

Test Report
for
FCC Part 15 Subpart B & C

of
WLAN 802.11g miniPCI module

Model

RM1
(Brand: Wistron NeWeb)

Applied by:

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Taiwan, R. O. C.

Test Performed by:

International Standards Laboratory

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LT LAB:NVLAP:200234-0;VCCI: R-1435,C-1440;NEMKO:ELA 113b,113d;BSMI:SL2-IN-E-0013;CNLA:0997

ISL-T10-R29-1

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1. General

1.1 Certification of Accuracy of Test Data

Standards: CFR 47 Part 15 Subpart B Class B
CFR 47 Part 15 Subpart C (Section 15.247)

Test Procedure: ANSI C63.4: 2001

Equipment Tested: WLAN 802.11g miniPCI module

Model: RM1

Applied by: Wistron Neweb Corporation

Sample received Date: 2004/05/28

Final test Date : 2004/06/04-2004/06/08

Test Site: Chamber 02, Conduction 02

Temperature Refer to each site test data

Humidity: Refer to each site test data

Test Engineer: Jerry Chiou

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Approve & Signature



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 68 pages, including 1 cover page , 3 contents page, and 64 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 functions of EUT has been tested according 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	MPE report attached
15.247 (d)	Power Spectral Density	Pass	

The 802.11g functions of EUT has been tested according 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	MPE report attached
15.247 (d)	Power Spectral Density	Pass	

3. Description of Equipment Under Test (EUT)

Description: WLAN 802.11g miniPCI Module
 Model No.: RM1
 FCC ID: **NKRRM1**
 Brand: Wistron NeWeb
 Frequency Range 802.11b/g: 2400~2483.5 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: Monopole ,reverse SMA
 (Model: Wss002, made by WanShih Electronic CO.)
 Antenna Connected: The antenna is connected to the RF connector of the
 WLAN adapter.
 Antenna peak Gain: 2.31 dBi (11b/g)
 WLAN Power Type : 3.3V DC from the EUT

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.

4. TEST RESULTS (802.11b)

4.1 Powerline Conducted Emissions [Section 15.207]

4.1.1 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.

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 6dB 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 6dB 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:

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

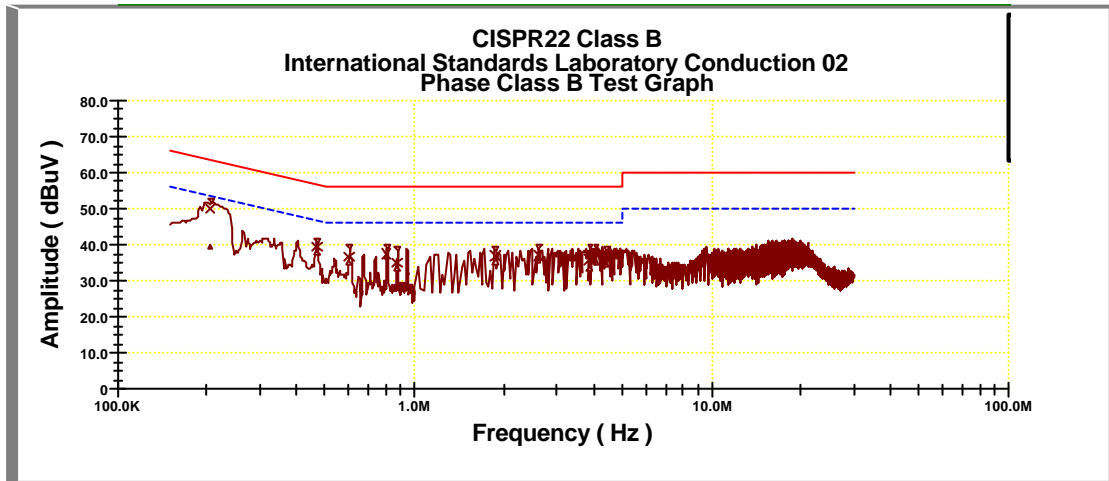
Operator: Jerry Chiou

Temperature (C): 25

Humidity (%): 58

04:10:59 PM, Wednesday, June 02, 2004

Frequency MHz	LISN Loss (dB)	Cable Loss (dB)	QP Corrc. Amp.(dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVE Corrc. Amp.(dBuV)	AVE Limit (dBuV)	AVE Margin (dB)
0.20468	0.10	0.02	50.01	64.44	-14.43	39.35	54.44	-15.08
0.46938	0.11	0.03	39.34	56.87	-17.53	37.52	46.87	-9.35
0.60086	0.13	0.04	36.58	56.00	-19.42	34.74	46.00	-11.26
0.80263	0.17	0.05	37.43	56.00	-18.57	36.75	46.00	-9.25
0.87135	0.18	0.06	34.88	56.00	-21.12	33.08	46.00	-12.92
1.87233	0.21	0.10	36.90	56.00	-19.10	35.15	46.00	-10.85
2.60822	0.20	0.11	37.03	56.00	-18.97	35.36	46.00	-10.64
3.87796	0.20	0.12	35.93	56.00	-20.07	33.20	46.00	-12.80
4.08006	0.20	0.12	37.11	56.00	-18.89	35.00	46.00	-11.00
4.41412	0.21	0.12	37.02	56.00	-18.98	34.41	46.00	-11.59



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

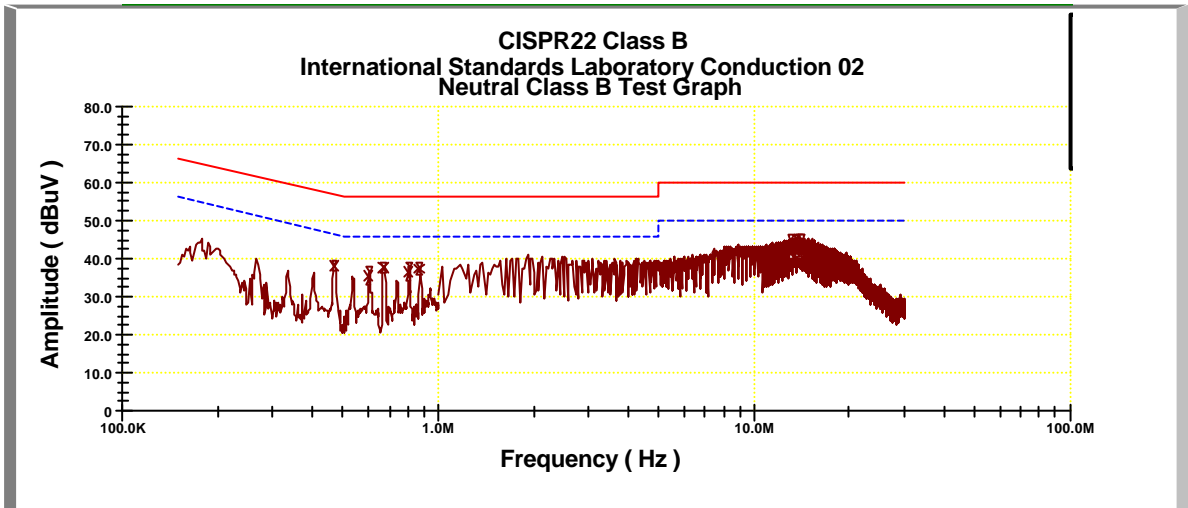
Operator: Jerry Chiou

Temperature (C): 25

Humidity (%): 58

04:22:48 PM, Wednesday, June 02, 2004

Frequency	LISN Loss	Cable Loss	QP Corrcr.	QP Limit	QP Margin	AVE Corrcr.	AVE Limit	AVE Margin
MHz	(dB)	(dB)	Amp.(dBuV)	(dBuV)	(dB)	Amp.(dBuV)	(dBuV)	(dB)
0.46876	0.11	0.03	38.08	56.89	-18.81	37.48	46.89	-9.41
0.60033	0.13	0.04	35.35	56.00	-20.65	33.63	46.00	-12.37
0.66961	0.14	0.04	37.71	56.00	-18.29	36.86	46.00	-9.14
0.80193	0.17	0.05	36.45	56.00	-19.55	34.96	46.00	-11.04
0.86983	0.18	0.06	37.30	56.00	-18.70	36.33	46.00	-9.67
13.088	0.12	0.25	43.44	60.00	-16.56	40.72	50.00	-9.28
13.6196	0.11	0.27	43.90	60.00	-16.10	41.06	50.00	-8.94
13.9548	0.11	0.27	43.72	60.00	-16.28	40.57	50.00	-9.43
14.0868	0.11	0.28	43.45	60.00	-16.55	40.36	50.00	-9.64
14.1495	0.11	0.28	43.45	60.00	-16.55	40.70	50.00	-9.30



* 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:

6dB Bandwidth

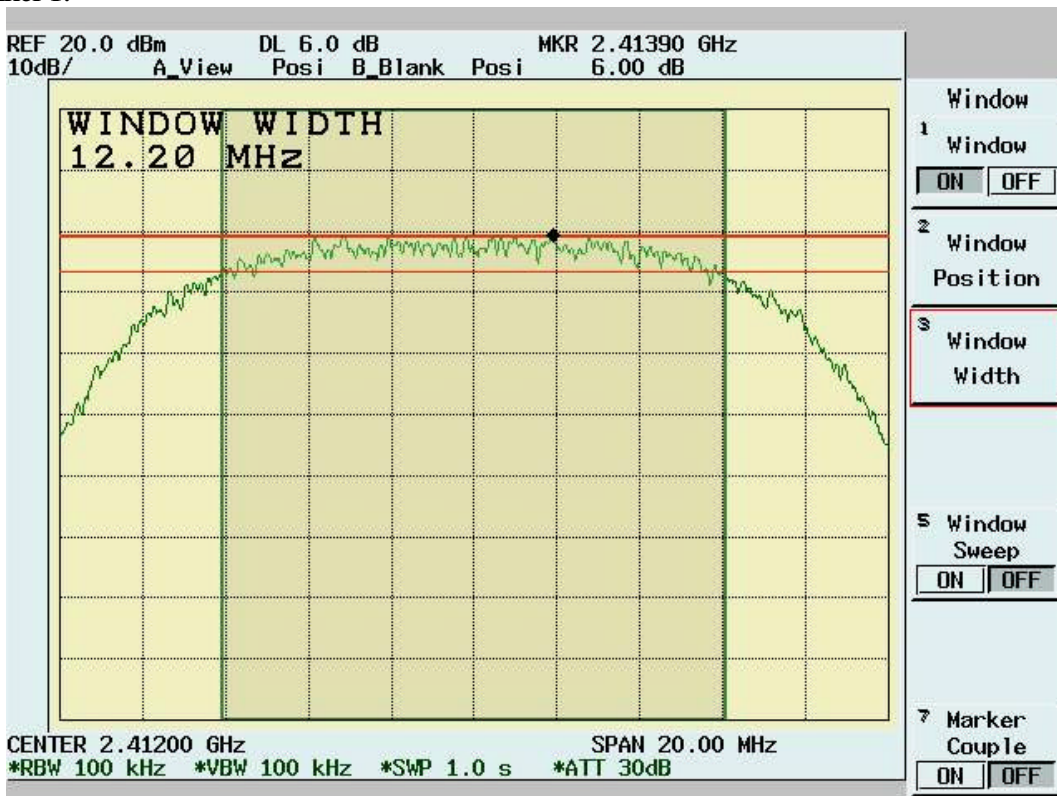
Temp. (deg. C): 26

Humidity (%): 47

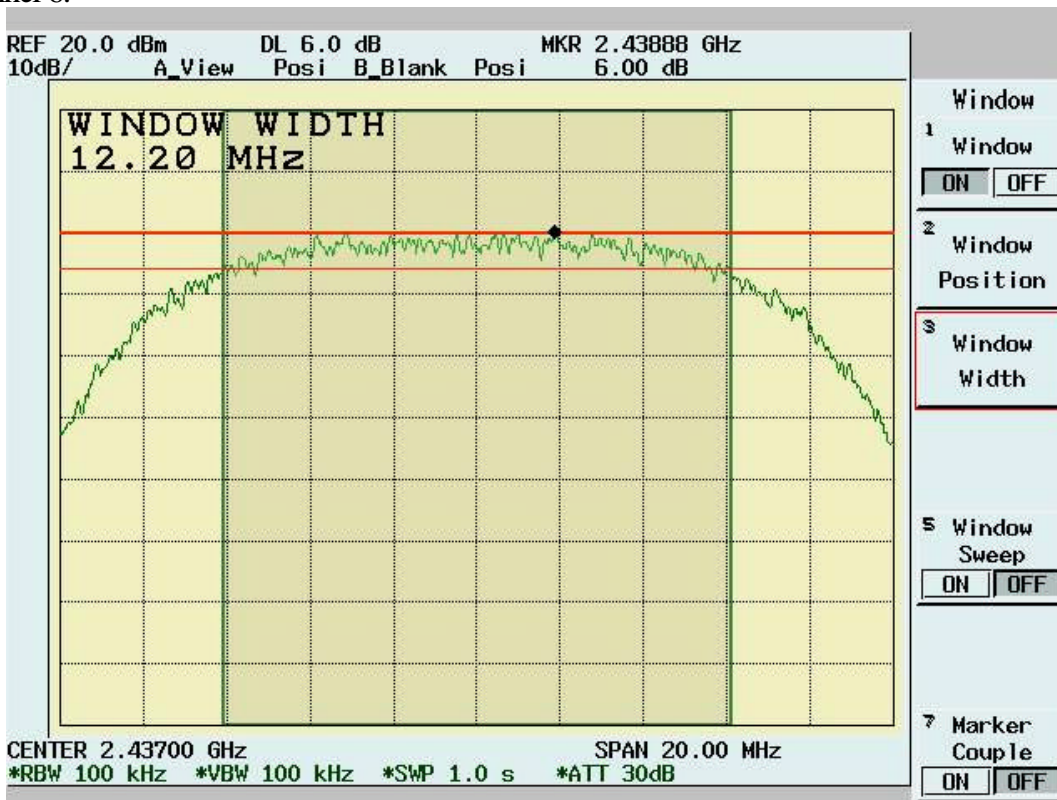
Test Engr: Jerry Chiou

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	12.2	0.5	Pass
6	2437	12.2	0.5	Pass
11	2462	12.2	0.5	Pass

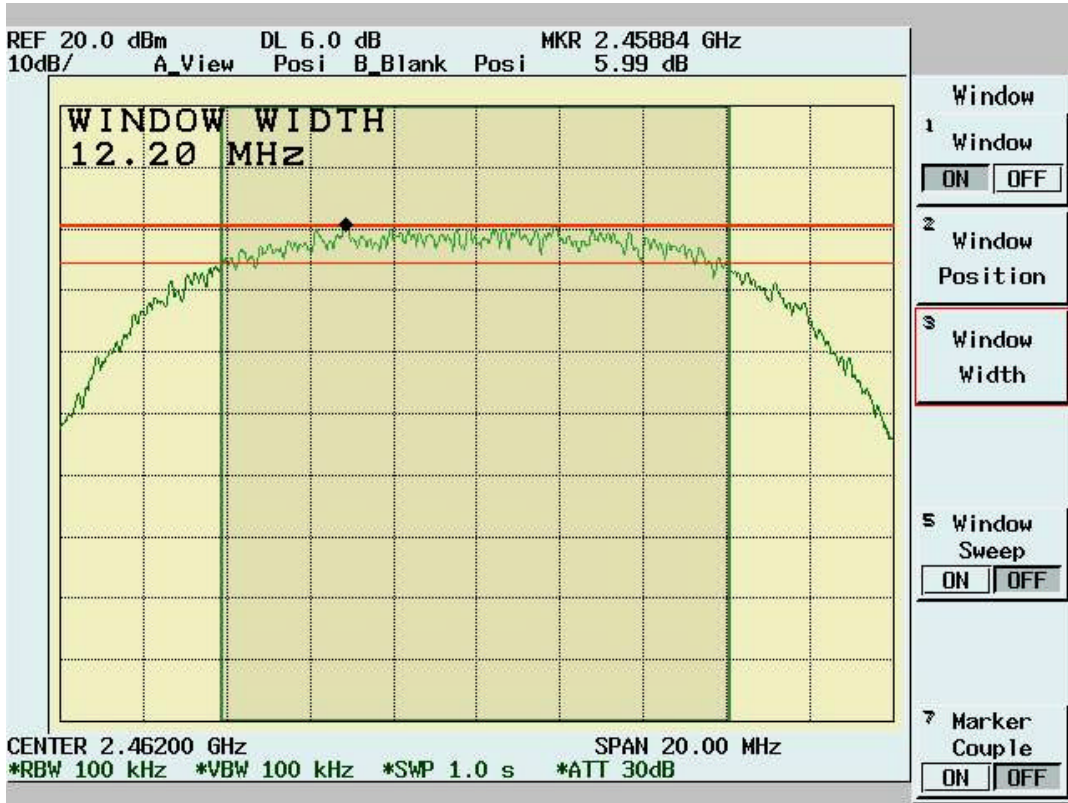
Channel 1:



Channel 6:



Channel 11:

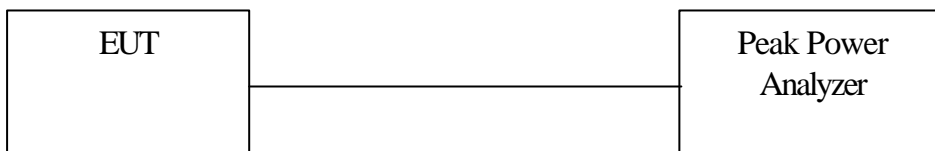


4.3 DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]

4.3.1 Test Procedure

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

Temp. (deg. C): 25

Test Engr: Jerry Chiou

Humidity (%): 50

Channel	Frequency (Mhz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	14.906	1.1	39.87	16.006	30	Pass
6	2437	15.343	1.1	44.09	16.443	30	Pass
11	2462	15.656	1.1	47.38	16.756	30	Pass

Note: Two RF output(MAIN & AUX) have been test,the worse data shown above.

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 2nd to 10th 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

Operator: Jerry Chiou
 Temperature (C): 23
 Humidity (%): 49

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
99.84	26.44	10.47	3.02	0.00	39.92	43.50	-3.58	100.00	259.00
132.82	19.30	11.25	3.52	0.00	34.07	43.50	-9.43	200.00	8.00
198.78	27.50	8.69	4.18	0.00	40.37	43.50	-3.13	100.00	259.00
298.69	21.35	12.57	4.69	0.00	38.62	46.00	-7.38	200.00	331.00
331.67	13.81	13.49	4.81	0.00	32.11	46.00	-13.89	100.00	172.00
365.62	17.52	14.50	5.08	0.00	37.09	46.00	-8.91	200.00	155.00
398.6	11.59	15.56	5.31	0.00	32.46	46.00	-13.54	150.00	155.00
431.58	15.89	15.92	5.61	0.00	37.41	46.00	-8.59	200.00	106.00
539.25	7.77	18.12	6.33	0.00	32.22	46.00	-13.78	100.00	259.00
831.22	4.71	20.02	7.98	0.00	32.72	46.00	-13.28	150.00	204.00

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

Operator: Jerry Chiou
 Temperature (C): 23
 Humidity (%): 49

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
98.87	24.41	10.26	3.00	0.00	37.66	43.50	-5.84	200.00	232.00
165.8	27.55	8.64	3.84	0.00	40.03	43.50	-3.47	100.00	37.00
198.78	15.10	8.69	4.18	0.00	27.97	43.50	-15.53	200.00	265.00
232.73	23.33	9.87	4.50	0.00	37.70	46.00	-8.30	150.00	282.00
365.62	9.11	14.50	5.08	0.00	28.69	46.00	-17.31	200.00	167.00
497.54	4.92	17.05	6.04	0.00	28.01	46.00	-17.99	100.00	282.00
564.47	4.10	18.37	6.57	0.00	29.04	46.00	-16.96	150.00	317.00
644.01	3.25	18.74	7.01	0.00	29.00	46.00	-17.00	200.00	232.00
652.74	8.39	18.81	7.05	0.00	34.25	46.00	-11.75	100.00	216.00
829.28	-0.00	20.02	7.97	0.00	27.99	46.00	-18.01	200.00	4.00

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

4.4.5 Test Data (1GHz – 25 GHz) .

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F.	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1062.44	55.68	24.79	1.54	46.03	35.98	54.00	-18.02	102	108
1796.70	51.11	29.29	2.00	46.21	36.19	54.00	-17.81	100	57
2448.55	49.32	30.91	2.75	46.21	36.77	54.00	-17.23	101	184
2773.23	49.09	31.01	2.82	46.41	36.50	54.00	-17.50	102	286
3097.90	46.62	31.18	2.67	46.59	33.87	54.00	-20.13	103	332
4821.68	35.09	34.92	1.28	46.88	24.41	54.00	-29.59	100	18

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F.	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1791.71	51.91	29.25	2.00	46.21	36.95	54.00	-17.05	100	57
2373.63	59.24	30.93	2.64	46.21	46.60	54.00	-7.40	101	160
3097.90	47.77	31.18	2.67	46.59	35.02	54.00	-18.98	103	332
3751.75	50.23	31.85	2.12	46.38	37.83	54.00	-16.17	102	164
4076.92	43.24	32.43	2.06	46.19	31.54	54.00	-22.46	102	92
4821.68	42.85	34.92	1.28	46.88	32.17	54.00	-21.83	100	18

Note:

“ * ”: Fundamental Frequency

“**”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“ pk ”: peak reading

“ av ”: average reading

“ --- ”: No meter reading data due to the emission level is smaller than spectrum noise level.

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1064.94	55.51	24.80	1.54	46.03	35.82	54.00	-18.18	102	108
1794.21	50.31	29.27	2.00	46.21	35.37	54.00	-18.63	100	57
2391.11	50.95	30.92	2.67	46.21	38.32	54.00	-15.68	101	166
3758.74	44.12	31.86	2.12	46.37	31.73	54.00	-22.27	102	162
3916.08	42.20	32.08	2.15	46.20	30.24	54.00	-23.76	102	122
4870.63	35.39	35.11	1.25	46.93	24.82	54.00	-29.18	100	13

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1794.21	53.02	29.27	2.00	46.21	38.08	54.00	-15.92	100	57
1874.13	54.63	29.94	2.04	46.21	40.41	54.00	-13.59	100	52
2398.60	61.48	30.92	2.68	46.21	48.87	54.00	-5.13	101	168
3755.24	48.98	31.86	2.12	46.37	36.59	54.00	-17.41	102	163
3916.08	46.95	32.08	2.15	46.20	34.98	54.00	-19.02	102	122
4083.92	42.34	32.45	2.05	46.19	30.64	54.00	-23.36	102	92

Note:

“ * ”: Fundamental Frequency

“**”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“pk”: peak reading

“av”: average reading

“--”: No meter reading data due to the emission level is smaller than spectrum noise level.

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1799.20	52.14	29.31	2.00	46.21	37.25	54.00	-16.75	100	57
2086.41	49.05	30.98	2.23	46.20	36.07	54.00	-17.93	100	70
2396.10	50.75	30.92	2.67	46.21	38.14	54.00	-15.86	101	167
2768.23	48.31	31.01	2.82	46.41	35.73	54.00	-18.27	102	284
3422.58	46.81	31.44	2.19	46.64	33.80	54.00	-20.20	103	248
4923.08	35.30	35.31	1.23	46.97	24.87	54.00	-29.13	100	8

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1796.70	54.59	29.29	2.00	46.21	39.68	54.00	-14.32	100	57
2388.61	54.07	30.92	2.66	46.21	41.45	54.00	-12.55	101	165
2423.58	61.40	30.92	2.71	46.21	48.82	54.00	-5.18	101	176
2833.17	50.07	31.03	2.82	46.46	37.47	54.00	-16.53	102	305
4923.08	42.02	35.31	1.23	46.97	31.59	54.00	-22.41	100	8
7377.62	36.58	39.70	3.24	46.14	33.38	54.00	-20.62	101	164

Note:

“ * ”: Fundamental Frequency

“**”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“pk”: peak reading

“av”: average reading

“--”: No meter reading data due to the emission level is smaller than spectrum noise level.

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.

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.
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:

Table: Band Edge measurement (Conducted)

Temp. (deg. C): 25
 Humidity (%): 50
 Test Engr: Jerry Chiou

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Carrier - Outsideband Limit: >20dB (dB)	Pass/Fail
1	2409.9	105.69	---	---
Outside band	2400	58.84	46.85	Pass
11	2460	106.75	---	---
Outside band	2476.9	61.02	45.73	Pass

Note: Two RF output(MAIN & AUX) have been test,the worse data shown above.

Band Edge Conducted measurement



Band Edge Conducted Measurement



4.5.4 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, 2.48GHz.
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.

4.5.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

4.5.6 Test Data

Table Band Edge measurement (Radiated)

Temp. (deg. C): 25

Test Engr: Jerry Chiou

Humidity (%): 50

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)	2409.3	68.16	33.61	101.77	---	---	1MHz	---
Outside band	2400	24.93	33.61	58.54	43.23	---	1MHz	Pass
1(average mode)	2410.3	65.24	33.61	98.85	---	---	10Hz	---
Restricted band	2390	7.04	33.61	40.65	---	54	10Hz	Pass
11(peak mode)	2463.6	68.63	33.68	102.31	---	---	1MHz	---
Outside band	2474.9	24.19	33.68	57.87	44.44	---	1MHz	Pass
11(average mode)	2463.7	65.98	33.68	99.66	---	---	10Hz	---
Restricted band	2544	9.67	33.68	43.35	---	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

Both Horizontal and Vertical polarizaion have been tested and the worst data is listed above.

**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 Ristricted Band(Radiated)
Average Mode (Channel 11)**



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

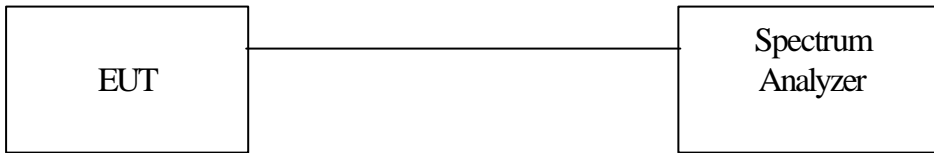
See MPE report

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

Temp. (deg. C): 25

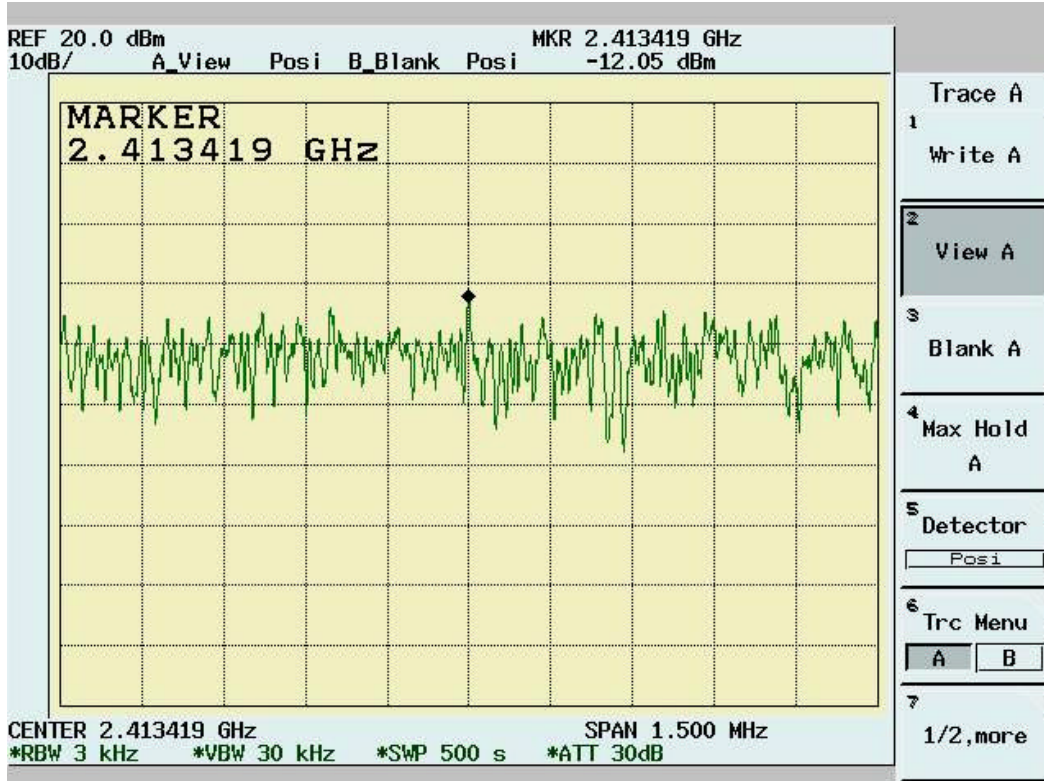
Test Engr: Jerry Chiou

Humidity (%): 50

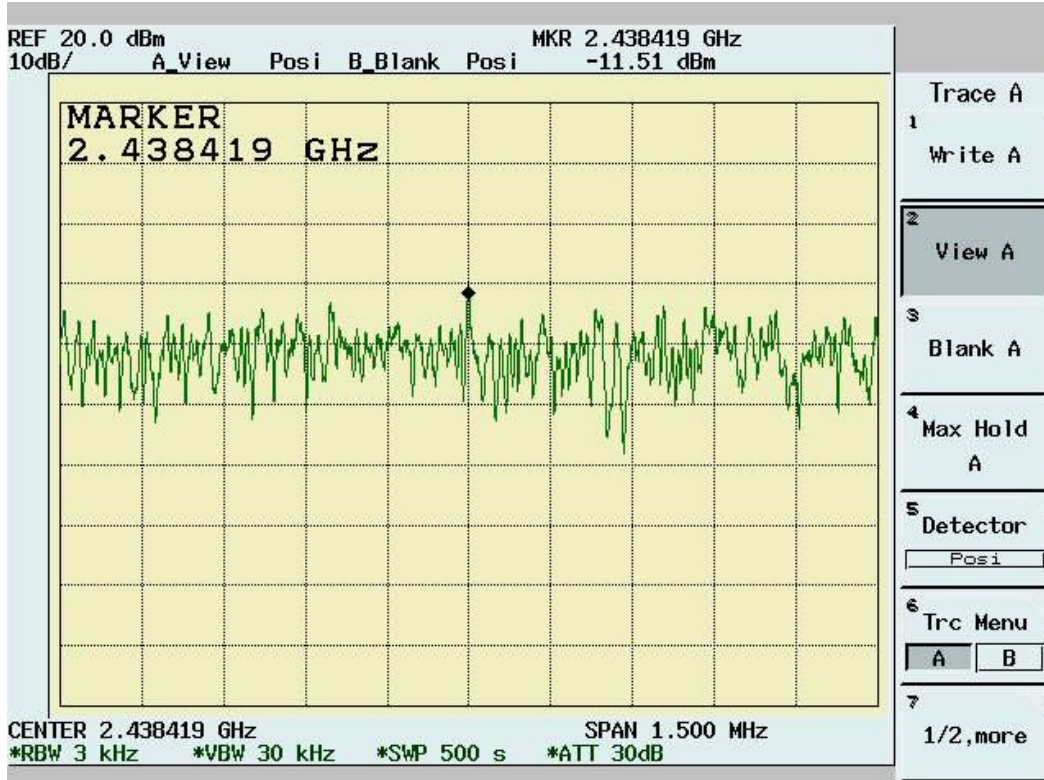
Frequency (MHz)	Spectrum Reading (dBm/3KHz)	Cable Loss (dB)	Peak Power Output (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
2412	-12.05	1.1	-10.95	8	Pass
2437	-11.51	1.1	-10.41	8	Pass
2462	-11.27	1.1	-10.17	8	Pass

Note: Two RF output(MAIN & AUX) have been test,the worse data shown above.

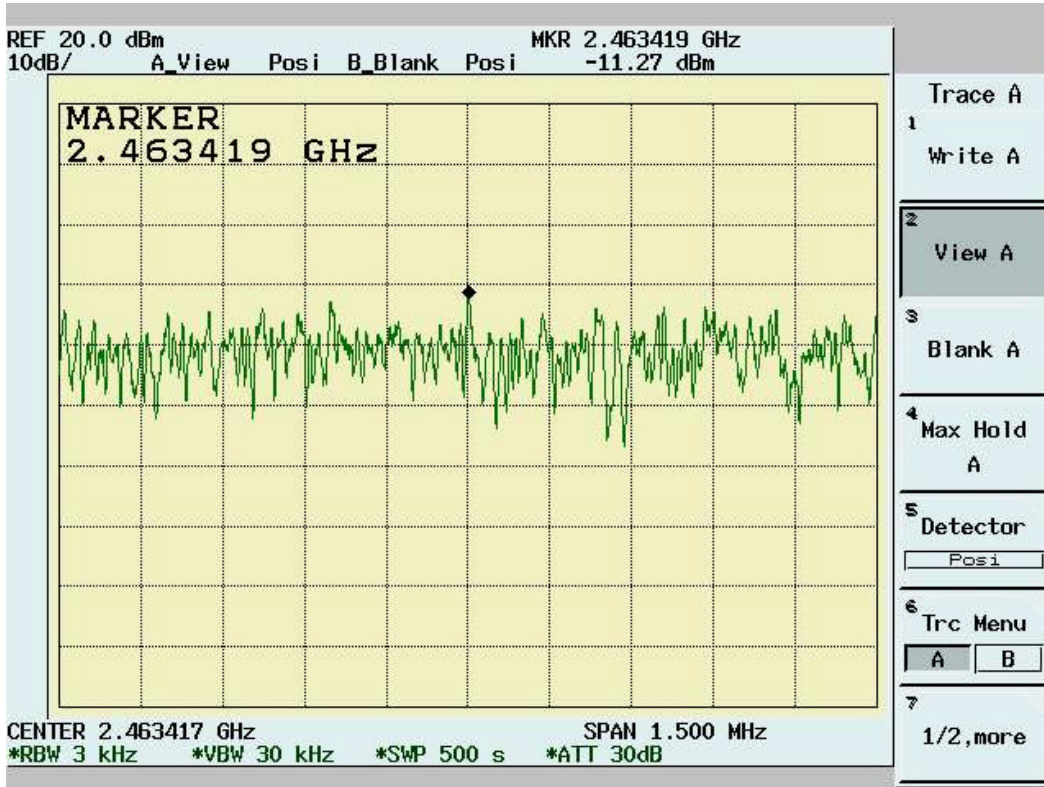
Channel 1



Channel 6



Channel 11



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 6dB 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 6dB 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

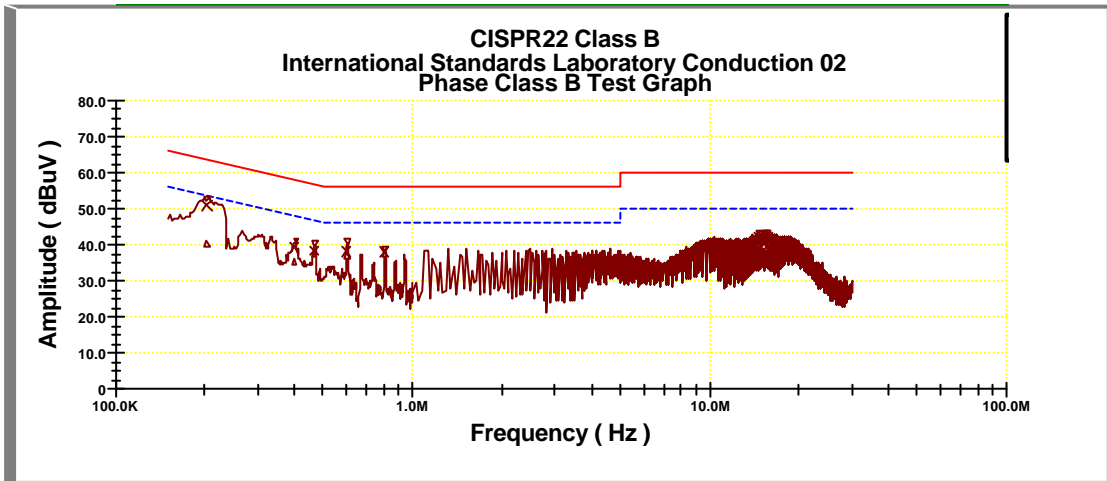
Operator: Jerry Chiou

Temperature (C): 25

Humidity (%): 58

04:47:02 PM, Wednesday, June 02, 2004

Frequency MHz	LISN Loss (dB)	Cable Loss (dB)	QP Corrct. Amp.(dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVE Corrct. Amp.(dBuV)	AVE Limit (dBuV)	AVE Margin (dB)
0.20306	0.10	0.02	50.83	64.48	-13.65	40.17	54.48	-14.31
0.39923	0.10	0.02	39.18	58.88	-19.69	35.18	48.88	-13.70
0.46673	0.11	0.03	38.27	56.95	-18.68	37.21	46.95	-9.74
0.59941	0.13	0.04	38.14	56.00	-17.86	36.80	46.00	-9.20
0.80038	0.17	0.05	37.98	56.00	-18.02	37.35	46.00	-8.65
14.5244	0.39	0.29	41.94	60.00	-18.06	39.70	50.00	-10.30
15.1879	0.42	0.30	41.90	60.00	-18.10	39.52	50.00	-10.48
15.3866	0.43	0.30	41.40	60.00	-18.60	39.12	50.00	-10.88
15.5213	0.44	0.30	42.11	60.00	-17.89	40.19	50.00	-9.81
15.7207	0.46	0.29	42.13	60.00	-17.87	40.24	50.00	-9.76



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

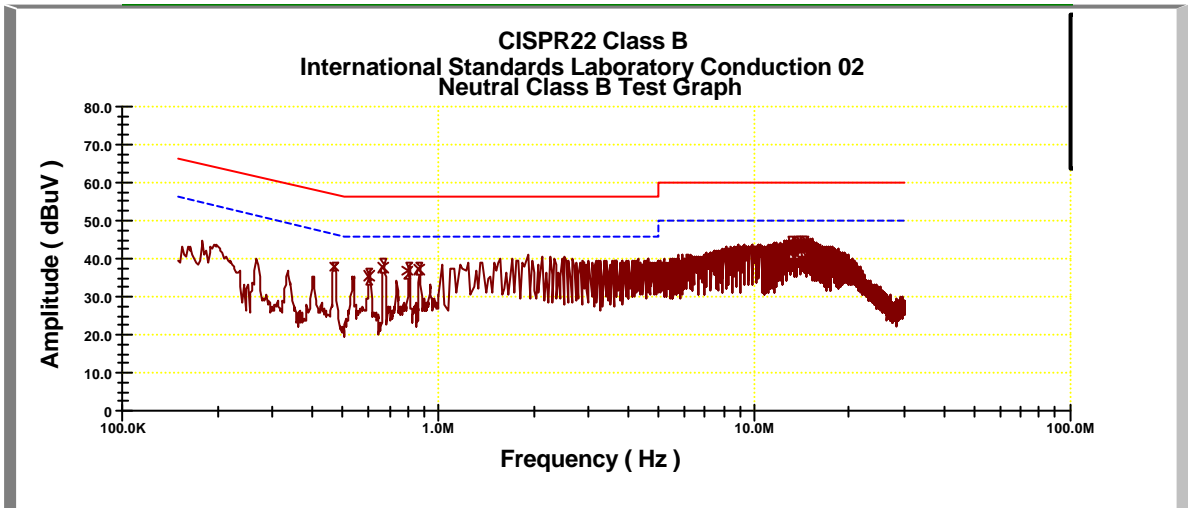
Operator: Jerry Chiou

Temperature (C): 25

Humidity (%): 58

04:34:06 PM, Wednesday, June 02, 2004

Frequency	LISN Loss	Cable Loss	QP Correc.	QP Limit	QP Margin	AVE Correc.	AVE Limit	AVE Margin
MHz	(dB)	(dB)	Amp.(dBuV)	(dBuV)	(dB)	Amp.(dBuV)	(dBuV)	(dB)
0.46848	0.11	0.03	37.92	56.90	-18.98	37.16	46.90	-9.74
0.60143	0.13	0.04	35.36	56.00	-20.64	33.46	46.00	-12.54
0.66698	0.14	0.04	37.77	56.00	-18.23	36.96	46.00	-9.04
0.8001	0.17	0.05	36.86	56.00	-19.14	35.05	46.00	-10.95
0.86698	0.18	0.06	37.28	56.00	-18.72	36.37	46.00	-9.63
13.0697	0.12	0.25	43.61	60.00	-16.39	40.66	50.00	-9.34
13.6712	0.11	0.27	43.60	60.00	-16.40	40.31	50.00	-9.69
13.9365	0.11	0.27	44.03	60.00	-15.97	41.24	50.00	-8.76
14.2685	0.11	0.28	43.86	60.00	-16.14	41.22	50.00	-8.78
14.4684	0.10	0.29	43.77	60.00	-16.23	41.57	50.00	-8.43



* 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

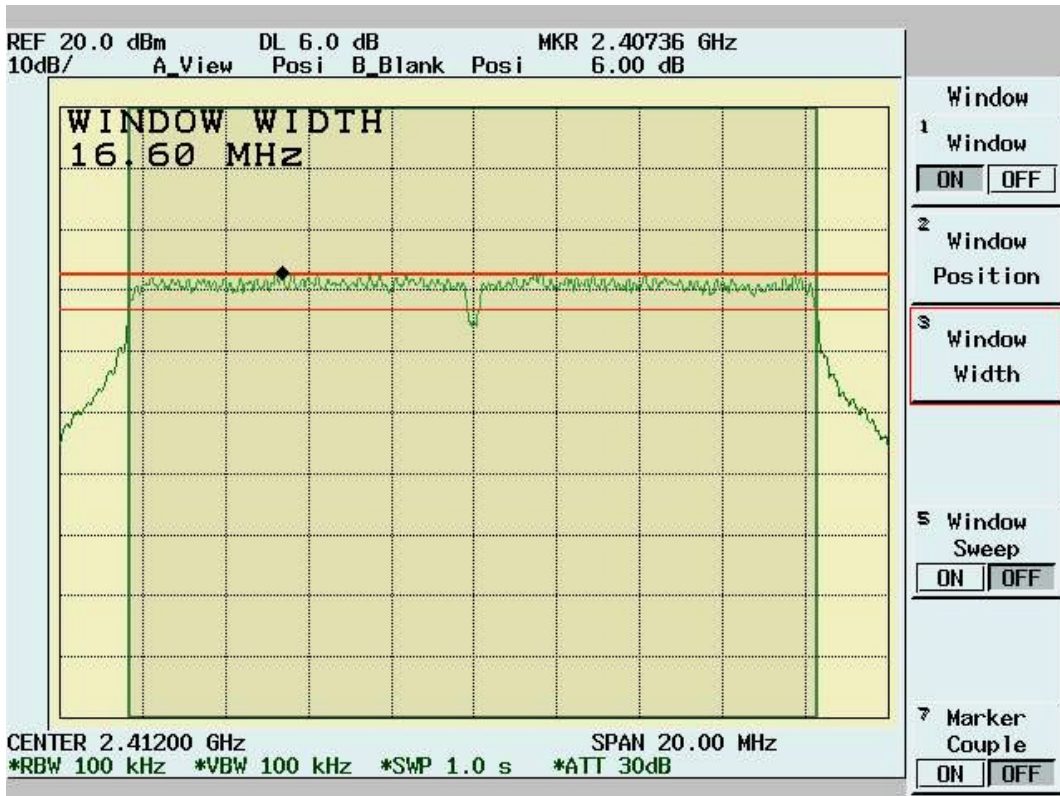
Temp. (deg. C): 26

Humidity (%): 47

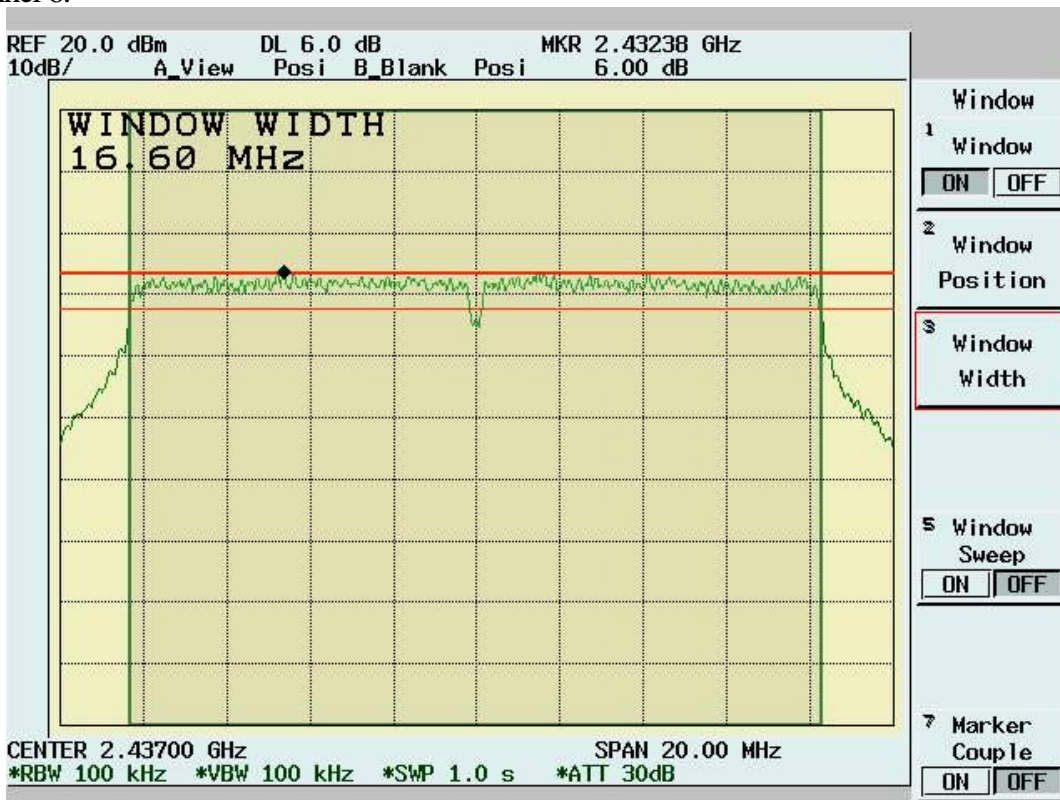
Test Engr: Jerry Chiou

Chennel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	16.6	0.5	Pass
6	2437	16.6	0.5	Pass
11	2462	16.6	0.5	Pass

Channel 1:



Channel 6:



Channel 11:



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

Temp. (deg. C): 25

Test Engr: Jerry Chiou

Humidity (%): 50

Channel	Frequency (Mhz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	17.437	1.1	71.40	18.537	30	Pass
6	2437	17.843	1.1	78.40	18.943	30	Pass
11	2462	17.937	1.1	80.11	19.037	30	Pass

Note: Two RF output(MAIN & AUX) have been test,the worse data shown above.

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 2nd to 10th 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

Operator: Jerry Chiou
 Temperature (C): 23
 Humidity (%): 49

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
99.84	26.17	10.47	3.02	0.00	39.65	43.50	-3.85	200.00	320.00
132.82	16.79	11.25	3.52	0.00	31.55	43.50	-11.95	250.00	140.00
198.78	27.34	8.69	4.18	0.00	40.20	43.50	-3.30	250.00	173.00
298.69	21.16	12.57	4.69	0.00	38.43	46.00	-7.57	150.00	288.00
331.67	14.59	13.49	4.81	0.00	32.89	46.00	-13.11	150.00	304.00
365.62	18.06	14.50	5.08	0.00	37.64	46.00	-8.36	100.00	107.00
397.63	10.82	15.52	5.30	0.00	31.65	46.00	-14.35	250.00	107.00
431.58	17.24	15.92	5.61	0.00	38.76	46.00	-7.24	250.00	74.00
539.25	8.93	18.12	6.33	0.00	33.38	46.00	-12.62	150.00	189.00
829.28	4.82	20.02	7.97	0.00	32.81	46.00	-13.19	150.00	189.00

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

Operator: Jerry Chiou
 Temperature (C): 23
 Humidity (%): 49

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
99.84	23.62	10.47	3.02	0.00	37.11	43.50	-6.39	200.00	268.00
165.8	27.48	8.64	3.84	0.00	39.96	43.50	-3.54	100.00	105.00
198.78	14.83	8.69	4.18	0.00	27.69	43.50	-15.81	250.00	317.00
231.76	23.00	9.78	4.48	0.00	37.26	46.00	-8.74	150.00	333.00
365.62	9.61	14.50	5.08	0.00	29.19	46.00	-16.81	100.00	219.00
497.54	5.33	17.05	6.04	0.00	28.42	46.00	-17.58	250.00	350.00
564.47	3.33	18.37	6.57	0.00	28.27	46.00	-17.73	150.00	186.00
642.07	3.92	18.72	7.00	0.00	29.64	46.00	-16.36	100.00	301.00
652.74	7.35	18.81	7.05	0.00	33.21	46.00	-12.79	200.00	284.00
832.19	-0.09	20.03	7.99	0.00	27.92	46.00	-18.08	150.00	154.00

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

5.4.5 Test Data (1GHz – 25 GHz) .

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1794.21	51.35	29.27	2.00	46.21	36.41	54.00	-17.59	100	57
2443.56	49.94	30.91	2.74	46.21	37.38	54.00	-16.62	101	182
3422.58	47.67	31.44	2.19	46.64	34.66	54.00	-19.34	103	248
3758.74	44.81	31.86	2.12	46.37	32.43	54.00	-21.57	102	162
7227.77	35.80	39.46	3.15	46.21	32.20	54.00	-21.80	101	142
9709.29	30.59	40.44	3.14	41.90	32.28	54.00	-21.72	102	6

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1794.21	54.16	29.27	2.00	46.21	39.23	54.00	-14.77	100	57
2198.80	52.67	30.96	2.39	46.20	39.82	54.00	-14.18	101	105
2775.72	52.21	31.01	2.82	46.41	39.63	54.00	-14.37	102	287
3102.90	49.77	31.18	2.67	46.59	37.03	54.00	-16.97	103	331
4562.94	42.07	33.94	1.40	46.66	30.75	54.00	-23.25	101	44
9589.41	31.05	40.70	3.19	42.22	32.73	54.00	-21.27	102	8

Note:

“ * ”: Fundamental Frequency

“***”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“ pk ”: peak reading

“ av ”: average reading

“ --- ”: No meter reading data due to the emission level is smaller than spectrum noise level.

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1791.71	53.51	29.25	2.00	46.21	38.55	54.00	-15.45	100	57
2388.61	52.93	30.92	2.66	46.21	40.31	54.00	-13.69	101	165
3222.78	46.66	31.28	2.49	46.61	33.81	54.00	-20.19	103	300
3923.08	43.23	32.09	2.15	46.19	31.29	54.00	-22.71	102	120
8768.23	33.81	41.27	3.27	42.67	35.68	54.00	-18.32	102	74
9661.34	31.13	40.55	3.16	42.03	32.80	54.00	-21.20	102	7

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 23

Frequency	Rx_R.(pk)	Ant_F	Cab_L.	PreAmpl	Emission(pk)	Limit(av)	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
1791.71	57.10	29.25	2.00	46.21	42.14	54.00	-11.86	100	571
2540.96	48.56	30.92	2.82	46.24	36.06	54.00	-17.94	102	213
3758.74	48.71	31.86	2.12	46.37	36.32	54.00	-17.68	102	162
4087.41	41.57	32.46	2.04	46.20	29.88	54.00	-24.12	102	91
8516.48	33.82	41.67	3.37	42.48	36.38	54.00	-17.62	102	134
9865.13	29.84	40.10	3.09	41.49	31.54	54.00	-22.46	101	3

Note:

“ * ”: Fundamental Frequency

“**”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“pk”: peak reading

“av”: average reading

“--”: No meter reading data due to the emission level is smaller than spectrum noise level.

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.