FCC Radio Test Report

FCC ID	:	**TKZAW7915-NPD**
Equipment	:	**Wi-Fi 6 11ax M.2 AE Key Module**
Brand Name	:	**AsiaRF Co., Ltd.**
Model Name	:	**AW7915-AED**
Applicant	:	**AsiaRF Co., Ltd.** **1F, 7, Houde Street, Yonghe Dist. New Taipei City Taiwan 23455**
Manufacturer	:	**AsiaRF Co., Ltd.** **1F, 7, Houde Street, Yonghe Dist. New Taipei City Taiwan 23455**
Standard	:	**47 CFR FCC Part 15.247**

The product was received on Nov. 26, 2024, and testing was started from Dec. 13, 2024 and completed on Dec. 14, 2024. We, SPORTON INTERNATIONAL INC. Hsinhua Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.

Approved by: Jackson Tsai

SPORTON INTERNATIONAL INC. Hsinhua Laboratory

No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR211912-03AC	01	Initial issue of report	Jan. 27, 2025

Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
-	15.207	AC Power-line Conducted Emissions	Not Required	Refer as 1.1.5
-	15.247(a)	DTS Bandwidth	Not Required	Refer as 1.1.5
-	15.247(b)	Maximum Conducted Output Power	Not Required	Refer as 1.1.5
-	15.247(e)	Power Spectral Density	Not Required	Refer as 1.1.5
-	15.247(d)	Emissions in Non-restricted Frequency Bands	Not Required	Refer as 1.1.5
3.1	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and explanations:
The EUT supports beamforming and CDD modes, and the CDD mode is the worst case. Therefore, all test items are evaluated in the report. The beamforming mode only evaluates the output power.

Reviewed by: Barry Hsiao

Report Producer: Amber Chiu

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
2400-2483.5	b, g, n (HT20), VHT20, ax(HEW20)	2412-2462	1-11 [11]
2400-2483.5	n (HT40), VHT40, ax(HEW40)	2422-2452	3-9 [7]

<Non-Beamforming>

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	802.11b	20	2TX
2.4-2.4835GHz	802.11g	20	2TX
2.4-2.4835GHz	802.11ax HEW20	20	2TX
2.4-2.4835GHz	802.11ax HEW40	40	2TX

<Beamforming>

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	802.11ax HEW20-BF	20	2TX
2.4-2.4835GHz	802.11ax HEW40-BF	40	2TX

Note:
- 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- VHT20, VHT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.
- HEW20, HEW40 use a combination of OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.
- BWch is the nominal channel bandwidth.
- Evaluated HEW20/HEW40 mode only due to the similar modulation. The power setting of HT20/HT40/VHT20/VHT40 mode are the same or lower than HEW20/HEW40.

1.1.2 Antenna Information

Group	Ant.	Brand	Model Name	Antenna Type	Connector	Support	Cable Loss (dBi)
1	1-2	Asiarf	ANT010-DAU	PCB	I-PEX / MMCX	2.4G+5G	0.3
2	3-4	Asiarf	ANT003	PCB	I-PEX / MMCX	2.4G+5G	0.3
3	5-6	Asiarf	A245005N	PCB	I-PEX / MMCX	2.4G+5G	0.3
4	7-8	Asiarf	A2405N	PCB	I-PEX / MMCX	2.4G	0.3
5	9-10	Asiarf	A5005N	PCB	I-PEX / MMCX	5G	0.3
6	11-12	Asiarf	A245004	Dipole	I-PEX / MMCX	2.4G+5G	0.3
7	13-14	Asiarf	A245002	Dipole	I-PEX / MMCX	2.4G+5G	0.3

Group	Ant.	Gain (dBi)	
		2.4G	5G
1	1-2	5.2	5.5
2	3-4	2.5	2.5
3	5-6	4	5.1
4	7-8	5.2	-
5	9-10	-	5
6	11-12	4	5.1
7	13-14	2	2

Note 1: EUT can match with above antennas for using. The higher gain (Ant. 1/6) were used to perform the worst configuration and result of that was recorded as the final test result.

Note 2: The antenna mentioned above will not be sold with the EUT in the market.

For 2.4GHz function:

For IEEE 802.11 b/g/n/VHT/ax mode (2TX/2RX)

Group 1, 2, 3, 4, 6, 7 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11 a/n/ac/ax mode (2TX/2RX)

Group 1, 2, 3, 5, 6, 7 could transmit/receive simultaneously.

Note 2: Directional gain information

	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$
BF	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

1.1.3 EUT Information

Operational Condition				
EUT Power Type	From Test Fixture			
EUT Function	☒	Point-to-multipoint	☐	Point-to-point
Beamforming Function	☒	With beamforming	☐	Without beamforming
Resource Uni	☒	Full RU	☐	Partial RU
	☐	MRU(static preamble puncturing)	☐	MRU(dynamic preamble puncturing)

Type of EUT		
☒	Stand-alone	
☐	Combined (EUT where the radio part is fully integrated within another device)	
	Combined Equipment - Brand Name / Model No.:	…
☐	Plug-in radio (EUT intended for a variety of host systems)	
	Host System - Brand Name / Model No.:	…
☐	Other:	

1.1.4 Mode Test Duty Cycle

<Non-Beamforming>

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11b_Nss1,(1Mbps)_2TX	0.992	0.03	n/a (DC>=0.98)	n/a (DC>=0.98)
802.11g_Nss1,(6Mbps)_2TX	0.96	0.18	1.397m	1k
802.11ax HEW20_Nss1,(MCS0)_2TX	0.948	0.23	1.028m	1k
802.11ax HEW40_Nss1,(MCS0)_2TX	0.905	0.43	547.5u	3k

<Beamforming>

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
802.11ax HEW20-BF_Nss1,(MCS0)_2TX	0.948	0.23	1.028m	1k
802.11ax HEW40-BF_Nss1,(MCS0)_2TX	0.905	0.43	547.5u	3k

Note. If DC < 0.98, the DCF was added while measuring Output power and PSD.

1.1.5 Table for Existing Change

This product is an extension of original one reported under Sporton project number: FR211912AC

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Equipment name, Model name was added and Change to M.2 interface. 2. RF area CON23, CON24 moved 1.27mm to the left and right because of the PCIE fixing holes 3. R21 is due to circuit modification and part position adjustment. 4. R12, R434 fine-tuned the position of components due to modification of PCIE gold finger circuit	The worst case of Radiated Unwanted Emissions below 1 GHz was evaluated

1.2 Testing Applied Standards

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

- 47 CFR FCC Part 15
- ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF:

- KDB 558074 D01 v05r02
- KDB 662911 D01 v02r01
- KDB 414788 D01 v01r01

1.3 Testing Location Information

Test Lab.：Sporton International Inc. Hsinhua Laboratory				
☒ Hsinhua **(TAF:** 3785**)**	**ADD:** No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)			
	TEL: 886-3-327-3456		**FAX:** 886-3-327-0973	
Test site Designation No. TW3785 with FCC.				
Test Condition	**Test Site No.**	**Test Engineer**	**Test Environment**	**Test Date**
Radiated_ below 1GHz (Verification)	03CH03-HY	Ian Liou	22.2~23.4°C / 50~52%	13/Dec/2024~14/Dec/2024
☐ Wen 33rd.St. **(TAF:** 3785**)**	**ADD:** No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)			
	TEL: 886-3-318-0787		**FAX:** 886-3-318-0287	
Test site Designation No. TW0008 with FCC.				

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Test Items	**Uncertainty**	**Remark**
Emissions in Restricted Frequency Bands	4.8 dB	Confidence levels of 95%
Temperature	0.41 °C	Confidence levels of 95%
Humidity	3.4 %	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Channel Mode

Test Software Version	QATool_Dbg 0.0.2.33

<Non-Beamforming>

Mode	Power Setting
802.11b_Nss1,(1Mbps)_2TX	-
2412MHz	11.5
2417MHz	11
2437MHz	13
2462MHz	13.5
802.11g_Nss1,(6Mbps)_2TX	-
2412MHz	17.5
2417MHz	17.5
2437MHz	17.5
2457MHz	18
2462MHz	17.5
802.11ax HEW20_Nss1,(MCS0)_2TX	-
2412MHz	15.5
2417MHz	16
2437MHz	18
2457MHz	16.5
2462MHz	16.5
802.11ax HEW40_Nss1,(MCS0)_2TX	-
2422MHz	15.5
2427MHz	15.5
2437MHz	16
2447MHz	15.5
2452MHz	15

<Beamforming>

Mode	Power Setting
802.11ax HEW20-BF_Nss1,(MCS0)_2TX	-
2412MHz	15.5
2417MHz	16
2437MHz	18
2457MHz	16.5
2462MHz	16.5
802.11ax HEW40-BF_Nss1,(MCS0)_2TX	-
2422MHz	15.5
2427MHz	15.5
2437MHz	16
2447MHz	15.5
2452MHz	15

2.2 The Worst Case Measurement Configuration

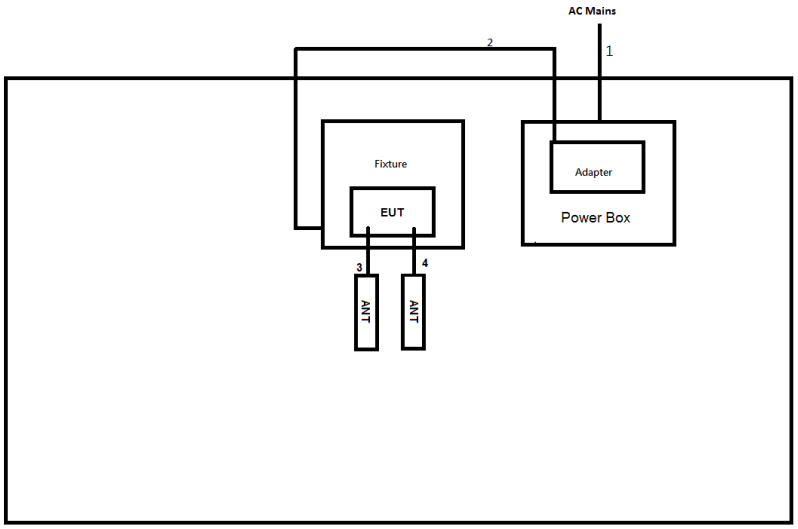
The Worst Case Mode for Following Conformance Tests			
Tests Item	Emissions in Restricted Frequency Bands		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
Operating Mode < 1GHz	CTX		
1	Test Fixture mode; Dipole Antenna		
Operating Mode > 1GHz	CTX		
Orthogonal Planes of EUT	**X Plane**	**Y Plane**	**Z Plane**
			
Worst Planes of EUT			V

2.3 Support Equipment

Support Equipment – Radiated					
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**	**Remark**
1	Adapter	SHENZHEN YINGHUIYUAN ELECTRONICS CO.,LTD	YHY-12004000	-	Provided by Customer
2	Fixture	Sinovoip	Banana Pi BPi-R64	-	Provided by Customer

2.4 Test Setup Diagram

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power cable	No	1.8	-
2	DC Power cable	No	1.0	-
3	RF Cable	No	0.1	-
4	RF Cable	No	0.1	-

3 Transmitter Test Result

3.1 Emissions in Restricted Frequency Bands

3.1.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

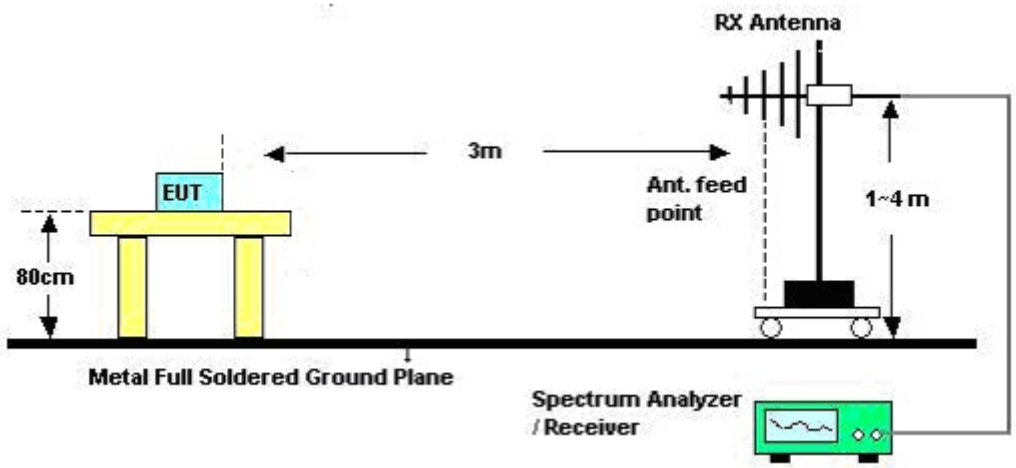
3.1.3 Test Procedures

Test Method	
▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
▪ For the transmitter unwanted emissions shall be measured using following options below:	
	▪ Refer as KDB 558074, clause 8.6 (11.12 of ANSI C63.10) for restricted frequency bands.
▪ For the transmitter band-edge emissions shall be measured using following options below:	
	▪ Refer as KDB 558074 clause 8.7.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	▪ Refer as KDB 558074, clause 8.7.2 (6.10.6 of ANSI C63.10) for marker-delta method for band-edge measurements.
	▪ Refer as KDB 558074, clause 8.7.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels.
▪ Use the following spectrum analyzer settings:	
	▪ Set RBW=100 kHz for f < 1 GHz; VBW=3 * RBW; Sweep = auto; Detector function = peak; Trace = max hold.
	▪ Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement. For average measurement, refer as 1.1.4.
▪ KDB 414788 Open-Field Test Sites and Chamber Correlation Justification.	
	▪ Based on FCC 15.31(f)(2): measurements may be performed at a distance closer than that specified in regulations; however, an attempt should be made to avoid making measurements in the near field.
	▪ Open-field site and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

3.1.4 Measurement Results Calculation

The measured Level is calculated using:
Corrected Reading: Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor)

3.1.5 Test Setup

Emissions in Restricted Frequency Bands
30MHz~1GHz


3.1.6 Test Result of Emissions in Restricted Frequency Bands (Below 30MHz)

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

3.1.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix A

4 Test Equipment and Calibration Data

Instrument for Radiated Test

Instrument	Manufacturer /Brand	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	14/Jul/2024	13/Jul/2025
EMI Test Receiver	R&S	ESR3	102051	9kHz~3.6GHz	17/May/2024	16/May/2025
Signal Analyzer	R&S	FSV40	101500	10Hz~40GHz	01/Nov/2024	31/Oct/2025
Loop Antenna	TESEQ	HLA 6120	31244	9kHz~30MHz	19/Mar/2024	18/Mar/2025
Bilog Antenna & 6dB Attenuator	SCHAFFNER / EMCI	CBL6112B / N-6-05	22237 / AT-N-0603	30MHz~1GHz	14/Oct/2024	13/Oct/2025
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz~30MHz	12/Jun/2024	11/Jun/2025
RF Cable-R03m	Jye Bao	RG142	03CH03-cable-02	30MHz~1GHz	12/Jun/2024	11/Jun/2025
Amplifier	Aglient	8447D	2944A08033	100kHz~1.3GHz	13/Sep/2024	12/Sep/2025
SENSE-15247_DTS	Sporton	V5.11.19	N/A	N/A	N/A	N/A

Summary

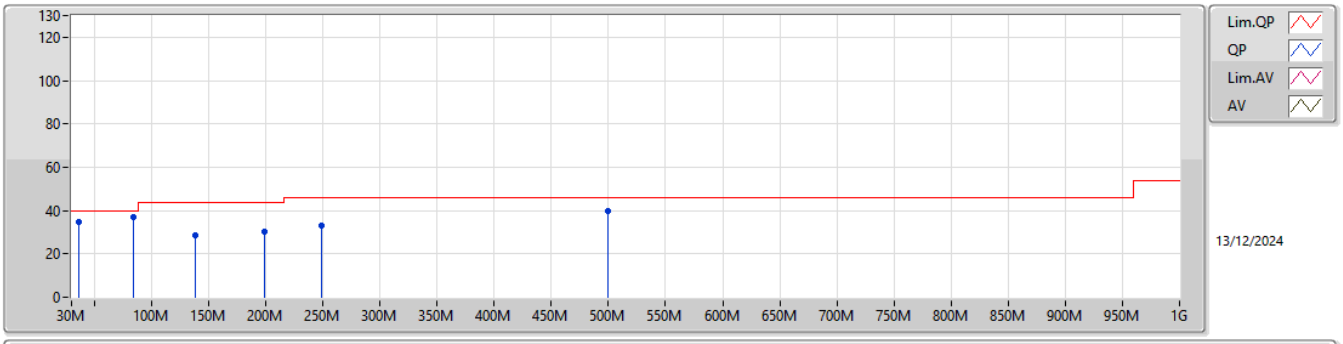
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-
802.11ax HEW40_Nss1,(MCS0)_2TX	Pass	PK	84.32M	36.73	40.00	-3.27	3	Vertical	360	1.00

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
802.11ax HEW40_Nss1,(MCS0)_2TX	-	-	-	-	-	-	-	-	-	-
2437MHz	Pass	PK	84.32M	36.73	40.00	-3.27	3	Vertical	360	1.00
2437MHz	Pass	PK	138.64M	28.53	43.50	-14.97	3	Vertical	360	1.00
2437MHz	Pass	PK	198.78M	30.23	43.50	-13.27	3	Vertical	360	1.00
2437MHz	Pass	PK	249.22M	32.84	46.00	-13.16	3	Vertical	360	1.00
2437MHz	Pass	PK	499.48M	39.75	46.00	-6.25	3	Vertical	360	1.00
2437MHz	Pass	QP	36.84M	34.80	40.00	-5.20	3	Vertical	287	1.00
2437MHz	Pass	PK	30M	31.13	40.00	-8.87	3	Horizontal	0	1.00
2437MHz	Pass	PK	107.6M	34.88	43.50	-8.62	3	Horizontal	0	1.00
2437MHz	Pass	PK	249.22M	41.79	46.00	-4.21	3	Horizontal	0	1.00
2437MHz	Pass	PK	332.64M	30.90	46.00	-15.10	3	Horizontal	0	1.00
2437MHz	Pass	PK	400.54M	34.94	46.00	-11.06	3	Horizontal	0	1.00
2437MHz	Pass	PK	499.48M	37.71	46.00	-8.29	3	Horizontal	0	1.00

2.4-2.4835GHz_802.11ax HEW40_Nss1,(MCS0)_2TX

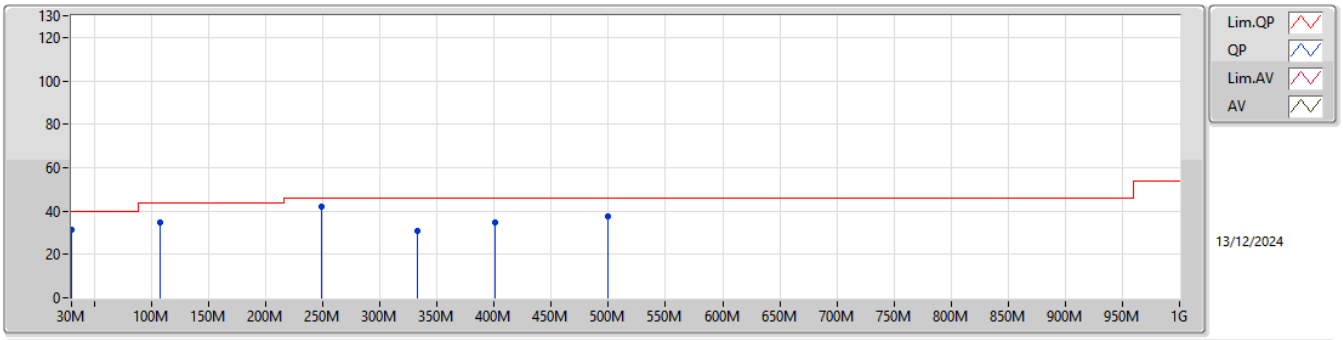
2437MHz_Test Fixture



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)
PK	84.32M	36.73	40.00	-3.27	-12.66	3	Vertical	360	1.00	49.39	13.85	0.82	27.33
PK	138.64M	28.53	43.50	-14.97	-8.23	3	Vertical	360	1.00	36.76	17.48	1.48	27.19
PK	198.78M	30.23	43.50	-13.27	-9.57	3	Vertical	360	1.00	39.80	15.36	2.02	26.95
PK	249.22M	32.84	46.00	-13.16	-6.12	3	Vertical	360	1.00	38.96	18.46	2.16	26.74
PK	499.48M	39.75	46.00	-6.25	-1.29	3	Vertical	360	1.00	41.04	23.65	3.24	28.18
QP	36.84M	34.80	40.00	-5.20	-6.42	3	Vertical	287	1.00	41.22	20.78	0.29	27.49

2.4-2.4835GHz_802.11ax HEW40_Nss1,(MCS0)_2TX

2437MHz_Test Fixture



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)
PK	30M	31.13	40.00	-8.87	-3.00	3	Horizontal	0	1.00	34.13	24.27	0.24	27.51
PK	107.6M	34.88	43.50	-8.62	-8.19	3	Horizontal	0	1.00	43.07	18.00	1.08	27.27
PK	249.22M	41.79	46.00	-4.21	-6.12	3	Horizontal	0	1.00	47.91	18.46	2.16	26.74
PK	332.64M	30.90	46.00	-15.10	-4.59	3	Horizontal	0	1.00	35.49	19.94	2.41	26.94
PK	400.54M	34.94	46.00	-11.06	-2.90	3	Horizontal	0	1.00	37.84	21.89	2.70	27.49
PK	499.48M	37.71	46.00	-8.29	-1.29	3	Horizontal	0	1.00	39.00	23.65	3.24	28.18