Test Report

Product Name : WLAN mini-PCI card

Model No.: WL-120

FCC ID.: MSQPCCWL120

Applicant : ASUSTeK COMPUTER INC.

Address : 4FL., No, 150, Li-Te Rd., Peitou, Taipei, Taiwan, R.O.C.

Date of Receipt : Mar. 31, 2003

Date of Test : Apr. 01, 2003

Report No. : 034L004FI

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

Test Date : Apr. 01, 2003
Report No. : 034L004FI

QuieTek Corporation

Accredited by NIST (NVLAP)
NVLAP Lab Code: 200533-0

Product Name	:	WLAN mini-PCI card
Applicant	:	ASUSTeK COMPUTER INC.
Address	:	4FL., No, 150, Li-Te Rd., Peitou, Taipei, Taiwan, R.O.C.
Manufacturer	:	ASUSTeK COMPUTER INC.
Model No.	:	WL-120
FCC ID.	:	MSQPCCWL120
Rated Voltage	:	DC 3.3V
Trade Name	:	ASUS
Measurement Standard	:	FCC Part 15 Subpart C Paragraph 15.247
Measurement Procedure	:	ANSI C63.4: 1992
Test Result	:	Complied

NVLAP
NVLAP Lab Code: 200533-0

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 : Chialinchen
(Chialin Chen)

Tested By : Tom Hsieh
(Tom Hsieh)

Approved By : Genechang
(Gene Chang)

TABLE OF CONTENTS

Description		Page
1.	**GENERAL INFORMATION**	**5**
1.1.	EUT Description	5
1.2.	Operational Description	6
1.3.	Tested System Datails	7
1.4.	Configuration of tested System	7
1.5.	EUT Exercise Software	8
1.6.	Test Facility	8
2.	**Conducted Emission**	**9**
2.1.	Test Equipment	9
2.2.	Test Setup	9
2.3.	Limits	9
2.4.	Test Procedure	10
2.5.	Test Result of Conducted Emission	11
3.	**Peak Power Output**	**13**
3.1.	Test Equipment	13
3.2.	Test Setup	13
3.3.	Limits	13
3.4.	Test Result of Peak Power Output	14
4.	**RF Exposure Evaluation**	**15**
4.1.	Limits	15
4.2.	Test Procedure	15
4.3.	Test Result of RF Exposure Evaluation	16
5.	**Radiated Emission**	**17**
5.1.	Test Equipment	17
5.2.	Test Setup	17
5.3.	Limits	18
5.4.	Test Procedure	19
5.5.	Test Result of Radiated Emission	20
6.	**Band Edge**	**32**
6.1.	Test Equipment	32
6.2.	Test Setup	32
6.3.	Limits	33
6.4.	Test Procedure	33
6.5.	Test Result of Band Edge	34
7.	**Occupied Bandwidth**	**36**
7.1.	Test Equipment	36
7.2.	Test Setup	36
7.3.	Limits	36
7.4.	Test Result of Occupied Bandwidth	37
8.	**Power Density**	**40**

8.1. Test Equipment 40
8.2. Test Setup 40
8.3. Limits 40
8.4. Test Result of Power Density 41

9. EMI Reduction Method During Compliance Testing 44

Attachment 1: EUT Test Photographs
Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	:	WLAN mini-PCI card
Trade Name	:	ASUS
FCC ID.	:	MSQPCCWL120
Model No.	:	WL-120
Frequency Range	:	2412MHz to 2462MHz
Channel Number	:	11
Chip Rate	:	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Type of Modulation	:	Direct Sequence Spread Spectrum
Operator Selection of Operating Frequency	:	By software
Antenna type	:	Connector
Antenna #A	:	ASUS, L5H
Antenna #B	:	NINPUT OUTPUT, W201-108-D2
Antenna Gain #A	:	-1.2dBi
Antenna Gain #B	:	2dBi

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		

Note:

1. This device is a 2.4GHz WLAN mini-PCI card included a 2.4GHz receiving function, a 2.4GHz transmitting function.
2. Regards to the frequency band operation; included the lowest、middle and highest frequency of channel were selected to perform the test, then shown on this report.
3. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
4. This device is a composite device in accordance with Part 15 regulations. The function receiving was measured and made a test report that the report number is 034L004F under Declaration of Conformity.

1.2. Operational Description

EUT is a WLAN mini-PCI card with wireless LAN adapter. This device provided 11 channels and four kind of transmitting speed 1,2,5.5 and 11Mbps. The device of RF carrier is DQPSK, DB PSK and CCK.

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

This WLAN mini-PCI card is an IEEE 802.11b 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 Direst Sequence Spread Spectrum (DSSS) radio transmission, the WLAN mini-PCI card transfers data at speeds up to 64/128-bit Wired Equivalent Protection (WEP) algorithm is used. In addition, its standard compliance ensures that it can communicate with any 802.11b network.

1.3. Tested System Datails

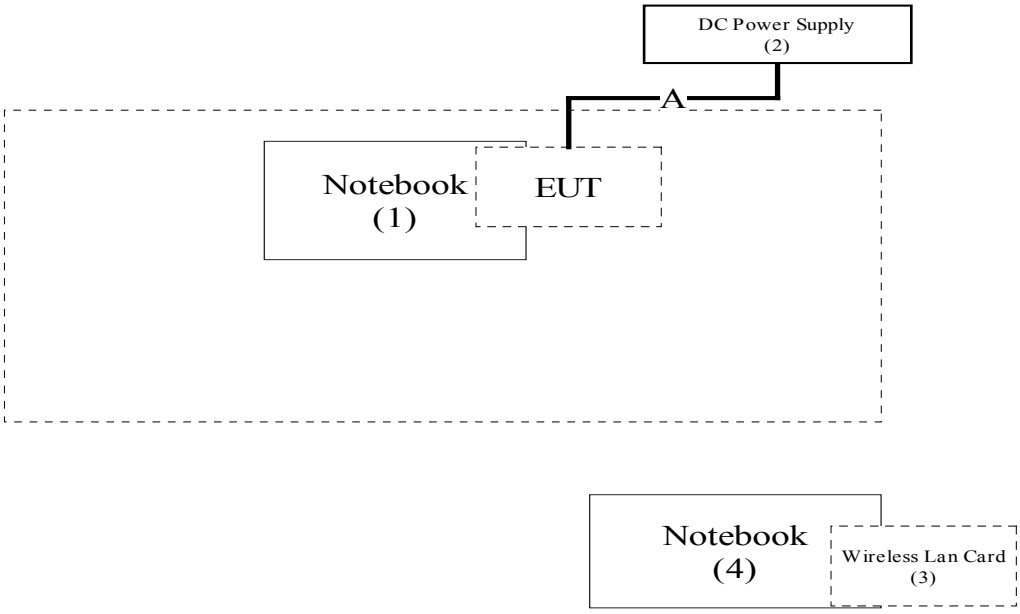
The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	FCC ID.	Power Cord
(1)	Notebook	ASUS	S1300	26NP018680	DoC	Non-shielded, 1.8m
(2)	DC power supply	Topward	6303D	670302	DoC	Non-shielded, 1.8m
(3)	Wireless LAN Card	LEMEL	LM-WLC030	1231Q048877	H8NWLC030	N/A
(4)	Notebook	ASUS	S1300	24NP035390	DoC	Non-shielded, 1.8m

Signal Cable Type		Signal cable Description
A.	DC Power Cord	Non-Shielded, 1.8m

1.4. Configuration of tested System

Tx & Rx



1.5. EUT Exercise Software

(1) Setup the EUT and simulators as shown on 1.4
(2) Turn on the power of all equipment.
(3) Notebook PC reads data from disk.
(4) Data will be transmitting and receiving through EUT.
(5) The transmitted and receive status will be shown on the monitor.
(6) Repeat the above procedure (3) to (5)

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: June 22, 2001 File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Reference 31040/SIT1300F2

July 03, 2001 Accreditation on NVLAP
NVLAP Lab Code: 200533-0

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

2. Conducted Emission

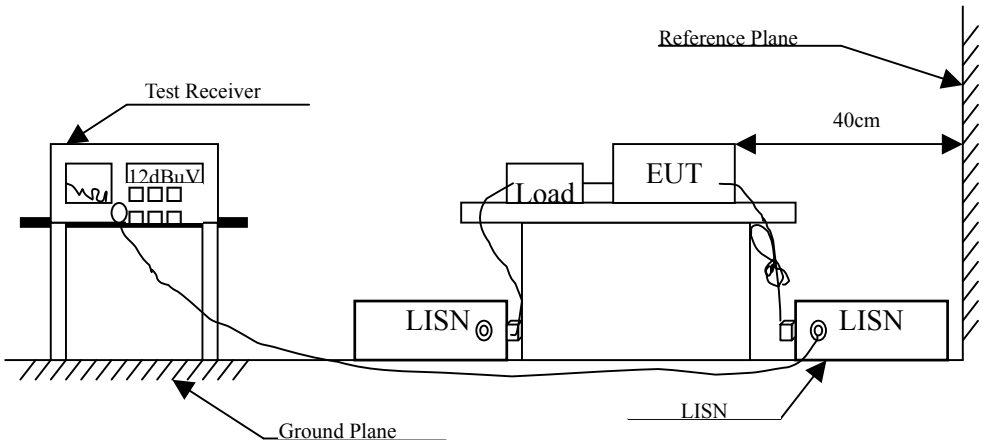
2.1. Test Equipment

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, 2002	
2	L.I.S.N.	R & S	ESH3-Z5/825016/6	May, 2002	EUT
3	L.I.S.N.	Kyoritsu	KNW-407/8-1420-3	May, 2002	Peripherals
4	Pulse Limiter	R & S	ESH3-Z2	N/A	
5	No.1 Shielded Room			N/A	

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

2.2. Test Setup



2.3. Limits

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

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 C63.4:1992 on conducted measurement.

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

2.5. Test Result of Conducted Emission

Product : WLAN mini-PCI card
Test Item : Conducted Emission Test
Test Mode : Normal Operation

	Frequency MHz	Cable Loss dB	LISN Factor dB	Reading Level dBuV	Emission Level dBuV	Limits dBuV
Line 1						
Quasi-Peak:						
	0.170	0.21	0.10	28.90	29.21	64.98
	5.755	0.28	0.18	23.00	23.46	60.00
*	11.677	0.15	0.26	32.30	32.70	60.00
	19.724	0.39	0.45	18.90	19.74	60.00
	24.575	0.28	0.53	17.50	18.31	60.00
	28.337	0.38	0.58	17.50	18.46	60.00
Average:						
	0.170	0.21	0.10	3.40	3.71	54.98
	5.755	0.28	0.18	19.40	19.86	50.00
	11.677	0.15	0.26	31.70	32.10	50.00
	19.724	0.39	0.45	15.20	16.04	50.00
	24.575	0.28	0.53	15.60	16.41	50.00
	28.337	0.38	0.58	15.50	16.46	50.00

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + LISN Factor + Cable Loss.

Product : WLAN mini-PCI card
Test Item : Conducted Emission
Test Mode : Normal Operation

	Frequency MHz	Cable Loss dB	LISN Factor dB	Reading Level dBuV	Emission Level dBuV	Limits dBuV
Line 1						
Quasi-Peak:						
	0.166	0.21	0.10	27.00	27.31	65.18
	5.255	0.29	0.17	21.60	22.06	60.00
	6.986	0.33	0.18	28.20	28.71	60.00
*	11.735	0.15	0.26	33.40	33.81	60.00
	17.896	0.36	0.41	17.80	18.57	60.00
	20.009	0.39	0.45	22.10	22.94	60.00
Average:						
	0.166	0.21	0.10	2.30	2.61	55.18
	5.255	0.29	0.17	18.60	19.06	50.00
	6.986	0.33	0.18	26.00	26.51	50.00
	11.735	0.15	0.26	33.00	33.41	50.00
	17.896	0.36	0.41	16.20	16.97	50.00
	20.009	0.39	0.45	18.40	19.24	50.00

Note:

1. All Reading Levels are Quasi-Peak value.
2. “ * ”, means this data is the worst emission level.
3. Emission Level = Reading Level + LISN Factor + Cable Loss.

3. Peak Power Output

3.1. Test Equipment

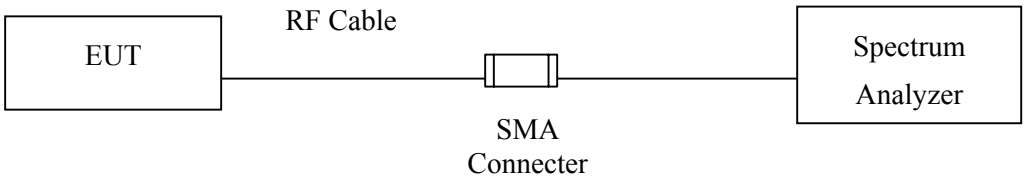
The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	Advantest	R3272 / 72421194	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

3.2. Test Setup

Conduction Power Measurement



3.3. Limits

The maximum peak power shall be less 1 Watt.

3.4. Test Result of Peak Power Output

Product : WLAN mini-PCI card
Test Item : Peak Power Output Data
Test Site : No.2 OATS
Test Mode : Normal Operation

Data Speed: 11Mbps

Channel No.	Frequency (MHz)	Measurement	Required Limit	Result
1	2413.0	20.46 dBm	1Watt= 30 dBm	Pass
6	2438.0	19.55 dBm	1Watt= 30 dBm	Pass
11	2463.0	19.15dBm	1Watt= 30 dBm	Pass

4. RF Exposure Evaluation

4.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)
LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula
Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$

Where
Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm^2 . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.2. Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.
The temperature and related humidity: 18℃and 78％ RH.

4.3. Test Result of RF Exposure Evaluation

Product : WLAN mini-PCI card
Test Item : RF Exposure Evaluation Data
Test Site : No.2 OATS
Test Mode : Normal Operation

Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2dBi or 2 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Minimum Allowable Distance ® From Skin(cm)
1 (11Mbps)	2413.0	111.1732	3.74451221
6 (11Mbps)	2438.0	90.15711	3.37205967
11 (11Mbps)	2463.0	82.22426	3.22029199

The distance r (4th column) calculated from the Fries transmission formula is far shorter than 20 cm separation requirement. So, RF exposure limit warning or SAR test are not required.

5. Radiated Emission

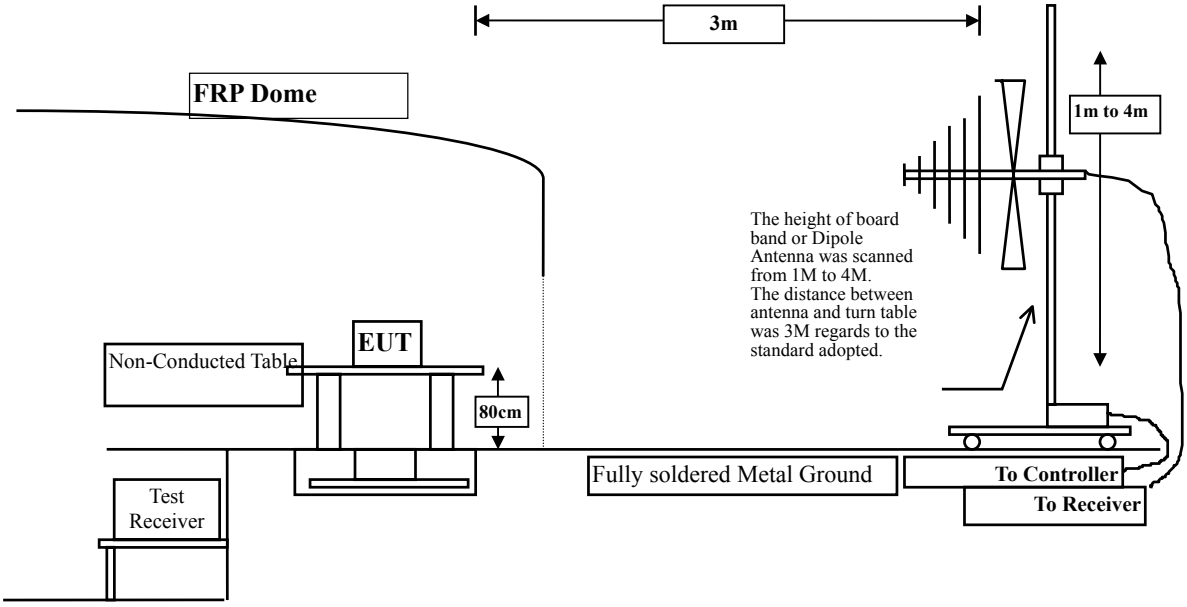
5.1. Test Equipment

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, 2002
		Spectrum Analyzer	Advantest	R3261C / 71720140	May, 2002
		Pre-Amplifier	HP	8447D/3307A01812	May, 2002
		Bilog Antenna	Chase	CBL6112B / 12452	Sep., 2002
		Horn Antenna	EM	EM6917 / 103325	May, 2002
Site # 2	X	Test Receiver	R & S	ESCS 30 / 825442/17	May, 2002
	X	Spectrum Analyzer	Advantest	R3261C / 71720609	May, 2002
	X	Pre-Amplifier	HP	8447D/3307A01814	May, 2002
	X	Bilog Antenna	Chase	CBL6112B / 2455	Sep., 2002
	X	Horn Antenna	EM	EM6917 / 103325	May, 2002
Site # 3		Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2002
		Spectrum Analyzer	Advantest	3162 / 100803480	May, 2002
		Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2002
		Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2002
		Horn Antenna	ETS	3115 / 0005-6160	Jul., 2002
		Pre-Amplifier	QTK	QTK-AMP-01 / 0001	Jul., 2002

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

5.2. Test Setup



5.3. Limits

➢ **General Radiated Emission 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.

5.4. 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 additional latch filter below 1GHz was used to measure the level of harmonics radiated emission during field dtrength of harmonics measurement.
The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCS 30)is 120 kHz, above 1GHz are 1 MHz.
The frequency range from 30MHz to 10th harminics is checked.

5.5. Test Result of Radiated Emission

Product : WLAN mini-PCI card
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 1 (11Mbps)-Antenna #A

Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal								
Peak Detector:								
4823.890	6.17	33.64	33.42	47.36	53.75	20.25	74.00	54.00
7236.300	7.33	36.77	33.44	41.64	52.30	21.70	74.00	54.00
9648.500	8.73	38.24	32.84	39.70	53.82	20.18	74.00	54.00
12060.50	9.98	39.03	33.86	38.70	53.86	20.14	74.00	54.00
14472.30	10.65	40.51	34.28	34.39	51.26	22.74	74.00	54.00
Vertical								
Peak Detector:								
4824.100	6.17	33.64	33.42	46.72	53.11	20.89	74.00	54.00
7235.690	7.33	36.77	33.44	42.46	53.12	20.88	74.00	54.00
9647.490	8.73	38.24	32.84	39.35	53.47	20.53	74.00	54.00
12059.60	9.98	39.03	33.86	37.78	52.94	21.06	74.00	54.00
14470.69	10.65	40.51	34.28	34.47	51.34	22.66	74.00	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz。
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz。
4. Emission Level = Reading Level + Probe Factor + Cable Loss- PreAMP.
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 : WLAN mini-PCI card
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 6 (11Mbps)-Antenna #A

Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal								
Peak Detector:								
4874.100	6.20	33.77	33.35	48.32	54.94	19.06	74.00	54.00
7310.890	7.37	36.98	33.30	40.96	52.00	22.00	74.00	54.00
9748.300	8.87	38.35	32.85	38.90	53.27	20.73	74.00	54.00
12185.70	10.13	39.07	33.68	36.70	52.22	21.78	74.00	54.00
14621.69	10.67	40.02	33.62	34.36	51.42	22.58	74.00	54.00
Average:								
4871.890	6.20	33.77	33.35	34.71	41.33	12.67	74.00	54.00
Vertical								
Peak Detector:								
4873.810	6.20	33.77	33.35	48.12	54.74	19.26	74.00	54.00
7311.900	7.37	36.98	33.30	40.11	51.15	22.85	74.00	54.00
9748.420	8.87	38.35	32.85	38.71	53.08	20.92	74.00	54.00
12185.42	10.13	39.07	33.68	35.81	51.33	22.67	74.00	54.00
14622.30	10.67	40.02	33.62	33.52	50.58	23.42	74.00	54.00
Average:								
4872.010	6.20	33.77	33.35	34.55	41.17	12.83	74.00	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz。
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz。
4. Emission Level = Reading Level + Probe Factor + Cable Loss- PreAMP.
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 : WLAN mini-PCI card
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 11 (11Mbps)- Antenna #A

Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal								
Peak Detector:								
4923.690	6.23	33.82	33.28	48.62	55.39	18.61	74.00	54.00
7385.930	7.42	37.14	33.17	42.91	54.29	19.71	74.00	54.00
9847.450	8.97	38.47	32.85	39.30	53.89	20.11	74.00	54.00
12309.93	10.27	39.12	33.62	37.89	53.66	20.34	74.00	54.00
14771.69	10.68	39.53	33.05	28.77	45.93	28.07	74.00	54.00
Average:								
4921.770	6.23	33.82	33.28	34.41	41.18	12.82	74.00	54.00
7387.863	7.42	37.14	33.17	30.75	42.13	11.87	74.00	54.00
Vertical								
Peak Detector:								
4923.690	6.23	33.82	33.28	48.95	55.72	18.28	74.00	54.00
7386.300	7.42	37.14	33.17	41.60	52.98	21.02	74.00	54.00
9847.690	8.97	38.47	32.85	39.11	53.70	20.30	74.00	54.00
12310.30	10.27	39.12	33.62	37.59	53.36	20.64	74.00	54.00
14772.40	10.68	39.53	33.05	29.32	46.48	27.52	74.00	54.00
Average:								
4925.860	6.26	33.90	33.24	35.69	42.61	11.39	74.00	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz。
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz。
4. Emission Level = Reading Level + Probe Factor + Cable Loss- PreAMP.
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 : WLAN mini-PCI card
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 1 (11Mbps)- Antenna #A

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
	65.880	1.05	5.66	0.00	28.40	35.12	4.88	40.00
*	131.956	1.39	11.69	0.00	29.92	43.01	0.49	43.50
	166.116	1.57	9.12	0.00	26.82	37.51	5.99	43.50
	527.990	3.44	16.57	0.00	16.46	36.47	9.53	46.00
	564.189	3.62	17.04	0.00	11.39	32.05	13.95	46.00
	703.996	4.34	18.22	0.00	15.73	38.29	7.71	46.00
Vertical:								
*	33.190	0.88	18.04	0.00	18.00	36.92	3.08	40.00
	66.575	1.06	5.96	0.00	26.08	33.10	6.90	40.00
	133.211	1.40	10.55	0.00	25.15	37.10	6.40	43.50
	166.115	1.57	8.42	0.00	24.51	34.50	9.00	43.50
	298.590	2.25	12.14	0.00	17.56	31.96	14.04	46.00
	497.810	3.28	16.30	0.00	7.21	26.78	19.22	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss.

Product : WLAN mini-PCI card
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 6 (11Mbps)- Antenna #A

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
*	131.900	1.39	11.69	0.00	29.80	42.89	0.61	43.50
	165.990	1.57	9.12	0.00	28.03	38.72	4.78	43.50
	366.800	2.60	13.98	0.00	17.11	33.70	12.30	46.00
	431.240	2.93	15.81	0.00	13.86	32.60	13.40	46.00
	497.630	3.28	16.31	0.00	13.07	32.66	13.34	46.00
	666.300	4.14	18.34	0.00	8.84	31.33	14.67	46.00
Vertical:								
	32.930	0.88	18.04	0.00	12.63	31.55	8.45	40.00
*	132.810	1.40	10.55	0.00	31.15	43.10	0.40	43.50
	164.810	1.56	8.52	0.00	28.92	39.01	4.49	43.50
	298.560	2.25	12.14	0.00	18.54	32.94	13.06	46.00
	632.350	3.97	18.65	0.00	12.07	34.69	11.31	46.00
	699.300	4.32	18.19	0.00	13.59	36.10	9.90	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss.

Product : WLAN mini-PCI card
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 11 (11Mbps)- Antenna #A

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
	299.630	2.26	12.53	0.00	18.36	33.15	12.85	46.00
	399.510	2.77	14.62	0.00	14.54	31.93	14.07	46.00
	527.520	3.44	16.57	0.00	16.90	36.91	9.09	46.00
	662.600	4.13	18.42	0.00	12.73	35.29	10.71	46.00
*	703.200	4.34	18.22	0.00	15.13	37.69	8.31	46.00
	766.330	4.66	19.86	0.00	9.54	34.06	11.94	46.00
Vertical:								
*	133.710	1.40	10.49	0.00	30.22	42.12	1.38	43.50
	294.910	2.23	12.23	0.00	19.63	34.09	11.91	46.00
	330.450	2.41	12.46	0.00	21.27	36.15	9.85	46.00
	397.610	2.76	16.13	0.00	15.20	34.09	11.91	46.00
	628.440	3.96	18.53	0.00	13.64	36.13	9.87	46.00
	709.230	4.37	18.75	0.00	10.11	33.23	12.77	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss.

Product : WLAN mini-PCI card
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 1 (11Mbps)-Antenna #B

Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal								
Peak Detector:								
4824.060	6.17	33.64	33.42	46.70	53.09	20.91	74.00	54.00
7232.450	7.33	36.77	33.44	45.30	55.96	18.04	74.00	54.00
9647.930	8.73	38.24	32.84	40.24	54.36	19.64	74.00	54.00
12060.06	9.98	39.03	33.86	38.70	53.86	20.14	74.00	54.00
14472.18	10.65	40.51	34.28	33.00	49.87	24.13	74.00	54.00
Average:								
7240.620	7.33	36.77	33.44	33.71	44.37	9.63	74.00	54.00
9647.930	8.73	38.24	32.84	30.81	44.93	9.07	74.00	54.00
Vertical								
Peak Detector:								
4823.810	6.17	33.64	33.42	45.93	52.32	21.68	74.00	54.00
7232.450	7.33	36.77	33.44	44.98	55.64	18.36	74.00	54.00
9647.930	8.73	38.24	32.84	40.64	54.76	19.24	74.00	54.00
12059.93	9.98	39.03	33.86	37.17	52.33	21.67	74.00	54.00
14472.66	10.65	40.51	34.28	32.76	49.63	24.37	74.00	54.00
Average:								
7232.450	7.33	36.77	33.44	30.21	40.87	13.13	74.00	54.00
9647.930	8.73	38.24	32.84	31.13	45.25	8.75	74.00	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz。
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz。
4. Emission Level = Reading Level + Probe Factor + Cable Loss- PreAMP.
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 : WLAN mini-PCI card
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 6 (11Mbps)-Antenna #B

Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal								
Peak Detector:								
4873.570	6.20	33.77	33.35	39.46	46.08	27.92	74.00	54.00
7311.060	7.37	36.98	33.30	38.96	50.00	24.00	74.00	54.00
9748.660	8.87	38.35	32.85	39.43	53.80	20.20	74.00	54.00
12185.18	10.13	39.07	33.68	35.26	50.78	23.22	74.00	54.00
14622.42	10.67	40.02	33.62	34.05	51.11	22.89	74.00	54.00
Average:								
--								
Vertical								
Peak Detector:								
4873.930	6.20	33.77	33.35	39.70	46.32	27.68	74.00	54.00
7310.930	7.37	36.98	33.30	40.75	51.79	22.21	74.00	54.00
9747.570	8.84	38.34	32.85	39.05	53.38	20.62	74.00	54.00
12184.93	10.13	39.07	33.68	35.38	50.90	23.10	74.00	54.00
14621.93	10.67	40.02	33.62	33.76	50.82	23.18	74.00	54.00
Average:								
--								

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz。
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz。
4. Emission Level = Reading Level + Probe Factor + Cable Loss- PreAMP.
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 : WLAN mini-PCI card
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 11 (11Mbps)- Antenna #B

Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal								
Peak Detector:								
4923.810	6.23	33.82	33.28	40.55	47.32	26.68	74.00	54.00
7385.810	7.42	37.14	33.17	39.99	51.37	22.63	74.00	54.00
9848.660	8.97	38.47	32.85	38.68	53.27	20.73	74.00	54.00
12309.93	10.27	39.12	33.62	35.41	51.18	22.82	74.00	54.00
14771.57	10.68	39.53	33.05	26.83	43.99	30.01	74.00	54.00
Average:								
--								
Vertical								
Peak Detector:								
4924.180	6.26	33.90	33.24	39.56	46.48	27.52	74.00	54.00
7382.810	7.42	37.14	33.17	42.49	53.87	20.13	74.00	54.00
9848.420	8.97	38.47	32.85	39.06	53.65	20.35	74.00	54.00
12309.93	10.27	39.12	33.62	35.44	51.21	22.79	74.00	54.00
14771.93	10.68	39.53	33.05	28.03	45.19	28.81	74.00	54.00
Average:								
--								

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz。
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz。
4. Emission Level = Reading Level + Probe Factor + Cable Loss- PreAMP.
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 : WLAN mini-PCI card
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 1 (11Mbps)- Antenna #B

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
	233.700	0.80	9.20	21.20	47.43	36.23	9.77	46.00
	331.660	1.00	13.85	21.00	42.65	36.50	9.50	46.00
*	335.510	1.00	14.02	20.80	46.09	40.31	5.69	46.00
	400.520	1.00	17.20	21.00	43.10	40.30	5.70	46.00
	429.600	1.00	18.17	20.80	38.34	36.71	9.29	46.00
	497.520	1.20	20.24	21.00	38.19	38.63	7.37	46.00
Vertical:								
	298.610	0.80	13.07	21.20	39.84	32.51	13.49	46.00
	373.310	1.20	14.30	21.00	39.72	34.22	11.78	46.00
	467.410	1.00	16.61	21.00	41.50	38.11	7.89	46.00
	527.630	1.20	17.33	21.00	39.87	37.40	8.60	46.00
	658.500	1.40	21.61	20.80	34.89	37.10	8.90	46.00
*	665.310	1.40	21.32	21.00	37.08	38.80	7.20	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss.

Product : WLAN mini-PCI card
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 6 (11Mbps)- Antenna #B

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
	367.410	1.20	15.70	21.20	40.53	36.23	9.77	46.00
	392.710	1.00	16.91	21.20	35.89	32.60	13.40	46.00
	431.510	1.00	18.24	21.00	35.34	33.58	12.42	46.00
	442.210	1.00	18.59	20.80	39.14	37.93	8.07	46.00
*	527.630	1.20	20.65	21.00	38.66	39.51	6.49	46.00
	664.390	1.20	22.76	21.00	33.34	36.30	9.70	46.00
Vertical:								
	266.610	1.00	13.51	21.00	43.06	36.57	9.43	46.00
	373.320	1.20	14.30	21.00	41.77	36.27	9.73	46.00
	531.410	1.20	17.17	21.00	39.33	36.70	9.30	46.00
	658.510	1.40	21.61	20.80	34.89	37.10	8.90	46.00
*	703.140	1.40	19.76	21.40	38.53	38.29	7.71	46.00
	866.190	1.60	22.35	21.40	33.65	36.20	9.80	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss.

Product : WLAN mini-PCI card
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 11 (11Mbps)- Antenna #B

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
	392.710	1.00	16.91	21.20	40.11	36.82	9.18	46.00
	435.850	1.00	18.37	21.00	36.12	34.49	11.51	46.00
	503.340	1.00	20.34	21.20	36.49	36.63	9.37	46.00
	527.630	1.20	20.65	21.00	32.66	33.51	12.49	46.00
*	598.360	1.40	21.50	21.20	36.95	38.65	7.35	46.00
	802.210	1.60	23.79	21.60	33.77	37.56	8.44	46.00
Vertical:								
	527.630	1.20	17.33	21.00	38.91	36.44	9.56	46.00
*	648.820	1.20	21.99	20.80	34.36	36.75	9.25	46.00
	665.320	1.40	21.32	21.00	34.14	35.86	10.14	46.00
	866.120	1.60	22.35	21.40	32.69	35.24	10.76	46.00
	871.930	1.40	22.31	21.40	33.84	36.15	9.85	46.00
	953.420	1.60	23.01	21.60	30.30	33.31	12.69	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss.

6. Band Edge

6.1. Test Equipment

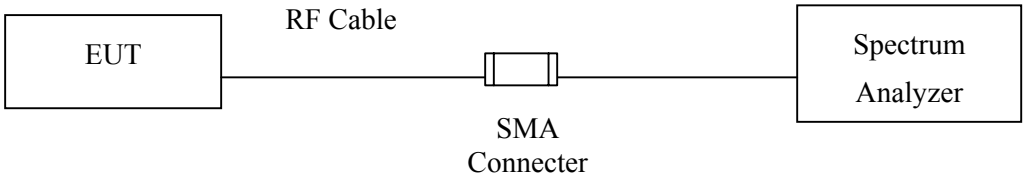
The following test equipments are used during the band edge tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	Advantest	R3272 / 72421194	May, 2002
X	Test Receiver	R & S	ESCS 30 / 825442/14	May, 2002
X	Spectrum Analyzer	Advantest	R3261C / 71720140	May, 2002
X	Pre-Amplifier	HP	8447D/3307A01812	May, 2002
X	Bilog Antenna	Chase	CBL6112B / 12452	Sep., 2002
X	Horn Antenna	EM	EM6917 / 103325	May, 2002

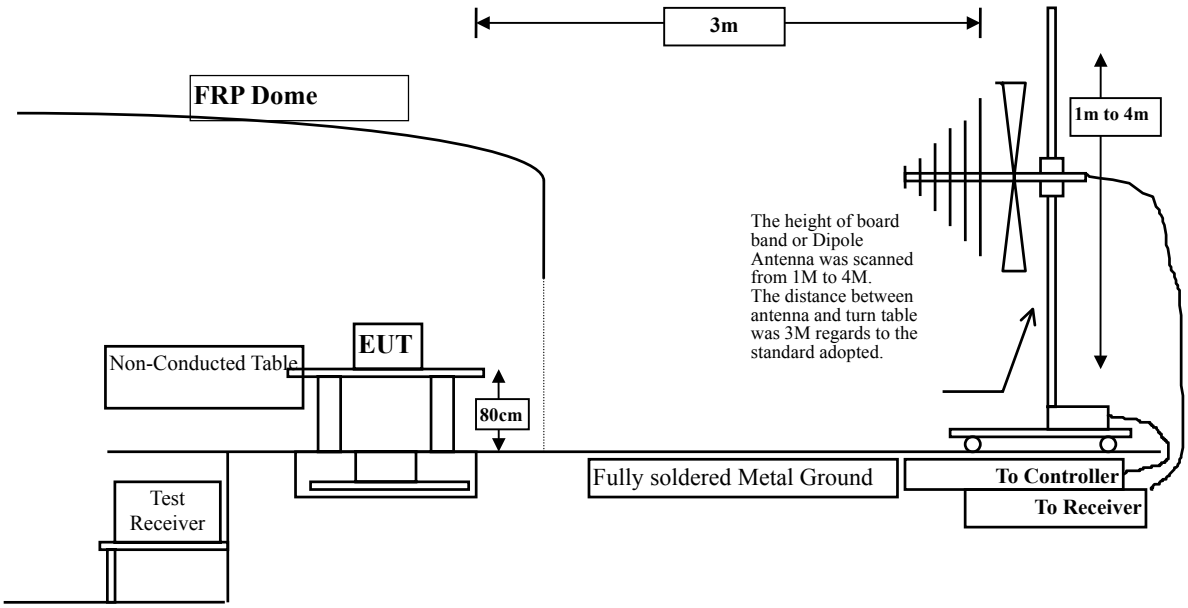
Note: 1. All equipments that need to calibrate are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

6.2. Test Setup

RF Conducted Measurement:



RF Radiated Measurement:



6.3. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:1992 on radiated measurement.
The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCS 30)is 120 kHz, above 1GHz are 1 MHz.

6.5. Test Result of Band Edge

Product : WLAN mini-PCI card
Test Item : Band Edge Data
Test Site : No.2 OATS
Test Mode : Channel 1 (11Mbps)

RF Radiated Measurement:

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
1 (Horizontal)	<2400	>20	Pass
1 (Vertical)	<2400	>20	Pass

Figure Channel 1: (Horizontal)

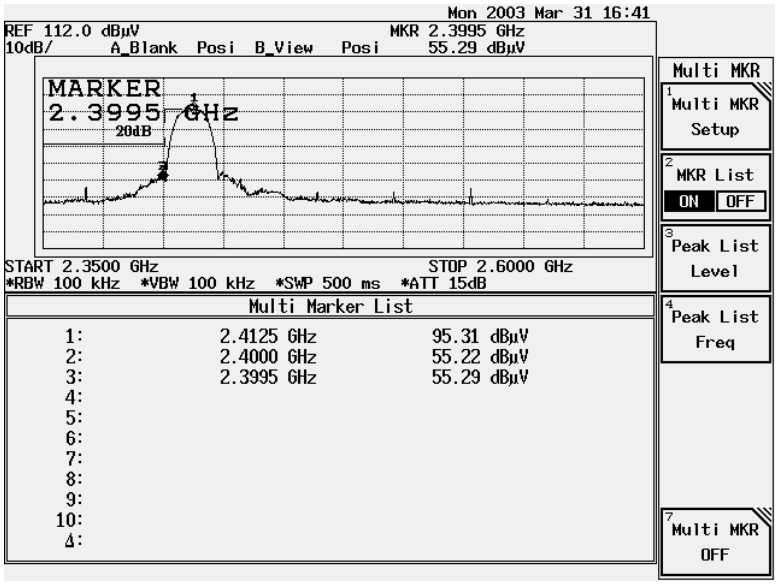
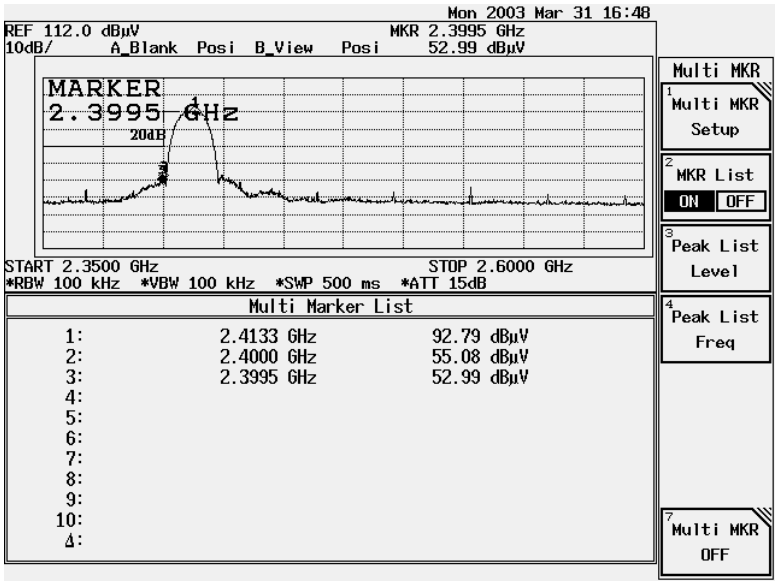


Figure Channel 1: (Vertical)



Product : WLAN mini-PCI card
Test Item : Band Edge Data
Test Site : No.2 OATS
Test Mode : Channel 11 (11Mbps)

RF Radiated Measurement:

Channel No.	Frequency (MHz)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Arerage Limit (dBuV/m)	Result
11(Horizontal)	2496.0	53.32	51.52	74.00	54.00	Pass
11(Vertical)	2499.5	53.57	51.77	74.00	54.00	Pass

Figure Channel 11: (Horizontal)

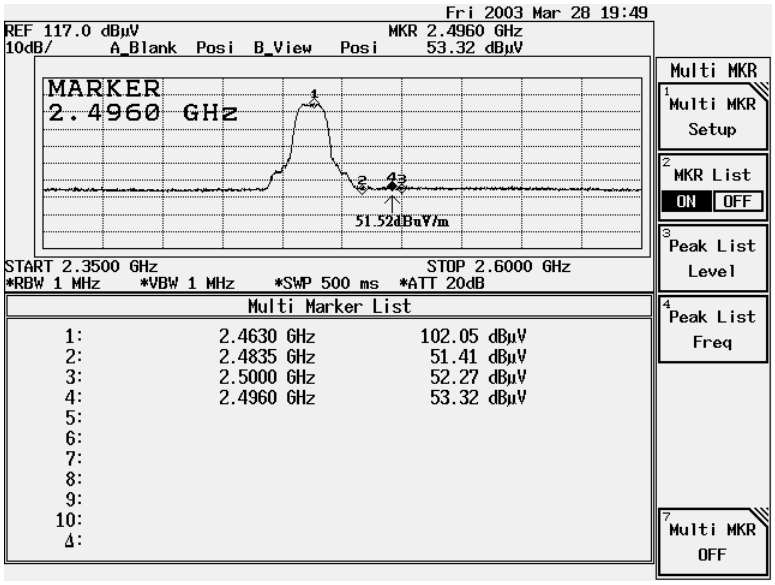
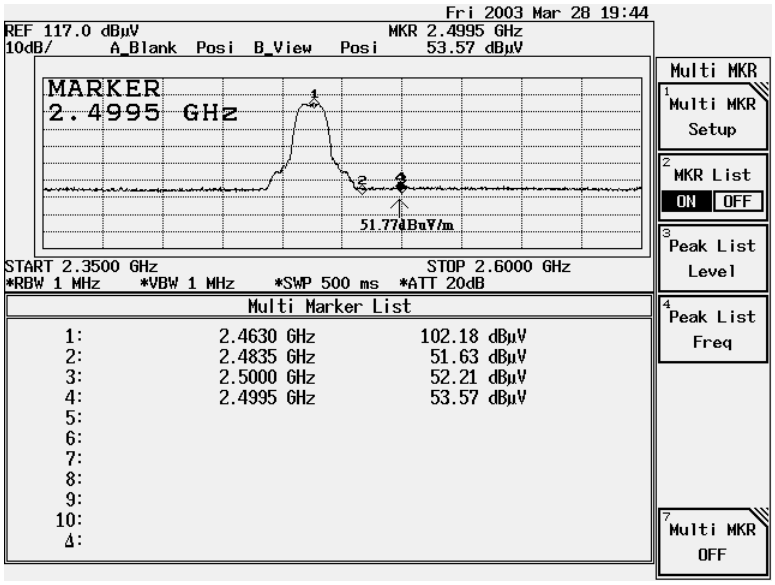


Figure Channel 11: (Vertical)



Note: 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.

7. Occupied Bandwidth

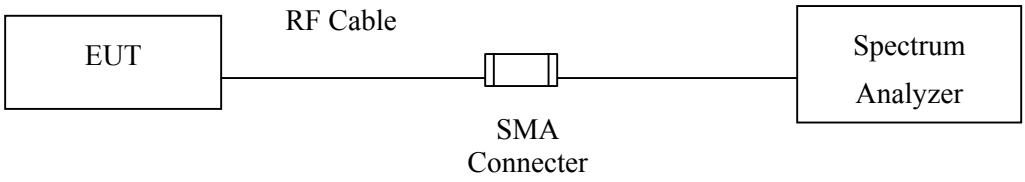
7.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	Advantest	R3272 / 72421194	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

7.2. Test Setup



7.3. Limits

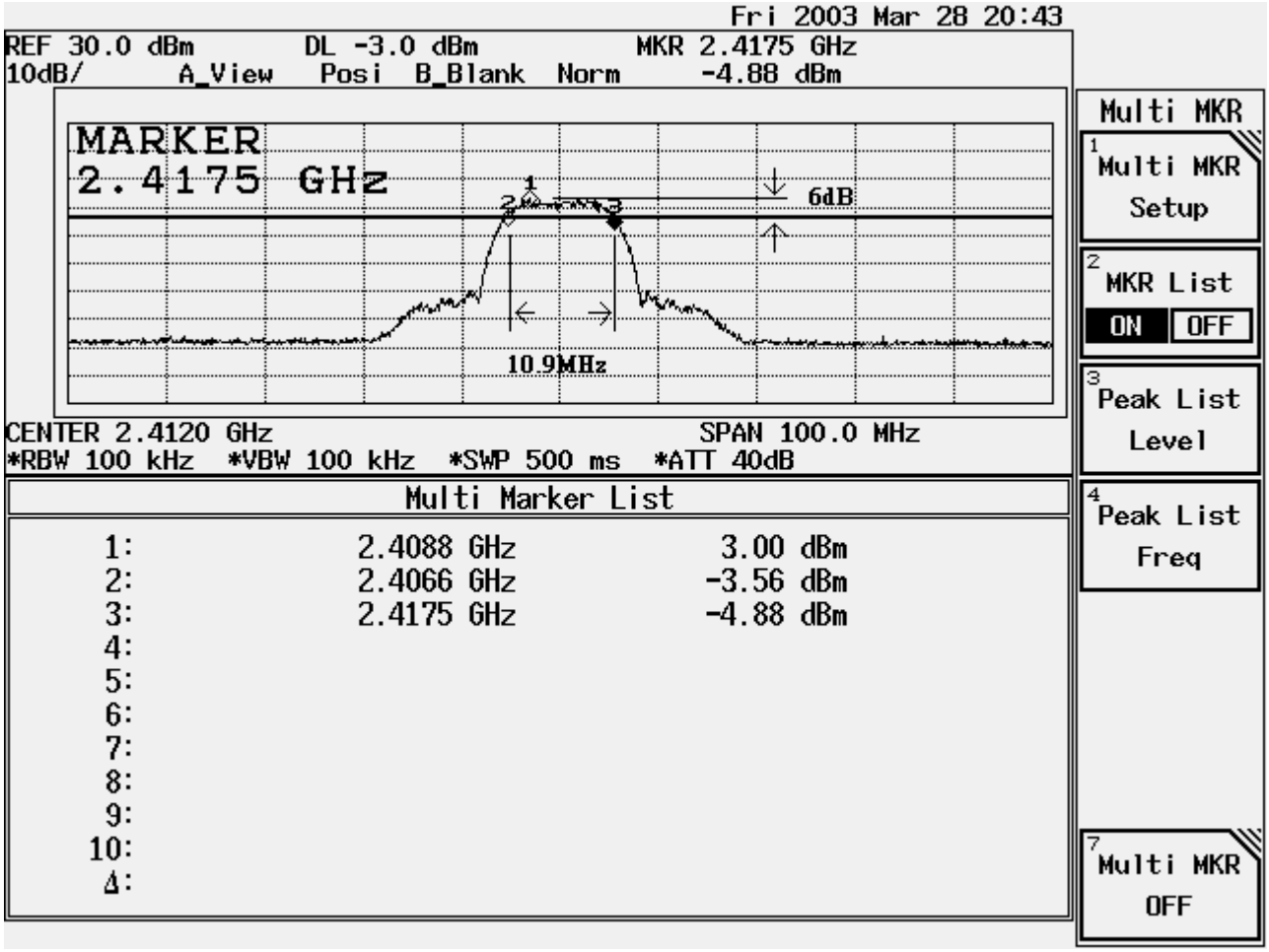
The minimum bandwidth shall be at least 500kHz.

7.4. Test Result of Occupied Bandwidth

Product : WLAN mini-PCI card
Test Item : Occupied Bandwidth Data
Test Site : No.2 OATS
Test Mode : Channel 1

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
1 (11Mbps)	2408.8	10900	>500	Pass

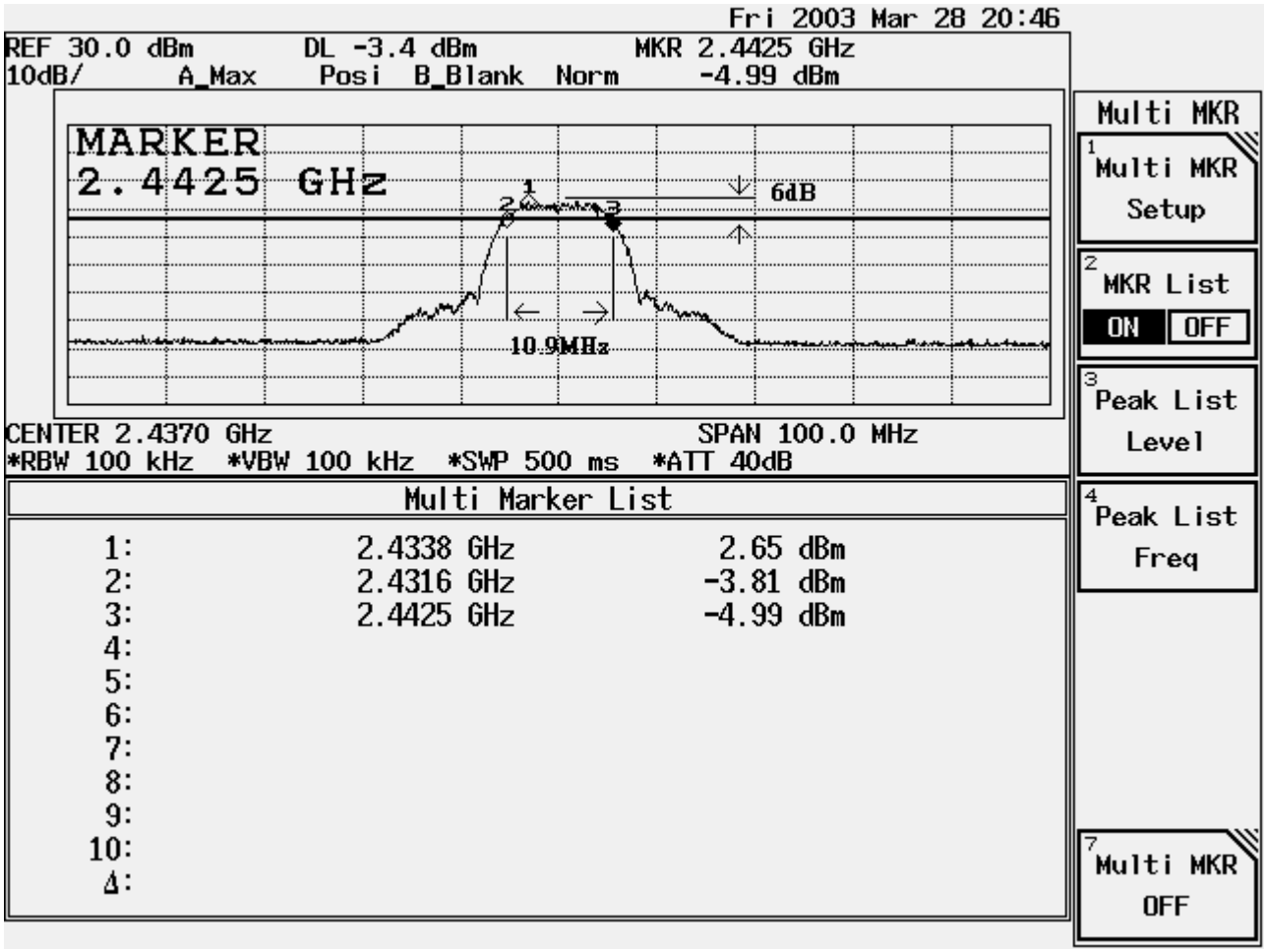
Figure Channel 1: 11Mbps



Product : WLAN mini-PCI card
Test Item : Occupied Bandwidth Data
Test Site : No.2 OATS
Test Mode : Channel 6

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
6 (11Mbps)	2433.8	10900	>500	Pass

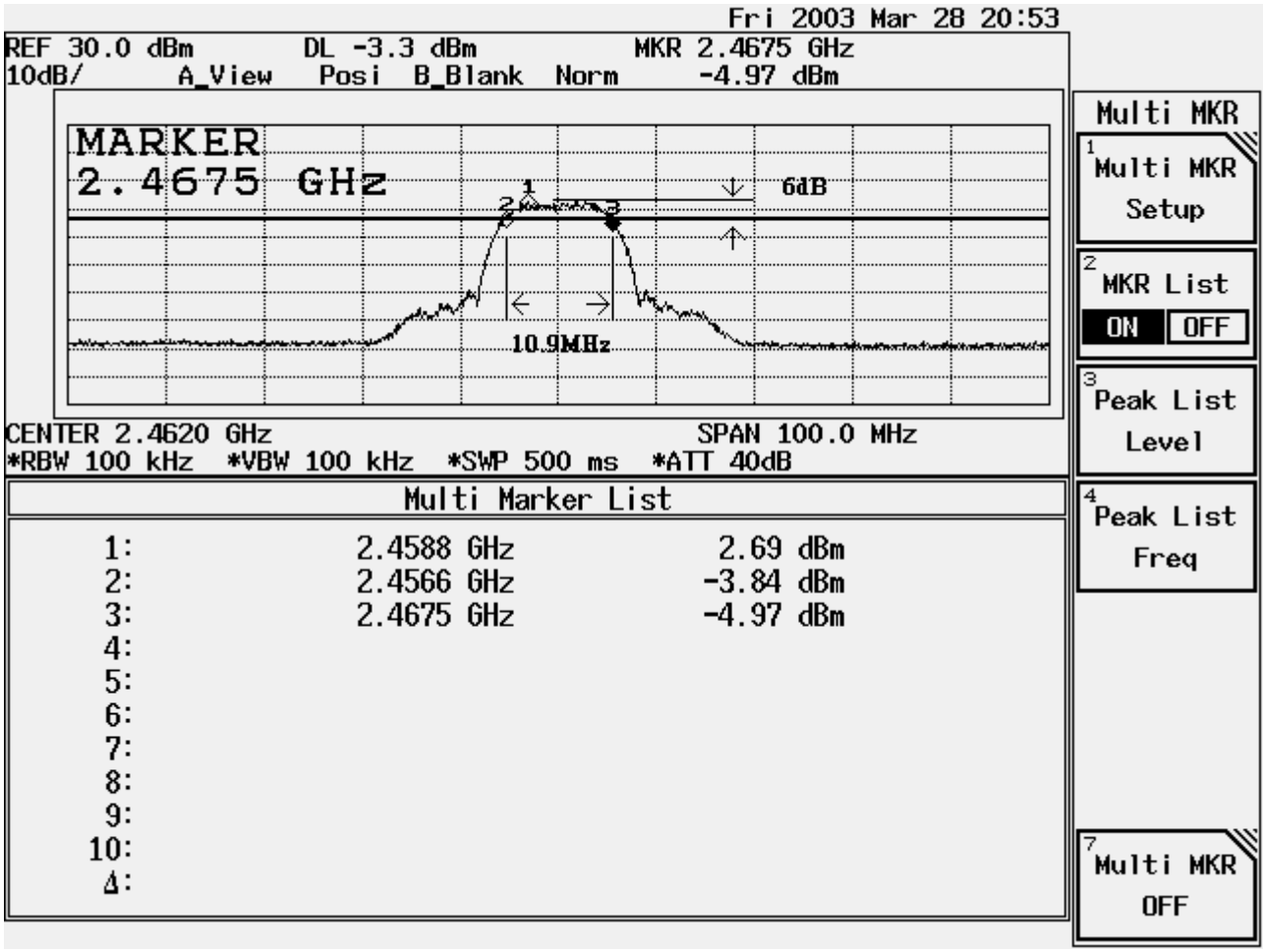
Figure Channel 6: 11Mbps



Product : WLAN mini-PCI card
Test Item : Occupied Bandwidth Data
Test Site : No.2 OATS
Test Mode : Channel 11

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
11 (11Mbps)	2458.8	10900	>500	Pass

Figure Channel 11: 11Mbps



8. Power Density

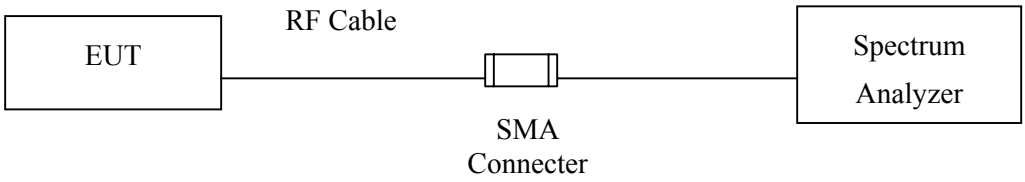
8.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	Advantest	R3272 / 72421194	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

8.2. Test Setup



8.3. Limits

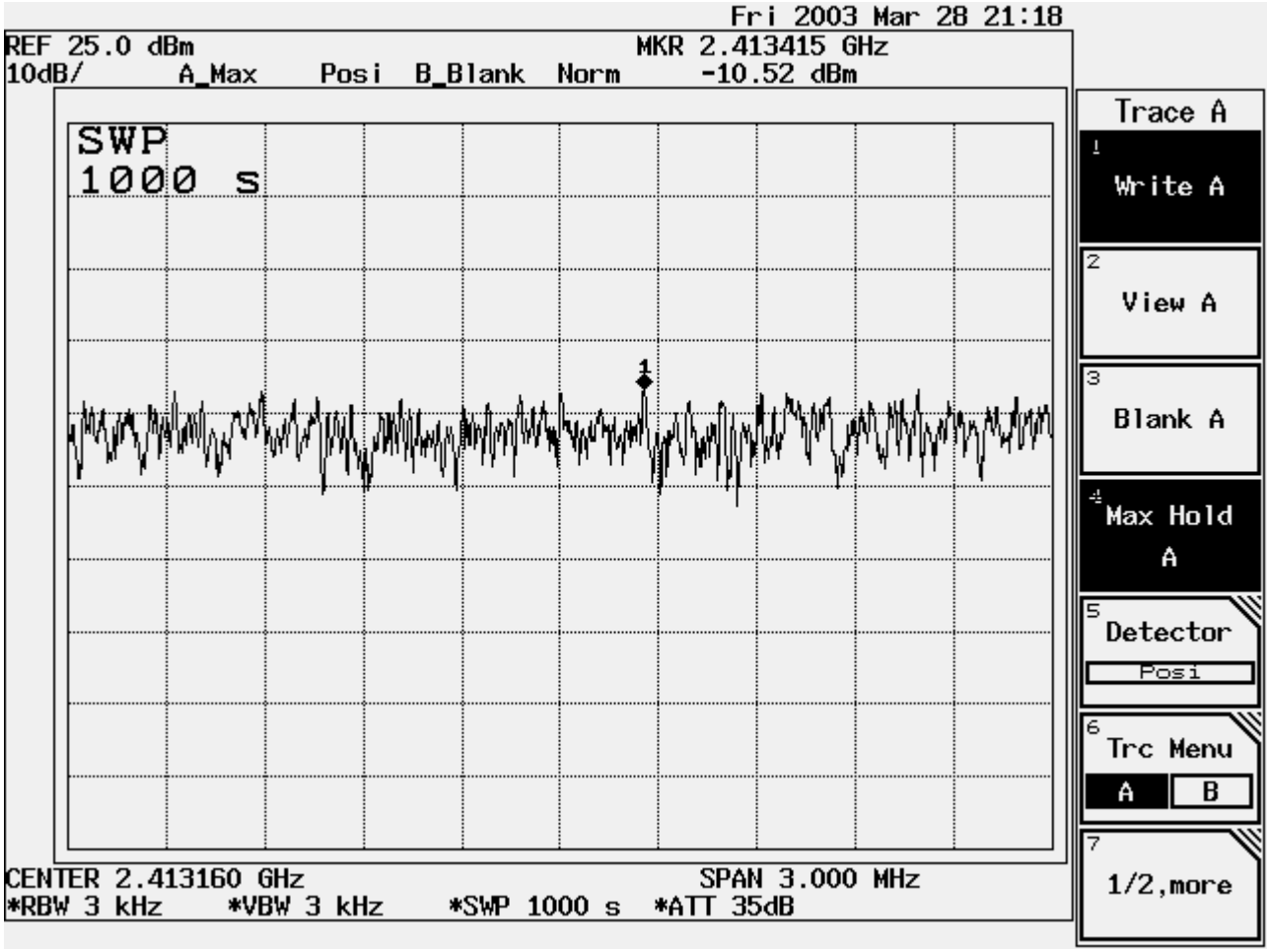
The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.4. Test Result of Power Density

Product : WLAN mini-PCI card
Test Item : Power Density Data
Test Site : No.2 OATS
Test Mode : Channel 1

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1 (11Mbps)	2143.415	-10.52	< 8dBm	Pass

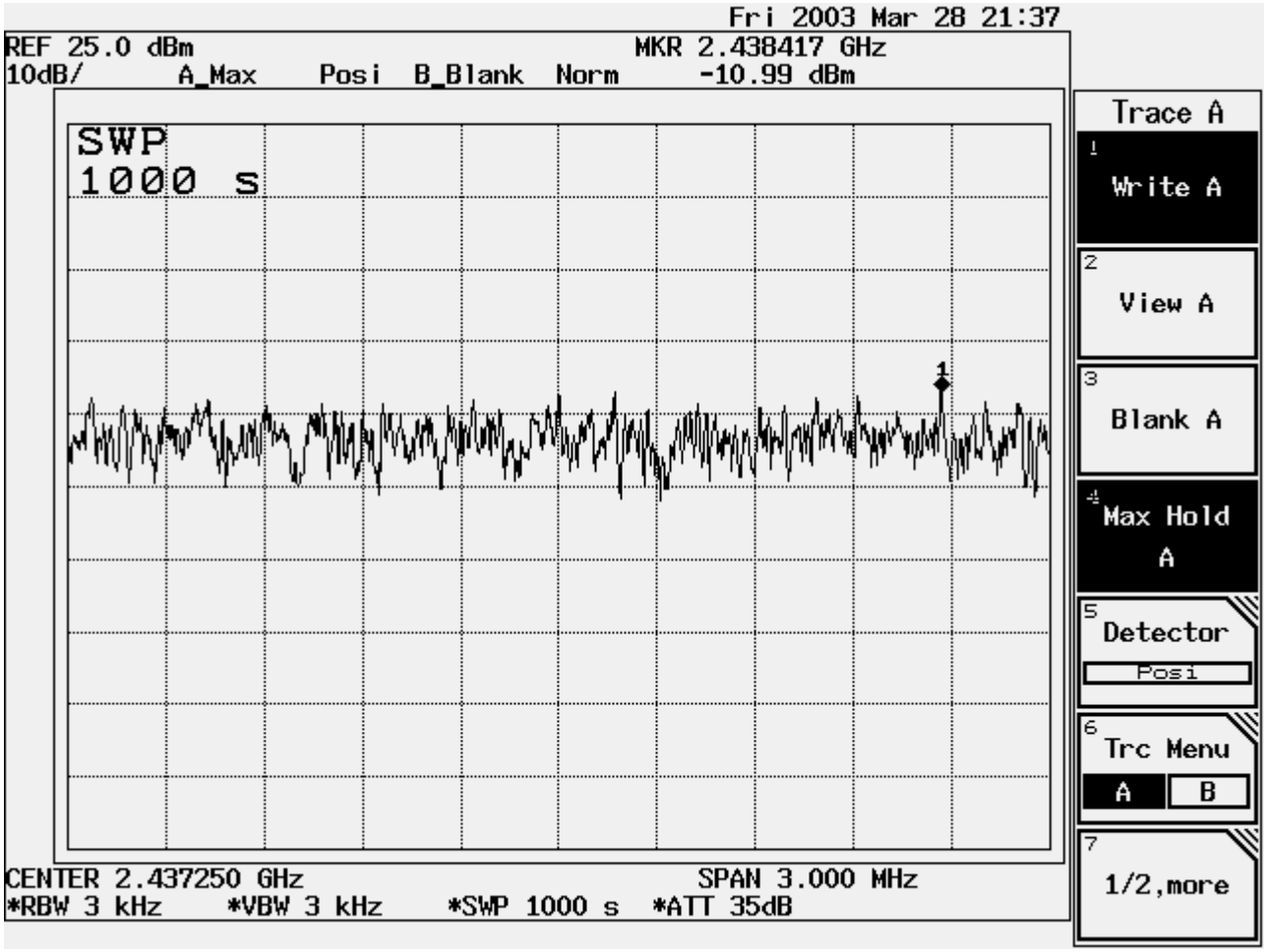
Figure Channel 1: 11Mbps



Product : WLAN mini-PCI card
Test Item : Power Density Data
Test Site : No.2 OATS
Test Mode : Channel 6

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
6 (11Mbps)	2438.417	-10.99	< 8dBm	Pass

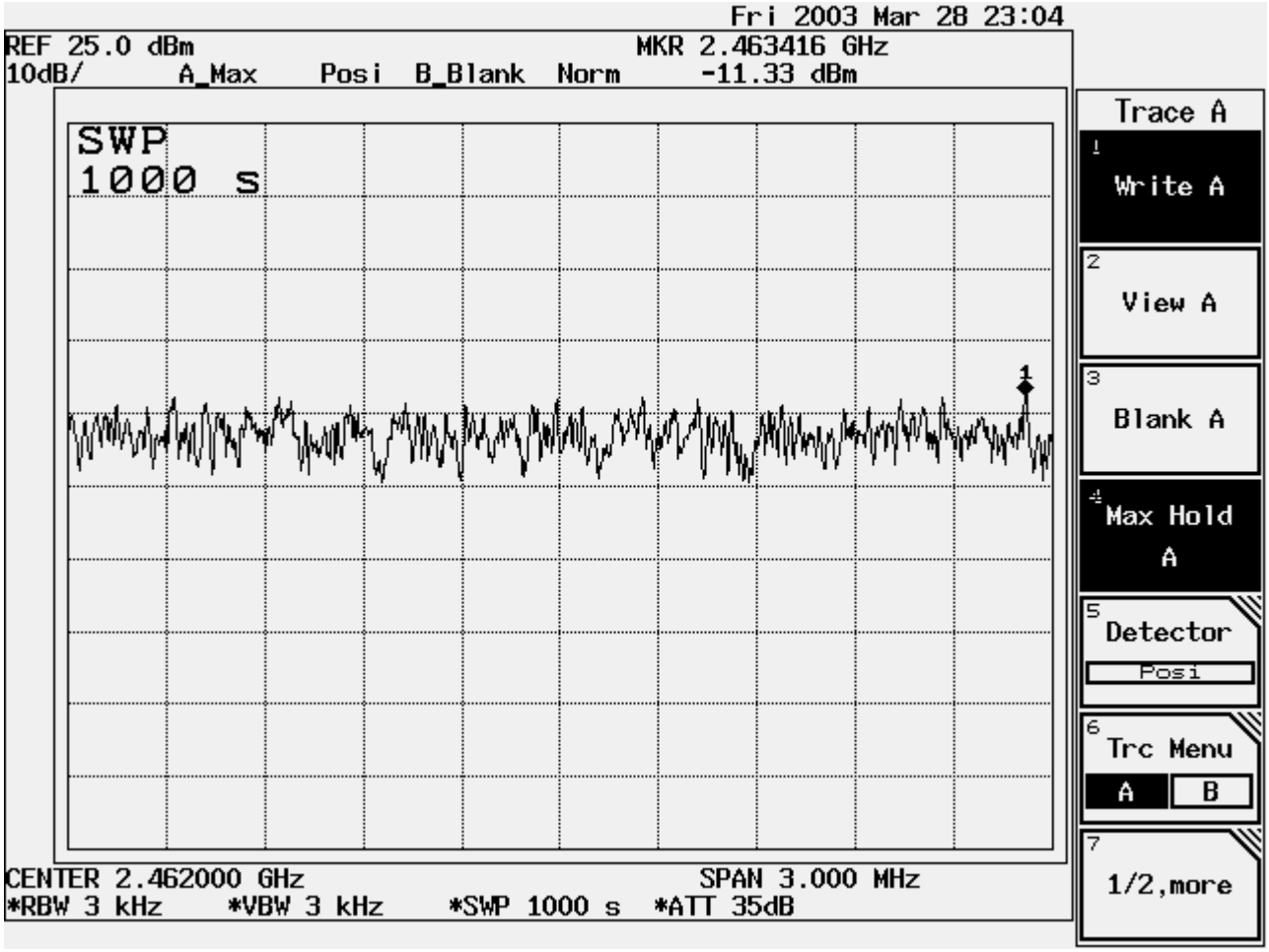
Figure Channel 6: 11Mbps



Product : WLAN mini-PCI card
Test Item : Density Data
Test Site : No.2 OATS
Test Mode : Channel 11

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
11 (11Mbps)	2463.416	-11.33	< 8dBm	Pass

Figure Channel 11: 11Mbps



9. EMI Reduction Method During Compliance Testing

No modification was made during testing.

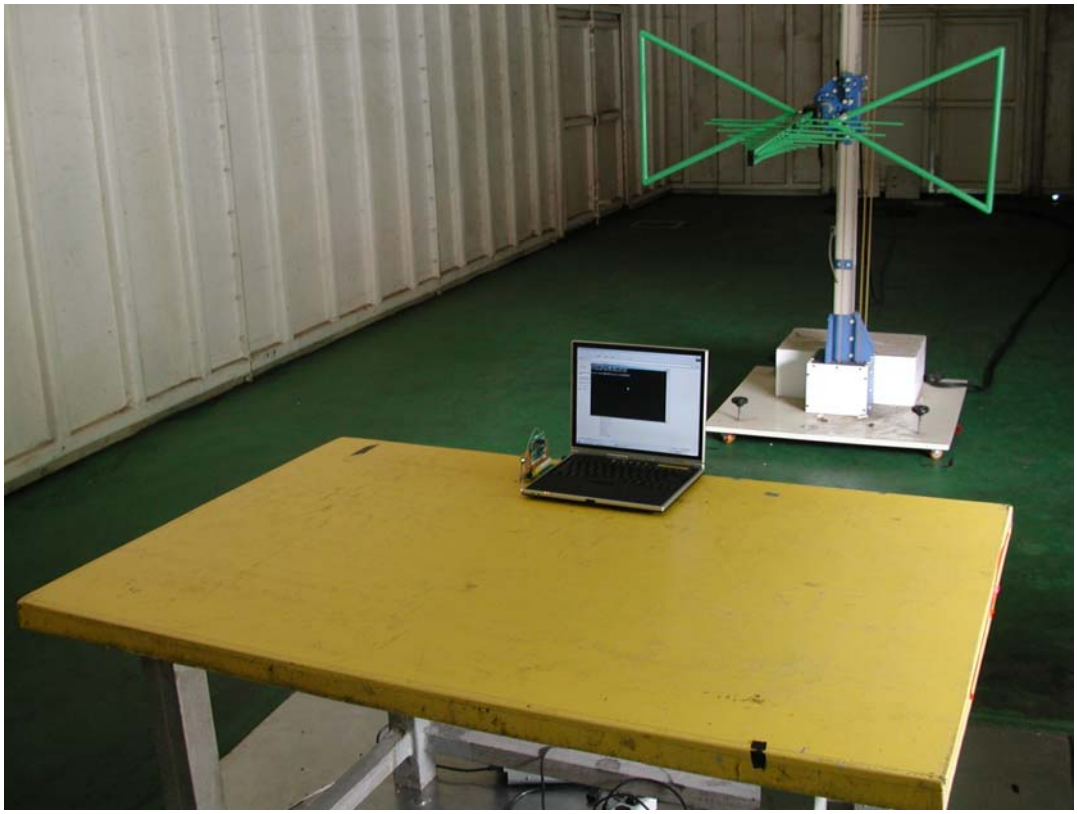
Attachment 1: EUT Test Photographs

Attachment 1: EUT Test Setup Photographs

Front View of Conducted Test (Mode 1)

Back View of Conducted Test (Mode 1)

Front View of Radiated Test (Mode 1)



Back View of Radiated Test (Mode 1)

Front View of Radiated Test (Mode 2)

Back View of Radiated Test (Mode 2)

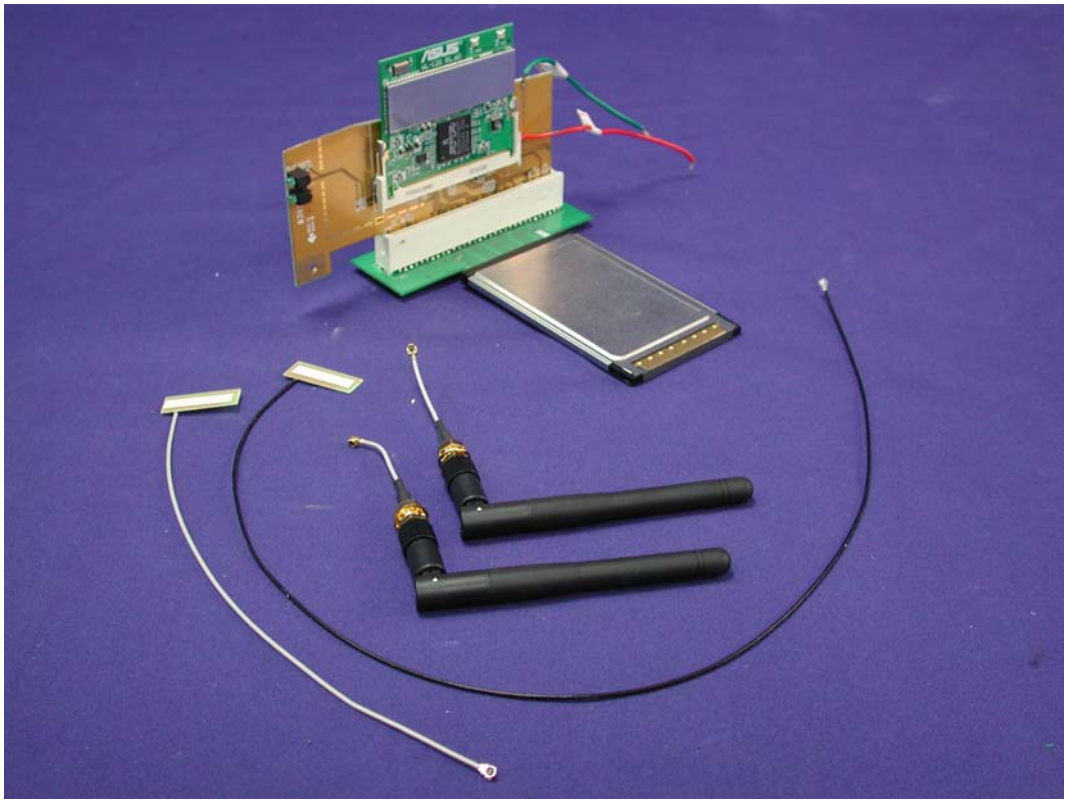
Front View of Radiated Test (Horn)(Mode 1)

Front View of Radiated Test (Horn)(Mode 2)

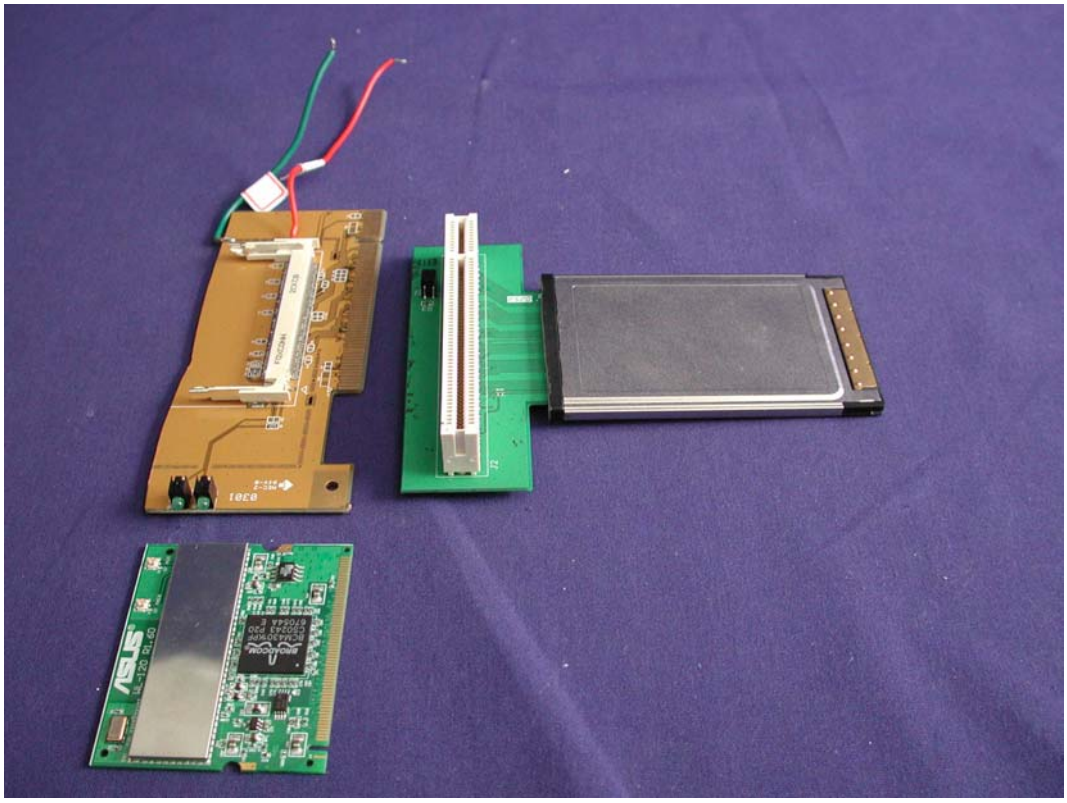
Attachment 2: EUT Detailed Photographs

Attachment 2 : EUT Detailed Photographs

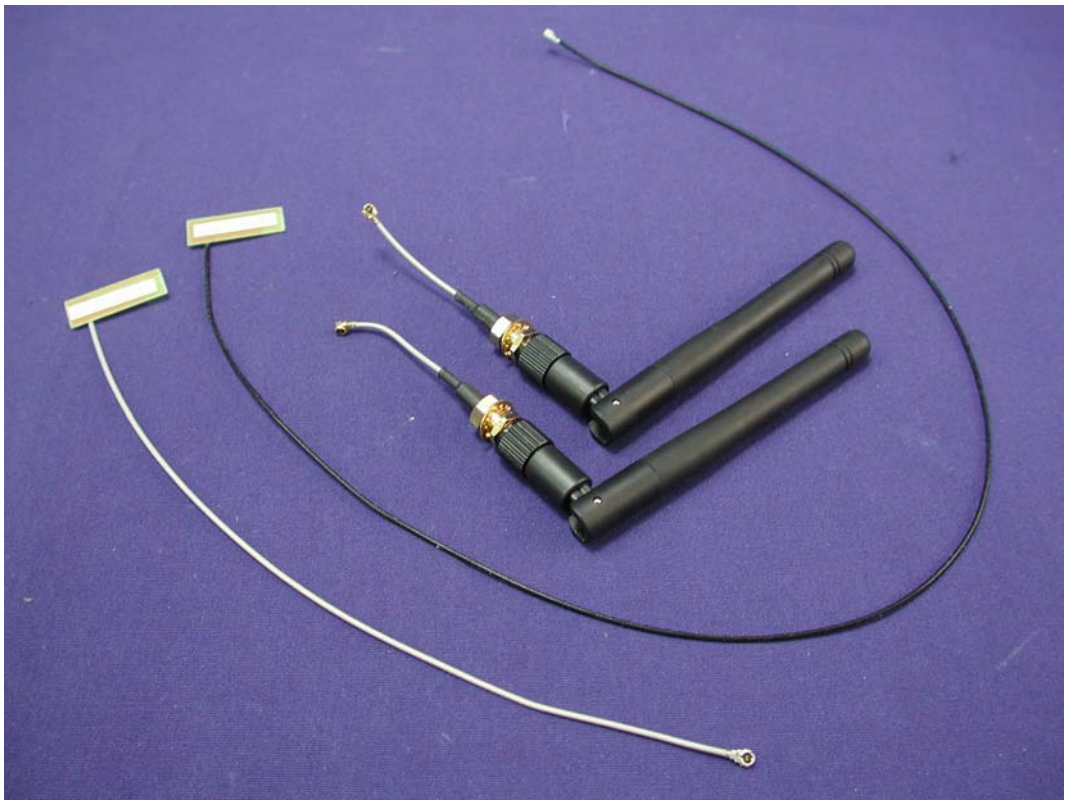
(1) EUT Photo



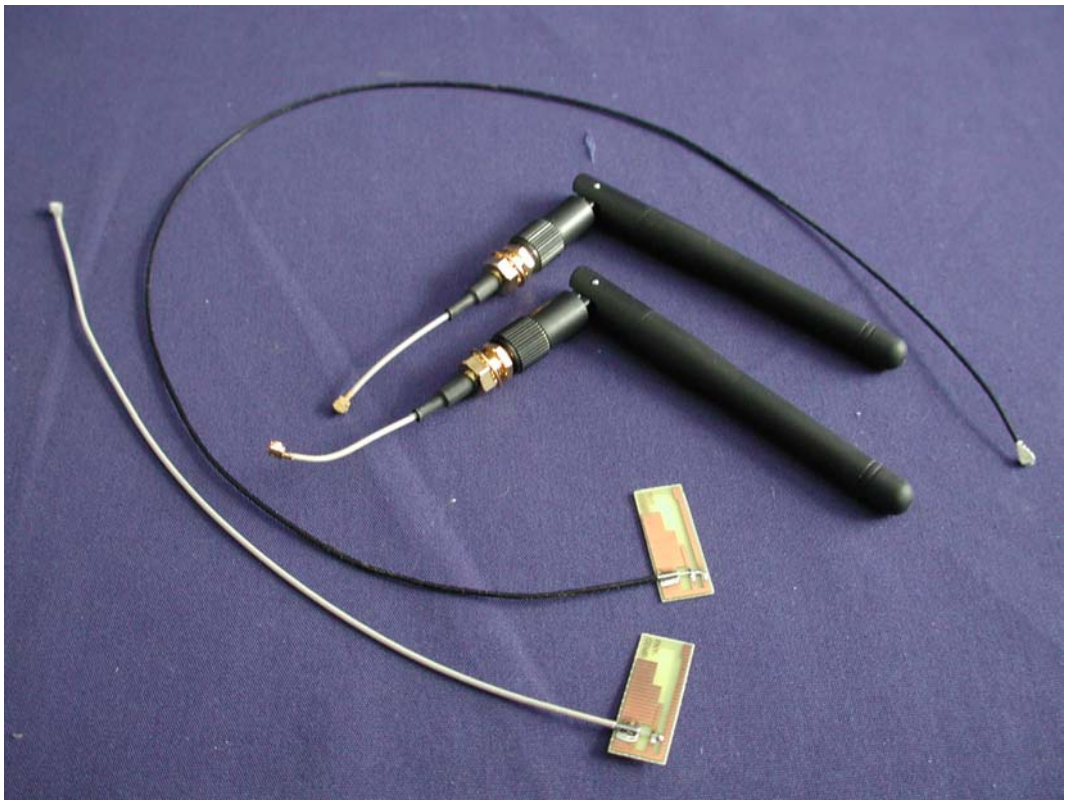
(2) EUT Photo



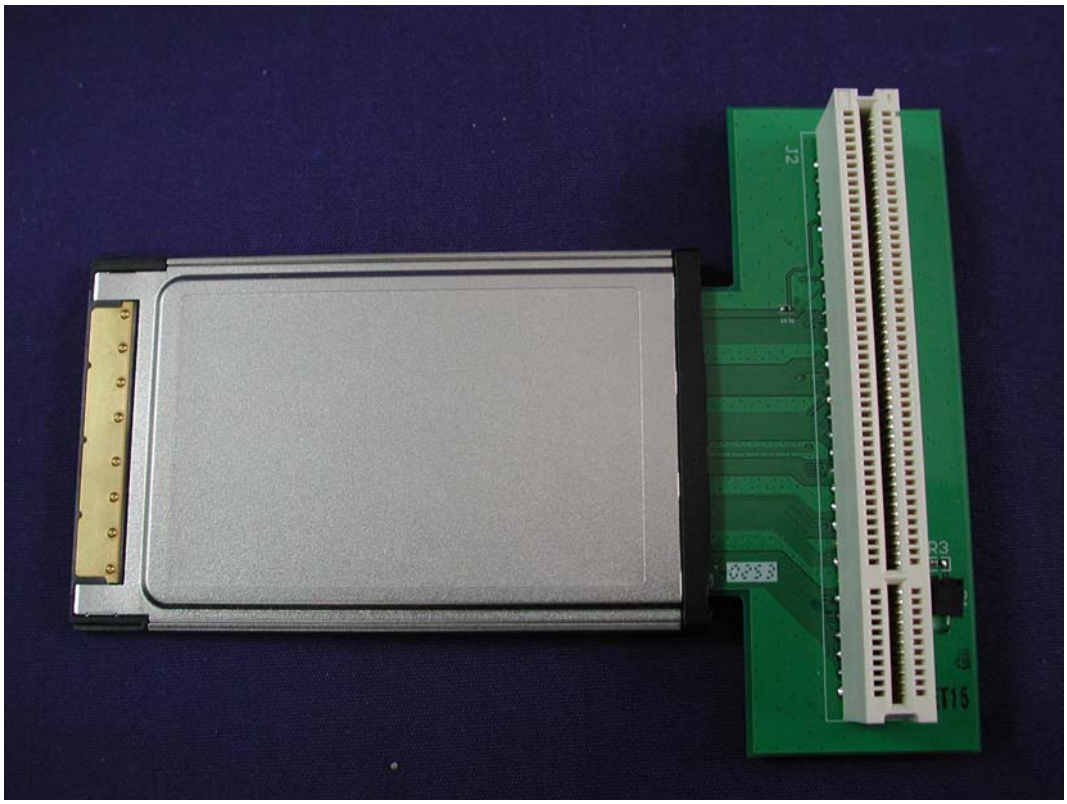
(3) EUT Photo



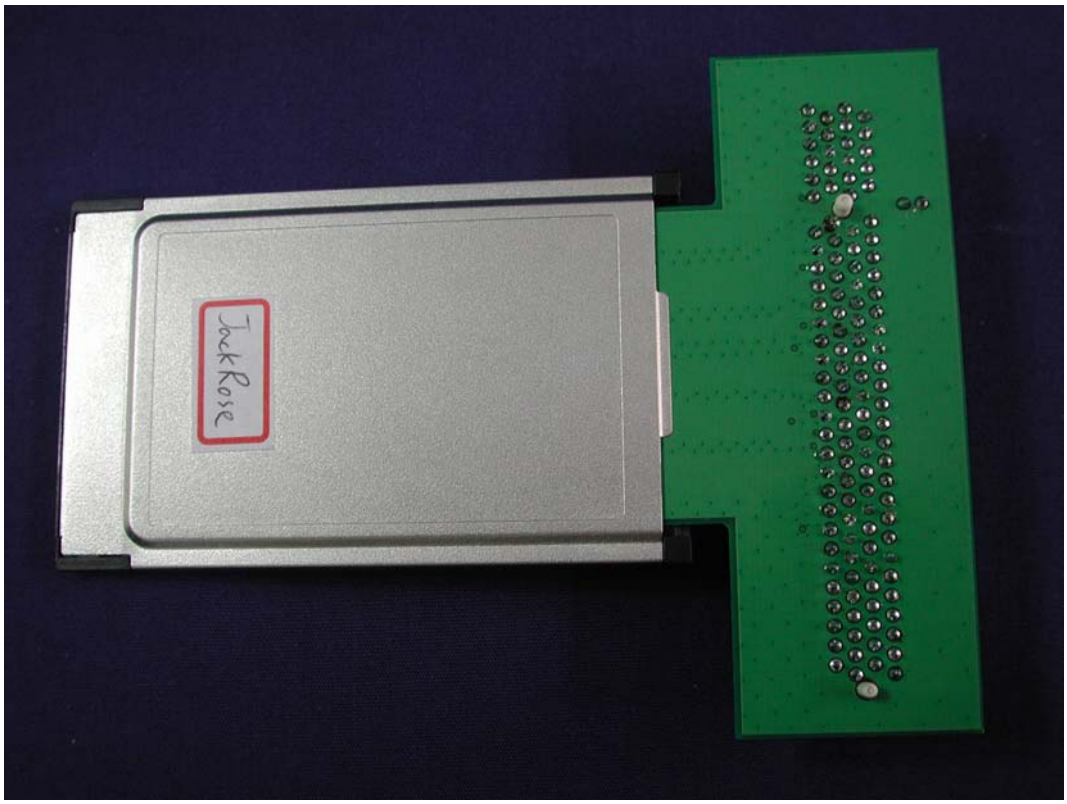
(4) EUT Photo



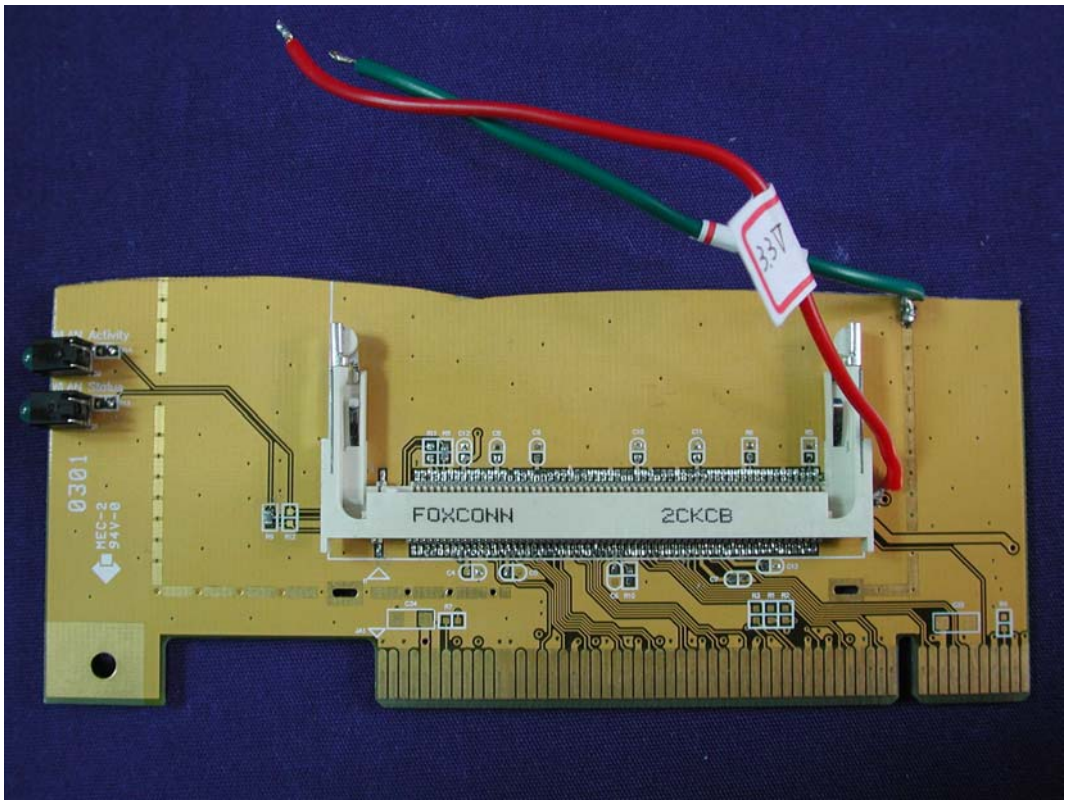
(5) EUT Photo



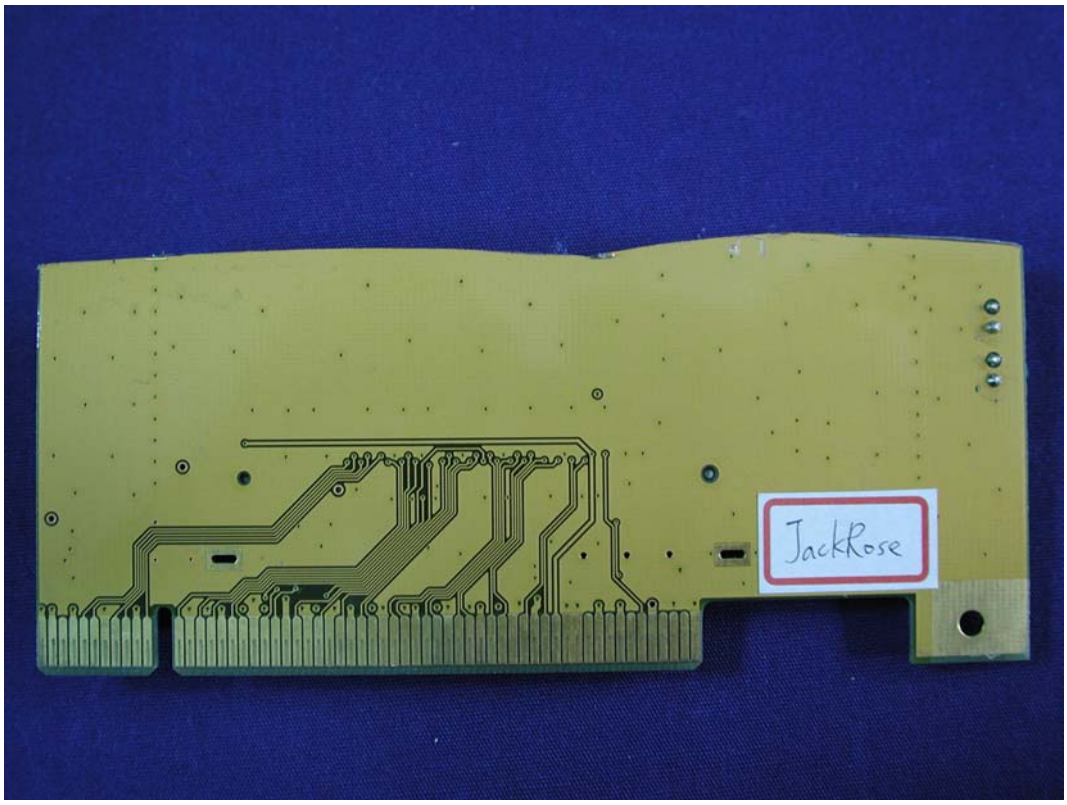
(6) EUT Photo



(7) EUT Photo

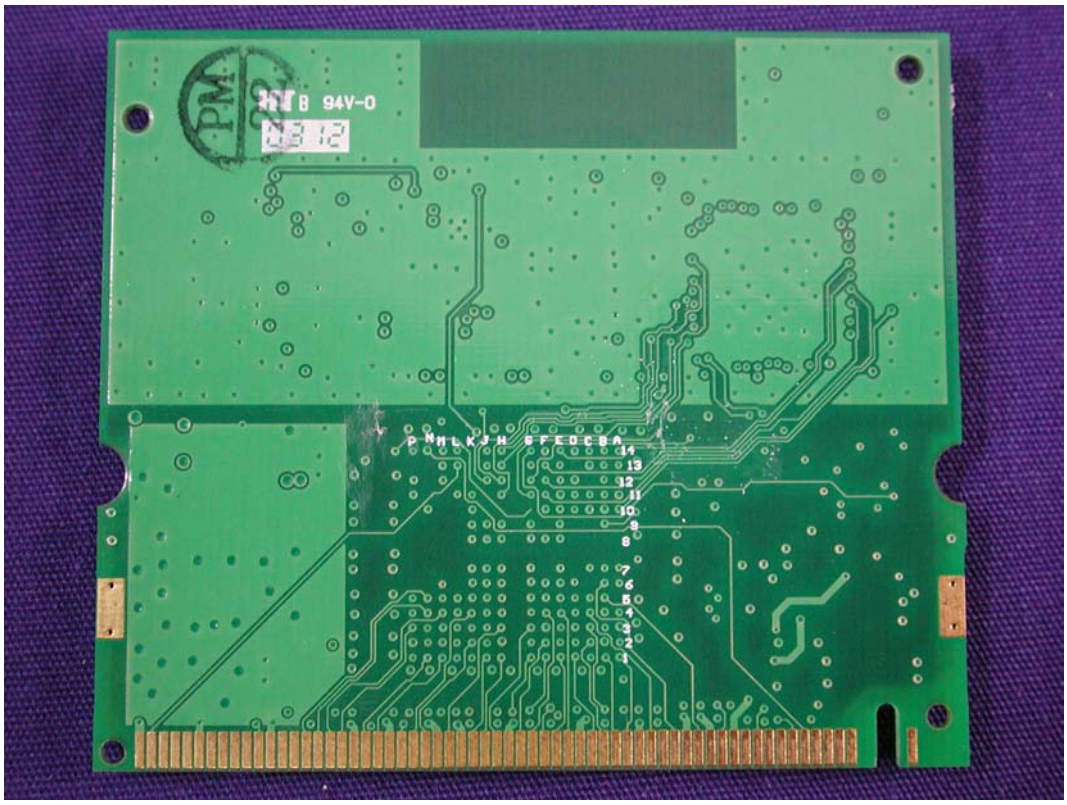


(8) EUT Photo



(9) EUT Photo

(10) EUT Photo

(11) EUT Photo

(12) EUT Photo