FCC Test Report
(Class II Permissive Change)

Product Name	IEEE 802.11a/b/g miniPCI module
Model No	WAPA003
FCC ID	SLE-WAPA003

Applicant	MOXA Inc.
Address	FL.4, NO. 135. LANE 235, BAOQIAO RD. XINDIAN DIST.,NEW TAIPEI CITY, TAIWAN

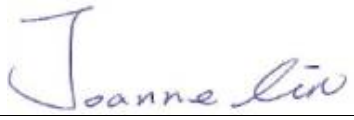
Date of Receipt	Mar. 16, 2015
Issued Date	May 08, 2015
Report No.	1530322R-RFUSP06V00
Report Version	V1.0

Testing Laboratory
3023

Test Report

Issued Date: May 08, 2015
Report No.: 1530322R-RFUSP06V00

Product Name	IEEE 802.11a/b/g miniPCI module
Applicant	MOXA Inc.
Address	FL.4, NO. 135. LANE 235, BAOQIAO RD. XINDIAN DIST.,NEW TAIPEI CITY, TAIWAN
Manufacturer	MOXA Inc.
Model No.	WAPA003
FCC ID.	SLE-WAPA003
EUT Rated Voltage	DC 3.3V(Power by PCI-E)
EUT Test Voltage	DC 3.3V(Power by PCI-E)
Trade Name	MOXA
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2014 ANSI C63.4: 2009, C63.10: 2009 789033 D02 General UNII Test Procedures New Rules v01
Test Result	Complied

Documented By : 

(Senior Adm. Specialist / Joanne Lin)

Tested By : 

(Engineer / Jack Hsu)

Approved By : 

(Director / Vincent Lin)

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Description Page

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	IEEE 802.11a/b/g miniPCI module
Trade Name	MOXA
FCC ID.	SLE-WAPA003
Model No.	WAPA003
Frequency Range	802.11a: 5180-5240MHz, 5745-5825MHz
Number of Channels	802.11a: 9
Data Rate	802.11a: 6 - 54Mbps
Type of Modulation	802.11a: OFDM, BPSK, QPSK, 16QAM, 64QAM
Antenna type	Dipole Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Antenna type	Peak Gain
1	KINSUN	SMA-Male-RP (main)(aux)	Dipole	2dBi for 2.4GHz 2dBi for 5GHz
2	KINSUN	ANT-WSB-ANM-05 (main)(aux)	Dipole	5dBi for 2.4GHz
3	KINSUN	ANT-WDB-ANM-0609 (main)(aux)	Dipole	6dBi for 2.4GHz 9dBi for 5GHz

Note:

1. The antenna of EUT is conform to FCC 15.203
2. Only the higher gain antenna was tested and recorded in this report.
3. When the device equipped with single band antenna (2.4GHz band only), then the 5GHz band function will be disabled.

802.11a 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
Channel 149:	5745 MHz	Channel 153:	5765 MHz	Channel 157:	5785 MHz	Channel 161:	5805 MHz
Channel 165:	5825 MHz						

Note:

1. This device is a IEEE 802.11a/b/g miniPCI module with a built-in 2.4GHz and 5GHz WLAN transceiver, this report for 5GHz.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. At result of pretests, module supports dual-channel transmission, only the worst case is shown in the report. (802.11a is chain A)
4. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report. (802.11a is 6Mbps)
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. This is requesting a Class II permissive change for FCC ID: SLE-WAPA003.
   The differences are listed as below:

(1) Original grant compliance band 1 and band 3 are following old rule of UNII requirements, changed to meet the requirements of the new rules, and all other hardware is identical with original granted.

(2) Band 2a and Band 2c UNII requirements haven't changed, the test data is not presented in the test report.

Test Mode	Mode 1: Transmit (802.11a-6Mbps)

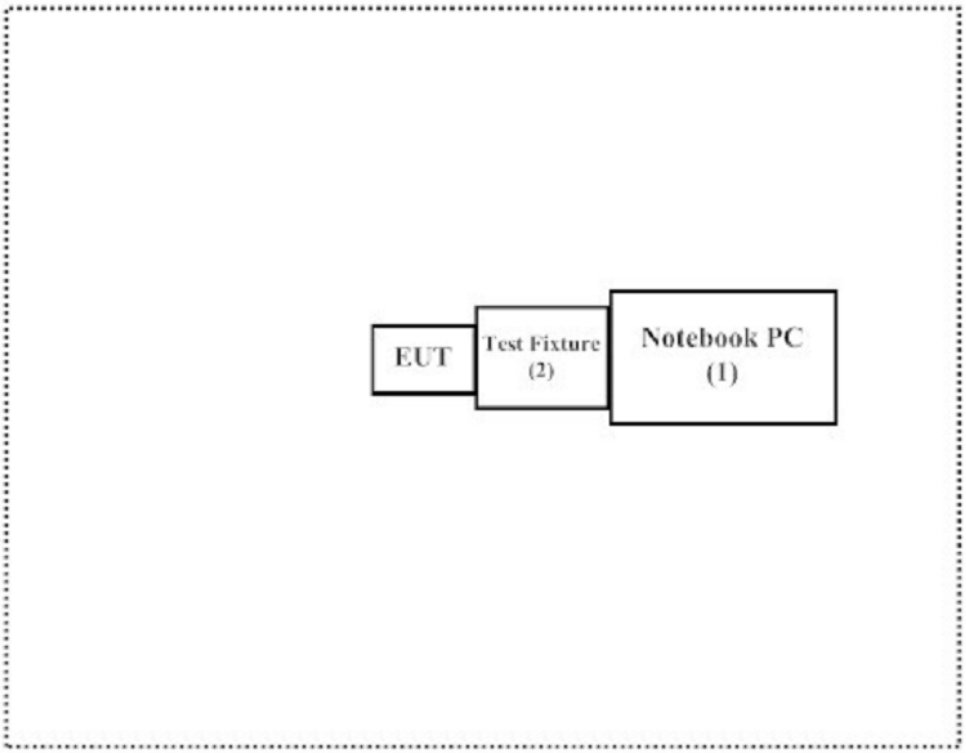
1.3. Tested System Datails

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
2	Test Fixture	MOXA	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
N/A	

1.4. Configuration of tested System



1.5. EUT Exercise Software

(1) Setup the EUT as shown in Section 1.4
(2) Execute “Hyperterminal V5.1” 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://www.quietek.com/chinese/about/certificates.aspx?bval=5
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. Maximun conducted output power

2.1. Test Equipment

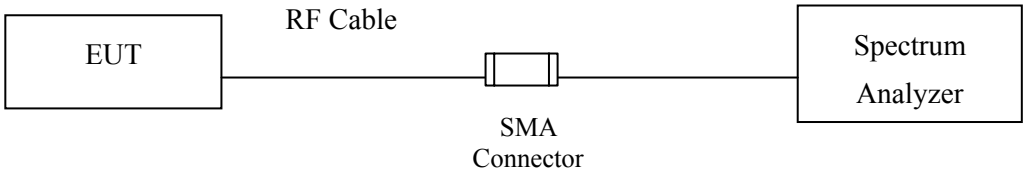
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2015
X	Power Sensor	Anritsu	MA2411B/0738448	Jun., 2014
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note:

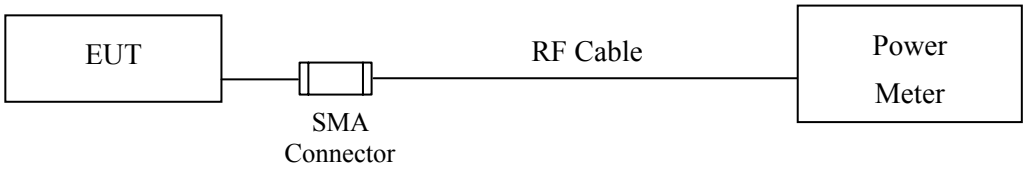
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

2.2. Test Setup

26dBc Occupied Bandwidth



Conduction Power Measurement (for 802.11an)



2.3. Limits

2.3.1. 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-topoint 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.

2.3.2. 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 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.

2.3.3. 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.

2.4. Test Procedure

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 the 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≦40MHz) 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=80MHz) 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.

2.5. Uncertainty

± 1.27 dB

2.6. Test Result of Maximum conducted output power

Product : IEEE 802.11a/b/g miniPCI module
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	16.31	--	--	--	--	--	--	--	<21dBm
40	5200	16.35	16.22	16.15	16.09	15.96	15.88	15.81	15.74	<21dBm
48	5240	16.03	--	--	--	--	--	--	--	<21dBm
149	5745	12.16	--	--	--	--	--	--	--	<27dBm
157	5785	12.57	12.44	12.34	12.17	11.94	11.70	11.47	11.23	<27dBm
165	5825	12.57	--	--	--	--	--	--	--	<27dBm

Note:
1. Maximum conducted output power Value =Reading value on average power meter + cable loss
2. The maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3. Peak Power Spectral Density

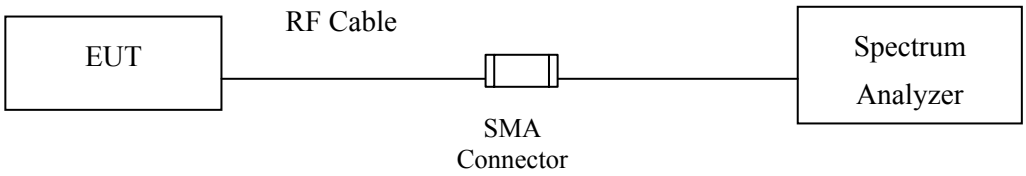
3.1. Test Equipment

	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, 2015

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



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 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-topoint 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.

3.4. Test Procedure

The EUT was setup to ANSI C63.10, 2009; tested to UNII 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.
For the band 5.725-5.85 GHz, Scale the observed power level to an equivalent value in 500 kHz by adjusting (increase) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log (500 kHz/100 kHz) = 6.98 dB.

3.5. Uncertainty

± 1.27 dB

3.6. Test Result of Peak Power Spectral Density

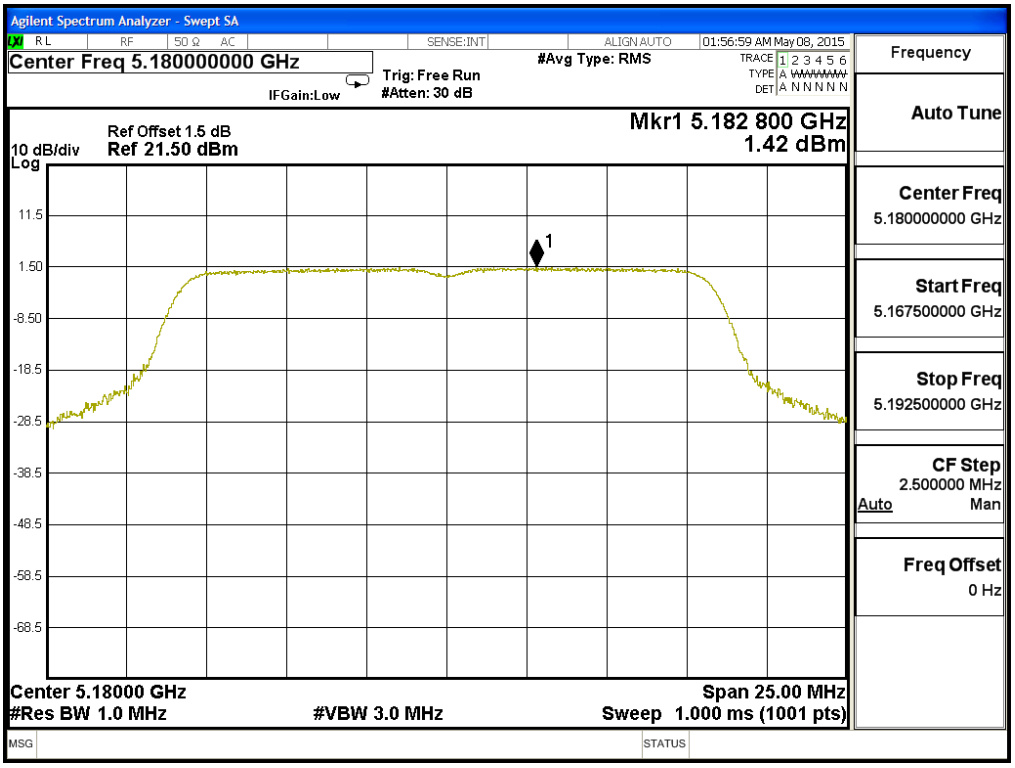
Product : IEEE 802.11a/b/g miniPCI module
Test Item : Peak Power Spectral Density
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps)

Channel Number	Frequency (MHz)	Data Rata (Mbps)	Measurement Level (dBm)	Required Limit (dBm)	Result
36	5180	6	1.42	8	Pass
40	5200	6	1.24	8	Pass
48	5240	6	1.02	8	Pass

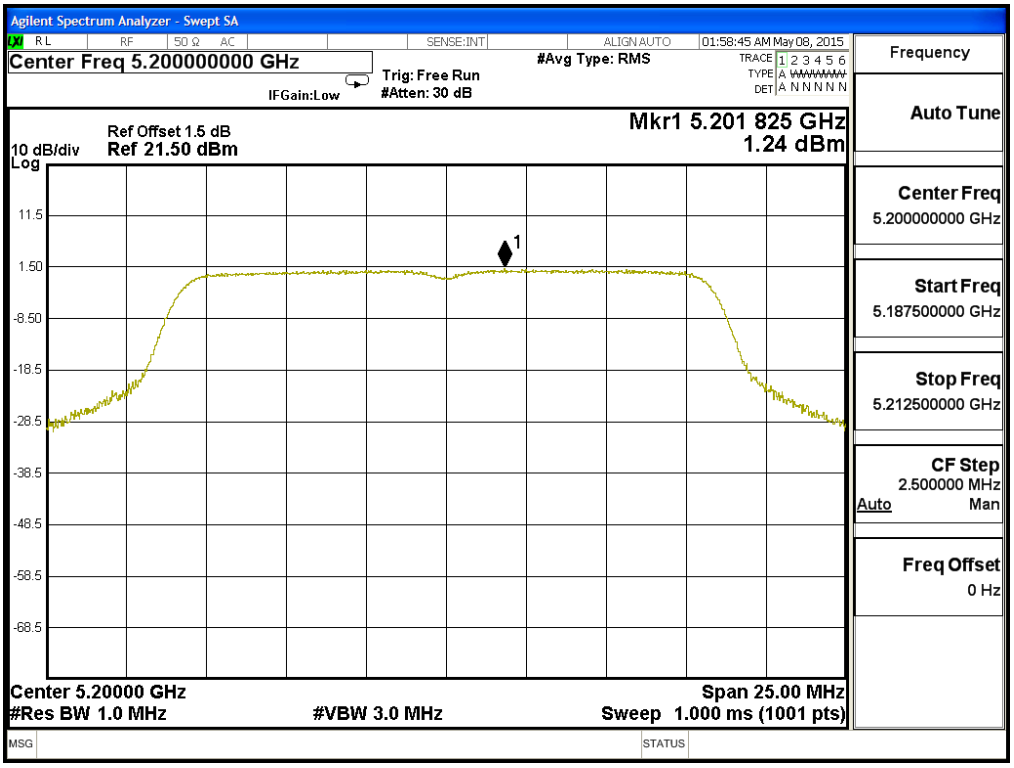
Channel Number	Frequency (MHz)	Data Rata (Mbps)	PPSD (dBm)	BWCF (dB)	Total PPSD (dBm)	Required Limit (dBm)	Result
149	5745	6	0.180	6.980	7.160	27	Pass
157	5785	6	-0.490	6.980	6.490	27	Pass
165	5825	6	-1.040	6.980	5.940	27	Pass

Note 1: The maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

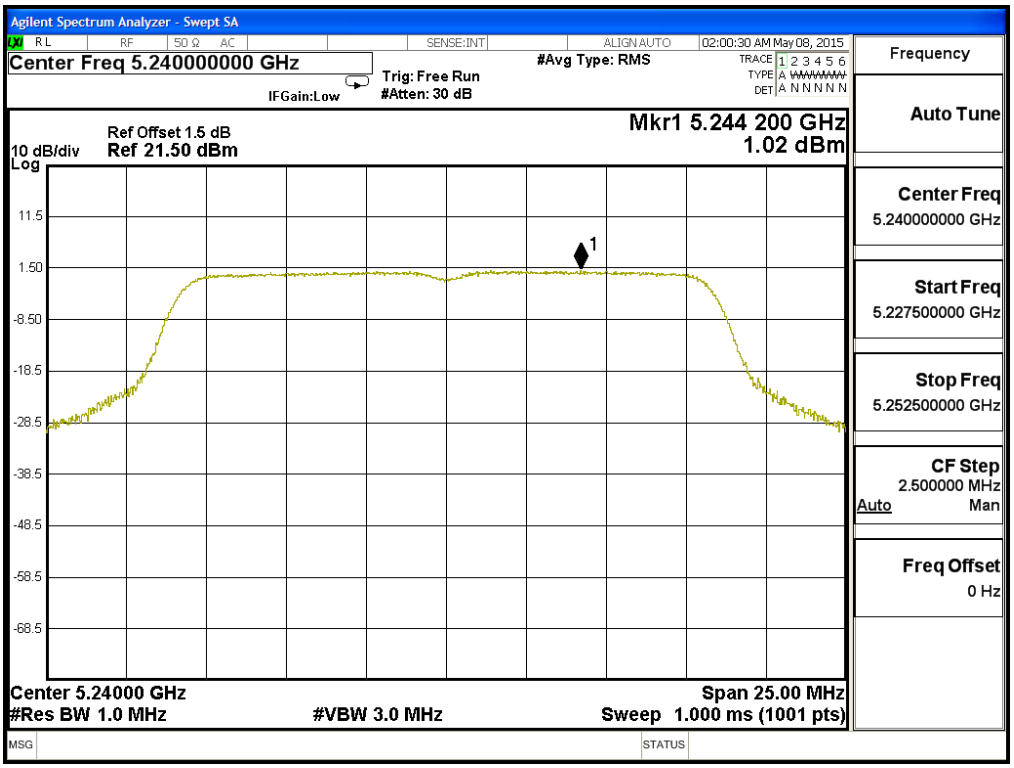
Channel 36:



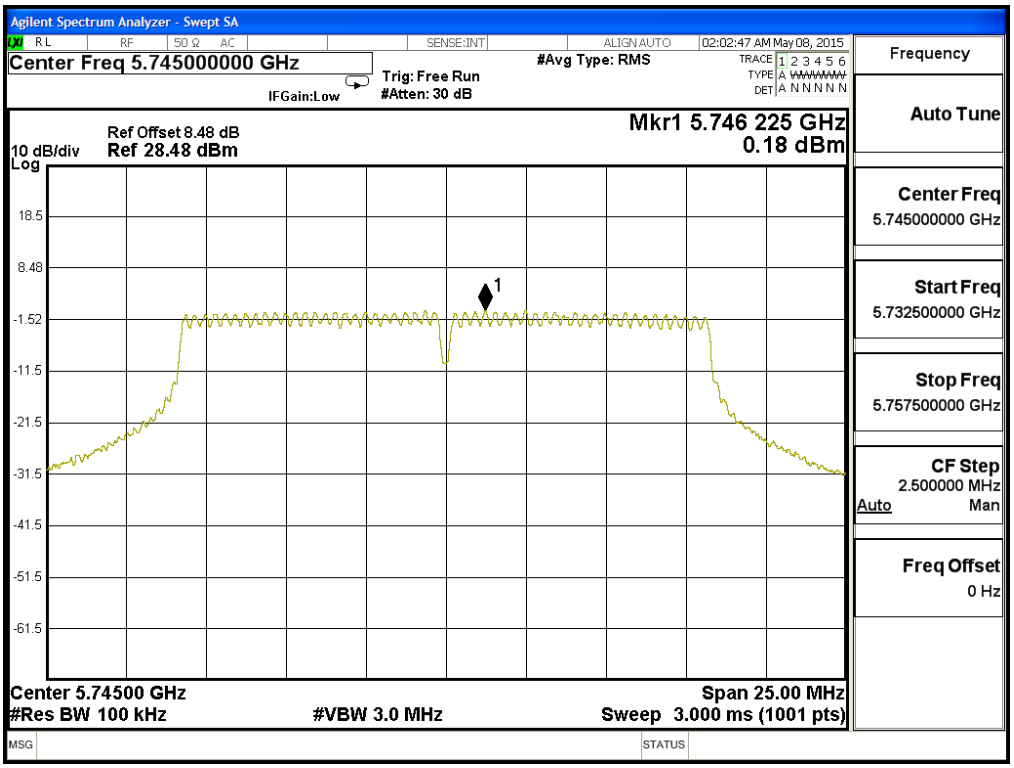
Channel 40:



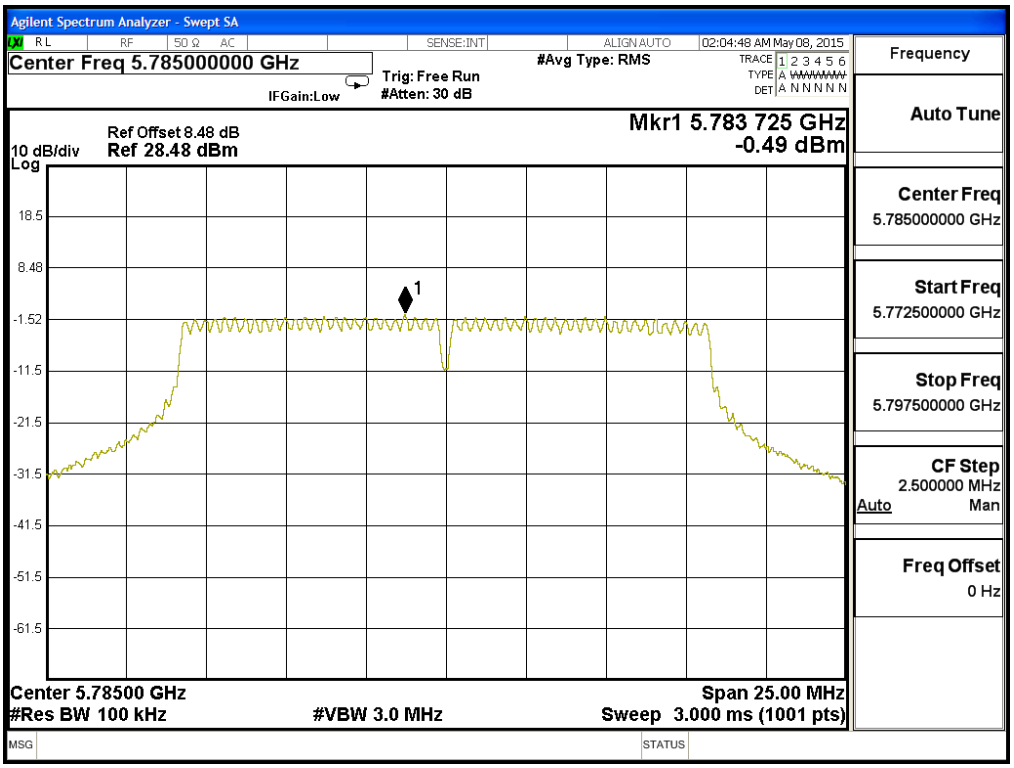
Channel 48:



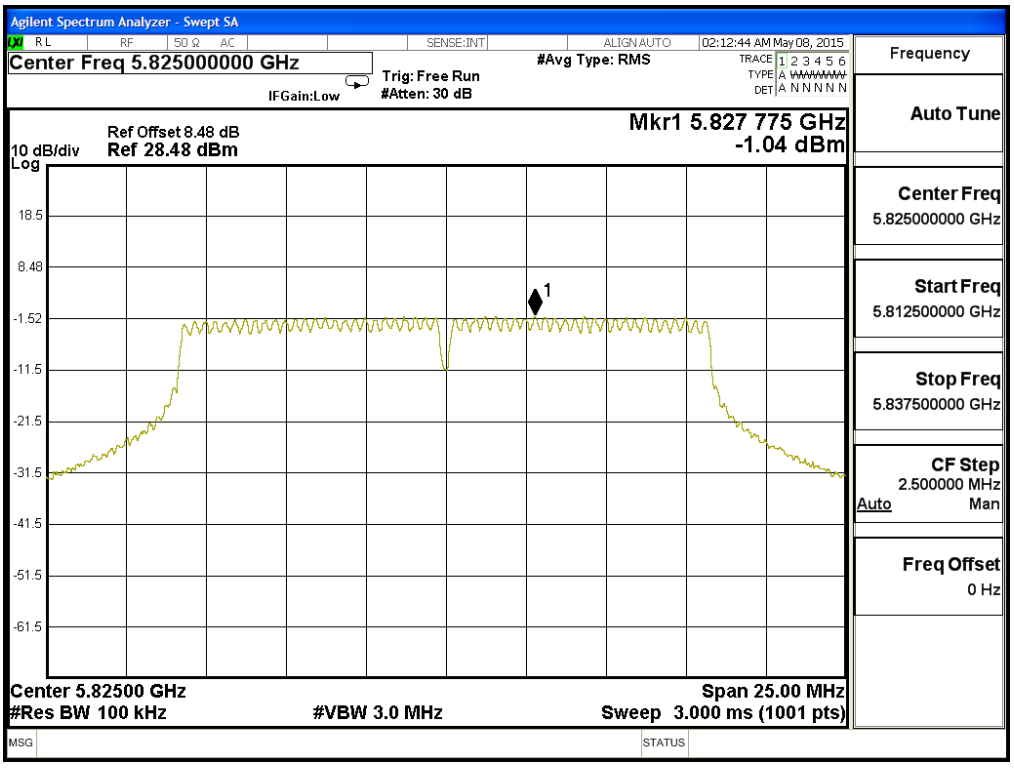
Channel 149:



Channel 157:



Channel 165:



4. Radiated Emission

4.1. Test Equipment

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

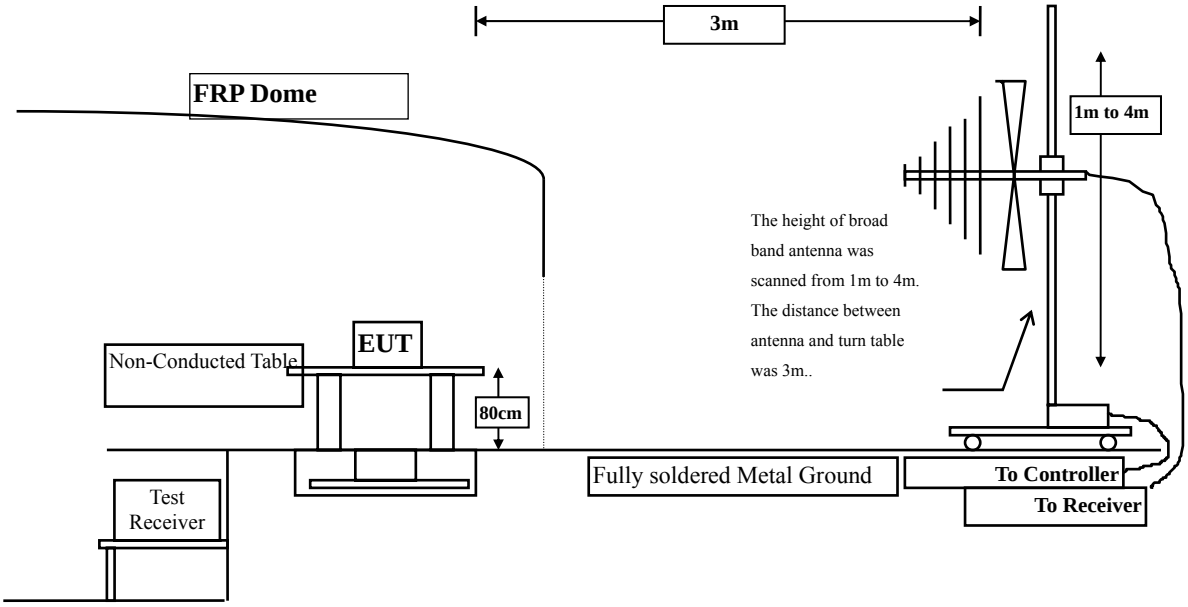
Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	X	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep., 2014
	X	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun., 2014
	X	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun., 2014
	X	Coaxial Cable	QTK(Arnist)	RG 214/ LC003-RG	Jun., 2014
	X	Coaxial signal switch	Arnist	MP59B/ 6200798682	Jun., 2014

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
☒CB # 8	X	Spectrum Analyzer	R&S	FSP40/ 100339	Oct., 2014
	X	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	X	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan., 2015
	X	Horn Antenna	TRC	AH-0801/95051	Aug., 2014
	X	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	X	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2014
	X	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2014

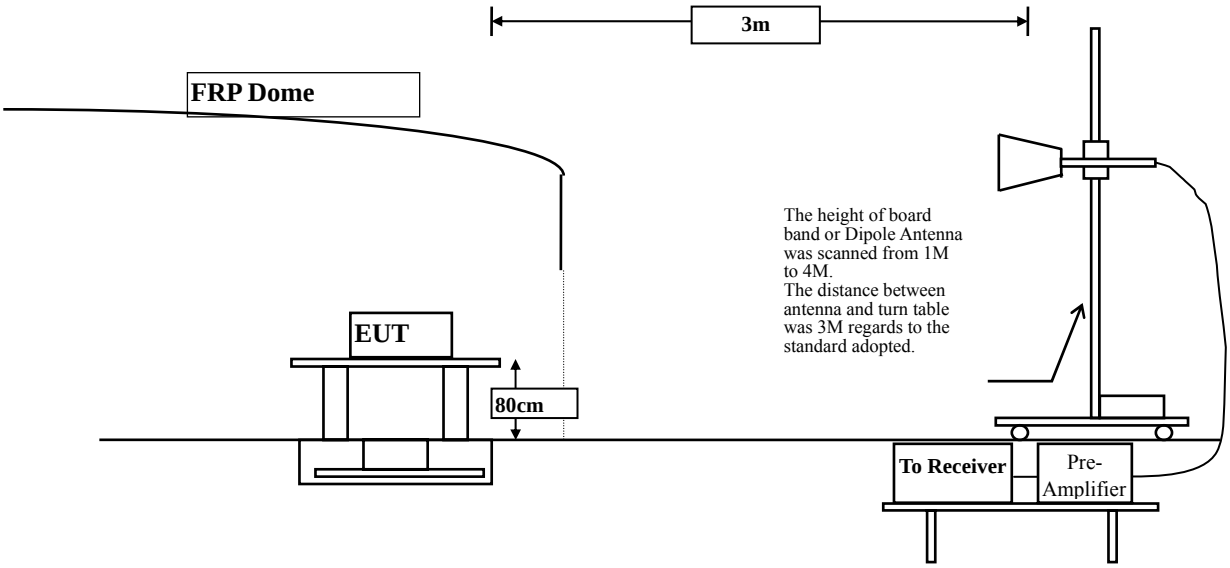
Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

4.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



4.3. 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 (dBμV/m) = 20 log E field strength (uV/m)

4.4. 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 between 1 meter and 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 form 9kHz - 10th Harmonic of fundamental was investigated.

4.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

4.6. Test Result of Radiated Emission

Product : IEEE 802.11a/b/g miniPCI module
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 dBμV	Measurement Level dBμV/m	Margin dB	Limit dBμV/m
Horizontal					
Peak Detector:					
10360.000	12.930	33.106	46.036	-27.964	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	13.724	32.949	46.673	-27.327	74.000
15540.000	*	*	*	*	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 : IEEE 802.11a/b/g miniPCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5200MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Horizontal					
Peak Detector:					
10400.000	12.959	34.510	47.469	-26.531	74.000
15660.000	*	*	*	*	74.000
20880.000	*	*	*	*	74.000
26100.000	*	*	*	*	74.000
Average Detector:					
--					
Vertical					
Peak Detector:					
10400.000	13.877	33.284	47.161	-26.839	74.000
15660.000	*	*	*	*	74.000
20880.000	*	*	*	*	74.000
26100.000	*	*	*	*	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 : IEEE 802.11a/b/g miniPCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5240MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Horizontal					
Peak Detector:					
10480.000	13.693	35.779	49.473	-24.527	74.000
15720.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
10480.000	14.620	36.313	50.934	-23.066	74.000
15720.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	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 : IEEE 802.11a/b/g miniPCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5745MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal Peak Detector:					
11490.000	17.106	38.202	55.309	-18.691	74.000
17235.000	*	*	*	*	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000
Average Detector:					
11490.000	17.106	22.698	39.805	-14.195	54.000
Vertical Peak Detector:					
11490.000	18.034	41.493	59.528	-14.472	74.000
17235.000	*	*	*	*	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000
Average Detector:					
11490.000	18.034	24.138	42.173	-11.827	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.

Product : IEEE 802.11a/b/g miniPCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5785MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
11570.000	16.809	42.354	59.163	-14.837	74.000
17355.000	*	*	*	*	74.000
20800.000	*	*	*	*	74.000
26000.000	*	*	*	*	74.000
31200.000	*	*	*	*	74.000
36400.000	*	*	*	*	74.000
Average					
Detector:					
11570.000	16.809	26.345	43.154	-10.846	54.000
Vertical					
Peak Detector:					
11570.000	17.698	46.129	63.827	-10.173	74.000
17355.000	*	*	*	*	74.000
20800.000	*	*	*	*	74.000
26000.000	*	*	*	*	74.000
31200.000	*	*	*	*	74.000
36400.000	*	*	*	*	74.000
Average					
Detector:					
11570.000	17.698	28.716	46.414	-7.586	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.

Product : IEEE 802.11a/b/g miniPCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5825MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal Peak Detector:					
11650.000	16.158	42.473	58.631	-15.369	74.000
17475.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
31440000	*	*	*	*	74.000
36680.000	*	*	*	*	74.000
Average Detector:					
11650.000	16.158	26.850	43.008	-10.992	54.000
Vertical Peak Detector:					
11650.000	17.274	45.564	62.839	-11.161	74.000
17475.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
31440000	*	*	*	*	74.000
36680.000	*	*	*	*	74.000
Average Detector:					
11650.000	17.274	28.608	45.883	-8.117	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.

Product : IEEE 802.11a/b/g miniPCI module
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5200MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Horizontal					
Peak Detector					
148.340	-7.806	38.372	30.566	-12.934	43.500
359.800	-0.226	40.965	40.739	-5.261	46.000
551.860	3.390	35.682	39.072	-6.928	46.000
697.360	3.231	35.001	38.232	-7.768	46.000
840.920	6.064	27.870	33.934	-12.066	46.000
965.080	7.222	24.792	32.014	-21.986	54.000
Vertical					
Peak Detector					
144.460	-5.503	41.471	35.968	-7.532	43.500
398.600	-2.371	37.383	35.012	-10.988	46.000
499.480	-0.199	40.559	40.359	-5.641	46.000
600.360	1.302	31.830	33.132	-12.868	46.000
833.160	1.716	35.355	37.071	-8.929	46.000
901.060	1.858	26.910	28.768	-17.232	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 : IEEE 802.11a/b/g miniPCI module
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) (5785MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Horizontal					
Peak Detector					
117.300	-9.196	47.333	38.137	-5.363	43.500
282.200	-5.211	43.485	38.274	-7.726	46.000
449.040	-2.238	39.290	37.052	-8.948	46.000
650.800	2.175	31.921	34.096	-11.904	46.000
811.820	5.081	32.485	37.565	-8.435	46.000
955.380	6.247	28.702	34.949	-11.051	46.000
Vertical					
Peak Detector					
107.600	-0.318	39.374	39.056	-4.444	43.500
227.880	-8.519	47.062	38.544	-7.456	46.000
406.360	-6.660	39.695	33.035	-12.965	46.000
540.220	0.121	29.639	29.760	-16.240	46.000
668.260	-1.694	40.358	38.664	-7.336	46.000
901.060	3.331	32.854	36.185	-9.815	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.

5. Band Edge

5.1. Test Equipment

RF Radiated Measurement:

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

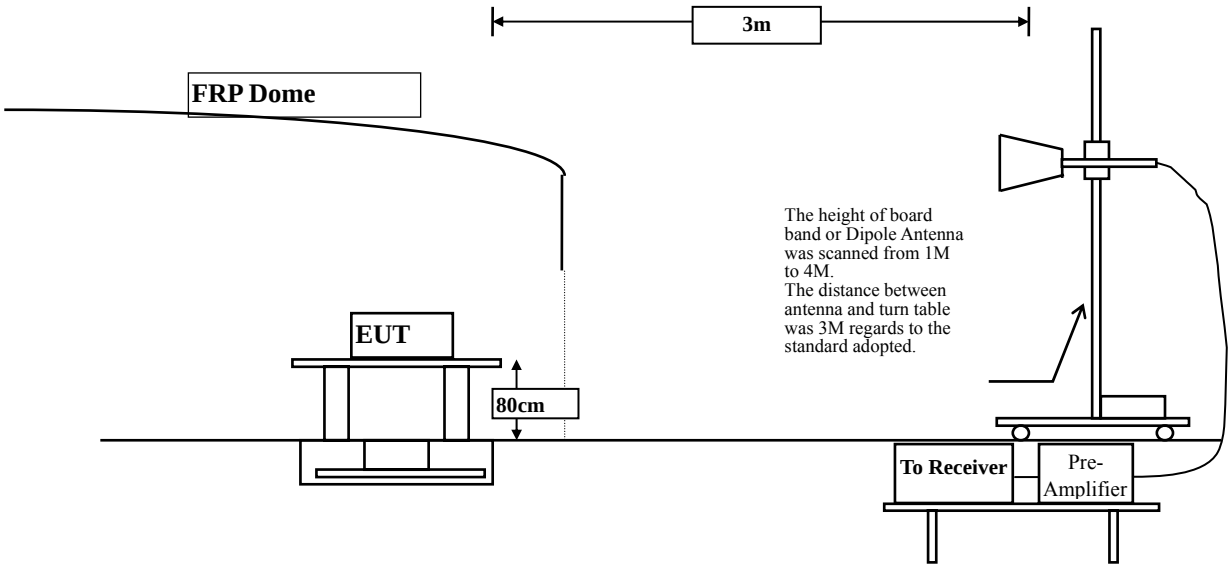
Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
☒CB # 8	X	Spectrum Analyzer	R&S	FSP40/ 100339	Oct., 2014
	X	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	X	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan., 2015
	X	Horn Antenna	TRC	AH-0801/95051	Aug., 2014
	X	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	X	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2014
	X	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2014

Note: 1. All instruments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

5.2. Test Setup

RF Radiated Measurement:



5.3. 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	dBμV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks : 1. RF Voltage (dBμV) = 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.

5.4. Test Procedure

The EUT is 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 UNII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

5.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

5.6. Test Result of Band Edge

Product : IEEE 802.11a/b/g miniPCI module
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 (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
36 (Peak)	5150.000	3.340	40.424	43.764	74.00	54.00	Pass
36 (Peak)	5182.900	3.224	84.953	88.177	--	--	--
36 (Average)	5150.000	3.340	28.466	31.806	74.00	54.00	Pass
36 (Average)	5182.000	3.227	74.282	77.509	--	--	--

Figure Channel 36: Horizontal (Peak)

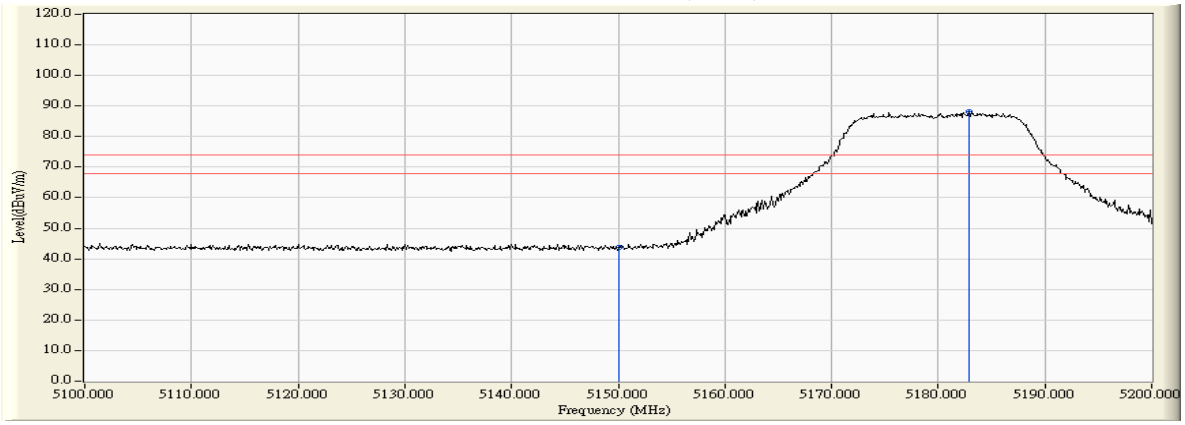
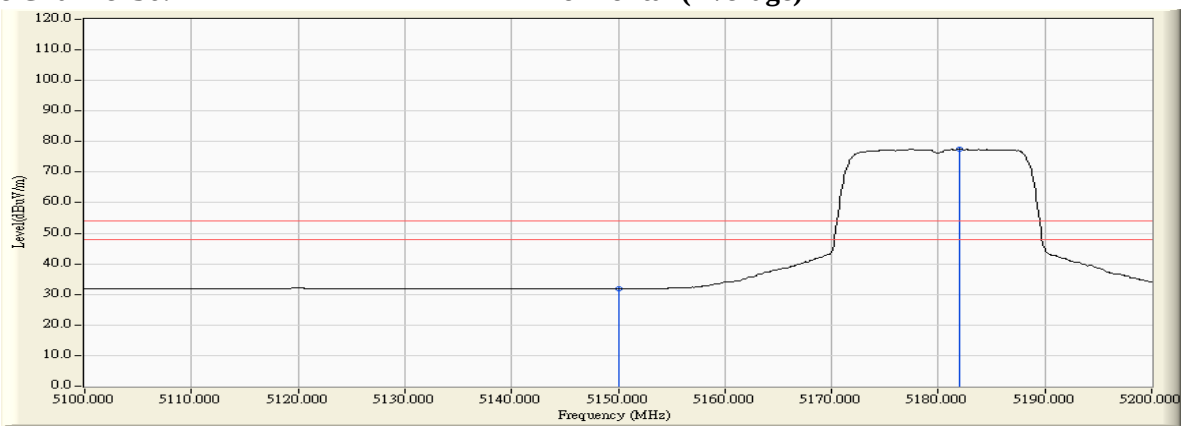


Figure Channel 36: Horizontal (Average)



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.

Product : IEEE 802.11a/b/g miniPCI module
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 (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
36 (Peak)	5145.200	5.247	46.381	51.628	74.00	54.00	Pass
36 (Peak)	5150.000	5.260	45.826	51.086	74.00	54.00	Pass
36 (Peak)	5182.400	5.348	96.369	101.717	--	--	--
36 (Average)	5120.000	5.177	32.648	37.826	74.00	54.00	Pass
36 (Average)	5150.000	5.260	30.218	35.478	74.00	54.00	Pass
36 (Average)	5184.400	5.353	85.524	90.878	--	--	--

Figure Channel 36: Vertical (Peak)

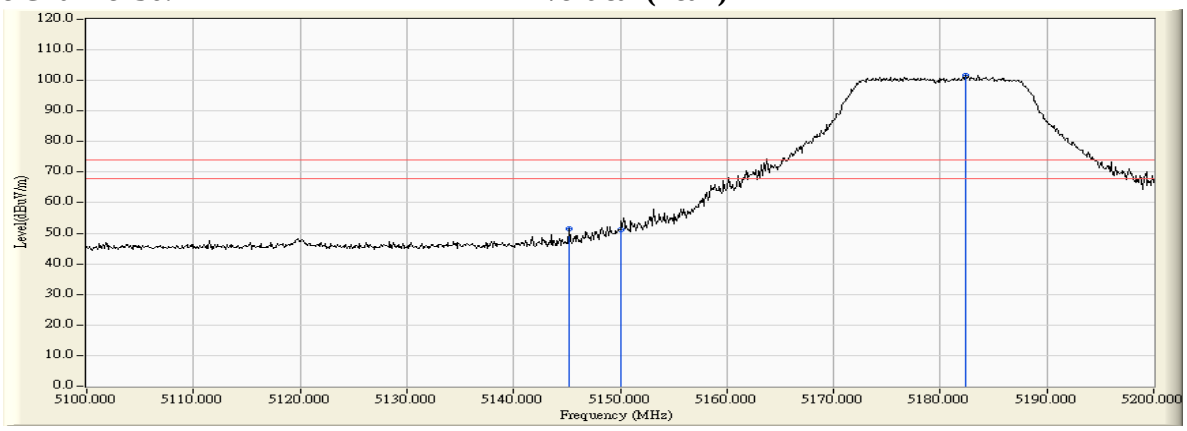
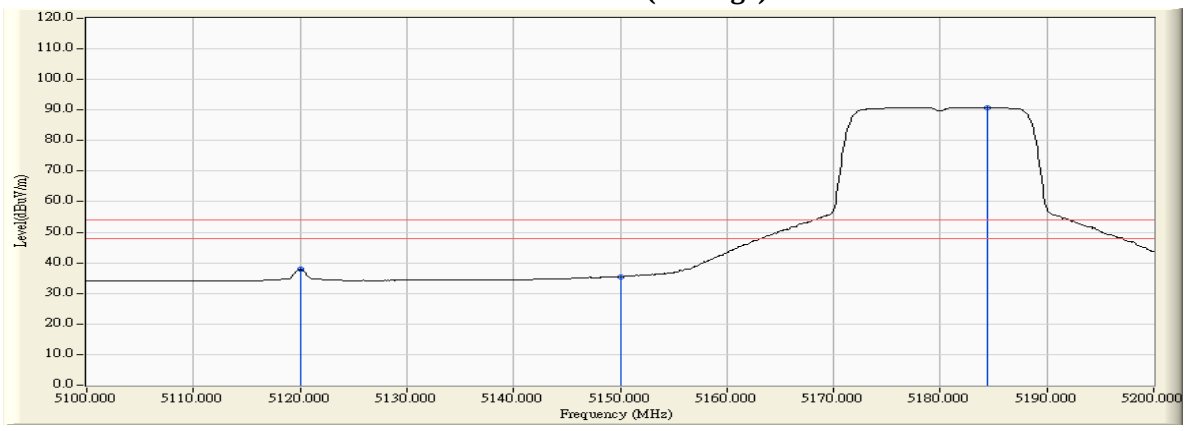


Figure Channel 36: Vertical (Average)



Note:

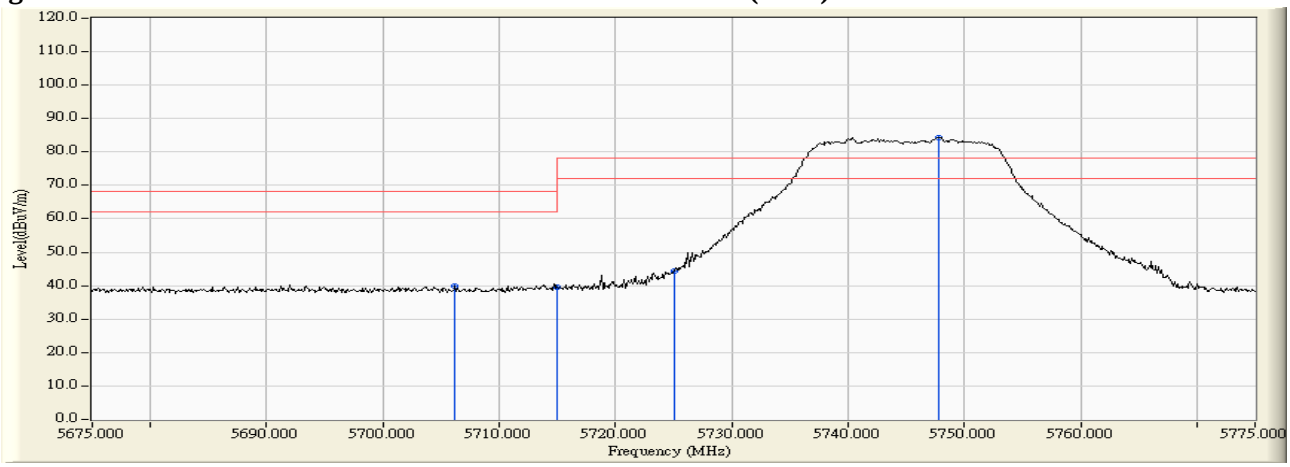
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. " * ", means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : IEEE 802.11a/b/g miniPCI module
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) -Channel 149

RF Radiated Measurement (Horizontal):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Horizontal	5706.200	4.643	35.338	39.981	-28.239	68.220	Pass
Horizontal	5715.000	4.652	34.817	39.469	-28.751	68.220	Pass
Horizontal	5725.000	4.654	39.778	44.432	-33.788	78.220	Pass
Horizontal	5747.800	4.658	79.776	84.433	--	--	Pass

Figure Channel 149: Horizontal (Peak)

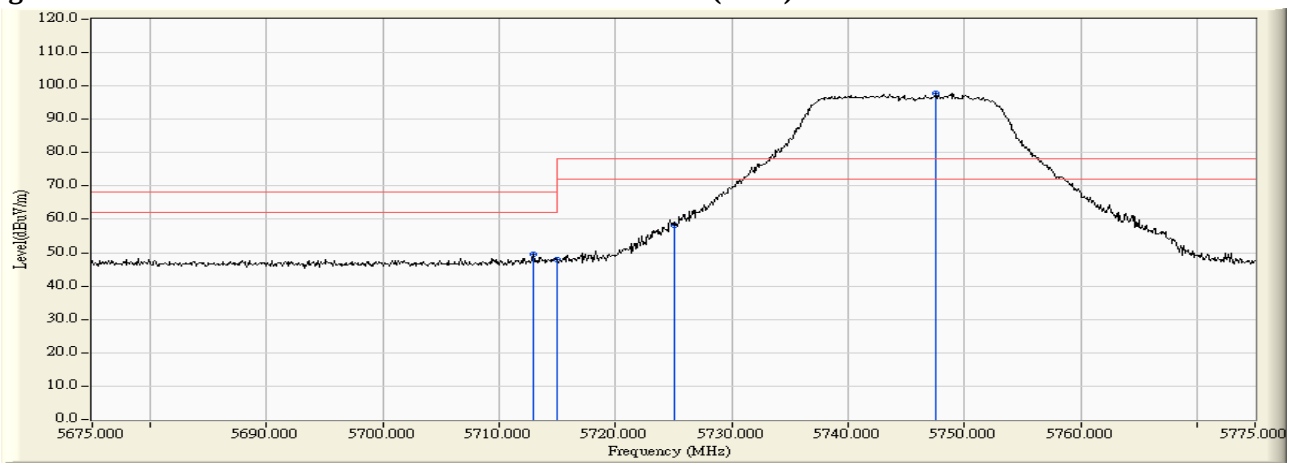


Product : IEEE 802.11a/b/g miniPCI module
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) -Channel 149

RF Radiated Measurement (Vertical):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Vertical	5712.900	5.994	43.567	49.561	-18.659	68.220	Pass
Vertical	5715.000	5.994	41.907	47.901	-20.319	68.220	Pass
Vertical	5725.000	5.992	52.317	58.310	-19.910	78.220	Pass
Vertical	5747.600	5.988	91.881	97.869	--	--	Pass

Figure Channel 149: Vertical (Peak)

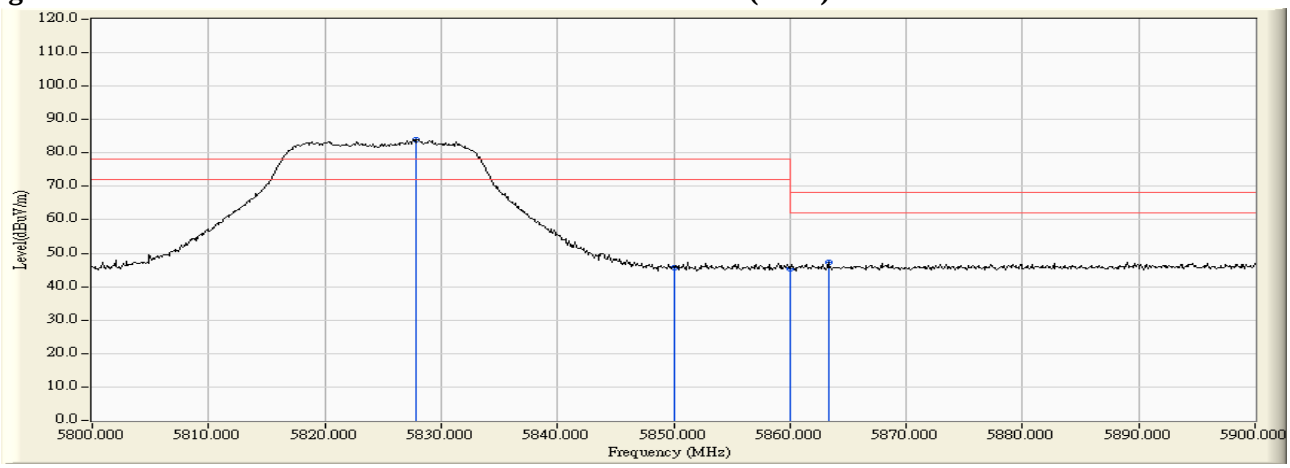


Product : IEEE 802.11a/b/g miniPCI module
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) -Channel 165

RF Radiated Measurement (Horizontal):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Horizontal	5827.900	4.831	79.114	83.945	--	--	Pass
Horizontal	5850.000	4.964	40.625	45.589	-32.631	78.220	Pass
Horizontal	5860.000	5.023	40.221	45.244	-22.976	68.220	Pass
Horizontal	5863.300	5.042	42.171	47.213	-21.007	68.220	Pass

Figure Channel 165: Horizontal (Peak)

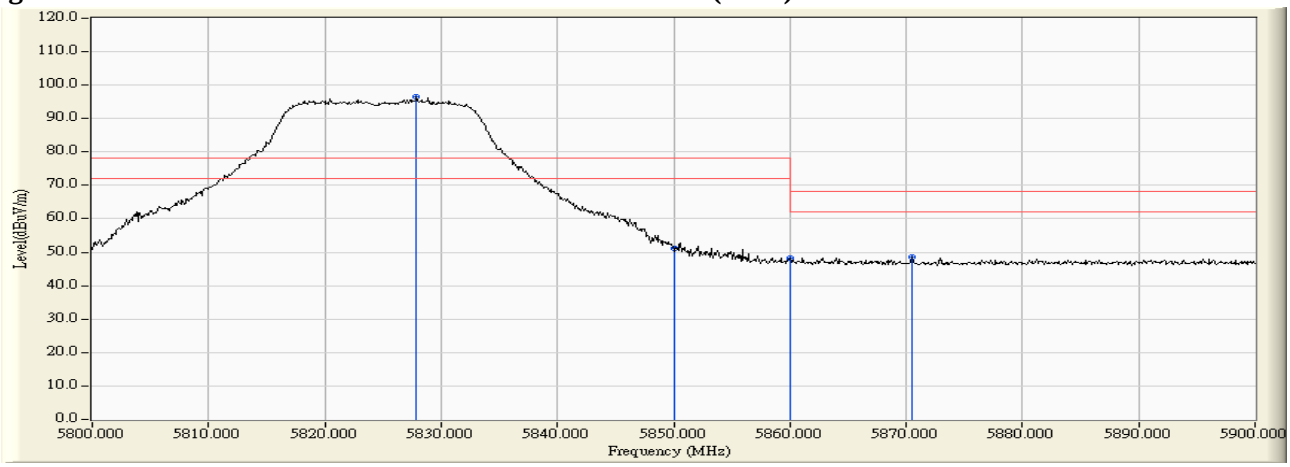


Product : IEEE 802.11a/b/g miniPCI module
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps) -Channel 165

RF Radiated Measurement (Vertical):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Vertical	5827.900	6.011	90.639	96.650	--	--	Pass
Vertical	5850.000	6.037	44.993	51.030	-27.190	78.220	Pass
Vertical	5860.000	6.047	42.054	48.101	-20.119	68.220	Pass
Vertical	5870.500	6.058	42.509	48.568	-19.652	68.220	Pass

Figure Channel 165: Vertical (Peak)



6. Occupied Bandwidth

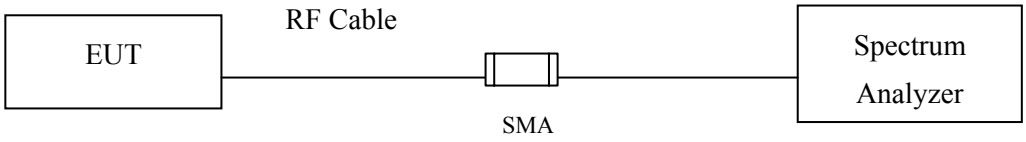
6.1. Test Equipment

	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., 2015

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.

6.2. Test Setup



6.3. Limits

For the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz

6.4. Test Procedure

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

6.5. Uncertainty

± 150Hz

6.6. Test Result of Occupied Bandwidth

Product : IEEE 802.11a/b/g miniPCI module
Test Item : Occupied Bandwidth Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (802.11a-6Mbps)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
149	5745	16450	>500	Pass
157	5785	16500	>500	Pass
165	5825	16450	>500	Pass

Figure Channel 149:

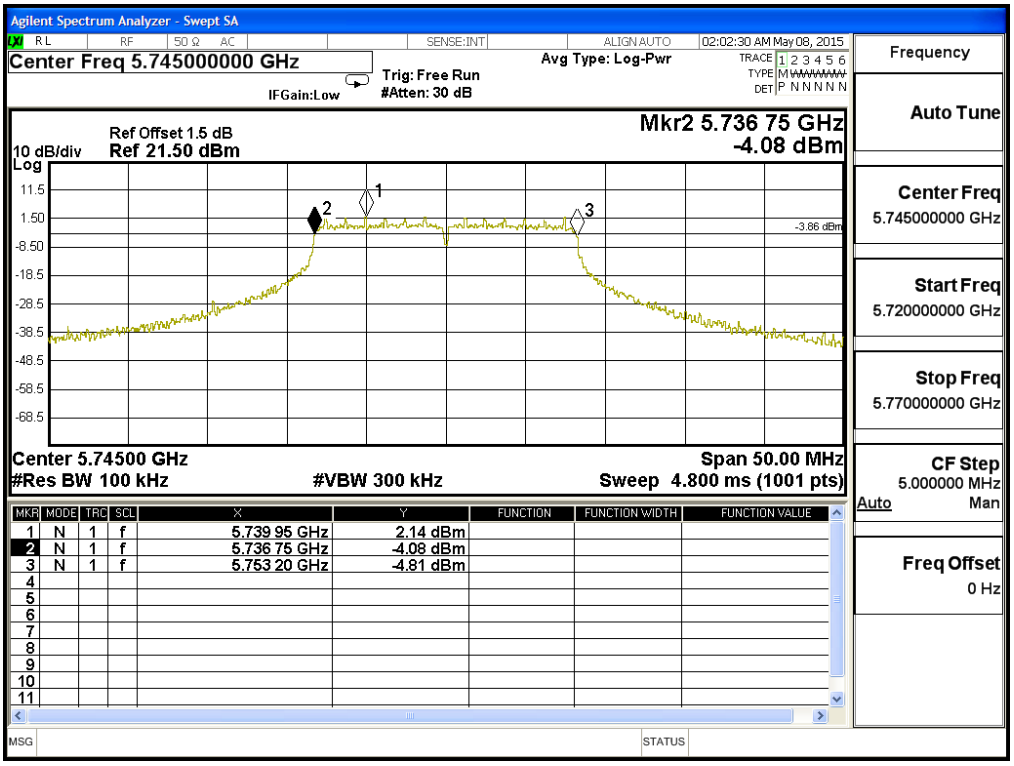


Figure Channel 157:

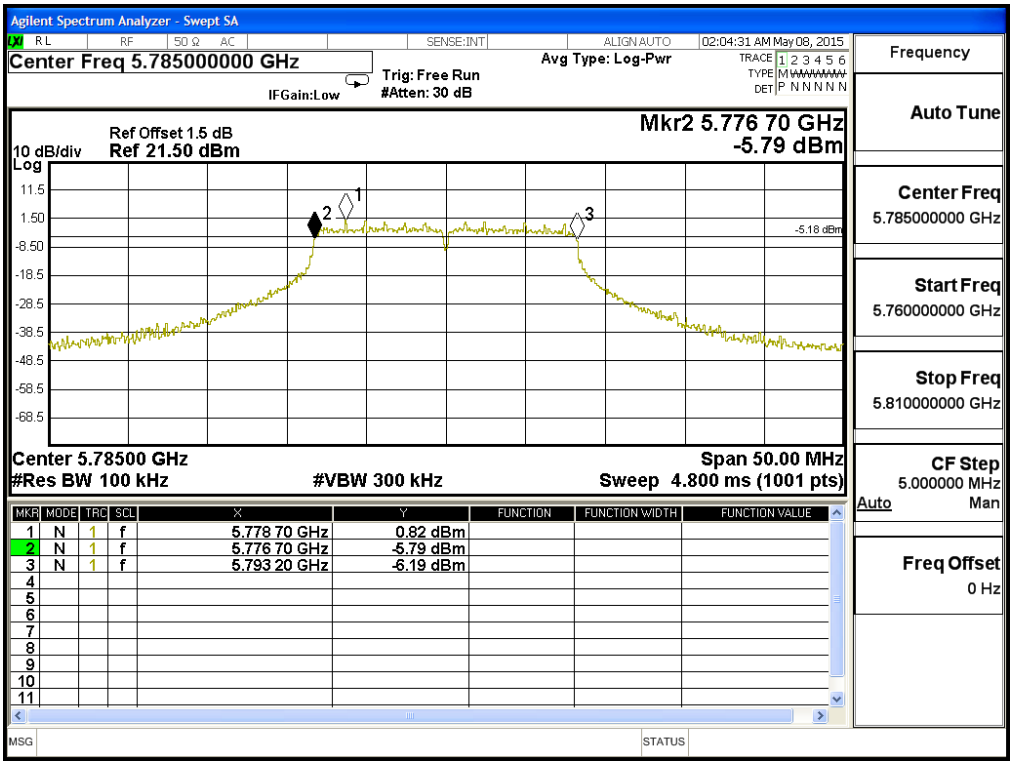
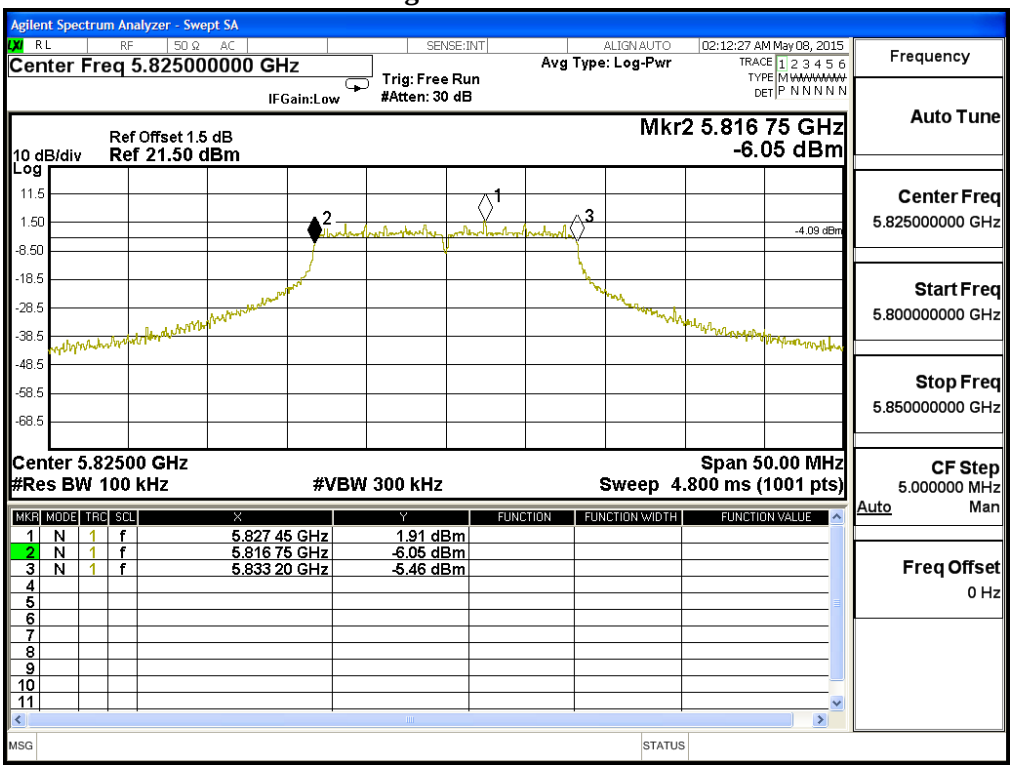


Figure Channel 165:



7. Frequency Stability

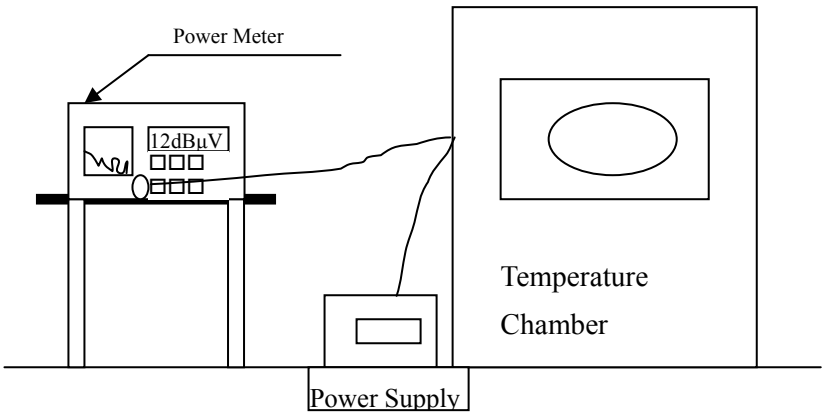
7.1. Test Equipment

	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., 2015

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 UNII 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 : IEEE 802.11a/b/g miniPCI module
Test Item : Frequency Stability
Test Site : Temperature Chamber
Test Mode : Carrier Wave

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	ΔF (MHz)
Tnom (20) °C	Vnom (120)V	36	5180.0000	5180.0068	-0.0068
		44	5200.0000	5200.0082	-0.0082
		48	5240.0000	5240.0077	-0.0077
		149	5745.0000	5745.0105	-0.0105
		157	5785.0000	5785.0101	-0.0101
		165	5825.0000	5825.0097	-0.0097
Tmax (50) °C	Vmax (126.5)V	36	5180.0000	5180.0068	-0.0068
		44	5200.0000	5200.0082	-0.0082
		48	5240.0000	5240.0077	-0.0077
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0105	-0.0105
		165	5825.0000	5825.0100	-0.0100
Tnom (50) °C	Vnom (93.5)V	36	5180.0000	5180.0064	-0.0064
		44	5200.0000	5200.0094	-0.0094
		48	5240.0000	5240.0082	-0.0082
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0105	-0.0105
		165	5825.0000	5825.0100	-0.0100
Tnom (0) °C	Vnom (126.5)V	36	5180.0000	5180.0064	-0.0064
		44	5200.0000	5200.0094	-0.0094
		48	5240.0000	5240.0082	-0.0082
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0089	-0.0089
		165	5825.0000	5825.0081	-0.0081
Tnom (0) oC	Vnom (93.5)V	36	5180.0000	5180.0000	0.0000
		44	5200.0000	5200.0000	0.0000
		48	5240.0000	5240.0000	0.0000
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0089	-0.0089
		165	5825.0000	5825.0081	-0.0081

8. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs