



FCC Part 15C Test Report

FCC ID: 2AEZA-GWBOB01

Applicant: GUANGZHOU BOSMA TECHNOLOGY CO., LTD

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Guangzhou Hi-tech Industrial Development Zone, Guangzhou China

Manufacturer: GUANGZHOU BOSMA TECHNOLOGY CO., LTD

Address: Floor 3nd, Building A5, No.11, Kaiyuan Avenue,
Guangzhou Hi-tech Industrial Development Zone, Guangzhou China

EUT: Gateway

Trade Mark: N/A

Model Number: GWBOB01, GWB01, SHBOB01, SHB01

Date of Receipt: Jun. 14, 2022

Test Date: Jun. 14, 2022 - Jun. 24, 2022

Date of Report: Jun. 24, 2022

Prepared By: Shenzhen DL Testing Technology Co., Ltd.

Address: 101-201, Building C, Shuanghuan, No.8, Baoqing Road, Baolong Industrial Zone,
Baolong Street, Longgang District, Shenzhen, Guangdong, China

Applicable Standards: FCC PART 15 C 15.247
ANSI C63.10:2013

Test Result: Pass

Report Number: DL-20220622003-1E

Prepared (Test Engineer): Pxing Huang

Reviewer (Supervisor): Jack Bu

Approved (Manager): Jade Yang



This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Shenzhen DL Testing Technology Co., Ltd.



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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.247(c)	Radiated Spurious Emission	PASS	
15.205	Band Edge Emission	PASS	
15.247(b)(1)	Peak Output Power	PASS	
15.247(a)(2)	6dB Bandwidth	PASS	
15.247(e)	Power Spectral Density	PASS	
15.247(d)	Band edge measurements	PASS	
15.247(d)	Conducted Spurious Emission	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

(1) "N/A" denotes test is not applicable in this Test Report

1.1 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 2.56\text{dB}$
2	RF power,conducted	$\pm 0.42\text{dB}$
3	Spurious emissions,conducted	$\pm 2.76\text{dB}$
4	All emissions,radiated(<1G)	$\pm 3.65\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

1.2 TEST FACILITY

Shenzhen DL Testing Technology Co., Ltd.

Add.: 101-201, Building C, Shuanghuan, No.8, Baoqing Road, Baolong Industrial Zone, Baolong Street, Longgang District, Shenzhen, Guangdong, China

FCC Test Firm Registration Number: 854456

Designation Number: CN1307

IC Registered No.: CN0118



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product Name:	Gateway
Trademark:	N/A
Model No.:	GWBOB01
Model Difference:	GWB01, SHBOB01, SHB01 (All models have same circuits diagram, PCB Layout, construction and rated power, only different is the model name.)
Sample No.:	DL-20220622003#
Operation Frequency:	WIFI: 2412~2462 MHz for 802.11b/g/nHT20; BLE: 2402~2480 MHz
Channel Numbers:	11 Channels for 802.11b/g/n(HT20) for WIFI; 40 Channels for BLE
Channel Separation:	5MHz for WIFI; 2MHz for BLE
Modulation Type:	DSSS, OFDM for WIFI; GFSK for BLE
Antenna Type:	PCB Antenna
Antenna Gain:	1.88dBi
Power Supply:	DC 5V/1000mA from Adapter
Adapter:	Model: GAT-0501000U Input: AC 100-240V, 50/60Hz Output: DC 5V/1000mA

Note:

1.For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.The EUT's all information provided by client.

3.Channel List

WIFI

Channel	Frequency (GHz)	Channel	Frequency (GHz)
01	2.412	06	2.437
02	2.417	07	2.442
03	2.422	08	2.447
04	2.427	09	2.452
05	2.432	10	2.457
11	2.462		

BLE

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	10	2422	20	2442	30	2462
01	2404	11	2424	21	2444	31	2464
02	2406	12	2426	22	2446	32	2466
03	2408	13	2428	23	2448	33	2468
04	2410	14	2430	24	2450	34	2470
05	2412	15	2432	25	2452	35	2472
06	2414	16	2434	26	2454	36	2474
07	2416	17	2436	27	2456	37	2476
08	2418	18	2438	28	2458	38	2478
09	2420	19	2440	29	2460	39	2480



2.2 DESCRIPTION OF TEST MODES

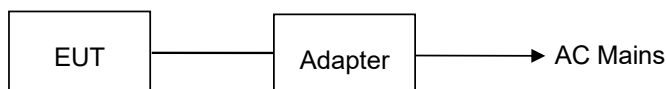
To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description for WIFI
	802.11b
Mode 1	2412MHz
Mode 2	2437MHz
Mode 3	2462MHz
Pretest Mode	Description for WIFI
	802.11g
Mode 4	2412MHz
Mode 5	2437MHz
Mode 6	2462MHz
Pretest Mode	Description for WIFI
	802.11n (20MHz)
Mode 7	2412MHz
Mode 8	2437MHz
Mode 9	2462MHz
Pretest Mode	Description for BLE
	GFSK
Mode 10	2402MHz
Mode 11	2440MHz
Mode 12	2480MHz

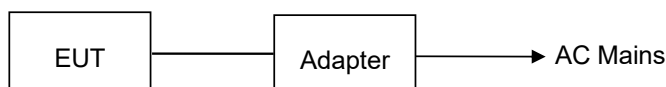
Remark: The WIFI and BLE does not transmit simultaneously.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conducted Spurious Emission Test



**2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)**

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Model/Type No.	Series No.	Note
1	Notebook	Lenovo G475	GB14477457	AE

Item	Shielded Type	Ferrite Core	Length	Note

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation test, Band-edge test and 6db bandwidth test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4408B	MY50140780	Dec. 06, 2021	Dec. 05, 2022
2	Test Receiver (9kHz-7GHz)	R&S	ESRP7	101393	Dec. 06, 2021	Dec. 05, 2022
3	Bilog Antenna (30MHz-1GHz)	R&S	VULB9162	00306	Dec. 06, 2021	Dec. 05, 2022
4	Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA9120D	02139	Dec. 06, 2021	Dec. 05, 2022
5	Horn Antenna (18GHz-40GHz)	A.H. Systems	SAS-574	588	Dec. 06, 2021	Dec. 05, 2022
6	Amplifier (9KHz-6GHz)	Schwarzbeck	BBV9743B	00153	Dec. 06, 2021	Dec. 05, 2022
7	Amplifier (1GHz-18GHz)	EMEC	EM01G8GA	00270	Dec. 06, 2021	Dec. 05, 2022
8	Amplifier (18GHz-40GHz)	Quanjuda	DLE-161	97	Dec. 06, 2021	Dec. 05, 2022
9	Loop Antenna (9KHz-30MHz)	Schwarzbeck	FMZB1519B	00014	Dec. 06, 2021	Dec. 05, 2022
10	RF cables1 (9kHz-1GHz)	ChengYu	966	004	Dec. 06, 2021	Dec. 05, 2022
11	RF cables2 (1GHz-40GHz)	ChengYu	966	003	Dec. 06, 2021	Dec. 05, 2022
12	Antenna connector	Florida RF Labs	N/A	RF 01#	Dec. 06, 2021	Dec. 05, 2022
13	Power probe	KEYSIGHT	U2021XA	MY55210018	Dec. 06, 2021	Dec. 05, 2022
14	Signal Analyzer 9kHz-26.5GHz	Agilent	N9020A	MY55370280	Dec. 06, 2021	Dec. 05, 2022
15	Test Receiver 20kHz-40GHz	R&S	ESU 40	100376	Dec. 06, 2021	Dec. 05, 2022
16	D.C. Power Supply	LongWei	PS-305D	010964729	Dec. 06, 2021	Dec. 05, 2022

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	843 Shielded Room	ChengYu	843 Room	843	Nov. 25, 2019	Nov. 24, 2022
2	EMI Receiver	R&S	ESR	101421	Dec. 06, 2021	Dec. 05, 2022
3	LISN	Schwarzbeck	NNLK 8128	5089	Dec. 06, 2021	Dec. 05, 2022
4	843 Cable 1#	ChengYu	CE Cable	001	Dec. 06, 2021	Dec. 05, 2022

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	AUDIX	e3	6.101223a
2	EMC radiation test system	AUDIX	e3	210616 crt-emc
3	RF test system	MAIWEI	MTS8310	2.0.0.0
4	RF communication test system	MAIWEI	MTS8200	2.0.0.0



3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.2 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Limit (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.3 TEST PROCEDURE

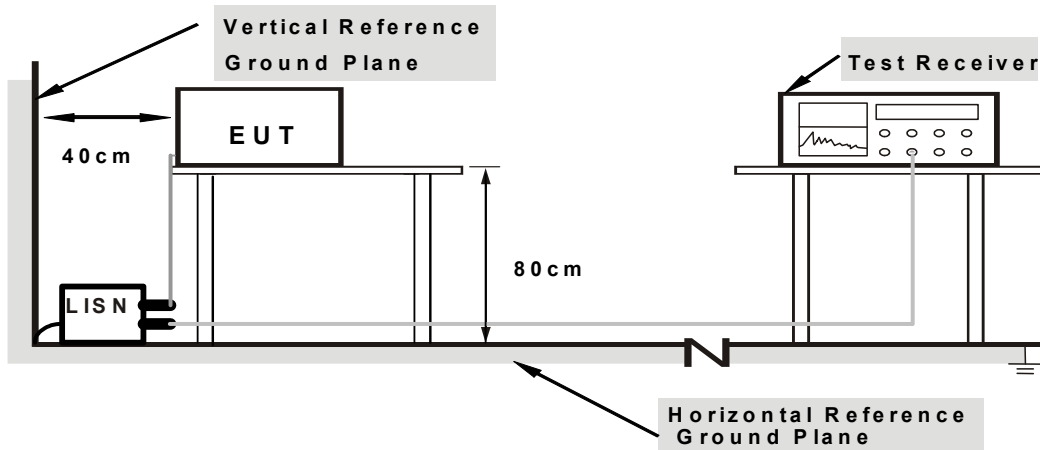
- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.4 DEVIATION FROM TEST STANDARD

No deviation



3.5 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.6 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

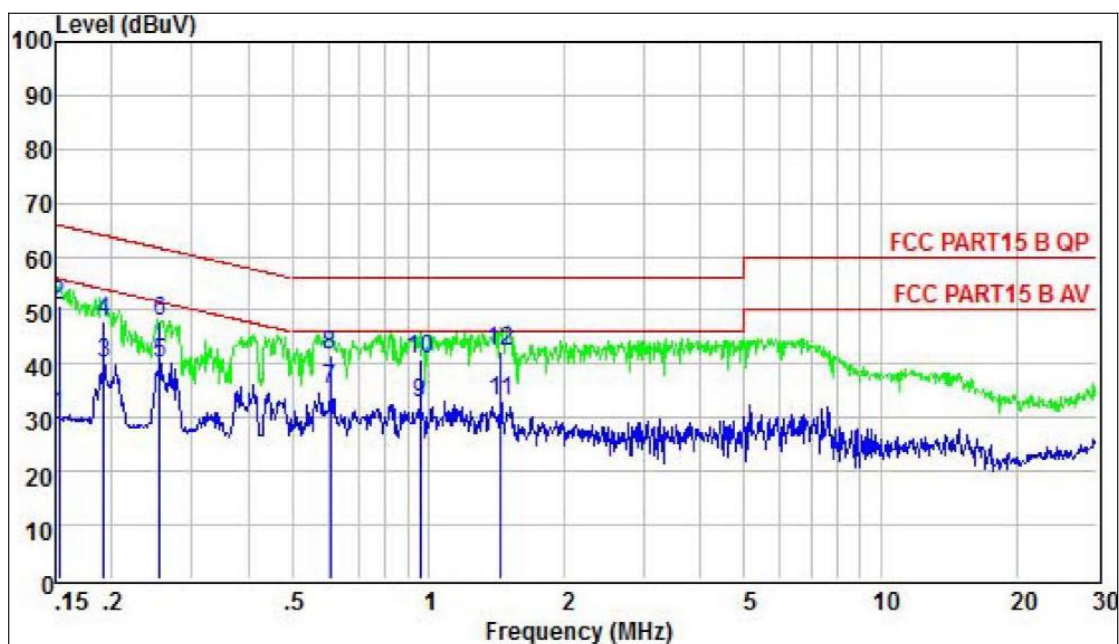
3.7 TEST RESULTS

Note: 1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.

2. All modes of WIFI and BLE were Pre tested, and only WIFI worst mode 1 and BLE worst mode 10 were reported in the report.



Temperature:	25 ℃	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	L
Test Voltage:	AC 120V/60Hz		
Test Mode:	Mode 1		



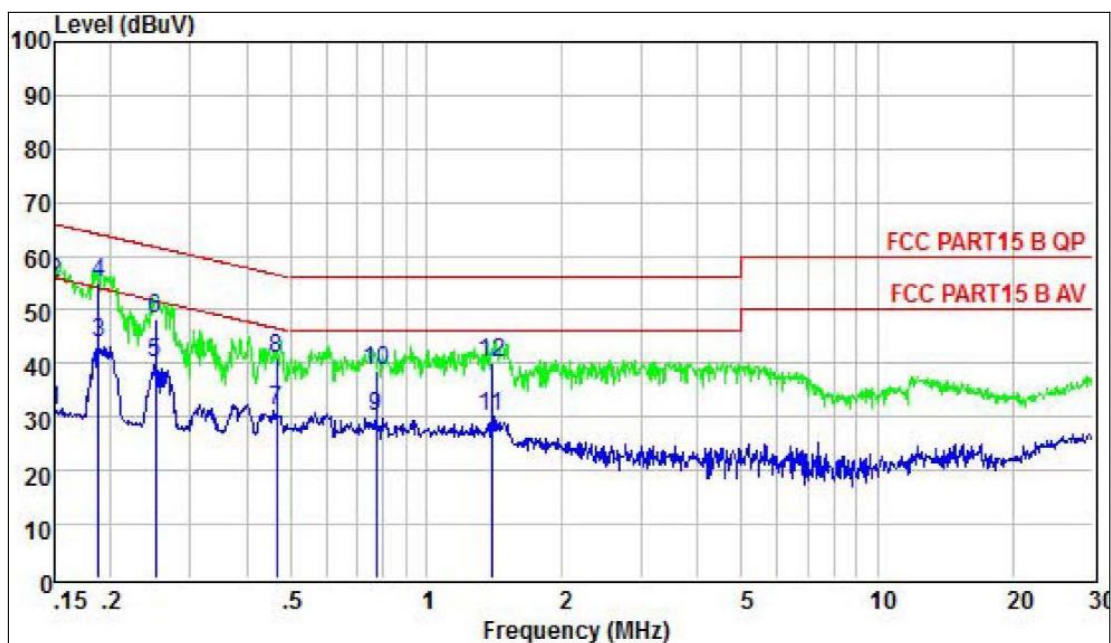
Remark:

Over Limit = Limit – Level

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	Line	Limit	
			dBuV	dB	
1	0.15	30.36	55.87	-25.51	Average
2	0.15	51.00	65.87	-14.87	QP
3	0.19	40.13	53.98	-13.85	Average
4	0.19	48.00	63.98	-15.98	QP
5	0.25	40.28	51.60	-11.32	Average
6	0.25	48.00	61.60	-13.60	QP
7	0.61	35.45	46.00	-10.55	Average
8	0.61	41.70	56.00	-14.30	QP
9	0.96	32.86	46.00	-13.14	Average
10	0.96	40.89	56.00	-15.11	QP
11	1.45	33.05	46.00	-12.95	Average
12	1.45	42.28	56.00	-13.72	QP



Temperature:	25 °C	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	N
Test Voltage:	AC 120V/60Hz		
Test Mode:	Mode 1		



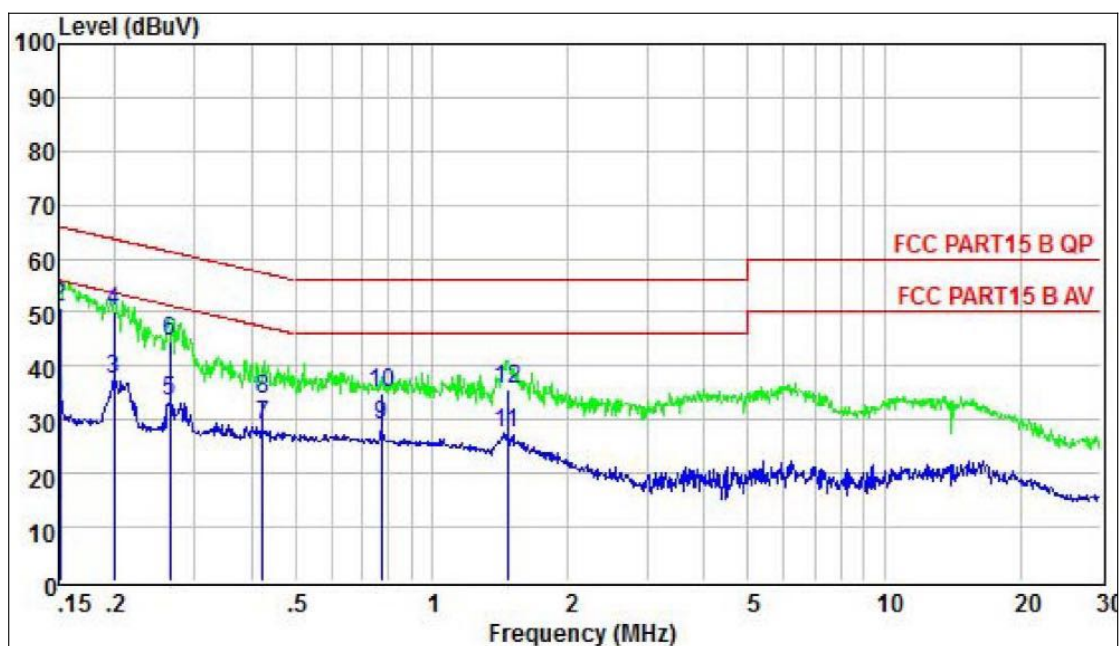
Remark:

Over Limit = Limit – Level

	Freq	Level	Limit	Over	
	MHz	dBuV	Line	Limit	Remark
			dBuV	dB	
1	0.15	31.25	56.00	-24.75	Average
2	0.15	55.00	66.00	-11.00	QP
3	0.19	43.69	54.11	-10.42	Average
4	0.19	55.00	64.11	-9.11	QP
5	0.25	40.20	51.73	-11.53	Average
6	0.25	48.30	61.73	-13.43	QP
7	0.47	31.39	46.58	-15.19	Average
8	0.47	41.00	56.58	-15.58	QP
9	0.78	30.02	46.00	-15.98	Average
10	0.78	38.50	56.00	-17.50	QP
11	1.40	30.13	46.00	-15.87	Average
12	1.40	40.29	56.00	-15.71	QP



Temperature:	25 °C	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	L
Test Voltage:	AC 120V/60Hz		
Test Mode:	Mode 10		

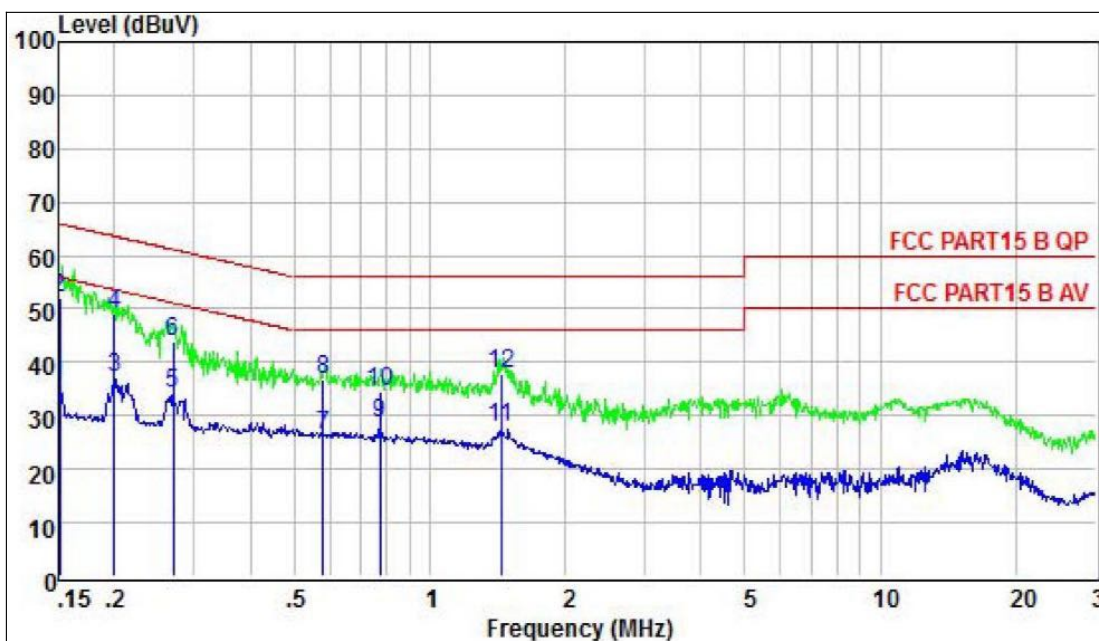


Remark:

Over Limit = Limit – Level

	Freq	Level	Limit	Over	
	MHz	dBuV	Line	Limit	Remark
			dBuV	dB	
1	0.15	33.75	55.96	-22.21	Average
2	0.15	50.90	65.96	-15.06	QP
3	0.20	37.52	53.67	-16.15	Average
4	0.20	50.00	63.67	-13.67	QP
5	0.26	33.60	51.29	-17.69	Average
6	0.26	44.74	61.29	-16.55	QP
7	0.42	28.91	47.37	-18.46	Average
8	0.42	34.00	57.37	-23.37	QP
9	0.78	28.82	46.00	-17.18	Average
10	0.78	34.90	56.00	-21.10	QP
11	1.47	27.37	46.00	-18.63	Average
12	1.47	35.73	56.00	-20.27	QP

Temperature:	25 ℃	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	N
Test Voltage:	AC 120V/60Hz		
Test Mode:	Mode 10		



Remark:

$$\text{Over Limit} = \text{Limit} - \text{Level}$$

	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.15	35.53	55.96	-20.43	Average
2	0.15	52.00	65.96	-13.96	QP
3	0.20	37.06	53.62	-16.56	Average
4	0.20	49.00	63.62	-14.62	QP
5	0.27	34.09	51.12	-17.03	Average
6	0.27	44.00	61.12	-17.12	QP
7	0.58	26.57	46.00	-19.43	Average
8	0.58	36.90	56.00	-19.10	QP
9	0.78	28.46	46.00	-17.54	Average
10	0.78	34.71	56.00	-21.29	QP
11	1.44	27.82	46.00	-18.18	Average
12	1.44	37.90	56.00	-18.10	QP



4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	25GHz
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP



4.2 TEST PROCEDURE

Below 1GHz test procedure as below:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
- Test the EUT in the lowest channel, the middle channel, the Highest channel

Note:

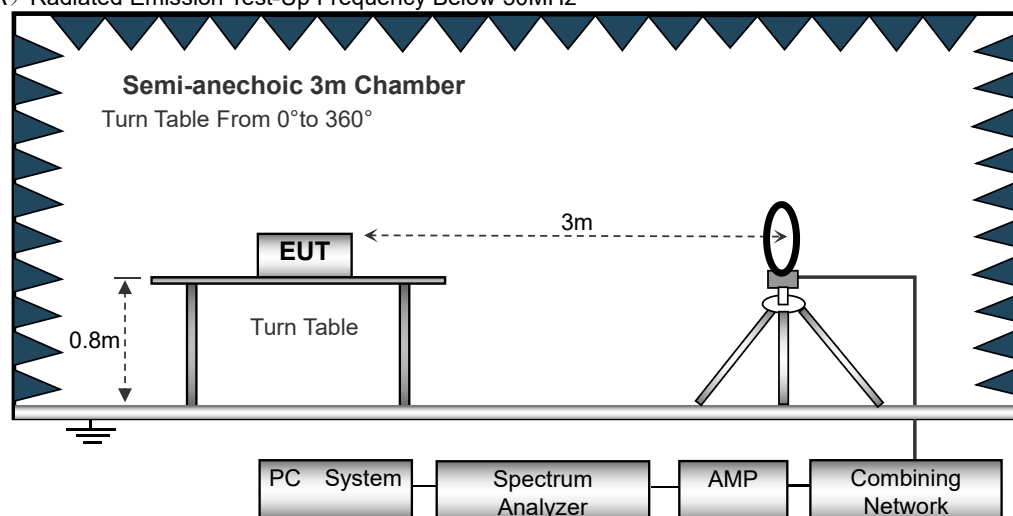
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

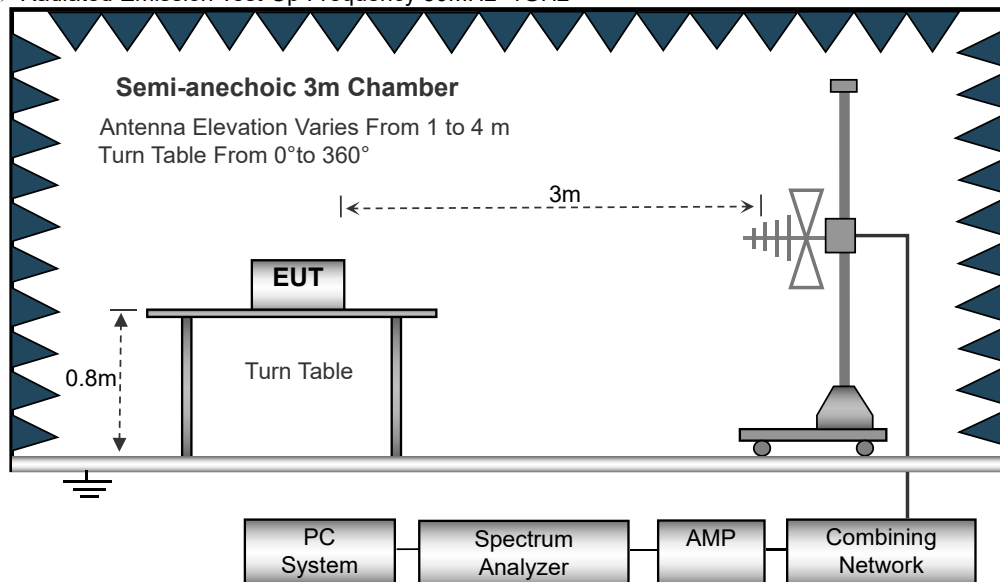
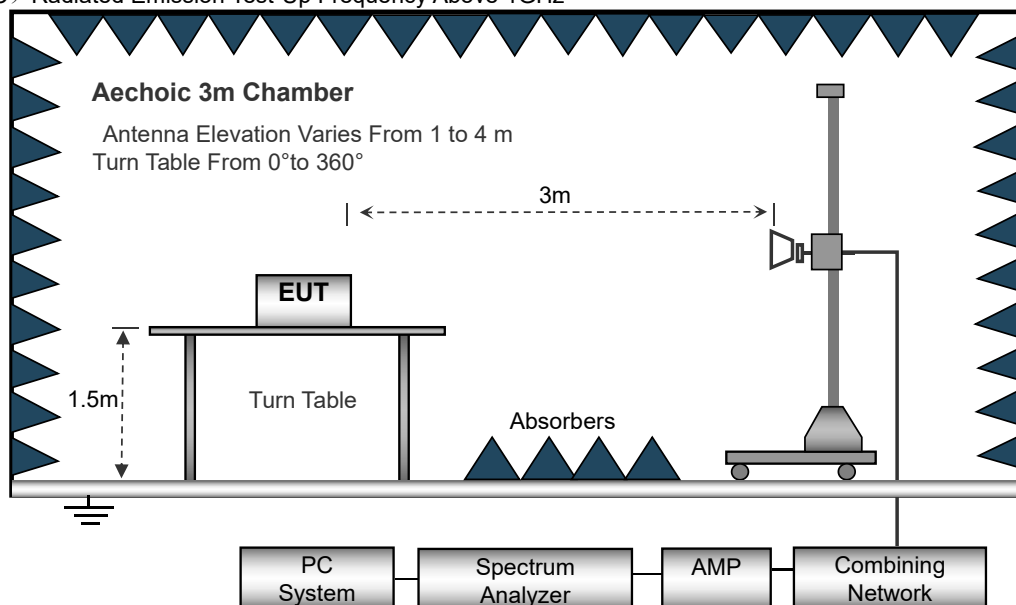
4.3 DEVIATION FROM TEST STANDARD

No deviation

4.4 TEST SETUP

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



**(B) Radiated Emission Test-Up Frequency 30MHz~1GHz****(C) Radiated Emission Test-Up Frequency Above 1GHz****4.5 EUT OPERATING CONDITIONS**

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

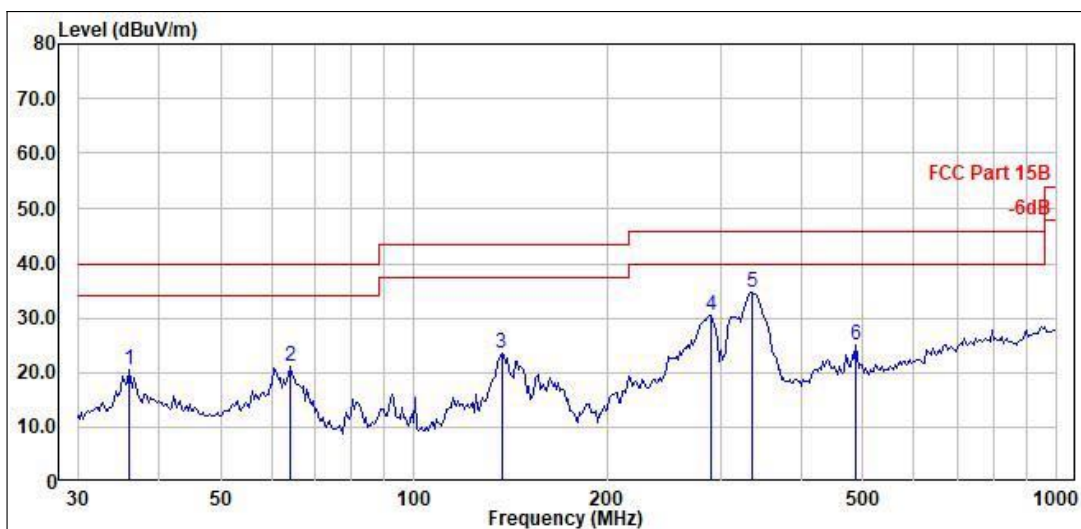
4.6 TEST RESULTS

Note: 1. All modes of WIFI and BLE were Pre tested, and only WIFI worst mode 1 and BLE worst mode 10 were reported in the report.

2. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.

**Below 1GHz Test Results**

Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz		
Test Mode :	Mode 1		



Remark:

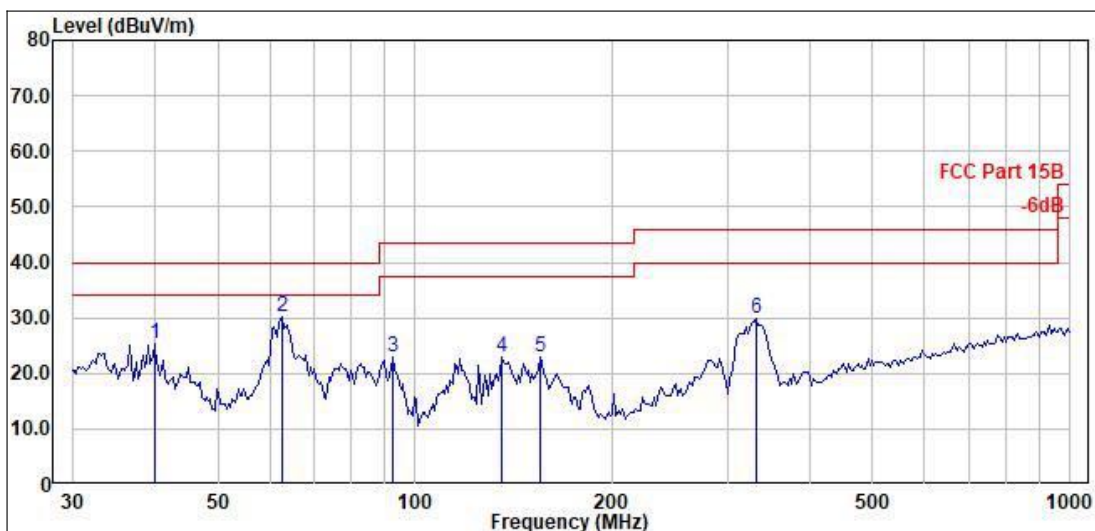
Correct Factor = Cable loss + Antenna factor – Preamplifier;

Level = Reading Level + Correct Factor; Margin = Limit – Level;

		Read		Limit	Ant	Over		
	Freq	Level	Level	Line	Factor	Limit	Pol/Phase	Remark
	MHz	dBuV	dBuV/m	dBuV/m	dB/m	dB		
1	36.014	41.39	20.54	40.00	12.43	-19.46	Horizontal	QP
2	64.080	43.26	21.19	40.00	10.87	-18.81	Horizontal	QP
3	136.875	43.54	23.48	43.50	12.18	-20.02	Horizontal	QP
4	290.317	48.94	30.47	46.00	12.35	-15.53	Horizontal	QP
5	336.482	51.64	34.81	46.00	13.57	-11.19	Horizontal	QP
6	488.326	38.84	25.05	46.00	16.74	-20.95	Horizontal	QP



Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz		
Test Mode :	Mode 1		



Remark:

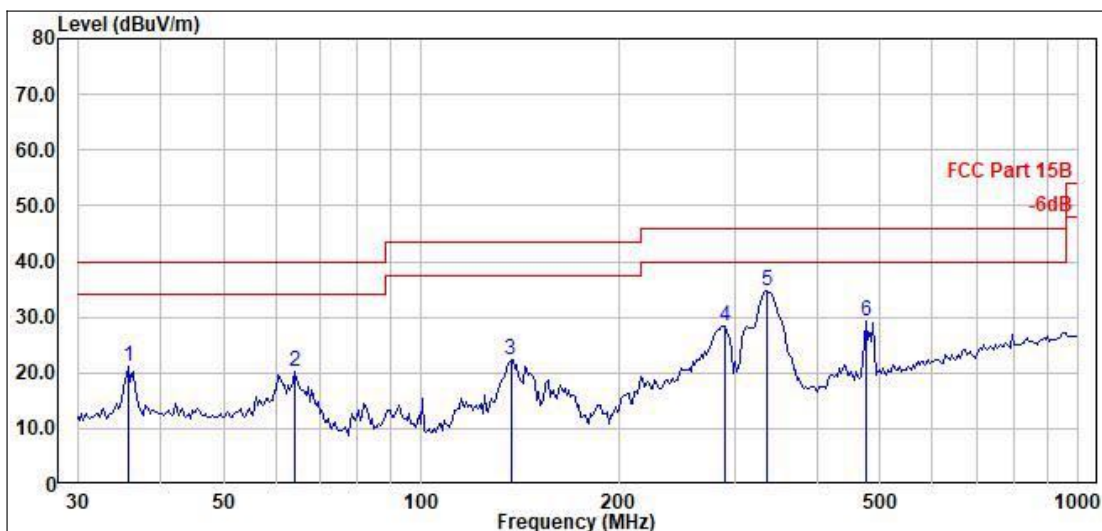
Correct Factor = Cable loss + Antenna factor – Preamplifier;

Level = Reading Level + Correct Factor; Margin = Limit – Level;

		Read		Limit	Ant	Over		
	Freq	Level	Level	Line	Factor	Limit	Pol/Phase	Remark
	MHz	dBuV	dBuV/m	dBuV/m	dB/m	dB		
1	40.017	45.53	25.26	40.00	12.97	-14.74	Vertical	QP
2	62.743	52.09	30.27	40.00	11.13	-9.73	Vertical	QP
3	92.346	47.27	23.08	43.50	8.51	-20.42	Vertical	QP
4	135.916	43.19	23.07	43.50	12.12	-20.43	Vertical	QP
5	155.331	42.03	22.94	43.50	13.05	-20.56	Vertical	QP
6	331.786	46.77	29.84	46.00	13.48	-16.16	Vertical	QP



Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz		
Test Mode :	Mode 10		



Remark:

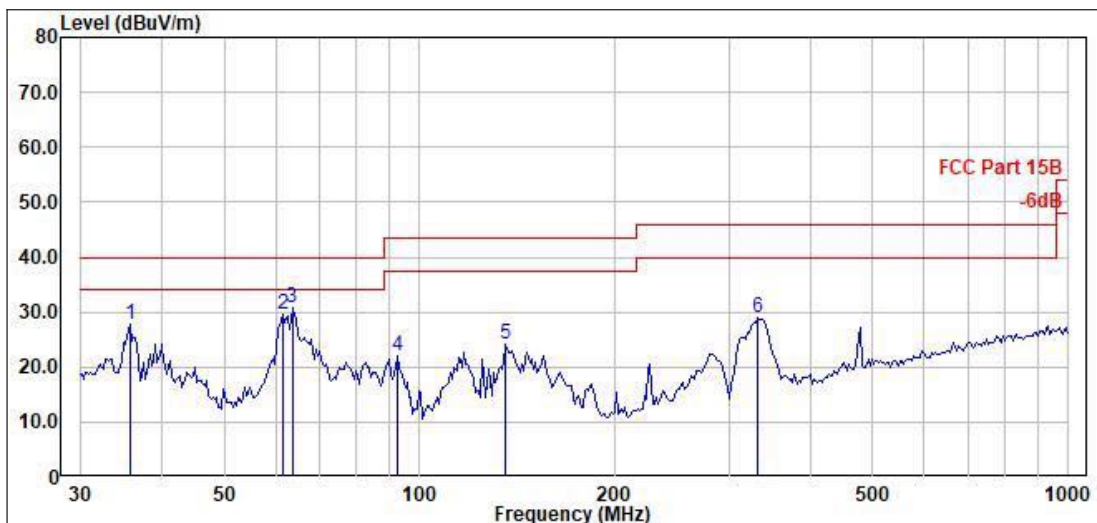
Correct Factor = Cable loss + Antenna factor – Preamplifier;

Level = Reading Level + Correct Factor; Margin = Limit – Level;

		Read		Limit	Ant	Over		
	Freq	Level	Level	Line	Factor	Limit	Pol/Phase	Remark
	MHz	dBuV	dBuV/m	dBuV/m	dB/m	dB		
1	35.762	42.11	21.22	40.00	12.39	-18.78	Horizontal	QP
2	64.080	42.26	20.19	40.00	10.87	-19.81	Horizontal	QP
3	136.875	42.54	22.48	43.50	12.18	-21.02	Horizontal	QP
4	290.317	46.94	28.47	46.00	12.35	-17.53	Horizontal	QP
5	336.482	51.64	34.81	46.00	13.57	-11.19	Horizontal	QP
6	474.791	43.25	29.23	46.00	16.55	-16.77	Horizontal	QP



Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz		
Test Mode :	Mode 10		



Remark:

Correct Factor = Cable loss + Antenna factor – Preamplifier;

Level = Reading Level + Correct Factor; Margin = Limit – Level;

		Read		Limit	Ant	Over		
	Freq	Level	Level	Line	Factor	Limit	Pol/Phase	Remark
	MHz	dBuV	dBuV/m	dBuV/m	dB/m	dB		
1	35.762	48.80	27.91	40.00	12.39	-12.09	Vertical	QP
2	61.434	51.14	29.56	40.00	11.38	-10.44	Vertical	QP
3	63.631	52.66	30.68	40.00	10.96	-9.32	Vertical	QP
4	92.346	46.27	22.08	43.50	8.51	-21.42	Vertical	QP
5	135.916	44.19	24.07	43.50	12.12	-19.43	Vertical	QP
6	331.786	45.77	28.84	46.00	13.48	-17.16	Vertical	QP

**Above 1GHz Test Results
(WIFI: 802.11b Worst Case)**

Polar (H/V)	Frequency	Meter Reading	Pre- amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Mode 1: 2412MHz									
V	4824.00	67.57	50.65	6.87	31.34	55.13	74.00	-18.87	PK
V	4824.00	56.33	50.65	6.87	31.34	43.89	54.00	-10.11	AV
V	7236.00	67.56	49.98	7.19	36.68	61.45	74.00	-12.55	PK
V	7236.00	51.53	49.98	7.19	36.68	45.42	54.00	-8.58	AV
V	16087.00	48.56	51.53	11.43	41.57	50.03	74.00	-23.97	PK
H	4824.00	66.37	50.65	6.72	31.34	53.78	74.00	-20.22	PK
H	4824.00	55.78	50.65	6.72	31.34	43.19	54.00	-10.81	AV
H	7236.00	69.56	49.98	7.19	36.68	63.45	74.00	-10.55	PK
H	7236.00	51.73	49.98	7.19	36.68	45.62	54.00	-8.38	AV
H	16087.00	49.07	51.53	11.43	41.57	50.54	74.00	-23.46	PK
Mode 2: 2437MHz									
V	4874.00	67.33	50.67	6.91	31.38	54.95	74.00	-19.05	PK
V	4874.00	55.45	50.67	6.91	31.38	43.07	54.00	-10.93	AV
V	7311.00	69.43	50.02	7.27	36.63	63.31	74.00	-10.69	PK
V	7311.00	53.23	50.02	7.27	36.63	47.11	54.00	-6.89	AV
V	16087.00	48.65	51.53	11.45	41.52	50.09	74.00	-23.91	PK
H	4874.00	66.21	50.67	6.91	31.38	53.83	74.00	-20.17	PK
H	4874.00	55.65	50.67	6.91	31.38	43.27	54.00	-10.73	AV
H	7311.00	69.33	50.02	7.27	36.63	63.21	74.00	-10.79	PK
H	7311.00	52.44	50.02	7.27	36.63	46.32	54.00	-7.68	AV
H	16087.00	48.88	51.53	11.45	41.52	50.32	74.00	-23.68	PK
Mode 3: 2462MHz									
V	4924.00	68.14	50.79	6.98	31.36	55.69	74.00	-18.31	PK
V	4924.00	55.45	50.79	6.98	31.36	43.00	54.00	-11.00	AV
V	7386.00	69.27	50.11	7.35	36.58	63.09	74.00	-10.91	PK
V	7386.00	53.38	50.11	7.35	36.58	47.2	54.00	-6.80	AV
V	16087.00	49.43	51.53	11.54	41.52	50.96	74.00	-23.04	PK
H	4924.00	67.29	50.79	6.98	31.36	54.84	74.00	-19.16	PK
H	4924.00	55.12	50.79	6.98	31.36	42.67	54.00	-11.33	AV
H	7386.00	67.07	50.11	7.35	36.58	60.89	74.00	-13.11	PK
H	7386.00	52.45	50.11	7.35	36.58	46.27	54.00	-7.73	AV
H	16087.00	49.61	51.53	11.54	41.52	51.14	74.00	-22.86	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-Amplifier,
Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



BLE: GFSK

Polar (H/V)	Frequency	Meter Reading	Pre- amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Mode 10: 2402MHz									
V	4804.00	67.56	50.65	6.88	31.29	55.08	74.00	-18.92	PK
V	4804.00	55.78	50.65	6.88	31.29	43.30	54.00	-10.70	AV
V	7206.00	66.34	49.98	7.16	36.63	60.15	74.00	-13.85	PK
V	7206.00	51.78	49.98	7.16	36.63	45.59	54.00	-8.41	AV
V	16086.00	48.87	51.53	11.34	41.52	50.20	74.00	-23.8	PK
H	4804.00	66.74	50.65	6.88	31.29	54.26	74.00	-19.74	PK
H	4804.00	55.18	50.65	6.88	31.29	42.70	54.00	-11.30	AV
H	7206.00	69.93	49.98	7.16	36.63	63.74	74.00	-10.26	PK
H	7206.00	51.39	49.98	7.16	36.63	45.20	54.00	-8.80	AV
H	16086.00	49.05	51.53	11.34	41.52	50.38	74.00	-23.62	PK
Mode 11: 2440MHz									
V	4880.00	67.86	50.67	6.89	31.38	55.46	74.00	-18.54	PK
V	4880.00	55.67	50.67	6.89	31.38	43.27	54.00	-10.73	AV
V	7320.00	69.76	50.02	7.24	36.63	63.61	74.00	-10.39	PK
V	7332.00	53.32	50.02	7.24	36.63	47.17	54.00	-6.83	AV
V	16087.00	48.67	51.53	11.34	41.52	50.00	74.00	-24.00	PK
H	4880.00	66.32	50.67	6.89	31.38	53.92	74.00	-20.08	PK
H	4880.00	55.11	50.67	6.89	31.38	42.71	54.00	-11.29	AV
H	7320.00	69.43	50.02	7.24	36.63	63.28	74.00	-10.72	PK
H	7320.00	51.23	50.02	7.24	36.63	45.08	54.00	-8.92	AV
H	16087.00	48.95	51.53	11.34	41.52	50.28	74.00	-23.72	PK
Mode 12: 2480MHz									
V	4960.00	68.66	50.79	6.83	31.36	56.06	74.00	-17.94	PK
V	4960.00	56.65	50.79	6.83	31.36	44.05	54.00	-9.95	AV
V	7440.00	69.66	50.11	7.25	36.58	63.38	74.00	-10.62	PK
V	7440.00	53.76	50.11	7.25	36.58	47.48	54.00	-6.52	AV
V	16087.00	49.76	51.53	11.34	41.52	51.09	74.00	-22.91	PK
H	4960.00	67.13	50.79	6.83	31.36	54.53	74.00	-19.47	PK
H	4960.00	55.67	50.79	6.83	31.36	43.07	54.00	-10.93	AV
H	7440.00	67.35	50.11	7.25	36.58	61.07	74.00	-12.93	PK
H	7440.00	52.76	50.11	7.25	36.58	46.48	54.00	-7.52	AV
H	16087.00	49.86	51.53	11.34	41.52	51.19	74.00	-22.81	PK
Remark:									
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-Amplifier, Margin= Emission Level - Limit									
2. If peak below the average limit, the average emission was no test.									
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.									



5. RADIATED BAND EMISSION MEASUREMENT

5.1 TEST REQUIREMENT:

FCC Part15 C Section 15.209 and 15.205

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520MHz
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

5.2 TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel,the Highest channel

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

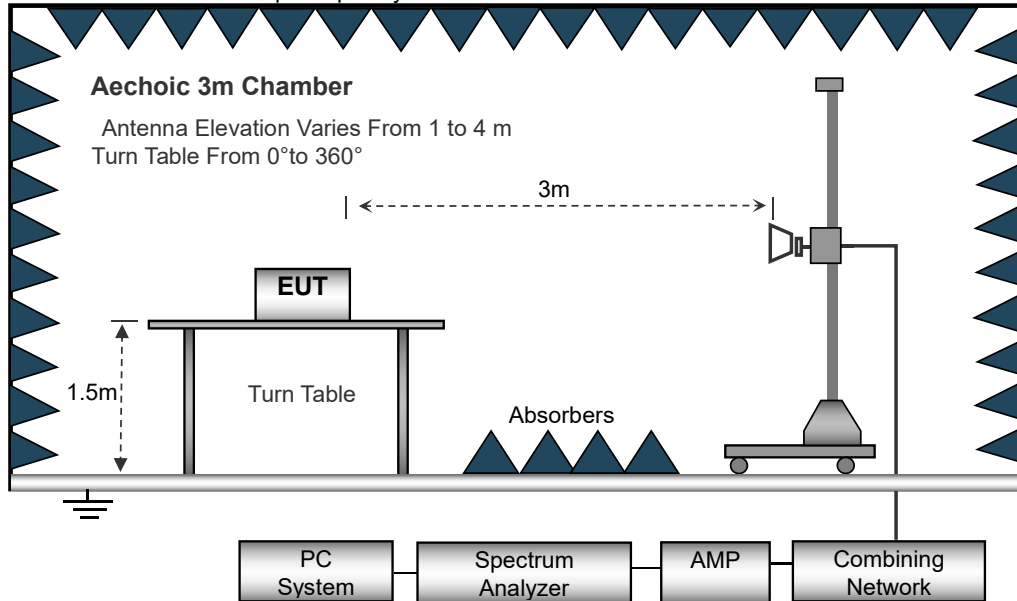
5.3 DEVIATION FROM TEST STANDARD

No deviation



5.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



5.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



5.6 TEST RESULT

WIFI: 802.11b Worst Case

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Mode 1: 2412MHz									
V	2390.00	77.22	52.12	2.73	27.38	55.21	74.00	-18.79	PK
V	2390.00	66.23	52.12	2.73	27.38	44.22	54.00	-9.78	AV
V	2400.00	76.56	52.16	2.78	27.41	54.59	74.00	-19.41	PK
V	2400.00	64.87	52.16	2.78	27.41	42.90	54.00	-11.10	AV
H	2390.00	76.44	52.12	2.73	27.38	54.43	74.00	-19.57	PK
H	2390.00	65.17	52.12	2.73	27.38	43.16	54.00	-10.84	AV
H	2400.00	76.98	52.16	2.78	27.41	55.01	74.00	-18.99	PK
H	2400.00	65.56	52.16	2.78	27.41	43.59	54.00	-10.41	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Mode 3: 2462MHz									
V	2483.50	77.05	52.23	2.86	27.44	55.12	74.00	-18.88	PK
V	2483.50	65.14	52.23	2.86	27.44	43.21	54.00	-10.79	AV
V	2500.00	76.97	52.26	2.88	27.49	55.08	74.00	-18.92	PK
V	2500.00	64.44	52.26	2.88	27.49	42.55	54.00	-11.45	AV
H	2483.50	76.85	52.23	2.86	27.44	54.92	74.00	-19.08	PK
H	2483.50	65.76	52.23	2.86	27.44	43.83	54.00	-10.17	AV
H	2500.00	76.25	52.26	2.88	27.49	54.36	74.00	-19.64	PK
H	2500.00	65.14	52.26	2.88	27.49	43.25	54.00	-10.75	AV

Remark:

1. Emission Level = Reading Level+Antenna Factor+Cable loss-Preamp Factor.
2. Over Limit= Absolute Level - Limit.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.
4. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)



BLE:GFSK

Polar (H/V)	Frequency	Meter Reading	Pre- amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Mode 10: 2402MHz									
V	2390.00	74.65	52.12	2.73	27.38	52.64	74.00	-21.36	PK
V	2390.00	64.33	52.12	2.73	27.38	42.32	54.00	-11.68	AV
V	2400.00	75.18	52.16	2.78	27.41	53.21	74.00	-20.79	PK
V	2400.00	63.22	52.16	2.78	27.41	41.25	54.00	-12.75	AV
H	2390.00	75.03	52.12	2.73	27.38	53.02	74.00	-20.98	PK
H	2390.00	64.33	52.12	2.73	27.38	42.32	54.00	-11.68	AV
H	2400.00	74.11	52.16	2.78	27.41	52.14	74.00	-21.86	PK
H	2400.00	62.99	52.16	2.78	27.41	41.02	54.00	-12.98	AV

Polar (H/V)	Frequency	Meter Reading	Pre- amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Mode 12: 2480MHz									
V	2483.50	75.44	52.23	2.86	27.44	53.51	74.00	-20.49	PK
V	2483.50	62.87	52.23	2.86	27.44	40.94	54.00	-13.06	AV
V	2500.00	73.67	52.26	2.88	27.49	51.78	74.00	-22.22	PK
V	2500.00	64.67	52.26	2.88	27.49	42.78	54.00	-11.22	AV
H	2483.50	74.32	52.23	2.86	27.44	52.39	74.00	-21.61	PK
H	2483.50	63.17	52.23	2.86	27.44	41.24	54.00	-12.76	AV
H	2500.00	74.05	52.26	2.88	27.49	52.16	74.00	-21.84	PK
H	2500.00	64.07	52.26	2.88	27.49	42.18	54.00	-11.82	AV

Remark:

2. Emission Level = Reading Level+Antenna Factor+Cable loss-Preamp Factor.
2. Over Limit= Absolute Level - Limit.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.
4. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)



6. PEAK OUTPUT POWER

6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

6.2 TEST PROCEDURE

- a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

WIFI				
Test Mode	Channel	Peak Power[dBm]	Conducted Limit[dBm]	Verdict
11B	2412	9.56	≤30	PASS
	2437	10.78	≤30	PASS
	2462	12.80	≤30	PASS
11G	2412	12.96	≤30	PASS
	2437	14.51	≤30	PASS
	2462	15.71	≤30	PASS
11N20SISO	2412	12.66	≤30	PASS
	2437	13.62	≤30	PASS
	2462	14.83	≤30	PASS

BLE				
Test Mode	Channel	Peak Power[dBm]	Conducted Limit[dBm]	Verdict
GFSK	2402	4.38	≤30	PASS
	2440	4.48	≤30	PASS
	2480	4.01	≤30	PASS



7. POWER SPECTRAL DENSITY TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	= the frequency band of operation
RB	$RBW \geq 3kHz$
VB	$VBW \geq 3RBW$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.