Test Report

FOR

FCC Part 15 Subpart C

of

WLAN 802.11g Mini-PCI Module

Model

RM8

(Brand: Wistron NeWeb)

Applied by:

Wistron NeWeb Corporation
No. 10-1, Li-hsin Road I,
Science-based Industrial Park Hsinchu 300,
Taiwan, R. O. C.

Test Performed by:

International Standards Laboratory

No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd.
Lung-Tan Hsiang, Tao Yuan County 325
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Report Number: 03LR026FC **Test Date: 2003/12/08**
NVLAP Lab. Code: 200234-0; VCCI: R-1435, C-1440; NEMKO Aut. No: ELA 113; BSMI Lab. Code: SL2-IN-E-0013

Contents of Report

1. General

1.1 Certification of Accuracy of Test Data

The electromagnetic interference tests which this report describes were conducted by an independent electromagnetic compatibility consultant, International Standards Laboratory in accordance with the test procedure specified in CFR 47 Part 15 Subpart C (Section 15.247) , and ANSI C63.4 Rules.

The test results contained in this report accurately represent the measurements of the EMC characteristics and the energy generated by sample equipment under test at the time of the test.

Equipment Tested:	WLAN 802.11g Mini-PCI Module Model: RM8 Applied by Wistron NeWeb Corp.
Sample received Date:	2003/11/21
Final test Date :	2003/12/06
Test Site:	Chamber 02, Conduction 02
Temperature	20º C(Conduction Test); 23º C (Radiation Test)
Humidity:	51% (Conduction Test); 50% (Radiation Test)
Test Engineer:	Jerry Chiou

The results show that the sample equipment tested as described in this report is in compliance with the Class B conducted and radiated emission limits of FCC Rules Part 15 Subpart B, and the limit of Part Subpart C Sec. 15.247.

Approve & Signature

Eddy Hsiung

Eddy Hsiung/Director

Test results given in this report apply only to the specific sample(s) tested under stated test conditions. This report shall not be reproduced other than in full without the explicit written consent of ISL. This report totally contains 75 pages, including 1 cover page , 3 contents page, and71 pages for the test description. This report must not be use to claim product endorsement by NVLAP or any agency of the U.S. Government.

This test data shown below is traceable to NIST or national or international standard. International Standards Laboratory certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

1.2 Test Results Summary

The 802.11b and 802.11g functions of EUT has been tested to the FCC regulations listed below:

Tested Standards: 47 CFR Part 15 Subpart C			
Standard Section	Test Type	Result	Remarks
15.207	AC Power Line Emissions	Pass	
15.247(a)(2)	Spectrum Bandwidth Of DSSS device	Pass	
15.247(b)	Max. Peak Output Power	Pass	
15.247(c)	Radiated Emissions 30MHz – 25 GHz	Pass	
15.247 (c)	Band Edge Measurement	Pass	
15.247(b)(4)	Radiation Exposure	Pass	
15.247 (d)	Power Spectral Density	Pass	

1.3 Description of Equipment Under Test (EUT)

Description:	WLAN 802.11g Mini-PCI Module
Model No.:	RM8
FCC ID:	NKRRM8
Brand:	Wistron NeWeb
Frequency Range 802.11b/g:	2412 - 2462 MHz
Support channel:	
802.11b/g	11 Channels
Modulation Skill:	
802.11b	DBPSK(1Mbps), DQPSK(2Mbps), CCK(5.5/11Mbps)
802.11g	OFDM (6M - 54Mbps)
Antennas Type:	PIFA Type in Meta made by Wistron NeWeb Corp.
Antenna P/N:	DC330011800
Antenna Connected:	Connected to RF connector on the PCB of the 802.11g WLAN Adapter.
Antenna peak Gain:	
Main antenna	0.66 dBi
Power Type of LAN module:	3.3V DC from Notebook PC

The channel and the operation frequency of 802.11b and 802.11g is listed below:

Channel	Frequency(MHz)	Channel	Frequency(MHz)
01	2412	07	2442
02	2417	08	2447
03	2422	09	2452
04	2427	10	2457
05	2432	11	2462
06	2437		

During the test, the EUT was tested as a modular device of a notebook PC using a PCMCIA extender board to extend the EUT outside the notebook PC enclosure. The EUT was then connected to a set of antennas via its transmit and receive connectors.

1.4 Test Standards and Procedure

Test Specification:	FCC Part 15 subpart C (Section 15.247) and subpart B and/or CISPR 22/EN55022, RSS210
Test Procedure:	ANSI C63.4, CFR 47 Sec. 15.247 as detailed in Appendices

1.5 General Test Conditions

1. During the test, the EUT was set in continuously transmitting mode with a duty cycle of 99% (maximum allowed).
2. The channel 1, 6, 11 of of 802.11b and 802.11g of EUT were all tested.
3. "Normal mode" of 802.11g allows data rates up to 54 Mbps.

2. TEST RESULTS (802.11b)

2.1 Powerline Conducted Emissions [Section 15.207]

2.1.1 EUT Configuration

The EUT was set up on the non-conductive table that is 1.0 by 1.5 meter, 80cm above ground. The wall of the shielded room was located 40cm to the rear of the EUT.

Power to the EUT was provided through the LISN. The impedance vs. frequency characteristic of the LISN is complied with the limit shown on the figure 1 of ANSI C63.4-2001.

Both lines (neutral and hot) were connected to the LISN in series at testing. A coaxial-type connector which provides one 50 ohms terminating impedance was provided for connecting the test instrument. The excess length of the power cord was folded back and forth at the center of the lead so as to form a bundle not exceeding 40cm in length.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

If the EUT is a Personal Computer or a peripheral of personal computer, and the personal computer has an auxiliary AC outlet which can be used for providing power to an external monitor, then all measurements will be made with the monitor power from first the computer-mounted AC outlet and then a floor-mounted AC outlet.

2.1.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. The main power line conducted EMI tests were run on the hot and neutral conductors of the power cord and the results were recorded. The effect of varying the position of the interface cables has been investigated to find the configuration that produces maximum emission.

At the frequencies where the peak values of the emissions were higher than 6dß below the applicable limits, the emissions were also measured with the quasi-peak detectors. At the frequencies where the quasi-peak values of the emissions were higher than 6dß below the applicable average limits, the emissions were also measured with the average detectors.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

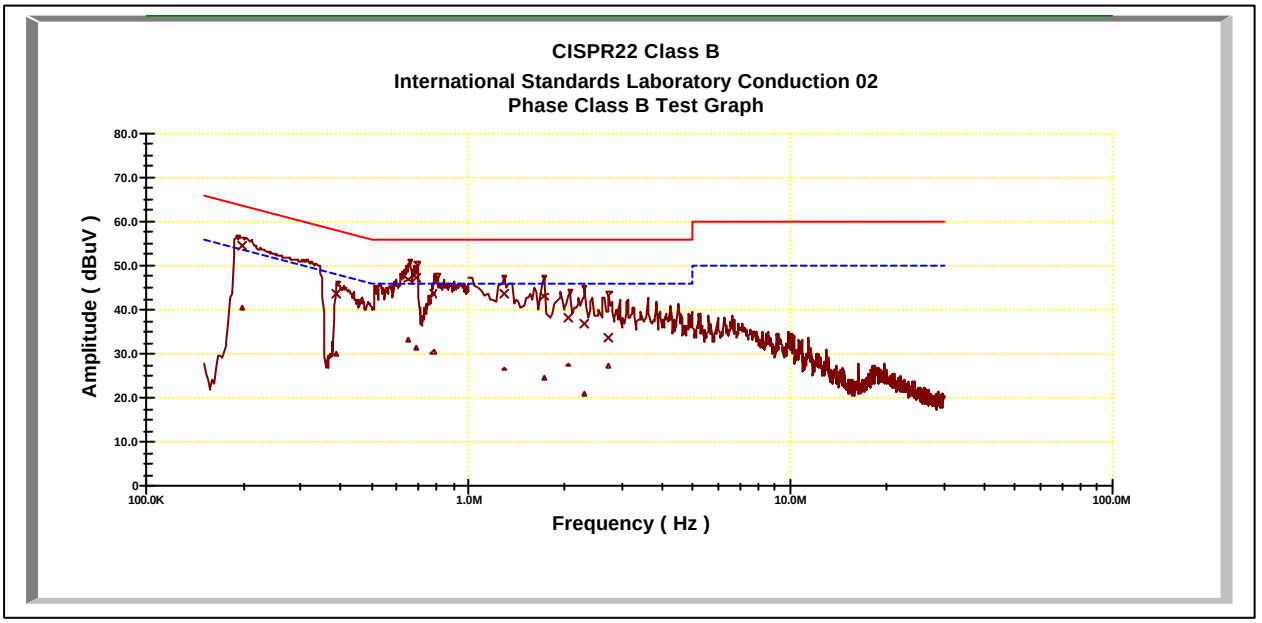
2.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	150 KHz--30MHz
Detector Function:	Quasi-Peak/Average
Bandwidth (RBW):	9KHz

2.1.4 Test Data:

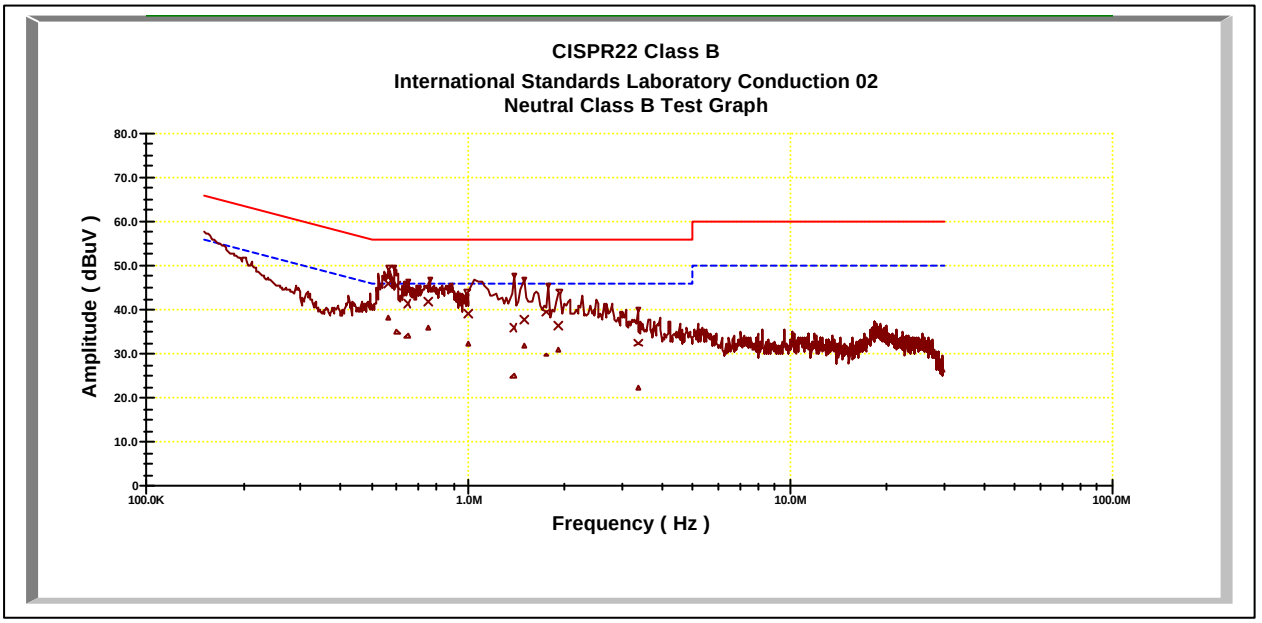
Power Line Conducted Emissions (Hot) Channel 1, 6, 11

	Corrective Factor		Quasi-Peak			Average		
Frequency (MHz)	LISN Loss (dB)	Cable Loss (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
0.19723	0.10	0.02	54.56	64.65	-10.09	40.44	54.65	-14.21
0.39015	0.10	0.02	43.72	59.14	-15.41	29.97	49.14	-19.17
0.65218	0.14	0.04	47.02	56.00	-8.98	32.98	46.00	-13.02
0.6871	0.15	0.04	47.12	56.00	-8.88	31.36	46.00	-14.64
0.7785	0.16	0.05	43.70	56.00	-12.30	30.20	46.00	-15.80
1.29863	0.41	0.08	43.61	56.00	-12.39	26.53	46.00	-19.47
1.71968	0.28	0.09	42.96	56.00	-13.04	24.37	46.00	-21.63
2.04211	0.20	0.10	38.06	56.00	-17.94	27.45	46.00	-18.55
2.28746	0.21	0.10	36.68	56.00	-19.32	21.07	46.00	-24.93
2.73431	0.24	0.11	33.48	56.00	-22.52	27.09	46.00	-18.91



Power Line Conducted Emissions (Neutral) Channel 1, 6, 11

	Corrective Factor		Quasi-Peak			Average		
Frequency (MHz)	LISN Loss (dB)	Cable Loss (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
0.5647	0.13	0.04	46.02	56.00	-9.98	38.17	46.00	-7.83
0.6009	0.13	0.04	45.31	56.00	-10.69	35.13	46.00	-10.87
0.64621	0.14	0.04	41.32	56.00	-14.68	34.07	46.00	-11.93
0.75175	0.16	0.05	41.72	56.00	-14.28	35.83	46.00	-10.17
0.99735	0.20	0.07	39.16	56.00	-16.84	32.23	46.00	-13.77
1.37939	0.26	0.08	35.78	56.00	-20.22	24.95	46.00	-21.05
1.49826	0.25	0.08	37.65	56.00	-18.35	31.81	46.00	-14.19
1.75429	0.22	0.09	39.34	56.00	-16.66	29.70	46.00	-16.30
1.90919	0.21	0.10	36.33	56.00	-19.67	30.93	46.00	-15.07
3.37666	0.20	0.11	32.48	56.00	-23.52	22.25	46.00	-23.75



* NOTE: During the test, the EMI receiver was set to Max. Hold then switch the EUT Channel between 1 , 6, 11 to get the maximum reading of all these channels .
Margin = Amplitude + Insertion Loss- Limit
A margin of -8dB means that the emission is 8dB below the limit

2.2 Bandwidth for DSSS [Section 15.247 (a)(2)]

2.2.1 Test Procedure

The Transmitter output of EUT was connected to the spectrum analyzer. The 6 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

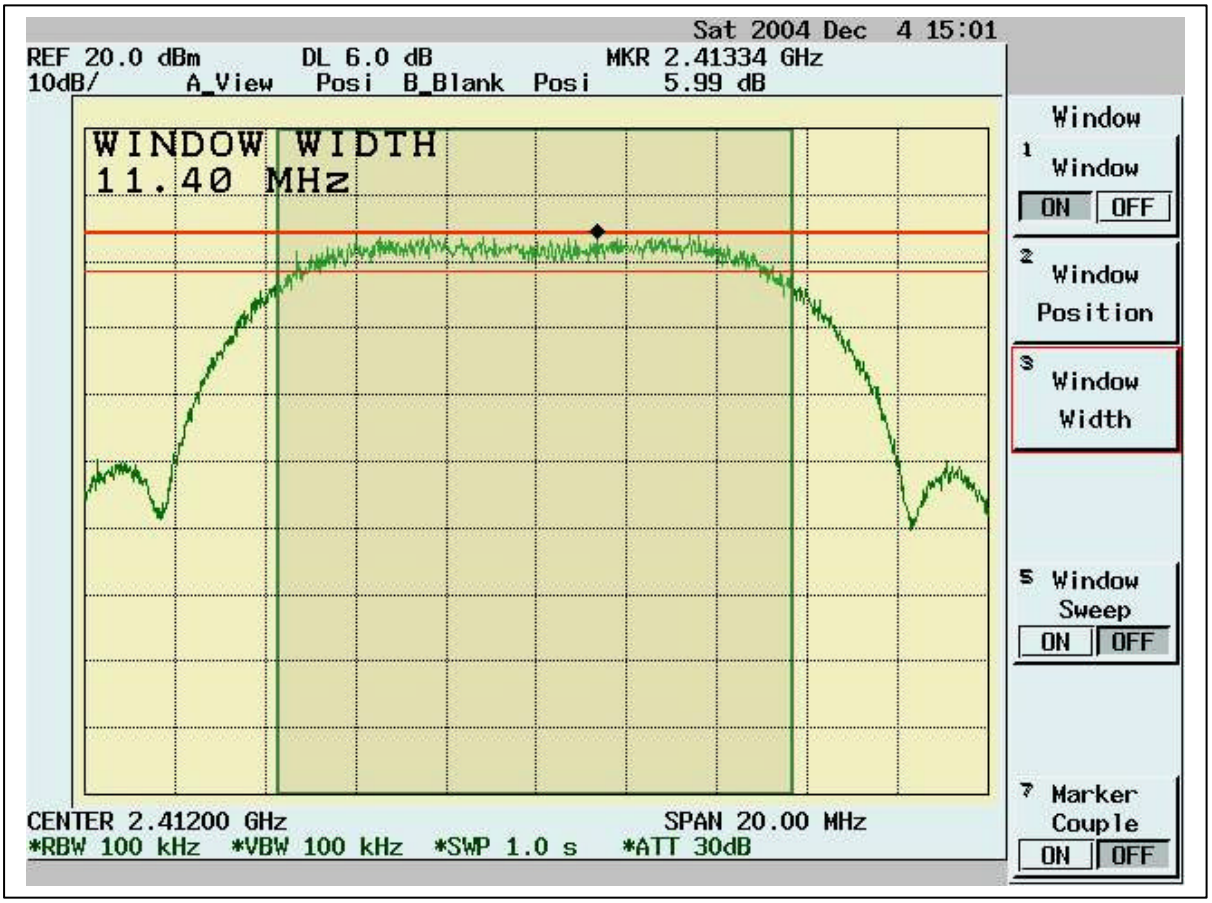
Equipment mode: Spectrum analyzer
Detector function: Peak mode
RBW: 100KHz
VBW: 100KHz

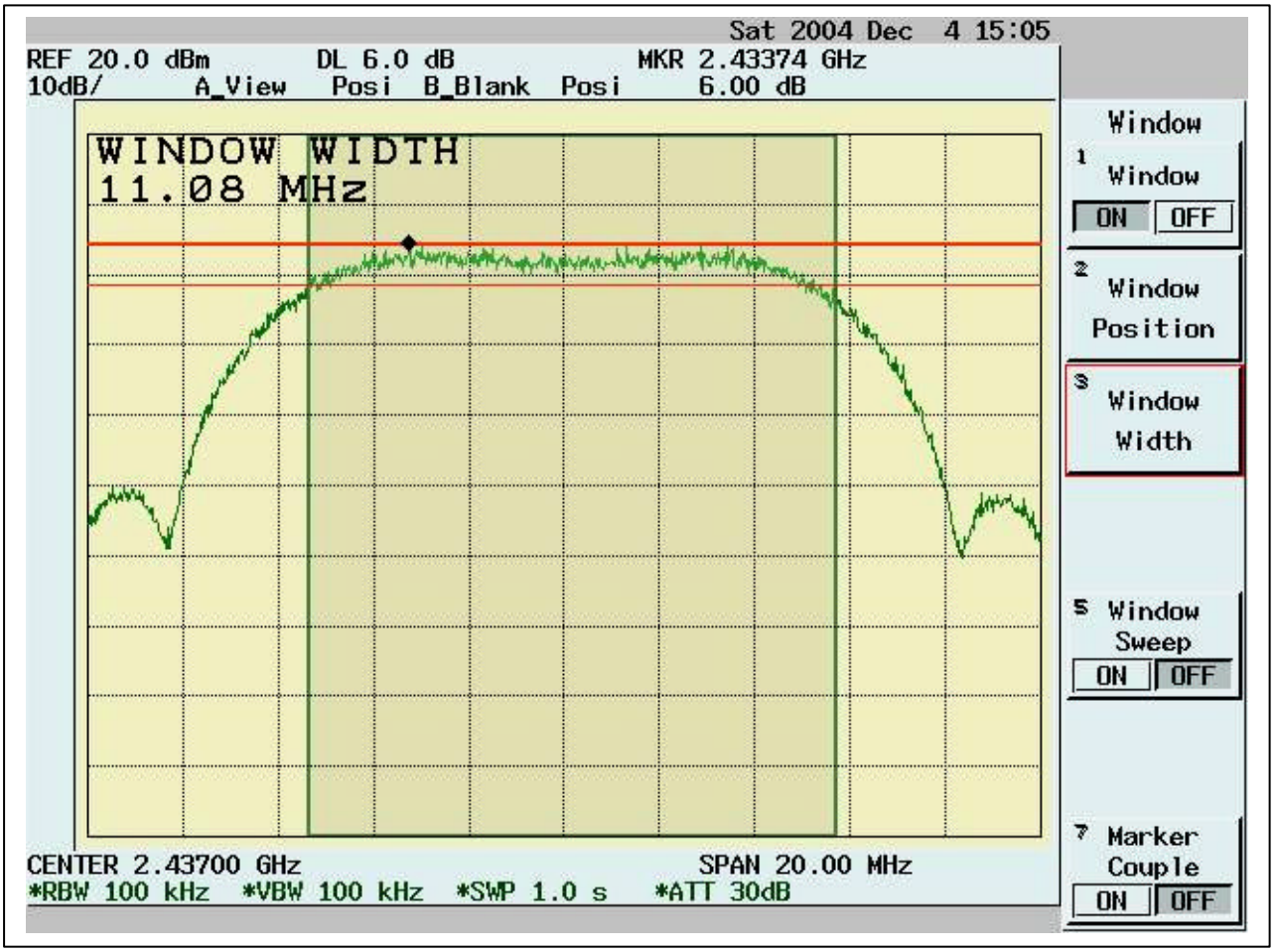
2.2.2 Test Setup

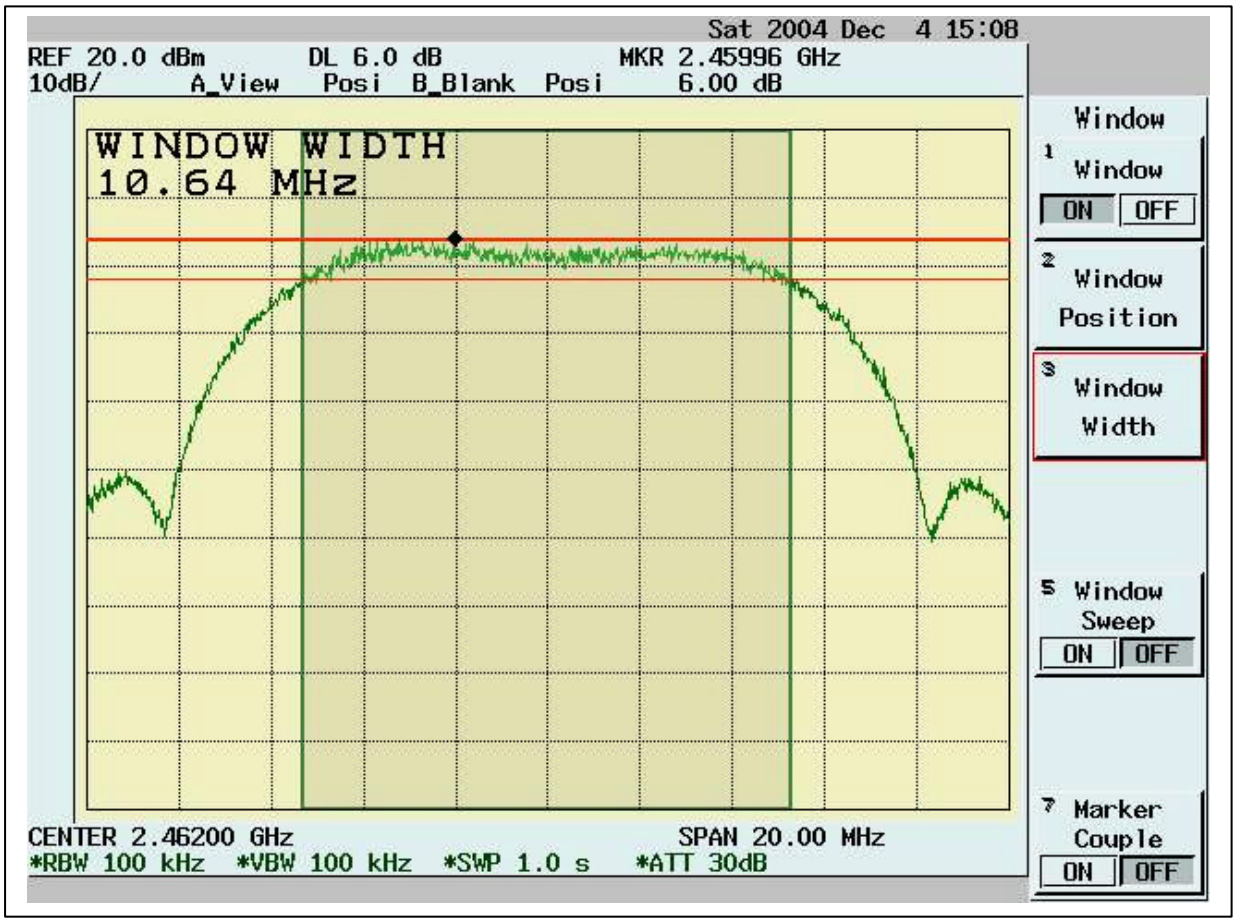
2.2.3 Test Data

Table 6dB Bandwidth

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	11.40	0.5	Pass
6	2437	11.08	0.5	Pass
11	2462	10.64	0.5	Pass


Sat 2004 Dec 4 15:01
REF 20.0 dBm
10dB/
DL 6.0 dB
A_View Posi
B_Blank Posi
MKR 2.41334 GHz
5.99 dB
WINDOW WIDTH
11.40 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 2.41200 GHz
SPAN 20.00 MHz
*RBW 100 kHz *VBW 100 kHz *SWP 1.0 s *ATT 30dB


Sat 2004 Dec 4 15:05
REF 20.0 dBm
DL 6.0 dB
MKR 2.43374 GHz
10dB/
A_View
Posi
B_Blank
Posi
6.00 dB
WINDOW WIDTH
11.08 MHz
Window
1 Window
ON
OFF
2 Window Position
3 Window Width
5 Window Sweep
ON
OFF
7 Marker Couple
ON
OFF
CENTER 2.43700 GHz
SPAN 20.00 MHz
*RBW 100 kHz
*VBW 100 kHz
*SWP 1.0 s
*ATT 30dB


Sat 2004 Dec 4 15:08
REF 20.0 dBm
10dB/
DL 6.0 dB
A_View Posi
B_Blank Posi
MKR 2.45996 GHz
6.00 dB
WINDOW WIDTH
10.64 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 2.46200 GHz
SPAN 20.00 MHz
*RBW 100 kHz *VBW 100 kHz *SWP 1.0 s *ATT 30dB

2.3 DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]

2.3.1 Test Procedure

1. The Transmitter output of EUT was connected to the peak power analyzer .

2.3.2 Test Setup

2.3.3 Test Data:

Maximum Peak Output Power

Chennel	Frequency (MHz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	17.667	1.02	73.90	18.687	30	Pass
6	2437	17.636	1.02	73.38	18.656	30	Pass
11	2462	17.230	1.02	66.83	18.250	30	Pass

2.4 Radiated Emission Measurement [Section [15.247(c)(4)]

2.4.1 EUT Configuration

The equipment under test was set up on the 10 meter chamber with measurement distance of 3 meters. The EUT was placed on a non-conductive table 80cm above ground.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

2.4.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. We found the maximum readings by varying the height of antenna and then rotating the turntable. Both polarization of antenna, horizontal and vertical, are measured.

30M to 1GHz: The highest emissions between 30 MHz to 1000 MHz were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission.

1GHz – 25GHz: The highest emissions were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in peak mode to determine the precise amplitude of the emission. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission. During test the EMI receiver and spectrum was setup according to *EMI Receiver/Spectrum Analyzer Configuration*.
For the test of 2^{nd} to 10^{th} harmonics frequencies , the equipment setup was also refer to *EMI Receiver/Spectrum Analyzer Configuration*. The frequencies were tested using Peak mode first, if the test data is higher than the emissions limit, an additional measurement using Average mode will be performed and the average reading will be compared to the limit and record in test report.

2.4.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range Tested:	30MHz~1000MHz
Detector Function:	Quasi-Peak Mode
Resolution Bandwidth (RBW):	120KHz
Video Bandwidth (VBW)	1MHz

Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Peak Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	1MHz

Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Average Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	10 Hz

2.4.4 Test Data (30MHz – 1GHz) :.

30M – 1GHz Open Field Radiated Emissions (Horizontal) Channel 1, 6, 11

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Tumtable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
191.02	19.05	8.63	3.70	0.00	31.38	43.50	-12.12	100.00	251.00
232.73	24.58	9.87	4.09	0.00	38.54	46.00	-7.46	150.00	283.00
266.68	20.01	12.43	4.32	0.00	36.76	46.00	-9.24	100.00	202.00
299.66	24.91	12.59	4.53	0.00	42.04	46.00	-3.96	150.00	347.00
332.64	24.68	13.51	4.77	0.00	42.96	46.00	-3.04	100.00	186.00
344.28	15.55	13.84	4.86	0.00	34.24	46.00	-11.76	200.00	331.00
366.59	21.84	14.53	5.01	0.00	41.39	46.00	-4.61	100.00	56.00
398.6	15.16	15.56	5.20	0.00	35.92	46.00	-10.08	200.00	56.00
432.55	19.77	15.86	5.39	0.00	41.03	46.00	-4.97	100.00	315.00
766.23	6.60	19.66	7.09	0.00	33.36	46.00	-12.64	100.00	283.00

30M – 1GHz Open Field Radiated Emissions (Vertical) Channel 1, 6, 11

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin* (dB)	Height (cm)	Position (°)
39.7	20.17	12.57	1.72	0.00	34.47	40.00	-5.53	150.00	169.00
132.82	21.13	11.15	3.08	0.00	35.36	43.50	-8.14	150.00	217.00
299.66	25.87	12.59	4.53	0.00	42.99	46.00	-3.01	200.00	234.00
331.67	24.53	13.49	4.76	0.00	42.78	46.00	-3.22	100.00	250.00
342.34	19.79	13.79	4.84	0.00	38.42	46.00	-7.58	200.00	266.00
365.62	18.51	14.50	5.01	0.00	38.01	46.00	-7.99	100.00	250.00
433.52	17.29	15.87	5.40	0.00	38.55	46.00	-7.45	100.00	298.00
498.51	13.61	17.07	5.78	0.00	36.46	46.00	-9.54	100.00	234.00
565.44	12.68	18.30	6.14	0.00	37.12	46.00	-8.88	200.00	169.00
631.4	12.40	18.55	6.46	0.00	37.41	46.00	-8.59	200.00	217.00

* NOTE:
During the test, the EUT was set to Channel 1 , 6, 11 respectively to get the maximum reading of all the critical emission frequencies.
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
All frequencies from 30MHz to 1GHz have been tested

2.4.5 Test Data (1GHz – 25 GHz) .

1GHz~ 25 GHz (Horizontal), Channel 1 : 2412 MHz (RBW=1MHz VBW=1MHz)

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3207.79	54.73	31.05	1.42	46.61	40.58	54.00	-13.42	100	322
7147.85	43.09	39.82	2.35	46.24	39.01	54.00	-14.99	101	264
7215.78	42.80	39.74	2.36	46.22	38.68	54.00	-15.32	100	174
14688.3	30.09	44.22	3.43	42.34	35.41	54.00	-18.59	100	359
15282.7	26.02	43.15	3.49	43.30	29.36	54.00	-24.64	101	224
15707.3	26.41	43.46	3.54	42.10	31.31	54.00	-22.69	104	222

‘ pk’ ---- peak, ‘ av’ ----average

1GHz~ 25 GHz (Vertical), Channel 1 : 2412 MHz (RBW=1MHz VBW=1MHz)

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3207.79	50.19	31.05	1.42	46.61	36.04	54.00	-17.96	102	211
7215.78	43.51	39.74	2.36	46.22	39.39	54.00	-14.61	100	199
7555.44	36.85	39.60	2.42	45.83	33.04	54.00	-20.96	100	288
7623.38	35.02	39.84	2.43	45.51	31.79	54.00	-22.21	101	208
14705.3	30.60	44.19	3.43	42.43	35.80	54.00	-18.20	102	121
15690.3	26.55	43.41	3.54	42.16	31.34	54.00	-22.66	102	38

‘ pk’ ---- peak, ‘ av’ ----average

Note:

The Spectrum noise level + Correction Factor < Limit - 6 dB
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
All frequencies from 1GHz to 25 GHz have been tested.

1GHz~ 25 GHz (Horizontal), Channel 6 : 2437 MHz (RBW=1MHz VBW=1MHz)

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3241.76	48.52	31.09	1.43	46.61	34.42	54.00	-19.58	104	114
7130.87	42.71	39.84	2.34	46.25	38.64	54.00	-15.36	100	298
11223.8	25.90	41.35	2.99	40.99	29.24	54.00	-24.76	101	296
14688.3	29.38	44.22	3.43	42.34	34.70	54.00	-19.30	100	112
15690.3	27.70	43.41	3.54	42.16	32.48	54.00	-21.52	101	291
15979.0	24.84	44.33	3.57	41.20	31.55	54.00	-22.45	100	99

‘ pk’ ---- peak, ‘ av’ ----average

1GHz~ 25 GHz (Vertical), Channel 6 : 2437 MHz (RBW=1MHz VBW=1MHz)

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3241.76	45.17	31.09	1.43	46.61	31.08	54.00	-22.92	100	290
7130.87	42.77	39.84	2.34	46.25	38.71	54.00	-15.29	101	349
7300.70	42.54	39.64	2.37	46.18	38.37	54.00	-15.63	100	264
7521.48	35.63	39.48	2.41	45.99	31.53	54.00	-22.47	100	119
14688.3	29.48	44.22	3.43	42.34	34.79	54.00	-19.21	100	352
15265.7	25.92	43.17	3.49	43.34	29.25	54.00	-24.75	100	112

‘ pk’ ---- peak, ‘ av’ ----average

Note:

The Spectrum noise level + Correction Factor < Limit - 6 dB

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 1GHz to 25 GHz have been tested.

1GHz~ 25 GHz (Horizontal), Channel 11: 2462 MHz (RBW=1MHz VBW=1MHz)

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3275.72	49.26	31.13	1.44	46.62	35.21	54.00	-18.79	100	214
3394.61	50.76	31.27	1.48	46.64	36.88	54.00	-17.12	101	110
7147.85	42.80	39.82	2.35	46.24	38.72	54.00	-15.28	100	347
14688.3	29.86	44.22	3.43	42.34	35.18	54.00	-18.82	100	224
15724.3	26.30	43.52	3.54	42.05	31.32	54.00	-22.68	100	118
15979.0	25.63	44.33	3.57	41.20	32.34	54.00	-21.66	100	188

‘ pk’ ---- peak, ‘ av’ ----average

1GHz~ 25 GHz (Vertical), Channel 11 : 2462 MHz (RBW=1MHz VBW=1MHz)

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3173.83	44.01	31.01	1.40	46.60	29.82	54.00	-24.18	100	234
3275.72	44.82	31.13	1.44	46.62	30.77	54.00	-23.23	100	225
7130.87	43.13	39.84	2.34	46.25	39.06	54.00	-14.94	101	282
7572.43	35.39	39.66	2.42	45.75	31.72	54.00	-22.28	100	220
14688.3	29.66	44.22	3.43	42.34	34.98	54.00	-19.02	100	165
15639.4	26.45	43.25	3.53	42.33	30.90	54.00	-23.10	100	166

‘ pk’ ---- peak, ‘ av’ ----averag

Note:

The Spectrum noise level + Correction Factor < Limit - 6 dB

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 1GHz to 25 GHz have been tested.

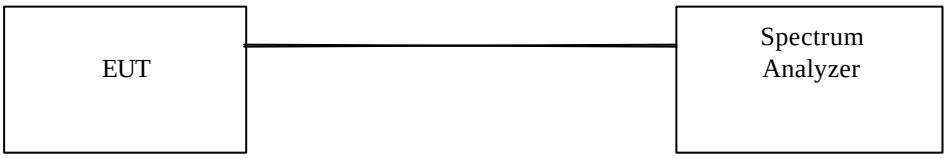
2.5 Band Edge Measurement

2.5.1 Test Procedure (Conducted)

1. The Transmitter output of EUT was connected to the spectrum analyzer.
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN: 100MHz
   RBW: 100KHz
   VBW: 100KHz
   Center frequency: 2.412GHz, 2.462GHz.
   Sweep time= 200ms sec.

2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.
3. Find the next peak frequency outside the operation frequency band.

2.5.2 Test Setup (Conducted)



2.5.3 Test Data:

Table Band Edge measurement (Conducted)

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Carrier - Outsideband Limit: > 20dB (dB)	Pass/Fail
1	2415.5	110.87	---	---
Outside band	2397.0	71.10	39.77	Pass
11	2458.1	110.34	---	---
Outside band	2471.0	75.30	35.04	Pass

.

=**Band Edge Conducted measurement**

Band Edge Conducted Measurement

2.5.4 Band Edge measurement Test Procedure (Radiated)

1. Antenna and Turntable test procedure same as *Radiated Emission Measurement*
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN:100MHz
   RBW: 1MHz
   VBW: 1MHz
   Center frequency: 2.395GHz, 2.48 GHz.

2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.
3. Find the next peak frequency outside the operation frequency band.

4. For peak frequency emission level measurement in Restricted Band ,
   Change RBW: 1MHz ,
   VBW: 10Hz,
   Span: 100MHz.
5. Get the spectrum reading after Maximum Hold function is completed.

2.5.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

2.5.6 Test Data:

Table Band Edge measurement (Radiated)

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit: > 20dB (dBC)	Limit (dBuV/m)	Equip. Setup VBW	Pass or Fail
1(peak mode)	2409.1	67.1	31.67	98.77	---	---	1MHz	---
Outside band	2397.1	28.27	31.67	59.94	38.83	---	1MHz	Pass
1(average mode)	2409.1	44.44	31.67	76.11	---	---	10Hz	---
Restricted band	2390.0	7.0	31.67	38.67	-----	54	10Hz	Pass
11(peak mode)	2464.0	67.96	31.64	99.6	----	---	1MHz	---
Outside band	2476.7	28.20	31.64	59.84	39.76	---	1MHz	Pass
11(average mode)	2459.8	44.95	31.64	76.59	----	---	10Hz	---
Restricted band	2483.5	8.34	31.64	39.98	-----	54	10Hz	Pass

Note: The Spectrum plot of emission level measurement in Restricted band is attached.
Emission Level = Spectrum Reading + Correction Factor
Correction Factor = Antenna Factor + cable loss – amplifier gain

Band Edge measurement for radiated emission in Restricted Band(Radiated)

Peak Mode (Channel 1)

Band Edge measurement for radiated emission in Restricted Band(Radiated)

Average Mode (Channel 1)

Band Edge measurement for radiated emission in Ristricted Band(Radiated)

Peak Mode (Channel 11)

Band Edge measurement for radiated emission in Restricted Band(Radiated)

Average Mode (Channel 11)

2.6 RF Exposure Measurement [Section 15.247(b)(4) & 1.1307(b)]

2.6.1 Applied Standards

FCC PART 1.1307, 1.1310, 2.1091, 2.1093 RF EXPOSURE

2.6.2 Calculation for Maximum Permissible Exposure (MPE)

From FCC 1.1310 Table 1B, the maximum permissible RF exposure for an uncontrolled environment is 1 mW/cm2 .The actual power density for the EUT with the antenna is calculated as shown below. The EUT is a professionally installed, fixed, point-to-point operating system.

$$S = (P \times G) / (4 \times \pi \times d^2)$$

where:
S = power density
P = transmitter conducted power in (W)
G = antenna numeric gain
d = distance to radiation center (m)

Antenna Manufacturer	Antenna Type	Gain (dBi)	Numeric Gain	Power (dBm)	Power (mW)	Separation Distance (cm)	Power Density (W/m2)	Power Density (mW/cm2)
WNC	PIFA	0.66	1.164	18.687	73.90	20	0.171	0.0171

WARNING:
It is the responsibility of the professional installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only the antenna specified above may be used. The use of any other antenna is expressly forbidden in accordance with FCC rules CFR 47 part 15.204.
NOTICE:
FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits for an uncontrolled environment when installed as directed. This equipment should be installed and operated with WNC PIFA antenna in a fixed-mount configuration, installed with a maximum of 18.687 dBm of radiated output power during normal operation

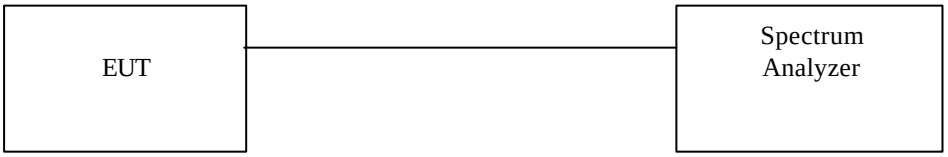
2.7 DSSS Peak Power Spectral Density [Section 15.247(d)]

2.7.1 Test Procedure

1. The Transmitter output of EUT was connected to the spectrum analyzer.
   Equipment mode: Spectrum analyzer
   Detector function: Peak mode
   SPAN:1.5MHz
   RBW: 3KHz
   VBW: 30KHz
   Center frequency: fundamental frequency tested.
   Sweep time= 500 sec.

2. Using Peak Search to read the peak power after Maximum Hold function is completed.

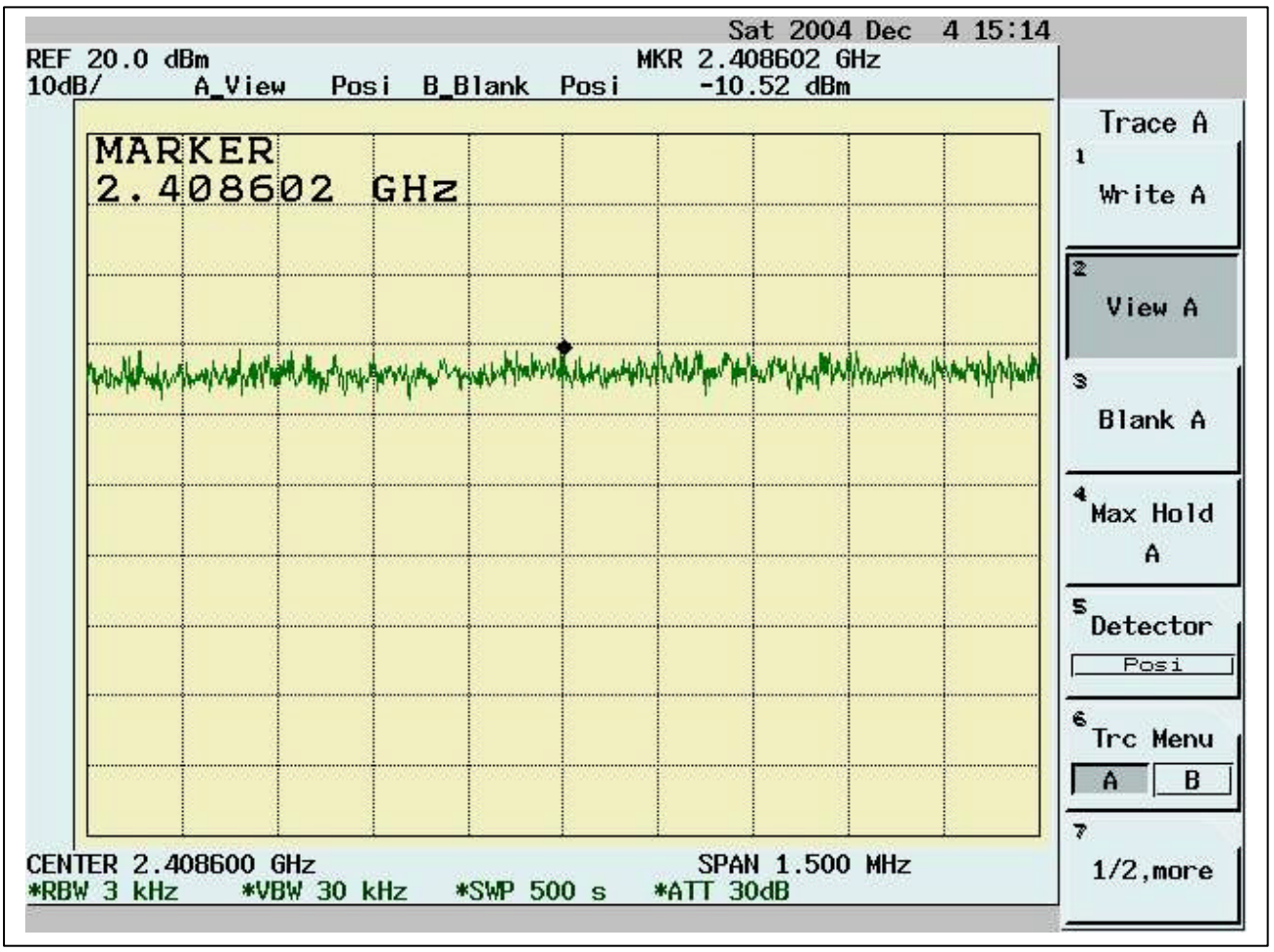
2.7.2 Test Setup

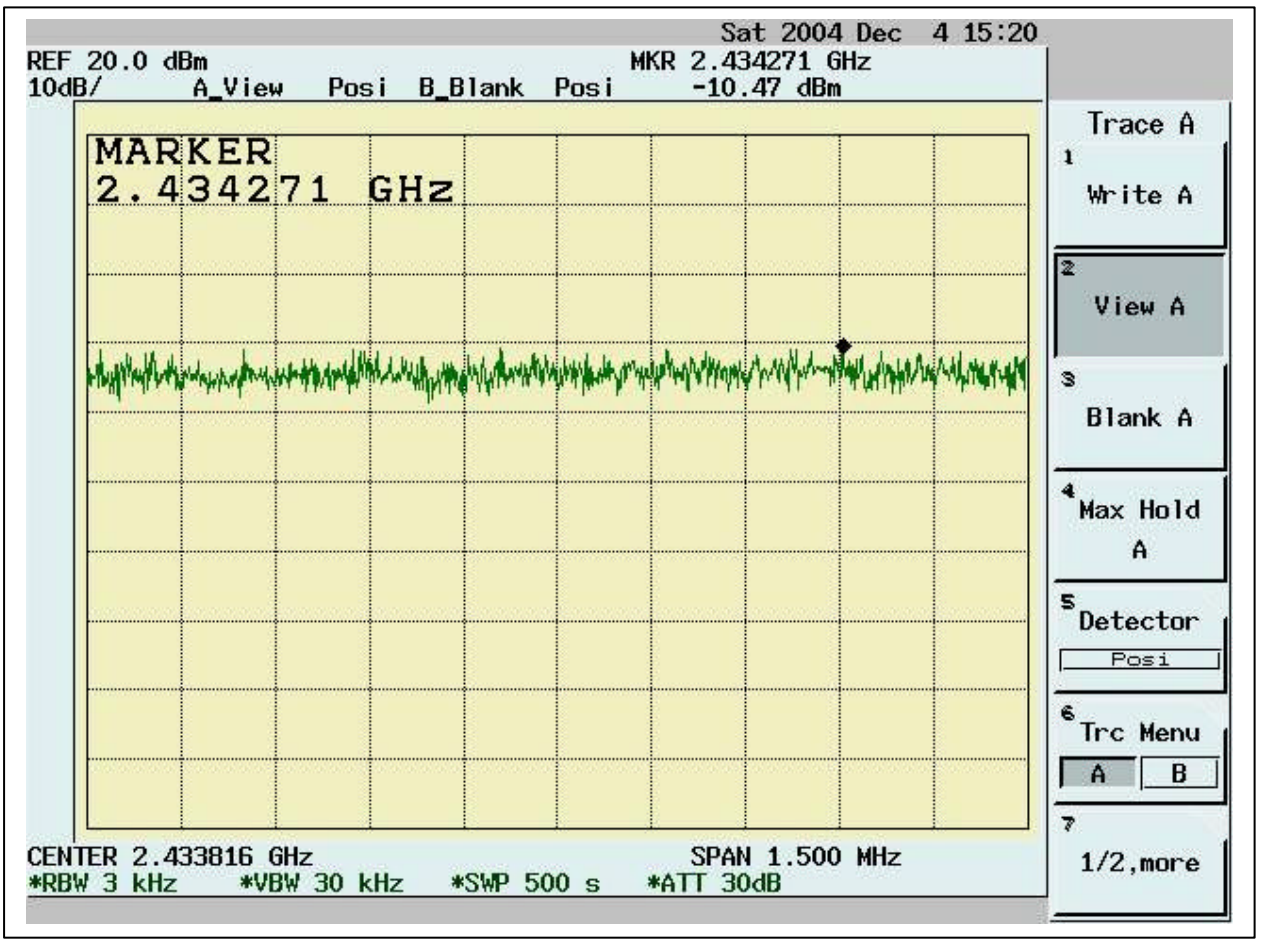


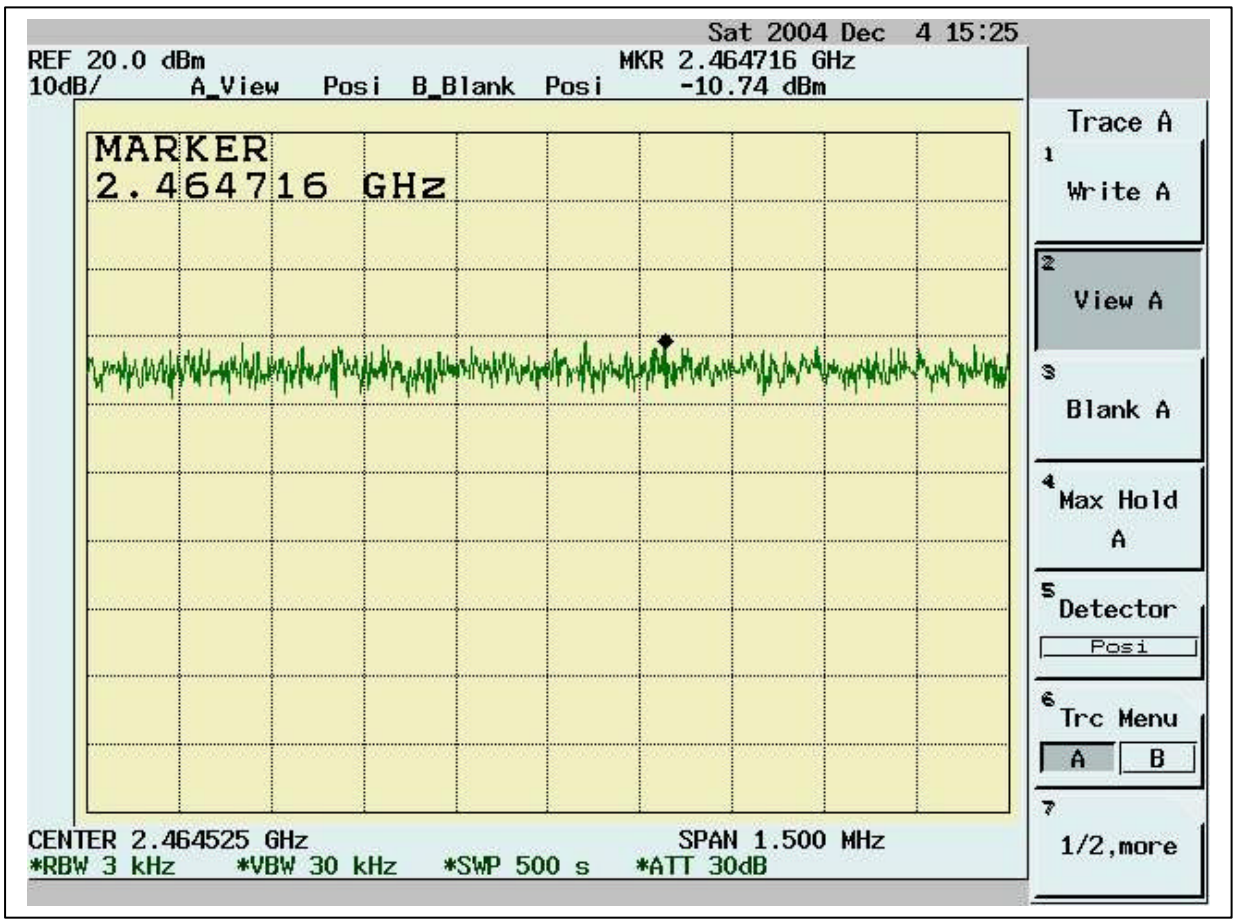
2.7.3 Test Data:

Table Maximum Peak Output Power Density

Chennel	Spectrum Reading (dBm/3KHz)	Cable Loss (dB)	Peak Power Output (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
1	-10.52	1.02	-9.5	8	Pass
6	-10.47	1.02	-9.45	8	Pass
11	-10.74	1.02	-9.72	8	Pass


Sat 2004 Dec 4 15:14
REF 20.0 dBm
MKR 2.408602 GHz
10dB/ A_View Posi B_Blank Posi -10.52 dBm
MARKER
2.408602 GHz
Trace A
1 Write A
2 View A
3 Blank A
4 Max Hold A
5 Detector
Posi
6 Trc Menu
A B
7 1/2,more
CENTER 2.408600 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB


Sat 2004 Dec 4 15:20
REF 20.0 dBm
MKR 2.434271 GHz
10dB/ A_View Posi B_Blank Posi -10.47 dBm
MARKER
2.434271 GHz
CENTER 2.433816 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB
Trace A
1 Write A
2 View A
3 Blank A
4 Max Hold A
5 Detector
Posi
6 Trc Menu
A B
7 1/2,more


Sat 2004 Dec 4 15:25
REF 20.0 dBm
10dB/
A_View Posi B_Blank Posi
MKR 2.464716 GHz
-10.74 dBm
MARKER
2.464716 GHz
Trace A
1 Write A
2 View A
3 Blank A
4 Max Hold A
5 Detector
Posi
6 Trc Menu
A B
7 1/2,more
CENTER 2.464525 GHz
SPAN 1.500 MHz
*RBW 3 kHz
*VBW 30 kHz
*SWP 500 s
*ATT 30dB

3. TEST RESULTS (802.11g)

3.1 Powerline Conducted Emissions [Section 15.207]

3.1.1 EUT Configuration

The conducted emission test setups are in accordance with Figs 9, 10(a) and 10(b) of ANSI C63.4-2001, CFR 47 Part 15 Subpart B; or EN55022:1994/ A1:1995/A2:1997; CISPR 22:1993/A1:1995/A2:1996.

The EUT was set up on the non-conductive table that is 1.0 by 1.5 meter, 80cm above ground. The wall of the shielded room was located 40cm to the rear of the EUT.

Power to the EUT was provided through the LISN. The impedance vs. frequency characteristic of the LISN is complied with the limit shown on the figure 1 of ANSI C63.4-2001.

Both lines (neutral and hot) were connected to the LISN in series at testing. A coaxial-type connector which provides one 50 ohms terminating impedance was provided for connecting the test instrument. The excess length of the power cord was folded back and forth at the center of the lead so as to form a bundle not exceeding 40cm in length.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

If the EUT is a Personal Computer or a peripheral of personal computer, and the personal computer has an auxiliary AC outlet which can be used for providing power to an external monitor, then all measurements will be made with the monitor power from first the computer-mounted AC outlet and then a floor-mounted AC outlet.

3.1.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. The main power line conducted EMI tests were run on the hot and neutral conductors of the power cord and the results were recorded. The effect of varying the position of the interface cables has been investigated to find the configuration that produces maximum emission.

At the frequencies where the peak values of the emissions were higher than 6dß below the applicable limits, the emissions were also measured with the quasi-peak detectors. At the frequencies where the quasi-peak values of the emissions were higher than 6dß below the applicable average limits, the emissions were also measured with the average detectors.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

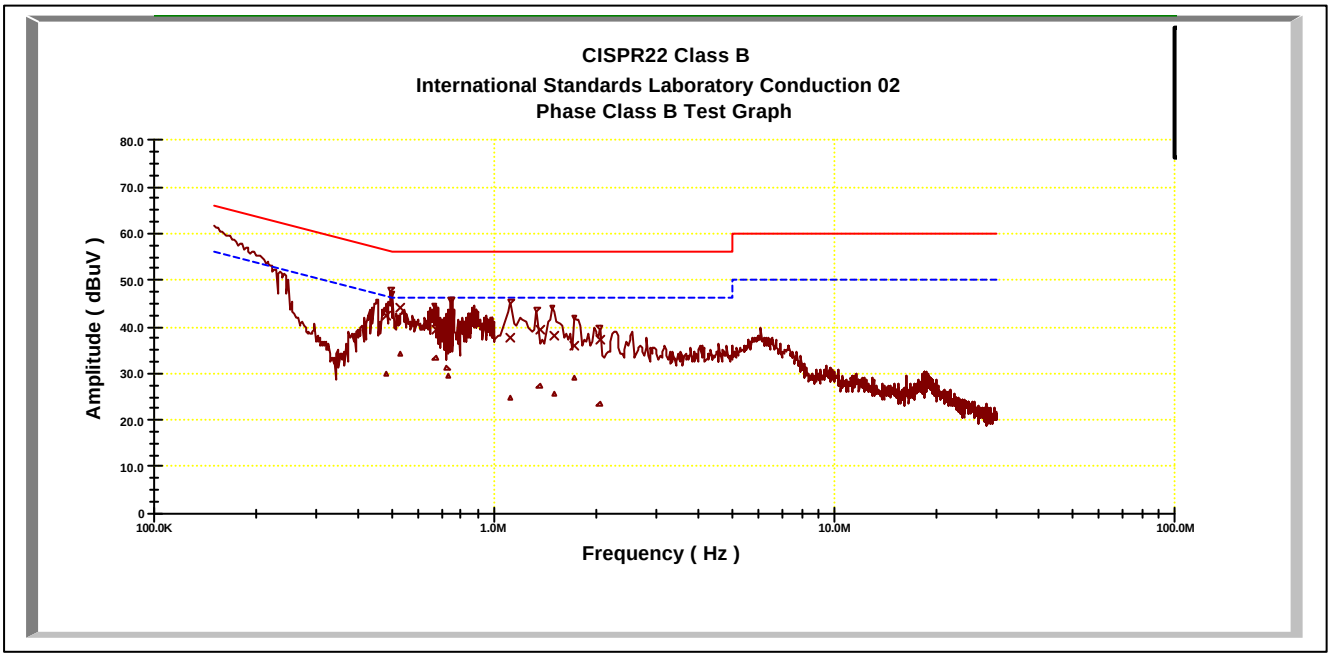
3.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	150 KHz--30MHz
Detector Function:	Quasi-Peak/Average
Bandwidth (RBW):	9KHz

3.1.4 Test Data:

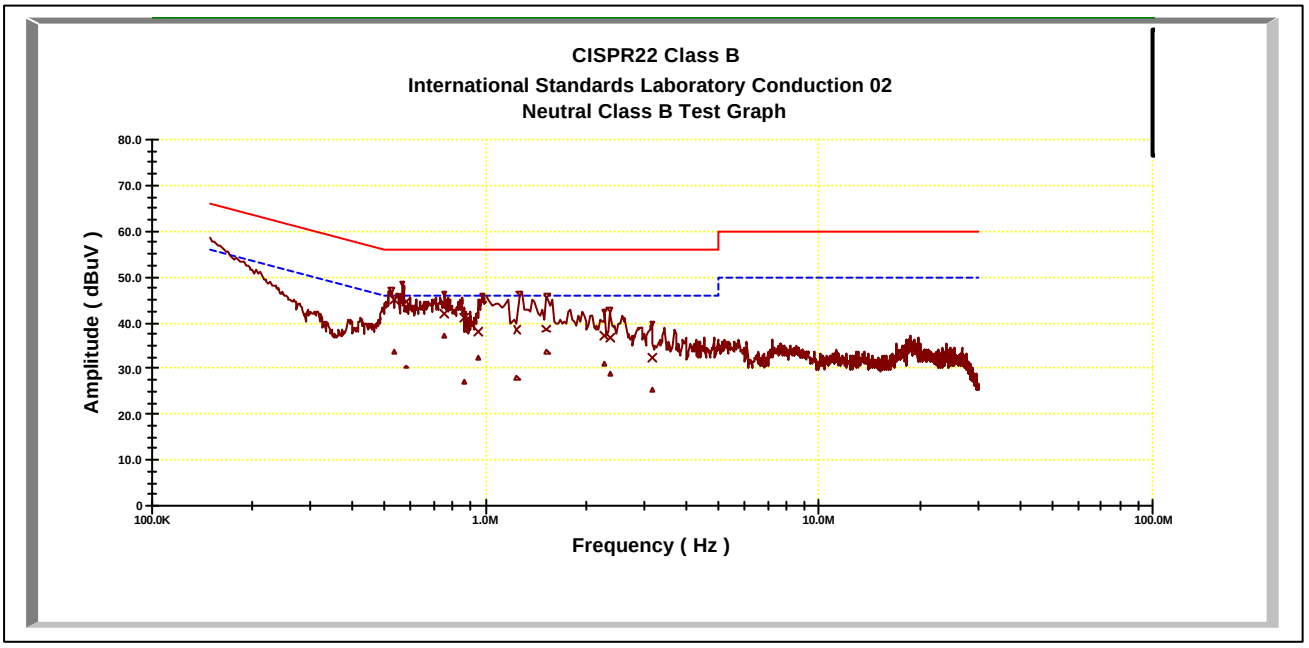
Power Line Conducted Emissions (Hot) Channel 1, 6, 11

	Corrective Factor		Quasi-Peak			Average		
Frequency (MHz)	LISN Loss (dB)	Cable Loss (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
0.48373	0.11	0.03	42.45	56.46	-14.01	29.93	46.46	-16.54
0.52773	0.12	0.03	43.87	56.00	-12.13	34.04	46.00	-11.96
0.67165	0.15	0.04	39.46	56.00	-16.54	33.06	46.00	-12.94
0.72703	0.15	0.05	39.94	56.00	-16.06	31.03	46.00	-14.97
0.7343	0.16	0.05	39.86	56.00	-16.14	29.51	46.00	-16.49
1.11093	0.47	0.07	37.50	56.00	-18.50	24.69	46.00	-21.31
1.35859	0.39	0.08	39.23	56.00	-16.77	27.21	46.00	-18.79
1.50763	0.35	0.09	38.07	56.00	-17.93	25.61	46.00	-20.39
1.72103	0.28	0.09	36.04	56.00	-19.96	29.05	46.00	-16.95
2.04097	0.20	0.10	37.34	56.00	-18.66	23.51	46.00	-22.49



Power Line Conducted Emissions (Neutral) Channel 1, 6, 11

	Corrective Factor		Quasi-Peak			Average		
Frequency (MHz)	LISN Loss (dB)	Cable Loss (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
0.53338	0.12	0.03	45.08	56.00	-10.92	33.71	46.00	-12.29
0.57963	0.13	0.04	44.40	56.00	-11.60	30.31	46.00	-15.69
0.75165	0.16	0.05	42.06	56.00	-13.94	36.94	46.00	-9.06
0.86793	0.18	0.06	40.91	56.00	-15.09	26.86	46.00	-19.14
0.95683	0.19	0.07	38.01	56.00	-17.99	32.41	46.00	-13.59
1.24671	0.28	0.08	38.64	56.00	-17.36	27.96	46.00	-18.04
1.53092	0.25	0.09	38.67	56.00	-17.33	33.64	46.00	-12.36
2.26591	0.20	0.10	37.05	56.00	-18.95	30.86	46.00	-15.14
2.36736	0.20	0.10	36.75	56.00	-19.25	28.61	46.00	-17.39
3.14768	0.20	0.11	32.23	56.00	-23.77	25.19	46.00	-20.81



* NOTE: During the test, the EMI receiver was set to Max. Hold then switch the EUT Channel between 1 , 6, 11 to get the maximum reading of all these channels.
Two type of antennas have been test, and the worse data show above.
Margin = Amplitude + Insertion Loss- Limit
A margin of -8dB means that the emission is 8dB below the limit

3.2 Bandwidth for DSSS [Section 15.247 (a)(2)]

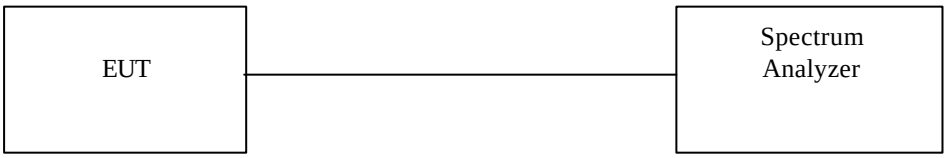
3.2.1 Test Procedure

3.3

The Transmitter output of EUT was connected to the spectrum analyzer. The 6 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

Equipment mode: Spectrum analyzer
Detector function: Peak mode
RBW: 100KHz
VBW: 100KHz

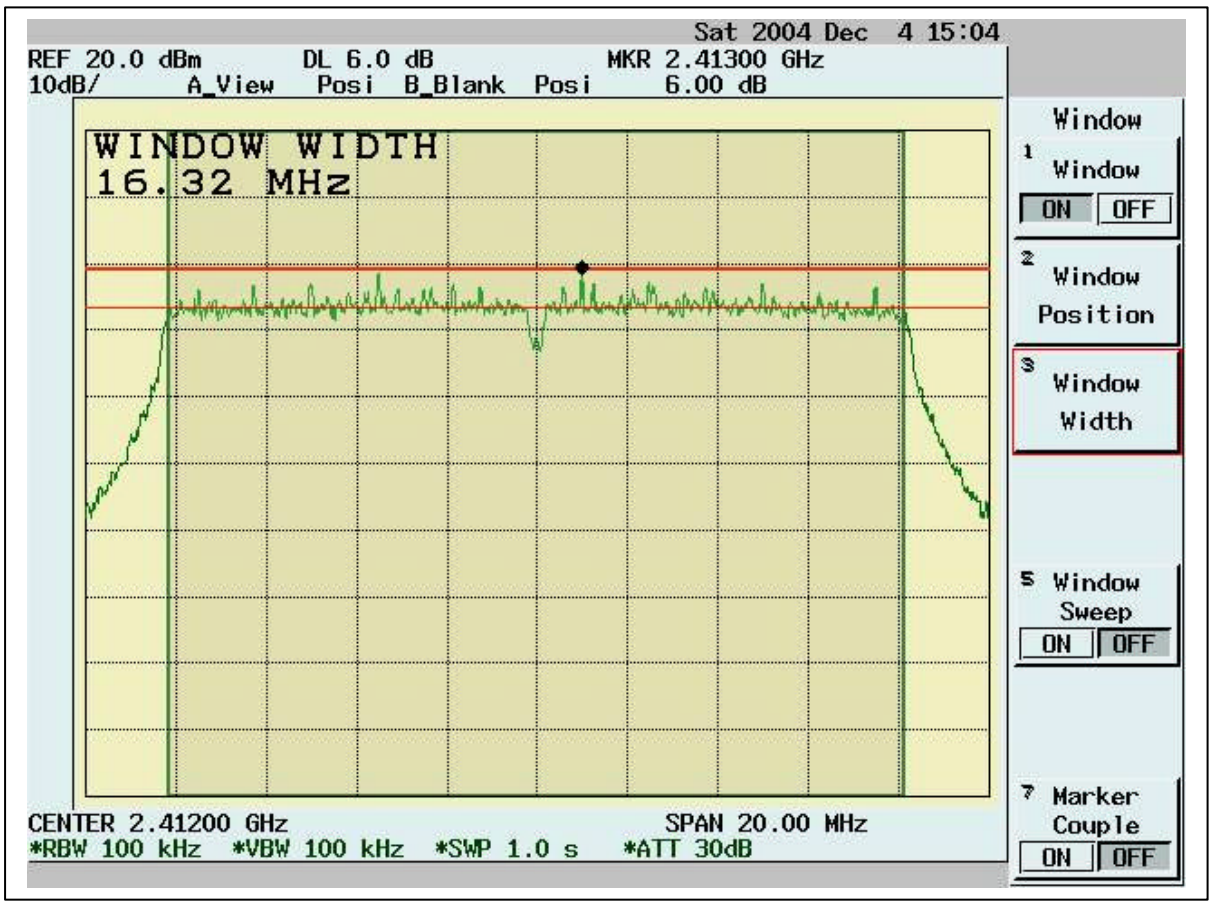
3.3.1 Test Setup



3.3.2 Test Data:

Table 6dB Bandwidth

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	16.32	0.5	Pass
6	2437	16.28	0.5	Pass
11	2462	16.44	0.5	Pass


Sat 2004 Dec 4 15:04
REF 20.0 dBm
DL 6.0 dB
MKR 2.41300 GHz
10dB/
A_View
Posi
B_Blank
Posi
6.00 dB
WINDOW WIDTH
16.32 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 2.41200 GHz
SPAN 20.00 MHz
*RBW 100 kHz
*VBW 100 kHz
*SWP 1.0 s
*ATT 30dB