Test Report

Product Name	MOXA IEEE802.11 a/b/g mini PCI module
Model No	WAPA003
FCC ID	SLE-WAPA003-1

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

Date of Receipt	Apr. 12, 2012
Issued Date	Jun. 05, 2012
Report No.	124286R-RFUSP36V01
Report Version	V1.0

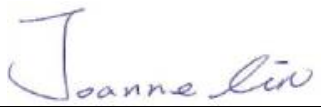
Testing Laboratory
0914

Test Report Certification

Issued Date: Jun. 05, 2012
Report No.: 124286R-RFUSP36V01

Product Name	MOXA IEEE802.11 a/b/g mini PCI module
Applicant	Moxa Inc.
Address	Fl.4, No. 135, Lane 235, Pao-Chiao Rd., Shing Tien City, Taipei, Taiwan, R.O.C.
Manufacturer	Moxa Inc.
Model No.	WAPA003
FCC ID.	SLE-WAPA003-1
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 90 Subpart Y: 2009 ANSI TIA-603-C-2004
Test Result	Complied

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

Documented By : 
(Adm. Specialist / Joanne Lin)

Tested By : 
(Engineer / Jack Hsu)

Approved By : 
(Manager / Vincent Lin)

TABLE OF CONTENTS

Description Page

1. GENERAL INFORMATION 5

1.1. EUT Description 5
1.2. Operational Description 7
1.3. Tested System Datails 8
1.4. Configuration of tested System 8
1.5. EUT Exercise Software 8
1.6. Test Facility 9

2. Transmitter output power 10

2.1. Test Equipment 10
2.2. Test Setup 10
2.3. Limits 10
2.4. Test Procedur 11
2.5. Uncertainty 11
2.6. Test Result of Peak Transmit Power 12

3. Peak Power Spectral Density 13

3.1. Test Equipment 14
3.2. Test Setup 14
3.3. Limits 14
3.4. Test Procedure 15
3.5. Uncertainty 15
3.6. Test Result of Peak Power Spectral Density 16

4. Occupied Bandwidth 17

4.1. Test Equipment 18
4.2. Test Setup 18
4.3. Limits 18
4.4. Uncertainty 18
4.5. Test Result of Occupied Bandwidth 19

5. Power spectral density mask 21

5.1. Test Equipment 21
5.2. Test Setup 21
5.3. Limits 21
5.4. Test Procedure 23
5.5. Uncertainty 23
5.6. Test Result of Occupied Bandwidth and Power spectral density mask 24

6. Peak Excursion 26

6.1. Test Equipment 26
6.2. Test Setup 26
6.3. Limits 26
6.4. Test Procedure 27
6.5. Uncertainty 27
6.6. Test Result of Peak Excursion 28

7. Frequency Stability 30

7.1. Test Equipment 30

7.2. Test Setup 30
7.3. Limits 30
7.4. Test Procedure 31
7.5. Uncertainty 31
7.6. Test Result of Frequency Stability....32

8. Conductive Spurious Emission....33

8.1. Test Equipment....33
8.2. Test Setup 33
8.3. Limits 33
8.4. Test Procedure 33
8.5. Uncertainty 33
8.6. Test Result of Conductive Spurious Emission 34

9. Radiated Spurious Emission....39

9.1. Test Equipment....39
9.2. Test Setup 39
9.3. Limits 39
9.4. Test Procedure 41
9.5. Uncertainty 41
9.6. Test Result of Radiated Emission....42

10. EMI Reduction Method During Compliance Testing 46

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	MOXA IEEE802.11 a/b/g mini PCI module
Trade Name	MOXA
FCC ID.	SLE-WAPA003-1
Model No.	WAPA003
Frequency Range	4960-4980MHz
Number of Channels	20MHz: 2CH
Data Rate	Up to 54Mbps
Channel Control	Auto
Type of Modulation	OFDM
Antenna type	Dipole Antenna
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Peak Gain
1	KINSUN	ANT-WDB-O-2 BK (main)(aux)	2.34dBi in 4.9GHz
2	KINSUN	ANT-WDB-ANM-0502 (main)(aux)	1.41dBi in 4.9GHz

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.

Center Working Frequency of Each Channel: (20MHz Bandwidth)

Channel	Frequency	Channel	Frequency
Channel 1:	4960MHz	Channel 2:	4980MHz

Note:

1. This device is an MOXA IEEE802.11 a/b/g mini PCI module with a built-in WLAN transceiver.
2. The device is applied for modular approval.
3. Regarding to the operation frequency, the lowest 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.
4. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90 Subpart Y.

Test Mode	Mode 1: Transmit (20MHz Bandwidth)

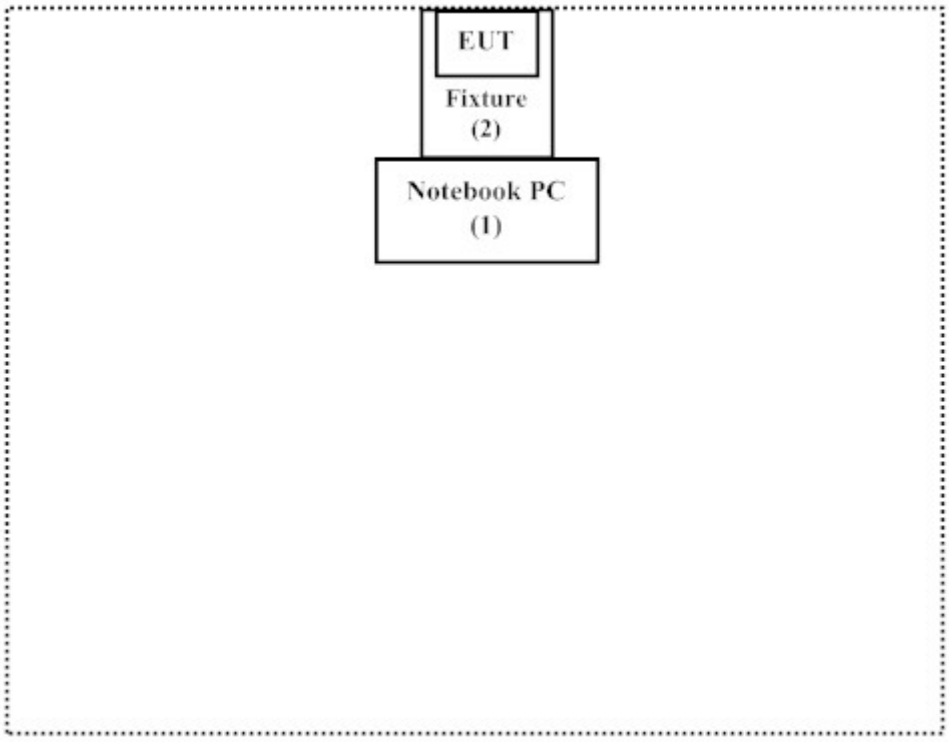
1.3. Tested System Datails

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	PP18L	36119001664	Non-Shielded, 0.8m
2	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 program on the Notebook.

(3) Configure the test mode, the test channel, and the data rate.

(4) Press “OK” to start the continuous Transmit.

(5) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

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

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

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

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

Accreditation on NVLAP
NVLAP Lab Code: 200533-0

Site Name: Quietek Corporation
Site Address: No. 5-22, Rueishu Keng, 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. Transmitter output power

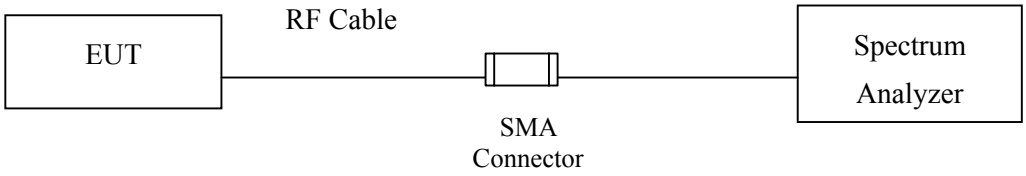
2.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr, 2012

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



2.3. Limits

§90.1215: The transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this section.

Channel bandwidth (MHz)	Low power maximum conducted output power (dBm)	High power maximum conducted output power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

2.4. Test Procedur

TIA-603-C Section 2.2.1

The EUT transmitter output was connected through an appropriate 50-ohm attenuator to a spectrum analyzer. The peak transmit power was measured as a conducted emission over the interval of continuous transmission in terms of an RMS equivalent voltage with a 1 second sweep and a resolution bandwidth of 1 MHz.

A 10 dB attenuator was used between the EUT and the spectrum analyzer for all power measurements. No cable was used between the EUT and the analyzer.

The system loss was measured to be 10 dB and entered as an offset into the spectrum analyzer.

2.5. Uncertainty

± 1.27 dB

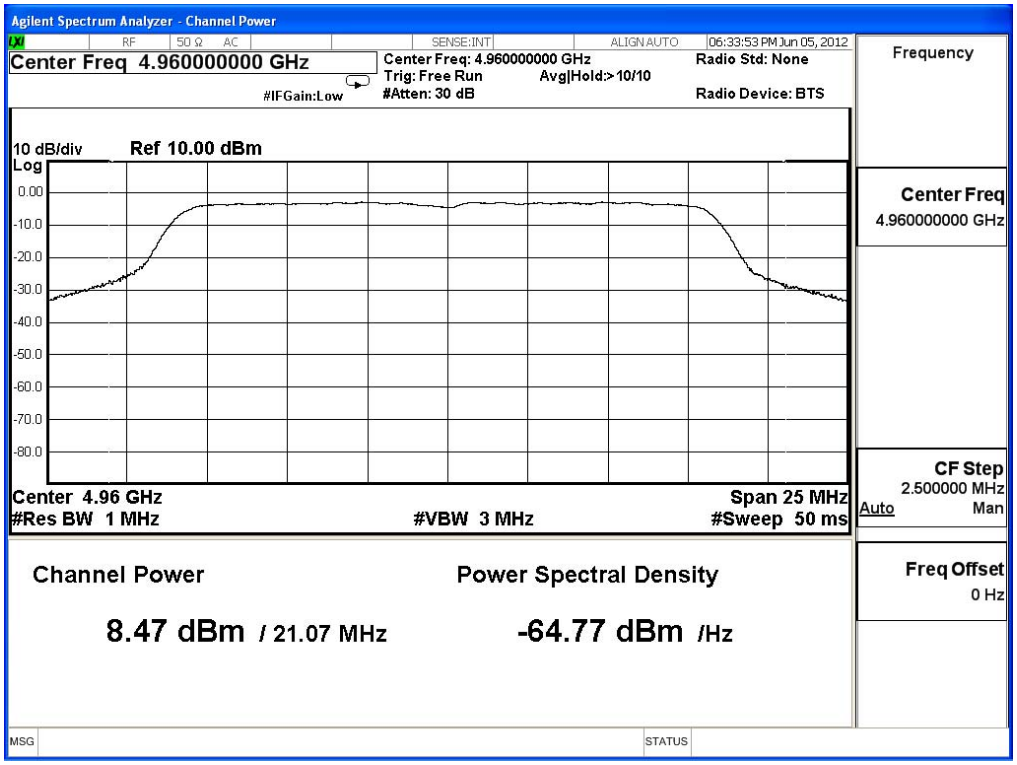
2.6. Test Result of Peak Transmit Power

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Peak Transmit Power
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

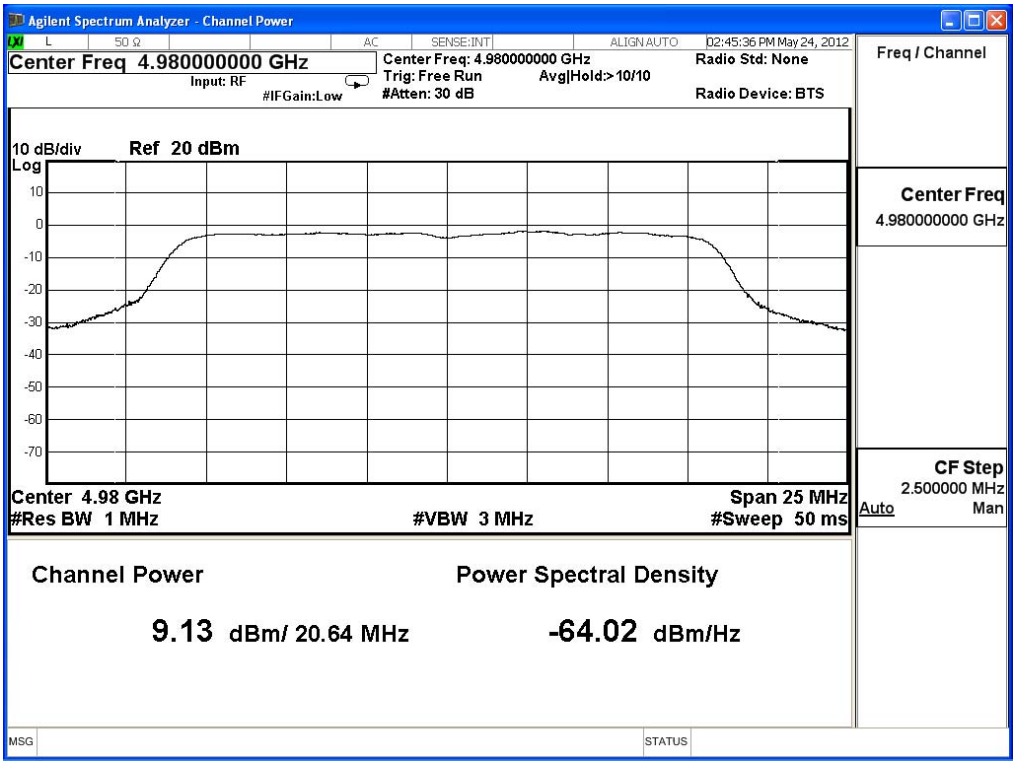
Peak Transmit Power - 20MHz Bandwidth

Channel	Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)
1	4960	8.47	20
2	4980	9.13	20

Channel 1



Channel 2


Agilent Spectrum Analyzer - Channel Power
Center Freq 4.980000000 GHz
Input: RF
#IFGain:Low
Center Freq: 4.980000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
02:45:36 PM May 24, 2012
Freq / Channel
10 dB/div
Log
Ref 20 dBm
10
0
-10
-20
-30
-40
-50
-60
-70
Center Freq
4.980000000 GHz
Center 4.98 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 25 MHz
#Sweep 50 ms
CF Step
2.500000 MHz
Auto
Man
Channel Power
9.13 dBm/ 20.64 MHz
Power Spectral Density
-64.02 dBm/Hz
MSG
STATUS

3. Peak Power Spectral Density

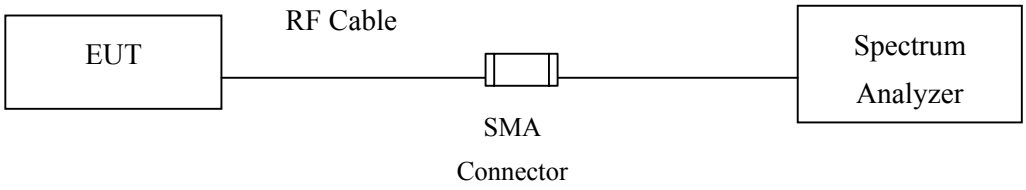
3.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr, 2012

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

High power devices are limited to a peak power spectral density of 21 dBm per 1 MHz.

The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used.
Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less.
A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

Limit determined by antenna gain:

Antenna Gain (dBi)	Limit (dBm)
Up to 26 dBi	21

Low power maximum conducted output power (dBm/MHz)	High power maximum conducted output power (dBm/MHz)
8	21

3.4. Test Procedure

The EUT transmitter output was connected through the appropriate 50-ohm attenuator to a spectrum analyzer. Resolution bandwidth was set to 1% of occupied bandwidth and video bandwidth was set to a value greater than the resolution bandwidth. Peak search was used to find peak spectral density within 5 or 10 MHz signal bandwidth and centered within the 1 MHz span of measurement; the spectrum analyzer integrated measurement plot was taken.

3.5. Uncertainty

± 1.27 dB

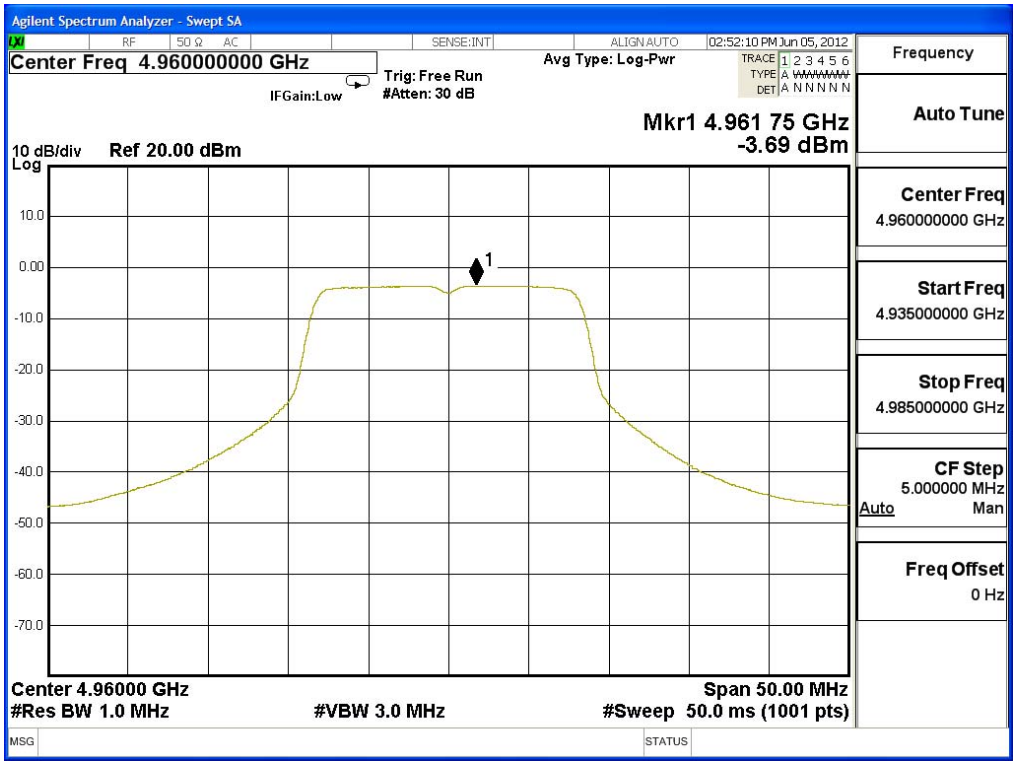
3.6. Test Result of Peak Power Spectral Density

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Peak Power Spectral Density
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

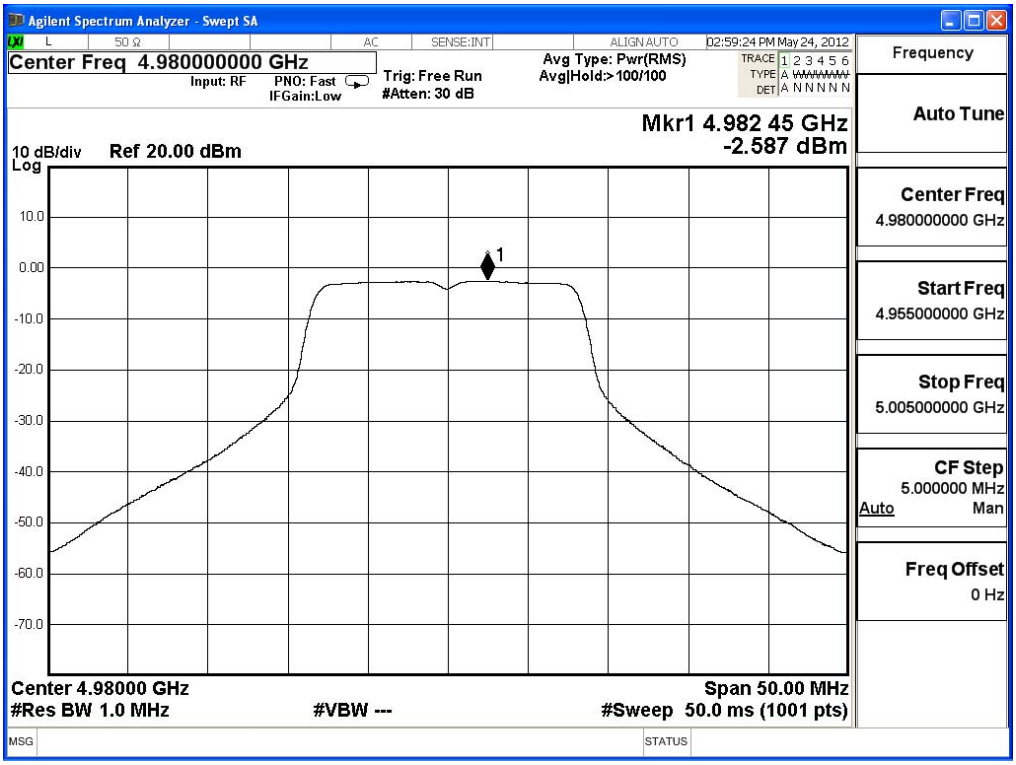
Peak Power Spectral Density

Channel	Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)
1	4960	-3.690	8
2	4980	-2.587	8

Channel 1



Channel 2


Agilent Spectrum Analyzer - Swept SA
Center Freq 4.980000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Pwr(RMS)
Avg|Hold:>100/100
02:59:24 PM May 24, 2012
Mkr1 4.982 45 GHz
-2.587 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 4.98000 GHz
#Res BW 1.0 MHz
#VBW ---
Span 50.00 MHz
#Sweep 50.0 ms (1001 pts)
Frequency
Auto Tune
Center Freq
4.980000000 GHz
Start Freq
4.955000000 GHz
Stop Freq
5.005000000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

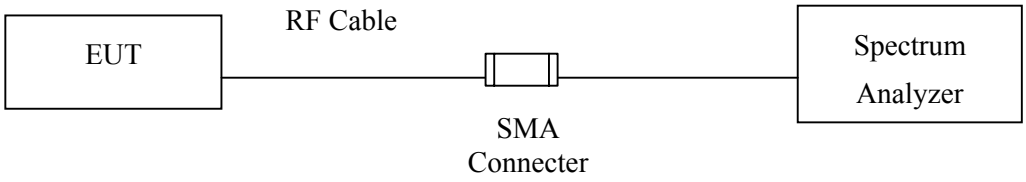
4. Occupied Bandwidth

4.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2012

Note: 1. All instruments 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

No Required

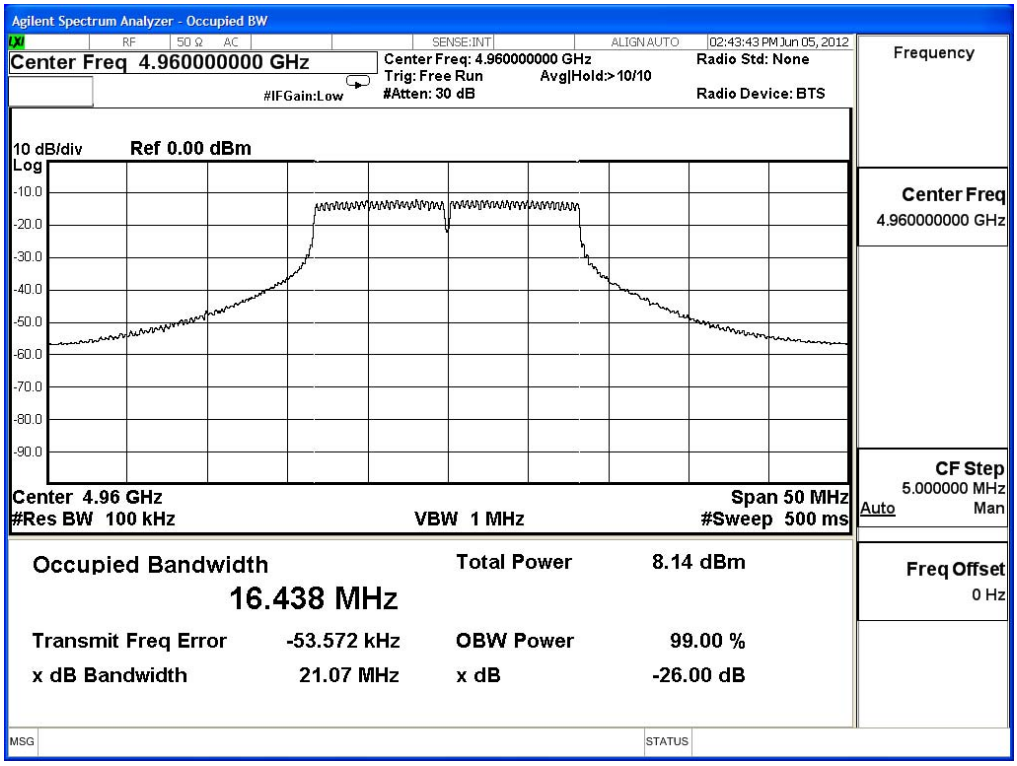
4.4. Uncertainty

150Hz

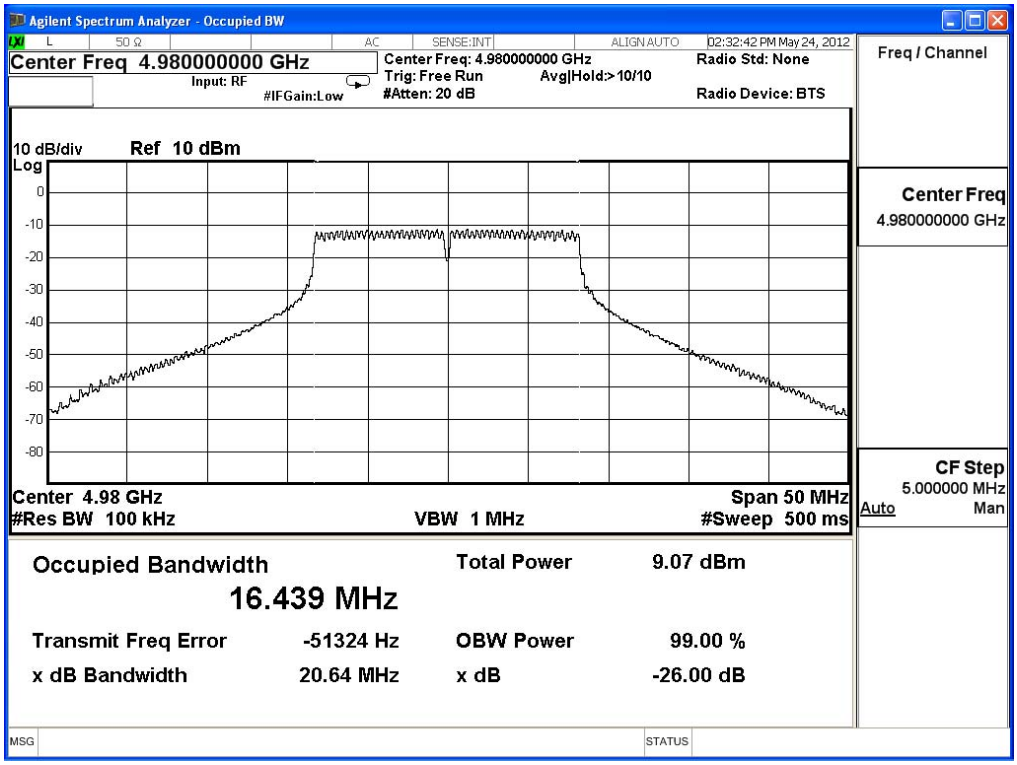
4.5. Test Result of Occupied Bandwidth

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Occupied Bandwidth
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

Channel 1



Channel 2


Agilent Spectrum Analyzer - Occupied BW
Center Freq 4.980000000 GHz
Input: RF
#IFGain:Low
Center Freq: 4.980000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
02:32:42 PM May 24, 2012
Freq / Channel
10 dB/div
Log
Ref 10 dBm
0
-10
-20
-30
-40
-50
-60
-70
-80
Center Freq
4.980000000 GHz
CF Step
5.000000 MHz
Auto
Man
Center 4.98 GHz
#Res BW 100 kHz
VBW 1 MHz
Span 50 MHz
#Sweep 500 ms
Occupied Bandwidth
16.439 MHz
Total Power 9.07 dBm
Transmit Freq Error -51324 Hz
OBW Power 99.00 %
x dB Bandwidth 20.64 MHz
x dB -26.00 dB
MSG
STATUS

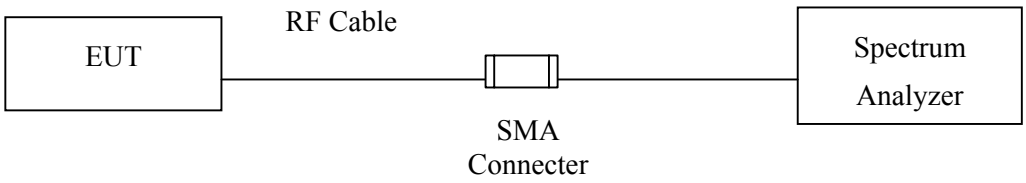
5. Power spectral density mask

5.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2012

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



5.3. Limits

Emission Mask L. For low power transmitters (20 dBm or less) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 10 + 242 log (% of (BW)/50) dB.

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 20 + 31 log (% of (BW)/55) dB attenuation.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 28 + 68 log (% of (BW)/100) dB attenuation.

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.

(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz.

The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

Emission Mask M. For high power transmitters (greater than 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:
(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.
(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB.
(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

Equipment Classification	
☒ Emission Mask L	☐ Emission Mask M

NOTE:

Emission Mask L. For low power transmitters (20 dBm or less)

Emission Mask M. For high power transmitters (greater than 20 dBm)

5.4. Test Procedure

TIA-603-C Section 2.2.11, 2.2.13 (with FCC deviations)

The EUT transmitter was connected to a spectrum analyzer through an appropriate 50 ohm attenuator. The reference level for the mask was set using the highest average power of the fundamental emission measured across the channel bandwidth using a RBW of at least 1% of the occupied bandwidth of the fundamental emission (91 kHz for this test) and a VBW of 30 kHz.

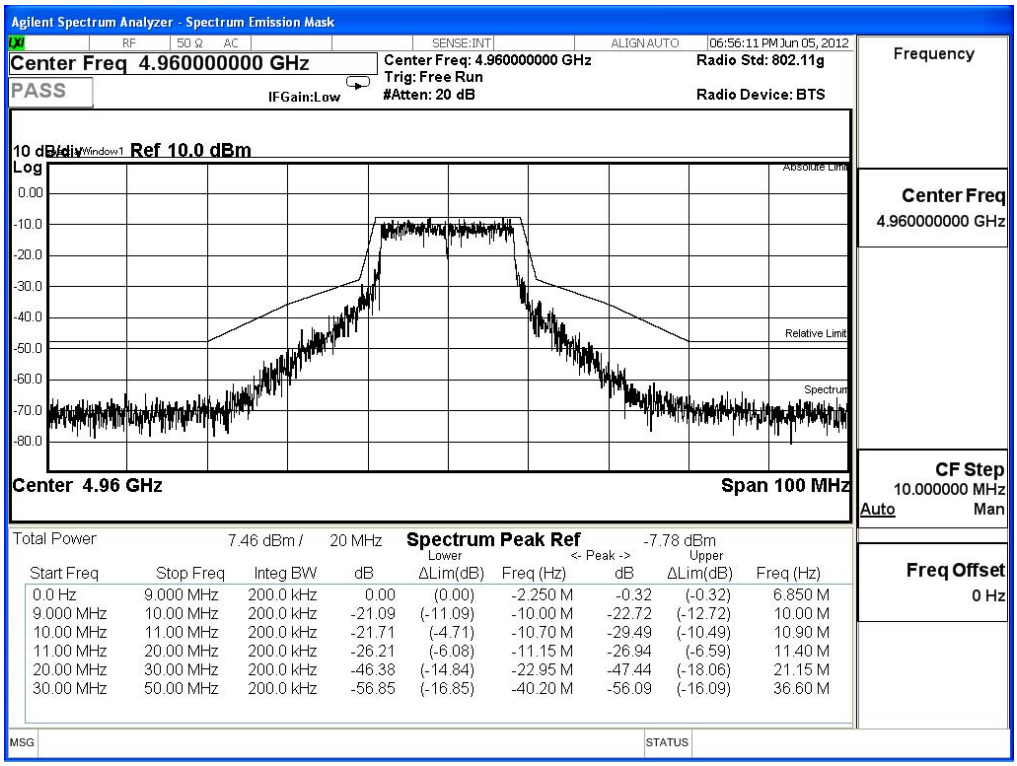
5.5. Uncertainty

±1.27dB

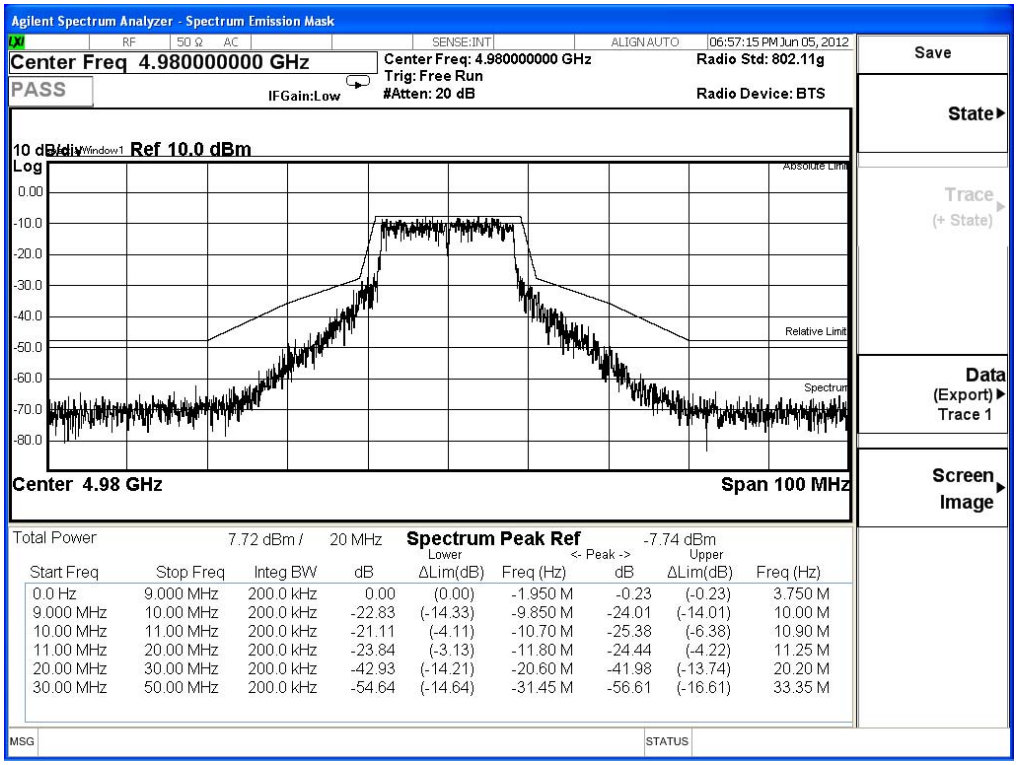
5.6. Test Result of Occupied Bandwidth and Power spectral density mask

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Power spectral density mask
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

Channel 1



Channel 2


Agilent Spectrum Analyzer - Spectrum Emission Mask
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
06:57:15 PM Jun 05, 2012
Center Freq 4.980000000 GHz
PASS
IFGain:Low
Center Freq: 4.980000000 GHz
Trig: Free Run
#Atten: 20 dB
Radio Std: 802.11g
Radio Device: BTS
Save
State
Trace
(+ State)
Data
(Export)
Trace 1
Screen
Image
10 dB/div
Log
Ref 10.0 dBm
Absolute Limit
Relative Limit
Spectrum
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 4.98 GHz
Span 100 MHz
Total Power
7.72 dBm / 20 MHz
Spectrum Peak Ref
-7.74 dBm
Lower
<- Peak ->
Upper
Start Freq | Stop Freq | Integ BW | dB | ΔLim(dB) | Freq (Hz) | dB | ΔLim(dB) | Freq (Hz)
0.0 Hz | 9.000 MHz | 200.0 kHz | 0.00 | (0.00) | -1.950 M | -0.23 | (-0.23) | 3.750 M
9.000 MHz | 10.00 MHz | 200.0 kHz | -22.83 | (-14.33) | -9.850 M | -24.01 | (-14.01) | 10.00 M
10.00 MHz | 11.00 MHz | 200.0 kHz | -21.11 | (-4.11) | -10.70 M | -25.38 | (-6.38) | 10.90 M
11.00 MHz | 20.00 MHz | 200.0 kHz | -23.84 | (-3.13) | -11.80 M | -24.44 | (-4.22) | 11.25 M
20.00 MHz | 30.00 MHz | 200.0 kHz | -42.93 | (-14.21) | -20.60 M | -41.98 | (-13.74) | 20.20 M
30.00 MHz | 50.00 MHz | 200.0 kHz | -54.64 | (-14.64) | -31.45 M | -56.61 | (-16.61) | 33.35 M
MSG
STATUS

6. Peak Excursion

6.1. Test Equipment

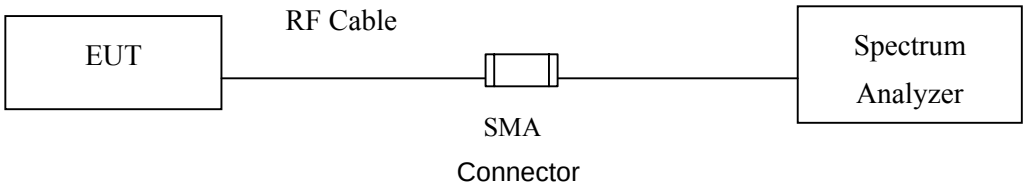
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2012

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

Conduction Power Measurement



6.3. Limits

The ratio of the peak excursion of the modulation envelope (measured suing 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.

6.4. Test Procedure

1) Compliance with the peak excursion requirement of Section 90.1215 shall be demonstrated by confirming that the ratio of the maximum of the peak-max-hold spectrum to the maximum of the average spectrum for continuous transmission does not exceed 13 dB. (Earlier procedures that required computing the ratio of the two spectra at each frequency across the emission bandwidth can lead to unintended failures at band edges and will no longer be required.)
2) Set the spectrum analyzer span to view the entire emission bandwidth.
3) Find the maximum of the peak-max-hold spectrum.
   a) Set RBW = 1 MHz.
   b) VBW ≥ 3 MHz.
   c) Detector = peak.
   d) Trace mode = max-hold.
   e) Allow the sweeps to continue until the trace stabilizes.
   f) Use the peak search function to find the peak of the spectrum.
4) Use the procedure found under E) to measure the PPSD.
5) Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

6.5. Uncertainty

± 1.27 dB

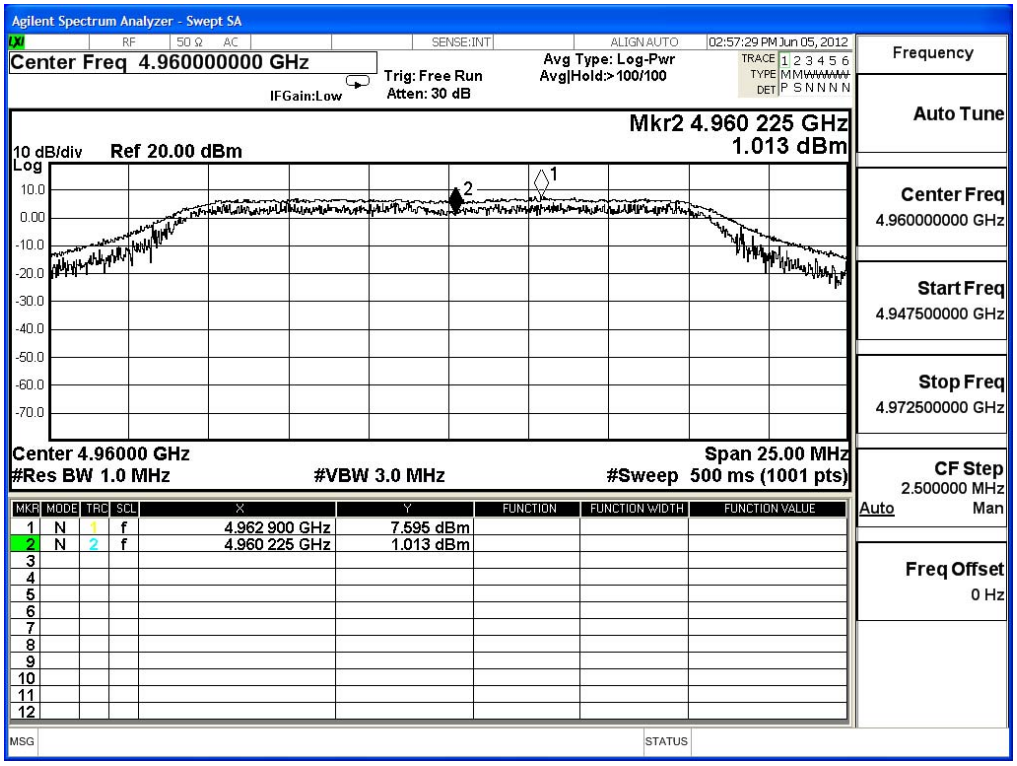
6.6. Test Result of Peak Excursion

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Peak Excursion
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

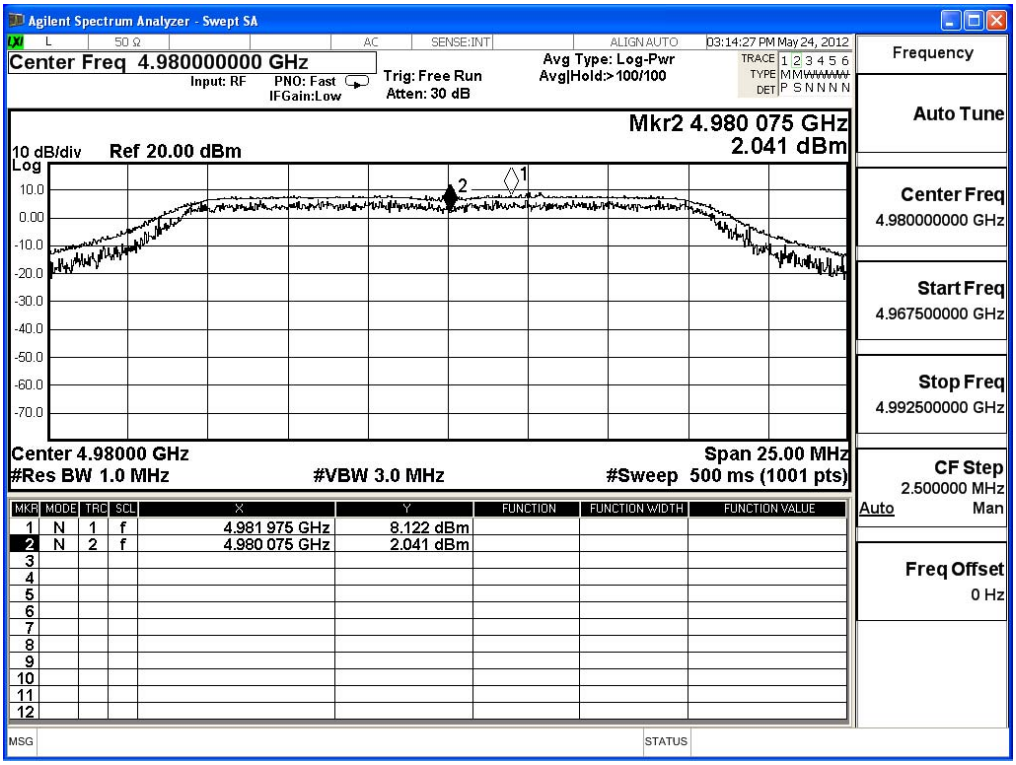
Peak Excursion - 20MHz Bandwidth

Channel No.	Frequency (MHz)	Measurement Level (dB)	Required Limit (dB)	Result
1	4960	6.582	<13	Pass
2	4980	6.081	<13	Pass

Channel 1



Channel 2


Agilent Spectrum Analyzer - Swept SA
Center Freq 4.980000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
03:14:27 PM May 24, 2012
Mkr2 4.980 075 GHz
2.041 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 4.98000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 25.00 MHz
#Sweep 500 ms (1001 pts)
1 N 1 f 4.981 975 GHz 8.122 dBm
2 N 2 f 4.980 075 GHz 2.041 dBm
Frequency
Auto Tune
Center Freq
4.980000000 GHz
Start Freq
4.967500000 GHz
Stop Freq
4.992500000 GHz
CF Step
2.500000 MHz
Auto
Man
Freq Offset
0 Hz

7. Frequency Stability

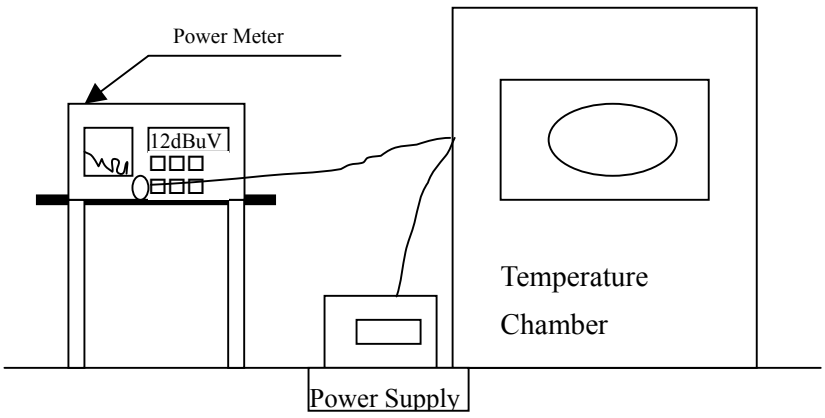
7.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2012

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 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

TIA-603-C-2004, section 2.3.1 and 2.3.2.

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.
The EUT was evaluated over the temperature range -30°C to +50°C.
The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10°C through the range. A ½ hour period was observed to stabilize the EUT at each measurement step, and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal and range of input voltages.

7.5. Uncertainty

± 150 Hz

7.6. Test Result of Frequency Stability

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Frequency Stability
Test Site : Temperature Chamber
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

Channel 1:

Test Conditions		Measure Level (MHz)	Delta Frequency (MHz)	ppm
T_{nom} 20 ℃	V_{nom} 110.00 V	4960.0000	4959.9380	0.0620
T_{nom} 20 ℃	V_{nom} 110.00 V	4980.0000	4979.9450	0.0550
T_{nom} 20 ℃	V_{max} 138.00 V	4960.0000	4959.9380	0.0620
T_{nom} 20 ℃	V_{max} 138.00 V	4980.0000	4979.9450	0.0550
T_{nom} 20 ℃	V_{min} 102.00 V	4960.0000	4959.9380	0.0620
T_{nom} 20 ℃	V_{min} 102.00 V	4980.0000	4979.9450	0.0550
T_{max} 50 ℃	V_{max} 138.00 V	4960.0000	4959.9850	0.0150
T_{max} 50 ℃	V_{max} 138.00 V	4980.0000	4979.9640	0.0360
T_{min} -30 ℃	V_{min} 102.00 V	4960.0000	4960.0200	-0.0200
T_{min} -30 ℃	V_{min} 102.00 V	4980.0000	4980.0400	-0.0400
T_{max} 50 ℃	V_{max} 138.00 V	4960.0000	4959.9850	0.0150
T_{max} 50 ℃	V_{max} 138.00 V	4980.0000	4979.9640	0.0360
T_{min} -30 ℃	V_{min} 102.00 V	4960.0000	4960.0200	-0.0200
T_{min} -30 ℃	V_{min} 102.00 V	4980.0000	4980.0400	-0.0400

8. Conductive Spurious Emission

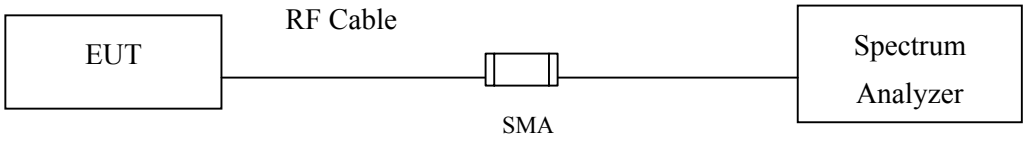
8.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2012

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.

8.2. Test Setup



8.3. Limits

Low power transmitter ≤ 20dBm	Low power transmitter > 20dBm
assigned frequency above 150% of the authorized bandwidth: 40 dBc.	assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

8.4. Test Procedure

Set RBW ≥ 1% of OBW, VBW ≥RBW, Test Range : 30MHz – 40GHz

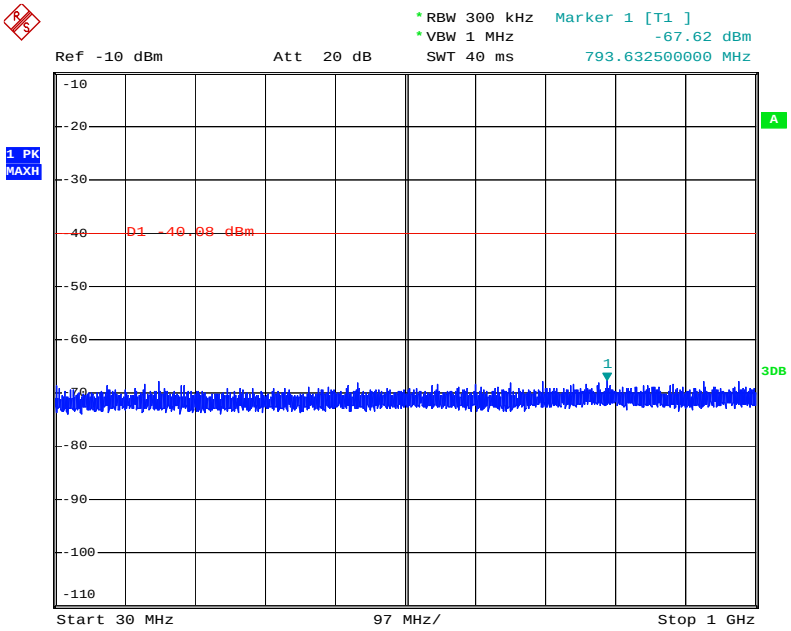
8.5. Uncertainty

± 1.27dB

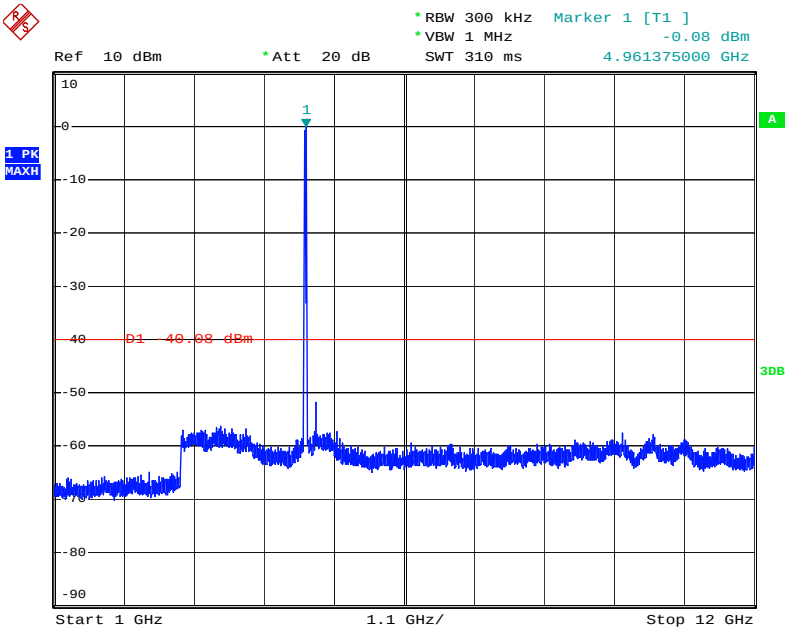
8.6. Test Result of Conductive Spurious Emission

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Conductive Spurious Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth)

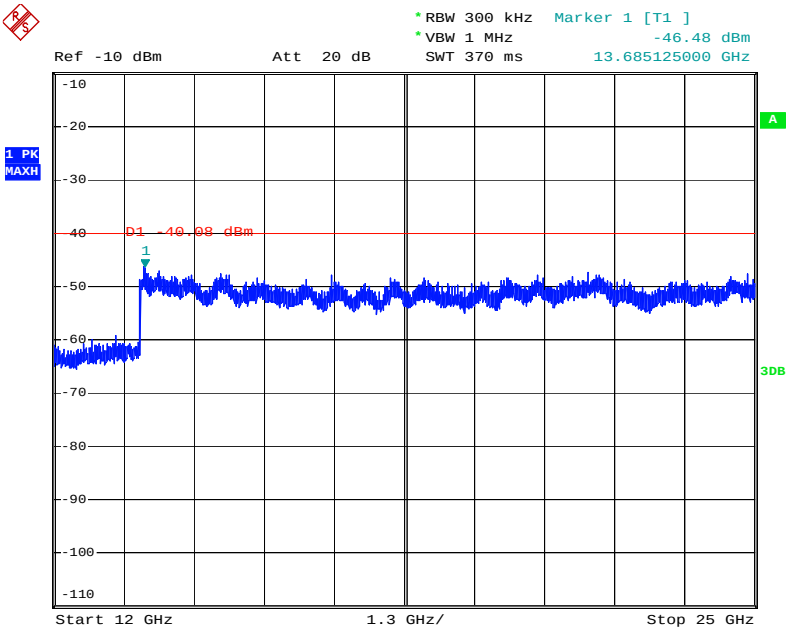
Channel 1 (20MHz Bandwidth)



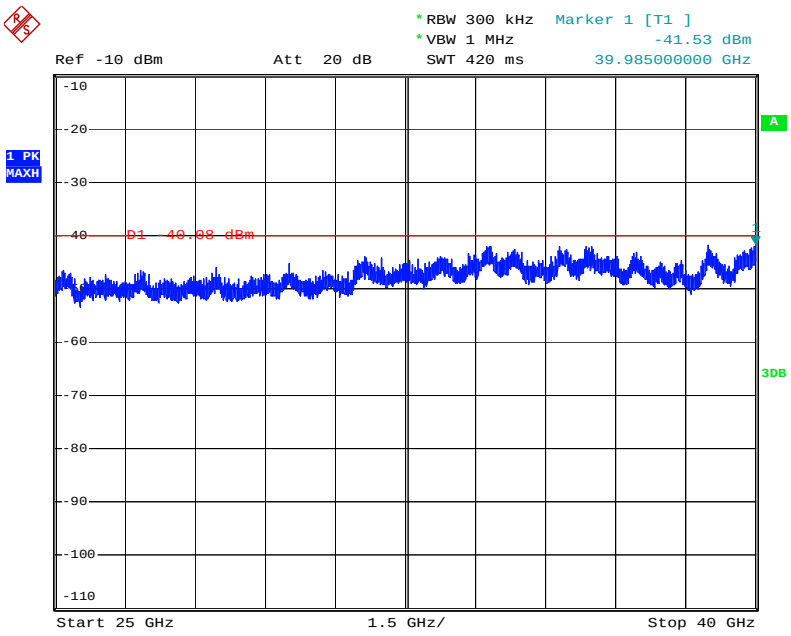
Date: 15.JUN.2012 11:10:48



Date: 15.JUN.2012 11:00:03

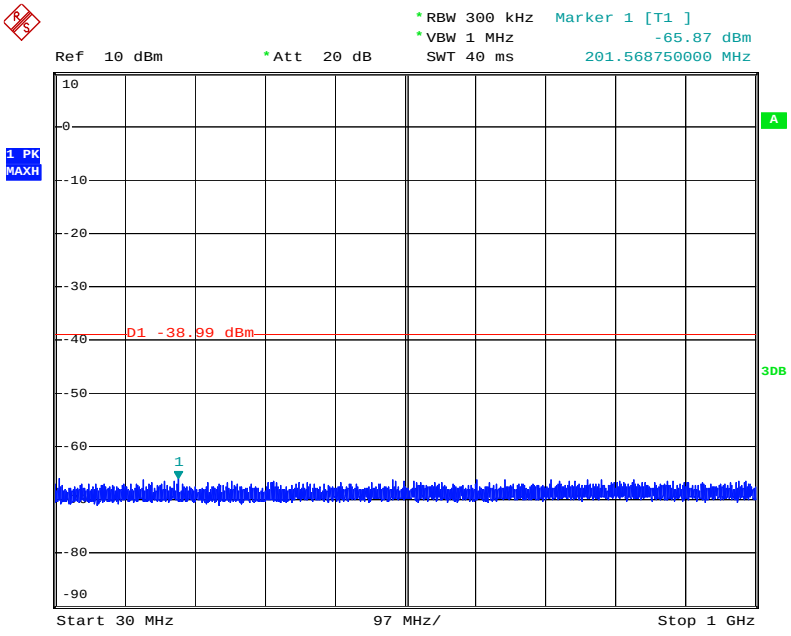


Date: 15.JUN.2012 11:11:18

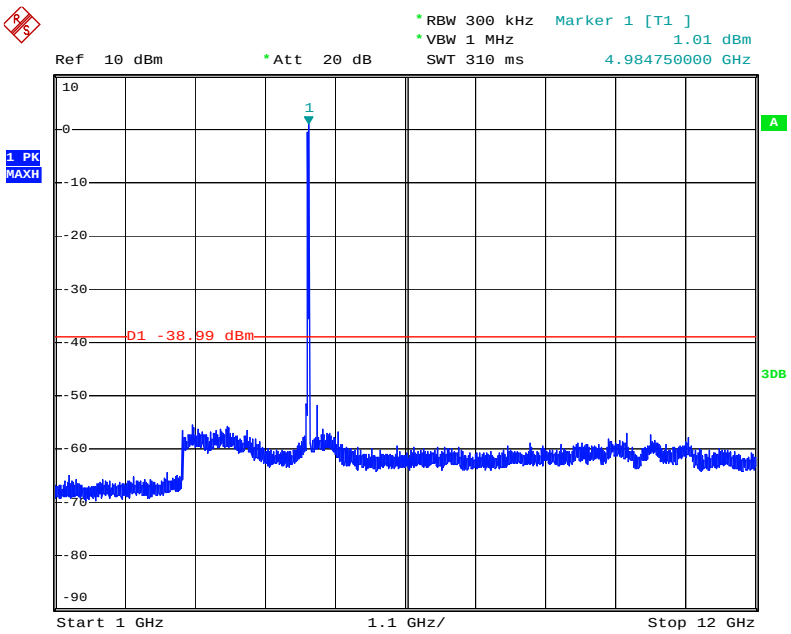


Date: 15.JUN.2012 11:11:43

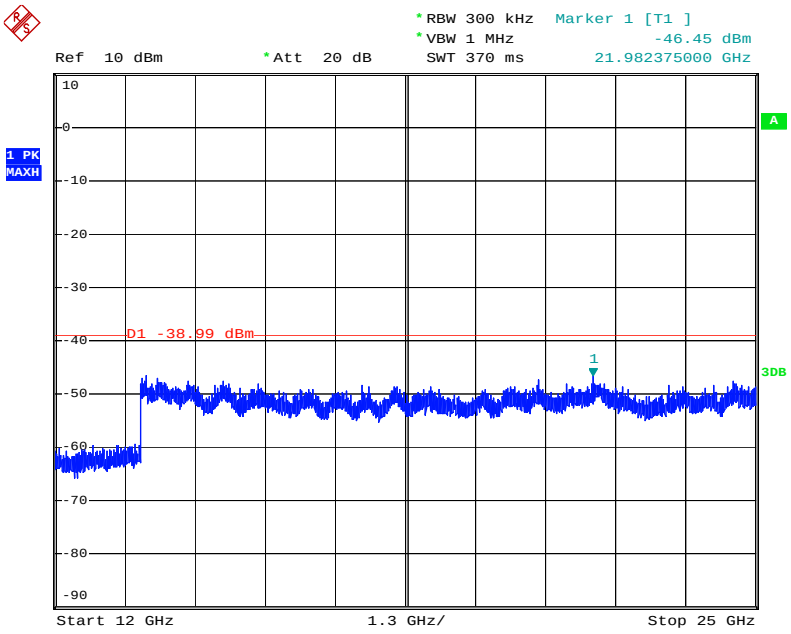
Channel 2 (20MHz Bandwidth)



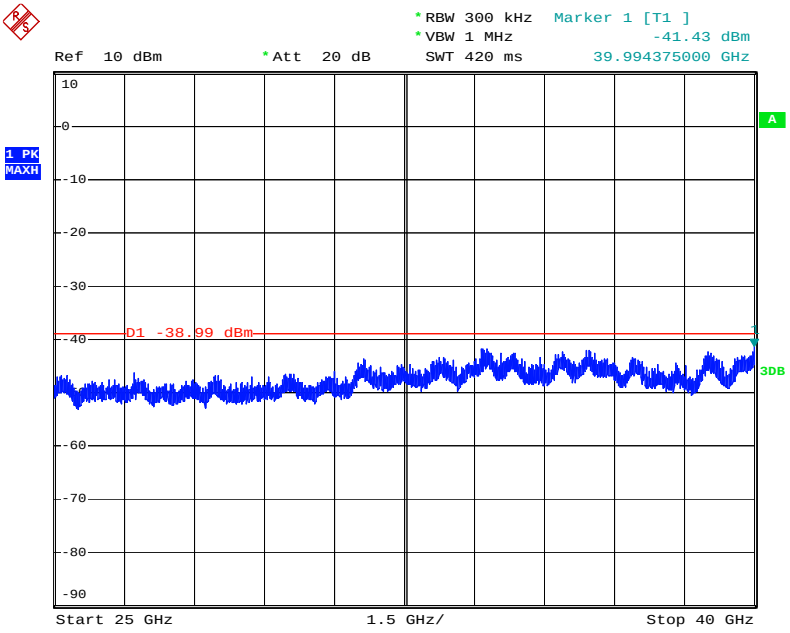
Date: 15.JUN.2012 11:15:58



Date: 15.JUN.2012 11:14:44



Date: 15.JUN.2012 11:17:12



Date: 15.JUN.2012 11:17:41

9. Radiated Spurious Emission

9.1. Test Equipment

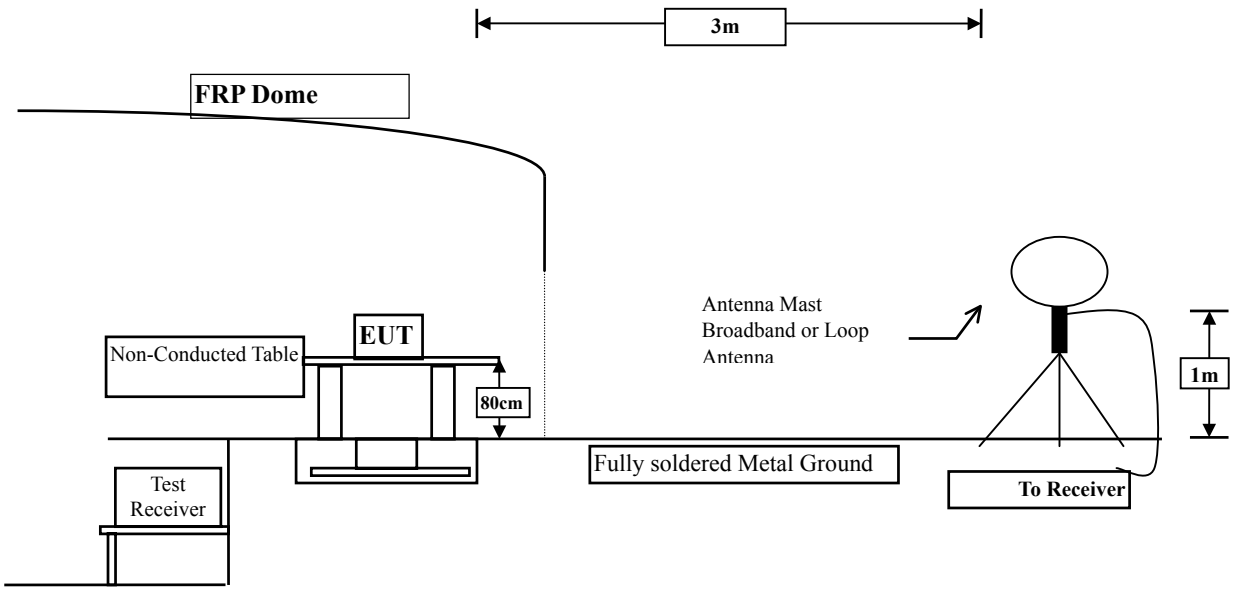
The following test equipments are used during the radiated emission test:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	X	Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2011
	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2011
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2011
	X	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2011
	X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2012
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2011
	X	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2012
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2012

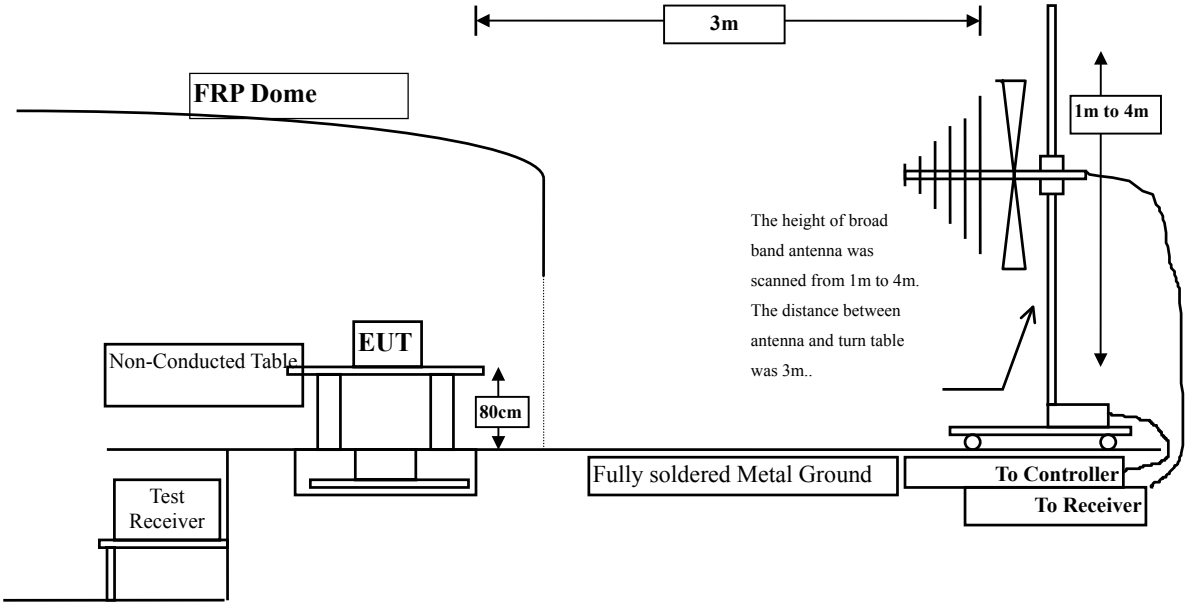
Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

9.2. Test Setup

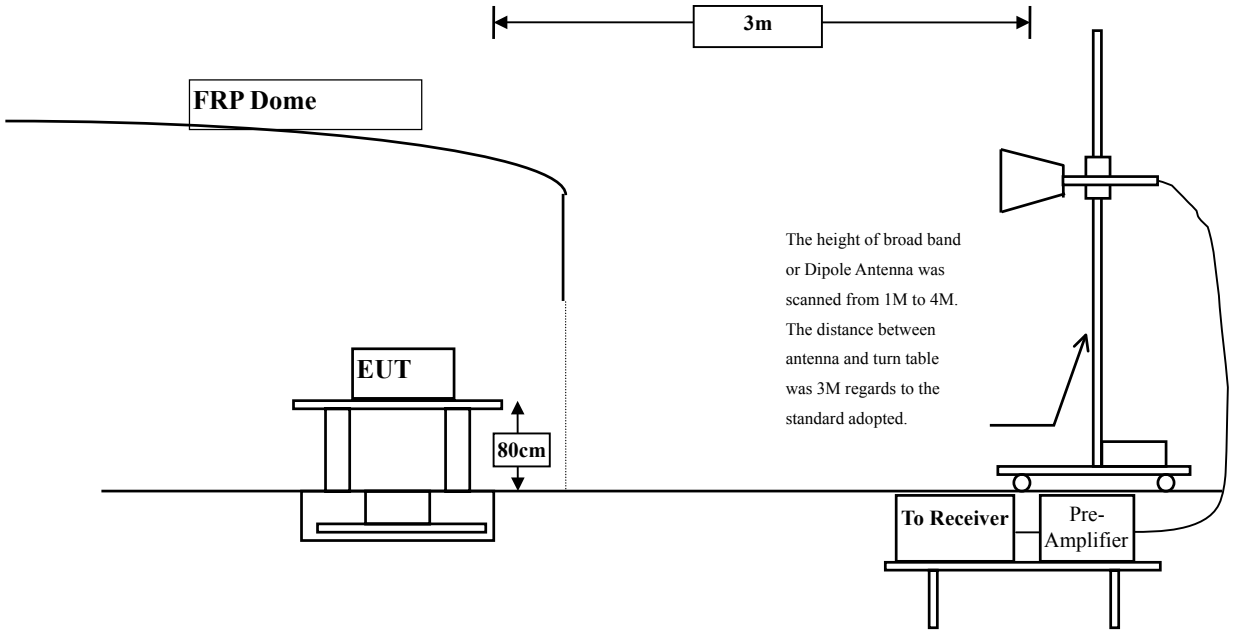
Radiated Emission Below 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



9.3. Limits

Low power transmitter ≤ 20dBm	Low power transmitter > 20dBm
assigned frequency above 150% of the authorized bandwidth: 40 dBc.	assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

9.4. Test Procedure

The EUT is placed on a turn table which is 0.8 meters 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.
Broadband antenna (calibrated bi-log and horn antenna) are used as a receiving antenna.
Both horizontal and vertical polarization of the antenna are set on measurement. And a high frequency preamlifier were used increase the sensitivity of the measuring. The additional notch filter below 1GHz was used to measure the level of harmonics radiated emission during field dtrength of harmonics measurement.
The frequency range from 9kHz to 40GHz is checked.

9.5. Uncertainty

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

9.6. Test Result of Radiated Emission

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth) (4960MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
9920.000	26.565	-70.050	-43.485	-2.562	-40.923
Vertical					
Peak Detector					
9920.000	25.907	-67.790	-41.883	-12.281	-29.602

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor
4. Limit= fundamental power level down 40dBc.

Fundamental Power (EIRP)

Frequency	Correct Factor	Reading Level	Measurement Level
MHz	dB	dBm	dBm
Horizontal			
Peak Detector			
4960.000	49.377	-50.300	-0.923
Vertical			
Peak Detector			
4960.000	50.548	-40.150	10.398

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth) (4980MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
9960.000	26.683	-70.640	-43.957	-3.603	-40.354
Vertical					
Peak Detector					
9960.000	25.931	-68.560	-42.629	-12.954	-29.675

Note:
1. All Reading are peak value.
2. "" means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor
4. Limit= fundamental power level down 40dBc.

Fundamental Power (EIRP)

Frequency	Correct Factor	Reading Level	Measurement Level
MHz	dB	dBm	dBm
Horizontal			
Peak Detector			
4980.000	49.236	-49.590	-0.354
Vertical			
Peak Detector			
4980.000	50.385	-40.060	10.325

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth) (4960MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
396.660	3.071	33.447	36.518	-9.482	46.000
528.580	3.365	34.080	37.445	-8.555	46.000
623.640	3.546	33.506	37.052	-8.948	46.000
734.220	3.846	31.620	35.466	-10.534	46.000
868.080	3.918	29.010	32.928	-13.072	46.000
912.700	3.879	28.934	32.813	-13.187	46.000
Vertical					
Peak Detector					
355.920	6.372	37.014	43.386	-2.614	46.000
454.860	6.621	32.835	39.455	-6.545	46.000
567.380	6.864	31.058	37.922	-8.078	46.000
623.640	6.969	32.770	39.739	-6.261	46.000
734.220	7.269	31.639	38.908	-7.092	46.000
912.700	7.302	32.751	40.053	-5.947	46.000

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

Product : MOXA IEEE802.11 a/b/g mini PCI module
Test Item : Harmonic Radiated Emission Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit (20MHz Bandwidth) (4980MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBm	dBm	dB	dBm
Horizontal					
Peak Detector					
396.660	3.071	33.235	36.306	-9.694	46.000
528.580	3.365	33.057	36.422	-9.578	46.000
664.380	3.679	34.765	38.444	-7.556	46.000
734.220	3.846	31.756	35.602	-10.398	46.000
846.740	3.958	29.098	33.056	-12.944	46.000
934.040	3.889	26.814	30.703	-15.297	46.000
Vertical					
Peak Detector					
355.920	6.372	38.017	44.389	-1.611	46.000
456.800	6.633	33.344	39.977	-6.023	46.000
623.640	6.969	33.101	40.070	-5.930	46.000
699.300	7.165	32.002	39.167	-6.833	46.000
817.640	7.312	28.646	35.958	-10.042	46.000
912.700	7.302	30.676	37.978	-8.022	46.000

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor

10. EMI Reduction Method During Compliance Testing

No modification was made during testing.