



FCC Part 15E Test Report

FCC ID: 2A8RG-X1PRO

Applicant: QQQuan Technology Hebei Co., Ltd.

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EUT: StreamBox Elite

Trade Mark: N/A

Model Number: X-1Pro

Date of Receipt: Sep. 02, 2022

Test Date: Sep. 02, 2022 - Sep. 23, 2022

Date of Report: Sep. 23, 2022

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Applicable Standards: FCC PART 15 E 15.407
ANSI C63.10:2013

Test Result: Pass

Report Number: DL-20220923042E

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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 (15.407) , Subpart E			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.407(b), 15.209	Radiated Spurious Emission	PASS	
15.407 (b)	Band Edge Emission	PASS	
15.407 (a)	Peak Output Power	PASS	
15.407 (a)	Power Spectral Density	PASS	
15.403(i) 15.407(e)	26dB bandwidth and 99%dB Bandwidth	PASS	
15.407(g)	Frequency Stability	PASS	
15.407(c)	Transmission in case of Absence of Information	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 expended 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	$\pm 2\%$
8	Bandwidth	$\pm 0.2\text{MHz}$
9	Power Spectral Density	$\pm 2.45\text{dBm}$
10	Frequency Stability	$\pm 0.3\text{MHz}$
11	DUTY CYCLE	$\pm 0.53\text{dB}$



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product Name:	StreamBox Elite
Trademark	N/A
Model No.:	X-1Pro
Model Difference	N/A
Operation Frequency:	5180-5240MHz(802.11a/n/ac(HT20)) 5190-5230MHz(802.11n/ac(HT40)) 5210MHzMHz (802.11ac(HT80))
Channel numbers:	See channel list
Channel separation:	20MHz/40MHz/80MHz
Modulation technology:	64QAM, 16QAM, QPSK, BPSK for OFDM
Rate of Transmitter	802.11a: 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps,54Mbps 802.11n: Up to 500Mbps
Antenna Type:	External Antenna
Antenna gain:	2.25dBi
Power supply:	DC 5V from adaspter
Aaspter:	Model No.: CT050200-078ED Input: 100-240V~ 50/60Hz 0.3A Output: 5.0V/2000mA

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.



2. Channel List

Channel List for 802.11a/n(HT20)/ac(HT20)			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220
40	5200	48	5240

Channel List for 802.11n(HT40)/ac(HT40)			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	46	5230

Channel List for 802.11ac(HT80)			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210	/	/

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.

Description		
Pretest Mode	Channel	Band 1
Mode 1	802.11a/n/acHT20	CH36, CH44, CH48
Mode 2	802.11n/acHT40	CH38, CH46
Mode 3	802.11acHT80	CH42
Mode 4	Other	Link Mode

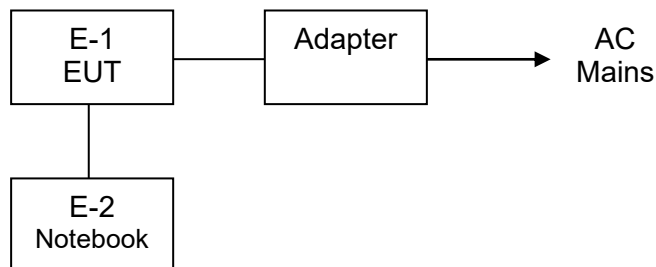
For Radiated Emission		
Pretest Mode	Channel	Band 1
Mode 1	802.11a/n/acHT20	CH36, CH44, CH48
Mode 2	802.11n/acHT40	CH38, CH46
Mode 3	802.11acHT80	CH42
Mode 4	Other	Link Mode

Note: 1. The measurements are performed at the highest, middle, lowest available channels.
2. During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.

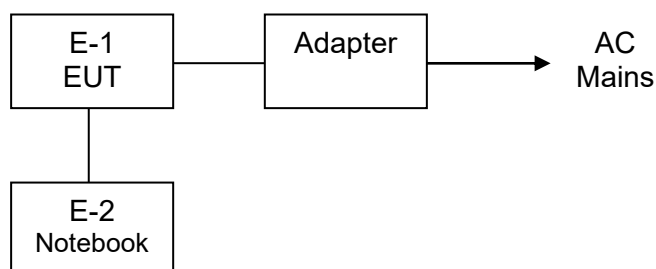


2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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
E-1	StreamBox Elite	X-1Pro	N/A	EUT
E-2	Notebook	310S-14AST		

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 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing, channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the end product.

Max output power Setting				
Test software Version	Test program: AXDN-0002.0			
Mode	802.11a	802.11n HT20	802.11n HT40	802.11ac HT20/HT40/HT80
Data Rate	6Mbps	MSC0	MSC0	MSC0
Power Setting of Software	60	60	66	66



2.6 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	Nov. 06, 2021	Nov. 05, 2022
2	Test Receiver (9kHz-7GHz)	R&S	ESRP7	101393	Nov. 06, 2021	Nov. 05, 2022
3	Bilog Antenna (30MHz-1GHz)	R&S	VULB9162	00306	Nov. 06, 2021	Nov. 05, 2022
4	Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA9120D	02139	Nov. 06, 2021	Nov. 05, 2022
5	Horn Antenna (18GHz-40GHz)	A.H. Systems	SAS-574	588	Nov. 06, 2021	Nov. 05, 2022
6	Amplifier (9KHz-6GHz)	Schwarzbeck	BBV9743B	00153	Nov. 06, 2021	Nov. 05, 2022
7	Amplifier (1GHz-18GHz)	EMEC	EM01G8GA	00270	Nov. 06, 2021	Nov. 05, 2022
8	Amplifier (18GHz-40GHz)	Quanjuda	DLE-161	97	Nov. 06, 2021	Nov. 05, 2022
9	Loop Antenna (9KHz-30MHz)	Schwarzbeck	FMZB1519B	00014	Nov. 06, 2021	Nov. 05, 2022
10	RF cables1 (9kHz-1GHz)	ChengYu	966	004	Nov. 06, 2021	Nov. 05, 2022
11	RF cables2 (1GHz-40GHz)	ChengYu	966	003	Nov. 06, 2021	Nov. 05, 2022
12	Antenna connector	Florida RF Labs	N/A	RF 01#	Nov. 06, 2021	Nov. 05, 2022
13	Power probe	KEYSIGHT	U2021XA	MY55210018	Nov. 06, 2021	Nov. 05, 2022
14	Signal Analyzer 9kHz-26.5GHz	Agilent	N9020A	MY55370280	Nov. 06, 2021	Nov. 05, 2022
15	Test Receiver 20kHz-40GHz	R&S	ESU 40	100376	Nov. 06, 2021	Nov. 05, 2022
16	D.C. Power Supply	LongWei	PS-305D	010964729	Nov. 06, 2021	Nov. 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	Nov. 06, 2021	Nov. 05, 2022
3	LISN	R&S	ENV216	102417	Nov. 06, 2021	Nov. 05, 2022
4	843 Cable 1#	ChengYu	CE Cable	001	Nov. 06, 2021	Nov. 05, 2022

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	FALA	EZ_EMCC	EMC-CON 3A1.1
2	EMC radiation test system	FALA	EZ_EMCC	FA-03A2
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

3.1.1 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
0.5 -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

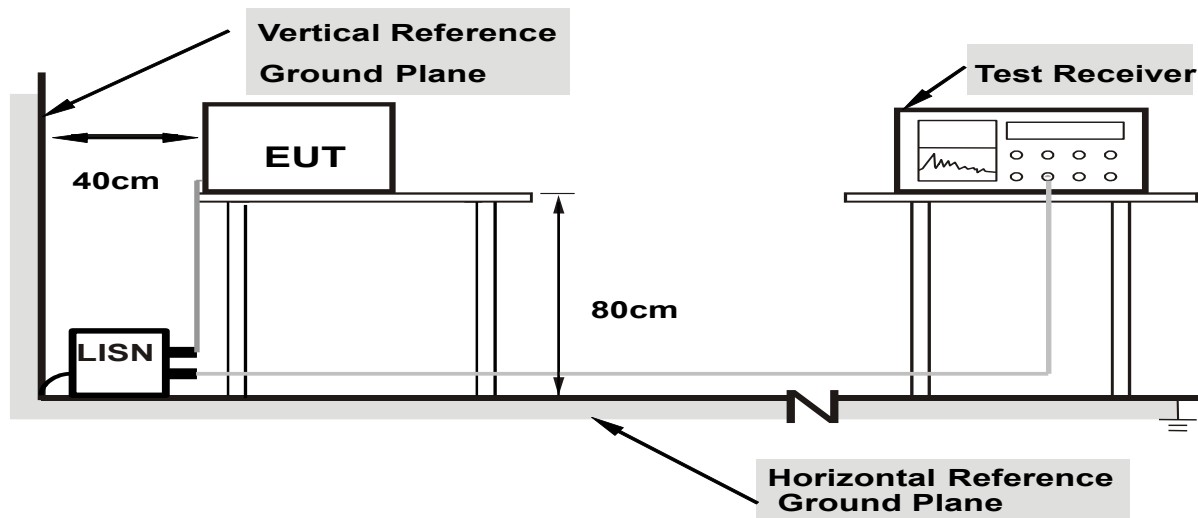
3.1.2 TEST PROCEDURE

- 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.

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 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 from other units and other metal planes

3.1.5 EUT OPERATING CONDITIONS

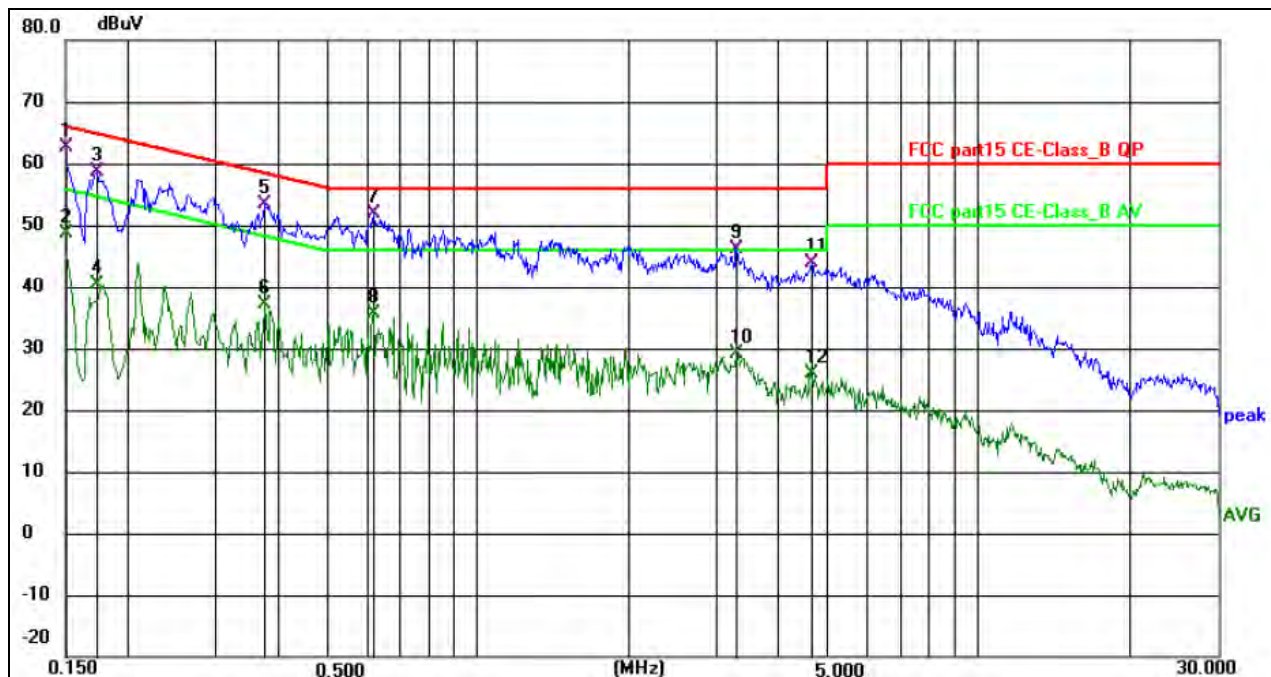
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

We pretest AC 120V and AC 230V, the worst voltage was AC 120V and the data recording in the report.

3.1.6 TEST RESULTS



Temperature:	25 °C	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	L
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 4



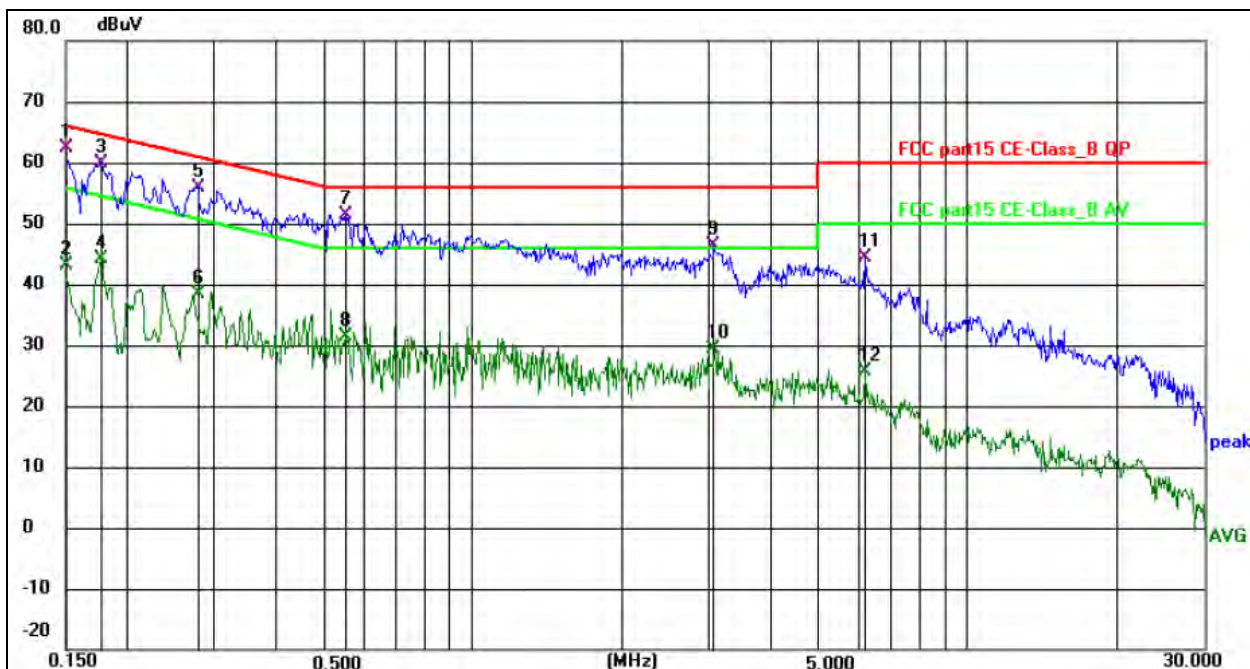
Remark:

Margin = Limit – Level, Correct Factor = Cable lose + LISN insertion loss, Level= Reading + Correct factor

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.150000	52.08	10.50	62.58	66.00	-3.42	QP	P	
2	0.150000	38.10	10.50	48.60	56.00	-7.40	AVG	P	
3	0.172300	48.61	10.04	58.65	64.85	-6.20	QP	P	
4	0.172300	30.39	10.04	40.43	54.85	-14.42	AVG	P	
5	0.375000	44.19	9.10	53.29	58.39	-5.10	QP	P	
6	0.375000	28.11	9.10	37.21	48.39	-11.18	AVG	P	
7	0.617900	42.53	9.33	51.86	56.00	-4.14	QP	P	
8	0.617900	26.41	9.33	35.74	46.00	-10.26	AVG	P	
9	3.277400	37.23	8.86	46.09	56.00	-9.91	QP	P	
10	3.277400	20.20	8.86	29.06	46.00	-16.94	AVG	P	
11	4.641000	34.14	9.66	43.80	56.00	-12.20	QP	P	
12	4.641000	16.18	9.66	25.84	46.00	-20.16	AVG	P	



Temperature:	25 °C	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	N
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 4



Remark:

Margin = Limit – Level, Correct Factor = Cable lose + LISN insertion loss, Level= Reading + Correct factor

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.150000	51.96	10.35	62.31	66.00	-3.69	QP	P	
2	0.150000	32.87	10.35	43.22	56.00	-12.78	AVG	P	
3	0.176600	50.28	9.55	59.83	64.64	-4.81	QP	P	
4	0.176600	34.54	9.55	44.09	54.64	-10.55	AVG	P	
5	0.276000	46.92	9.00	55.92	60.94	-5.02	QP	P	
6	0.276000	29.36	9.00	38.36	50.94	-12.58	AVG	P	
7	0.552200	42.03	9.31	51.34	56.00	-4.66	QP	P	
8	0.552200	21.96	9.31	31.27	46.00	-14.73	AVG	P	
9	3.065900	36.46	9.83	46.29	56.00	-9.71	QP	P	
10	3.065900	19.53	9.83	29.36	46.00	-16.64	AVG	P	
11	6.216000	34.58	9.84	44.42	60.00	-15.58	QP	P	
12	6.216000	15.87	9.84	25.71	50.00	-24.29	AVG	P	



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 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	40GHz
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



3.2.2 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:

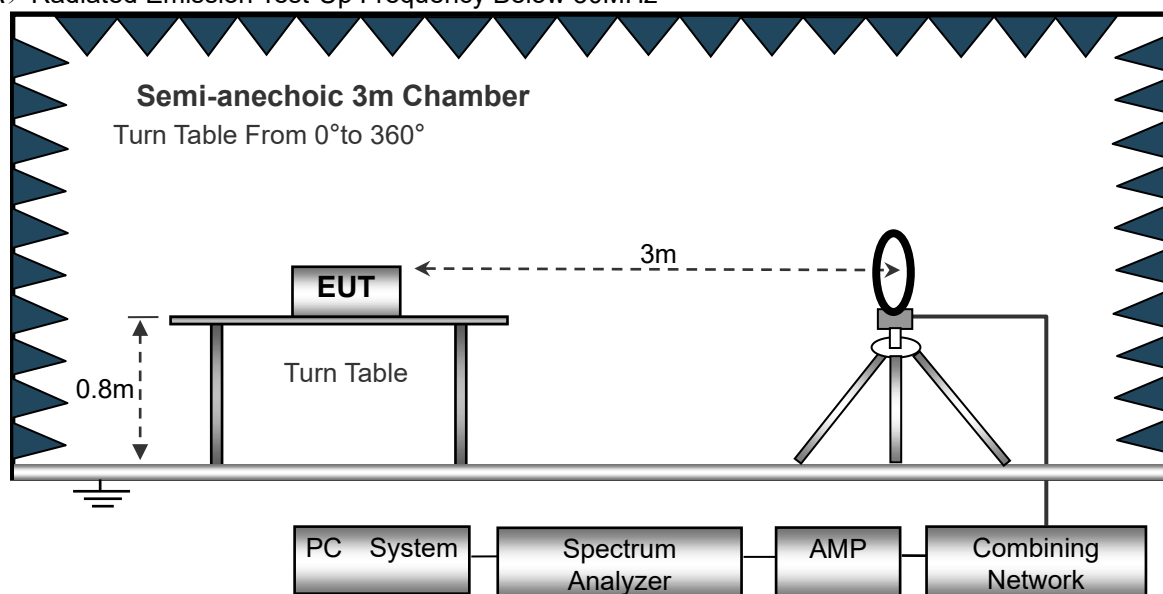
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

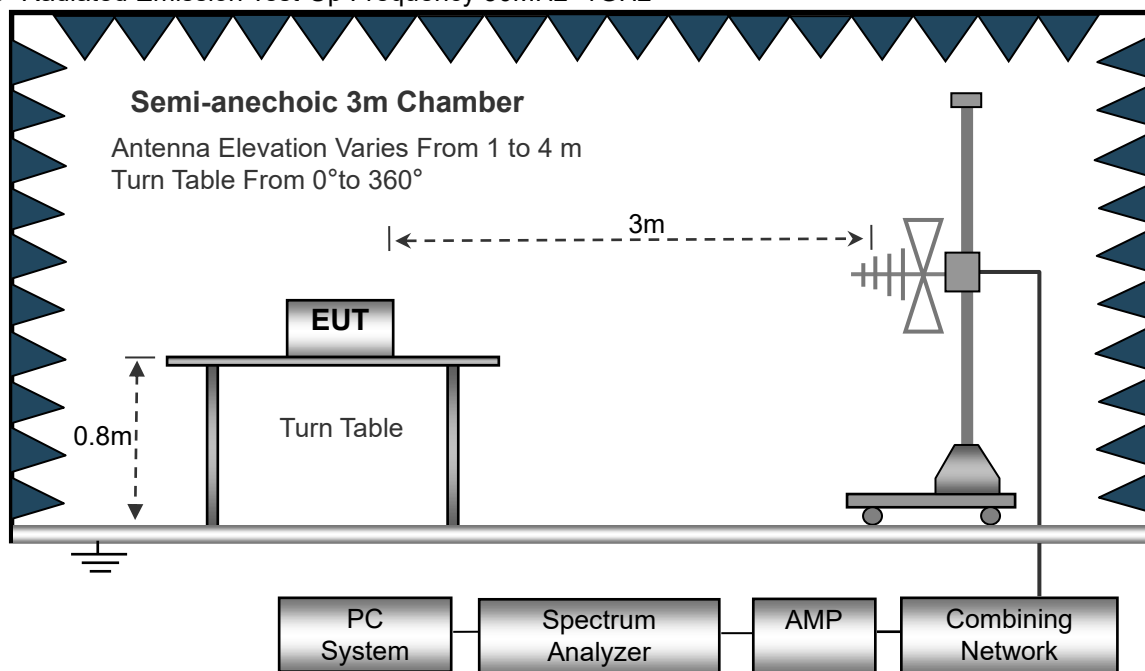
No deviation

3.2.4 TEST SETUP

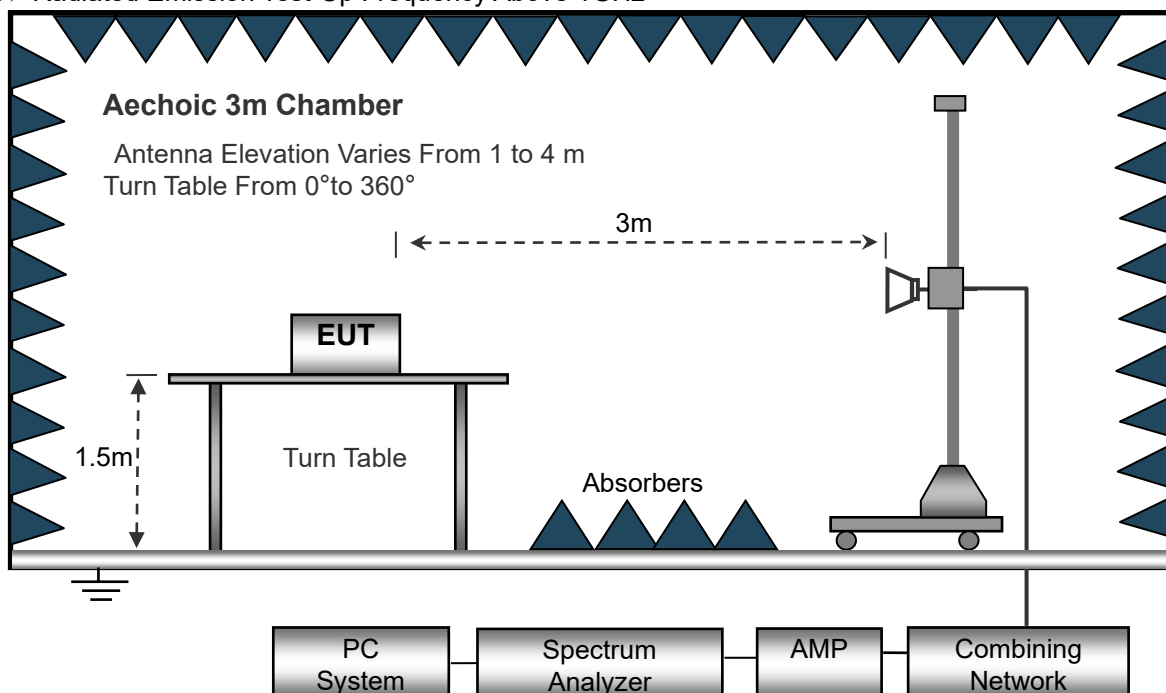
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 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.

**3.2.6 TEST RESULTS (Between 9KHz – 30 MHz)**

Temperature:	20℃	Relative Humidity:	48%
Pressure:	1010 hPa	Test Voltage :	AC 120V/60Hz
Test Mode :	Mode 4	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

**3.2.7 TEST RESULTS (Between 30MHz – 1GHz)**

Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz		
Test Mode :	Mode 4		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	47.9940	40.30	-11.62	28.68	40.00	-11.32	QP
2	102.3596	44.13	-15.17	28.96	43.50	-14.54	QP
3	231.7178	48.16	-12.32	35.84	46.00	-10.16	QP
4	297.2240	46.03	-10.76	35.27	46.00	-10.73	QP
5	431.0314	44.34	-8.51	35.83	46.00	-10.17	QP
6 *	815.9678	41.16	-2.03	39.13	46.00	-6.87	QP

Remark:

Correct Factor = Cable loss + Antenna factor – Preamplifier;

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



Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Vertical
test voltage :	AC 120V/60Hz		
Test Mode :	Mode 4		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	30.7454	49.73	-14.63	35.10	40.00	-4.90	QP
2	107.5100	47.54	-15.39	32.15	43.50	-11.35	QP
3	201.3930	47.29	-12.95	34.34	43.50	-9.16	QP
4	297.2240	45.86	-9.68	36.18	46.00	-9.82	QP
5	431.0314	42.63	-7.54	35.09	46.00	-10.91	QP
6	564.6385	41.52	-5.11	36.41	46.00	-9.59	QP

Remark:

Correct Factor = Cable loss + Antenna factor – Preamplifier;

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

**3.2.8 TEST RESULTS (1ghz~40ghZ)**

802.11a band 1

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)	
operation frequency:5180									
V	10360	56.33	49.05	15.3	37.39	59.97	68.2	-8.23	PK
V	10360	41.49	49.05	15.3	37.39	45.13	68.2	-23.07	AV
V	15540	56.64	49.16	15.27	40.45	63.2	74	-10.80	PK
V	15540	39.13	49.16	15.27	40.45	45.69	54	-8.31	AV
H	10360	56.05	49.05	15.3	37.39	59.69	68.2	-8.51	PK
H	10360	40.41	49.05	15.3	37.39	44.05	68.2	-24.15	AV
H	15540	59.18	49.16	15.27	40.45	65.74	74	-8.26	PK
H	15540	38.06	49.16	15.27	40.45	44.62	54	-9.38	AV
operation frequency:5200									
V	10400	57.43	49.09	15.34	37.42	61.1	68.2	-7.10	PK
V	10400	39.37	49.09	15.34	37.42	43.04	68.2	-25.16	AV
V	15600	59.49	49.18	15.29	40.47	66.07	74	-7.93	PK
V	15600	38.18	49.18	15.29	40.47	44.76	54	-9.24	AV
H	10400	56.34	49.09	15.34	37.42	60.01	68.2	-8.19	PK
H	10400	39.75	49.09	15.34	37.42	43.42	68.2	-24.78	AV
H	15600	59.46	49.18	15.29	40.47	66.04	74	-7.96	PK
H	15600	38.31	49.18	15.29	40.47	44.89	54	-9.11	AV
operation frequency:5240									
V	10480	58.53	49.11	15.37	37.46	62.25	68.2	-5.95	PK
V	10480	39.35	49.11	15.37	37.46	43.07	68.2	-25.13	AV
V	15720	59.16	49.21	15.34	40.51	65.8	74	-8.20	PK
V	15720	38.32	49.21	15.34	40.51	44.96	54	-9.04	AV
H	10480	57.28	49.11	15.37	31.31	54.85	68.2	-13.35	PK
H	10480	45.53	49.11	15.37	31.31	43.1	68.2	-25.10	AV
H	15720	57.46	49.21	15.34	40.51	64.1	74	-9.90	PK
H	15720	37.57	49.21	15.34	40.51	44.21	54	-9.79	AV

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.



802.11n HT20

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)	
operation frequency:5180									
V	10360	56.19	49.05	15.3	37.39	59.83	68.2	-8.37	PK
V	10360	38.48	49.05	15.3	37.39	42.12	68.2	-26.08	AV
V	15540	56.56	49.16	15.27	40.45	63.12	74	-10.88	PK
V	15540	38.28	49.16	15.27	40.45	44.84	54	-9.16	AV
H	10360	56.67	49.05	15.3	37.39	60.31	68.2	-7.89	PK
H	10360	39.36	49.05	15.3	37.39	43	68.2	-25.20	AV
H	15540	54.14	49.16	15.27	40.45	60.7	74	-13.30	PK
H	15540	38.39	49.16	15.27	40.45	44.95	54	-9.05	AV
operation frequency:5200									
V	10400	56.23	49.09	15.34	37.42	59.9	68.2	-8.30	PK
V	10400	39.78	49.09	15.34	37.42	43.45	68.2	-24.75	AV
V	15600	55.39	49.18	15.29	40.47	61.97	74	-12.03	PK
V	15600	38.34	49.18	15.29	40.47	44.92	54	-9.08	AV
H	10400	55.51	49.09	15.34	37.42	59.18	68.2	-9.02	PK
H	10400	40.36	49.09	15.34	37.42	44.03	68.2	-24.17	AV
H	15600	55.07	49.18	15.29	40.47	61.65	74	-12.35	PK
H	15600	39.26	49.18	15.29	40.47	45.84	54	-8.16	AV
operation frequency:5240									
V	10480	57.12	49.11	15.37	37.46	60.84	68.2	-7.36	PK
V	10480	40.54	49.11	15.37	37.46	44.26	68.2	-23.94	AV
V	15720	54.36	49.21	15.34	40.51	61	74	-13.00	PK
V	15720	38.42	49.21	15.34	40.51	45.06	54	-8.94	AV
H	10480	57.17	49.11	15.37	31.31	54.74	68.2	-13.46	PK
H	10480	44.66	49.11	15.37	31.31	42.23	68.2	-25.97	AV
H	15720	55.38	49.21	15.34	40.51	62.02	74	-11.98	PK
H	15720	39.24	49.21	15.34	40.51	45.88	54	-8.12	AV

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.



802.11n HT40

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)	
operation frequency:5190									
V	10380	56.73	49.07	15.33	37.41	60.4	68.2	-7.80	PK
V	10380	39.26	49.07	15.33	37.41	42.93	68.2	-25.27	AV
V	15570	56.28	49.17	15.28	40.46	62.85	74	-11.15	PK
V	15570	38.35	49.17	15.28	40.46	44.92	54	-9.08	AV
H	10380	56.66	49.07	15.33	37.41	60.33	68.2	-7.87	PK
H	10380	40.31	49.07	15.33	37.41	43.98	68.2	-24.22	AV
H	15570	54.64	49.17	15.28	40.46	61.21	74	-12.79	PK
H	15570	38.23	49.17	15.28	40.46	44.8	54	-9.20	AV
operation frequency:5230									
V	10460	57.18	49.11	15.37	37.46	60.9	68.2	-7.30	PK
V	10460	39.45	49.11	15.37	37.46	43.17	68.2	-25.03	AV
V	15690	54.46	49.21	15.34	40.51	61.1	74	-12.90	PK
V	15690	38.31	49.21	15.34	40.51	44.95	54	-9.05	AV
H	10460	57.22	49.11	15.37	31.31	54.79	68.2	-13.41	PK
H	10460	44.86	49.11	15.37	31.31	42.43	68.2	-25.77	AV
H	15690	55.35	49.21	15.34	40.51	61.99	74	-12.01	PK
H	15690	39.08	49.21	15.34	40.51	45.72	54	-8.28	AV

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.



802.11ac HT20

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)	
operation frequency:5180									
V	10360	56.76	49.05	15.3	37.39	60.4	68.2	-7.80	PK
V	10360	39.57	49.05	15.3	37.39	43.21	68.2	-24.99	AV
V	15540	56.15	49.16	15.27	40.45	62.71	74	-11.29	PK
V	15540	38.36	49.16	15.27	40.45	44.92	54	-9.08	AV
H	10360	56.18	49.05	15.3	37.39	59.82	68.2	-8.38	PK
H	10360	38.14	49.05	15.3	37.39	41.78	68.2	-26.42	AV
H	15540	54.21	49.16	15.27	40.45	60.77	74	-13.23	PK
H	15540	39.36	49.16	15.27	40.45	45.92	54	-8.08	AV
operation frequency:5200									
V	10400	56.59	49.09	15.34	37.42	60.26	68.2	-7.94	PK
V	10400	41.75	49.09	15.34	37.42	45.42	68.2	-22.78	AV
V	15600	55.52	49.18	15.29	40.47	62.1	74	-11.90	PK
V	15600	40.36	49.18	15.29	40.47	46.94	54	-7.06	AV
H	10400	55.14	49.09	15.34	37.42	58.81	68.2	-9.39	PK
H	10400	40.53	49.09	15.34	37.42	44.2	68.2	-24.00	AV
H	15600	55.05	49.18	15.29	40.47	61.63	74	-12.37	PK
H	15600	41.28	49.18	15.29	40.47	47.86	54	-6.14	AV
operation frequency:5240									
V	10480	57.44	49.11	15.37	37.46	61.16	68.2	-7.04	PK
V	10480	40.69	49.11	15.37	37.46	44.41	68.2	-23.79	AV
V	15720	54.37	49.21	15.34	40.51	61.01	74	-12.99	PK
V	15720	39.76	49.21	15.34	40.51	46.4	54	-7.60	AV
H	10480	57.17	49.11	15.37	31.31	54.74	68.2	-13.46	PK
H	10480	44.51	49.11	15.37	31.31	42.08	68.2	-26.12	AV
H	15720	55.66	49.21	15.34	40.51	62.3	74	-11.70	PK
H	15720	40.08	49.21	15.34	40.51	46.72	54	-7.28	AV

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.



3.3 CONDUCTED BAND EMISSION MEASUREMENT

3.3.1 TEST REQUIREMENT:

FCC Part15 C Section 15.209 and 15.407

(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.

Spectrum Parameter	Setting	
Attenuation	Auto	
Start Frequency	5150MHz	5725MHz
Stop Frequency	5250MHz	5850MHz
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average	

3.3.2 TEST PROCEDURE

Test method: FCC KDB 789033 G)& Parts 15.407(b)(4) & 15.209(a)

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP



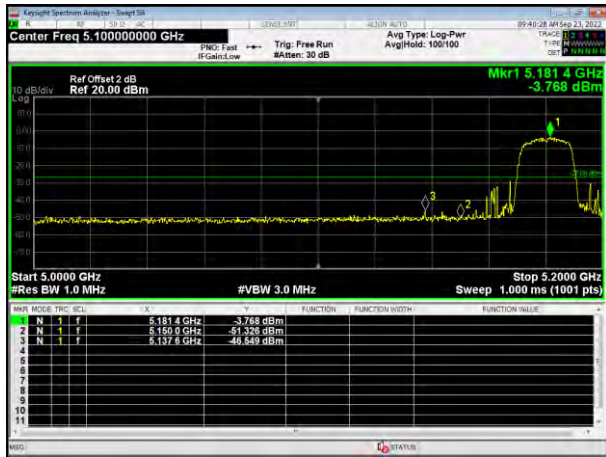
3.3.5 EUT OPERATING CONDITIONS

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.

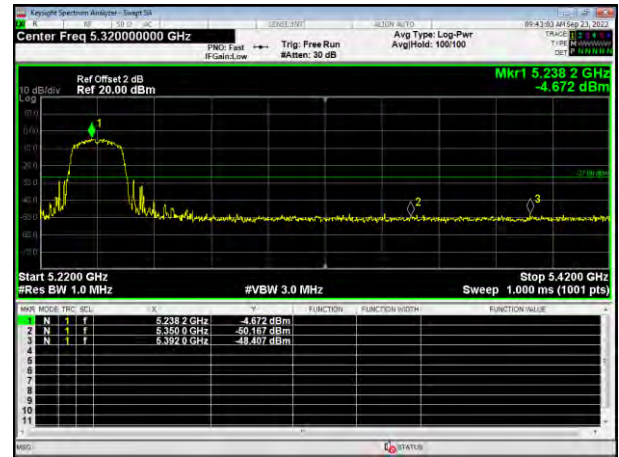


3.3.6 TEST RESULT

802.11a

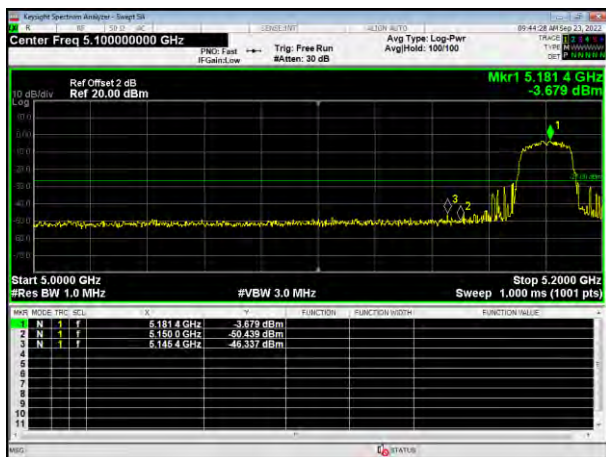


5180MHz

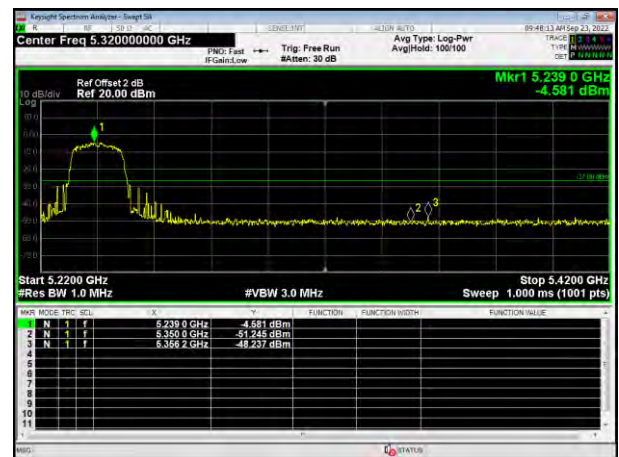


5240MHz

802.11n HT20

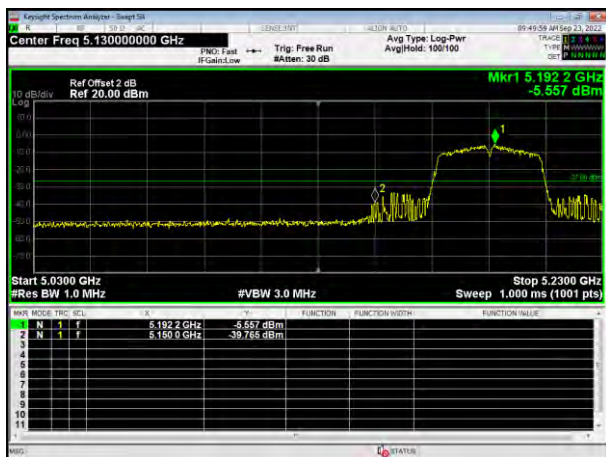


5180MHz

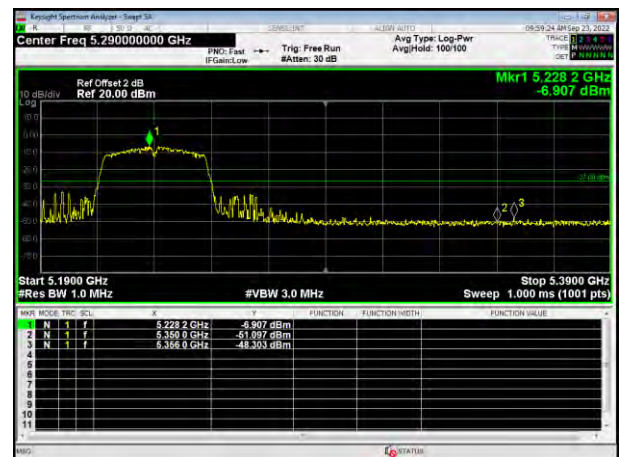


5240MHz

802.11n HT40



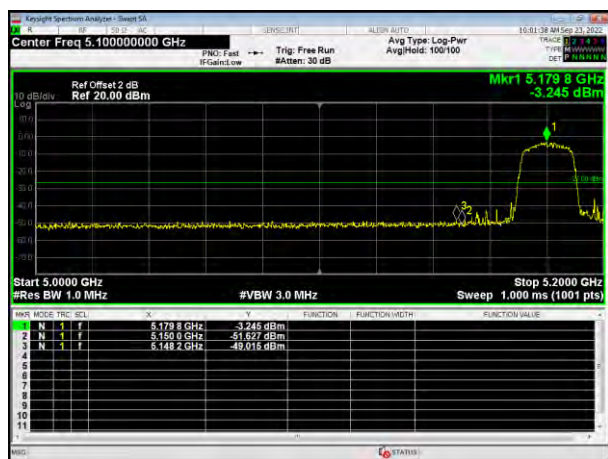
5190MHz



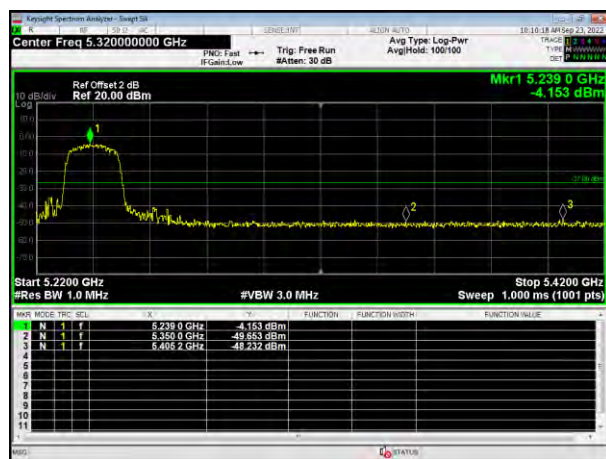
5230MHz



802.11ac HT20

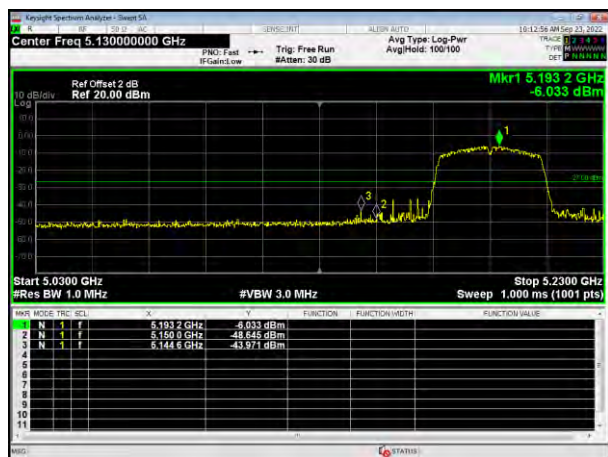


5180MHz

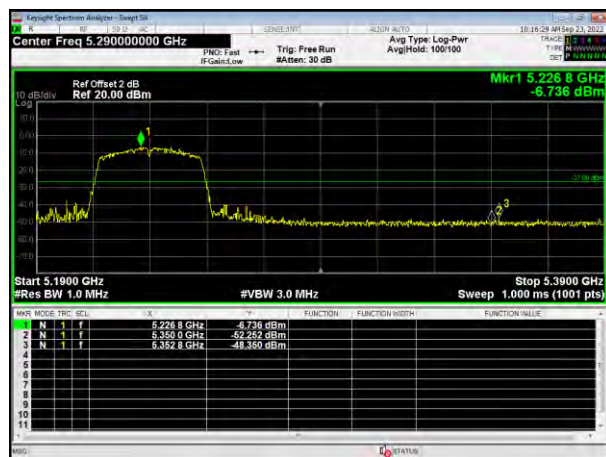


5240MHz

802.11ac HT40

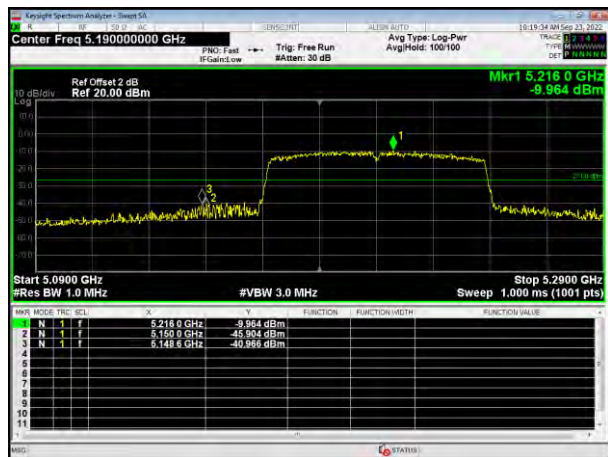


5190MHz



5230MHz

802.11ac HT80



5210MHz



4. AVERAGE OUTPUT POWER

4.1 APPLIED PROCEDURES / LIMIT

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

4.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
VBW $\geq$ RBW
Sweep = auto
Detector function = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
Trace = max hold

4.1.2 DEVIATION FROM STANDARD

No deviation.

4.1.3 TEST SETUP



4.1.4 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.

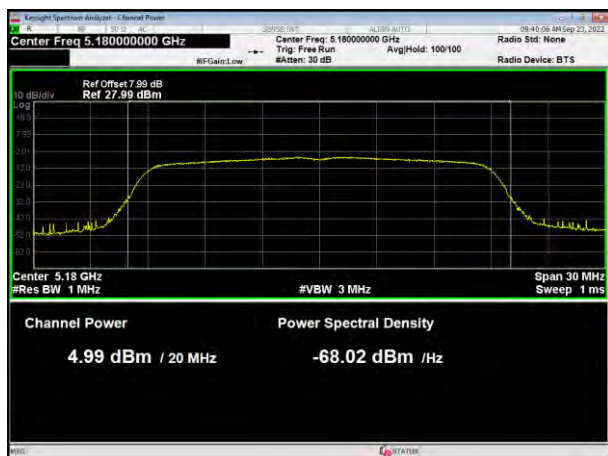
**4.1.5 TEST RESULTS**

Temperature:	25 °C	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage :	AC 120V/60Hz

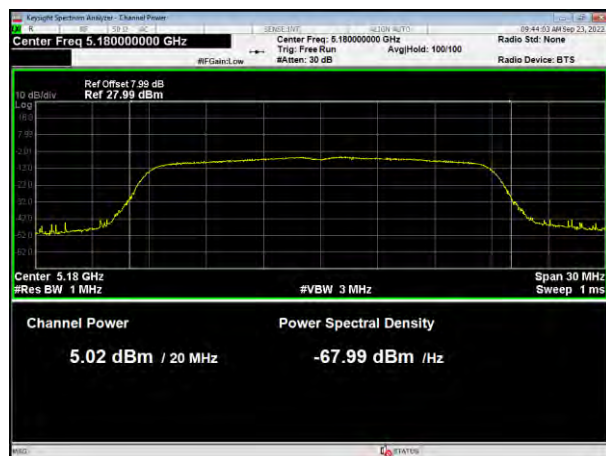
Band	Mode	Test Channel	Average Output Power (dBm)	Duty factor (dB)	Total Output Power(dB)	LIMIT (dBm)
Band 1	802.11a	Low	4.988	0.11	5.098	23.98
		Moddle	4.221	0.11	4.331	23.98
		High	4.448	0.11	4.558	23.98
	802.11n HT20	Low	5.026	0.11	5.136	23.98
		Moddle	4.228	0.11	4.338	23.98
		High	4.349	0.11	4.459	23.98
	802.11n HT40	Low	4.711	0.21	4.921	23.98
		High	4.364	0.21	4.574	23.98
	802.11ac HT20	Low	5.01	0.11	5.12	23.98
		Moddle	4.303	0.11	4.413	23.98
		High	4.396	0.11	4.506	23.98
	802.11ac HT40	Low	5.011	0.21	5.221	23.98
		High	4.415	0.21	4.625	23.98
	802.11ac HT80	/	4.364	0.41	4.774	23.98



802.11a



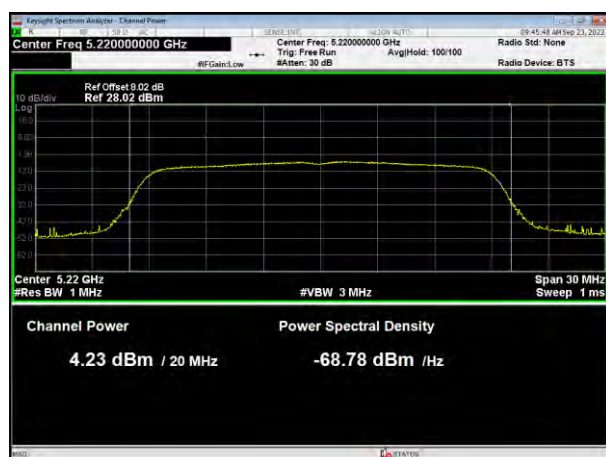
802.11n HT20



5180MHz



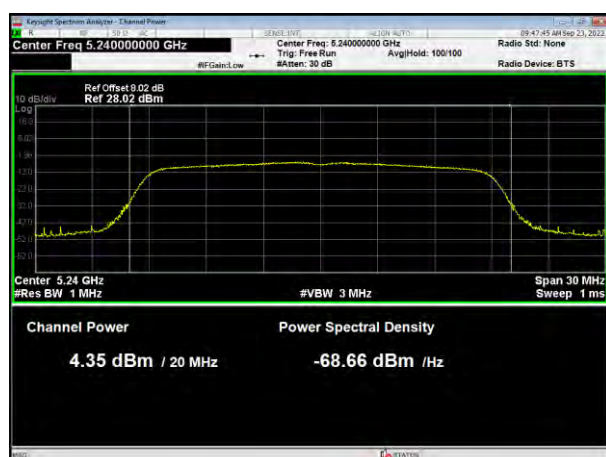
5180MHz



5200MHz



5200MHz

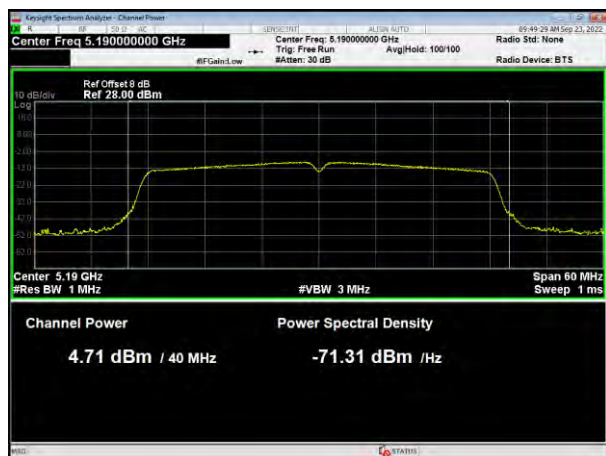


5240MHz

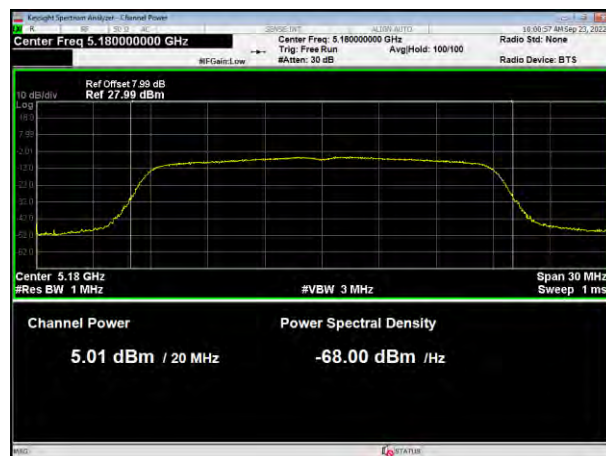
5240MHz



802.11n HT40



802.11ac HT20



5190MHz



5180



5230MHz

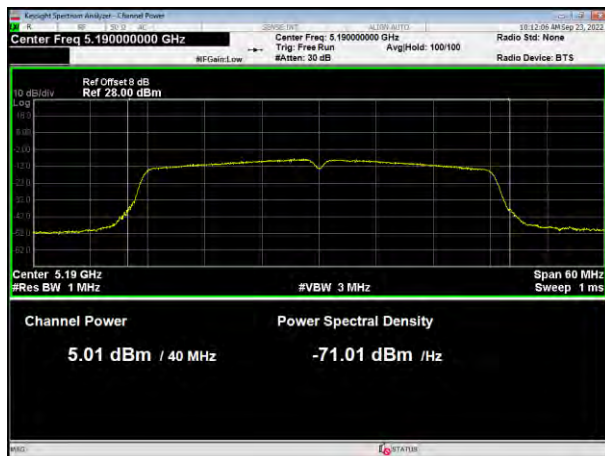


5200

5240



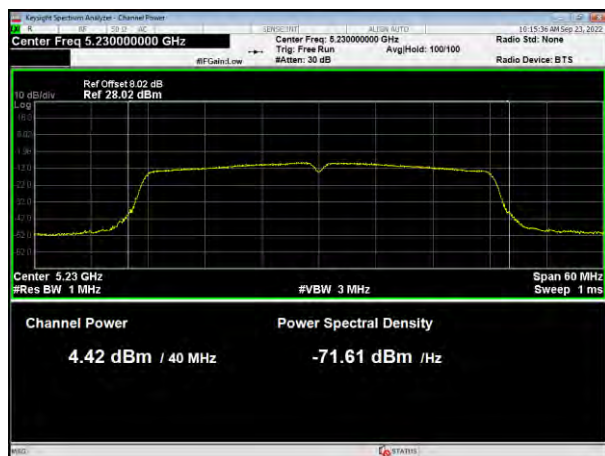
802.11ac HT40



802.11ac HT80



5190MHz



5210

5230MHz



5. POWER SPECTRAL DENSITY TEST

5.1 APPLIED PROCEDURES / LIMIT

In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	= the frequency band of operation
RB	RBW $\geq$ 1MHz for band 1 RBW $\geq$ 510KHz for band 4
VB	VBW $\geq$ 3RBW
Detector	RMS (i.e., power averaging).
Trace	Max Hold
Sweep Time	Auto

5.1.1 TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. For U-NII1, U-NII-2A, U-NII-2C Band:
Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
For U-NII-3 Band:
Set RBW=510 kHz, VBW=3*RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
5. Use the cursor on spectrum to peak search the highest level of trace
6. Record the max. reading and add 10 log(1/duty cycle).
we test all antennas, the antenna 1 was worst mode and the data recording in the report.
7. Duty factor Reference is made to the test results in Section 7.1.5.

5.1.2 DEVIATION FROM STANDARD

No deviation.

5.1.3 TEST SETUP



5.1.4 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.

**5.1.5 TEST RESULTS**

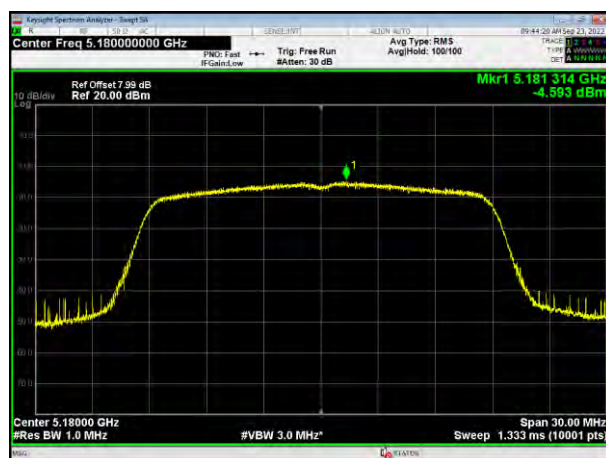
	Mode	Test Channel	Reading Level (dBm)	Duty factor (dB)	PSD (dBm/MHz)	Limit (dBm)	Result
Band1	802.11a	Low	-4.907	0.11	-4.797	11.00	PASS
		Moddle	-5.565	0.11	-5.455	11.00	PASS
		High	-5.412	0.11	-5.302	11.00	PASS
	802.11n20	Low	-4.593	0.11	-4.483	11.00	PASS
		Moddle	-5.526	0.11	-5.416	11.00	PASS
		High	-5.355	0.11	-5.245	11.00	PASS
	802.11n40	Low	-7.714	0.21	-7.504	11.00	PASS
		High	-8.036	0.21	-7.826	11.00	PASS
	802.11ac20	Low	-4.781	0.11	-4.671	11.00	PASS
		Moddle	-5.592	0.11	-5.482	11.00	PASS
		High	-5.322	0.11	-5.212	11.00	PASS
	802.11ac40	Low	-7.25	0.21	-7.04	11.00	PASS
		High	-8.073	0.21	-7.863	11.00	PASS
	802.11ac80	/	-11.889	0.41	-11.479	11.00	PASS



802.11a



802.11n HT20



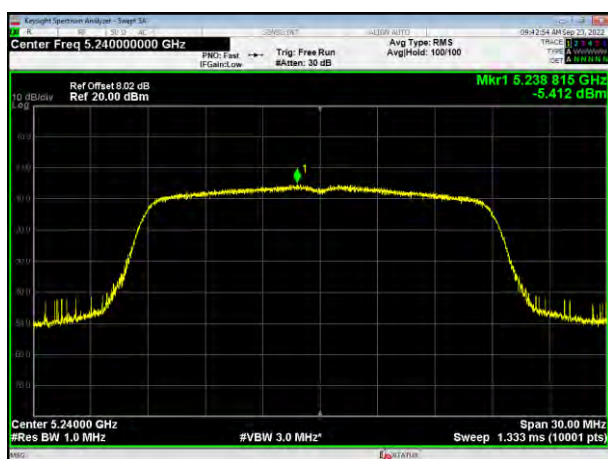
5180MHz



5180MHz



5200MHz



5200MHz



5240MHz

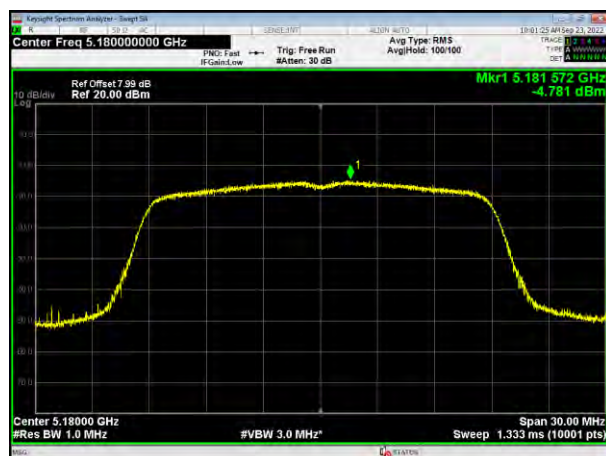
5240MHz



802.11n HT40



802.11ac HT20



5190MHz



5180



5230MHz



5200

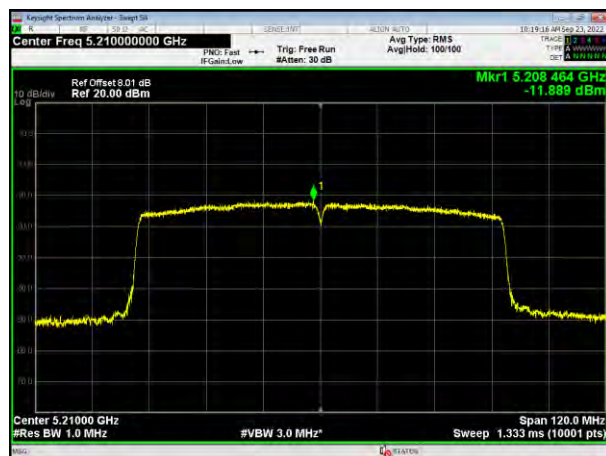
5240



802.11ac HT40



802.11ac HT80



5190MHz



5210

5230MHz



6. 26DB&99% BANDWIDTH TEST

6.1 APPLIED PROCEDURES / LIMIT

The 26 dB bandwidth is used to determine the conducted power limits.

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.

6.1.1 TEST PROCEDURE

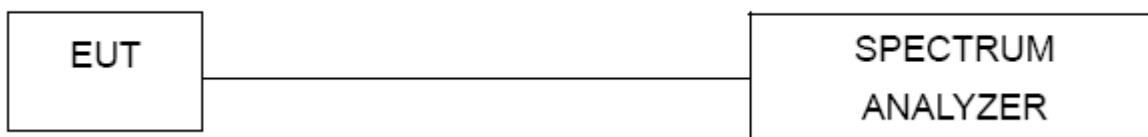
26dB Bandwidth	
Spectrum Parameters	Setting
RBW	approximately 1% of the emission bandwidth
VBW	>RBW
Span	30MHz(20MHz Bandwidth mode) 60MHz(40MHz Bandwidth mode) 120MHz(80MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

99% Occupied Bandwidth	
Spectrum Parameters	Setting
RBW	1% to 5% of the OBW
VBW	Approximately three times the RBW
Span	between 1.5 times and 5.0 times the OBW
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

6.1.2 DEVIATION FROM STANDARD

No deviation.

6.1.3 TEST SETUP



6.1.4 EUT OPERATION CONDITIONS

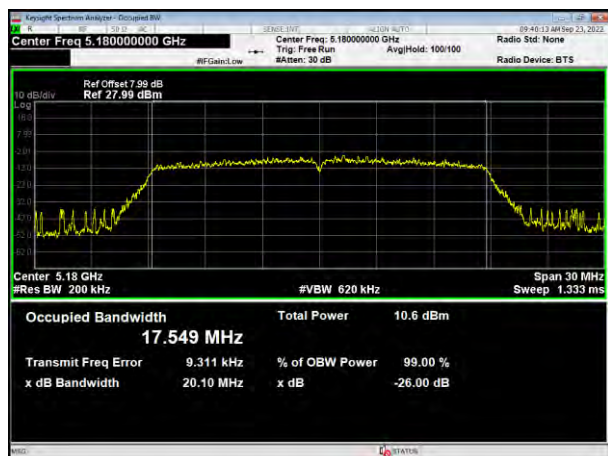
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

**6.1.5 TEST RESULTS**

		Test Channel	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
Band 1	802.11a	Low	20.10	17.549	Pass
		Middle	20.07	17.548	Pass
		High	19.88	17.535	Pass
	802.11n HT20	Low	19.84	17.557	Pass
		Middle	20.13	17.565	Pass
		High	20.15	17.556	Pass
	802.11n HT40	Low	40.22	35.807	Pass
		High	40.41	35.891	Pass
	802.11ac HT20	Low	20.08	17.524	Pass
		Middle	20.16	17.550	Pass
		High	20.08	17.539	Pass
	802.11ac HT40	Low	39.92	35.801	Pass
		High	39.80	35.854	Pass
	802.11ac HT80	/	80.38	75.132	Pass



802.11a



802.11n HT20



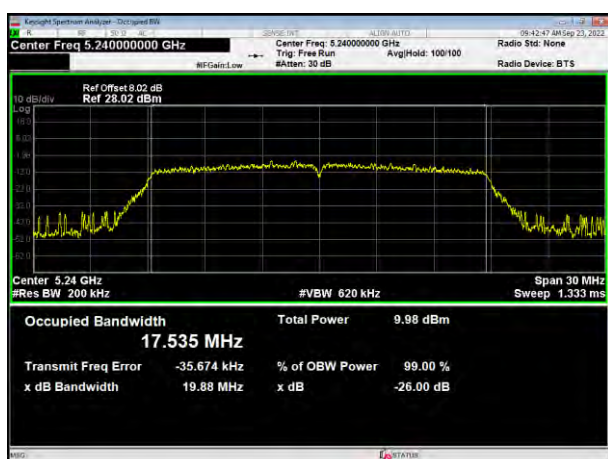
5180MHz



5180MHz



5200MHz



5200MHz



5240MHz

5240MHz



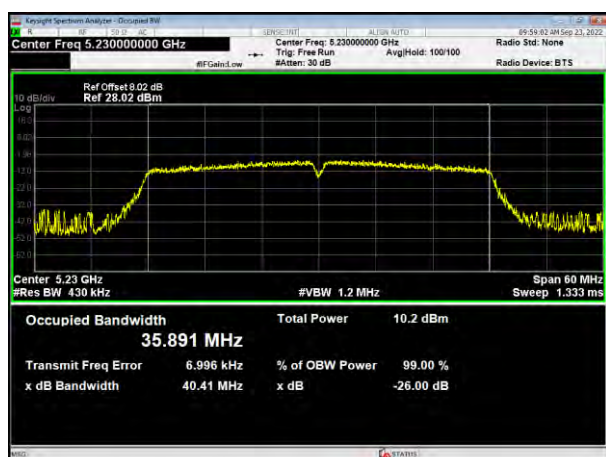
802.11n HT40



802.11ac HT20



5190MHz



5180MHz



5230MHz



5200MHz



5240MHz



802.11ac HT40



802.11ac HT80



5190MHz



5210MHz

5230MHz



7. DUTY CYCLE TEST SIGNAL

7.1 APPLIED PROCEDURES / LIMIT

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle. All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

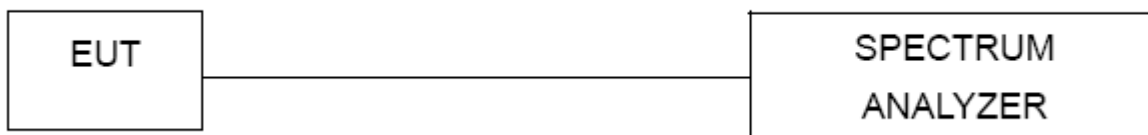
7.1.1 TEST PROCEDURE

1. Set RBW = 1 MHz.
2. Set the video bandwidth (VBW) $\geq$ RBW.
3. Detector = Peak.
4. Sweep = auto couple.
5. Allow the trace to stabilize.
6. Span=0

7.1.2 DEVIATION FROM STANDARD

No deviation.

7.1.3 TEST SETUP



7.1.4 EUT OPERATION CONDITIONS

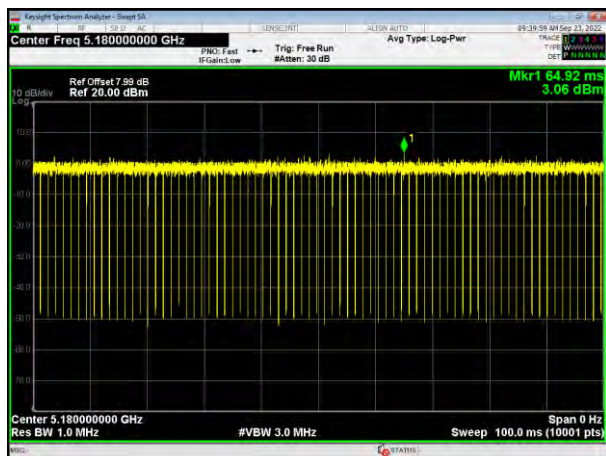
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

**7.1.5 TEST RESULTS**

Operation Mode		Duty Cycle(%)	Duty Fator (dB) $10 * \log (1/ \text{Duty cycle})$
Band 1	802.11a	97.54	0.11
	802.11n(HT20)	97.54	0.11
	802.11n(HT40)	95.22	0.21
	802.11ac(HT20)	97.56	0.11
	802.11ac(HT40)	95.25	0.21
	802.11ac(HT80)	91	0.41



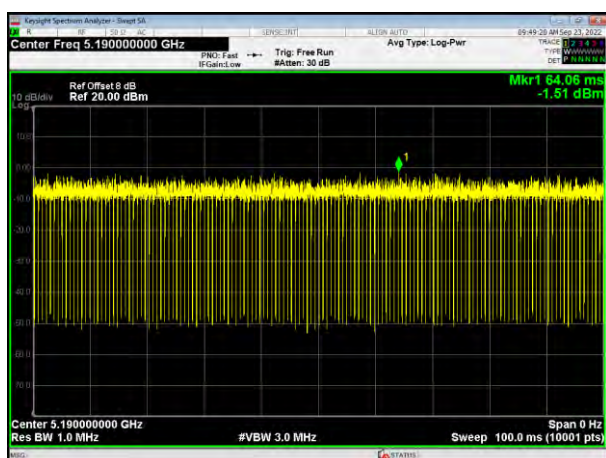
802.11a



802.11n HT20



802.11n HT40



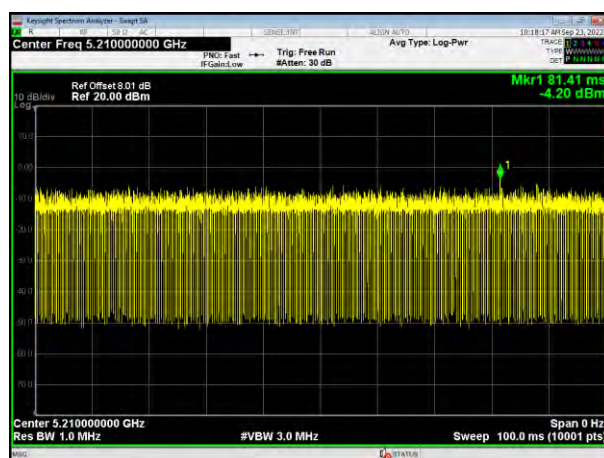
802.11ac HT20



802.11ac HT40



802.11ac HT80





8. FREQUENCY STABILITY

8.1 APPLIED PROCEDURES / LIMIT

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

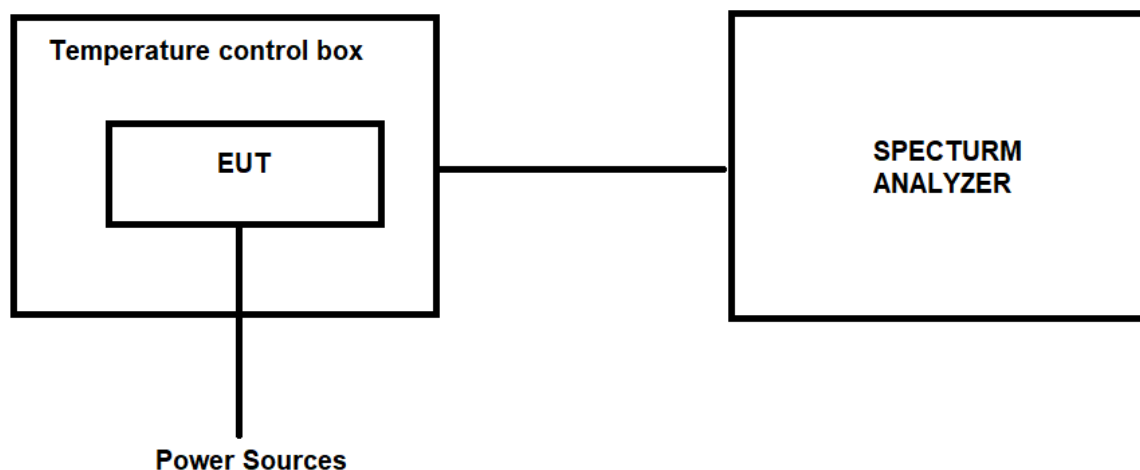
8.1.1 TEST PROCEDURE

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.

8.1.2 DEVIATION FROM STANDARD

No deviation.

8.1.3 TEST SETUP



8.1.4 EUT OPERATION 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.



8.1.5 TEST RESULTS

Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)			Δ Frequency (MHz)		
			802.11a	802.11n HT20	802.11ac HT20	802.11a	802.11n HT20	802.11ac HT20
132V	-20℃	5180	5180.0328	5180.0354	5180.0331	-0.0328	-0.0354	-0.0331
		5220	5220.0341	5220.0316	5220.0365	-0.0341	-0.0316	-0.0365
		5240	5240.0233	5240.0267	5240.0256	-0.0233	-0.0267	-0.0256
108V		5180	5180.0238	5180.026	5180.0237	-0.0238	-0.026	-0.0237
		5220	5220.0326	5220.0354	5220.0343	-0.0326	-0.0354	-0.0343
		5240	5240.0229	5240.0263	5240.0235	-0.0229	-0.0263	-0.0235
120V	25℃	5180	5180.0544	5180.0538	5180.0574	-0.0544	-0.0538	-0.0574
		5220	5220.0261	5220.0284	5220.0266	-0.0261	-0.0284	-0.0266
		5240	5240.0356	5240.0343	5240.0347	-0.0356	-0.0343	-0.0347
132V	50℃	5180	5180.0313	5180.0368	5180.0353	-0.0313	-0.0368	-0.0353
		5220	5220.0276	5220.0245	5220.0232	-0.0276	-0.0245	-0.0232
		5240	5240.0327	5240.0356	5240.0374	-0.0327	-0.0356	-0.0374
108V	50℃	5180	5180.0314	5180.0323	5180.0366	-0.0314	-0.0323	-0.0366
		5220	5220.0216	5220.0265	5220.0272	-0.0216	-0.0265	-0.0272
		5240	5240.0329	5240.0357	5240.0354	-0.0329	-0.0357	-0.0354



Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)		Δ Frequency (MHz)	
			802.11n HT40	802.11ac HT40	802.11n HT40	802.11ac HT40
132V	-20℃	5190	5190.0216	5190.0235	-0.0216	-0.0235
		5230	5230.0328	5230.0367	-0.0328	-0.0367
108V		5190	5190.0253	5190.0236	-0.0253	-0.0236
		5230	5230.0328	5230.0345	-0.0328	-0.0345
120V	25℃	5190	5190.0272	5190.0258	-0.0272	-0.0258
		5230	5230.0668	5230.0536	-0.0668	-0.0536
132V	50℃	5190	5190.0656	5190.0641	-0.0656	-0.0641
		5230	5230.0564	5230.0553	-0.0564	-0.0553
108V	50℃	5190	5190.0553	5190.0547	-0.0553	-0.0547
		5230	5230.0334	5230.0335	-0.0334	-0.0335

Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)	Δ Frequency (MHz)
			802.11ac HT80	802.11ac HT80
132V	-20°C	5210	5210.0133	-0.0133
108V		5210	5210.0286	-0.0286
230V	25°C	5210	5210.0474	-0.0474
132V	50°C	5210	5210.0318	-0.0318
108V	50°C	5210	5210.0337	-0.0337



9. TRANSMISSION IN THE ABSENCE OF DATA

9.1 STANDARD REQUIREMENT

According to §15.407(c)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

9.2 TEST RESULT

No non-compliance noted:
Refer to the theory of operation.

10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, 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.

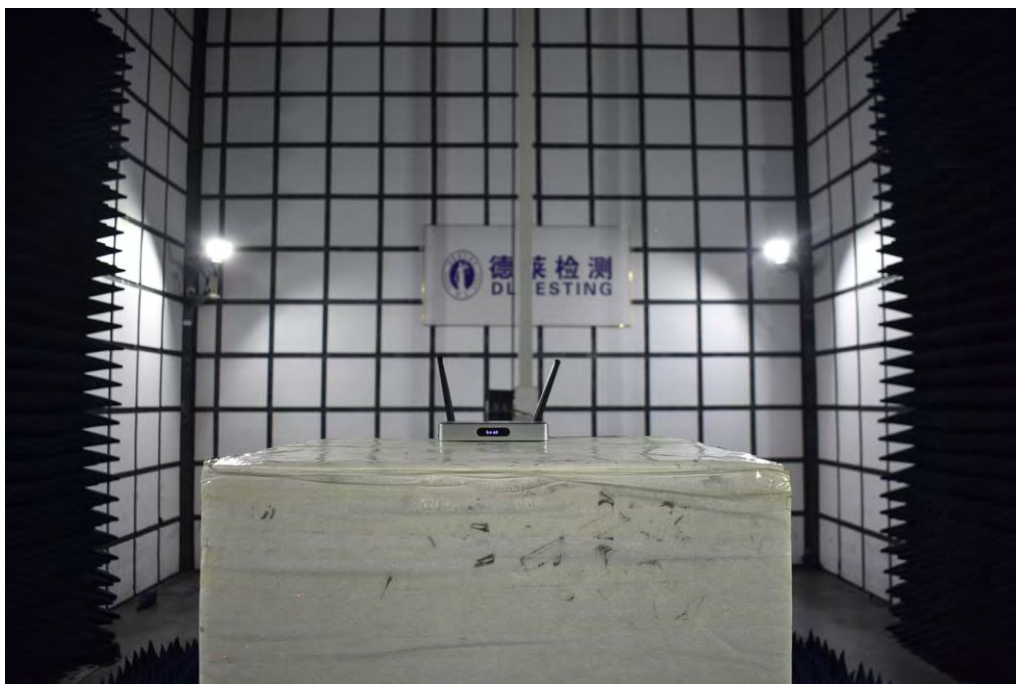
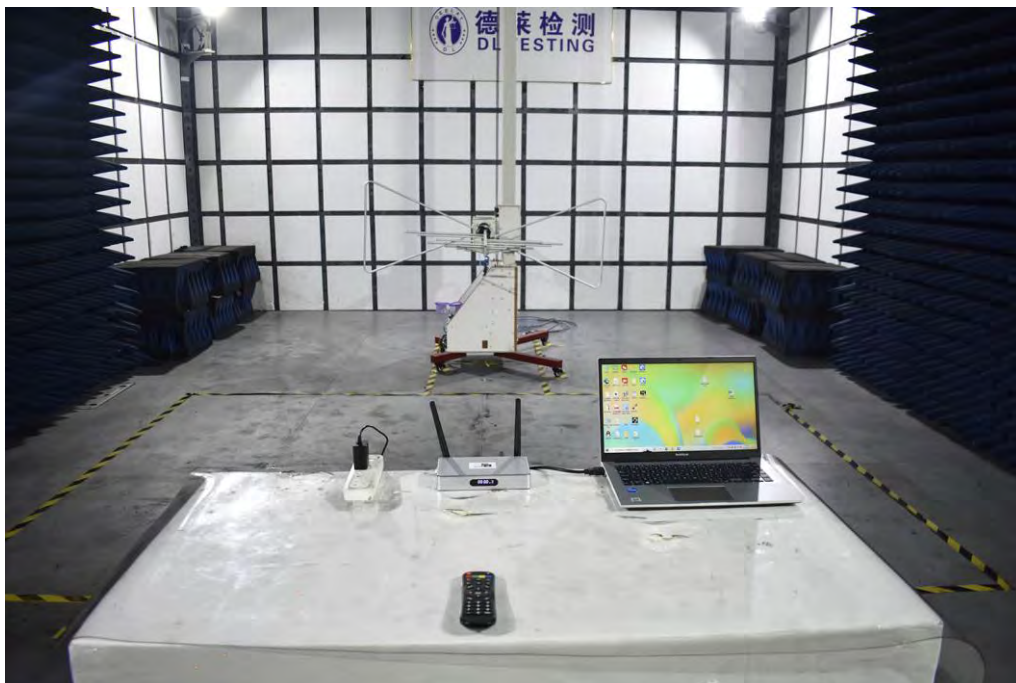
10.2 EUT ANTENNA

The EUT antenna is External antenna, It comply with the standard requirement.



11. TEST SEUUP PHOTO

Radiated Measurement Photos



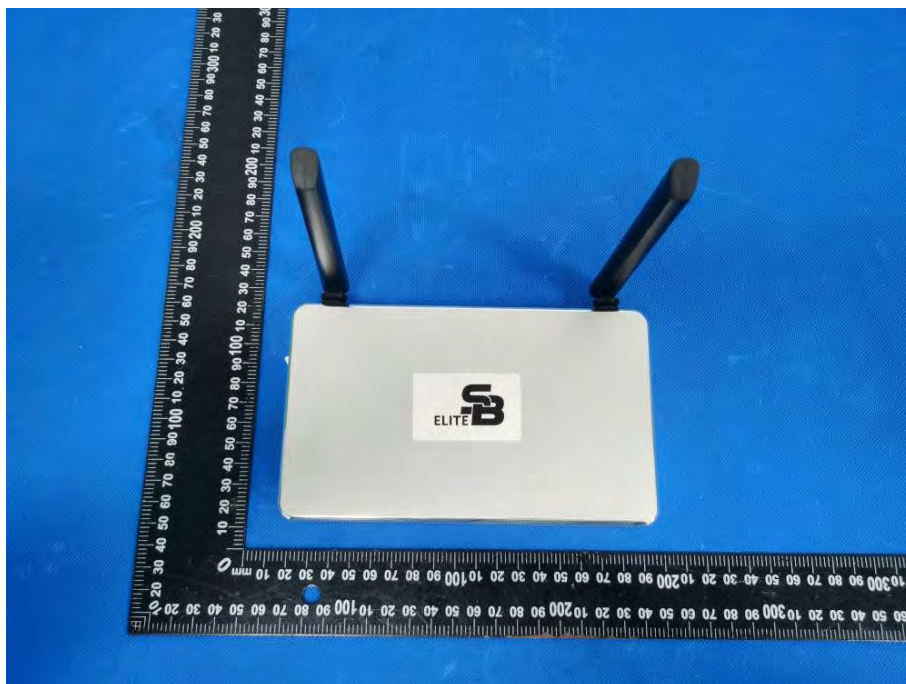


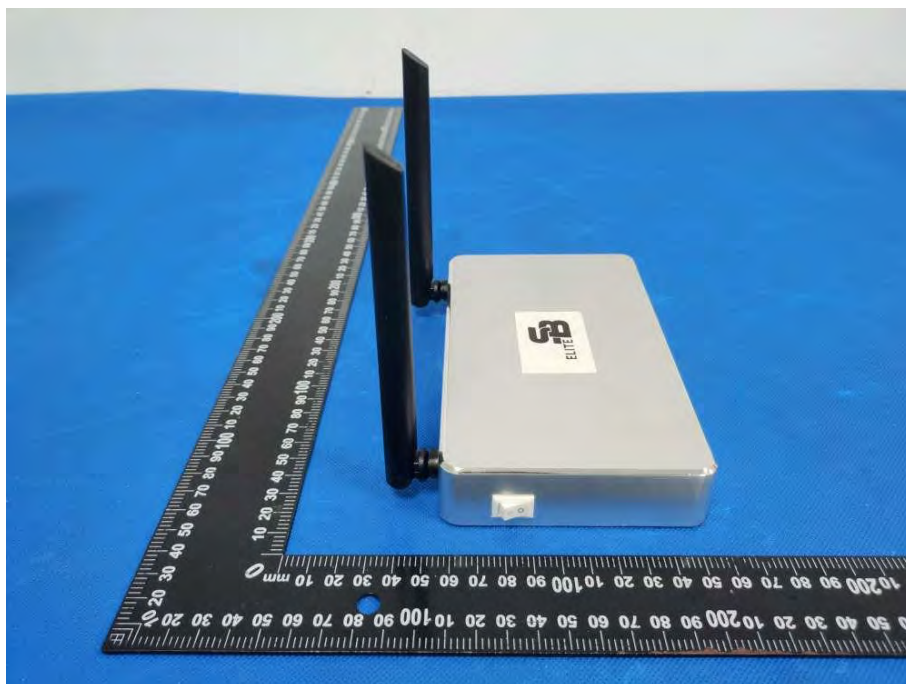
Conducted Measurement Photos

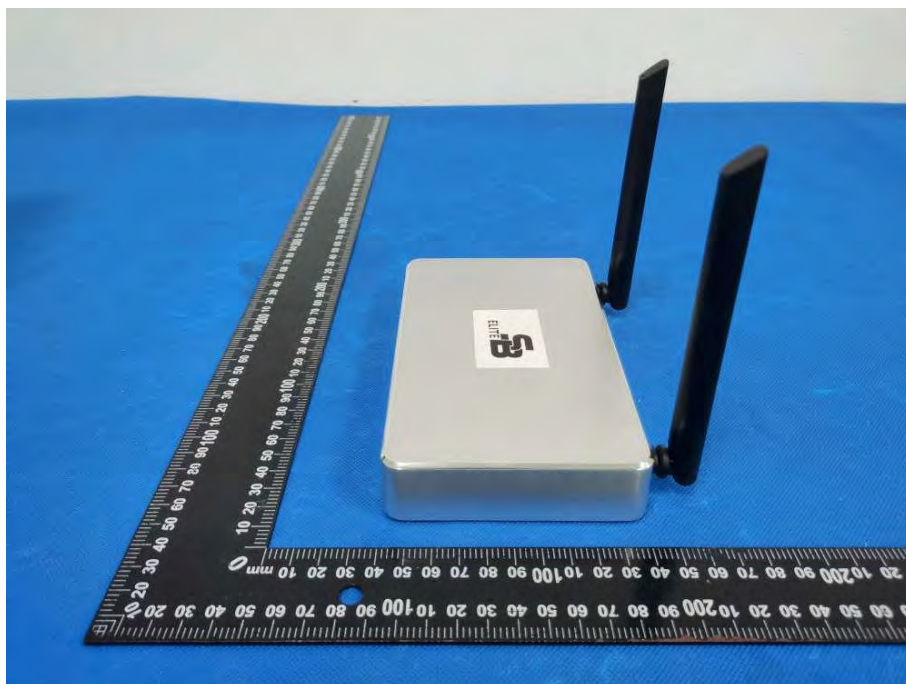


12. EUT PHOTO

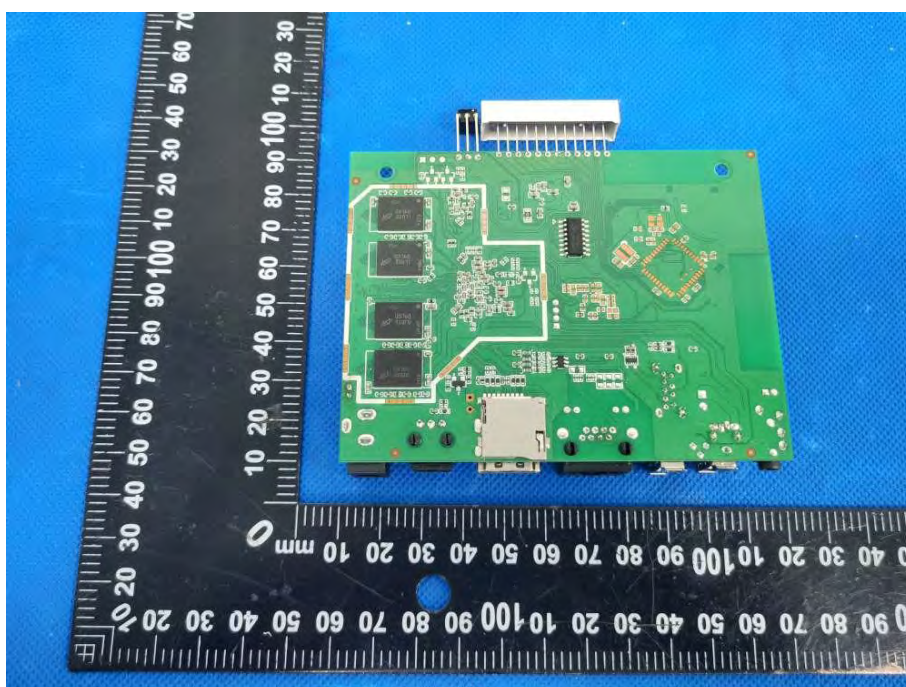
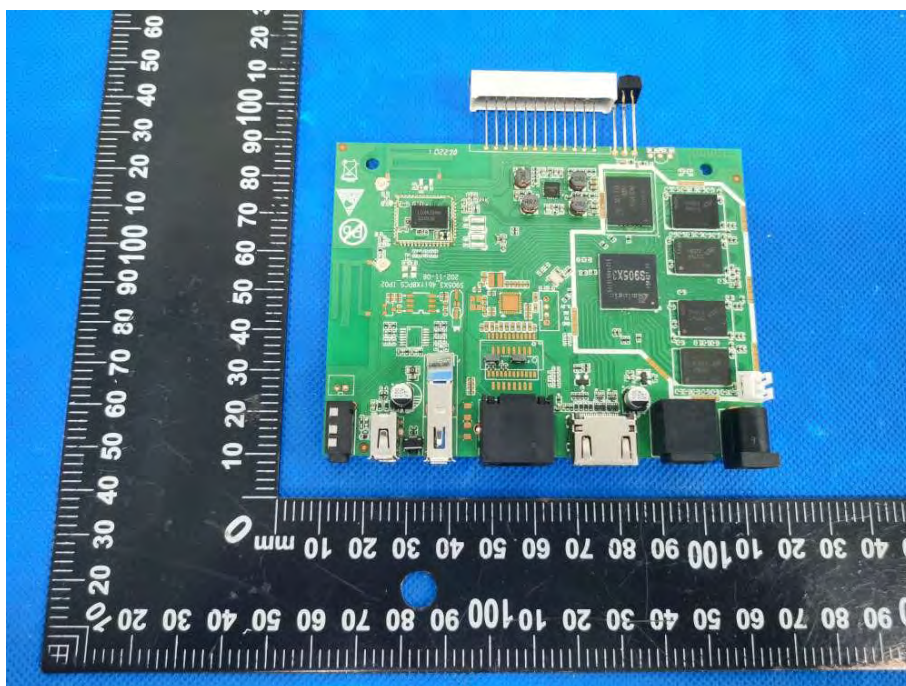














***** END OF REPORT *****