



FCC RADIO TEST REPORT

FCC ID : S9GR670
Equipment : R670 Access Point
Brand Name : RUCKUS
Model Name : R670
Applicant : Ruckus Wireless LLC
350 W. Java Dr., Sunnyvale CA 94089 USA
Manufacturer : Ruckus Wireless LLC
350 W. Java Dr., Sunnyvale CA 94089 USA
Standard : FCC Part 15 Subpart E §15.407

The product was received on Nov. 02, 2023 and testing was performed from Nov. 09, 2023 to Jul. 10, 2024. We, Sporton International (USA) Inc, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International (USA) Inc, the test report shall not be reproduced except in full.

Approved by: Neil Kao

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035



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History of this test report

Report No.	Version	Description	Issue Date
FR240104006G	01	Initial issue of report	Jul. 12, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(a)(10)	26dB Emission Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.407(a)(4)	Fundamental Maximum EIRP	Pass	-
3.3	15.407(a)(4)	Fundamental Power Spectral Density	Pass	-
3.4	15.407(b)(6)	In-Band Emissions (Channel Mask)	Pass	-
-	15.407(d)(6)	Contention Based Protocol	Not Required	Not applicable for Standard Access Points
3.5	15.407(b)	Unwanted Emissions	Pass	0.96 dB under the limit at 5924.52 MHz
3.6	15.207	AC Conducted Emission	Pass	8.03 dB under the limit at 0.39 MHz
3.7	15.203	Antenna Requirement	Pass	-

Note: Not required means after assessing, test items are not necessary to carry out.

Conformity Assessment Condition:

- The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
- The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax/be, Wi-Fi 5GHz 802.11a/n/ac/ax/be, Wi-Fi 6GHz 802.11a/n/ac/ax/be, and ZigBee.
Antenna Type Bluetooth – LE: Omni-Directional Antenna WLAN: <Ant. 1>: Omni-Directional Antenna <Ant. 2>: Omni-Directional Antenna <Ant. 3>: Omni-Directional Antenna <Ant. 4>: Omni-Directional Antenna ZigBee: Omni-Directional Antenna

Antenna information			
5925 MHz ~ 6425 MHz	Peak Gain (dBi)	Horizontal	<Ant. 2>: 3.3
		Vertical	<Ant. 4>: 3.5
6525 MHz ~ 6875 MHz	Peak Gain (dBi)	Horizontal	<Ant. 2>: 3.9
		Vertical	<Ant. 4>: 3.4

Remark:

1. The device is a special case of MIMO system with two outputs driving a cross-polarized pair of linearly polarized antennas which are vertically/horizontally mounted on the PCB board as indicated in equipment photo exhibits.
2. Horizontal and vertical antennas are cross-polarized antennas and the transmitting outputs are a 90-degree phase-shifted replica against the other and the phase centers of the two antennas' orientation are co-located.
3. Directional gain of EHT320 is determined by maximum gain of each occupied frequency band.
4. Channel puncturing is not implemented.
5. The EUT information mentioned or listed above is declared by the manufacturer.

1.1.1 Antenna Directional Gain

Follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)c)i)

Cross-polarized antennas. For a system in which the antennas have fixed orientations relative to one another that ensure that the antennas are cross-polarized regardless of any user actions, the directional gain is computed as follows.

- (i) Cross-polarized antennas with $N_{ANT} = 2$. In the case of a transmitter with only two outputs driving a pair of antennas that are cross-polarized (e.g., vertical and horizontal or left-circular and right-circular), directional gain is the gain of an individual antenna. If the two antennas have different gains, the larger gain applies.

The directional gain "DG" is calculated as following table.

	Vertical	Horizontal	DG for Power	DG for PSD	Power Limit Reduction	PSD Limit Reduction
	Ant 4	Ant 2	(dBi)	(dBi)	(dB)	(dB)
5925 MHz~6425 MHz	3.50	3.30	3.50	3.50	0.00	0.00
6525 MHz~6875 MHz	3.40	3.90	3.90	3.90	0.00	0.00

Calculation example:

If a device has two cross-polarized antenna, $G_{ANT1} = 3.50\text{dBi}$; $G_{ANT3} = 3.30\text{dBi}$

Directional gain of power measurement = $\max(3.50, 3.30) = 3.50\text{ dBi}$

Directional gain of PSD measurement = $\max(3.50, 3.30) = 3.50\text{ dBi}$

Power and PSD limit reduction = Directional gain – 6dBi, (min = 0)



1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International (USA) Inc.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	Sporton Site No. TH01-CA, CO01-CA, 03CH02-CA

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: US1250

1.4 Applicable Standards

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

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

Remark: All the test items were validated and recorded in accordance with the standards without any modification during the testing.

2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

BW 20M	Channel	1	5	9	13	17	21	25	29
	Freq. (MHz)	5955	5975	5995	6015	6035	6055	6075	6095
BW 40M	Channel	3		11		19		27	
	Freq. (MHz)	5965		6005		6045		6085	
BW 80M	Channel	7				23			
	Freq. (MHz)	5985				6065			
BW 160M	Channel	15							
	Freq. (MHz)	6025							
BW 320M	Channel	31							
	Freq. (MHz)	6105							

BW 20M	Channel	33	37	41	45	49	53	57	61
	Freq. (MHz)	6115	6135	6155	6175	6195	6215	6235	6255
BW 40M	Channel	35		43		51		59	
	Freq. (MHz)	6125		6165		6205		6245	
BW 80M	Channel	39				55			
	Freq. (MHz)	6145				6225			
BW 160M	Channel	47							
	Freq. (MHz)	6185							
BW 320M	Channel	63							
	Freq. (MHz)	6265							



BW 20M	Channel	65	69	73	77	81	85	89	93
	Freq. (MHz)	6275	6295	6315	6335	6355	6375	6395	6415
BW 40M	Channel	67		75		83		91	
	Freq. (MHz)	6285		6325		6365		6405	
BW 80M	Channel	71				87			
	Freq. (MHz)	6305				6385			
BW 160M	Channel	79							
	Freq. (MHz)	6345							

BW 20M	Channel	117	121	125
	Freq. (MHz)	6535	6555	6575
BW 40M	Channel	123		
	Freq. (MHz)	6565		

BW 20M	Channel	129	133	137	141	145	149	153	157
	Freq. (MHz)	6595	6615	6635	6655	6675	6695	6715	6735
BW 40M	Channel	131		139		147		155	
	Freq. (MHz)	6605		6645		6685		6725	
BW 80M	Channel	135				151			
	Freq. (MHz)	6625				6705			
BW 160M	Channel	143							
	Freq. (MHz)	6665							

BW 20M	Channel	161	165	169	173	177	181	-	-
	Freq. (MHz)	6755	6775	6795	6815	6835	6855	-	-
BW 40M	Channel	163		171		179		-	
	Freq. (MHz)	6765		6805		6845		-	
BW 80M	Channel	167				-			
	Freq. (MHz)	6785				-			

2.2 Test Mode

The final test modes include the worst data rates for each modulation shown in the table below.

MIMO Mode

Specification	MCS index /Data Rate
802.11a	6 Mbps
802.11n HT20 (Covered by EHT20)	MCS0
802.11n HT40 (Covered by EHT40)	MCS0
802.11ac VHT20 (Covered by EHT20)	MCS0
802.11ac VHT40 (Covered by EHT40)	MCS0
802.11ac VHT80 (Covered by EHT80)	MCS0
802.11ac VHT160 (Covered by EHT160)	MCS0
802.11ax HE20 (Covered by EHT20)	MCS0
802.11ax HE40 (Covered by EHT40)	MCS0
802.11ax HE80 (Covered by EHT80)	MCS0
802.11ax HE160 (Covered by EHT160)	MCS0
802.11be EHT20	MCS0
802.11be EHT40	MCS0
802.11be EHT80	MCS0
802.11be EHT160	MCS0
802.11be EHT320	MCS0

Remark:

- 1 Based on the manufacturer's declaration, 802.11be covers the 802.11n, 11ac and 11ax due to the same modulation family scheme. For 802.11be, only full resource unit assignment mode is tested since the EUT does not support partial resource unit assignment mode.
- 2 Based on the manufacturer's declaration, RF power on each chain in MIMO mode is parameterized to be greater than the power in SISO mode, giving the condition that the SISO Mode is covered by MIMO Mode which is deemed the worst case selected for testing.
- 3 The EUT information mentioned or listed above is declared by the manufacturer.

Test Cases	
AC Conducted Emission	Mode 1: WLAN (6GHz) Link + USB Load + LAN 1 + LAN 2 + Adapter

MIMO <Ant. 4+2>

Ch. #		UNII-5 (5925-6425 MHz)	UNII-7 (6525-6875 MHz)
		802.11a	802.11a
L	Low	001	117
M	Middle	045	149
H	High	093	181

Ch. #		UNII-5 (5925-6425 MHz)	UNII-7 (6525-6875 MHz)
		802.11be EHT20	802.11be EHT20
L	Low	001	117
M	Middle	045	149
H	High	093	181

Ch. #		UNII-5 (5925-6425 MHz)	UNII-7 (6525-6875 MHz)
		802.11be EHT40	802.11be EHT40
L	Low	003	123
M	Middle	043	147
H	High	091	179

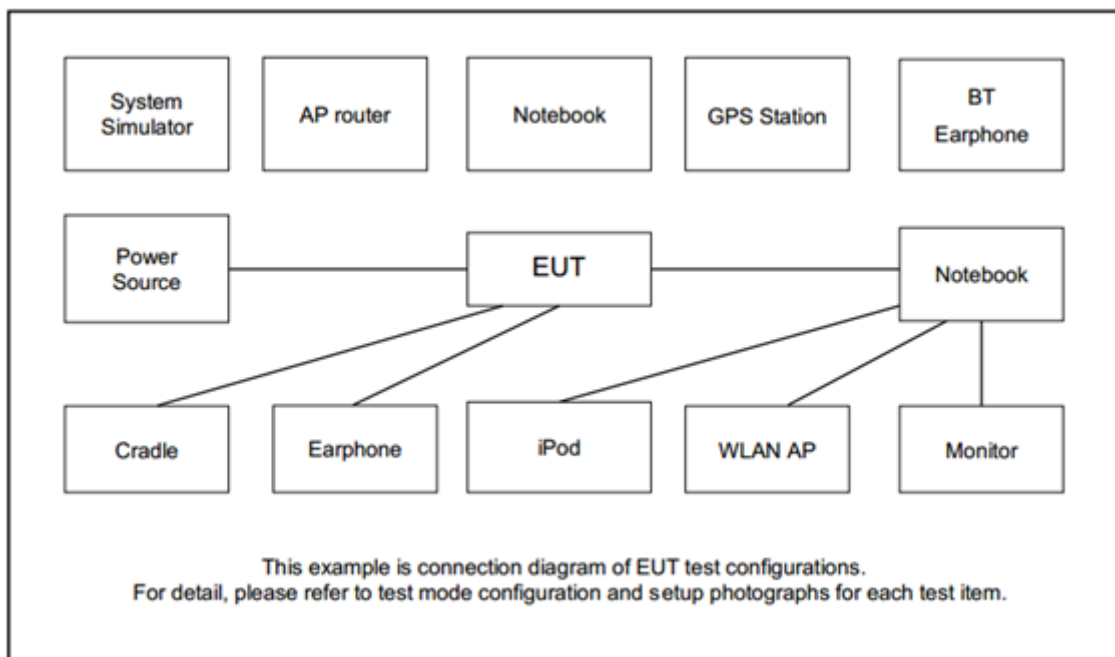
Ch. #		UNII-5 (5925-6425 MHz)	UNII-7 (6525-6875 MHz)
		802.11be EHT80	802.11be EHT80
L	Low	007	135
M	Middle	039	151
H	High	087	167

Ch. #		UNII-5 (5925-6425 MHz)	UNII-7 (6525-6875 MHz)
		802.11be EHT160	802.11be EHT160
L	Low	015	143
M	Middle	047	
H	High	079	

Ch. #		UNII-5 (5925-6425 MHz)
		802.11be EHT320
L	Low	031
M	Middle	
H	High	
Straddle		063

Remark: Based on ANSI C63.10 clause 5.6.2.2, b) Spurious emissions, measure the mode with the highest output power and the mode with highest output power spectral density for each modulation family.

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Laptop	Dell	Latitude 5440	NA	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	Laptop	Acer	N18Q13	NA	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Laptop	Dell	Latitue E7470	NA	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Adapter	Ruckus	740-64277-001	NA	NA	Unshielded, 1.0m
5.	USB Flash drive	SanDisk	N/A	N/A	N/A	USB Flash drive
6.	POE Adapter	Ruckus	740-64310-001	NA	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “Tera Term 4.106 and QSPR V5.14.00227.1” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Limit of 26dB & 99% Occupied Bandwidth

<FCC 14-30 CFR 15.407>

(a)(10) The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.

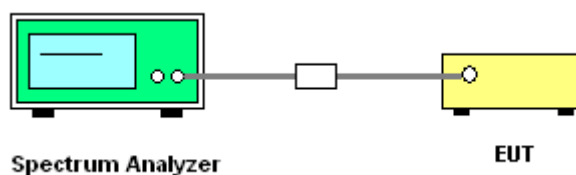
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * RBW$.
8. Measure and record the results in the test report.

3.1.4 Test Setup



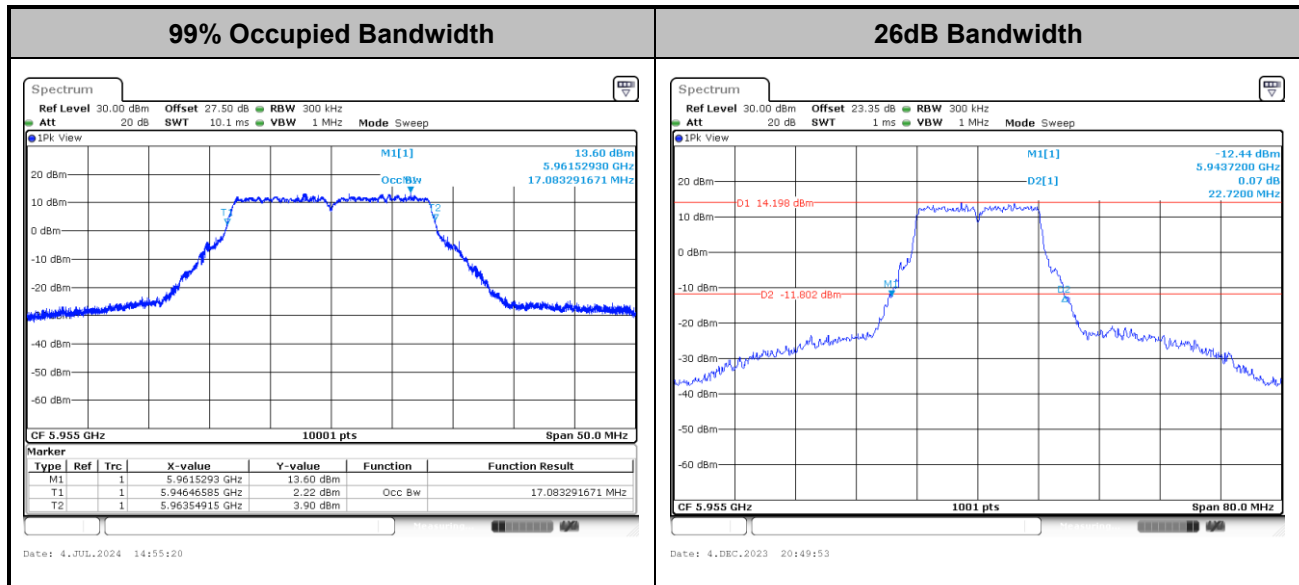
3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.



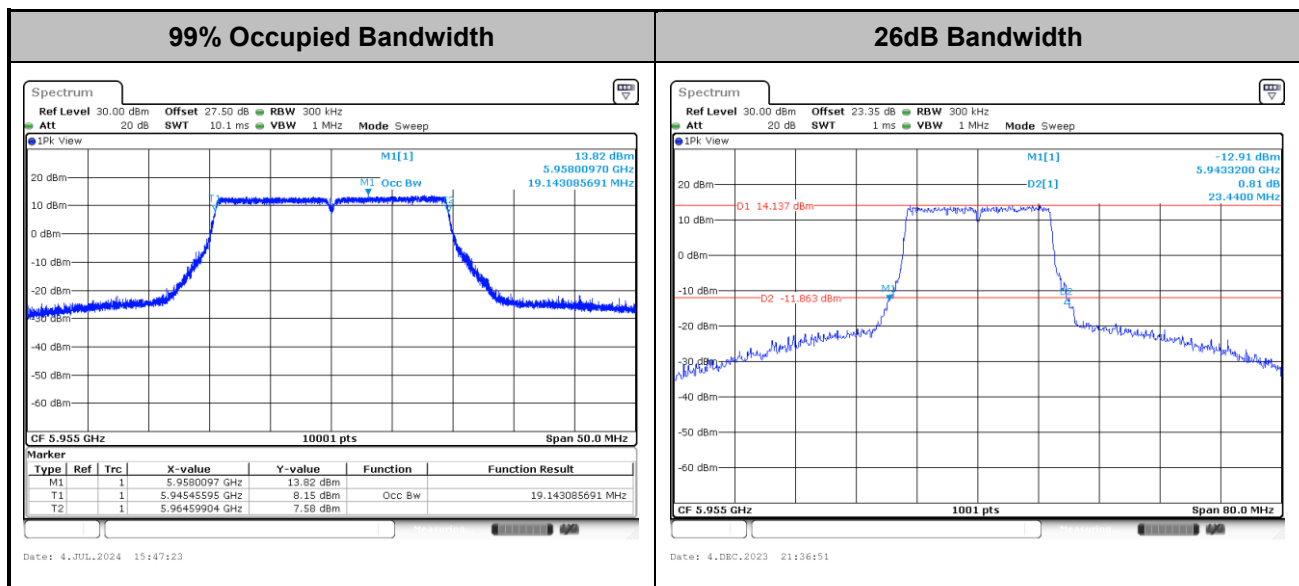
MIMO <Ant. 4+2>

<802.11a>



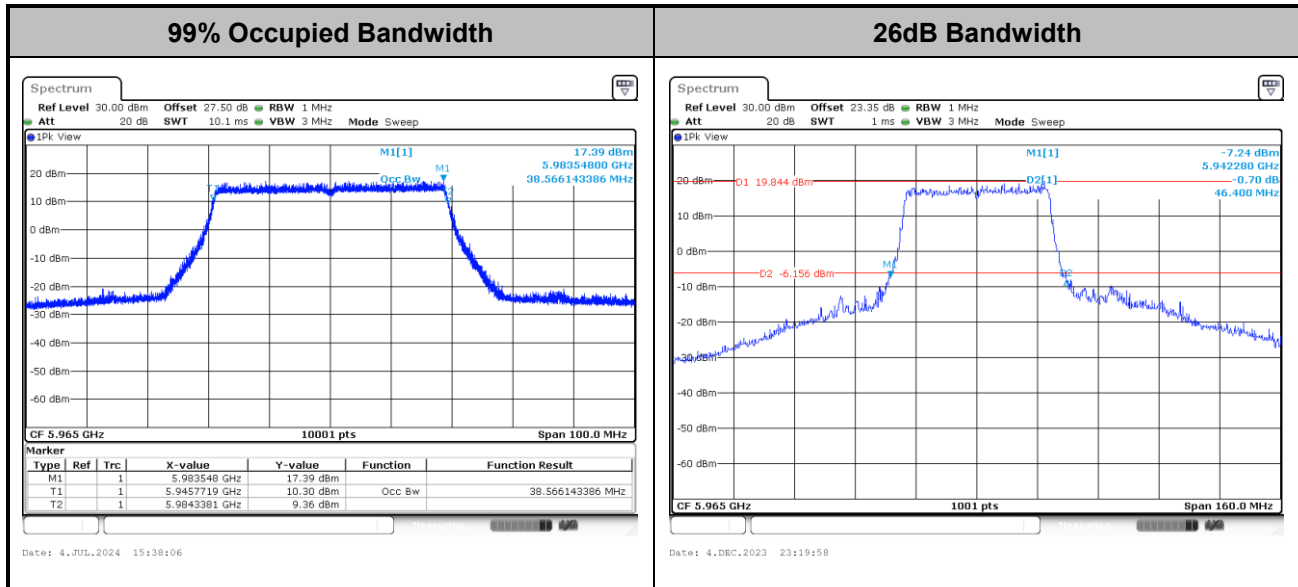
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11be EHT20>



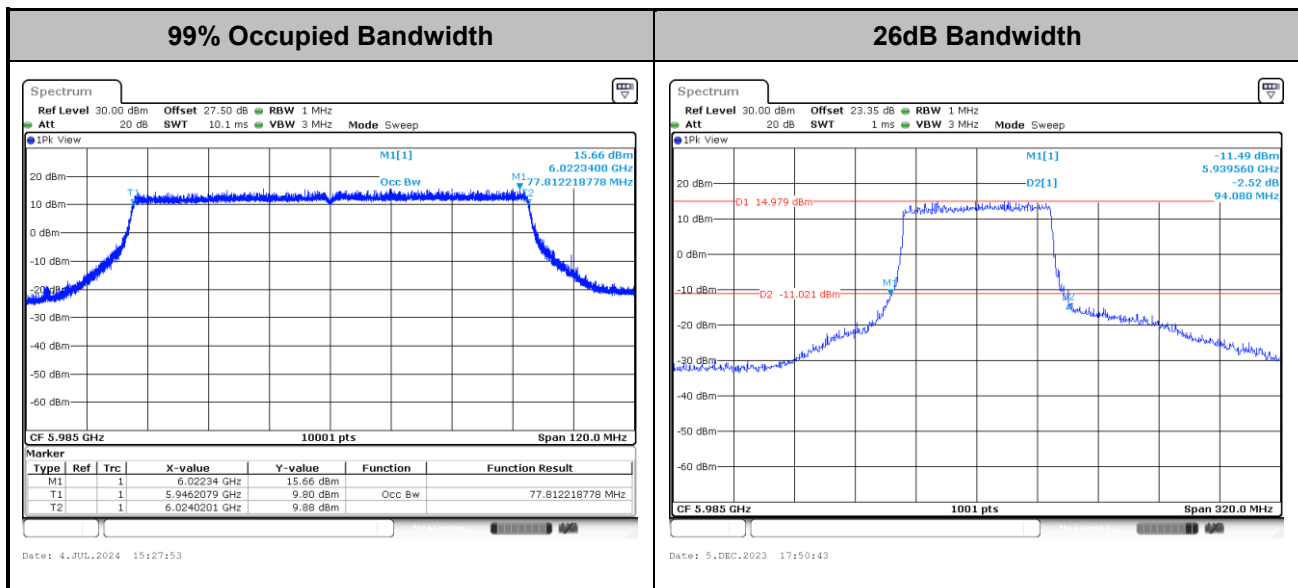
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11be EHT40>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

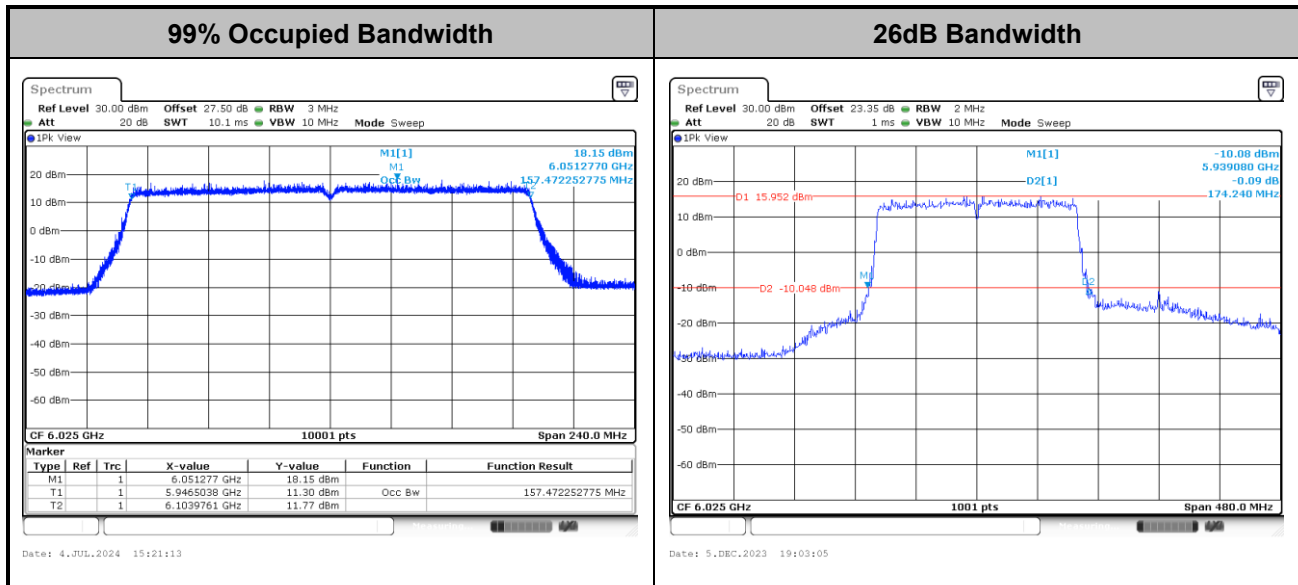
<802.11be EHT80>



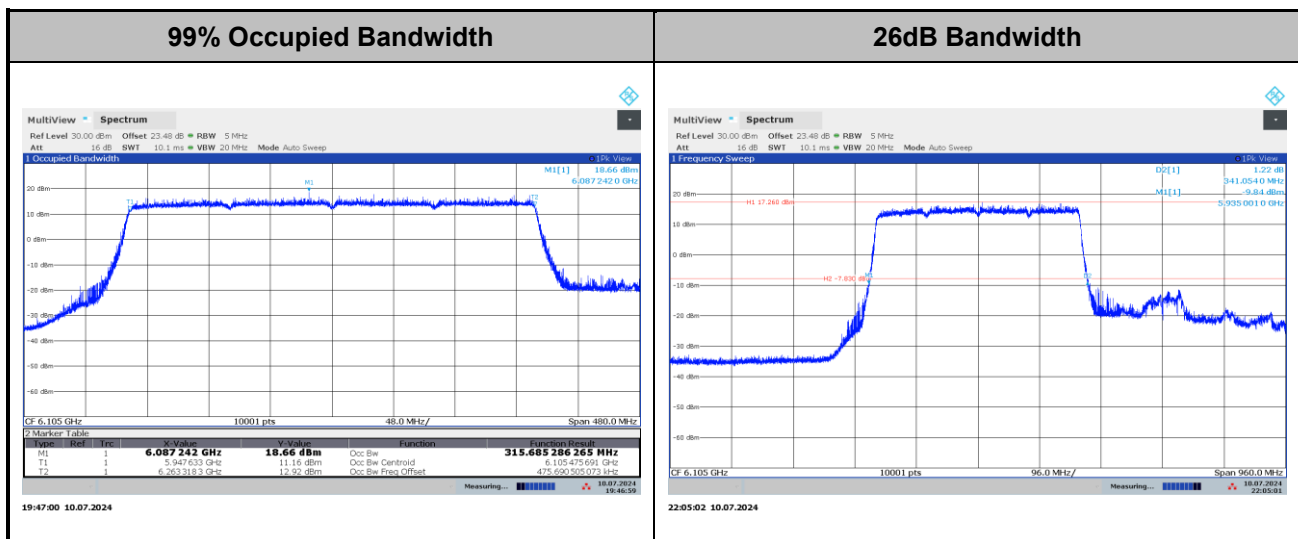
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



<802.11be EHT160>



<802.11be EHT320>



3.2 Fundamental Maximum EIRP Measurement

3.2.1 Limit of Fundamental Maximum EIRP

<FCC 14-30 CFR 15.407>

(a)(4) For a standard power access point and fixed client device operating in the 5.925–6.425 GHz and 6.525–6.875 GHz bands, the maximum power spectral density must not exceed 23 dBm e.i.r.p in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm.

For outdoor devices, the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

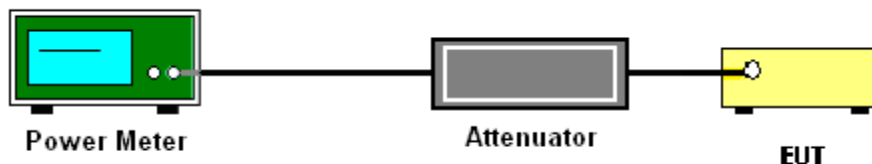
3.2.3 Test Procedures

The testing follows Method PM-G of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM-G (Measurement using a gated RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit at its maximum power control level.
3. Measure the average power of the transmitter.
4. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Fundamental Maximum EIRP

Please refer to Appendix A.

3.3 Fundamental Power Spectral Density Measurement

3.3.1 Limit of Fundamental Power Spectral Density

<FCC 14-30 CFR 15.407>

(a)(4) For a standard power access point and fixed client device operating in the 5.925–6.425 GHz and 6.525–6.875 GHz bands, the maximum power spectral density must not exceed 23 dBm e.i.r.p in any 1-megahertz band.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 T Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section F) Maximum power spectral density.

Method SA-1

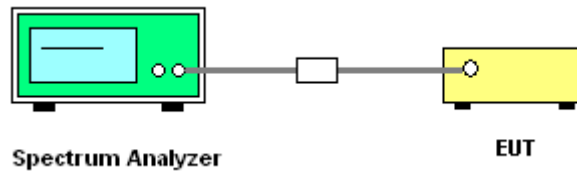
(trace averaging with the EUT transmitting at full power throughout each sweep).

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
 - Set RBW = 1 MHz.
 - Set VBW $\geq$ 3 MHz.
 - Number of points in sweep $\geq$ 2 Span / RBW.
 - Sweep time = auto.
 - Detector = RMS
 - Trace average at least 100 traces in power averaging mode.
 - The EUT transmits continuously (duty cycle $\geq$ 98%).
1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
 2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
 3. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (a): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points; the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

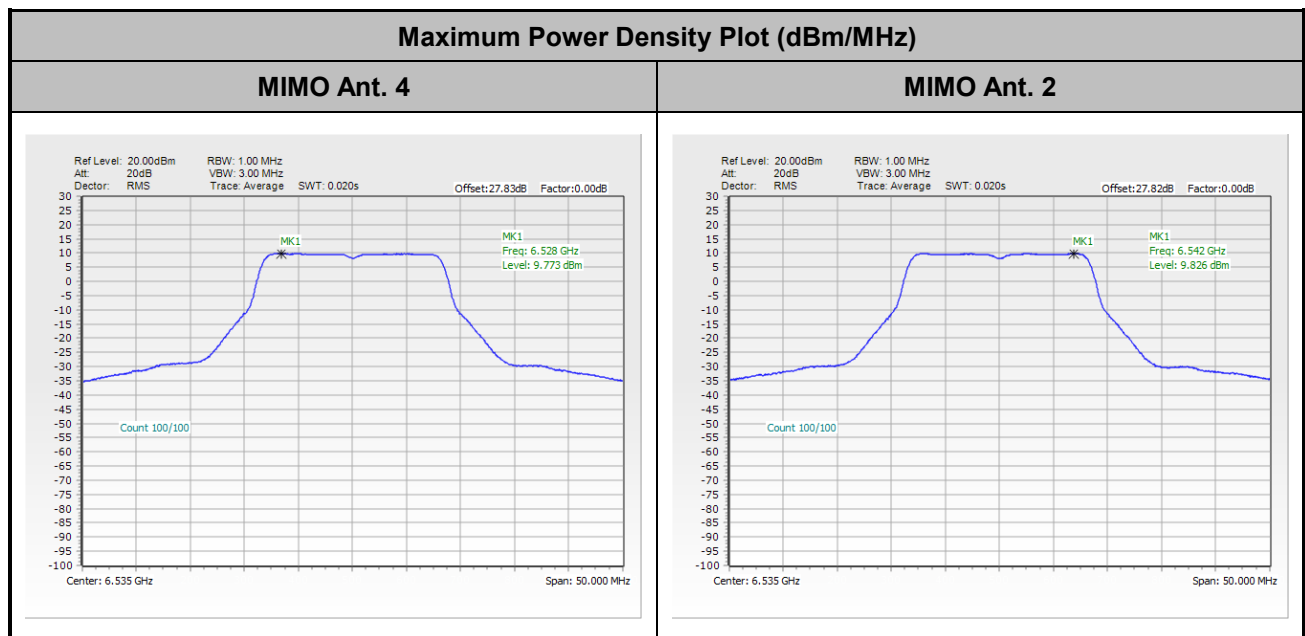
3.3.5 Test Setup



3.3.6 Test Result of Power Spectral Density

Please refer to Appendix A.

<802.11a 6535MHz>

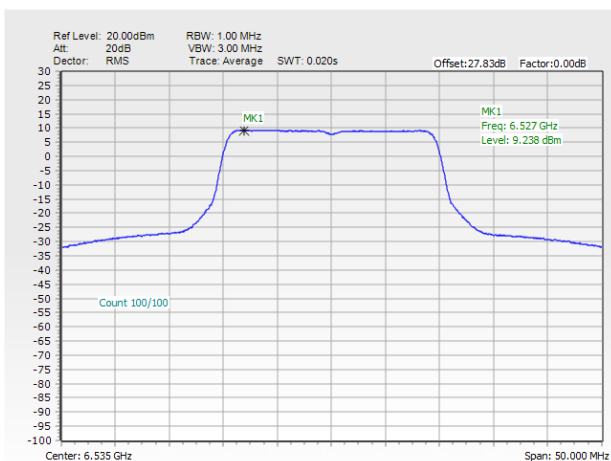




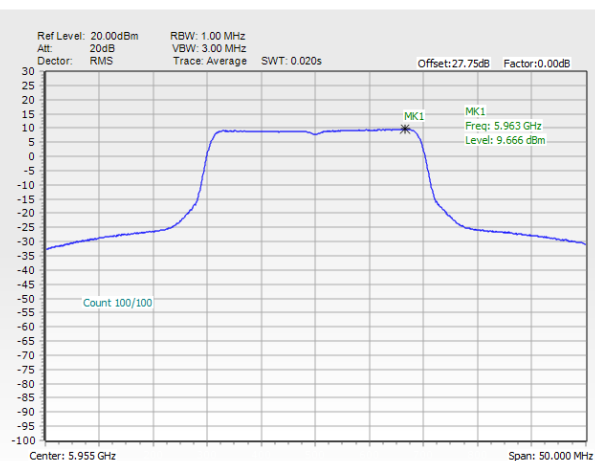
<802.11be EHT20 6535MHz and 5955MHz>

Maximum Power Density Plot (dBm/MHz)

MIMO Ant. 4



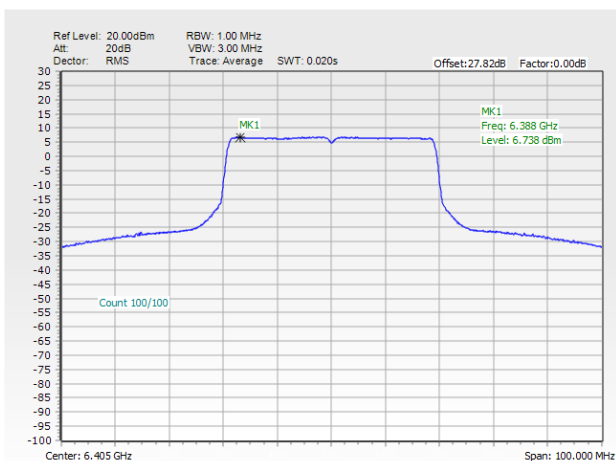
MIMO Ant. 2



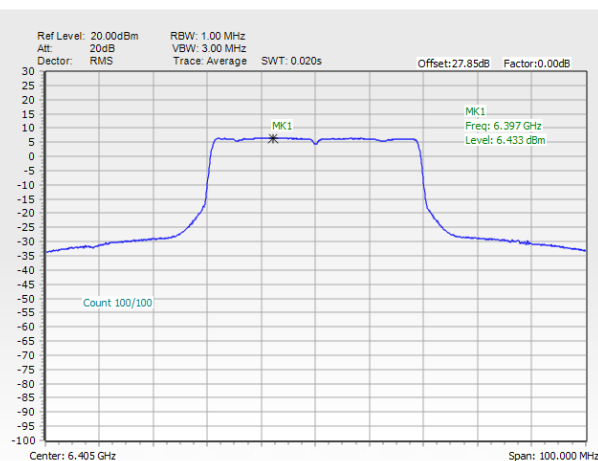
<802.11be EHT40 6405MHz>

Maximum Power Density Plot (dBm/MHz)

MIMO Ant. 4



MIMO Ant. 2

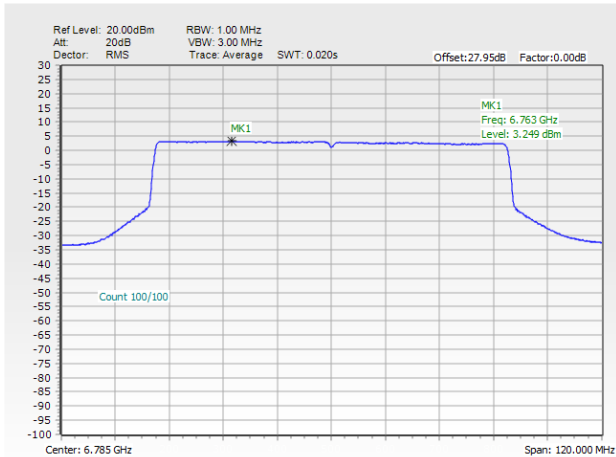




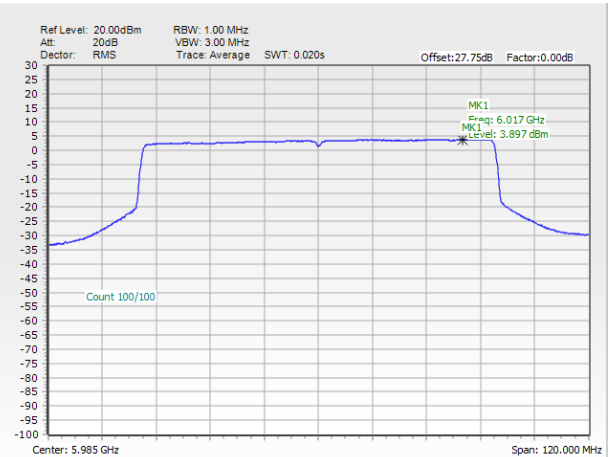
<802.11be EHT80 6785MHz and 5985MHz>

Maximum Power Density Plot (dBm/MHz)

MIMO Ant. 4



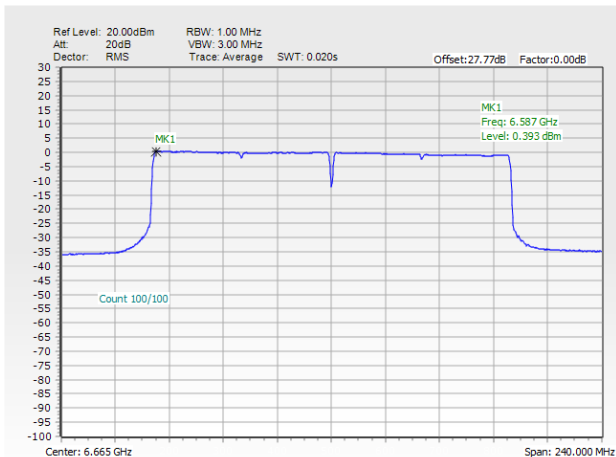
MIMO Ant. 2



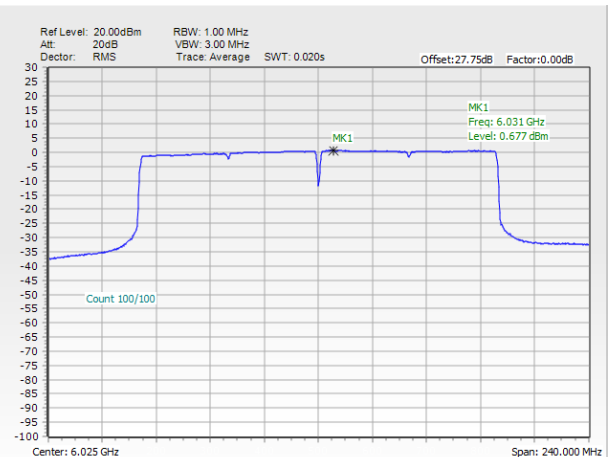
<802.11be EHT160 6665MHz and 6025MHz>

Maximum Power Density Plot (dBm/MHz)

MIMO Ant. 4

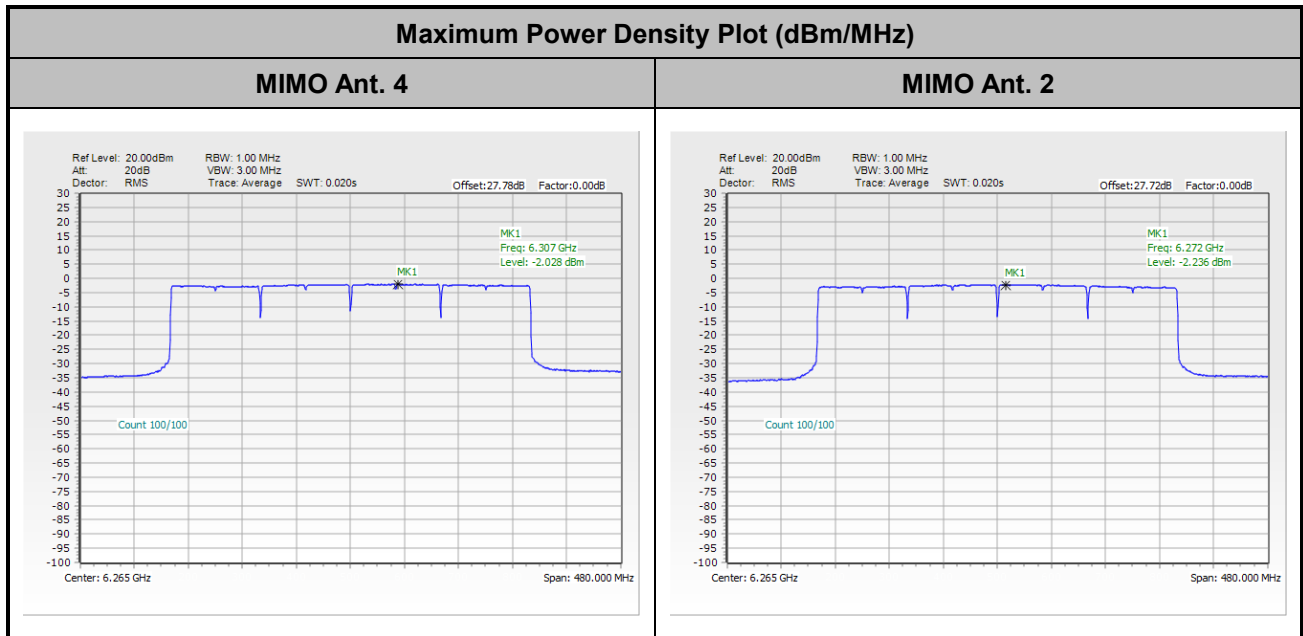


MIMO Ant. 2





<802.11be EHT320 6265MHz>





3.4 In-Band Emissions (Channel Mask)

3.4.1 Limit of Unwanted Emissions

<FCC 14-30 CFR 15.407>

(a)(6) For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

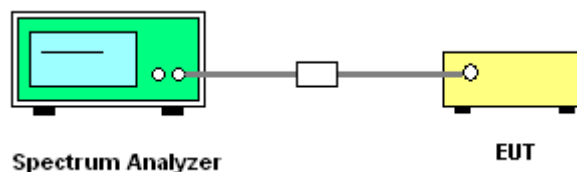
3.4.3 Test Procedures

The testing follows FCC KDB 987594 D02 U-NII 6GHz EMC Measurement v02.

Section J) In-Band Emissions.

1. Take nominal bandwidth as reference channel bandwidth provided that 26 dB emission bandwidth is always larger than nominal bandwidth
2. Measure the power spectral density (which will be used for emissions mask reference) using the following procedure:
 - a) Set the span to encompass the entire 26 dB EBW of the signal.
 - b) Set RBW = same RBW used for 26 dB EBW measurement.
 - c) Set VBW $\geq 3 \times$ RBW
 - d) Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$.
 - e) Sweep time = auto.
 - f) Detector = RMS (i.e., power averaging)
 - g) Trace average at least 100 traces in power averaging (rms) mode.
 - h) Use the peak search function on the instrument to find the peak of the spectrum.
3. Using the measuring equipment limit line function, develop the emissions mask based on the following requirements. The emissions power spectral density must be reduced below the peak power spectral density (in dB) as follows:
 - a. Suppressed by 20 dB at 1 MHz outside of the channel edge.
 - b. Suppressed by 28 dB at one channel bandwidth from the channel center.
 - c. Suppressed by 40 dB at one- and one-half times the channel bandwidth from the channel center.
4. Adjust the span to encompass the entire mask as necessary.
5. Clear trace.
6. Trace average at least 100 traces in power averaging (rms) mode.
7. Adjust the reference level as necessary so that the crest of the channel touches the top of the emission mask.

3.4.4 Test Setup





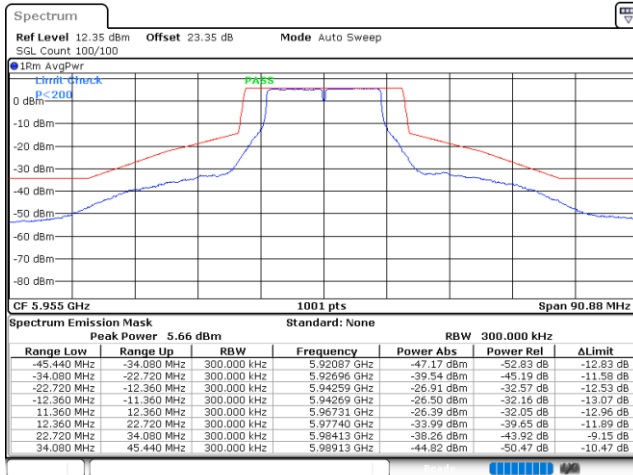
3.4.5 Test Result

MIMO <Ant. 4+2(4)>

EUT Mode :

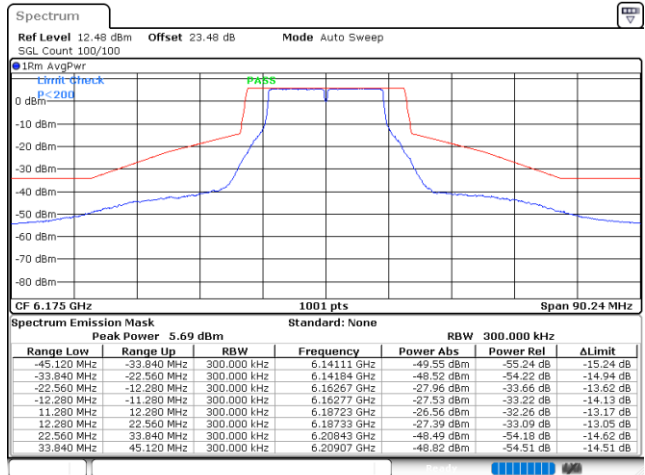
802.11a

Plot on Channel 5955MHz



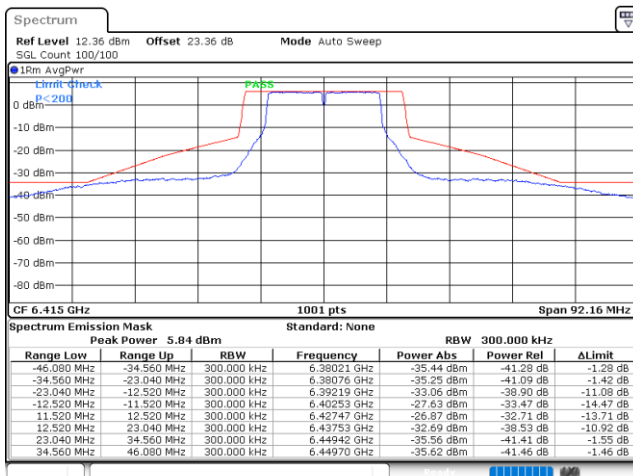
Date: 4.DEC.2023 20:54:28

Plot on Channel 6175MHz



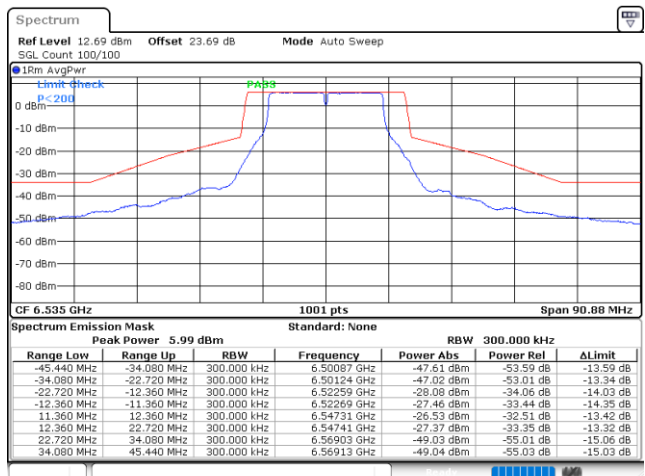
Date: 4.DEC.2023 20:57:14

Plot on Channel 6415MHz



Date: 4.DEC.2023 21:16:47

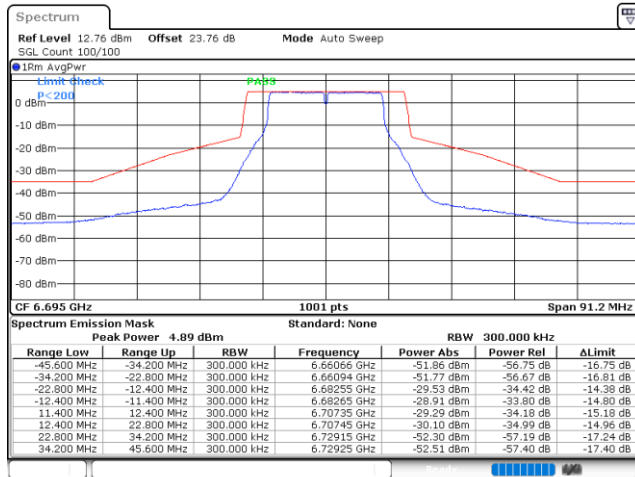
Plot on Channel 6535MHz



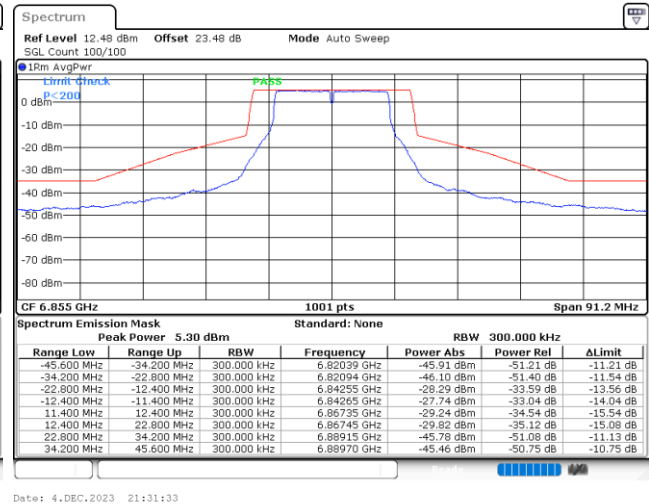
Date: 4.DEC.2023 21:23:23



Plot on Channel 6695MHz



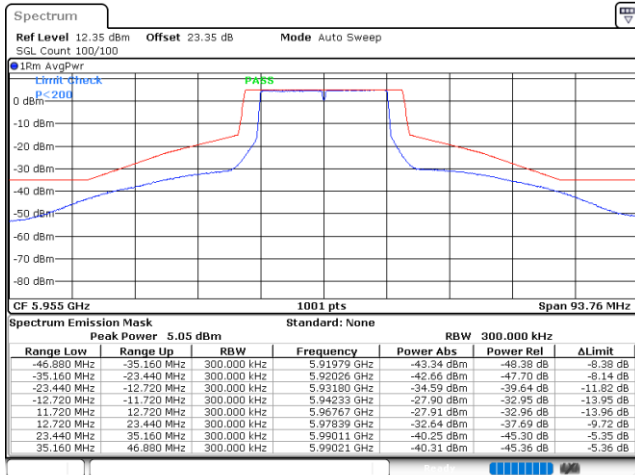
Plot on Channel 6855MHz





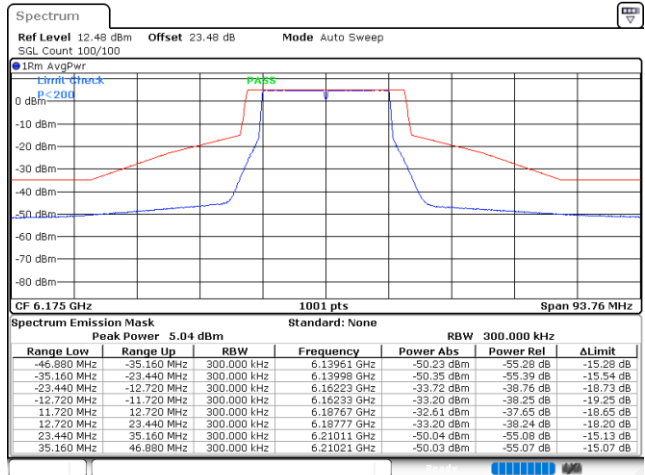
EUT Mode : 802.11be EHT20

Plot on Channel 5955MHz



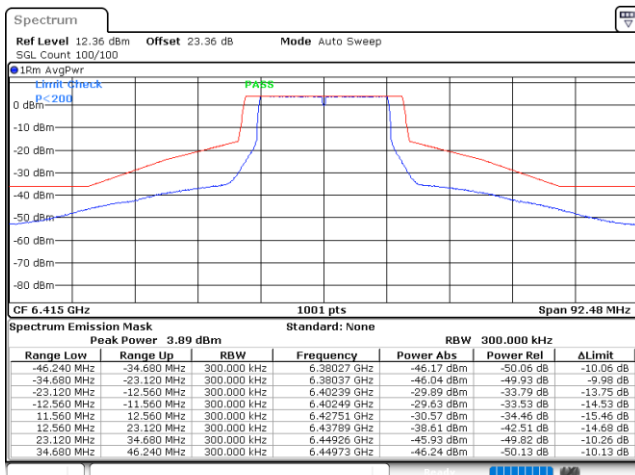
Date: 4.DEC.2023 21:41:31

Plot on Channel 6175MHz



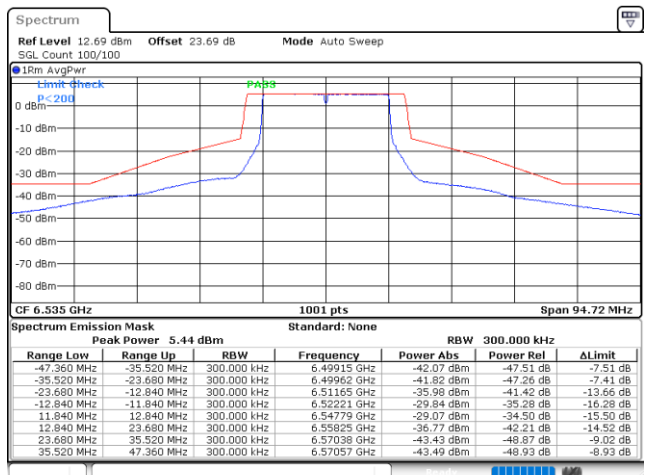
Date: 4.DEC.2023 21:53:37

Plot on Channel 6415MHz



Date: 4.DEC.2023 22:30:06

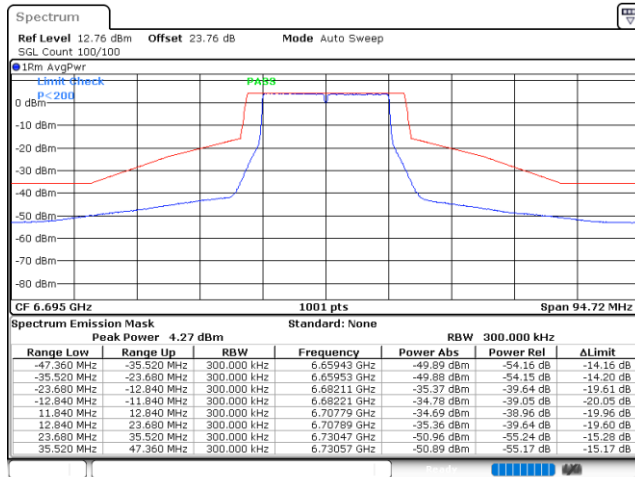
Plot on Channel 6535MHz



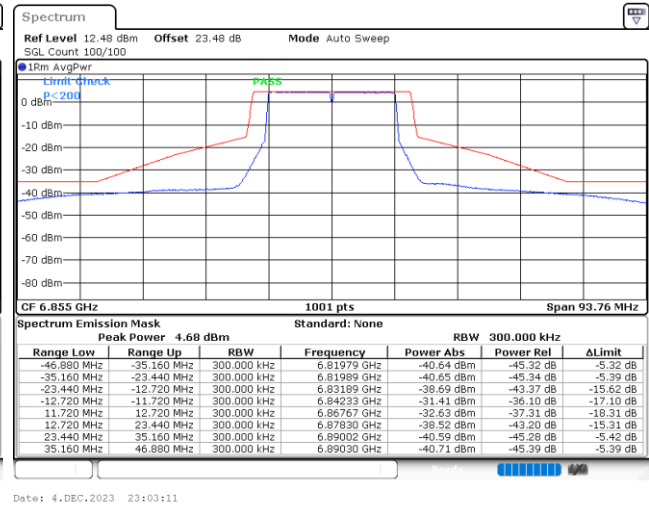
Date: 4.DEC.2023 22:55:18



Plot on Channel 6695MHz



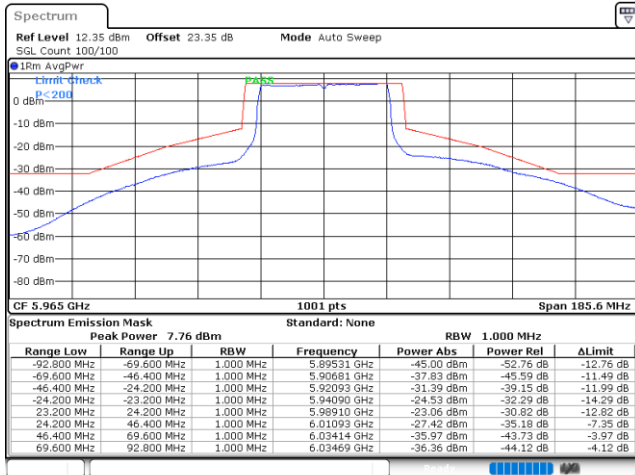
Plot on Channel 6855MHz





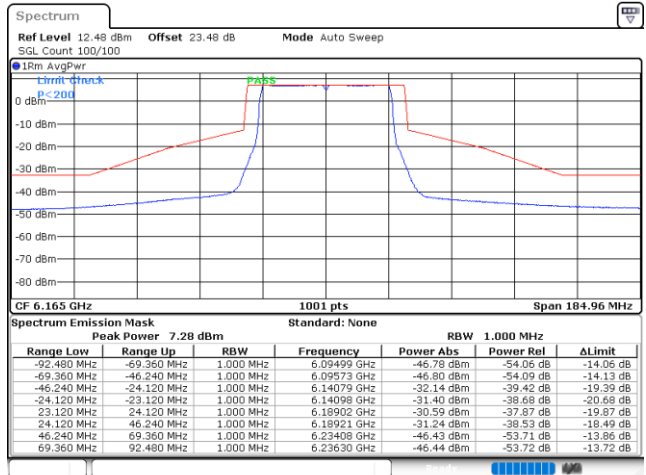
EUT Mode : 802.11be EHT40

Plot on Channel 5965MHz



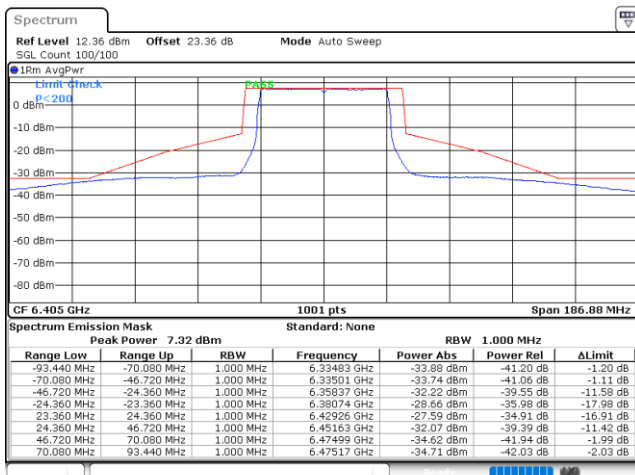
Date: 4.DEC.2023 23:29:22

Plot on Channel 6165MHz



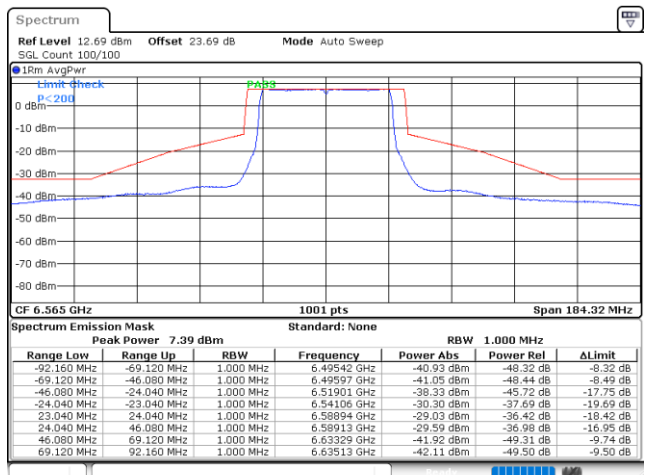
Date: 4.DEC.2023 23:24:37

Plot on Channel 6405MHz



Date: 4.DEC.2023 23:28:50

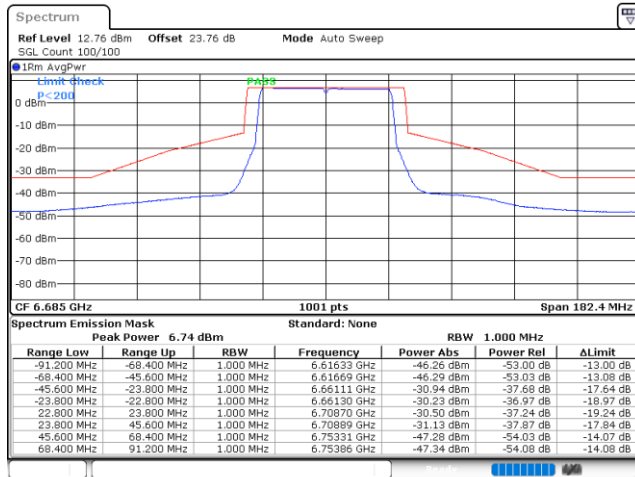
Plot on Channel 6565MHz



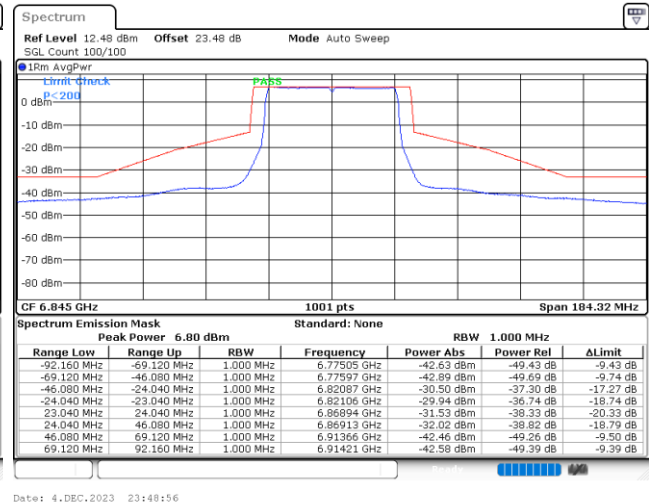
Date: 4.DEC.2023 23:41:34



Plot on Channel 6685MHz



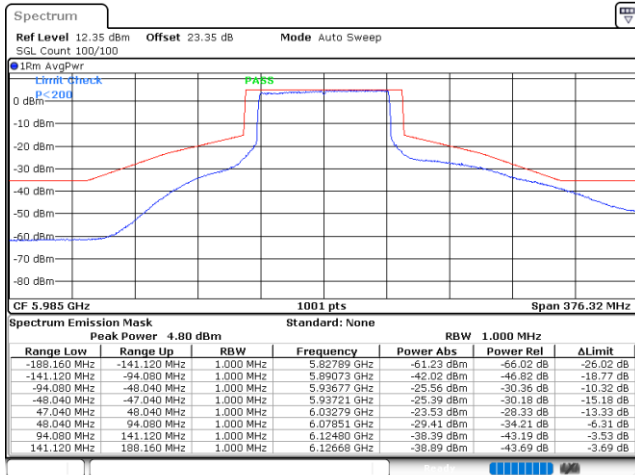
Plot on Channel 6845MHz





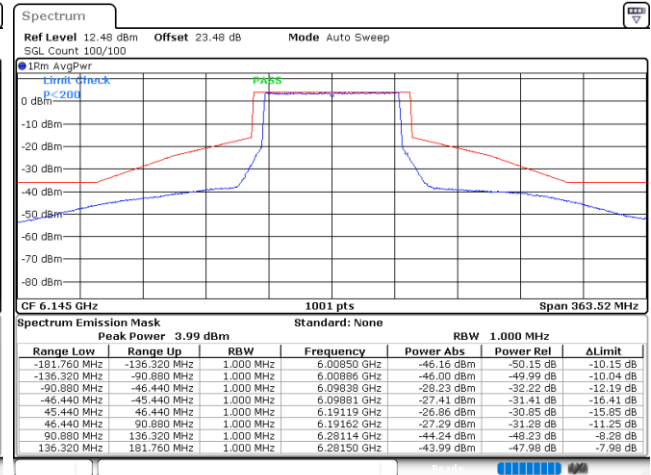
EUT Mode : 802.11be EHT80

Plot on Channel 5985MHz



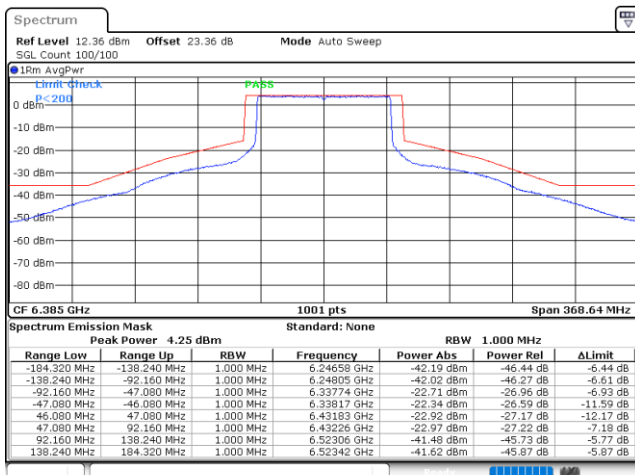
Date: 5.DEC.2023 17:51:10

Plot on Channel 6145MHz



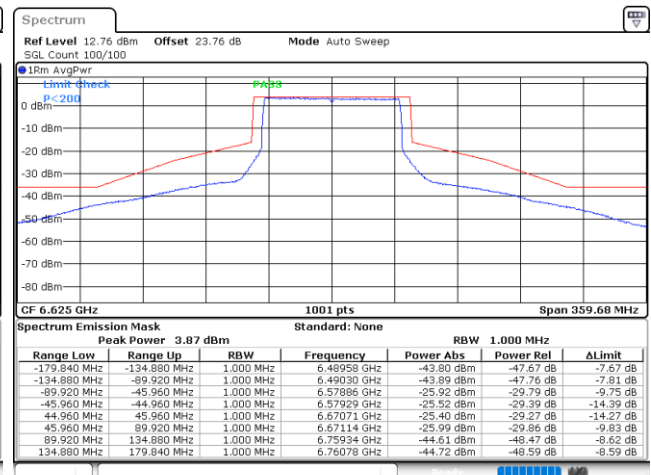
Date: 5.DEC.2023 18:02:51

Plot on Channel 6385MHz



Date: 5.DEC.2023 18:21:20

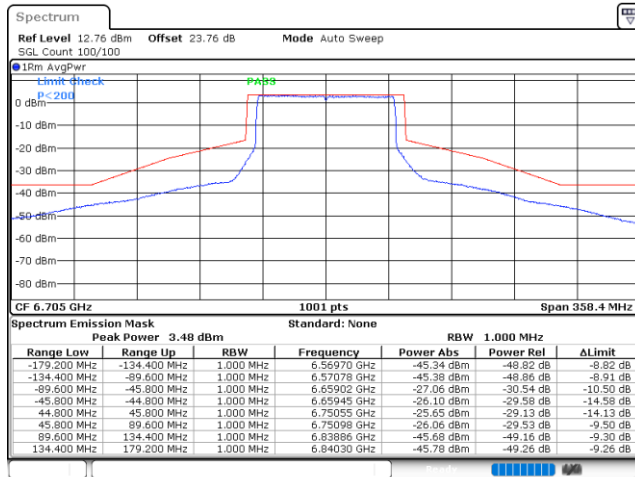
Plot on Channel 6625MHz



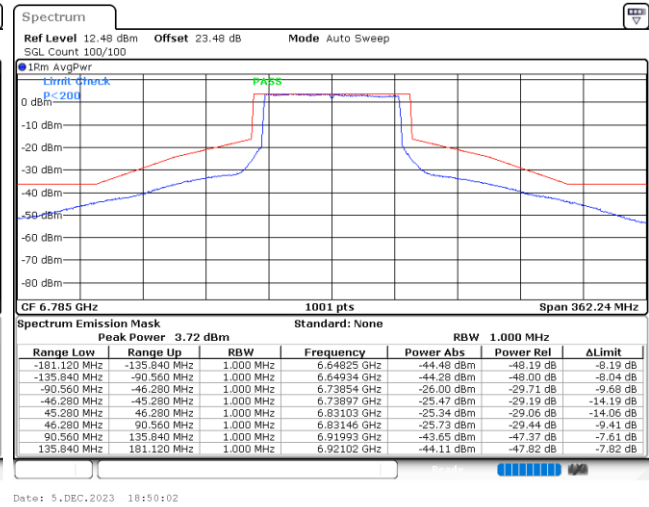
Date: 5.DEC.2023 18:25:38



Plot on Channel 6705MHz



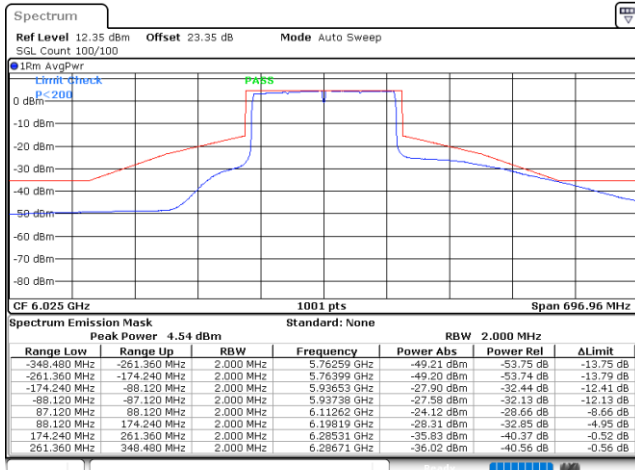
Plot on Channel 6785MHz





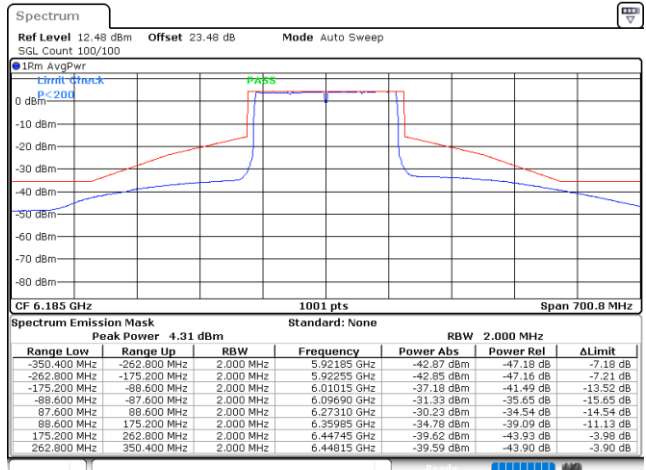
EUT Mode : 802.11be EHT160

Plot on Channel 6025MHz



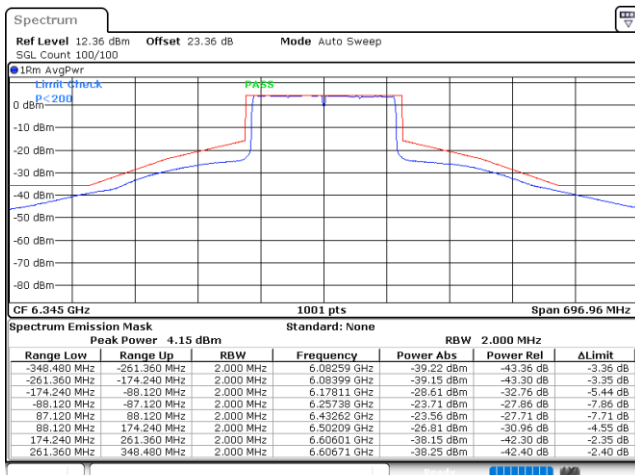
Date: 5.DEC.2023 19:03:31

Plot on Channel 6185MHz



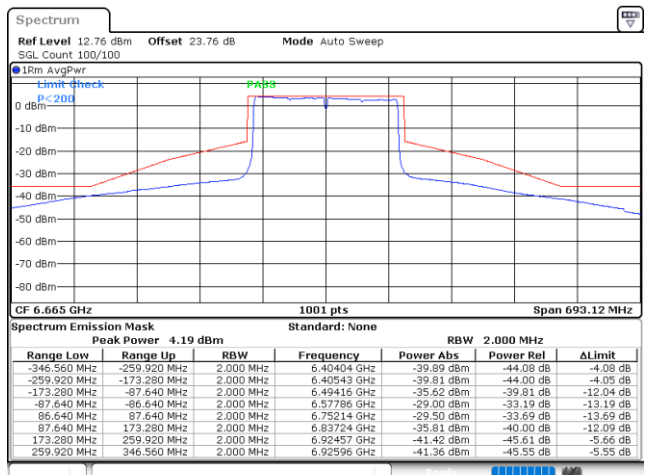
Date: 5.DEC.2023 19:10:31

Plot on Channel 6345MHz



Date: 5.DEC.2023 19:20:23

Plot on Channel 6665MHz

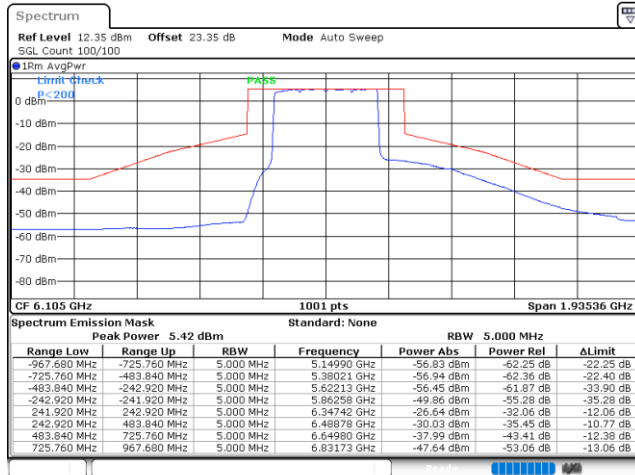


Date: 5.DEC.2023 19:28:49



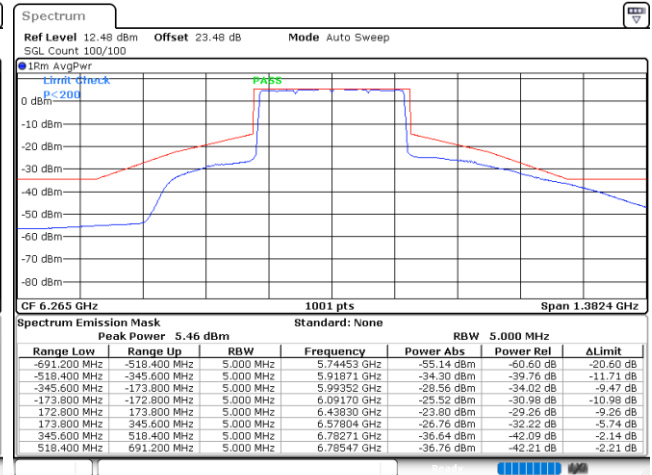
EUT Mode : 802.11be EHT320

Plot on Channel 6105MHz



Date: 5.DEC.2023 19:52:27

Plot on Channel 6265MHz



Date: 5.DEC.2023 20:00:42

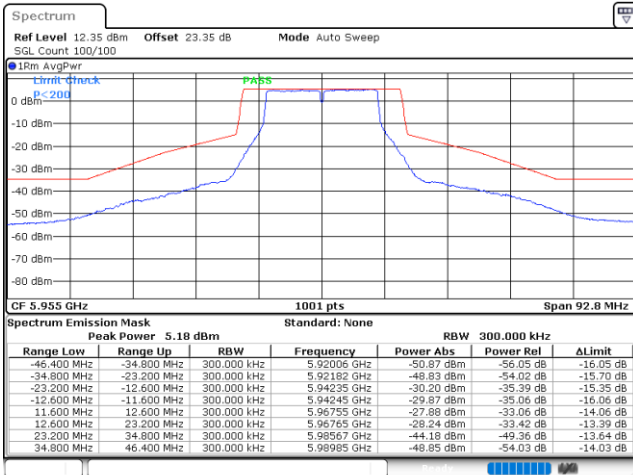


MIMO <Ant. 4+2(2)>

EUT Mode :

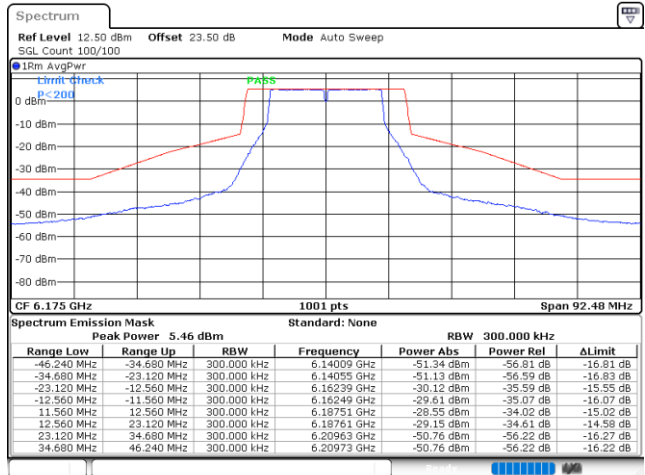
802.11a

Plot on Channel 5955MHz



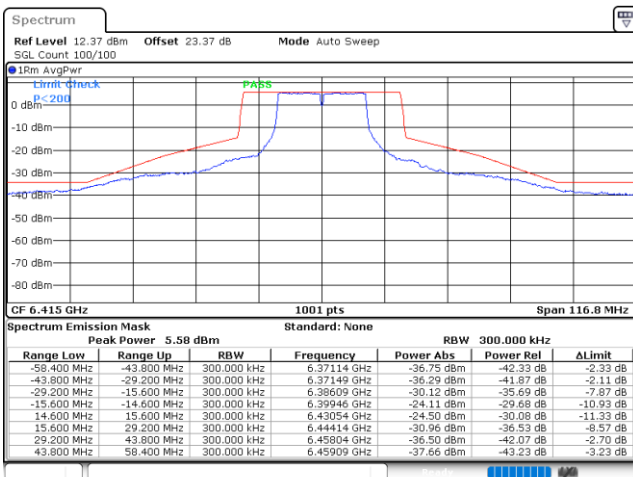
Date: 4.DEC.2023 20:55:40

Plot on Channel 6175MHz



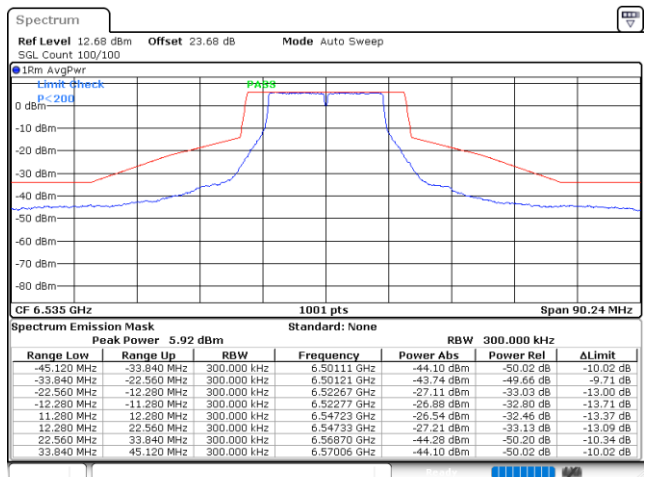
Date: 4.DEC.2023 20:58:29

Plot on Channel 6415MHz



Date: 4.DEC.2023 21:19:51

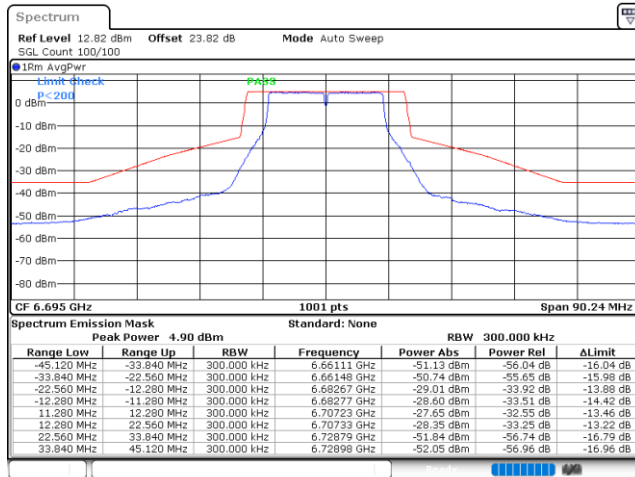
Plot on Channel 6535MHz



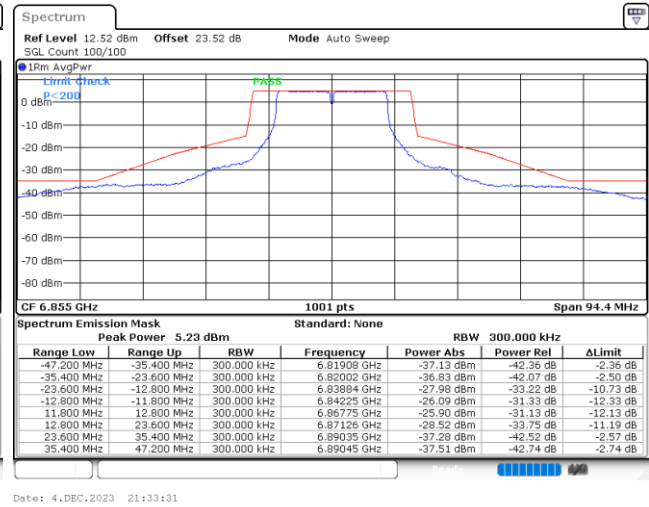
Date: 4.DEC.2023 21:24:29



Plot on Channel 6695MHz



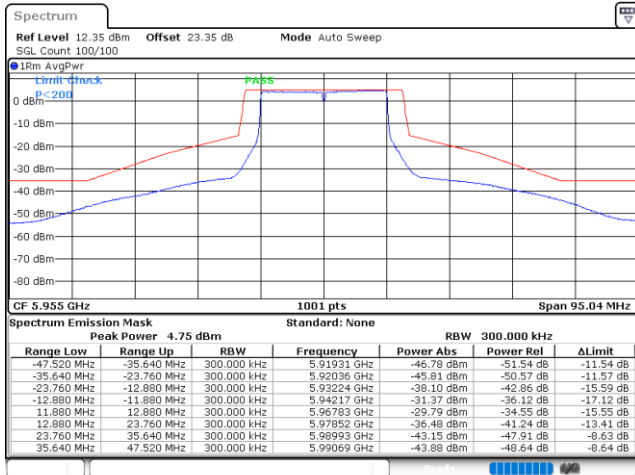
Plot on Channel 6855MHz





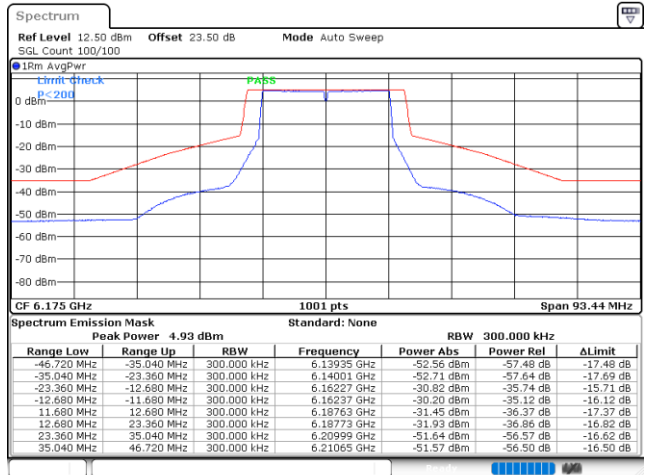
EUT Mode : 802.11be EHT20

Plot on Channel 5955MHz



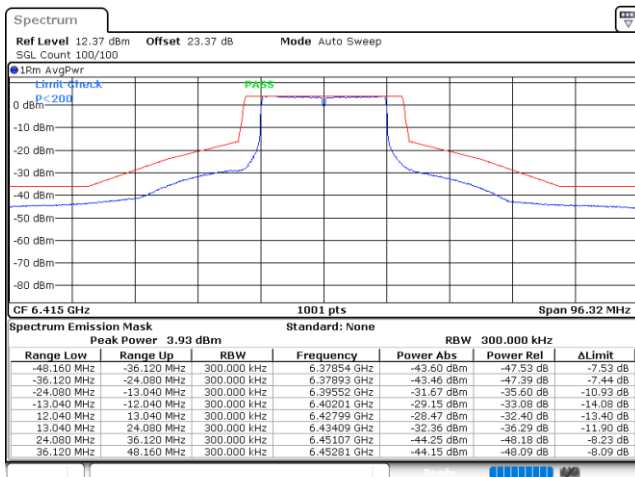
Date: 4.DEC.2023 21:46:34

Plot on Channel 6175MHz



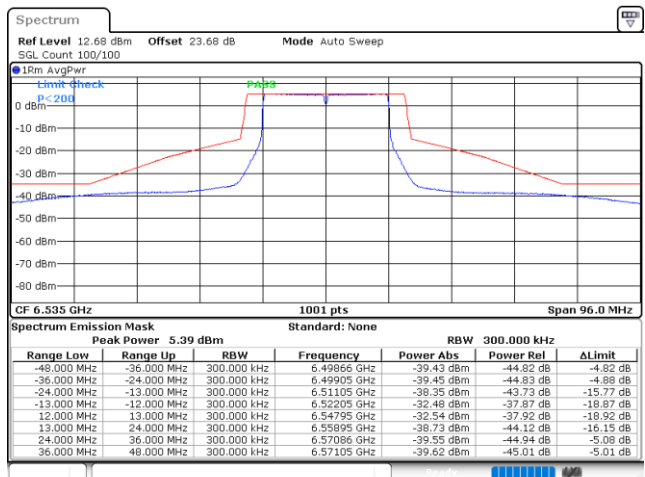
Date: 4.DEC.2023 21:54:58

Plot on Channel 6415MHz



Date: 4.DEC.2023 22:31:01

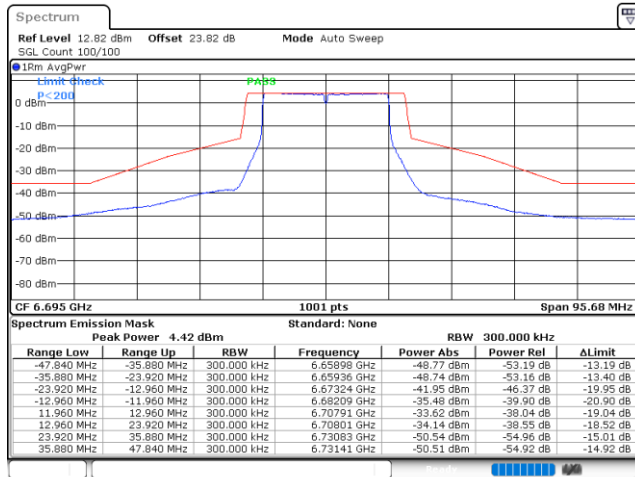
Plot on Channel 6535MHz



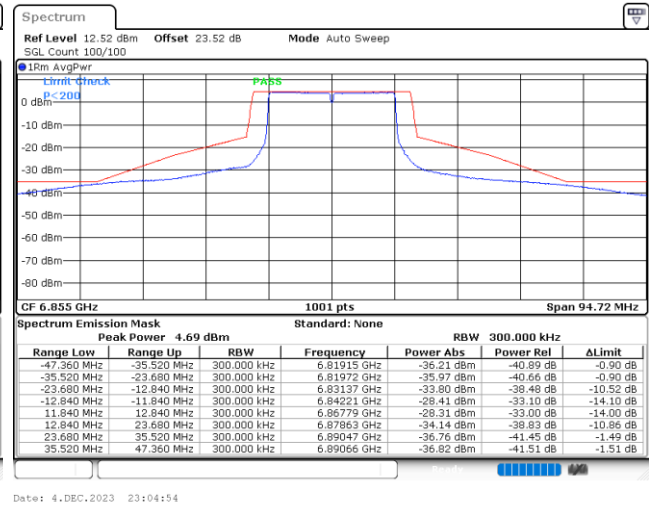
Date: 4.DEC.2023 22:57:41



Plot on Channel 6695MHz



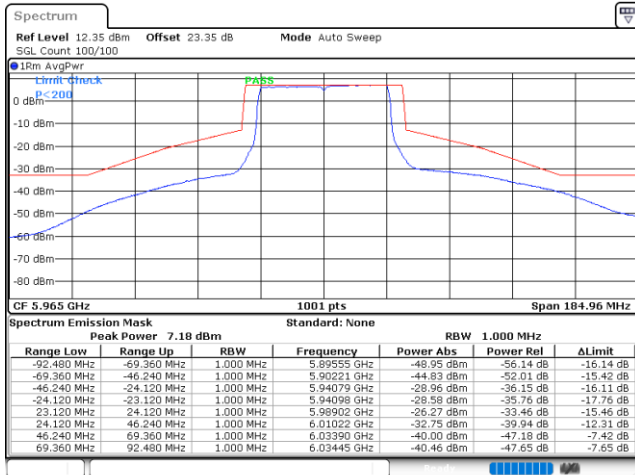
Plot on Channel 6855MHz



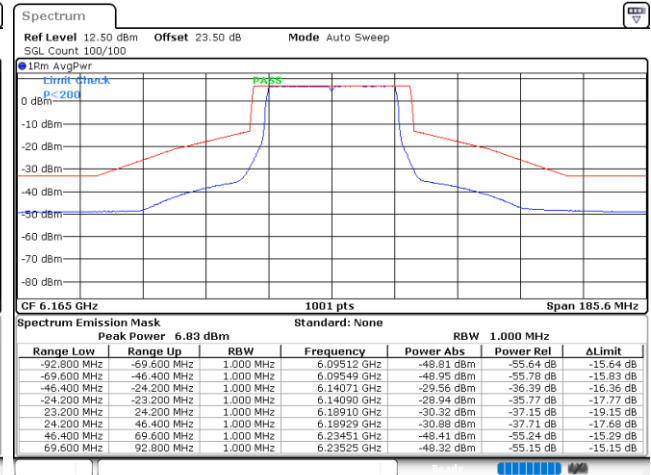


EUT Mode : 802.11be EHT40

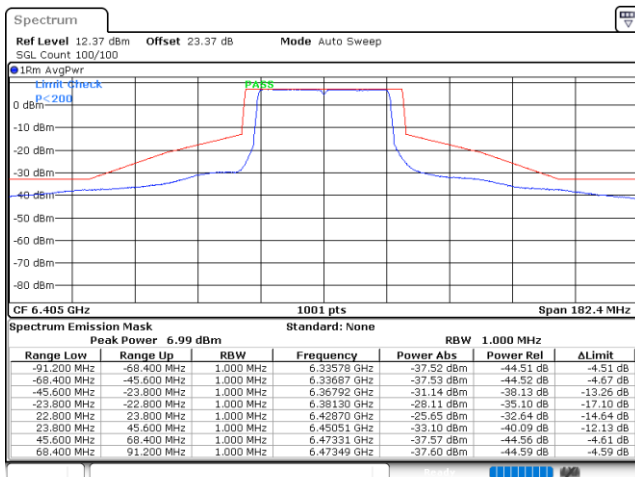
Plot on Channel 5965MHz



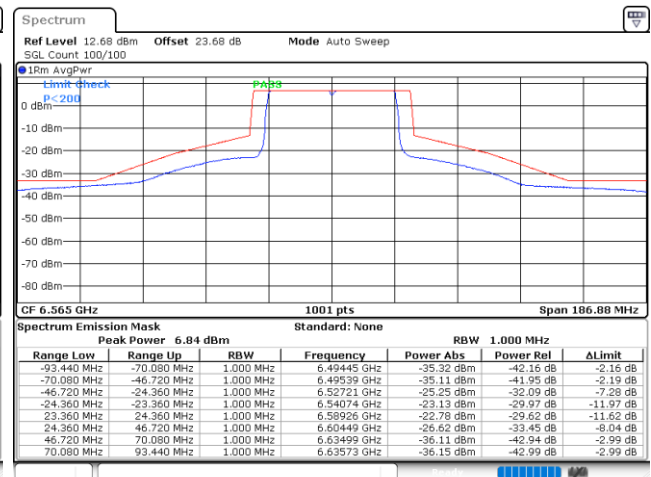
Plot on Channel 6165MHz



Plot on Channel 6405MHz

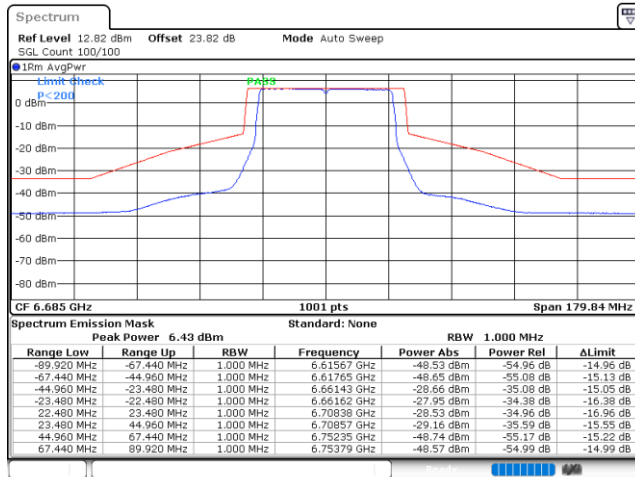


Plot on Channel 6565MHz

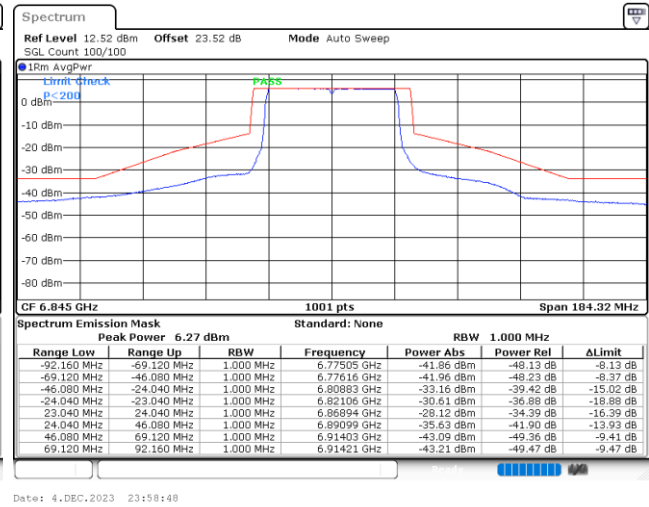




Plot on Channel 6685MHz



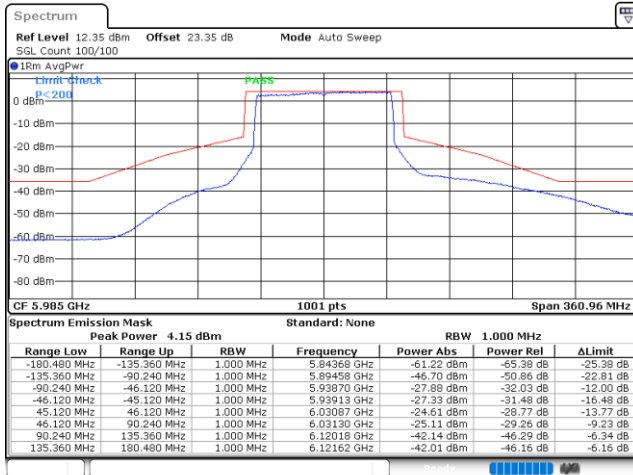
Plot on Channel 6845MHz





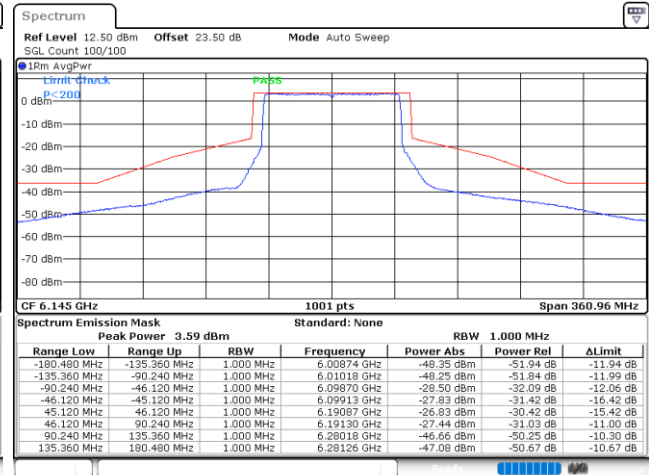
EUT Mode : 802.11be EHT80

Plot on Channel 5985MHz



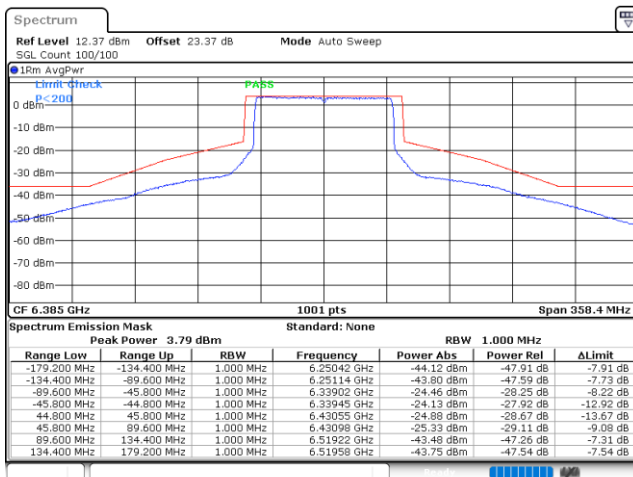
Date: 5.DEC.2023 17:56:15

Plot on Channel 6145MHz



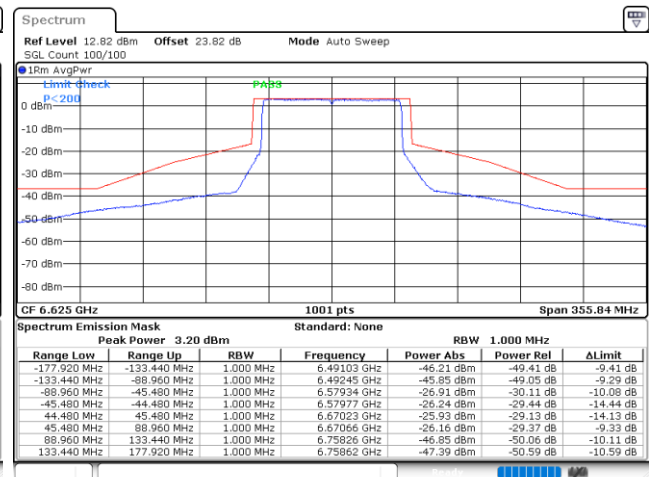
Date: 5.DEC.2023 18:06:55

Plot on Channel 6385MHz



Date: 5.DEC.2023 18:23:03

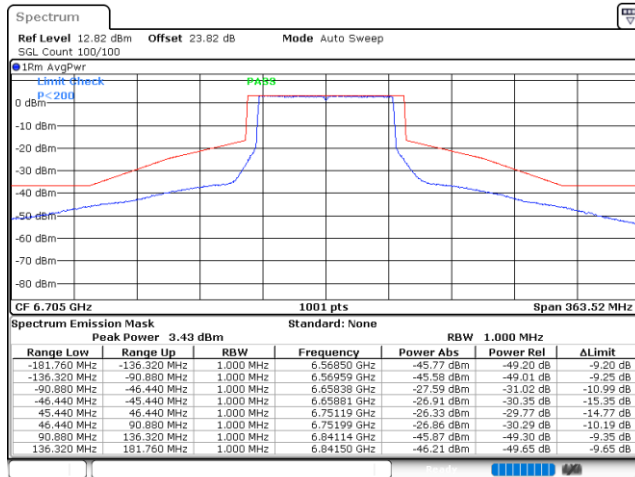
Plot on Channel 6625MHz



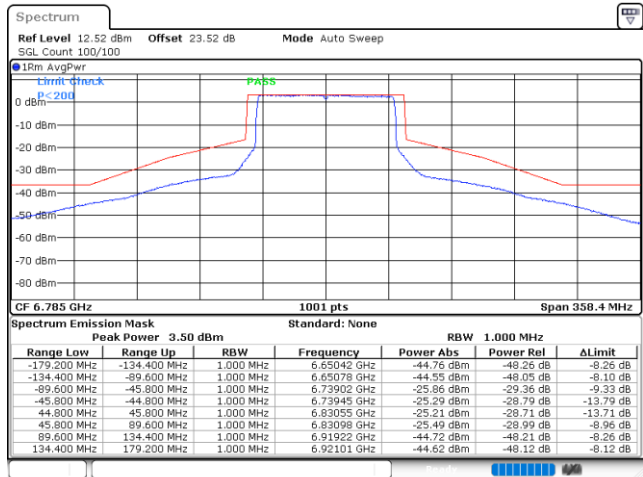
Date: 5.DEC.2023 18:29:25



Plot on Channel 6705MHz



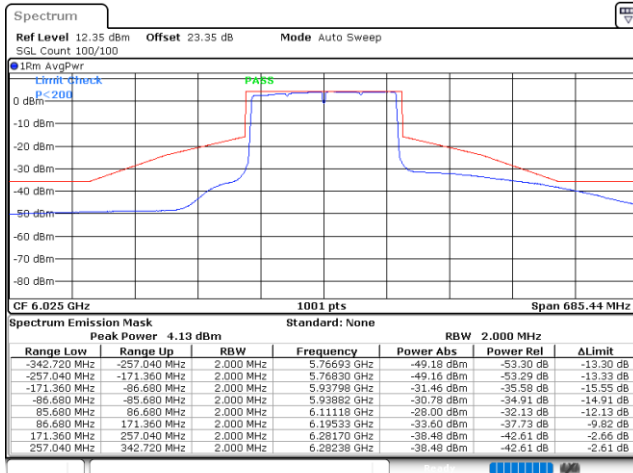
Plot on Channel 6785MHz





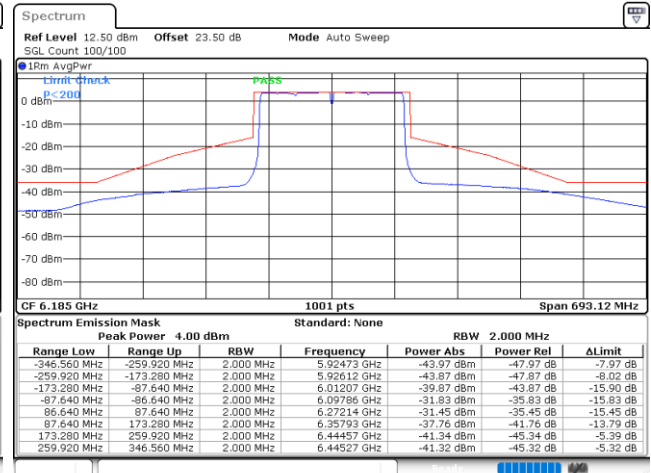
EUT Mode : 802.11be EHT160

Plot on Channel 6025MHz



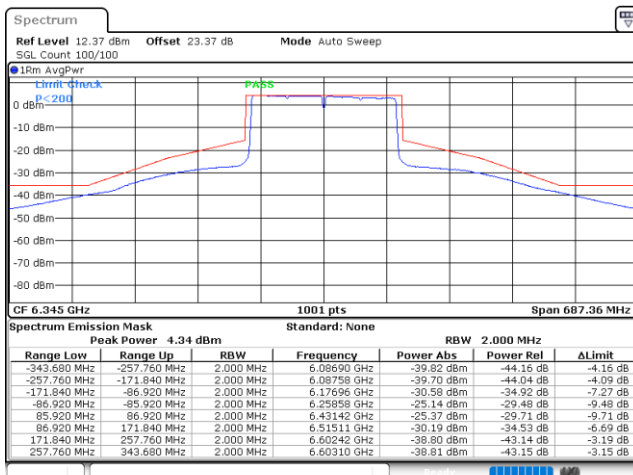
Date: 5.DEC.2023 19:06:20

Plot on Channel 6185MHz



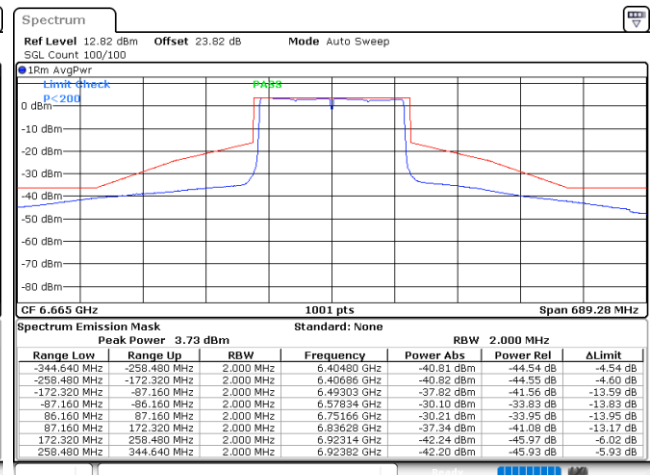
Date: 5.DEC.2023 19:13:15

Plot on Channel 6345MHz



Date: 5.DEC.2023 19:23:16

Plot on Channel 6665MHz

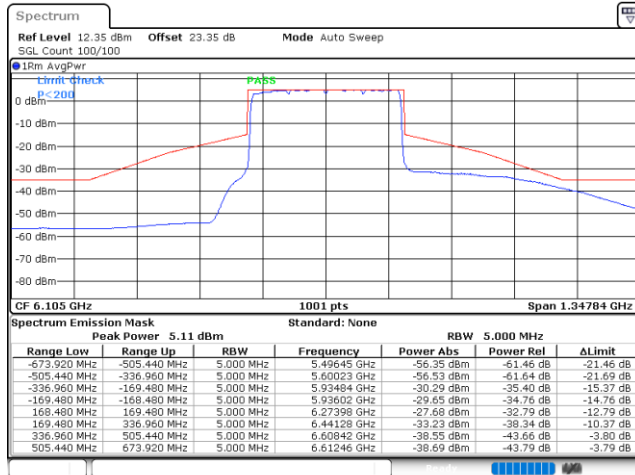


Date: 5.DEC.2023 19:31:14



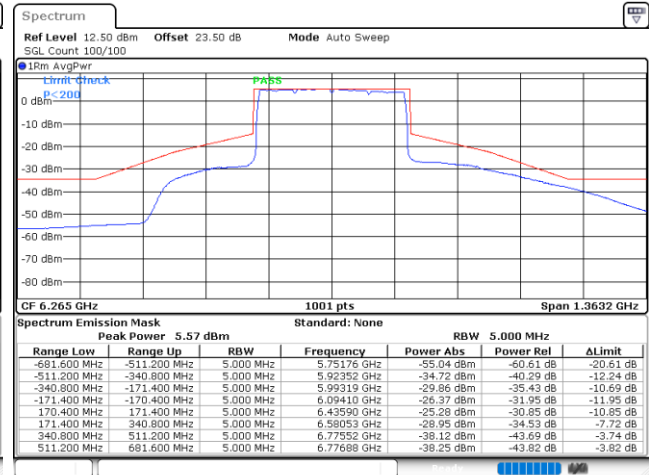
EUT Mode : 802.11be EHT320

Plot on Channel 6105MHz



Date: 5.DEC.2023 19:56:25

Plot on Channel 6265MHz



Date: 5.DEC.2023 20:02:06

3.5 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.5.1 Limit of Unwanted Emissions

- (1) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of -27 dBm/MHz.

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27 (RMS)	68.3
- 7 (Peak)	88.3

According 987594 D02 U-NII 6GHz EMC Measurement v02 section G:

Unwanted emissions outside of restricted bands are measured with a RMS detector.

In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit

- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$

3.5.2 Measuring Instruments

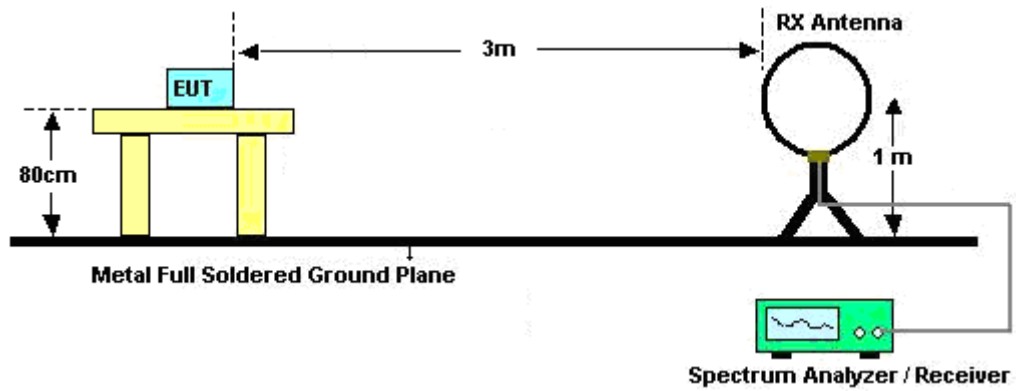
Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

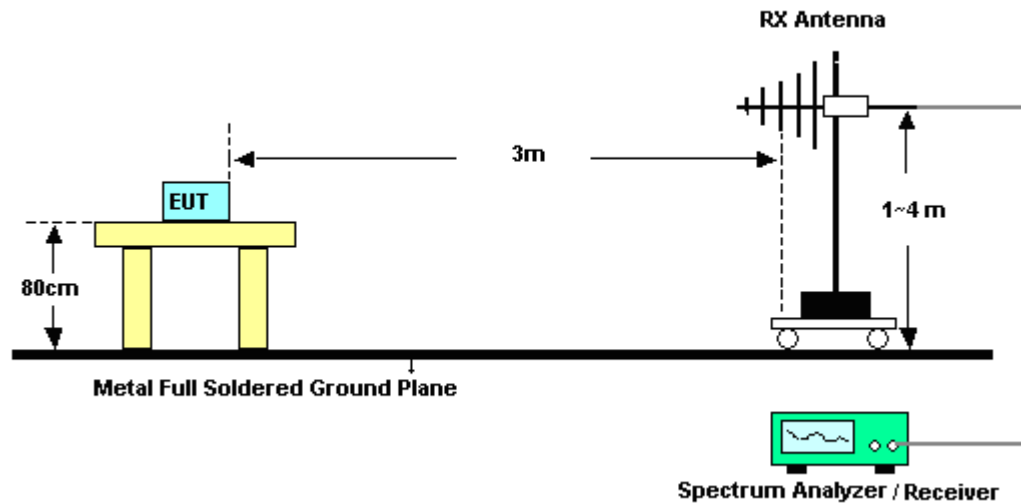
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW $\geq$ 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT is set 3 meters away from the receiving antenna which is mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT is arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-”.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-”.

3.5.4 Test Setup

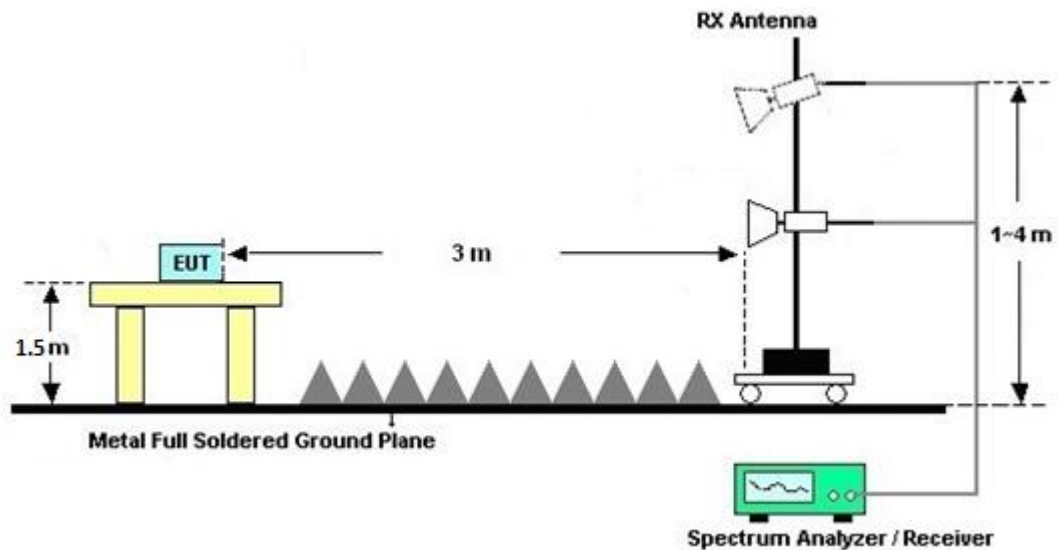
For radiated emissions below 30MHz



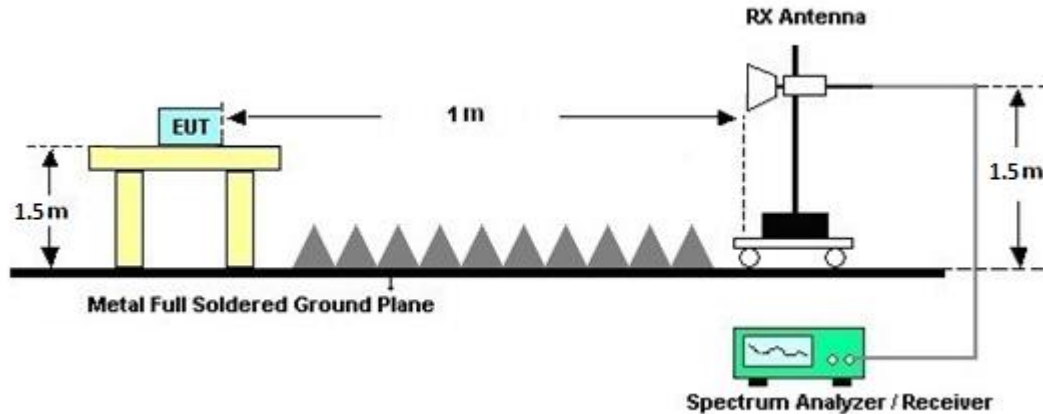
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

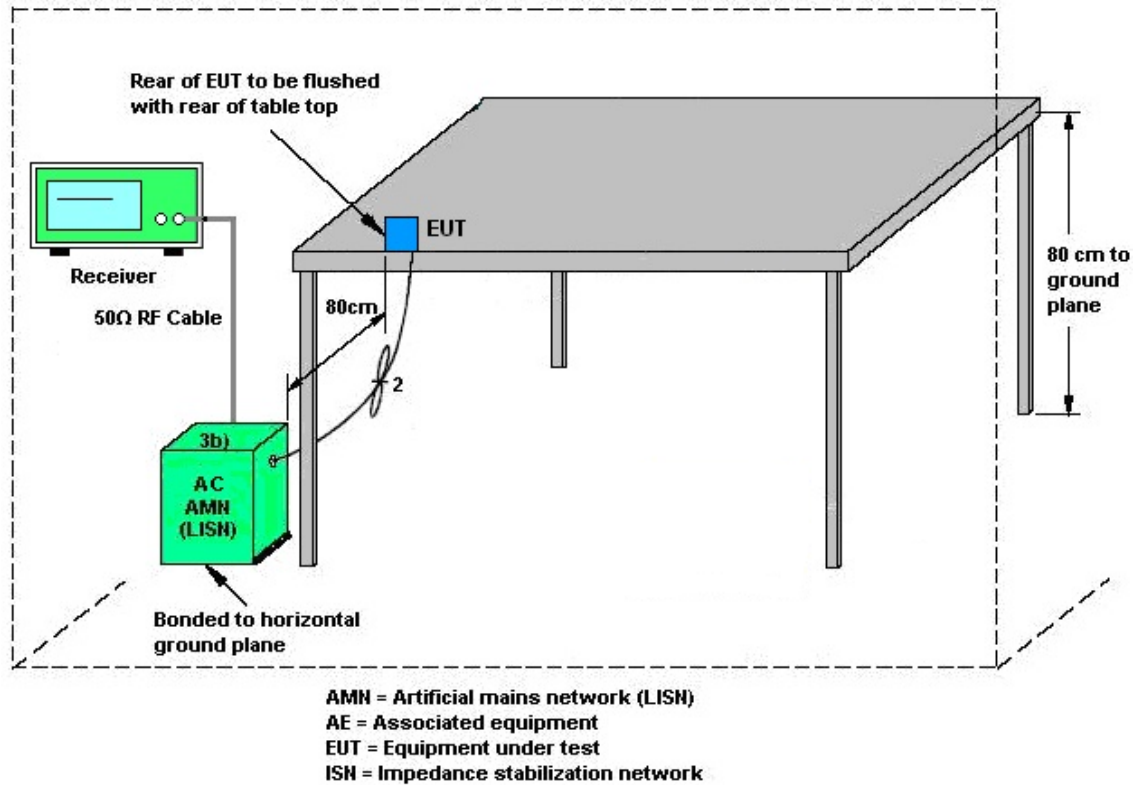
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LISN	TESEQ	NNB51	47415	N/A	Aug. 04, 2023	Feb. 13, 2024	Aug. 03, 2024	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9kHz~7GHz	May 23, 2023	Feb. 13, 2024	May 22, 2024	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F-N00412	N/A	Jun. 05, 2023	Feb. 13, 2024	Jun. 04, 2024	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Feb. 13, 2024	N/A	Conduction (CO01-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Nov. 13, 2023	Nov. 28, 2023~Jan. 18, 2024	Nov. 12, 2024	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02113	1GHz~18GHz	Jun. 07, 2023	Jan. 07, 2024~Jan. 18, 2024	Jun. 06, 2024	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02140	1GHz~18GHz	Jan. 09, 2023	Nov. 28, 2023~Jan. 07, 2024	Jan. 08, 2024	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA9170	00841	18GHz~40GHz	Aug. 22, 2023	Nov. 28, 2023~Jan. 18, 2024	Aug. 21, 2024	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	May 03, 2023	Nov. 28, 2023~Jan. 18, 2024	May 02, 2024	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	May 04, 2023	Nov. 28, 2023~Jan. 18, 2024	May 03, 2024	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18 G-56-01-A70	EC1900252	1GHz~18GHz	May 23, 2023	Nov. 28, 2023~Jan. 18, 2024	May 22, 2024	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz~40GHz	May 04, 2023	Nov. 28, 2023~Jan. 18, 2024	May 03, 2024	Radiation (03CH02-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	804209/2, 802406/2, 802875/2, 802952/2	N/A	Oct. 13, 2023	Nov. 28, 2023~Jan. 18, 2024	Oct. 12, 2024	Radiation (03CH02-CA)
High Pass Filter	WOKEN	WFIL-H8000-2 5000F-01	WR32BNW2B 1	8G~25G	Jun. 05, 2023	Nov. 28, 2023~Jan. 18, 2024	Jun. 04, 2024	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1 272-11000-40 SS	SN2	1.2GHz Low Pass Filter	Jun. 05, 2023	Nov. 28, 2023~Jan. 18, 2024	Jun. 04, 2024	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 30, 2023	Nov. 28, 2023~Jan. 18, 2024	Aug. 29, 2024	Radiation (03CH02-CA)
Controller	ChainTek	EM-1000	060876	NA	N/A	Nov. 28, 2023~Jan. 18, 2024	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Nov. 28, 2023~Jan. 18, 2024	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Nov. 28, 2023~Jan. 18, 2024	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Nov. 28, 2023~Jan. 18, 2024	N/A	Radiation (03CH02-CA)
Hygrometer	Testo	608-H1	45141354	N/A	Jul. 26, 2023	Nov. 09, 2023~Jul. 10, 2024	Jul. 25, 2024	Conducted (TH01-CA)
Power Sensor	DARE!!	RPR3006W	RPR8W-2301 002	10MHz-8GHz	Feb. 08, 2023	Nov. 09, 2023~Feb. 06, 2024	Feb. 07, 2024	Conducted (TH01-CA)
Power Sensor	DARE!!	RPR3006W	RPR8W-2301 001	10MHz-8GHz	Feb. 22, 2024	Feb. 23, 2024~Jul. 10, 2024	Feb. 21, 2025	Conducted (TH01-CA)
Switch Box	EM Electronics	EMSW18	1070902	N/A	Aug. 25, 2023	Nov. 09, 2023~Jul. 10, 2024	Aug. 24, 2024	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	May 22, 2023	Nov. 09, 2023~Apr. 25, 2024	May 21, 2024	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Apr. 24, 2024	Apr. 26, 2023~Jul. 10, 2024	Apr. 23, 2025	Conducted (TH01-CA)
Spectrum Analyzer	R&S	FSW43	104042	2Hz~43GHz	Dec. 22, 2023	Jul. 04, 2024~Jul. 10, 2024	Dec. 21, 2024	Conducted (TH01-CA)

5 Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.7 dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.5 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.9 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.2 dB
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Venkata Kondepudi	Temperature:	17.3~23.9	°C
Test Date:	2023/11/09~2024/07/10	Relative Humidity:	31.4~63	%