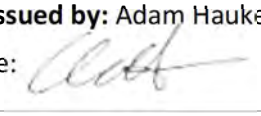
Test Report 3768-165-5G-UNII2C

Equipment Under Test:	Module, SONA NX 611 M.2 2230, 2 MHF
Requirement(s):	eCFR 47 Part 15.407 | RSS-247
Test Date(s):	02/12/2024-07/10/2024
Prepared for:	Ezurio Attn: Brian Petted W66 N220 Commerce Ct. Cedarburg, WI 53012

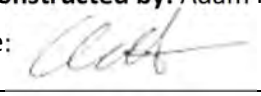
Report Issued by: Adam Hauke, EMC Engineer

Signature:  Date: 08/08/2024

Report Reviewed by: Adam Alger, Manager EMC Laboratory

Signature:  Date: 8/07/2024

Report Constructed by: Adam Hauke, EMC Engineer

Signature:  Date: 08/08/2024

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Ezurio Test Services in Review

The Ezurio laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted

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Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Government of Canada

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

1 TEST REPORT SUMMARY

During **02/15/2024-07/10/2024** the Equipment Under Test (EUT), **Module, SONA NX611 M.2 2230, 2 MHF**, as provided by **Ezurio** was tested to the following requirements:

Operation in the 5.47-5.725 GHz bands

Requirements	Description	Method	Compliant
15.407(b)(3) & (10) 15.209 RSS-247 Clause 6.2.3 RSS-GEN	Spurious Radiated Emissions in Restricted Bands 30-40000 MHz	ANSI C63.10 12.7	Yes
15.407(a)(2) RSS-247 Clause 6.2.3	26dB and 99% Occupied Bandwidth	ANSI C63.10 12.5	Yes
15.407(a)(2) RSS-247 Clause 6.2.3	RF Output Power	ANSI C63.10 12.4	Yes
15.407(b)(3) RSS-247 Clause 6.2.3	Conducted Out-of-band Emissions	ANSI C63.10 12.7	Yes
15.407(a)(2) RSS-247 Claus 6.2.3	Power Spectral Density	ANSI C63.10 12.6	Yes
15.407(b)(9) 15.207 RSS-GEN	AC Conducted Emissions	ANSI C63.10 6.2	Yes
15.407(g)	Frequency Stability	ANSI C63.10 6.8	Reported

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	0.5 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Ezurio
Contact Person	Brian Petted
Address	W66 N220 Commerce Ct. Cedarburg, WI 53012

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Module, SONA NX611 M.2 2230, 2 MHF
Part Number	453-00165
Serial Number	00047
FCC ID	SQG-SONANX611M
IC ID	3147A-SONANX611M

2.2 Product Description

The NX611 is based upon NXP IW611 Wi-Fi 6 chipset. Feature-set includes 802.11 a/b/g/n/ac/ax Wi-Fi 6 and Dual-Mode Bluetooth v5.3 (BDR + EDR + BLE).

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 EUT Information

Power Supply – INPUT:100-240VAC 50/60 Hz 0.3A

OUTPUT: 5VDC 2A

Firmware - sduart_nw61x_v1.bin.se

Sduart_nw61x_v1_mfg.bin.se

2.6 Ancillary Equipment

Equipment used for EUT programming (not part of the EUT)

Development Kit, SU60-SOMC 6.0

P/N: 463-00138-K1 Rev 1

Power Supply: INPUT: 100-240 VAC 50/60Hz 0.7A

OUTPUT: 12VDC 2A

HP Elitebook 840G1

Labtool Version: 1.0.0.45.6

2.7 Antenna Information

Manufacturer	Model	Part Number	Dimension	Type	Peak Gain (dBi)	
					2400-2500 MHz	4900-5925 MHz
Laird Connectivity	FlexMIMO 6E	EFD2471A3S-10MH4L	39.5mm X 39.5mm X 4.7mm	PIFA	2.2	3.8
Laird Connectivity	FlexPIFA 6E	EFB2471A3S-10MH4L	16mm X 36mm X 2.5mm	PIFA	2.2	3.9
Laid Connectivity	Mini NanoBlade Flex 6E	EMF2471A3S-10MH4L	36mm X 12mm X 0.3mm	PCB Dipole	2.4	4.4
Joymax Electronics	N/A	TWX-100BRS3B	137mm X 13mm	Dipole	2.0	4.0
Laird Connectivity	FlexPIFA	EFB2455A3S-16MHF1	38.5mm X 12.7 mm X 2.5mm	PIFA	2.5	3.0

2.8 Test Channels

Channel	Frequency (MHz)	Bandwidth (MHz)	Data Rates
100	5500	20	802.11a – 6 and 54 Mbps 802.11n – MCS0 and MCS7 802.11ac – MCS0 and MCS9 802.11ax – MCS0 and MCS11
FCC – 120 ISED - 116	5600 5580	20	
144	5720	20	
102	5510	40	
118	5590	40	
142	5710	40	
106	5530	80	
138	5690	80	

2.9 Power Table and Reduced Video Bandwidth for Average Measurements

802.11	Channel BW (MHz)	Data Rate	Minimum Average VBW (Hz)	Power Setting
a	20	6 Mbps	698	16
a	20	54 Mbps	5565	16
n	20	MCS0	746	14
n	20	MCS7	5959	14
ac	20	MCS0	742	14
ac	20	MCS8	6361	14
ax	20	MCS0	956	11
ax	20	MCS11	8628	10
n	40	MCS0	1506	13
n	40	MCS7	9980	13
ac	40	MCS0	1489	13
ac	40	MCS9	10870	12
ax	40	MCS0	1815	11
ax	40	MCS11	11737	10
ac	80	MCS0	3013	11
ac	80	MCS9	15601	11
ax	80	MCS0	3414	9
ax	80	MCS11	13280	9

3 WORST CASE TEST RESULTS SUMMARY

UNII-1

Requirement	Radio	Channel and Data Rate	Frequency (MHz)	Measurement	Limit	Margin
15.407(a)(2) RSS-247 Clause 6.2.3 26dB Bandwidth	802.11ax20	100 MCS0 | RU26	-	19.0 MHz	at least 500 kHz	-
15.407(a)(2) RSS-247 Clause 6.2.3 Output Power	802.11a	120 | 54 Mbps	-	16.2 dBm	24.0 dBm	7.8 dB
15.407(a)(2) RSS-247 Clause 6.2.3 PSD	802.11ax20	100 MCS0 | RU26	-	10.1 dBm/1 MHz	11.0 dBm/1 MHz	0.9 dB
15.407(b)(3) RSS-247 Clause 6.2.3 Restricted Band	802.11ac80	106 | MCS9	5456.9	-42.3 dBm	-41.2 dBm	1.1 dB
15.407(b)(9) RSS-GEN Spurious Below 1 GHz	802.11a	64 | 6 Mbps	66.2	38.6 dBµV/m	40.0 dBµV/m	1.4 dB
15.407(b)(9) RSS-GEN AC Conducted	802.11a	6 | 1 Mbps	0.150	59.1 dBµV	66.0 dBµV	6.9 dB

4 REFERENCES

Publication	Edition	Date
FCC eCFR 47 Part 15	-	2023
ANSI C63.10	-	2020
RSS-247	3	2023
RSS-GEN	5	2019
KDB 558074 D01	-	2019

5 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References
CISPR 16-4-1
CISPR 16-4-2
CISPR 32
ANSI C63.23
A2LA P103
A2LA P103c
ETSI TR 100-028

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

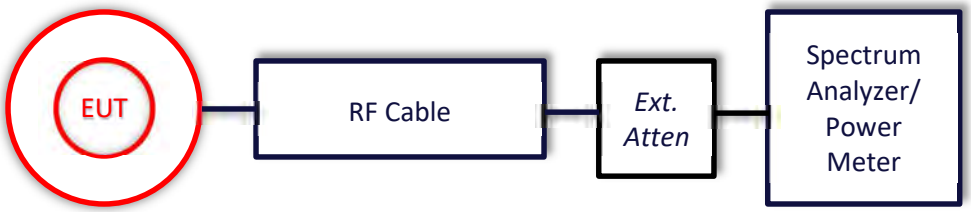
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

6 TEST DATA

6.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



6.1.1 26dB and 99% Occupied Bandwidth

Operator	Dylan Rosenfeldt | Anthony Smith	**QA**	Anthony Smith | Adam Hauke
Temperature	21.8°C | 22.1°C	**R.H. %**	30.30% | 25.70%
Test Date	02/21/2024 | 03/28/2024	**Location**	Conducted RF Bench
Requirement	15.407 (a)(2) RSS-247 Clause 6.2.3	**Method**	ANSI C63.10 12.5

Limits: The minimum 26 dB bandwidth shall be at least 500 kHz

Test Parameters

Frequency	5470-5725 MHz		
RBW	20 MHZ BW – 200 kHz 40 MHz BW – 420 kHz 80 MHz BW – 1 MHz	**VBW**	20 MHZ BW – 620 kHz 40 MHz BW – 1.5 MHz 80 MHz BW – 3 MHz
Detector(s)	Peak	**Settings**	Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	6/13/2023	6/12/2024	Active Verification
EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/10/2023	4/10/2024	Active Calibration

EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx
Frequency	5500-5720 MHz	**Channel**	See 2.8

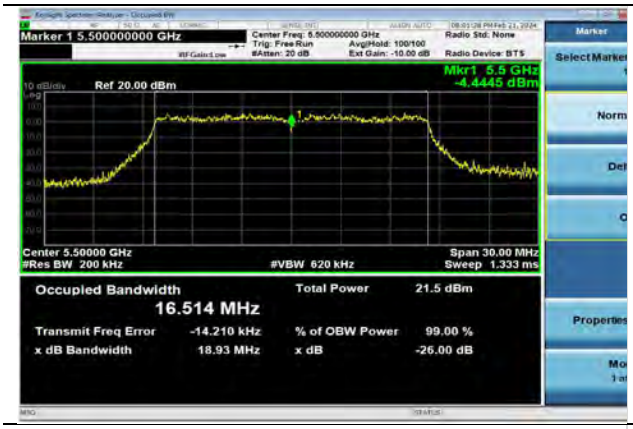
Measurements

Mode	Rate	Channel	26 dB BW (MHz)	99% BW (MHz)
802.11a	6 Mbps	100	19.5	16.5
		120	19.4	16.5
		144	19.1	16.5
	54 Mbps	100	18.9	16.5
		120	19.2	16.5
		144	19.0	16.5
802.11n20	MCS0	100	19.7	17.6
		120	19.6	17.6
		144	19.8	17.6
	MCS7	100	19.5	17.6
		120	19.5	17.6
		144	19.8	17.6
802.11ac20	MCS0	100	19.7	17.6
		120	19.6	17.6
		144	19.5	17.6
	MCS8	100	19.7	17.6
		120	19.5	17.6
		144	19.5	17.6
802.11ax20	MCS0	100	20.1	18.8
		120	20.1	18.8
		144	20.2	18.7
	MCS11	100	20.2	18.8
		120	20.1	18.7
		144	20.3	18.7

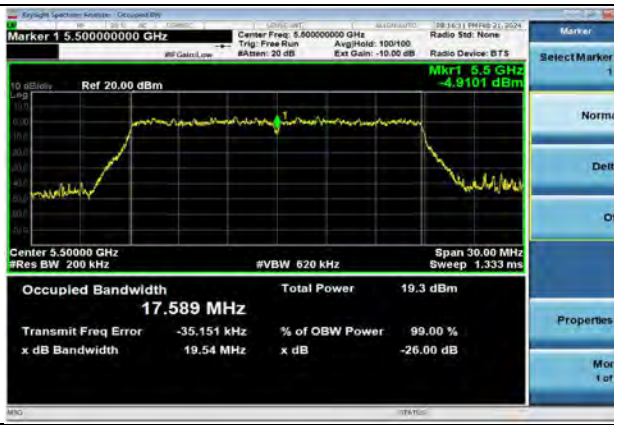
Mode	Rate	Channel	26 dB BW (MHz)	99% BW (MHz)
802.11n40	6 Mbps	102	40.5	36.1
		118	40.3	36.1
		142	40.3	36.1
	54 Mbps	102	39.8	36.2
		118	39.6	36.1
		142	39.6	36.2
802.11ac40	MCS0	102	40.4	36.1
		118	40.0	36.1
		142	39.9	36.1
	MCS7	102	40.3	36.2
		118	40.2	36.2
		142	40.3	36.2
802.11ax40	MCS0	102	39.8	37.6
		118	40.2	37.5
		142	40.4	37.5
	MCS8	102	40.3	37.5
		118	40.3	37.5
		142	40.2	37.5
802.11ac80	MCS0	106	81.7	76.1
		138	81.6	76.0
	MCS9	106	81.8	76.3
		138	81.8	76.3
802.11ax80	MCS0	106	80.7	77.6
		138	80.5	77.7
	MCS9	106	80.6	77.6
		138	80.7	77.5

Mode	Rate	Channel	RU Tone / Index	26 dB BW (kHz)	99% BW (MHz)
802.11ax20	MCS0	100	26 / 0	19020.0	18.0
			52 / 37	19130.0	17.8
			106 / 63	19170.0	17.9
		144	26 / 8	19100.0	18.1
			52 / 40	19160.0	18.0
			106 / 54	19230.0	18.1
802.11ax40	MCS0	102	242 / 61	36700.0	20.2
		142	242 / 62	36620.0	20.2
802.11ax80	MCS0	106	484 / 65	80310.0	52.6
		138	484 / 66	80350.0	50.7

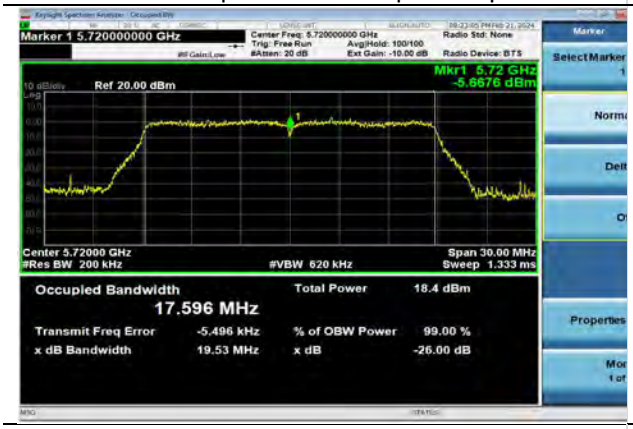
Plots



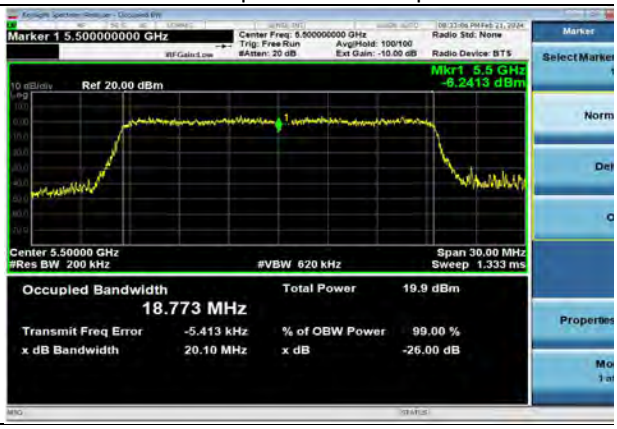
802.11a | Channel 100 | 54 Mbps



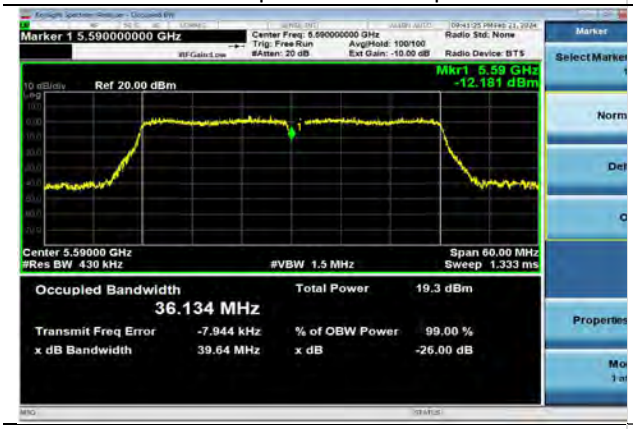
802.11n20 | Channel 100 | MCS7



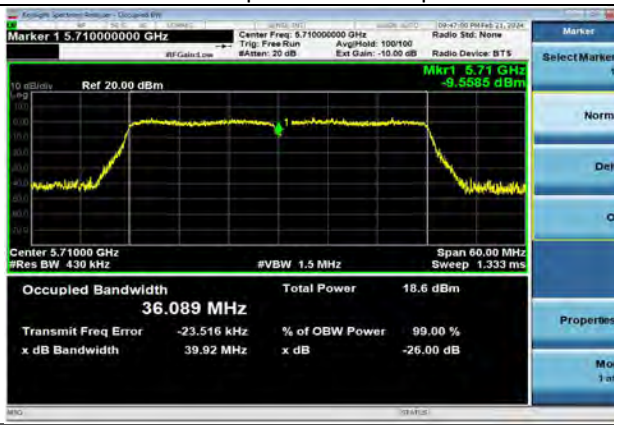
802.11ac20 | Channel 144 | MCS0



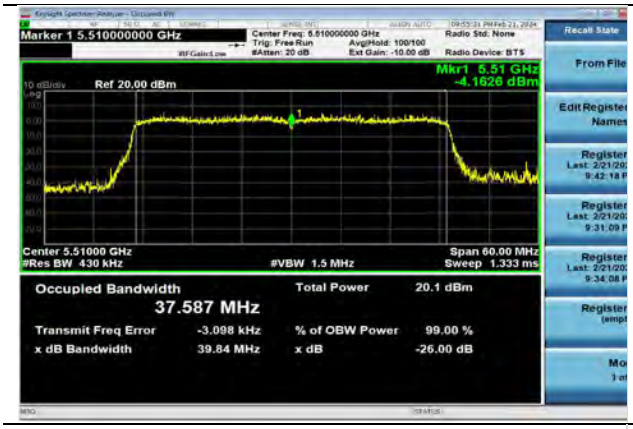
802.11ax20 | Channel 100 | MCS0



802.11n40 | Channel 118 | MCS7



802.11ac40 | Channel 142 | MCS0

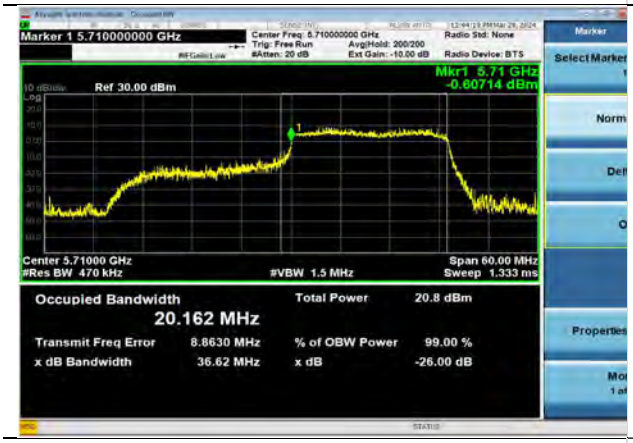


802.11ax40 | Channel 102 | MCS0

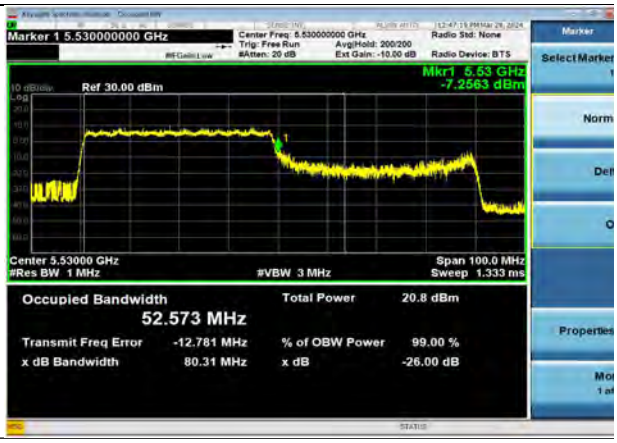
802.11ac80 | Channel 138 | MCS0

802.11ax80 | Channel 138 | MCS0

802.11ax20 | Channel 100 | MCS0 | RU Tone 26 Index 0



802.11ax40 | Channel 142 | MCS0 | RU Tone 242 Index 62



802.11ax80 | Channel 106 | MCS0 | RU Tone 484 Index 65

6.1.2 RF Output Power

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	21.6°C | 22.1°C 21.8°C | 21.6°C	**R.H. %**	25.90% | 29.30% 53.50% | 44.40%
Test Date	02/26/2024-02/27/2024 04/29/2024-04/30/2024	**Location**	Conducted RF Bench
Requirement	15.407 (a)(2) RSS-247 Clause 6.2.3	**Method**	ANSI C63.10 12.4 AVGSA-2

Limit: The maximum peak conducted output power of the intentional radiator shall not exceed 250 mW.

Test Parameters

Frequency	5470-5725 MHz	**Setup**	
RBW	1 MHz	**VBW**	3 MHz
Detector(s)	Peak	**Settings**	Max Hold Span: 30 MHz | 60 MHz | 120 MHz
Example Calculations	Average Output Power = Measured Power + 10*log(1/D) where D is the duty cycle.		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	06/13/2023	06/12/2024	Active Verification
EE 960087	Analyzer – Spectrum	Agilent	N9010A	MY53400296	04/11/2023	04/11/2024	Active Calibration

EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx
Frequency	5500-5720 MHz	**Channel**	See 2.9

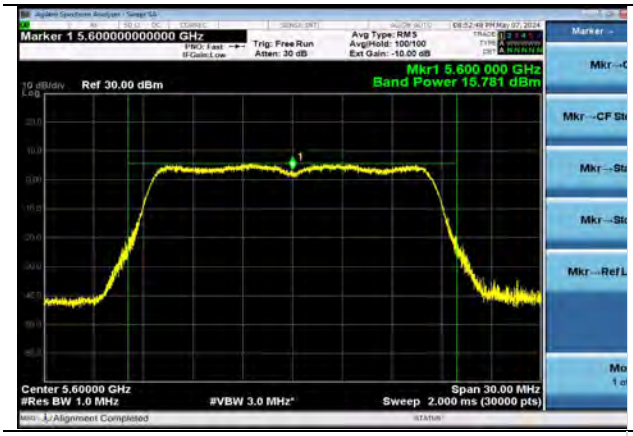
Measurements

Mode	Rate	Channel	Average Output Power (dBm)	Duty Cycle Correction (dB)	Corrected Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11a	6 Mbps	100	15.1	-	15.1	24.0	8.9
		116	15.9	-	15.9	24.0	8.1
		120	16.1	-	16.1	24.0	7.9
		144	15.4	-	15.4	24.0	8.6
	54 Mbps	100	15.2	0.4	15.6	24.0	8.5
		116	15.5	0.4	15.9	24.0	8.1
		120	15.8	0.4	16.2	24.0	7.8
		144	15.3	0.4	15.7	24.0	8.3
802.11n20	MCS0	100	14.5	-	14.5	24.0	9.5
		116	14.9	-	14.9	24.0	9.1
		120	15.1	-	15.1	24.0	8.9
		144	14.8	-	14.8	24.0	9.2
	MCS7	100	14.2	0.4	14.6	24.0	9.4
		116	14.6	0.4	15.0	24.0	9.0
		120	14.8	0.4	15.2	24.0	8.8
		144	14.5	0.4	14.9	24.0	9.1
802.11ac20	MCS0	100	14.4	-	14.4	24.0	9.6
		116	14.9	-	14.9	24.0	9.1
		120	15.1	-	15.1	24.0	8.9
		144	14.7	-	14.7	24.0	9.3
	MCS8	100	14.0	0.4	14.4	24.0	9.6
		116	14.5	0.4	14.9	24.0	9.1
		120	14.7	0.4	15.1	24.0	8.9
		144	14.4	0.4	14.8	24.0	9.2
802.11ax20	MCS0	100	10.4	-	10.4	24.0	13.6
		116	11	-	11.0	24.0	13.0
		120	11.1	-	11.1	24.0	12.9
		144	10.9	-	10.9	24.0	13.1
	MCS11	100	9.8	0.5	10.3	24.0	13.7
		116	10.4	0.5	10.9	24.0	13.1
		120	10.6	0.5	11.1	24.0	12.9
		144	10.5	0.5	11.0	24.0	13.0

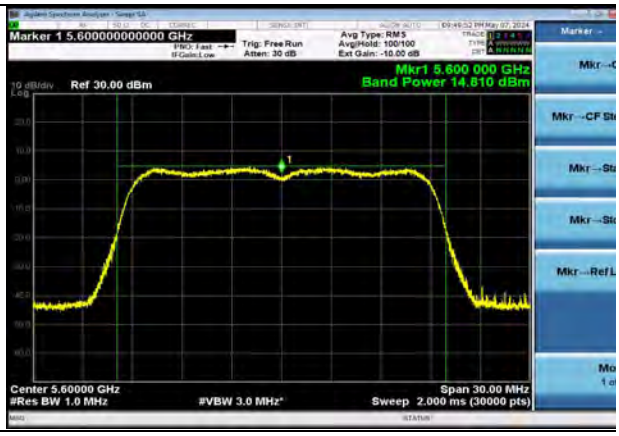
Mode	Rate	Channel	Average Output Power (dBm)	Duty Cycle Correction (dB)	Corrected Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n40	MCS0	102	14.7	0.1	14.8	24.0	9.2
		110	14.5	0.1	14.6	24	9.4
		142	15.3	0.1	15.4	24.0	8.6
	MCS7	102	14.2	0.6	14.8	24.0	9.2
		110	14.4	0.6	15.0	24	9.0
		142	14.9	0.6	15.5	24.0	8.5
802.11ac40	MCS0	102	14.4	0.1	14.5	24.0	9.5
		110	14.8	0.1	14.9	24	9.1
		142	15.3	0.1	15.4	24.0	8.6
	MCS9	102	11.9	0.7	12.6	24.0	11.4
		110	12.0	0.7	12.7	24	11.3
		142	12.9	0.7	13.6	24.0	10.5
802.11ax40	MCS0	102	10.8	0.1	10.9	24.0	13.1
		110	10.8	0.1	10.9	24	13.1
		142	11.5	0.1	11.6	24.0	12.4
	MCS11	102	10.1	0.7	10.8	24.0	13.2
		110	10.1	0.7	10.8	24	13.2
		142	11.0	0.7	11.7	24.0	12.3
802.11ac80	MCS0	106	12.8	0.2	13.0	24.0	11.0
		122	13.4	0.2	13.6	24.0	10.4
		138	14.0	0.2	14.2	24.0	9.8
	MCS9	106	12.2	1.0	13.2	24.0	10.8
		122	12.7	1.0	13.7	24.0	10.3
		138	13.3	1.0	14.3	24.0	9.7
802.11ax80	MCS0	106	10.1	0.2	10.3	24.0	13.7
		122	10.7	0.2	10.9	24.0	13.1
		138	11.4	0.2	11.6	24.0	12.4
	MCS11	106	9.4	0.8	10.2	24.0	13.8
		122	10.0	0.8	10.8	24.0	13.2
		138	10.7	0.8	11.5	24.0	12.5

Mode	Rate RU	Channel	Average Output Power (dBm)	Duty Cycle Correction (dB)	Corrected Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11ax20	MCS0 RU26	100	10.7	0.2	10.9	24.0	13.1
		120	11.1	0.2	11.3	24.0	12.7
		144	10.8	0.2	11.0	24.0	13.0
	MCS0 RU52	100	10.7	0.2	10.9	24.0	13.1
		120	11.2	0.2	11.4	24.0	12.6
		144	10.6	0.2	10.8	24.0	13.2
	MCS0 RU106	100	10.7	0.2	10.9	24.0	13.1
		120	11.3	0.2	11.5	24.0	12.5
		144	10.8	0.2	11.0	24.0	13.0
802.11ax40	MCS0 RU26	102	10.8	0.2	11.0	24.0	13.0
		118	11.6	0.2	11.8	24.0	12.2
		142	11.9	0.2	12.1	24.0	11.9
	MCS0 RU52	102	11.9	0.2	12.1	24.0	11.9
		118	12.6	0.2	12.8	24.0	11.2
		142	12.7	0.2	12.9	24.0	11.1
	MCS0 RU106	102	12.0	0.2	12.2	24.0	11.8
		118	12.5	0.2	12.7	24.0	11.3
		142	12.7	0.2	12.9	24.0	11.1
	MCS0 RU242	102	12.2	0.2	12.4	24.0	11.6
		118	12.7	0.2	12.9	24.0	11.1
		142	12.8	0.2	13.0	24.0	11.0
802.11ax80	MCS0 RU26	106	11.1	0.2	11.3	24.0	12.7
		122	11.7	0.2	11.9	24.0	12.1
		138	11.3	0.2	11.5	24.0	12.5
	MCS0 RU52	106	11.0	0.2	11.2	24.0	12.8
		122	12.1	0.2	12.3	24.0	11.7
		138	11.5	0.2	11.7	24.0	12.3
	MCS0 RU106	106	11.0	0.2	11.2	24.0	12.8
		122	12.0	0.2	12.2	24.0	11.8
		138	11.3	0.2	11.5	24.0	12.5
	MCS0 RU242	106	11.1	0.2	11.3	24.0	12.7
		122	11.9	0.2	12.1	24.0	11.9
		138	11.3	0.2	11.5	24.0	12.5
	MCS0 RU484	106	11.4	0.2	11.6	24.0	12.4
		122	11.9	0.2	12.1	24.0	11.9
		138	11.5	0.2	11.7	24.0	12.3

Plots



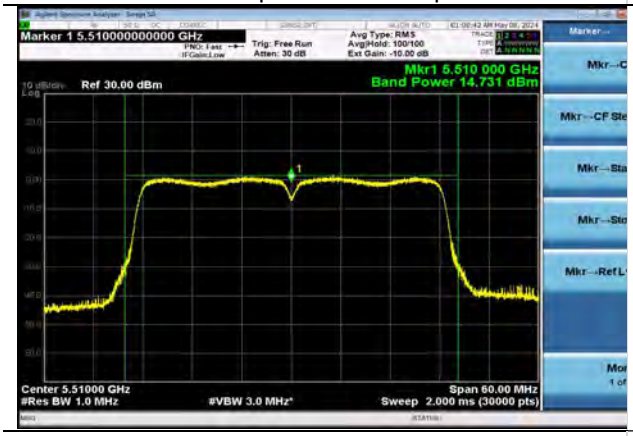
802.11a | Channel 120 | 54 Mbps



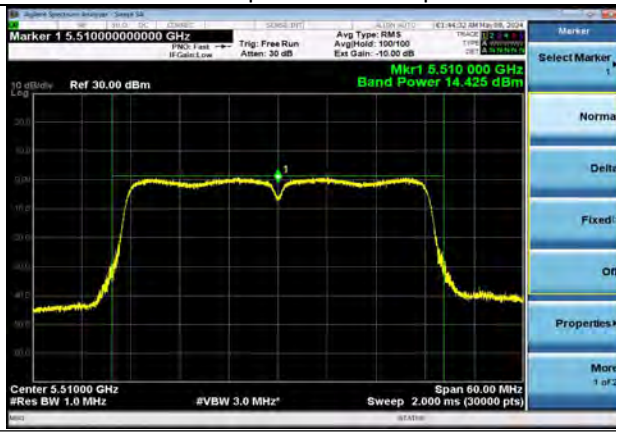
802.11n20 | Channel 120 | MCS7

802.11ac20 | Channel 120 | MCS8

802.11ax20 | Channel 120 | MCS0



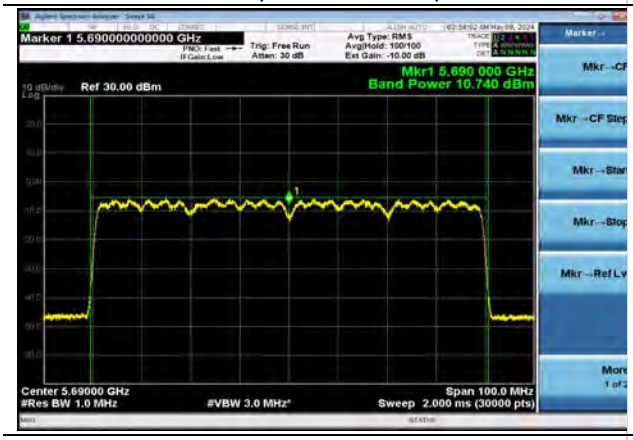
802.11n40 | Channel 102 | MCS0



802.11ac40 | Channel 102 | MCS0

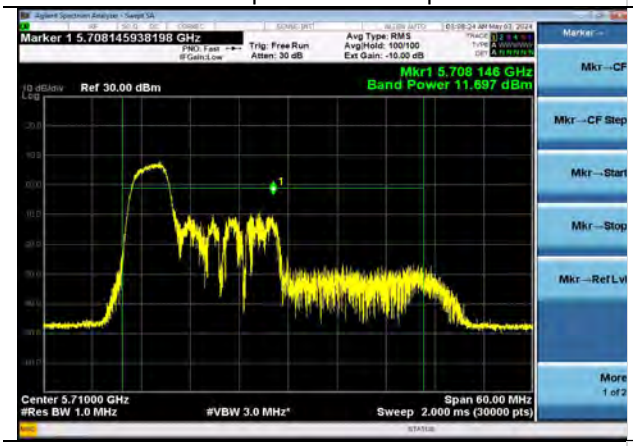
802.11ax40 | Channel 102 | MCS0

802.11ac80 | Channel 138 | MCS9

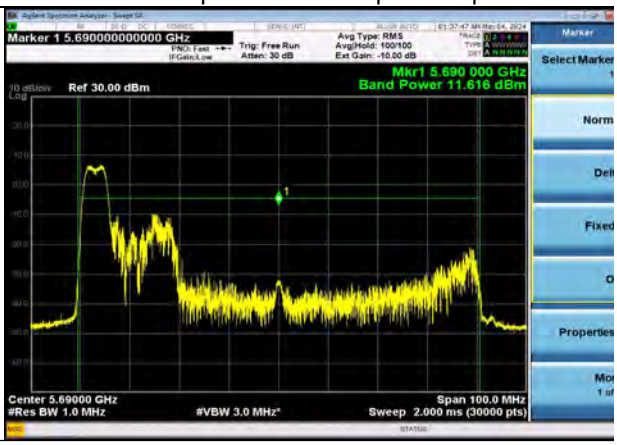


802.11ax80 | Channel 138 | MCS11

802.11ax20 | Channel 120 | MCS0 | RU52



802.11ax40 | Channel 142 | MCS0 | RU52



802.11ax80 | Channel 138 | MCS0 | RU52

6.1.3 Power Spectral Density

Operator	Dylan Rosenfeldt | Anthony Smith	**QA**	Adam Hauke
Temperature	22.0°C | 21.1°C 22.0°C | 21.9°C	**R.H. %**	26.60% | 20.20% 30.50% | 52.90%
Test Date	02/28/2024-02/29/2024 04/25/2024-04/29/2024	**Location**	Conducted RF Bench
Requirement	15.407 (a)(2) RSS-247 Clause 6.2.3	**Method**	ANSI C63.10 12.6 AVGPSD-2

Limits: Power spectral density shall not be greater than 11 dBm in any 1 MHz band.

Test Parameters

Frequency	5470-5725 MHz	**Detector(s)**	Avg (RMS)
RBW	1 MHz	**VBW**	3 MHz
Notes	The same method of determining the conducted output power shall be used to determine the power spectral density		
Example Calculations	Average PSD = Measured PSD + 10*log(1/D) where D is the duty cycle.		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	06/13/2023	06/12/2024	Active Verification
EE 960087	Analyzer – Spectrum	Agilent	N9010A	MY53400296	04/11/2023	04/11/2024	Active Calibration

EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx
Frequency	5500-5720 MHz	**Channel**	See 2.9

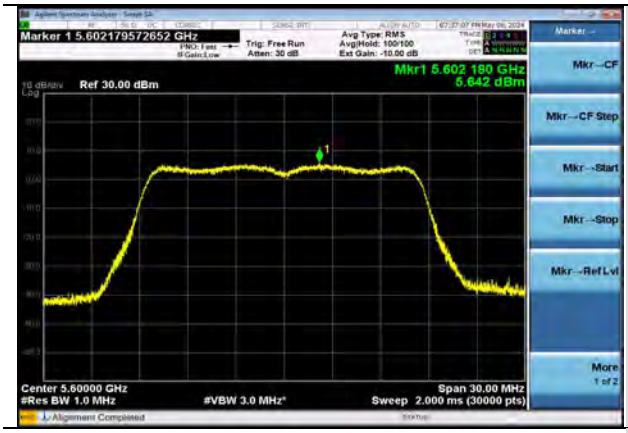
Measurements

Mode	Rate	Channel	Maximum Average PSD (dBm/1 MHz)	Duty Cycle Correction (dB)	Corrected Output Value (dBm/1 MHz)	Limit (dBm/1 MHz)	Margin (dB)
802.11a	6 Mbps	100	5.3	-	5.3	11.0	5.7
		116	6.0	-	6.0	11.0	5.0
		144	5.8	-	5.8	11.0	5.2
	54 Mbps	100	5.4	0.4	5.8	11.0	5.2
		116	5.7	0.4	6.1	11.0	4.9
		144	5.2	0.4	5.6	11.0	5.4
802.11n20	MCS0	100	4.1	-	4.1	11.0	6.9
		116	4.5	-	4.5	11.0	6.5
		144	4.2	-	4.2	11.0	6.8
	MCS7	100	4.0	0.4	4.4	11.0	6.6
		116	4.4	0.4	4.8	11.0	6.2
		144	4.2	0.4	4.6	11.0	6.4
802.11ac20	MCS0	100	4.0	-	4.0	11.0	7.0
		116	4.2	-	4.2	11.0	6.8
		144	4.3	-	4.3	11.0	6.7
	MCS8	100	4.0	0.4	4.4	11.0	6.6
		116	4.2	0.4	4.6	11.0	6.4
		144	4.0	0.4	4.4	11.0	6.6
802.11ax20	MCS0	100	-0.1	-	-0.1	11.0	11.1
		116	0.7	-	0.7	11.0	10.3
		144	0.3	-	0.3	11.0	10.7
	MCS11	100	-0.6	0.5	-0.1	11.0	11.1
		116	0.2	0.5	0.7	11.0	10.3
		144	0.0	0.5	0.5	11.0	10.5
802.11n40	MCS0	102	1.3	0.1	1.4	11.0	9.6
		142	2.0	0.1	2.1	11.0	8.9
	MCS7	102	1.1	0.6	1.7	11.0	9.3
		142	2.0	0.6	2.6	11.0	8.4
802.11ac40	MCS0	102	1.5	0.1	1.6	11.0	9.4
		142	2.2	0.1	2.3	11.0	8.7
	MCS9	102	-0.7	0.7	0.0	11.0	11.0
		142	-0.5	0.7	0.2	11.0	10.8
802.11ax40	MCS0	102	-2.5	0.1	-2.4	11.0	13.4
		142	-1.9	0.1	-1.8	11.0	12.8
	MCS11	102	-3.0	0.7	-2.3	11.0	13.3
		142	-2.1	0.7	-1.4	11.0	12.4

Mode	Rate	Channel	Maximum Average PSD (dBm/1 MHz)	Duty Cycle Correction (dB)	Corrected Output Value (dBm/1 MHz)	Limit (dBm/1 MHz)	Margin (dB)
802.11ac80	MCS0	106	-3.8	0.2	-3.6	11.0	14.6
		122	-3.6	0.2	-3.4	11.0	14.4
		138	-3.5	0.2	-3.3	11.0	14.3
	MCS9	106	-4.2	1.0	-3.2	11.0	14.2
		122	-3.9	1.0	-2.9	11.0	13.9
		138	-3.5	1.0	-2.5	11.0	13.5
802.11ax80	MCS0	106	-6.5	0.2	-6.3	11.0	17.3
		122	-5.8	0.2	-5.6	11.0	16.6
		138	-5.9	0.2	-5.7	11.0	16.7
	MCS11	106	-6.8	0.8	-6.0	11.0	17.0
		122	-6.5	0.8	-5.7	11.0	16.7
		138	-6.1	0.8	-5.3	11.0	16.3

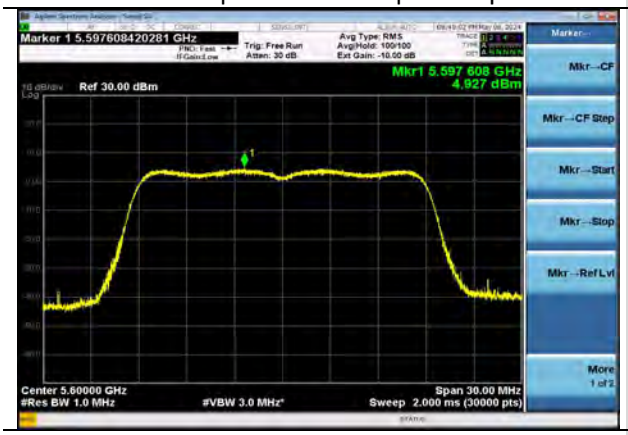
Mode	Rate RU	Channel	Maximum Average PSD (dBm/1 MHz)	Duty Cycle Correction (dB)	Corrected Output Value (dBm/1 MHz)	Limit (dBm/1 MHz)	Margin (dB)
802.11ax20	MCS0 RU26	100	9.9	0.2	10.1	11.0	0.9
		120	9.1	0.2	9.3	11.0	1.7
		144	9.4	0.2	9.6	11.0	1.4
	MCS0 RU52	100	6.1	0.2	6.3	11.0	4.7
		120	7.0	0.2	7.2	11.0	3.8
		144	6.9	0.2	7.1	11.0	3.9
	MCS0 RU106	100	3.0	0.2	3.2	11.0	7.8
		120	3.9	0.2	4.1	11.0	6.9
		144	4.1	0.2	4.3	11.0	6.7
802.11ax40	MCS0 RU26	102	9.3	0.2	9.5	11.0	1.5
		118	9.4	0.2	9.6	11.0	1.4
		142	9.0	0.2	9.2	11.0	1.9
	MCS0 RU52	102	6.3	0.2	6.5	11.0	4.5
		118	7.1	0.2	7.3	11.0	3.7
		142	7.5	0.2	7.7	11.0	3.3
	MCS0 RU106	102	3.6	0.2	3.8	11.0	7.2
		118	4.0	0.2	4.2	11.0	6.8
		142	4.4	0.2	4.6	11.0	6.4
	MCS0 RU242	102	0.0	0.2	0.2	11.0	10.8
		118	0.7	0.2	0.9	11.0	10.1
		142	1.4	0.2	1.6	11.0	9.4
802.11ax80	MCS0 RU26	106	8.7	0.2	8.9	11.0	2.1
		122	9.8	0.2	10.0	11.0	1.0
		138	9.7	0.2	9.9	11.0	1.1
	MCS0 RU52	106	5.5	0.2	5.7	11.0	5.3
		122	6.8	0.2	7.0	11.0	4.0
		138	6.9	0.2	7.1	11.0	3.9
	MCS0 RU106	106	3.1	0.2	3.3	11.0	7.7
		122	4.3	0.2	4.5	11.0	6.5
		138	3.9	0.2	4.1	11.0	6.9
	MCS0 RU242	106	-0.2	0.2	0.1	11.0	11.0
		122	1.0	0.2	1.2	11.0	9.8
		138	0.5	0.2	0.7	11.0	10.3
	MCS0 RU484	106	-3.0	0.2	-2.8	11.0	13.8
		122	-1.8	0.2	-1.6	11.0	12.6
		138	-2.2	0.2	-2.0	11.0	13.0

Plots

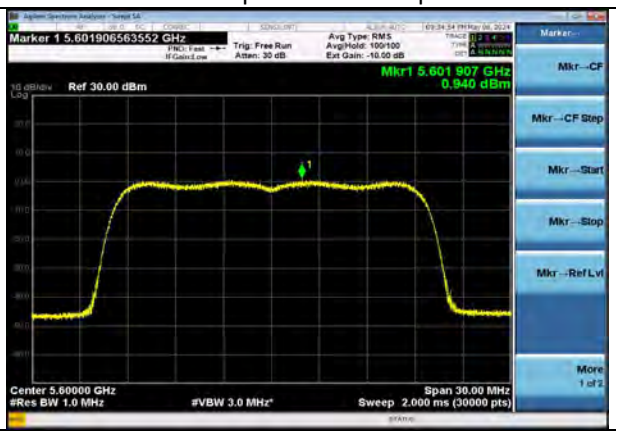


802.11a | Channel 120 | 54 Mbps

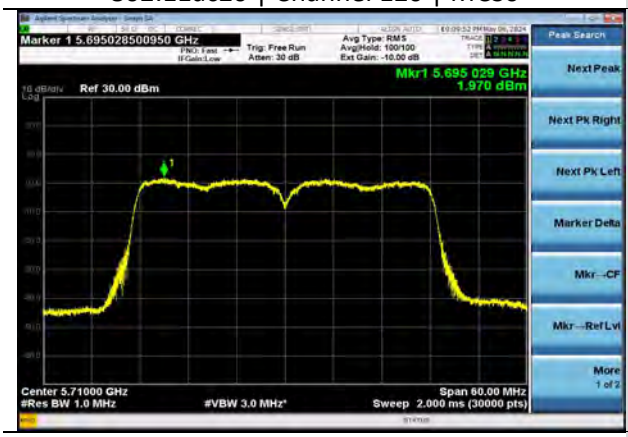
802.11n20 | Channel 120 | MCS7



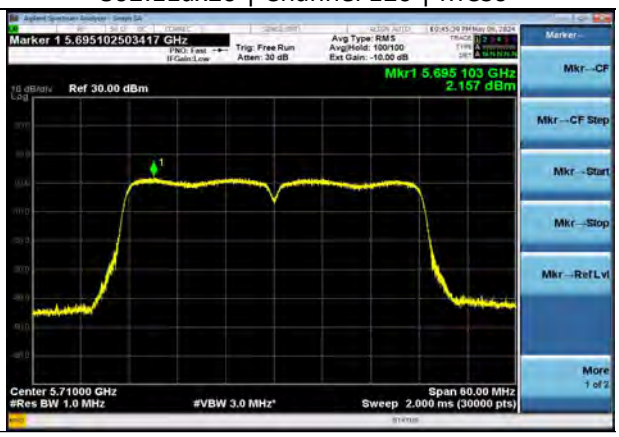
802.11ac20 | Channel 120 | MCS0



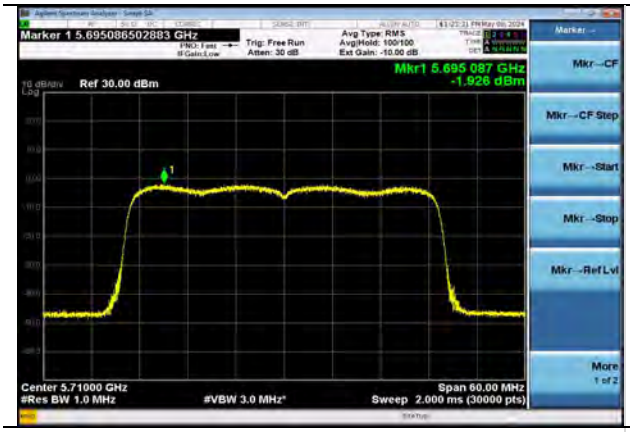
802.11ax20 | Channel 120 | MCS0



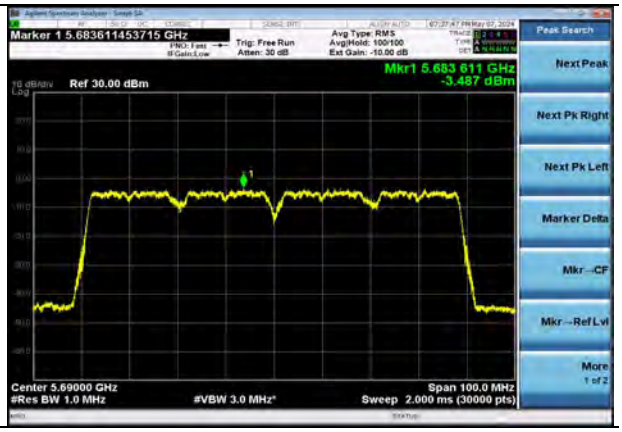
802.11n40 | Channel 142 | MCS7



802.11ac40 | Channel 142 | MCS0

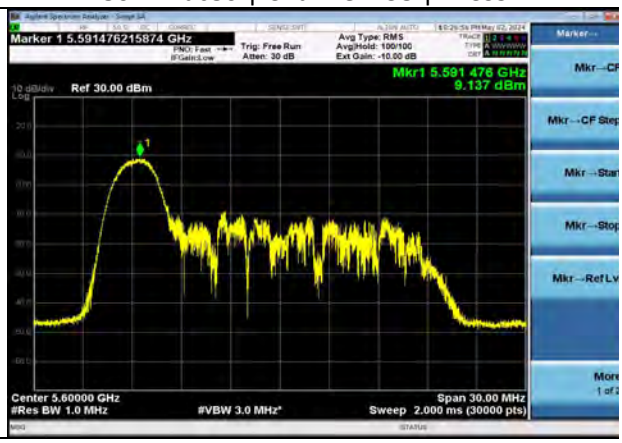


802.11ax40 | Channel 142 | MCS0

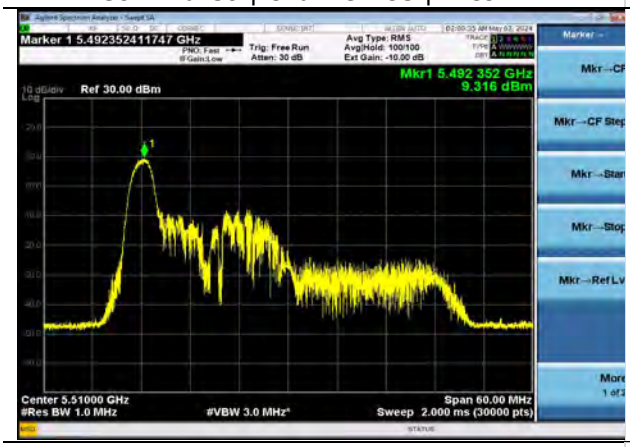


802.11ac80 | Channel 138 | MCS9

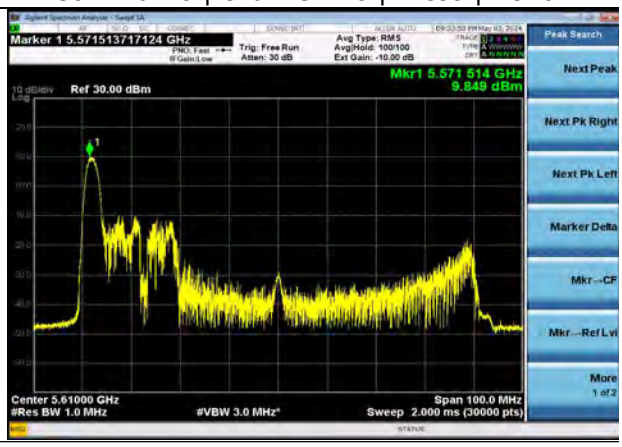
802.11ax80 | Channel 138 | MCS11



802.11ax20 | Channel 120 | MCS0 | RU26



802.11ax40 | Channel 102 | MCS0 | RU26



802.11ax80 | Channel 122 | MCS0 | RU26

6.1.4 Out-of-band Emissions

Operator	Anthony Smith | Dylan Rosenfeldt	**QA**	Adam Hauke
Temperature	21.6°C-21.9°C 21.8°C-22.2°C	**R.H. %**	19.90%-41.10% 29.70%-38.0%
Test Date	02/29/2024-03/05/2024 04/05/2024-04/08/2024	**Location**	Conducted RF Bench
Requirement	15.407(b)(3) RSS-247 Clause 6.2.3	**Method**	ANSI C63.10 12.7

Limits: For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

15.209 Limits:

Frequency (MHz)	Quasi-Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-40000	-	54.0	74.0

Test Parameters

Frequency	5350-5470 MHz	**Setup**	
RBW	1 MHz	**VBW**	3 MHz
Detector(s)	Peak and Average (RMS)	**Settings**	
Notes	Declared antenna gain for band edge – 4.4 dBi		
Example Calculations	Correction Factor = 20 log (1/D), where D is the duty cycle		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	06/13/2023	06/12/2024	Active Verification
EE 960087	Analyzer – Spectrum	Agilent	N9010A	MY53400296	04/11/2023	04/11/2024	Active Calibration

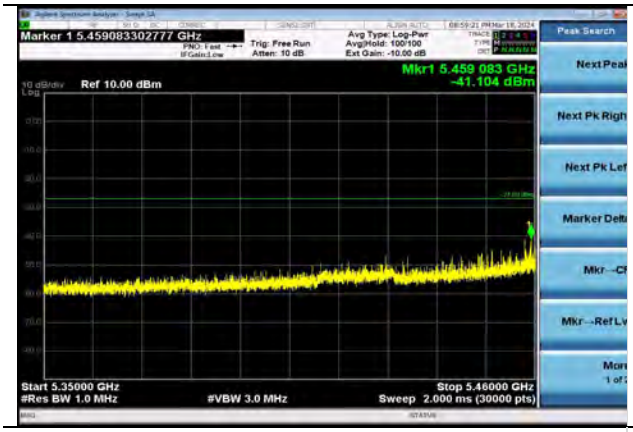
Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx
Frequency	5180-5530 MHz	**Channel**	See 2.9

Measurements – Lower Band Edge

Mode	Rate	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	Antenna Gain (dBi)	Duty Cycle Correction (dB)	Limit (dBm)	Margin (dB)
802.11a	6 Mbps	100	Peak	5458.1	-43.1	4.4		-27.0	11.7
		100	Average	5458.0	-54.5	4.4		-41.2	8.9
	54 Mbps	100	Peak	5459.1	-41.1	4.4		-27.0	9.7
		100	Average	5459.3	-55.6	4.4	0.4	-41.2	9.6
802.11n20	MCS0	100	Peak	5459.9	-42.4	4.4		-27.0	11.0
		100	Average	5459.9	-56.5	4.4		-41.2	10.9
	MCS7	100	Peak	5457.9	-45.9	4.4		-27.0	14.5
		100	Average	5459.7	-56.6	4.4	0.4	-41.2	10.6
802.11ac20	MCS0	100	Peak	5456.9	-45.1	4.4		-27.0	13.7
		100	Average	5459.5	-56.6	4.4		-41.2	11.0
	MCS8	100	Peak	5459.2	-40.8	4.4		-27.0	9.4
		100	Average	5457.9	-57.3	4.4	0.4	-41.2	11.3
802.11ax20	MCS0	100	Peak	5454.9	-41.2	4.4		-27.0	9.8
		100	Average	5457.4	-55.6	4.4		-41.2	10.0
	MCS11	100	Peak	5459.1	-51.1	4.4		-27.0	19.7
		100	Average	5457.5	-61.4	4.4	0.5	-41.2	15.3
802.11n40	MCS0	102	Peak	5457.9	-38.7	4.4		-27.0	7.3
		102	Average	5459.9	-52.3	4.4	0.1	-41.2	6.6
	MCS7	102	Peak	5459.9	-39.9	4.4		-27.0	8.5
		102	Average	5460.0	-51.1	4.4	0.6	-41.2	4.9
802.11ac40	MCS0	102	Peak	5455.5	-39.3	4.4		-27.0	7.9
		102	Average	5458.6	-52.5	4.4	0.1	-41.2	6.8
	MCS9	102	Peak	5459.4	-43.1	4.4		-27.0	11.7
		102	Average	5457.1	-56.1	4.4	0.7	-41.2	9.8
802.11ax40	MCS0	102	Peak	5457.9	-34.7	4.4		-27.0	3.3
		102	Average	5458.2	-51.6	4.4	0.1	-41.2	5.9
	MCS11	102	Peak	5457.1	-45.9	4.4		-27.0	14.5
		102	Average	5459.8	-59.6	4.4	0.7	-41.2	13.3
802.11ac80	MCS0	106	Peak	5445.4	-36.3	4.4		-27.0	4.9
		106	Average	5458.6	-48.2	4.4	0.2	-41.2	2.4
	MCS9	106	Peak	5439.5	-36.9	4.4		-27.0	5.5
		106	Average	5456.9	-47.7	4.4	1.0	-41.2	1.1
802.11ax80	MCS0	106	Peak	5454.8	-35.0	4.4		-27.0	3.6
		106	Average	5457.0	-48.0	4.4	0.2	-41.2	2.2
	MCS11	106	Peak	5447.5	-42.6	4.4		-27.0	11.2
		106	Average	5458.5	-52.7	4.4	0.8	-41.2	6.3

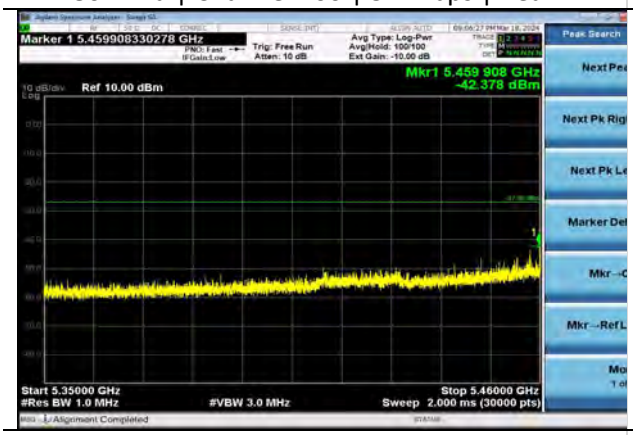
Mode	Rate	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	Antenna Gain (dBi)	Duty Cycle Correction (dB)	Limit (dBm)	Margin (dB)
802.11ax20	MCS0	100	Peak	5457.1	-34.2	4.4		-27.0	2.8
	RU26	100	Average	5457.8	-55.5	4.4		-41.2	9.9
	MCS0	100	Peak	5459.8	-40.6	4.4		-27.0	9.2
	RU52	100	Average	5459.3	-55.1	4.4		-41.2	9.5
	MCS0	100	Peak	5453.3	-41.8	4.4		-27.0	10.4
	RU106	100	Average	5459.0	-55.2	4.4		-41.2	9.6
802.11ax40	MCS0	102	Peak	5457.4	-36.1	4.4		-27.0	4.7
	RU26	102	Average	5456.1	-47.1	4.4	0.1	-41.2	1.4
	MCS0	102	Peak	5451.7	-39.0	4.4		-27.0	7.6
	RU52	102	Average	5459.7	-54.6	4.4	0.1	-41.2	8.9
	MCS0	102	Peak	5458.8	-38.3	4.4		-27.0	6.9
	RU106	102	Average	5459.4	-49.6	4.4	0.1	-41.2	3.9
	MCS0	102	Peak	5456.0	-39.1	4.4		-27.0	7.7
	RU242	102	Average	5459.9	-53.3	4.4	0.1	-41.2	7.6
802.11ax80	MCS0	106	Peak	5413.5	-33.2	4.4		-27.0	1.8
	RU26	106	Average	5415.7	-50.4	4.4	0.2	-41.2	4.6
	MCS0	106	Peak	5459.1	-39.4	4.4		-27.0	8.0
	RU52	106	Average	5459.2	-56.5	4.4	0.2	-41.2	10.7
	MCS0	106	Peak	5457.5	-38.5	4.4		-27.0	7.1
	RU106	106	Average	5419.0	-55.0	4.4	0.2	-41.2	9.2
	MCS0	106	Peak	5420.6	-39.3	4.4		-27.0	7.9
	RU242	106	Average	5423.0	-56.1	4.4	0.2	-41.2	10.3
	MCS0	106	Peak	5415.8	-34.6	4.4		-27.0	3.2
	RU484	106	Average	5415.6	-51.3	4.4	0.8	-41.2	4.9

Worst Case Plots



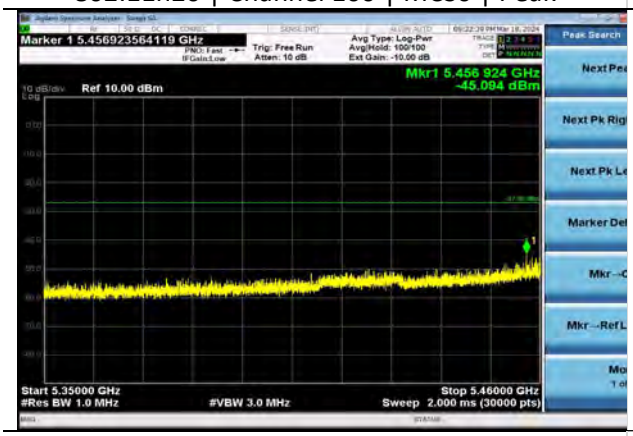
802.11a | Channel 100 | 54 Mbps | Peak

802.11a | Channel 100 | 54 Mbps | Average



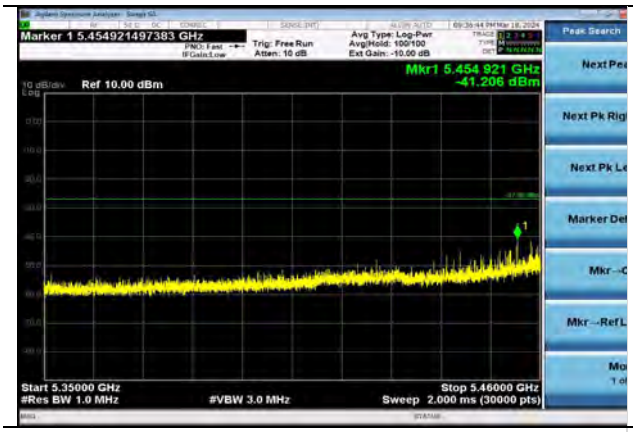
802.11n20 | Channel 100 | MCS0 | Peak

802.11n20 | Channel 100| MCS0 | Average



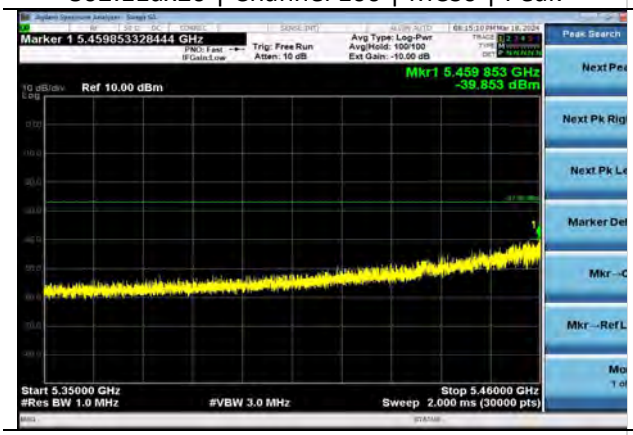
802.11ac20 | Channel 100 | MCS0 | Peak

802.11ac20 | Channel 100 | MCS0 | Average



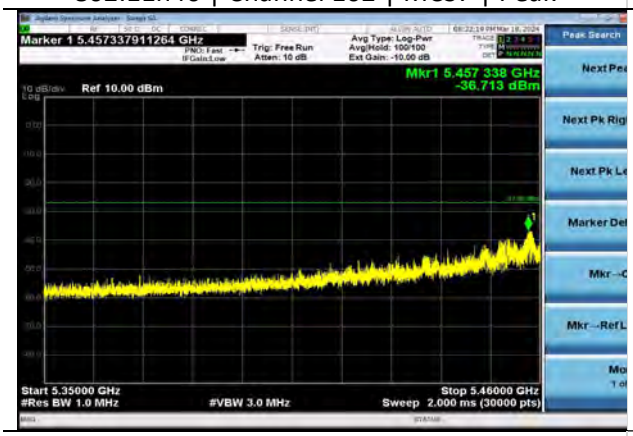
802.11ax20 | Channel 100 | MCS0 | Peak

802.11ax20 | Channel 100 | MCS0 | Average



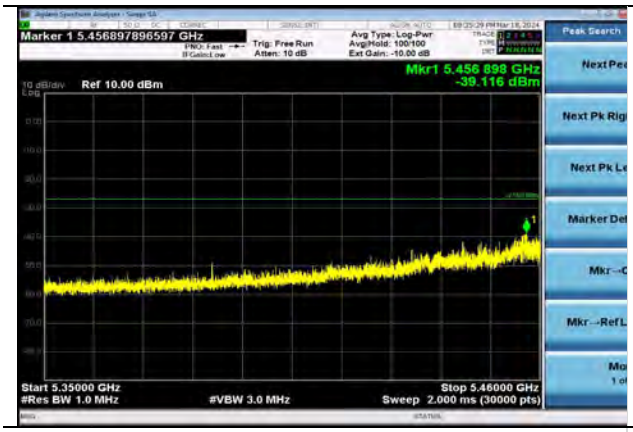
802.11n40 | Channel 102 | MCS7 | Peak

802.11ax20 | Channel 102 | MCS7 | Average



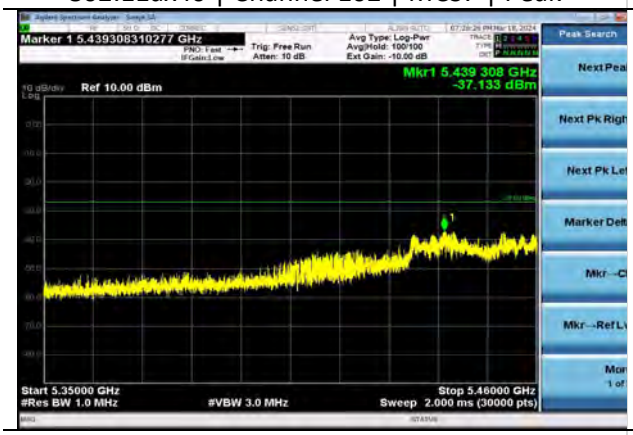
802.11ac40 | Channel 102 | MCS7 | Peak

802.11ac40 | Channel 102 | MCS7 | Average



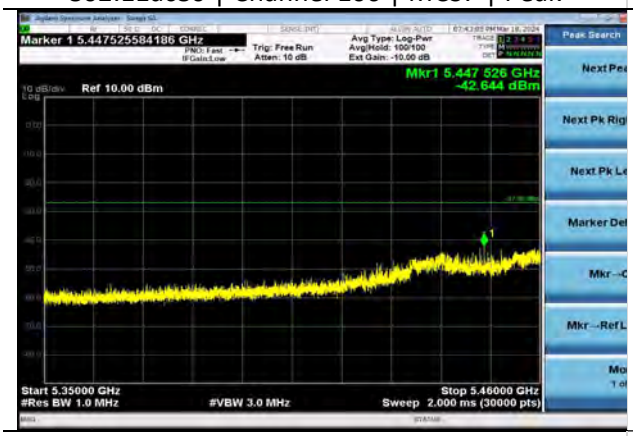
802.11ax40 | Channel 102 | MCS7 | Peak

802.11ax40 | Channel 102 | MCS7 | Average



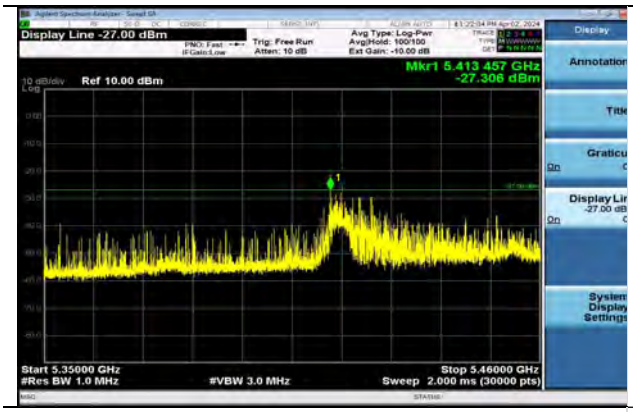
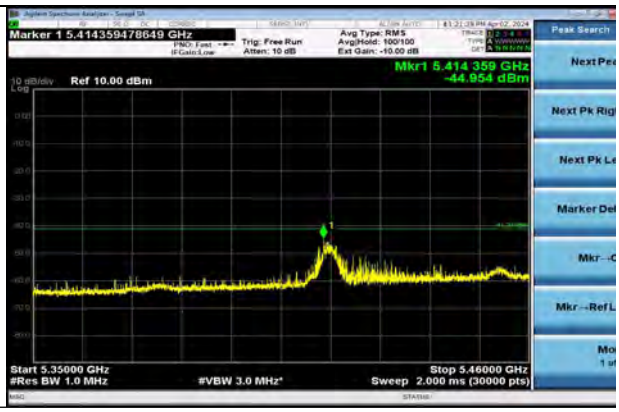
802.11ac80 | Channel 106 | MCS7 | Peak

802.11ac80 | Channel 106 | MCS7 | Average



802.11ax80 | Channel 106 | MCS11 | Peak

802.11ax80 | Channel 106 | MCS11 | Average

	
802.11ax80| Channel 106 | MCS0 | RU26 | Peak	802.11ax80 | Channel 106 | MCS0 | RU26 | Average

6.1.5 Spurious Emissions

Operator	Anthony Smith	**QA**	Anthony Smith
Temperature	21.8°C	**R.H. %**	35.90%
Test Date	03/04/2024	**Location**	Conducted RF Bench
Requirement	15.407(b)(1),(2),(9), & 10 RSS-247 Clause 6.2.1 & 6.2.2 RSS-GEN	**Method**	ANSI C63.10 12.7

15.209 Limits:

Frequency (MHz)	Quasi-Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-40000	-	54.0	62.8

Test Parameters

Frequency	30-40000 MHz	**Setup**	
RBW	1 MHz	**VBW**	3 MHz
Detector(s)	Peak	**Settings**	
Notes	Declared antenna gain– 4.4 dBi		
Example Calculations	Correction Factor = 20 log (1/D), where D is the duty cycle		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	387	06/13/2023	06/12/2024	Active Verification
EE 960085	Analyzer – Spectrum	Agilent	N9010A	MY53400296	04/11/2023	04/11/2024	Active Calibration
AA 960161	Filter - Highpass 5 GHz	K&L Microwave	11SH10-8000	2	4/11/2023	4/11/2024	Active Calibration

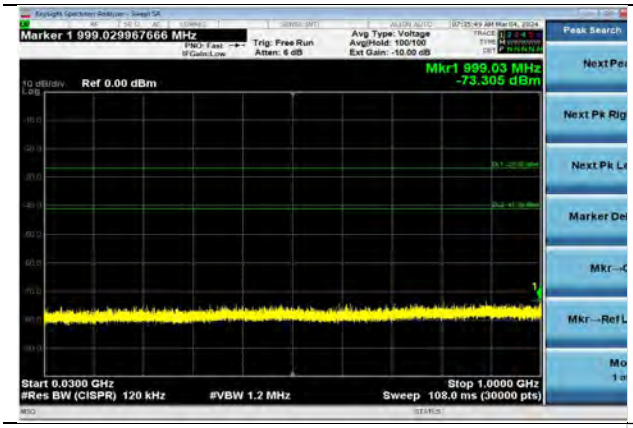
EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx
Frequency	5500-5720 MHz	**Channel**	

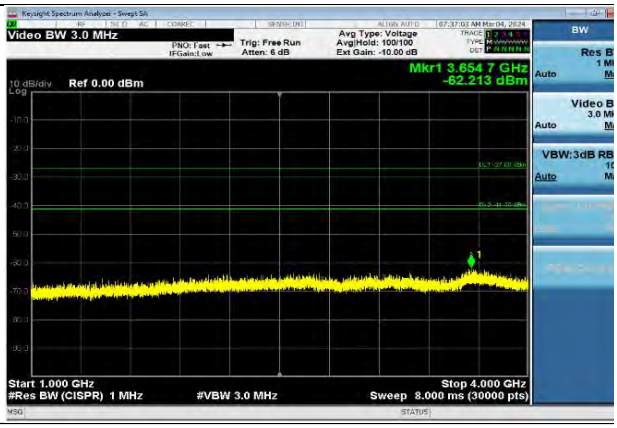
Table

Mode	Rate	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
802.11a	6 Mbps	144	Peak	11440.5	-58.3	4.4	-27.0	26.9
		144	Average	11439.7	-69.0	4.4	-41.2	23.4
802.11n	MCS0	144	Peak	11439.4	-60.6	4.4	-27.0	29.2
		144	Average	11441.1	-70.8	4.4	-41.2	25.2
802.11ac20	MCS0	144	Peak	11446.7	-61.3	4.4	-27.0	29.9
		144	Average	11440.4	-70.8	4.4	-41.2	25.2
802.11ax20	MCS0	144	Peak	11438.1	-60.2	4.4	-27.0	28.8
		144	Average	11439.1	-70.9	4.4	-41.2	25.3
802.11n40	MCS0	144	Peak	11440.5	-58.3	4.4	-27.0	26.9
		144	Average	11439.7	-69.0	4.4	-41.2	23.4

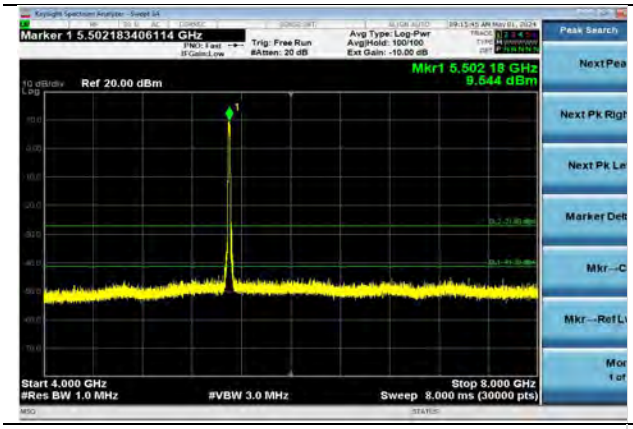
Worst Case Plots



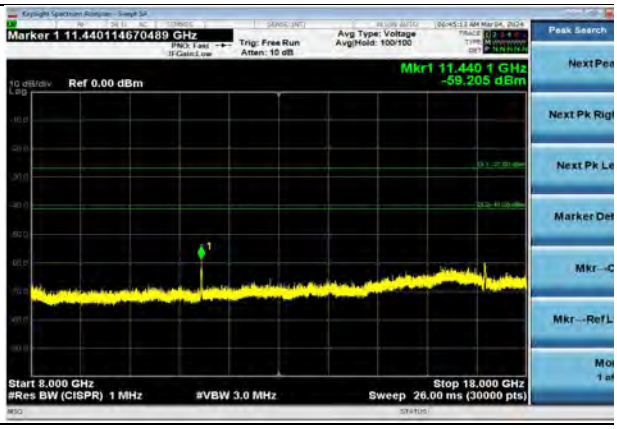
802.11a | Channel 100 | 6 Mbps | 30-1000 MHz



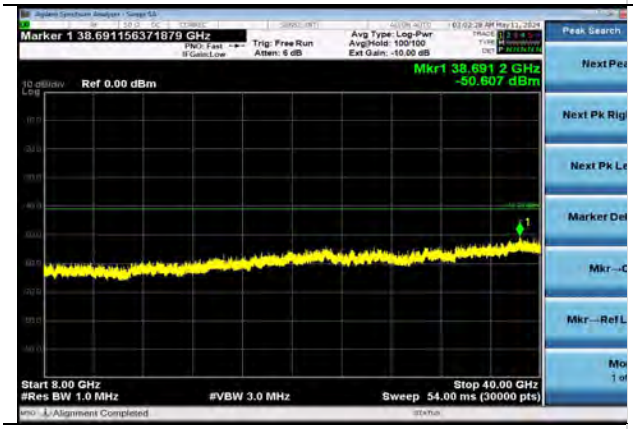
802.11a | Channel 100 | 6 Mbps | 1000-4000 MHz



802.11a | Channel 100 | 6 Mbps | 4000-8000 MHz



802.11a | Channel 144 | 6 Mbps | 8000-18000 MHz



802.11a | Channel 100 | 6 Mbps | 8000-40000 MHz

6.1.6 Frequency Stability

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	21.8°C	**R.H. %**	31.90%
Test Date	04/25/2024	**Location**	Conducted RF Bench
Requirement	15.407(g) RSS-GEN Clause 6.11	**Method**	ANSI C63.10 6.8

Test Parameters

Frequency	5550-5720 MHz	**Voltage**	4.3 VDC, 5 VDC, and 5.8 VDC
Detector(s)	Peak	**Settings**	Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	387	06/13/2023	06/12/2024	Active Verification
EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/10/2023	4/10/2024	Active Calibration

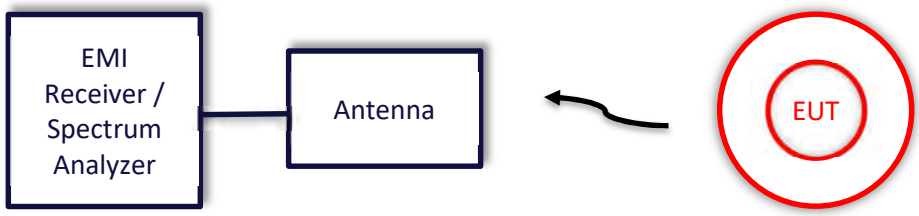
Table

Channel	Voltage	Center Frequency (Hz)
100	5	5500002434
	4.3	5500002702
	5.8	5500002469
120	5	5600002333
	4.3	5600002420
	5.8	5600002553
140	5	5700003614
	4.3	5700003481
	5.8	5700003376

6.2 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBµV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBµV/m) Margin (dB) = Limit (dBµV/m) - Corrected Reading (dBµV/m) Example at 4000 MHz: Reading = 40 dBµV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBµV/m Average Limit = 20 log (500) = 54 dBµV/m Margin = 54 dBµV/m - 50.8 dBµV/m = 3.2 dB

Block Diagram



6.2.1 Spurious Radiated Emissions in the Restricted Bands

Operator	Mitchell Freund | Nicole Sedmak Jon Dilley | Zachary Brown	**QA**	Anthony Smith | Adam Alger Adam Hauke | Dylan Rosenfeldt
Temperature	23.2°C-25.1°C	**R.H. %**	21.30%-25.90%
Test Date	02/12/2024-03/27/2024	**Location**	Chamber 3 | Chamber 5
Requirement	15.247 (b)(1),(2),(9) & (10) RSS-247 Clause 6.2.1 & 6.2.2 RSS-GEN Clause 8.9	**Method**	ANSI C63.10 12.7

15.209 Limits:

Frequency (MHz)	Quasi-Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-40000	-	54.0	68.2

Test Parameters

Frequency	30-40000 MHz	**Distance**	3 m
Detector(s)	Peak Trac Peak and Average Final	**Table height**	150 cm
RBW	<1000 MHz – 120 kHz >1000 – 1 MHz	**VBW**	<1000 – 1.2 MHz >1000 – See 2.9

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	8/10/2023	8/10/2024	Active Calibration
AA 960081	Antenna - Double Ridge Horn	EMCO	3115	6907	1/11/2024	1/11/2025	Active Calibration
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	2/7/2024	2/7/2025	Active Calibration
AA 960161	Filter - Highpass 5 GHz	K&L Microwave	11SH10-8000	2	4/11/2023	4/11/2024	Active Calibration
AA 960163	Antenna - Log Periodic	A.H. Systems, Inc.	SAS-512-2	500	8/10/2023	8/10/2024	Active Calibration
AA 960217	Antenna - Biconical	A.H. Systems, Inc.	SAS-540	852	7/17/2023	7/17/2024	Active Calibration

AA 960220	Cable	A.H. Systems, Inc.	SAC-26G-6	552	2/16/2023	2/16/2025	Active Verification
AA 960221	Cable	A.H. Systems, Inc.	SAC-26G-6	524	6/13/2023	6/13/2024	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/27/2023	4/27/2024	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/11/2023	4/11/2024	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	1/5/2024	1/5/2025	Active Verification
LSC-500	Cable	Chamber 5 Emissions	-	-	1/8/2024	1/8/2025	Active Verification

EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx
EUT	X, Y, Z Plane Orientations Antenna ports terminated with 50 Ω SMA terminators	**AE**	HP Elitebook 840G1 Ezurio – SOM60 Development Kit
Notes	6000 MHz Emission from auxiliary equipment. Not a function of the EUT. No Spurious emissions observed 1000-40000 MHz. Only worst case EUT orientation reported.		

Radiated Spurious – 30-1000 MHz – All Modes

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
66.3	H	122	200	34.4	40.0	5.6
111.1	V	224	171	39.9	43.5	13.6
113.2	H	145	120	28.7	43.5	14.8
395.6	H	100	212	38.8	46.0	7.2
479.2	H	176	203	35.7	46.0	10.3

*The spurious signals detected do not depend on either the operating channel or the modulation mode

1000-40000 MHz – 802.11a

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
6 Mbps	100	Z Plane	Peak	5379.1	Vertical	51.0	68.2	17.2
			Average	5404.3	Vertical	39.5	54.0	14.5
54 Mbps	100	Z Plane	Peak	5464.5	Vertical	51.2	68.2	17.0
			Average	5404.3	Vertical	41.4	54.0	12.6

1000-40000 MHz – 802.11n20

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	100	Z Plane	Peak	5468.0	Vertical	51.0	68.2	17.2
			Average	5419.6	Vertical	39.4	54.0	14.6
MCS7	100	Z Plane	Peak	5454.1	Vertical	51.0	68.2	17.2
			Average	5429.5	Vertical	41.3	54.0	12.7

1000-40000 MHz – 802.11ac20

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	100	Z Plane	Peak	5400.3	Vertical	50.3	68.2	17.9
			Average	5453.2	Vertical	39.4	54.0	14.6
MCS8	100	Z Plane	Peak	5456.3	Vertical	50.3	68.2	17.9
			Average	5350.4	Vertical	41.8	54.0	12.2

1000-40000 MHz – 802.11ax20

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	100	Z Plane	Peak	5352.8	Vertical	50.9	68.2	17.3
			Average	5398.0	Vertical	39.7	54.0	14.3
MCS11	100	Z Plane	Peak	5469.8	Vertical	50.7	68.2	17.5
			Average	5425.2	Vertical	41.9	54.0	12.1

1000-40000 MHz – 802.11n40

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	102	Z Plane	Peak	5415.5	Horizontal	51.2	68.2	17.0
			Average	5402.8	Horizontal	39.9	54.0	14.1
MCS7	102	Z Plane	Peak	5369.1	Horizontal	50.9	68.2	17.3
			Average	5351.6	Horizontal	41.9	54.0	12.1

1000-40000 MHz – 802.11ac40

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	102	Z Plane	Peak	5461.3	Horizontal	51.5	68.2	16.7
			Average	5406.3	Horizontal	39.8	54.0	14.2
MCS9	102	Z Plane	Peak	5393.5	Horizontal	50.4	68.2	17.8
			Average	5419.3	Horizontal	42.3	54.0	11.7

1000-40000 MHz – 802.11ax40

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	102	Z Plane	Peak	5458.7	Horizontal	51.1	68.2	17.1
			Average	5438.5	Horizontal	40.0	54.0	14.0
MCS11	102	Z Plane	Peak	5464.8	Horizontal	51.3	68.2	16.9
			Average	5426.9	Horizontal	42.2	54.0	11.8

1000-40000 MHz – 802.11ac80

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	106	X Plane	Peak	5462.8	Vertical	50.8	68.2	17.4
			Average	5447.2	Vertical	40.4	54.0	13.6
MCS8	106	X Plane	Peak	5460.9	Vertical	51.4	68.2	16.8
			Average	5452.5	Vertical	43.2	54.0	10.9

1000-40000 MHz – 802.11ax80

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	106	X Plane	Peak	5388.6	Vertical	50.9	68.2	17.3
			Average	5368.0	Vertical	40.8	54.0	13.2
MCS11	106	X Plane	Peak	5397.8	Vertical	50.9	68.2	17.3
			Average	5373.5	Vertical	42.6	54.0	11.4

1000-40000 MHz – 802.11ax20 – MU-RU – MCS0

Band Edge

EUT Orientation	Channel	RU	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Z Plane	100	0	Peak	5465.8	Vertical	49.9	68.2	18.3
			Average	5434.6	Vertical	38.4	54.0	15.6
		3	Peak	5466.4	Vertical	50.1	68.2	18.1
			Average	5450.1	Vertical	38.5	54.0	15.5
		8	Peak	5466.8	Vertical	49.6	68.2	18.6
			Average	5434.1	Vertical	38.3	54.0	15.7

1000-40000 MHz – 802.11ax40 – MU-RU – MCS0

Band Edge

EUT Orientation	Channel	RU	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Z Plane	102	0	Peak	5462.7	Horizontal	50.4	68.2	17.8
			Average	5443.7	Horizontal	38.9	54.0	15.1
		8	Peak	5466.5	Horizontal	49.8	68.2	18.4
			Average	5431.8	Horizontal	38.8	54.0	15.2
		17	Peak	5435.2	Horizontal	49.7	68.2	18.5
			Average	5459.8	Horizontal	38.9	54.0	15.1

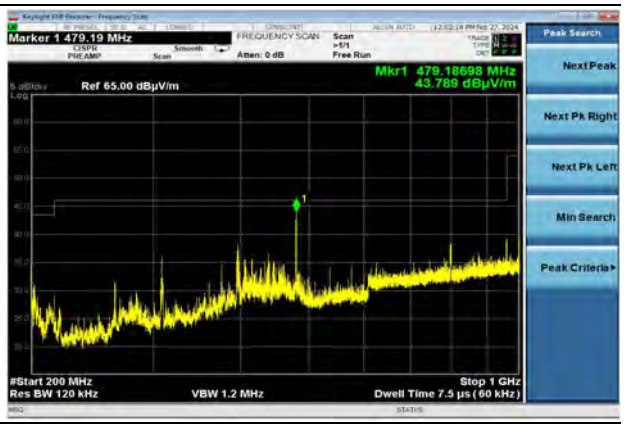
1000-40000 MHz – 802.11ax80 – MU-RU – MCS0

Band Edge

EUT Orientation	Channel	RU	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Z Plane	106	0	Peak	5405.0	Vertical	49.8	68.2	18.4
			Average	5446.5	Vertical	39.3	54.0	14.7
		17	Peak	5460.7	Vertical	49.7	68.2	18.5
			Average	5448.0	Vertical	39.3	54.0	14.7
		36	Peak	5467.7	Vertical	49.0	68.2	19.2
			Average	5436.6	Vertical	39.5	54.0	14.5

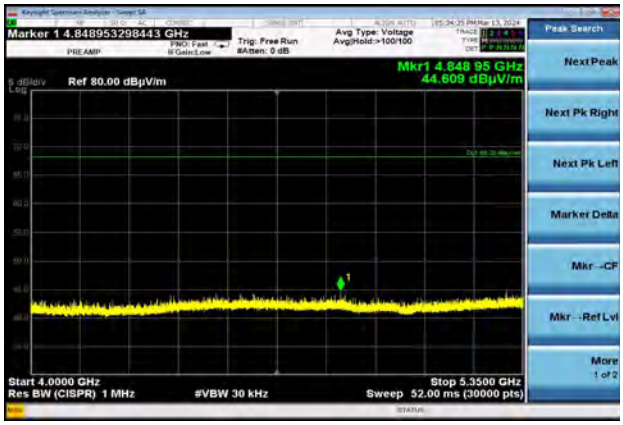
Worst Case Plots

802.11a | Channel 120 | 6 Mbps | Y Plane
30-200 MHz | Horizontal

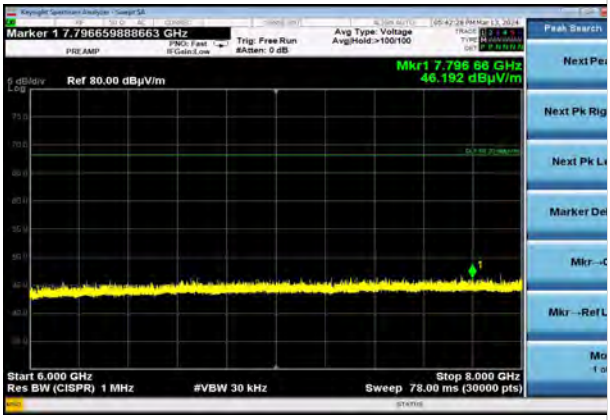


802.11a | Channel 120 | 6 Mbps | Y Plane
200-1000 MHz | Vertical

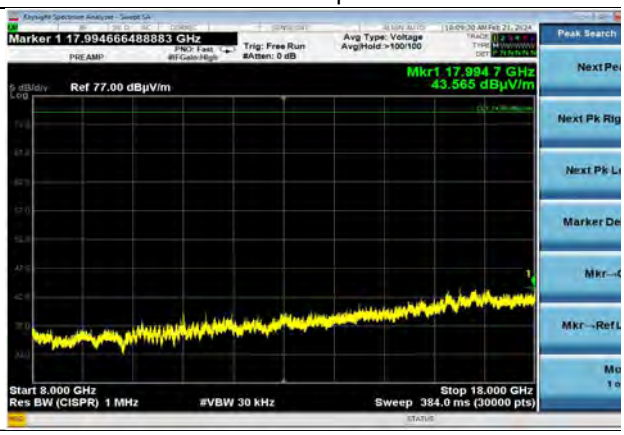
802.11a | Channel 100 | 6 Mbps | Y Plane
1000-4000 MHz | Horizontal



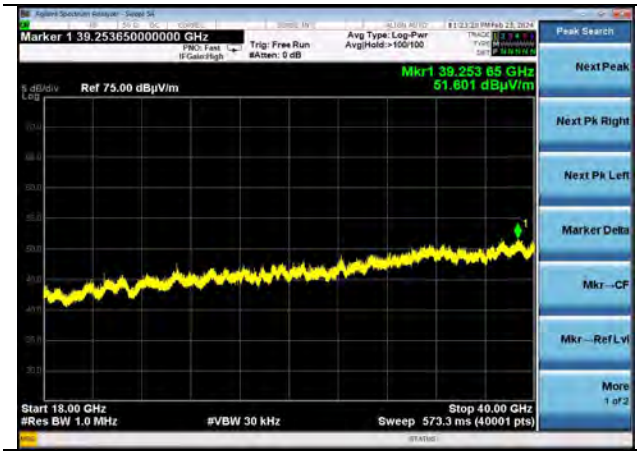
802.11a | Channel 100 | 6 Mbps | Z Plane
4000-5350 MHz | Horizontal



802.11a | Channel 100 | 6 Mbps | X Plane
6000-8000 MHz | Vertical



802.11a | Channel 100 | 6 Mbps | Y Plane
8000-18000 MHz | Horizontal

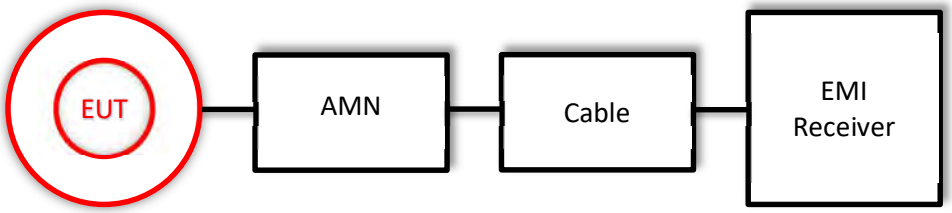


802.11a | Channel 120 | 6 Mbps | Z Plane
18000-40000 MHz | Vertical

6.3 AC Mains Conducted Emissions

Description of Measurement	A line impedance stabilization network (LISN) or artificial mains network (AMN) allows the emissions of the power supply conductors to be measured while isolating the EUT from the supply mains. The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values. Maximum emissions are determined with a peak max hold trace then measurements at a selection of the highest points are made with quasi-peak and average detectors. Results are recorded and compared to limit for each line. (e.g. line and neutral)
Example Calculations	Measurement (dBµV) + Cable factor (dB) + Other (dB) = Corrected Reading (dBµV) Margin (dB) = Limit (dBµV) - Corrected Reading (dBµV)

Block Diagram



6.3.1 AC Mains Conducted Emissions

Operator	Jon Dilley	**QA**	Adam Hauke
Temperature	21.2°C	**R.H. %**	28.40%
Test Date	04/05/2024	**Location**	AC Conducted Bench
Requirement	15.407(b)(9) RSS-GEN	**Method**	ANSI C63.10 6.2

Limits:

Frequency (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)
0.15-0.5	66.0-56.0*	56.0-46.0*
0.5-5	56.0	46.0
5-30	60.0	50.0

*Decreases with the logarithm of the frequency.

Test Parameters

Frequency	0.15-30 MHz	**Distance**	40 cm from wall 80 cm from LISN
Detector(s)	Peak Trace Quasi-Peak, Average Final	**Table height**	80 cm
RBW	9 kHz	**VBW**	62 kHz
Notes	Channel has no effect on emission		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/27/2023	4/27/2024	Active Calibration
EE 960089	LISN	COM-POWER	LI-215A	191943	4/10/2023	4/10/2024	Active Calibration
EE 960162	LISN	COM-POWER	LI-215A	191969	4/10/2023	4/10/2024	Active Calibration
LSC-212	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071-001	1/8/2024	1/8/2025	Active Verification

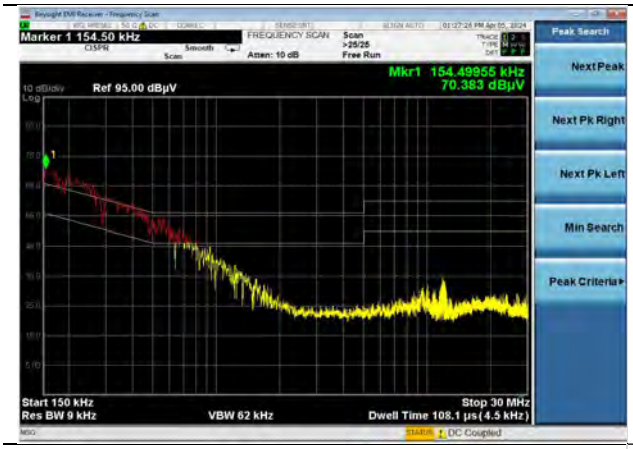
EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	5 GHz WLAN Tx Channel 100

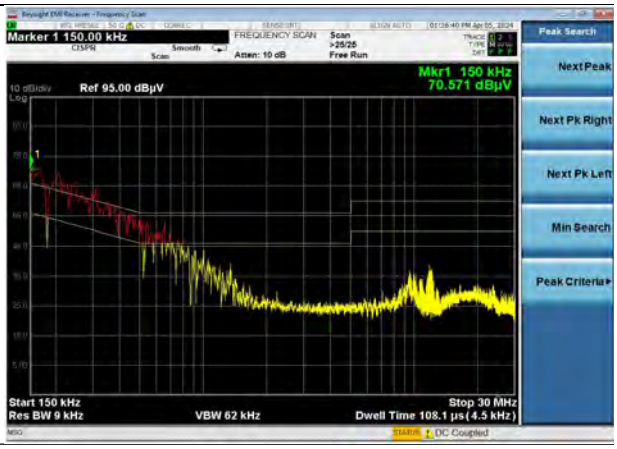
Measurements

Line	Frequency (MHz)	Quasi Peak Reading (dBµV)	Quasi-Peak Limit (dBµV)	Quasi Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
1	0.159	64.5	65.5	1.0	36.9	55.5	18.6
1	0.532	47.1	56.0	8.9	25.0	46.0	21.0
1	12.080	34.6	60.0	25.4	23.4	50.0	26.6
2	0.163	63.7	65.3	1.6	36.3	55.3	19.0
2	0.500	44.2	56.0	11.8	24.4	46.0	21.6
2	12.098	28.9	60.0	31.1	15.4	50.0	34.6

Plots



Line 1



Line 2

7 REVISION HISTORY

Version	Date	Notes	Person
0.0	08/05/2024	Initial Draft	Adam Hauke
1.0	08/08/2024	Final Draft	Adam Hauke

END OF REPORT