



Test Report

Product Name	Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
Model No	AWK-3121-US, AWK-3121-US-T
FCC ID	SLE-AWK-3121

Applicant	Moxa Inc.
Address	F1.4, No. 135, Lane 235, Pao-Chiao Rd., Shing Tien City, Taipei, Taiwan, R.O.C.

Date of Receipt	Apr. 18, 2008
Issued Date	May. 19, 2008
Report No.	084316R-RFUSP09V01
Version	V1.0

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quietek Corporation.

This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

Test Report Certification

Issued Date: May. 19, 2008

Rport No.: 084316R-RFUSP09V01



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Applicant	Moxa Inc.
Address	F1.4, No. 135, Lane 235, Pao-Chiao Rd., Shing Tien City, Taipei, Taiwan, R.O.C.
Manufacturer	Moxa Inc.
Model No.	AWK-3121-US, AWK-3121-US-T
FCC ID.	SLE-AWK-3121
Rated Voltage	AC 120V/60Hz
Working Voltage	DC 12V
Trade Name	Moxa
Applicable Standard	FCC CFR Title 47 Part 15 Subpart E: 2007 ANSI C63.4: 2003
Test Result	Complied



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(Assistant Engineer /Johnson Liao)



Approved By : Vincent Lin
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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
Trade Name	Moxa
FCC ID.	SLE-AWK-3121
Model No.	AWK-3121-US, AWK-3121-US-T
Frequency Range	2412 – 2462MHz for 802.11 b/g 5180 – 5240MHz, 5745 – 5825MHz for 802.11a
Number of Channels	11 for 802.11 b/g 9 for 802.11 a
Channel Control	Auto
Data Rate	802.11b – 1, 2, 5.5, 11Mbps 802.11a/g – 6, 9, 12, 18, 24, 36, 48, 54Mbps
Type of Modulation	802.11b:DSSS DBPSK, DQPSK, CCK 802.11 a/g: OFDM BPSK, QPSK, 16QAM, 64QAM
Antenna type	Dipole
Antenna Gain	Refer to the table “Antenna List”
Power Adapter	MFR: ENG, M/N: 3A-161DA12 Input: AC 100V-240V, 50-60Hz, 0.6A Output: DC 12V, 1.25A Cable out: Non-Shielded, 1.8m with two ferrite cores bonded. Power Cord: Non-Shielded, 1.8m.

Antenna List

No.	Manufacturer	Part No.	Peak Gain
1	Smart Ant	SAA05-220420	2.0dBi in 2.4 GHz 2.0dBi in 5GHz
2	WANSHIH	N/A	1.76dBi in 2.4 GHz 1.33dBi in 5GHz
3	Wha Yu	C600- 510013-A	1.8dBi in 2.4 GHz 1.8dBi in 5GHz

2.4GHz Band Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1:	2412 MHz	Channel 5:	2432 MHz	Channel 9:	2452 MHz
Channel 2:	2417 MHz	Channel 6:	2437 MHz	Channel 10:	2457 MHz
Channel 3:	2422 MHz	Channel 7:	2442 MHz	Channel 11:	2462 MHz
Channel 4:	2427 MHz	Channel 8:	2447 MHz		

5GHz Band Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1	5180 MHz	Channel 2	5200 MHz	Channel 3	5220 MHz	Channel 4	5240 MHz
Channel 5	5745 MHz	Channel 6	5765 MHz	Channel 7	5785 MHz	Channel 8	5805 MHz
Channel 9	5825 MHz						

Note:

1. This device is an Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client with a built-in 2.4GHz and 5GHz transceiver.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report. (802.11b is 1Mbps and 802.11a/g is 6Mbps)
3. 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.

1.2. Operational Description

The EUT is an Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client with 11 channels. for 802.11b/g and 9 channels for 802.11a. This device provides four kinds of transmitting speed 1, 2, 5.5 and 11Mbps. The modulation of device is BPSK, QPSK and CCK (IEEE 802.11b) and eight kinds of transmitting speed 6, 9, 12, 18, 24, 36, 48 and 54Mbps are provided. The technology of this device used is OFDM (IEEE 802.11 a/g).

The device adapts direct sequence spread spectrum modulation. The antenna provides diversity function to improve the receiving function.

This Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client, compliant with IEEE 802.11b and IEEE 802.11 a/g, is a high-efficiency Wireless LAN adapter. It allows your computer to connect to a wireless network and to share resources, such as files or printers without being bound to the network wires. Operation in 2.4GHz Direct Sequence Spread Spectrum (DSSS) radio transmission, the Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client Wired Equivalent Protection (WEP) algorithm is used. In addition, its standard compliance ensures that it can communicate with any IEEE 802.11b and IEEE 802.11 a/g network.

Test Mode	Mode 1: Transmitter 802.11a
-----------	-----------------------------

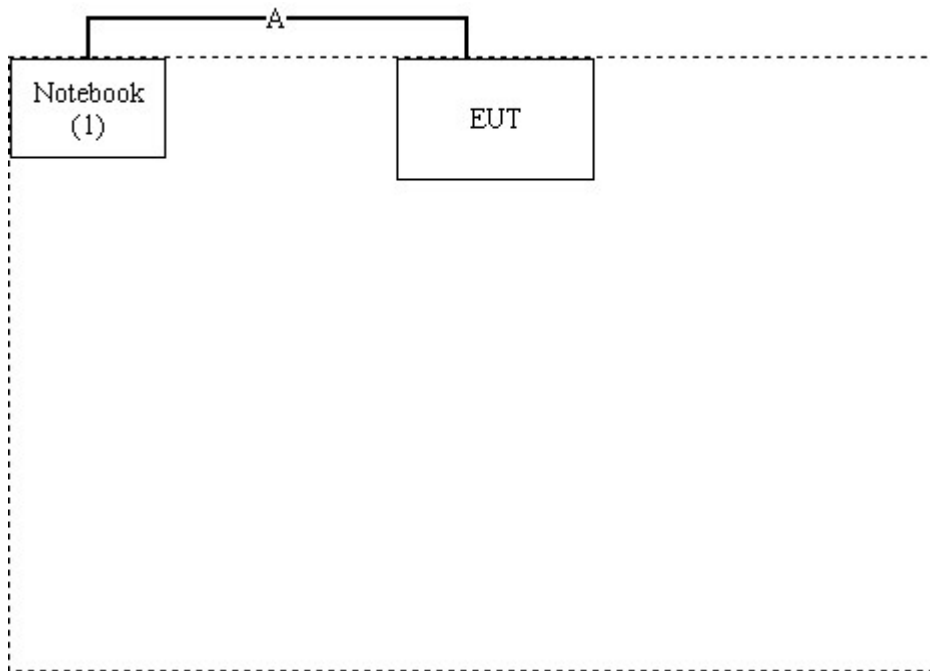
1.3. Tested System Details

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 USB to LAN Cable	Shielded, 2.0m

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4
- (2) Execute the RF program (the continuous transmission program) on the EUT
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Press “OK” to 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

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



Accreditation on NVLAP
 NVLAP Lab Code: 200533-0



Site Name: Quietek Corporation
 Site Address: No. 5-22, Ruei-Shu Valley, Ruei-Ping Tsuen,
 Lin-Kou Shiang, Taipei,
 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

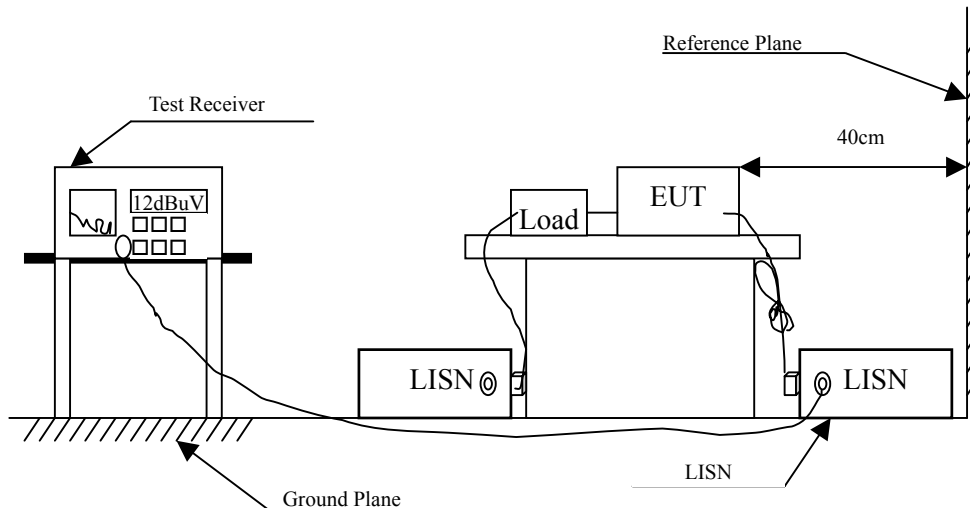
2.1. Test Equipment

The following test equipment are used during the conducted emission test:

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30/825442/17	May, 2008	
2	L.I.S.N.	R & S	ESH3-Z5/825016/6	May, 2008	EUT
3	L.I.S.N.	Kyoritsu	KNW-407/8-1420-3	May, 2008	Peripherals
4	Pulse Limiter	R & S	ESH3-Z2	May, 2008	
5	No.1 Shielded Room			N/A	

Note: All equipments are calibrated every one year.

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 C63.4: 2003 on conducted measurement.

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

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
LINE 1					
Quasi-Peak					
0.185	0.753	46.130	46.883	-18.117	65.000
0.240	0.369	39.290	39.659	-23.770	63.429
0.310	0.300	37.380	37.680	-23.749	61.429
0.353	0.300	37.380	37.680	-22.520	60.200
0.490	0.300	31.650	31.950	-24.336	56.286
2.377	0.350	28.330	28.680	-27.320	56.000
Average					
0.185	0.753	36.830	37.583	-17.417	55.000
0.240	0.369	30.610	30.979	-22.450	53.429
0.310	0.300	27.470	27.770	-23.659	51.429
0.353	0.300	26.340	26.640	-23.560	50.200
0.490	0.300	24.500	24.800	-21.486	46.286
2.377	0.350	18.750	19.100	-26.900	46.000

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 : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
LINE 2					
Quasi-Peak					
0.177	0.300	44.860	45.160	-20.069	65.229
0.248	0.300	36.070	36.370	-26.830	63.200
0.302	0.300	37.430	37.730	-23.927	61.657
0.361	0.310	36.700	37.010	-22.961	59.971
1.080	0.320	29.650	29.970	-26.030	56.000
2.380	0.360	29.670	30.030	-25.970	56.000
Average					
0.177	0.300	32.820	33.120	-22.109	55.229
0.248	0.300	23.710	24.010	-29.190	53.200
0.302	0.300	34.080	34.380	-17.277	51.657
0.361	0.310	33.060	33.370	-16.601	49.971
1.080	0.320	20.870	21.190	-24.810	46.000
2.380	0.360	20.370	20.730	-25.270	46.000

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. Peak Transmit Power

3.1. Test Equipment

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

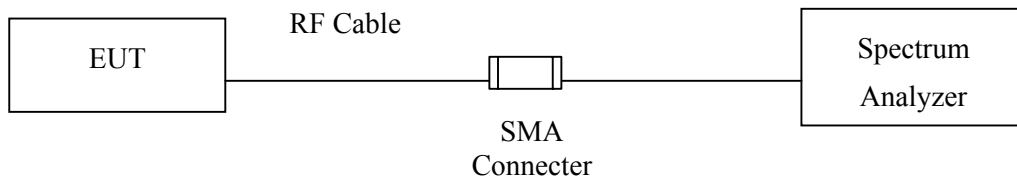
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2007
X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2008
X	Power Sensor	Anritsu	MA2491A/034457	May, 2008

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

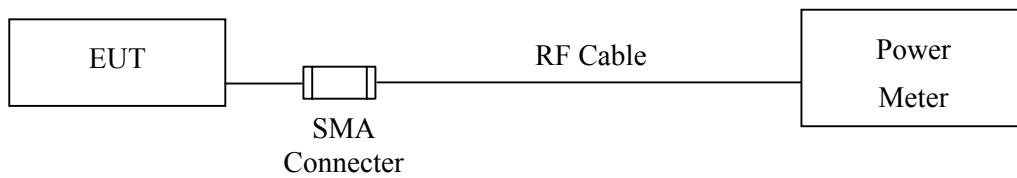
3.2. Test Setup

Conduction Power Measurement

26-dB emission bandwidth Measurement



Conducted Power Measurement



3.3. Limits

- (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (2) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band 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 MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (3) For the band 5.725-5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1W or $17 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

3.4. Test Procedur

As an alternative to DA 02-2138, the EUT peak power was measured with a peak power meter employing a video bandwidth greater than 6dB BW of the emission under test. Peak 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 DA 02-2138, and provides more accurate measurements.

3.5. Uncertainty

$\pm 1.27 \text{ dB}$

3.6. Test Result of Peak Transmit Power

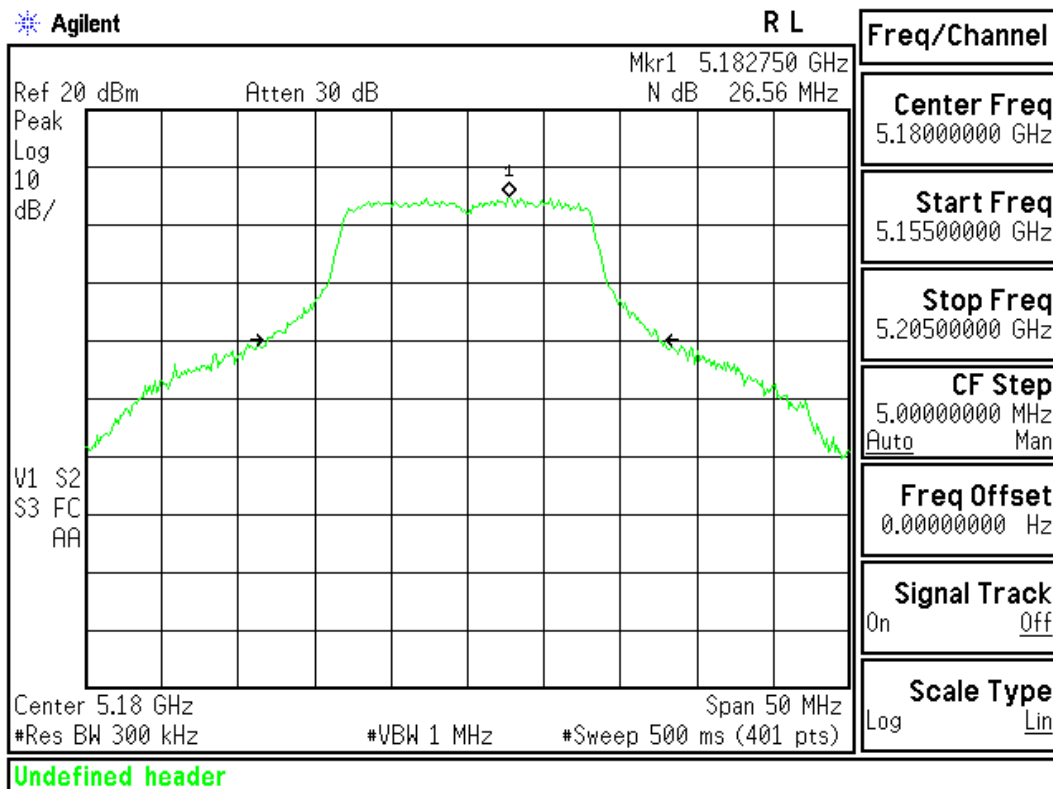
Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Peak Transmit Power
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

Peak Transmit Power Measurement:

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
1	5180	26.56	12.42

Limits (dBm)	Result
50mW (17dBm) or 4dBm+10 log (B= 26.56MHz)=18.42dBm	Pass

26dBc Occupied Bandwidth: Channel 1



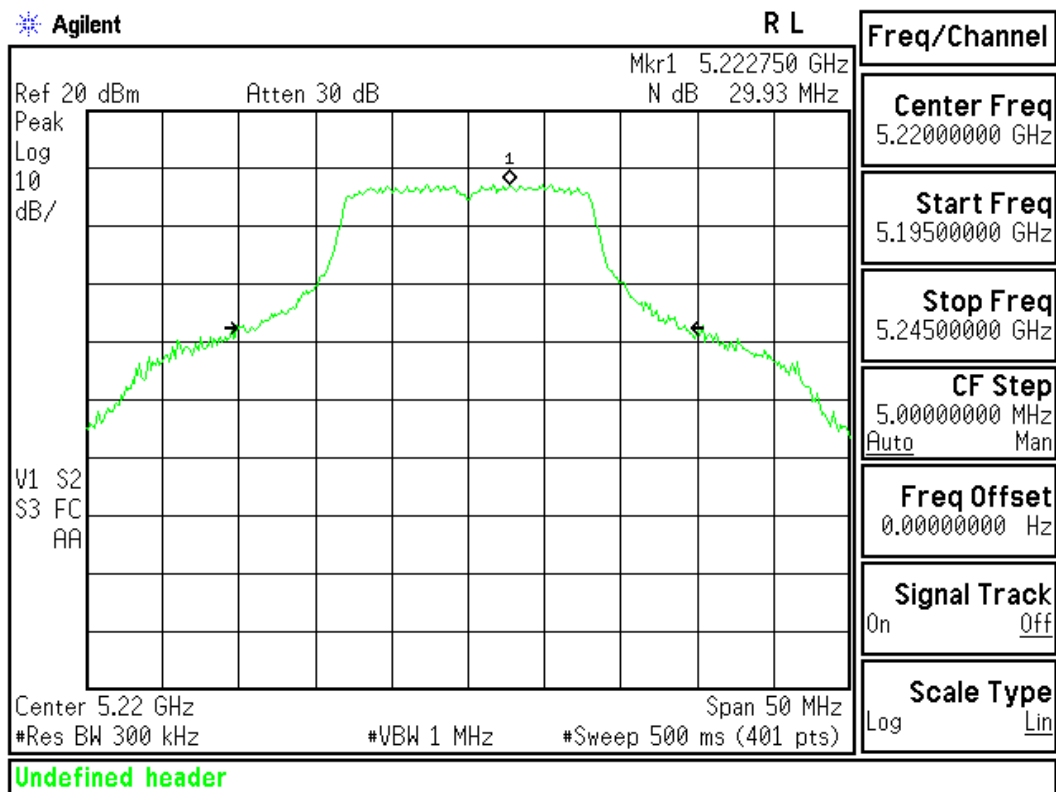
Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Peak Transmit Power
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Peak Transmit Power Measurement:

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
3	5220	29.93	14.54

Limits (dBm)	Result
50mW (17dBm) or 4dBm+10 log (B= 29.93MHz)=18.76dBm	Pass

**26dBc Occupied Bandwidth:
Channel 3**



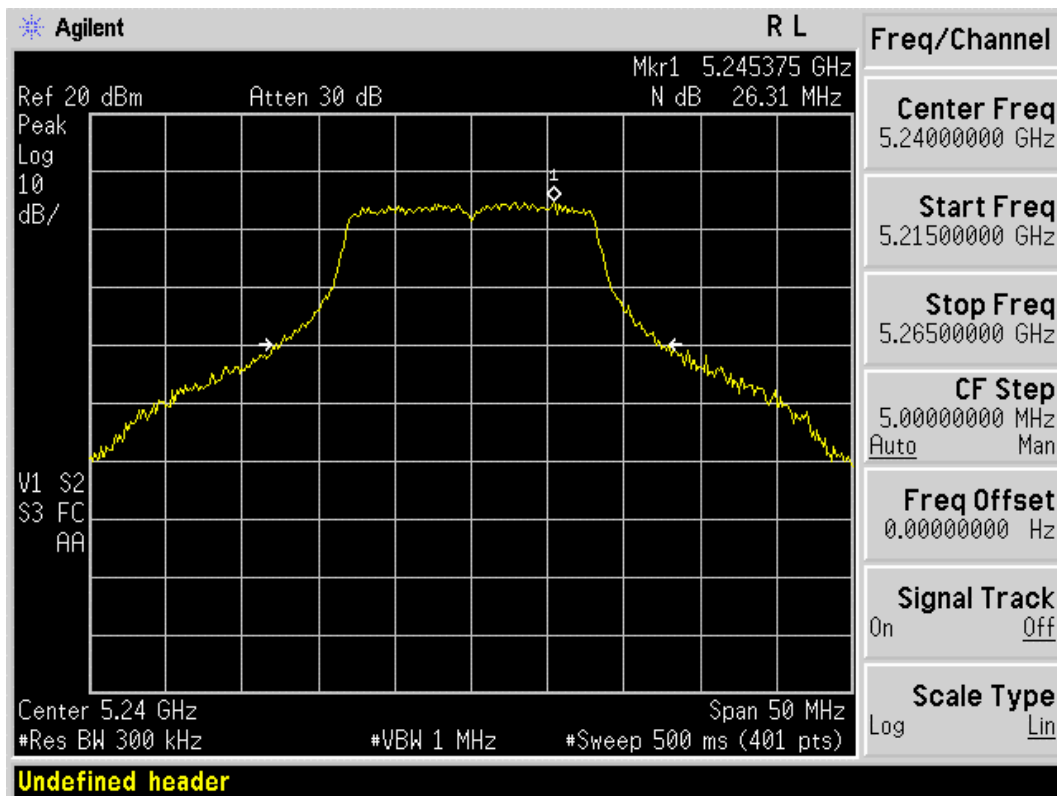
Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Peak Transmit Power
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

Peak Transmit Power Measurement:

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
4	5240	26.31	12.14

Limits (dBm)	Result
50mW (17dBm) or 4dBm+10 log (B=26.31MHz)=18.20dBm	Pass

**26dBc Occupied Bandwidth:
Channel 4**



4. Peak Power Spectral Density

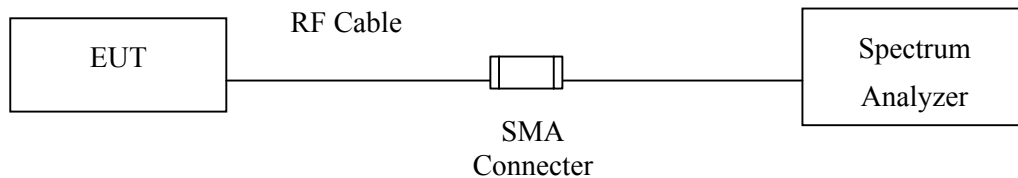
4.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2007
X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008

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

4.2. Test Setup



4.3. Limits

- (4) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (5) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (6) For the band 5.725-5.825 GHz, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (7) exceeds 6 dBi.

4.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003 and tested according to FCC Public Notice DA 02-2138 test procedure for compliance to FCC 47CFR 15. 407 requirements.

We followed method 1 in DA 02-2138.

Use peak detector mode and max hold.

Set RBW= 1MHz , VBW =3 MHz. The Peak Power Spectral Density is the highest level found across the emission in any 1 MHz band.

4.5. Uncertainty

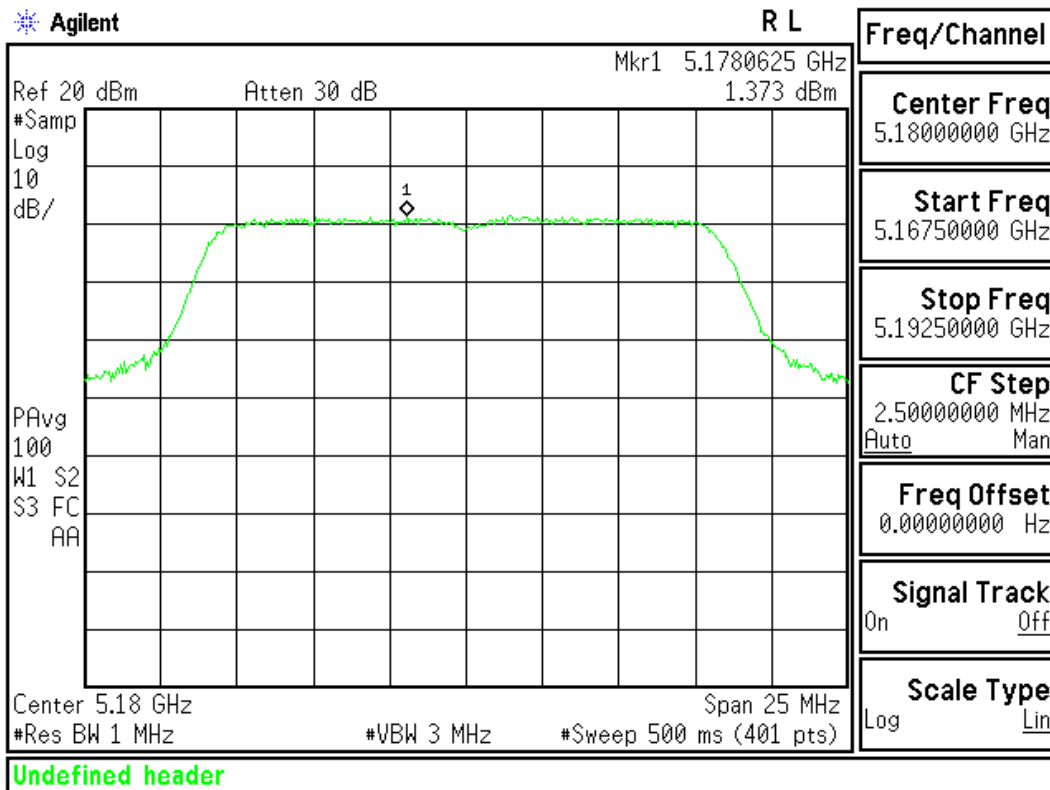
± 1.27 dB

4.6. Test Result of Peak Power Spectral Density

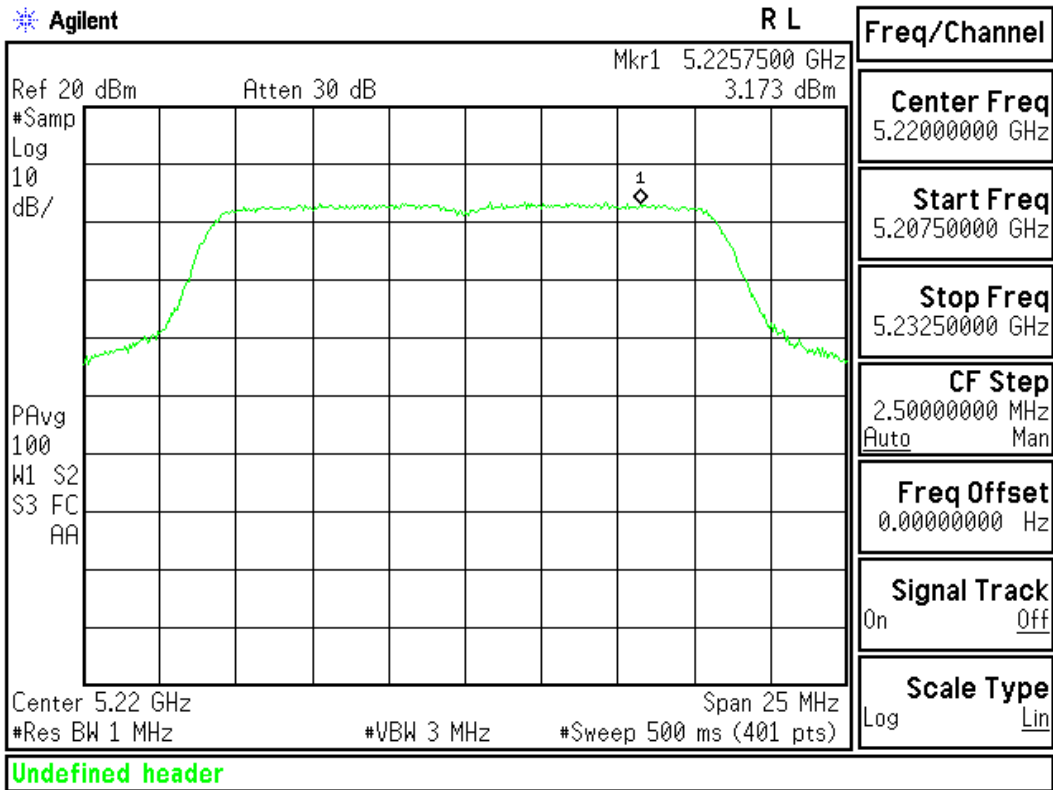
Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Peak Power Spectral Density
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
1	5180.00	1.373	< 4	Pass
3	5220.00	3.173	< 4	Pass
4	5240.00	0.978	< 4	Pass

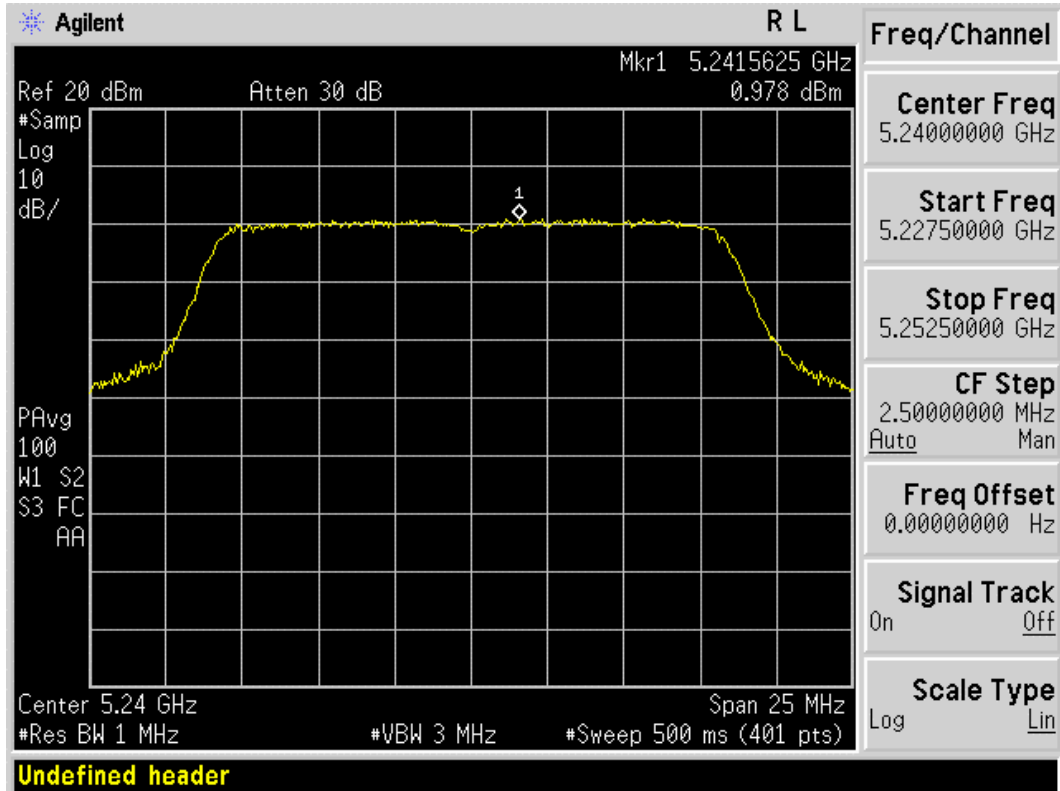
Channel 1:



Channel 3:



Channel 4:



5. Peak Excursion

5.1. Test Equipment

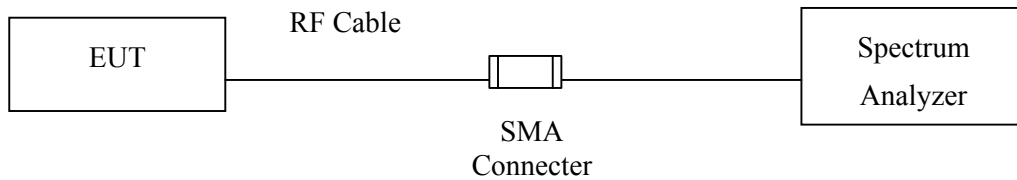
The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2007
X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008

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

5.2. Test Setup

Conduction Power Measurement



5.3. Limits

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

5.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003 and tested according to FCC Public Notice DA 02-2138 test procedure for compliance to FCC 47CFR 15. 407 requirements.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be ≤ 13 dB for all frequencies across the emission bandwidth.

Spectrum plot:

1st Trace

1. Set RBW = 1 MHz, VBW ≥ 3 MHz with peak detector and maxhold settings.

2nd Trace

2. Set RBW = 1 MHz, VBW = 10 Hz with peak detector and maxhold settings.

5.5. Uncertainty

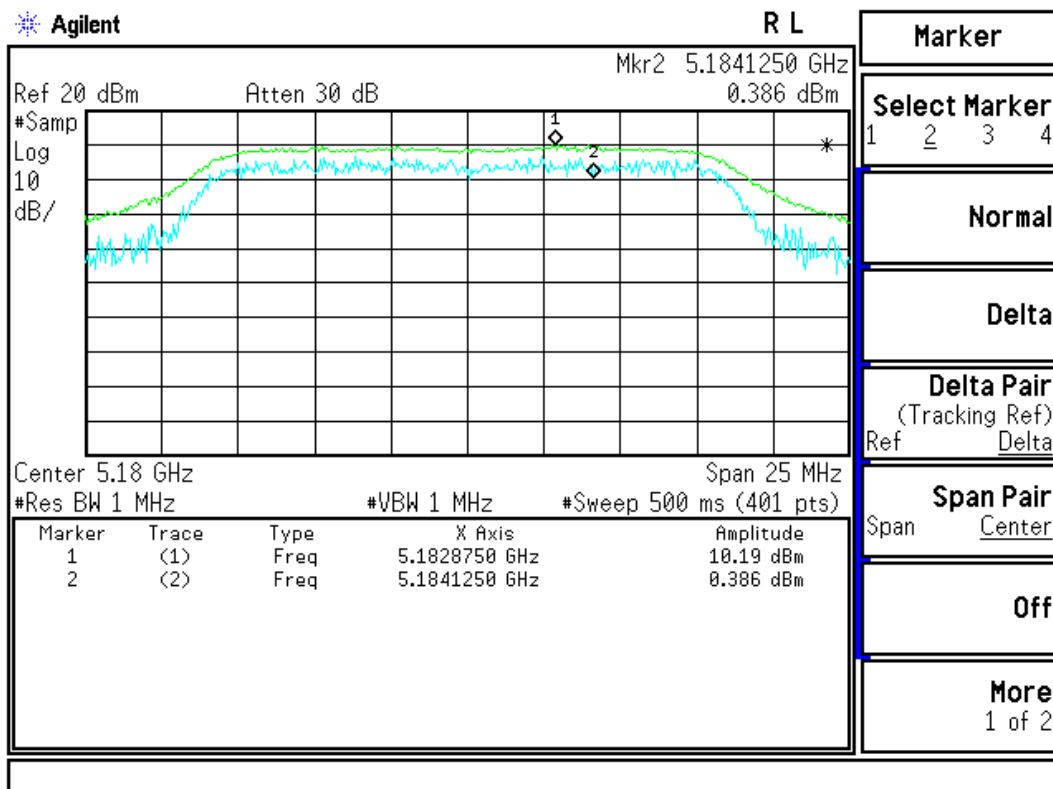
± 1.27 dB

5.6. Test Result of Peak Excursion

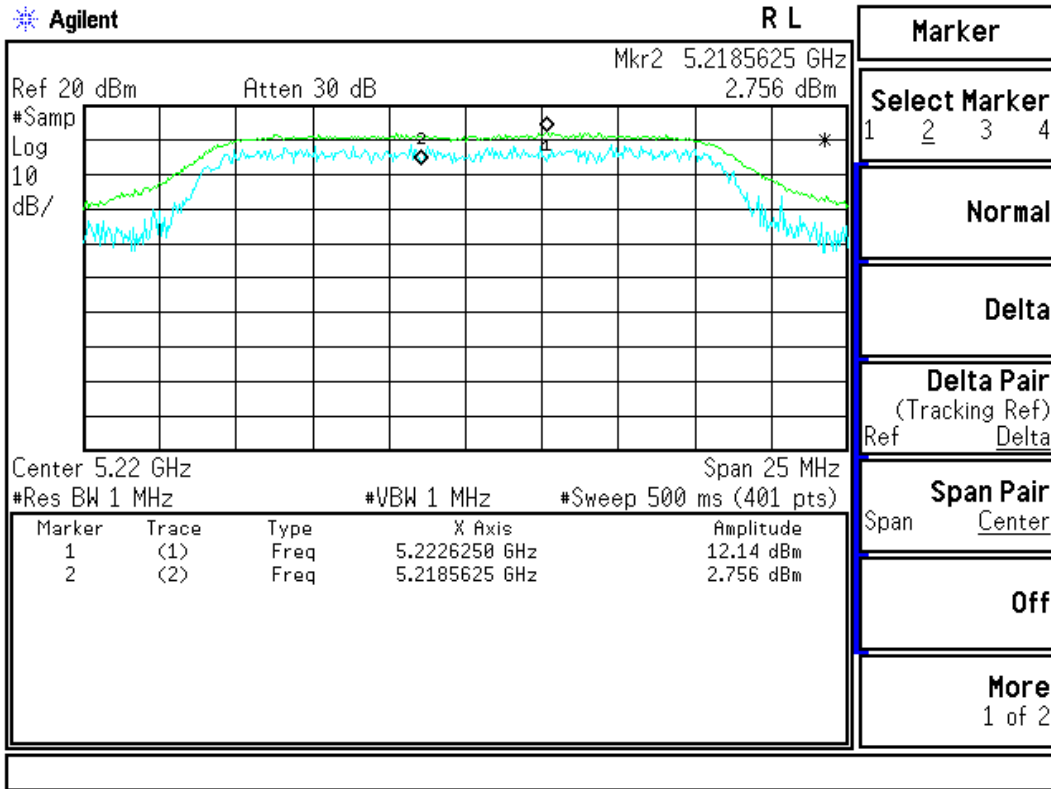
Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Peak Excursion
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a

Channel No.	Frequency (MHz)	Measurement Level (dB)	Required Limit (dB)	Result
1	5180.00	9.804	≤ 13	Pass
3	5220.00	9.384	≤ 13	Pass
4	5240.00	8.574	≤ 13	Pass

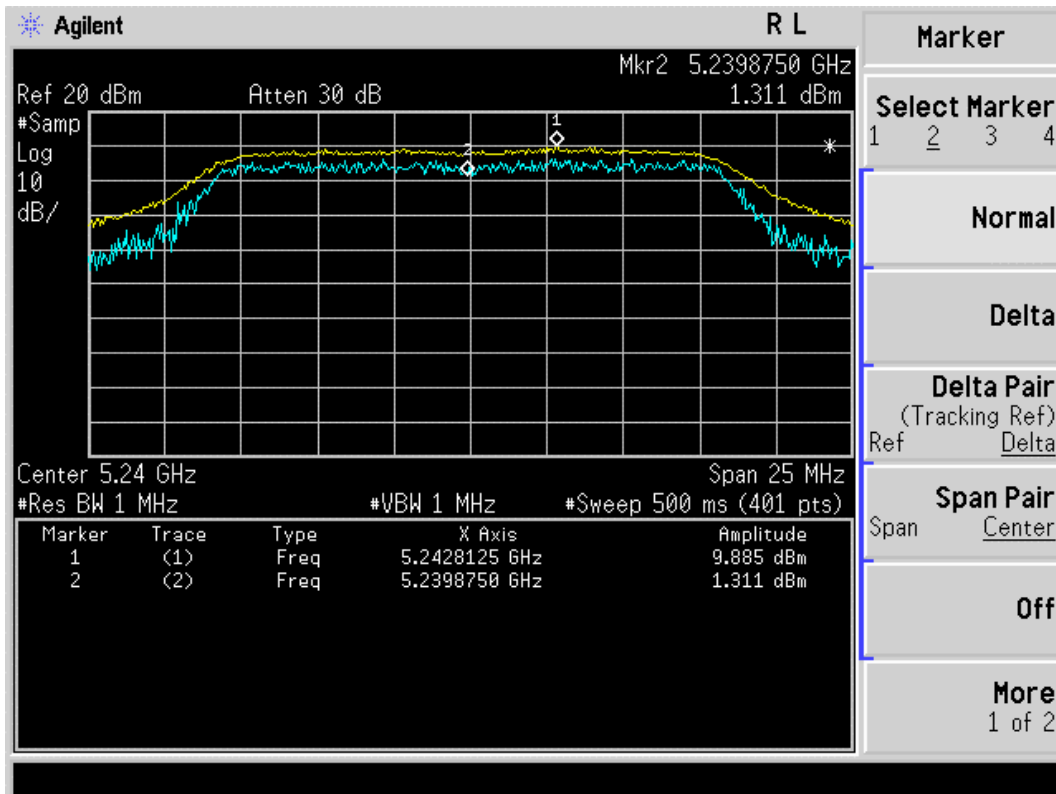
Channel 1:



Channel 3:



Channel 4:



6. Undesirable Emission

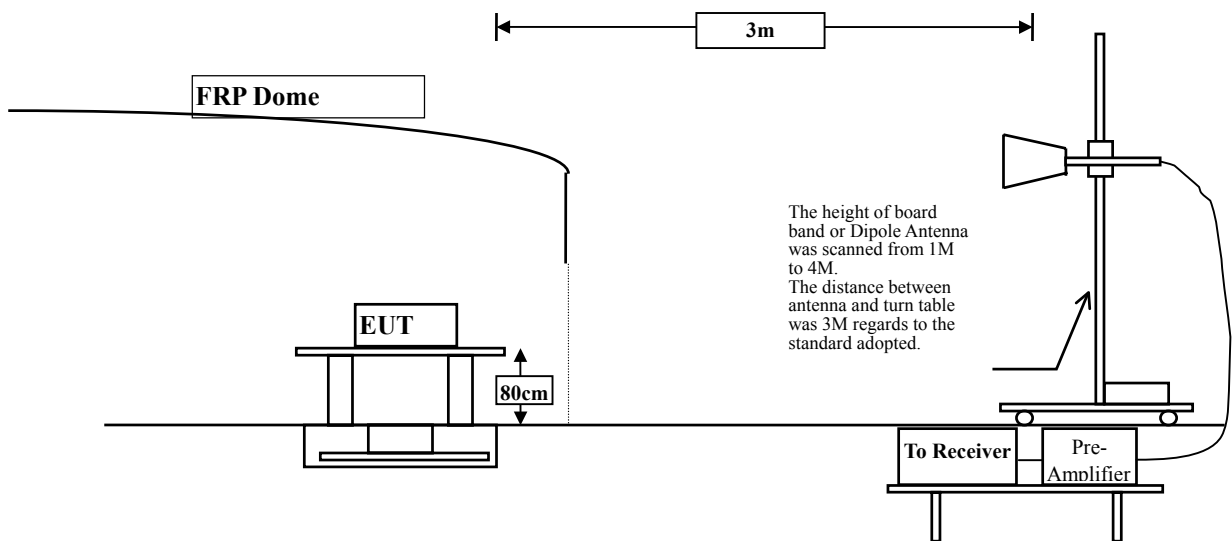
6.1. Test Equipment

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

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 3	X Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2008
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2008
	X Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2008
	X Horn Antenna	ETS	3115 / 0005-6160	July, 2007
	X Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007

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

6.2. Test Setup



6.3. Limits

Inside of the restricted band(section 15.205): Apply to 15.209 limit.

Outside of the restricted band (section 15.407):

- 5.15GHz - 5.35 GHz < -27 dBm/MHz EIRP,
- 5.47GHz - 5.725 GHz < -27 dBm/MHz EIRP,
- 5.725GHz - 5.825 GHz < -27 dBm/MHz EIRP,
- <-17 dBm/MHz EIRP (all emission within the frequency range from the band edge to 10 MHz above or below the band edge).

6.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003 and tested according to FCC Public Notice DA 02-2138 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 C63.4:2003 on radiated measurement.

6.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

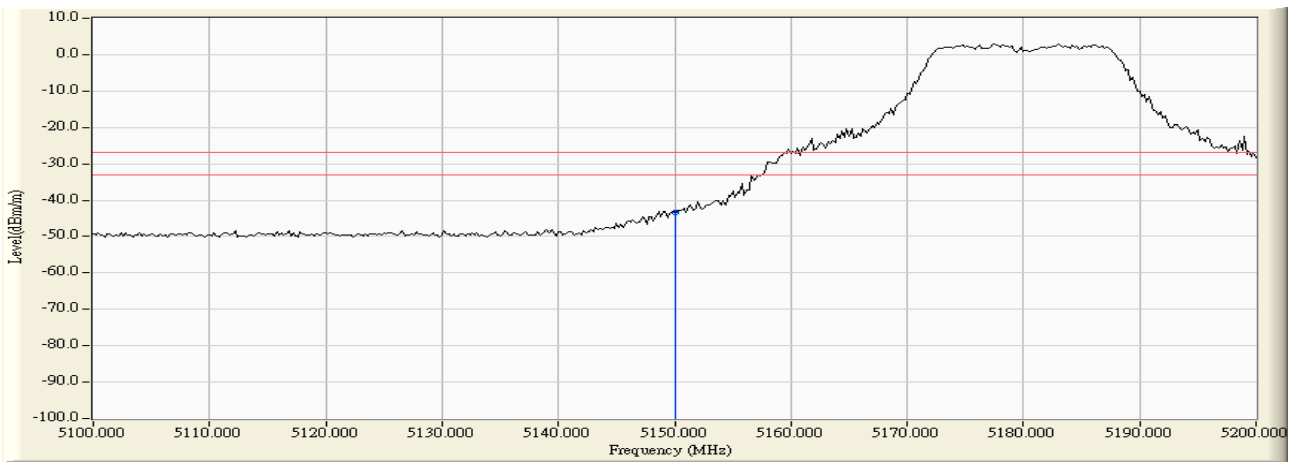
6.6. Test Result of Undesirable Emission

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

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
1 (Peak)	5150.000	14.272	-57.613	-43.341	74.00	54.00	Pass

Figure Channel 1: Horizontal (Peak)



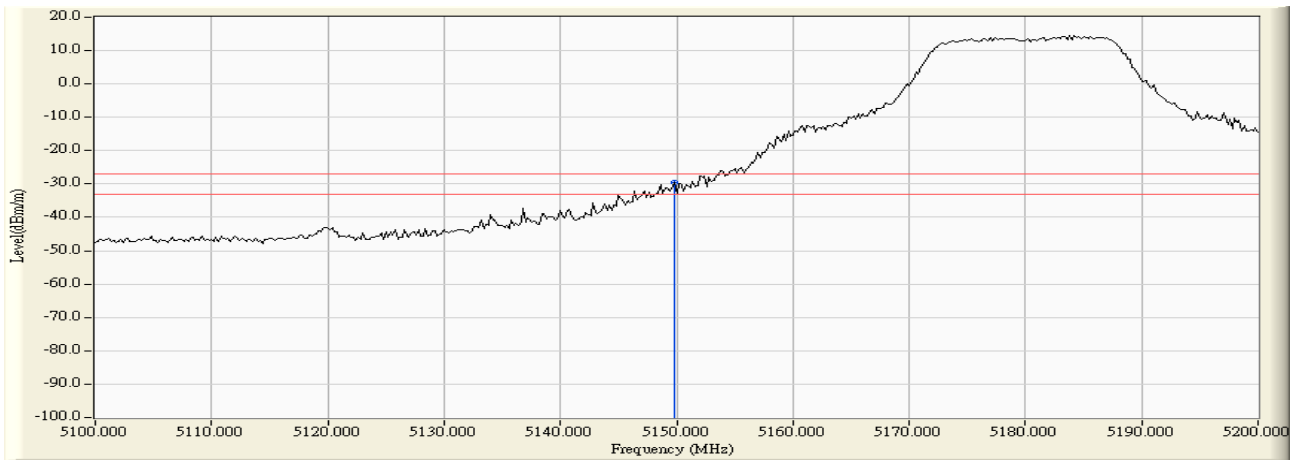
Note: Spectrum setting: Detector=Peak detector and maximum hold,
 RBW= 1MHz, VBW=3 MHz.

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

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
1 (Peak)	5149.800	14.632	-44.303	-29.672	74.00	54.00	Pass

Figure Channel 1: Vertical (Peak)



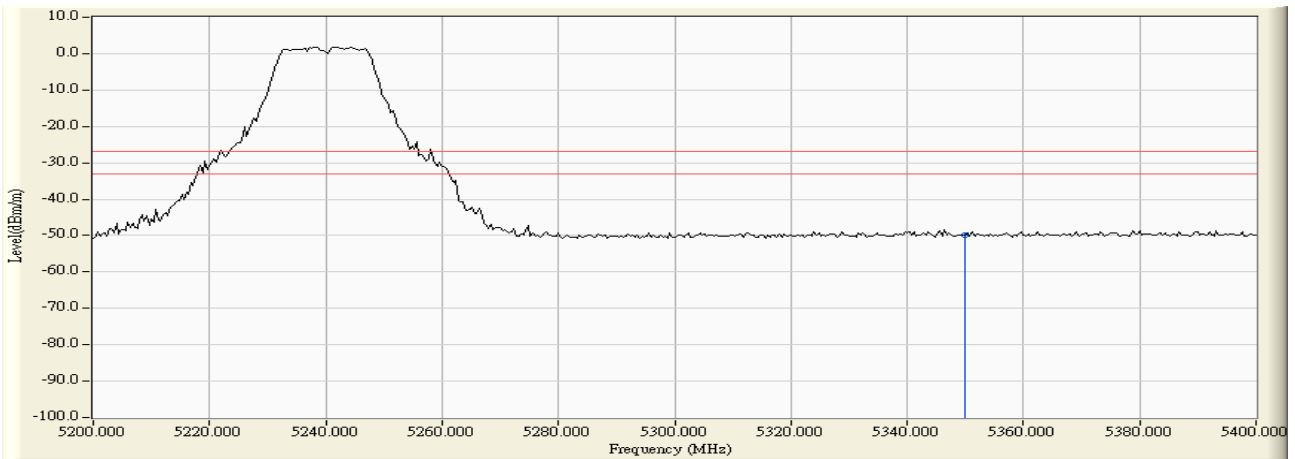
Note: Spectrum setting: Detector=Peak detector and maximum hold,
 RBW= 1MHz, VBW=3 MHz.

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

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
4 (Peak)	5350.000	14.464	-64.457	-49.993	74.00	54.00	Pass

Figure Channel 4: Horizontal (Peak)



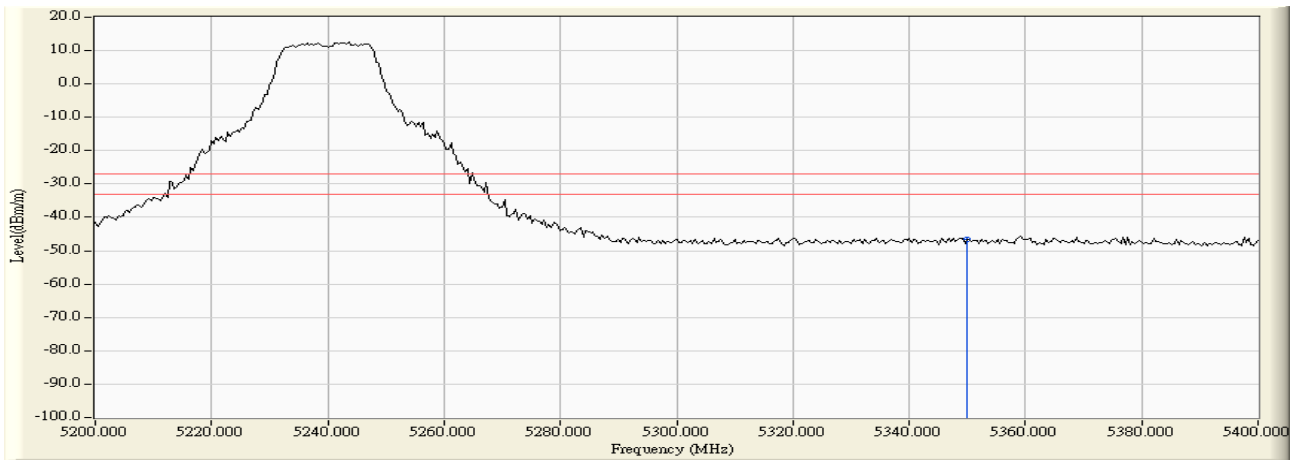
Note: Spectrum setting: Detector=Peak detector and maximum hold,
 RBW= 1MHz, VBW=3 MHz.

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

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
4 (Peak)	5350.000	14.773	-61.416	-46.643	74.00	54.00	Pass

Figure Channel 4: Vertical (Peak)



Note: Spectrum setting: Detector=Peak detector and maximum hold,
 RBW= 1MHz, VBW=3 MHz.

7. Radiated Emission

7.1. Test Equipment

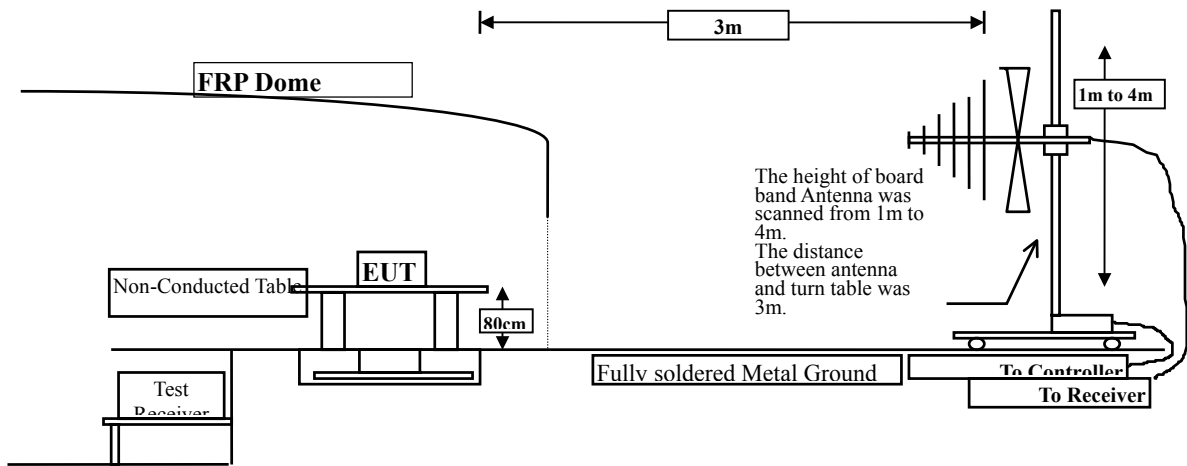
The following test equipment are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 1	Test Receiver	R & S	ESCS 30 / 825442/14	May, 2008
	Spectrum Analyzer	Advantest	R3261C / 71720140	May, 2008
	Pre-Amplifier	HP	8447D/3307A01812	May, 2008
	Bilog Antenna	Chase	CBL6112B / 12452	Sep., 2007
	Horn Antenna	EM	EM6917 / 103325	May, 2008
Site # 2	Test Receiver	R & S	ESCS 30 / 825442/17	May, 2008
	Spectrum Analyzer	Advantest	R3261C / 71720609	May, 2008
	Pre-Amplifier	HP	8447D/3307A01814	May, 2008
	Bilog Antenna	Chase	CBL6112B / 2455	Sep., 2007
	Horn Antenna	EM	EM6917 / 103325	May, 2008
Site # 3	X Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2008
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008
	X Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2008
	X Horn Antenna	Schwarzbeck	BBHA9120D / 305, 306	July, 2007
	X Horn Antenna	Schwarzbeck	BBHA9170 / 208, 209	July, 2007
	X Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2008
X Pre-Amplifier	HP	8449B / 3008A01123	July, 2007	

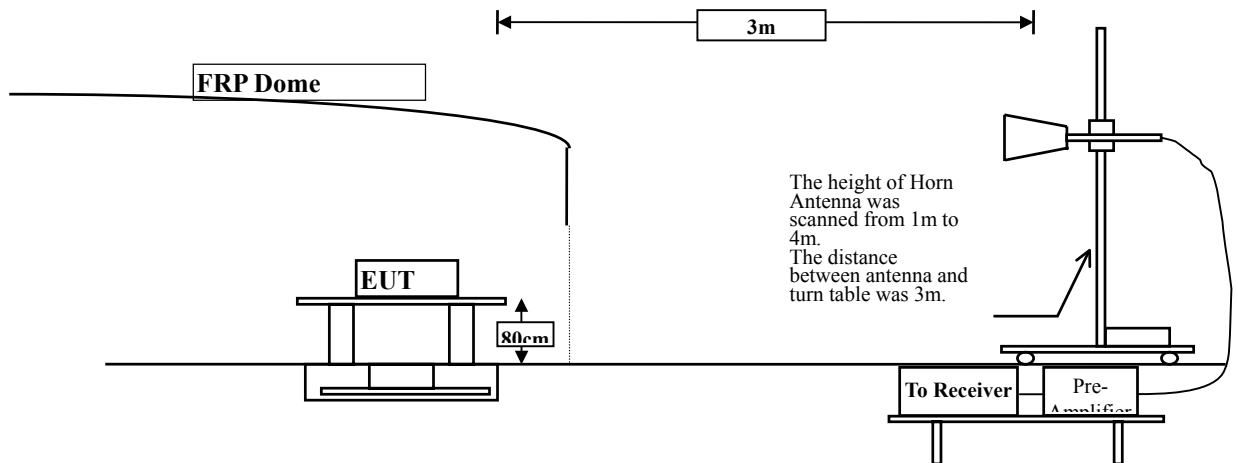
- Note:
1. All instruments are calibrated every one year.
 2. The test instruments marked by "X" are used to measure the final test results.

7.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



7.3. 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	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.

7.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003 and tested according to DTS test procedure of Oct 2002 KDB558074 for compliance to FCC 47CFR 15.247 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 resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz. Radiated emission measurements below 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 beam width of the antenna. The worst radiated emission is measured on the Final Measurement. The frequency range from 30MHz to 10th harmonics is checked.

7.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

7.6. Test Result of Radiated Emission

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Undesirable Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector					
10360.000	6.944	51.010	57.954	-16.046	74.000
15540.000	8.643	42.590	51.232	-22.768	74.000
Average Detector					
10360.000	6.944	37.830	44.774	-9.226	54.000
Vertical					
Peak Detector					
10360.000	6.944	52.350	59.294	-14.706	74.000
15540.000	8.643	42.550	51.192	-22.808	74.000
Average Detector					
10360.000	6.944	34.970	41.914	-12.086	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:10MHz.
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:10MHz.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Undesirable Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector					
10440.000	6.794	53.090	59.884	-14.116	74.000
15660.000	7.579	43.050	50.630	-23.370	74.000
Average Detector					
10440.000	6.794	40.100	46.894	-7.106	54.000
Vertical					
Peak Detector					
10440.000	6.794	59.500	66.294	-7.706	74.000
15660.000	7.579	47.920	55.500	-18.500	74.000
Average Detector					
10640.000	6.467	44.810	51.277	-2.723	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:10MHz.
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:10MHz.
4. Measurement Level = Reading Level + Correct Factor..
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Undesirable Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector					
10480.000	6.540	52.490	59.030	-14.970	74.000
15720.000	6.549	45.120	51.669	-22.331	74.000
Average Detector					
10480.000	6.540	37.950	44.490	-9.510	54.000
Vertical					
Peak Detector					
10480.000	6.540	60.760	67.300	-6.700	74.000
15720.000	6.949	46.480	53.429	-20.571	74.000
Average Detector					
10480.000	6.540	45.590	52.130	-1.870	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:10MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:10MHz ◦
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Undesirable Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector					
142.520	12.083	14.267	26.350	-17.150	43.500
297.720	14.089	9.491	23.580	-22.420	46.000
478.590	18.930	7.840	26.770	-19.230	46.000
561.560	19.291	5.209	24.500	-21.500	46.000
759.440	21.779	1.691	23.470	-22.530	46.000
933.140	22.851	1.749	24.600	-21.400	46.000
Vertical					
Peak Detector					
216.240	10.702	16.438	27.140	-18.860	46.000
363.678	16.416	12.144	28.560	-17.440	46.000
480.080	18.459	5.891	24.350	-21.650	46.000
534.820	19.499	9.170	28.670	-17.330	46.000
709.200	21.260	2.870	24.130	-21.870	46.000
812.560	21.715	4.635	26.350	-19.650	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "█" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor
4. The radiated emissions below 1GHz of the lowest, middle, highest frequency are pretested. Only the worst case is shown on the report.

8. Band Edge

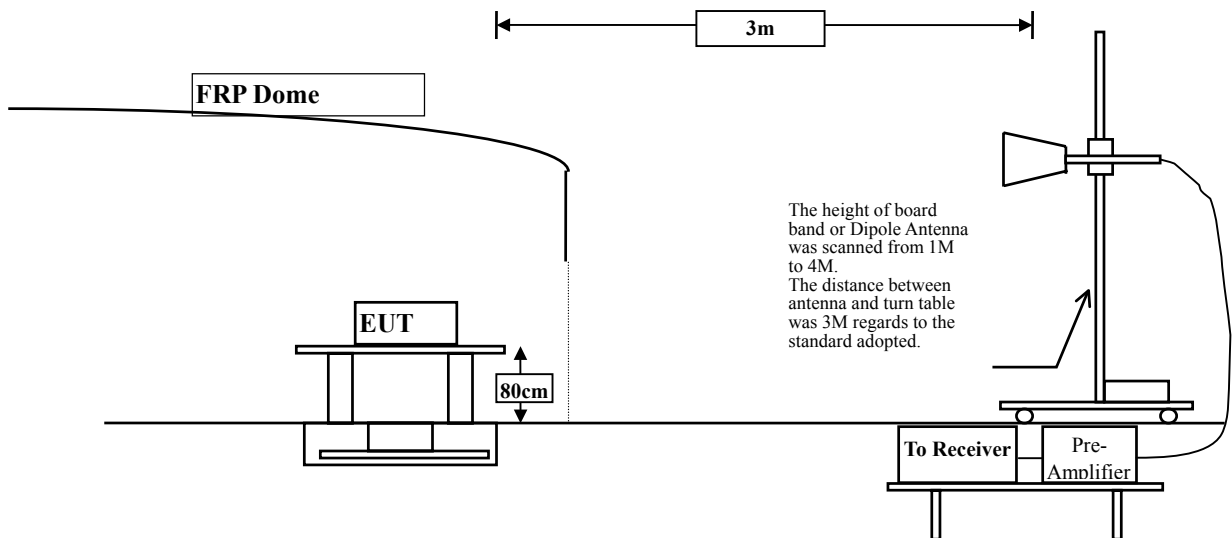
8.1. Test Equipment

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

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 3	X Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2008
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2008
	X Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2008
	X Horn Antenna	ETS	3115 / 0005-6160	July, 2007
	X Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007

8.2. Test Setup

RF Radiated Measurement:



8.3. 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.

8.4. 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 C63.4:1992 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz.

8.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

8.6. Test Result of Band Edge

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

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
1 (Peak)	5150.000	0.407	57.171	57.579	74.00	54.00	Pass
1 (Average)	5150.000	0.407	40.696	41.104	74.00	54.00	Pass

Figure Channel 1: Horizontal (Peak)

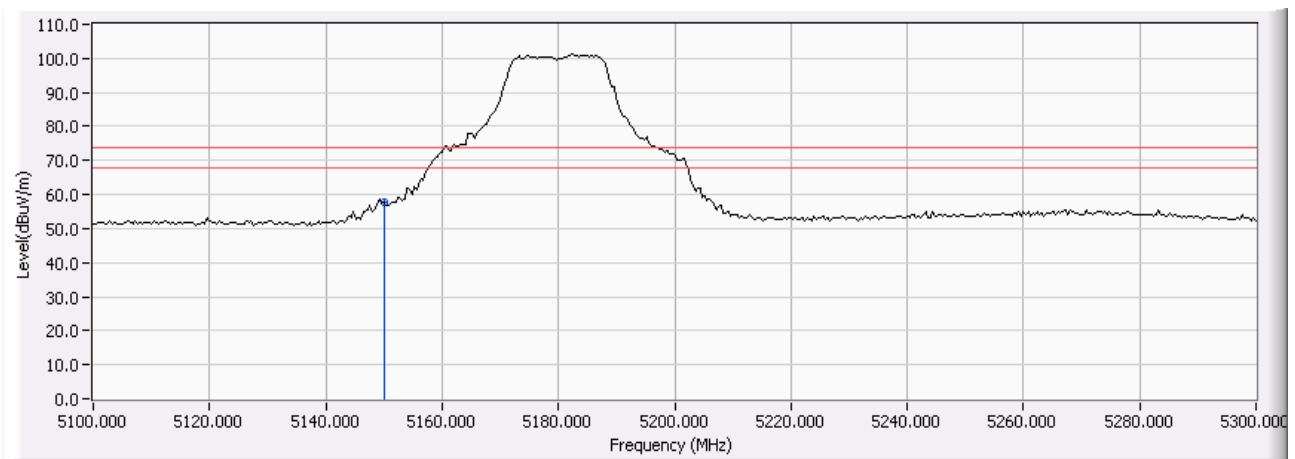
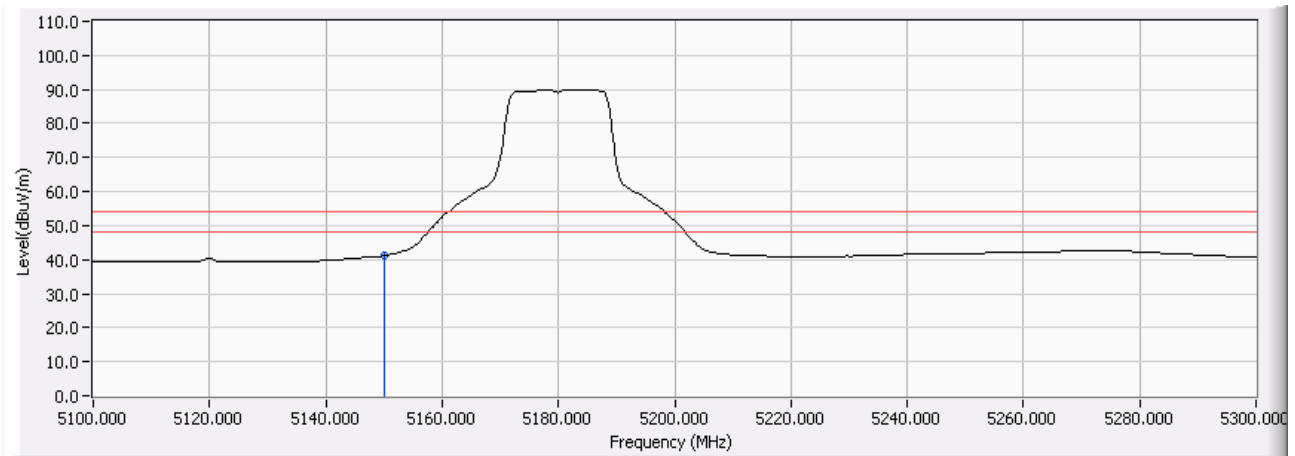


Figure Channel 1: Horizontal (Average)



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 : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

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
1 (Peak)	5150.000	0.407	68.129	68.537	74.00	54.00	Pass
1 (Average)	5150.000	0.407	45.011	45.419	74.00	54.00	Pass

Figure Channel 1: Vertical (Peak)

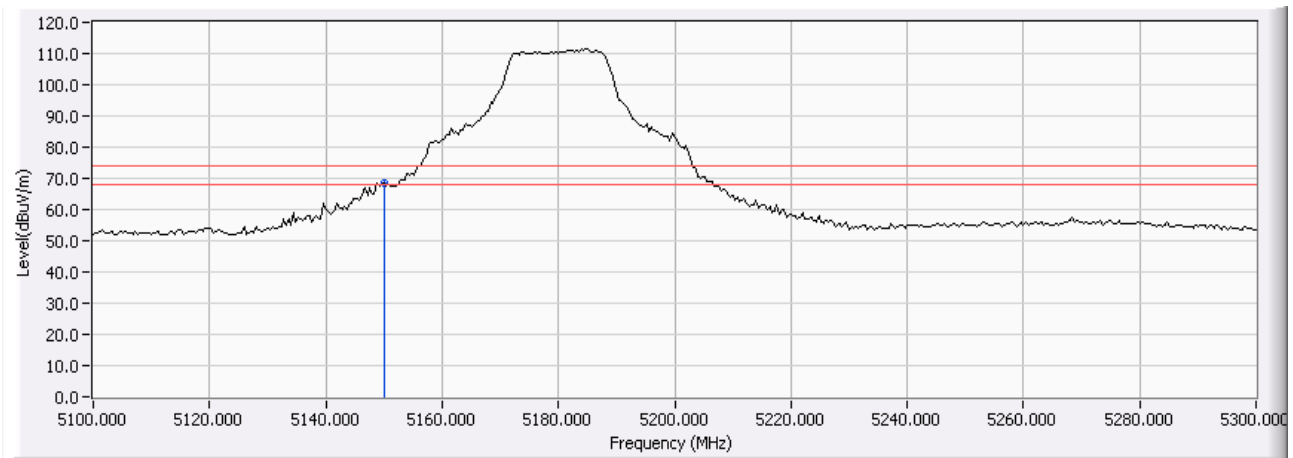
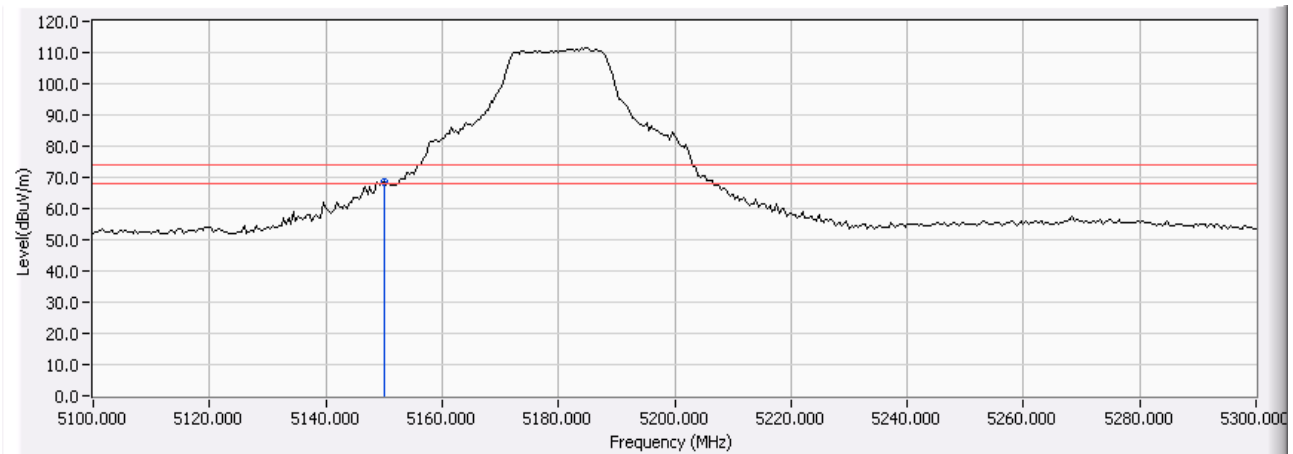


Figure Channel 1: Vertical (Peak)



Note:

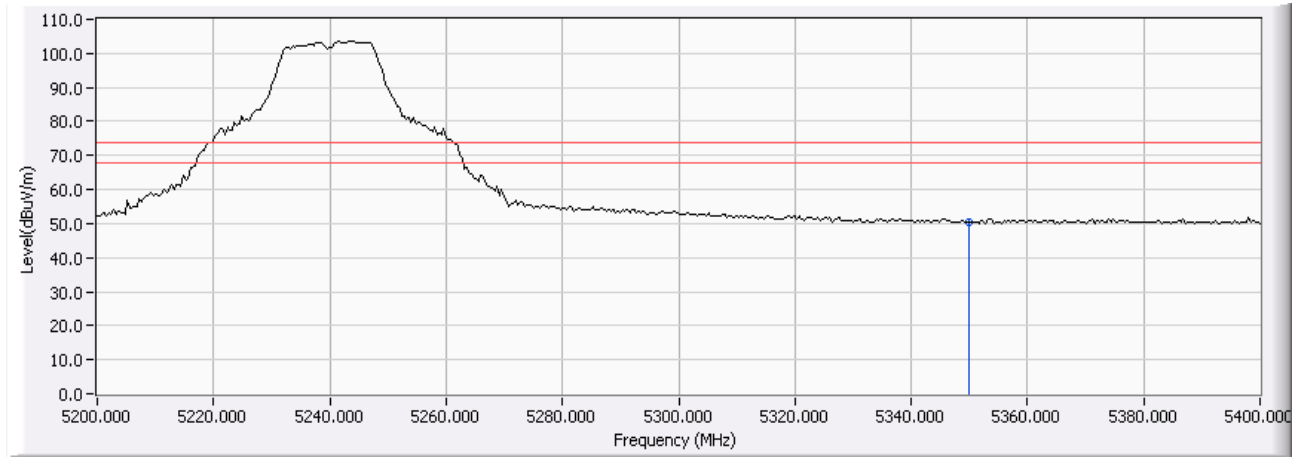
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading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

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

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
4 (Peak)	5350.000	-0.127	50.670	50.544	74.00	54.00	Pass

Figure Channel 4: Horizontal (Peak)



Note:

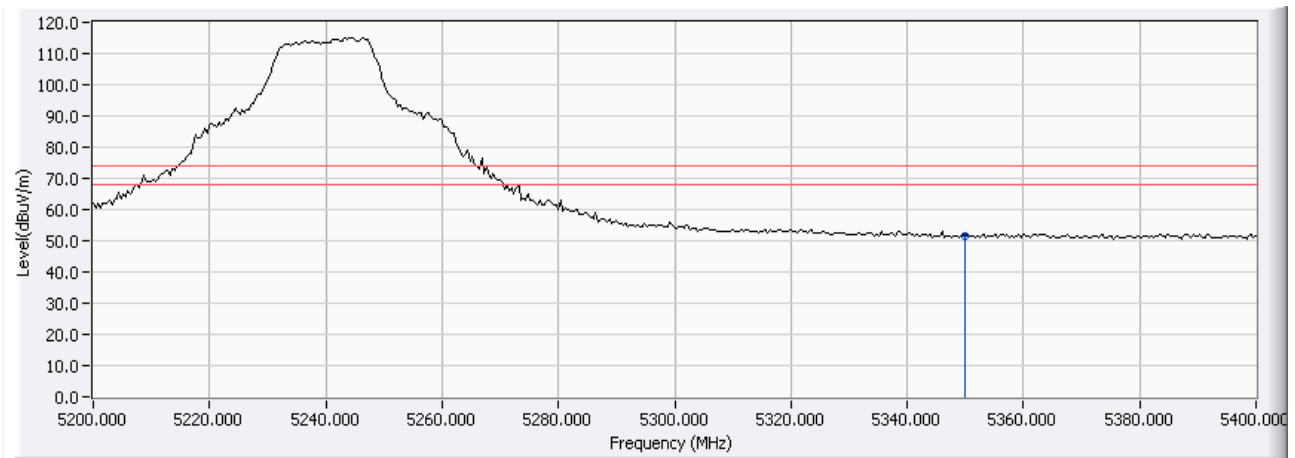
1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading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

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

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
4 (Peak)	5350.000	-0.127	51.563	51.437	74.00	54.00	Pass

Figure Channel 4: Vertical (Peak)



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.

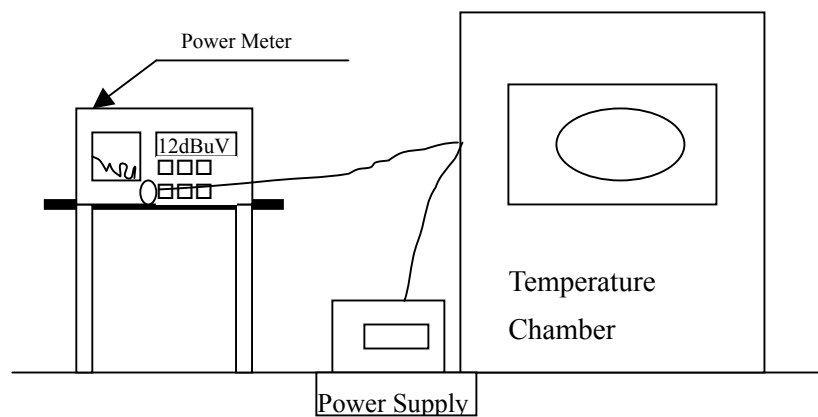
9. Frequency Stability

9.1. Test Equipment

Equipment	Manufacturer	Model No./Serial No.	Last Cal.	Remark
Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2008	
Temperature Chamber	WIT GROUP	TH-1S-B / WIT-02121901	June, 2007	

Note: All equipments are calibrated every one year.

9.2. Test Setup



9.3. 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

9.4. Uncertainty

± 150 Hz

9.5. Test Result of Frequency Stability

Product : Industrial IEEE 802.11a/b/g wireless Access Point/Bridge/Client
 Test Item : Frequency Stability
 Test Site : Temperature Chamber
 Test Mode : Mode 1: Transmitter 802.11a

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	ΔF (MHz)
Tnom (25) °C	Vnom (110)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
Tmax (50) °C	Vmax (126.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
Tmax (50) °C	Vnim (93.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
Tnim (-20) °C	Vmax (126.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
Tnim (-20) °C	Vnim (93.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00

10. EMI Reduction Method During Compliance Testing

No modification was made during testing.