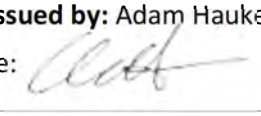
Test Report TR3768-165-2.4G

Equipment Under Test:	Module, SONA NX 611 M.2 2230, 2 MHF
Requirement(s):	eCFR 47 Part 15.247 | RSS-247
Test Date(s):	02/12/2024-04/30/2024
Prepared for:	Ezurio Attn: Brian Petted W66 N220 Commerce Ct. Cedarburg, WI 53012

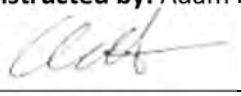
Report Issued by: Adam Hauke, EMC Engineer

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 **02/12/2024-04/30/2024** the Equipment Under Test (EUT), **Module, SONA NX611 M.2 2230, 2 MHF**, as provided by **Ezurio** was tested to the following requirements:

FCC 15.247 | RSS-247 – DTS 2.4 GHz WLAN

Requirements	Description	Method	Compliant
15.247(d) 15.209 RSS-247 Clause 5.5 RSS-GEN Clause 8.10	Spurious Radiated Emissions in Restricted Bands 30-40000 MHz	ANSI C63.10	Yes
15.247(a)(2) RSS-247 Clause 5.2 (a)	6dB and 99% Occupied Bandwidth	ANSI C63.10	Yes
15.247(b)(3) RSS-247 Clause 5.4 (d)	RF Output Power	ANSI C63.10	Yes
15.247(d) RSS-247 Clause 5.5 RSS-GEN A1 Clause 8.9	Out-of-band Emissions	ANSI C63.10	Yes
15.247(e) RSS-247 Clause 5.2 (b)	Power Spectral Density	ANSI C63.10	Yes
2.1055(d) RSS-GEN 6.11	Frequency Stability	ANSI C63.10	Reported
15.207 RSS-GEN 8.8	AC Conducted Emissions	ANSI C63.10	Yes

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
Laird 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
1	2402	20	802.11b – 1 and 11 Mbps 802.11g – 6 and 54 Mbps 802.11n – MCS0 and MCS7 802.11ax – MCS0 and MCS11
6	2437	20	
11	2462	20	
3	2422	40	
6	2437	40	
9	2452	40	

2.9 Power Table and Reduced Video Bandwidth for Average Measurements

802.11	Channel BW (MHz)	Data Rate	Minimum Average VBW (Hz)	Power Setting
b	20	1 Mbps	116	18
b	20	11 Mbps	1044	18
g	20	6 Mbps	698	14
g	20	54 Mbps	5565	14
n	20	MCS0	746	13
n	20	MCS7	5959	13
ax	20	MCS0	956	13
ax	20	MCS11	8628	13
n	40	MCS0	1506	12
n	40	MCS7	9980	12
ax	40	MCS0	1815	13
ax	40	MCS11	11737	11

3 WORST CASE TEST RESULTS SUMMARY

Requirement	Radio	Channel and Data Rate	Frequency (MHz)	Measurement	Limit	Margin
15.247 (a)(2) RSS-247 Clause 5.2(a)	802.11b	6 | 11 Mbps	-	9757 kHz	at least 500 kHz	-
15.247 (b)(3) RSS-247 Clause 5.4 (d)	802.11b	6 | 1 Mbps	-	17.6 dBm	30 dBm	12.4 dB
15.247 (e) RSS-247 Clause 5.2 (b)	802.11b	1 | 1 Mbps	-	0.3 dBm/100 kHz	8.0 dBm/3 kHz	7.7 dB
15.247 (d) RSS-247 Clause 5.5 Conducted	802.11g	1 | 54 Mbps	2389.5	51.8 dBµV/m	54.0 dBµV/m	2.2 dB
	802.11ax20	11 | MCS0	2484.7	73.4 dBµV/m	74.0 dBµV/m	0.6 dB
15.247(d) RSS-247 Clause 5.5 RSS-GEN Clause 8.10 Radiated	802.11ax40	11 | MCS0 RU38	2499.4	38.6 dBµV/m	54.0 dBµV/m	15.4 dB
15.207 RSS-GEN Clause 8.8	802.11b	6 | 1 Mbps	0.150	64.2 dBµV	66.0 dBµV	1.8 dB

4 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR 47 Part 15	-	2023	-	-
ANSI C63.10	-	2020	-	-
RSS-247	3	2023	-	-
RSS-GEN	5	2018	2019	2021
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

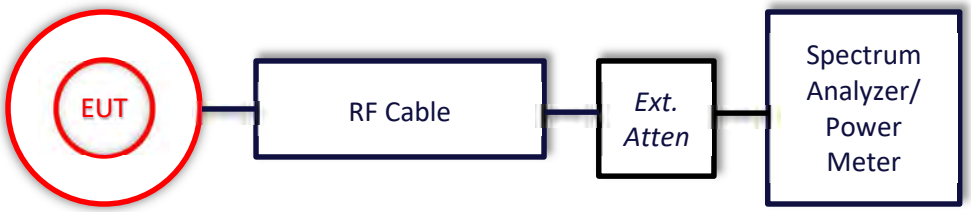
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
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 6dB and 99% Occupied Bandwidth

Operator	Anthony Smith	**QA**	Adam Hauke
Temperature	20.8°C-22.2°C	**R.H. %**	24.30%-33.90%
Test Date	02/12/2024-02/14/2024	**Location**	Conducted RF Bench
Requirement	15.247 (a)(2) RSS-247 Clause 5.2 (a)	**Method**	ANSI C63.10 6.9

Limits: The minimum 6 dB bandwidth shall be at least 500 kHz

Test Parameters

Frequency	2400-2483.5 MHz	**Setup**	Antenna Port
RBW	200 kHz	**VBW**	620 kHz
Detector(s)	Peak	**Settings**	Max Hold

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

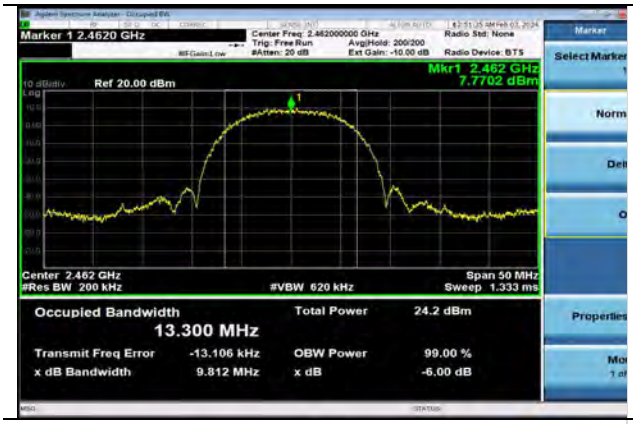
Input Power	120 VAC @ 60 Hz	**Mode**	2.4 GHz WLAN Tx
Frequency	2400-2483.5 MHz	**Channel**	See 2.10

Table

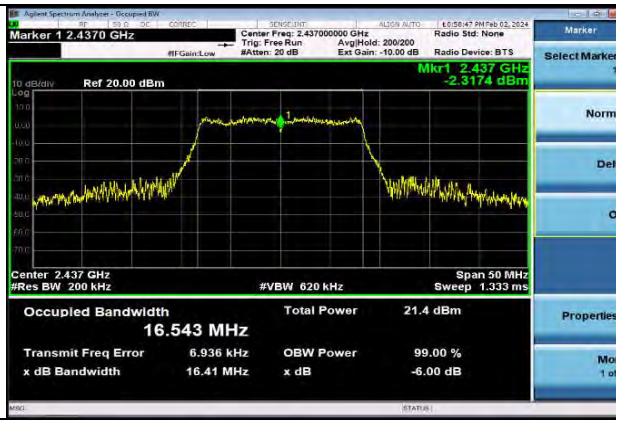
Mode	Rate	Channel	6 dB BW (kHz)	99% BW (MHz)
802.11b	1 Mbps	1	10150	13.4
		6	10150	13.3
		11	10150	13.3
	11 Mbps	1	9819	13.3
		6	9757	13.2
		11	9812	13.3
802.11g	6 Mbps	1	16420	16.5
		6	16410	16.5
		11	16420	16.6
	54 Mbps	1	16540	16.5
		6	16540	16.5
		11	16490	16.5
802.11n20	MCS0	1	17610	17.6
		6	17560	17.6
		11	17560	17.6
	MCS7	1	17730	17.6
		6	17700	17.6
		11	17730	17.7
802.11n40	MCS0	3	36130	36.1
		6	36320	36.2
		9	36270	36.2
	MCS7	3	35820	36.2
		6	36150	36.2
		9	36040	36.2

Mode	Rate	Channel	6 dB BW (kHz)	99% BW (MHz)
802.11ax20	MCS0	1	18680	18.8
		6	18340	18.8
		11	18500	18.8
	MCS11	1	18890	18.7
		6	18930	18.8
		11	18750	18.8
802.11ax40	MCS0	3	37680	37.6
		6	37630	37.6
		9	37460	37.5
	MCS11	3	37390	37.5
		6	37430	37.5
		9	37390	37.5

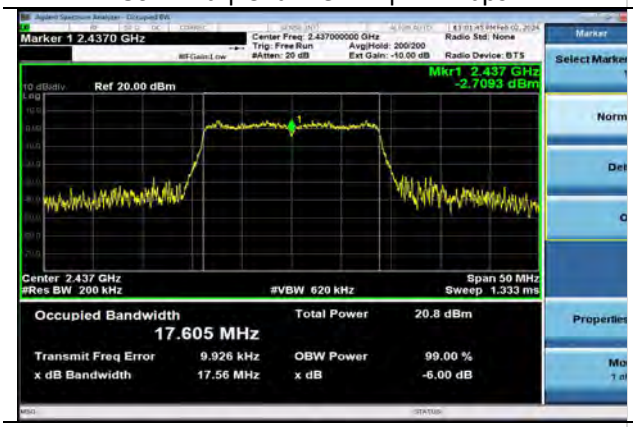
Plots



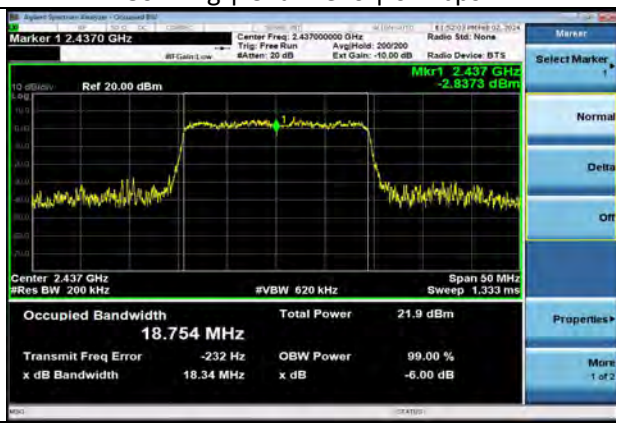
802.11b | Channel 11 | 11 Mbps



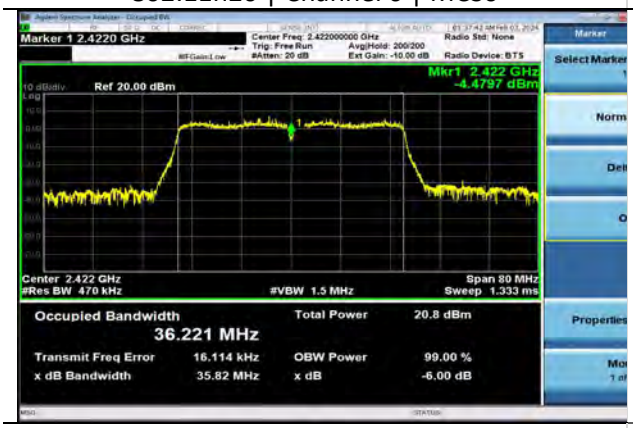
802.11g | Channel 6 | 6 Mbps



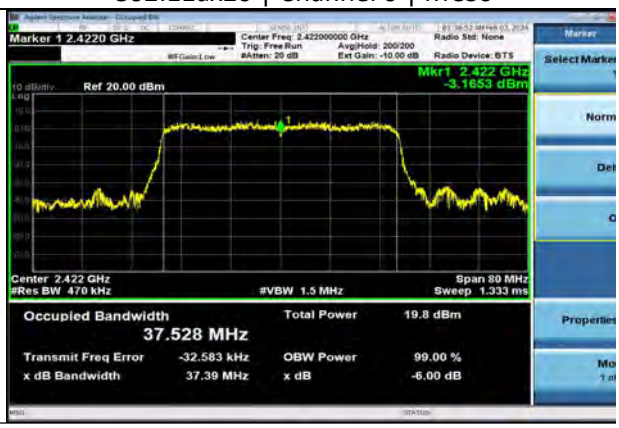
802.11n20 | Channel 6 | MCS0



802.11ax20 | Channel 6 | MCS0



802.11n40 | Channel 3 | MCS7



802.11ax40 | Channel 3 | MCS11

6.1.2 RF Output Power

Operator	Anthony Smith	**QA**	Adam Hauke
Temperature	20.8°C-22.2°C	**R.H. %**	24.30%-33.90%
Test Date	02/12/2024-02/14/2024	**Location**	Conducted RF Bench
Requirement	15.247 (b)(3) RSS-247 Clause 5.4 (d)	**Method**	ANSI C63.10 11.9.2.2.4 AVGSA-2

Limit: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

Test Parameters

Frequency	2400-2483.5 MHz	**Setup**	Antenna Port
RBW	20 MHz BW – 200 kHz 40 MHz BW – 390 kHz	**VBW**	20 MHz BW – 620 kHz 40 MHz BW – 2 MHz
Detector(s)	Peak	**Settings**	Max Hold Span: 30 MHz | 60 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**	2.4 GHz WLAN Tx
Frequency	2400-2483.5 MHz	**Channel**	See 2.10

Tables

Mode	Rate	Channel	Average Output Power (dBm)	Duty Cycle Correction (dB)	Corrected Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	1 Mbps	1	17.4	-	17.4	30.0	12.6
		6	17.6	-	17.6	30.0	12.4
		11	17.6	-	17.6	30.0	12.4
	11 Mbps	1	17.2	-	17.2	30.0	12.8
		6	17.5	-	17.5	30.0	12.5
		11	17.4	-	17.4	30.0	12.6
802.11g	6 Mbps	1	15.2	-	15.2	30.0	14.8
		6	15.4	-	15.4	30.0	14.6
		11	15.4	-	15.4	30.0	14.6
	54 Mbps	1	14.9	0.4	15.3	30.0	14.7
		6	15.0	0.4	15.4	30.0	14.6
		11	14.9	0.4	15.3	30.0	14.7
802.11n20	MCS0	1	14.2	-	14.2	30.0	15.8
		6	14.4	-	14.4	30.0	15.6
		11	14.3	-	14.3	30.0	15.7
	MCS7	1	13.9	0.4	14.3	30.0	15.7
		6	14.2	0.4	14.6	30.0	15.4
		11	13.9	0.4	14.3	30.0	15.7
802.11n40	MCS0	3	14.3	0.1	14.4	30.0	15.6
		6	14.4	0.1	14.5	30.0	15.5
		9	14.4	0.1	14.5	30.0	15.5
	MCS7	3	13.8	0.6	14.4	30.0	15.6
		6	13.9	0.6	14.5	30.0	15.5
		9	13.9	0.6	14.5	30.0	15.5
802.11ax20	MCS0	1	14.4	-	14.4	30.0	15.6
		6	14.7	-	14.7	30.0	15.3
		11	14.5	-	14.5	30.0	15.5
	MCS11	1	11.9	0.5	12.4	30.0	17.6
		6	12.1	0.5	12.6	30.0	17.4
		11	12.1	0.5	12.6	30.0	17.4
802.11ax40	MCS0	3	14.6	0.1	14.7	30.0	15.3
		6	14.7	0.1	14.8	30.0	15.2
		9	14.6	0.1	14.7	30.0	15.3
	MCS11	3	11.9	0.7	12.6	30.0	17.4
		6	12.1	0.7	12.8	30.0	17.2
		9	12.0	0.7	12.7	30.0	17.3

Mode	Rate and RU	Channel	Average Output Power (dBm)	Duty Cycle Correction (dB)	Corrected Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11ax20	MCS0 RU26	1	13.5	0.2	13.7	30.0	16.3
		6	14.0	0.2	14.2	30.0	15.8
		11	13.3	0.2	13.5	30.0	16.5
	MCS0 RU52	1	13.4	0.2	13.6	30.0	16.4
		6	13.2	0.2	13.4	30.0	16.6
		11	13.3	0.2	13.5	30.0	16.5
	MCS0 RU106	1	13.5	0.2	13.7	30.0	16.3
		6	13.2	0.2	13.4	30.0	16.6
		11	13.4	0.2	13.6	30.0	16.4
802.11ax40	MCS0 RU26	3	11.6	0.2	11.8	30.0	18.2
		6	12.4	0.2	12.6	30.0	17.4
		9	11.5	0.2	11.7	30.0	18.3
	MCS0 RU52	3	12.3	0.2	12.5	30.0	17.5
		6	12.6	0.2	12.8	30.0	17.3
		9	12.5	0.2	12.7	30.0	17.3
	MCS0 RU106	3	11.9	0.2	12.1	30.0	17.9
		6	12.8	0.2	13.0	30.0	17.0
		9	12.6	0.2	12.8	30.0	17.2
	MCS0 RU242	3	12.6	0.2	12.8	30.0	17.2
		6	12.5	0.2	12.7	30.0	17.3
		9	12.2	0.2	12.4	30.0	17.6

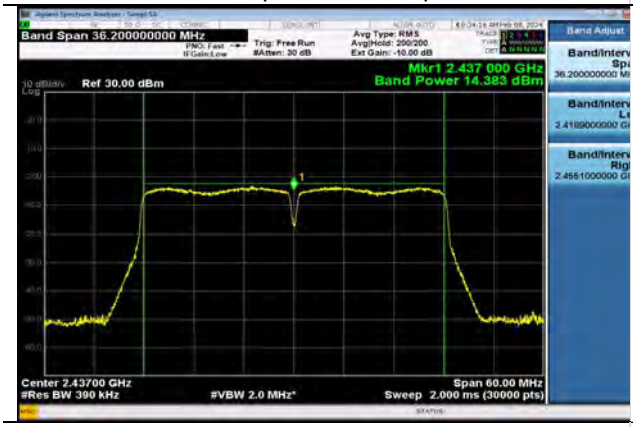
Plots

802.11b | Channel 11 | 11 Mbps

802.11g | Channel 11 | 54 Mbps

802.11n20 | Channel 11 | MCS7

802.11ax20 | Channel 11 | MCS0



802.11n40 | Channel 6 | MCS0

802.11ax40 | Channel 6 | MCS7

6.1.3 Power Spectral Density

Operator	Anthony Smith	**QA**	Adam Hauke
Temperature	22.0°C	**R.H. %**	25.60% | 24.70%
Test Date	02/12/2024-02/13/2024	**Location**	Conducted RF Bench
Requirement	15.247 (e) RSS-247 Clause 5.2 (b)	**Method**	ANSI C63.10 11.10.5 AVGPSD-2

Limits: Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

Test Parameters

Frequency	2400-2483.5 MHz	**Detector(s)**	Avg (RMS)
RBW	200 kHz	**VBW**	620 kHz
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/D0 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**	2.4 GHz WLAN Tx
Frequency	2400-2483.5 MHz	**Channel**	See 2.10

Table

Mode	Rate	Channel	Maximum Average PSD (dBm/100 kHz)	Duty Cycle Correction (dB)	Corrected Output Value (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)
802.11b	1 Mbps	1	0.3		0.3	8.0	7.7
		6	0.3		0.3	8.0	7.7
		11	0.3		0.3	8.0	7.7
	11 Mbps	1	0.0		0.0	8.0	8.0
		6	-0.2		-0.2	8.0	8.2
		11	-0.8		-0.8	8.0	8.8
802.11g	6 Mbps	1	-4.5		-4.5	8.0	12.5
		6	-4.3		-4.3	8.0	12.3
		11	-3.6		-3.6	8.0	11.6
	54 Mbps	1	-3.0	0.4	-2.6	8.0	10.6
		6	-3.3	0.4	-2.9	8.0	10.9
		11	-3.1	0.4	-2.7	8.0	10.7
802.11n20	MCS0	1	-5.6		-5.6	8.0	13.6
		6	-5.2		-5.2	8.0	13.2
		11	-5.3		-5.3	8.0	13.3
	MCS7	1	-3.8	0.4	-3.4	8.0	11.4
		6	-4.0	0.4	-3.6	8.0	11.6
		11	-3.8	0.4	-3.4	8.0	11.4
802.11n40	MCS0	3	-7.7	0.1	-7.6	8.0	15.6
		6	-7.8	0.1	-7.7	8.0	15.7
		9	-8.2	0.1	-8.1	8.0	16.1
	MCS7	3	-6.3	0.6	-5.7	8.0	13.7
		6	-6.6	0.6	-6.0	8.0	14.0
		9	-6.7	0.6	-6.1	8.0	14.1
802.11ax20	MCS0	1	-6.3		-6.3	8.0	14.3
		6	-6.0		-6.0	8.0	14.0
		11	-5.8		-5.8	8.0	13.8
	MCS11	1	-6.2	0.5	-5.7	8.0	13.7
		6	-5.7	0.5	-5.2	8.0	13.2
		11	-6.0	0.5	-5.5	8.0	13.5
802.11ax40	MCS0	3	-8.6	0.1	-8.5	8.0	16.5
		6	-8.4	0.1	-8.3	8.0	16.3
		9	-8.7	0.1	-8.6	8.0	16.6
	MCS11	3	-7.7	0.7	-7.0	8.0	15.0
		6	-8.1	0.7	-7.4	8.0	15.4
		9	-8.1	0.7	-7.4	8.0	15.4

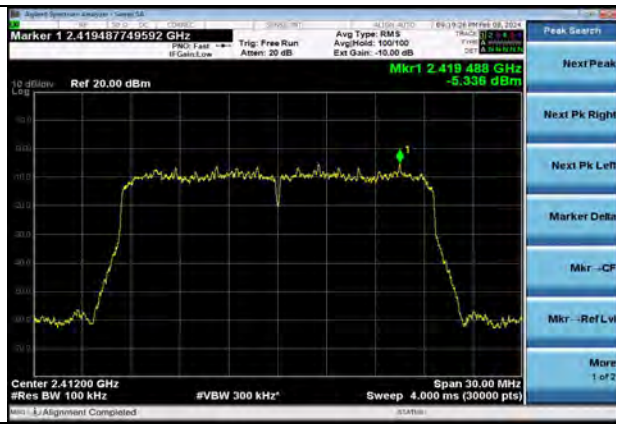
Mode	Rate and RU	Channel	Maximum Average PSD (dBm/100 kHz)	Duty Cycle Correction (dB)	Corrected Output Value (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)
802.11ax20	MCS0 RU26	1	1.8	0.2	2.0	8.0	6.0
		6	2.3	0.2	2.5	8.0	5.5
		11	1.9	0.2	2.1	8.0	5.9
	MCS0 RU52	1	-1.3	0.2	-1.1	8.0	9.1
		6	-1.2	0.2	-1.0	8.0	9.0
		11	-1.2	0.2	-1.0	8.0	9.0
	MCS0 RU106	1	-3.5	0.2	-3.3	8.0	11.3
		6	-4.1	0.2	-3.9	8.0	11.9
		11	-3.8	0.2	-3.6	8.0	11.6
802.11ax40	MCS0 RU26	3	-0.4	0.2	-0.2	8.0	8.2
		6	0.2	0.2	0.4	8.0	7.6
		9	0.2	0.2	0.4	8.0	7.6
	MCS0 RU52	3	-1.7	0.2	-1.5	8.0	9.5
		6	-2.3	0.2	-2.1	8.0	10.1
		9	-2.0	0.2	-1.8	8.0	9.8
	MCS0 RU106	3	-4.8	0.2	-4.6	8.0	12.6
		6	-4.9	0.2	-4.7	8.0	12.7
		9	-4.8	0.2	-4.6	8.0	12.6
	MCS0 RU242	3	-7.7	0.2	-7.5	8.0	15.5
		6	-8.5	0.2	-8.3	8.0	16.3
		9	-7.8	0.2	-7.6	8.0	15.6

Plots

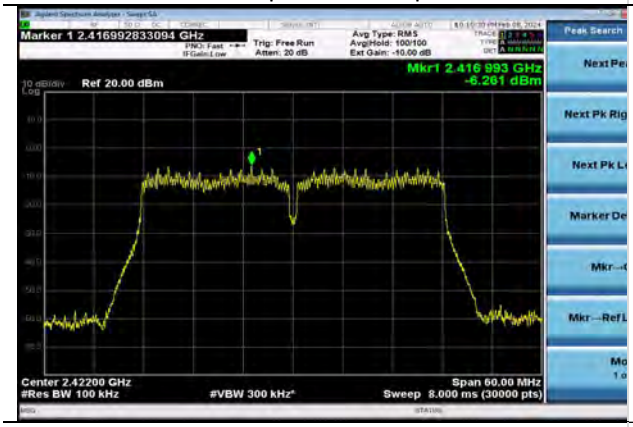
802.11b | Channel 1 | 11 Mbps

802.11g | Channel 1 | 54 Mbps

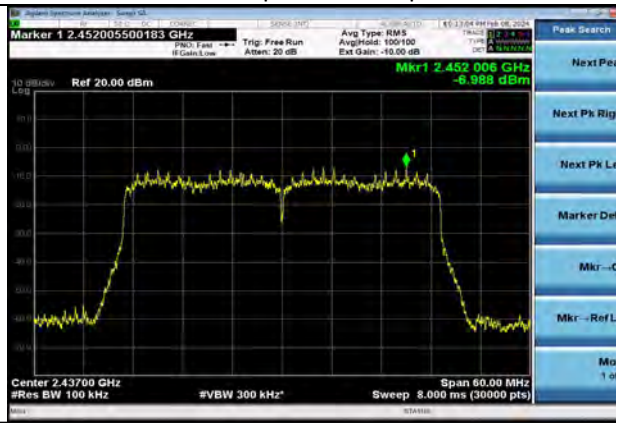
802.11n20 | Channel 6 | MCS7



802.11ax20 | Channel 1 | MCS9



802.11n40 | Channel 3 | MCS7



802.11ax40 | Channel 6 | MCS9

6.1.4 Out-of-band Emissions

Operator	Anthony Smith	**QA**	Adam Hauke
Temperature	22.1°C-22.3°C	**R.H. %**	23.40%-26.00%
Test Date	2/12/2024-2/14/2024	**Location**	Conducted RF Bench
Requirement	15.247(d) RSS-247 Clause 5.5	**Method**	ANSI C63.10 11.12.2.5.2

Limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement provided the transmitter demonstrates compliance with the peak conducted power limits.

Reference Level (Worst Case PSD)

Channel 1 – 1 Mbps – -8.0 dBm/100 kHz

0.3 dBm-30 dB = -22.0 dBm Limit

Test Parameters

Frequency	30-40000 MHz	**Setup**	Antenna Port
RBW	100 kHz	**VBW**	300 kHz
Detector(s)	Peak and Average (RMS)		
Notes	Declared antenna gain for band edge – 2.5 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

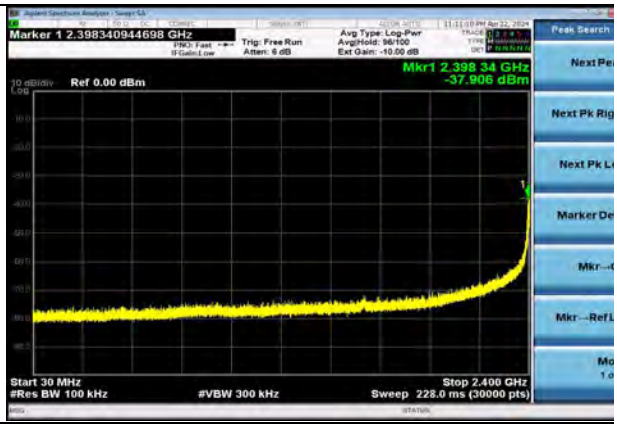
Input Power	120 VAC @ 60 Hz	**Mode**	2.4 GHz WLAN Tx
Frequency	2400-2483.5 MHz	**Channel**	See 2.10

Measurements

Mode	Rate	Channel	Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
802.11b	1 Mbps	1	2398.5	-46.6	-22.0	24.6
		11	4924.0	-50.7	-22.0	28.7
802.11g	6 Mbps	1	2398.7	-37.6	-22.0	15.6
	54 Mbps	1	2399.7	-39.5	-22.0	17.5
802.11n20	MCS0	1	2398.9	-38.4	-22.0	16.4
	MCS7	1	2398.5	-39.6	-22.0	17.6
802.11n40	MCS0	3	2399.7	-44.0	-30.0	14.0
		9	2489.8	-47.3	-30.0	17.3
	MCS7	6	2399.5	-47.8	-30.0	17.8
802.11ax40	MCS0	3	2393.7	-50.1	-30.0	20.1
	MCS11	3	2400.0	-44.7	-30.0	14.7

Worst Case Plots

802.11b | Channel 6 | 11 Mbps | Reference



802.11g | Channel 1 | 6 Mbps | 30-2400 MHz

802.11g | Channel 11 | 6 Mbps | 2483.5-40000

6.1.5 Spurious Emissions in Restricted Bands

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	22.1°C-22.3°C	**R.H. %**	23.40%-26.00%
Test Date	02/12/2024-02/14/2024	**Location**	Conducted RF Bench
Requirement	15.247(d) RSS-247 Clause 5.5	**Method**	ANSI C63.10 11.12.2.5.2

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	30-40000 MHz	**Setup**	Antenna Port
RBW	1 MHz	**VBW**	3 MHz
Detector(s)	Peak	**Method**	Terminated
Notes	Declared antenna gain– 2.5 dBi		
Example Calculations	Correction Factor = 20 log (1/D), where D is the duty cycle EIRP = Measurement + Antenna Gain + Correction Factor E-Field = EIRP – 20log3 + 104.8		

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**	2.4 GHz WLAN Tx
Frequency	2412 MHz	**Channel**	6

Measurements – Lower Band Edge

Mode	Rate	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	EIRP (dBm)	E-Field (dBµV/m)	Limit (dBµV/m))	Margin (dB)
802.11b	1 Mbps	1	Peak	2389.6	-43.6	-41.1	51.7	74.0	22.3
		1	Average	2389.5	-49.1	-46.59	46.2	54.0	7.8
	11 Mbps	1	Peak	2389.9	-42.1	-39.55	53.2	74.0	20.8
		1	Average	2389.4	-50.2	-47.68	45.1	54.0	8.9
802.11g	6 Mbps	1	Peak	2389.6	-24.8	-22.3	70.5	74.0	3.5
		1	Average	2388.8	-45.6	-43.1	49.7	54.0	4.3
	54 Mbps	1	Peak	2389.8	-26.1	-23.6	69.2	74.0	4.8
		1	Average	2389.8	-43.5	-41.0	51.8	54.0	2.2
802.11n20	MCS0	1	Peak	2389.8	-30.1	-27.7	65.2	74.0	8.8
		1	Average	2389.0	-50.3	-47.9	45.0	54.0	9.0
	MCS7	1	Peak	2388.9	-32.6	-30.2	62.7	74.0	11.3
		1	Average	2390.0	-52.7	-49.9	42.6	54.0	11.4
802.11n40	MCS0	3	Peak	2388.7	-26.2	-23.8	69.1	74.0	4.9
		3	Average	2388.0	-44.8	-42.3	50.5	54.0	3.5
	MCS7	3	Peak	2385.0	-34.7	-32.3	60.6	74.0	13.4
		3	Average	2385.6	-49.8	-46.8	45.5	54.0	8.5
802.11ax20	MCS0	1	Peak	2387.3	-27.3	-24.9	68.0	74.0	6.0
		1	Average	2390.0	-47.8	-45.4	47.5	54.0	6.5
	MCS11	1	Peak	2388.2	-34.3	-31.9	61.0	74.0	13.0
		1	Average	2389.4	-53.7	-50.8	41.6	54.0	12.4
802.11ax40	MCS0	3	Peak	2385.9	-26.6	-24.2	68.7	74.0	5.3
		3	Average	2385.2	-46.7	-44.2	48.6	54.0	5.4
	MCS11	3	Peak	2389.8	-38.0	-35.6	57.3	74.0	16.7
		3	Average	2386.0	-51.2	-48.1	44.1	54.0	9.9

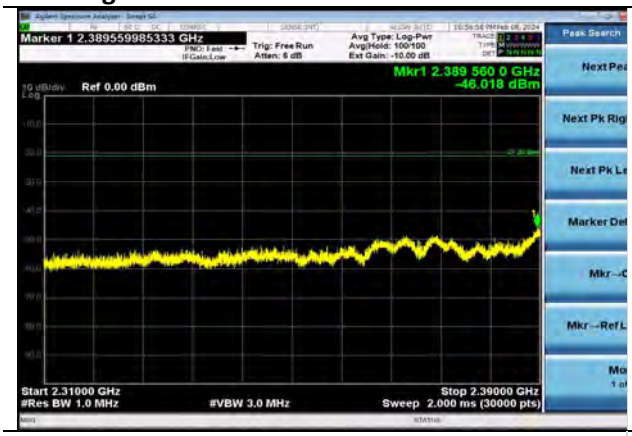
Mode	Rate and RU	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	EIRP (dBm)	E-Field (dBµV/m)	Limit (dBµV/m))	Margin (dB)
802.11ax20	MCS0 RU26	1	Peak	2387.2	-37.3	-34.9	60.4	74.0	13.6
		1	Average	2386.5	-51.2	-48.6	46.7	54.0	7.3
	MCS0 RU52	1	Peak	2389.3	-35.3	-32.9	62.4	74.0	11.6
		1	Average	2388.5	-53.3	-50.7	44.6	54.0	9.4
	MCS0 RU106	1	Peak	2389.5	-38.9	-36.5	58.8	74.0	15.2
		1	Average	2389.0	-54.2	-51.6	43.7	54.0	10.3
802.11ax40	MCS0 RU26	3	Peak	2388.5	-35.6	-33.2	62.1	74.0	11.9
		3	Average	2387.6	-53.5	-50.9	44.4	54.0	9.6
	MCS0 RU52	3	Peak	2389.4	-30.7	-28.3	67.0	74.0	7.0
		3	Average	2389.3	-53.0	-50.4	44.9	54.0	9.1
	MCS0 RU106	3	Peak	2389.8	-35.7	-33.3	62.0	74.0	12.0
		3	Average	2388.9	-53.5	-50.9	44.4	54.0	9.6
	MCS0 RU242	3	Peak	2388.2	-31.0	-28.6	66.7	74.0	7.3
		3	Average	2389.2	-52.7	-50.1	45.2	54.0	8.8

Measurements – Upper Band Edge

Mode	Rate	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	EIRP (dBm)	E-Field (dBµV/m)	Limit (dBµV/m))	Margin (dB)
802.11b	1 Mbps	11	Peak	2487.9	-44.2	-41.8	53.5	74.0	20.5
		11	Average	2487.2	-49.3	-46.9	48.4	54.0	5.6
	11 Mbps	11	Peak	2485.5	-40.7	-38.3	57.0	74.0	17.0
		11	Average	2484.5	-51.7	-49.3	46.0	54.0	8.0
802.11g	6 Mbps	11	Peak	2483.5	-24.6	-22.2	73.1	74.0	0.9
		11	Average	2483.8	-45.7	-43.3	52.0	54.0	2.0
	54 Mbps	11	Peak	2484.6	-25.2	-22.8	72.5	74.0	1.5
		11	Average	2483.7	-45.5	-42.7	52.6	54.0	1.4
802.11n20	MCS0	11	Peak	2483.6	-30.2	-27.8	67.5	74.0	6.5
		11	Average	2484.4	-46.7	-44.3	51.0	54.0	3.0
	MCS7	11	Peak	2484.0	-27.1	-24.7	70.6	74.0	3.4
		11	Average	2484.1	-47.1	-44.3	51.0	54.0	3.0
802.11n40	MCS0	9	Peak	2483.5	-28.6	-26.2	69.1	74.0	4.9
		9	Average	2483.6	-45.8	-43.3	52.0	54.0	2.0
	MCS7	9	Peak	2491.3	-30.4	-28.0	67.3	74.0	6.7
		9	Average	2389.6	-47.5	-44.5	50.8	54.0	3.2
802.11ax20	MCS0	11	Peak	2484.7	-24.3	-21.9	73.4	74.0	0.6
		11	Average	2484.0	-46.4	-44.0	51.3	54.0	2.7
	MCS11	11	Peak	2485.2	-33.5	-31.1	64.2	74.0	9.8
		11	Average	2483.8	-53.2	-50.3	45.0	54.0	9.0
802.11ax40	MCS0	9	Peak	2486.4	-30.9	-28.5	66.8	74.0	7.2
		9	Average	2486.3	-49.1	-46.6	48.7	54.0	5.3
	MCS11	9	Peak	2484.0	-33.1	-30.7	64.6	74.0	9.4
		9	Average	2484.2	-47.7	-44.6	50.7	54.0	3.3

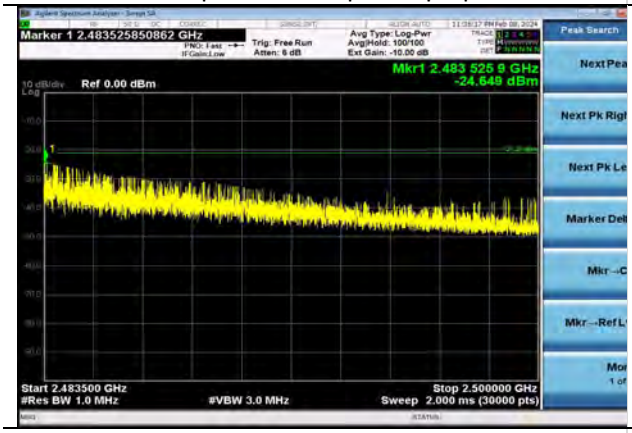
Mode	Rate and RU	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	EIRP (dBm)	E-Field (dBµV/m)	Limit (dBµV/m))	Margin (dB)
802.11ax20	MCS0	11	Peak	2483.8	-31.3	-28.9	66.4	74.0	7.6
	RU26	11	Average	2487.0	-52.2	-49.6	45.7	54.0	8.3
	MCS0	11	Peak	2484.6	-31.0	-28.6	66.7	74.0	7.3
	RU52	11	Average	2484.9	-50.0	-47.4	47.9	54.0	6.1
	MCS0	11	Peak	2485.0	-33.4	-31.0	64.3	74.0	9.7
	RU106	11	Average	2483.7	-52.7	-50.1	45.2	54.0	8.8
802.11ax40	MCS0	9	Peak	2484.6	-32.0	-29.6	65.7	74.0	8.3
	RU26	9	Average	2487.9	-52.3	-49.7	45.6	54.0	8.4
	MCS0	9	Peak	2484.0	-24.2	-21.8	73.5	74.0	0.5
	RU52	9	Average	2484.4	-46.5	-43.9	51.4	54.0	2.6
	MCS0	9	Peak	2483.7	-33.6	-31.2	64.1	74.0	9.9
	RU106	9	Average	2485.9	-52.1	-49.5	45.8	54.0	8.2
	MCS0	9	Peak	2486.0	-30.4	-28.0	67.3	74.0	6.7
	RU242	9	Average	2483.8	-51.0	-48.4	46.9	54.0	7.1

Band Edge Worst Case Plots

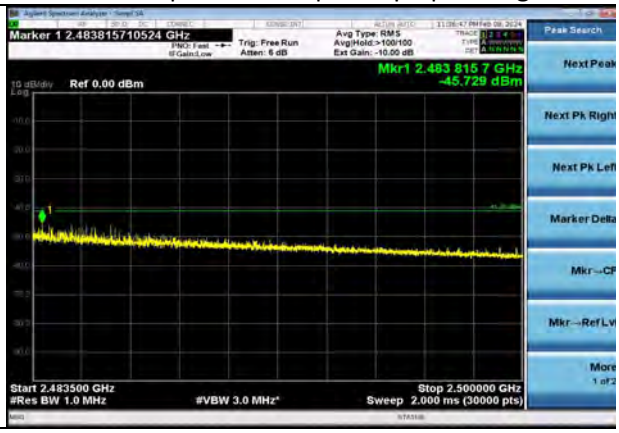


802.11b | Channel 1 | 1 Mbps | Peak

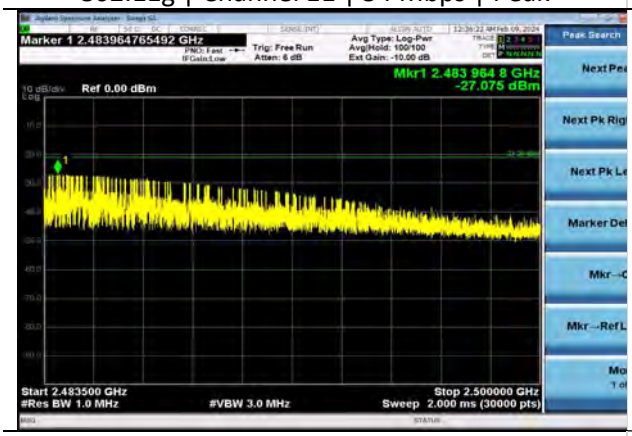
802.11b | Channel 1 | 1 Mbps | Average



802.11g | Channel 11 | 54 Mbps | Peak

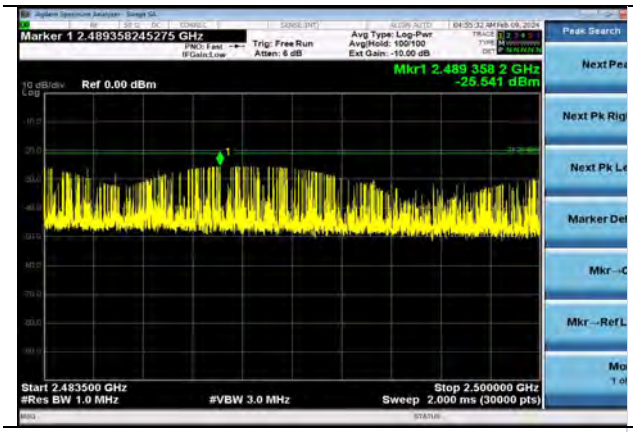


802.11g | Channel 11 | 54 Mbps | Average

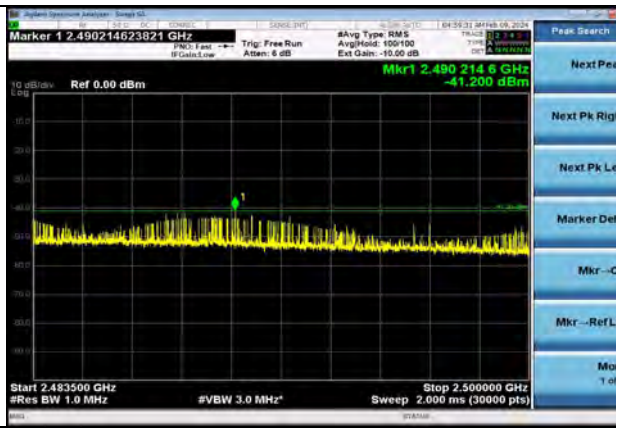


802.11n20 | Channel 1 | MCS7 | Peak

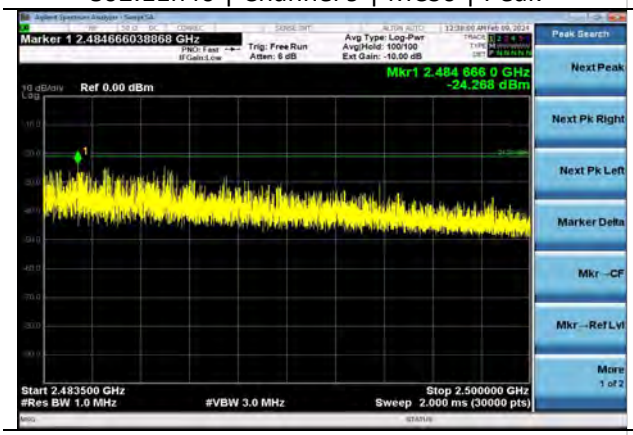
802.11n20 | Channel 1 | MCS7 | Average



802.11n40 | Channel 9 | MCS0 | Peak

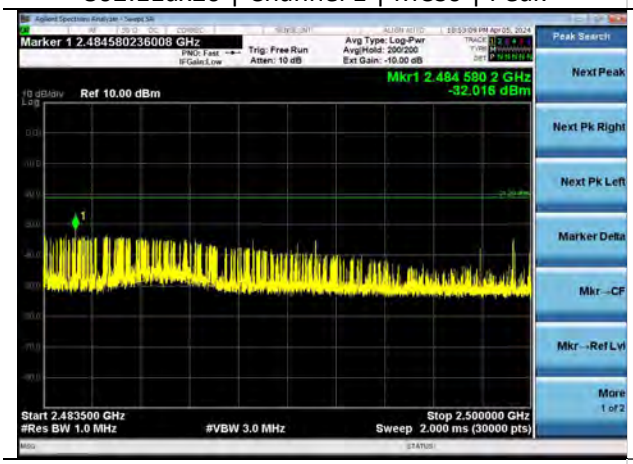


802.11n40 | Channel 9 | MCS0 | Average

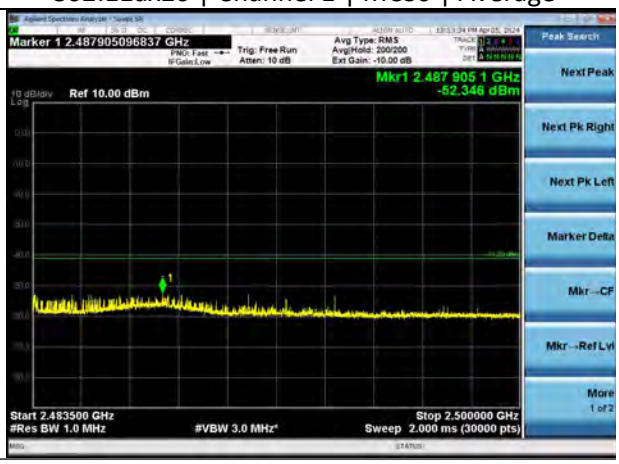


802.11ax20 | Channel 1 | MCS0 | Peak

802.11ax20 | Channel 1 | MCS0 | Average



802.11ax40 | Channel 9 | MCS0 | RU26 | Peak

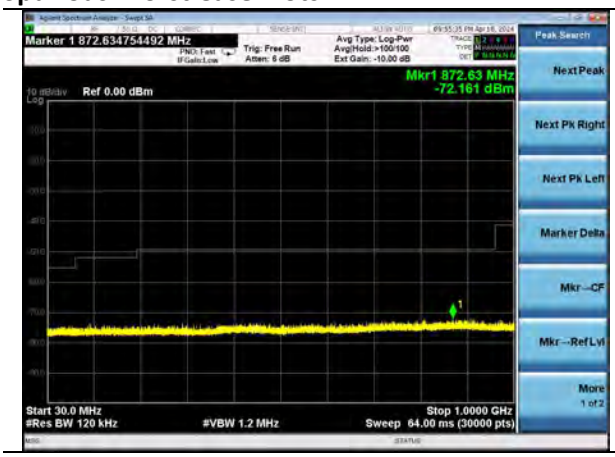


802.11ax40 | Channel 9 | MCS0 | RU26 | Average

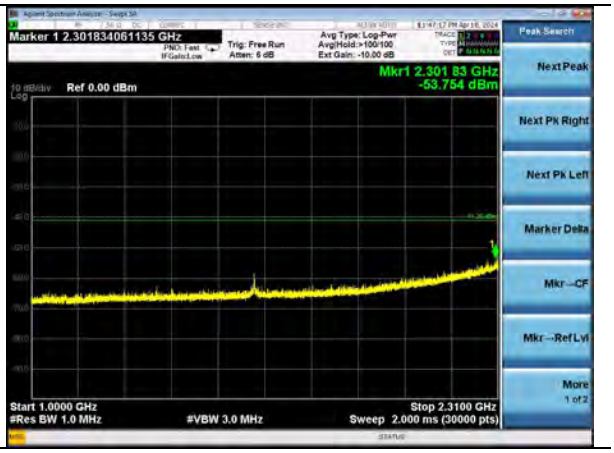
Spurious Table

Mode	Rate	Channel	Measurement Type	Frequency (MHz)	Measurement (dBm)	EIRP (dBm)	E-Field (dBµV/m)	Limit (dBµV/m))	Margin (dB)
802.11b	1 Mbps	1	Peak	4873.8	-47.2	-44.7	50.5	74.0	23.5
		1	Average	4874.0	-48.9	-46.4	48.8	54.0	5.2
		6	Peak	4824.1	-47.8	-45.3	49.9	74.0	24.1
		6	Average	4823.9	-49.6	-47.1	48.1	54.0	5.9
		11	Peak	4924.0	-46.8	-44.3	50.9	74.0	23.1
		11	Average	4924.0	-48.6	-46.1	49.1	54.0	4.9
802.11g	6 Mbps	6	Peak	4864.3	-53.1	-50.6	44.6	74.0	29.4
		6	Average	4874.0	-64.1	-61.6	33.6	54.0	20.4
802.11n20	MCS0	6	Peak	4870.1	-55.9	-53.4	41.8	74.0	32.2
		6	Average	4875.7	-65.7	-63.2	32.0	54.0	22.0
802.11ax20	MCS0	6	Peak	4877.5	-55.4	-52.9	42.3	74.0	31.7
		6	Average	4872.9	-65.3	-62.8	32.4	54.0	21.6
802.11ax40	MCS0	6	Peak	1623.7	-52.6	-50.1	45.1	74.0	28.9
		6	Average	1623.7	-72.6	-69.7	25.5	54.0	28.5

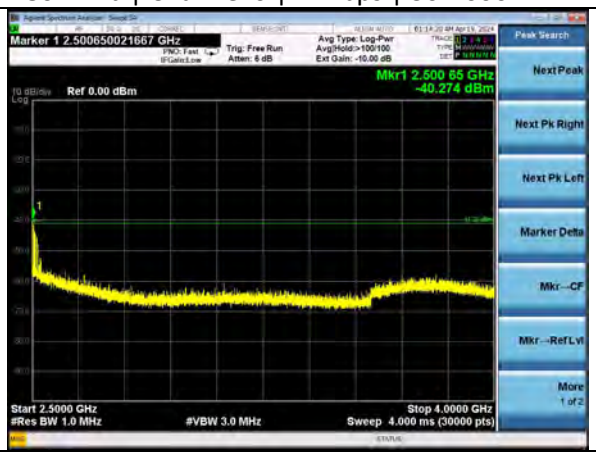
Spurious Worst Case Plots



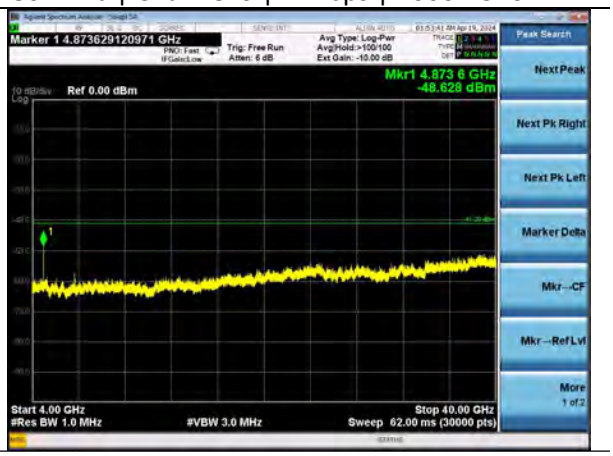
802.11b | Channel 6 | 1 Mbps | 30-1000 MHz



802.11b | Channel 6 | 1 Mbps | 1000-2310 MHz



802.11n40 | Channel 6 | MCS0 | 2500-4000 MHz



802.11b | Channel 6 | 1 Mbps | 4000-40000 MHz

6.1.6 Frequency Stability

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	21.8°C	**R.H. %**	31.40%
Test Date	04/25/2024	**Location**	Conducted RF Bench
Requirement	2.1055(d) RSS-GEN Clause 6.11	**Method**	ANSI C63.10 6.8

Test Parameters

Frequency	2402-2480 MHz	**Voltage**	4.3 VDC, 5 VDC, and 5.8 VDC
Detector(s)	Peak	**Settings**	Max Hold
Notes	DC power supply used for voltage variation.		

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

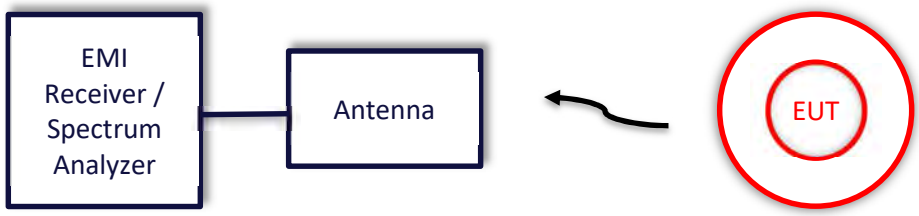
Table

Channel	Voltage (VDC)	Center Frequency (Hz)
1	5	2411990317
	4.3	2411990101
	5.8	2411990027
6	5	2436990548
	4.3	2436990604
	5.8	2436990749
11	5	2461990532
	4.3	2461990413
	5.8	2461990351

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 (d) | 15.209 RSS-247 Clause 5.5 RSS-GEN Clause 8.10	**Method**	ANSI C63.10

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	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 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	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 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**	2.4 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.		

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)
69.0	Horizontal	221	174	36.1	40.0	3.9
98.4	Vertical	111	193	39.3	43.5	4.2
395.6	Horizontal	128	198	33.7	46.0	12.3
395.9	Horizontal	107	210	34.2	46.0	11.8
479.2	Vertical	150	60	36.2	46.0	9.8

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

1000-40000 MHz – 802.11b

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1 Mbps	1	X Plane	Peak	2368.9	H	47.6	74.0	26.4
			Average	2389.5	H	24.9	54.0	19.1
		Y Plane	Peak	2381.4	V	47.1	74.0	26.9
			Average	2388.9	H	35.0	54.0	19.0
		Z Plane	Peak	2366.9	V	47.9	74.0	26.1
			Average	2389.7	V	35.1	54.0	18.9
	11	X Plane	Peak	2485.8	H	47.4	74.0	26.6
			Average	2488.4	H	34.8	54.0	19.2
		Y Plane	Peak	2491.2	V	47.7	74.0	26.3
			Average	2484.4	V	34.9	54.0	19.1
		Z Plane	Peak	2494.4	H	47.6	74.0	26.4
			Average	2499.1	H	34.8	54.0	19.2
11 Mbps	1	Z Plane	Peak	2373.5	V	46.8	74.0	27.2
			Average	2387.9	V	35.5	54.0	18.5
	11	Y Plane	Peak	2492.7	V	47.0	74.0	27.0
			Average	2490.7	V	35.7	54.0	18.3

Spurious

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1 Mbps	6	X Plane	Peak	4874.1	V	46.9	74.0	27.1
			Average	4874.1	V	46.5	54.0	7.5
		Y Plane	Peak	4874.2	H	48.0	74.0	26.0
			Average	4874.2	H	42.4	54.0	11.6
		Z Plane	Peak	4874.1	H	45.3	74.0	28.7
			Average	4874.1	H	44.1	54.0	9.9

1000-40000 MHz – 802.11g

Band Edge

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
6 Mbps	1	Z Plane	Peak	2382.3	V	47.6	74.0	26.4
			Average	2389.9	V	35.3	54.0	18.7
	11	Z Plane	Peak	2487.8	V	46.9	74.0	27.1
			Average	2488.5	V	35.4	54.0	18.6
54 Mbps	1	Y Plane	Peak	2382.7	V	46.9	74.0	27.1
			Average	2370.6	V	36.9	54.0	17.1
	11	Y Plane	Peak	2484.1	V	47.0	74.0	27.0
			Average	2491.8	V	37.1	54.0	16.9

Spurious

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
6 Mbps	6	X Plane	Peak	4925.9	V	36.3	74.0	37.7
			Average	4925.9	V	33.6	54.0	20.4
		Y Plane	Peak	4873.6	H	39.7	74.0	34.3
			Average	4873.6	H	35.9	54.0	18.1
		Z Plane	Peak	4865.2	V	35.1	74.0	38.9
			Average	4865.2	V	33.2	54.0	20.8

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	1	Z Plane	Peak	2358.0	V	47.1	74.0	26.9
			Average	2389.7	V	35.4	54.0	18.6
	11	Z Plane	Peak	2487.4	V	46.9	74.0	27.1
			Average	2489.3	V	35.4	54.0	18.6
MCS7	1	Y Plane	Peak	2377.4	V	46.4	74.0	27.6
			Average	2383.3	V	37.1	54.0	16.9
	11	Y Plane	Peak	2499.2	V	46.8	74.0	27.2
			Average	2486.0	V	37.3	54.0	16.7

Spurious

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	6	X Plane	Peak	4872.7	V	37.5	74.0	36.5
			Average	4872.7	V	34.2	54.0	19.8
		Y Plane	Peak	4925.9	H	36.0	74.0	38.0
			Average	4925.9	H	33.4	54.0	20.6
		Z Plane	Peak	4913.1	H	36.6	74.0	37.4
			Average	4913.1	H	33.9	54.0	20.1

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	3	Y Plane	Peak	2359.0	H	47.4	74.0	26.6
			Average	2385.7	H	36.3	54.0	17.7
	9	X Plane	Peak	2485.3	H	47.1	74.0	26.9
			Average	2495.5	H	36.4	54.0	17.6
MCS7	3	Y Plane	Peak	2348.4	H	46.7	74.0	27.3
			Average	2381.9	H	37.6	54.0	16.4
	9	X Plane	Peak	2488.3	H	46.6	74.0	27.4
			Average	2490.7	H	38.1	54.0	15.9

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	1	Z Plane	Peak	2384.9	V	46.8	74.0	27.2
			Average	2376.3	V	35.5	54.0	18.5
	11	Y Plane	Peak	2485.7	V	47.2	74.0	26.8
			Average	2485.6	V	35.6	54.0	18.4
MCS11	1	Z Plane	Peak	2380.7	V	46.8	74.0	27.2
			Average	2390.0	V	37.9	54.0	16.1
	11	Y Plane	Peak	2497.1	V	47.1	74.0	26.9
			Average	2485.7	V	37.5	54.0	16.5

Spurious

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	6	X Plane	Peak	4875.0	V	36.1	74.0	37.9
			Average	4875.0	V	32.3	54.0	21.7
		Y Plane	Peak	4875.5	H	35.9	74.0	38.1
			Average	4875.5	H	33.9	54.0	20.1
		Z Plane	Peak	4872.7	V	34.5	74.0	39.5
			Average	4872.7	V	29.0	54.0	25.0

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	3	Y Plane	Peak	2376.2	H	47.0	74.0	27.0
			Average	2381.0	H	35.9	54.0	18.1
	9	X Plane	Peak	2494.1	H	46.7	74.0	27.3
			Average	2495.1	H	36.2	54.0	17.8
MCS11	3	Y Plane	Peak	2326.1	H	47.0	74.0	27.0
			Average	2387.4	H	38.1	54.0	15.9
	9	X Plane	Peak	2486.7	H	47.8	74.0	26.2
			Average	2497.3	H	38.1	54.0	15.9

Spurious

Rate	Channel	EUT Orientation	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
MCS0	6	X Plane	Peak	4874.8	V	41.3	74.0	32.7
			Average	4873.7	V	30.4	54.0	23.6
		Y Plane	Peak	4873.7	V	40.5	74.0	33.5
			Average	4874.0	V	29.1	54.0	24.9
		Z Plane	Peak	4874.6	V	40.5	74.0	33.5
			Average	4874.0	V	29.3	54.0	24.7
	3	X Plane	Peak	4844.9	V	41.6	74.0	32.4
			Average	4844.0	V	30.5	54.0	23.5
	9	Y Plane	Peak	4903.2	H	40.3	74.0	33.7
			Average	4904.4	H	29.3	54.0	24.7

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	1	0	Peak	2376.5	V	47.7	74.0	26.3
			Average	2381.6	V	37.0	54.0	17.0
		3	Peak	2385.9	V	48.1	74.0	25.9
			Average	2382.4	V	36.9	54.0	17.1
		8	Peak	2318.6	V	47.8	74.0	26.2
			Average	2373.2	V	37.0	54.0	17.0
		37	Peak	2388.1	V	48.4	74.0	25.6
			Average	2374.7	V	37.1	54.0	16.9
		38	Peak	2374.4	V	48.3	74.0	25.7
			Average	2387.2	V	36.9	54.0	17.1
		40	Peak	2369.8	V	48.6	74.0	25.4
			Average	2377.1	V	36.9	54.0	17.1
		53	Peak	2334.0	V	48.6	74.0	25.4
			Average	2368.9	V	37.0	54.0	17.0
		54	Peak	2339.0	V	47.7	74.0	26.3
			Average	2379.7	V	36.9	54.0	17.1
Y Plane	11	0	Peak	2487.0	V	48.3	74.0	25.7
			Average	2488.2	V	37.0	54.0	17.0
		3	Peak	2487.0	V	48.2	74.0	25.8
			Average	2484.8	V	36.9	54.0	17.1
		8	Peak	2491.4	V	48.2	74.0	25.8
			Average	2485.0	V	36.9	54.0	17.1
		37	Peak	2485.4	V	49.0	74.0	25.0
			Average	2490.0	V	37.0	54.0	17.0
		38	Peak	2485.6	V	48.1	74.0	25.9
			Average	2497.9	V	37.1	54.0	16.9
		40	Peak	2485.4	V	48.0	74.0	26.0
			Average	2484.1	V	37.1	54.0	16.9
		53	Peak	2483.7	V	48.8	74.0	25.2
			Average	2492.4	V	36.8	54.0	17.2
		54	Peak	2493.7	V	48.0	74.0	26.0
			Average	2489.6	V	36.8	54.0	17.2

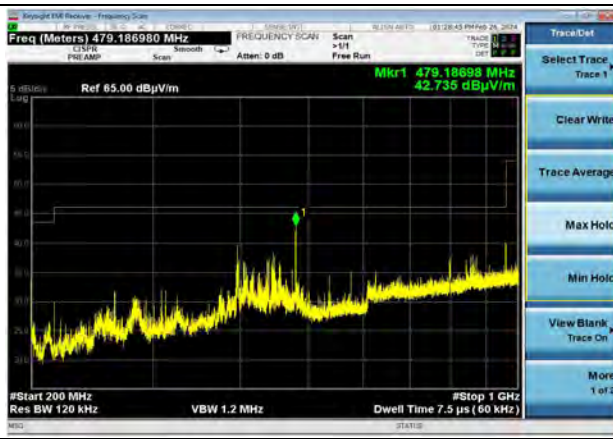
1000-40000 MHz – 802.11ax40 – MU-RU – MCS0

Band Edge

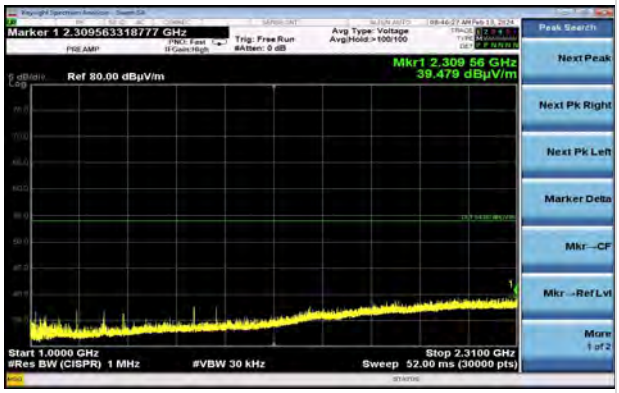
EUT Orientation	Channel	RU	Measurement Type	Frequency (MHz)	Antenna Polarity	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)
X Plane	3	0	Peak	2369.0	V	48.0	74.0	26.0
			Average	2375.1	V	37.5	54.0	16.5
		8	Peak	2374.2	V	48.4	74.0	25.6
			Average	2389.5	V	37.3	54.0	16.7
		17	Peak	2362.2	V	47.9	74.0	26.1
			Average	2378.0	V	37.4	54.0	16.6
		37	Peak	2380.1	V	49.2	74.0	24.8
			Average	2373.8	V	37.4	54.0	16.6
		40	Peak	2381.8	V	48.4	74.0	25.6
			Average	2376.5	V	37.3	54.0	16.7
		44	Peak	2335.7	V	47.9	74.0	26.1
			Average	2367.1	V	37.3	54.0	16.7
		53	Peak	2376.2	V	47.8	74.0	26.2
			Average	2387.6	V	37.4	54.0	16.6
		54	Peak	2373.8	V	47.7	74.0	26.3
			Average	2380.3	V	37.3	54.0	16.7
		56	Peak	2368.5	V	47.9	74.0	26.1
			Average	2389.5	V	37.4	54.0	16.6
		61	Peak	2353.0	V	48.0	74.0	26.0
			Average	2382.0	V	37.3	54.0	16.7
		62	Peak	2385.4	V	48.4	74.0	25.6
			Average	2362.0	V	37.5	54.0	16.5
Y Plane	9	0	Peak	2483.8	H	48.2	74.0	25.8
			Average	2484.5	H	37.9	54.0	16.1
		8	Peak	2492.5	H	48.1	74.0	25.9
			Average	2493.7	H	37.6	54.0	16.4
		17	Peak	2497.6	H	48.4	74.0	25.6
			Average	2499.1	H	37.4	54.0	16.6
		37	Peak	2488.7	H	48.3	74.0	25.7
			Average	2488.0	H	37.5	54.0	16.5
		40	Peak	2487.8	H	48.6	74.0	25.4
			Average	2488.9	H	37.5	54.0	16.5
		44	Peak	2485.8	H	48.0	74.0	26.0
			Average	2487.7	H	37.5	54.0	16.5
		53	Peak	2499.2	H	48.9	74.0	25.1
			Average	2495.1	H	37.4	54.0	16.6
		54	Peak	2499.4	H	48.7	74.0	25.3
			Average	2494.1	H	37.4	54.0	16.6
		56	Peak	2485.5	H	47.9	74.0	26.1
			Average	2494.2	H	37.4	54.0	16.6
		61	Peak	2494.2	H	48.1	74.0	25.9
			Average	2493.2	H	37.3	54.0	16.7
		62	Peak	2494.8	H	48.3	74.0	25.7
			Average	2497.9	H	37.4	54.0	16.6

Worst Case Plots

802.11b | Channel 6 | 1 Mbps |
30-200 MHz | Vertical



802.11b | Channel 6 | 1 Mbps |
200-1000 MHz | Vertical



802.11ax40 | Channel 3 | MCS0 | RU38
1000-2310 MHz | Vertical

802.11ax20 | Channel 11 | MCS0 | RU38
2500-4000 MHz | Vertical

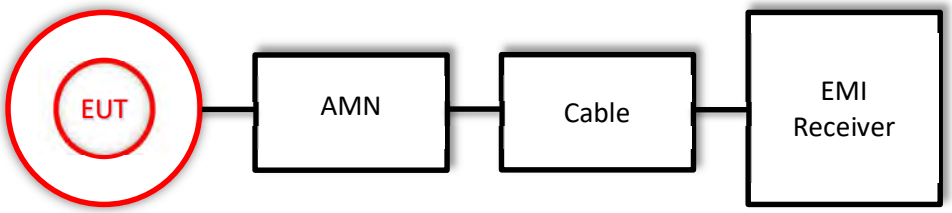
802.11ax20 | Channel 6 | MCS0
4000-18000 MHz | Vertical

802.11b | Channel 6 | 1 Mbps
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	15.207 RSS-GEN 8.8	**Method**	ANSI C63.10

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

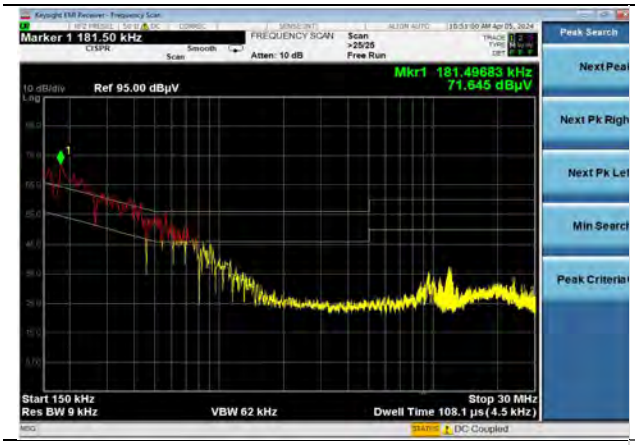
EUT Parameters

Input Power	120 VAC @ 60 Hz	**Mode**	2.4 GHz WLAN Tx Channel 6

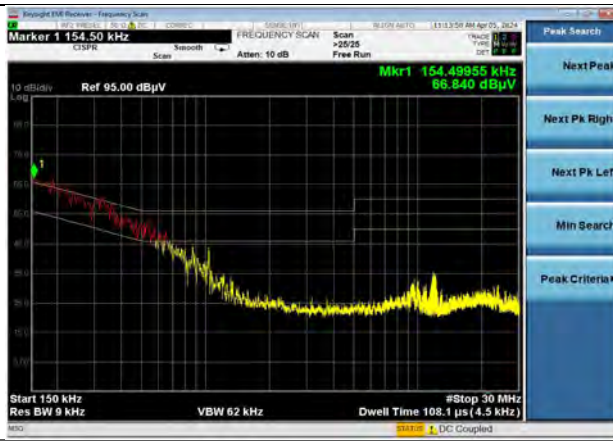
Measurements

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	0.150	64.2	66.0	1.8	37.9	56.0	18.1
1	0.527	42.7	56.0	13.3	26.1	46.0	19.9
1	12.104	32.9	60.0	27.1	18.9	50.0	31.1
2	0.168	61.0	65.1	4.1	34.9	55.1	20.2
2	0.514	46.8	56.0	9.2	24.7	46.0	21.3
2	11.758	29.7	60.0	30.3	18.0	50.0	32.0

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