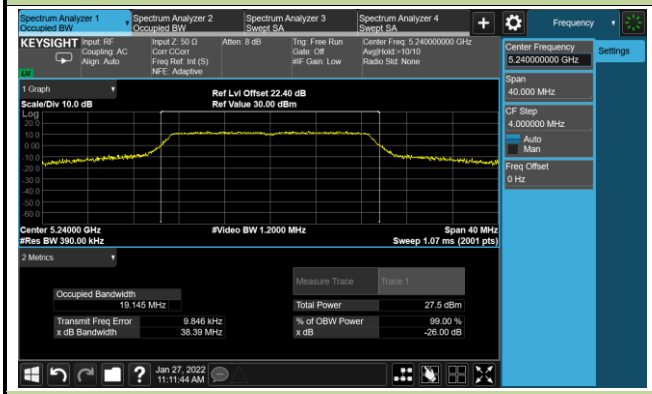


802.11ac-VHT20 26dB Bandwidth

Channel 36 (5180MHz)

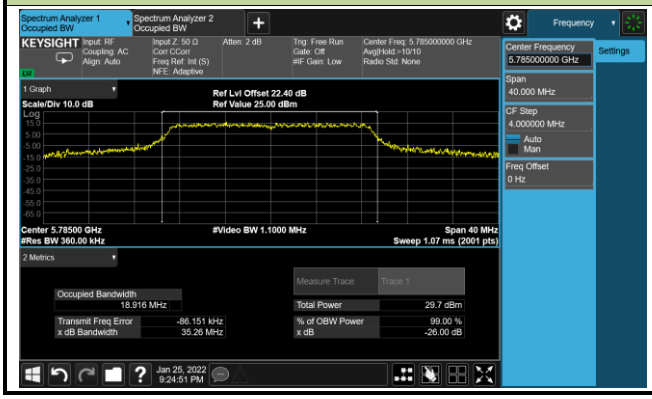
Channel 44 (5220MHz)

Channel 48 (5240MHz)

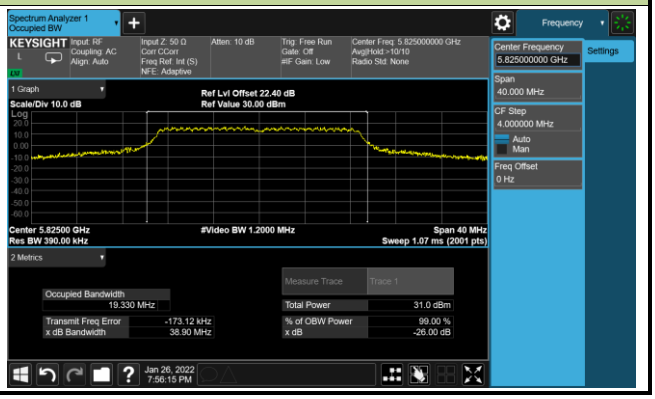


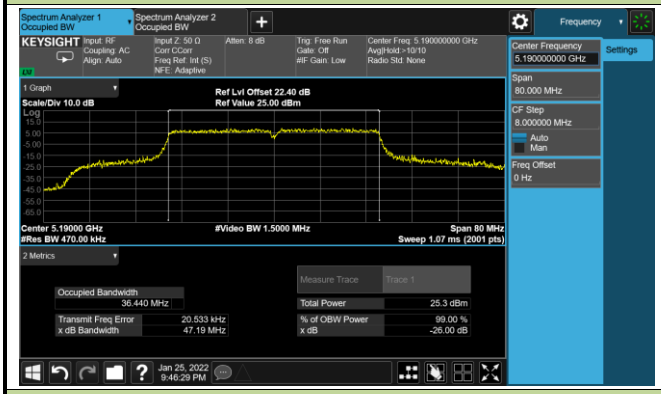
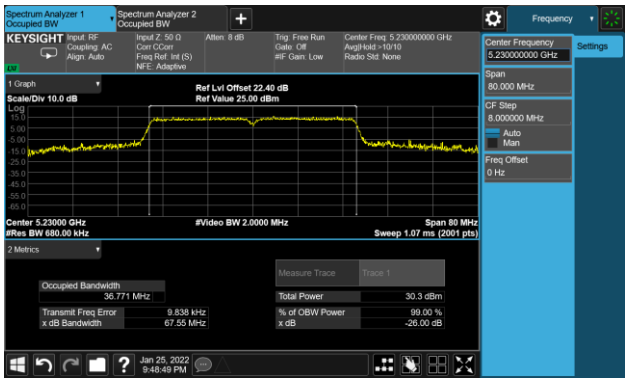
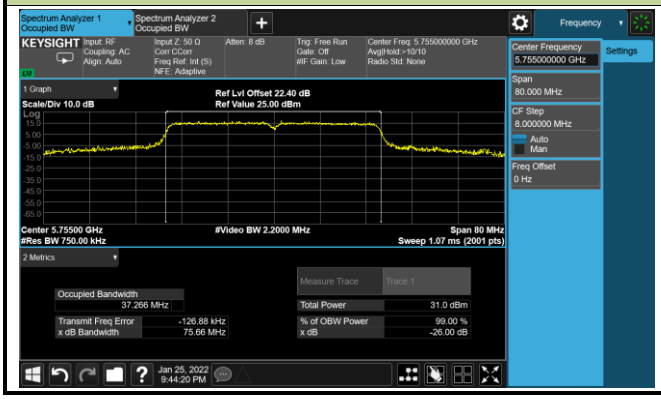
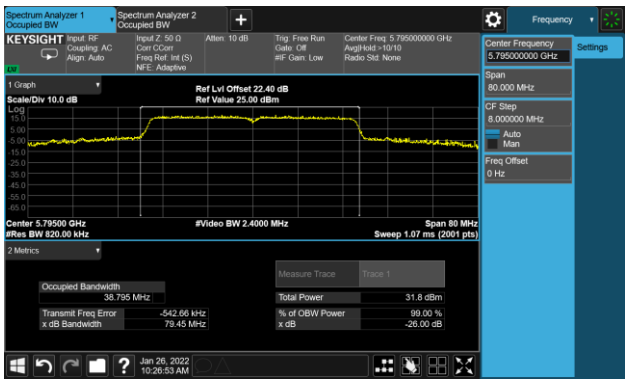
Channel 149 (5745MHz)

Channel 157 (5785MHz)



Channel 165 (5825MHz)

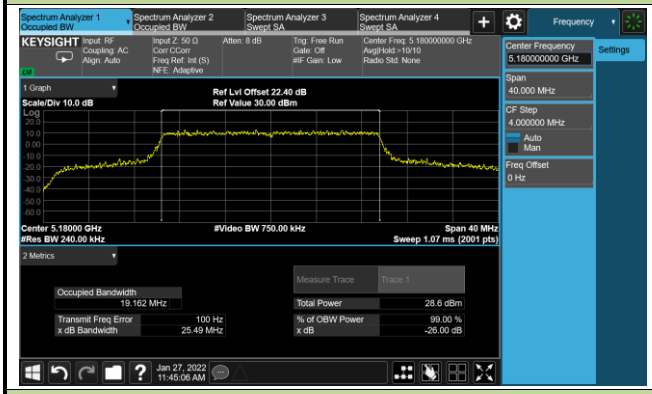


802.11ac-VHT40 26dB Bandwidth	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT80 26dB Bandwidth	
Channel 42 (5210MHz)	Channel 155 (5775MHz)

802.11ax-HE20 26dB Bandwidth

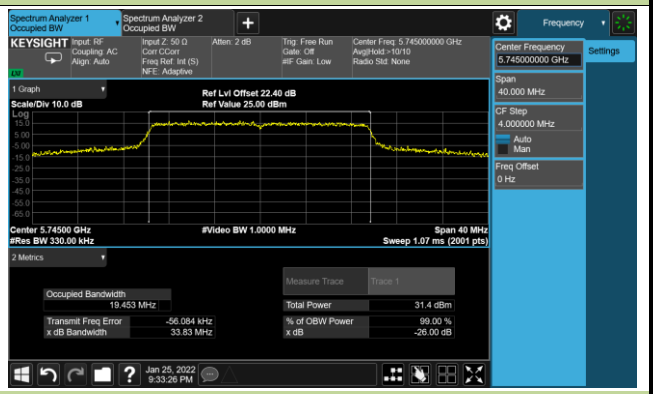
Channel 36 (5180MHz)



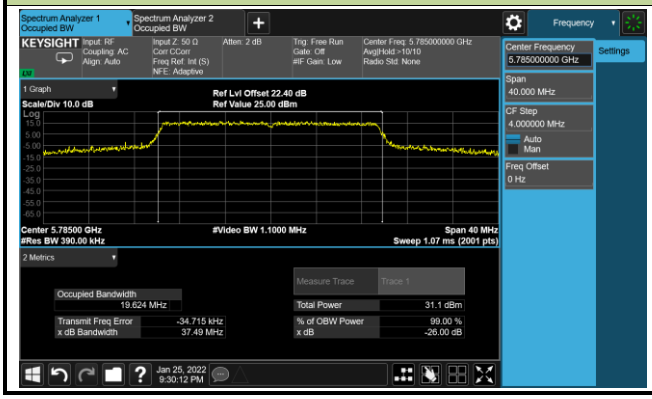
Channel 44 (5220MHz)

Channel 48 (5240MHz)

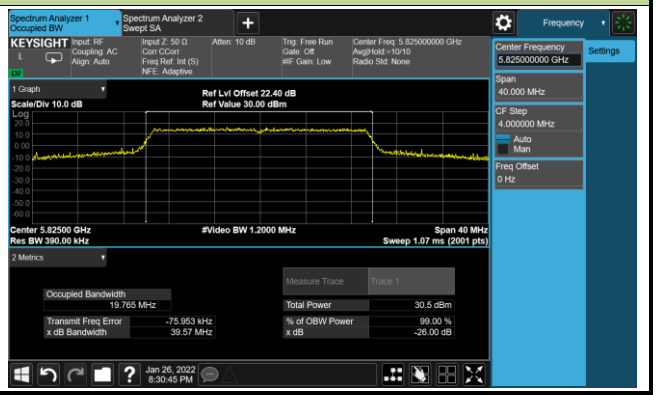
Channel 149 (5745MHz)

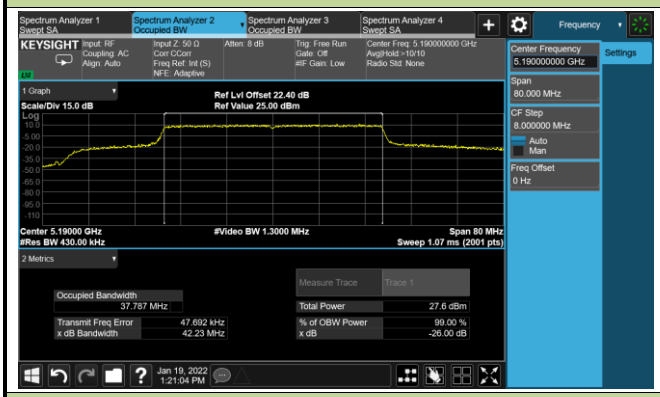
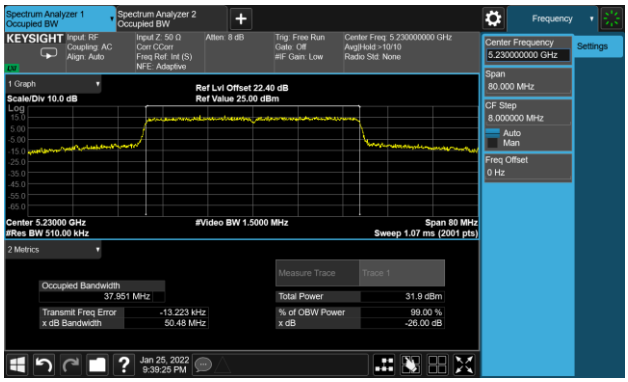
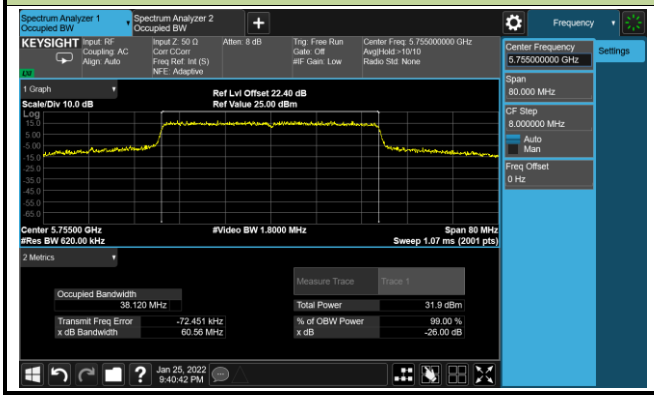
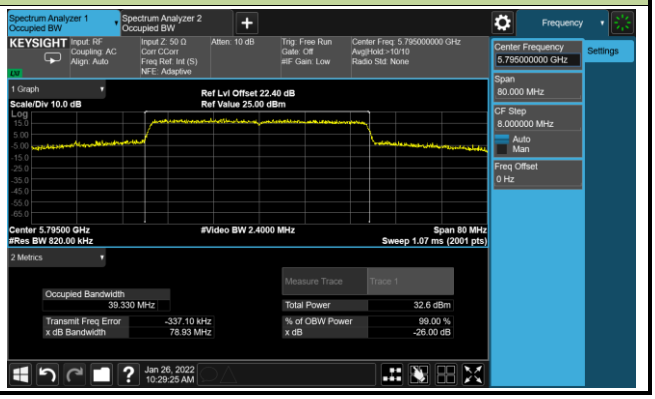


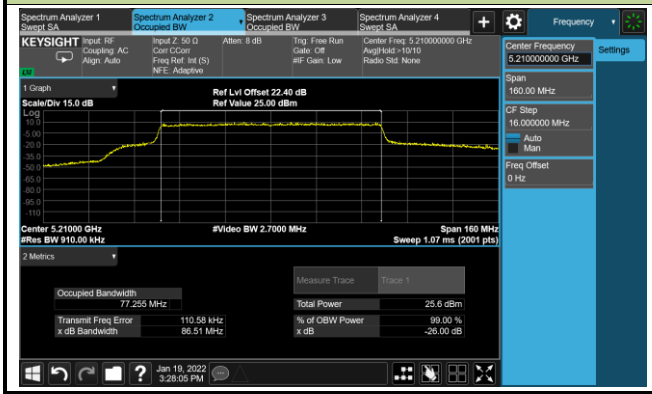
Channel 157 (5785MHz)



Channel 165 (5825MHz)



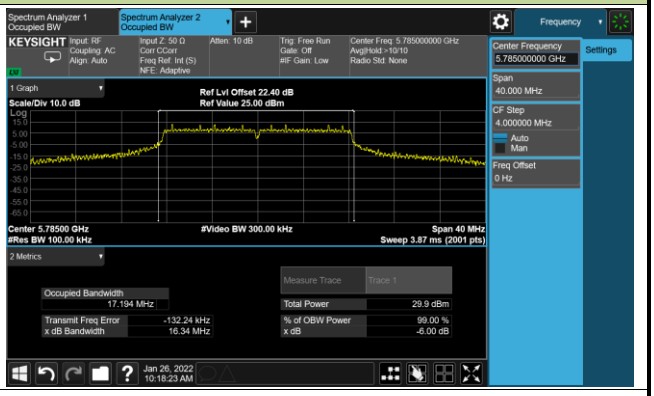
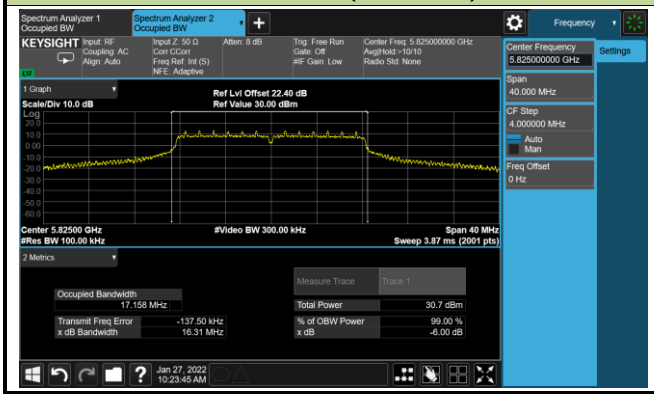
802.11ax-HE40 26dB Bandwidth	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ax-HE80 26dB Bandwidth	
Channel 42 (5210MHz)	Channel 155 (5775MHz)
	

A.3 6dB Bandwidth Test Result

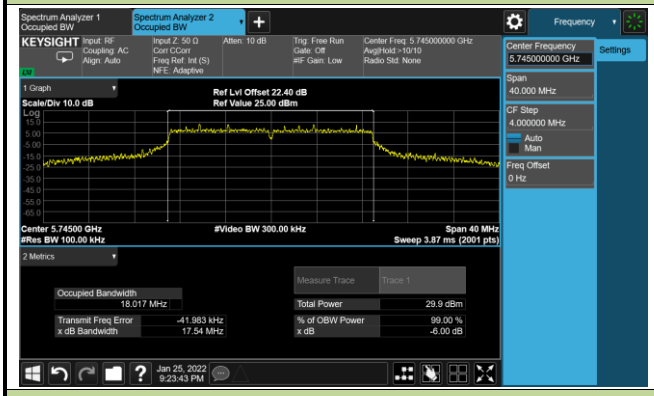
Test Site	WZ-SR4	Test Engineer	Luis Yang
Test Date	2022/01/25 ~ 2022/01/27		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11a	6Mbps	149	5745	16.10	≥0.5
11a	6Mbps	157	5785	16.34	≥0.5
11a	6Mbps	165	5825	16.31	≥0.5
11ac-VHT20	MCS0	149	5745	17.54	≥0.5
11ac-VHT20	MCS0	157	5785	17.62	≥0.5
11ac-VHT20	MCS0	165	5825	17.32	≥0.5
11ac-VHT40	MCS0	151	5755	36.34	≥0.5
11ac-VHT40	MCS0	159	5795	36.35	≥0.5
11ac-VHT80	MCS0	155	5775	75.48	≥0.5
11ax-HE20	MCS0	149	5745	18.74	≥0.5
11ax-HE20	MCS0	157	5785	18.85	≥0.5
11ax-HE20	MCS0	165	5825	18.86	≥0.5
11ax-HE40	MCS0	151	5755	37.58	≥0.5
11ax-HE40	MCS0	159	5795	37.66	≥0.5
11ax-HE80	MCS0	155	5775	77.15	≥0.5

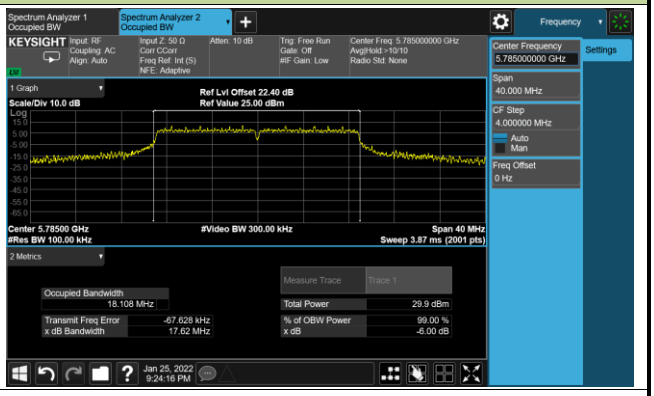
802.11a 6dB Bandwidth	
Channel 149 (5745MHz)	Channel 157 (5785MHz)
	
Channel 165 (5825MHz)	
	

802.11ac-VHT20 6dB Bandwidth

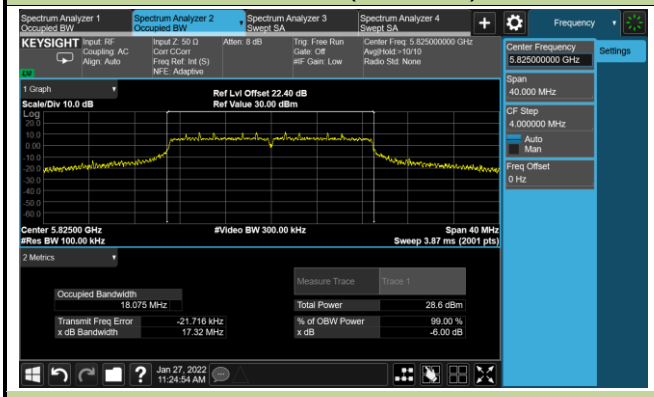
Channel 149 (5745MHz)



Channel 157 (5785MHz)

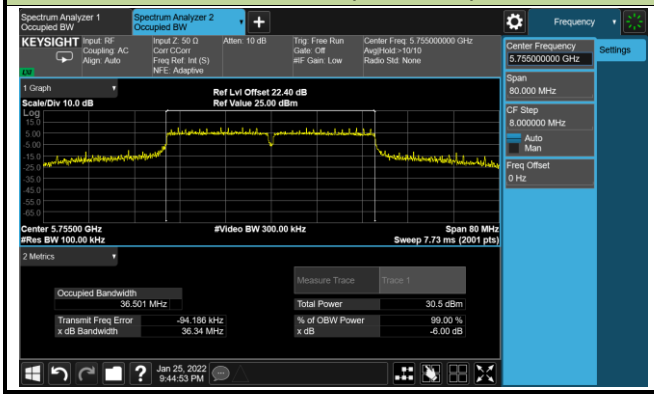


Channel 165 (5825MHz)

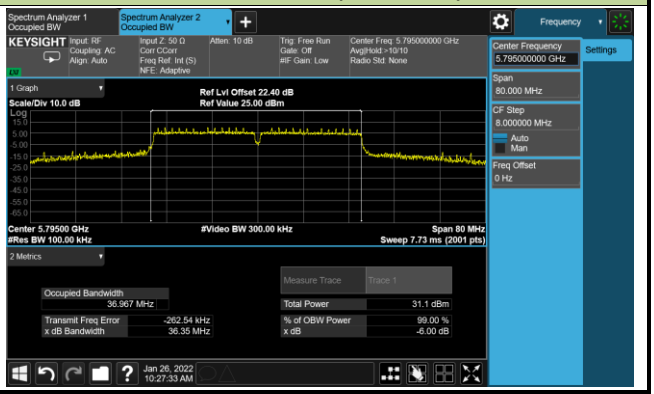


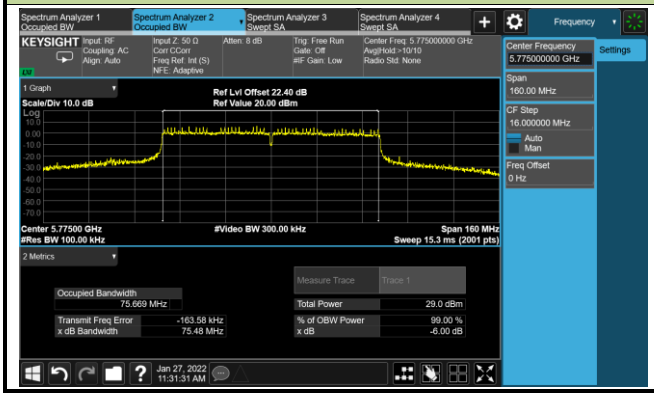
802.11ac-VHT40 6dB Bandwidth

Channel 151 (5755MHz)



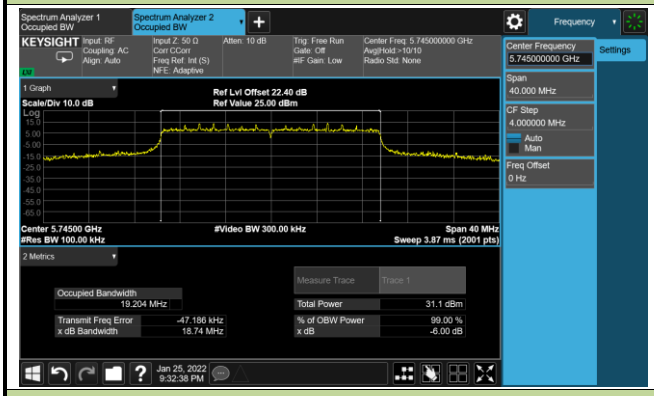
Channel 159 (5795MHz)



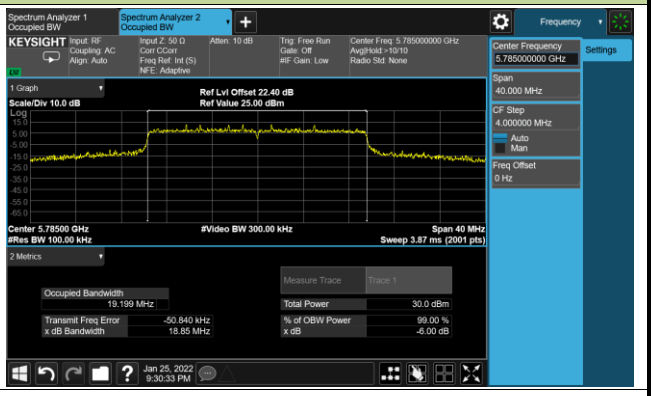
802.11ac-VHT80 6dB Bandwidth	
Channel 155 (5775MHz)	
	

802.11ax-HE20 6dB Bandwidth

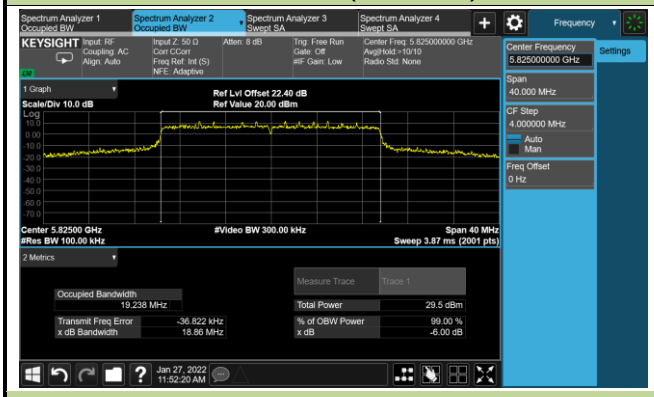
Channel 149 (5745MHz)



Channel 157 (5785MHz)

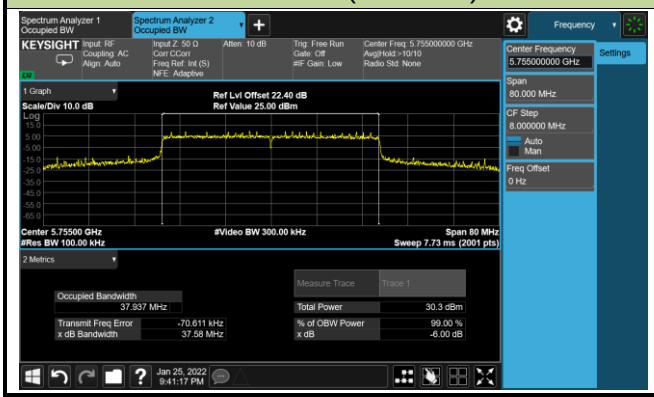


Channel 165 (5825MHz)

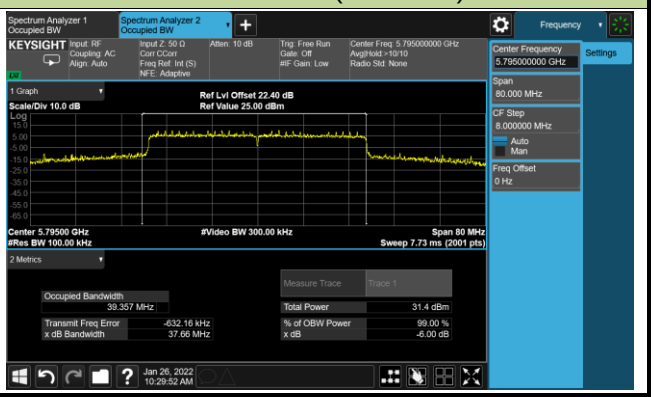


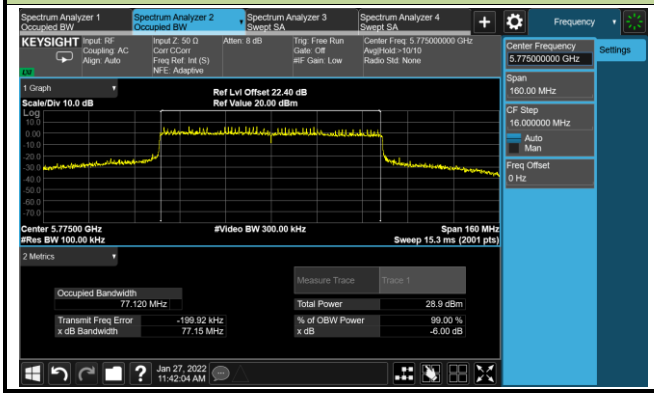
802.11ac-VHT40 6dB Bandwidth

Channel 151 (5755MHz)



Channel 159 (5795MHz)



802.11ax-HE80 6dB Bandwidth	
Channel 155 (5775MHz)	
	

A.4 Output Power Test Result

Test Site	WZ-SR4	Test Engineer	Luis Yang
Test Date	2022/01/19 ~ 2022/01/27		

Test Mode	Data Rate MCS	Channel No.	Freq. (MHz)	Average Power (dBm)				Total Average Power (dBm)	Average Power Limit (dBm)
				Ant 0	Ant 1	Ant 2	Ant 3		
11a	6Mbps	36	5180	20.60	21.95	21.35	21.10	27.30	≤ 30.00
11a	6Mbps	44	5220	21.76	24.08	23.80	23.56	29.41	≤ 30.00
11a	6Mbps	48	5240	21.51	24.12	23.67	23.25	29.26	≤ 30.00
11a	6Mbps	149	5745	23.03	24.31	23.72	23.75	29.75	≤ 30.00
11a	6Mbps	157	5785	22.07	23.70	23.08	23.03	29.03	≤ 30.00
11a	6Mbps	165	5825	21.90	23.70	22.70	22.96	28.88	≤ 30.00
11ac-VHT20	MCS0	36	5180	20.91	22.68	21.63	21.72	27.80	≤ 30.00
11ac-VHT20	MCS0	44	5220	20.72	23.12	22.93	21.51	28.20	≤ 30.00
11ac-VHT20	MCS0	48	5240	20.65	23.16	22.86	22.52	28.42	≤ 30.00
11ac-VHT20	MCS0	149	5745	22.35	23.78	23.35	23.23	29.23	≤ 30.00
11ac-VHT20	MCS0	157	5785	22.13	23.69	22.90	22.90	28.96	≤ 30.00
11ac-VHT20	MCS0	165	5825	21.97	23.86	22.78	22.49	28.85	≤ 30.00
11ac-VHT40	MCS0	38	5190	18.10	18.90	18.90	18.68	24.68	≤ 30.00
11ac-VHT40	MCS0	46	5230	22.00	23.70	23.90	23.38	29.33	≤ 30.00
11ac-VHT40	MCS0	151	5755	22.60	23.38	23.33	23.40	29.21	≤ 30.00
11ac-VHT40	MCS0	159	5795	22.48	23.42	23.30	23.50	29.21	≤ 30.00
11ac-VHT80	MCS0	42	5210	17.30	18.56	18.37	18.02	24.11	≤ 30.00
11ac-VHT80	MCS0	155	5775	20.24	22.06	21.41	21.31	27.32	≤ 30.00
11ax-HE20	MCS0	36	5180	20.79	22.66	21.79	21.43	27.74	≤ 30.00
11ax-HE20	MCS0	44	5220	20.98	23.22	22.75	22.32	28.41	≤ 30.00
11ax-HE20	MCS0	48	5240	20.70	23.30	23.00	22.28	28.45	≤ 30.00
11ax-HE20	MCS0	149	5745	22.60	23.96	23.20	23.12	29.27	≤ 30.00
11ax-HE20	MCS0	157	5785	21.95	23.56	23.03	23.32	29.03	≤ 30.00
11ax-HE20	MCS0	165	5825	21.45	22.98	22.27	22.35	28.32	≤ 30.00

11ax-HE40	MCS0	38	5190	17.58	18.57	18.52	18.21	24.26	≤ 30.00
11ax-HE40	MCS0	46	5230	22.10	23.73	23.92	23.38	29.36	≤ 30.00
11ax-HE40	MCS0	151	5755	22.13	22.69	22.68	23.02	28.66	≤ 30.00
11ax-HE40	MCS0	159	5795	22.72	23.80	23.59	23.90	29.55	≤ 30.00
11ax-HE80	MCS0	42	5210	16.76	17.98	17.69	17.73	23.58	≤ 30.00
11ax-HE80	MCS0	155	5775	20.56	22.13	21.35	21.20	27.37	≤ 30.00

Note: Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 0 Average Power }/10)} + 10^{(\text{Ant 1 Average Power }/10)} + 10^{(\text{Ant 2 Average Power }/10)} + 10^{(\text{Ant 3 Average Power }/10)}\}$.

A.5 Power Spectral Density Test Result

Test Site	WZ-SR4	Test Engineer	Luis Yang
Test Date	2022/01/17 ~ 2022/01/27		
Test Item	Power Spectral Density (NII-Band 1)		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	AVPSD (dBm/ MHz)				Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/ MHz)
				Ant 0	Ant 1	Ant 2	Ant 3			
11a	6Mbps	36	5180	8.40	10.15	9.18	9.45	95.07	15.58	16.54
11a	6Mbps	44	5220	8.46	10.82	10.61	9.99	95.07	16.30	16.54
11a	6Mbps	48	5240	8.51	10.93	10.62	9.99	95.07	16.35	16.54
11ac-VHT20	MCS0	36	5180	8.19	9.01	8.86	8.67	98.47	14.71	16.54
11ac-VHT20	MCS0	44	5220	8.86	10.95	10.60	9.60	98.47	16.10	16.54
11ac-VHT20	MCS0	48	5240	8.50	11.16	10.58	10.18	98.47	16.23	16.54
11ac-VHT40	MCS0	38	5190	3.08	3.86	3.95	3.61	97.18	9.78	16.54
11ac-VHT40	MCS0	46	5230	6.73	8.30	8.43	8.07	97.18	14.08	16.54
11ac-VHT80	MCS0	42	5210	-0.43	0.70	0.37	0.04	94.25	6.47	16.54
11ax-HE20	MCS0	36	5180	8.23	10.04	9.10	9.28	98.28	15.23	16.54
11ax-HE20	MCS0	44	5220	8.67	10.88	10.56	9.96	98.28	16.12	16.54
11ax-HE20	MCS0	48	5240	8.51	11.06	10.76	10.20	98.28	16.26	16.54
11ax-HE40	MCS0	38	5190	2.36	3.38	3.41	3.58	96.39	9.39	16.54
11ax-HE40	MCS0	46	5230	6.48	8.13	8.45	7.89	96.39	13.98	16.54
11ax-HE80	MCS0	42	5210	-1.26	0.10	-0.26	-0.47	93.65	5.86	16.54

Note: When EUT duty cycle < 98%, the total PSD (dBm/MHz) =10*log {$10^{(\text{Ant 0 AVGPSD}/10)}$ + $10^{(\text{Ant 1 AVGPSD}/10)}$ +$10^{(\text{Ant 2 AVGPSD}/10)}$ + $10^{(\text{Ant 3 AVGPSD}/10)}$} +10*log (1/Duty cycle).

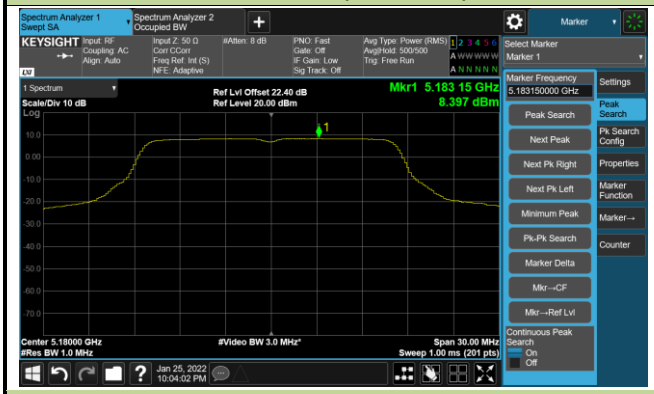
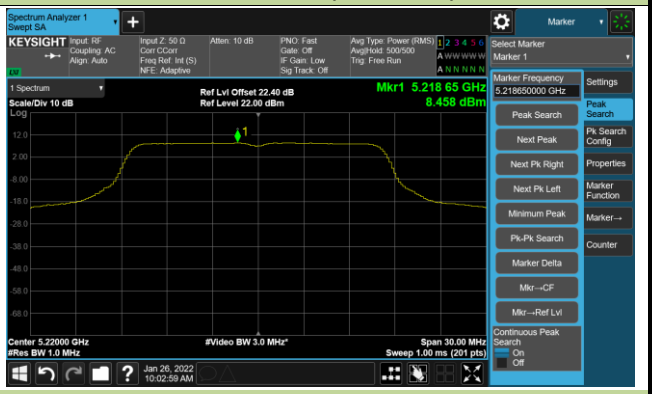
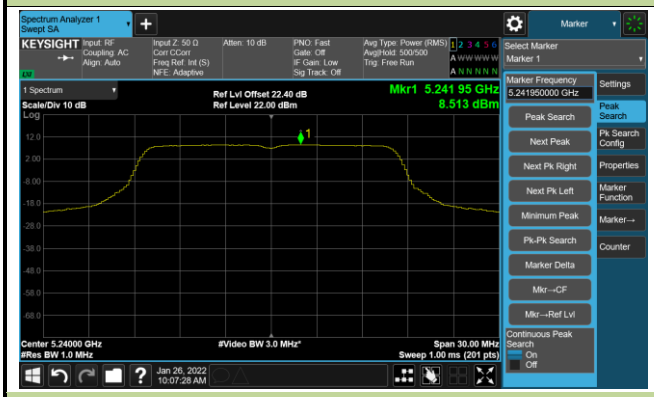
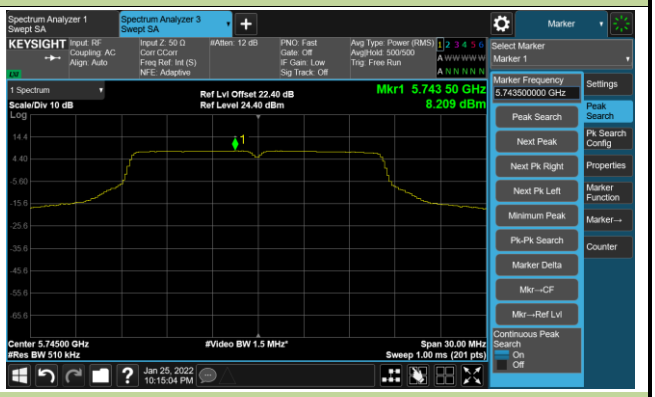
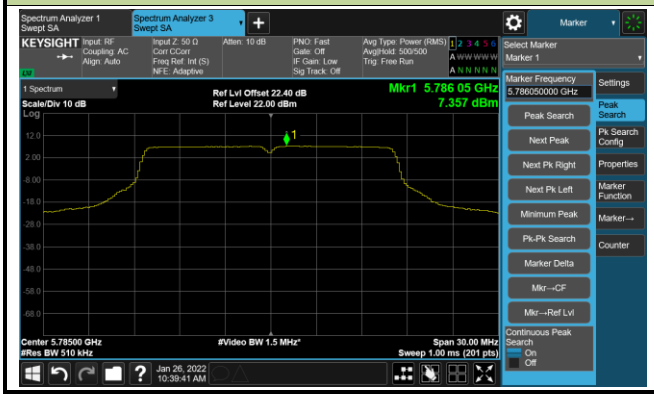
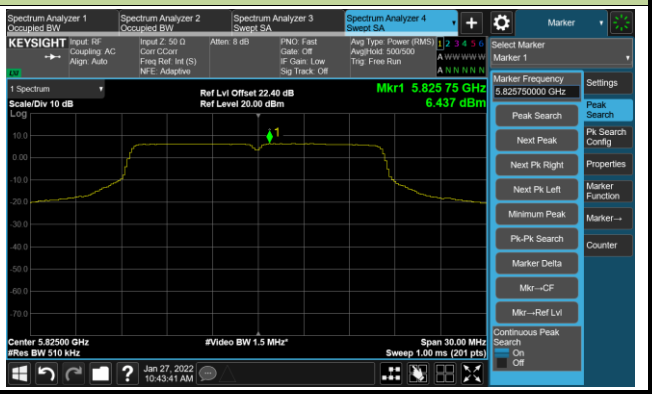
When EUT duty cycle ≥ 98%, the total PSD (dBm/MHz) =10*log {$10^{(\text{Ant 0 AVGPSD}/10)}$ + $10^{(\text{Ant 1 AVGPSD}/10)}$ +$10^{(\text{Ant 2 AVGPSD}/10)}$ + $10^{(\text{Ant 3 AVGPSD}/10)}$}.

Test Site	WZ-TR3	Test Engineer	Luis Yang
Test Date	2022/01/25 ~ 2022/01/27		
Test Item	Power Spectral Density (NII-Band 3)		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	AVPSD (dBm/ 510KHz)				Duty Cycle (%)	Total PSD (dBm/ 510KHz)	PSD Limit (dBm/ 500KHz)
				Ant 0	Ant 1	Ant 2	Ant 3			
11a	6Mbps	149	5745	8.21	9.57	9.08	8.88	95.07	15.20	≤ 29.10
11a	6Mbps	157	5785	7.36	9.04	8.54	8.28	95.07	14.58	≤ 29.10
11a	6Mbps	165	5825	6.44	8.41	7.27	7.37	95.07	13.67	≤ 29.10
11ac-VHT20	MCS0	149	5745	7.66	8.98	8.44	8.41	98.47	14.42	≤ 29.10
11ac-VHT20	MCS0	157	5785	7.14	8.90	8.12	8.13	98.47	14.14	≤ 29.10
11ac-VHT20	MCS0	165	5825	6.67	8.06	7.16	7.31	98.47	13.35	≤ 29.10
11ac-VHT40	MCS0	151	5755	5.12	5.66	5.58	5.79	97.18	11.69	≤ 29.10
11ac-VHT40	MCS0	159	5795	4.58	5.80	5.61	6.09	97.18	11.70	≤ 29.10
11ac-VHT80	MCS0	155	5775	-0.19	1.95	0.85	1.03	94.25	7.26	≤ 29.10
11ax-HE20	MCS0	149	5745	7.62	8.76	8.15	8.22	98.28	14.23	≤ 29.10
11ax-HE20	MCS0	157	5785	7.21	8.74	8.18	8.00	98.28	14.09	≤ 29.10
11ax-HE20	MCS0	165	5825	6.69	8.18	7.37	7.50	98.28	13.49	≤ 29.10
11ax-HE40	MCS0	151	5755	4.47	5.28	5.22	5.47	96.39	11.31	≤ 29.10
11ax-HE40	MCS0	159	5795	4.75	5.90	5.40	5.69	96.39	11.64	≤ 29.10
11ax-HE80	MCS0	155	5775	-0.01	1.91	0.72	1.00	93.65	7.26	≤ 29.10

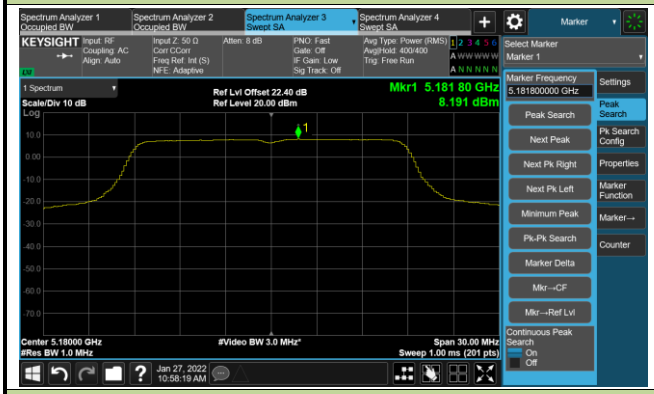
Note: When EUT duty cycle < 98%, the total PSD (dBm/510kHz) =10*log {$10^{(\text{Ant 0 AVGPSD}/10)}$ + $10^{(\text{Ant 1 AVGPSD}/10)}$ +$10^{(\text{Ant 2 AVGPSD}/10)}$ + $10^{(\text{Ant 3 AVGPSD}/10)}$} +10*log (1/Duty cycle).

When EUT duty cycle ≥ 98%, the total PSD (dBm/510kHz) =10*log {$10^{(\text{Ant 0 AVGPSD}/10)}$ + $10^{(\text{Ant 1 AVGPSD}/10)}$ +$10^{(\text{Ant 2 AVGPSD}/10)}$ + $10^{(\text{Ant 3 AVGPSD}/10)}$}.

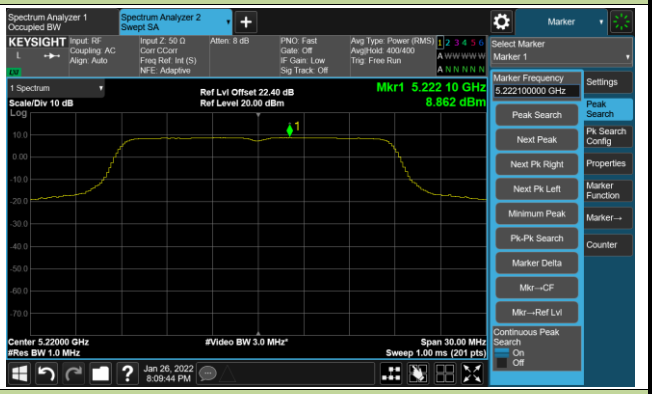
802.11a Power Spectral Density - Ant 0	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11ac-VHT20 Power Spectral Density - Ant 0

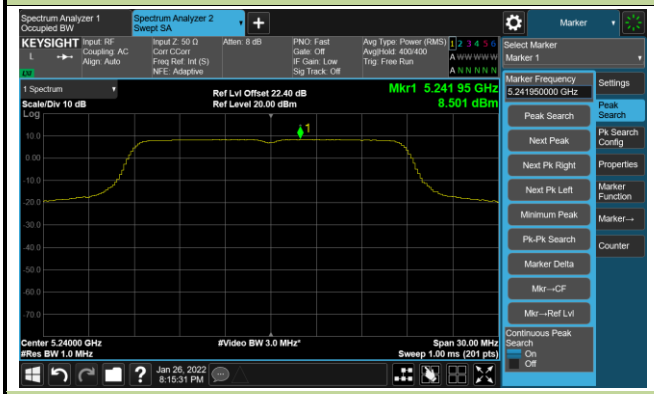
Channel 36 (5180MHz)



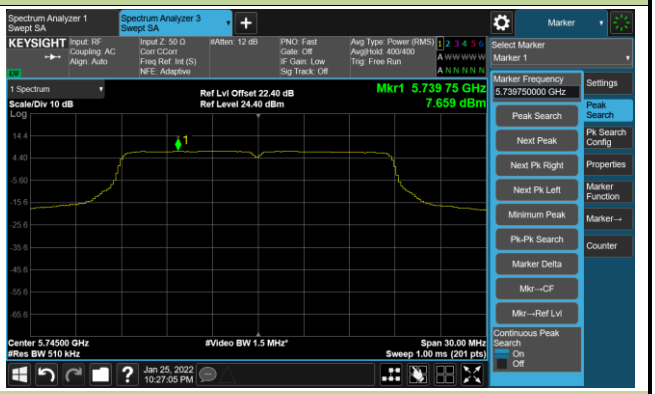
Channel 44 (5220MHz)



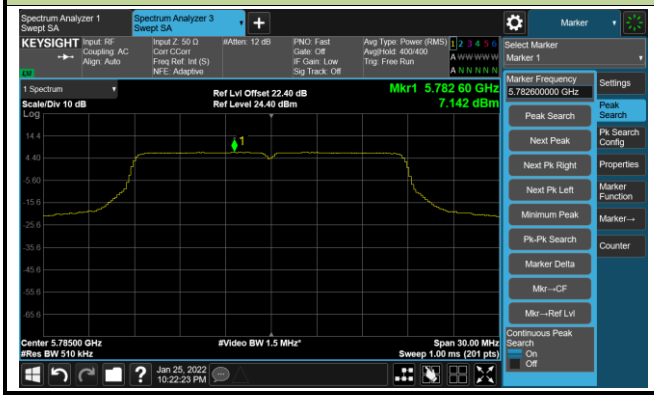
Channel 48 (5240MHz)



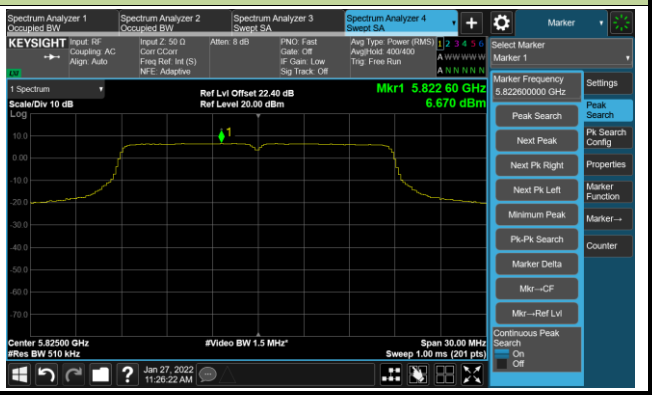
Channel 149 (5745MHz)

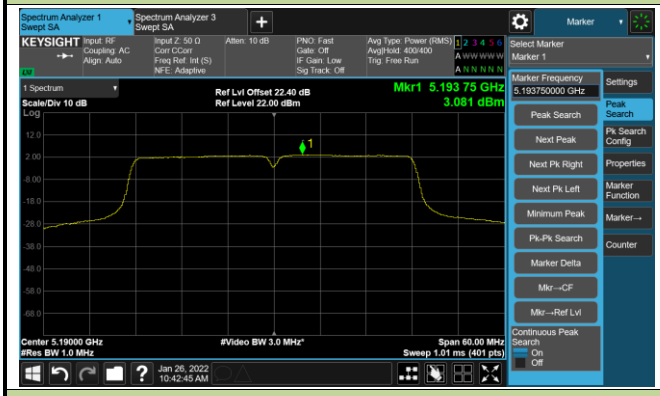
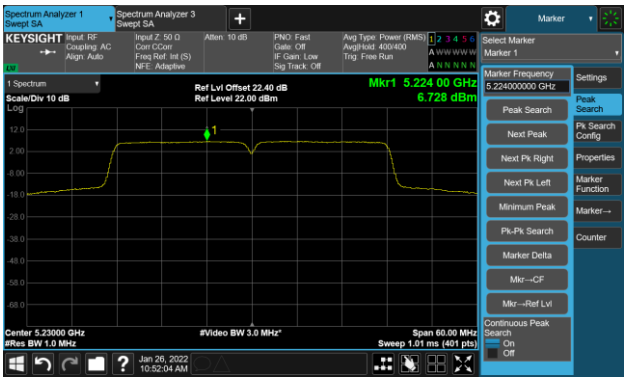
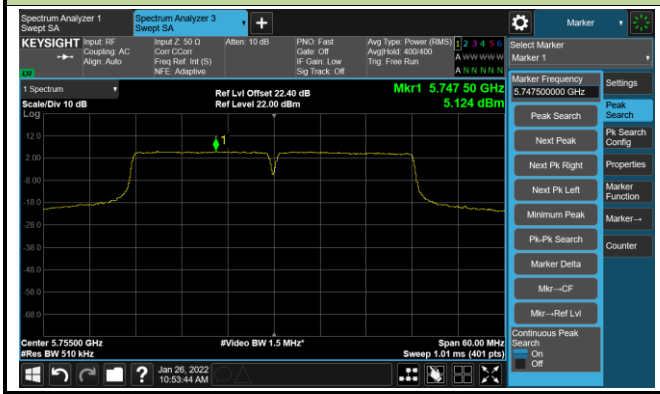
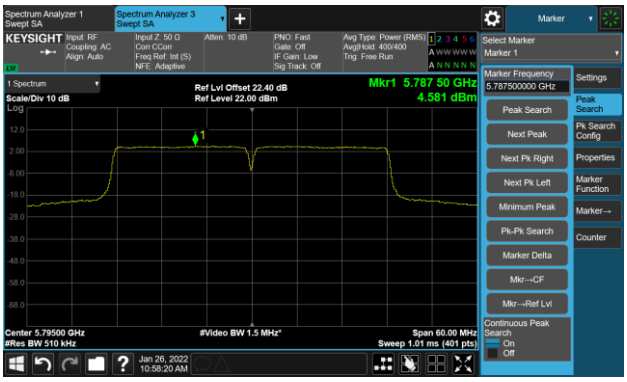
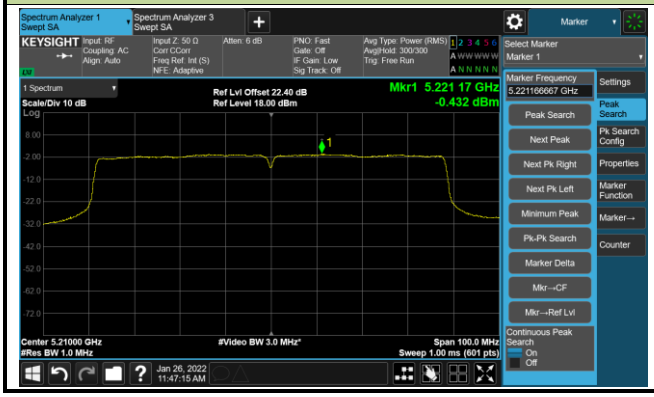
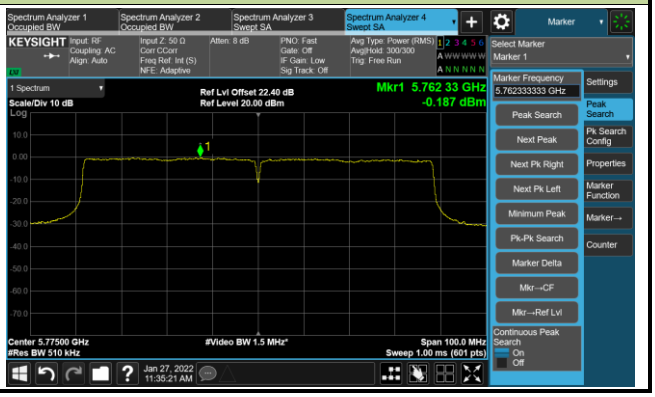


Channel 157 (5785MHz)



Channel 165 (5825MHz)



802.11ac-VHT40 - Power Spectral Density - Ant 0	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT80 Power Spectral Density - Ant 0	
Channel 42 (5210MHz)	Channel 155 (5775MHz)