



FCC PART 15.407


TEST REPORT

For

Vuzix Corporation

25 Hendrix Rd, West Henrietta, New York, United States 14586

FCC ID: 2AA9D-472

Report Type: Class II Permissive Change	Product Type: M400
Report Number: SZ1210802-52717E-RF-00A1	
Report Date: 2021-11-01	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	M400
Tested Model	472
Frequency Range	5G Wi-Fi: 5250-5350MHz; 5470-5725MHz
Mode	802.11a/n20/n40/ac20/ac40/ac80
Maximum Conducted Average Output Power	5250-5350MHz: 12.96dBm 5470-5725MHz: 13.36dBm
Modulation Technique	OFDM
Antenna Specification*	Antenna gain:3.0dBi (It is provided by the manufacturer)
Voltage Range	DC 3.7V from battery or DC 5V from USB-C port
Sample serial number	RF conducted: SZ1210802-52717E-RFA1-S1 CE&RE: SZ1210802-52717E-RFA1-S2 (Assigned by ATC)
Received date	2021-08-02
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and E of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 rules.

This is a CIIPC application of the device; the differences between the original device and the current one are as follows:

- (1) Adding DFS bands (5250-5350MHz & 5470-5725MHz) by software.

Based on above differences, it will affected partial test data, so the changed items were performed.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices; KDB789033 D02 General U-NII Test Procedures New Rules v02r01 and KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB
	26.5GHz- 40GHz	4.72dB
Temperature		1°C
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A-2.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer.

The device only supports 802.11a/n20/n40/ac20/ac40/ac80 modes, which was declared by manufacturer.

For 5250-5350MHz Band, 7 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	60	5300
54	5270	62	5310
56	5280	64	5320
58	5290	/	/

For 802.11a/n20/ac20 mode: channel 52, 56, 64 were tested;

For 802.11n40/ac40 mode: channel 54, 62 were tested;

For 802.11ac80 mode, channel 58 was tested.

For 5470-5725MHz Band, 21 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	124	5620
102	5510	126	5630
104	5520	128	5640
106	5530	132	5660
108	5540	134	5670
110	5550	136	5680
112	5560	138	5690
116	5580	140	5700
118	5590	142	5710
120	5600	144	5720
122	5610	/	/

For 802.11a/n20/ac20 mode: channel 100, 116, 144 were tested;

For 802.11n40/ac40 mode: channel 102, 110, 142 were tested.

For 802.11ac80/ax80 mode, channel 106, 122, 138 was tested.

EUT Exercise Software

“QRCT”* exercise software was used. The software and power level was provided by the applicant.

The worst case was performed under:

U-NII	Mode	Frequency (MHz)	Data Rate	Power Level*
5250 – 5350MHz	802.11 a	5260	6Mbps	15
		5280	6Mbps	15
		5320	6Mbps	15
	802.11 n20	5260	MCS0	15
		5280	MCS0	15
		5320	MCS0	15
	802.11 n40	5270	MCS0	15
		5310	MCS0	15
	802.11 ac20	5260	MCS0	15
		5280	MCS0	15
		5320	MCS0	15
	802.11 ac40	5270	MCS0	15
		5310	MCS0	15
	802.11 ac80	5290	MCS0	15
	5470 – 5725MHz	802.11 a	5500	6Mbps
5580			6Mbps	15
5720			6Mbps	15
802.11 n20		5500	MCS0	15
		5580	MCS0	15
		5720	MCS0	15
802.11 n40		5510	MCS0	15
		5550	MCS0	15
		5710	MCS0	15
802.11 ac20		5500	MCS0	15
		5580	MCS0	15
		5720	MCS0	15
802.11 ac40		5510	MCS0	15
		5550	MCS0	15
		5710	MCS0	15
802.11 ac80		5530	MCS0	15
		5610	MCS0	15
		5690	MCS0	15

The worse-case data rates are determined to be as follows for each mode based upon investigations by measuring the output power and PSD across all data rated bandwidths, and modulations.

For DFS test, “Lantest.exe” software was used

Duty cycle

Test Result: Pass. Please refer to the Appendix.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

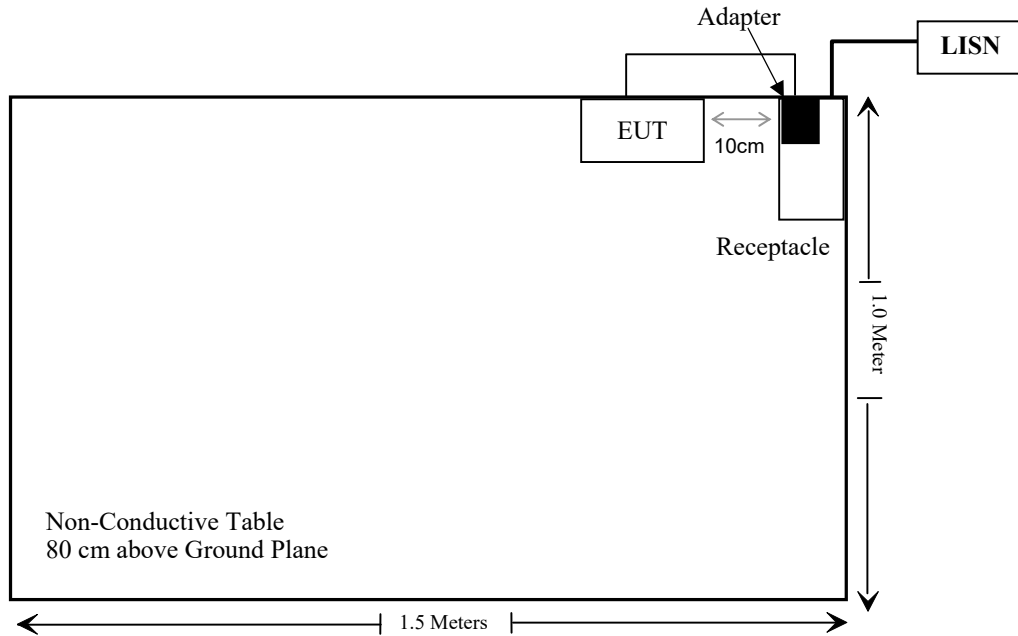
Manufacturer	Description	Model	Serial Number
HuaJin	Adapter	HJ-0502000W2-US	10294410
DELL	PC	67CTQ12	1350545499398
DELL	Monitor	REV A00	CN-0JH6ND-74445-45E-D0GL
Lenovo	Mouse	M120Pro	31099145JK049889
DELL	KeyBoard	L100	CN0RH6565890855000E
GOSPELL	POE	G0720-480-050	212701319
DELL	NoteBook	Latitude E4710	PC201911252059
Grandstream	Router (FCC ID: YZZGWN7660)	GWN7660	259LAT9M123E850C

External I/O Cable

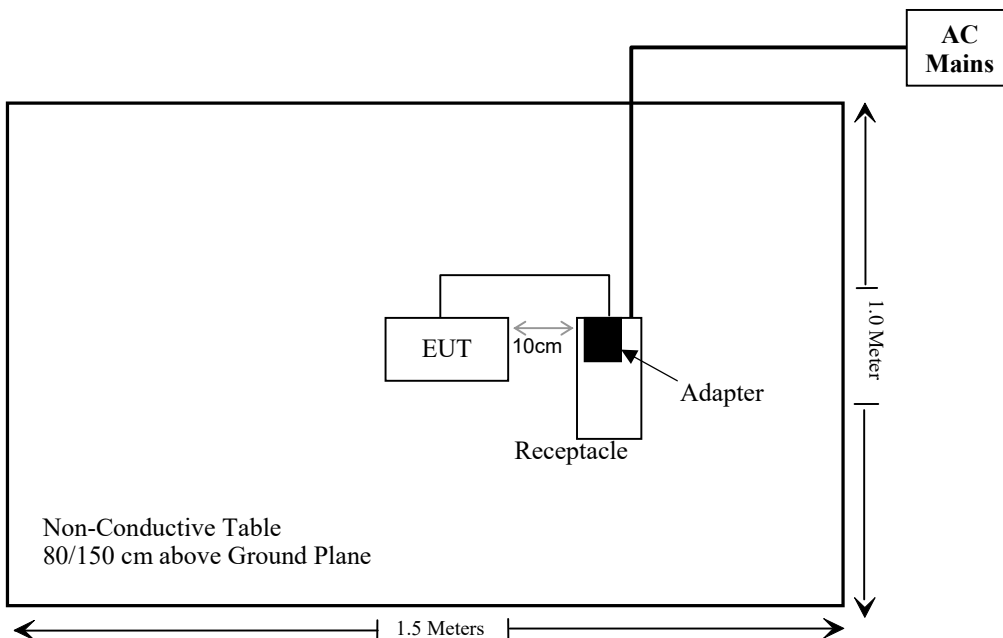
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.2	Adapter	EUT
Un-shielding Detachable RJ45 Cable	1.5	POE	Router
Un-shielding Detachable RJ45 Cable	1.5	POE	PC
Un-shielding Detachable USB Cable	0.5	EUT	NoteBook
Shielding Detachable RF Cable	0.5	RF Contorl unit	Router
Shielding Detachable RF Cable	0.5	RF Contorl unit	EUT
Un-shielding Detachable VGA Cable	1.2	Monitor	PC
Un-shielding Detachable USB Cable	1.2	Mouse	PC
Un-shielding Detachable USB Cable	1.2	KeyBoard	PC

Block Diagram of Test Setup

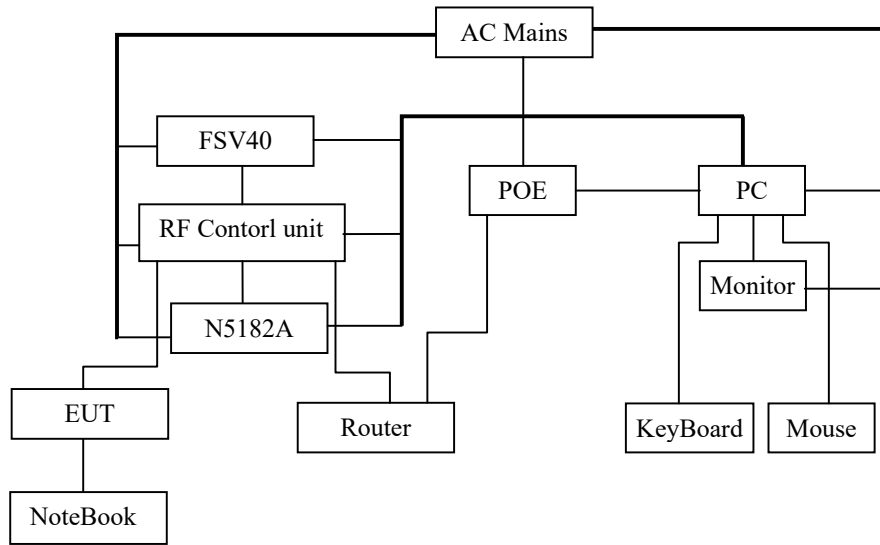
For conducted emission:



For Radiated emission:



For DFS:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b) (1) & §2.1093	RF EXPOSURE	Compliant
§15.203	Antenna Requirement	Compliant
§15.407(b)(9)& §15.207(a)	Conducted Emissions	Compliant
§15.205& §15.209 &§15.407(b)	Undesirable Emission& Restricted Bands	Compliant
§15.407(a) (e)	26 dB Emission Bandwidth & 6dB Bandwidth	Compliant
§15.407(a)	Conducted Transmitter Output Power	Compliant
§15.407 (a)	Power Spectral Density	Compliant
§15.407 (h)	Transmit Power Control (TPC)	Not Applicable
§15.407 (h)	Dynamic Frequency Selection (DFS)	Compliant

Not Applicable: the EUT has no TPC function which was declared by the applicant.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted emission test					
Rohde& Schwarz	Test Receiver	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50ΩCoaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-2m	No.2	2020/12/25	2021/12/24
Conducted Emission Test Software: ES-K1 V1.71					
Radiated emission test					
Rohde& Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
OREGON SCIENTIFIC	Temperature & Humidity Meter	JB913R	GZ-WS004	2020/01/02	2023/01/01
Radiated Emission Test Software: EZ_EMV V 1.1.4.2					
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
CD	Band Reject Filter	BRM-5.15/5.35g-45	075	2020/12/25	2021/12/24
CD	Band Reject Filter	BRM-5.47/5.725G-45	075	2020/12/25	2021/12/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF conducted test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
Tonscend	RF Control Unit	JS0806-2	19G8060182	2021/07/06	2022/07/05
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2020/12/24	2021/12/23
AGILENT	Vector Signal Generator	N5182A	MY50143401	2021/01/04	2022/01/03

* **Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Measurement Result

Please refer to SAR test report: SZ1210802-32217E-SACA1.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.407 (a), if the transmitting antennas of directional gain greater than 6dBi are used, the transmit power and power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has one internal antenna which was permanently attached, and the maximum antenna gain is 3.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

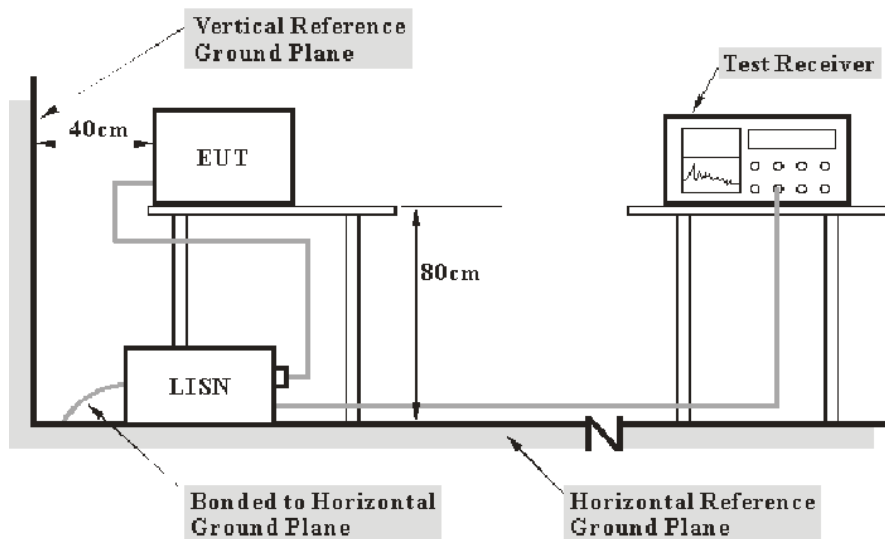
Result: Compliance.

FCC §15.407 (b) (6) §15.207 (a) – CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207, §15.407(b) (6)

EUT Setup



- Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and Average detection mode.

Test Data

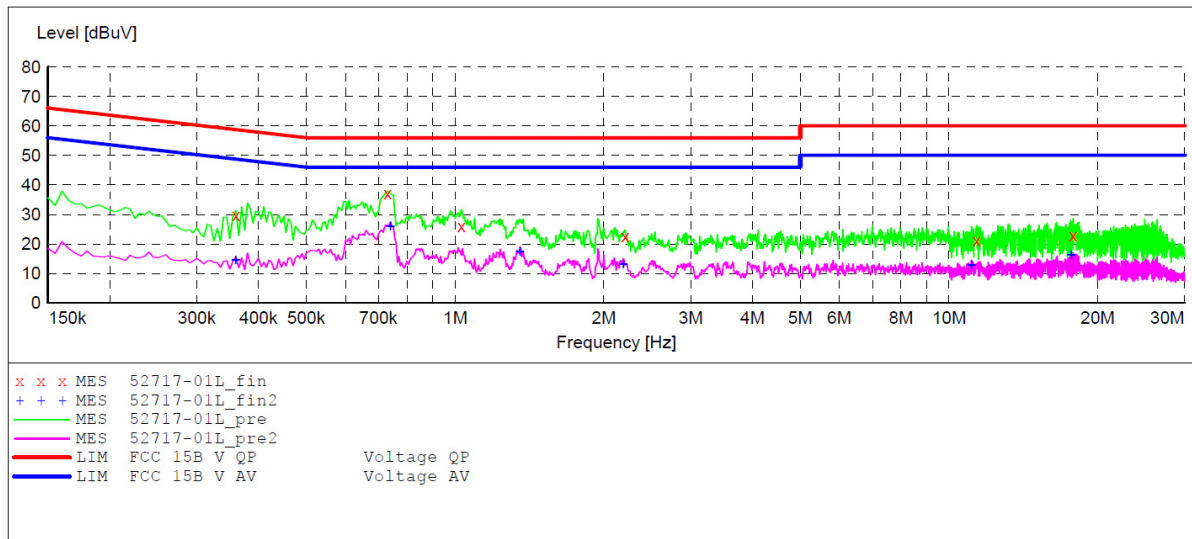
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Anny on 2021-10-19.

EUT operation mode: Transmitting (worst case is 802.11n40 5710MHz)

AC 120V/60 Hz, Line:



MEASUREMENT RESULT: "52717-01L_fin"

2021-10-19 11:17

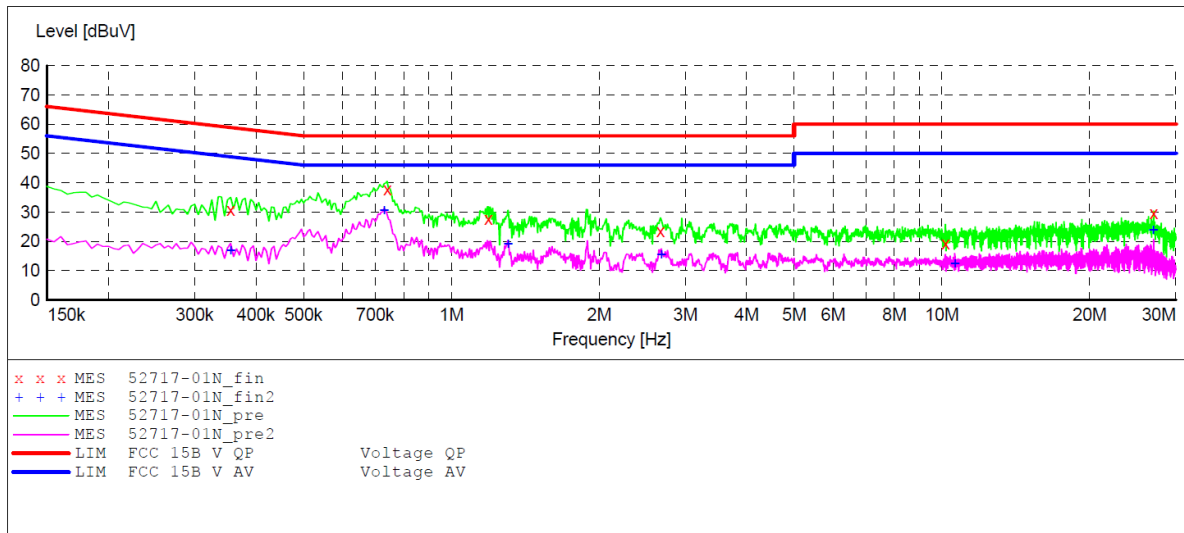
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.360000	29.60	10.9	59	29.4	QP	L1	GND
0.730000	37.20	11.1	56	18.8	QP	L1	GND
1.030000	26.10	11.1	56	29.9	QP	L1	GND
2.210000	22.70	11.3	56	33.3	QP	L1	GND
11.375000	21.20	11.6	60	38.8	QP	L1	GND
17.850000	22.90	11.7	60	37.1	QP	L1	GND

MEASUREMENT RESULT: "52717-01L_fin2"

2021-10-19 11:19

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.360000	14.70	10.9	49	35.3	AV	L1	GND
0.740000	26.10	11.1	46	19.9	AV	L1	GND
1.355000	17.40	11.2	46	32.6	AV	L1	GND
2.190000	13.30	11.3	46	36.7	AV	L1	GND
11.100000	12.90	11.6	50	39.1	AV	L1	GND
17.700000	16.40	11.7	50	37.6	AV	L1	GND

AC 120V/60 Hz, Neutral:



MEASUREMENT RESULT: "52717-01N_fin"

2021-10-19 11:17

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.355000	30.70	10.9	59	28.3	QP	N	GND
0.740000	37.80	11.1	56	18.2	QP	N	GND
1.190000	27.60	11.2	56	28.4	QP	N	GND
2.670000	23.50	11.3	56	32.5	QP	N	GND
10.175000	19.30	11.6	60	40.7	QP	N	GND
27.025000	29.50	11.8	60	30.5	QP	N	GND

MEASUREMENT RESULT: "52717-01N_fin2"

2021-10-19 11:16

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.355000	16.70	10.9	49	32.3	AV	N	GND
0.730000	30.60	11.1	46	15.4	AV	N	GND
1.305000	18.90	11.2	46	27.1	AV	N	GND
2.680000	15.40	11.3	46	30.6	AV	N	GND
10.625000	12.40	11.6	50	37.6	AV	N	GND
27.025000	23.80	11.8	50	26.2	AV	N	GND

§15.205 & §15.209 & §15.407(B)– UNDESIRABLE EMISSION

Applicable Standard

FCC §15.407 (b); §15.209; §15.205;

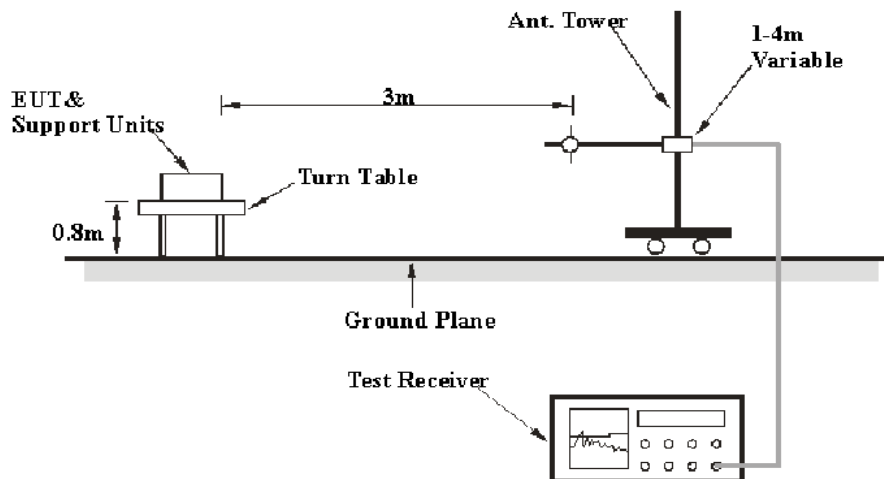
(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

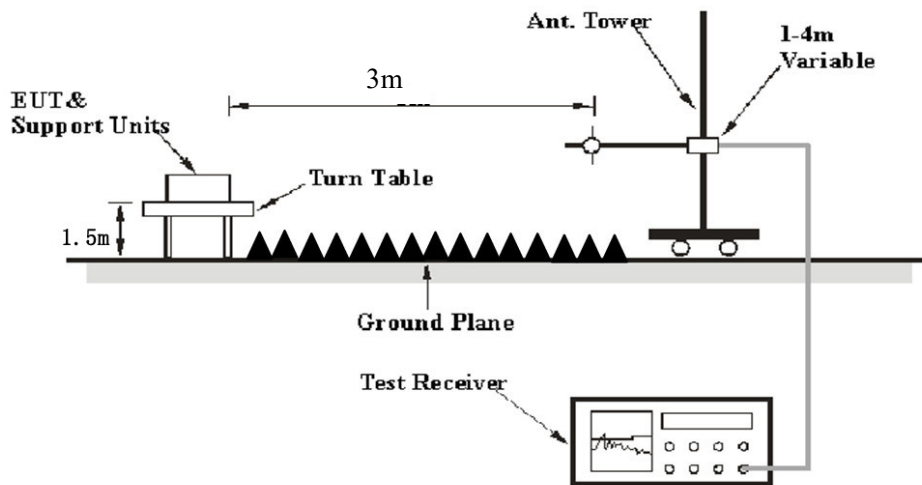
- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (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:
 - (i) 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.

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

EUT Setup

Below 1 GHz:



Above 1 GHz:

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC 15.209 and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1MHz	10 Hz ^{Note 1}	/	Average
	1MHz	> 1/T ^{Note 2}	/	Average

Note 1: when duty cycle is no less than 98%

Note 2: when duty cycle is less than 98%

Test Procedure**Radiated Spurious Emission**

During the radiated emission test, the adapter was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all the installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz, peak and Average detection modes for frequencies above 1GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

Test Data

Environmental Conditions

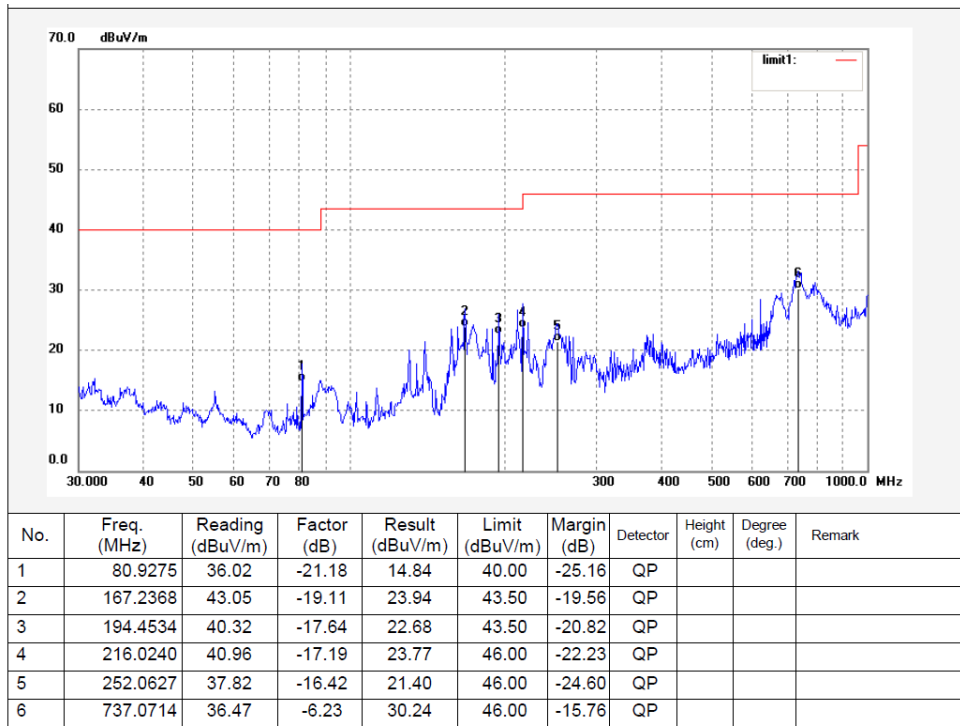
Temperature:	23 °C
Relative Humidity:	48 %
ATM Pressure:	101.1 kPa

The testing was performed by Chao Mo on 2021-10-19 for below 1GHz and 2021-10-16, 2021-10-22 for above 1GHz.

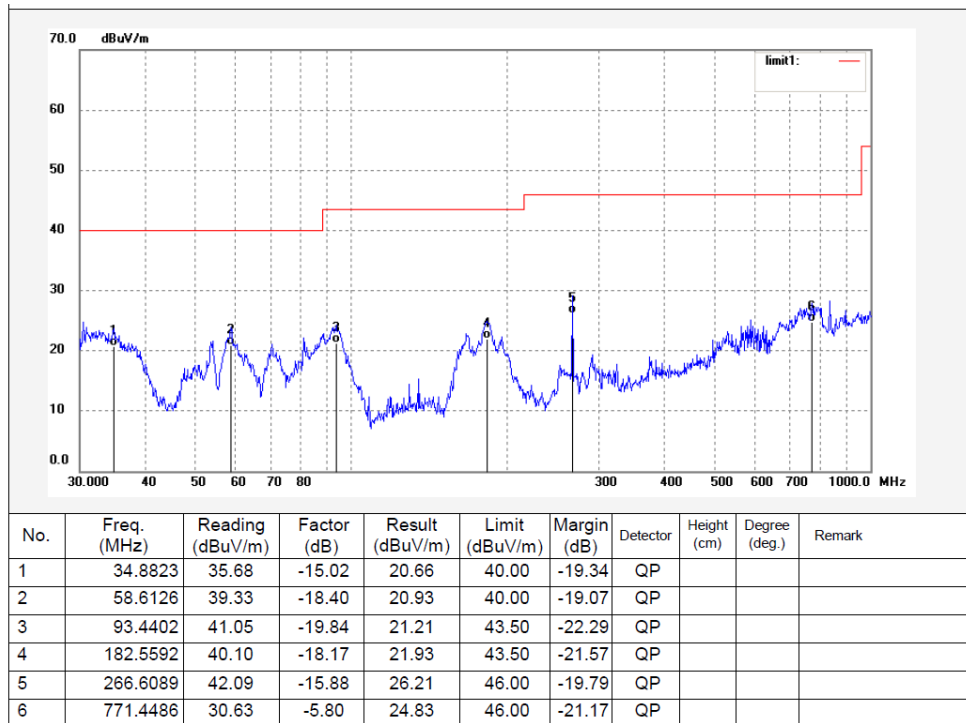
EUT operation mode: Transmitting

30 MHz – 1 GHz: (worst case is 802.11n40 5710MHz)

Horizontal



Vertical



5250-5350 MHz:

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB μ V/m)	FCC Part 15.407	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dB μ V/m)	Margin (dB)
5250-5350MHz									
802.11a ,5260 MHz									
4500	58.12	PK	297	1.1	H	1.89	60.01	74	-13.99
4500	43.84	Ave.	297	1.1	H	1.89	45.73	54	-8.27
4500	50.88	PK	356	1.6	V	1.89	52.77	74	-21.23
5150	57.88	PK	205	1.5	H	3.37	61.25	74	-12.75
5150	43.40	Ave.	205	1.5	H	3.37	46.77	54	-7.23
5150	50.60	PK	27	1.5	V	3.37	53.97	74	-20.03
10520	37.68	PK	159	2.3	H	14.63	52.31	68.2	-15.89
10520	37.24	PK	74	1.3	V	14.63	51.87	68.2	-16.33
802.11a ,5280 MHz									
10560	38.09	PK	201	1.6	H	14.75	52.84	68.2	-15.36
10560	37.43	PK	57	2.1	V	14.75	52.18	68.2	-16.02
802.11a ,5320MHz									
5350	58.13	PK	300	1.1	H	3.33	61.46	74	-12.54
5350	43.55	Ave.	300	1.1	H	3.33	46.88	54	-7.12
5350	50.34	PK	140	1.7	V	3.33	53.67	74	-20.33
5460	56.68	PK	299	1.9	H	3.31	59.99	74	-14.01
5460	42.31	Ave.	299	1.9	H	3.31	45.62	54	-8.38
5460	47.42	PK	154	2.1	V	3.31	50.73	74	-23.27
10640	37.55	PK	239	1.4	H	15.05	52.60	74	-21.40
10640	36.61	PK	30	2.2	V	15.05	51.66	74	-22.34

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB μ V/m)	FCC Part15.407	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dB μ V/m)	Margin (dB)
802.11n20,5260 MHz									
4500	57.17	PK	282	1.4	H	1.89	59.06	74	-14.94
4500	43.29	Ave.	282	1.4	H	1.89	45.18	54	-8.82
4500	49.80	PK	243	1.3	V	1.89	51.69	74	-22.31
5150	58.04	PK	73	1.7	H	3.37	61.41	74	-12.59
5150	43.43	Ave.	73	1.7	H	3.37	46.8	54	-7.20
5150	49.47	PK	301	2.4	V	3.37	52.84	74	-21.16
10520	36.40	PK	128	1.8	H	14.63	51.03	68.2	-17.17
10520	35.69	PK	150	2	V	14.63	50.32	68.2	-17.88
802.11n20,5280 MHz									
10560	37.00	PK	356	2.4	H	14.75	51.75	68.2	-16.45
10560	36.24	PK	120	1.9	V	14.75	50.99	68.2	-17.21
802.11n20,5320MHz									
5350	57.33	PK	350	1.4	H	3.33	60.66	74	-13.34
5350	43.38	Ave.	350	1.4	H	3.33	46.71	54	-7.29
5350	49.49	PK	266	2.1	V	3.33	52.82	74	-21.18
5460	56.36	PK	279	1.1	H	3.31	59.67	74	-14.33
5460	42.45	Ave.	279	1.1	H	3.31	45.76	54	-8.24
5460	48.06	PK	222	1.4	V	3.31	51.37	74	-22.63
10640	36.94	PK	284	1.6	H	15.05	51.99	74	-22.01
10640	36.24	PK	112	2.3	V	15.05	51.29	74	-22.71
802.11n40,5270 MHz									
5270 MHz									
4500	57.28	PK	0	1	H	1.89	59.17	74	-14.83
4500	45.07	Ave.	0	1	H	1.89	46.96	54	-7.04
4500	49.75	PK	105	2.3	V	1.89	51.64	74	-22.36
5150	58.35	PK	219	1.7	H	3.37	61.72	74	-12.28
5150	44.67	Ave.	219	1.7	H	3.37	48.04	54	-5.96
5150	50.56	PK	75	2	V	3.37	53.93	74	-20.07
10540	36.28	PK	323	1.1	H	14.72	51.00	68.2	-17.20
10540	35.52	PK	338	2.4	V	14.72	50.24	68.2	-17.96
802.11n40,5310 MHz									
5350	57.97	PK	102	2.1	H	3.33	61.30	74	-12.70
5350	44.74	Ave.	102	2.1	H	3.33	48.07	54	-5.93
5350	50.31	PK	358	1.6	V	3.33	53.64	74	-20.36
5460	57.28	PK	281	2.4	H	3.31	60.59	74	-13.41
5460	43.38	Ave.	281	2.4	H	3.31	46.69	54	-7.31
5460	49.26	PK	171	1.5	V	3.31	52.57	74	-21.43
10620	36.62	PK	102	1	H	15.05	51.67	74	-22.33
10620	35.49	PK	9	2.4	V	15.05	50.54	74	-23.46

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB μ V/m)	FCC Part15.407	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dB μ V/m)	Margin (dB)
802.11ac20,5260 MHz									
5260 MHz									
4500	57.45	PK	143	2	H	1.89	59.34	74	-14.66
4500	44.89	Ave.	143	2	H	1.89	46.78	54	-7.22
4500	49.75	PK	165	2.1	V	1.89	51.64	74	-22.36
5150	58.64	PK	272	1.9	H	3.37	62.01	74	-11.99
5150	44.47	Ave.	272	1.9	H	3.37	47.84	54	-6.16
5150	50.25	PK	147	2.5	V	3.37	53.62	74	-20.38
10520	36.75	PK	336	1.5	H	14.63	51.38	68.2	-16.82
10520	36.03	PK	95	2.4	V	14.63	50.66	68.2	-17.54
802.11ac20,5280 MHz									
10560	36.79	PK	204	1.4	H	14.75	51.54	68.2	-16.66
10560	35.43	PK	198	2.5	V	14.75	50.18	68.2	-18.02
802.11ac20,5320 MHz									
5350	57.9	PK	18	2.4	H	3.33	61.23	74	-12.77
5350	44.66	Ave.	18	2.4	H	3.33	47.99	54	-6.01
5350	49.33	PK	57	2.3	V	3.33	52.66	74	-21.34
5460	55.78	PK	123	2.3	H	3.31	59.09	74	-14.91
5460	43.16	Ave.	123	2.3	H	3.31	46.47	54	-7.53
5460	48.25	PK	259	1.2	V	3.31	51.56	74	-22.44
10640	36.68	PK	355	2.4	H	15.05	51.73	74	-22.27
10640	35.44	PK	167	1.6	V	15.05	50.49	74	-23.51

Frequency (MHz)	Receiver		Turn- Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB μ V/m)	FCC Part15.407	
	Reading (dB μ V)	Detector (PK/QP/AV)		Height (m)	Polar (H / V)			Limit (dB μ V/m)	Margin (dB)
802.11ac40,5270 MHz									
5270 MHz									
4500	57.41	PK	269	1.1	H	1.89	59.30	74	-14.70
4500	44.72	Ave.	269	1.1	H	1.89	46.61	54	-7.39
4500	50.73	PK	232	2	V	1.89	52.62	74	-21.38
5150	57.79	PK	39	1.7	H	3.37	61.16	74	-12.84
5150	44.49	Ave.	39	1.7	H	3.37	47.86	54	-6.14
5150	50.46	PK	321	1.9	V	3.37	53.83	74	-20.17
10540	36.69	PK	125	1.3	H	14.72	51.41	68.2	-16.79
10540	35.67	PK	124	2.1	V	14.72	50.39	68.2	-17.81
802.11ac40,5310 MHz									
5350	57.83	PK	65	1	H	3.33	61.16	74	-12.84
5350	44.49	Ave.	65	1	H	3.33	47.82	54	-6.18
5350	50.52	PK	196	1.5	V	3.33	53.85	74	-20.15
5460	55.92	PK	175	2.2	H	3.31	59.23	74	-14.77
5460	43.56	Ave.	175	2.2	H	3.31	46.87	54	-7.13
5460	47.97	PK	162	1.6	V	3.31	51.28	74	-22.72
10620	35.37	PK	190	1.8	V	15.05	50.42	74	-23.58
10620	30.78	PK	136	1.8	V	15.05	45.83	74	-28.17
802.11ac80,5290 MHz									
4500	56.31	PK	43	1.7	H	1.89	58.20	74	-15.80
4500	43.90	Ave.	43	1.7	H	1.89	45.79	54	-8.21
4500	48.85	PK	166	1.9	V	1.89	50.74	74	-23.26
5150	55.93	PK	95	1.2	H	3.37	59.30	74	-14.70
5150	43.50	Ave.	95	1.2	H	3.37	46.87	54	-7.13
5150	49.12	PK	210	2.3	V	3.37	52.49	74	-21.51
5350	57.74	PK	19	1.1	H	3.33	61.07	74	-12.93
5350	45.91	Ave.	19	1.1	H	3.33	49.24	54	-4.76
5350	50.56	PK	316	2.5	V	3.33	53.89	74	-20.11
5460	56.33	PK	353	1.6	H	3.31	59.64	74	-14.36
5460	43.15	Ave.	353	1.6	H	3.31	46.46	54	-7.54
5460	48.97	PK	156	1.1	V	3.31	52.28	74	-21.72
10580	35.73	PK	127	2.1	H	14.80	50.53	68.2	-17.67
10580	34.71	PK	34	2.1	V	14.80	49.51	68.2	-18.69

5470-5725MHz:

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part15.407	
	Reading (dBμV)	Detector (PK/QP/AV)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11a									
802.11a ,5500 MHz									
5400	55.02	PK	336	2.3	H	3.33	58.35	74	-15.65
5400	40.45	Ave.	336	2.3	H	3.33	43.78	54	-10.22
5400	53.45	PK	104	1.6	V	3.33	56.78	74	-17.22
5400	38.52	Ave.	104	1.6	V	3.33	41.85	54	-12.15
5470	59.72	PK	158	1.3	H	3.31	63.03	68.2	-5.17
5470	58.67	PK	248	1.1	V	3.31	61.98	68.2	-6.22
11000	35.08	PK	14	2.3	H	16.30	51.38	74	-22.62
11000	33.07	PK	266	1.2	V	16.30	49.37	74	-24.63
802.11a ,5580 MHz									
11160	35.60	PK	72	2.4	H	15.84	51.44	74	-22.56
11160	33.75	PK	286	2.2	V	15.84	49.59	74	-24.41
802.11a ,5720 MHz									
5850	59.92	PK	145	1.1	H	3.96	63.88	68.2	-4.32
5850	59.05	PK	145	1.1	V	3.96	63.01	68.2	-5.19
5925	56.51	PK	293	2.4	H	4.03	60.54	68.2	-7.66
5925	55.92	PK	293	2.4	V	4.03	59.95	68.2	-8.25
11440	37.17	PK	150	1.1	H	14.90	52.07	74	-21.93
11440	35.41	PK	150	1.1	V	14.90	50.31	74	-23.69
802.11n20 ,5500 MHz									
5400	55.41	PK	308	2	H	3.33	58.74	74	-15.26
5400	40.49	Ave.	308	2	H	3.33	43.82	54	-10.18
5400	53.94	PK	156	1.1	V	3.33	57.27	74	-16.73
5400	39.39	Ave.	156	1.1	V	3.33	42.72	54	-11.28
5470	57.98	PK	335	1.5	H	3.31	61.29	68.2	-6.91
5470	57.56	PK	106	1.5	V	3.31	60.87	68.2	-7.33
11000	35.23	PK	70	1.7	H	16.30	51.53	74	-22.47
11000	33.73	PK	315	1	V	16.30	50.03	74	-23.97
802.11n20 ,5580 MHz									
11160	35.47	PK	162	2.3	H	15.84	51.31	74	-22.69
11160	34.01	PK	36	1.4	V	15.84	49.85	74	-24.15
802.11n20 ,5720 MHz									
5850	60.02	PK	285	1.5	H	3.96	63.98	68.2	-4.22
5850	59.08	PK	285	1.5	V	3.96	63.04	68.2	-5.16
5925	58.04	PK	213	1	H	4.03	62.07	68.2	-6.13
5925	56.65	PK	213	1	V	4.03	60.68	68.2	-7.52
11440	37.19	PK	121	1	H	14.90	52.09	74	-21.91
11440	35.44	PK	121	1	V	14.90	50.34	74	-23.66

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part15.407	
	Reading (dBμV)	Detector (PK/QP/AV)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n40									
802.11n40 ,5510 MHz									
5400	55.23	PK	313	1.4	H	3.33	58.56	74	-15.44
5400	40.44	Ave.	313	1.4	H	3.33	43.77	54	-10.23
5400	53.46	PK	114	1.9	V	3.33	56.79	74	-17.21
5400	38.74	Ave.	114	1.9	V	3.33	42.07	54	-11.93
5470	58.76	PK	99	2.4	H	3.31	62.07	68.2	-6.13
5470	57.97	PK	158	2.2	V	3.31	61.28	68.2	-6.92
11020	35.14	PK	272	1.2	H	16.30	51.44	74	-22.56
11020	32.93	PK	127	1.5	V	16.30	49.23	74	-24.77
802.11n40 ,5550 MHz									
11100	35.05	PK	189	1.7	H	15.99	51.04	74	-22.96
11100	33.64	PK	80	1	V	15.99	49.63	74	-24.37
802.11n40 ,5710 MHz									
5850	60.19	PK	94	2.4	H	3.96	64.15	68.2	-4.05
5850	59.11	PK	94	2.4	V	3.96	63.07	68.2	-5.13
5925	57.24	PK	9	2.1	H	4.03	61.27	68.2	-6.93
5925	56.90	PK	9	2.1	V	4.03	60.93	68.2	-7.27
11420	37.10	PK	66	2.5	H	14.98	52.08	74	-21.92
11420	35.90	PK	66	2.5	V	14.98	50.88	74	-23.12
802.11ac20 ,5500 MHz									
5400	55.49	PK	197	1.2	H	3.33	58.82	74	-15.18
5400	40.60	Ave.	197	1.2	H	3.33	43.93	54	-10.07
5400	53.78	PK	178	1.3	V	3.33	57.11	74	-16.89
5400	39.03	Ave.	178	1.3	V	3.33	42.36	54	-11.64
5470	59.28	PK	354	1.1	H	3.31	62.59	68.2	-5.61
5470	58.15	PK	231	1.2	V	3.31	61.46	68.2	-6.74
11000	35.23	PK	190	2.2	H	16.30	51.53	74	-22.47
11000	33.55	PK	260	2	V	16.30	49.85	74	-24.15
802.11ac20 ,5580 MHz									
11160	35.69	PK	168	1.4	H	15.84	51.53	74	-22.47
11160	33.85	PK	54	1.2	V	15.84	49.69	74	-24.31
802.11ac20 ,5720 MHz									
5850	59.55	PK	69	1.8	H	3.96	63.51	68.2	-4.69
5850	58.91	PK	69	1.8	V	3.96	62.87	68.2	-5.33
5925	57.28	PK	120	1.2	H	4.03	61.31	68.2	-6.89
5925	56.63	PK	120	1.2	V	4.03	60.66	68.2	-7.54
11440	36.94	PK	312	1	H	14.90	51.84	74	-22.16
11440	35.29	PK	312	1	V	14.90	50.19	74	-23.81

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part15.407	
	Reading (dBμV)	Detector (PK/QP/AV)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11ac40									
802.11ac40,5510 MHz									
5400	55.04	PK	32	1.4	H	3.33	58.37	74	-15.63
5400	40.09	Ave.	32	1.4	H	3.33	43.42	54	-10.58
5400	53.29	PK	255	1.1	V	3.33	56.62	74	-17.38
5400	38.49	Ave.	255	1.1	V	3.33	41.82	54	-12.18
5470	58.46	PK	305	1.6	H	3.31	61.77	68.2	-6.43
5470	57.20	PK	194	1.5	V	3.31	60.51	68.2	-7.69
11020	35.41	PK	149	1.3	H	16.30	51.71	74	-22.29
11020	33.57	PK	213	1.4	V	16.30	49.87	74	-24.13
802.11ac40,5550 MHz									
11100	34.44	PK	220	1.2	H	15.99	50.43	74	-23.57
11100	32.83	PK	357	2.2	V	15.99	48.82	74	-25.18
802.11ac40,5710 MHz									
5850	59.83	PK	304	1.6	H	3.96	63.79	68.2	-4.41
5850	58.67	PK	304	1.6	V	3.96	62.63	68.2	-5.57
5925	57.03	PK	282	1.6	H	4.03	61.06	68.2	-7.14
5925	56.54	PK	282	1.6	V	4.03	60.57	68.2	-7.63
11420	36.59	PK	201	1.3	H	14.98	51.57	74	-22.43
11420	34.76	PK	201	1.3	V	14.98	49.74	74	-24.26
802.11ac80,5530 MHz									
5400	54.44	PK	73	2	H	3.33	57.77	74	-16.23
5400	39.52	Ave.	73	2	H	3.33	42.85	54	-11.15
5400	52.99	PK	296	1.8	V	3.33	56.32	74	-17.68
5400	38.34	Ave.	296	1.8	V	3.33	41.67	54	-12.33
5470	60.07	PK	330	2.1	H	3.31	63.38	68.2	-4.82
5470	59.63	PK	34	1.2	V	3.31	62.94	68.2	-5.26
11060	35.50	PK	135	1.6	H	16.15	51.65	74	-22.35
11060	33.57	PK	151	2.4	V	16.15	49.72	74	-24.28
802.11ac80,5610 MHz									
11220	35.56	PK	99	1.8	H	15.60	51.16	74	-22.84
11220	33.38	PK	73	1.6	V	15.60	48.98	74	-25.02
802.11ac80,5690 MHz									
5850	60.08	PK	62	2	H	3.96	64.04	68.2	-4.16
5850	58.97	PK	62	2	V	3.96	62.93	68.2	-5.27
5925	57.35	PK	123	1.5	H	4.03	61.38	68.2	-6.82
5925	56.64	PK	123	1.5	V	4.03	60.67	68.2	-7.53
11380	36.71	PK	174	2.3	H	15.13	51.84	74	-22.16
11380	34.76	PK	174	2.3	V	15.13	49.89	74	-24.11

Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

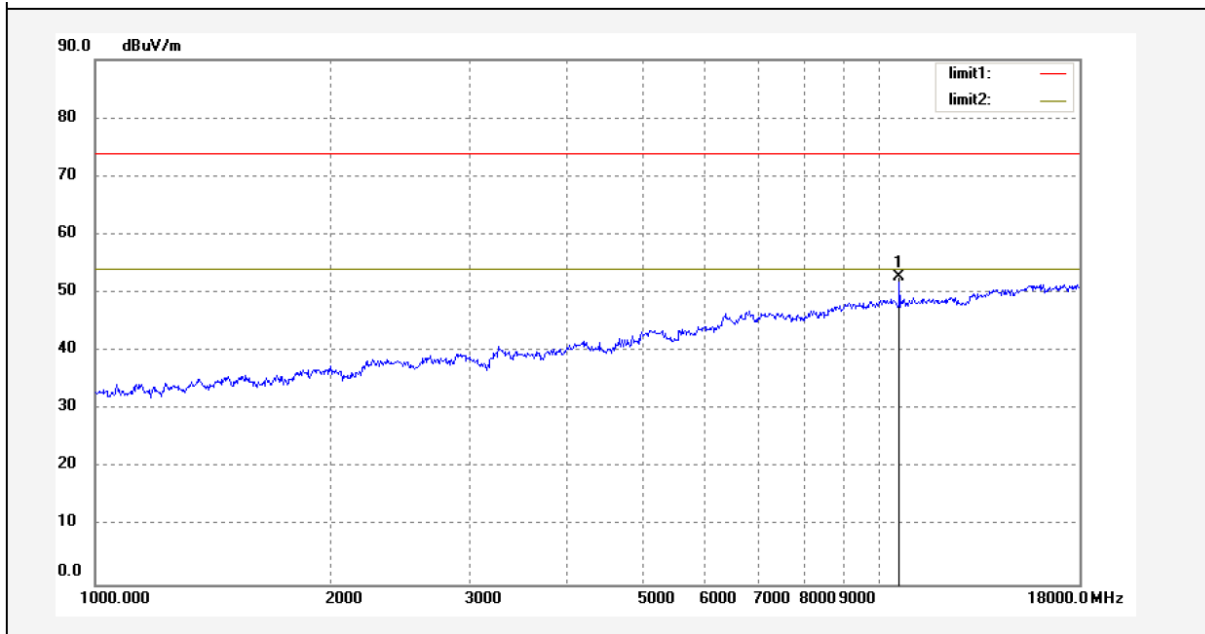
Margin = Corrected. Amplitude - Limit

The other spurious emission which is in the noise floor level was not recorded.

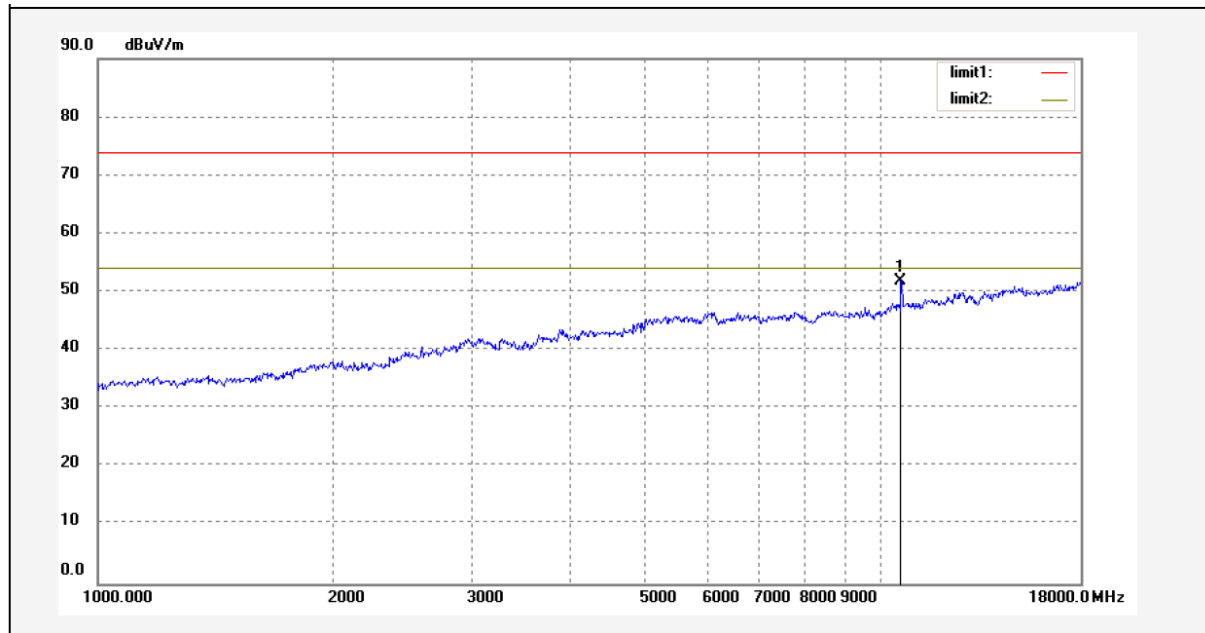
The test result of peak was less than the limit of average, so just peak values were recorded.

1-18 GHz:
Pre-scan Plots:

Peak
Pre-scan with 802.11a, 5280MHz
Horizontal



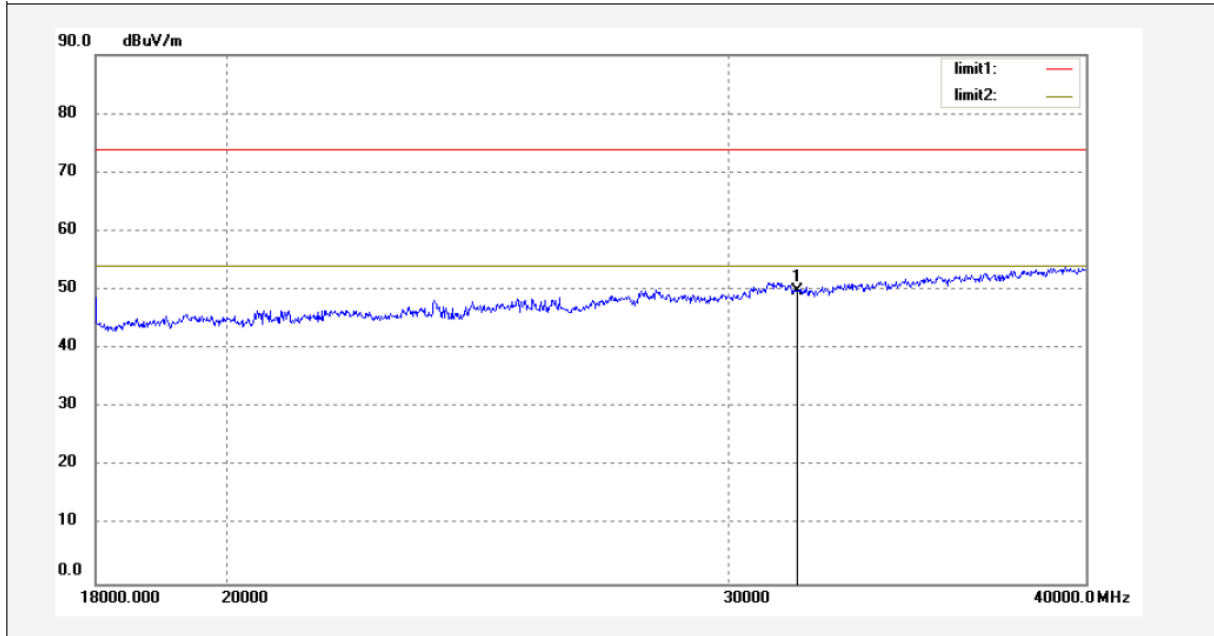
Vertical



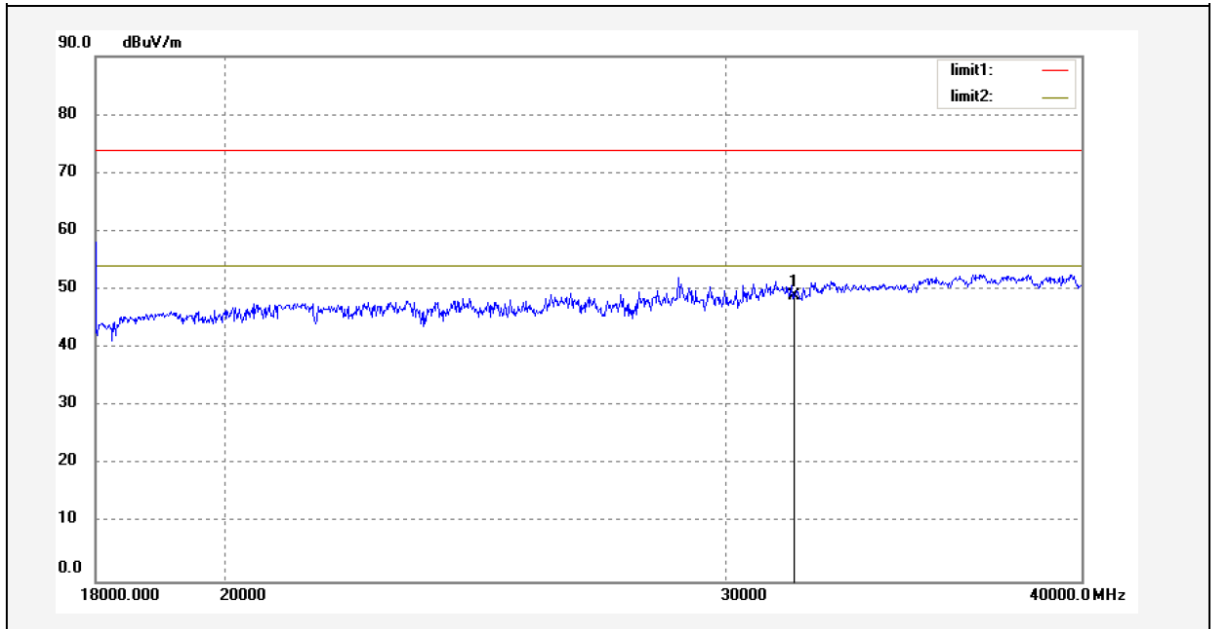
18 -40GHz:

Pre-scan Plots:

Horizontal



Vertical



FCC §15.407(a),(e) – 26 dB & 6dB EMISSION BANDWIDTH

Applicable Standard

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

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. Emission Bandwidth (EBW)

- a) Set RBW = approximately 1% of the emission bandwidth.
- b) Set the VBW > RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Measure the maximum width of the emission that is 26 dB down from the maximum 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%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.725-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) 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.

