TEST REPORT

Applicant Name :	Seeed Technology Co., Ltd
Address :	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Report Number :	SZNS211025-54608E-00B
FCC ID:	Z4T-RESERVER-A

Test Standard (s)

FCC PART 15.247

Sample Description

Product:	reServer-X86-A1135
Trademark:	Seeed Studio
Tested Model:	reServer-I51135(64G+512G/z)
Multiple Product and Model:	reServer-X86-A1115, reServer-I31115(xx+yy/z); reServer-X86-A1125, reServer-I31125(xx+yy/z) reServer-X86-A1135, reServer-I51135(xx+yy/z) (Note: xx: DDR, 8G/16G/32G/64G yy: SSD, 128G/256G/512G; z: wifi module)
Date Received:	2021-10-20
Date of Test:	2021-10-22 to 2022-04-18
Report Date:	2022-04-19

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Ting Lü

EMC Engineer

Approved By:

Candy Li

EMC Engineer

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	reServer-X86-A1135	
Trademark	Seeed Studio	
Tested Model	reServer-I51135(64G+512G/z)	
Multiple Product and Model	reServer-X86-A1115	reServer-I31115(xx+yy/z)
	reServer-X86-A1125	reServer-I31125(xx+yy/z)
	reServer-X86-A1135	reServer-I51135(xx+yy/z)
	(Note: xx: DDR, 8G/16G/32G/64G; yy: SSD, 128G/256G/512G; z: wifi module)	
Model difference	Please refer to the DoS letter	
Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2462MHz	
Maximum Conducted Peak Output Power	BLE: 2.84dBm Wi-Fi: Ant1: 16.34dBm(802.11b), 15.97dBm(802.11g) 16.18dBm(802.11n20), 15.98dBm(802.11n40) Ant2: 16.37dBm(802.11b), 16.05dBm(802.11g) 16.14dBm(802.11n20), 16.00dBm(802.11n40)	
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM	
Antenna Specification*	External Antenna 1&2: 2.13dBi (provided by the applicant)	
Voltage Range	DC 12V from adapter.	
Sample serial number	SZNS211025-54608E-RF-S1	
Sample/EUT Status	Good condition	
Adapter 1 information	Model: HA-1600-12 Input: 100-240V~1.7A 50/60Hz, Output: DC 12V, 5A	
Adapter 2 information	Model: PA-1061-81 Input: 100-240V~, 50/60Hz 1.6A Output: DC 12V, 5A, 60W	

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

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.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

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.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz – 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1℃
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 (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 mode, total 11 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

802.11b, 802.11g and 802.11n-HT20 mode was tested with Channel 1, 6 and 11.
802.11n-HT40 mode was tested with Channel 3, 6 and 9.

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Software of “app DRTU”* provided by manufacturer and power level as below:

Item	Mode	Data Rate (Mbps)	Power Level*
Wi-Fi	802.11 b	1	12.5
	802.11 g	6	12.5
	802.11 n20	MCS0	12.5
	802.11 n40	MCS0	12.5
BLE 1M	Default	Default	6
BLE 2M	Default	Default	6

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

The device only supports SISO in all modes for Wi-Fi, per pretest and all the antenna ports have the same power level for SISO modes.

Support Equipment List and Details

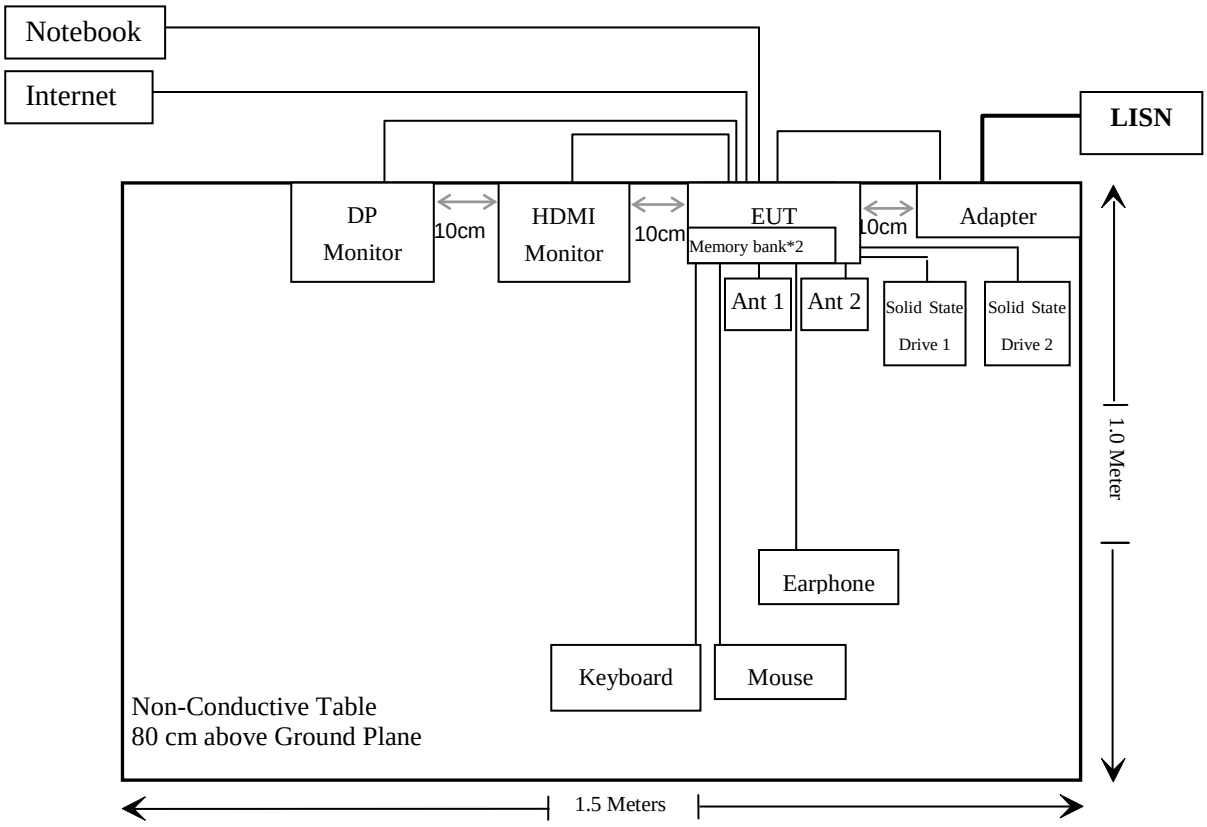
Manufacturer	Description	Model	Serial Number
DELL	Keyboard	L100	CN0RH66658985C018C
DELL	Mouse	MOC5UG	Unknown
PHILIPS	DP Monitor	275M7C	Unknown
DELL	HDMI Monitor	ST2310f	Unknown
ZHIKE	Solid State Drive 1	U300	USA210510105
ZHIKE	Solid State Drive 2	U300	USA210510106
BORY	NVME PCIE SSD	Unknown	800295763
Kingston	Memory bank 1	9905700-E15.AOOG	Unknown
Kingston	Memory bank 2	99P5711-002.AOOG	Unknown
Unknown	M.2 PCI-E	YX-520	2106H520A 128GA 18829
SCI	Earphone	SCRC-130A	Unknown
Lenovo	Notebook	T430	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Detachable DC output Cable	1.15	Adapter 1	EUT
Unshielded Detachable DC output Cable	1.0	Adapter2	EUT
Unshielded Detachable AC power Cable	1.0	EUT	Adapter 1
Unshielded Detachable AC power Cable	1.5	EUT	Adapter 2
Shielded Detachable HDMI Cable	1.75	EUT	HDMI Monitor
Shielded Detachable DP Cable	1.75	EUT	DP Monitor
Unshielded Detachable USB Cable	1.5	EUT	Mouse
Unshielded Detachable USB Cable	1.5	EUT	Keyboard
Unshielded Detachable RJ45 Cable 1	3	Internet	EUT
Unshielded Detachable RJ45 Cable 2	3	Notebook	EUT
Unshielded Detachable earphone Cable	0.75	EUT	Earphone

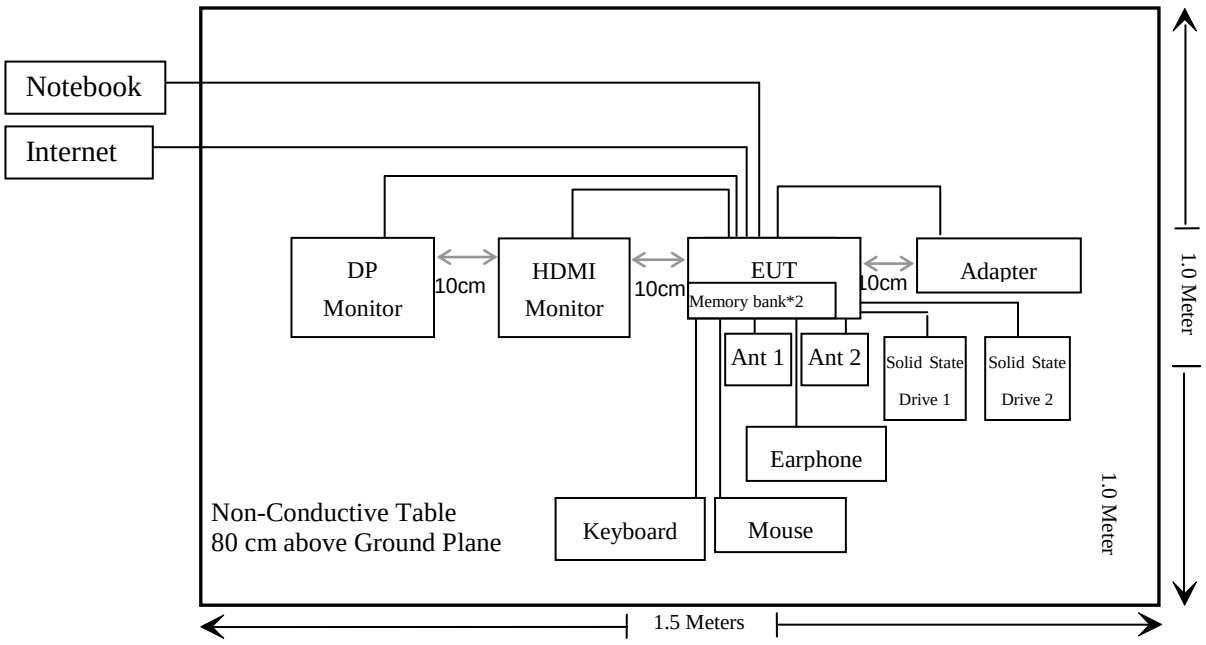
Block Diagram of Test Setup

For conducted emission:

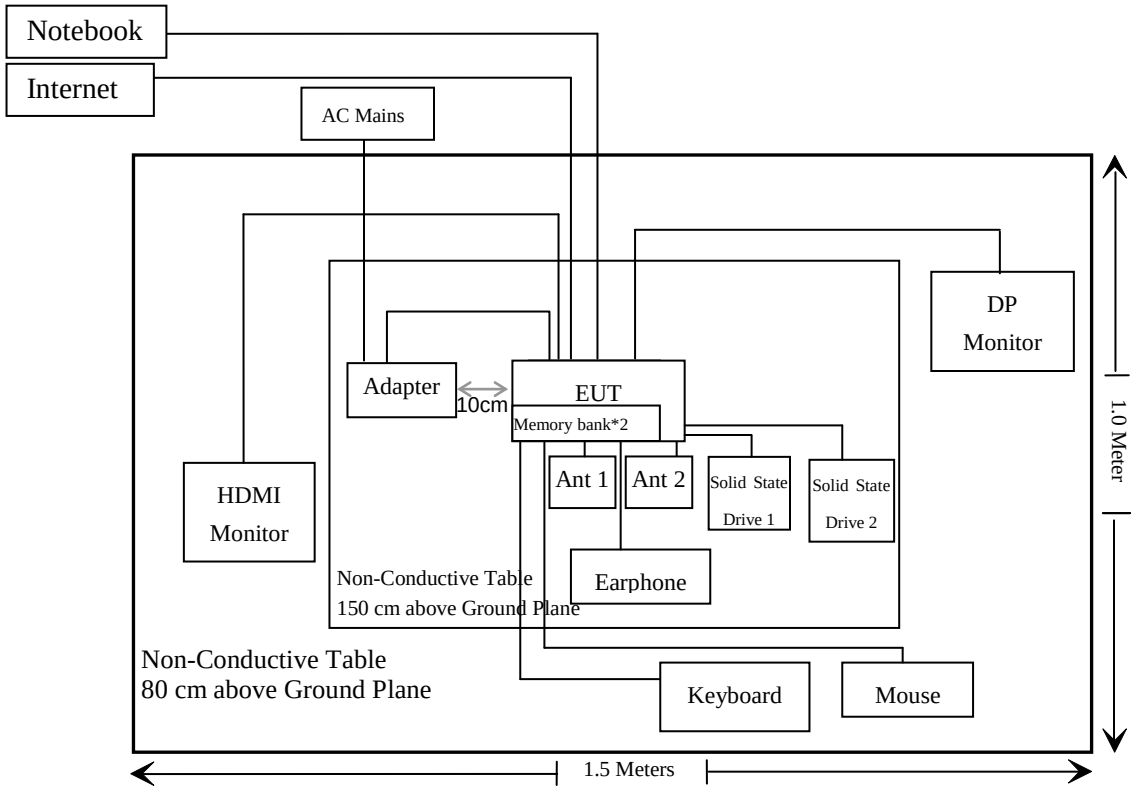


For Radiated Emission:

Below 1GHz:



Above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i), §2.1091	Maximum Permissible Exposure(MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant*
§15.247(b)(3)	Maximum Conducted Output Power	Compliant* (Note*)
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant*
§15.247(e)	Power Spectral Density	Compliant*

Compliant*: This device contains one same PCBA Module Radio unit, which certified with product model of ODYSSEY-I51135(64G+512G/z), FCC ID: Z4T-ODYSSEY-A, please refers to report: SZNS211008-51520E-00B.
Note: Per pre-test for all models, and the worst case about maximum emission is model of reServer-I51135(64G+512G/z), which was recorded in this report.
Note*: The EUT had been tested and verified the RF parameters consistently with the PCBA Module.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2021/02/03	2022/02/02
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50Ω Coaxial 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: e3 19821b (V9)					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2020/12/25	2021/12/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/5/18	2022/5/17
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/11/9	2022/11/8
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
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.3	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-10m	No.7	2020/11/09	2021/11/08
Unknown	RF Coaxial Cable	N-2m	No.8	2020/11/09	2021/11/08
Radiated Emission Test Software: e3 19821b (V9)					
RF Conducted Test					
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2021/12/13	2022/12/12
WEINSCHEL	10dB Attenuator	5324	AU 3842	Each time	
Unknown	RF Coaxial Cable	No.32	RF-02	Each time	

*** 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 §15.247 (i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For worst case:

Frequency (MHz)	Maximum Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
2402-2480	2.13	1.63	3	2.00	20	0.0006	1
2412-2462	2.13	1.63	16.5	44.67	20	0.0145	1

Note: 1. The tune up conducted power was declared by the applicant.
2. The BT and Wi-Fi can not transmit at the same time.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

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 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has two external Antennas arrangement for 2.4G Wi-Fi, which was used a unique coupling and the antenna gain is 2.13dBi, fulfill the requirement of this section. Please refer to the EUT photos.

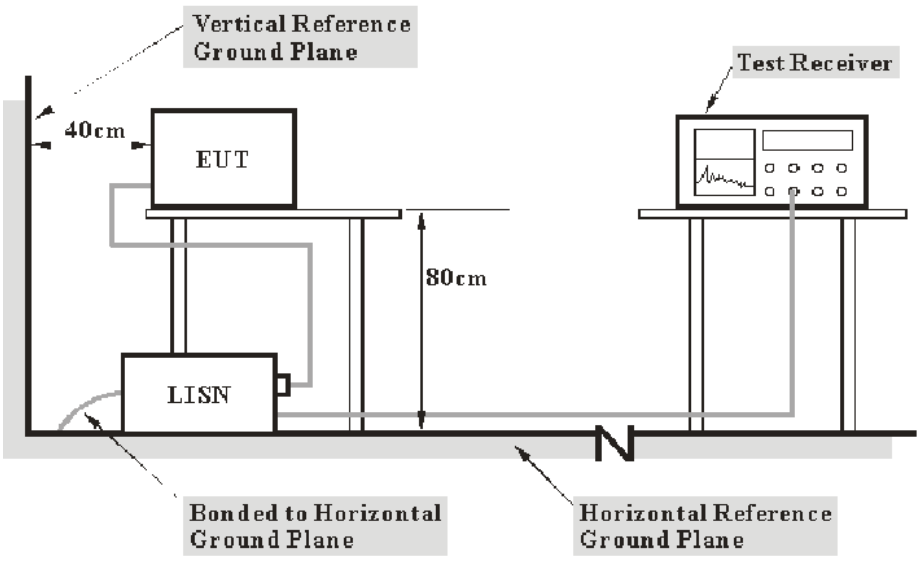
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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 outlet of the LISN.

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

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

Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss. The basic equation is as follows:

Transd Factor = LISN VDF + Cable Loss

The "**Over limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

Test Data

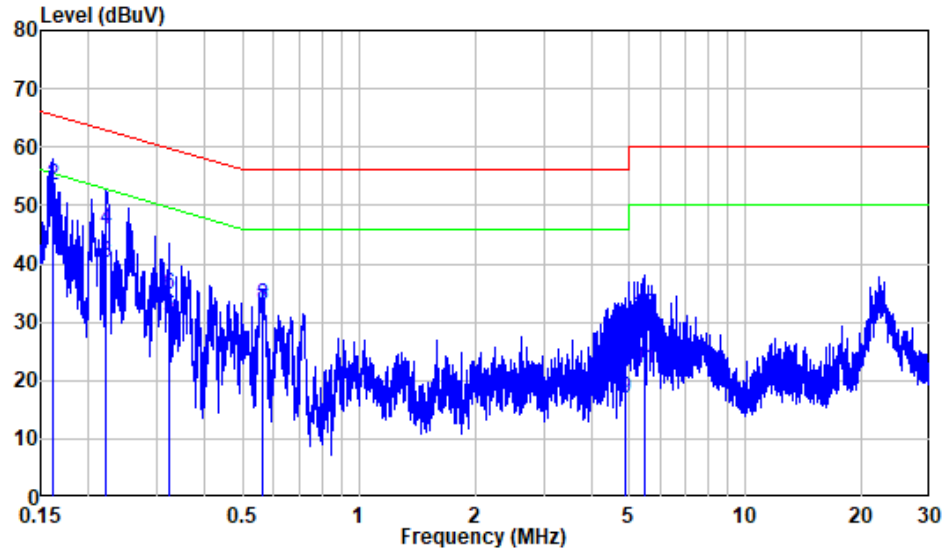
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Bin Duan on 2021-11-18.

EUT operation mode: 2.4G Wi-Fi transmitting (worst case)

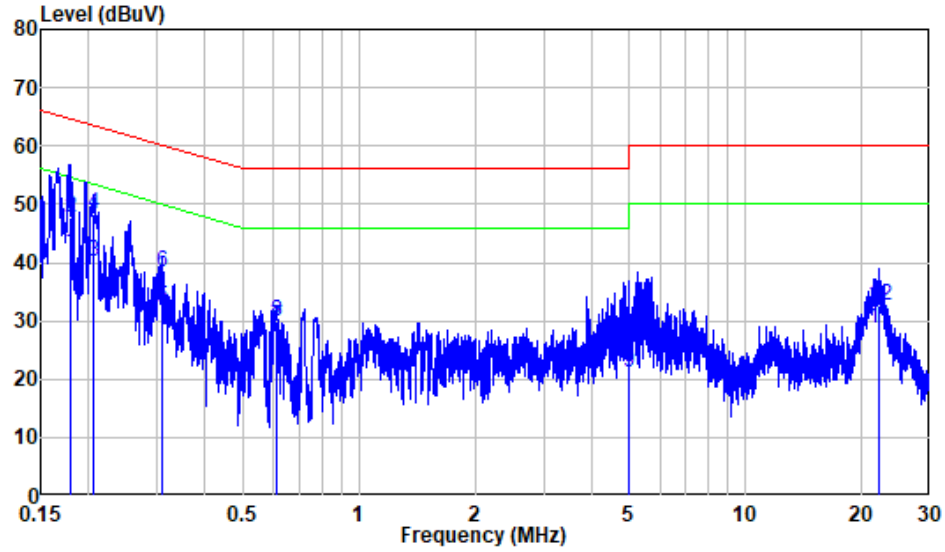
Adapter 1:
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Mode : 2.4G WIFI
Model : reServer-I51135 (64G+512G/z)

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.161	9.87	37.04	46.91	55.40	-8.49	Average
2	0.161	9.87	43.64	53.51	65.40	-11.89	QP
3	0.222	9.80	30.39	40.19	52.73	-12.54	Average
4	0.222	9.80	36.17	45.97	62.73	-16.76	QP
5	0.322	9.80	20.99	30.79	49.65	-18.86	Average
6	0.322	9.80	24.85	34.65	59.65	-25.00	QP
7	0.564	9.81	22.14	31.95	46.00	-14.05	Average
8	0.564	9.81	23.06	32.87	56.00	-23.13	QP
9	4.896	9.99	7.00	16.99	46.00	-29.01	Average
10	4.896	9.99	17.43	27.42	56.00	-28.58	QP
11	5.455	10.01	11.94	21.95	50.00	-28.05	Average
12	5.455	10.01	21.06	31.07	60.00	-28.93	QP

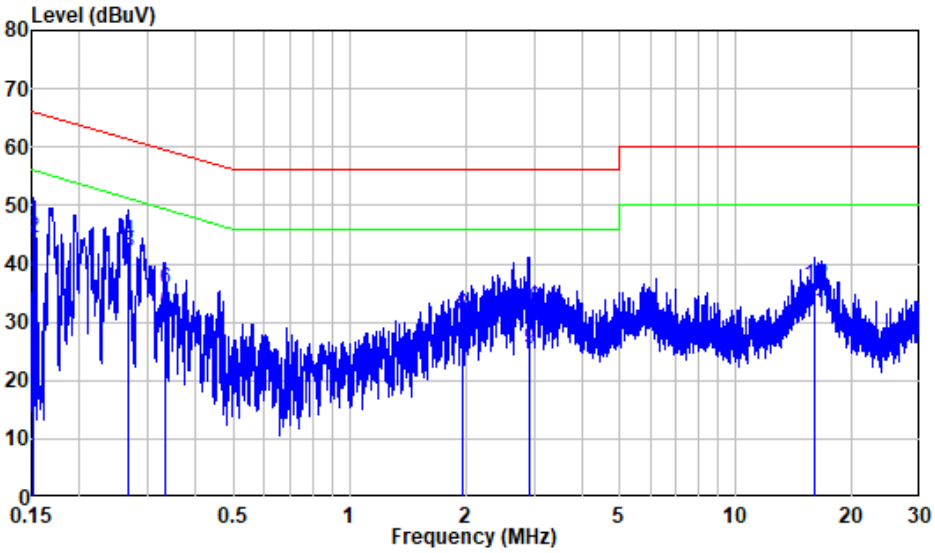
AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Mode : 2.4G WIFI
Model : reServer-I51135 (64G+512G/z)

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.179	9.96	31.73	41.69	54.55	-12.86	Average
2	0.179	9.96	37.88	47.84	64.55	-16.71	QP
3	0.206	10.00	30.03	40.03	53.35	-13.32	Average
4	0.206	10.00	38.36	48.36	63.35	-14.99	QP
5	0.308	9.95	22.35	32.30	50.02	-17.72	Average
6	0.308	9.95	28.35	38.30	60.02	-21.72	QP
7	0.610	9.91	19.15	29.06	46.00	-16.94	Average
8	0.610	9.91	20.00	29.91	56.00	-26.09	QP
9	4.968	10.05	11.05	21.10	46.00	-24.90	Average
10	4.968	10.05	17.87	27.92	56.00	-28.08	QP
11	22.048	10.24	18.57	28.81	50.00	-21.19	Average
12	22.048	10.24	22.23	32.47	60.00	-27.53	QP

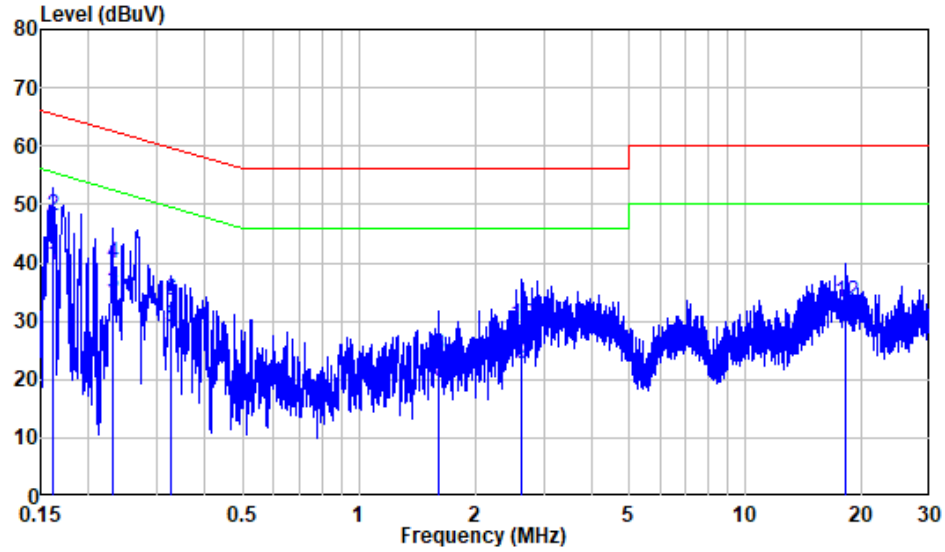
Adapter 2:
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Mode : 2.4G WIFI
Model : reServer-I51135 (64G+512G/z)

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.152	9.89	27.08	36.97	55.87	-18.90	Average
2	0.152	9.89	34.51	44.40	65.87	-21.47	QP
3	0.266	9.80	32.31	42.11	51.23	-9.12	Average
4	0.266	9.80	34.00	43.80	61.23	-17.43	QP
5	0.331	9.80	21.60	31.40	49.42	-18.02	Average
6	0.331	9.80	25.95	35.75	59.42	-23.67	QP
7	1.953	9.92	15.05	24.97	46.00	-21.03	Average
8	1.953	9.92	21.24	31.16	56.00	-24.84	QP
9	2.907	9.93	15.56	25.49	46.00	-20.51	Average
10	2.907	9.93	22.25	32.18	56.00	-23.82	QP
11	15.959	10.08	21.53	31.61	50.00	-18.39	Average
12	15.959	10.08	26.08	36.16	60.00	-23.84	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Mode : 2.4G WIFI
Model : reServer-I51135 (64G+512G/z)

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.162	9.93	29.53	39.46	55.36	-15.90	Average
2	0.162	9.93	38.13	48.06	65.36	-17.30	QP
3	0.230	9.98	24.74	34.72	52.46	-17.74	Average
4	0.230	9.98	29.74	39.72	62.46	-22.74	QP
5	0.326	9.95	18.89	28.84	49.56	-20.72	Average
6	0.326	9.95	23.42	33.37	59.56	-26.19	QP
7	1.601	9.92	9.79	19.71	46.00	-26.29	Average
8	1.601	9.92	14.12	24.04	56.00	-31.96	QP
9	2.640	9.97	12.70	22.67	46.00	-23.33	Average
10	2.640	9.97	19.37	29.34	56.00	-26.66	QP
11	18.183	10.15	18.86	29.01	50.00	-20.99	Average
12	18.183	10.15	22.98	33.13	60.00	-26.87	QP

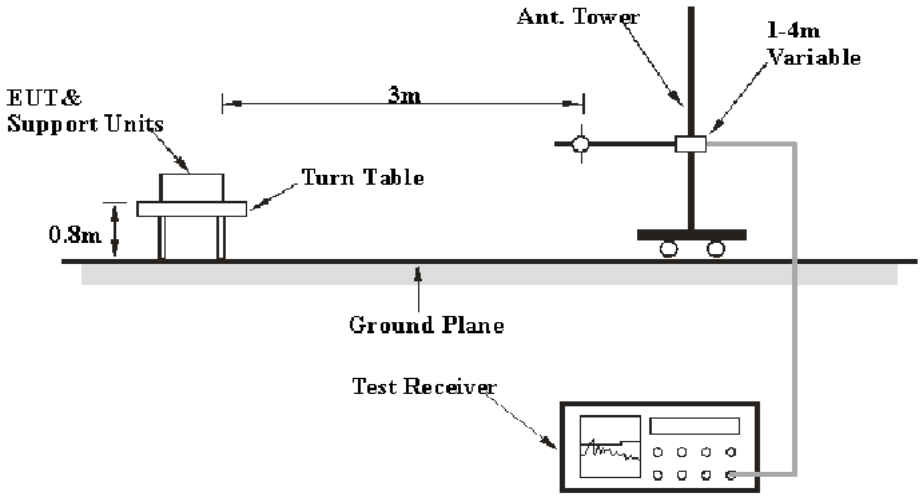
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

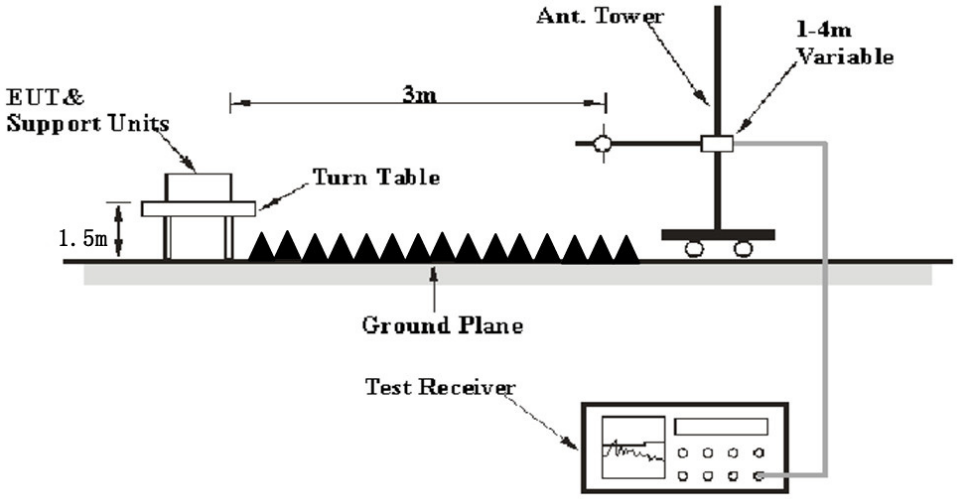
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

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	1MHz	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

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

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

Factor & Margin Calculation

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

Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Over Limit = Result / Corrected Amplitude – Limit
Result / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

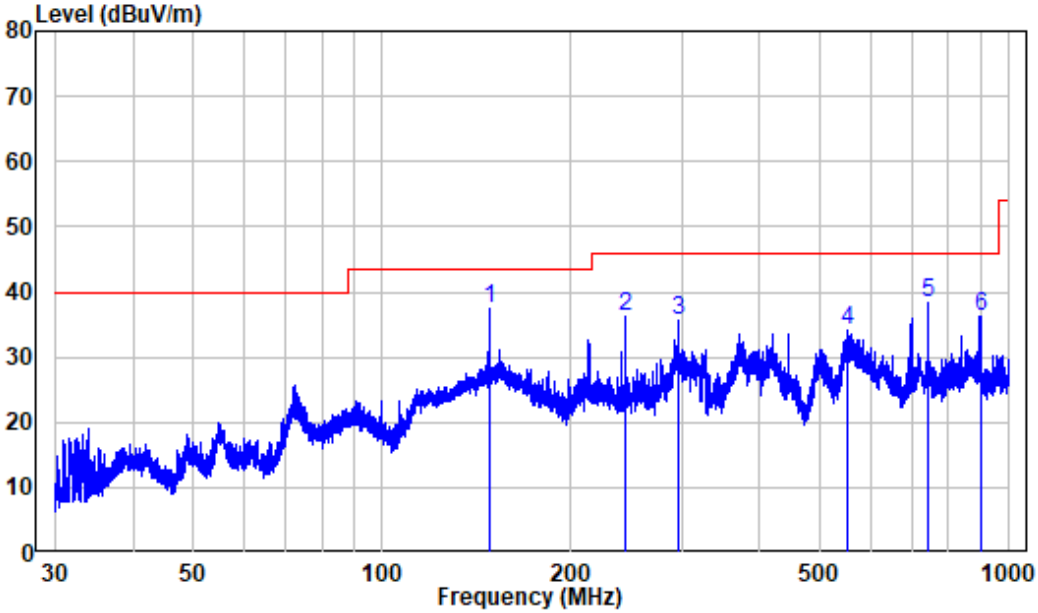
Temperature:	23 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Chao Mo on 2021-11-16 for below 1GHz and by Chao Mo on 2021-11-22 for above

EUT operation mode: Transmitting (worst case as below)

30MHz-1GHz: (Worst case for 802.11B mode, Low Channel, Antenna 1)
Adapter 1:

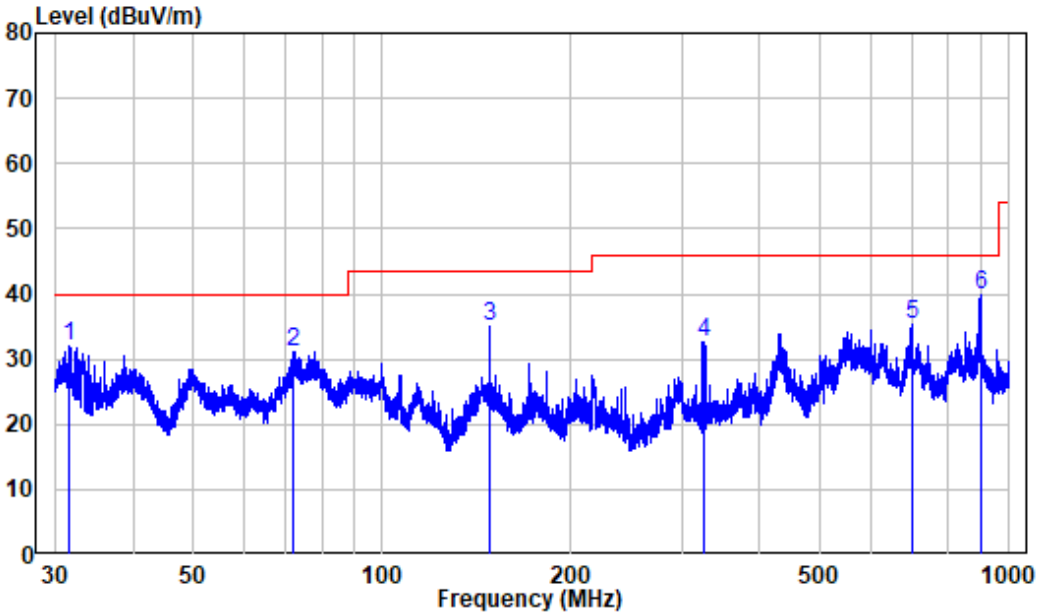
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS211025-54608E-RF
Test Mode: 2.4GWIFI
Note : Adapter 1#

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	148.51	-21.63	59.07	37.44	43.50	-6.06	Peak
2	243.70	-18.64	54.79	36.15	46.00	-9.85	Peak
3	296.96	-16.77	52.52	35.75	46.00	-10.25	Peak
4	552.16	-12.36	46.45	34.09	46.00	-11.91	Peak
5	742.58	-11.14	49.44	38.30	46.00	-7.70	Peak
6	900.15	-8.11	44.47	36.36	46.00	-9.64	Peak

Vertical

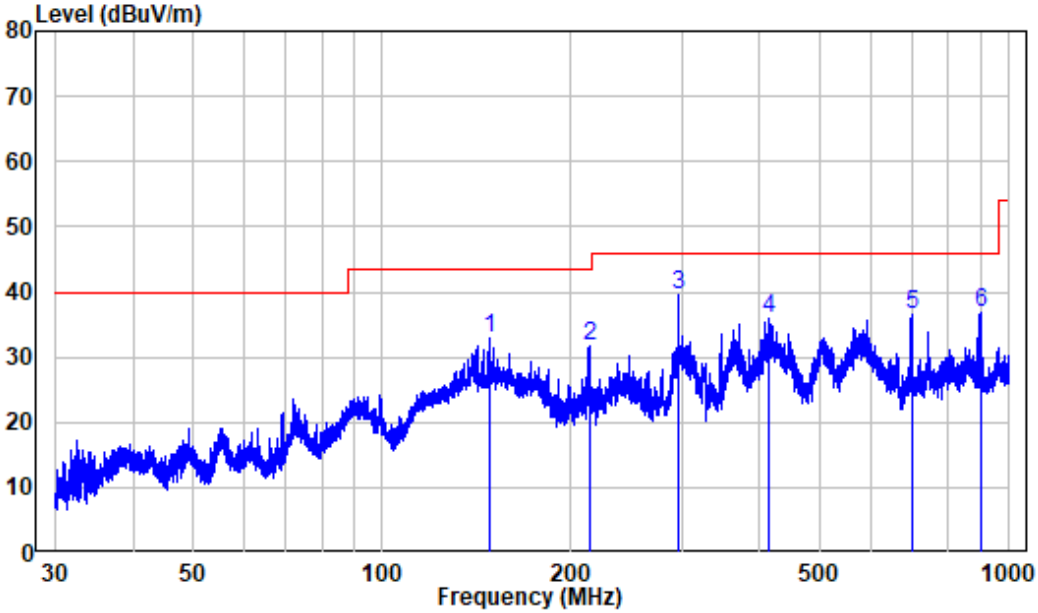


Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS211025-54608E-RF
Test Mode: 2.4GWIFI
Note : Adapter 1#

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	31.66	-20.18	52.08	31.90	40.00	-8.10	Peak
2	72.27	-21.74	52.92	31.18	40.00	-8.82	Peak
3	148.51	-21.63	56.62	34.99	43.50	-8.51	Peak
4	326.17	-16.75	49.33	32.58	46.00	-13.42	Peak
5	698.69	-11.40	46.81	35.41	46.00	-10.59	Peak
6	899.36	-8.14	47.86	39.72	46.00	-6.28	Peak

Adapter 2:

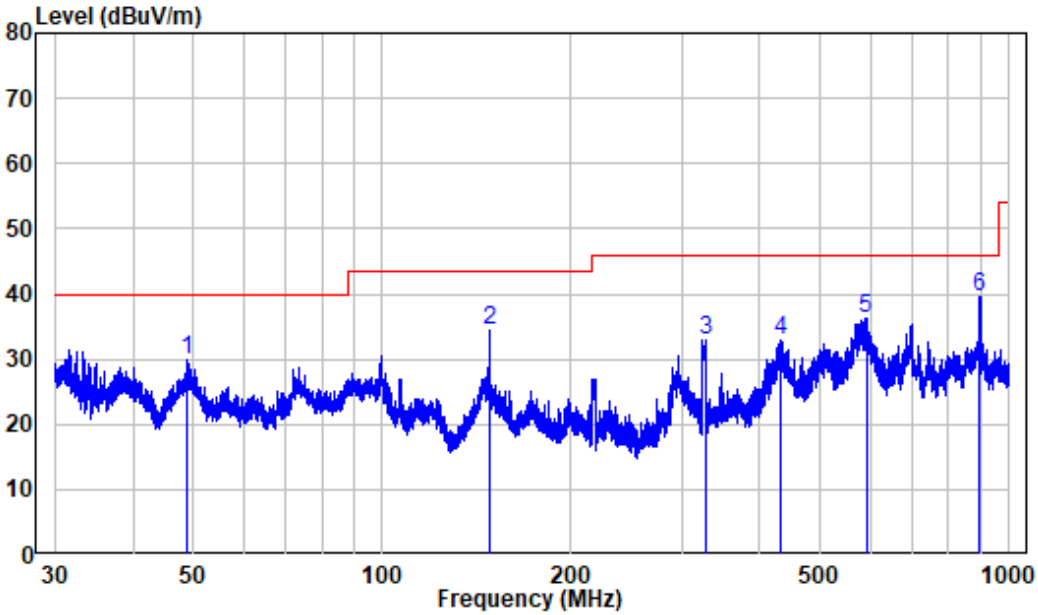
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS211025-54608E-RF
Test Mode: 2.4GWIFI
Note : Adapter 2#

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	148.51	-21.63	54.44	32.81	43.50	-10.69	Peak
2	213.86	-18.99	50.75	31.76	43.50	-11.74	Peak
3	296.96	-16.77	56.23	39.46	46.00	-6.54	Peak
4	412.55	-15.11	50.91	35.80	46.00	-10.20	Peak
5	699.92	-11.37	47.93	36.56	46.00	-9.44	Peak
6	899.75	-8.12	44.87	36.75	46.00	-9.25	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS211025-54608E-RF
Test Mode: 2.4GWIFI
Note : Adapter 2#

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	48.86	-17.29	47.12	29.83	40.00	-10.17	Peak
2	148.51	-21.63	56.14	34.51	43.50	-8.99	Peak
3	327.46	-16.71	49.71	33.00	46.00	-13.00	Peak
4	431.98	-14.37	47.19	32.82	46.00	-13.18	Peak
5	591.23	-10.98	47.25	36.27	46.00	-9.73	Peak
6	897.00	-8.24	47.73	39.49	46.00	-6.51	Peak

1-25 GHz:
BLE:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
BLE 1M Low channel									
2310	50.87	PK	216	1.6	H	-6.84	44.03	74	-29.97
2310	50	PK	106	2.2	V	-6.84	43.16	74	-30.84
2390	52.24	PK	123	1.7	H	-6.44	45.8	74	-28.2
2390	51.1	PK	138	1.3	V	-6.44	44.66	74	-29.34
4804	40.58	PK	198	1.2	H	2.81	43.39	74	-30.61
4804	39.34	PK	226	1.1	V	2.81	42.15	74	-31.85
BLE 1M Middle channel									
4880	39.94	PK	254	1.8	H	3.04	42.98	74	-31.02
4880	39	PK	150	1.3	V	3.04	42.04	74	-31.96
BLE 1M High channel									
2483.5	51.66	PK	227	2.1	H	-5.96	45.7	74	-28.3
2483.5	50.86	PK	157	1.2	V	-5.96	44.9	74	-29.1
2500	49.78	PK	176	2.0	H	-5.88	43.9	74	-30.1
2500	48.83	PK	160	1.6	V	-5.88	42.95	74	-31.05
4960	39.69	PK	350	1.5	H	3.29	42.98	74	-31.02
4960	38.3	PK	33	1.2	V	3.29	41.59	74	-32.41
BLE 2M Low channel									
2310	51.06	PK	232	1.4	H	-6.84	44.22	74	-29.78
2310	50.41	PK	337	1.4	V	-6.84	43.57	74	-30.43
2390	53.47	PK	7	1.9	H	-6.44	47.03	74	-26.97
2390	51.75	PK	240	1.1	V	-6.44	45.31	74	-28.69
4804	40.79	PK	190	1.3	H	2.81	43.6	74	-30.4
4804	39.63	PK	185	1.8	V	2.81	42.44	74	-31.56
BLE 2M Middle channel									
4880	39.66	PK	134	1.1	H	3.04	42.7	74	-31.3
4880	39.09	PK	300	2.1	V	3.04	42.13	74	-31.87
BLE 2M High channel									
2483.5	53.47	PK	349	1.3	H	-5.96	47.51	74	-26.49
2483.5	52.09	PK	275	2.0	V	-5.96	46.13	74	-27.87
2500	50.24	PK	216	1.5	H	-5.88	44.36	74	-29.64
2500	51.86	PK	320	1.3	V	-5.88	45.98	74	-28.02
4960	40.1	PK	286	2.2	H	3.29	43.39	74	-30.61
4960	38.77	PK	140	2.0	V	3.29	42.06	74	-31.94

Wi-Fi: Pre-scan with two antennas, and worst case for antenna 1 was recorded

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
802.11B Low channel									
2310	51.9	PK	269	1.4	H	-6.84	45.06	74	-28.94
2310	51.69	PK	273	1.8	V	-6.84	44.85	74	-29.15
2390	56.9	PK	314	1.1	H	-6.44	50.46	74	-23.54
2390	56.31	PK	274	1.8	V	-6.44	49.87	74	-24.13
4824	41.26	PK	314	2.0	H	2.87	44.13	74	-29.87
4824	40.39	PK	98	1.1	H	2.87	43.26	74	-30.74
802.11B Middle channel									
4874	39.94	PK	200	1.5	H	3.01	42.95	74	-31.05
4874	38.35	PK	347	1.8	V	3.01	41.36	74	-32.64
802.11B High channel									
2483.5	55.61	PK	2	1.7	H	-5.96	49.65	74	-24.35
2483.5	54.94	PK	7	2.0	V	-5.96	48.98	74	-25.02
2500	51.01	PK	325	1.5	H	-5.88	45.13	74	-28.87
2500	50.17	PK	169	2.0	V	-5.88	44.29	74	-29.71
4924	40.81	PK	56	2.0	H	3.17	43.98	74	-30.02
4924	39.78	PK	328	1.1	V	3.17	42.95	74	-31.05
802.11G Low channel									
2310	51.84	PK	324	1.2	H	-6.84	45	74	-29
2310	50.78	PK	114	2.1	V	-6.84	43.94	74	-30.06
2390	56.38	PK	199	1.9	H	-6.44	49.94	74	-24.06
2390	54.63	PK	128	1.1	V	-6.44	48.19	74	-25.81
4824	40.85	PK	207	1.6	H	2.87	43.72	74	-30.28
4824	39.24	PK	125	1.6	V	2.87	42.11	74	-31.89
802.11G Middle channel									
4874	40.7	PK	234	1.3	H	3.01	43.71	74	-30.29
4874	39.05	PK	241	2.0	V	3.01	42.06	74	-31.94
802.11G High channel									
2483.5	55.28	PK	133	1.7	H	-5.96	49.32	74	-24.68
2483.5	54.81	PK	252	1.1	V	-5.96	48.85	74	-25.15
2500	50.91	PK	113	2.1	H	-5.88	45.03	74	-28.97
2500	50.5	PK	198	1.3	V	-5.88	44.62	74	-29.38
4924	40.29	PK	18	1.4	H	3.17	43.46	74	-30.54
4924	38.99	PK	185	1.1	V	3.17	42.16	74	-31.84
802.11N20 Low channel									
2310	51.54	PK	219	1.5	H	-6.84	44.7	74	-29.3
2310	50.69	PK	322	1.7	V	-6.84	43.85	74	-30.15
2390	56.31	PK	295	2.1	H	-6.44	49.87	74	-24.13
2390	54.77	PK	96	1.8	V	-6.44	48.33	74	-25.67
4824	41.05	PK	258	1.4	H	2.87	43.92	74	-30.08
4824	39.41	PK	260	1.2	V	2.87	42.28	74	-31.72
802.11N20 Middle channel									
4874	40.35	PK	166	1.9	H	3.01	43.36	74	-30.64
4874	39.12	PK	294	1.9	V	3.01	42.13	74	-31.87
802.11N20 High channel									
2483.5	55.94	PK	130	1.7	H	-5.96	49.98	74	-24.02
2483.5	54.29	PK	191	1.5	V	-5.96	48.33	74	-25.67

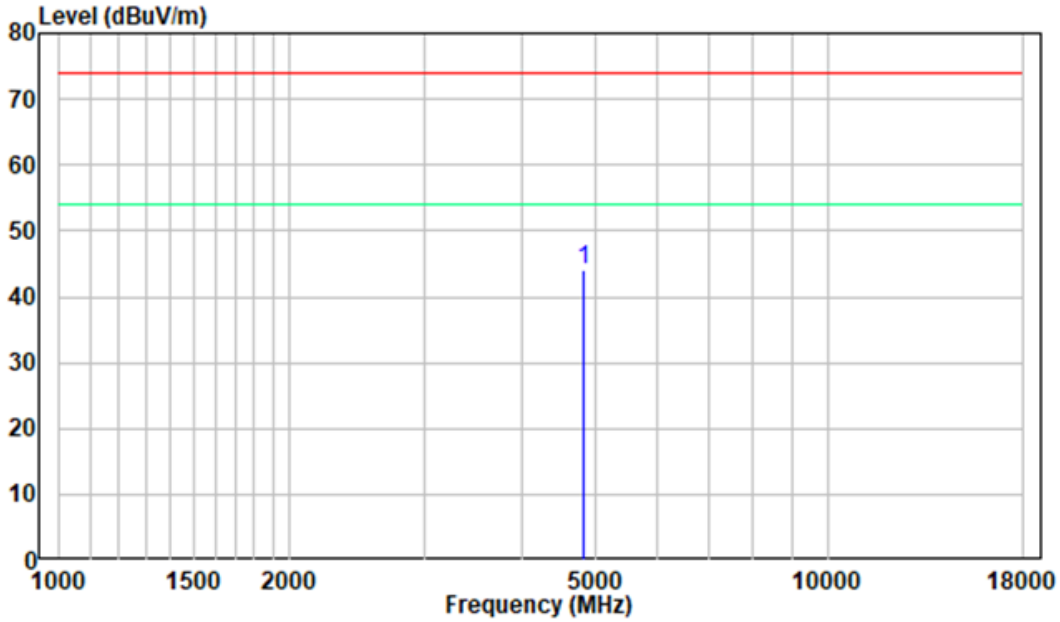
2500	50.24	PK	186	1.7	H	-5.88	44.36	74	-29.64
2500	49.31	PK	148	1.1	V	-5.88	43.43	74	-30.57
4924	39.85	PK	308	1.1	H	3.17	43.02	74	-30.98
4924	39.24	PK	337	1.6	V	3.17	42.41	74	-31.59
802.11N40 Low channel									
2310	51.87	PK	118	1.3	H	-6.84	45.03	74	-28.97
2310	51.03	PK	88	1.4	V	-6.84	44.19	74	-29.81
2390	55.83	PK	117	1.5	H	-6.44	49.39	74	-24.61
2390	55.07	PK	152	1.3	V	-6.44	48.63	74	-25.37
4844	40.5	PK	217	1.9	H	2.92	43.42	74	-30.58
4844	39.14	PK	282	1.9	V	2.92	42.06	74	-31.94
802.11N40 Middle channel									
4874	40.26	PK	306	1.3	H	3.01	43.27	74	-30.73
4874	39.04	PK	301	1.6	V	3.01	42.05	74	-31.95
802.11N40 High channel									
2483.5	55.47	PK	186	2.1	H	-5.96	49.51	74	-24.49
2483.5	54.13	PK	20	1.2	V	-5.96	48.17	74	-25.83
2500	50.74	PK	204	1.1	H	-5.88	44.86	74	-29.14
2500	49.48	PK	0	1.1	V	-5.88	43.6	74	-30.4
4904	40.16	PK	8	1.5	H	3.11	43.27	74	-30.73
4904	39.08	PK	153	2.2	V	3.11	42.19	74	-31.81

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Absolute Level (Corrected Amplitude) = Factor + Reading
Margin = Absolute Level (Corrected Amplitude) – Limit
The other spurious emission which is in the noise floor level was not recorded.
The test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, so just peak value was recorded.

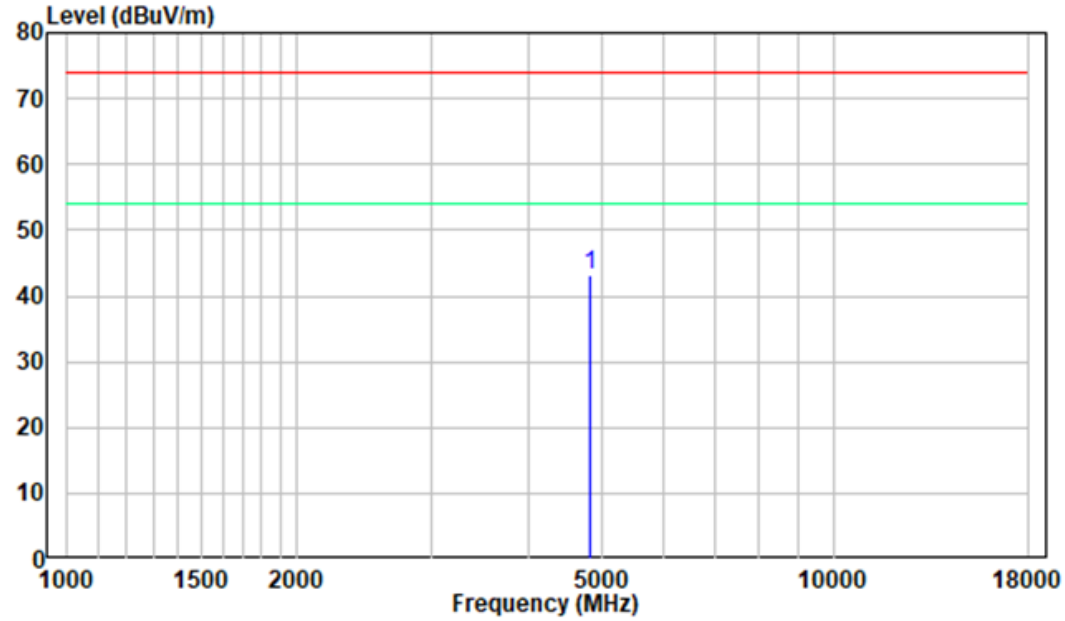
1-18 GHz:

Pre-scan plots:

802.11 b Low Channel
Horizontal



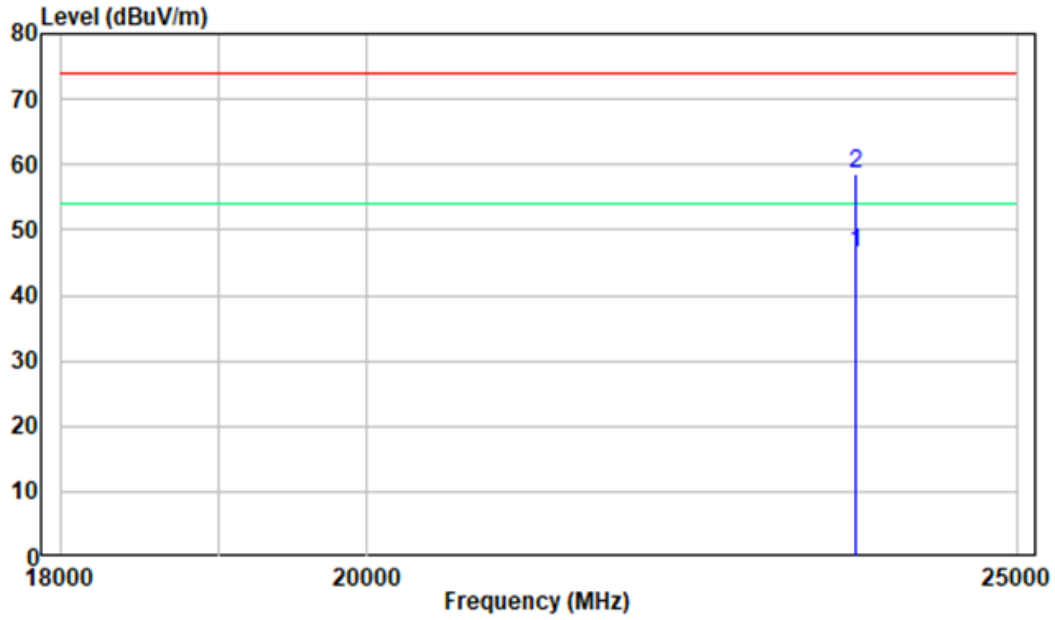
Vertical



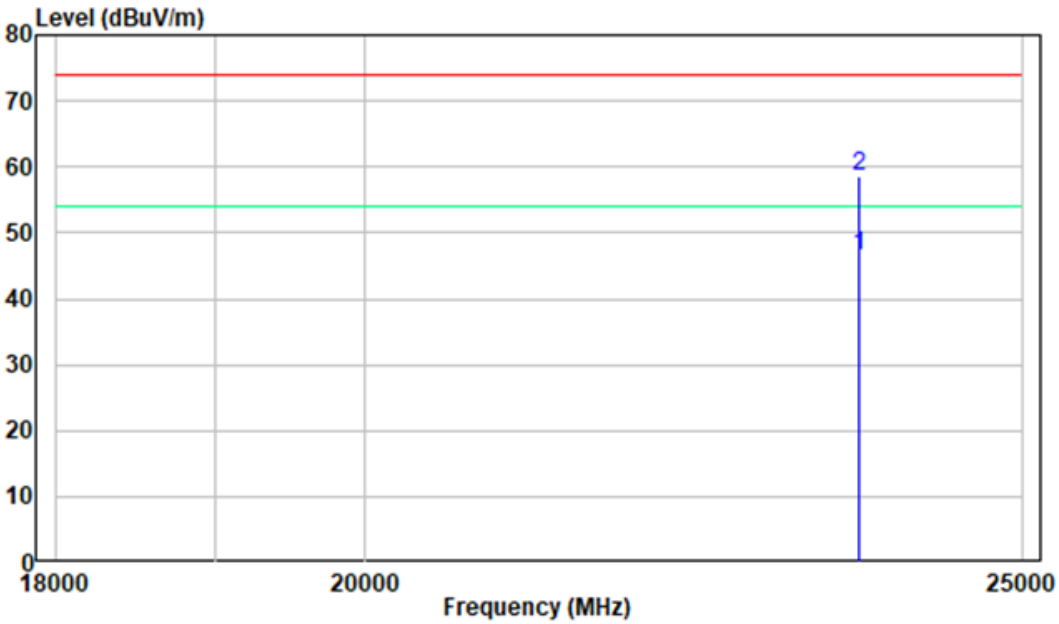
18 -25GHz:

Pre-scan plots

802.11 b Low Channel
Horizontal



Vertical



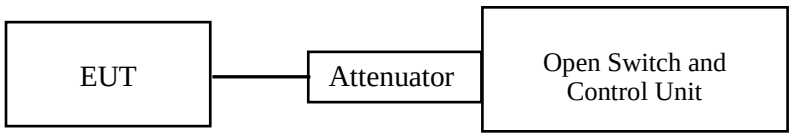
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Key Pei on 2022-04-18.

EUT operation mode: Transmitting

Test Result: Compliant.

For Wi-Fi Mode:

Peak output power:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	15.92	<=30	PASS
		2437	16.19	<=30	PASS
		2462	16.30	<=30	PASS
11G	Ant1	2412	15.37	<=30	PASS
		2437	15.60	<=30	PASS
		2462	15.94	<=30	PASS
11N20SISO	Ant1	2412	15.59	<=30	PASS
		2437	15.70	<=30	PASS
		2462	16.18	<=30	PASS
11N40SISO	Ant1	2422	15.58	<=30	PASS
		2437	15.72	<=30	PASS
		2452	15.93	<=30	PASS

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant2	2412	16.10	<=30	PASS
		2437	16.12	<=30	PASS
		2462	16.32	<=30	PASS
11G	Ant2	2412	15.72	<=30	PASS
		2437	15.91	<=30	PASS
		2462	16.00	<=30	PASS
11N20SISO	Ant2	2412	15.86	<=30	PASS
		2437	15.80	<=30	PASS
		2462	16.17	<=30	PASS
11N40SISO	Ant2	2422	15.50	<=30	PASS
		2437	15.77	<=30	PASS
		2452	16.05	<=30	PASS

Average output power:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	14.12	<=30	PASS
		2437	14.37	<=30	PASS
		2462	14.43	<=30	PASS
11G	Ant1	2412	12.60	<=30	PASS
		2437	12.67	<=30	PASS
		2462	12.90	<=30	PASS
11N20SISO	Ant1	2412	12.77	<=30	PASS
		2437	12.76	<=30	PASS
		2462	13.08	<=30	PASS
11N40SISO	Ant1	2422	11.70	<=30	PASS
		2437	11.99	<=30	PASS
		2452	12.06	<=30	PASS

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant2	2412	14.31	<=30	PASS
		2437	14.30	<=30	PASS
		2462	14.57	<=30	PASS
11G	Ant2	2412	12.85	<=30	PASS
		2437	12.90	<=30	PASS
		2462	13.07	<=30	PASS
11N20SISO	Ant2	2412	12.89	<=30	PASS
		2437	12.92	<=30	PASS
		2462	13.17	<=30	PASS
11N40SISO	Ant2	2422	11.78	<=30	PASS
		2437	11.93	<=30	PASS
		2452	12.05	<=30	PASS

For BLE mode:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	2.79	<=30	PASS
		2440	2.80	<=30	PASS
		2480	2.84	<=30	PASS
BLE_2M	Ant1	2402	2.50	<=30	PASS
		2440	2.80	<=30	PASS
		2480	2.81	<=30	PASS

******* END OF REPORT *******