

FCC Test Report (Class II Permissive Change)

Product Name	Access Point
Model No	RocketM5 Titanium
FCC ID	SWX-RM5T-DFS

Applicant	Ubiquiti Networks, Inc.
Address	12F, No. 105, Song Ren Rd., Sin Yi District, Taipei 110, Taiwan

Date of Receipt	June 16, 2014
Issued Date	July 18, 2014
Report No.	1460432R-RFUSP05V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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Test Report

Issued Date: July 18, 2014

Report No.: 1460432R-RFUSP05V00



Product Name	Access Point
Applicant	Ubiquiti Networks, Inc.
Address	12F, No. 105, Song Ren Rd., Sin Yi District, Taipei 110, Taiwan
Manufacturer	Ubiquiti Networks, Inc.
Model No.	RocketM5 Titanium
FCC ID.	SWX-RM5T-DFS
EUT Rated Voltage	DC 24V
EUT Test Voltage	AC 120V/60Hz
Trade Name	UBIQUITI
Applicable Standard	FCC CFR Title 47 Part 15 Subpart E: 2014 ANSI C63.10: 2009 KDB 789033 D02 General UNII Test Procedures New Rules v01
Test Result	Complied

Documented By :



(Senior Adm. Specialist / Genie Chang)

Tested By :



(Engineer / Andy Lin)

Approved By :



(Director / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION	5
1.1. EUT Description.....	5
1.2. Operational Description	7
1.3. Tested System Details.....	8
1.4. Configuration of tested System	8
1.5. EUT Exercise Software	8
1.6. Test Facility	9
2. Conducted Emission.....	10
2.1. Test Equipment.....	10
2.2. Test Setup	10
2.3. Limits	11
2.4. Test Procedure	11
2.5. Uncertainty	11
2.6. Test Result of Conducted Emission.....	12
3. Maximun conducted output power	14
3.1. Test Equipment.....	14
3.2. Test Setup	14
3.3. Limits	15
3.4. Test Procedur	16
3.5. Uncertainty	16
3.6. Test Result of Maximum conducted output power.....	17
4. Peak Power Spectral Density.....	20
4.1. Test Equipment.....	20
4.2. Test Setup	20
4.3. Limits	20
4.4. Test Procedure	21
4.5. Uncertainty	21
4.6. Test Result of Peak Power Spectral Density	22
5. Radiated Emission.....	31
5.1. Test Equipment.....	31
5.2. Test Setup	31
5.3. Limits	32
5.4. Test Procedure	33
5.5. Uncertainty	33
5.6. Test Result of Radiated Emission.....	34
6. Band Edge	45
6.1. Test Equipment.....	45
6.2. Test Setup	45
6.3. Limits	46
6.4. Test Procedure	46
6.5. Uncertainty	46
6.6. Test Result of Band Edge	47
7. Frequency Stability.....	58

7.1.	Test Equipment.....	58
7.2.	Test Setup	58
7.3.	Limits	58
7.4.	Test Procedure	58
7.5.	Uncertainty	58
7.6.	Test Result of Frequency Stability.....	59
8.	EMI Reduction Method During Compliance Testing	61
Attachment 1: EUT Test Photographs		
Attachment 2: EUT Detailed Photographs		

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Access Point
Trade Name	UBIQUITI
FCC ID.	SWX-RM5T-DFS
Model No.	RocketM5 Titanium
Frequency Range	802.11a/n-20MHz: 5180-5240MHz 802.11n-40MHz: 5190-5230MHz
Number of Channels	802.11a/n-20MHz: 4, n-40MHz: 2
Data Rate	802.11a/n: 6-54Mbps, 802.11n: up to 300Mbps
Channel Control	Auto
Type of Modulation	802.11a/n:OFDM, BPSK, QPSK, 16QAM, 64QAM
Antenna type	Dish Antenna
Antenna Gain	Refer to the table “Antenna List”
Power Adapter (POE)	MFR: UBIQUITI, M/N: GP-D480-050G Input: AC 100-240V ~ 50/60Hz, 0.75A Output: DC 48V, 0.5A

Antenna List

No.	Manufacturer	Part No.	Antenna type	Peak Gain
1.	UBIQUITI	N/A	Dish Antenna	30dBi for 5.15~5.25GHz

Note: The antenna of EUT is conform to FCC 15.203

802.11a/n-20MHz Center Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 36:	5180 MHz	Channel 40:	5200 MHz	Channel 44:	5220 MHz	Channel 48:	5240 MHz

802.11n-40MHz Center Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency
Channel 38:	5190 MHz	Channel 46:	5230 MHz

Note:

1. This device is a Fixed Point-to-Point Access Point with a built-in IEEE 802.11a/n transceiver..
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report. (802.11a is 6Mbps, 802.11n-20BW is 14.4Mbps and 802.11n-40BW are 30Mbps)
4. At result of pretests, module supports dual-channel transmission, only the worst case is shown in the report. (802.11a/n is chain A)
5. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart E for Unlicensed National Information Infrastructure devices.
6. The customer no use sector antenna for this device so C2PC only use Dish antenna.
7. This is requesting a Class II permissive change for FCC ID: SWX-RM5T-DFS. Originally granted on 02/22/2013.

The differences are listed as below:

- Add the frequency band from 5180-5240MHz and 5190 – 5230MHz by software.
- All other hardware is identical with original granted.

Test Mode	Mode 1: Transmit (802.11a-6Mbps) Mode 2: Transmit (802.11n-20BW 14.4Mbps) Mode 3: Transmit (802.11n-40BW 30Mbps)
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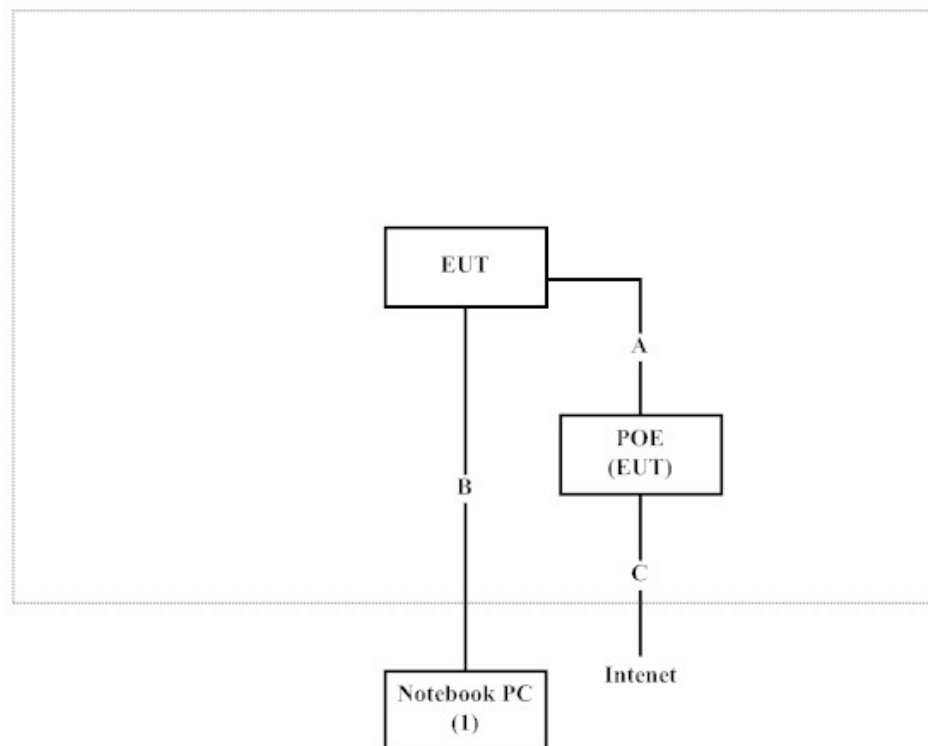
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
(1) Notebook PC	DELL	PPT	N/A	Non-Shielded, 0.8m

Signal Cable Type	Signal cable Description
A LAN Cable	Non-Shielded, 1.2m
B LAN Cable	Shielded, 1.2m
C LAN Cable	Non-Shielded, 1.8m

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT and peripherals as shown in section 1.4.
- (2) Execute “Art2-GUI V2.2” program on the Notebook PC.
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Start the continuous transmission.
- (5) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site : <http://tw.quietek.com/modules/myalbum/>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site : <http://www.quietek.com/>

Site Description: File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng Linkou Dist., New Taipei City
24451, Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

2. Conducted Emission

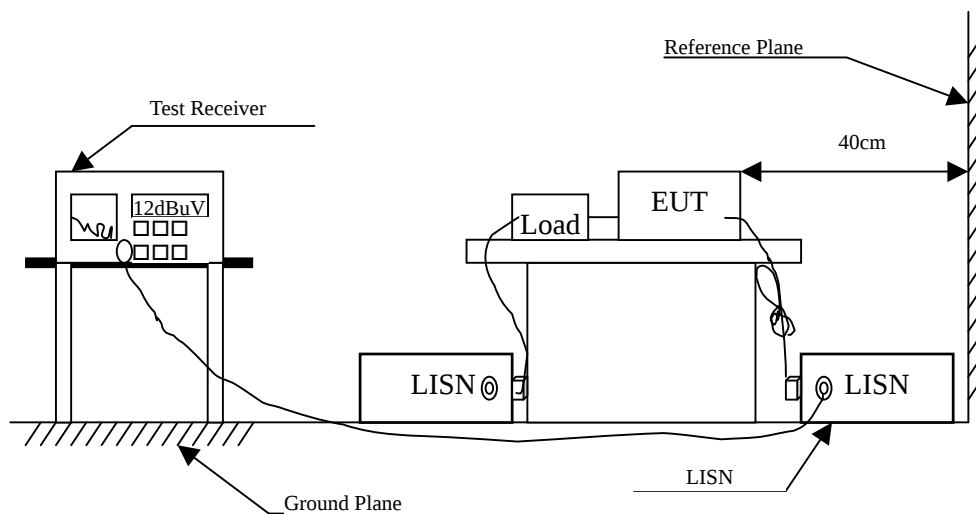
2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2013	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2014	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2014	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2014	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2014	
	No.1 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by "X" are used to measure the final test results.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks : In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2009 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.10, 2009; tested to NII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

Product : Access Point
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) (5190MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
LINE 1					
Quasi-Peak					
0.159	9.658	47.890	57.548	-8.195	65.743
0.212	9.651	39.150	48.801	-15.428	64.229
0.498	9.667	24.500	34.167	-21.890	56.057
3.611	9.822	23.030	32.852	-23.148	56.000
10.295	9.984	19.770	29.754	-30.246	60.000
18.896	10.162	23.680	33.842	-26.158	60.000
Average					
0.159	9.658	34.900	44.558	-11.185	55.743
0.212	9.651	25.600	35.251	-18.978	54.229
0.498	9.667	21.570	31.237	-14.820	46.057
3.611	9.822	15.440	25.262	-20.738	46.000
10.295	9.984	13.020	23.004	-26.996	50.000
18.896	10.162	21.870	32.032	-17.968	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Access Point
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) (5190MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.166	9.659	46.070	55.729	-9.814	65.543
0.212	9.661	39.010	48.671	-15.558	64.229
0.455	9.664	25.130	34.794	-22.492	57.286
3.560	9.821	22.730	32.551	-23.449	56.000
10.923	10.019	20.210	30.229	-29.771	60.000
18.900	10.192	23.940	34.132	-25.868	60.000
Average					
0.166	9.659	32.360	42.019	-13.524	55.543
0.212	9.661	25.680	35.341	-18.888	54.229
0.455	9.664	14.660	24.324	-22.962	47.286
3.560	9.821	15.320	25.141	-20.859	46.000
10.923	10.019	13.240	23.259	-26.741	50.000
18.900	10.192	22.770	32.962	-17.038	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Maximun conducted output power

3.1. Test Equipment

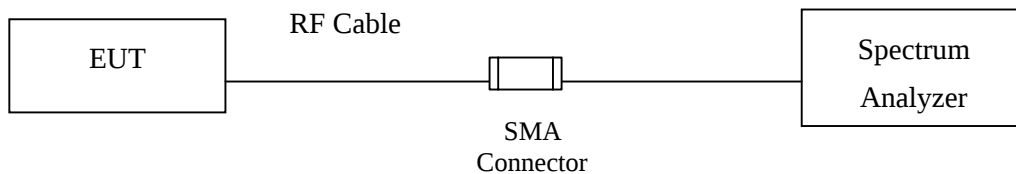
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2014
X	Power Sensor	Anritsu	MA2411B/0738448	Jun, 2014
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2014

Note:

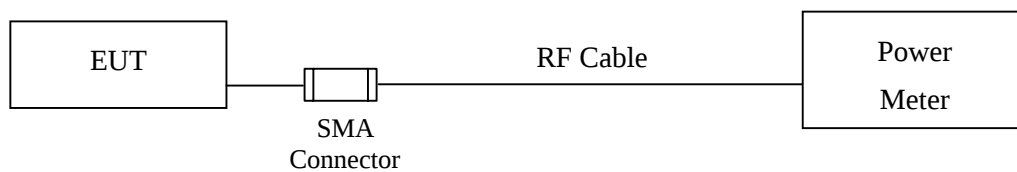
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

3.2. Test Setup

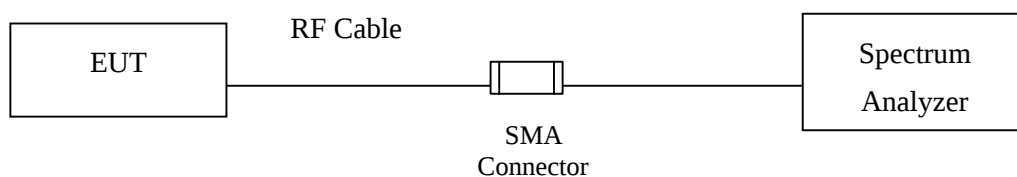
26dBc Occupied Bandwidth



Conduction Power Measurement (for 802.11an)



Conduction Power Measurement (for 802.11ac)



3.3. Limits

- (1) For the band 5.15-5.25 GHz,
 - (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
 - (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
 - (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
 - (iv) 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. In addition. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power 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 conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- (3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point UNII 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-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

3.4. Test Procedur

As an alternative to FCC KDB-789033, the EUT maximum conducted output power was measured with an average power meter employing a video bandwidth greater than 6dB BW of the emission under test. Maximum conducted output power was read directly from the meter across all data rates, and across three channels within each sub-band. Special care was used to make sure that the EUT was transmitting in continuous mode. This method exceeds the limitations of FCC KDB-789033, and provides more accurate measurements.

802.11an ($BW \leq 40\text{MHz}$) Maximum conducted output power using KDB 789033 section E)3)b) Method PM-G (Measurement using a gated RF average power meter)

Note: the power meter have a video bandwidth that is greater than or equal to the measurement bandwidth, (Anritsu/ MA2411B video bandwidth: 65MHz)

802.11ac ($BW=80\text{MHz}$) Maximum conducted output power using KDB 789033 section E)2)b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep).

When transmitted signals consist of two or more non-contiguous spectrum segments (e.g., 80+80 MHz mode) or when a single spectrum segment of a transmission crosses the boundary between two adjacent U-NII bands, KDB 644545 D01 section F) procedure is used for measurements.

3.5. Uncertainty

$\pm 1.27 \text{ dB}$

3.6. Test Result of Maximum conducted output power

Product : Access Point
Test Item : Maximum conducted output power
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps)

CHAIN A

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		6	9	12	18	24	36	48	54	
		Measurement Level (dBm)								
36	5180	8.30	--	--	--	--	--	--	--	<23dBm
44	5220	7.89	7.77	7.62	7.59	7.51	7.48	7.37	7.2	<23dBm
48	5240	8.24	--	--	--	--	--	--	--	<23dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

CHAIN B

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		6	9	12	18	24	36	48	54	
		Measurement Level (dBm)								
36	5180	1.40	--	--	--	--	--	--	--	<23dBm
44	5220	2.17	2.08	2.01	1.95	1.82	1.71	1.65	1.59	<23dBm
48	5240	2.24	--	--	--	--	--	--	--	<23dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

Maximum conducted output power Measurement:

(CHAIN A)

Channel Number	Frequency (MHz)	Output Power (dBm)	Output Power Limit	Result
			(dBm)	
36	5180	8.30	23	Pass
44	5220	7.89	23	Pass
48	5240	8.24	23	Pass

Note:

- Power Output Value =Reading value on average power meter + cable loss.
- For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi.

Product : Access Point
 Test Item : Maximum conducted output power
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps)

CHAIN A

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		14.4	28.9	43.3	57.8	86.7	115.6	130	144.4	
		Measurement Level (dBm)								
36	5180	10.17	--	--	--	--	--	--	--	<23dBm
44	5220	9.07	8.95	8.81	8.71	8.6	8.52	8.47	8.39	<23dBm
48	5240	10.17	--	--	--	--	--	--	--	<23dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

CHAIN B

Channel

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		14.4	28.9	43.3	57.8	86.7	115.6	130	144.4	
		Measurement Level (dBm)								
36	5180	3.08	--	--	--	--	--	--	--	<23dBm
44	5220	3.12	2.89	2.77	2.71	2.68	2.61	2.55	2.49	<23dBm
48	5240	2.47	--	--	--	--	--	--	--	<23dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

Maximum conducted output power Measurement:

(CHAIN A+ B)

Channel Number	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Output Power (dBm)	Output Power Limit	Result
					(dBm)	
36	5180	10.17	3.08	10.95	23	Pass
44	5220	9.07	3.12	10.05	23	Pass
48	5240	8.92	2.47	9.81	23	Pass

Note:

- Power Output Value =Reading value on average power meter + cable loss
- Output Power (dBm) = 10LOG (Chain A Power (mW)+ Chain B Power (mW))
- For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi.

Product : Access Point
 Test Item : Maximum conducted output power
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps)

CHAIN A

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		30	60	90	120	180	240	270	300	
		Measurement Level (dBm)								
38	5190	10.24	--	--	--	--	--	--	--	<23dBm
46	5230	9.34	9.29	9.18	9.09	8.99	8.89	8.81	8.74	<23dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

CHAIN B

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		30	60	90	120	180	240	270	300	
		Measurement Level (dBm)								
38	5190	3.37	--	--	--	--	--	--	--	<23dBm
46	5230	3.64	3.57	3.51	3.47	3.41	3.39	3.29	3.21	<23dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

Maximum conducted output power Measurement:

(CHAIN A+ B)

Channel Number	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Output Power (dBm)	Output Power Limit	Result
					(dBm)	
38	5190	10.24	3.37	11.05	23	Pass
46	5230	9.34	3.64	10.38	23	Pass

Note:

- Power Output Value =Reading value on average power meter + cable loss
- Output Power (dBm) = 10LOG (Chain A Power (mW)+ Chain B Power (mW))
- For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi.

4. Peak Power Spectral Density

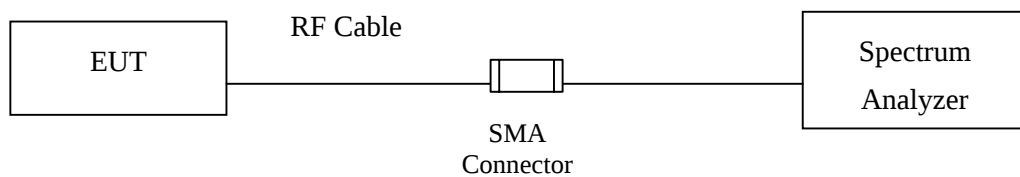
4.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2014
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2014
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr, 2014

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

4.2. Test Setup



4.3. Limits

- (1) For the band 5.15-5.25 GHz,
 - (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
 - (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
 - (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated

transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) 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, 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, 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 5.725-5.85 GHz, the maximum 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, the maximum 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 UNII 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-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

4.4. Test Procedure

The EUT was setup to ANSI C63.10, 2009; tested to NII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

The Peak Power Spectral Density using KDB 789033 section F) procedure, Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer.

SA-1 method is selected to run the test.

4.5. Uncertainty

± 1.27 dB

4.6. Test Result of Peak Power Spectral Density

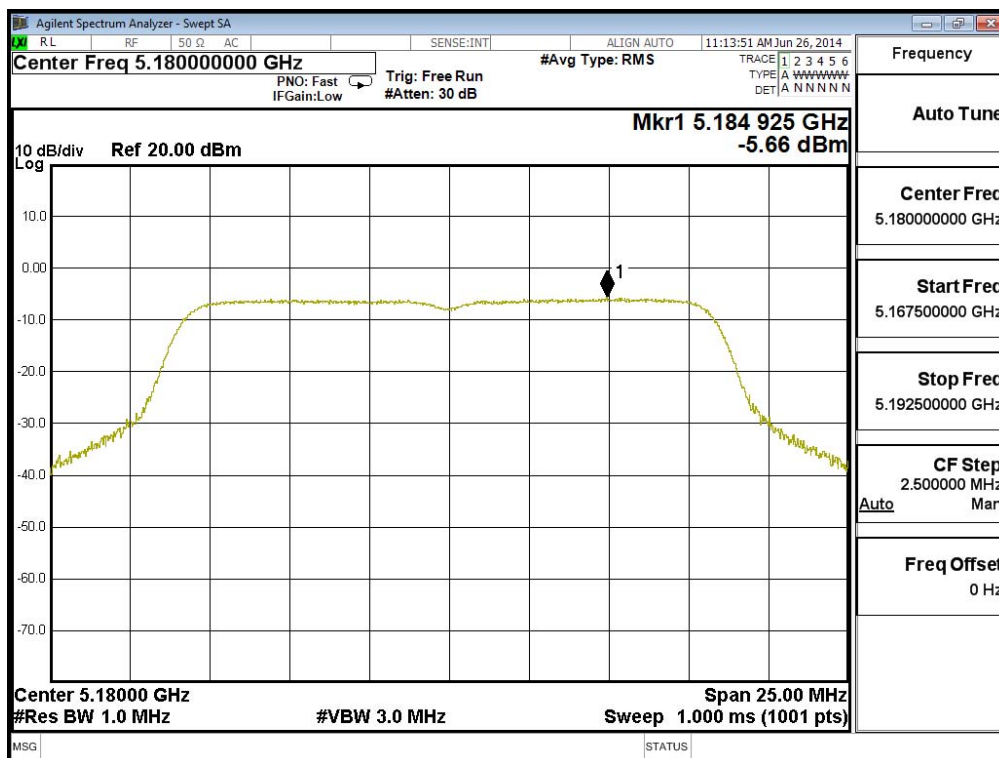
Product : Access Point
 Test Item : Peak Power Spectral Density
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11a-6Mbps)

Channel Number	Frequency (MHz)	Data Rate (Mbps)	Measurement Level (dBm)	Required Limit (dBm)	Result
36	5180	6	-5.660	<10	Pass
44	5220	6	-5.770	<10	Pass
48	5240	6	-5.130	<10	Pass

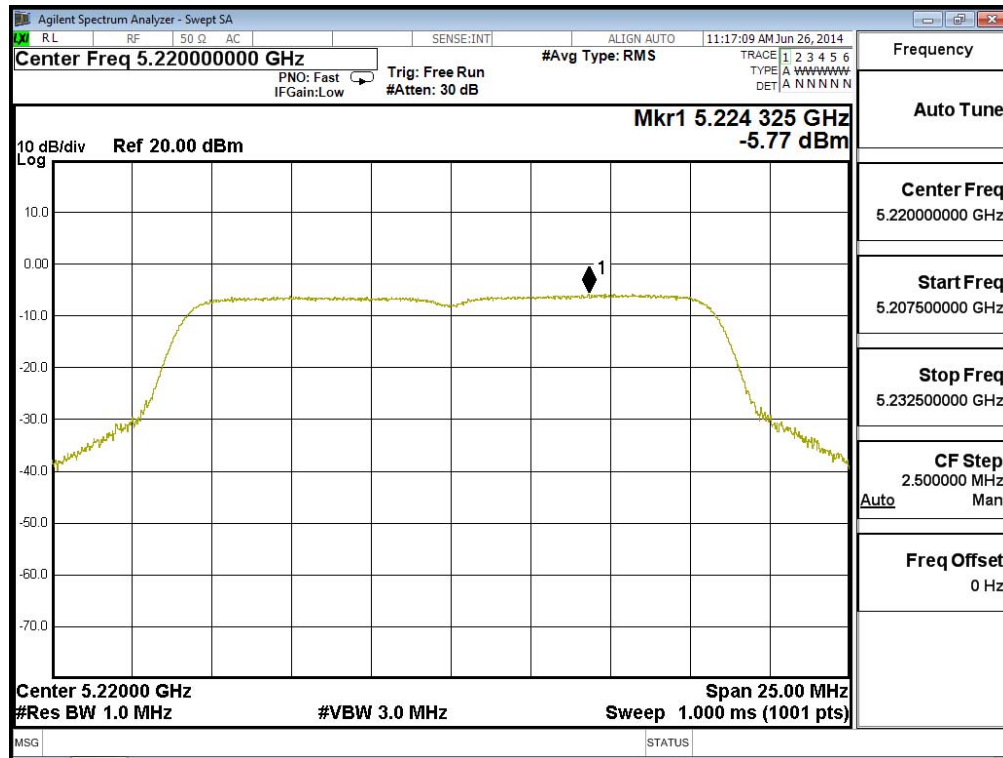
Note

- For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

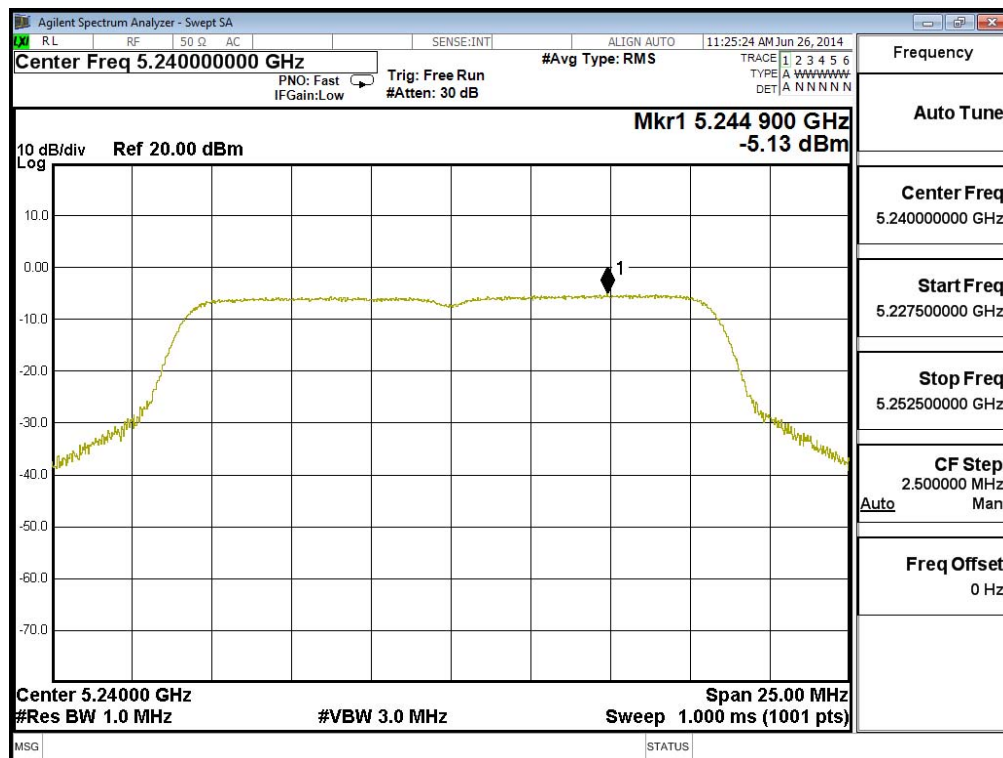
Channel 36:



Channel 44:



Channel 48:



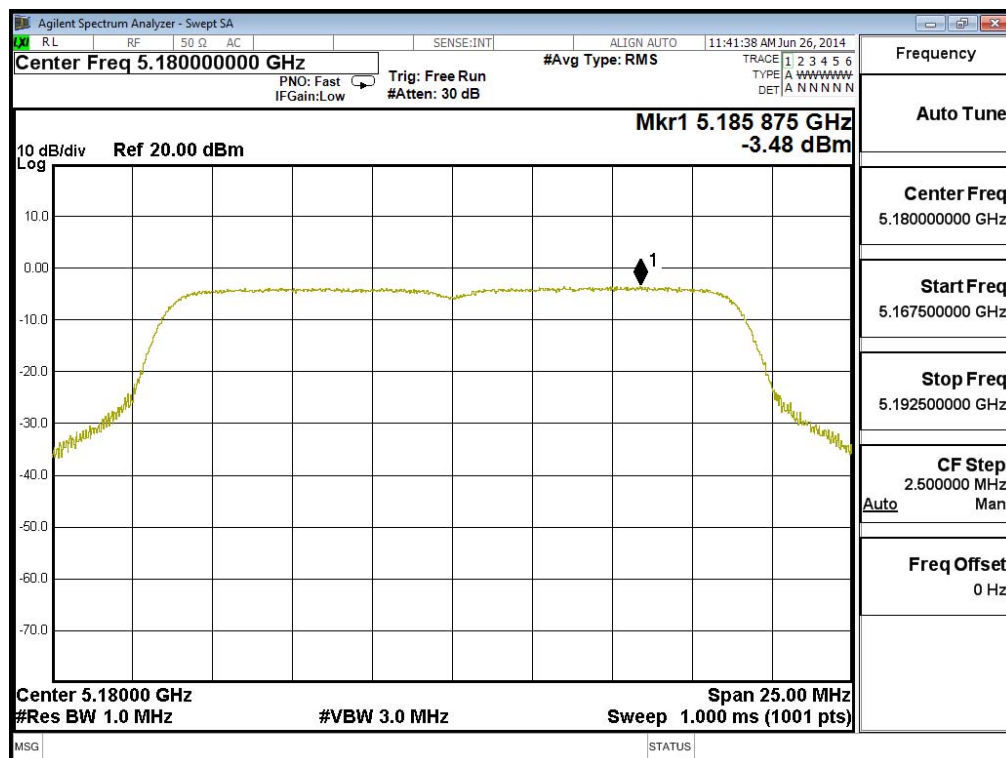
Product : Access Point
 Test Item : Peak Power Spectral Density
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps)

Channel Number	Frequency (MHz)	Chain	PPSD/MHz (dBm)	Total PPSD/MHz (dBm) ₁	Required Limit (dBm)	Result
36	5180	A	-3.480	-0.470	<10	Pass
		B	-10.480	-7.470	<10	Pass
44	5220	A	-3.540	-0.530	<10	Pass
		B	-9.510	-6.500	<10	Pass
48	5240	A	-2.660	0.350	<10	Pass
		B	-10.560	-7.550	<10	Pass

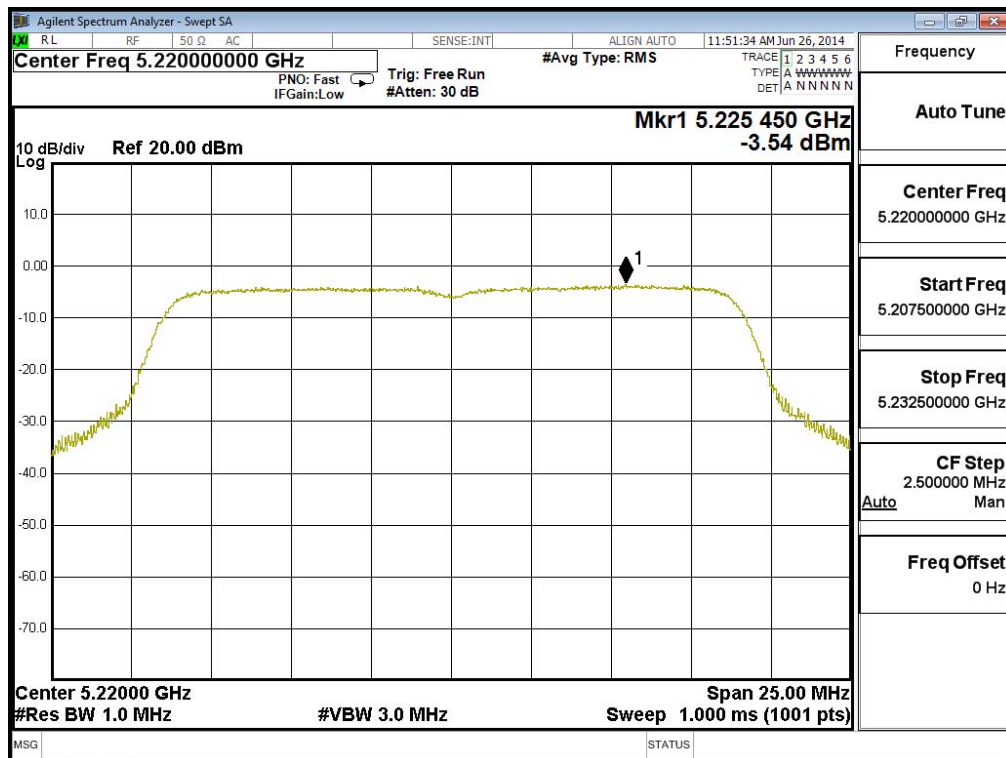
Note

1. The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.
2. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

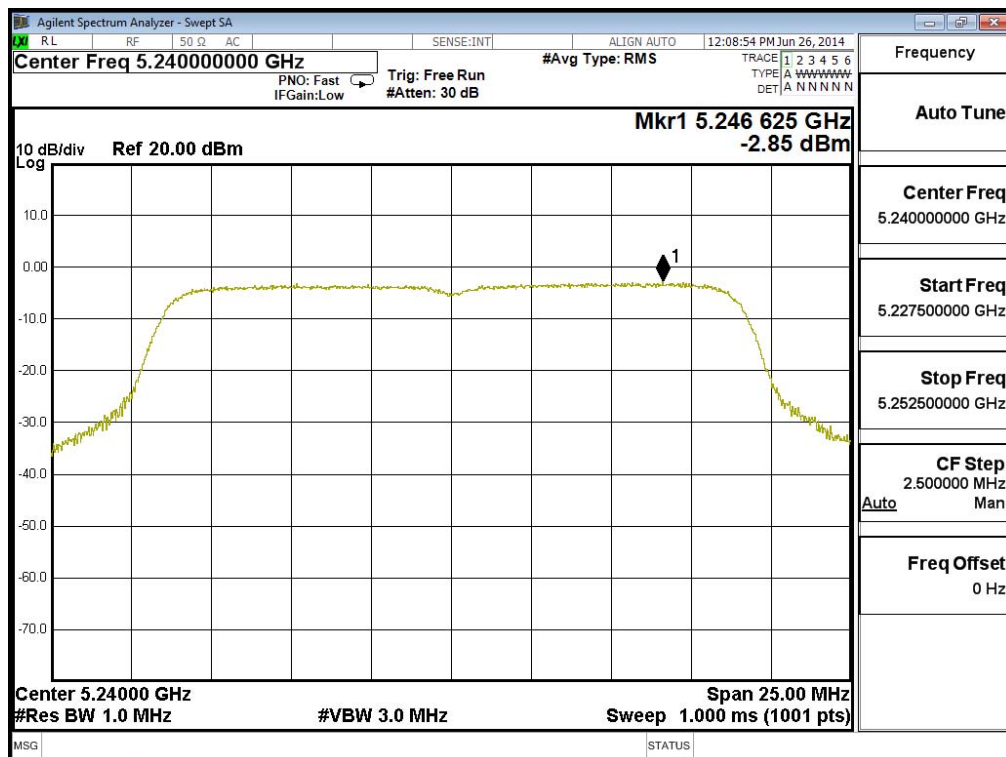
Channel 36 – Chain A



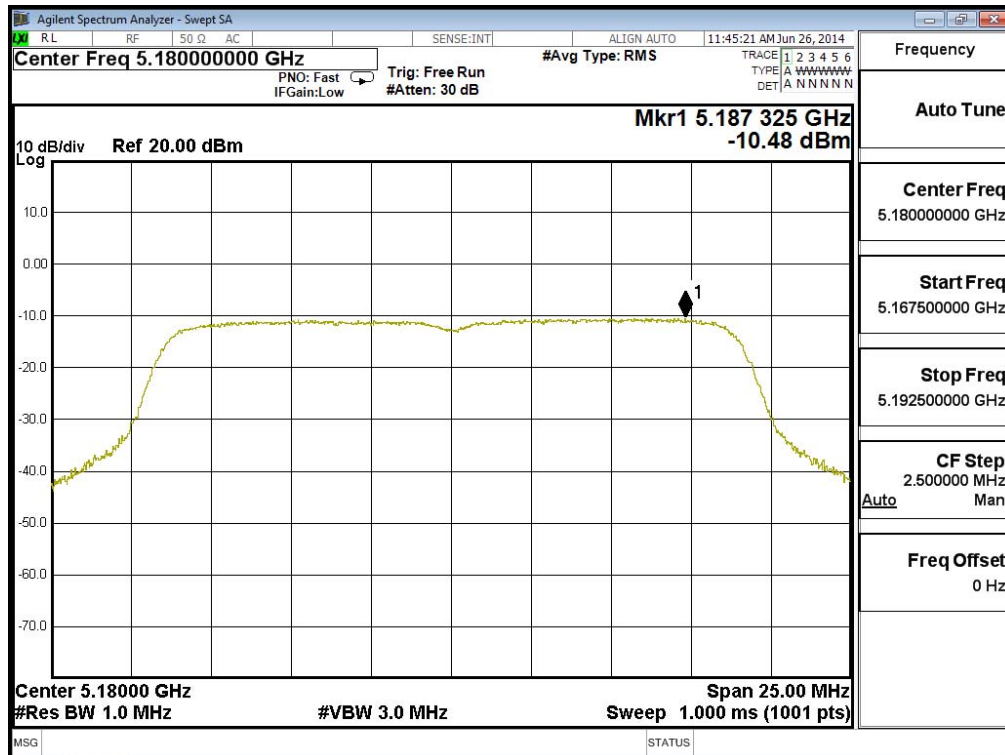
Channel 44 – Chain A



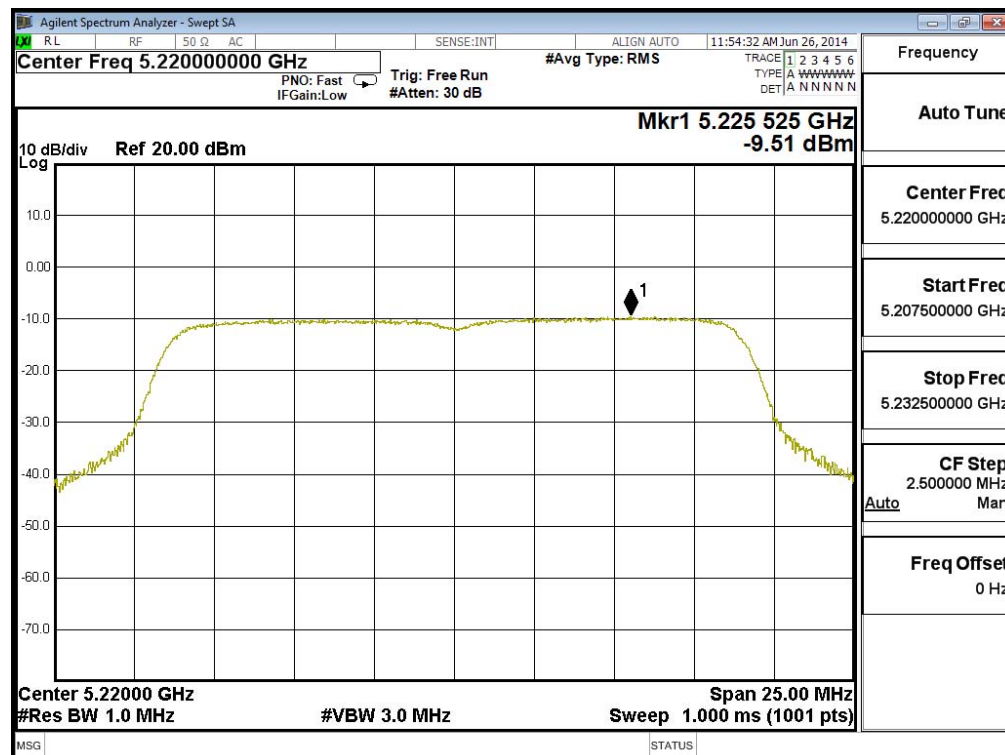
Channel 48 – Chain A



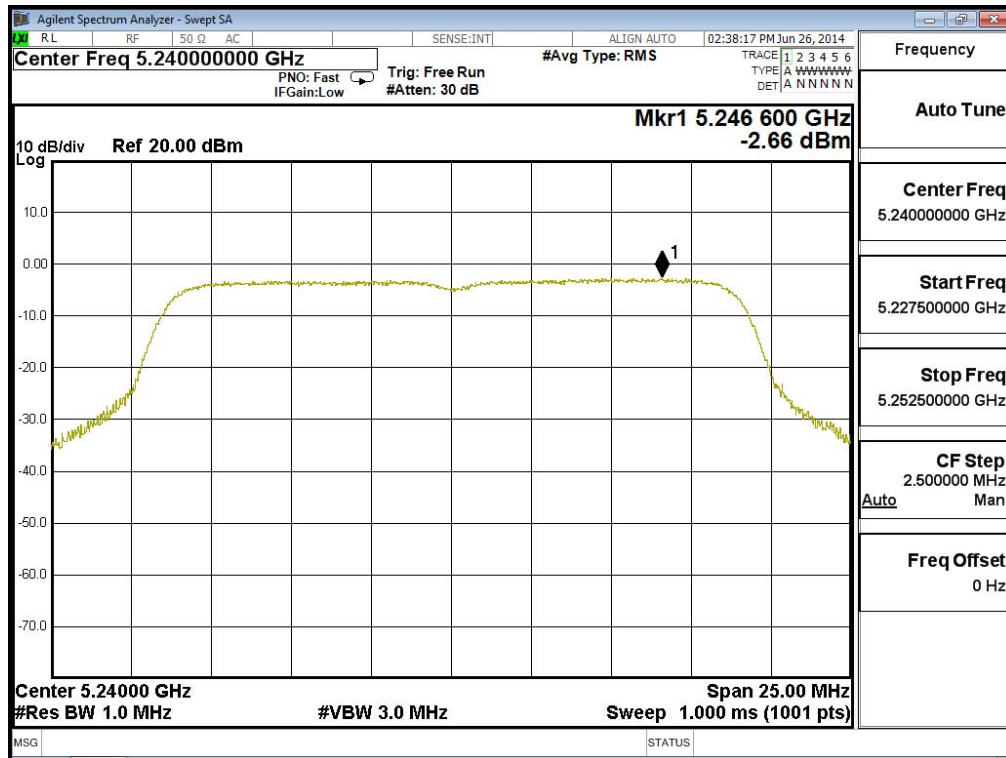
Channel 36 – Chain B



Channel 44 – Chain B



Channel 48 – Chain B



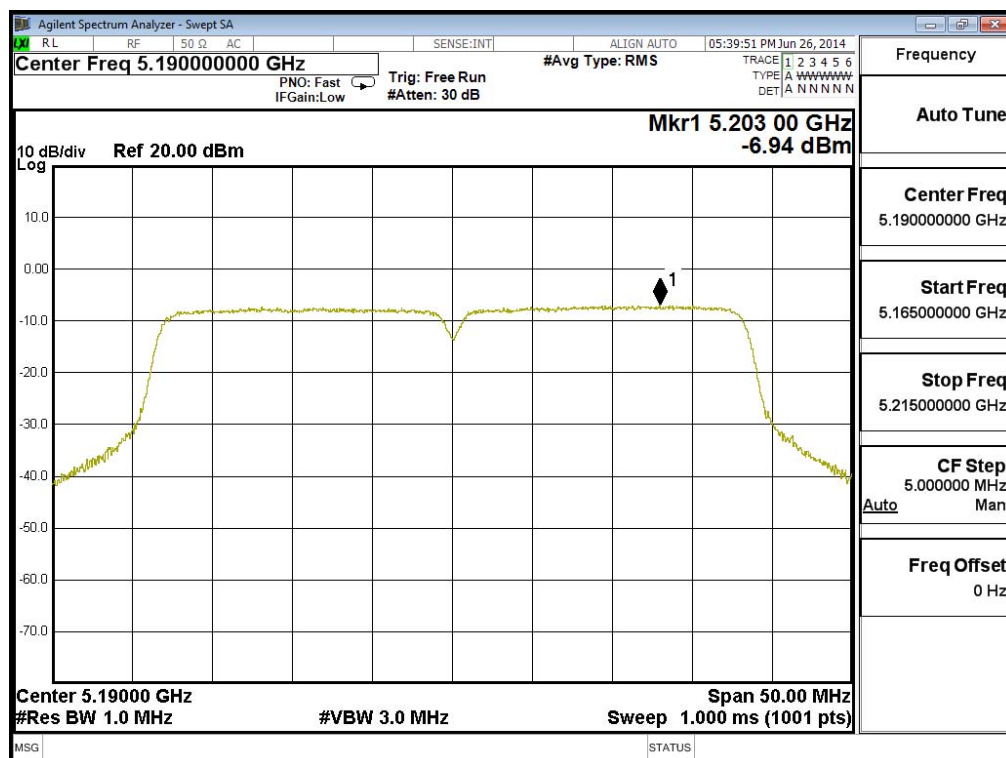
Product : Access Point
 Test Item : Peak Power Spectral Density
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps)

Channel Number	Frequency (MHz)	Chain	PPSD/MHz (dBm)	Total PPSD/MHz (dBm) ₁	Required Limit (dBm)	Result
38	5190	A	-6.940	-3.930	<10	Pass
		B	-12.390	-9.380	<10	Pass
46	5230	A	-5.710	-2.700	<10	Pass
		B	-11.520	-8.510	<10	Pass

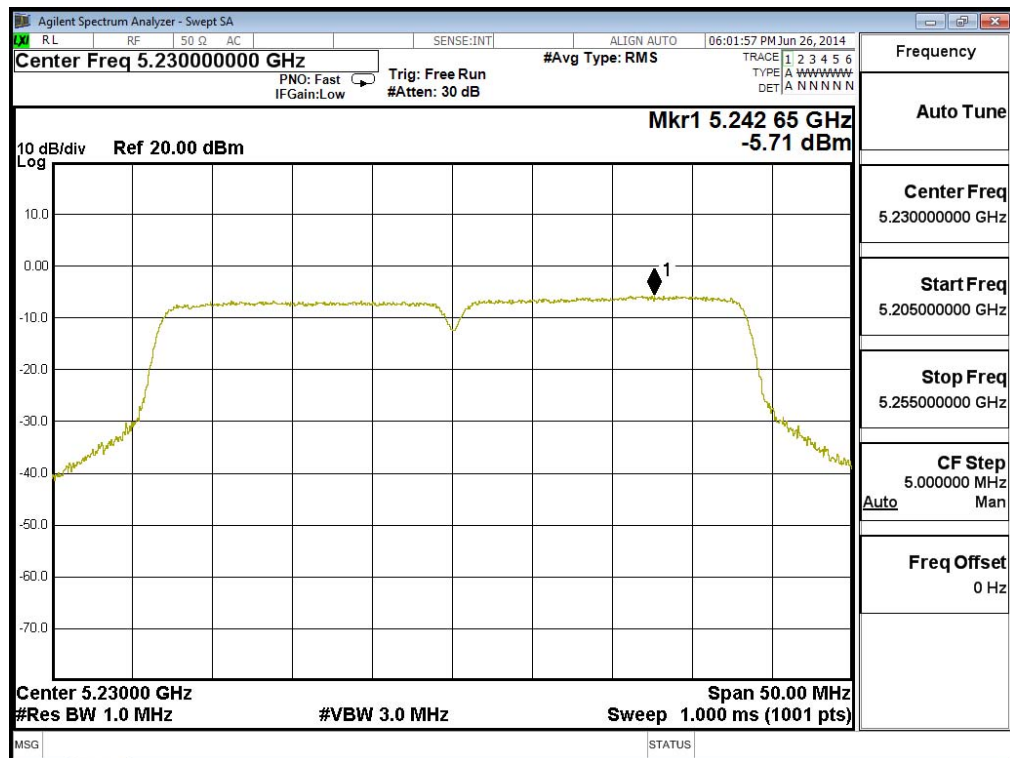
Note

- The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.
- For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

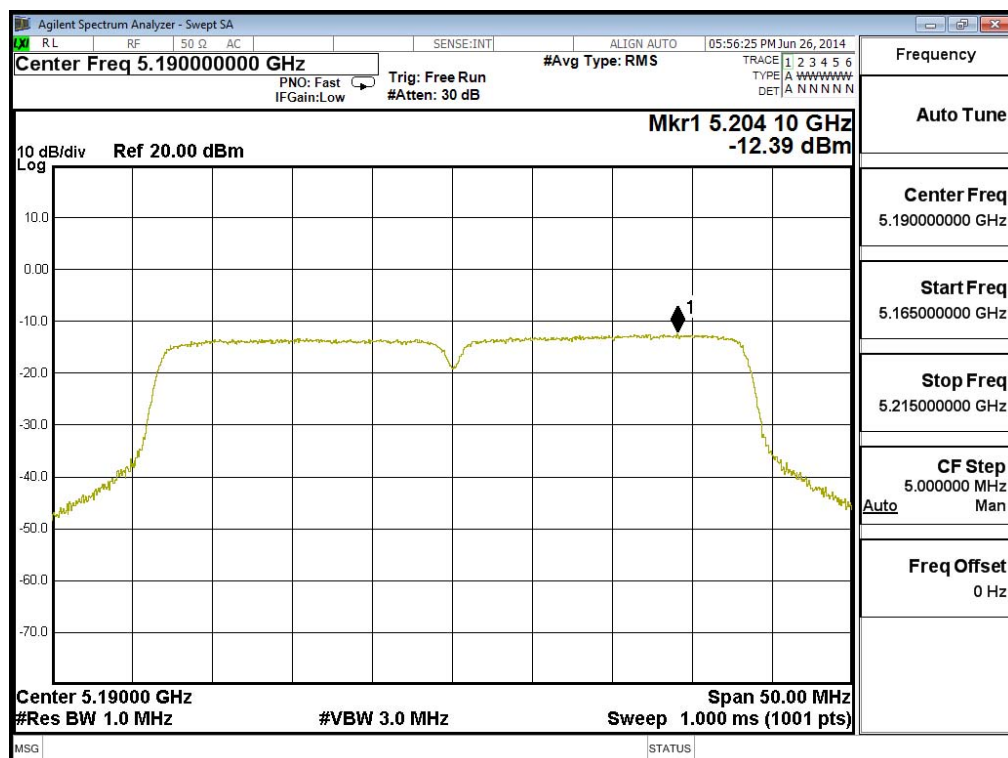
Channel 38 – Chain A



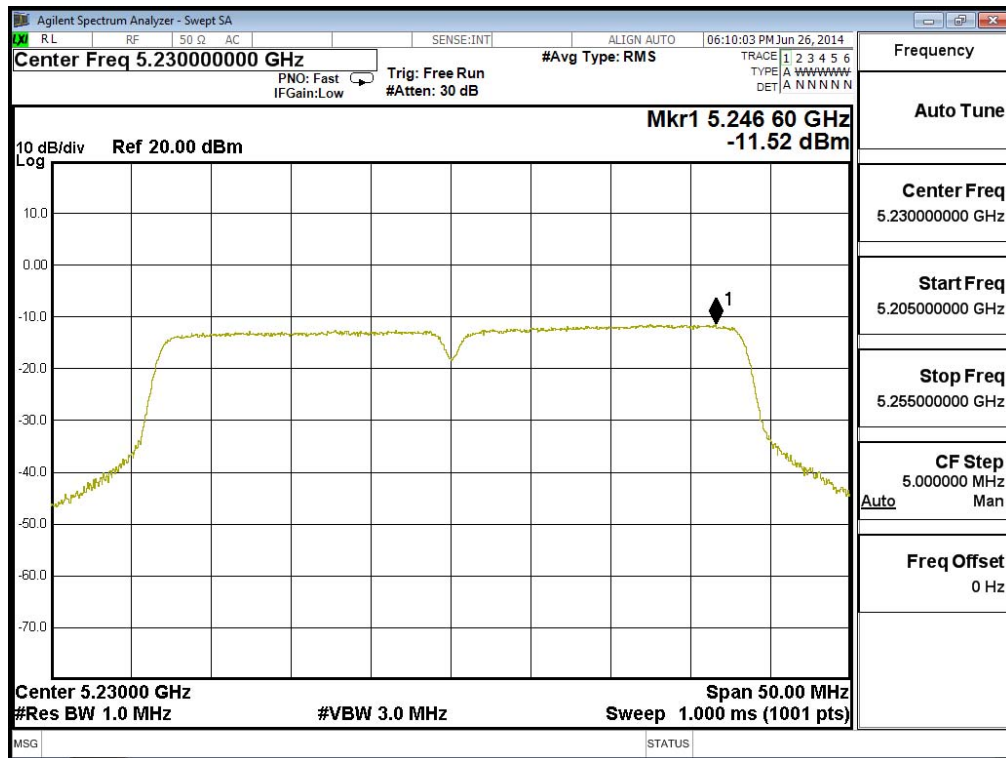
Channel 46 – Chain A



Channel 38 – Chain B



Channel 46 – Chain B



5. Radiated Emission

5.1. Test Equipment

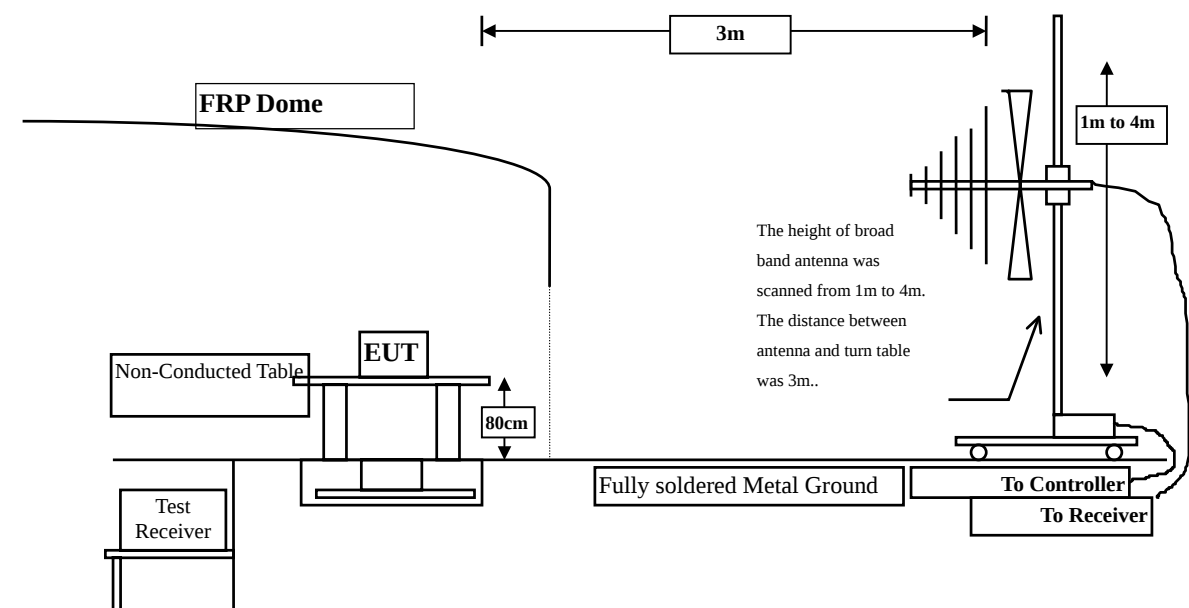
The following test equipments are used during the radiated emission test:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X	Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2014
	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2013
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2013
	X	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2014
	X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2014
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2013
	X	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2014
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2014
	X	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2013
	X	Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2014
	X	Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

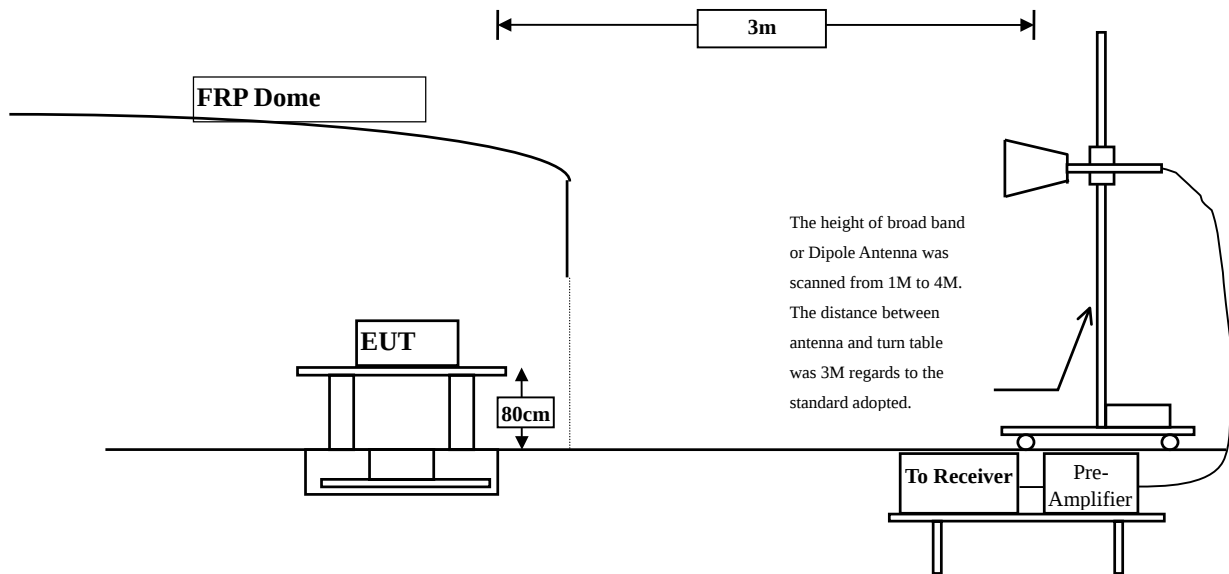
- Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

5.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



5.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dBuV/m) = 20 log E field strength (uV/m)

5.4. Test Procedure

The EUT was setup according to ANSI C63.10, 2009 and tested according to FCC KDB-789033 test procedure for compliance to FCC 47CFR 15. 407 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10, 2009 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range from 9KHz - 10th Harmonic of fundamental was investigated.

5.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

5.6. Test Result of Radiated Emission

Product : Access Point
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5180MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
10360.000	13.054	37.150	50.204	-23.796	74.000
15540.000	*	*	*	*	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
10360.000	13.848	38.020	51.868	-22.132	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5220MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
10440.000	13.462	37.590	51.051	-22.949	74.000
15600.000	*	*	*	*	74.000
20800.000	*	*	*	*	74.000
26000.000	*	*	*	*	74.000
31200.000	*	*	*	*	74.000
36400.000	*	*	*	*	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
10440.000	14.385	38.260	52.645	-21.355	74.000
20800.000	*	*	*	*	74.000
26000.000	*	*	*	*	74.000
31200.000	*	*	*	*	74.000
36400.000	*	*	*	*	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5240MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector:

10480.000	13.813	37.590	51.404	-22.596	74.000
15720.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
31440000	*	*	*	*	74.000
36680.000	*	*	*	*	74.000

Average

Detector:

--

Vertical

Peak Detector:

10480.000	14.740	38.260	53.000	-21.000	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
31440000	*	*	*	*	74.000
36680.000	*	*	*	*	74.000

Average

Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps) (5180MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector:

10360.000	13.054	38.150	51.204	-22.796	74.000
15540.000	*	*	*	*	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000

Average

Detector:

--

Vertical

Peak Detector:

10360.000	13.848	37.150	50.998	-23.002	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000

Average

Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps) (5220MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector:

10440.000	13.462	37.260	50.721	-23.279	74.000
15660.000	*	*	*	*	74.000
20880.000	*	*	*	*	74.000
26100.000	*	*	*	*	74.000
31320.000	*	*	*	*	74.000
36540.000	*	*	*	*	74.000

Average

Detector:

--

Vertical

Peak Detector:

10440.000	14.385	37.590	51.975	-22.025	74.000
20880.000	*	*	*	*	74.000
26100.000	*	*	*	*	74.000
31320.000	*	*	*	*	74.000
36540.000	*	*	*	*	74.000

Average

Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps) (5240MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
10480.000	13.813	38.560	52.374	-21.626	74.000
15720.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
31440.000	*	*	*	*	74.000
36680.000	*	*	*	*	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
10480.000	14.740	38.260	53.000	-21.000	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
31440.000	*	*	*	*	74.000
36680.000	*	*	*	*	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) (5190MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
10380.000	13.081	37.590	50.671	-23.329	74.000
15570.000	*	*	*	*	74.000
20760.000	*	*	*	*	74.000
25950.000	*	*	*	*	74.000
31140.000	*	*	*	*	74.000
36330.000	*	*	*	*	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
10380.000	13.938	37.590	51.528	-22.472	74.000
20760.000	*	*	*	*	74.000
25950.000	*	*	*	*	74.000
31140.000	*	*	*	*	74.000
36330.000	*	*	*	*	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) (5230MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector:

10460.000	13.638	37.860	51.498	-22.502	74.000
15690.000	*	*	*	*	74.000
20920.000	*	*	*	*	74.000
26150.000	*	*	*	*	74.000
31380.000	*	*	*	*	74.000
36610.000	*	*	*	*	74.000

Average

Detector:

--

Vertical

Peak Detector:

10460.000	14.563	38.060	52.623	-21.377	74.000
20920.000	*	*	*	*	74.000
26150.000	*	*	*	*	74.000
31380.000	*	*	*	*	74.000
36610.000	*	*	*	*	74.000

Average

Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Access Point
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5220MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector					
107.600	-7.058	34.548	27.490	-16.010	43.500
245.340	-6.346	37.064	30.718	-15.282	46.000
398.600	-2.268	35.449	33.181	-12.819	46.000
544.100	3.512	34.994	38.506	-7.494	46.000
689.600	3.628	35.134	38.762	-7.238	46.000
873.900	5.200	34.933	40.133	-5.867	46.000
Vertical					
Peak Detector					
99.840	-0.021	35.972	35.951	-7.549	43.500
247.280	-8.042	39.026	30.983	-15.017	46.000
326.820	-5.468	37.690	32.223	-13.777	46.000
487.840	-3.132	39.100	35.968	-10.032	46.000
582.900	-5.795	47.130	41.335	-4.665	46.000
850.620	0.392	38.154	38.546	-7.454	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

Product : Access Point
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps) (5220MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector					
103.720	-6.751	42.886	36.134	-7.366	43.500
243.400	-6.441	42.994	36.553	-9.447	46.000
359.800	-1.680	42.440	40.760	-5.240	46.000
557.680	1.971	38.962	40.933	-5.067	46.000
701.240	2.668	37.701	40.369	-5.631	46.000
903.000	5.646	32.685	38.331	-7.669	46.000
Vertical					
Peak Detector					
111.480	-0.954	38.232	37.278	-6.222	43.500
249.220	-7.634	43.517	35.883	-10.117	46.000
390.840	-3.099	41.167	38.068	-7.932	46.000
559.620	-5.246	39.774	34.528	-11.472	46.000
701.240	0.198	37.701	37.899	-8.101	46.000
850.620	0.392	38.154	38.546	-7.454	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

Product : Access Point
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) (5230MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector					
103.720	-6.751	42.886	36.134	-7.366	43.500
313.240	-4.111	41.718	37.607	-8.393	46.000
433.520	-1.972	42.517	40.545	-5.455	46.000
549.920	2.943	38.644	41.587	-4.413	46.000
716.760	3.537	36.171	39.708	-6.292	46.000
885.540	6.102	35.087	41.189	-4.811	46.000
Vertical					
Peak Detector					
119.240	-3.541	38.699	35.158	-8.342	43.500
216.240	-8.317	41.965	33.648	-12.352	46.000
450.980	-7.106	40.080	32.975	-13.025	46.000
646.920	-4.957	38.011	33.054	-12.946	46.000
837.040	2.223	38.353	40.575	-5.425	46.000
982.540	2.885	45.350	48.235	-5.765	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

6. Band Edge

6.1. Test Equipment

RF Radiated Measurement:

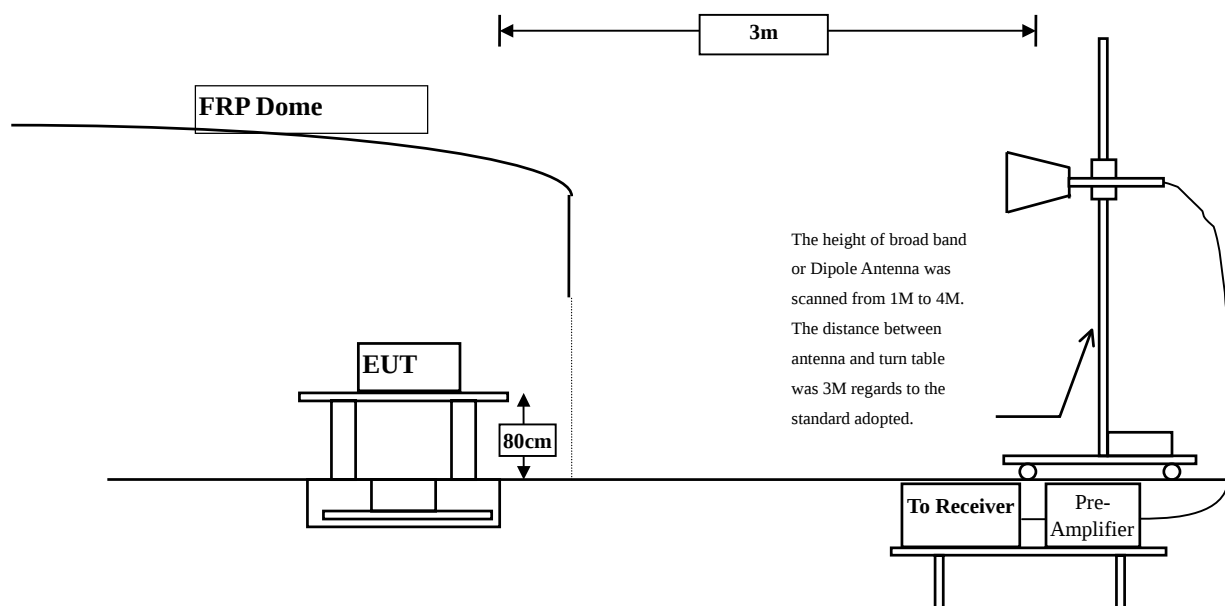
The following test equipments are used during the band edge tests:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 3		Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2013
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2013
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2014
		Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2014
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2013
		Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2014
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2014
		Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2013
	X	Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2014
	X	Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

- Note:
1. All instruments are calibrated every one year.
 2. The test instruments marked by "X" are used to measure the final test results.

6.2. Test Setup

RF Radiated Measurement:



6.3. Limits

The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209:

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks :

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

6.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10:2009 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz. The EUT was setup to ANSI C63.10, 2009; tested to NII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

6.5. Uncertainty

± 3.8 dB below 1GHz
 ± 3.9 dB above 1GHz

6.6. Test Result of Band Edge

Product : Access Point
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11a-6Mbps)-Channel 36

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
36 (Peak)	5101.840	35.379	39.814	75.193	83.54	63.54	Pass
36 (Peak)	5150.000	35.135	36.883	72.018	83.54	63.54	Pass
36 (Peak)	5182.960	34.950	90.700	125.649	--	--	--
36 (Average)	5092.480	35.366	26.337	61.703	83.54	63.54	Pass
36 (Average)	5105.920	35.364	27.154	62.519	83.54	63.54	Pass
36 (Average)	5150.000	35.135	23.964	59.099	83.54	63.54	Pass
36 (Average)	5184.880	34.939	79.475	114.414	--	--	--

Figure Channel 36: Horizontal (Peak)

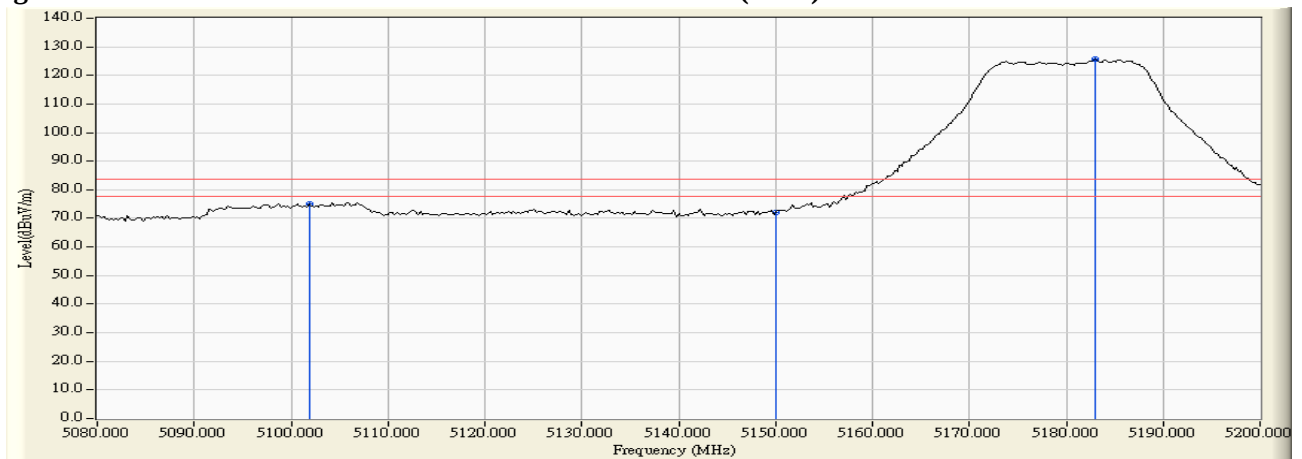
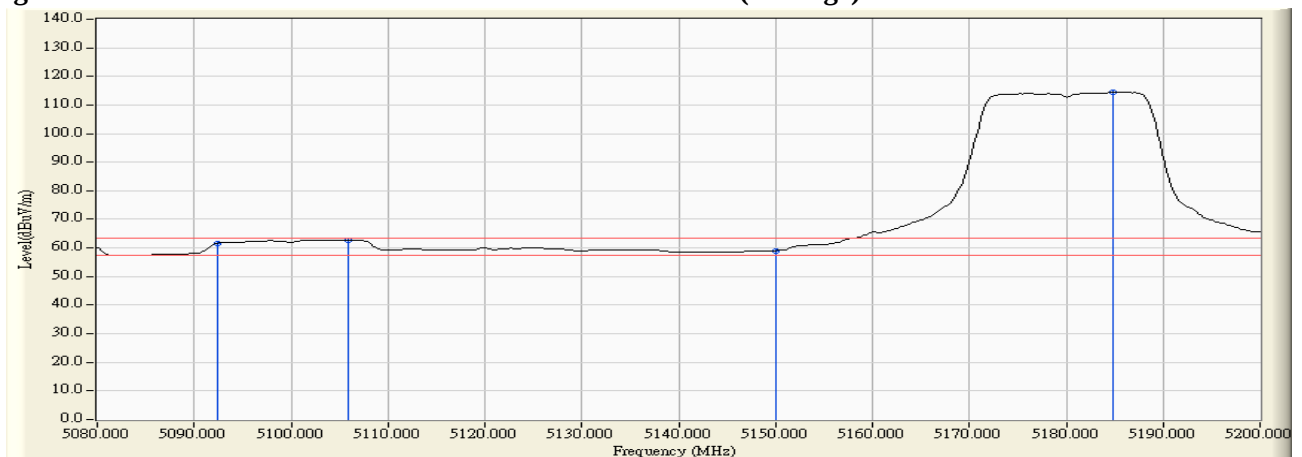


Figure Channel 36: Horizontal (Average)



- Note:1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
 4. “ * ”, means this data is the worst emission level.
 5. Measurement Level = Reading Level + Correct Factor.
 6. The average measurement was not performed when the peak measured data under the limit of average detection.
 7. Measuring distance used in 1M, PK / AVG limit increase Correct factor 9.54dB via the following formula: $20 \text{ LOG } (3\text{M}/1\text{M})=9.54\text{dB}$.

Product : Access Point
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (802.11a-6Mbps)-Channel 36

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
36 (Peak)	5146.960	37.053	32.759	69.812	83.54	63.54	Pass
36 (Peak)	5150.000	37.055	30.751	67.806	83.54	63.54	Pass
36 (Peak)	5185.120	37.077	71.992	109.069	--	--	--
36 (Average)	5150.000	37.055	19.615	56.670	83.54	63.54	Pass
36 (Average)	5175.760	37.072	61.435	98.506	--	--	--

Figure Channel 36:

Vertical (Peak)

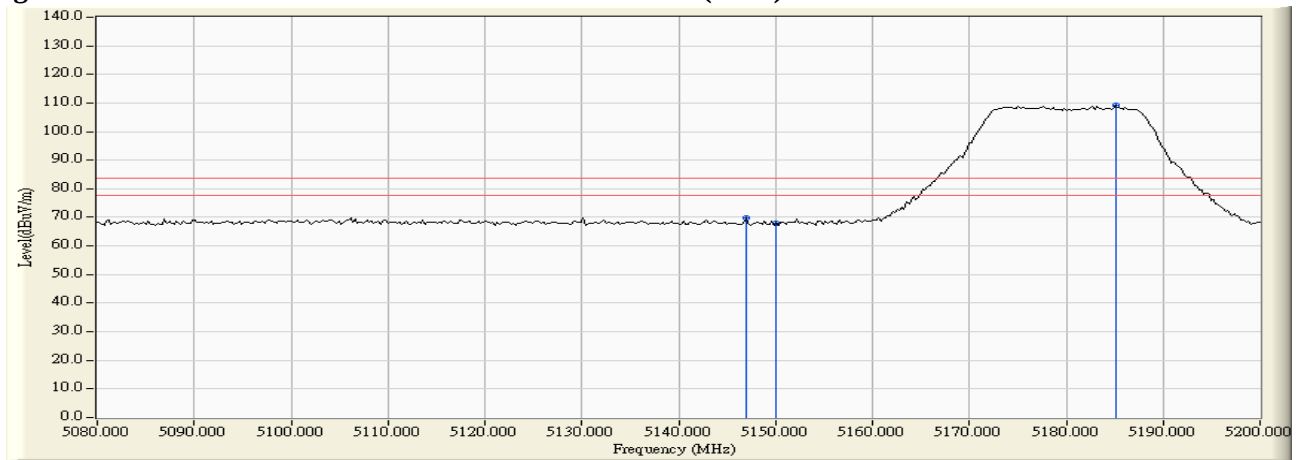
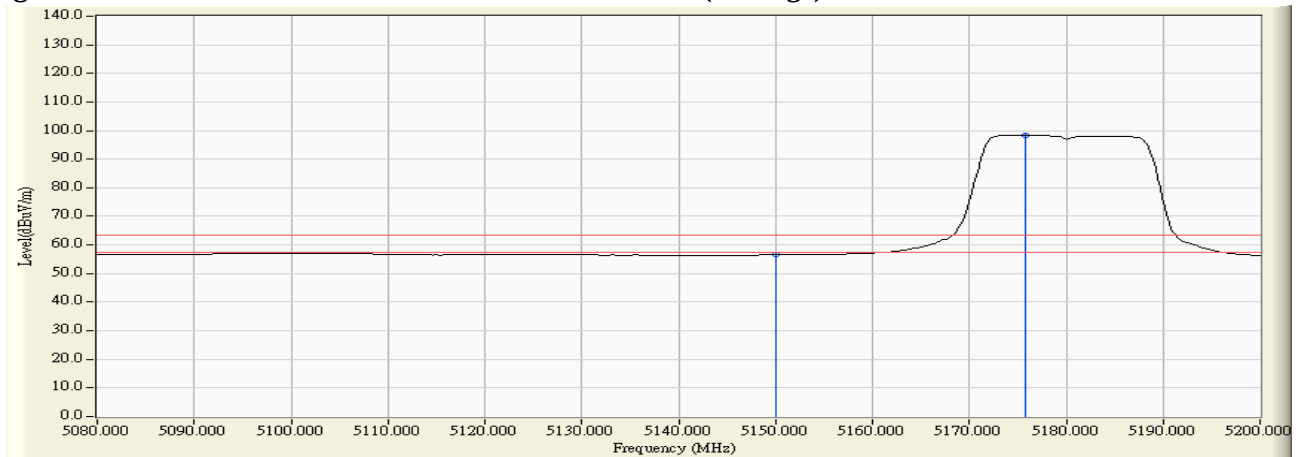


Figure Channel 36:

Vertical (Average)



Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. Measuring distance used in 1M, PK / AVG limit increase Correct factor 9.54dB via the following formula: $20 \text{ LOG } (3\text{M}/1\text{M})=9.54\text{dB}$.

Product : Access Point
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps) -Channel 36

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
36 (Peak)	5150.000	35.135	42.563	77.698	83.54	63.54	Pass
36 (Peak)	5185.600	34.935	94.455	129.390	--	--	--
36 (Average)	5104.000	35.371	27.147	62.518	83.54	63.54	Pass
36 (Average)	5150.000	35.135	26.867	62.002	83.54	63.54	Pass
36 (Average)	5185.600	34.935	79.549	114.484	--	--	--

Figure Channel 36: Horizontal (Peak)

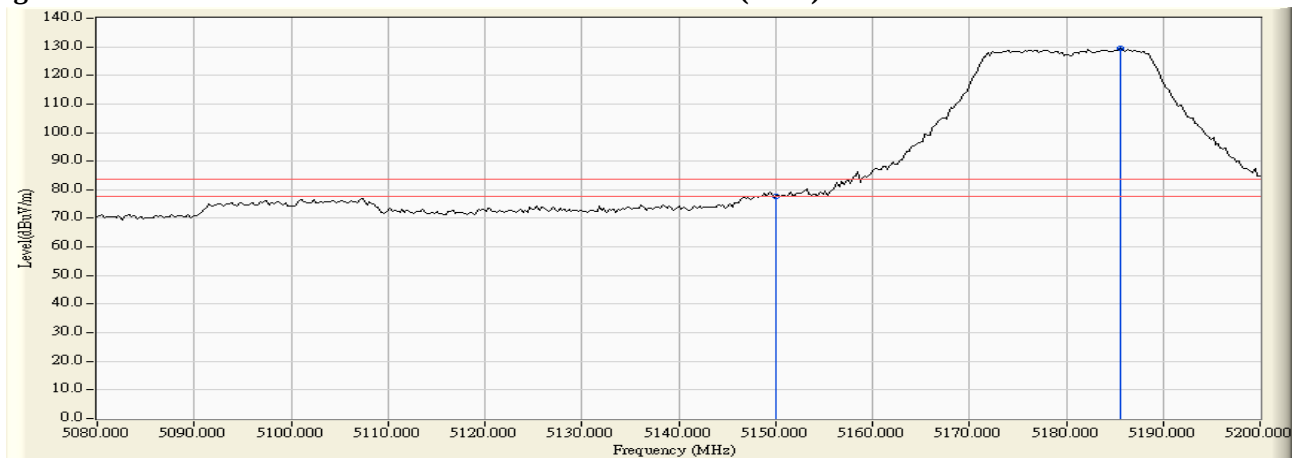
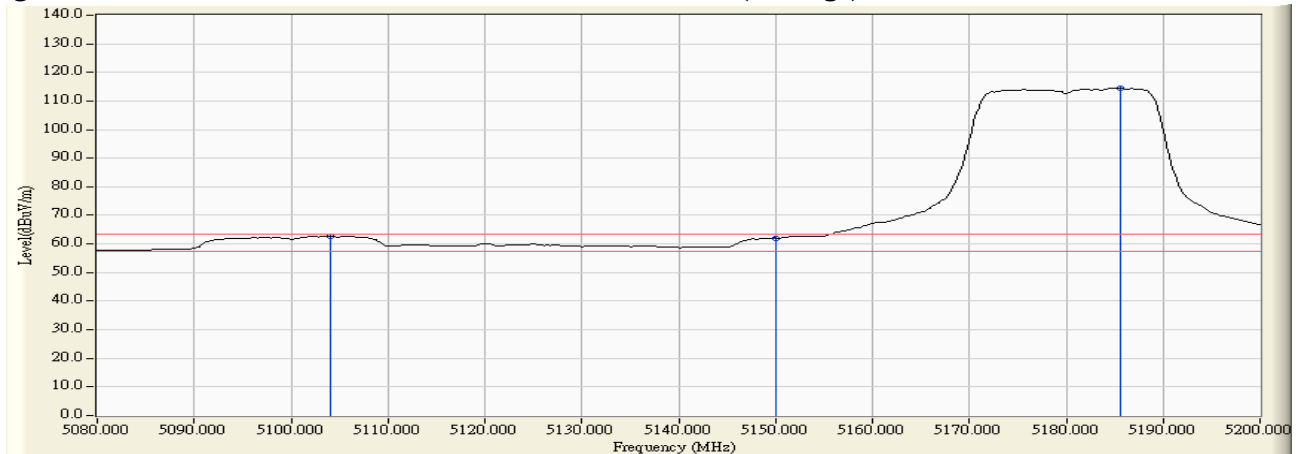


Figure Channel 36: Horizontal (Average)



Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. Measuring distance used in 1M, PK / AVG limit increase Correct factor 9.54dB via the following formula: $20 \text{ LOG } (3\text{M}/1\text{M})=9.54\text{dB}$.

Product : Access Point
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmit (802.11n-20BW 14.4Mbps) -Channel 36

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
36 (Peak)	5103.760	37.037	36.770	73.807	83.54	63.54	Pass
36 (Peak)	5150.000	37.055	34.506	71.561	83.54	63.54	Pass
36 (Peak)	5187.520	37.080	89.338	126.417	--	--	--
36 (Average)	5104.000	37.036	25.088	62.125	83.54	63.54	Pass
36 (Average)	5150.000	37.055	21.035	58.090	83.54	63.54	Pass
36 (Average)	5187.280	37.078	72.006	109.085	--	--	--

Figure Channel 36: Vertical (Peak)

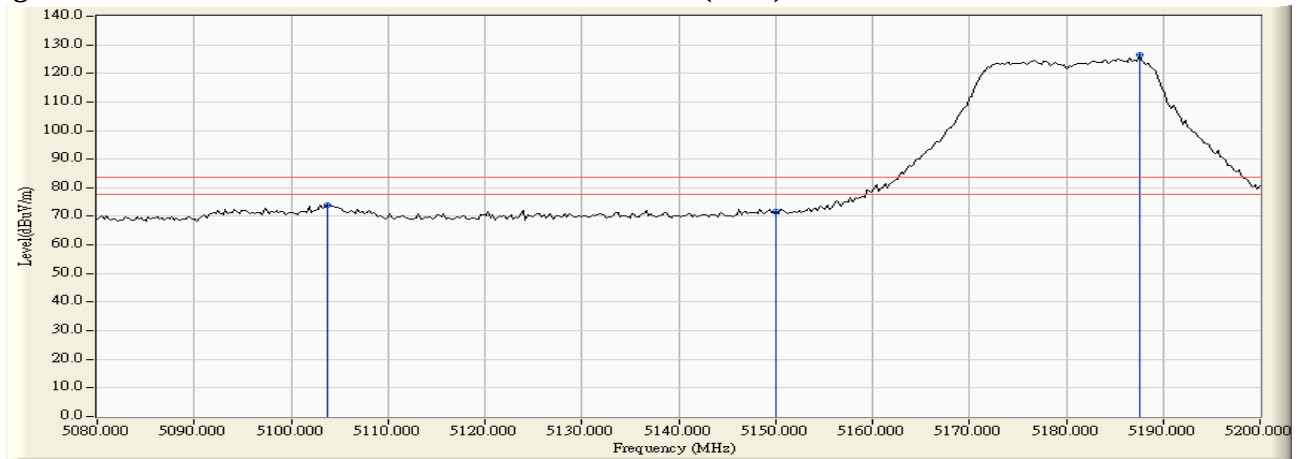
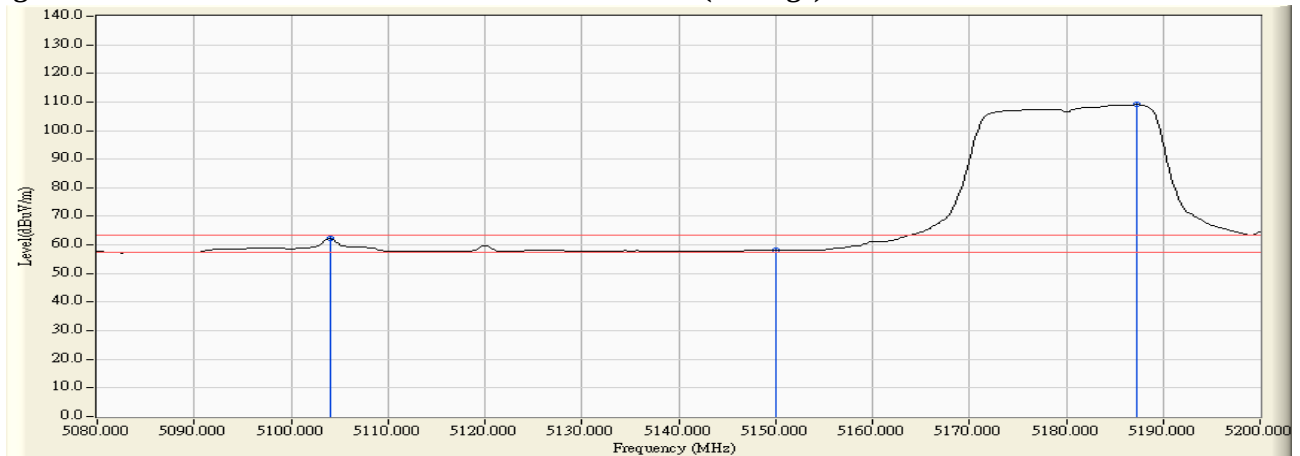


Figure Channel 36: Vertical (Average)



Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. Measuring distance used in 1M, PK / AVG limit increase Correct factor 9.54dB via the following formula: $20 \text{ LOG } (3\text{M}/1\text{M})=9.54\text{dB}$.

Product : Access Point
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) -Channel 38

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
38 (Peak)	5150.000	35.135	40.896	76.031	83.54	63.54	Pass
38 (Peak)	5180.080	34.966	84.219	119.185	--	--	--
38 (Average)	5150.000	35.135	25.400	60.535	83.54	63.54	Pass
38 (Average)	5199.040	34.848	70.862	105.710	--	--	--

Figure Channel 38:

Horizontal (Peak)

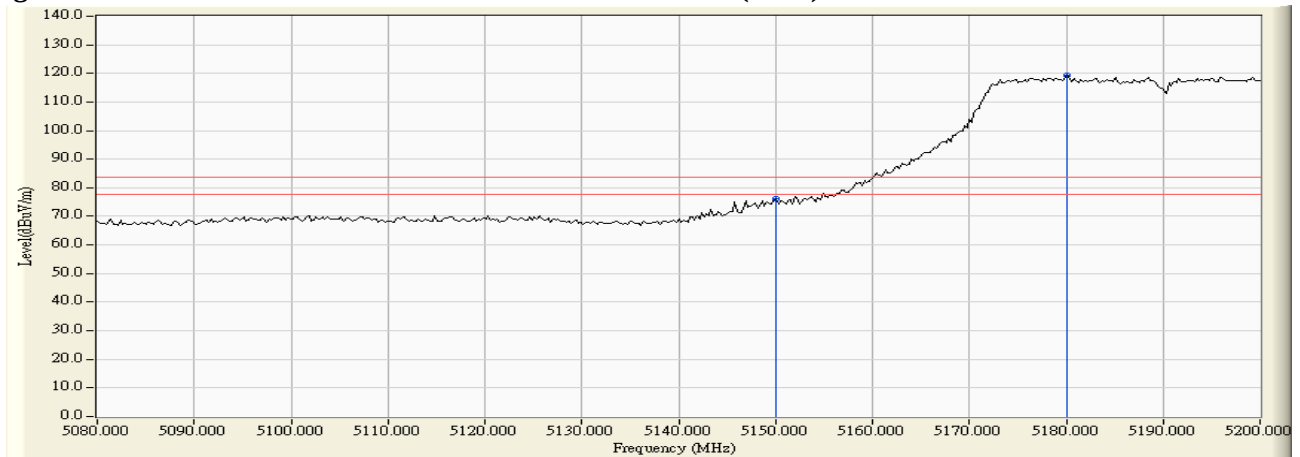
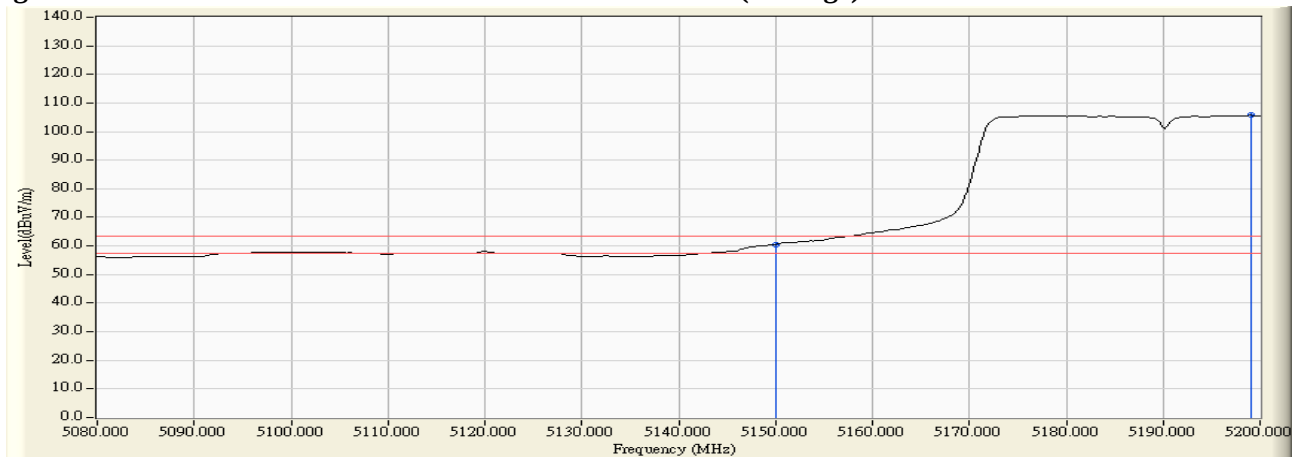


Figure Channel 38:

Horizontal (Average)



Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. Measuring distance used in 1M, PK / AVG limit increase Correct factor 9.54dB via the following formula: $20 \text{ LOG } (3\text{M}/1\text{M})=9.54\text{dB}$.

Product : Access Point
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmit (802.11n-40BW 30Mbps) -Channel 38

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
38 (Peak)	5150.000	37.055	40.185	77.240	83.54	63.54	Pass
38 (Peak)	5198.800	37.075	86.379	123.454	--	--	--
38 (Average)	5103.760	37.037	24.609	61.646	83.54	63.54	Pass
38 (Average)	5120.080	37.035	25.303	62.338	83.54	63.54	Pass
38 (Average)	5150.000	37.055	22.126	59.181	83.54	63.54	Pass
38 (Average)	5199.040	37.075	69.999	107.074	--	--	--

Figure Channel 38: Vertical (Peak)

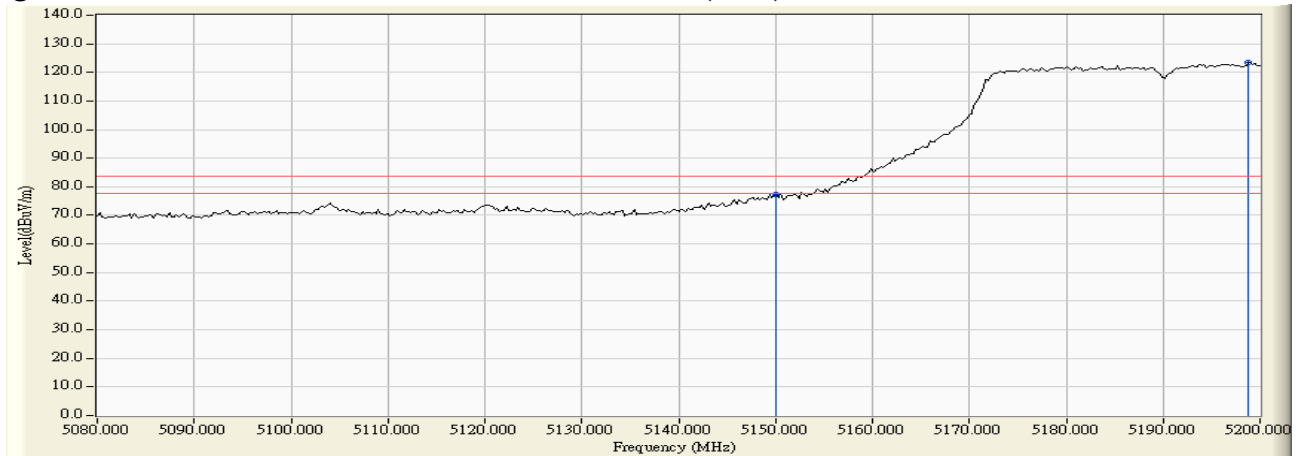
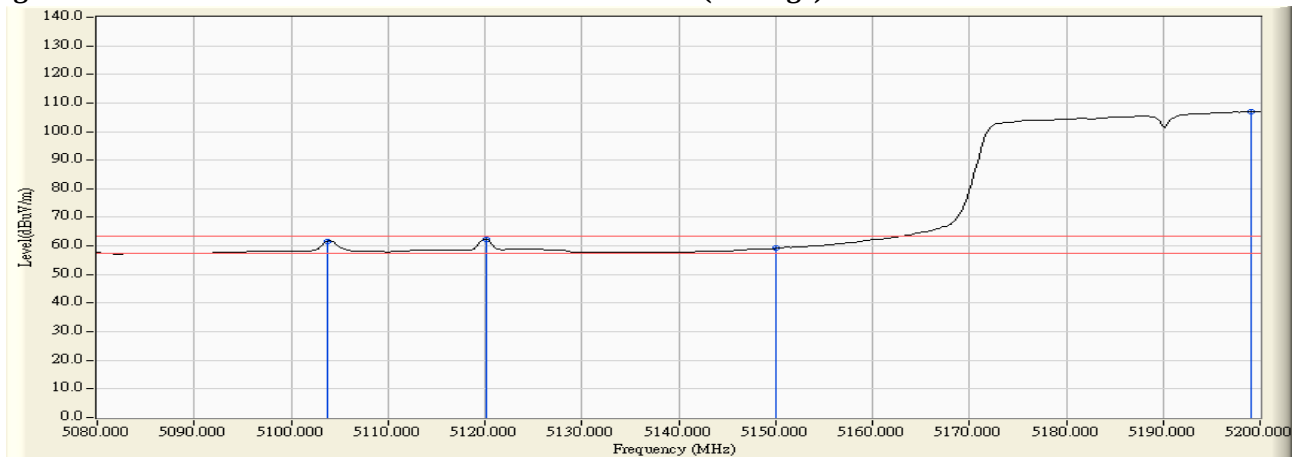


Figure Channel 38: Vertical (Average)



Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. Measuring distance used in 1M, PK / AVG limit increase Correct factor 9.54dB via the following formula: $20 \text{ LOG } (3\text{M}/1\text{M})=9.54\text{dB}$.

7. Frequency Stability

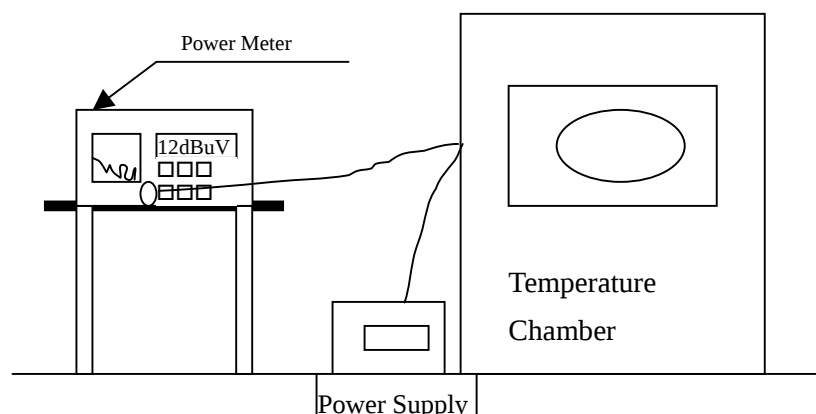
7.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2014
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2014
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2014

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

7.2. Test Setup



7.3. Limits

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

7.4. Test Procedure

The EUT was setup to ANSI C63.10, 2009; tested to NII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

7.5. Uncertainty

± 150 Hz

7.6. Test Result of Frequency Stability

Product : Access Point
 Test Item : Frequency Stability
 Test Site : Temperature Chamber
 Test Mode : Carrier Wave

Chain A

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	ΔF (MHz)
Tnom (20) °C	Vnom (120)V	36	5180.0000	5180.0067	-0.0067
		38	5190.0000	5190.0040	-0.0040
		44	5220.0000	5220.0092	-0.0092
		46	5230.0000	5230.0054	-0.0054
		48	5240.0000	5240.0088	-0.0088
Tmax (50) °C	Vmax (138)V	36	5180.0000	5180.0063	-0.0063
		38	5190.0000	5190.0044	-0.0044
		44	5220.0000	5220.0088	-0.0088
		46	5230.0000	5230.0074	-0.0074
		48	5240.0000	5240.0059	-0.0059
Tmax (50) °C	Vmin (102)V	36	5180.0000	5180.0057	-0.0057
		38	5190.0000	5190.0077	-0.0077
		44	5220.0000	5220.0072	-0.0072
		46	5230.0000	5230.0070	-0.0070
		48	5240.0000	5240.0081	-0.0081
Tmin (0) °C	Vmax (138)V	36	5180.0000	5180.0054	-0.0054
		38	5190.0000	5190.0071	-0.0071
		44	5220.0000	5220.0092	-0.0092
		46	5230.0000	5230.0072	-0.0072
		48	5240.0000	5240.0068	-0.0068
Tmin (0) °C	Vmin (102)V	36	5180.0000	5180.0054	-0.0054
		38	5190.0000	5190.0071	-0.0071
		44	5220.0000	5220.0092	-0.0092
		46	5230.0000	5230.0072	-0.0072
		48	5240.0000	5240.0068	-0.0068

Chain B

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	ΔF (MHz)
Tnom (20) °C	Vnom (120)V	36	5180.0000	5180.0051	-0.0051
		38	5190.0000	5190.0055	-0.0055
		44	5220.0000	5220.0082	-0.0082
		46	5230.0000	5230.0061	-0.0061
		48	5240.0000	5240.0039	-0.0039
Tmax (50) °C	Vmax (138)V	36	5180.0000	5180.0081	-0.0081
		38	5190.0000	5190.0049	-0.0049
		44	5220.0000	5220.0071	-0.0071
		46	5230.0000	5230.0049	-0.0049
		48	5240.0000	5240.0061	-0.0061
Tmax (50) °C	Vmin (102)V	36	5180.0000	5180.0052	-0.0052
		38	5190.0000	5190.0067	-0.0067
		44	5220.0000	5220.0054	-0.0054
		46	5230.0000	5230.0068	-0.0068
		48	5240.0000	5240.0063	-0.0063
Tmin (0) °C	Vmax (138)V	36	5180.0000	5180.0072	-0.0072
		38	5190.0000	5190.0072	-0.0072
		44	5220.0000	5220.0089	-0.0089
		46	5230.0000	5230.0071	-0.0071
		48	5240.0000	5240.0075	-0.0075
Tmin (0) °C	Vmin (102)V	36	5180.0000	5180.0063	-0.0063
		38	5190.0000	5190.0071	-0.0071
		44	5220.0000	5220.0089	-0.0089
		46	5230.0000	5230.0075	-0.0075
		48	5240.0000	5240.0071	-0.0071

8. EMI Reduction Method During Compliance Testing

No modification was made during testing.