FCC Part 15E Test Report

FCC ID: 2ASPCMPTI

Product Name:	MPtouch Interactive
Trademark:	IMAGINEEAR
Model Name :	MPti
Prepared For : Address :	Imagineear Ltd The Compton Rooms Fulham Palace Bishops Avenue London SW6 6EA United Kingdom
Prepared By : Address :	Shenzhen BCTC Testing Co., Ltd. BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
Test Date:	Jan. 23, 2019 – Mar. 08, 2019
Date of Report :	Mar. 08, 2019
Report No.:	BCTC-LH190100122-4E

TEST RESULT CERTIFICATION

Applicant's name	:	Imagineear Ltd
Address	:	The Compton Rooms Fulham Palace Bishops Avenue London SW6 6EA United Kingdom
Manufacture's Name	:	Chempros Limited
Address	:	2312, Eastern Tower, Coastal Era Building, Nanshan, Shenzhen, China 518051
Product description		
Product name	:	MPtouch Interactive
Trademark	:	N/A
Model and/or type reference	:	MPti
Standards	:	FCC Part15 15.407 ANSI C63.10-2013

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Revision History

Report No.	Version	Description	Issued Date
BCTC-LH190100122-4E	Rev.01	Initial issue of report	Mar. 08, 2019

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 Emissions	PASS	
15.209(a), 15.407 (b)(1) 15.407 (b)(6)	Spurious Radiated Emissions	PASS	
15.407 (a)(5) 15.1049	26 dB and 99% Emission Bandwidth	PASS	
15.407 (a)(1) 15.407 (a)(3)	Maximum Conducted Output Power	PASS	
2.1051, 15.407(b)(1)	Band Edge	PASS	
15.407 (a)(1)	Power Spectral Density	PASS	
2.1051, 15.407(b)	Spurious Emissions at Antenna Terminals	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

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

1.1 TEST FACILITY

Shenzhen BCTC Testing Co., Ltd.
Add. : BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
FCC Test Firm Registration Number: 712850
IC Registered No.: 23583

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± 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	3m camber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
3	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
4	Conducted Adjacent channel power	U=1.38dB
5	Conducted output power uncertainty Above 1G	U=1.576dB
6	Conducted output power uncertainty below 1G	U=1.28dB
7	humidity uncertainty	U=5.3%
8	Temperature uncertainty	U=0.59℃
9	Radiated disturbance(30MHz-1000MHz)	U=4.8dB
10	Radiated disturbance(1GHz-6GHz)	U=4.9dB
11	Radiated disturbance(1GHz-18GHz)	U=5.0dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	MPtouch Interactive	
Trade Name	IMAGINEEAR	
Model Name	MPti	
Model Difference	N/A	
Product Description	Operating frequency	5180-5240 MHz(5G 802.11a/ac 5190-5230 MHz(802.11ac(HT40)) 5210 MHz (802.11ac(HT80))
	Data Rate	802.11 a/ac(HT20): 6,9,12,18,24,36,48,54Mbps; 802.11ac(HT40):MCS0-MCS15; 802.11ac(HT80): NSS1,MCS0-MCS9,NSS2,MCS0-MCS
	Modulation	64QAM, 16QAM, QPSK, BPSK for OFDM
	Number of Channels	See channel list
	Antenna Type	External antenna
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.	
Channel List	Please refer to the Note 2.	
Power supply	DC 3.7V	
Connecting I/O Port(s)	Please refer to the User's Manual	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Frequency and Channel list:

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

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

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

Tx Antenna

Antenna	Antenna Type	Antenna Gain(dBi)
Antenna	PCB antenna	0.5

2.2 DESCRIPTION OF TEST MODES

802.11a/n/(20)

Frequency	Band 1
Low	5180MHz
Middle	5200MHz
High	5240MHz

802.11n(40)

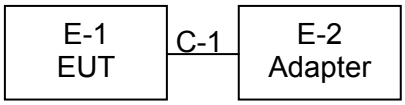
Frequency	Band 1
Low	5190MHz
Middle	-
High	5230MHz

802.11ac(80)

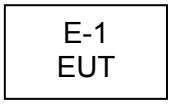
Frequency	Band 1
	5210MHz

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Conducted Emission



Radiated Spurious Emission



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	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	MPtouch Interactive	IMAGINEEAR	MPti	N/A	EUT
E-2	Adapter	N/A	BCTC001	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1.0M	USB cable unshielded

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) 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 equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4407B	MY45109572	2018.06.20	2019.06.20
2	Test Receiver (9kHz-7GHz)	R&S	ESR7	101154	2018.06.20	2019.06.20
3	Bilog Antenna (30MHz-3GHz)	SCHWARZBECK	VULB9163	VULB9163-942	2018.06.23	2019.06.23
4	Horn Antenna (1GHz-18GHz)	SCHWARZBECK	BBHA9120D	1541	2018.06.23	2021.06.22
5	Horn Antenna (18GHz-40GHz)	SCHWARZBECK	BBHA9170	822	2018.08.06	2019.08.06
6	Amplifier (9KHz-6GHz)	SCHWARZBECK	BBV9744	9744-0037	2018.06.20	2019.06.20
7	Amplifier (0.5GHz-18GHz)	SCHWARZBECK	BBV9718	9718-309	2018.06.20	2019.06.20
8	Amplifier (18GHz-40GHz)	MITEQ	TTA1840-35-HG	2034381	2018.08.06	2019.08.06
9	Loop Antenna (9KHz-30MHz)	SCHWARZBECK	FMZB1519B	014	2018.06.23	2019.06.23
10	RF cables1 (9kHz-30MHz)	Huber+Suhnar	9kHz-30MHz	B1702988-0008	2018.02.12	2019.02.12
11	RF cables2 (30MHz-1GHz)	Huber+Suhnar	30MHz-1GHz	1486150	2018.03.27	2019.03.27
12	RF cables3 (1GHz-40GHz)	Huber+Suhnar	1GHz-40GHz	1607106	2018.06.19	2019.06.19
13	Power Metter	Keysight	E4419	\	2018.04.15	2019.04.15
14	Power Sensor (AV)	Keysight	E9 300A	\	2018.04.15	2019.04.15
15	Signal Analyzer 20kHz-26.5GHz	KEYSIGHT	N9020A	MY49100060	2018.08.14	2019.08.13
16	Test Receiver 9kHz-40GHz	R&S	FSP40	100550	2018.06.13	2019.06.12
17	D.C. Power Supply	LongWei	TPR-6405D	\	\	\
18	Software	Frad	EZ-EMC	FA-03A2 RE	\	\

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Test Receiver	R&S	ESR3	102075	2018.06.20	2019.06.20
2	LISN	SCHWARZBECK	NSLK8127	8127739	2018.06.19	2019.06.19
3	LISN	R&S	ENV216	101375	2018.06.20	2019.06.20
4	RF cables	Huber+Suhnar	9kHz-30MHz	B1702988-0008	2018.02.12	2019.02.12
5	Software	Frad	EZ-EMC	EMC-CON 3A1	\	\

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

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

FREQUENCY (MHz)	Class B (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC/ RSS-247
0.50 -5.0	56.00	46.00	FCC/ RSS-247
5.0 -30.0	60.00	50.00	FCC/ RSS-247

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.

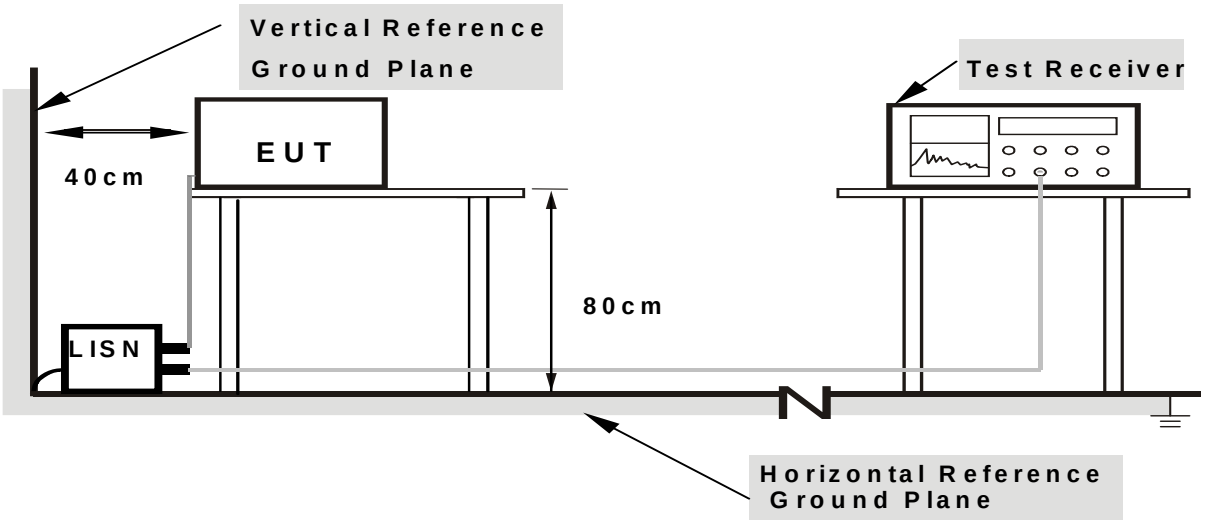
d. LISN at least 80 cm from nearest part of EUT chassis.

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 all adapter's emission, only the adapter 1's data was worst and the data was recording in the report.

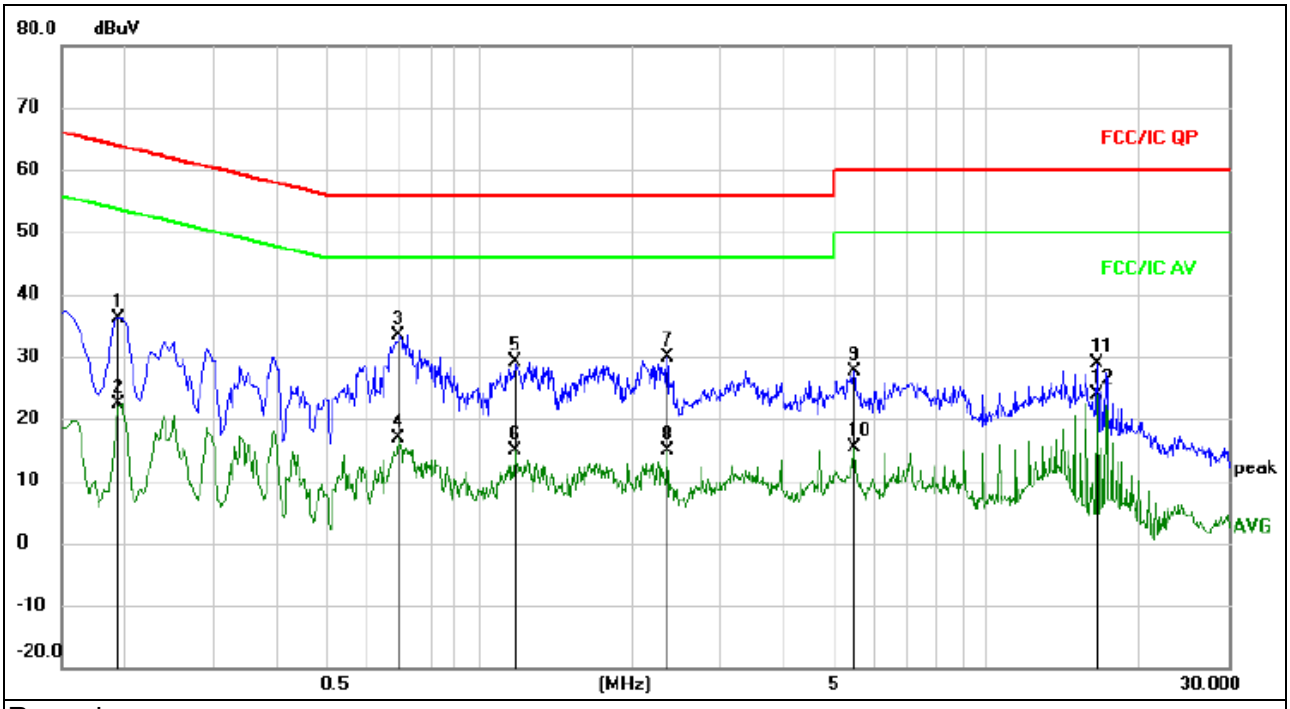
The data only show the worst mode.

If peak level comply with Quasi-Peak limit, then the Quasi-Peak level is deemed to comply with Quasi-Peak limit.

We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.

3.1.1 TEST RESULTS

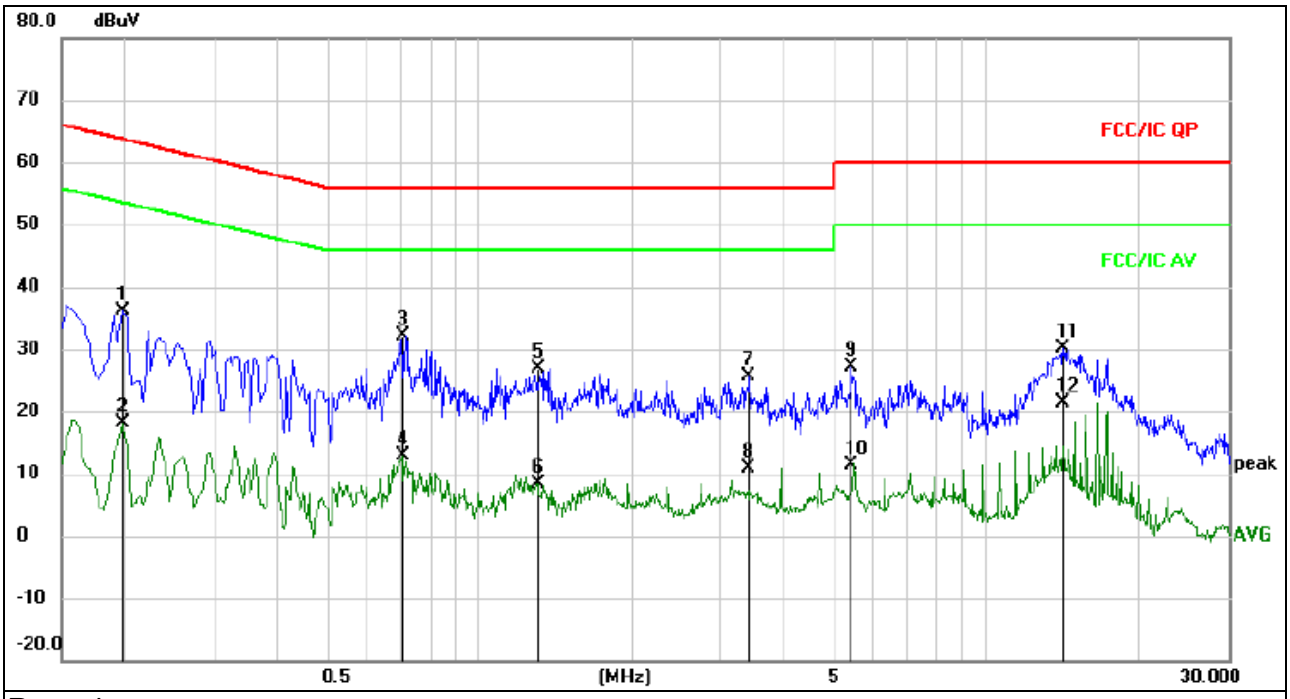
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	L
Test Voltage :	DC 5V from adapter	Test Mode:	Link Mode



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.1940	26.77	9.47	36.24	63.86	-27.62	QP	
2		0.1940	12.95	9.47	22.42	53.86	-31.44	AVG	
3	*	0.6900	23.81	9.68	33.49	56.00	-22.51	QP	
4		0.6900	7.21	9.68	16.89	46.00	-29.11	AVG	
5		1.1820	19.62	9.57	29.19	56.00	-26.81	QP	
6		1.1820	5.39	9.57	14.96	46.00	-31.04	AVG	
7		2.3500	20.24	9.61	29.85	56.00	-26.15	QP	
8		2.3500	5.32	9.61	14.93	46.00	-31.07	AVG	
9		5.4979	17.82	9.78	27.60	60.00	-32.40	QP	
10		5.4979	5.62	9.78	15.40	50.00	-34.60	AVG	
11		16.5059	19.25	9.73	28.98	60.00	-31.02	QP	
12		16.5059	14.04	9.73	23.77	50.00	-26.23	AVG	

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	N
Test Voltage :	DC 5V from adapter	Test Mode:	Link Mode



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.1980	26.59	9.46	36.05	63.69	-27.64	QP	
2		0.1980	8.62	9.46	18.08	53.69	-35.61	AVG	
3	*	0.7060	22.55	9.65	32.20	56.00	-23.80	QP	
4		0.7060	3.22	9.65	12.87	46.00	-33.13	AVG	
5		1.3060	17.21	9.58	26.79	56.00	-29.21	QP	
6		1.3060	-1.08	9.58	8.50	46.00	-37.50	AVG	
7		3.4060	15.95	9.69	25.64	56.00	-30.36	QP	
8		3.4060	1.15	9.69	10.84	46.00	-35.16	AVG	
9		5.4300	17.39	9.78	27.17	60.00	-32.83	QP	
10		5.4300	1.72	9.78	11.50	50.00	-38.50	AVG	
11		14.1500	20.53	9.70	30.23	60.00	-29.77	QP	
12		14.1500	11.69	9.70	21.39	50.00	-28.61	AVG	

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 APPLICABLE STANDARD

According to FCC Part 15.407(d) and 15.209

3.2.2 CONFORMANCE LIMIT

According to FCC Part 15.407(b)(7): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

20dBc in any 100 kHz bandwidth outside the operating frequency band. 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.

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009~0.490	2400/F(KHz)	20 log (uV/m)	300
0.490~1.705	2400/F(KHz)	20 log (uV/m)	30
1.705~30.0	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Limits of Radiated Emission Measurement(Above 1000MHz)

Frequency(MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

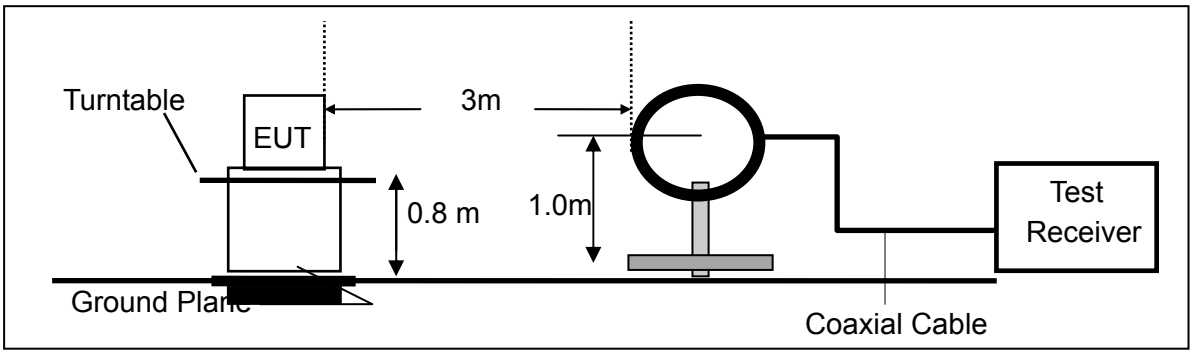
Remark :1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

3.2.3 MEASURING INSTRUMENTS

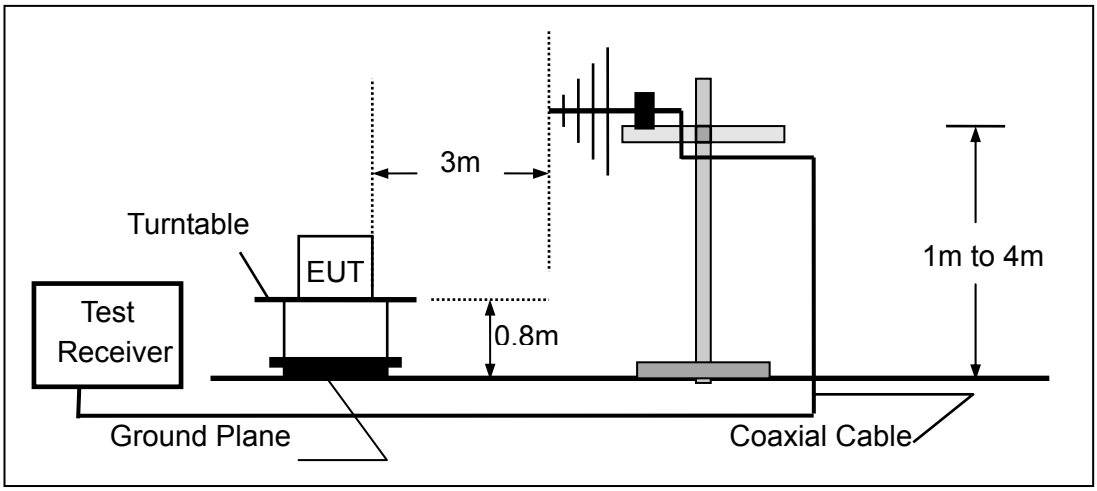
The Measuring equipment is listed in the section 6.3 of this test report.

3.2.4 TEST CONFIGURATION

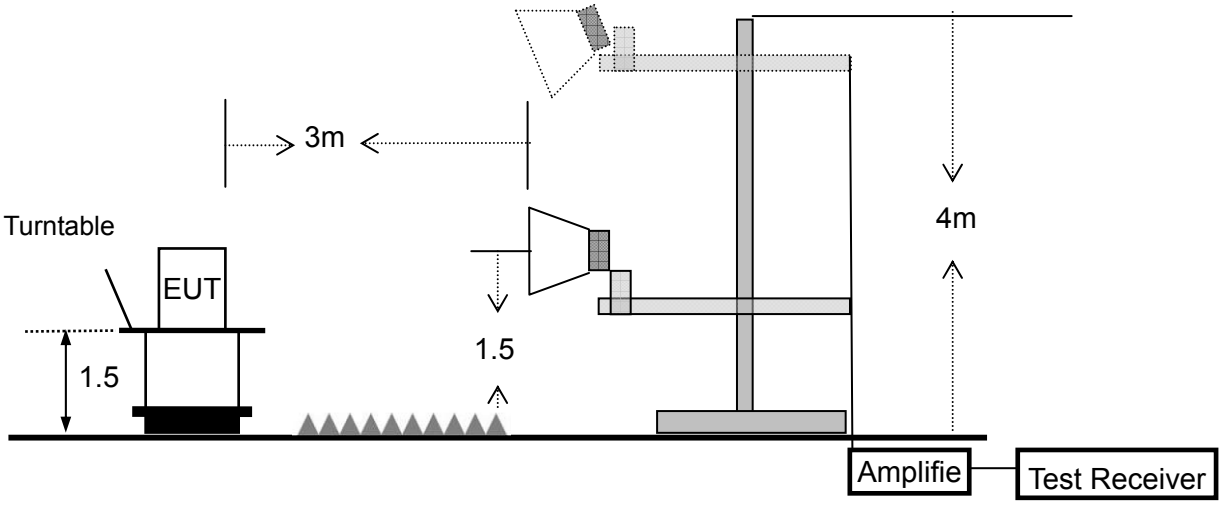
(a) For radiated emissions below 30MHz



(b) For radiated emissions from 30MHz to 1000MHz



(c) For radiated emissions above 1000MHz



3.2.5 TEST PROCEDURE

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.
This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT.
Use the following spectrum analyzer settings:

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
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

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

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

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Note: for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

3.2.6 TEST RESULTS (9KHZ – 30 MHZ)

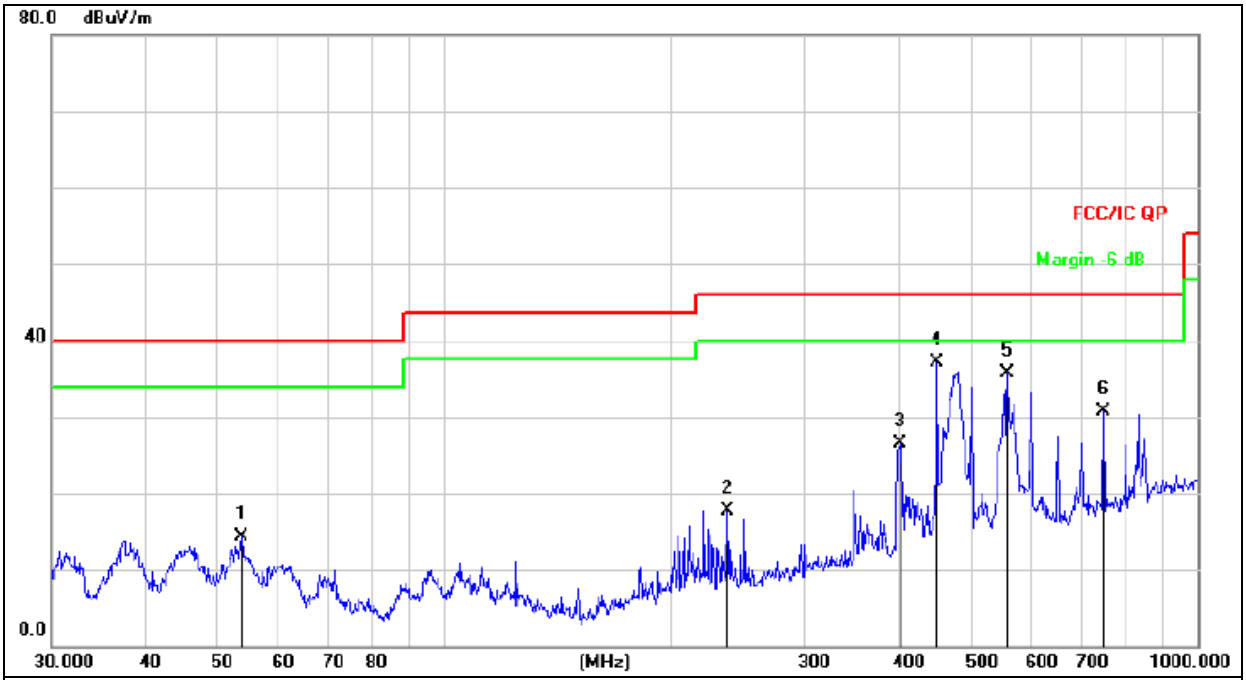
Temperature：	25℃	Relative Humidtity：	54%
Pressure：	101kPa	Test Voltage ：	DC 3.7V from adapter
Test Mode ：	Link Mode	Polarization :	--

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

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 (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

3.2.7 TEST RESULTS (30MHZ – 1GHZ)

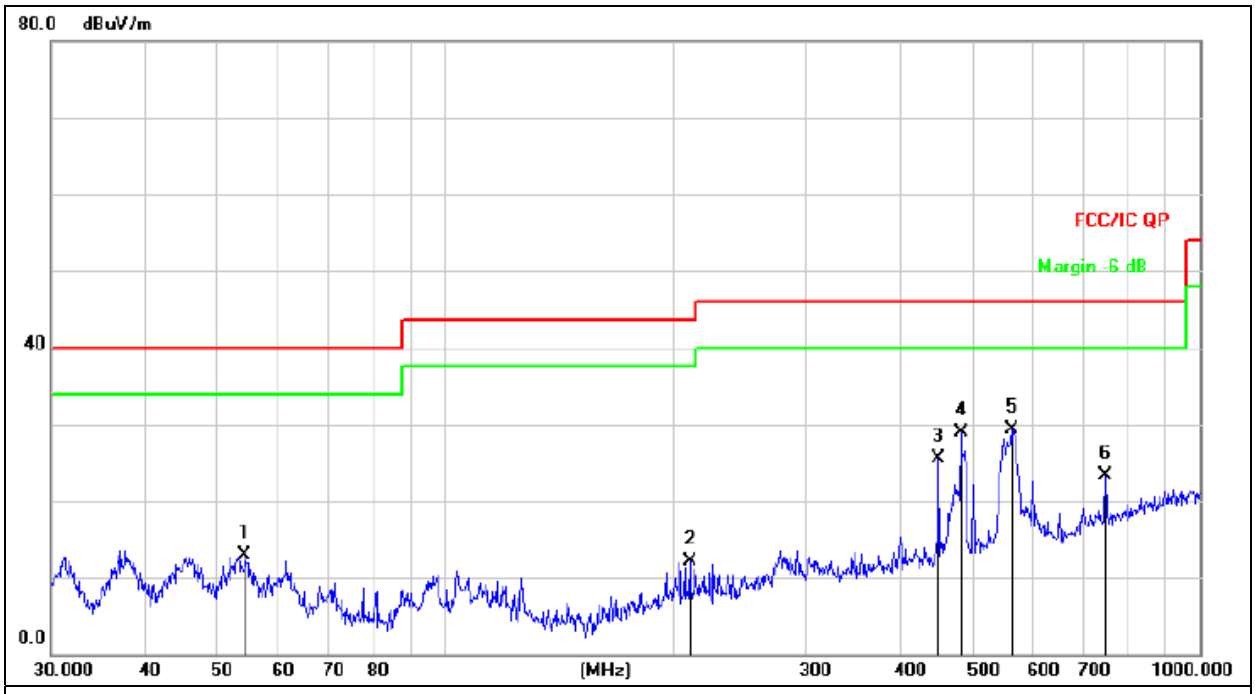
Temperature：	25℃	Relative Humidity：	54%
Pressure：	101 kPa	Polarization：	Horizontal
Test Voltage ：	DC 3.7V		
Test Mode ：	Link Mode		



Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		53.6932	29.50	-15.24	14.26	40.00	-25.74	QP
2		237.4760	33.24	-15.44	17.80	46.00	-28.20	QP
3		401.8385	37.65	-11.05	26.60	46.00	-19.40	QP
4	*	451.1350	47.11	-9.95	37.16	46.00	-8.84	QP
5		558.7302	43.28	-7.48	35.80	46.00	-10.20	QP
6		750.1083	35.06	-4.34	30.72	46.00	-15.28	QP

Temperature：	25℃	Relative Humidity：	54%
Pressure：	101kPa	Polarization：	Vertical
Test Voltage ：	DC 3.7V		
Test Mode ：	Link Mode		



Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		54.2610	28.13	-15.30	12.83	40.00	-27.17	QP
2		210.7860	28.16	-16.05	12.11	43.50	-31.39	QP
3		451.1350	35.50	-9.95	25.55	46.00	-20.45	QP
4		482.2156	38.17	-9.31	28.86	46.00	-17.14	QP
5	*	562.6624	36.74	-7.39	29.35	46.00	-16.65	QP
6		750.1083	27.62	-4.34	23.28	46.00	-22.72	QP

3.2.8 TEST RESULTS (ABOVE 1GHZ)

For the frequency band 5150-5250GHz
Harmonics and Spurious Emissions

Polar	Frequency	Meter Reading	Cable loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Detector Type
(H/V)	(MHz)	(dBuV)	(dB)	dB/m	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Low channel （ 5180 MHz）									
Vertical	10360	58.64	8.47	37.88	44.51	60.48	74.00	-13.52	Pk
Vertical	10360	40.27	8.47	37.88	44.51	42.11	54.00	-11.89	AV
Vertical	15540	49.63	10.12	38.8	44.10	54.45	74.00	-19.55	Pk
Vertical	15540	34.68	10.12	38.8	42.70	40.9	54.00	-13.1	AV
Horizontal	1036	56.24	8.47	38.64	44.50	58.85	74.00	-15.15	Pk
Horizontal	1036	39.17	8.47	38.64	44.50	41.78	54.00	-12.22	AV
Horizontal	15540	50.43	10.12	38.38	44.10	54.83	74.00	-19.17	Pk
Horizontal	15540	37.46	10.12	38.38	44.10	41.86	54.00	-12.14	AV
High channel （ 5240 MHz）									
Vertical	10480	58.02	8.47	37.88	44.51	59.86	74.00	-14.14	Pk
Vertical	10480	41.15	8.47	37.88	44.51	42.99	54.00	-11.01	AV
Vertical	15720	50.38	10.12	38.8	44.10	55.2	74.00	-18.8	Pk
Vertical	15720	35.07	10.12	38.8	42.70	41.29	54.00	-12.71	AV
Horizontal	10480	56.36	8.47	38.64	44.50	58.97	74.00	-15.03	Pk
Horizontal	10480	40.49	8.47	38.64	44.50	43.1	54.00	-10.9	AV
Horizontal	15720	56.66	10.12	38.38	44.10	61.06	74.00	-12.94	Pk
Horizontal	15720	38.27	10.12	38.38	44.10	42.67	54.00	-11.33	AV

Note:

1. This EUT was tested in 802.11a/ac(HT20)/ac(HT40)/ac(HT80) mode and 802.11a the worst case position data was reported

2.PK value is lower than the Average value limit, So average didn't record.

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value

has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4. POWER SPECTRAL DENSITY TEST

4.1 APPLIED PROCEDURES / LIMIT

1. For mobile and portable client devices in the 5.15-5.25 GHz band, , the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
2. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
3. For the band 5.725-5.850 GHz, the peak power spectral density shall not exceed 30 dBm in any 500KHz band. If transmitting antenna directional gain is greater than 6 dBi, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2 TEST SETUP

1.The setting follows Method SA-1 of FCC KDB D02 General UNII Test Procedures New Rules v01r03.

For devices operating in the band, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

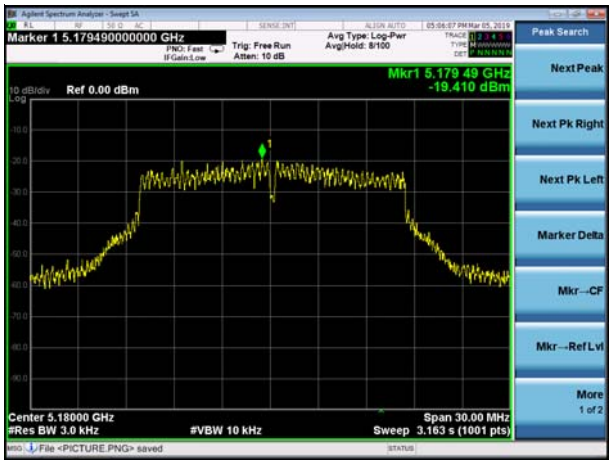
Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

4.3 TEST RESULTS

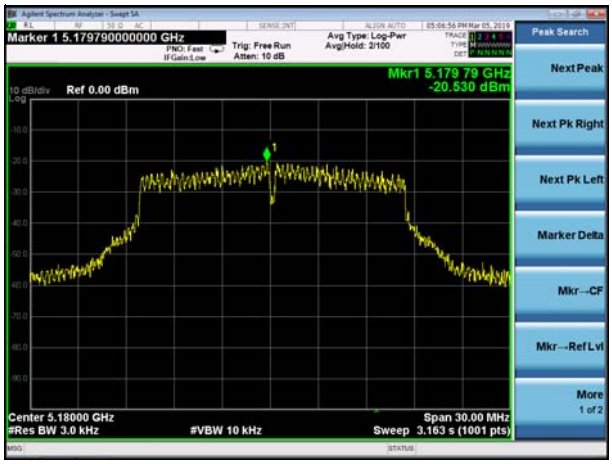
Test data as below

Mode	Frequency MHz	Measured Power Density (dBm)	Limit (dBm)	Result
802.11 a	5180	-19.410	11	PASS
	5200	-19.535	11	PASS
	5240	-20.533	11	PASS
802.11 ac(HT20)	5180	-20.530	11	PASS
	5200	-20.890	11	PASS
	5240	-19.707	11	PASS
802.11 ac(HT40)	5190	-23.862	11	PASS
	5230	-22.935	11	PASS
802.11 ac(HT80)	5210	-26.186	11	PASS

(802.11a) PSD plot on channel 36

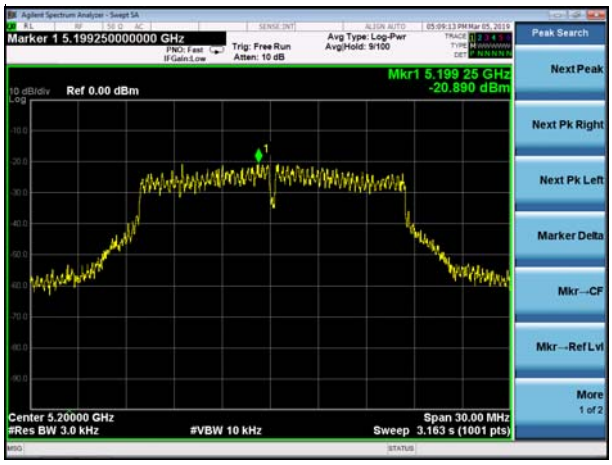


(802.11ac20) PSD plot on channel 36

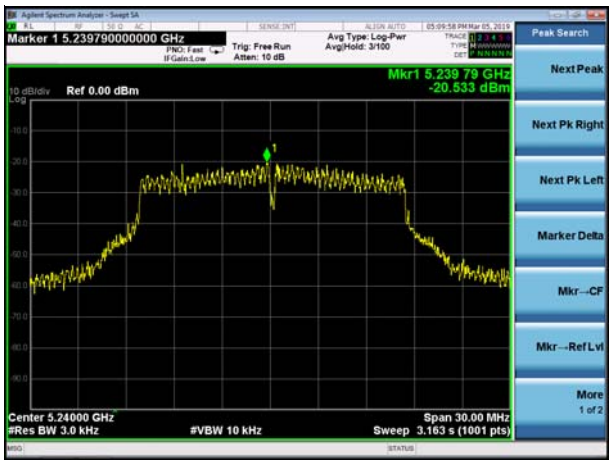


(802.11a) PSD plot on channel 40

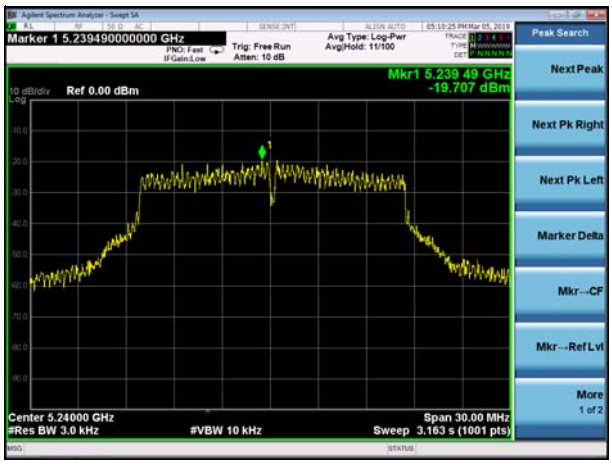
(802.11ac20) PSD plot on channel 40



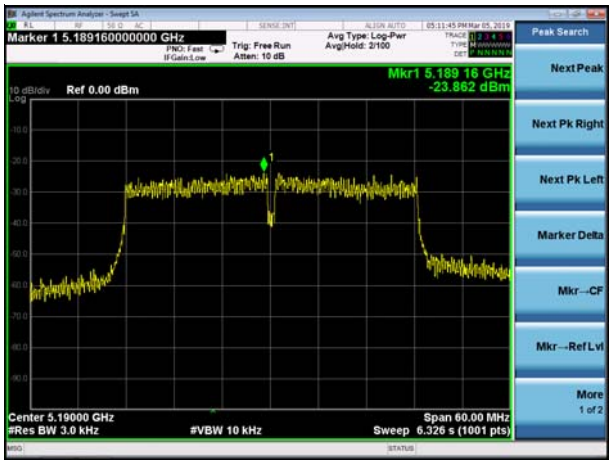
(802.11a) PSD plot on channel 48



(802.11ac20) PSD plot on channel 48

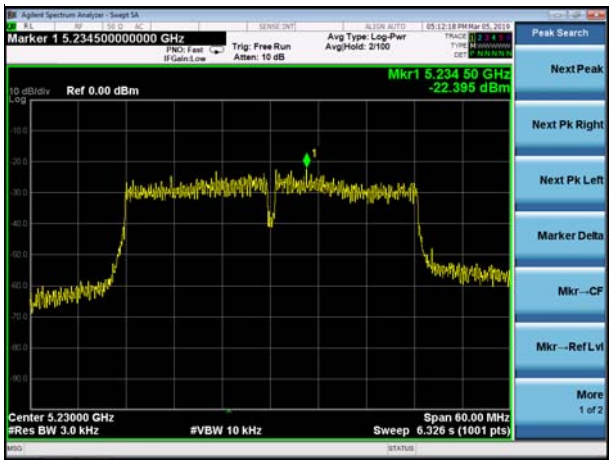


(802.11ac40) PSD plot on channel 38



(802.11ac80) PSD plot on channel 42

(802.11ac40) PSD plot on channel 46



5. 26DB & 99% EMISSION BANDWIDTH

Section	Test Item	Limit	Result
15.407(a)(5)	Bandwidth	N/A	PASS

5.1 TEST PROCEDURE

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > =RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%

5.2 TEST RESULTS

Mode	Frequency MHz	26dB bandwidth(MHz)	99% bandwidth(MHz)	Result
802.11 a	5180	20.81	16.459	PASS
	5200	20.74	16.464	PASS
	5240	20.85	16.468	PASS
802.11 ac(HT20)	5180	20.75	16.464	PASS
	5200	20.87	16.468	PASS
	5240	20.80	16.478	PASS
802.11 ac(HT40)	5190	39.02	36.096	PASS
	5230	39.36	36.080	PASS
802.11 ac(HT80)	5210	78.15	75.162	PASS

(802.11a) -26dB&99% Bandwidth plot on channel 36

(802.11ac20) -26dB&99% Bandwidth plot on channel 36

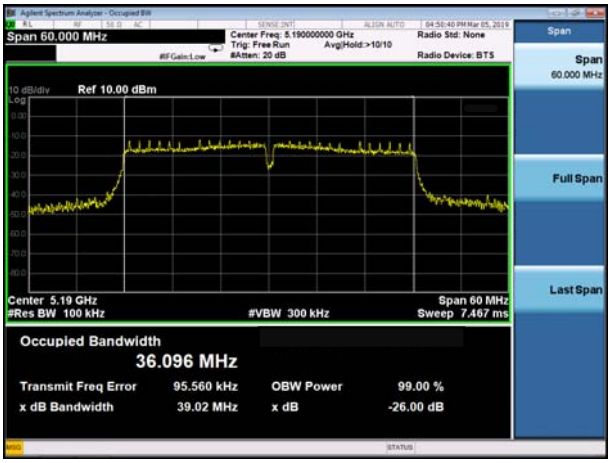
(802.11a) -26dB&99% Bandwidth plot on channel 40

(802.11ac20) -26dB&99% Bandwidth plot on channel 40

(802.11a) -26dB&99% Bandwidth plot on channel 48

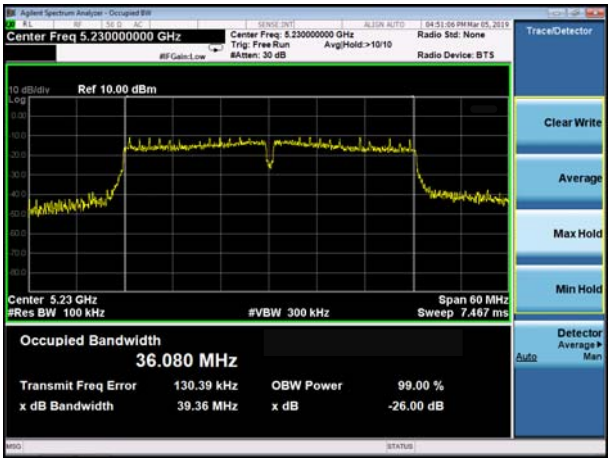
(802.11ac20) -26dB&99% Bandwidth plot on channel 48

(802.11ac40) -26dB&99% Bandwidth plot on channel 38



(802.11ac80) -26dB&99% Bandwidth plot on channel 42

(802.11ac40) -26dB&99% Bandwidth plot on channel 46



6. MAXIMUM CONDUCTED OUTPUT POWER

6.1 PPLIED 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz,If transmitting antennas of directional gain greater than 6 dBi are used.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used.

<table>
<tr><th colspan="5">FCC Part15 (15.407) , Subpart E</th></tr>
<tr><td>Section</td><td>Test Item</td><td>LIMIT</td><td>Frequency Range MHz</td><td>Result</td></tr>
<tr><td rowspan="2">15.407(a) (1) (iv)</td><td rowspan="3">Peak Output Power</td><td>0.25 watt</td><td>5150-5250</td><td rowspan="3">PASS</td></tr>
<tr><td>The lesser of 250 mW or 11 dBm + 10 log (26 dB emission bandwidth)</td><td>5250-5350
5470-5725</td></tr>
<tr><td>15.407(a) (3)</td><td>1 watt</td><td>5725-5825</td></tr>
</table>

6.2 TEST PROCEDURE

a. The EUT was directly connected to the Power meter

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 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 3.7V

Mode	Frequency MHz	Total Power Conducted Output Power(PK)	LIMIT	Result
		dBm	dBm	
802.11 a	5180	7.40	23.98	PASS
	5200	7.87	23.98	PASS
	5240	7.05	23.98	PASS
802.11 ac(HT20)	5180	7.49	23.98	PASS
	5200	7.86	23.98	PASS
	5240	7.06	23.98	PASS
802.11 ac(HT40)	5190	6.59	23.98	PASS
	5230	6.21	23.98	PASS
802.11 ac(HT80)	5210	4.07	23.98	PASS

7. OUT OF BAND EMISSIONS

7.1 APPLICABLE STANDARD

According to FCC §15.407(b)

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

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

(2) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

7.2 TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

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.

7.6 TEST RESULTS

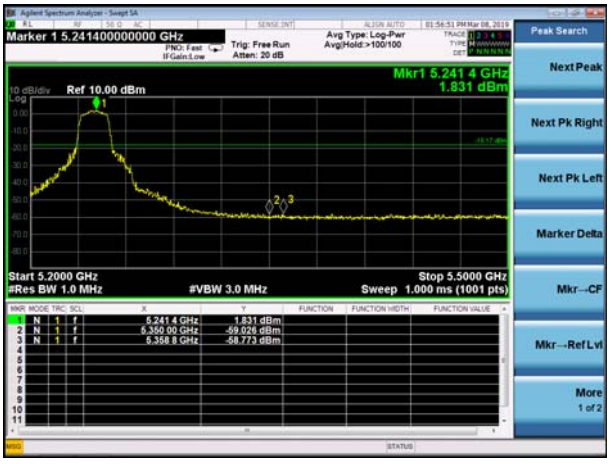
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 3.7V

5.15~5.25 GHz

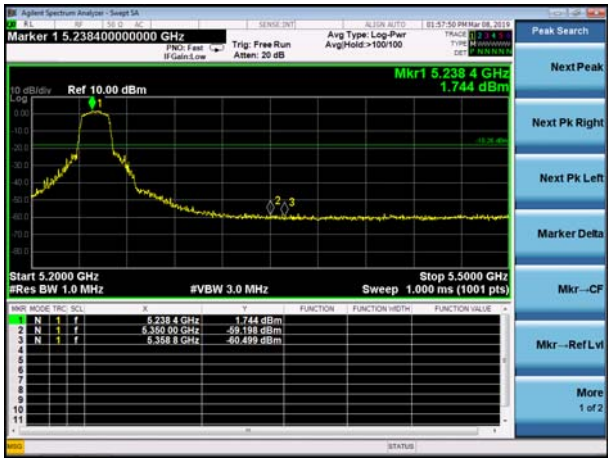
(802.11a) Band Edge, Left Side

(802.11ac20) Band Edge, Left Side

(802.11a) Band Edge, Right Side

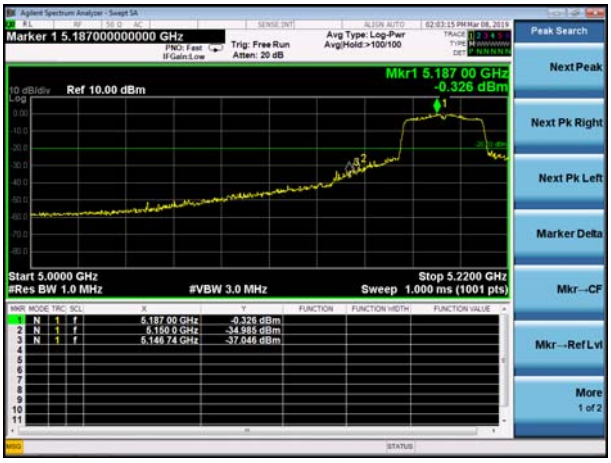


(802.11ac20) Band Edge, Right Side



5.15~5.25 GHz

(802.11ac40) Band Edge, Left Side



(802.11ac80) Band Edge, Left, Right Side

(802.11ac40) Band Edge, Right Side

+

Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-34.985	-27
Highest	Above 5350	-53.161	-27

9. SPURIOUS RF CONDUCTED EMISSIONS

9.1 CONFORMANCE LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

9.2 MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

9.3 TEST SETUP

Please refer to Section 6.1 of this test report.

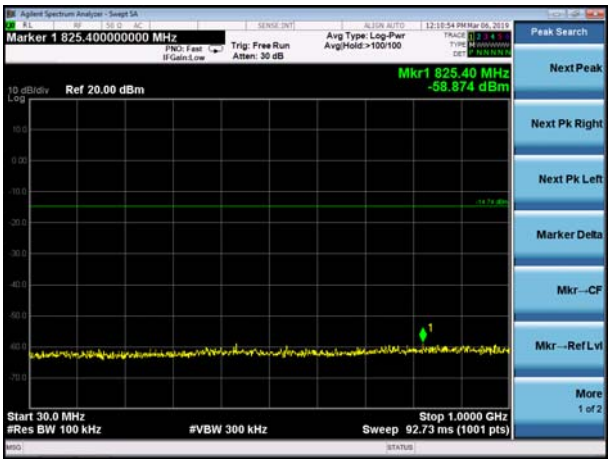
9.4 TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300KHz to measure the peak field strength , and mwasure frequeny range from 9KHz to 26.5GHz.

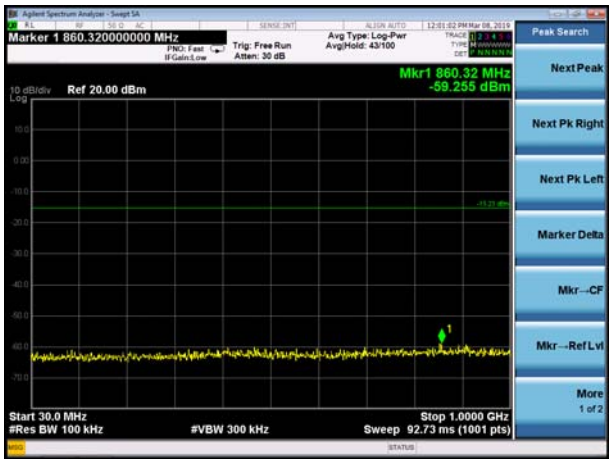
9.5 TEST RESULTS

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

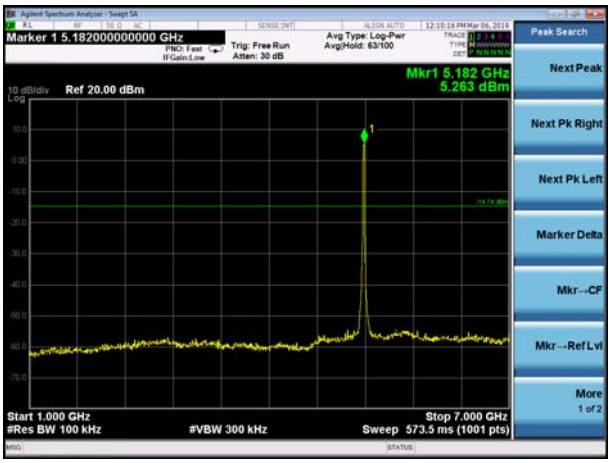
(802.11a) 30mHz-1GHz
channel 36



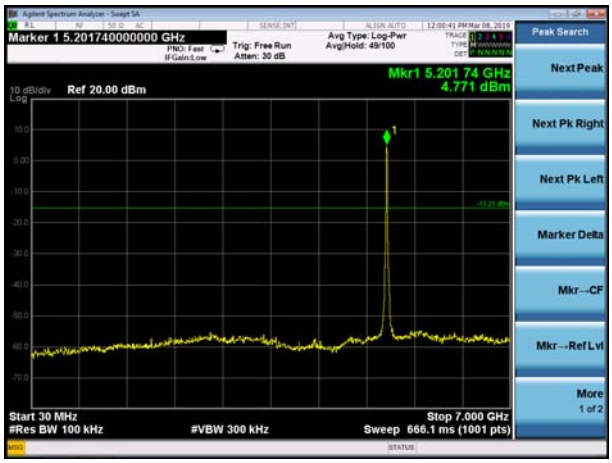
(802.11a) 30MHz-1GHz
channel 40



(802.11a) 1-7GHz
channel 36



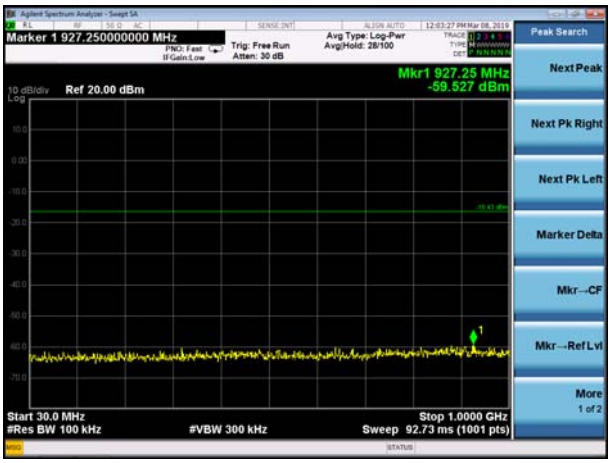
(802.11ac) 1-7GHz
channel 40



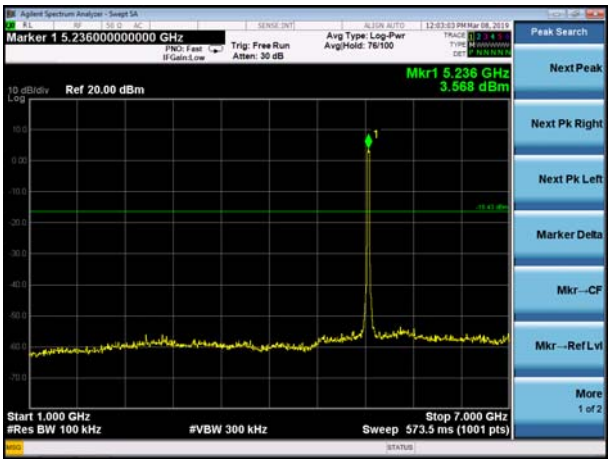
(802.11a) 7-26.5GHz
channel 36

(802.11a) 7-26.5GHz
channel 40

(802.11a) 30MHz-1GHz
channel 48



(802.11a) 1-7GHz
channel 48



(802.11a) 7-26.5GHz
channel 48

Note: This EUT was tested in 802.11a/ac(HT20)/ac(HT40)/ac(HT80) mode and 802.11a the worst case position data was reported

10. Frequency Stability Measurement

10.1 LIMIT

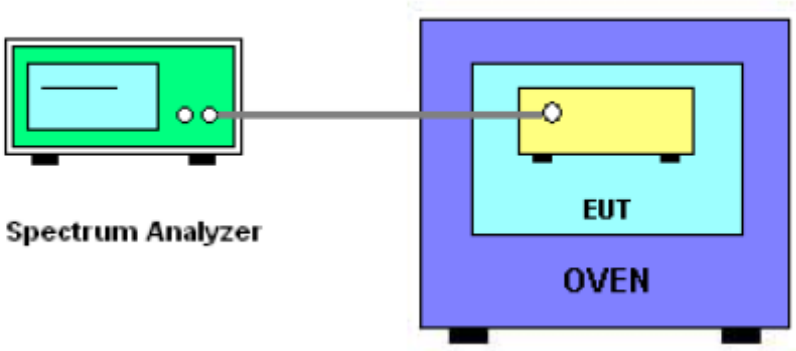
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

10.2 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 10^6 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -20°C~70°C.

10.3 TEST SETUP LAYOUT



10.4 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously un-modulation transmitting mode.

10.5 TEST RESULTS

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 3.7V
Test mode	802.11a		

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.70	5180.0218	5180	0.0218	4.2085
		V max (V)	4.26	5180.0171	5180	0.0171	3.3012
		V min (V)	3.15	5180.0304	5180	0.0304	5.8687
Limits				± 20 ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.7	T (°C)	-20	5180.0253	5180	0.0253	4.8842
		T (°C)	-10	5180.0175	5180	0.0175	3.3784
		T (°C)	0	5180.0218	5180	0.0218	4.2085
		T (°C)	10	5180.0242	5180	0.0242	4.6718
		T (°C)	20	5180.0218	5180	0.0218	4.2085
		T (°C)	30	5180.0167	5180	0.0167	3.2239
		T (°C)	40	5180.0407	5180	0.0407	7.8571
		T (°C)	50	5180.0391	5180	0.0391	7.5483
		T (°C)	60	5180.0403	5180	0.0403	7.7799
		T (°C)	70	5180.0415	5180	0.0415	8.0116
Limits				± 20 ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.70	5200.0202	5200	0.0202	3.8846
		V max (V)	4.26	5200.0118	5200	0.0118	2.2692
		V min (V)	3.15	5200.0253	5200	0.0253	4.8654
Limits				± 20 ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.7	T (°C)	-20	5200.0321	5200	0.0321	6.1731
		T (°C)	-10	5200.0146	5200	0.0146	2.8077
		T (°C)	0	5200.0264	5200	0.0264	5.0769
		T (°C)	10	5200.0172	5200	0.0172	3.3077
		T (°C)	20	5200.0202	5200	0.0202	3.8846
		T (°C)	30	5200.0183	5200	0.0183	3.5192
		T (°C)	40	5200.0347	5200	0.0347	6.6731
		T (°C)	50	5200.0421	5200	0.0421	8.0962
		T (°C)	60	5200.0381	5200	0.0381	7.3269
		T (°C)	70	5200.0434	5200	0.0434	8.3462
Limits				± 20 ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.70	5240.0215	5240	0.0215	4.1031
		V max (V)	4.26	5240.0341	5240	0.0341	6.5076
		V min (V)	3.15	5240.0290	5240	0.0290	5.5344
Limits				± 20 ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.7	T (°C)	-20	5240.0357	5240	0.0357	6.8130
		T (°C)	-10	5240.0403	5240	0.0403	7.6908
		T (°C)	0	5240.0319	5240	0.0319	6.0878
		T (°C)	10	5240.0284	5240	0.0284	5.4198
		T (°C)	20	5240.0215	5240	0.0215	4.1031
		T (°C)	30	5240.0269	5240	0.0269	5.1336
		T (°C)	40	5240.0335	5240	0.0335	6.3931
		T (°C)	50	5240.0417	5240	0.0417	7.9580
		T (°C)	60	5240.0372	5240	0.0372	7.0992
		T (°C)	70	5240.0434	5240	0.0434	8.2824
Limits				± 20 ppm			
Result				Complies			

Note: This EUT was tested in 802.11a/ac(HT20)/ac(HT40)/ac(HT80) mode and 802.11a the worst case position data was reported

11. ANTENNA REQUIREMENT

11.1 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.

11.2 EUT ANTENNA

The EUT antenna is PCB antenna. It comply with the standard requirement.

12. EUT TEST PHOTO

Conducted Emission

Radiated Measurement Photos


倍测检测
BCTC TEST

13. EUT PHOTO

※※※※※ **END OF REPORT** ※※※※※