

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15 SUBPART E 15.407

Report Reference No......: **MTEB23060046 -R1**

FCC ID..... : **2BBL5-MA01**

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Date of issue.....: **Jun.06,2023**

Representative Laboratory Name.: **Shenzhen Most Technology Service Co., Ltd.**

Address: No.5, 2nd Langshan Road, North District, Hi-tech Industrial Park,
Nanshan, Shenzhen, Guangdong, China.

Applicant's name.....: **Matrix Electronic Technology Co., LTD**

Address: Room 801 Block B, #111 Fengcheng 5th Road Xi'an, Shaanxi,
China

Test specification

Standard: **FCC Part 15 Subpart E 15.407**

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Test item description

Trade Mark: Matrix Audio

Manufacturer.....: **Matrix Electronic Technology Co., LTD**

Model/Type reference.....: mini-i Pro 4

Listed Models: element S, element S2, element X2 Pure, element X2, element X2S, element X3, element M2, element M2S, element M3, element i2, element i2S, element i3, mini-i 4

Ratings: 100V-240V~ 50/60Hz, 100W

Modulation: OFDM

Frequency.....: From 5180MHz-5240MHz

Hardware version: V1.5

Software version: 1.0.1 build008

Result.....: **PASS**

TEST REPORT

Equipment under Test : Music Streamer

Model /Type : mini-i Pro 4

Listed Models : element S, element S2, element X2 Pure, element X2, element X2S, element X3, element M2, element M2S, element M3, element i2, element i2S, element i3, mini-i 4

Remark : Difference in model names

Applicant : Matrix Electronic Technology Co., LTD

Address : Room 801 Block B, #111 Fengcheng 5th Road Xi'an, Shaanxi, China

Manufacturer : Matrix Electronic Technology Co., LTD

Address : Room 801 Block B, #111 Fengcheng 5th Road Xi'an, Shaanxi, China

Test Result:	PASS
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The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1 Revision History

Revision	Issue Date	Revisions	Revised By
00	2023-06-06	Initial Issue	Alisa Luo

2 TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15 Subpart E](#)—Unlicensed National Information Infrastructure Devices

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB789033 D02](#): General UNII Test Procedures New Rules v01r02

3 SUMMARY

3.1 General Remarks

Date of receipt of test sample	:	Jun.01,2023
Testing commenced on	:	Jun.02,2023
Testing concluded on	:	Jun.06,2023

3.2 Product Description

Product Description:	Music Streamer			
Model:	mini-i Pro 4			
Power supply:	100V-240V~ 50/60Hz, 100W			
Testing sample ID:	MTYP01707			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11a 802.11n	802.11n	N/A	N/A
Operation frequency:	5180MHz-5240MHz	5190MHz-5230MHz	N/A	N/A
Modulation:	OFDM	OFDM	N/A	N/A
Antenna type:	FPC antenna			
Antenna gain:	3.91dBi			

3.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	<input type="radio"/> 230V / 50 Hz	<input checked="" type="radio"/> 120V / 60Hz
		<input type="radio"/> 12 V DC	<input type="radio"/> 24 V DC
		<input type="radio"/> Other (specified in blank below)	

3.4 Short description of the Equipment under Test (EUT)

This is a VT 31

For more details, refer to the user's manual of the EUT.

3.5 EUT operation mode

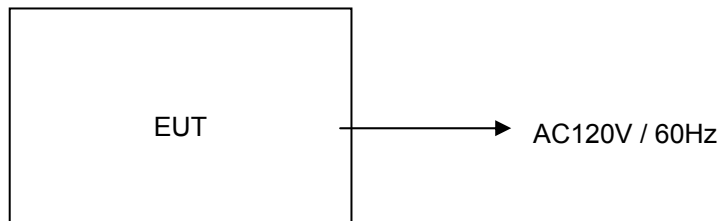
The Applicant provides communication tools software (AT command) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing. All test performed at the low, middle and high of operational frequency range of each mode.

Operation Frequency List WIFI on 5G Band:

Operating band	20MHz		40MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 1 (5150MHz-5250MHz)	36	5180	38	5190
	40	5200		
	44	5220	46	5230
	48	5240		

Note: The line display in grey is those Channels/Frequencies select to test in this report for each operation mode.

3.6 Block Diagram of Test Setup



3.1 Test Item (Equipment Under Test) Description*

Short designation	EUT Name	EUT Description	Serial number	Hardware status	Software status
EUT A					
EUT B					

*: declared by the applicant. According to customers information EUTs A and B are the same devices.

3.2 Auxiliary Equipment (AE) Description

AE short designation	EUT Name (if available)	EUT Description	Serial number (if available)	Software (if used)
AE 1				
AE 2				

3.3 Antenna Information*

Short designation	Antenna Name	Antenna Type	Frequency Range	Serial number	Antenna Peak Gain
Antenna 1	---	FPC antenna	5180MHz-5240MHz	---	3.91dBi
Antenna 2					

*: declared by the applicant.

3.4 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.

3.5 Modifications

No modifications were implemented to meet testing criteria.

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

Shenzhen Most Technology Service Co., Ltd.

No.5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong, China.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

4.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 0031192610

Shenzhen Most Technology Service Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

A2LA-Lab Cert. No.: 6343.01

Shenzhen Most Technology Service Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

4.3 Environmental conditions

Radiated Emission:

Temperature:	23 ° C
Humidity:	48 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing:

Temperature:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

4.4 Test Description

FCC Requirement		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.407(a)	Emission Bandwidth(26dBm Bandwidth)	PASS ^{Note1}
FCC Part 15.407(e)	Minimum Emission Bandwidth(6dBm Bandwidth)	N/A ^{Note2}
FCC Part 15.407(a)	Maximum Conducted Output Power	PASS
FCC Part 15.407(a)	Peak Power Spectral Density	PASS
FCC Part 15.407(g)	Frequency Stability	PASS
FCC Part 15.407(b)	Undesirable emission	PASS
FCC Part 15.407(b)/15.205/15.209	Radiated Emissions	PASS
FCC Part 15.407(h)	Dynamic Frequency Selection	N/A ^{Note 3}
FCC Part 15.203/15.247(b)	Antenna Requirement	PASS

Note 1: Apply to U-NII 1, U-NII 2A, and U-NII 2C band.

Note 2: Apply to U-NII 3 band only.

Note 3: This device not work in DFS band.

Data Rate Used:

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Maximum Conducted Output Power Power Spectral Density Emission Bandwidth(26dBm Bandwidth) Minimum Emission Bandwidth(6dBm Bandwidth) Undesirable emission Frequency Stability	11a/OFDM	54 Mbps
	11n(20MHz) /OFDM	MCS0
	11n(40MHz) /OFDM	MCS0

4.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Most Technology Service Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Most Technology Service Co., Ltd. is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 Db	(1)
Radiated Emission	1~18GHz	4.32 Db	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

4.6 Equipments Used during the Test

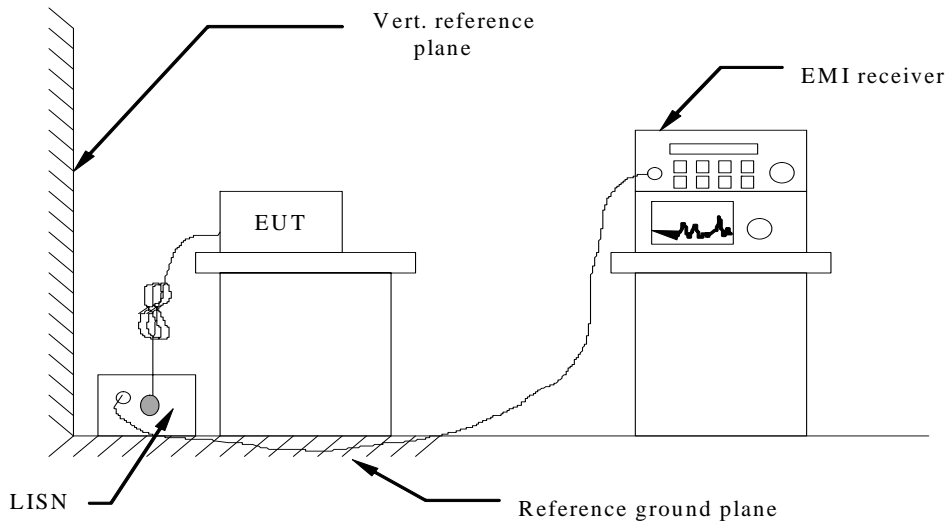
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N.	R&S	ENV216	100093	2023/03/17	1 Year
2	Three-phase artificial power network	Schwarzback Mess	NNLK8129	8129178	2023/03/17	1 Year
3.	Receiver	R&S	ESCI	100492	2023/03/17	1 Year
4	Receiver	R&S	ESPI	101202	2023/03/17	1 Year
5	Spectrum analyzer	Agilent	9020A	MT-E306	2023/03/17	1 Year
6	Bilong Antenna	Sunol Sciences	JB3	A121206	2023/03/17	1 Year
7	Horn antenna	HF Antenna	HF Antenna	MT-E158	2023/03/17	1 Year
8	Loop antenna	Beijing Daze	ZN30900B	/	2023/03/17	1 Year
9	Horn antenna	R&S	OBH100400	26999002	2023/03/17	1 Year
10	Wireless Communication Test Set	R&S	CMW500	/	2023/03/17	1 Year
11	Spectrum analyzer	R&S	FSP	100019	2023/03/17	1 Year
12	High gain antenna	Schwarzbeck	LB-180400KF	MT-E389	2023/03/17	1 Year
13	Preamplifier	Schwarzbeck	BBV 9743	MT-E390	2023/03/17	1 Year
14	Pre-amplifier	EMCI	EMC051845S E	MT-E391	2023/03/17	1 Year
15	Pre-amplifier	Agilent	83051A	MT-E392	2023/03/17	1 Year
16	High pass filter unit	Tonscend	JS0806-F	MT-E393	2023/03/17	1 Year
17	RF Cable(below1GHz)	Times	9kHz-1GHz	MT-E394	2023/03/17	1 Year
18	RF Cable(above 1GHz)	Times	1-40G	MT-E395	2023/03/17	1 Year
19	RF Cable (9KHz-40GHz)	Tonscend	170660	N/A	2023/03/17	1 Year

Note: The Cal.Interval was one year.

5 TEST CONDITIONS AND RESULTS

5.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC 12V power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

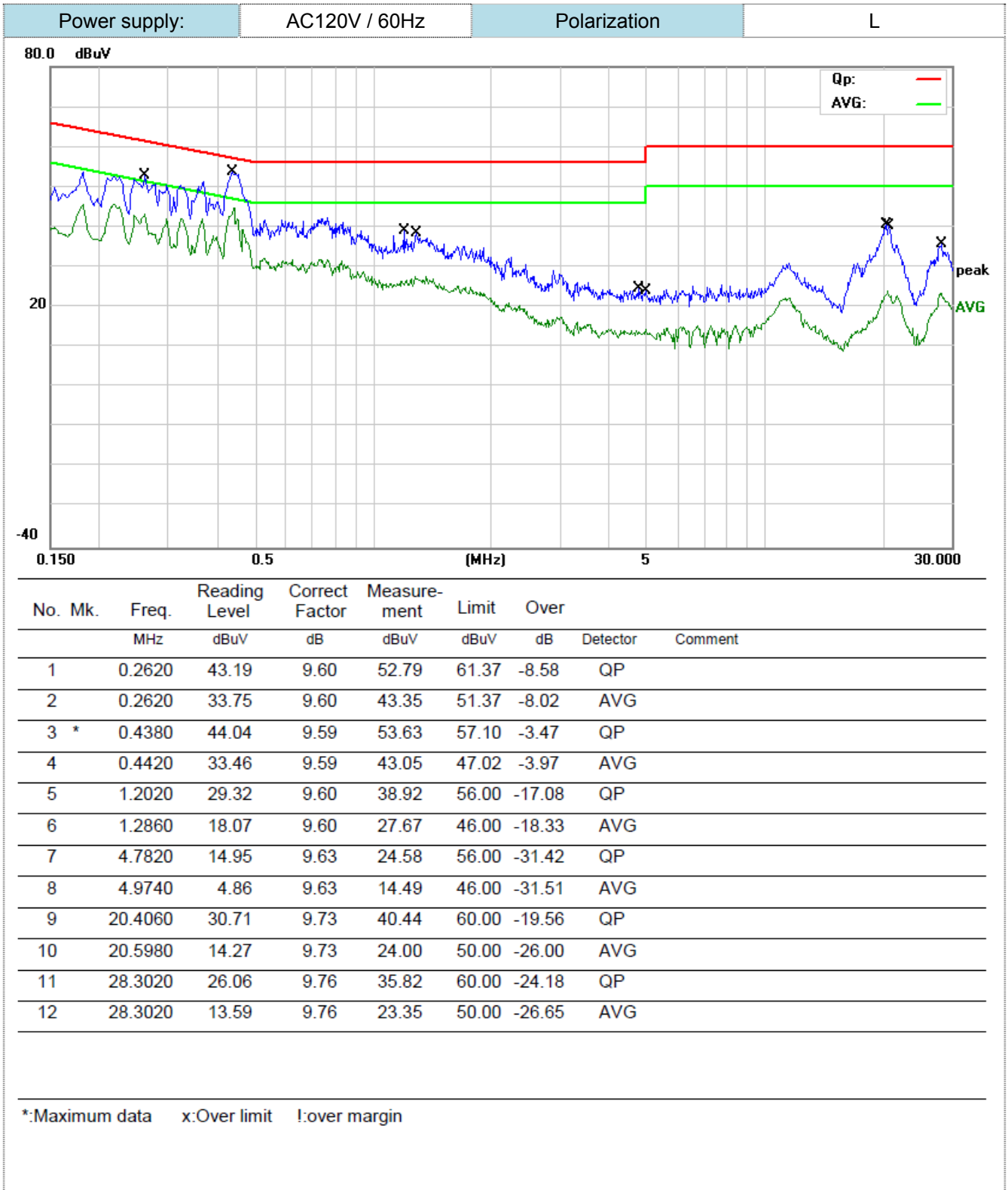
* Decreases with the logarithm of the frequency.

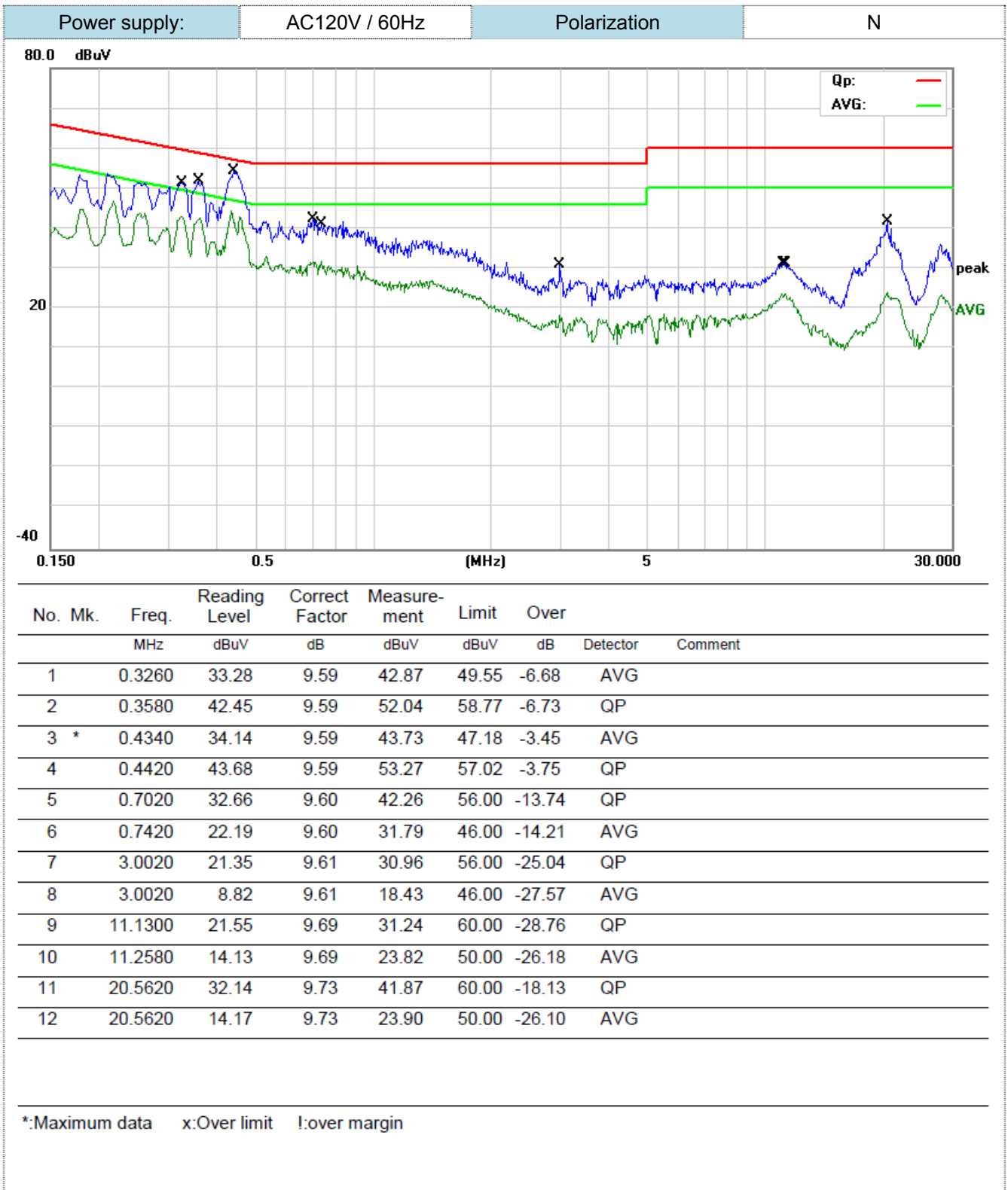
TEST RESULTS

Remark:

1. WIFI 5G modes were test at 802.11a, 802.11n(20), 802.11n(40)(Low, Middle, and High channel); only the worst result of 802.11a Middle Channel was reported as below:

2.





5.2 Radiated Emissions

Limit

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Undesirable emission limits

Requirement	Limit(EIRP)	Limit (Field strength at 3m) ^{Note1}
15.407(b)(1)	PK:-27(dBm/MHz)	PK:68.2(dBµV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)		

Note1: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

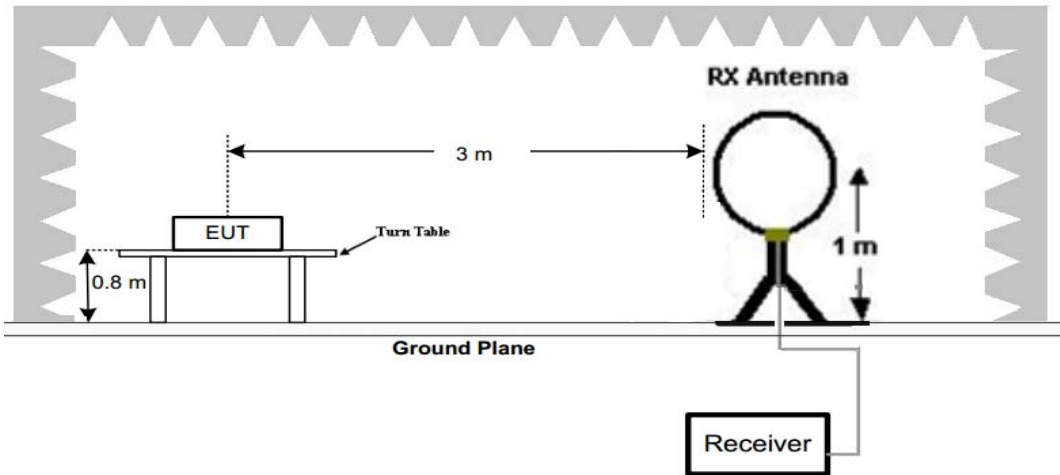
- (5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209
- (6) In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

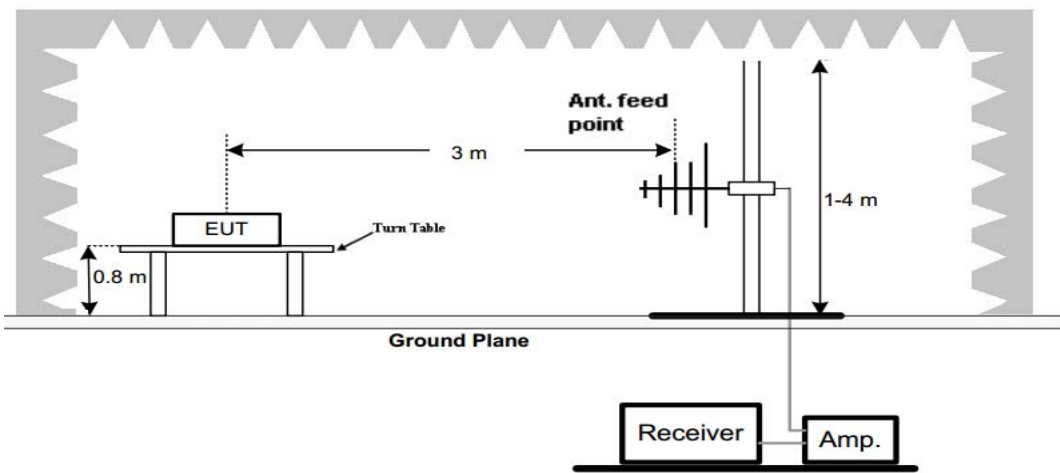
Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

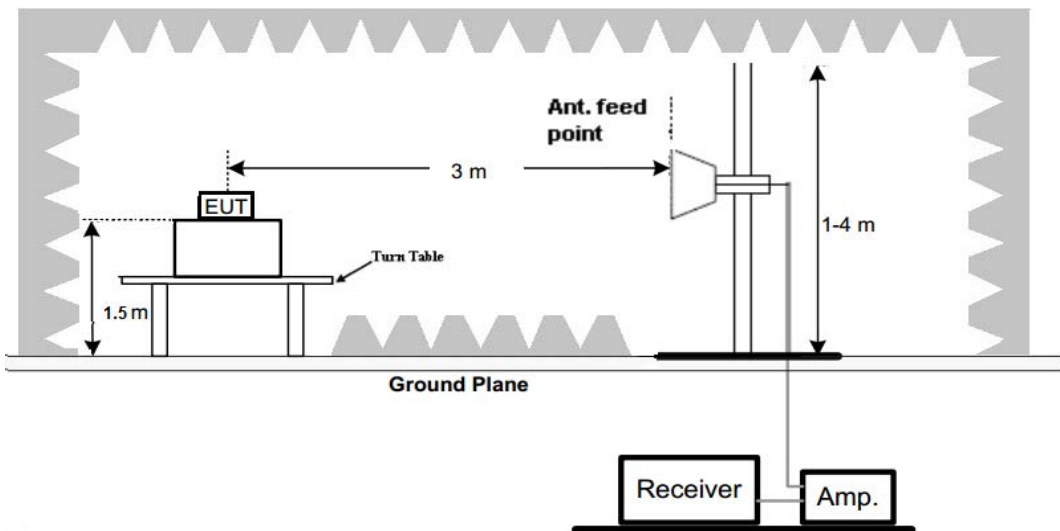
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

- Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
- Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT
- And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- Repeat above procedures until all frequency measurements have been completed.
- Radiated emission test frequency band from 9KHz to 40GHz.
- The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

- Setting test receiver/spectrum as following table states:

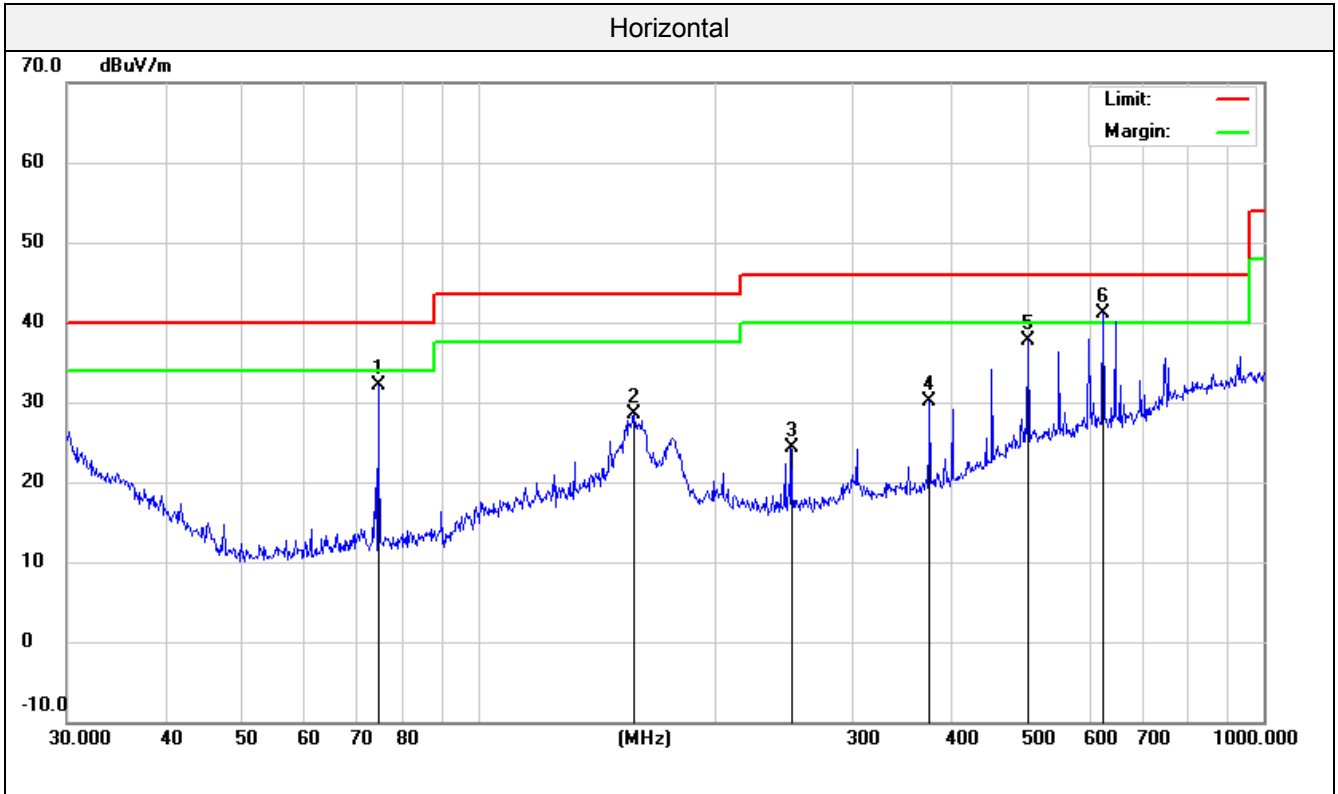
Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz, Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz, Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz, Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

TEST RESULTS

Remark:

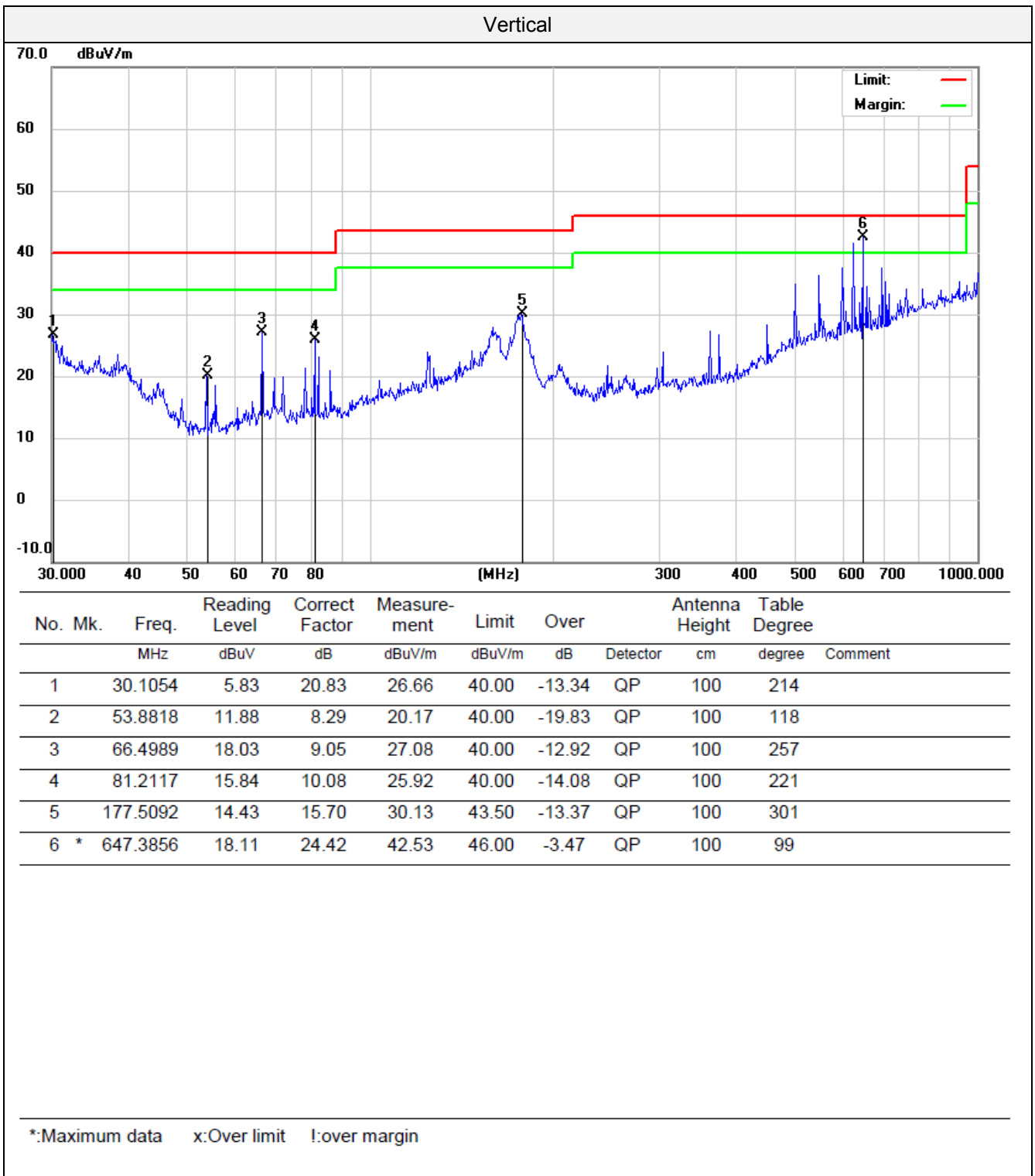
- This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
- All 802.11a / 802.11n (HT20) / 802.11n (HT40) modes have been tested for below 1GHz test, only the worst case 802.11a low channel of U-NII 1 band was recorded.
- All 802.11a / 802.11n (HT20) / 802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11a was recorded.
- Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.
- Remark: Result=Reading value+Factor

For 30MHz-1GHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree
1		74.6569	22.36	9.67	32.03	40.00	-7.97	200	258
2		158.1123	11.10	17.38	28.48	43.50	-15.02	200	321
3		250.3012	10.45	13.81	24.26	46.00	-21.74	200	154
4		375.9385	13.09	16.94	30.03	46.00	-15.97	200	189
5		501.1790	14.91	22.71	37.62	46.00	-8.38	200	178
6	*	625.0780	17.03	24.13	41.16	46.00	-4.84	200	125

*:Maximum data x:Over limit !:over margin



For 1GHz to 40GHz

Note: All 802.11a / 802.11n (HT20) / 802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11a was recorded.

U-NII 1

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
802.11a Mode -5180MHz									
V	3550	55.49	29.03	5.24	36.4	53.36	68.2	14.84	PK
V	3550	42.54	29.03	5.24	36.4	40.41	54	13.59	AV
H	3550	53.18	29.03	5.24	36.4	51.05	68.2	17.15	PK
H	3550	48.94	29.03	5.24	36.4	46.81	54	7.19	AV
V	10360	34.39	39.41	11.45	34.28	50.97	68.2	17.23	PK
V	10360	24.09	39.41	11.45	34.28	40.67	54	13.33	AV
H	10360	36.06	39.41	11.45	34.28	52.64	68.2	15.56	PK
H	10360	27.85	39.41	11.45	34.28	44.43	54	9.57	AV
802.11a Mode -5200MHz									
V	3550	54.73	29.03	5.24	36.4	52.6	68.2	15.6	PK
V	3550	43.21	29.03	5.24	36.4	41.08	54	12.92	AV
H	3550	55.14	29.03	5.24	36.4	53.01	68.2	15.19	PK
H	3550	48.61	29.03	5.24	36.4	46.48	54	7.52	AV
V	10400	36.73	39.42	11.47	34.28	53.34	68.2	14.86	PK
V	10400	27.16	39.42	11.47	34.28	43.77	54	10.23	AV
H	10400	37.24	39.42	11.47	34.28	53.85	68.2	14.35	PK
H	10400	28.55	39.42	11.47	34.28	45.16	54	8.84	AV
802.11b Mode -5240MHz									
V	3550	54.23	29.03	5.24	36.4	52.1	68.2	16.1	PK
V	3550	43.01	29.03	5.24	36.4	40.88	54	13.12	AV
H	3550	53.47	29.03	5.24	36.4	51.34	68.2	16.86	PK
H	3550	48.76	29.03	5.24	36.4	46.63	54	7.37	AV
V	10480	34.86	39.43	11.47	34.28	51.48	68.2	16.72	PK
V	10480	25.87	39.43	11.47	34.28	42.49	54	11.51	AV
H	10480	36.59	39.43	11.47	34.28	53.21	68.2	14.99	PK
H	10480	29	39.43	11.47	34.28	45.62	54	8.38	AV

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

Radiated Band Edge Test:

All 802.11a / 802.11n (HT20) / 802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11a was recorded.

U-NII 1

Polar (H/V)	Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
802.11a									
V	5150	56.28	31.22	7.62	36.5	58.62	74	15.38	PK
V	5150	38.33	31.22	7.62	36.5	40.67	54	13.33	AV
H	5150	53.97	31.22	7.62	36.5	56.31	74	17.69	PK
H	5150	41.85	31.22	7.62	36.5	44.19	54	9.81	AV
V	5350	54.62	31.56	7.83	35.82	58.19	74	15.81	PK
V	5350	40.03	31.56	7.83	35.82	43.6	54	10.4	AV
H	5350	53.52	31.56	7.83	35.82	57.09	74	16.91	PK
H	5350	41.21	31.56	7.83	35.82	44.78	54	9.22	AV

5.3 Conduction spurious emission

Limit

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

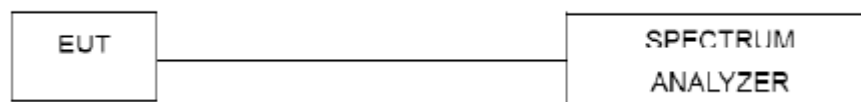
Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

Test Configuration



TEST RESULTS

See APPENDIX V

5.4 Maximum Conducted Average Output Power

Limit

For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

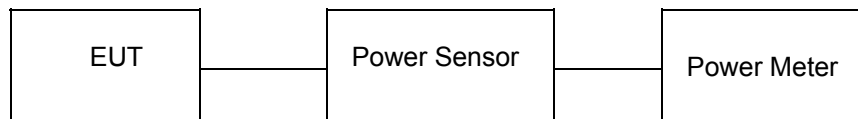
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration



Test Results

See APPENDIX II

5.5 Power Spectral Density

Limit

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. ^{note1}

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. ^{note1}

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. ^{note1}

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. ^{note1}

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. ^{note1, note2}

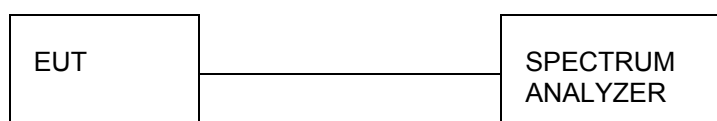
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 1MHz for U-NII 1, U-NII 2A, U-NII C band and 510KHz for U-NII 3 band.
3. Set the VBW $\geq 3 \times$ RBW.
4. Set the span to encompass the entire EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.

Test Configuration



Test Results

See APPENDIX VII

5.6 Emission Bandwidth (26dBm Bandwidth)

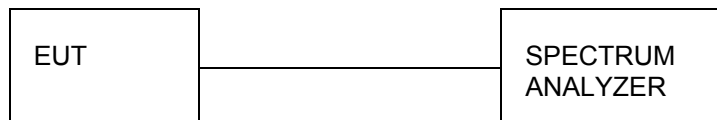
Limit

N/A

Test Procedure

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW.
2. Set the video bandwidth (VBW) > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. 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 %.

Test Configuration



Test Results

See APPENDIX IV

5.7 Minimum Emission Bandwidth (6dBm Bandwidth)

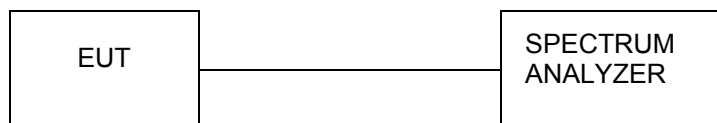
Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Configuration



Test Results

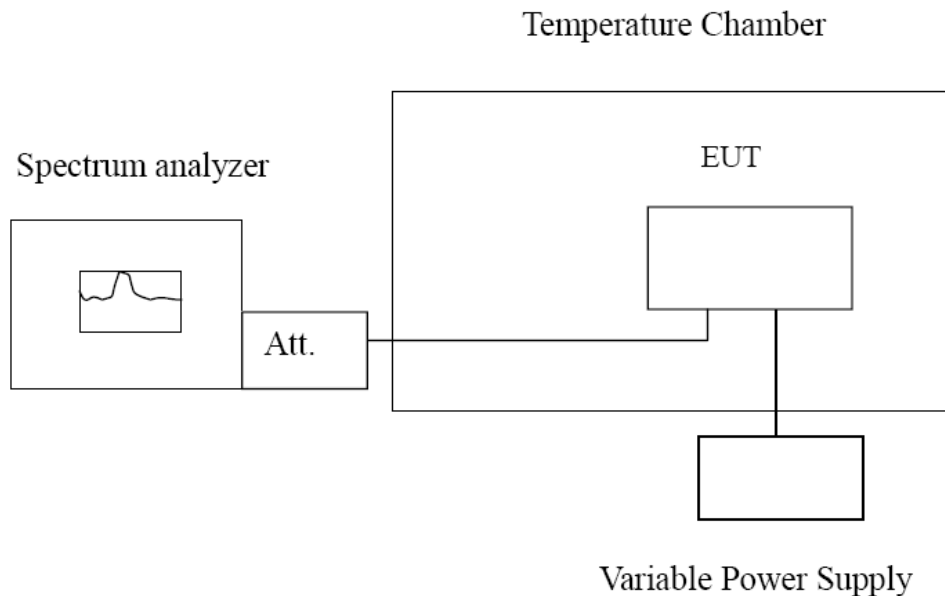
See APPENDIX III

5.8 Frequency Stability

LIMIT

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

TEST CONFIGURATION



TEST PROCEDURE

Frequency Stability under Temperature Variations:

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

Frequency Stability under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.

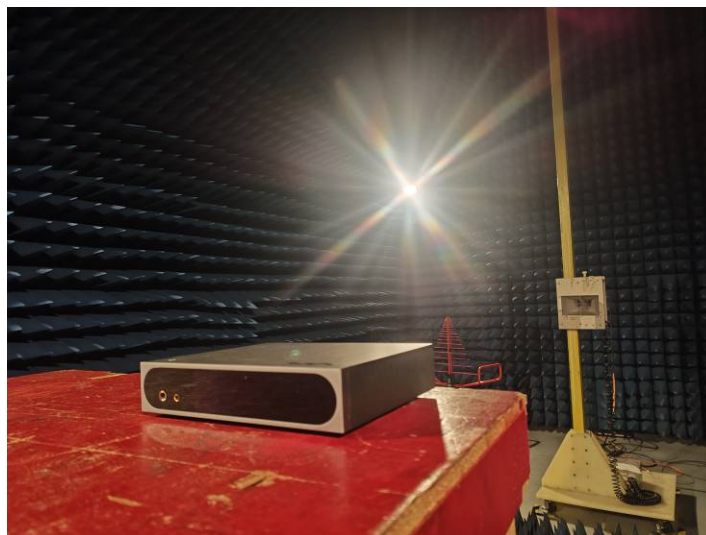
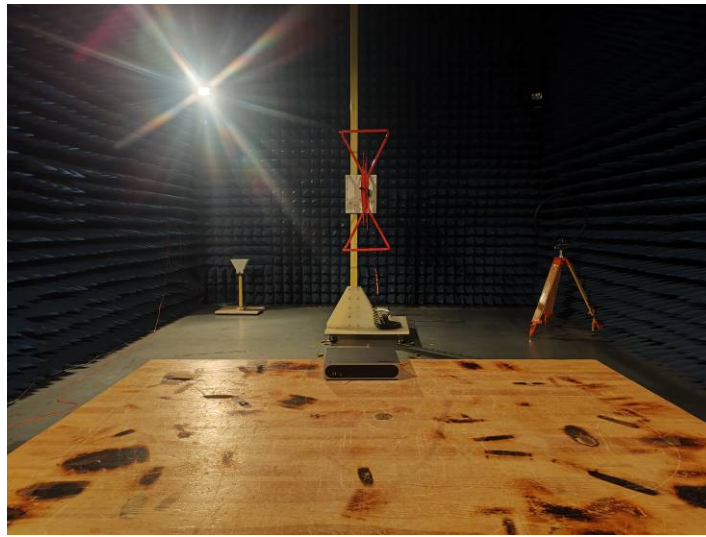
TEST RESULTS

See APPENDIX I

5.9 Duty Cycle Information

See APPENDIX VI

6 Test Setup Photos of the EUT



7 Photos of the EUT

see photo report.

APPENDIX I.Frequency Stability

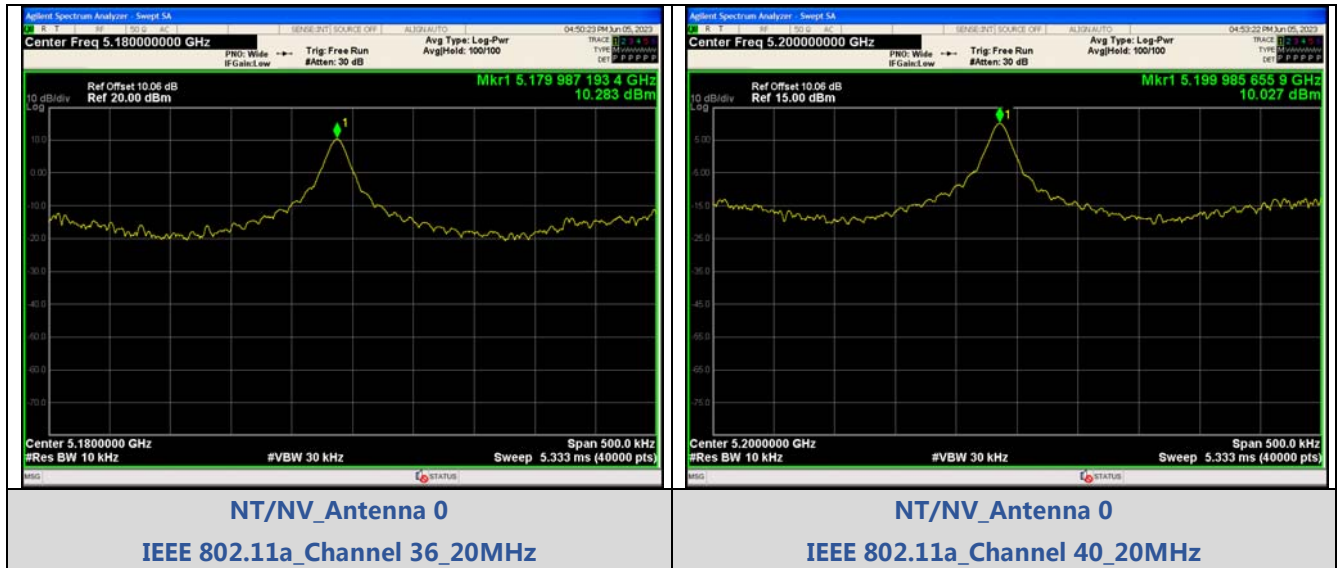
Test Result

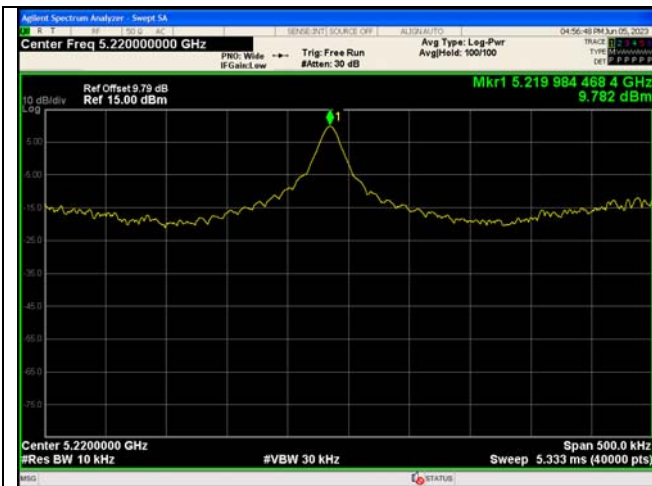
Condition	Mode	Ch	Antenna	Modulation Signal	Center Frequency (MHz)	Calculated Value of Center Frequency(MHz)	Result (ppm)	Limit (ppm)	State
NT/NV	IEEE 802.11a	36	3.91	False	5180.0	5179.987193	-2.47	Within authorized band	PASS
		40		False	5200.0	5199.985656	-2.76		PASS
		44		False	5220.0	5219.984468	-2.98		PASS
	IEEE 802.11n_20	36		False	5180.0	5179.984043	-3.08		PASS
		40		False	5200.0	5199.983931	-3.09		PASS
		44		False	5220.0	5219.983131	-3.23		PASS
	IEEE 802.11n_40	38		False	5190.0	5189.984018	-3.08		PASS
		46		False	5230.0	5229.984418	-2.98		PASS

Test Graphs

NT/NV

IEEE 802.11a

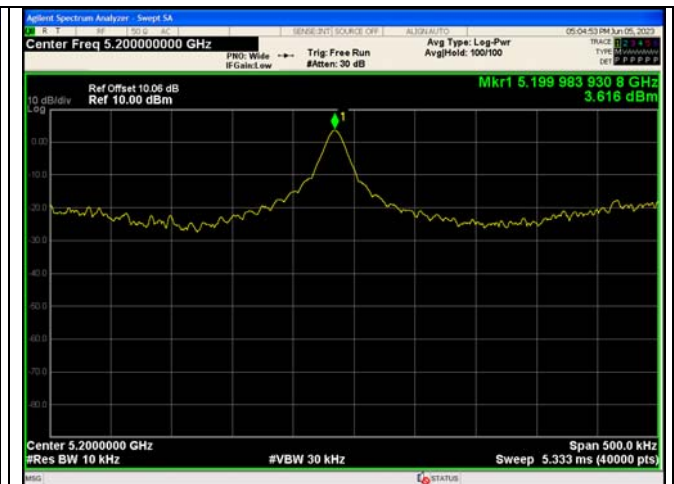




Void

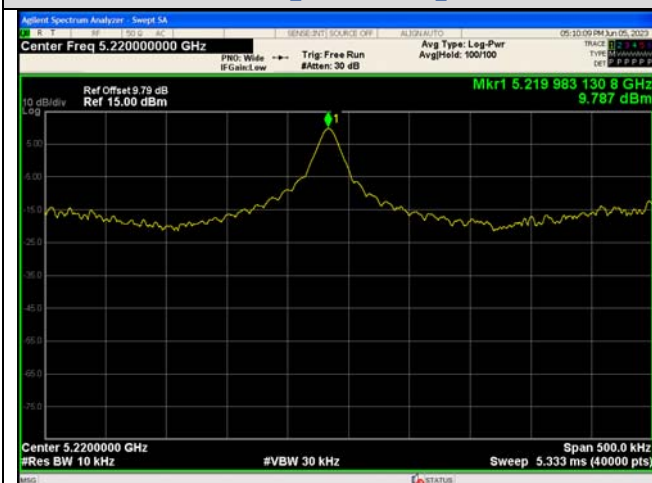
NT/NV_Antenna 0
IEEE 802.11a_Channel 44_20MHz

IEEE 802.11n_20



NT/NV_Antenna 0
IEEE 802.11n_Channel 36_20MHz

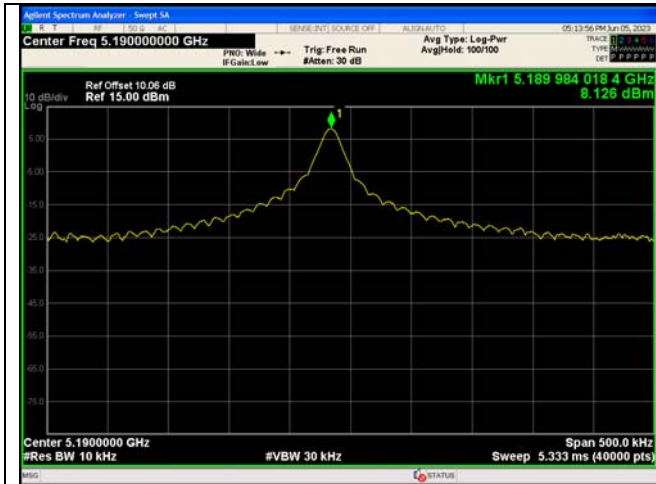
NT/NV_Antenna 0
IEEE 802.11n_Channel 40_20MHz



Void

NT/NV_Antenna 0
IEEE 802.11n_Channel 44_20MHz

IEEE 802.11n_40



NT/NV_Antenna 0
IEEE 802.11n_Channel 38_40MHz



NT/NV_Antenna 0
IEEE 802.11n_Channel 46_40MHz

APPENDIX II. Conducted Peak Output Power

Conducted peak output power

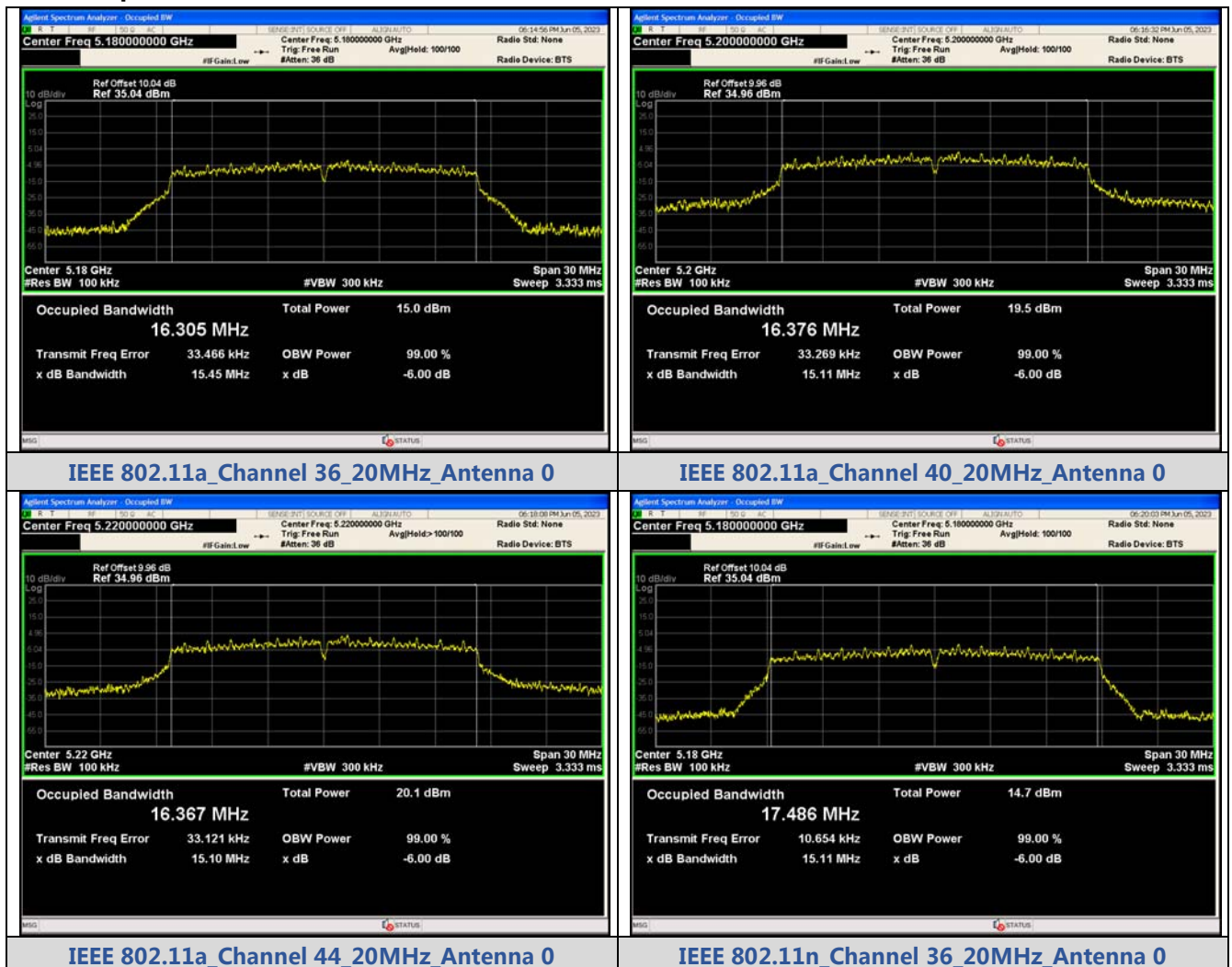
Mode	Channel	Ant. 0 (dBm)	Limit (dBm)	Result
IEEE 802.11a	36	11.171	24	PASS
	40	11.507	24	PASS
	44	11.418	24	PASS
IEEE 802.11n_20	36	11.193	24	PASS
	40	5.803	24	PASS
	44	11.390	24	PASS
IEEE 802.11n_40	38	10.758	24	PASS
	46	11.409	24	PASS

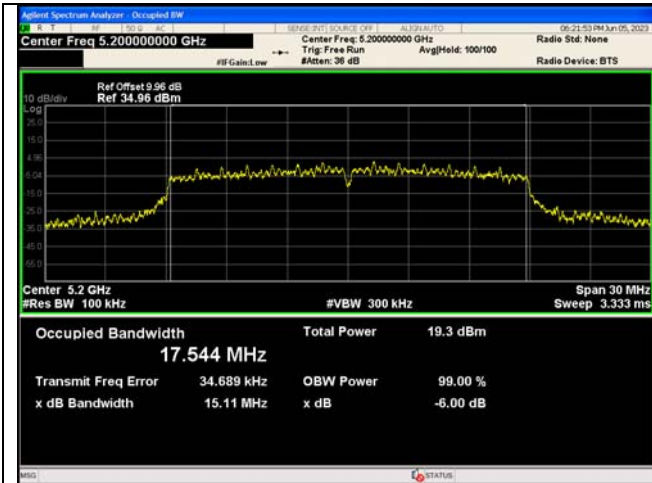
APPENDIX III.6dB Bandwidth

Test Result

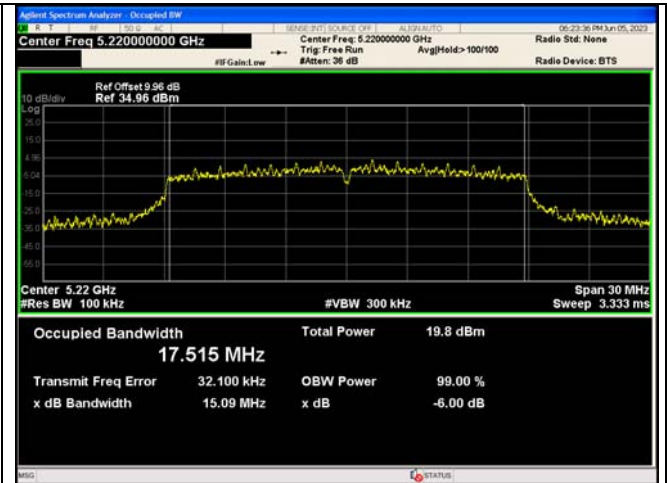
Mode	Channel	Ant.	Center Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
IEEE 802.11a	36	3.91	5180	15.45	0.5	PASS
	40		5200	15.11		PASS
	44		5220	15.10		PASS
IEEE 802.11n_20	36		5180	15.11		PASS
	40		5200	15.11		PASS
	44		5220	15.09		PASS
IEEE 802.11n_40	38		5190	35.05		PASS
	46		5230	35.07		PASS

Test Graphs

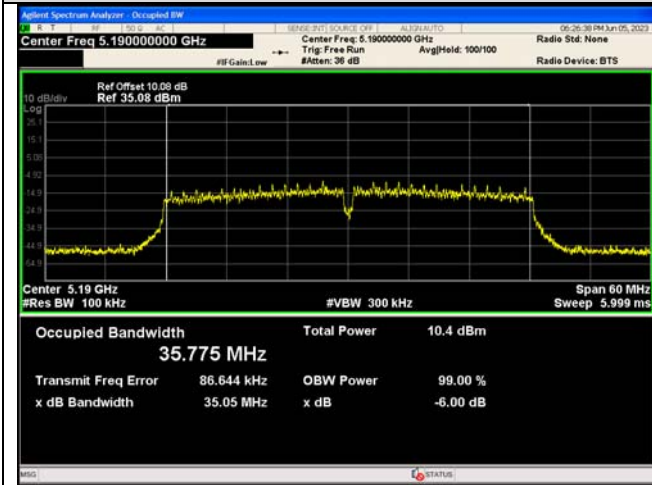




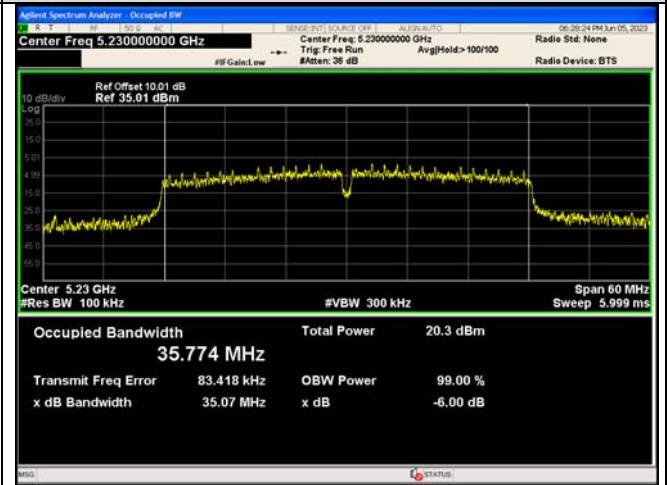
IEEE 802.11n_Channel 40_20MHz_Antenna 0



IEEE 802.11n_Channel 44_20MHz_Antenna 0



IEEE 802.11n_Channel 38_40MHz_Antenna 0



IEEE 802.11n_Channel 46_40MHz_Antenna 0

APPENDIX IV.26dB Bandwidth

Test Result

Mode	Channel	Ant.	Center Frequency (MHz)	26 dB Bandwidth (MHz)	RBW/EBW
IEEE 802.11a	36	3.91	5180	16.95	1.14
	40		5200	16.90	1.15
	44		5220	16.96	1.15
IEEE 802.11n_20	36		5180	18.17	1.13
	40		5200	18.17	1.13
	44		5220	18.03	1.14
IEEE 802.11n_40	38		5190	37.33	1.06
	46		5230	38.59	1.06

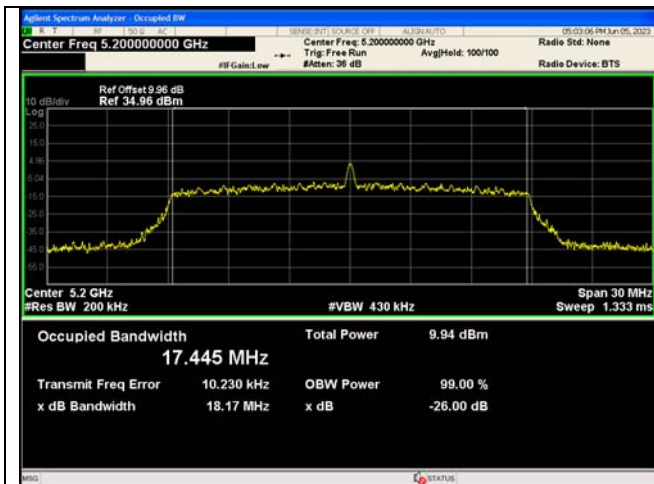
Test Graphs

IEEE 802.11a Channel 36 20MHz Antenna 0

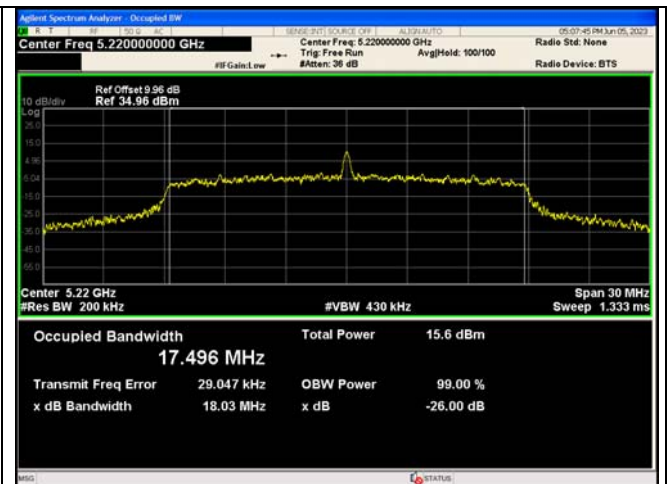
IEEE 802.11a Channel 40 20MHz Antenna 0

IEEE 802.11a Channel 44 20MHz Antenna 0

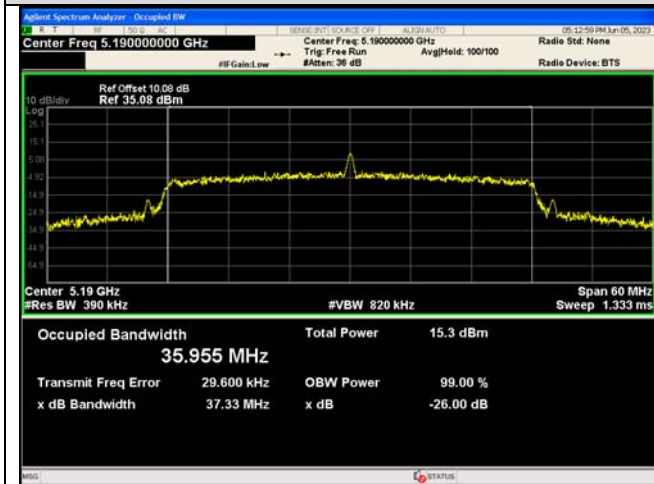
IEEE 802.11n Channel 36 20MHz Antenna 0



IEEE 802.11n_Channel 40_20MHz_Antenna 0



IEEE 802.11n_Channel 44_20MHz_Antenna 0



IEEE 802.11n_Channel 38_40MHz_Antenna 0



IEEE 802.11n_Channel 46_40MHz_Antenna 0

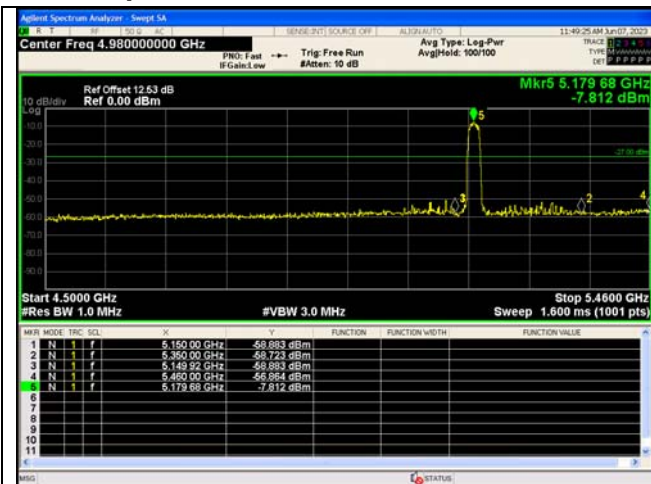
APPENDIX V. Conducted Out Of Band Emission

Test Result

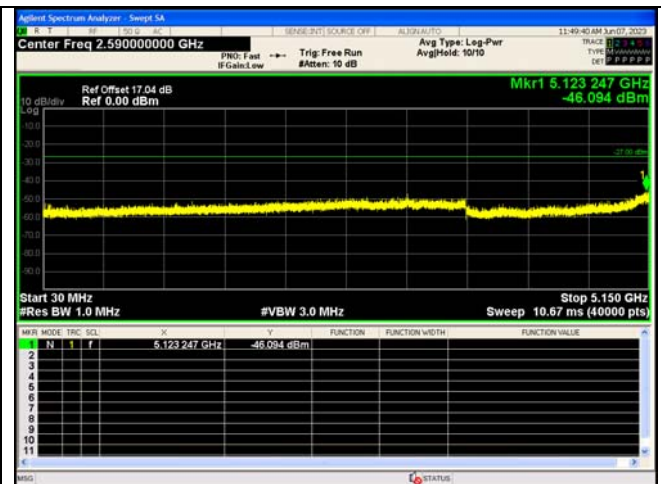
Mode	Channel	Ant.	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
IEEE 802.11a	36	3.91	5123.25	-46.094	-27	-19.090	PASS
			5149.92	-58.883	-27	-32	PASS
			5150.00	-58.883	-27	-32	PASS
			5350.00	-58.723	-27	-32	PASS
			5460.00	-56.864	-27	-30	PASS
			24938.1	-36.414	-27	-9.410	PASS
	40		2477.29	-41.750	-27	-14.750	PASS
			5148.96	-55.076	-27	-28	PASS
			5150.00	-58.509	-27	-32	PASS
			5350.00	-55.612	-27	-29	PASS
			5459.04	-54.331	-27	-27	PASS
			24986.2	-37.175	-27	-10.170	PASS
	48		2407.66	-46.836	-27	-19.840	PASS
			5148.96	-57.826	-27	-31	PASS
			5150.00	-58.280	-27	-31	PASS
			5350.00	-56.989	-27	-30	PASS
			5460.00	-55.451	-27	-28	PASS
			24876.2	-37.200	-27	-10.200	PASS
IEEE 802.11n_20	36	5146.08	-58.219	-27	-31	PASS	
		5148.85	-46.476	-27	-19.480	PASS	
		5150.00	-58.311	-27	-31	PASS	
		5350.00	-58.480	-27	-31	PASS	
		5460.00	-56.581	-27	-30	PASS	
		24975.9	-35.986	-27	-8.990	PASS	
	40	2410.48	-44.665	-27	-17.660	PASS	
		5059.68	-55.090	-27	-28	PASS	
		5150.00	-55.102	-27	-28	PASS	
		5350.00	-55.555	-27	-29	PASS	
		5458.08	-55.545	-27	-29	PASS	
		24835.9	-37.017	-27	-10.020	PASS	
	48	2479.73	-46.502	-27	-19.500	PASS	
		5149.92	-59.657	-27	-33	PASS	
		5150.00	-59.658	-27	-33	PASS	
		5350.00	-56.538	-27	-30	PASS	
		5460.00	-55.744	-27	-29	PASS	
		24916.0	-35.857	-27	-8.860	PASS	

IEEE 802.11n_40	38	2456.68	-42.350	-27	-15.350	PASS
		5148.00	-57.404	-27	-30	PASS
		5150.00	-57.429	-27	-30	PASS
		5350.00	-57.445	-27	-30	PASS
		5458.08	-56.695	-27	-30	PASS
	24958.2	-37.294	-27	-10.290	PASS	
	46	2431.21	-45.616	-27	-18.620	PASS
		5149.92	-58.247	-27	-31	PASS
		5150.00	-58.247	-27	-31	PASS
		5350.00	-59.596	-27	-33	PASS
5460.00		-54.528	-27	-28	PASS	
		24906.7	-36.994	-27	-9.990	PASS

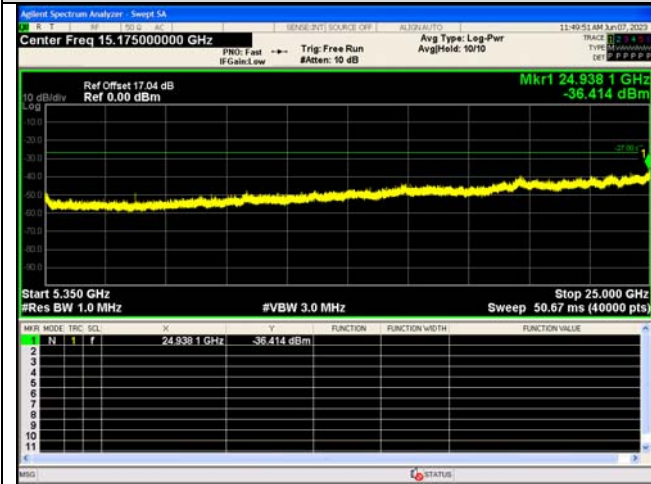
Test Graphs



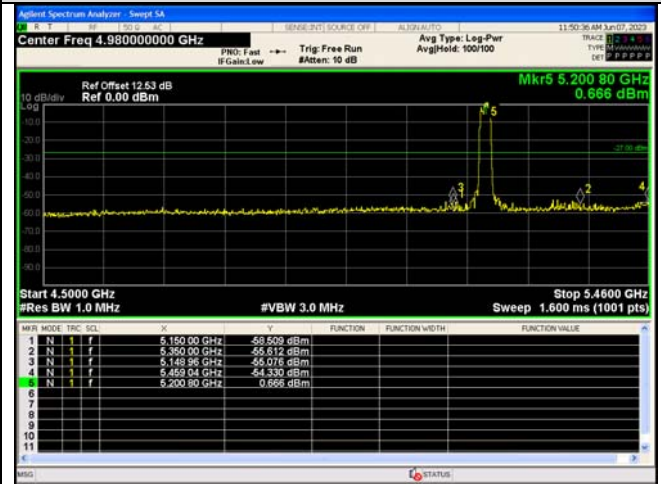
Out Of Band Emission
IEEE 802.11a_Channel 36_20MHz_Antenna 0



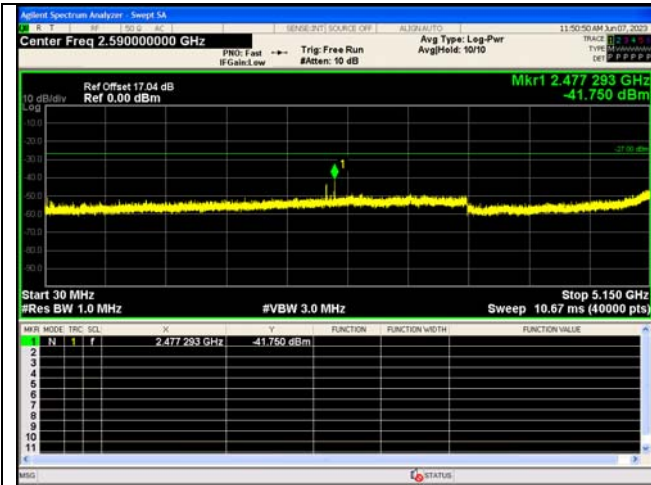
Spurious Emission:30.0~5150 MHz
IEEE 802.11a_Channel 36_20MHz_Antenna 0



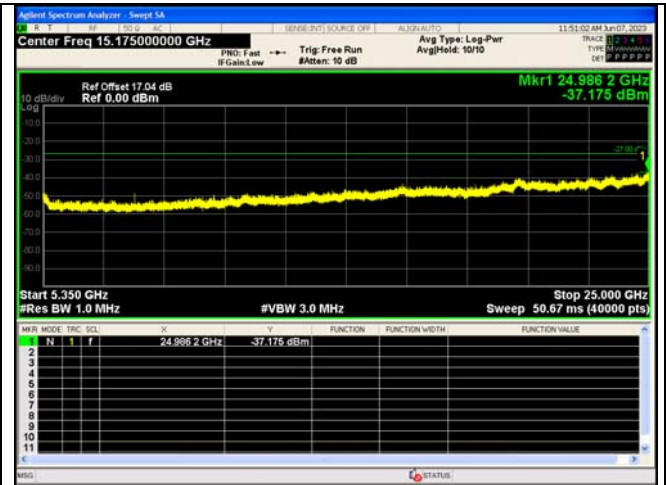
Spurious Emission:5350~25000.0 MHz
IEEE 802.11a_Channel 36_20MHz_Antenna 0



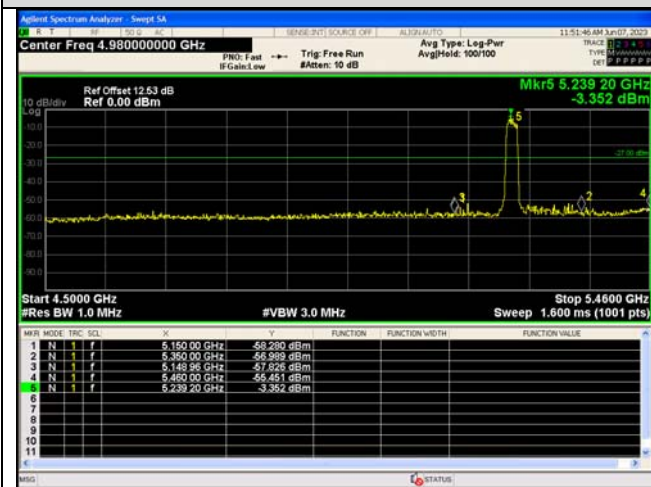
Out Of Band Emission
IEEE 802.11a_Channel 40_20MHz_Antenna 0



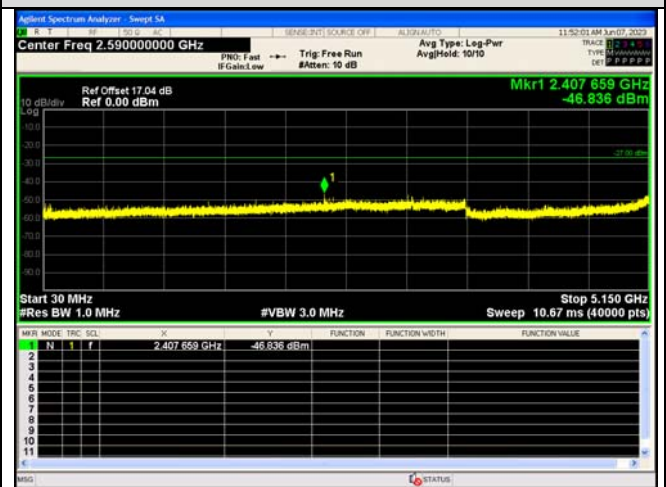
Spurious Emission:30.0~5150 MHz
 IEEE 802.11a_Channel 40_20MHz_Antenna 0



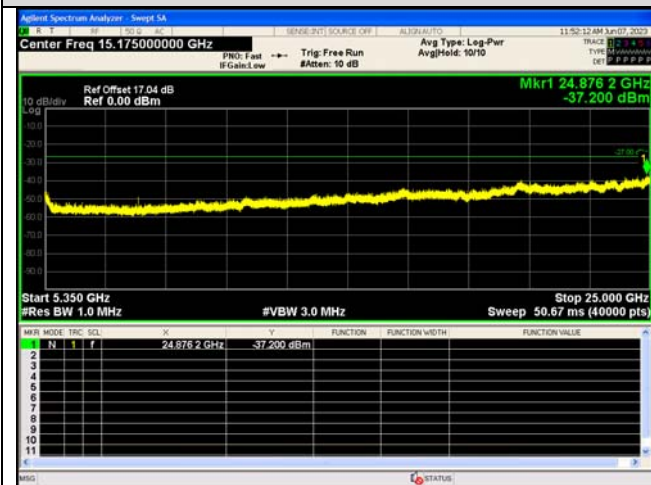
Spurious Emission:5350~25000.0 MHz
 IEEE 802.11a_Channel 40_20MHz_Antenna 0



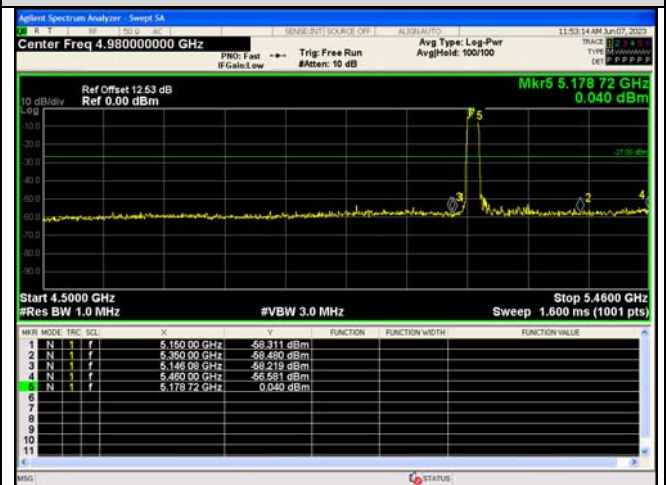
Out Of Band Emission
 IEEE 802.11a_Channel 48_20MHz_Antenna 0



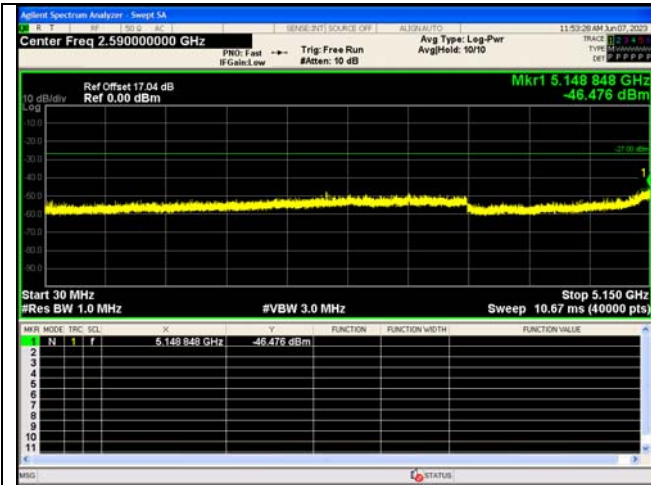
Spurious Emission:30.0~5150 MHz
 IEEE 802.11a_Channel 48_20MHz_Antenna 0



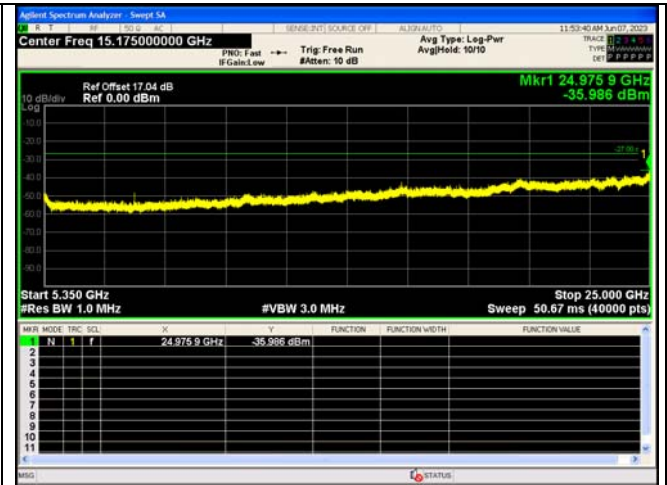
Spurious Emission:5350~25000.0 MHz
 IEEE 802.11a_Channel 48_20MHz_Antenna 0



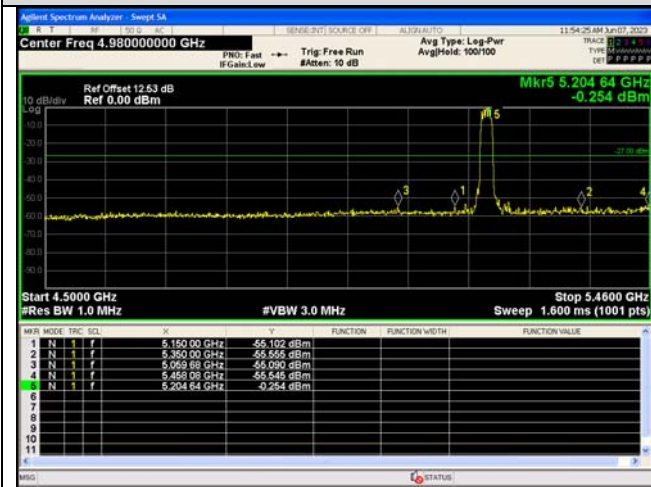
Out Of Band Emission
 IEEE 802.11n_Channel 36_20MHz_Antenna 0



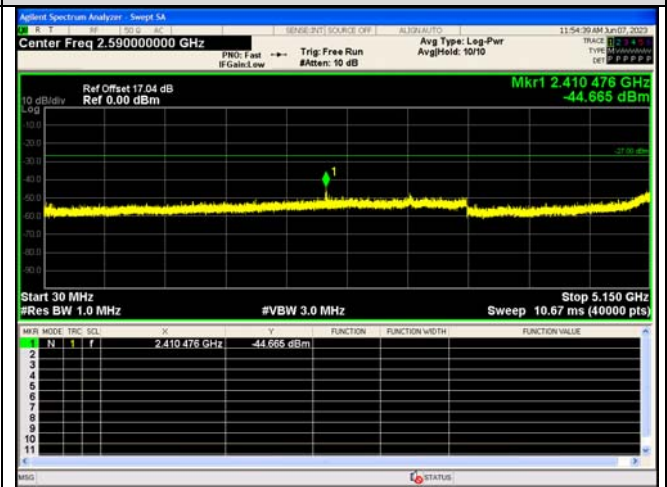
Spurious Emission:30.0~5150 MHz
IEEE 802.11n_Channel 36_20MHz_Antenna 0



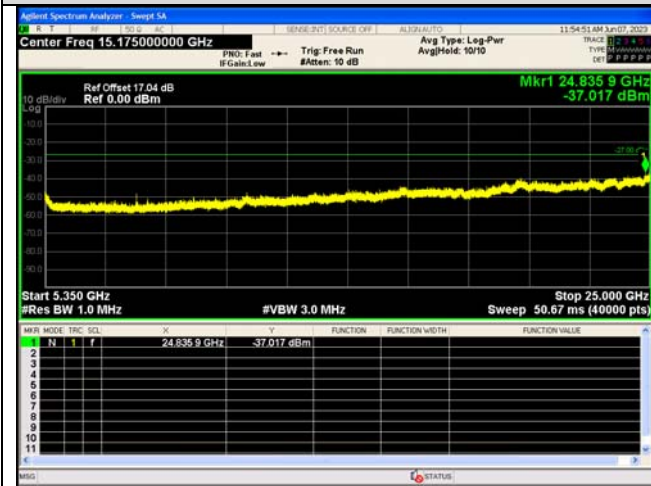
Spurious Emission:5350~25000.0 MHz
IEEE 802.11n_Channel 36_20MHz_Antenna 0



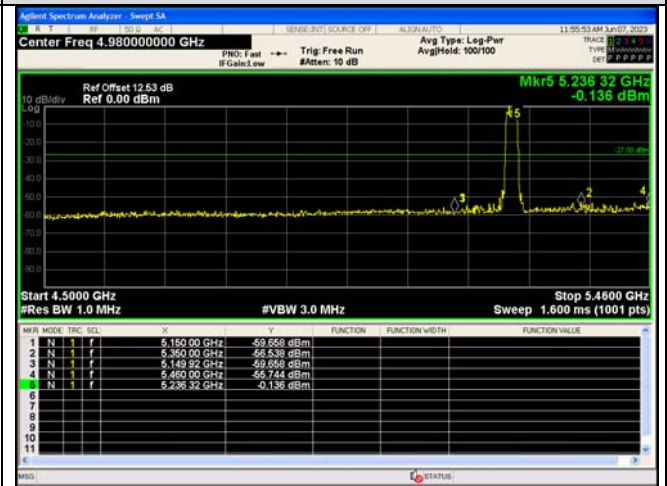
Out Of Band Emission
IEEE 802.11n_Channel 40_20MHz_Antenna 0



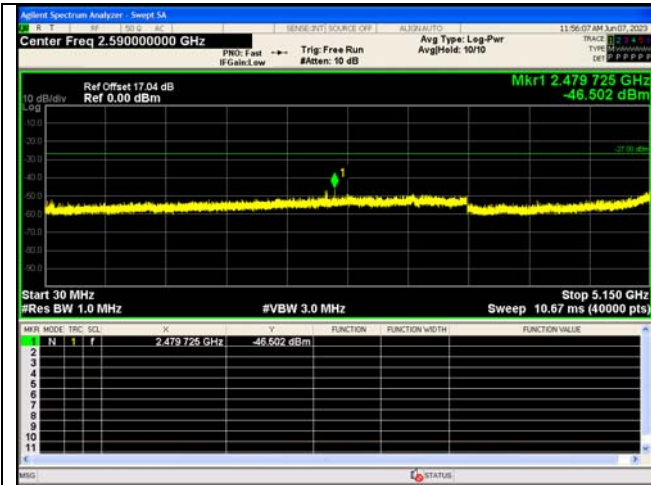
Spurious Emission:30.0~5150 MHz
IEEE 802.11n_Channel 40_20MHz_Antenna 0



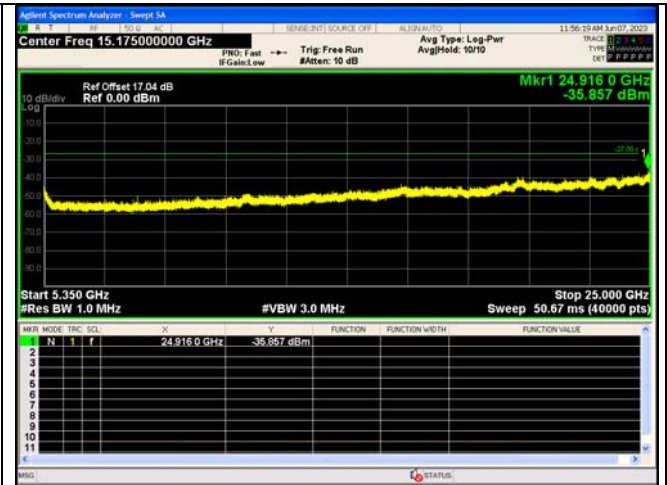
Spurious Emission:5350~25000.0 MHz
IEEE 802.11n_Channel 40_20MHz_Antenna 0



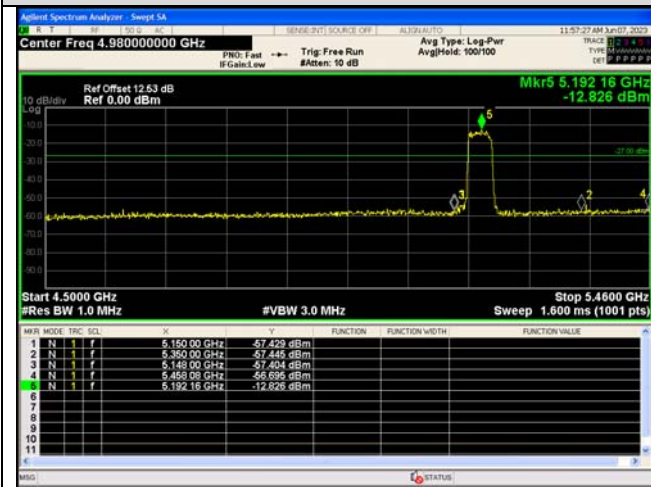
Out Of Band Emission
IEEE 802.11n_Channel 48_20MHz_Antenna 0



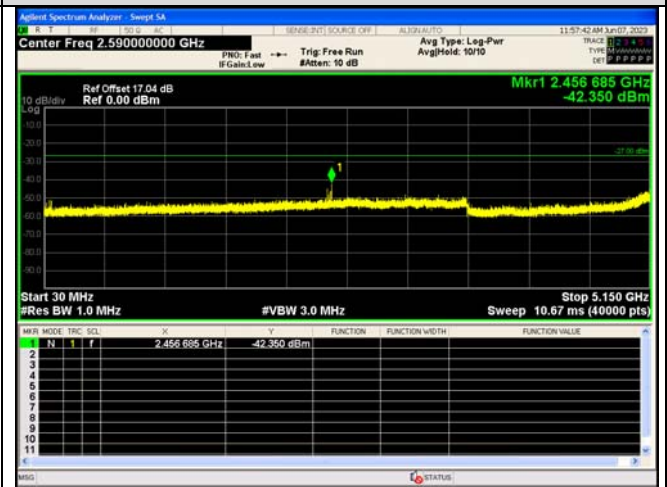
Spurious Emission:30.0~5150 MHz
 IEEE 802.11n_Channel 48_20MHz_Antenna 0



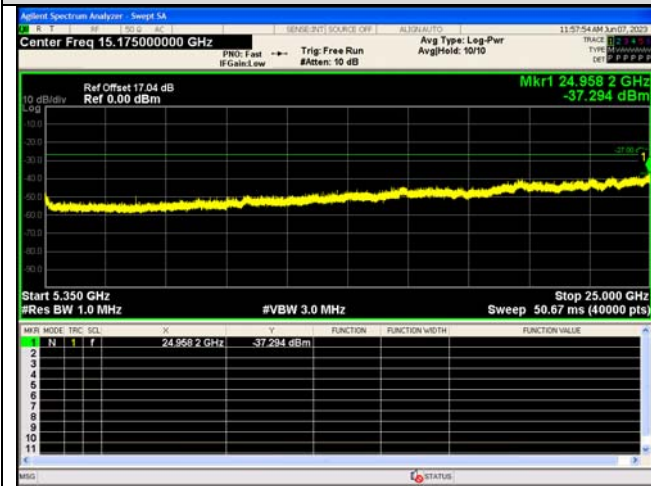
Spurious Emission:5350~25000.0 MHz
 IEEE 802.11n_Channel 48_20MHz_Antenna 0



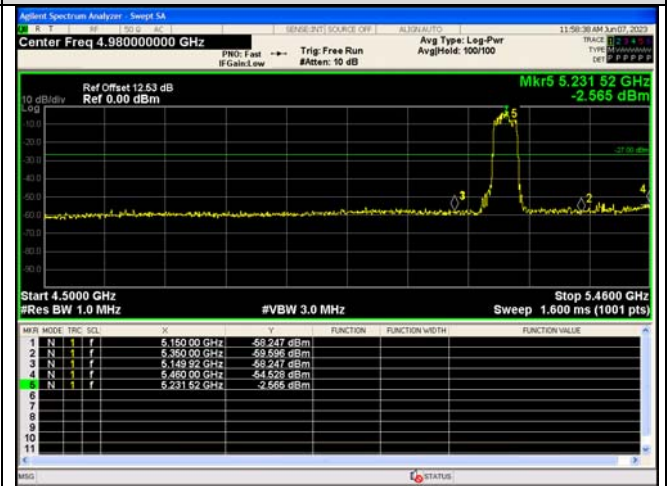
Out Of Band Emission
 IEEE 802.11n_Channel 38_40MHz_Antenna 0



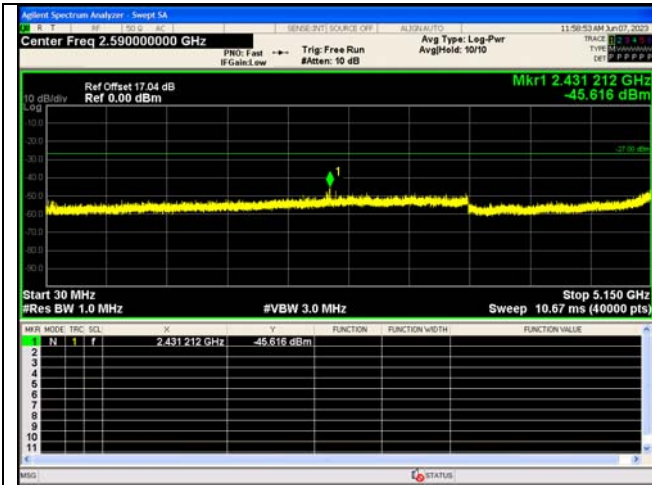
Spurious Emission:30.0~5150 MHz
 IEEE 802.11n_Channel 38_40MHz_Antenna 0



Spurious Emission:5350~25000.0 MHz
 IEEE 802.11n_Channel 38_40MHz_Antenna 0



Out Of Band Emission
 IEEE 802.11n_Channel 46_40MHz_Antenna 0



Spurious Emission:30.0~5150 MHz
IEEE 802.11n_Channel 46_40MHz_Antenna 0



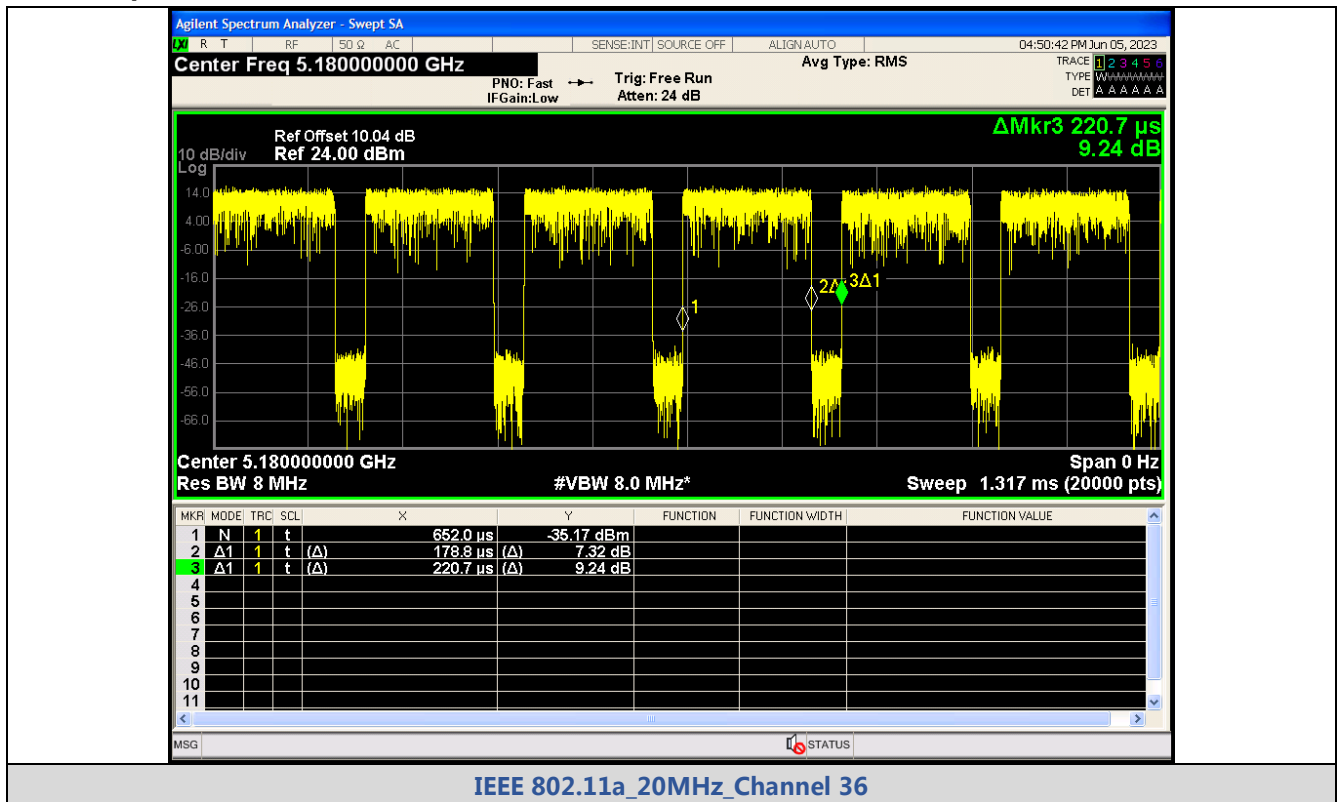
Spurious Emission:5350~25000.0 MHz
IEEE 802.11n_Channel 46_40MHz_Antenna 0

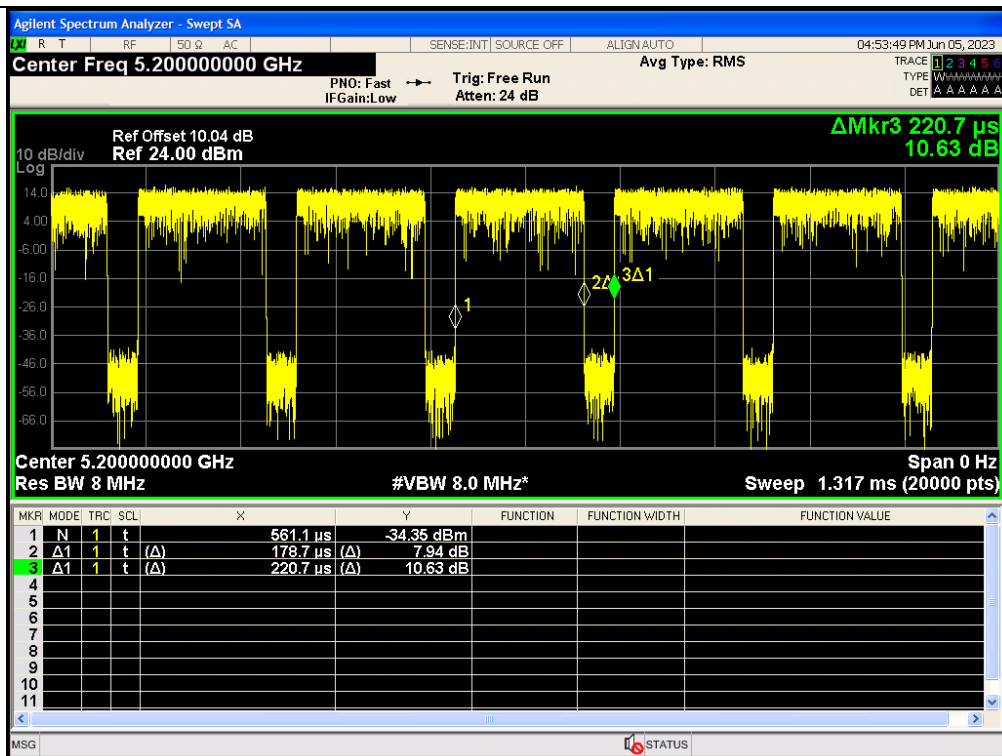
APPENDIX VI. Duty Cycle

Test Result

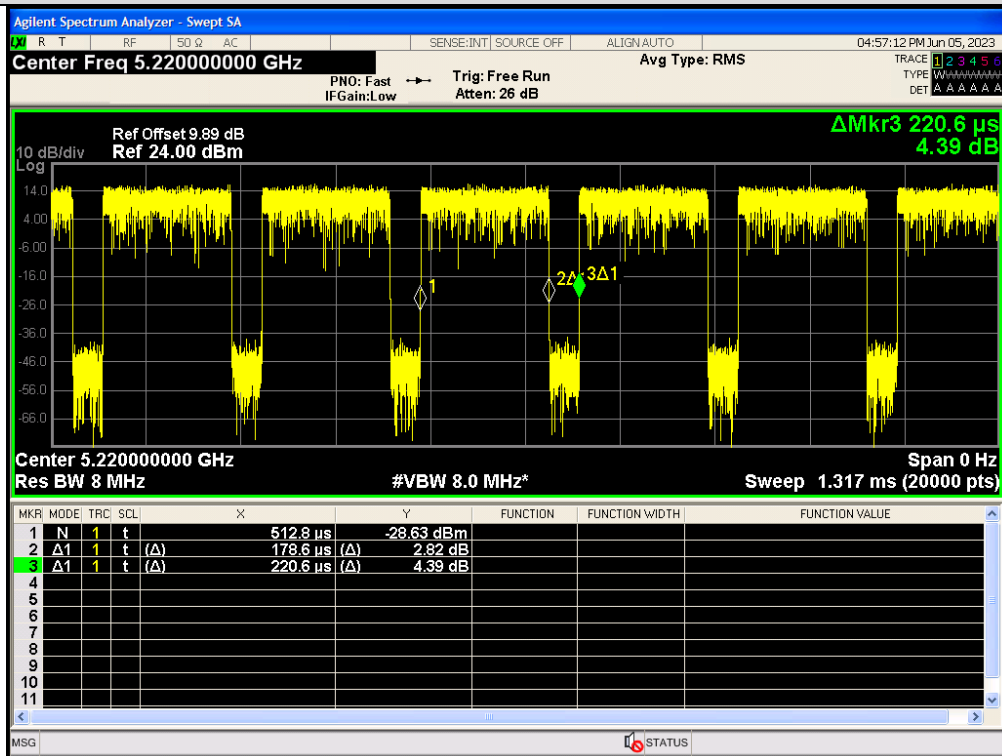
Mode	Data rates	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)
IEEE 802.11a	54	36	0.179	0.221	81.00	0.8100	0.9151
		40	0.179	0.221	80.99	0.8099	0.9157
		44	0.179	0.221	80.99	0.8099	0.9157
IEEE 802.11n_20	MCS 7	36	0.167	0.209	79.86	0.7986	0.9767
		40	0.167	0.209	79.89	0.7989	0.9751
		44	0.167	0.209	79.90	0.7990	0.9745
IEEE 802.11n_40		38	0.102	0.144	70.88	0.7088	1.4948
		46	0.102	0.144	70.84	0.7084	1.4972

Test Graphs

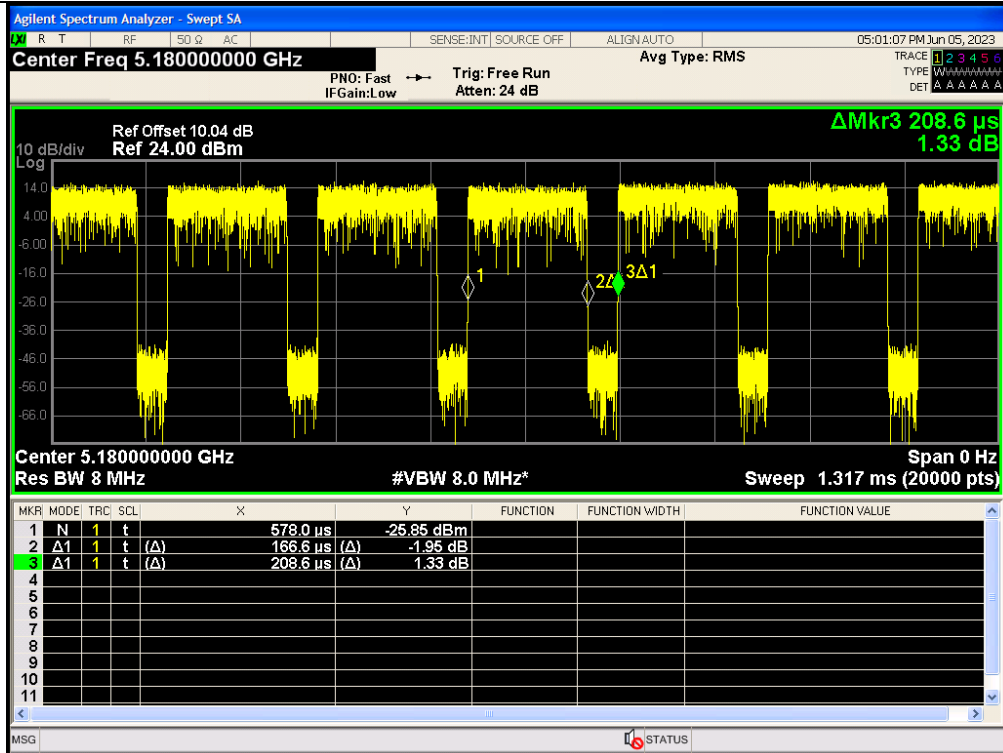




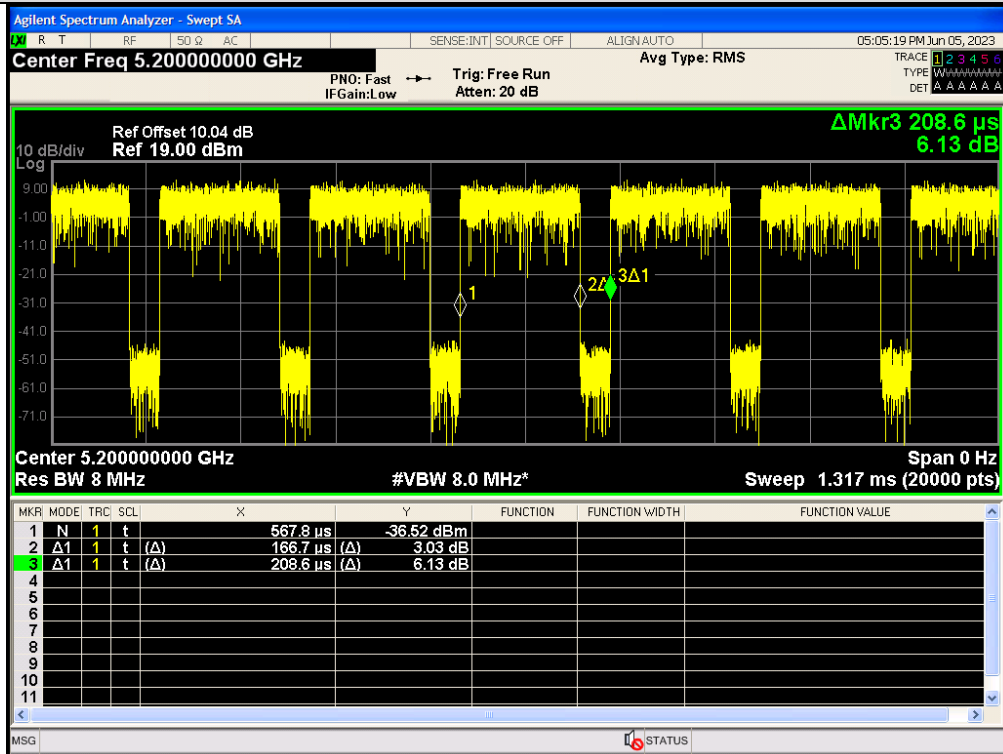
IEEE 802.11a_20MHz_Channel 40



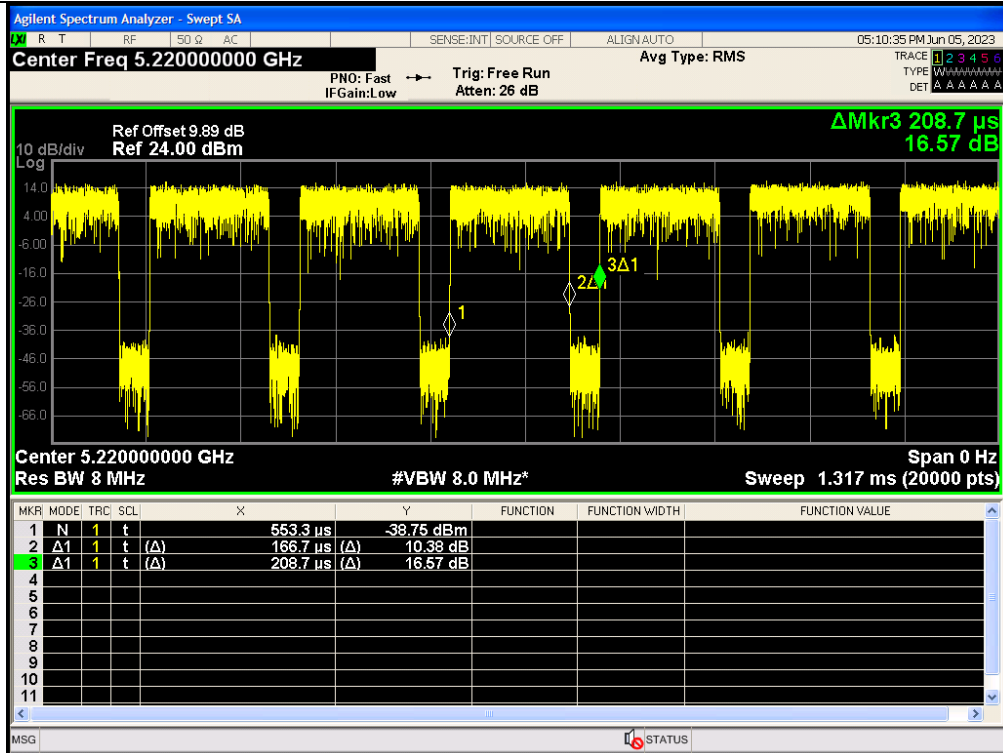
IEEE 802.11a_20MHz_Channel 44



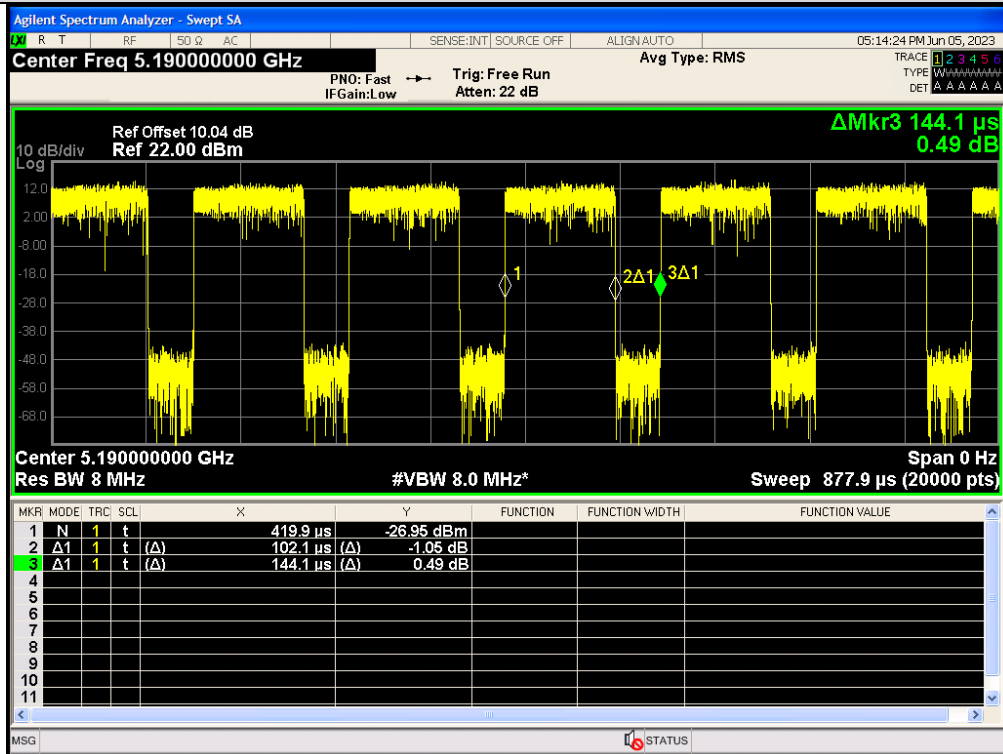
IEEE 802.11n_20MHz_Channel 36



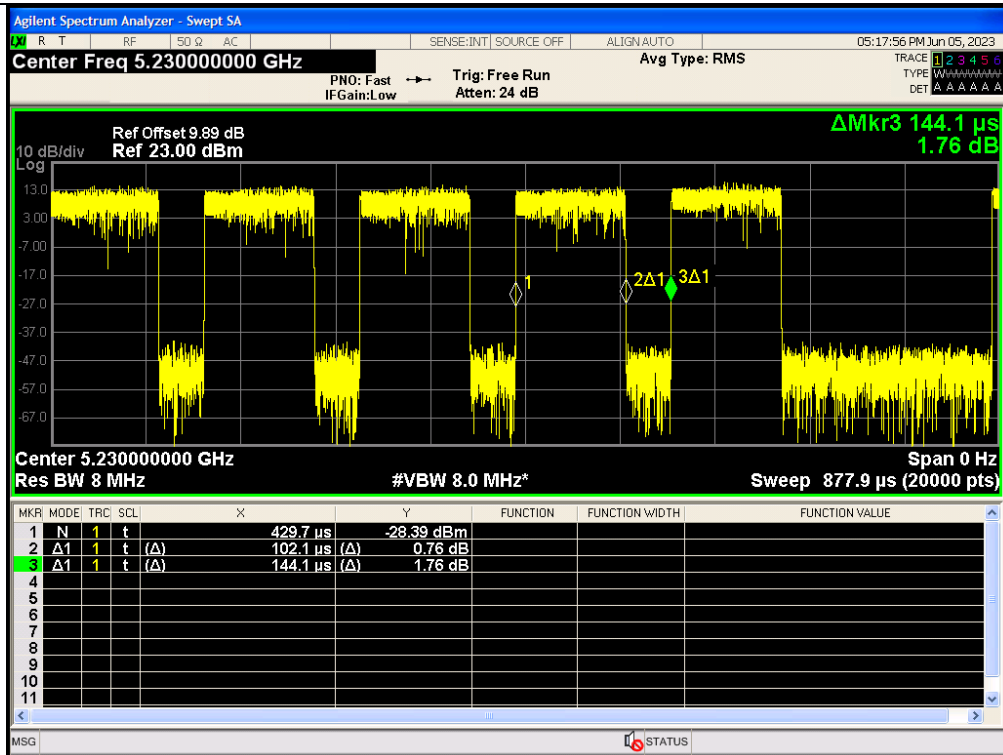
IEEE 802.11n_20MHz_Channel 40



IEEE 802.11n_20MHz_Channel 44



IEEE 802.11n_40MHz_Channel 38



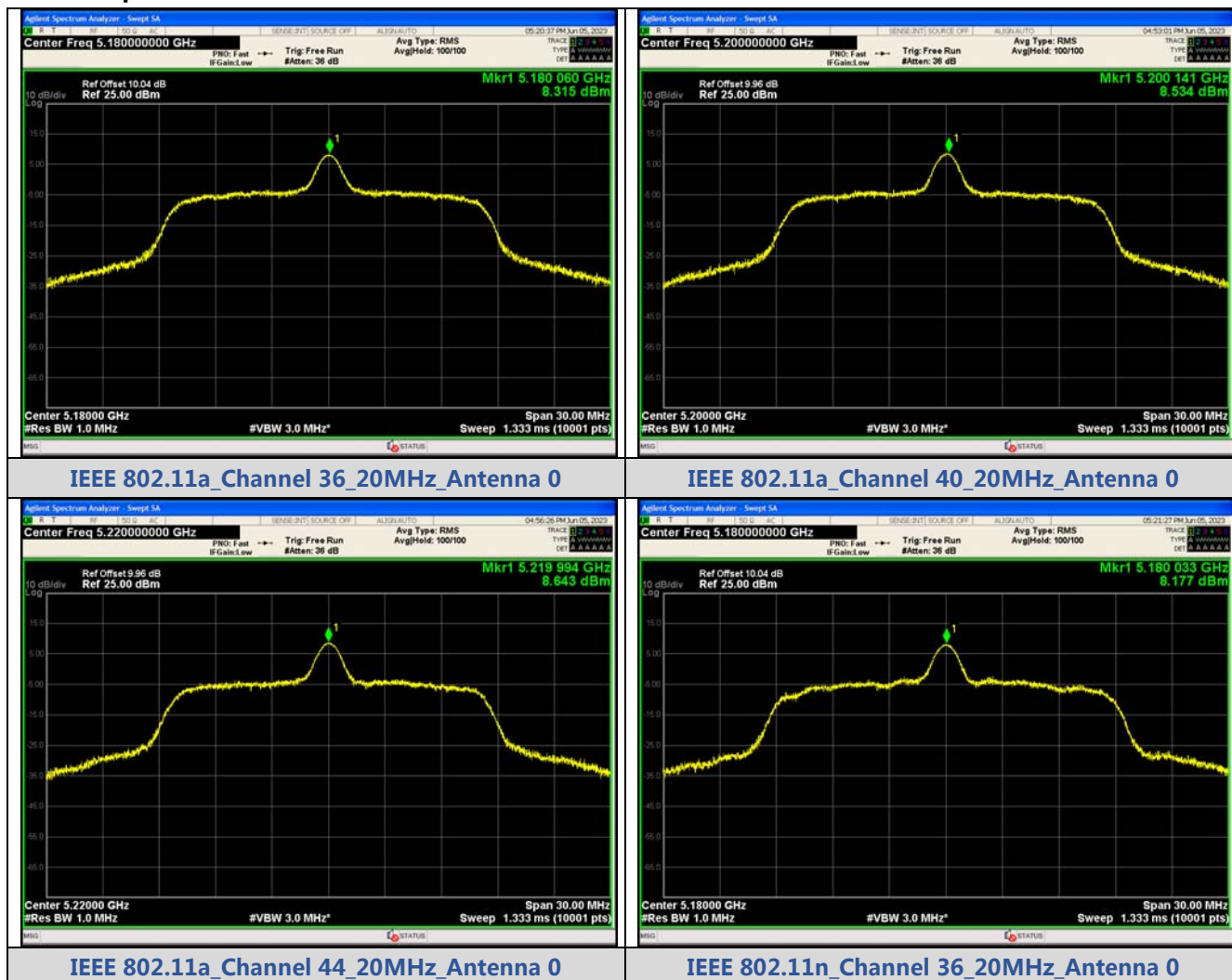
IEEE 802.11n_40MHz_Channel 46

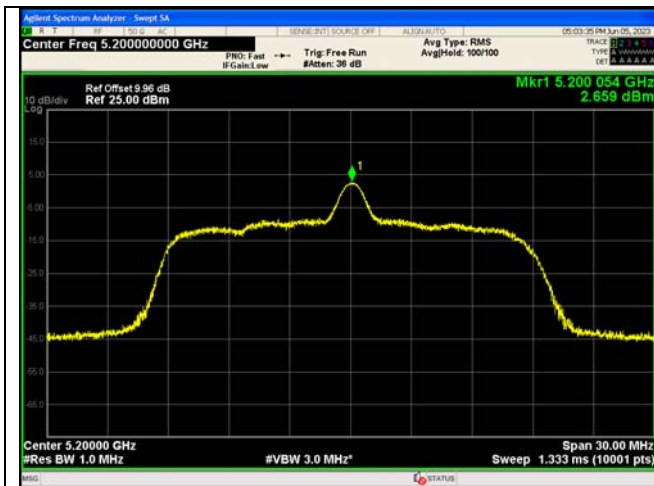
APPENDIX VII. Peak Power Spectral Density

Test Result

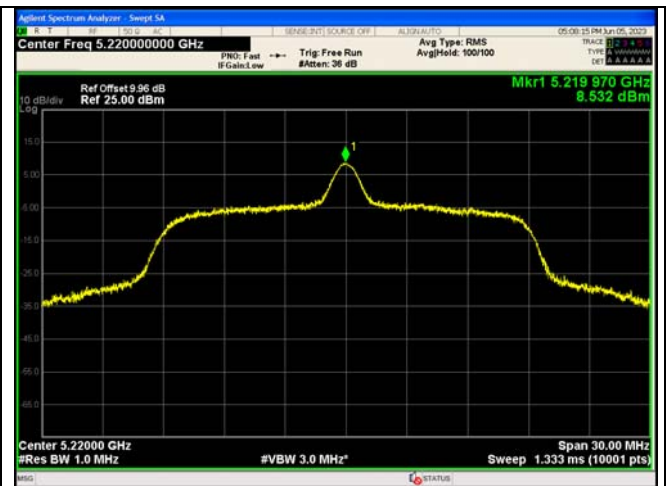
Mode	Channel	Ant. 0 Meas PSD (dBm/MHz or dBm/0.5MHz)	Ant. 0 Corr'd PSD (dBm/MHz or dBm/0.5MHz)	Limit (dBm/MHz or dBm/0.5MHz)	Result
IEEE 802.11a	36	8.315	9.231	11	PASS
	40	8.534	9.45		PASS
	44	8.643	9.559		PASS
IEEE 802.11n_20	36	8.177	9.152		PASS
	40	2.659	3.633		PASS
	44	8.532	9.507		PASS
IEEE 802.11n_40	38	6.358	7.855		PASS
	46	7.644	9.141		PASS

Test Graphs





IEEE 802.11n_Channel 40_20MHz_Antenna 0



IEEE 802.11n_Channel 44_20MHz_Antenna 0



IEEE 802.11n_Channel 38_40MHz_Antenna 0



IEEE 802.11n_Channel 46_40MHz_Antenna 0

APPENDIX VIII. 99% Bandwidth

Test Result

Mode	Channel	Ant.	99% BW (MHz)
IEEE 802.11a	36	3.91	16.453
	40		16.467
	48		16.463
IEEE 802.11n_20	36		17.555
	40		17.575
	48		17.582
IEEE 802.11n_40	38		35.928
	46		35.948

Test Graphs

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.180000000 GHz

Occupied Bandwidth: 16.453 MHz

Total Power: 12.4 dBm

Transmit Freq Error: 22.492 kHz

x dB Bandwidth: 19.47 MHz

OBW Power: 99.00 %

x dB: -26.00 dB

IEEE 802.11a_Channel 36_20MHz_Antenna 0

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.200000000 GHz

Occupied Bandwidth: 16.467 MHz

Total Power: 12.1 dBm

Transmit Freq Error: 48.413 kHz

x dB Bandwidth: 19.65 MHz

OBW Power: 99.00 %

x dB: -26.00 dB

IEEE 802.11a_Channel 40_20MHz_Antenna 0

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.240000000 GHz

Occupied Bandwidth: 16.463 MHz

Total Power: 12.3 dBm

Transmit Freq Error: 38.490 kHz

x dB Bandwidth: 19.63 MHz

OBW Power: 99.00 %

x dB: -26.00 dB

IEEE 802.11a_Channel 48_20MHz_Antenna 0

Agilent Spectrum Analyzer - Occupied BW

Center Freq: 5.180000000 GHz

Occupied Bandwidth: 17.555 MHz

Total Power: 12.2 dBm

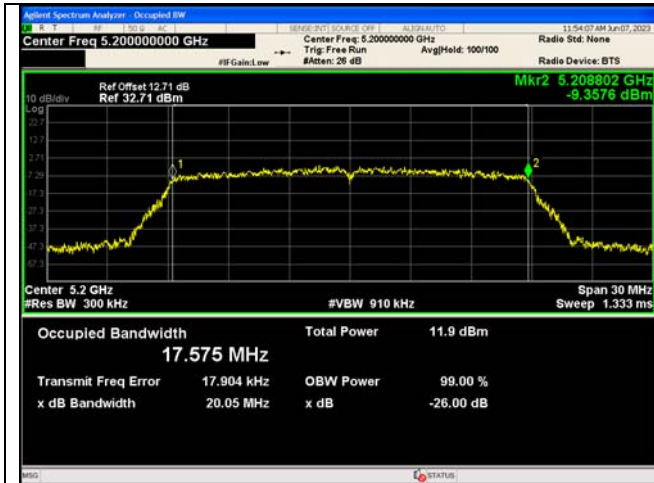
Transmit Freq Error: 36.429 kHz

x dB Bandwidth: 20.01 MHz

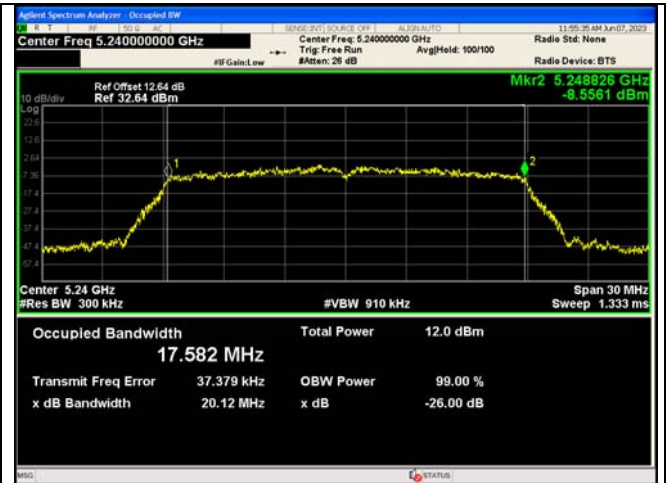
OBW Power: 99.00 %

x dB: -26.00 dB

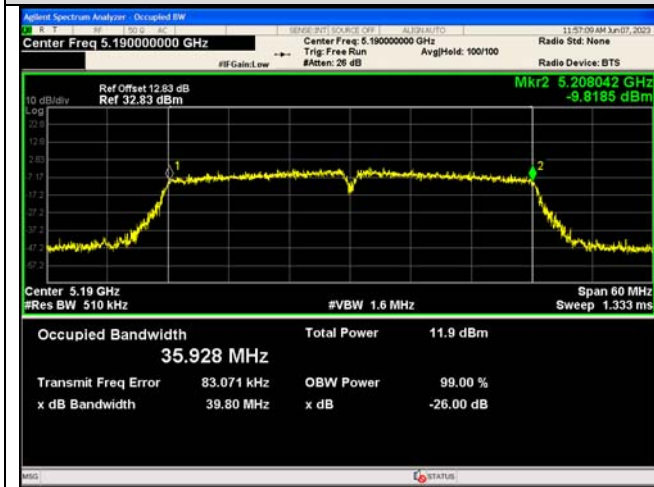
IEEE 802.11n_Channel 36_20MHz_Antenna 0



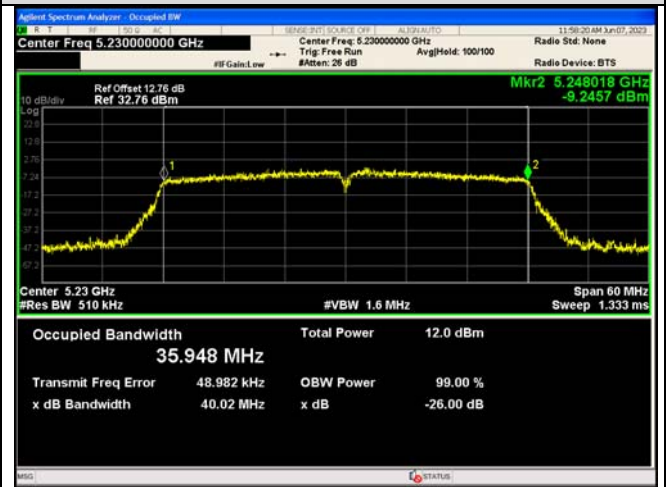
IEEE 802.11n_Channel 40_20MHz_Antenna 0



IEEE 802.11n_Channel 48_20MHz_Antenna 0



IEEE 802.11n_Channel 38_40MHz_Antenna 0



IEEE 802.11n_Channel 46_40MHz_Antenna 0

***** End of Report *****