Test Report

FOR

FCC Part 15 Subpart C & E

of

WLAN a+b+g Mini-PCI Module

Model

EM-500AG

(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
Taiwan, R.O.C.
Tel:(03)407-1718 Fax:(03)407-1738

Report Number: ISL-03LR029FC **Test Date: 2003/12/16**
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), Subpart E (15.407) , 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 a+b+g Mini-PCI module Model: EM-500AG Applied by Wistron NeWeb Corp.
Sample received Date:	2003/11/10
Final test Date :	2003/12/16
Test Site:	Chamber 02, Conduction 02
Temperature	20°C(Conduction Test); 20°C (Radiation Test)
Humidity:	48% (Conduction Test); 46% (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; and the limits of FCC Part 15 Subpart E (Section 15.407).

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 126 pages, including 1 cover page , 3 contents page, and 122 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).

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	

The 802.11a functions of EUT has been tested to the FCC regulations listed below:

Tested Standards: 47 CFR Part 15 Subpart E			
Standard Section	Test Type	Result	Remarks
15.407 (a)(1)(2)(3)	Peak Transmit Power	Pass	
15.407 (a)(1)(2)(3)	Peak Power Spectral Density	Pass	
15.407 (a)(6)	Peak Power Excursion	Pass	
15.407 (b)(5)	AC Power Line Emissions	Pass	
15.407 (b)(5)	Radiated Emissions 30MHz – 40 GHz	Pass	
15.407(f)	Radiation exposure	Pass	
15.407 (g)	Frequency Stability	Pass	

3. Description of Equipment Under Test (EUT)

Description:	WLAN a+b+g Mini-PCI module
Model No.:	EM-500AG
FCC ID:	NKREM500AG
Brand:	Wistron NeWeb
Frequency Range 802.11a:	5180 - 5320 MHz, 5745 - 5805 MHz
Frequency Range 802.11b/g:	2412 - 2462 MHz
Support channel:	
802.11a Normal mode	12 Channels
802.11a Turbo mode	5 Channels
802.11b	11 Channels
802.11g	11 Channels
Modulation Skill:	
802.11a Normal mode	OFDM (6 Mbps – 54 Mbps)
802.11a Turbo mode	OFDM (12 Mbps – 108 MBps)
802.11b	DBPSK(1Mbps), DQPSK(2Mbps), CCK(5.5/11Mbps)
802.11g	OFDM (6M - 54Mbps)
Antennas Type:	PIFA Type in Meta made by FOXCONN NWInG
Antenna Connected:	Connected to RF connector on the PCB of the 802.11a/b/g WLAN Adapter.
Antenna peak Gain:	
Main antenna	1.40 dBi (11b/g),0.52 dBi(11a)
Aux antenna	1.36dBi (11b/g), 1.35 dBi(11a)
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		

The channel and the operation frequency of 802.11a Normal Mode is listed below:

Channel	Frequency(MHz)	Channel	Frequency(MHz)
01	5180	07	5300
02	5200	08	5320
03	5220	09	5745
04	5240	10	5765
05	5260	11	5785
06	5280	12	5805

The channel and the operation frequency of 802.11a Turbo Mode is listed below:

Channel	Frequency(MHz)		
01	5210	04	5760
02	5250	05	5800
03	5290		

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.

3.1 Test Standards and Procedure

Test Specification: FCC Part 15 subpart C (Section 15.247) and subpart E (Section 15.407) and/or CISPR 22/EN55022, RSS210

Test Procedure: ANSI C63.4, CFR 47 Sec. 15.247, Sec. 15.407 as detailed in Appendices

3.2 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. The channel 1, 4, 5, 8,9,12 of Normal Mode of 802.11a and Channel 1, 2, 3,4,5 of Turbo Mode of 802.11a were also all tested.
4. "Normal mode" of 802.11a and 802.11g allows data rates up to 54 Mbps. The EUT was tested in the data rate that produced the highest output power (6 Mbps)
5. "Turbo mode" of 802.11a allows data rates up to 108 Mbps. The EUT was tested in the data rate that produced the highest output power (12 Mbps).
6. Both Main antenna and Aux antenna of EUT are able to be used as the Transmitting Antenna. Both antennas have been tested respectively, and the worst data is showed in the report.

4. TEST RESULTS (802.11b)

4.1 Powerline Conducted Emissions [Section 15.207]

4.1.1 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.

4.1.2 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.

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

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

4.1.4 Test Data:

Table 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)
0.19398	0.10	0.02	45.29	64.74	-19.45	22.27	54.74	-32.47
0.42943	0.10	0.03	39.04	58.02	-18.97	15.92	48.02	-32.10
0.5305	0.12	0.03	33.30	56.00	-22.70	22.91	46.00	-23.09
0.55343	0.13	0.03	34.93	56.00	-21.07	16.61	46.00	-29.39
0.7392	0.16	0.05	34.64	56.00	-21.36	20.97	46.00	-25.03
1.05494	0.48	0.07	34.33	56.00	-21.67	24.14	46.00	-21.86
1.07312	0.48	0.07	35.30	56.00	-20.70	24.12	46.00	-21.88
1.23927	0.43	0.08	34.04	56.00	-21.96	22.03	46.00	-23.97
1.51103	0.35	0.09	30.91	56.00	-25.09	21.74	46.00	-24.26
21.8199	0.90	0.28	25.51	60.00	-34.49	17.55	50.00	-32.45

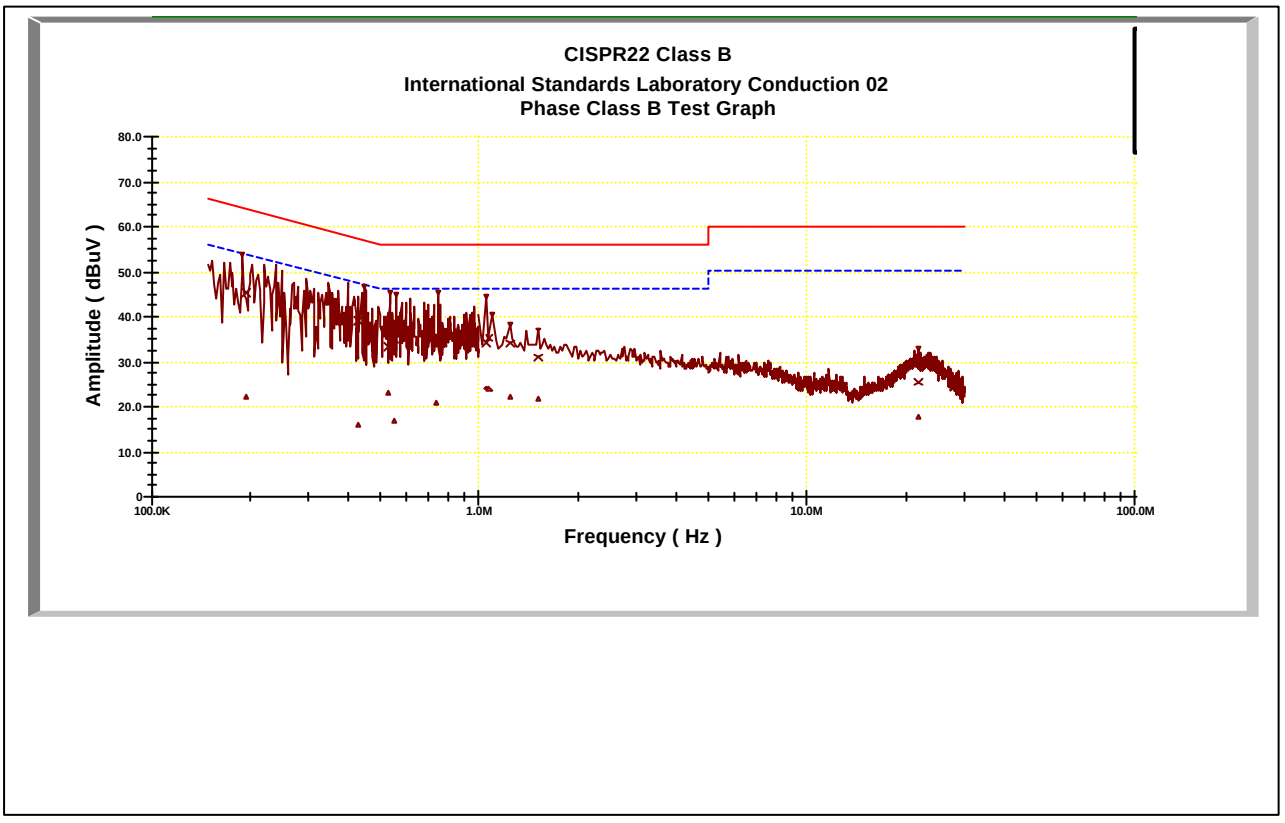
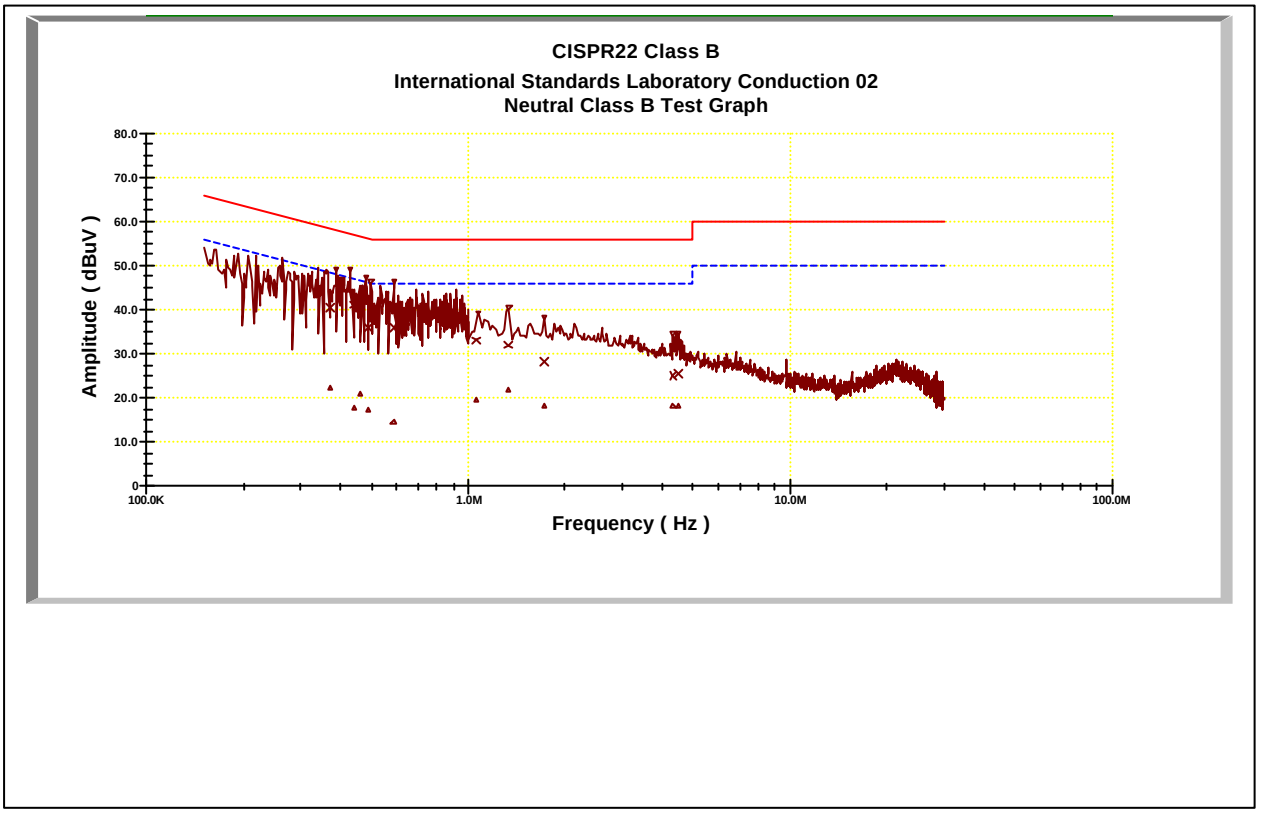


Table Power Line Conducted Emissions (Neutral) Channel 1, 6, 11

	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)
0.37203	0.10	0.02	40.39	59.66	-19.26	22.27	49.66	-27.38
0.44301	0.11	0.03	41.08	57.63	-16.54	17.83	47.63	-29.79
0.46093	0.11	0.03	41.60	57.12	-15.52	20.79	47.12	-26.32
0.48748	0.11	0.03	35.91	56.36	-20.44	17.14	46.36	-29.21
0.58415	0.13	0.04	35.86	56.00	-20.14	14.57	46.00	-31.43
1.06208	0.29	0.07	32.97	56.00	-23.03	19.66	46.00	-26.34
1.33278	0.27	0.08	32.06	56.00	-23.94	21.60	46.00	-24.40
1.71585	0.23	0.09	28.29	56.00	-27.71	18.28	46.00	-27.72
4.32923	0.21	0.12	25.14	56.00	-30.86	18.15	46.00	-27.85
4.49757	0.21	0.12	25.32	56.00	-30.68	17.95	46.00	-28.05



* 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

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

4.2.1 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

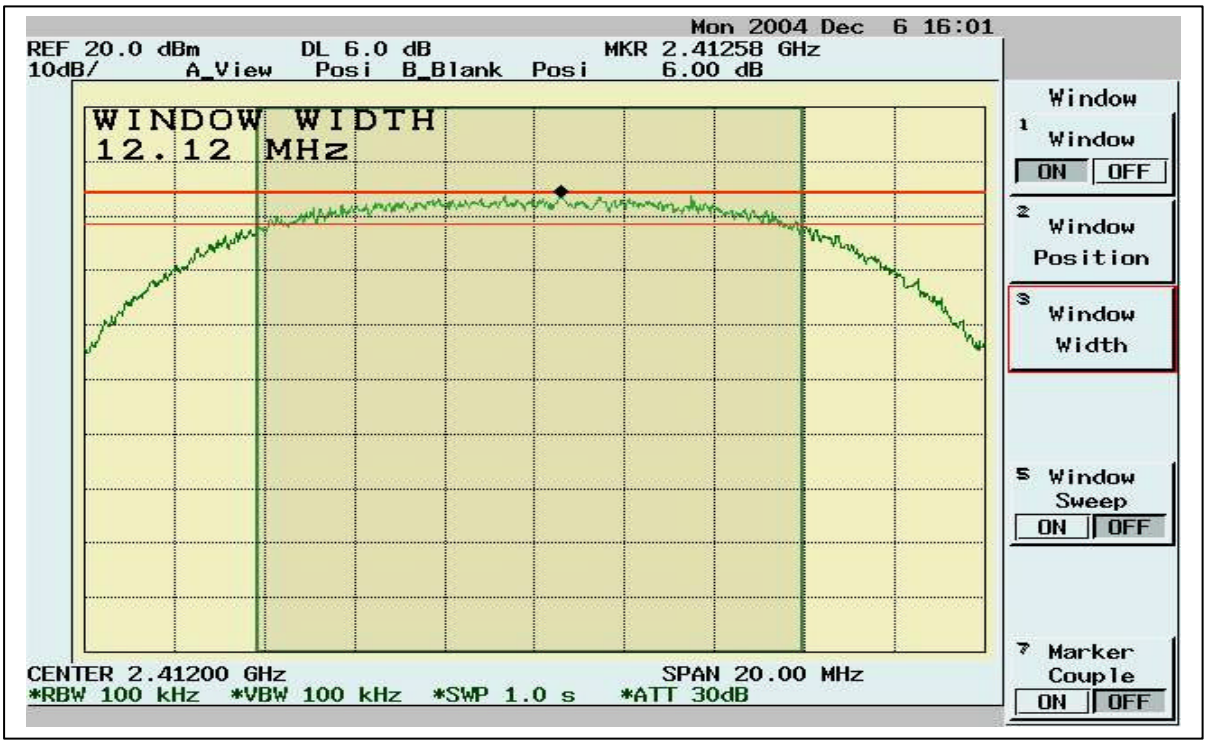
4.2.2 Test Setup

4.2.3 Test Data

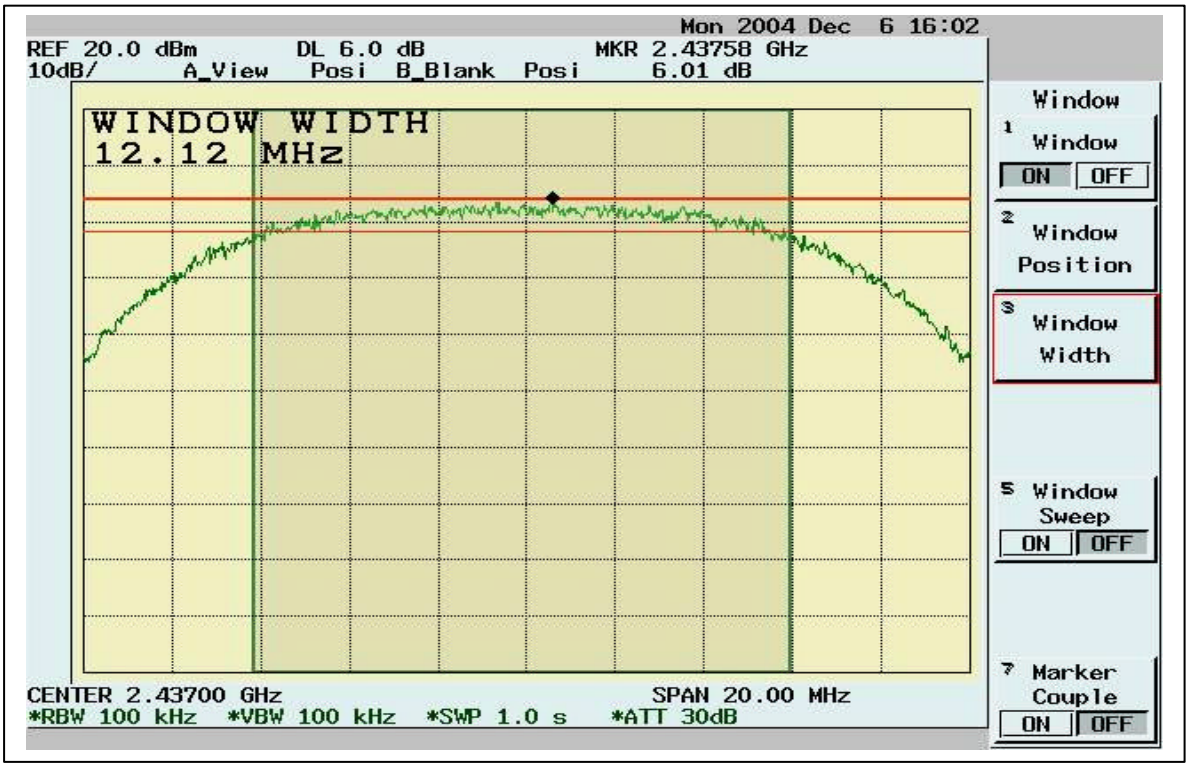
Table 6dB Bandwidth

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	12.12	0.5	Pass
6	2437	12.12	0.5	Pass
11	2462	12.04	0.5	Pass

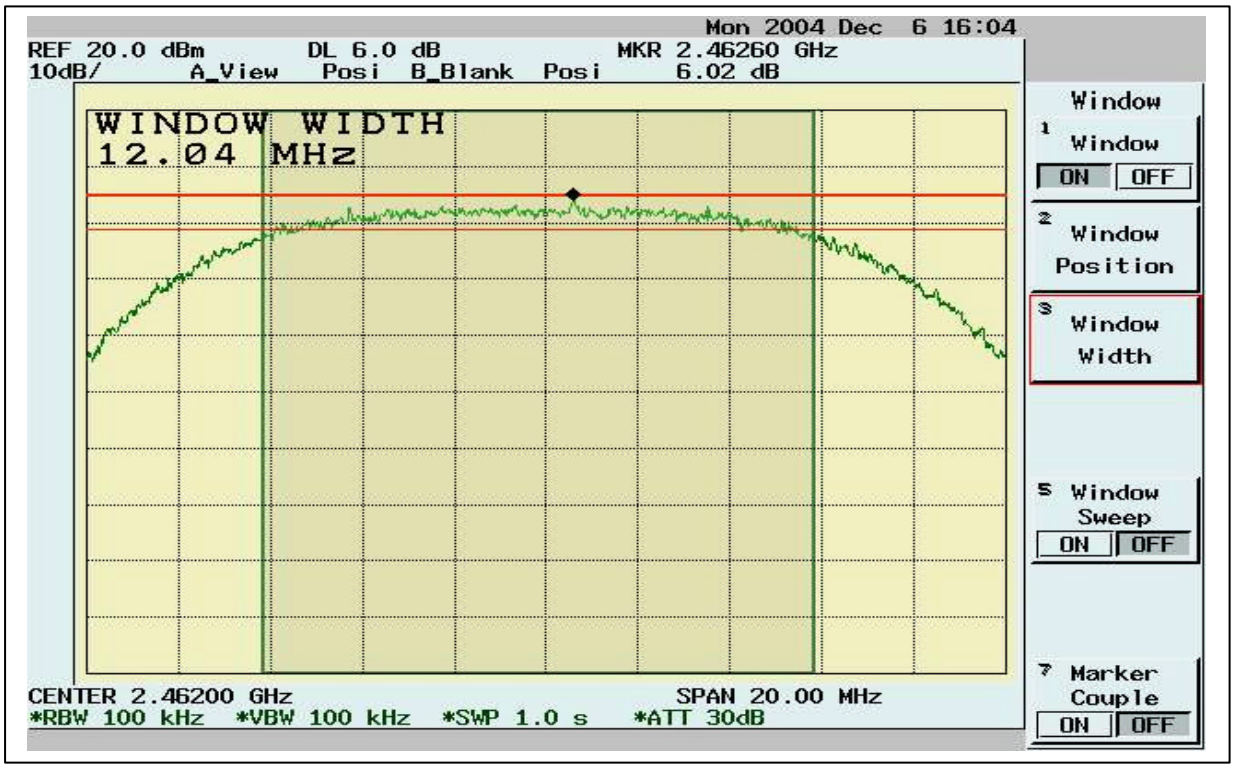
Channel1:



Channel6:



Channel11:

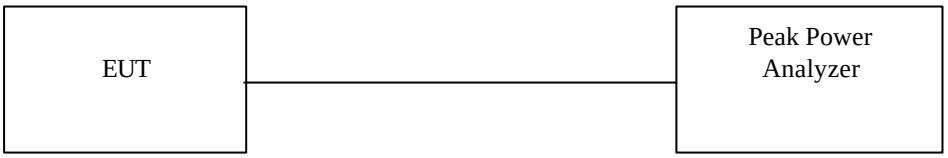

Mon 2004 Dec 6 16:04
REF 20.0 dBm
10dB/
DL 6.0 dB
A_View Posi
B_Blank Posi
MKR 2.46260 GHz
6.02 dB
WINDOW WIDTH
12.04 MHz
Window
1 Window
ON OFF
2 Window Position
3 Window Width
5 Window Sweep
ON OFF
7 Marker Couple
ON OFF
CENTER 2.46200 GHz
SPAN 20.00 MHz
*RBW 100 kHz *VBW 100 kHz *SWP 1.0 s *ATT 30dB

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

4.3.1 Test Procedure

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

4.3.2 Test Setup



4.3.3 Test Data:

Maximum Peak Output Power

Channel	Frequency (MHz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	16.956	1.1	63.09	18.056	30	Pass
6	2437	17.175	1.1	67.22	18.275	30	Pass
11	2462	17.175	1.1	67.22	18.275	30	Pass

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

4.4.1 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.

4.4.2 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.

4.4.3 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

4.4.4 Test Data (30MHz – 1GHz) :.

30M – 1GHz Open Field Radiated Emissions (Horizontal) 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 (°)
42.61	21.77	11.04	1.76	0.00	34.57	40.00	-5.43	150.00	265.00
165.80	28.25	8.68	3.44	0.00	40.37	43.50	-3.13	150.00	297.00
269.59	20.91	12.40	4.33	0.00	37.64	46.00	-8.36	100.00	120.00
337.49	17.65	13.65	4.80	0.00	36.10	46.00	-9.90	100.00	233.00
366.59	18.55	14.53	5.01	0.00	38.10	46.00	-7.90	150.00	120.00
472.32	20.49	16.49	5.61	0.00	42.60	46.00	-3.40	200.00	281.00
499.48	14.08	17.09	5.79	0.00	36.95	46.00	-9.05	100.00	346.00
539.25	14.90	18.04	6.01	0.00	38.95	46.00	-7.05	150.00	152.00
708.03	13.37	19.01	6.82	0.00	39.21	46.00	-6.79	100.00	216.00
944.71	13.84	20.47	7.83	0.00	42.14	46.00	-3.86	200.00	297.00

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 (°)
165.80	27.56	8.68	3.44	0.00	39.68	43.50	-3.82	150.00	46.00
235.64	27.05	10.16	4.12	0.00	41.33	46.00	-4.67	150.00	224.00
269.59	25.00	12.40	4.33	0.00	41.73	46.00	-4.27	150.00	159.00
337.49	24.29	13.65	4.80	0.00	42.74	46.00	-3.26	150.00	127.00
464.56	19.57	16.32	5.57	0.00	41.46	46.00	-4.54	200.00	337.00
472.32	20.73	16.49	5.61	0.00	42.84	46.00	-3.16	200.00	321.00
540.22	18.36	18.07	6.02	0.00	42.44	46.00	-3.56	200.00	14.00
675.05	17.02	18.80	6.66	0.00	42.48	46.00	-3.52	100.00	321.00
708.03	16.73	19.01	6.82	0.00	42.57	46.00	-3.43	100.00	288.00
944.71	13.96	20.47	7.83	0.00	42.26	46.00	-3.74	150.00	192.00

* 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

4.4.5 Test Data .

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

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m) (pk)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
4821.18	50.60	34.75	1.93	46.88	40.40	54.0	-13.60	100	180
7215.78	54.23	39.74	2.36	46.22	50.11	54.0	-3.89	100	183
9627.37	30.19	39.20	2.77	42.12	30.04	54.0	-23.96	100	275
14688.3	29.36	44.22	3.43	42.34	34.68	54.0	-19.32	102	112
15265.7	25.84	43.17	3.49	43.34	29.16	54.0	-24.84	100	193
15690.3	26.92	43.41	3.54	42.16	31.71	54.0	-22.29	105	226

pk: peak value, av: average value

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

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m) (pk)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
3156.84	47.30	30.99	1.40	46.60	33.08	54.00	-20.92	105	110
3224.78	46.20	31.07	1.42	46.61	32.08	54.00	-21.92	100	129
4821.18	55.95	34.75	1.93	46.88	45.74	54.00	-8.26	100	138
6315.68	39.13	36.73	2.20	46.68	31.38	54.00	-22.62	100	112
7215.78	54.93	39.74	2.36	46.22	50.81	54.00	-3.19	101	200
15656.3	26.85	43.30	3.53	42.27	31.42	54.00	-22.58	100	191

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.

pk: peak value, av: average value

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

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m) (pk)	Limit (dBuV/m) (av)	Margin (dB)	Height (cm)	Position (°)
4855.14	50.58	34.89	1.94	46.91	40.49	54.00	-13.51	103	123
5585.41	39.59	36.18	2.07	47.29	30.56	54.00	-23.44	100	184
6315.68	37.73	36.73	2.20	46.68	29.98	54.00	-24.02	103	122
7300.70	54.92	39.64	2.37	46.18	50.76	54.00	-3.24	101	192
14688.3	28.04	44.22	3.43	42.34	33.36	54.00	-20.64	100	205
15673.3	28.16	43.35	3.54	42.21	32.83	54.00	-21.17	100	246

pk: peak value, av: average value

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

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m) (pk)	Limit (dBuV/m) (av)	Margin* (dB)	Height (cm)	Position (°)
3207.79	46.60	31.05	1.42	46.61	32.46	54.00	-21.54	100	115
3241.76	48.86	31.09	1.43	46.61	34.76	54.00	-19.24	100	294
4855.14	56.94	34.89	1.94	46.91	46.85	54.00	-7.15	105	198
6315.68	41.03	36.73	2.20	46.68	33.28	54.00	-20.72	100	289
7283.72	54.66	39.66	2.37	46.19	50.50	54.00	-3.50	101	121
14603.4	25.42	44.39	3.42	41.89	31.35	54.00	-22.65	100	305

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.

pk: peak value, av: average value

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

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m) (pk)	Limit (dBuV/m) (av)	Margin* (dB)	Height (cm)	Position (°)
3394.61	44.03	31.27	1.48	46.64	30.15	54.00	-23.85	103	108
4906.09	49.90	35.11	1.94	46.96	39.99	54.00	-14.01	100	292
5619.38	38.93	36.18	2.07	47.26	29.92	54.00	-24.08	105	148
7368.63	46.91	39.56	2.39	46.15	42.70	54.00	-11.30	100	283
14688.3	27.58	44.22	3.43	42.34	32.90	54.00	-21.10	101	205
15690.3	26.62	43.41	3.54	42.16	31.41	54.00	-22.59	100	103

pk: peak value, av: average value

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

Meter Reading		Correction Factor			Corrected Emissions			Antenna	Turntable
Freq. (MHz)	Ampl. (dBuV) (pk)	Ant. (dB/m)	Cable (dB)	Pre-Ampl. (dB)	Ampl. (dBuV/m) (pk)	Limit (dBuV/m) (av)	Margin* (dB)	Height (cm)	Position (°)
3360.64	48.73	31.23	1.47	46.63	34.80	54.00	-19.20	101	130
4906.09	56.68	35.11	1.94	46.96	46.77	54.00	-7.23	100	129
6315.68	40.51	36.73	2.20	46.68	32.75	54.00	-21.25	100	138
7368.63	48.97	39.56	2.39	46.15	44.76	54.00	-9.24	100	112
14586.4	26.19	44.43	3.42	41.80	32.23	54.00	-21.77	101	200
15656.3	27.13	43.30	3.53	42.27	31.70	54.00	-22.30	100	99

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.

pk: peak value, av: average value

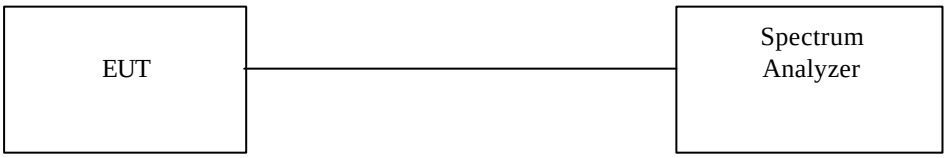
4.5 Band Edge Measurement

4.5.1 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: 2.4GHz, 2.4835GHz.
   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.

4.5.2 Test Setup (Conducted)



4.5.3 Test Data:

Band Edge measurement (Conducted)

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Carrier - Outsideband Limit: > 20dB (dB)	Pass/Fail
1	2411.3	109.8	---	---
Outside band	2398.8	78.2	31.6	Pass
11	2462.5	110.09	---	---
Outside band	2476.5	84.4	25.69	Pass

.

Band Edge Conducted measurement

Band Edge Conducted Measurement

4.5.4 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 Maximun 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 Maximun Hold function is completed.

4.5.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

4.5.6 Test Data:

Band Edge measurement (Radiated)

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Correction Factor (dB/m)	Emission Level (dBuV/m)	dBc (Limit: > 20dBc)	Limit (dBuV/m)	Equip. Setup VBW	Pass or Fail
1(peak mode)	2410.9	66.34	31.67	98.01	---	---	1MHz	---
Outside band	2398.3	39.47	31.67	71.14	26.87	---	1MHz	Pass
1(average mode)	2410.5	58.37	31.67	90.04	---	---	10Hz	---
Restricted band	2386.2	17.41	31.67	49.08	-----	54	10Hz	Pass
11(peak mode)	2460.7	67.36	31.64	99.00	----	---	1MHz	---
Outside band	2477.1	39.77	31.64	71.41	27.59	---	1MHz	Pass
11(average mode)	2463.5	59.00	31.64	90.64	----	---	10Hz	---
Restricted band	2487.0	15.82	31.64	47.46	-----	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 Restricted Band(Radiated)

Peak Mode (Channel 11)

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

Average Mode (Channel 11)

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

See MPE report

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

4.7.1 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.

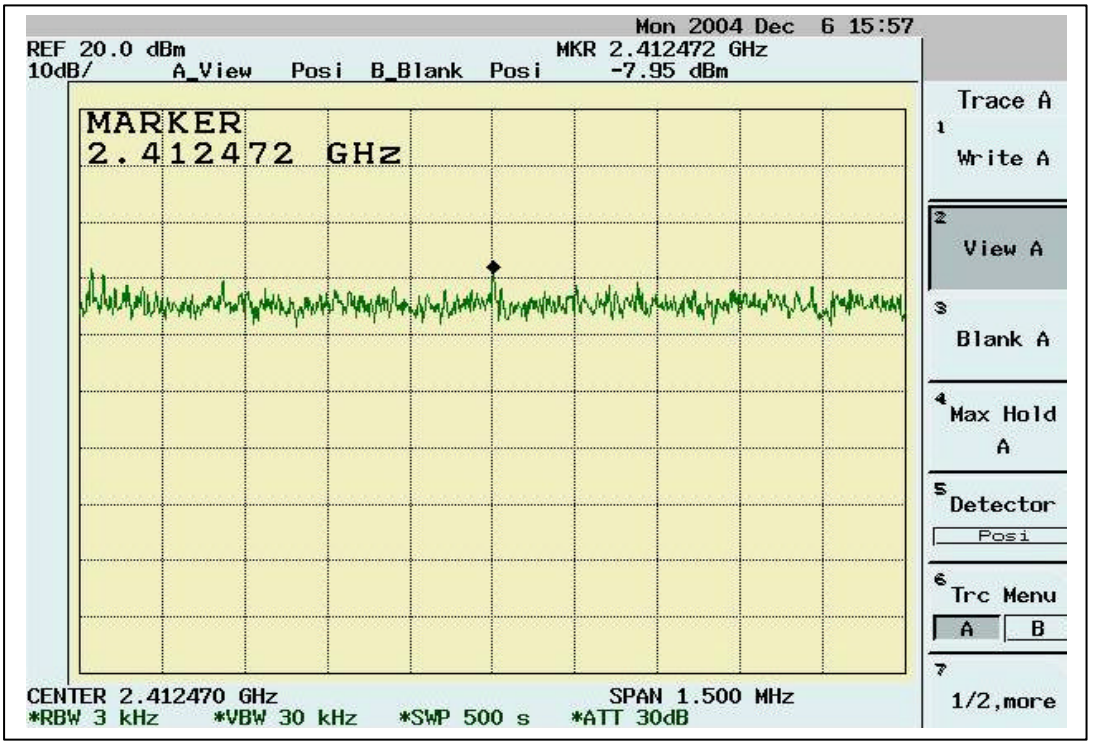
4.7.2 Test Setup

4.7.3 Test Data:

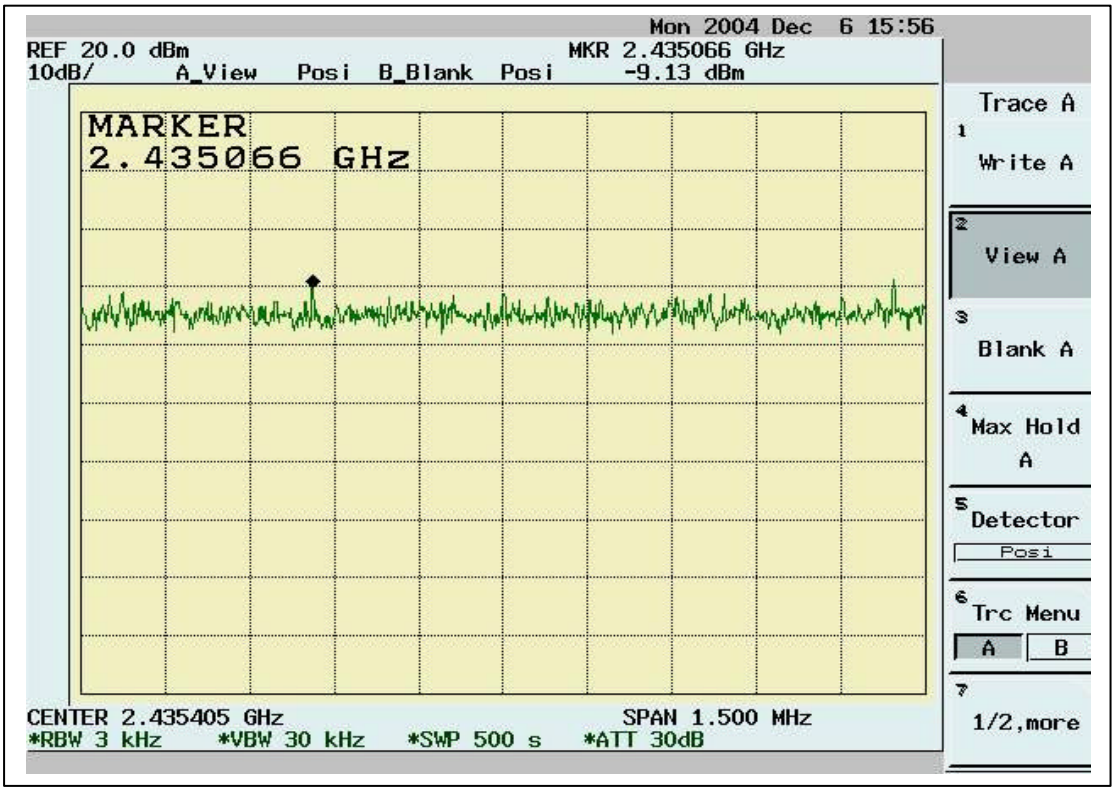
Maximum Peak Output Power Density

Chennel	Frequency (MHz)	Spectrum Reading (dBm/3KHz)	Cable Loss (dB)	Peak Power Output (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
1	2412	-7.95	1.1	-6.85	8	Pass
6	2437	-9.13	1.1	-8.03	8	Pass
11	2462	-7.43	1.1	-6.33	8	Pass

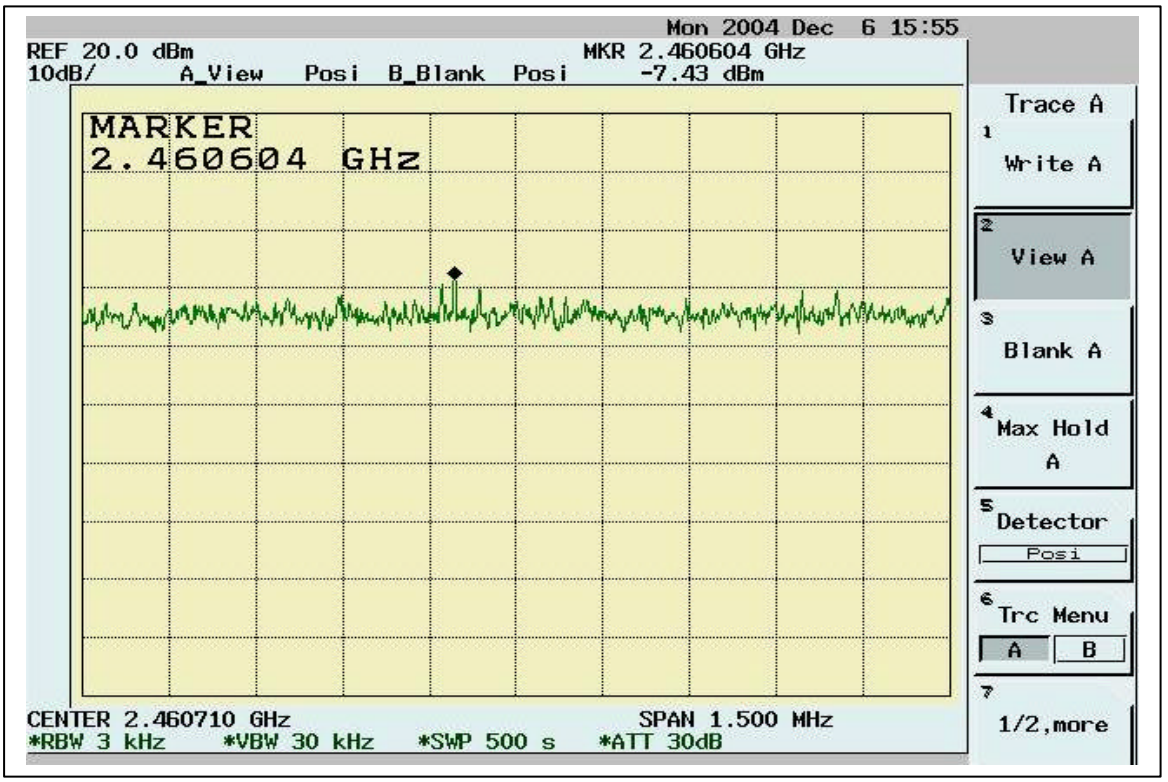
Channel 1



Channel6



Channel 11


Mon 2004 Dec 6 15:55
REF 20.0 dBm
10dB/ A_View Posi B_Blank Posi
MKR 2.460604 GHz
-7.43 dBm
MARKER
2.460604 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 2.460710 GHz
SPAN 1.500 MHz
*RBW 3 kHz *VBW 30 kHz *SWP 500 s *ATT 30dB

5. TEST RESULTS (802.11g)

5.1 Powerline Conducted Emissions [Section 15.207]

5.1.1 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.

5.1.2 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.

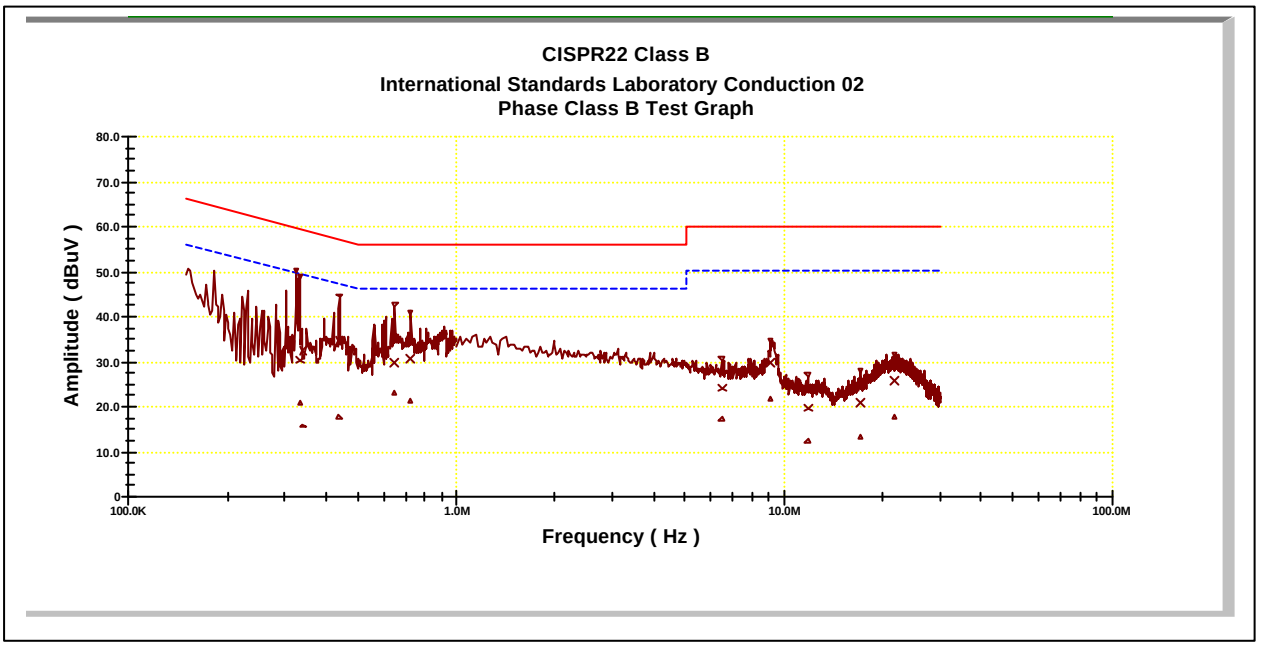
5.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

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

5.1.4 Test Data:

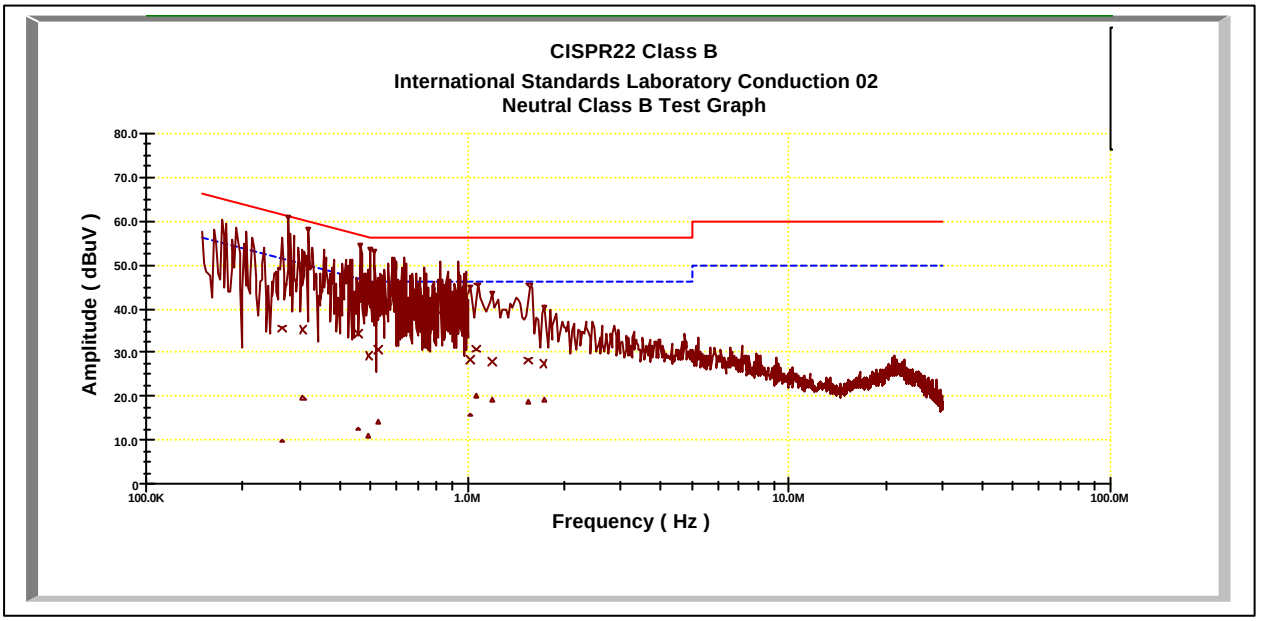
Power Line Conducted Emissions (Hot) Channel 1, 6, 11

	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)
0.33333	0.10	0.02	30.38	60.76	-30.38	20.80	50.76	-29.97
0.34041	0.10	0.02	32.54	60.56	-28.02	15.70	50.56	-34.86
0.43788	0.11	0.03	34.62	57.77	-23.15	17.50	47.77	-30.27
0.64893	0.14	0.04	29.61	56.00	-26.39	23.11	46.00	-22.89
0.72386	0.15	0.05	30.54	56.00	-25.46	21.38	46.00	-24.62
6.44621	0.39	0.14	24.20	60.00	-35.80	17.42	50.00	-32.58
9.11985	0.49	0.17	29.71	60.00	-30.29	21.78	50.00	-28.22
11.7985	0.58	0.22	19.74	60.00	-40.26	12.20	50.00	-37.80
17.1851	0.79	0.28	20.86	60.00	-39.14	13.13	50.00	-36.87
21.7469	0.90	0.28	25.60	60.00	-34.40	17.88	50.00	-32.12



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)
0.26521	0.10	0.02	35.48	62.71	-27.23	9.87	52.71	-42.84
0.30726	0.10	0.02	35.07	61.51	-26.44	19.66	51.51	-31.85
0.45423	0.11	0.03	34.40	57.31	-22.91	12.58	47.31	-34.73
0.4928	0.12	0.03	29.37	56.21	-26.84	11.02	46.21	-35.19
0.52558	0.12	0.03	30.77	56.00	-25.23	14.17	46.00	-31.83
1.02027	0.30	0.07	28.39	56.00	-27.61	15.78	46.00	-30.22
1.06396	0.29	0.07	30.83	56.00	-25.17	19.99	46.00	-26.01
1.19551	0.28	0.08	27.94	56.00	-28.06	19.39	46.00	-26.61
1.54631	0.25	0.09	28.20	56.00	-27.80	18.82	46.00	-27.18
1.72283	0.23	0.09	27.44	56.00	-28.56	19.32	46.00	-26.68



* 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

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

5.2.1 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

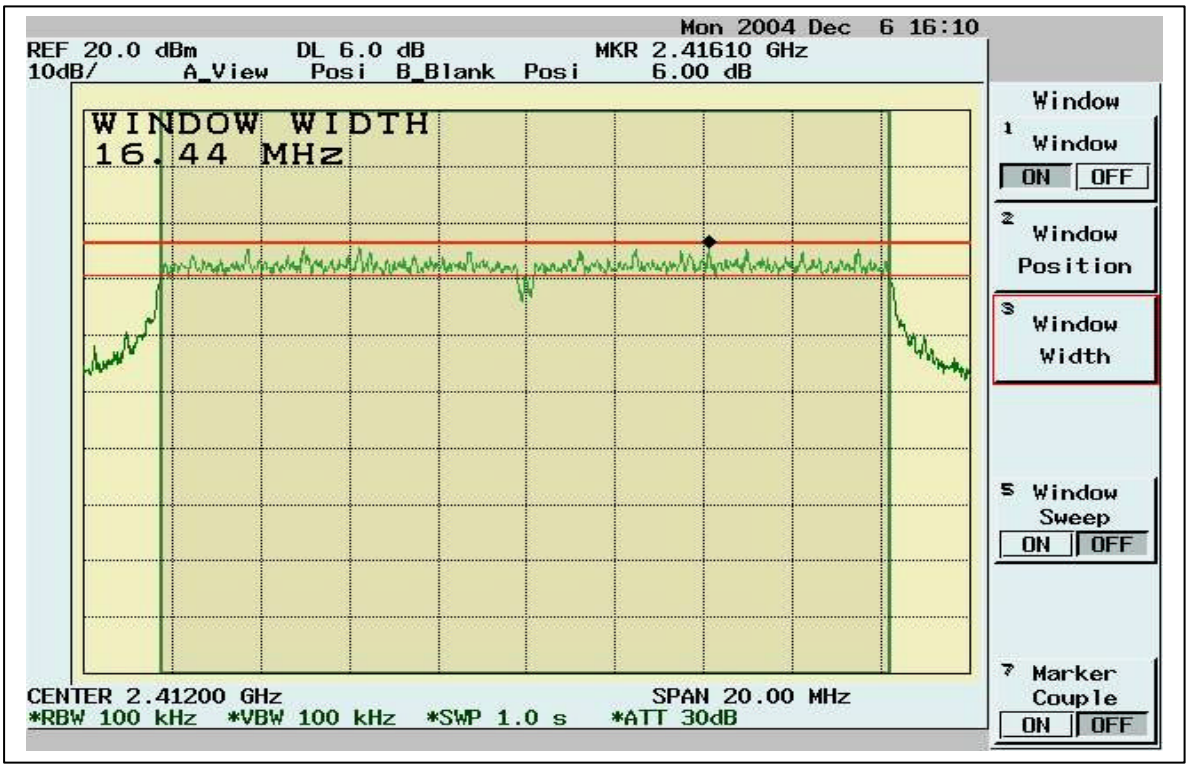
5.2.2 Test Setup

5.2.3 Test Data:

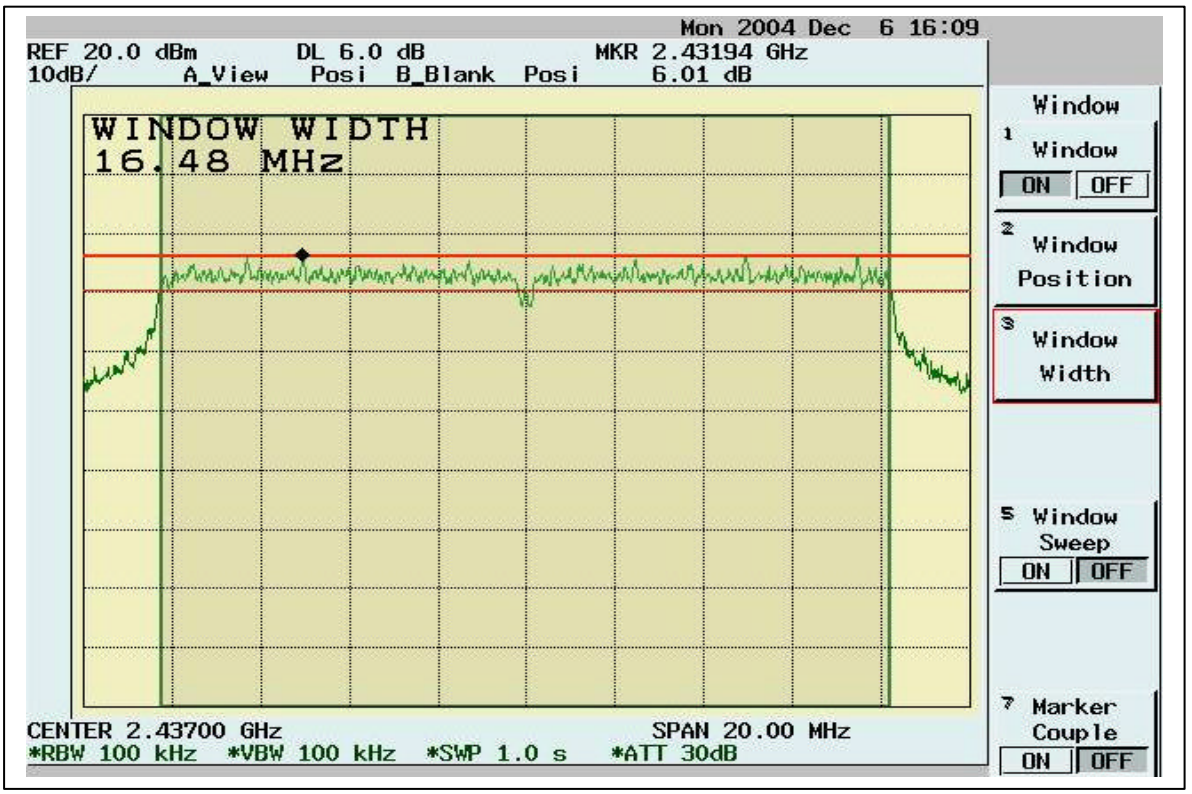
6dB Bandwidth

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	16.44	0.5	Pass
6	2437	16.48	0.5	Pass
11	2462	16.48	0.5	Pass

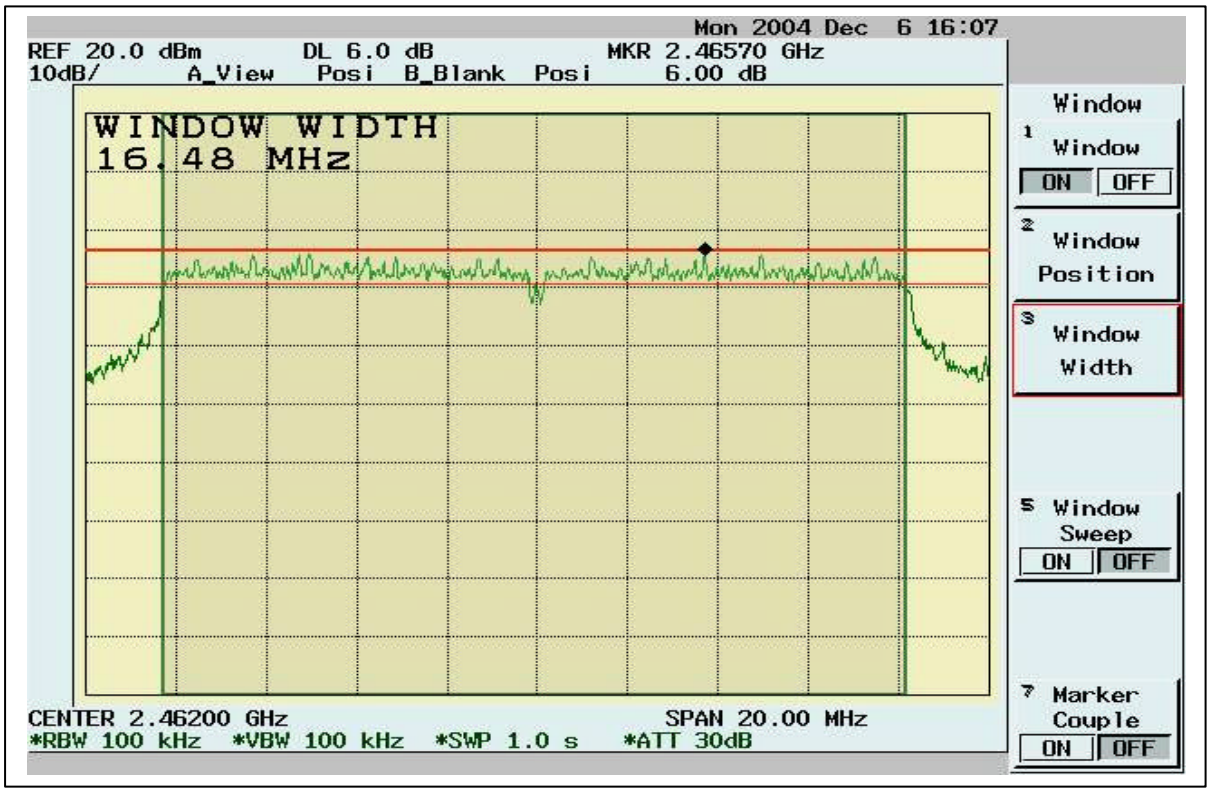
Channel 1:



Channel 6:



Channel 11:


Mon 2004 Dec 6 16:07
REF 20.0 dBm
DL 6.0 dB
MKR 2.46570 GHz
10dB/ A_View Posi B_Blank Posi 6.00 dB
WINDOW WIDTH
16.48 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

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

5.3.1 Test Procedure

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

5.3.2 Test Setup

5.3.3 Test Data

Maximum Peak Output Power

Channel	Frequency (MHz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	17.081	1.1	65.78	18.181	30	Pass
6	2437	17.143	1.1	66.72	18.243	30	Pass
11	2462	17.206	1.1	67.70	18.306	30	Pass

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

5.4.1 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.

5.4.2 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.

5.4.3 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

5.4.4 Test Data (30MHz – 1GHz) :.

30M – 1GHz Open Field Radiated Emissions (Horizontal) 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 (°)
232.73	23.57	9.87	4.09	0.00	37.53	46.00	-8.47	200.00	216.00
269.59	20.40	12.40	4.33	0.00	37.13	46.00	-8.87	100.00	119.00
365.62	17.57	14.50	5.01	0.00	37.08	46.00	-8.92	150.00	313.00
472.32	20.14	16.49	5.61	0.00	42.25	46.00	-3.75	100.00	152.00
675.05	12.95	18.80	6.66	0.00	38.41	46.00	-7.59	100.00	248.00
708.03	12.63	19.01	6.82	0.00	38.46	46.00	-7.54	150.00	345.00
730.34	10.10	19.32	6.90	0.00	36.33	46.00	-9.67	100.00	248.00
741.98	10.33	19.49	6.95	0.00	36.77	46.00	-9.23	100.00	168.00
830.25	10.09	19.92	7.39	0.00	37.41	46.00	-8.59	150.00	281.00
944.71	14.51	20.47	7.83	0.00	42.81	46.00	-3.19	150.00	281.00

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 (°)
42.61	22.77	11.04	1.76	0.00	35.57	40.00	-4.43	100.00	30.00
472.32	20.53	16.49	5.61	0.00	42.64	46.00	-3.36	100.00	321.00
493.66	15.92	16.96	5.75	0.00	38.63	46.00	-7.37	150.00	175.00
498.51	18.81	17.07	5.78	0.00	41.66	46.00	-4.34	100.00	111.00
539.25	15.17	18.04	6.01	0.00	39.22	46.00	-6.78	100.00	111.00
596.48	13.95	18.30	6.30	0.00	38.55	46.00	-7.45	150.00	305.00
708.03	12.18	19.01	6.82	0.00	38.01	46.00	-7.99	100.00	272.00
741.98	12.44	19.49	6.95	0.00	38.88	46.00	-7.12	100.00	305.00
898.15	11.20	20.19	7.66	0.00	39.05	46.00	-6.95	150.00	143.00
944.71	14.53	20.47	7.83	0.00	42.83	46.00	-3.17	100.00	159.00

* NOTE:
During the Pre-test, the EUT has been tested for Channel 1 , 6, 11 transmit from Main and Aux antenna respectively to get all the critical emission frequencies. In the final test all the critical emission frequencies has been tested and the test data are listed above.
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