RADIO TEST REPORT

Report No.:STS2112348W07

Issued for

Orbit Irrigation Products Inc

845 Overland Road, North Salt Lake, Utah 84054 USA

Product Name:	High Station Count Controller
Brand Name:	b-hyve / HYDRO RAIN
Model Name:	HSC-1600-M
Series Model:	HSC-6300-D
FCC ID:	ML6HSC
IC:	3330A-HSC
Test Standard:	FCC Part 15.407 RSS-247 Issue 2, February 2017 RSS-Gen Issue 5, Amendment 2, February 2021

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Shenzhen STS Test Services Co., Ltd.
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TEST RESULT CERTIFICATION

Applicant's Name	:	Orbit Irrigation Products Inc
Address	:	845 Overland Road, North Salt Lake, Utah 84054 USA
Manufacturer's Name	:	Pro-Mark, LLC
Address	:	845 Overland Road, North Salt Lake, Utah 84054 USA

Product Description

Product Name	:	High Station Count Controller
Brand Name	:	b-hyve / HYDRO RAIN
Model Name	:	HSC-1600-M
Series Model	:	HSC-6300-D
Test Standards	:	FCC Part15.407 RSS-247 Issue 2, February 2017 RSS-Gen Issue 5, Amendment 2, February 2021
Test Procedure		ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC/IC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test	:	
Date of receipt of test item	:	14 Jan. 2022
Date (s) of performance of tests	:	14 Jan. 2022 ~ 24 Feb. 2022
Date of Issue	:	24 Feb. 2022
Test Result	:	**Pass**

Testing Engineer : Chris Chen

(Chris Chen)

Technical Manager : Sean She

(Sean she)

Authorized Signatory : Vita Li

(Vita Li)

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	24 Feb. 2022	STS2112348W07	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

§ 15.407,KDB 789033 D02 General U-NII Test Procedures New Rules v02r01.

FCC Part 15.407 RSS-247 Issue 2		
FCC standard	Test Item	Results
15.207 RSS-Gen Issue 5	AC Conducted Emission	PASS
15.407 (a) /15.407 (e) RSS-Gen Issue 5 RSS-247 Issue 2	26dB/6dB &99% Bandwidth	PASS
15.407(a) RSS-247 Issue 2	Maximum Conducted Output Power	PASS
15.407(b)/15.205/15.209 RSS-247 Issue 2	Radiated Emission And (bandedge Emissions) Measurement	PASS
15.407(a) RSS-247 Issue 2	Power Spectral Density	PASS
15.407(c) RSS-Gen Issue 5	Automatically Discontinue Transmission	PASS
15.203/15.204 RSS-Gen Issue 5	Antenna Requirement	PASS
RSS-Gen Issue 5	Frequency Stability	PASS

NOTE:

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

(2) All tests are according to ANSI C63.10-2013.

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
FCC test Firm Registration Number: 625569
IC test Firm Registration Number: 12108A
A2LA Certificate No.: 4338.01

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	RF output power, conducted	±0.87dB
2	Unwanted Emissions, conducted	±2.895dB
3	All emissions, radiated 9K-30MHz	±3.80dB
4	All emissions, radiated 30M-1GHz	±4.09dB
5	All emissions, radiated 1G-6GHz	±4.92dB
6	All emissions, radiated>6G	±5.49dB
7	Conducted Emission (9KHz-30MHz)	±2.73dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

<table>
<tr><td>Product Name</td><td>High Station Count Controller</td></tr>
<tr><td>Trade Name</td><td>b-hyve / HYDRO RAIN</td></tr>
<tr><td>Model Name</td><td>HSC-1600-M</td></tr>
<tr><td>Series Model</td><td>HSC-6300-D</td></tr>
<tr><td>Model Difference</td><td>
<table>
<tr><td>Model Names</td><td>Series Model</td><td></td></tr>
<tr><td>HSC-1600-M</td><td>04550</td><td>16-Station Modular Based Controller</td></tr>
<tr><td>HSC-6300-D</td><td>04554</td><td>Two Wire Controller</td></tr>
</table>
Both HSC-1600-M and HSC-6300-D are High Station Count Controllers that share the same main board hardware. Only the irrigation station system used is different.

The HSC-1600-M “Multi Wire” systems utilize a dedicated wire to each valve and shared common return wires. By default there is 2 of the 8 station modules, with option to expand with a total of up to 6 of the 8 station modules attached that provides for control of 48 total zones. We allow up to 4 of these zones to be active at a time.

The HSC-6300-D “Two Wire” systems utilize a digital addressing to separately control up to 63 unique decoders on a set of two wires. We allow up to 4 of these zones to be active at a time.</td></tr>
<tr><td>Product Description</td><td>The EUT is a High Station Count Controller
<table>
<tr><td>Operation Frequency:</td><td>IEEE 802.11a/ n(HT20): 5.180GHz-5.240GHz
IEEE 802.11n(HT40): 5.190GHz-5.230GHz</td></tr>
<tr><td>Modulation Type:</td><td>802.11a(OFDM): BPSK,QPSK,16-QAM,64-QAM
802.11n(OFDM): BPSK,QPSK,16-QAM,64-QAM
802.11ac(OFDM): BPSK,QPSK,16-QAM,64-QAM,256-QAM</td></tr>
<tr><td>Antenna Designation:</td><td>Please refer to the Note 3.</td></tr>
<tr><td>Max.Output Power(Conducted):</td><td>9.72 dBm</td></tr>
</table>
More details of EUT technical specification, please refer to the User's Manual.</td></tr>
<tr><td>Test Channel</td><td>Please refer to the Note 2.</td></tr>
<tr><td>Rating</td><td>Input: 110/208V~ 50/60Hz 0.76A 90VA or 230/240V~ 50/60Hz 0.38A 92VA
Output: 24VAC, 2.5Amps</td></tr>
<tr><td>Hardware version number</td><td>003</td></tr>
</table>

Software version number	V28
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

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

2.

Operation Frequency of channel	
5.180GHz-5.240GHz	
Channel	Frequency
36	5180
38	5190
40	5200
42	5210
44	5220
46	5230
48	5240

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Carrier Frequency Channel

5GHz:

For 802.11a/n(HT20)	
Channel	Freq.(MHz)
36	5180
40	5200
48	5240

For 802.11n(HT40)	
Channel	Freq.(MHz)
38	5190
46	5230

3.

Ant	Brand	Model Name	Ant Type	Connector	Gain (dBi)	NOTE
A	HSC-1600-MB	b-hyve / HYDRO RAIN	PCB	N/A	-0.15dBi	WLAN Ant.

Note: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report.

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.

Worst Mode	Description	Data Rate
Mode 1	TX IEEE 802.11a HT20 CH36&CH40&CH48	6 Mbps
Mode 2	TX IEEE 802.11n HT20 CH36&CH40&CH48	MCS 0
Mode 3	TX IEEE 802.11n HT40 CH38&CH46	MCS 0

Note: (1) The measurements are performed at the highest, middle, lowest available channels.

(2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(3) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation.

(4) The battery is fully-charged during the radited and RF conducted test.

AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 4: Keeping TX + WLAN Link

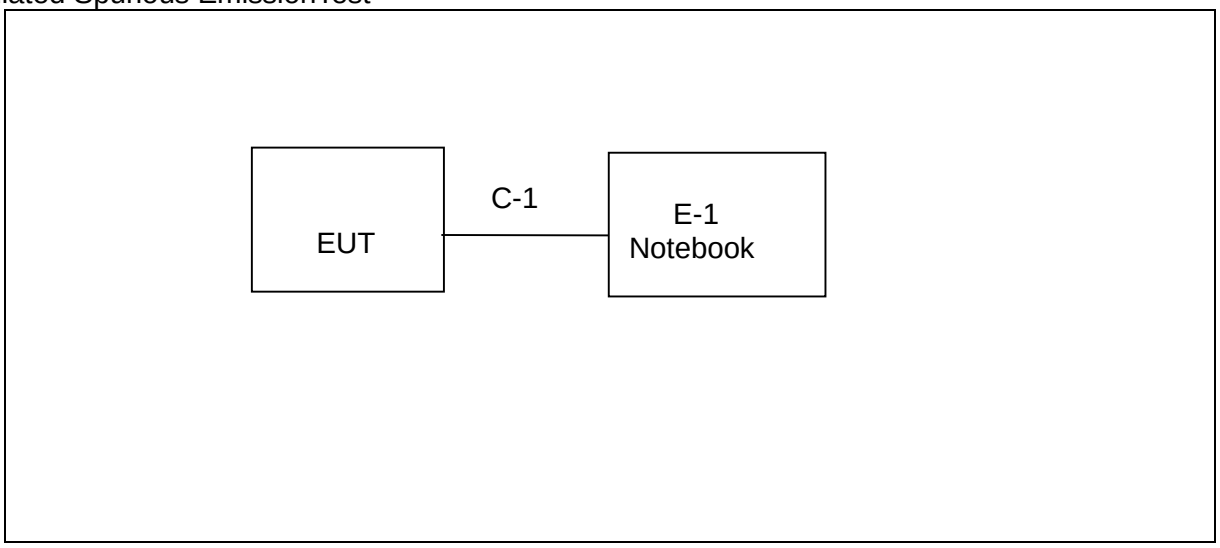
2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

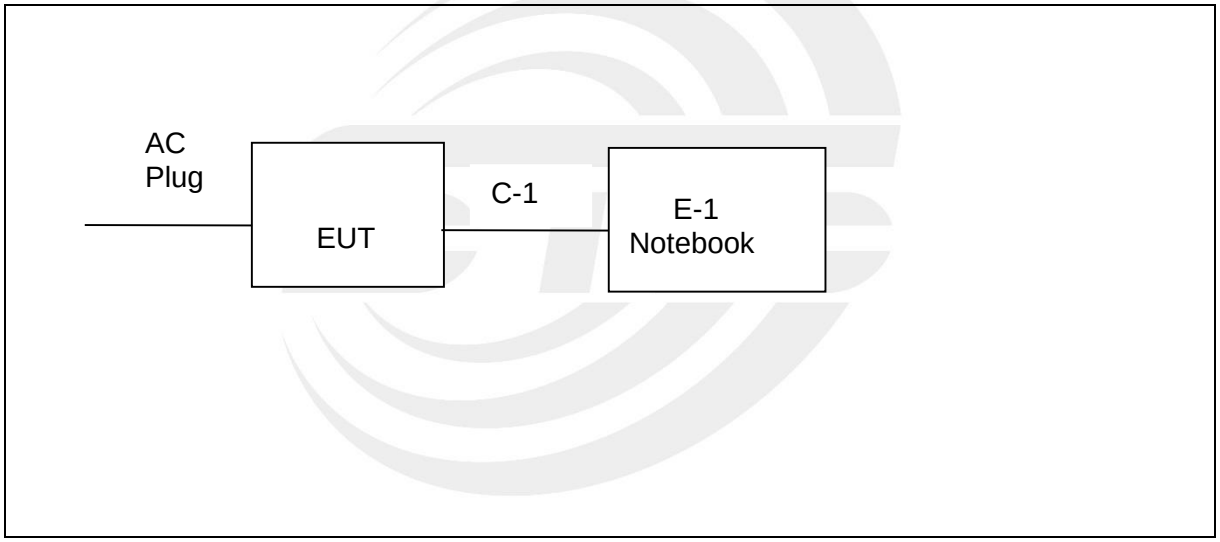
RF Function	Type	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
WIFI(5G)	5G WIFI (5150MHz-5250MHz)	802.11a	-0.15	40	GommGUI
		802.11n(HT20)		40	
		802.11n(HT40)		40	

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious EmissionTest



Conducted Emission Test



2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

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.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-1	Notebook	DELL	Inspiron 3501	N/A	N/A
C-1	USB Cable	N/A	N/A	150cm	NO

Note:

(1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
(2) “YES” is means “with core”; “NO” is means “without core”.

2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2021.09.30	2022.09.29
Signal Analyzer	Agilent	N9020A	MY51110105	2021.09.30	2022.09.29
Active loop Antenna	ZHINAN	ZN30900C	16035	2021.04.11	2023.04.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2021.10.11	2023.10.10
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2021.10.08	2022.10.07
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2021.09.30	2022.09.29
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2021.09.28	2022.09.27
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2021.09.30	2022.09.29
LISN	R&S	ENV216	101242	2021.09.30	2022.09.29
LISN	EMCO	3810/2NM	23625	2021.09.30	2022.09.29
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Power Sensor	Keysight	U2021XA	MY55520005	2021.09.30	2022.09.29
			MY55520006	2021.09.30	2022.09.29
			MY56120038	2021.09.30	2022.09.29
			MY56280002	2021.09.30	2022.09.29
Signal Analyzer	Agilent	N9020A	MY51110105	2021.03.04	2022.03.03
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08

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 *	CISPR
0.50 -5.0	56.00	46.00	CISPR
5.0 -30.0	60.00	50.00	CISPR

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

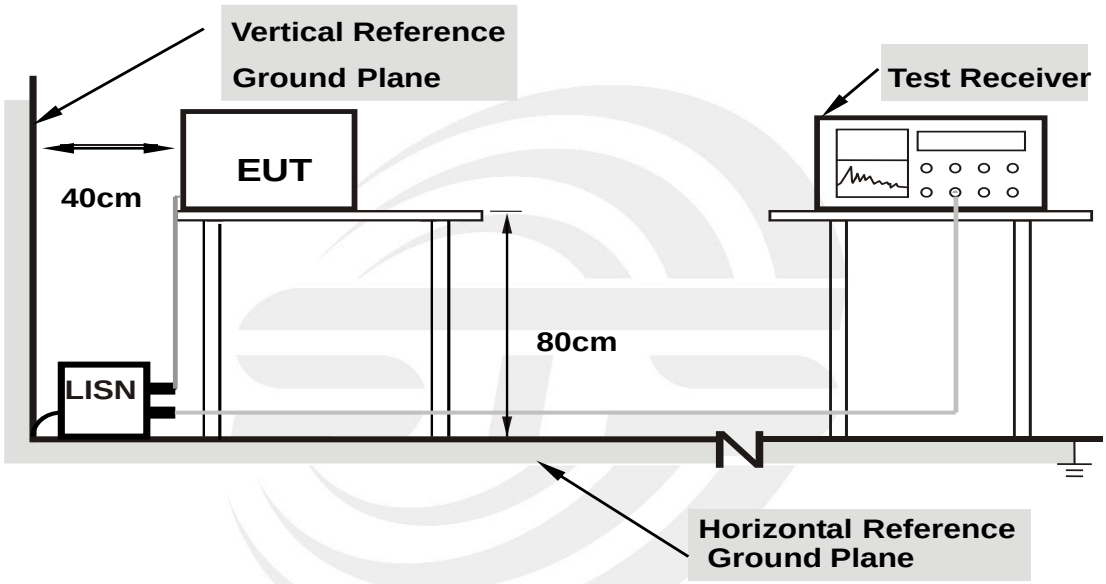
3.1.2 TEST PROCEDURE

a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 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 is at least 80 cm from the 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 cm from other units and other metal planes support units.

3.1.5 EUT OPERATING CONDITIONS

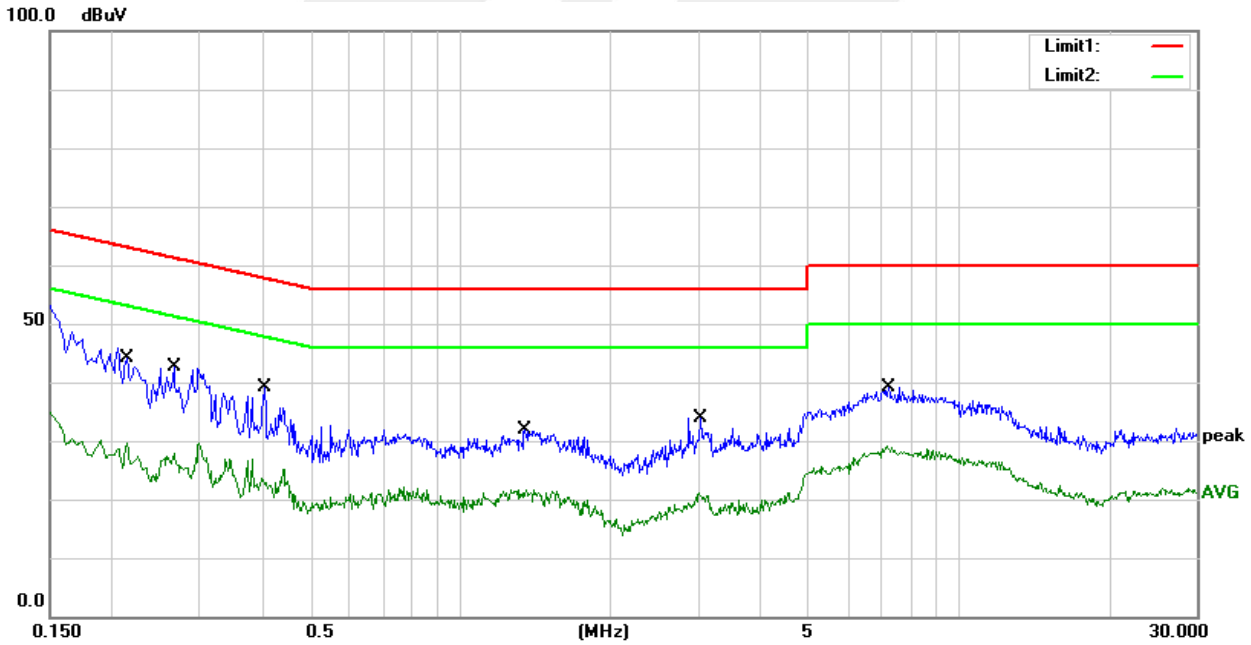
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.6 TEST RESULTS

Temperature:	23.6(C)	Relative Humidity:	22%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode：	Mode 4		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2140	23.59	20.46	44.05	63.05	-19.00	QP
2	0.2140	9.88	20.46	30.34	53.05	-22.71	AVG
3	0.2660	21.93	20.65	42.58	61.24	-18.66	QP
4	0.2660	8.94	20.65	29.59	51.24	-21.65	AVG
5	0.4060	18.53	20.57	39.10	57.73	-18.63	QP
6	0.4060	6.38	20.57	26.95	47.73	-20.78	AVG
7	1.3500	11.58	20.33	31.91	56.00	-24.09	QP
8	1.3500	1.40	20.33	21.73	46.00	-24.27	AVG
9	3.0380	13.37	20.45	33.82	56.00	-22.18	QP
10	3.0380	0.70	20.45	21.15	46.00	-24.85	AVG
11	7.2380	18.63	20.60	39.23	60.00	-20.77	QP
12	7.2380	8.58	20.60	29.18	50.00	-20.82	AVG

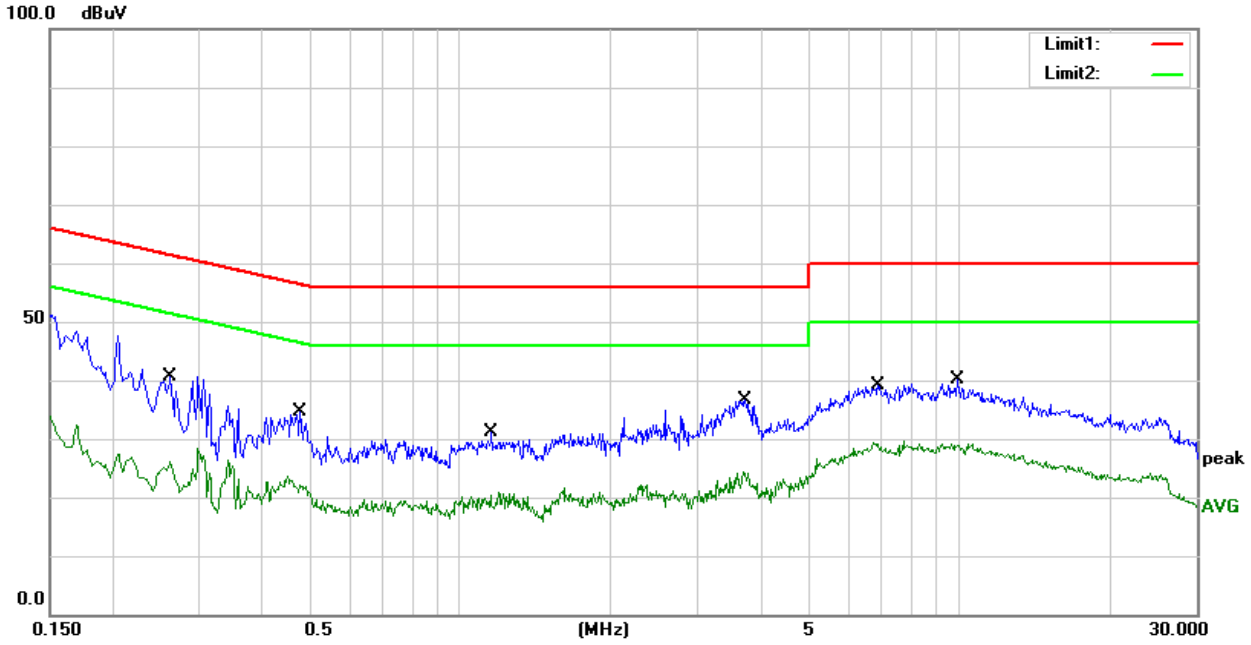
Remark:
1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



Temperature:	23.6(C)	Relative Humidity:	22%RH
Test Voltage	AC 120V/60Hz	Phase:	N
Test Mode	Mode 4		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2620	19.96	20.64	40.60	61.37	-20.77	QP
2	0.2620	7.72	20.64	28.36	51.37	-23.01	AVG
3	0.4780	14.12	20.51	34.63	56.37	-21.74	QP
4	0.4780	3.16	20.51	23.67	46.37	-22.70	AVG
5	1.1580	10.83	20.31	31.14	56.00	-24.86	QP
6	1.1580	0.55	20.31	20.86	46.00	-25.14	AVG
7	3.7220	16.22	20.49	36.71	56.00	-19.29	QP
8	3.7220	3.11	20.49	23.60	46.00	-22.40	AVG
9	6.8820	18.55	20.57	39.12	60.00	-20.88	QP
10	6.8820	9.18	20.57	29.75	50.00	-20.25	AVG
11	9.9300	19.14	20.91	40.05	60.00	-19.95	QP
12	9.9300	8.31	20.91	29.22	50.00	-20.78	AVG

Remark:
1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



3.2 RADIATED EMISSION AND (BANDEDGE) MEASUREMENT

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

In case the emission fall within the restricted band specified on 15.407(b)7& 15.205/209(a), then the 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)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	68.2	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15E.

(2) The tighter limit applies at the band edges.

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

LIMITS OF RESTRICTED FREQUENCY BANDS

FCC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	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	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	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	Above 38.6
13.36-13.41			

IC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note: In case the emission radiated emission above 1000MHz fall within the restricted band the restricted frequency bands, the peak limit is 74 dBuV/m.

LIMITS OF EMISSIONS OUTSIDE OF THE FREQUENCY BANDS

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

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

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

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Note: dBuV/m(at 3M) = EIRP(dBm) + 95.3.

Peak Limit = -27dBm/MHz + 95.3 = 68.3 dBuV/m.

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier harmonic (Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 1 MHz, AV=1 MHz /3 MHz

For Band edge

Spectrum Parameter	Setting
Detector	Peak
RB / VB (emission in restricted band)	1 MHz / 1 MHz, AV=1 MHz /3 MHz

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization 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 QuasiPeak detector mode will be re-measured.
e. If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

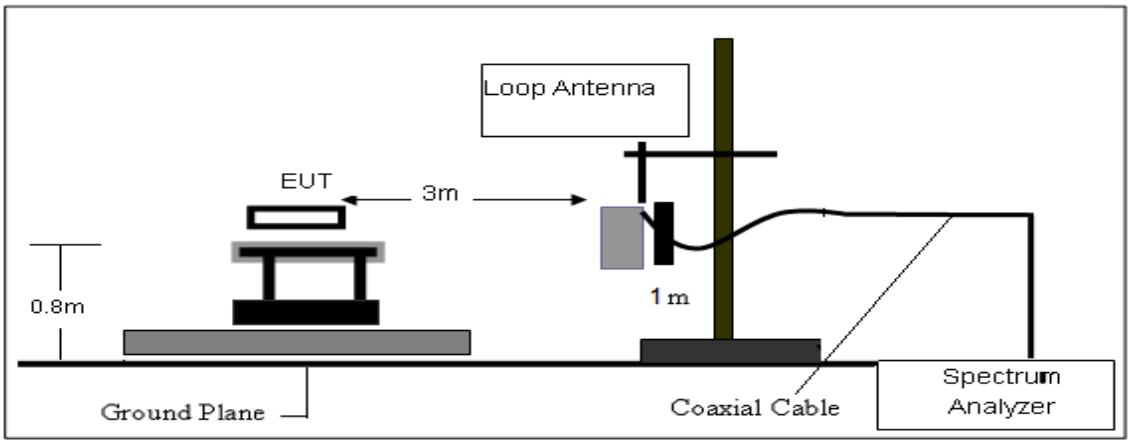
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.2 DEVIATION FROM TEST STANDARD

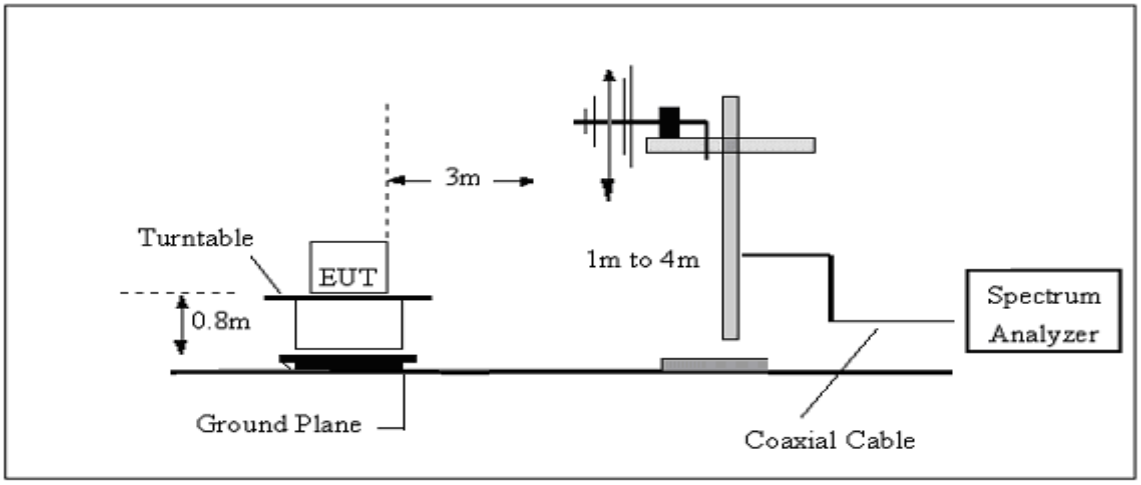
No deviation

3.2.3 TEST SETUP

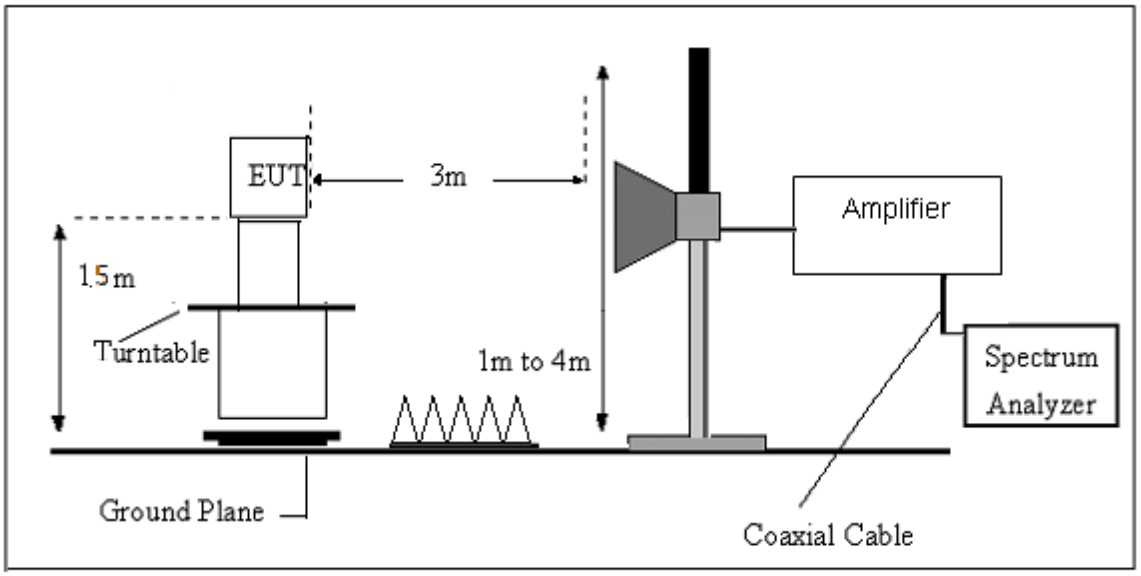
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



3.2.4 EUT OPERATING 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.

3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF + CL - AG
Where
FS = Field Strength
CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude
AG = Amplifier Gain
AF = Antenna Factor
For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

3.2.6 TEST RESULTS (Between 9KHz – 30 MHz)

Temperature:	23.1(C)	Relative Humidtity:	60%RH
Test Voltage:	AC 120V/60Hz	Polarization :	--
Test Mode:	TX Mode		

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

Note:

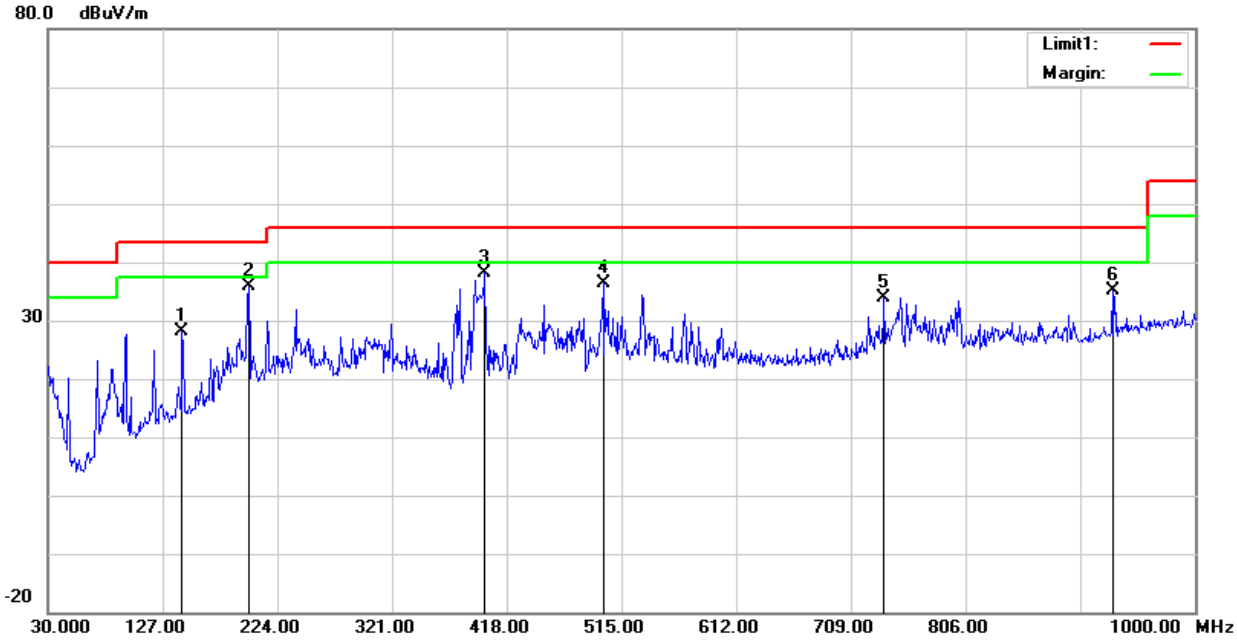
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

3.2.7 TEST RESULTS (Between 30MHz – 1GHz)

Temperature	23.1(C)	Relative Humidtity:	60%RH
Test Voltage	AC 120V/60Hz	Polarization:	Horizontal
Test Mode	Mode 1~3(Mode 2 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	143.4900	46.26	-18.23	28.03	43.50	-15.47	peak
2	199.7500	57.03	-21.11	35.92	43.50	-7.58	peak
3	399.5700	49.21	-11.16	38.05	46.00	-7.95	peak
4	499.4800	44.40	-8.02	36.38	46.00	-9.62	peak
5	737.1300	36.21	-2.22	33.99	46.00	-12.01	peak
6	930.1600	34.49	0.56	35.05	46.00	-10.95	peak

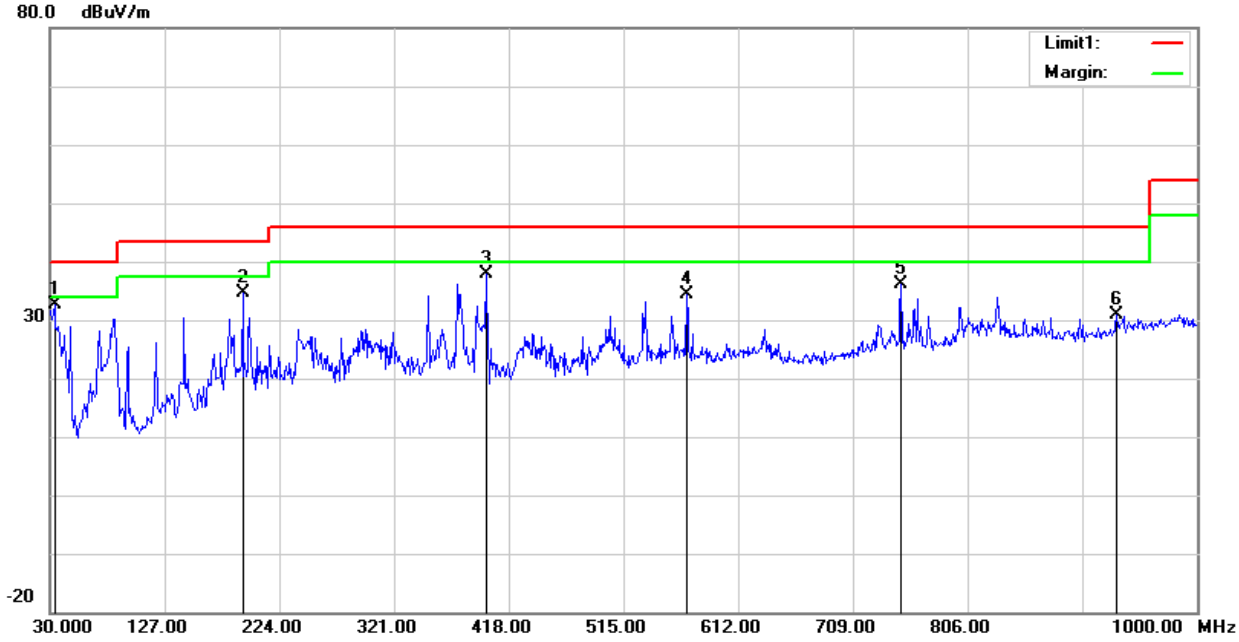
Remark:
1. Margin = Result (Result =Reading + Factor)–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



Temperature	23.1(C)	Relative Humidtity:	60%RH
Test Voltage	AC 120V/60Hz	Polarization:	Vertical
Test Mode	Mode 1~3(Mode 2 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.8800	47.45	-14.80	32.65	40.00	-7.35	peak
2	192.9600	55.73	-21.08	34.65	43.50	-8.85	peak
3	398.6000	49.06	-11.20	37.86	46.00	-8.14	peak
4	568.3500	40.07	-5.58	34.49	46.00	-11.51	peak
5	749.7400	38.35	-2.16	36.19	46.00	-9.81	peak
6	932.1000	30.27	0.72	30.99	46.00	-15.01	peak

Remark:
1. Margin = Result (Result =Reading + Factor)–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



3.2.8 TEST RESULTS (Above 1000 MHz)

5150-5250MHz

Frequency (MHz)	Reading (dBuV)	Amplifier (dB)	Loss (dB)	Antenna Factor (dB/m)	Orrected Factor (dB)	Emission Level (dBμV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Comment
Low Channel (802.11n(HT20)/ 5180 MHz)										
3256.13	44.49	44.70	6.70	28.20	-9.80	34.69	68.20	-33.51	Pk	Vertical
3256.13	41.04	44.70	6.70	28.20	-9.80	31.24	54.00	-22.76	AV	Vertical
3262.58	45.06	44.70	6.70	28.20	-9.80	35.26	74.00	-38.74	Pk	Horizontal
3262.58	41.35	44.70	6.70	28.20	-9.80	31.55	54.00	-22.45	AV	Horizontal
3990.18	39.05	44.20	7.90	29.70	-6.60	32.45	74.00	-41.55	Pk	Vertical
3990.18	36.21	44.20	7.90	29.70	-6.60	29.61	54.00	-24.39	AV	Vertical
3996.26	39.57	44.20	7.90	29.70	-6.60	32.97	74.00	-41.03	Pk	Horizontal
3996.26	36.61	44.20	7.90	29.70	-6.60	30.01	54.00	-23.99	AV	Horizontal
7233.44	37.35	43.50	11.40	35.50	3.40	40.75	68.20	-27.45	Pk	Vertical
7233.44	34.54	43.50	11.40	35.50	3.40	37.94	54.00	-16.06	AV	Vertical
7235.24	36.83	43.50	11.40	35.50	3.40	40.23	68.20	-27.97	Pk	Horizontal
7235.24	34.78	43.50	11.40	35.50	3.40	38.18	54.00	-15.82	AV	Horizontal
10360.34	39.40	44.50	13.80	38.80	8.10	47.50	68.20	-20.70	Pk	Vertical
10360.34	36.15	44.50	13.80	38.80	8.10	44.25	54.00	-9.75	AV	Vertical
10360.04	39.14	44.50	13.80	38.80	8.10	47.24	68.20	-20.96	Pk	Horizontal
10360.04	36.31	44.50	13.80	38.80	8.10	44.41	54.00	-9.59	AV	Horizontal
11022.93	34.01	43.60	14.30	39.50	10.20	44.21	74.00	-29.79	Pk	Vertical
11022.93	29.80	43.60	14.30	39.50	10.20	40.00	54.00	-14.00	AV	Vertical
11019.50	33.76	43.60	14.30	39.50	10.20	43.96	74.00	-30.04	Pk	Horizontal
11019.50	29.74	43.60	14.30	39.50	10.20	39.94	54.00	-14.06	AV	Horizontal
13293.04	32.96	42.60	15.90	38.90	12.20	45.16	74.00	-28.84	Pk	Vertical
13293.04	29.68	42.60	15.90	38.90	12.20	41.88	54.00	-12.12	AV	Vertical
13283.30	32.53	42.60	15.90	38.90	12.20	44.73	74.00	-29.27	Pk	Horizontal
13283.30	29.21	42.60	15.90	38.90	12.20	41.41	54.00	-12.59	AV	Horizontal
Mid Channel (802.11n(HT20)/ 5200 MHz)										
3251.01	44.56	44.70	6.70	28.20	-9.80	34.76	68.20	-33.44	Pk	Vertical
3251.01	41.77	44.70	6.70	28.20	-9.80	31.97	54.00	-22.03	AV	Vertical
3264.46	44.38	44.70	6.70	28.20	-9.80	34.58	74.00	-39.42	Pk	Horizontal
3264.46	41.24	44.70	6.70	28.20	-9.80	31.44	54.00	-22.56	AV	Horizontal
3996.26	38.89	44.20	7.90	29.70	-6.60	32.29	74.00	-41.71	Pk	Vertical
3996.26	37.13	44.20	7.90	29.70	-6.60	30.53	54.00	-23.47	AV	Vertical
3998.24	38.95	44.20	7.90	29.70	-6.60	32.35	74.00	-41.65	Pk	Horizontal
3998.24	36.96	44.20	7.90	29.70	-6.60	30.36	54.00	-23.64	AV	Horizontal
7220.83	37.44	43.50	11.40	35.50	3.40	40.84	68.20	-27.36	Pk	Vertical
7220.83	33.94	43.50	11.40	35.50	3.40	37.34	54.00	-16.66	AV	Vertical
7219.23	36.77	43.50	11.40	35.50	3.40	40.17	68.20	-28.03	Pk	Horizontal
7219.23	34.11	43.50	11.40	35.50	3.40	37.51	54.00	-16.49	AV	Horizontal
10400.04	38.79	44.50	13.80	38.80	8.10	46.89	68.20	-21.31	Pk	Vertical
10400.04	35.89	44.50	13.80	38.80	8.10	43.99	54.00	-10.01	AV	Vertical
10400.01	40.10	44.50	13.80	38.80	8.10	48.20	68.20	-20.00	Pk	Horizontal
10400.01	36.89	44.50	13.80	38.80	8.10	44.99	54.00	-9.01	AV	Horizontal
11018.67	34.20	43.60	14.30	39.50	10.20	44.40	74.00	-29.60	Pk	Vertical
11018.67	29.74	43.60	14.30	39.50	10.20	39.94	54.00	-14.06	AV	Vertical
11022.06	32.75	43.60	14.30	39.50	10.20	42.95	74.00	-31.05	Pk	Horizontal
11022.06	31.02	43.60	14.30	39.50	10.20	41.22	54.00	-12.78	AV	Horizontal
13298.93	31.95	42.60	15.90	38.90	12.20	44.15	74.00	-29.85	Pk	Vertical
13298.93	29.36	42.60	15.90	38.90	12.20	41.56	54.00	-12.44	AV	Vertical
13294.53	32.68	42.60	15.90	38.90	12.20	44.88	74.00	-29.12	Pk	Horizontal
13294.53	29.72	42.60	15.90	38.90	12.20	41.92	54.00	-12.08	AV	Horizontal

High Channel (802.11n(HT20)/ 5240 MHz)										
3249.19	44.46	44.70	6.70	28.20	-9.80	34.66	68.20	-33.54	Pk	Vertical
3249.19	40.90	44.70	6.70	28.20	-9.80	31.10	54.00	-22.90	AV	Vertical
3249.30	44.67	44.70	6.70	28.20	-9.80	34.87	68.20	-33.33	Pk	Horizontal
3249.30	41.39	44.70	6.70	28.20	-9.80	31.59	54.00	-22.41	AV	Horizontal
3998.37	38.71	44.20	7.90	29.70	-6.60	32.11	74.00	-41.89	Pk	Vertical
3998.37	36.84	44.20	7.90	29.70	-6.60	30.24	54.00	-23.76	AV	Vertical
3999.30	39.57	44.20	7.90	29.70	-6.60	32.97	74.00	-41.03	Pk	Horizontal
3999.30	35.65	44.20	7.90	29.70	-6.60	29.05	54.00	-24.95	AV	Horizontal
7235.09	36.47	43.50	11.40	35.50	3.40	39.87	68.20	-28.33	Pk	Vertical
7235.09	34.90	43.50	11.40	35.50	3.40	38.30	54.00	-15.70	AV	Vertical
7221.84	36.72	43.50	11.40	35.50	3.40	40.12	68.20	-28.08	Pk	Horizontal
7221.84	33.80	43.50	11.40	35.50	3.40	37.20	54.00	-16.80	AV	Horizontal
10480.27	38.95	44.50	13.80	38.80	8.10	47.05	68.20	-21.15	Pk	Vertical
10480.27	36.82	44.50	13.80	38.80	8.10	44.92	54.00	-9.08	AV	Vertical
10480.27	39.74	44.50	13.80	38.80	8.10	47.84	68.20	-20.36	Pk	Horizontal
10480.27	36.14	44.50	13.80	38.80	8.10	44.24	54.00	-9.76	AV	Horizontal
11020.25	33.16	43.60	14.30	39.50	10.20	43.36	74.00	-30.64	Pk	Vertical
11020.25	31.17	43.60	14.30	39.50	10.20	41.37	54.00	-12.63	AV	Vertical
11026.34	32.88	43.60	14.30	39.50	10.20	43.08	74.00	-30.92	Pk	Horizontal
11026.34	30.87	43.60	14.30	39.50	10.20	41.07	54.00	-12.93	AV	Horizontal
13294.96	32.43	42.60	15.90	38.90	12.20	44.63	74.00	-29.37	Pk	Vertical
13294.96	29.88	42.60	15.90	38.90	12.20	42.08	54.00	-11.92	AV	Vertical
13284.45	32.09	42.60	15.90	38.90	12.20	44.29	74.00	-29.71	Pk	Horizontal
13284.45	29.66	42.60	15.90	38.90	12.20	41.86	54.00	-12.14	AV	Horizontal

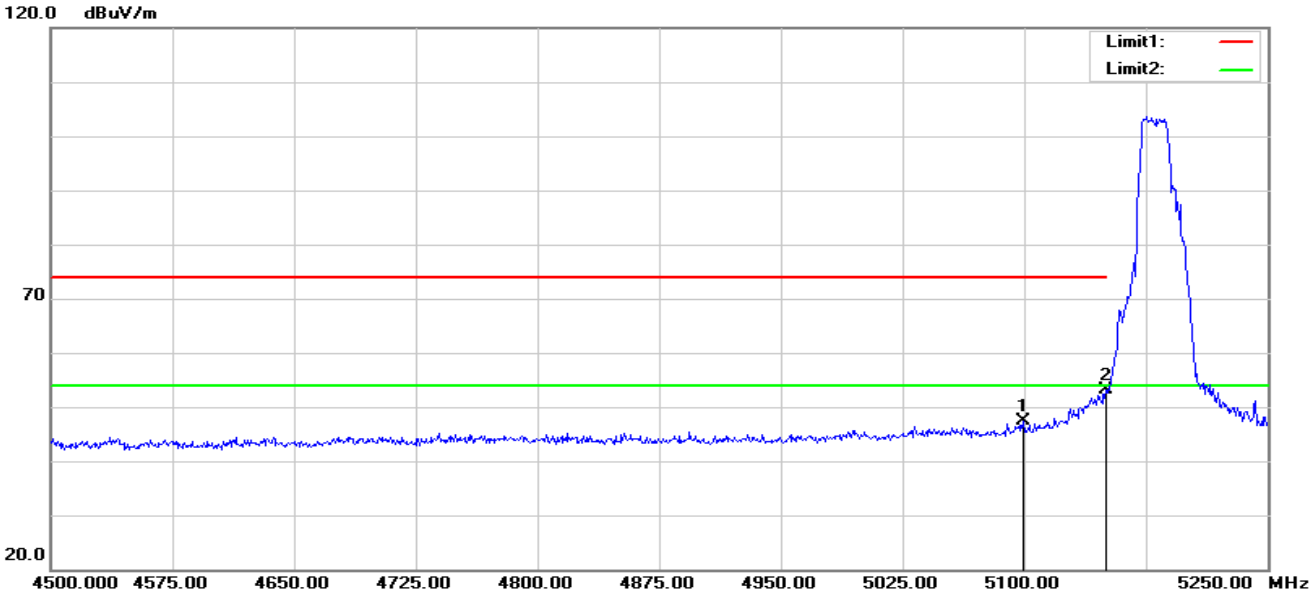
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Scan with 802.11a,802.11n (HT-20),802.11n (HT-40), the worst case is 802.11n (HT-20).
3. The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

3.2.9 RESTRICTED FREQUENCY BANDS AND BAND EDGE

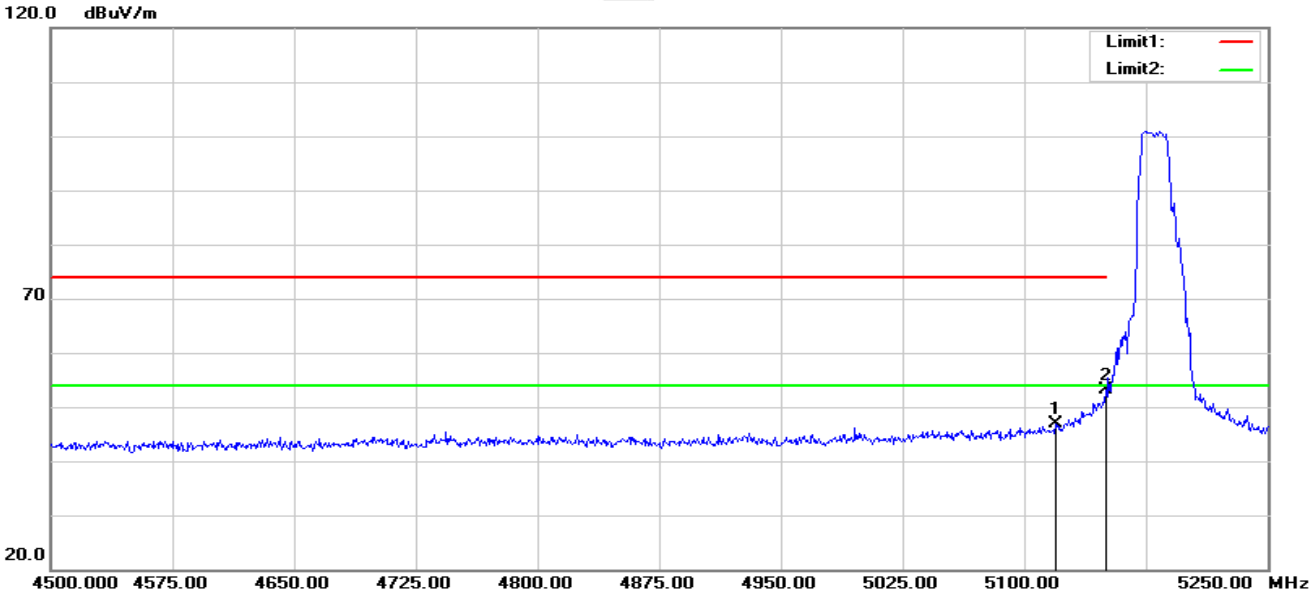
5150-5250MHz

RSE-802.11a20-L-H



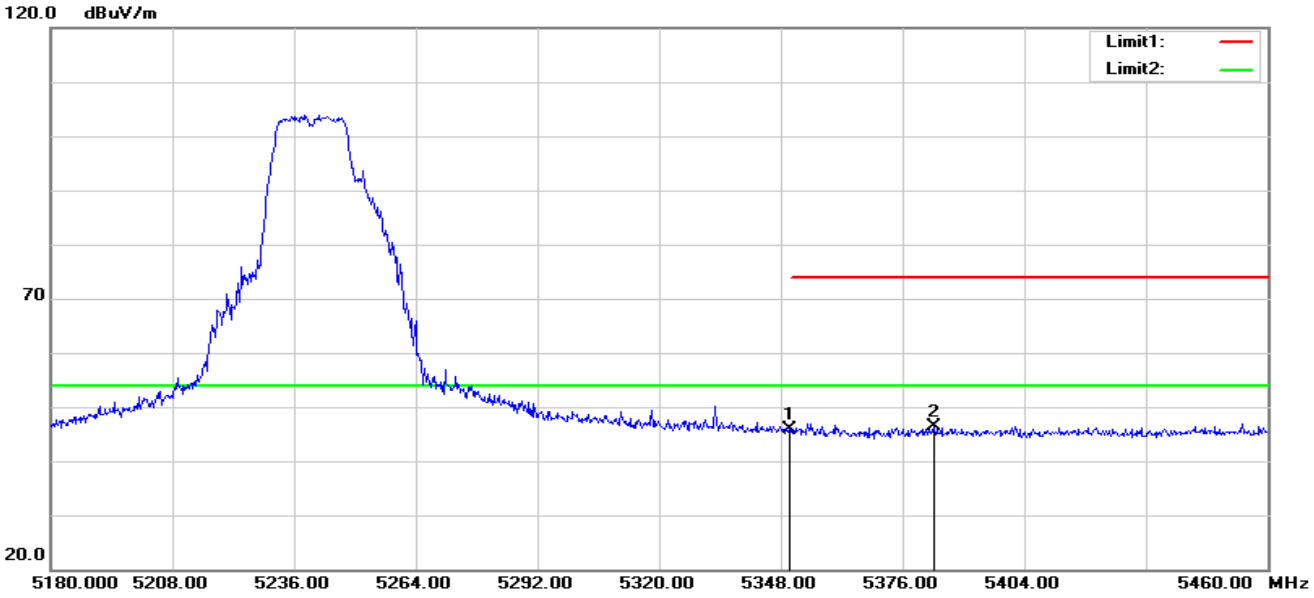
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5099.250	53.17	-5.74	47.43	74.00	-26.57	peak
2	5150.000	58.74	-5.73	53.01	74.00	-20.99	peak

RSE-802.11a20-L-V



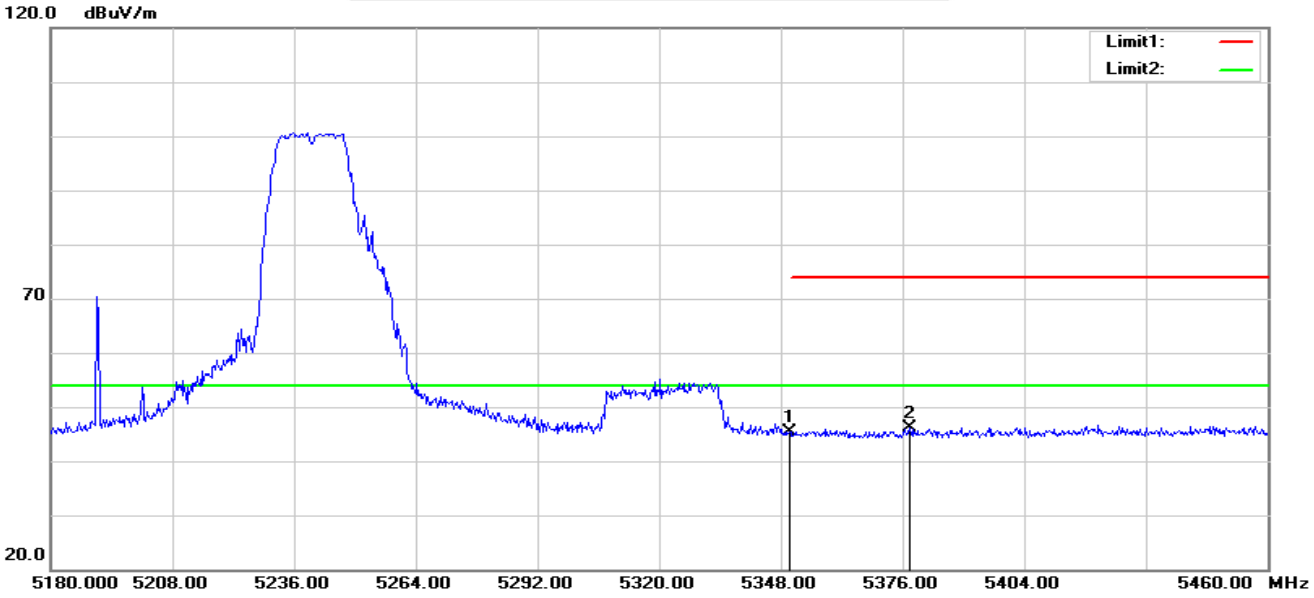
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5119.500	52.52	-5.73	46.79	74.00	-27.21	peak
2	5150.000	58.97	-5.73	53.24	74.00	-20.76	peak

RSE-802.11a20-H-H



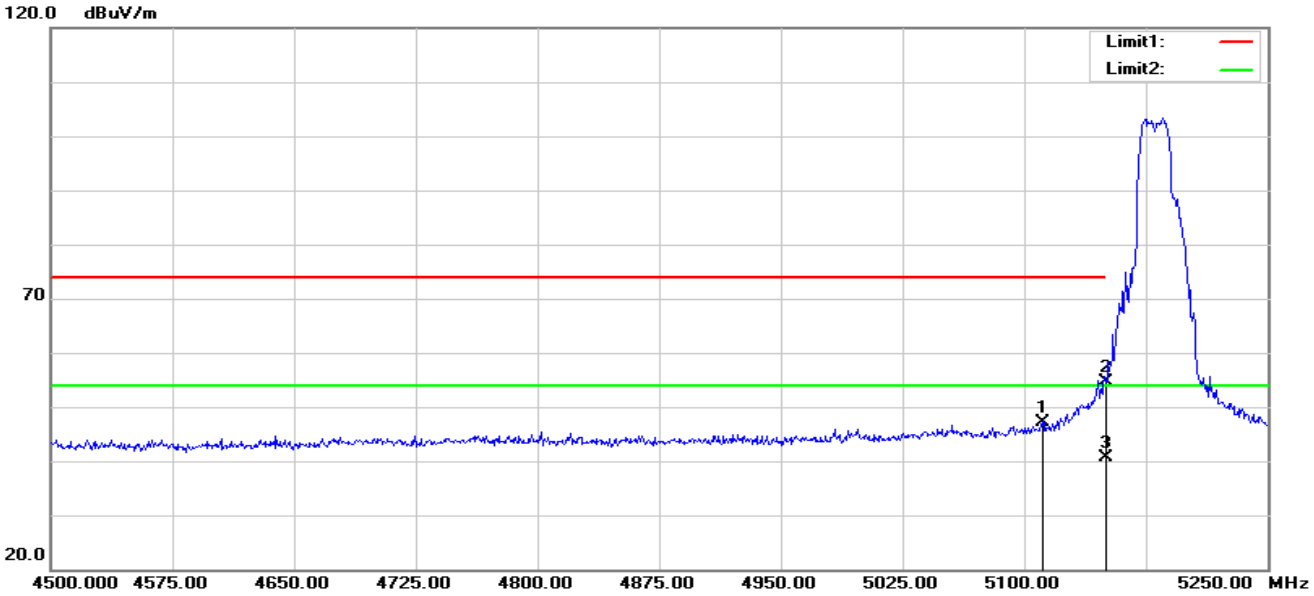
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5350.000	51.03	-5.23	45.80	74.00	-28.20	peak
2	5383.280	51.67	-5.24	46.43	74.00	-27.57	peak

RSE-802.11a20-H-V



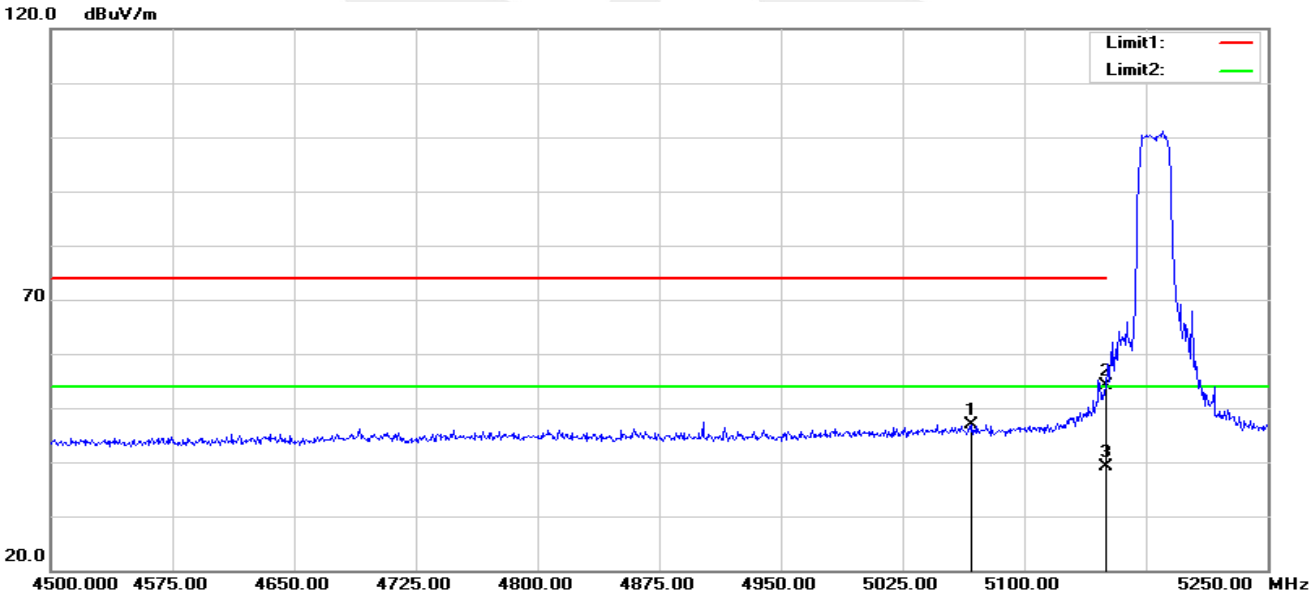
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5350.000	50.70	-5.23	45.47	74.00	-28.53	peak
2	5377.680	51.49	-5.24	46.25	74.00	-27.75	peak

RSE-802.11n20-L-H



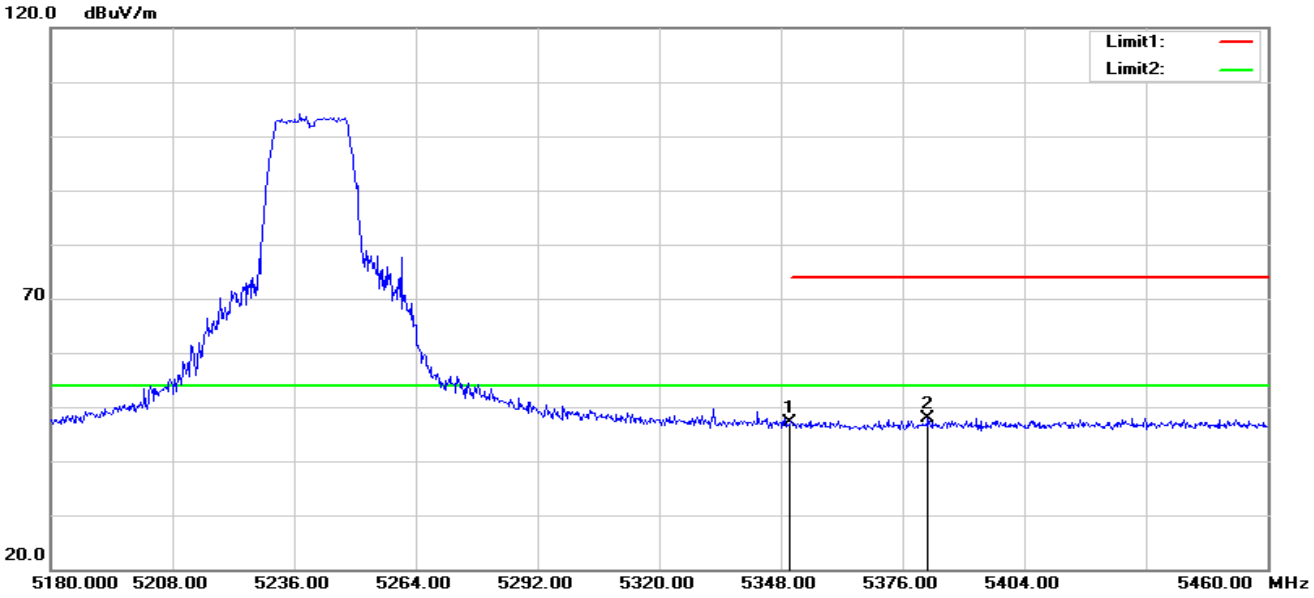
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5111.250	52.99	-5.74	47.25	74.00	-26.75	peak
2	5150.000	60.30	-5.73	54.57	74.00	-19.43	peak
3	5150.000	46.40	-5.73	40.67	54.00	-13.33	AVG

RSE-802.11n20-L-V



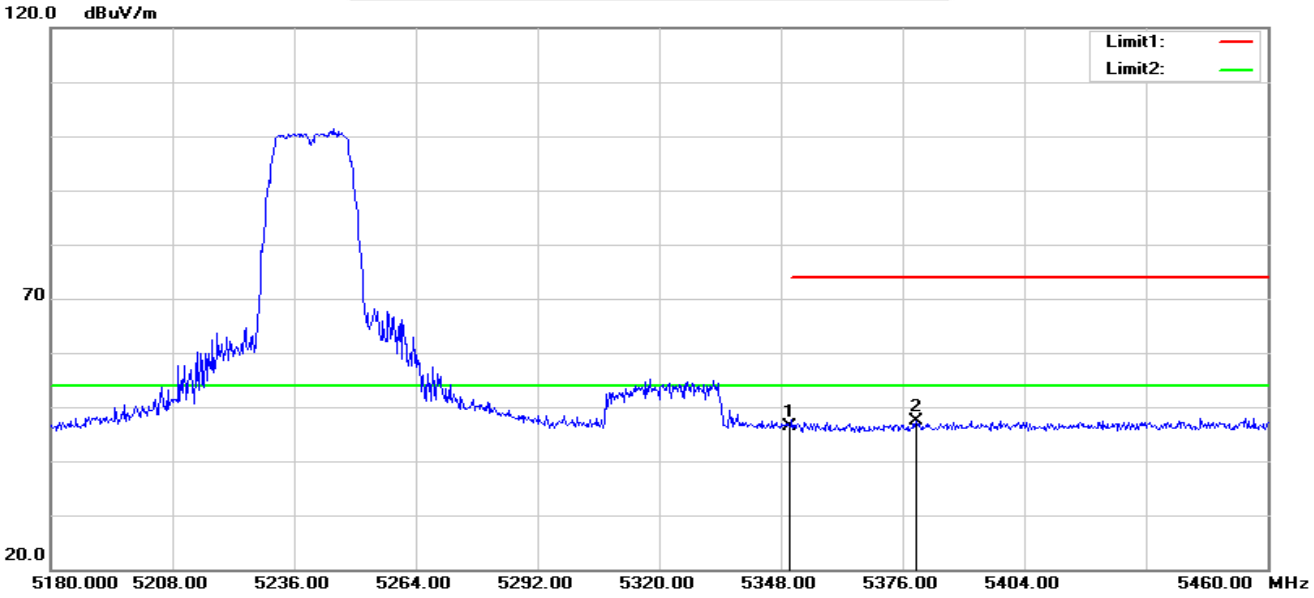
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5067.750	52.81	-5.89	46.92	74.00	-27.08	peak
2	5150.000	59.76	-5.73	54.03	74.00	-19.97	peak
3	5150.000	44.94	-5.73	39.21	54.00	-14.79	AVG

RSE-802.11n20-H-H



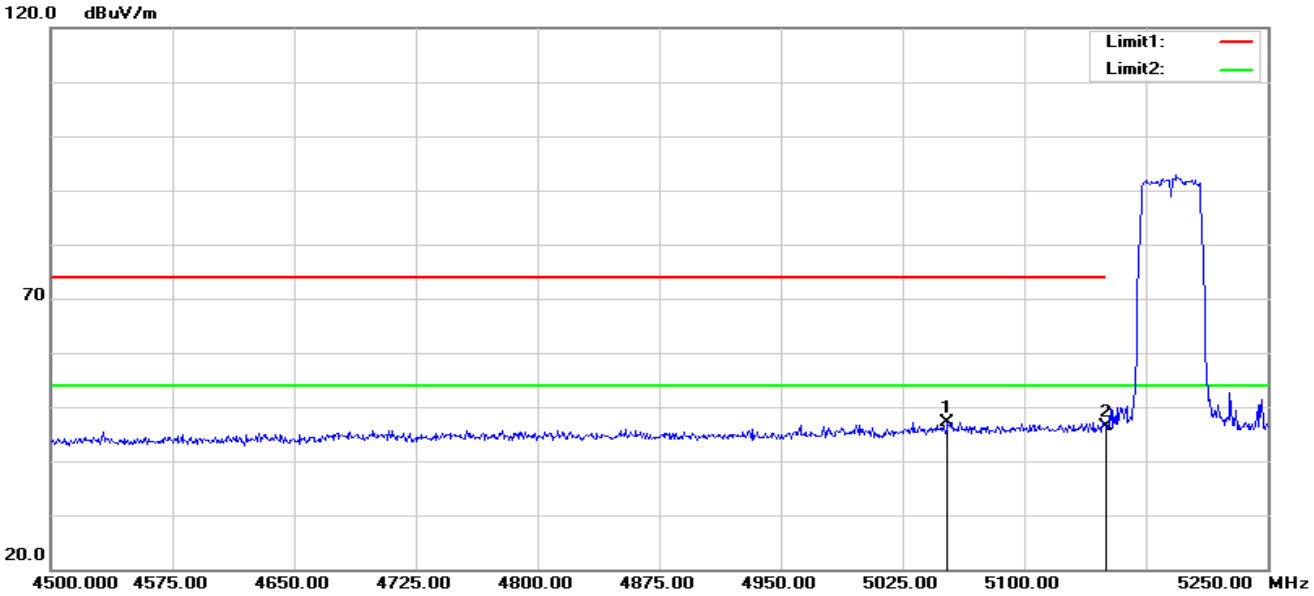
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5350.000	52.32	-5.23	47.09	74.00	-26.91	peak
2	5381.880	53.22	-5.24	47.98	74.00	-26.02	peak

RSE-802.11n20-H-V



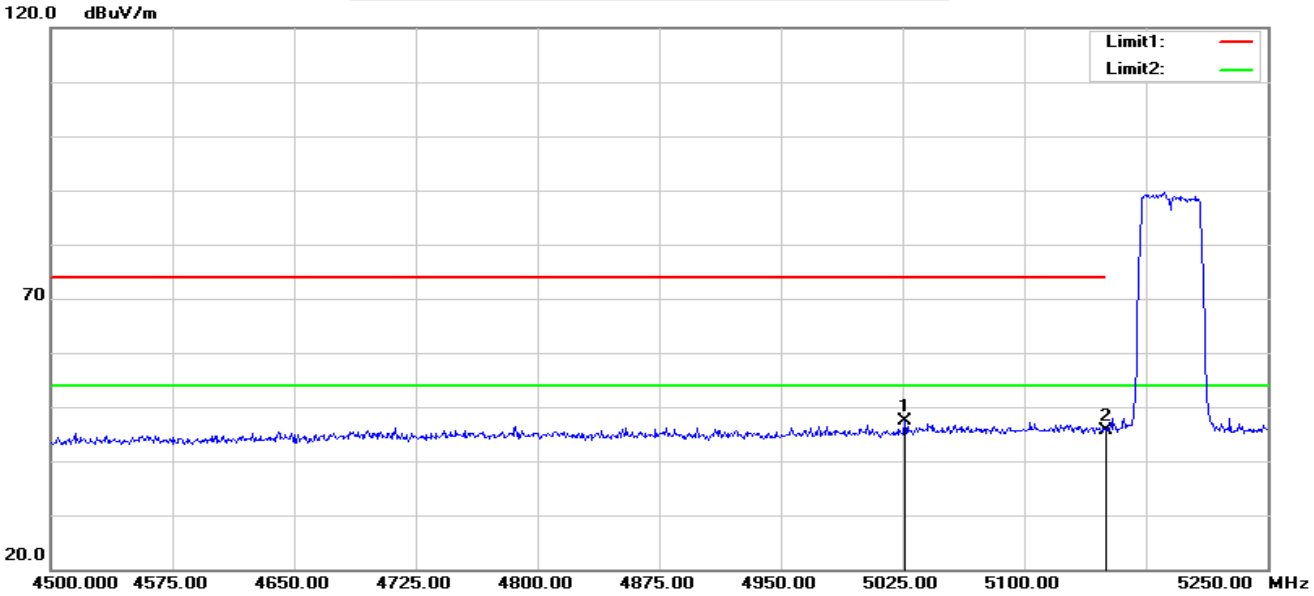
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5350.000	51.59	-5.23	46.36	74.00	-27.64	peak
2	5379.080	52.52	-5.24	47.28	74.00	-26.72	peak

RSE-802.11n40-L-H



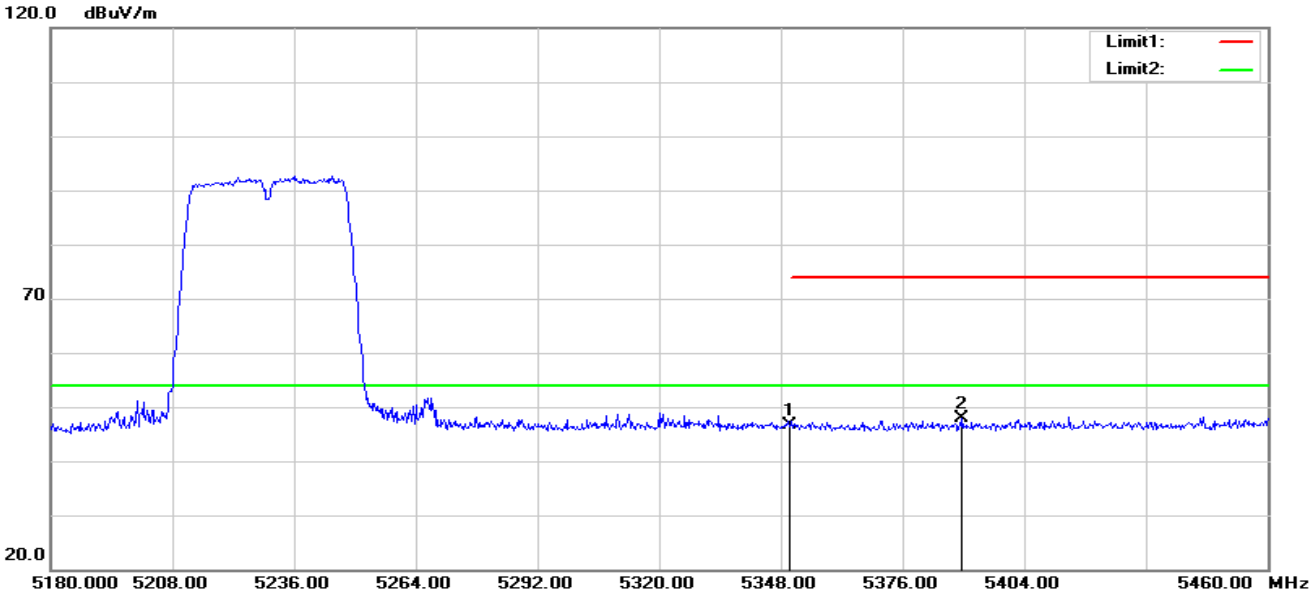
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5052.750	53.14	-5.95	47.19	74.00	-26.81	peak
2	5150.000	52.05	-5.73	46.32	74.00	-27.68	peak

RSE-802.11n40-L-V



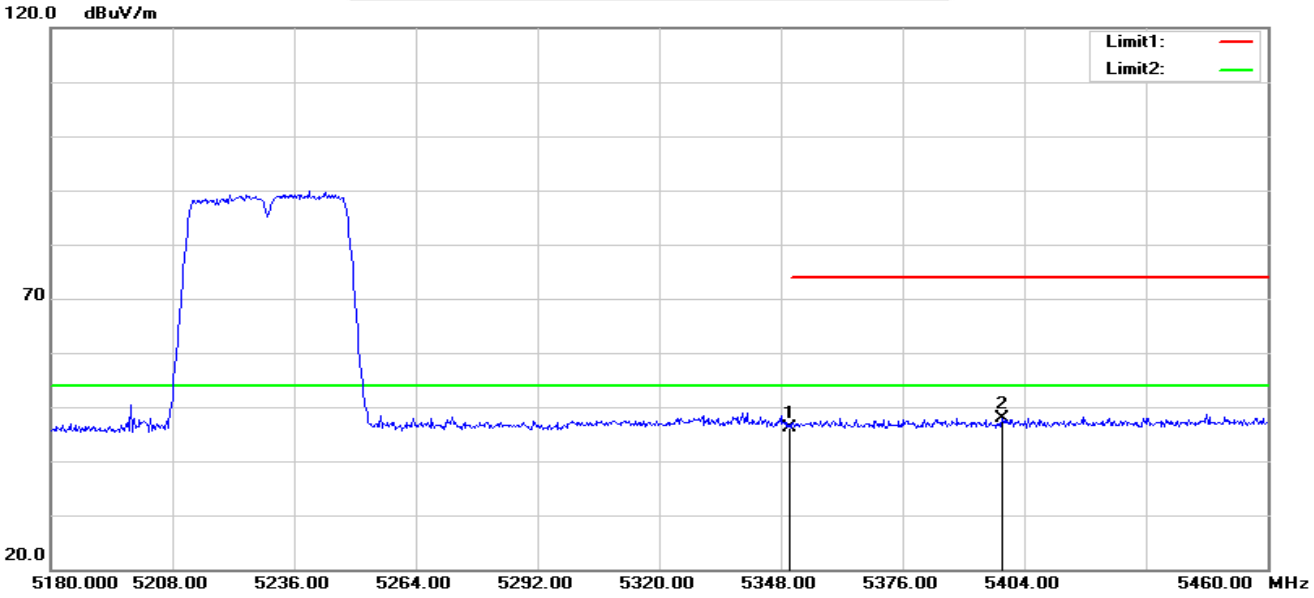
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5026.500	53.48	-6.07	47.41	74.00	-26.59	peak
2	5150.000	51.32	-5.73	45.59	74.00	-28.41	peak

RSE-802.11n40-H-H



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5350.000	51.88	-5.23	46.65	74.00	-27.35	peak
2	5389.720	53.21	-5.25	47.96	74.00	-26.04	peak

RSE-802.11n40-H-V



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	5350.000	51.41	-5.23	46.18	74.00	-27.82	peak
2	5398.960	53.19	-5.25	47.94	74.00	-26.06	peak

4. POWER SPECTRAL DENSITY TEST

4.1 LIMIT

FCC:

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.

IC:

1. For the 5.15-5.25 GHz, The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.
2. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
3. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-pointoperations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

4.2 TEST PROCEDURE

1. The setting follows Method SA-2 of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set span to encompass the EBW
3. Set RBW = 1MHz.
4. Set the VBW > =3MHz.
5. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto.
7. Detector = power averaging (rms), if available. Otherwise, use sample detector mode
8. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.

4.3 DEVIATION FROM STANDARD

No deviation.

4.4 TEST SETUP

4.5 EUT OPERATION CONDITIONS

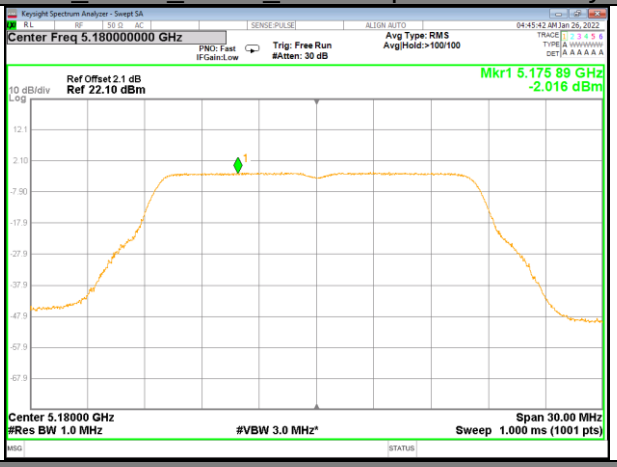
The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

4.6 TEST RESULTS

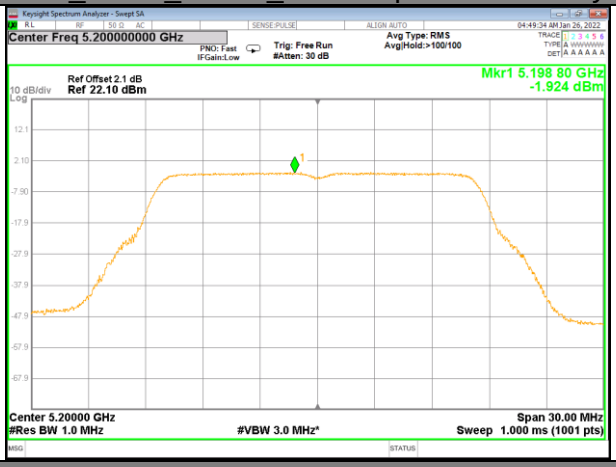
5150-5250MHz					
Frequency	Direct measurement Power Density (dBm)	Duty cycle factor (dB)	Final Power Density (dBm)	Limit (dBm)	Result
802.11a					
5180	-2.016	0.024	-1.992	11	PASS
5200	-1.924	0.024	-1.900	11	PASS
5240	-2.118	0.024	-2.094	11	PASS
802.11n20					
5180	-3.151	0.038	-3.113	11	PASS
5200	-3.322	0.038	-3.284	11	PASS
5240	-3.628	0.038	-3.590	11	PASS
802.11n40					
5190	-8.579	0.090	-8.489	11	PASS
5230	-8.472	0.090	-8.382	11	PASS

5150-5250MHz						
Frequency	Direct measurement Power Density (dBm)	Duty cycle factor (dB)	Ant Gain (dBi)	EIRP Power Density (dBm)	Limit	Result
802.11a						
5180	-2.016	0.02	-0.15	-2.14	10	PASS
5200	-1.924	0.02	-0.15	-2.05	10	PASS
5240	-2.118	0.02	-0.15	-2.24	10	PASS
802.11n20						
5180	-3.151	0.04	-0.15	-3.26	10	PASS
5200	-3.322	0.04	-0.15	-3.43	10	PASS
5240	-3.628	0.04	-0.15	-3.74	10	PASS
802.11n40						
5190	-8.579	0.09	-0.15	-8.64	10	PASS
5230	-8.472	0.09	-0.15	-8.53	10	PASS

W52_11a20_Lower_Power Spectrum Density

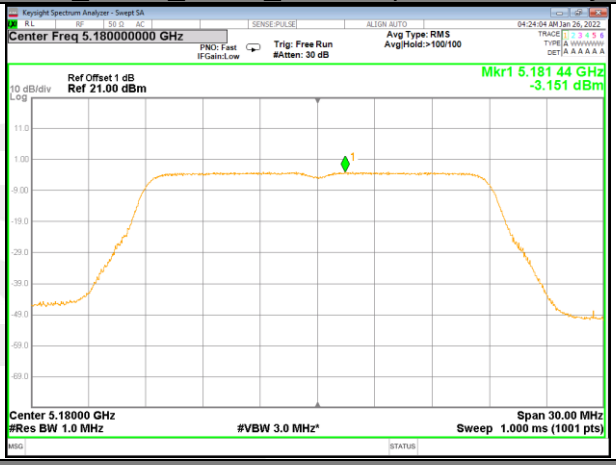


W52_11a20_Middle_Power Spectrum Density

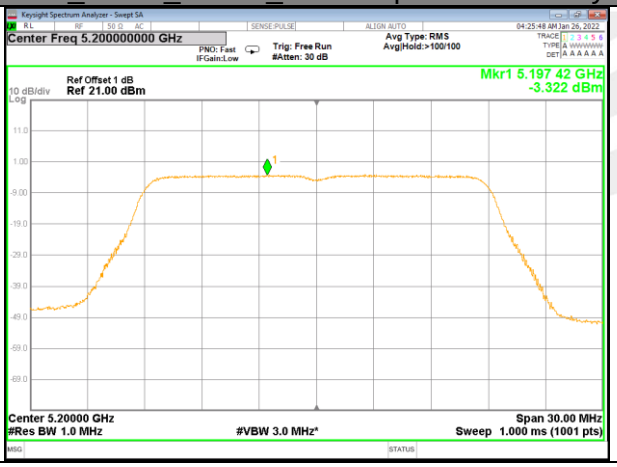


W52_11a20_Higher_Power Spectrum Density

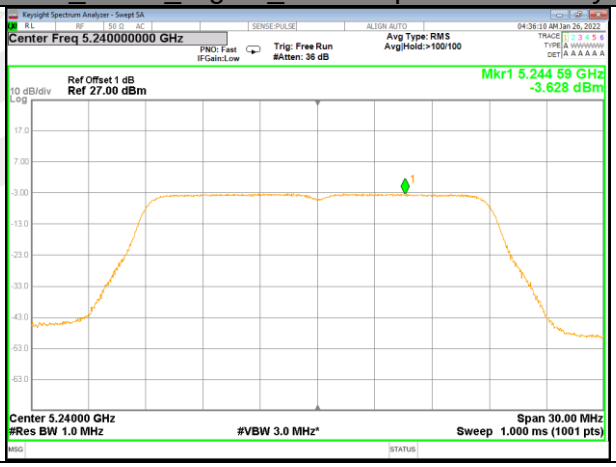
W52_11n20_Lower_Power Spectrum Density

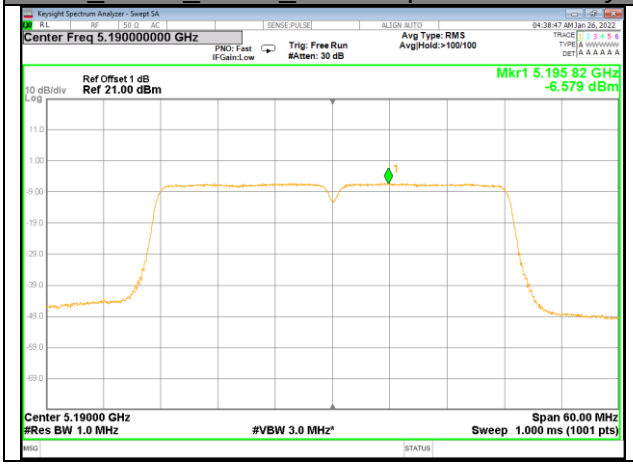
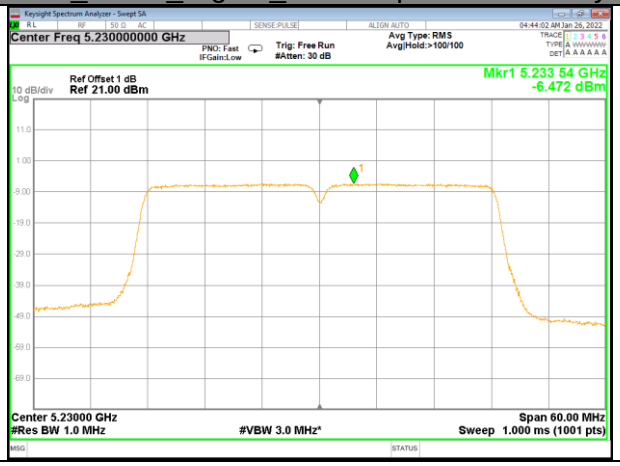


W52_11n20_Middle_Power Spectrum Density



W52_11n20_Higher_Power Spectrum Density



W52_11n40_Lower_Power Spectrum Density	W52_11n40_Higher_Power Spectrum Density
	

5. BANDWIDTH MEASUREMENT

5.1 EMISSION BANDWIDTH (EBW) 26 BANDWID PROCEDURES / LIMIT

The following procedure shall be used for measuring 26 bandwidth.

5.1.1 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%.

5.1.2 DEVIATION FROM STANDARD

No deviation.

6.1.3 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

Frequency (MHz)	26dB Bandwidth (MHz)	Pass/Fail
802.11a		
5180	21.27	Pass
5200	21.20	Pass
5240	21.20	Pass
802.11n(HT20)		
5180	21.63	Pass
5200	21.37	Pass
5240	21.56	Pass
802.11n(HT40)		
5190	39.83	Pass
5230	40.12	Pass

Test plot please refer to Sction 5.2.5.

5.2 OCCUPIED BANDWIDTH (99%) TEST APPLIED PROCEDURES / LIMIT

The following procedure shall be used for measuring (99 %) power bandwidth.

5.2.1 TEST PROCEDURE

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures v02r01.
The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5.0 times the OBW.

3. Set RBW = 1 % to 5 % of the OBW

4. Set VBW ≥ 3 · RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99 % power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

5.2.2 DEVIATION FROM STANDARD

No deviation.

5.2.3 TEST SETUP

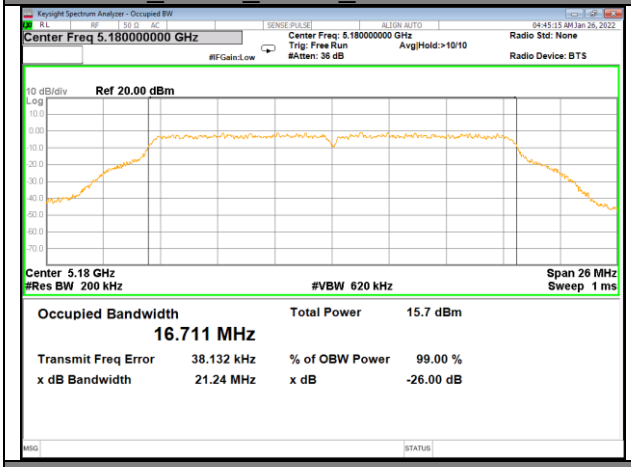
5.2.4 EUT OPERATION CONDITIONS

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.

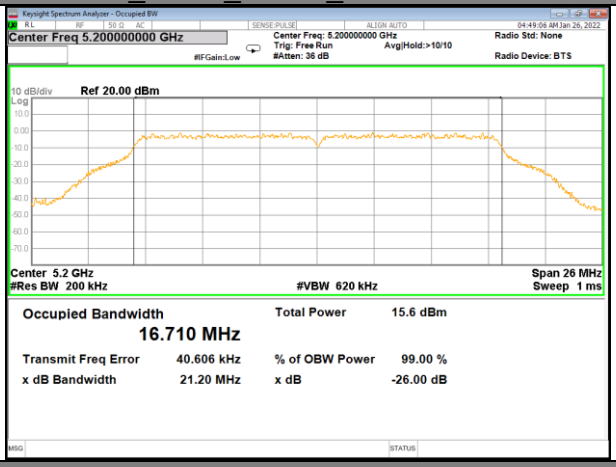
5.2.5 TEST RESULTS

Frequency (MHz)	99% Bandwidth (MHz)	Pass/Fail
802.11a		
5180	16.711	Pass
5200	16.710	Pass
5240	16.710	Pass
802.11n(HT20)		
5180	17.859	Pass
5200	17.855	Pass
5240	17.869	Pass
802.11n(HT40)		
5190	36.287	Pass
5230	36.303	Pass

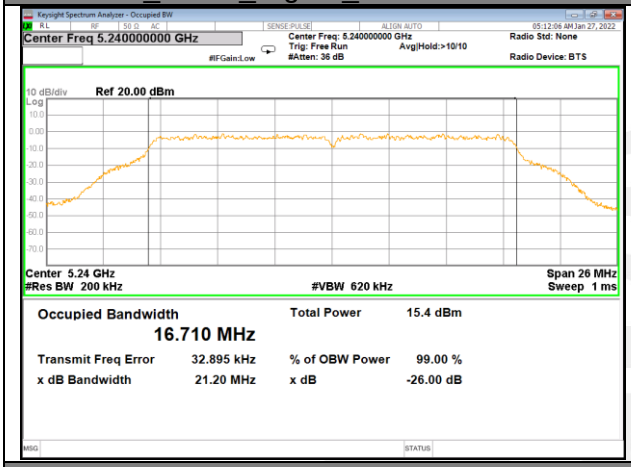
W52_11a20_Lower_26BW and 99%



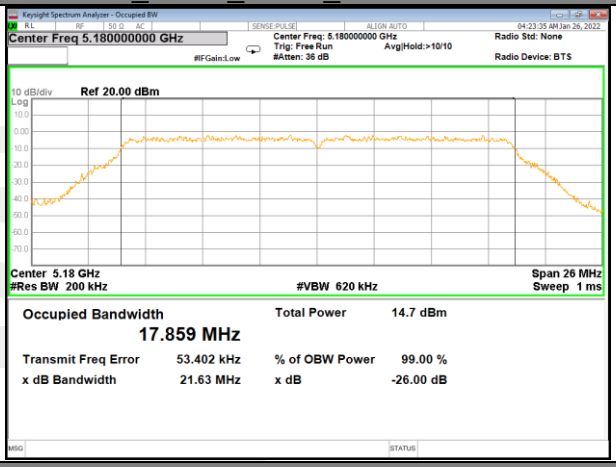
W52_11a20_Middle_26BW and 99%



W52_11a20_Higher_26BW and 99%



W52_11n20_Lower_26BW and 99%



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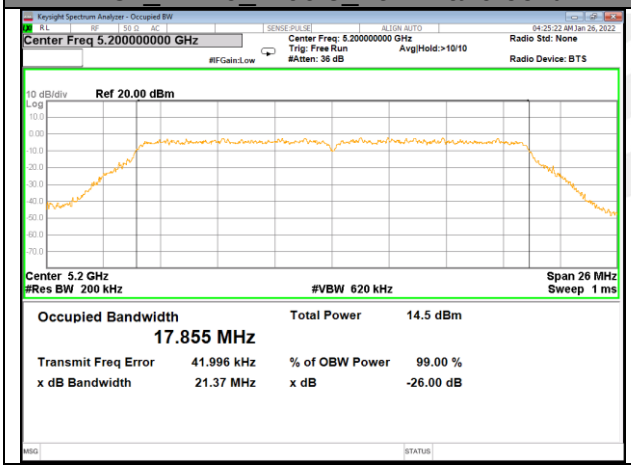
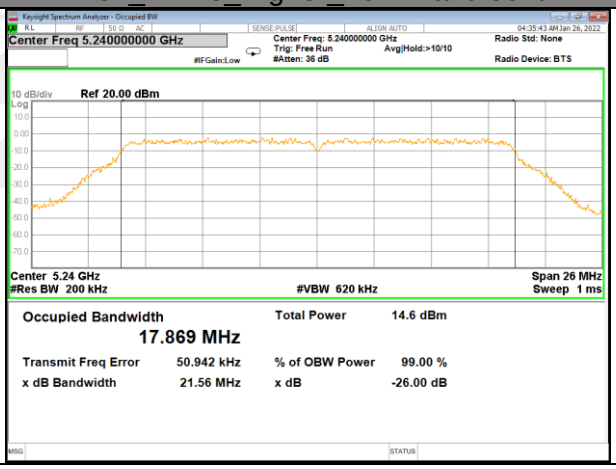
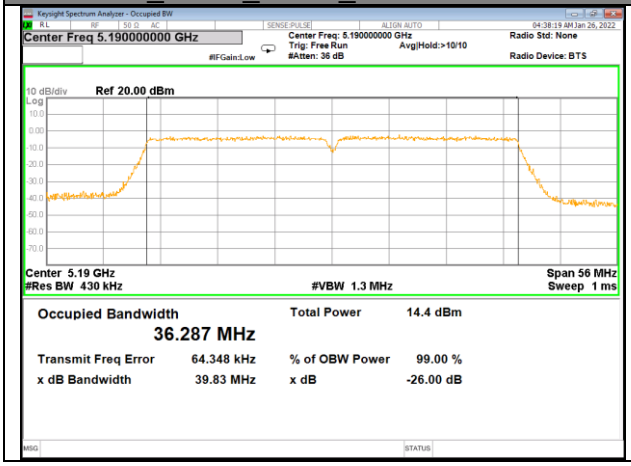
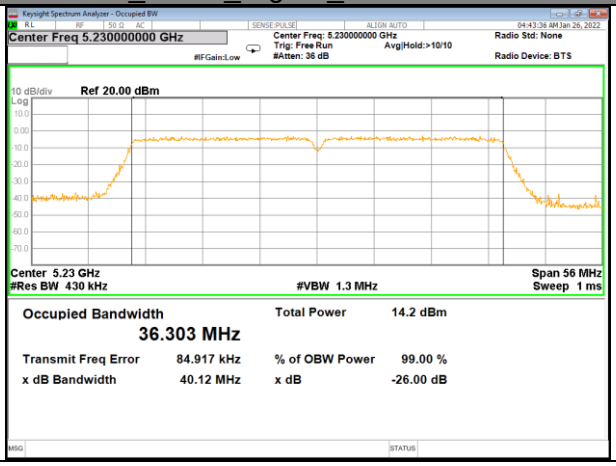


W52_11n20_Higher_26BW and 99%



W52_11n40_Lower_26BW and 99%	W52_11n40_Higher_26BW and 99%
	

5.3 MINIMUM EMISSION BANDWIDTH(6 DB) PROCEDURES / LIMIT

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

5.3.1 TEST PROCEDURE

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures v02r01.

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.2 DEVIATION FROM STANDARD

No deviation.

5.3.3 TEST SETUP

5.3.4 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.

5.3.5 TEST RESULTS

Note: The EUT not support Band 5.725-5.85 GHz, not applicable.

6. MAXIMUM CONDUCTED OUTPUT POWER

6.1 LIMIT

FCC:

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.

FCC Part15 (15.407) , Subpart E				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.407(a) (1) (iv)	Peak Output Power	0.25 watt	5150-5250	PASS
		The lesser of 250 mW or 11 dBm + 10 log (26 dB emission bandwidth)	5250-5350 5470-5725	
15.407(a) (3)		1 watt	5725-5825	

IC:

For devices in the 5.15-5.25 GHz band, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands:

1. The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
2. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

For the 5725-5850 MHz bands, The maximum conducted output power shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-pointoperations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

RSS-247 Issue 2, February 2017				
Section	Test Item	Limit	Frequency Range (MHz)	Result
6.2.1.1	Average Output Power	200 mW or 10 + 10 $\log_{10}$B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz	5150-5250	PASS
6.2.2.1 6.2.3.1		The lesser of 250 mW or 11 dBm + 10 log (26 dB emission bandwidth)	5250-5350 5470-5725	
6.2.4.1		1 watt	5725-5825	

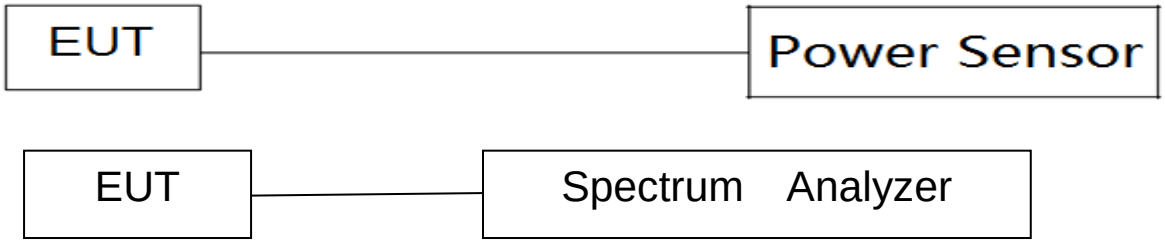
6.2 TEST PROCEDURE

The EUT was directly connected to the Power Sensor&PC

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

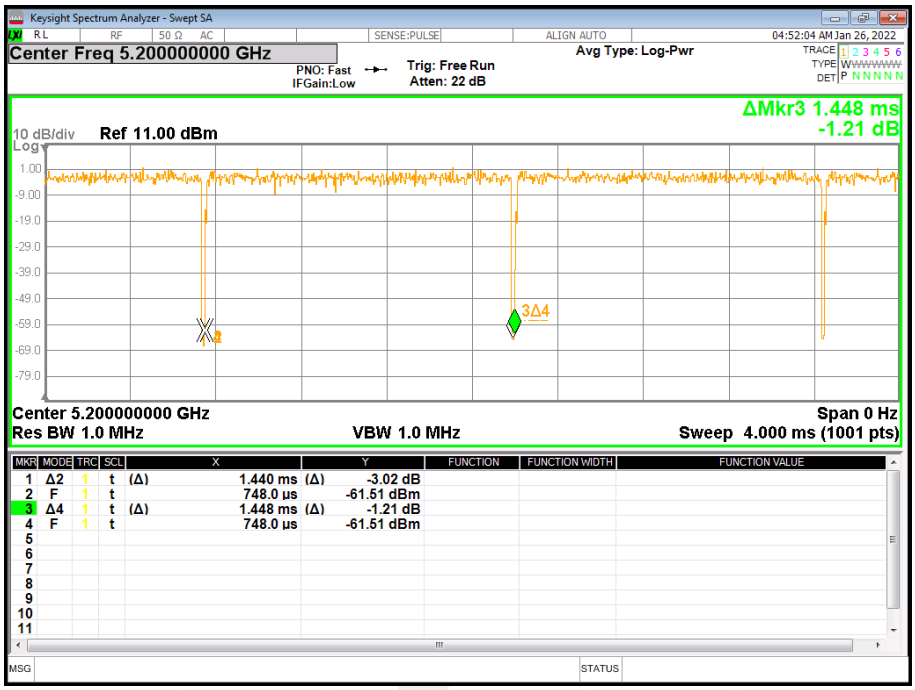
6.6 TEST RESULTS

(5.15-5.25GHz)					
Test Channel	Frequency (MHz)	Direct measurement AV Power (dBm)	Duty cycle factor (dB)	Final AV Power (dBm)	LIMIT (dBm)
802.11a					
36	5180	9.48	0.024	9.50	23.98
40	5200	9.69	0.024	9.71	23.98
48	5240	9.63	0.024	9.65	23.98
802.11n(HT20)					
36	5180	9.46	0.038	9.50	23.98
40	5200	9.55	0.038	9.59	23.98
48	5240	9.68	0.038	9.72	23.98
802.11n(HT40)					
38	5190	9.11	0.090	9.20	23.98
46	5230	9.34	0.090	9.43	23.98

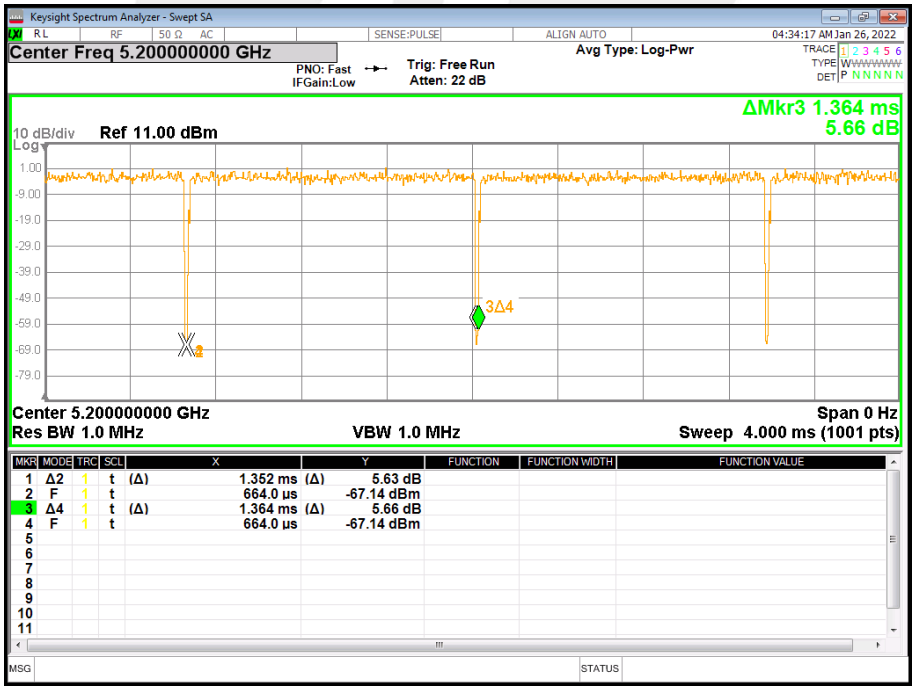
(5.15-5.25GHz)-EIRP							
Test Channel	Frequency (MHz)	Direct measurement AV Power (dBm)	Duty cycle factor (dB)	Antenna Gain (dBi)	E.I.R.P Power (dBm)	E.I.R.P LIMIT (dBm)	Result
802.11a							
36	5180	9.48	0.02	-0.15	9.35	23.01	Pass
40	5200	9.69	0.02	-0.15	9.56	23.01	Pass
48	5240	9.63	0.02	-0.15	9.50	23.01	Pass
802.11n(HT20)							
36	5180	9.46	0.04	-0.15	9.35	23.01	Pass
40	5200	9.55	0.04	-0.15	9.44	23.01	Pass
48	5240	9.68	0.04	-0.15	9.57	23.01	Pass
802.11n(HT40)							
38	5190	9.11	0.09	-0.15	9.05	23.01	Pass
46	5230	9.34	0.09	-0.15	9.28	23.01	Pass

Duty cycle

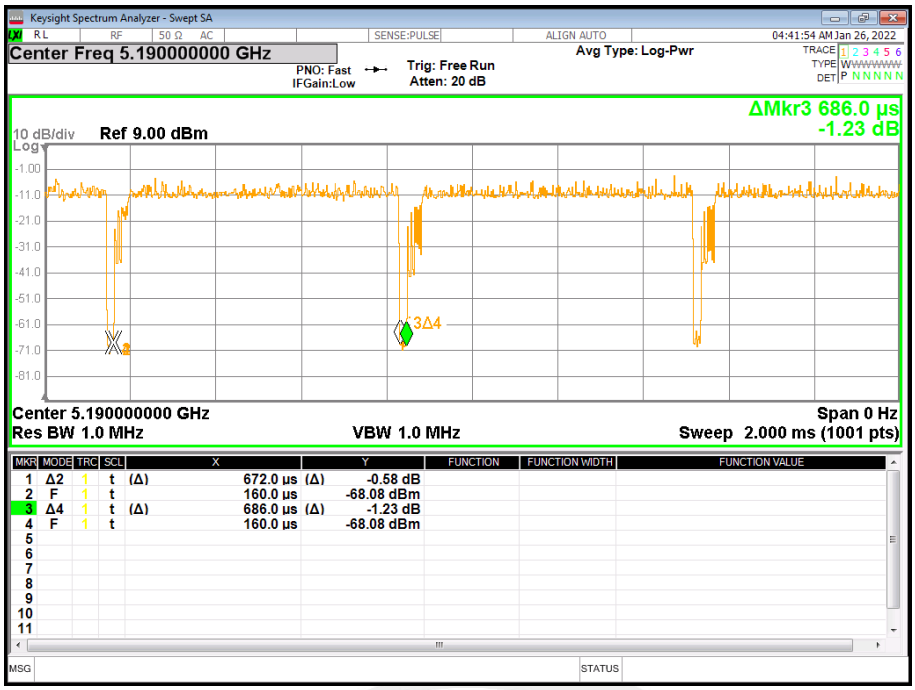
Band1				
Mode	Ton(ms)	Tp(ms)	Duty cycle(%)	Duty factor(dB)
a	1.440	1.448	99.45%	0.024
n20	1.352	1.364	99.12%	0.038
n40	0.672	0.686	97.96%	0.090



Band 1-a20



Band 1-n20


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:PULSE
ALIGN AUTO
04:41:54 AM Jan 26, 2022
Center Freq 5.190000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE WWWWW
DET P N N N N N
ΔMkr3 686.0 µs
-1.23 dB
10 dB/div
Log
Ref 9.00 dBm
-1.00
-11.0
-21.0
-31.0
-41.0
-51.0
-61.0
-71.0
-81.0
3Δ4
Center 5.190000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 2.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 Δ2 1 t (Δ) 672.0 µs (Δ) -0.58 dB
2 F 1 t 160.0 µs -68.08 dBm
3 Δ4 1 t (Δ) 686.0 µs (Δ) -1.23 dB
4 F 1 t 160.0 µs -68.08 dBm
5
6
7
8
9
10
11
MSG
STATUS

Band 1-n40

7. AUTOMATICALLY DISCONTINUE TRANSMISSION

7.1 LIMIT OF AUTOMATICALLY DISCONTINUE TRANSMISSION

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 to describe how this requirement is met.

7.2 TEST RESULT OF AUTOMATICALLY DISCONTINUE TRANSMISSION

During no any information transmission, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

8. ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

15.203&RSS Gen requirement: For intentional device, according to 15.203&RSS Gen: 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.

8.2 EUT ANTENNA

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

9. FREQUENCY STABILITY

9.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within +/-0.02% of the operating frequency over a temperature variation of -30 degrees to 50 degrees C at normal supply voltage,and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees.

9.2 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize,turn the EUT on and measure the operating frequency after 2,5,and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes.The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

9.3 TEST RESULT

Channel 40 (5200MHz)

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency(MHz)
138	5200.0032
120	5200.0025
102	5200.0026
Max.Deviation(MHz)	0.0032
Max.Deviation(ppm)	0.62

Rated working voltage: AC 120V/60Hz

Temperature vs. Frequency Stability

Temperature(℃)	Measurement Frequency(MHz)
-30	5200.0039
-20	5200.0032
-10	5200.0030
0	5200.0033
10	5200.0035
20	5200.0030
30	5200.0031
40	5200.0035
50	5200.0030
Max.Deviation(MHz)	0.0039
Max.Deviation(ppm)	0.75

APPENDIX - PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※