

Test Report for FCC Part 15 Subpart B & C

of

Product Name

PDA with wireless LAN 802.11b and Bluetooth

Model

n300

(Brand: acer)

Applied by:

Acer Inc.
8F, 88, Sec. 1, Hsin Tai Wu Rd.,
Hsichih, Taipei Hs
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-05LR029FC

Issue Date: 2005/10/25

HC LAB:NVLAP:200234-0;VCCI: R-341,C-354;NEMKO:ELA 113a,113c;BSMI:SL2-IN-E-0037;SL2-R1-E-0037;CNLA:1178

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

Contents of Report

1.	General	1
1.1	Certification of Accuracy of Test Data	1
2.	Test Results Summary	2
3.	Description of Equipment Under Test (EUT)	3
4.	TEST RESULTS (802.11b)	5
4.1	Powerline Conducted Emissions [Section 15.207]	5
4.1.1	EUT Configuration	5
4.1.2	Test Procedure	5
4.1.3	EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)	5
4.1.4	Test Data:	6
4.2	Bandwidth for DSSS [Section 15.247 (a)(2)]	8
4.2.1	Test Procedure	8
4.2.2	Test Setup	8
4.2.3	Test Data:	8
4.3	DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]	11
4.3.1	Test Procedure	11
4.3.2	Test Setup	11
4.3.3	Test Data	11
4.4	Radiated Emission Measurement [Section [15.247(c)(4)]	12
4.4.1	EUT Configuration	12
4.4.2	Test Procedure	12
4.4.3	EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)	12
4.4.4	Test Data (30MHz – 1GHz):	13
4.4.5	Test Data (1GHz – 25 GHz)	14
4.5	Band Edge Measurement	17
4.5.1	Test Procedure (Conducted)	17
4.5.2	Test Setup (Conducted)	17
4.5.3	Test Data:	17
4.5.4	Test Procedure (Radiated)	19
4.5.5	Test Setup (Radiated)	19
4.5.6	Test Data	20
4.6	RF Exposure Measurement [Section 15.247(b)(4) & 1.1307(b)]	23
4.7	DSSS Peak Power Spectral Density [Section 15.247(d)]	24
4.7.1	Test Procedure	24
4.7.2	Test Setup	24
4.7.3	Test Data	24
5.	TEST RESULTS (Bluetooth)	27
5.1	Powerline Conducted Emissions	27
5.1.1	EUT Configuration	27
5.1.2	Test Procedure	27
5.1.3	EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)	27
5.1.4	Test Data:	28
5.2	FHSS Maximum Peak Output Power	30
5.2.1	Test Procedure	30
5.2.2	Test Setup	30
5.2.3	Test Data	30

5.3	Radiated Emission Measurement	32
5.3.1	EUT Configuration	32
5.3.2	Test Procedure	32
5.3.3	EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested).....	32
5.3.4	Test Data (30MHz – 1GHz):	33
5.3.5	Test Data (1GHz – 25 GHz)	34
5.4	Band Edge Measurement.....	37
5.4.1	Test Procedure (Conducted)	37
5.4.2	Test Setup (Conducted)	37
5.4.3	Test Data:.....	37
5.4.4	Test Procedure (Radiated)	39
5.4.5	Test Setup (Radiated)	39
5.4.6	Test Data.....	40
5.5	Bandwidth & Hopping Channel Separation	43
5.5.1	Standard Applicable.....	43
5.5.2	Test Procedure	43
5.5.3	Test Setup	43
5.5.4	Test Data.....	44
5.6	Number of Hopping Frequency Used.....	48
5.6.1	Test Procedure	48
5.6.2	Test Setup	48
5.6.3	Test Data.....	48
5.7	Dwell Time	50
5.7.1	Test Procedure	50
5.7.2	Test Setup	50
5.7.3	Test Data.....	51
6.	Appendix	57
6.1	Appendix A: Measurement Procedure for Power line Conducted Emissions.....	57
6.2	Appendix B: Test Procedure for Radiated Emissions	58
6.3	Appendix C: Test Equipment	59
6.3.1	Test Equipment List.....	59
6.3.2	Software for Controlling Spectrum/Receiver and Calculating Test Data	59
6.4	Appendix D: Layout of EUT and Support Equipment	60
6.4.1	General Conducted Test Configuration	60
6.4.2	General Radiation Test Configuration	61
6.5	Appendix E: Description of Support Equipment.....	62
6.5.1	Description of Support Equipment	62
6.5.2	Software for Controlling Support Unit	62
6.5.3	I/O Cable Condition of EUT and Support Units.....	62
6.6	Appendix F: Accuracy of Measurement.....	63
6.7	Appendix G: Photographs of EUT Configuration Test Set Up	65
6.8	Appendix H: Antenna Spec.	68

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 C63.4:2003

Equipment Tested: PDA with wireless LAN 802.11b and Bluetooth

Model: n300

Applied by: Acer Inc.

Sample received Date: 2005/10/17

Final test Date : 2005/10/18

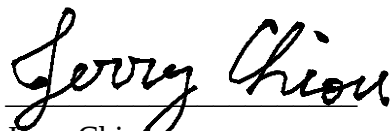
Test Result PASS

Test Site: Chamber 02, Conduction 02

Temperature Refer to each site test data

Humidity: Refer to each site test data

Test Engineer:


Jerry Chion

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 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 71 pages, including 1 cover page, 2 contents page, and 68 pages for the test description. This report must not be used 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	SAR report attached
15.247 (d)	Power Spectral Density	Pass	

The Bluetooth 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(a)	AC Power Line Emissions	Pass	
15.247(b) (1)	Max. Peak Output Power	Pass	
15.209(a)	Radiated Emissions 30MHz – 25 GHz	Pass	
15.247 (c)	Band Edge Measurement	Pass	
15.247(a)(1)(iii)	Number of Hopping Frequency Used	Pass	
15.247(a) (1)(ii)	Spectrum Bandwidth Of FHSS device	Pass	
15.247(a)(1)	Hopping Channel Separation	Pass	
15.247(a)(1)(iii)	Dwell Time	Pass	

3. Description of Equipment Under Test (EUT)

EUT

Description:	PDA with wireless LAN 802.11b and Bluetooth
Condition:	Pre-Production
Model:	n300
FCC ID:	HLZN300
Serial Number:	N/A
Brand:	acer
WLAN Module:	Samsung(Model: SWL-2455C)
Bluetooth chipset :	Murata(Model:LBMA477BK2)
Frequency Range WLAN/Bluetooth:	2400 - 2483.5 MHz
Support channel:	
802.11b	11 Channels
Bluetooth	79 Channels
Modulation Skill:	
802.11b	DBPSK(1Mbps), DQPSK(2Mbps), CCK(5.5/11Mbps)
Bluetooth	GFSK (1Mbps)
Antennas Type:	
802.11b	PIFA in Metal,made by WHA YU Industrial Co.,LTD. P/N: 20-01143-00A
Bluetooth	PIFA in Metal,made by WHA YU Industrial Co.,LTD. P/N: 20-01110-00A
Antenna Connected:	Mounted on the PCB. The user is not possible to change the antenna without disassembling the EUT.
Antenna peak Gain:	
802.11b	-0.71 dBi
Bluetooth	-0.16 dBi
Power Type of WLAN module:	3.3V DC from internal battery or AC adapter.
Power Type of BT chipset:	3.3V DC from internal battery or AC adapter.

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

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	2402	01	2403
02	2404	03	2405
04	2406	05	2407
.....			
75	2477	76	2478
77	2479	78	2480

AC ADAPTER:	YHi(Model:777-052000S-UF) or HJC(Model:HAPU05B2)
CPU	Samsung S3C2440 processor at 400 MHz
SDRAM	Infineon (Model:HYB39L256160AC_7.5) 64 MB mobile SDRAM
Battery	Welldone(Model:E4LI031202B11)1200mAH or C-Tech(Model:VA41021910)1200mAH.
LCD Panel	Sharp(Model:LS037V7DD05) 3.7" high-brightness transfective TFT LCD
Earphone Port	one
SD / MMC Card Slot	one
Touch pen	one
Power Key	one
Hold Key	one
Function Key	one
Reset Key	one
Docking port	one 26 pin
Maximum display Resolution	480 x 640 (VGA) resolution

EMI Noise Source:

Crystal : Y1(32.768KHz) , Y2(16.9344MHz) , Y3(15.36MHz) , Y4(32.768KHz) ,
X5(3.6864MHz)

EMI Solution:

- 1.add one gasket on bluetooth module contact to LCD back shell .
- 2.add one cooper foil in SD / MMC Card Slot.
- 3.add one aluminum foil on back case .
- 4.add one ferrite on USB cable .
- 5.add one ferrite on Power cable (YHi, Model:777-052000S-UF) .
- 6.add one ferrite on Power cable (HJC, Model:HAPU05B2).

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 used.

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)

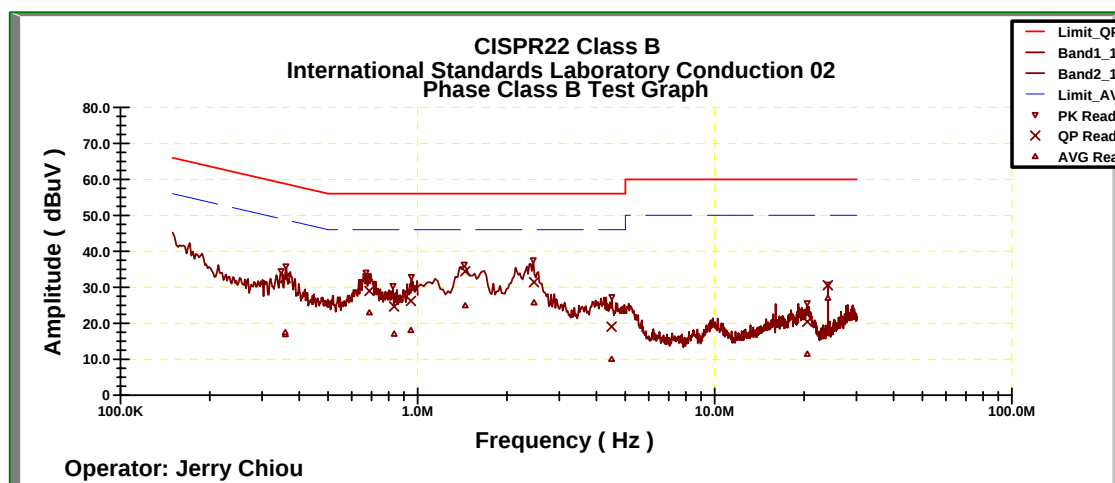
Frequency Range	150 KHz--30MHz
Detector Function	Quasi-Peak/Average
Bandwidth (RBW)	9KHz

4.1.4 Test Data:

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

Operator: Jerry Chiou
Temperature (C): 27
Humidity (%): 53

Frequency	LISN Loss	Cable Loss	QP Corrt.	QP Limit	QP Margin	AVE Corrt.	AVE Limit	AVE Margin
MHz	(dB)	(dB)	Amp.(dBuV)	(dBuV)	(dB)	Amp.(dBuV)	(dBuV)	(dB)
0.35881	0.18	0.09	32.79	60.03	-27.24	17.43	50.03	-32.61
0.35918	0.18	0.09	32.52	60.02	-27.50	16.88	50.02	-33.15
0.68856	0.20	0.07	28.95	56.00	-27.05	22.93	46.00	-23.07
0.83415	0.20	0.07	24.64	56.00	-31.36	16.99	46.00	-29.01
0.94966	0.20	0.07	26.22	56.00	-29.78	18.01	46.00	-27.99
1.44633	0.24	0.08	34.44	56.00	-21.56	24.88	46.00	-21.12
2.46493	0.32	0.10	31.39	56.00	-24.61	25.71	46.00	-20.29
4.49442	0.40	0.15	19.04	56.00	-36.96	9.98	46.00	-36.02
20.466	0.81	0.34	20.40	60.00	-39.60	11.44	50.00	-38.56
24.002	0.88	0.33	30.55	60.00	-29.45	26.97	50.00	-23.03



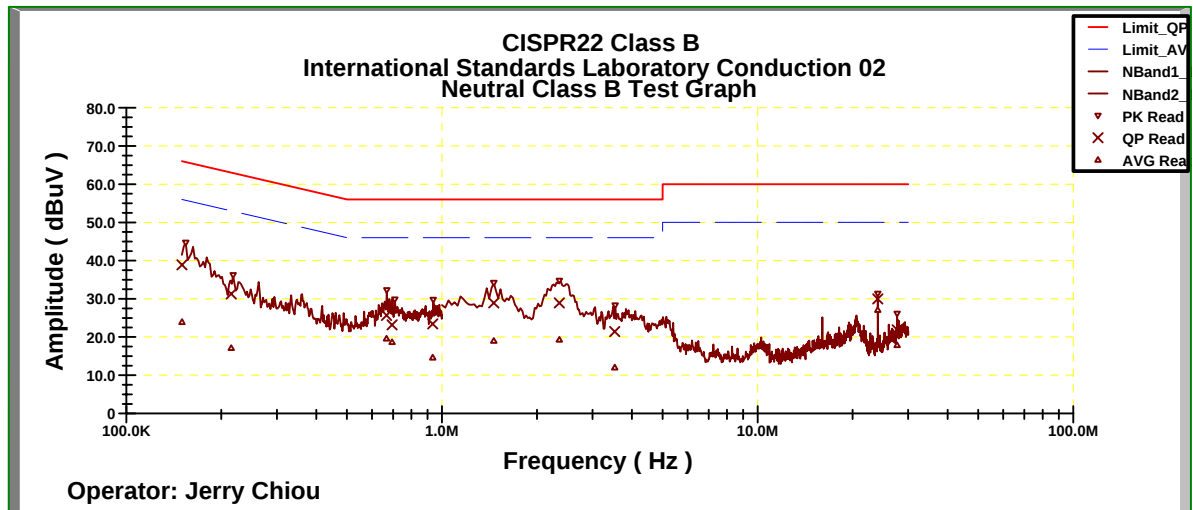
Power Line Conducted Emissions (Neutral) Channel 1, 6, 11

Operator: Jerry Chiou

Temperature (C): 27

Humidity (%): 53

Frequency	LISN Loss	Cable Loss	QP Corrt.	QP Limit	QP Margin	AVE Corrt.	AVE Limit	AVE Margin
MHz	(dB)	(dB)	Amp.(dBuV)	(dBuV)	(dB)	Amp.(dBuV)	(dBuV)	(dB)
0.150103	0.40	0.02	38.87	66.00	-27.13	23.90	56.00	-32.10
0.21501	0.40	0.05	31.25	64.14	-32.89	17.10	54.14	-37.04
0.66708	0.40	0.07	25.67	56.00	-30.33	19.55	46.00	-26.45
0.69471	0.40	0.07	23.15	56.00	-32.85	18.63	46.00	-27.37
0.93425	0.40	0.07	23.42	56.00	-32.58	14.61	46.00	-31.39
1.45879	0.50	0.08	28.90	56.00	-27.10	18.99	46.00	-27.01
2.35341	0.50	0.10	28.91	56.00	-27.09	19.28	46.00	-26.72
3.52588	0.50	0.13	21.39	56.00	-34.61	12.01	46.00	-33.99
24.0032	0.42	0.33	29.95	60.00	-30.05	27.07	50.00	-22.93
27.6485	0.40	0.35	21.88	60.00	-38.12	17.84	50.00	-32.16



* 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

Test Engineer: Jerry Chiou

Temperature (): 27

Tx Data Rate=1Mbps

Humidity (%): 55

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
1	2412	10.20	0.5	Pass
6	2437	10.16	0.5	Pass
11	2462	10.16	0.5	Pass

Channel 1:



Channel 6:



Channel 11:

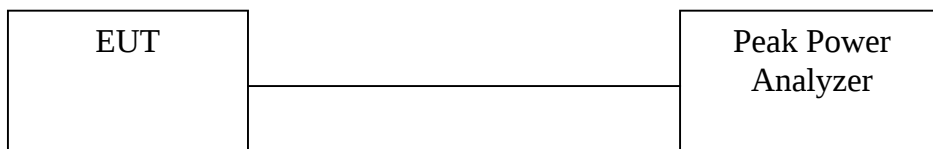


4.3 DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]

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

Test Engineer: Jerry
Chiou

Temperature (): 27

Tx Data Rate=1Mbps

Humidity (%): 55

Channel	Frequency (Mhz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
1	2412	15.48	0.66	41.11	16.14	30	Pass
6	2437	16.30	0.66	49.66	16.96	30	Pass
11	2462	16.62	0.66	53.46	17.28	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 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)	3MHz
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 (%): 54

Frequency	Rx Amp.	Ant Fact	CableLoss	PreAmpGain	Corrct. Emi.	Limit	Margin	Ant. Pos.	Table Pos.
MHz	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg)
67.83	15.91	5.40	1.44	0.00	22.75	40.00	-17.25	102.00	39.00
81.41	15.76	6.84	1.66	0.00	24.26	40.00	-15.74	102.00	300.00
106.63	12.01	11.10	1.99	0.00	25.10	43.50	-18.40	102.00	23.00
383.08	8.52	16.00	4.32	0.00	28.85	46.00	-17.15	102.00	23.00
388.9	7.83	15.97	4.36	0.00	28.16	46.00	-17.84	102.00	23.00
400.54	7.11	15.90	4.44	0.00	27.46	46.00	-18.54	102.00	39.00
406.36	7.18	15.94	4.48	0.00	27.60	46.00	-18.40	196.00	136.00
490.75	3.98	17.18	5.19	0.00	26.34	46.00	-19.66	102.00	39.00
676.99	0.37	19.00	6.47	0.00	25.85	46.00	-20.15	102.00	267.00
799.21	2.05	20.10	7.36	0.00	29.51	46.00	-16.49	102.00	153.00
846.74	1.89	20.57	7.74	0.00	30.20	46.00	-15.80	102.00	186.00
943.74	1.16	21.21	8.40	0.00	30.78	46.00	-15.22	102.00	88.00

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

Operator: Jerry Chiou
Temperature (C): 23
Humidity (%): 54

Frequency	Rx Amp.	Ant Fact	CableLoss	PreAmpGain	Corrct. Emi.	Limit	Margin	Ant. Pos.	Table Pos.
MHz	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg)
52.31	13.09	7.01	1.24	0.00	21.35	40.00	-18.65	102.00	169.00
67.83	18.43	5.40	1.44	0.00	25.27	40.00	-14.73	102.00	39.00
77.53	16.77	6.30	1.63	0.00	24.70	40.00	-15.30	102.00	55.00
106.63	14.62	11.10	1.99	0.00	27.71	43.50	-15.79	102.00	23.00
388.9	9.01	15.97	4.36	0.00	29.34	46.00	-16.66	102.00	23.00
406.36	5.99	15.94	4.48	0.00	26.41	46.00	-19.59	196.00	136.00
474.26	4.21	16.78	5.01	0.00	26.00	46.00	-20.00	102.00	55.00
490.75	4.48	17.18	5.19	0.00	26.84	46.00	-19.16	102.00	39.00
558.65	3.51	18.62	5.60	0.00	27.72	46.00	-18.28	102.00	137.00
582.9	0.96	18.67	5.76	0.00	25.39	46.00	-20.61	196.00	251.00
773.02	0.21	20.15	7.11	0.00	27.47	46.00	-18.53	102.00	316.00
901.06	1.10	20.61	8.09	0.00	29.80	46.00	-16.20	102.00	23.00

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

International Standards Laboratory

Report Number: 05LR029FC

HC LAB:NVLAP:200234-0;VCCI: R-341,C-354;NEMKO:ELA 113a,113c;BSMI:SL2-IN-E-0037;SL2-R1-E-0037;CNLA:1178

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

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): 27

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
1464.54	54.08 pk	26.64	2.23	34.18	48.76 pk	54.00 av	-5.24	101	80
4823.99	63.48 pk	34.93	2.12	37.72	62.82 pk	74.00 pk	-11.18	100.00	82.00
4823.99	49.58 av	34.93	2.12	37.72	48.91 av	54.00 av	-5.09	100.00	82.00
9648.05	48.73 pk	40.57	3.25	34.33	58.22 pk	74.00 pk	-15.78	100.00	60.00
9648.05	32.17 av	40.57	3.25	34.33	41.66 av	54.00 av	-12.34	100.00	60.00

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 27

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
1464.54	48.73 pk	26.64	2.23	34.18	43.42 pk	54.00 av	-10.58	101	80
4824.01	60.16 pk	34.93	2.12	37.72	59.50 pk	74.00 pk	-14.50	100.00	45.00
4824.01	46.72 av	34.93	2.12	37.72	46.05 av	54.00 av	-7.95	100.00	45.00
9647.97	47.83 pk	40.57	3.25	34.33	57.32 pk	74.00 pk	-16.68	100.00	96.00
9647.97	30.22 av	40.57	3.25	34.33	39.71 av	54.00 av	-14.29	100.00	96.00

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: 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): 27

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
1197.3	55.16 pk	25.41	2.19	34.04	48.72 pk	54.00 av	-5.28	102	98
4874.07	62.21 pk	35.12	2.14	37.77	61.70 pk	74.00 pk	-12.30	100.00	64.00
4874.07	48.25 av	35.12	2.14	37.77	47.74 av	54.00 av	-6.26	100.00	64.00
9748.07	47.55 pk	40.35	3.30	34.37	56.83 pk	74.00 pk	-17.17	100.00	360.00
9748.07	30.71 av	40.35	3.30	34.37	39.99 av	54.00 av	-14.01	100.00	360.00

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 27

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
1464.54	51.22 pk	26.64	2.23	34.18	45.90 pk	54.00 av	-8.10	101	80
4873.99	55.88 pk	35.12	2.14	37.77	55.37 pk	74.00 pk	-18.63	100.00	59.00
4873.99	40.63 av	35.12	2.14	37.77	40.12 av	54.00 av	-13.88	100.00	59.00
9747.99	47.43 pk	40.35	3.30	34.37	56.71 pk	74.00 pk	-17.29	100.00	64.00
9747.99	29.04 av	40.35	3.30	34.37	35.32 av	54.00 av	-6.68	100.00	64.00

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “***”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: 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): 27

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
1197.3	55.83 pk	25.41	2.19	34.04	49.39 pk	54.00 av	-4.61	102	98
4924.06	57.22 pk	35.31	2.15	37.83	56.86 pk	74.00 pk	-17.14	100.00	340.00
4924.06	42.45 av	35.31	2.15	37.83	42.08 av	54.00 av	-11.92	100.00	340.00
9847.98	47.82 pk	40.13	3.35	34.41	56.90 pk	74.00 pk	-17.10	100.00	17.00
9847.98	30.59 av	40.13	3.35	34.41	39.66 av	54.00 av	-14.34	100.00	17.00

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

Operator: Jerry Chiou

RBW: 1MHz
Humidity (%): 41
Temperature (C): 27

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
1841.66	49.13 pk	29.67	2.48	34.87	46.41 pk	54.00 av	-7.59	100	54
4924.08	57.56 pk	35.31	2.15	37.83	57.20 pk	74.00 pk	-16.80	100.00	44.00
4924.08	43.42 av	35.31	2.15	37.83	43.05 av	54.00 av	-10.95	100.00	44.00
9847.98	47.73 pk	40.13	3.35	34.41	56.81 pk	74.00 pk	-17.19	100.00	45.00
9847.98	29.85 av	40.13	3.35	34.41	38.92 av	54.00 av	-15.08	100.00	45.00

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: 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)

Test Engineer: Jerry Chiou

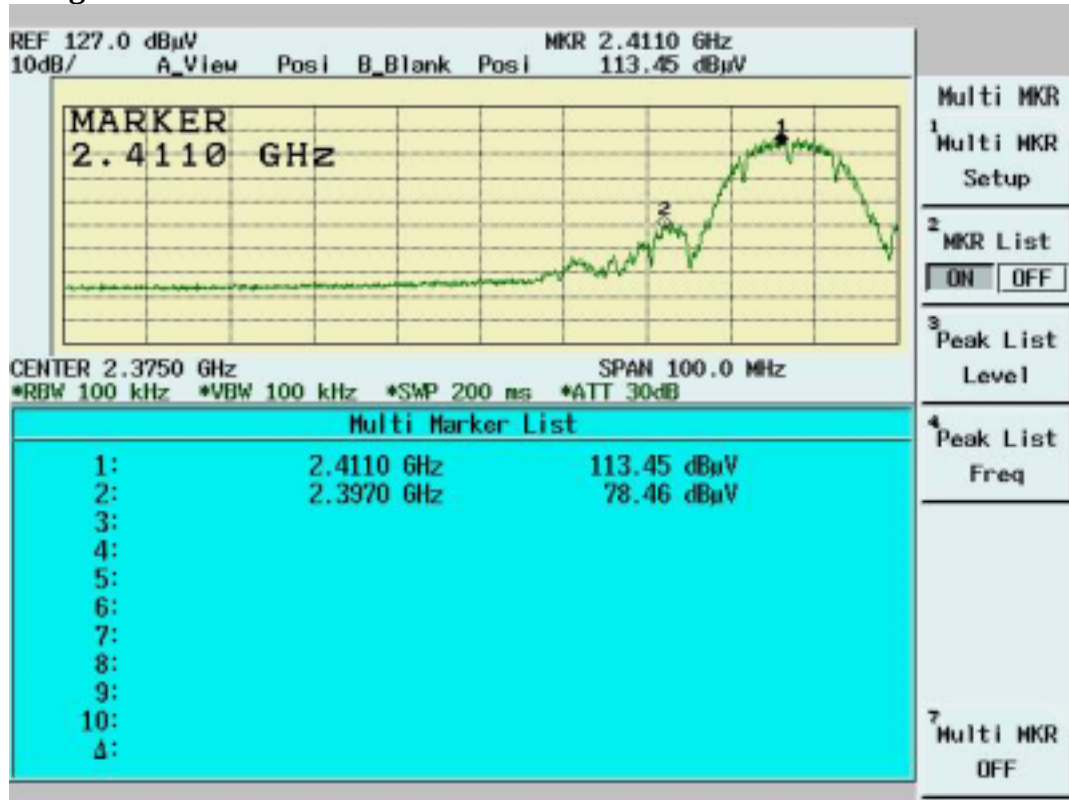
Temperature (): 27

Tx Data Rate=1Mbps

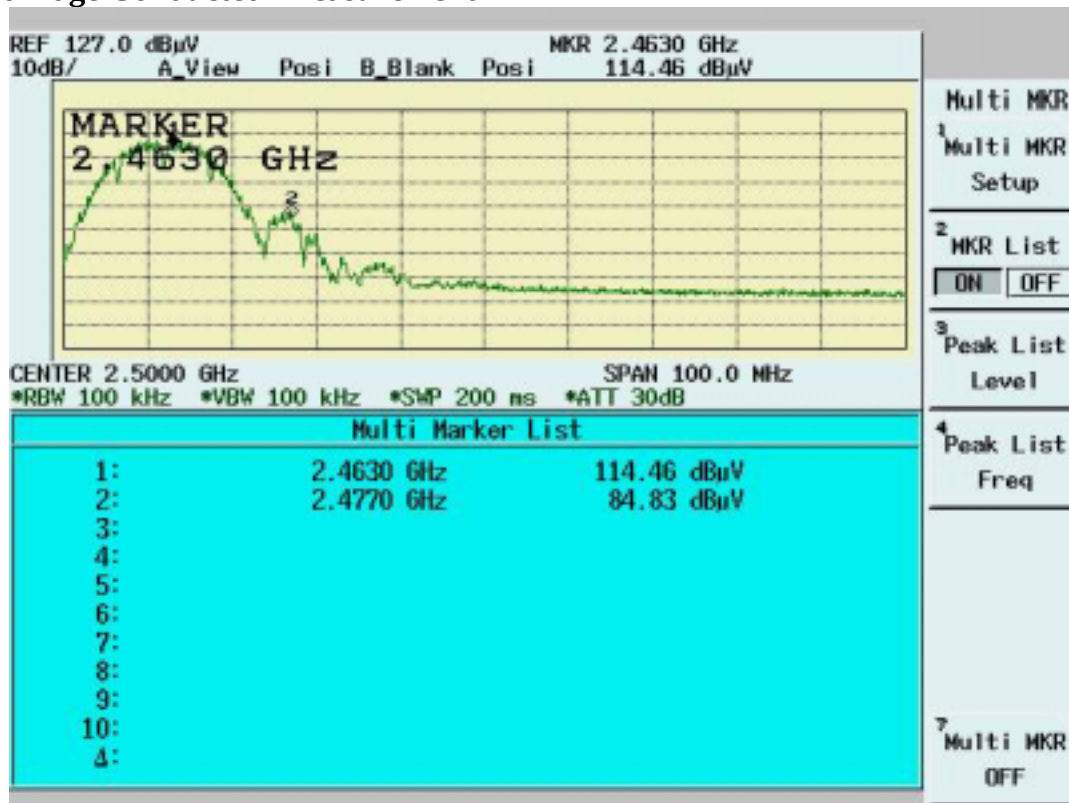
Humidity (%): 55

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Carrier - Outsideband Limit: >20dB (dB)	Pass/Fail
1	2411.0	113.45	---	---
Outside band	2397.0	78.46	34.99	Pass
11	2463.0	114.46	---	---
Outside band	2477.0	84.83	29.63	Pass

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: 3MHz
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)

Test Engineer: Jerry Chiou

Temperature (): 26

Tx Data Rate=1Mbps

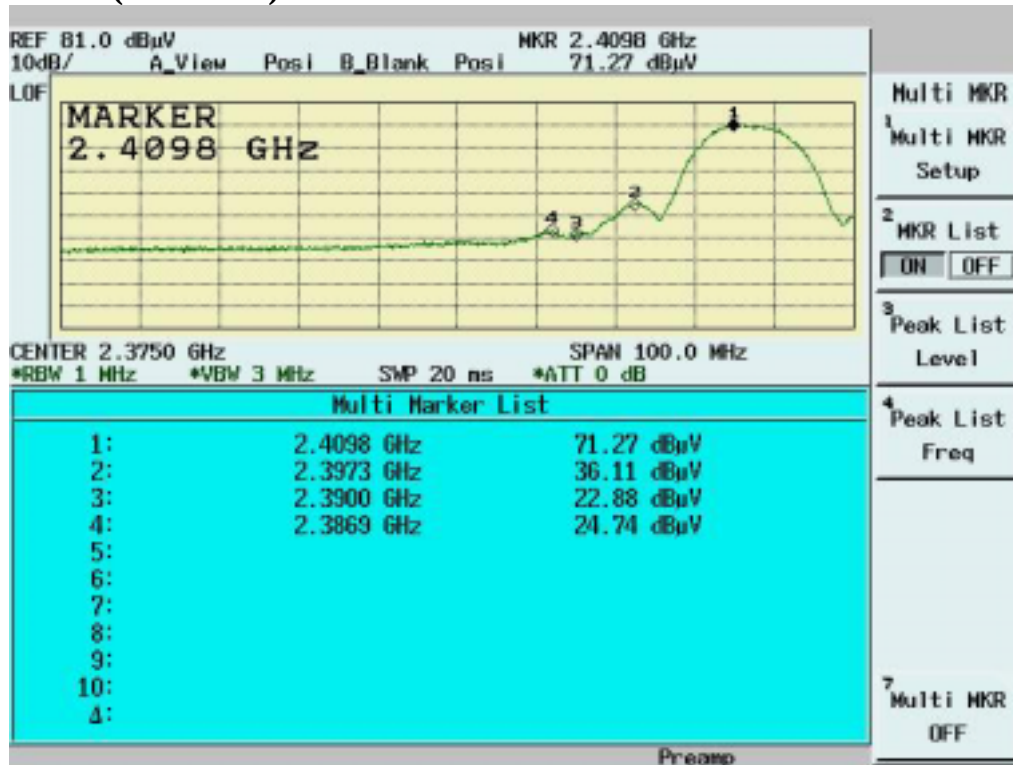
Humidity (%): 37

Description	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
Channel_1 (average mode)	2409.8	66.10	35.48	101.58	---	---	10Hz	---
Channel_1 (peak mode)	2409.8	71.27	35.48	106.75	---	---	3MHz	---
Outside band (peak mode)	2397.3	36.11	35.48	71.59	35.16	---	3MHz	Pass
Channel_11 (average mode)	2460.7	63.59	35.50	99.09	---	---	10Hz	---
Channel_11 (peak mode)	2462.9	68.29	35.50	103.79	---	---	3MHz	---
Outside band (peak mode)	2476.3	31.98	35.51	67.49	36.30	---	3MHz	Pass
Channel_1 Restricted band (peak mode)	2386.9	24.74	35.47	60.21	---	74	3MHz	Pass
Restricted band (average mode)	2386.3	13.63	35.47	49.10	---	54	10Hz	Pass
Channel_11 Restricted band (peak mode)	2485.8	20.95	35.51	56.46	---	74	3MHz	Pass
Restricted band (average mode)	2483.5	9.55	35.51	45.06	---	54	10Hz	Pass

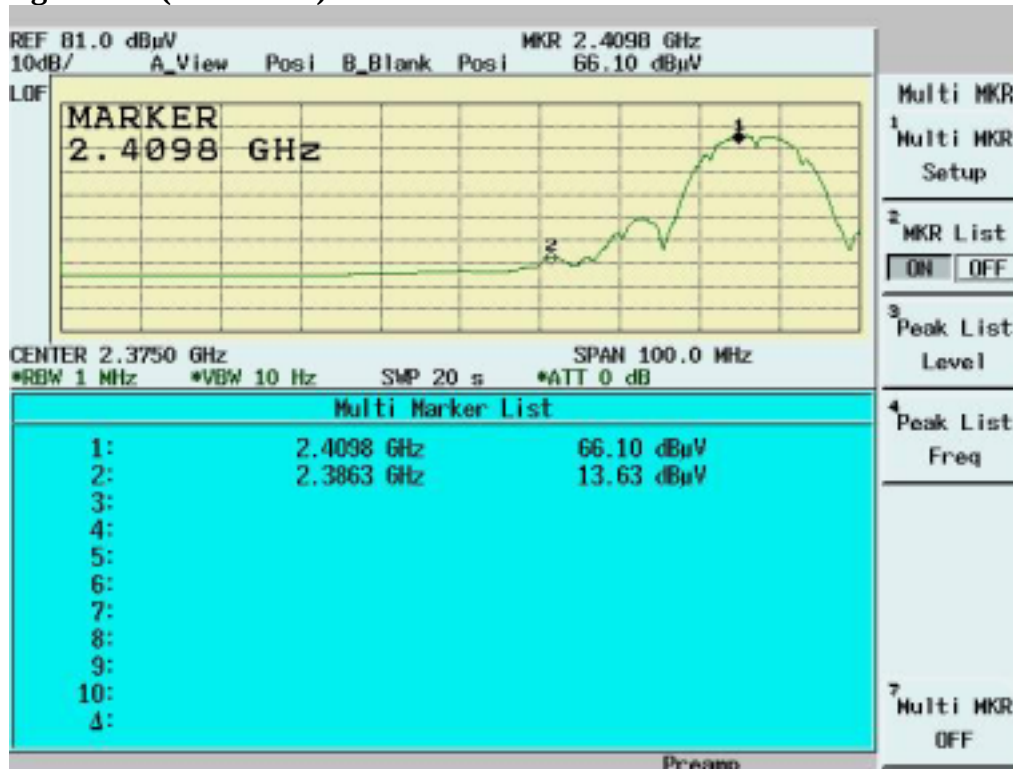
Note:

- 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 polarization have been tested and the worst data is listed above.

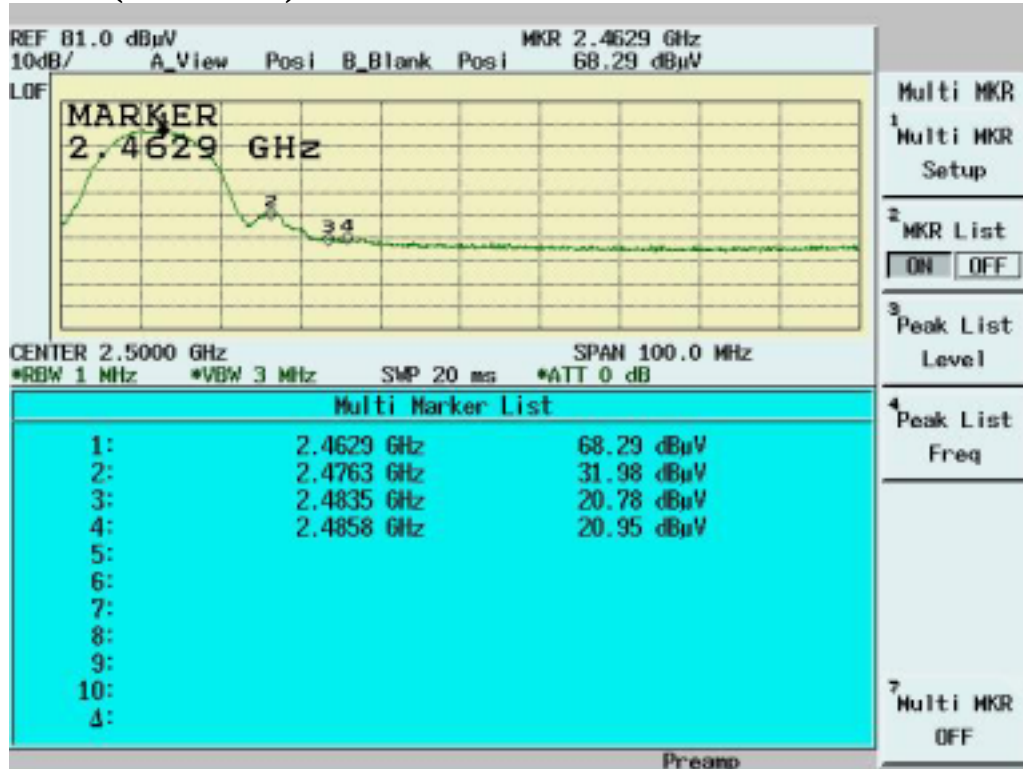
Band Edge measurement for radiated emission in Restricted Band(Radiated) Peak Mode (Channel 1)



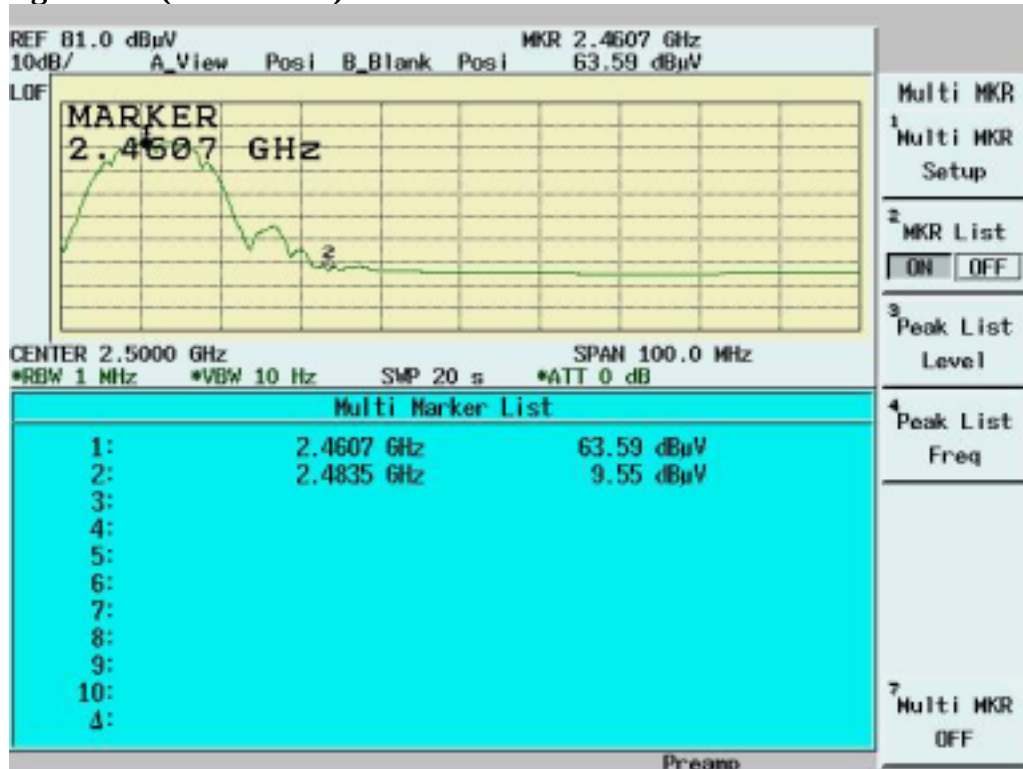
Band Edge measurement for radiated emission in Restricted Band(Radiated) Average Mode (Channel 1)



Band Edge measurement for radiated emission in Restricted Band(Radiated) Peak Mode (Channel 11)



Band Edge measurement for radiated emission in Restricted Band(Radiated) Average Mode (Channel 11)



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

See SAR 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

Test Engineer: Jerry
Chiou

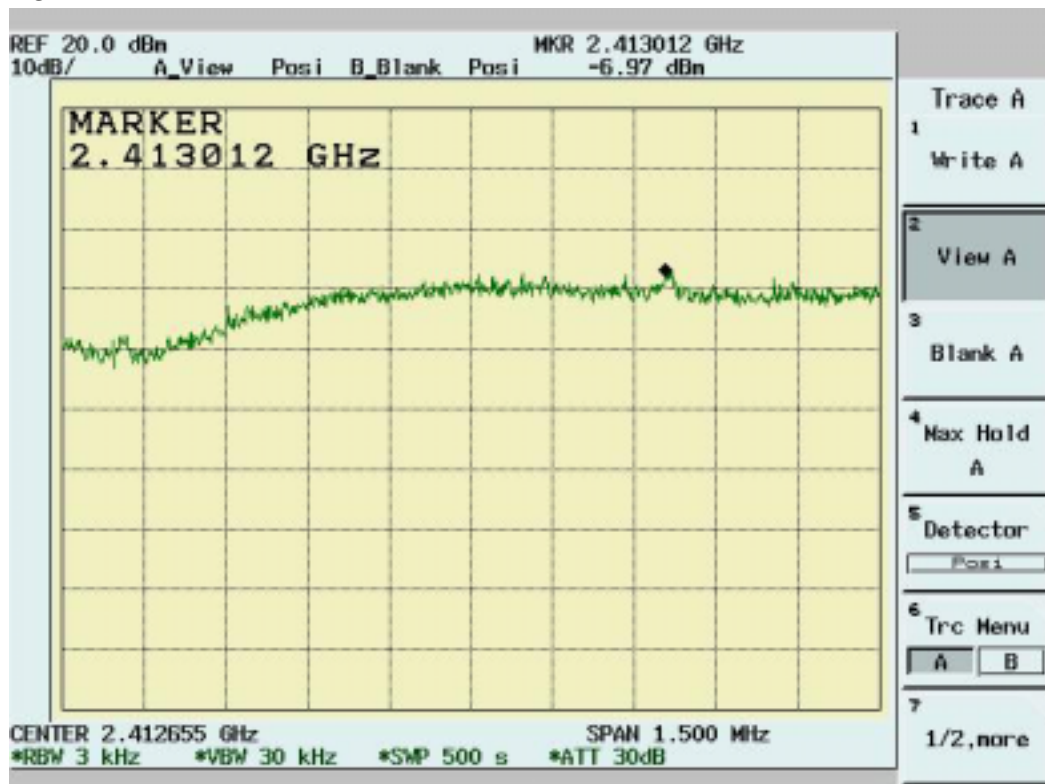
Temperature ():27

Tx Data Rate=1Mbps

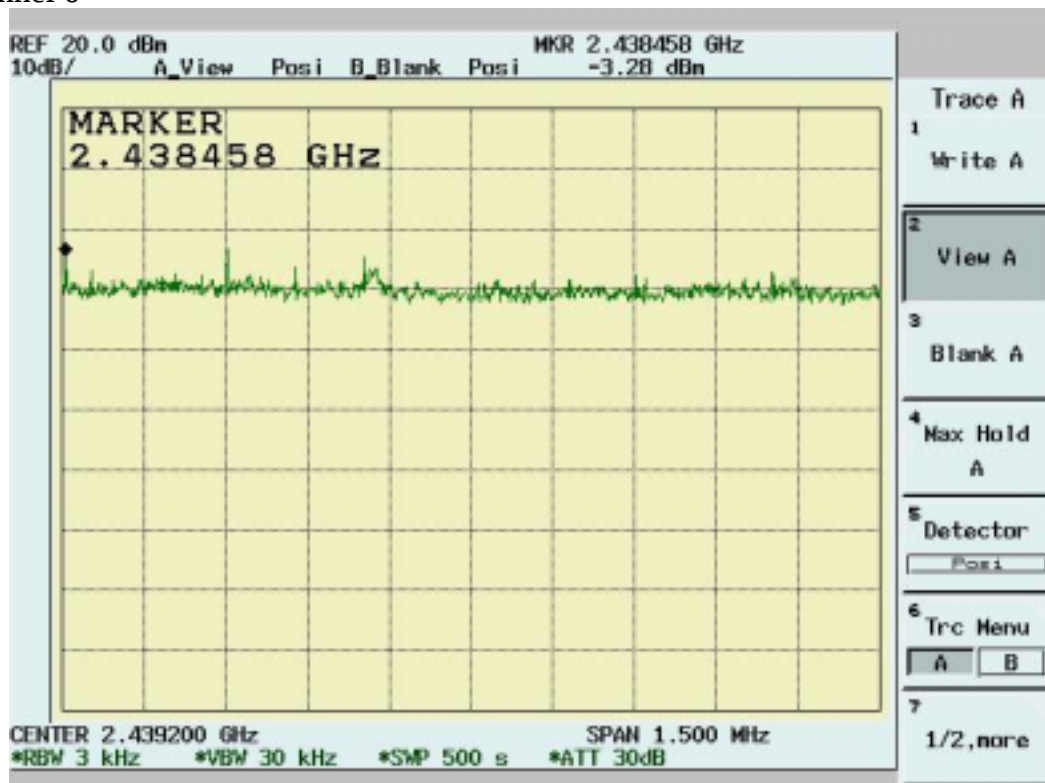
Humidity (%):55

Channel	Frequency (MHz)	Spectrum Reading (dBm/3KHz)	Cable Loss (dB)	Peak Power Output (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
1	2412	-6.97	0.66	-6.31	8	Pass
6	2437	-3.28	0.66	-2.62	8	Pass
11	2462	1.09	0.66	1.75	8	Pass

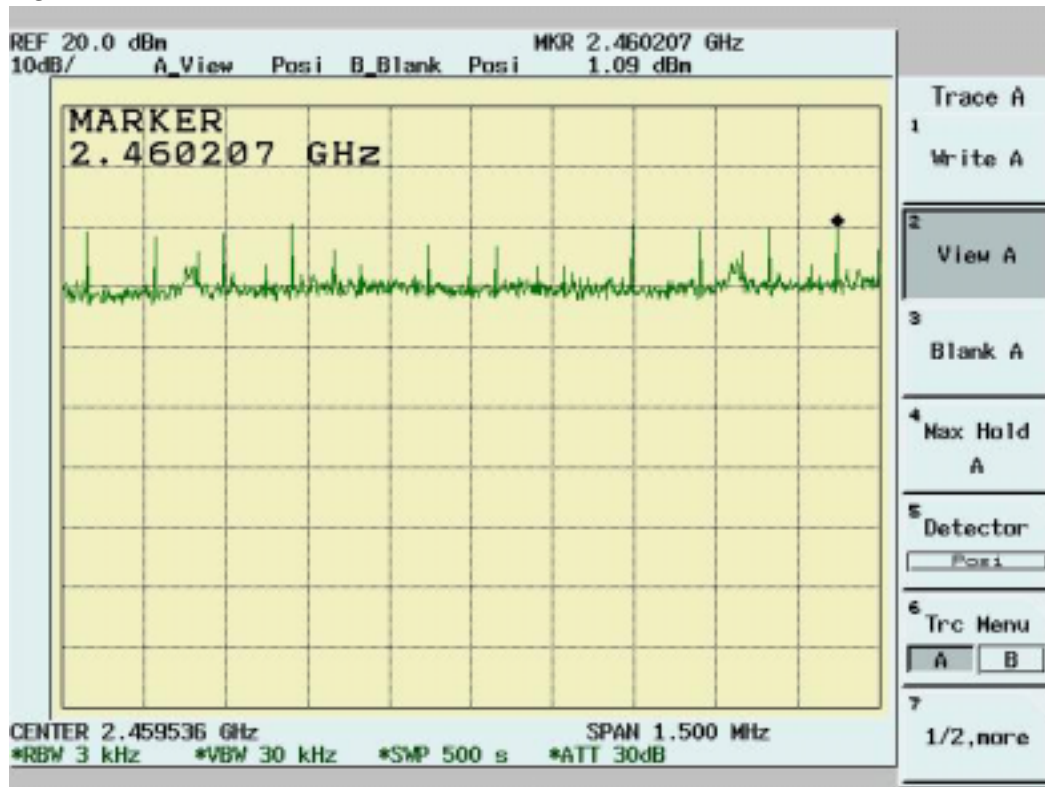
Channel 1



Channel 6



Channel 11



5. TEST RESULTS (Bluetooth)

5.1 Powerline Conducted Emissions

5.1.1 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 used.

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 00, 39, 78

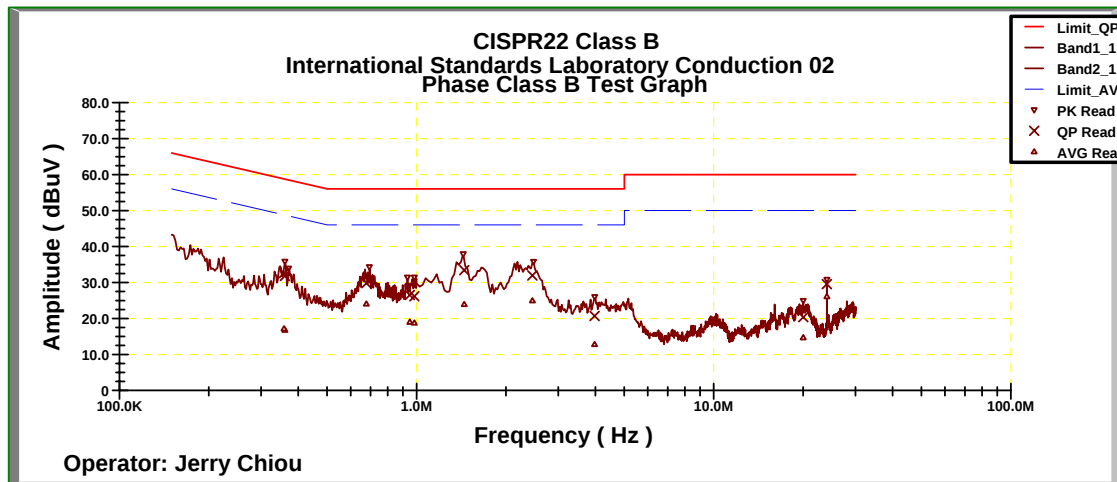
Operator: Jerry Chiou

Temperature (C): 27

06:56:04 PM, Friday, October 14, 2005

Humidity (%): 53

Frequency	LISN Loss	Cable Loss	QP Corrt.	QP Limit	QP Margin	AVE Corrt.	AVE Limit	AVE Margin
MHz	(dB)	(dB)	Amp.(dBuV)	(dBuV)	(dB)	Amp.(dBuV)	(dBuV)	(dB)
0.35803	0.18	0.09	32.59	60.06	-27.47	17.15	50.06	-32.91
0.36053	0.18	0.09	31.82	59.98	-28.16	16.77	49.98	-33.22
0.67758	0.20	0.07	29.80	56.00	-26.20	24.03	46.00	-21.97
0.94858	0.20	0.07	26.53	56.00	-29.47	18.98	46.00	-27.02
0.98293	0.20	0.07	26.14	56.00	-29.86	18.75	46.00	-27.25
1.44618	0.24	0.08	33.41	56.00	-22.59	23.92	46.00	-22.08
2.45272	0.32	0.10	31.92	56.00	-24.08	24.92	46.00	-21.08
3.96965	0.40	0.14	20.68	56.00	-35.32	12.79	46.00	-33.21
19.9991	0.80	0.34	20.34	60.00	-39.66	14.67	50.00	-35.33
24.0017	0.88	0.33	29.54	60.00	-30.46	26.11	50.00	-23.89



Power Line Conducted Emissions (Neutral) Channel 00, 39, 78

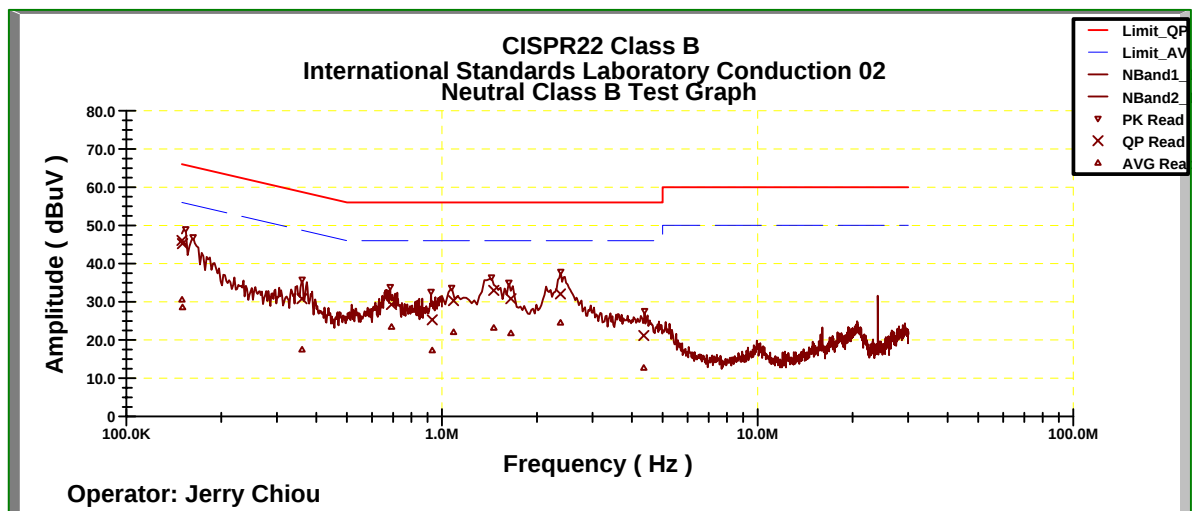
Operator: Jerry Chiou

Temperature (C): 27

06:48:05 PM, Friday, October 14, 2005

Humidity (%): 53

Frequency	LISN Loss	Cable Loss	QP Corrt.	QP Limit	QP Margin	AVE Corrt.	AVE Limit	AVE Margin
MHz	(dB)	(dB)	Amp.(dBuV)	(dBuV)	(dB)	Amp.(dBuV)	(dBuV)	(dB)
0.150132	0.40	0.02	46.04	66.00	-19.96	30.55	56.00	-25.45
0.150739	0.40	0.02	45.21	65.98	-20.77	28.53	55.98	-27.45
0.3603	0.40	0.09	30.78	59.99	-29.21	17.47	49.99	-32.52
0.69188	0.40	0.07	29.28	56.00	-26.72	23.41	46.00	-22.59
0.93116	0.40	0.07	25.29	56.00	-30.71	17.26	46.00	-28.74
1.08811	0.50	0.07	30.29	56.00	-25.71	22.03	46.00	-23.97
1.45945	0.50	0.08	32.95	56.00	-23.05	23.15	46.00	-22.85
1.65338	0.50	0.08	30.80	56.00	-25.20	21.72	46.00	-24.28
2.37315	0.50	0.10	32.06	56.00	-23.94	24.52	46.00	-21.48
4.35836	0.50	0.14	21.16	56.00	-34.84	12.70	46.00	-33.30



* NOTE: During the test, the EMI receiver was set to Max. Hold then switch the EUT Channel between 00, 39, 78 to get the maximum reading of all these channels.

Margin = Amplitude + Insertion Loss- Limit

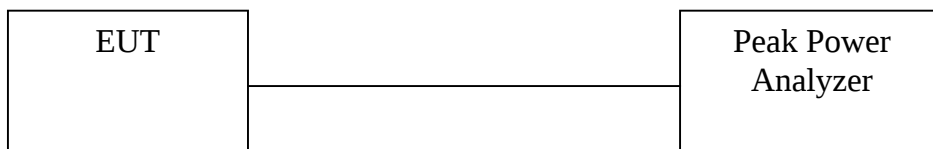
A margin of -8dB means that the emission is 8dB below the limit

5.2 FHSS Maximum Peak Output Power

5.2.1 Test Procedure

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

5.2.2 Test Setup



5.2.3 Test Data

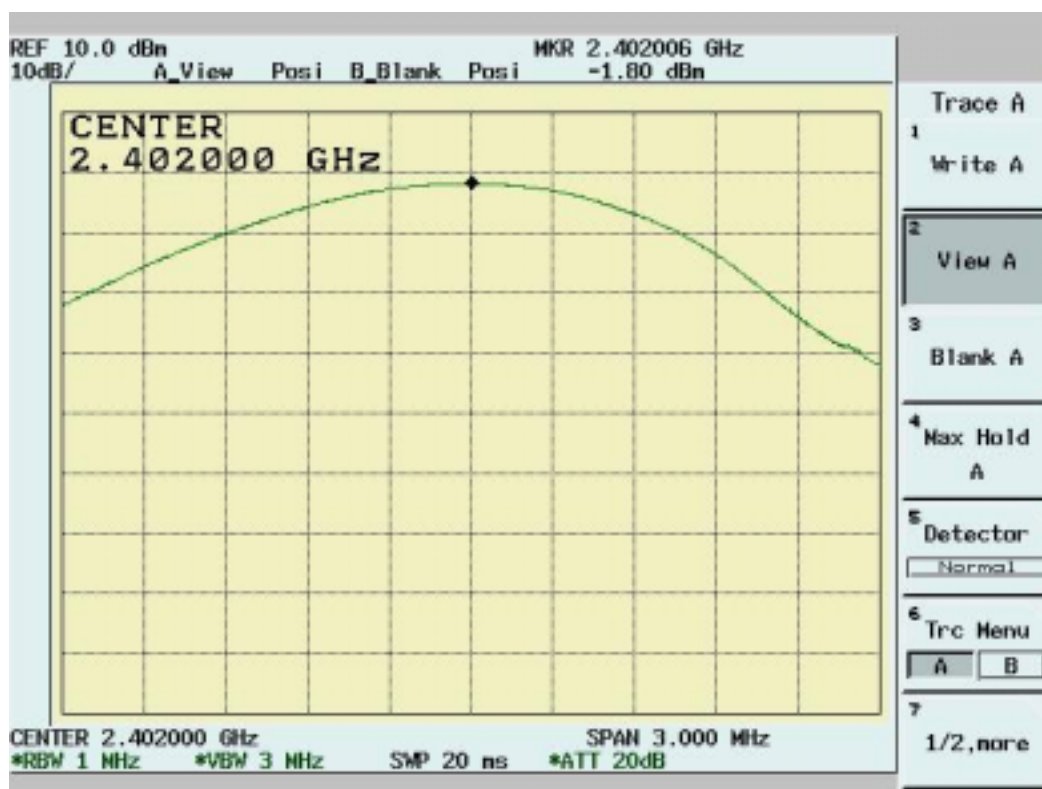
Maximum Peak Output Power

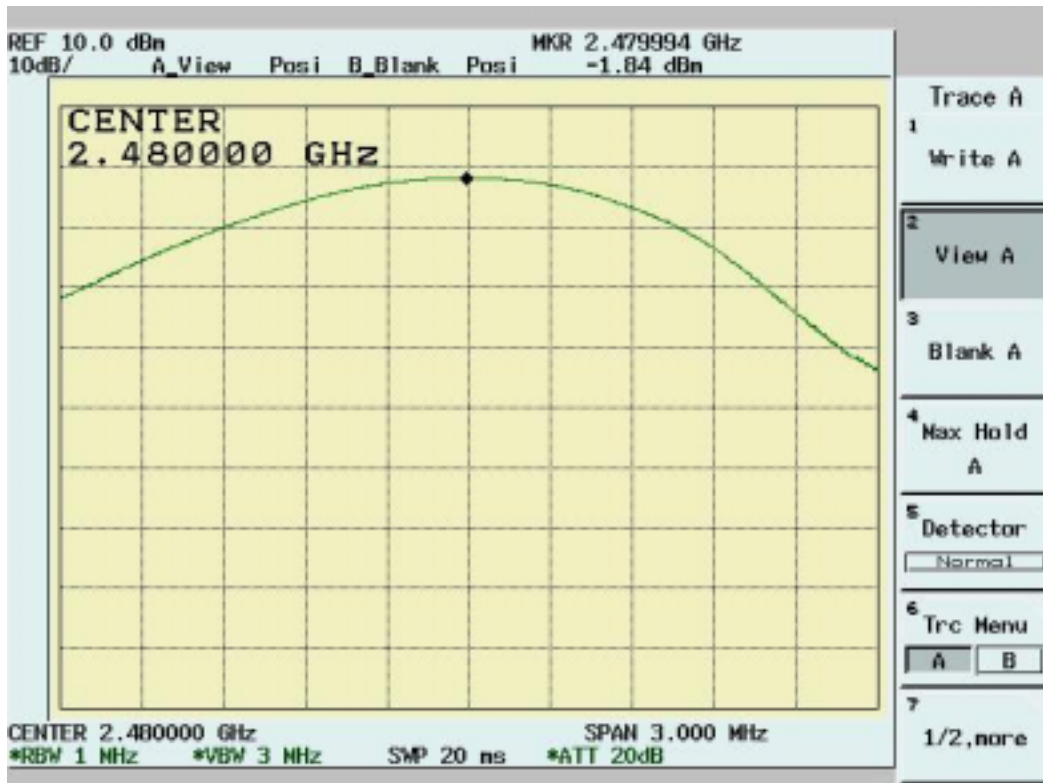
Temperature ():25

Test Engineer:Jerry Chiou

Humidity (%):55

Channel	Frequency (Mhz)	Analyzer Reading (dBm)	Cable Loss (dB)	Peak Power Output (mW)	Peak Power Output (dBm)	Limit (dBm)	Pass/Fail
00	2412	-1.80	0.66	0.77	-1.14	30	Pass
39	2437	-0.45	0.66	1.05	0.21	30	Pass
78	2462	-1.84	0.66	0.76	-1.18	30	Pass





5.3 Radiated Emission Measurement

5.3.1 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.

5.3.2 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.

5.3.3 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)	3MHz
Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Average Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	10 Hz

5.3.4 Test Data (30MHz – 1GHz):

30M – 1GHz Open Field Radiated Emissions (Horizontal) Channel 00, 39, 78

Operator: Jerry Chiou

Temperature (C): 23

09:22:08 AM, Friday, October 21, 2005

Humidity (%): 54

Frequency	Rx Amp.	Ant Fact	CableLoss	PreAmpGain	Corrct. Emi.	Limit	Margin	Ant. Pos.	Table Pos.
MHz	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg)
264.74	7.70	13.19	3.20	0.00	24.10	46.00	-21.90	103.00	6.00
295.78	6.18	15.27	3.54	0.00	24.98	46.00	-21.02	196.00	299.00
300.63	6.57	15.90	3.62	0.00	26.09	46.00	-19.91	196.00	120.00
328.76	4.74	16.07	3.91	0.00	24.73	46.00	-21.27	103.00	194.00
372.41	3.77	16.07	4.25	0.00	24.09	46.00	-21.91	103.00	57.00
558.65	0.64	18.62	5.60	0.00	24.85	46.00	-21.15	103.00	226.00
575.14	0.87	18.65	5.72	0.00	25.25	46.00	-20.75	103.00	242.00
665.35	3.32	19.00	6.40	0.00	28.72	46.00	-17.28	103.00	177.00
679.9	1.02	19.00	6.49	0.00	26.51	46.00	-19.49	103.00	112.00
707.06	3.68	19.17	6.68	0.00	29.53	46.00	-16.47	103.00	275.00
796.3	3.19	20.11	7.33	0.00	30.63	46.00	-15.37	196.00	169.00
799.21	4.93	20.10	7.36	0.00	32.39	46.00	-13.61	103.00	40.00

30M – 1GHz Open Field Radiated Emissions (Vertical) Channel 00, 39, 78

Operator: Jerry Chiou

Temperature (C): 23

09:22:08 AM, Friday, October 21, 2005

Humidity (%): 54

Frequency	Rx Amp.	Ant Fact	CableLoss	PreAmpGain	Corrct. Emi.	Limit	Margin	Ant. Pos.	Table Pos.
MHz	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg)
51.34	13.29	7.22	1.22	0.00	21.73	40.00	-18.27	103.00	79.00
67.83	16.00	5.40	1.44	0.00	22.84	40.00	-17.16	103.00	57.00
80.44	14.91	6.67	1.64	0.00	23.23	40.00	-16.77	103.00	40.00
106.63	14.28	11.10	1.99	0.00	27.37	43.50	-16.13	103.00	23.00
383.08	7.92	16.00	4.32	0.00	28.25	46.00	-17.75	103.00	23.00
388.9	8.48	15.97	4.36	0.00	28.81	46.00	-17.19	103.00	23.00
399.57	8.52	15.90	4.44	0.00	28.86	46.00	-17.14	196.00	169.00
406.36	7.12	15.94	4.48	0.00	27.55	46.00	-18.45	103.00	40.00
490.75	6.81	17.18	5.19	0.00	29.18	46.00	-16.82	103.00	57.00
555.74	3.76	18.61	5.57	0.00	27.94	46.00	-18.06	103.00	242.00
778.84	1.42	20.14	7.16	0.00	28.72	46.00	-17.28	103.00	194.00
799.21	2.87	20.10	7.36	0.00	30.34	46.00	-15.66	103.00	40.00

NOTE:

- During the Pre-test, the EUT has been tested for Channel 00, 39, 78 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
International Standards Laboratory
Report Number: 05LR029FC

HC LAB:NVLAP:200234-0;VCCI: R-341,C-354;NEMKO:ELA 113a,113c;BSMI:SL2-IN-E-0037;SL2-R1-E-0037;CNLA:1178

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

5.3.5 Test Data (1GHz – 25 GHz) .

1GHz~ 25 GHz (Horizontal), Channel 00: 2402 MHz

Operator: Jerry Chiou

RBW: 1MHz

Humidity (%): 41

Temperature (C): 27

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
1237.26	53.55 pk	25.59	2.20	34.06	47.28 pk	54.00 av	-6.72	102	96
1264.74	54.77 pk	25.72	2.20	34.07	48.61 pk	54.00 av	-5.39	101	94
1284.72	55.58 pk	25.81	2.20	34.08	49.51 pk	54.00 av	-4.49	101	92
1297.2	55.77 pk	25.87	2.21	34.09	49.75 pk	54.00 av	-4.25	101	91
1327.17	53.59 pk	26.00	2.21	34.11	47.69 pk	54.00 av	-6.31	101	89
1372.13	52.94 pk	26.21	2.21	34.13	47.23 pk	54.00 av	-6.77	101	86
1464.54	53.75 pk	26.64	2.23	34.18	48.43 pk	54.00 av	-5.57	101	80
1901.6	49.63 pk	30.17	2.53	34.99	47.34 pk	54.00 av	-6.66	100	50
4803.93	54.77 pk	34.85	2.12	37.69	54.05 pk	74.00 pk	-19.95	100.00	17.00
4803.93	40.90 av	34.85	2.12	37.69	40.18 av	54.00 av	-13.82	100.00	17.00
9607.88	44.66 pk	40.66	3.23	34.32	54.23 pk	74.00 pk	-19.77	100.00	328.00
9607.88	22.59 av	40.66	3.23	34.32	32.16 av	54.00 av	-21.84	100.00	328.00

1GHz~ 25 GHz (Vertical), Channel 00: 2402 MHz

Operator: Jerry Chiou

RBW: 1MHz

Humidity (%): 41

Temperature (C): 27

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
1149.85	54.38 pk	25.19	2.19	34.01	47.74 pk	54.00 av	-6.26	102	102
1197.3	52.62 pk	25.41	2.19	34.04	46.18 pk	54.00 av	-7.82	102	98
1237.26	56.55 pk	25.59	2.20	34.06	50.28 pk	54.00 av	-3.72	102	96
1284.72	56.16 pk	25.81	2.20	34.08	50.09 pk	54.00 av	-3.91	101	92
1297.2	55.68 pk	25.87	2.21	34.09	49.66 pk	54.00 av	-4.34	101	91
1319.68	52.83 pk	25.97	2.21	34.10	46.90 pk	54.00 av	-7.10	101	90
1397.1	51.99 pk	26.33	2.22	34.14	46.39 pk	54.00 av	-7.61	101	85
1464.54	56.88 pk	26.64	2.23	34.18	51.56 pk	54.00 av	-2.44	101	80
1901.6	48.85 pk	30.17	2.53	34.99	46.57 pk	54.00 av	-7.43	100	50
4803.85	52.61 pk	34.85	2.12	37.69	51.89 pk	54.00 av	-2.11	100.00	323.00
9607.99	44.13 pk	40.66	3.23	34.32	53.70 pk	54.00 av	-0.30	100.00	128.00

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: 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.

International Standards Laboratory

Report Number: 05LR029FC

HC LAB:NVLAP:200234-0;VCCI: R-341,C-354;NEMKO:ELA 113a,113c;BSMI:SL2-IN-E-0037;SL2-R1-E-0037;CNLA:1178

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

1GHz~ 25 GHz (Horizontal), Channel 39 : 2441 MHz

Operator: Jerry Chiou

RBW: 1MHz

Humidity (%): 41

Temperature (C): 27

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
1237.26	53.74 pk	25.59	2.20	34.06	47.47 pk	54.00 av	-6.53	102	96
1284.72	54.96 pk	25.81	2.20	34.08	48.89 pk	54.00 av	-5.11	101	92
1297.2	55.84 pk	25.87	2.21	34.09	49.82 pk	54.00 av	-4.18	101	91
1327.17	53.48 pk	26.00	2.21	34.11	47.59 pk	54.00 av	-6.41	101	89
1369.63	52.63 pk	26.20	2.21	34.13	46.91 pk	54.00 av	-7.09	101	86
1464.54	54.55 pk	26.64	2.23	34.18	49.24 pk	54.00 av	-4.76	101	80
1811.69	49.45 pk	29.42	2.46	34.81	46.51 pk	54.00 av	-7.49	100	56
1901.6	49.16 pk	30.17	2.53	34.99	46.88 pk	54.00 av	-7.12	100	50
2341.16	50.27 pk	30.93	1.56	35.19	47.57 pk	54.00 av	-6.43	101	150
4881.95	55.60 pk	35.15	2.14	37.78	55.11 pk	74.00 pk	-18.89	100.00	19.00
4881.95	40.88 av	35.15	2.14	37.78	40.39 av	54.00 av	-13.61	100.00	19.00
9764	43.81 pk	40.32	3.31	34.38	53.06 pk	54.00 av	-0.94	100.00	311.00

1GHz~ 25 GHz (Vertical), Channel 39 : 2441 MHz

Operator: Jerry Chiou

RBW: 1MHz

Humidity (%): 41

Temperature (C): 27

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
1149.85	52.57 pk	25.19	2.19	34.01	45.94 pk	54.00 av	-8.06	102	102
1197.3	50.85 pk	25.41	2.19	34.04	44.42 pk	54.00 av	-9.58	102	98
1237.26	54.38 pk	25.59	2.20	34.06	48.11 pk	54.00 av	-5.89	102	96
1284.72	53.75 pk	25.81	2.20	34.08	47.68 pk	54.00 av	-6.32	101	92
1297.2	52.15 pk	25.87	2.21	34.09	46.13 pk	54.00 av	-7.87	101	91
1327.17	50.17 pk	26.00	2.21	34.11	44.28 pk	54.00 av	-9.72	101	89
1369.63	50.29 pk	26.20	2.21	34.13	44.57 pk	54.00 av	-9.43	101	86
1459.54	52.07 pk	26.61	2.23	34.18	46.73 pk	54.00 av	-7.27	101	80
1464.54	55.82 pk	26.64	2.23	34.18	50.50 pk	54.00 av	-3.50	101	80
4881.95	52.52 pk	35.15	2.14	37.78	52.03 pk	54.00 av	-1.97	100.00	191.00
9764.12	43.80 pk	40.32	3.31	34.38	53.05 pk	54.00 av	-0.95	100.00	132.00

Note:

- According to the standards used:Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: 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 78: 2480 MHz

Operator: Jerry Chiou

RBW: 1MHz

Humidity (%): 41

Temperature (C): 27

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
1237.26	53.55 pk	25.59	2.20	34.06	47.28 pk	54.00 av	-6.72	102	96
1284.72	53.69 pk	25.81	2.20	34.08	47.62 pk	54.00 av	-6.38	101	92
1297.2	54.60 pk	25.87	2.21	34.09	48.58 pk	54.00 av	-5.42	101	91
1327.17	52.62 pk	26.00	2.21	34.11	46.72 pk	54.00 av	-7.28	101	89
1369.63	51.70 pk	26.20	2.21	34.13	45.98 pk	54.00 av	-8.02	101	86
1452.05	51.08 pk	26.58	2.22	34.17	45.71 pk	54.00 av	-8.29	101	81
1464.54	52.38 pk	26.64	2.23	34.18	47.06 pk	54.00 av	-6.94	101	80
2121.38	47.74 pk	30.98	2.23	35.18	45.76 pk	54.00 av	-8.24	100	81
2381.12	48.49 pk	30.92	1.44	35.20	45.66 pk	54.00 av	-8.34	101	163
4959.82	54.66 pk	35.45	2.16	37.87	54.40 pk	74.00 pk	-19.60	100.00	26.00
4959.82	39.34 av	35.45	2.16	37.87	39.08 av	54.00 av	-14.92	100.00	26.00
9920	44.69 pk	39.98	3.39	34.43	53.62 pk	54.00 av	-0.38	100.00	316.00

1GHz~ 25 GHz (Vertical), Channel 78 : 2480 MHz

Operator: Jerry Chiou

RBW: 1MHz

Humidity (%): 41

Temperature (C): 27

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
1149.85	53.28 pk	25.19	2.19	34.01	46.65 pk	54.00 av	-7.35	102	102
1237.26	54.83 pk	25.59	2.20	34.06	48.56 pk	54.00 av	-5.44	102	96
1284.72	54.38 pk	25.81	2.20	34.08	48.31 pk	54.00 av	-5.69	101	92
1297.2	53.45 pk	25.87	2.21	34.09	47.43 pk	54.00 av	-6.57	101	91
1319.68	51.73 pk	25.97	2.21	34.10	45.81 pk	54.00 av	-8.19	101	90
1327.17	51.51 pk	26.00	2.21	34.11	45.62 pk	54.00 av	-8.38	101	89
1369.63	50.27 pk	26.20	2.21	34.13	44.56 pk	54.00 av	-9.44	101	86
1459.54	51.92 pk	26.61	2.23	34.18	46.58 pk	54.00 av	-7.42	101	80
1464.54	55.59 pk	26.64	2.23	34.18	50.27 pk	54.00 av	-3.73	101	80
4959.73	51.47 pk	35.45	2.16	37.87	51.21 pk	54.00 av	-2.79	100.00	69.00
9919.83	44.52 pk	39.98	3.39	34.43	53.45 pk	54.00 av	-0.55	100.00	129.00

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: 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.

5.4 Band Edge Measurement

5.4.1 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

5.4.2 Test Setup (Conducted)



5.4.3 Test Data:

Table: Band Edge measurement (Conducted)

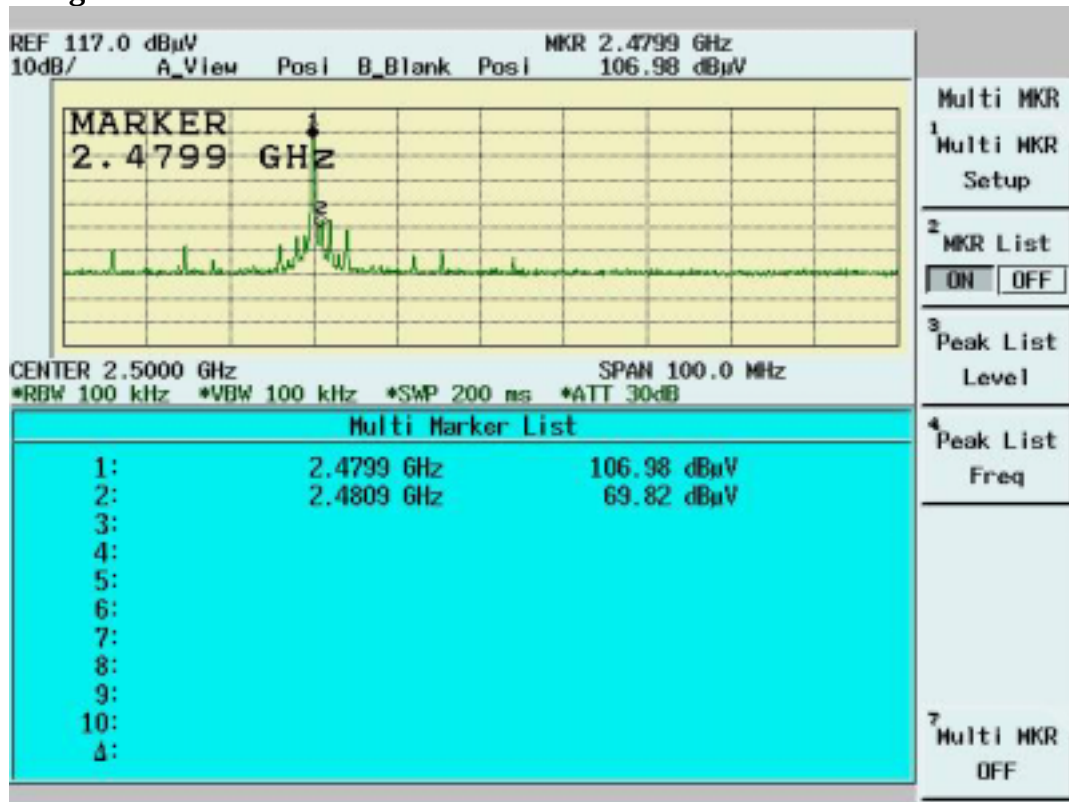
Temperature ():25

Test Engineer:Jerry Chiou

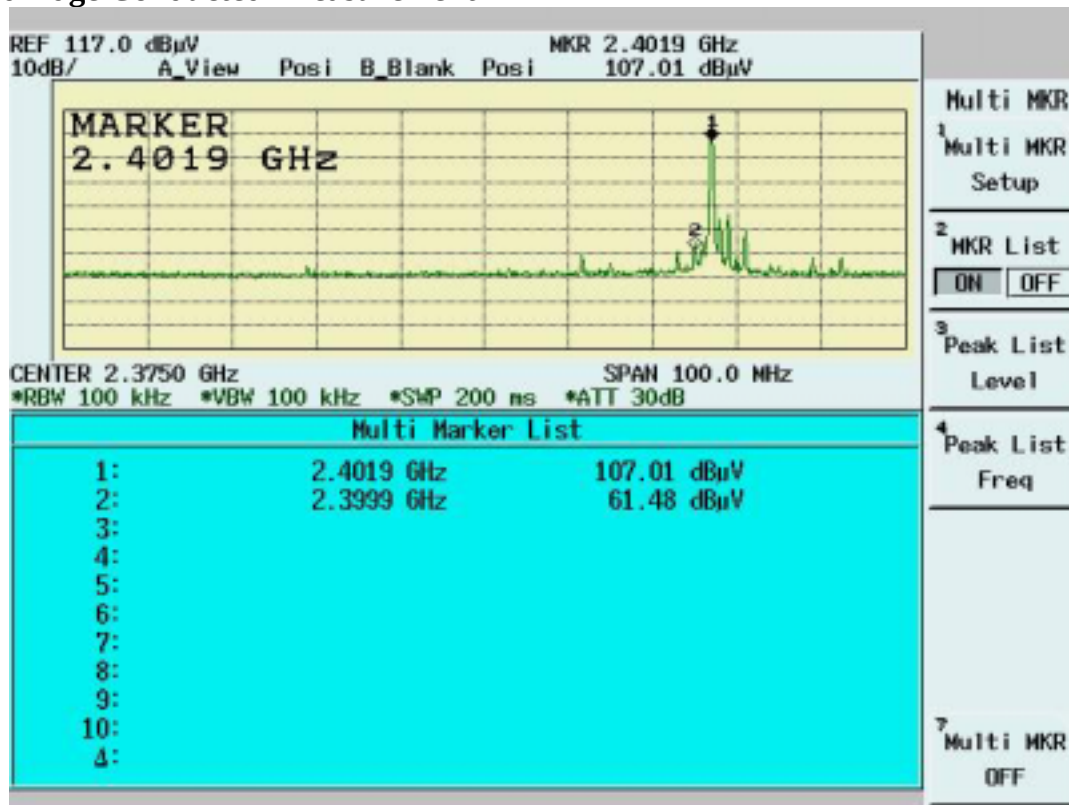
Humidity (%):55

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Carrier - Outsideband Limit: >20dB (dB)	Pass/Fail
00	2401.9	107.0	---	---
Outside band	2399.9	61.5	45.5	Pass
78	2479.9	107.0	---	---
Outside band	2480.9	69.8	37.2	Pass

Band Edge Conducted measurement



Band Edge Conducted Measurement



5.4.4 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: 3MHz
Center frequency: 2.375GHz, 2.500GHz.
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.

5.4.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

5.4.6 Test Data

Table Band Edge measurement (Radiated)

Test Engineer: Jerry Chiou

Temperature (): 27

Data Rate

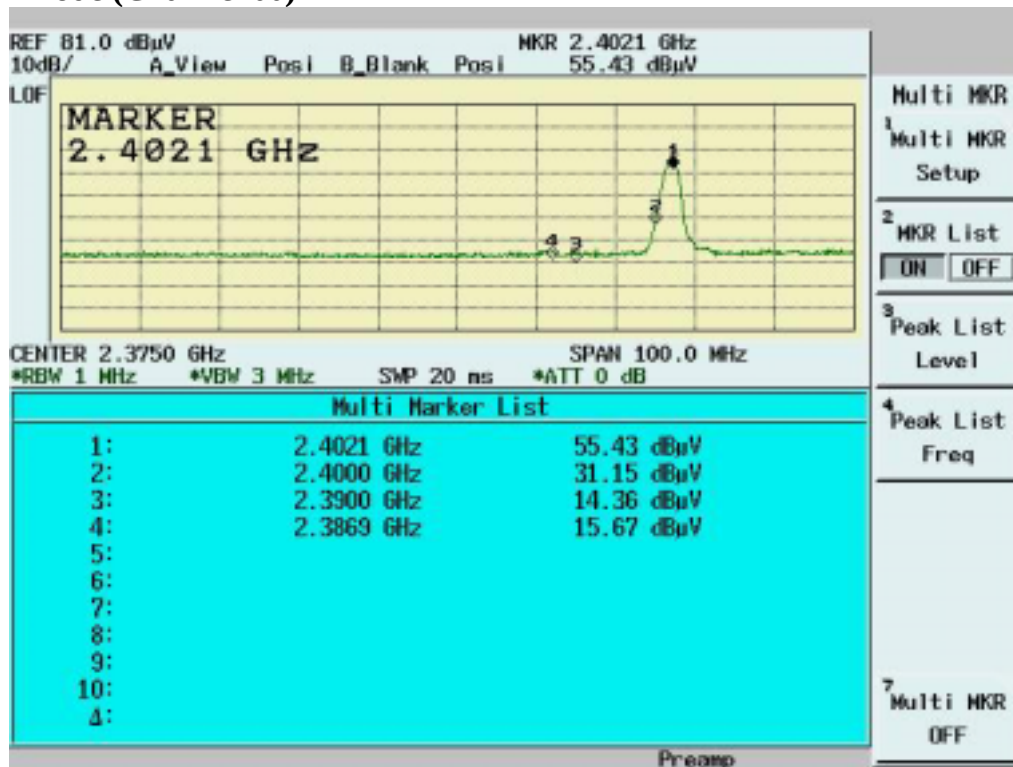
Humidity (%): 40

Description	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
Channel_00 (average mode)	2402.00	55.05	35.48	90.53	---	---	10Hz	---
Channel_00 (peak mode)	2402.00	55.41	35.48	90.89	---	---	3MHz	---
Outside band (peak mode)	2400.00	31.15	35.48	66.63	24.26	---	3MHz	Pass
Channel_78 (average mode)	2480.10	52.62	35.51	88.13	---	---	10Hz	---
Channel_78 (peak mode)	2480.10	53.88	35.51	89.39	---	---	3MHz	---
Outside band (peak mode)	2482.00	21.80	35.51	57.31	32.08	---	3MHz	Pass
Channel_00 Restricted band (peak mode)	2386.90	15.67	35.47	51.14	---	74	3MHz	Pass
Restricted band (average mode)	2386.70	6.59	35.47	42.06	---	54	10Hz	Pass
Channel_78 Restricted band (peak mode)	2495.10	16.97	35.51	52.48	---	74	3MHz	Pass
Restricted band (average mode)	2483.90	8.10	35.51	43.61	---	54	10Hz	Pass

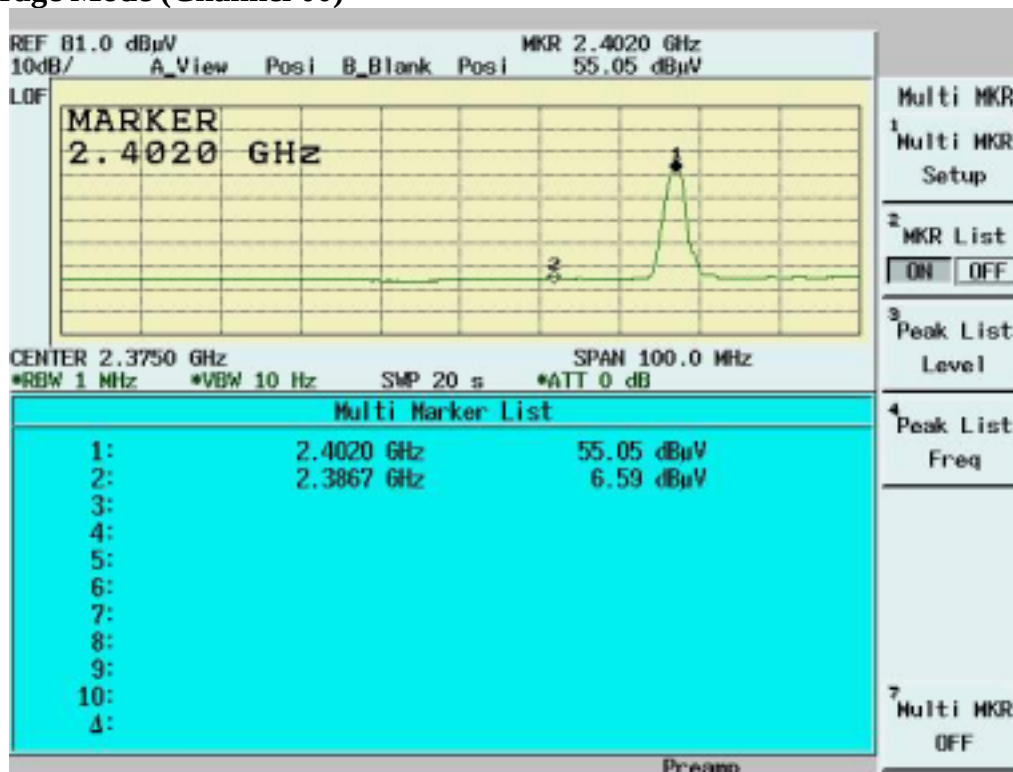
Note:

- 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 polarization have been tested and the worst data is listed above.

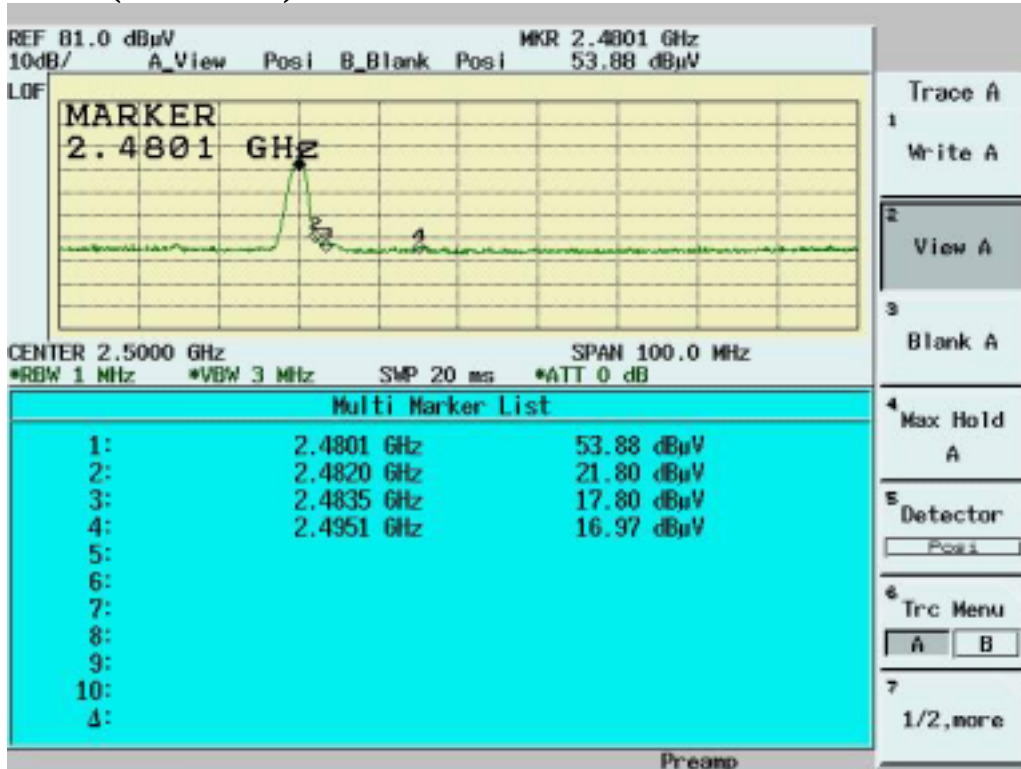
Band Edge measurement for radiated emission in Restricted Band(Radiated) Peak Mode (Channel 00)



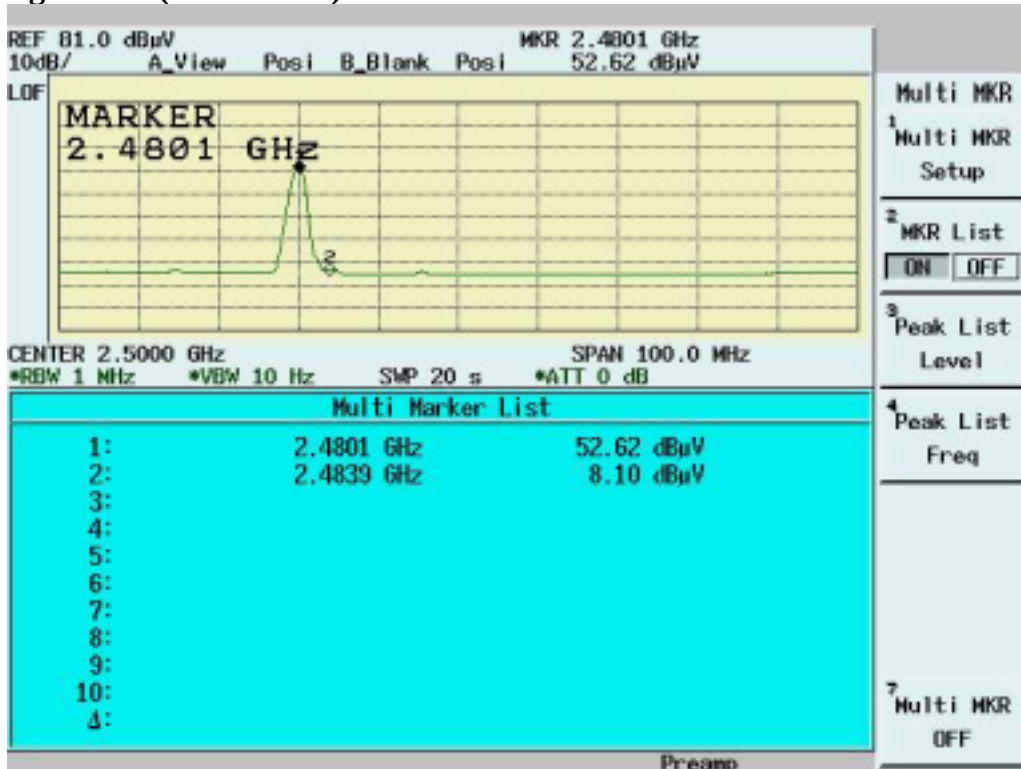
Band Edge measurement for radiated emission in Restricted Band(Radiated) Average Mode (Channel 00)



Band Edge measurement for radiated emission in Restricted Band(Radiated) Peak Mode (Channel 78)



Band Edge measurement for radiated emission in Restricted Band(Radiated) Average Mode (Channel 78)



5.5 Bandwidth & Hopping Channel Separation

5.5.1 Standard Applicable

According to §15.247(a)(1), frequency hopping system shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies.

5.5.2 Test Procedure

■ Bandwidth Test Procedure

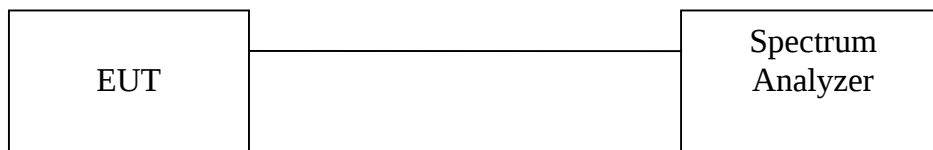
The Transmitter output of EUT was connected to the spectrum analyzer. The 20 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

Equipment mode	Spectrum analyzer
Detector function	Peak mode
RBW	30KHz
VBW	100KHz

■ Hopping Channel Separation Test Procedure

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 100KHz
VBW: 300KHz
SPAN:3MHz
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer Marker function.
4. Repeat above procedures until all frequencies measured were complete.

5.5.3 Test Setup



5.5.4 Test Data

20dB Bandwidth

Temperature ():25

Test Engineer:Jerry Chiou

Humidity (%):55

Channel	Frequency (MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Pass/Fail
00	2402	968	1000	Pass
39	2441	968	1000	Pass
78	2480	968	1000	Pass

Hopping Channel Separation

Temperature ():22

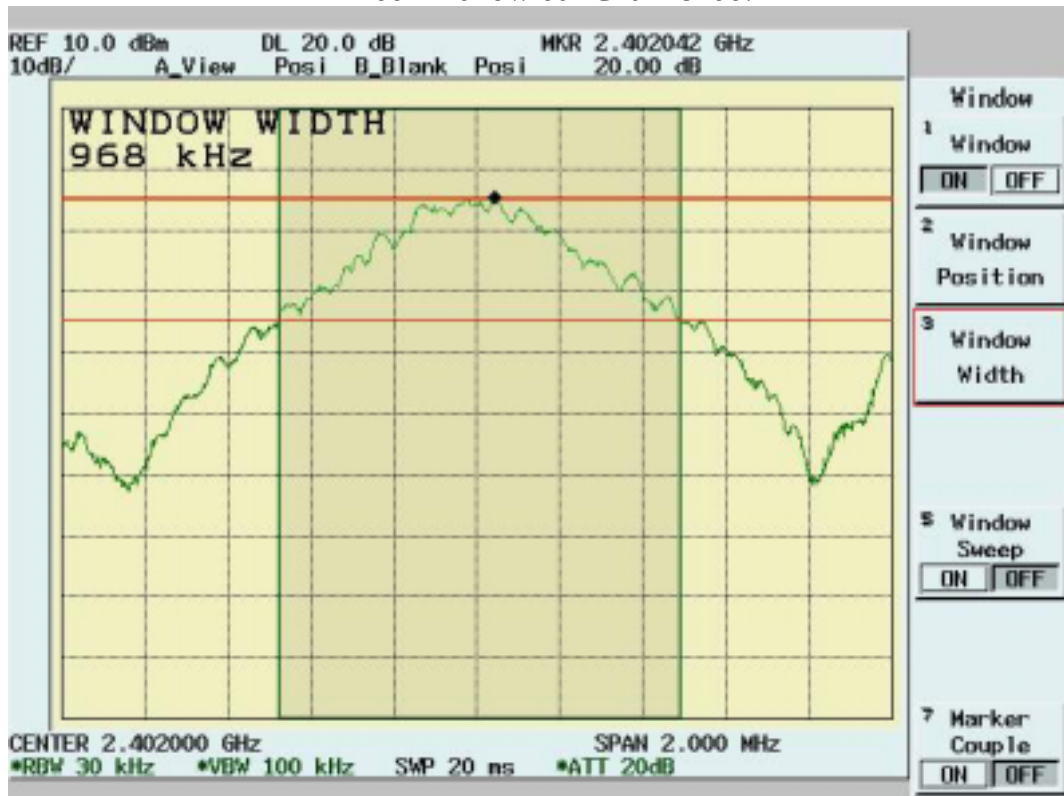
Test Engineer:Mailes

Humidity (%):25

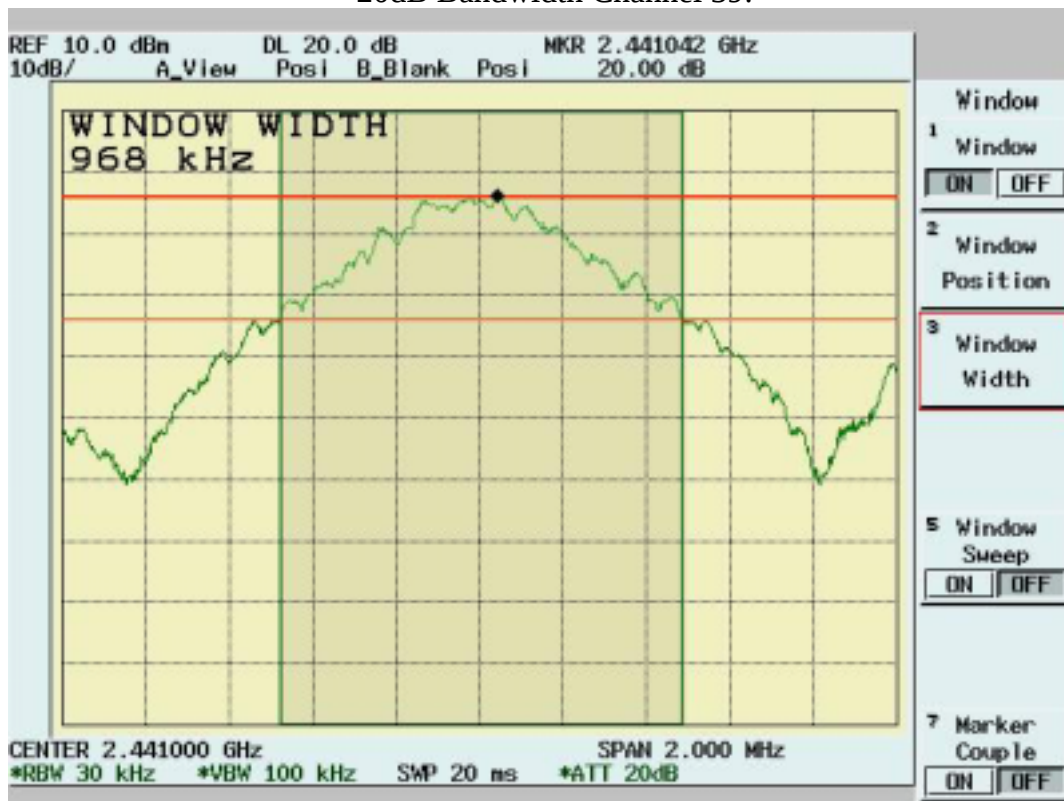
Hsieh

Channel	Frequency (MHz)	Separation (KHz)	Limit (KHz)	Pass/Fail
00	2402	999	968	Pass
39	2441	999	968	Pass
78	2480	999	968	Pass

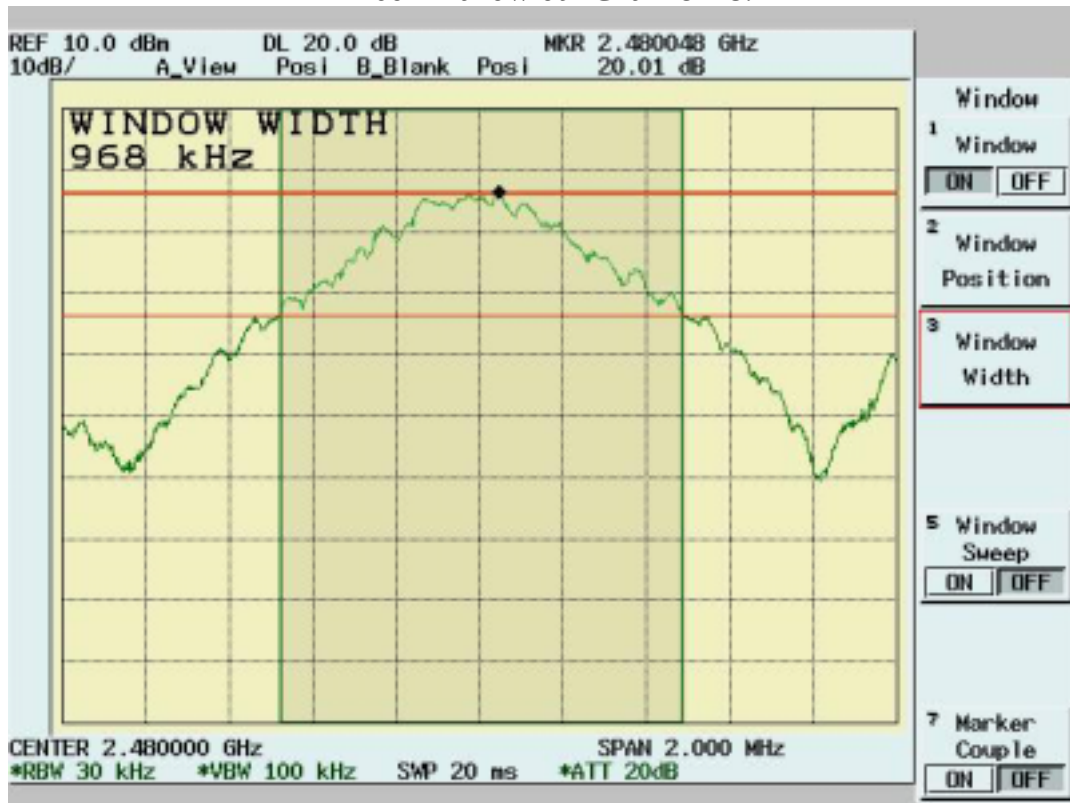
20dB Bandwidth Channel 00:



20dB Bandwidth Channel 39:



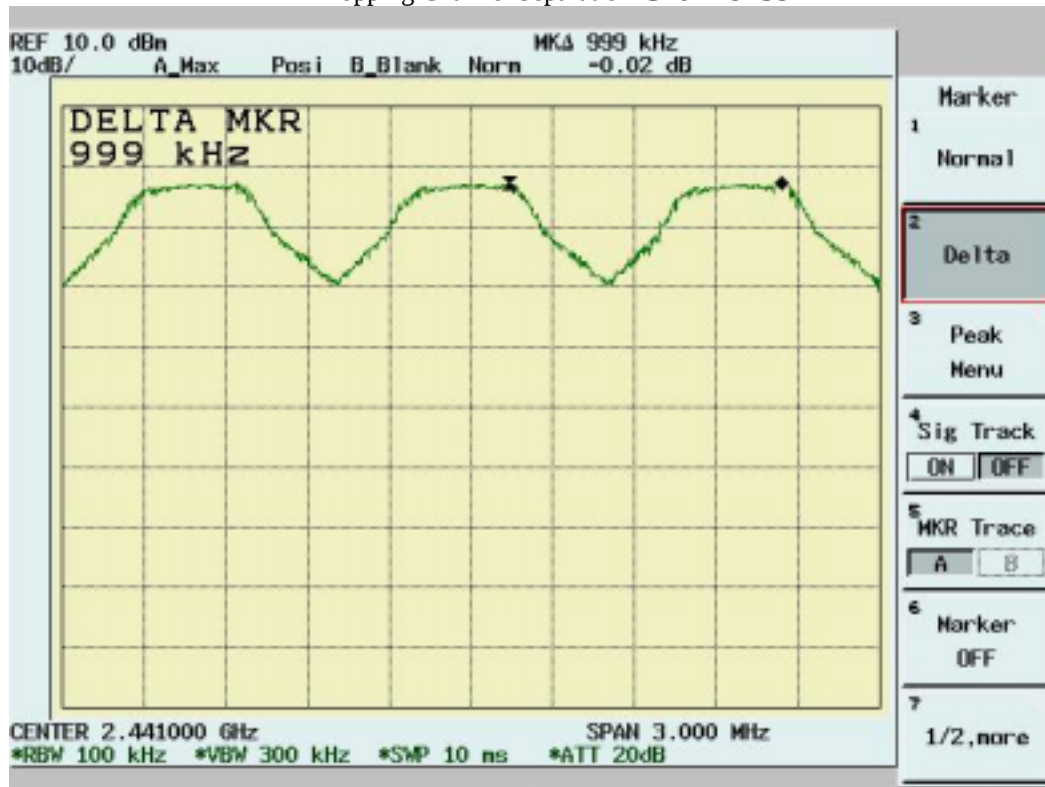
20dB Bandwidth Channel 78:



Hopping Channel Separation Channel 00



Hopping Channel Separation Channel 39



Hopping Channel Separation Channel 78

